PANORAMA
Mountain Village

COMPREHENSIVE DEVELOPMENT PLAN

VOLUME 1
LAND USE STRATEGY

INTRAWEST

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Courtesy of Windermere District Historical Society

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EXECUTIVE SUMMARY

Pan-o-ra-ma - (pan-a-ra'-ma) *n.* a complete view in every direction; a picture exhibited by being unrolled and made to pass continuously before the spectator. **panoramic** *a.* {Gk. *pan.* all; *horama*, a view}.

PANORAMIC VIEW LOOKING WEST TO MT. NELSON, SULTANA PEAK AND WATCH PEAK FROM PANORAMA RIDGE

The Webster's definition of a *panorama* must have been derived from a visit to Intrawest's spectacular mountain village resort in the midst of the Purcell Mountains of British Columbia. The Comprehensive Development Plan presented in this three volume set will surely reinforce this definition to all those who read it and visit Panorama Mountain Village.

The mountain village at Panorama has evolved over a 40-year history since the first local ski club saw potential in the surrounding mountains. Development of ski facilities and residential accommodation progressed over the years reflecting local demand and financial resources of different owners. In 1993 Intrawest Corporation purchased Panorama Resort and in the short time since that ownership change, have made significant changes and improvements. Perhaps the most important achievement is establishment of the vision which will take Panorama Mountain Village into the 21st century. That vision has already begun to take shape through the ambitious development initiatives which have been completed to date. It's complete realization requires a well defined road map which will allow Panorama to reach its destination as "the small jewel hidden in the mountains."

SMALL JEWEL HIDDEN IN THE MOUNTAINS

This vision is articulated through the Comprehensive Development Plan (CDP) which serves as the road map and strategy for implementing the magnitude and quality of resort development which is required for Panorama to reach its potential as a year-round destination resort.

The goals of the Comprehensive Development Plan are:

- To establish a clear definition of the land use programme and organization of land uses and activities within the resort's land base that reflect Intrawest's vision and resort development mandate;
- To provide the basis for establishment of land use policy governing resort expansion in the form of the Official Community Plan;
- To create a uniform format and document content which synthesizes previous documentation on the resort, establishing current, consistent base information to guide all levels of government, as well as Intrawest, with respect to future growth of Panorama;
- To consolidate the method in which information about Panorama is updated and distributed, and;
- To create a uniform and consistent set of design and development standards which will establish the desired quality and image for the resort experience at Panorama;

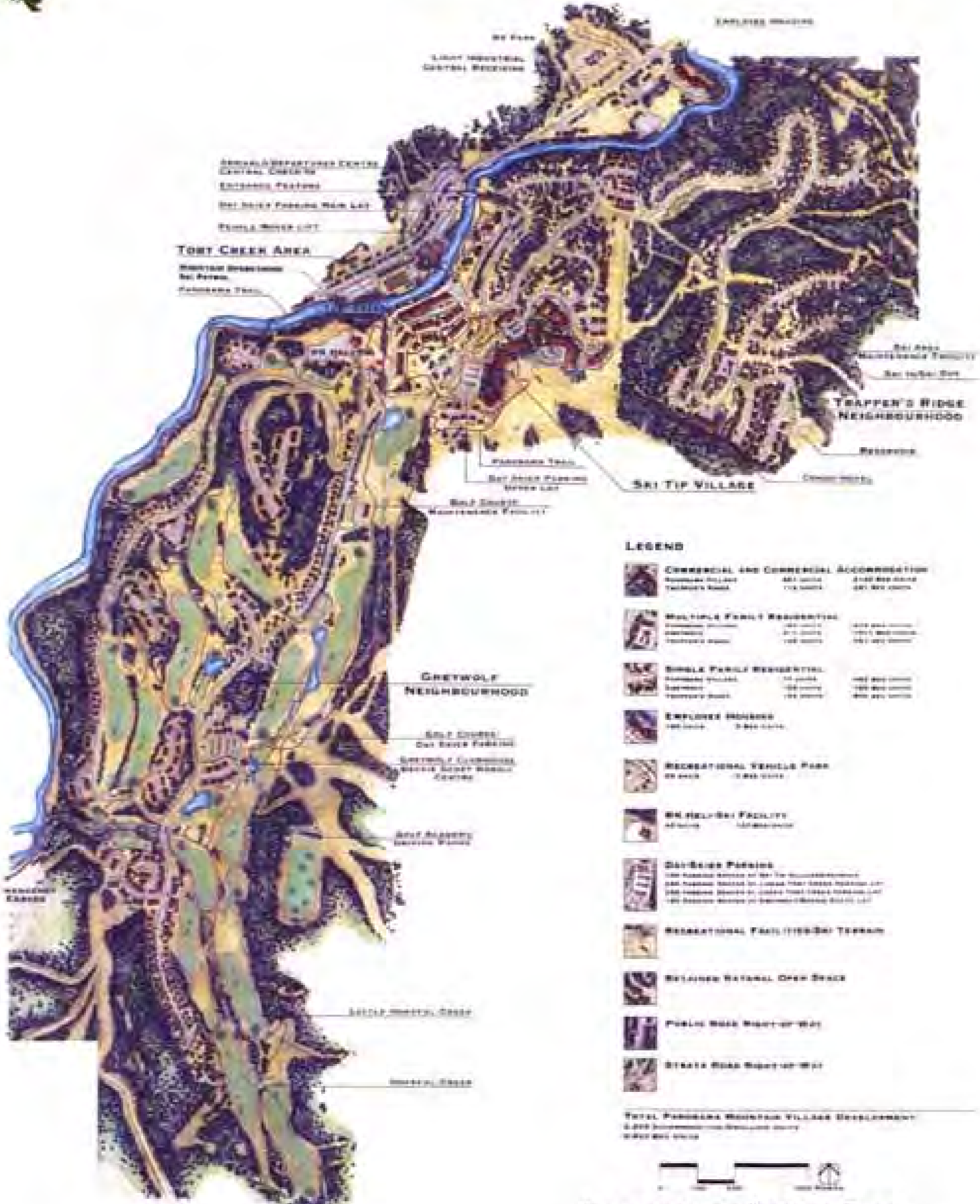
The format of the Comprehensive Development Plan (CDP) is comprised of a three volume set: Volume I - Land Use Strategy; Volume II - Technical Background Report, and; Volume III - Design Standards Manual. Together these volumes serve as the master planning and design documents which will guide future growth of Panorama Mountain Village. They represent consolidation of the various physical planning documents which have been prepared for the resort and reflect the new vision which has been established for Panorama Mountain Village. The Comprehensive Development Plan (CDP) documents contain information about the ultimate location, configuration, form and quality of development proposed, as well as specifications, design standards and methods of installation of the various resort development components.

Volume I - Land Use Strategy is the primary document, presents an overall summary of technical aspects contained within the CDP as well as a detailed description of the overall land use programme and related physical planning. These elements have been organized and are represented in a series of Master Plans prepared for each major development area within the resort and for the resort as a whole - The Panorama Mountain Village Master Plan. Included in this volume, is graphic support in the form of renderings and character images depicting the scale, form and character, and distribution of development.

Volume II - Technical Background Report contains the detailed technical reports upon which resort planning and Official Community Plan policy are based. These reports address: details of the Mountain Master Plan; development servicing strategy; biophysical and environmental conditions; archaeological resources; and geotechnical and hazard conditions of the resort land base.

Volume III - Design Standards Manual contains information pertaining to implementation of various components which are integral to the Panorama Mountain Village Master Plan. This includes: design guidelines; design details related construction of landscape and other features such as lighting, signage, paving systems and site furnishings, and; standard specifications reinforcing the quality of standards to be maintained in the implementation of these resort elements.

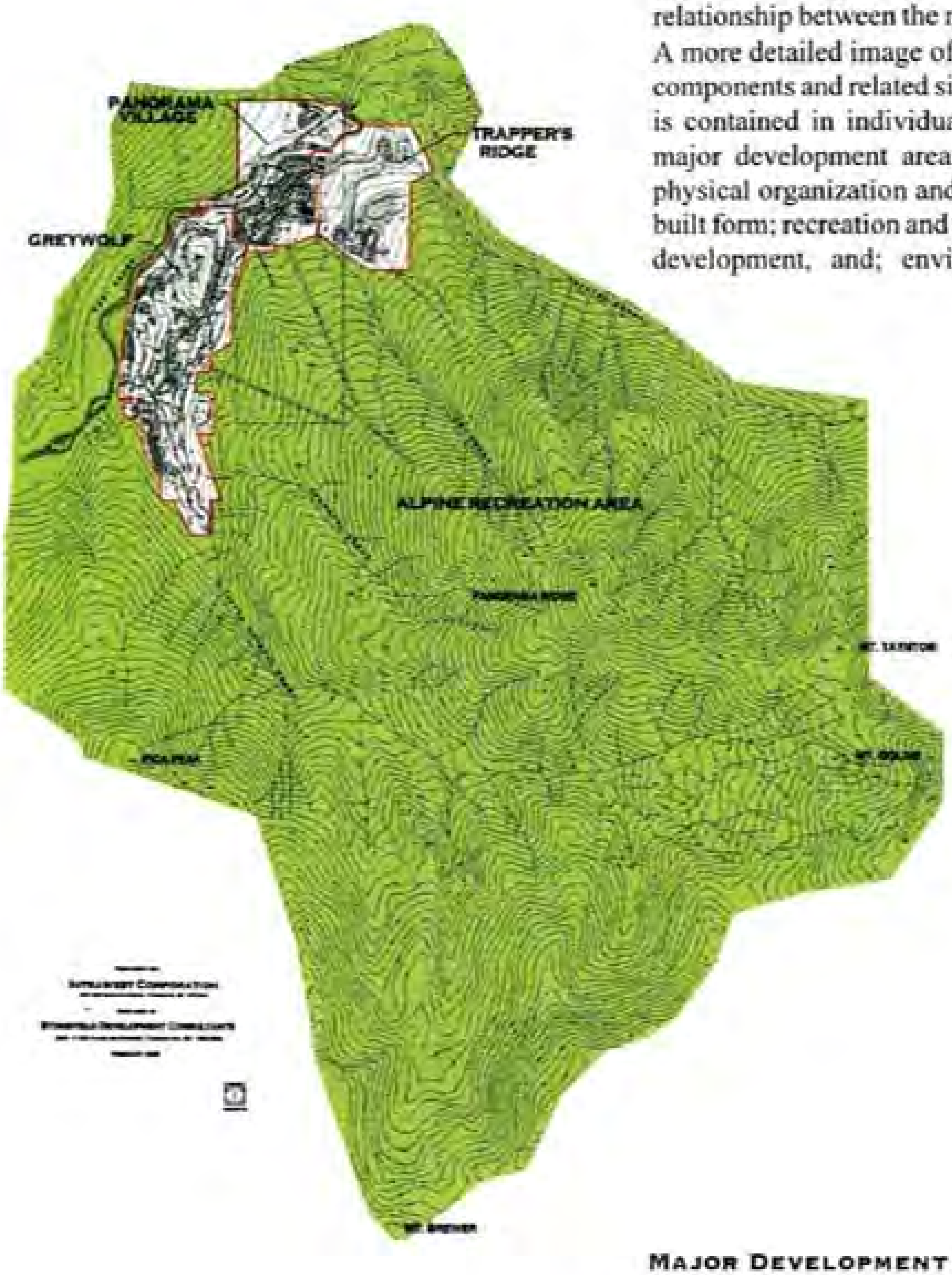
The Comprehensive Development Plan package replaces the previous 1989 Development Plan Amendment, which has served as the physical planning and programming document since that time. The CDP establishes a new physical plan - The Panorama Mountain Village Master Plan - and associated design thresholds for Panorama Mountain Village. It serves as the basis for preparation of the new Official Community Plan which contains land use policy governing future resort expansion.



ILLUSTRATIVE MASTER PLAN

PANORAMA MOUNTAIN
VILLAGE MASTER PLAN FIGURE 1-1

The Panorama Mountain Village Master Plan is comprised of four major development areas: 1) Panorama Village 2) Greywolf 3) Trapper's Ridge and 4) Mountain Ski Area. The overall master plan depicts the general location and physical relationship between the major development areas. A more detailed image of the land use programme components and related site planning of these areas is contained in individual master plans for each major development area. These plans show the physical organization and configuration of: roads; built form; recreation and trails; parking; landscape development, and; environmental preservation.



MAJOR DEVELOPMENT AREAS FIGURE I-2

A master land use programme has been developed for Panorama Mountain Village incorporating older established development in existence prior to the resort ownership change in 1993. This programme serves as the basis for preparation of the Panorama Mountain Village Master Plan, depicting the integration of existing land uses and facilities with phased resort expansion. A total of 2203 residential units, including 150 employee accommodation units, are contained within the Master Plan, offering a maximum number of bed units not exceeding 7084 bed units.

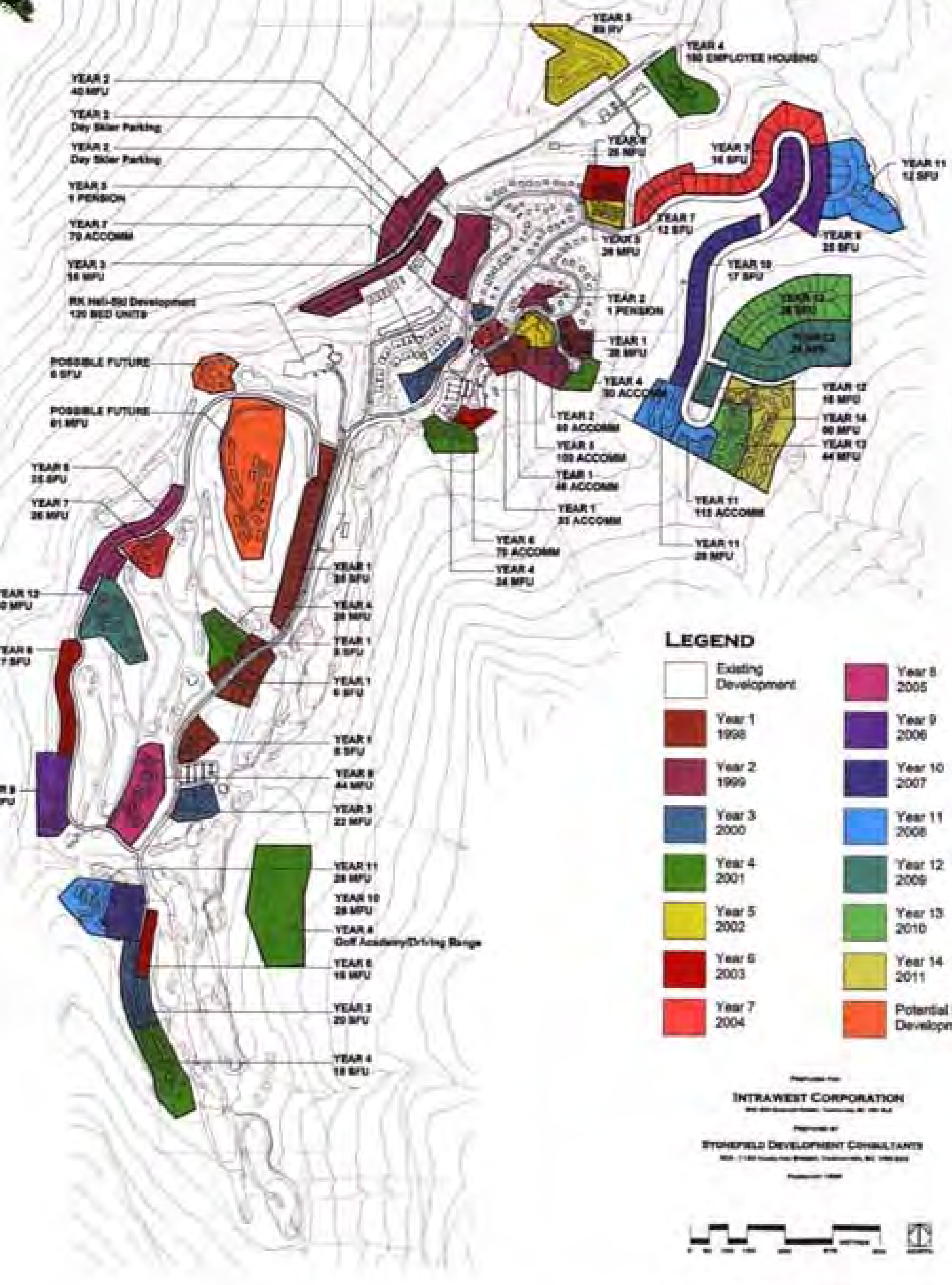
MASTER LAND USE PROGRAMME

TABLE I-1

AREA			ACCOMMODATION/ DWELLING UNITS		BED UNITS
PROJECT	PROJECT LOCATION DESCRIPTION	YEAR	PUBLIC	PRIVATE	
EXISTING DEVELOPMENT					
Horsethief Lodge			83	113	575
Toby Creek Lodge			48	10	174
Pine Inn and Pine Inn Annex			107	0	214
Toby Creek Single Family Subdivision			0	77	462
RK Heli-Ski			40	0	120
Sub-Total Existing Development			**278**	**200**	**1545**
PROPOSED DEVELOPMENT - PANORAMA VILLAGE					
The Hearth Stone		Year 1	0	28	106
Ski Tip Lodge		Year 1	33	0	72
Tamarack Lodge		Year 1	46	0	98
Riverbend		Year 2	0	40	160
Trapper's Crossing		Year 5 & 6	0	52	178
Pension #1		Year 2	1	0	8
Pension #2		Year 3	1	0	8
Building C	Expedition Station	Year 5	109	0	259
Building D	Panorama Springs	Year 2	80	0	195
Building E	Taynton Lodge	Year 4	80	0	195
Building F	across Summit Drive from Tamarack Lodge	Year 7	70	0	171
Building G	Conference Centre Condominium Hotel	Year 6	70	0	171
Building H	Conference Centre Multi-Family	Year 4	0	24	79
Building I	adjacent to skier overpass	Year 3	0	16	53
Employee Dormitory	adjacent to Light Industrial area	Year 4	0	150	0
Recreational Vehicle Park		Year 5	0	89	0
Sub-Total Proposed Development - Panorama Village			**490**	**399**	**1753**

AREA			ACCOMMODATION/ DWELLING UNITS		BED UNITS
PROJECT	PROJECT LOCATION DESCRIPTION	YEAR	PUBLIC	PRIVATE	
PROPOSED DEVELOPMENT - GREYWOLF					
Single Family Area #1	on Greywolf Drive adjacent to 11th hole	Year 1	0	25	150
Single Family Area #2	on Greywolf Drive adjacent to 18th hole	Year 1	0	6	36
Single Family Area #3	on Greywolf Drive adjacent to 18th hole	Year 1	0	6	36
Single Family Area #4	on Greywolf Drive adjacent to 5th hole	Year 3, 4	0	38	228
Single Family Area #5	on loop road adjacent to 7th hole	Year 6	0	17	102
Single Family Area #6	on loop road adjacent to 13th hole	Year 8	0	25	150
Single Family Area #7	on Greywolf Drive fronting "Cliffside"	Year 1	0	5	30
Single Family Area #8	on loop road adjacent to 12th hole	Potential Future	0	6	36
Multi-Family Area #1	on Greywolf Drive adjacent to "Cliffside"	Year 4	0	28	91
Multi-Family Area #2	adjacent to Greywolf Clubhouse	Year 3	0	22	72
Multi-Family Area #3	on knoll adjacent to 8th hole	Year 8	0	44	143
Multi-Family Area #4	on Greywolf Drive adjacent to 6th tee	Year 10, 11	0	52	169
Multi-Family Area #5	on loop road adjacent to 6th green	Year 9	0	20	65
Multi-Family Area #6	on loop road adjacent to 16th green	Year 7	0	28	91
Multi-Family Area #7	on knoll between 7th hole and 14th hole	Year 12	0	40	130
Multi-Family Area #8	Parcel B	Potential Future	0	61	198
Multi-Family Area #9	on Greywolf Drive adjacent to 5th hole	Year 6	0	16	52
Sub-Total Proposed Development - Greywolf			**0**	**439**	**1,779**
PROPOSED DEVELOPMENT - TRAPPER'S RIDGE					
Single Family Area #1	on lower plateau	Year 7, 9 & 11	0	53	318
Single Family Area #2	on lower plateau	Year 10	0	17	102
Single Family Area #3	between lower and upper plateaus	Year 12 & 13	0	52	312
Single Family Area #4	cabins	Year 7	0	12	72
Multi-Family Area #1	below hairpin at upper plateau	Year 11	0	28	91
Multi-Family Area #2	at hairpin at upper plateau	Year 12	0	16	52
Multi-Family Area #3	above hairpin to upper plateau	Year 13 & 14	0	104	338
Condohotel	at hairpin turn to upper plateau	Year 11	115	0	281
Sub-Total Proposed Development - Trapper's Ridge			**115**	**282**	**1,566**
TOTAL DEVELOPMENT			**883**	**1,320**	**6,643**

Development of the total number of units depicted on the Master Plan will follow a phasing strategy which will be implemented over a 12 to 15 year period. Generally, development will be concentrated in the Panorama Village and Greywolf development areas for the first 6 years and gradually diminishing as development of the Trapper's Ridge neighbourhood begins to intensify over the ensuing 8 year horizon.



PANORAMA MOUNTAIN VILLAGE
PHASING PLAN FIGURE I-3

DEVELOPMENT PHASING SCHEDULE

TABLE I-2

Phase Year	Project	Project Location Description	Project Start/ Turn Over	Type and # of Units	
Year 1 1998	The Hearth Stone		Apr 98/Dec 98	TH	28
	Ski Tip Lodge		Apr 97/Jan 98	CH	33
	Tamarack Lodge		Apr 97/May 98	CH	46
	Greywolf, Single Family Area #1	on Greywolf Drive adjacent to 11th hole	Jan 98/Aug 98	SF	25
	Greywolf, Single Family Area #2	on Greywolf Drive adjacent to 18th hole	Jan 98/Aug 98	SF	6
	Greywolf, Single Family Area #3	on Greywolf Drive adjacent to 18th hole	Aug 98/Apr 99	SF	6
	Greywolf, Single Family Area #7	on Greywolf Drive fronting "Cliffside"	Aug 98/Apr 99	SF	5
Year 2 1999	Panorama Springs		Apr 99/Apr 00	CH	80
	Riverbend		Apr 99/Dec 99	TH	40
	Pension Site #1		Apr 99/Dec 99	P	1
Year 3 2000	Greywolf, Single Family Area #4 - Phase 1	on Greywolf Drive adjacent to 5th hole	Apr 00/Aug 00	SF	20
	Greywolf, Multi Family Area #2	adjacent to Greywolf Clubhouse	Apr 00/Dec 00	TH	22
	Pension Site #2		Apr 00/Dec 00	P	1
	Building "I" (Multi-Family Townhouses)	adjacent to Skier Overpass	Apr 00/Dec 00	TH	16
Year 4 2001	Building "E"	Taynton Lodge	Apr 01/Apr 02	CH	80
	Building "H" (Multi-Family Townhouses)	Conference Centre Multi-Family	Apr 01/Dec 01	TH	24
	Greywolf, Multi Family Area #1	on Greywolf Drive, "Cliffside"	Apr 01/Dec 01	TH	28
	Greywolf, Single Family Area #4, Phase 2	on Greywolf Drive adjacent to 5th hole	Apr 01/Aug 01	SF	18
	Employee Dormitory	adjacent to Light Industrial area	Apr 01/Dec 01	EH	150
Year 5 2002	Building "C"	Expedition Station	Apr 02/Apr 03	CH	109
	Trapper's Crossing, Phase 1		Apr 02/Dec 02	TH	26
	Recreational Vehicle Park	adjacent to Light Industrial area	Apr 02/Aug 02	RV	89
Year 6 2003	Building "G"	Conference Centre Condo-Hotel	Apr 03/Apr 04	CH	70
	Trapper's Crossing, Phase 2		Apr 03/Dec 03	TH	26
	Greywolf, Multi Family Area #9	on Greywolf Drive adjacent to 5th hole	Apr 03/Dec 03	TH	16
	Greywolf, Single Family Area #5	On Loop Road adjacent to 7th hole	Apr 03/Aug 03	SF	17
Year 7 2004	Building "F"	across Summit Dr. from Tamarack Lodge	Apr 04/Apr 05	CH	70
	Greywolf, Multi Family Area #6	on Loop Road adjacent to 16th green	Apr 04/Dec 04	TH	28
	Trapper's, Single Family Area #4	cabins	Apr 04/Aug 04	SF	12
	Trapper's, Single Family Area #1, Phase 1	on lower plateau	Apr 04/Aug 04	SF	16
Year 8 2005	Greywolf, Multi Family Area #3	on knoll adjacent to 8th hole	Apr 05/Dec 05	TH	44
	Greywolf, Single Family Area #6	on Loop Road adjacent to 13th hole	Apr 05/Aug 05	SF	25
Year 9 2006	Greywolf, Multi Family Area #5	on Loop Road adjacent to 6th green	Apr 06/Dec 06	TH	20
	Trapper's, Single Family Area #1, Phase 2	on lower plateau	Apr 06/Aug 06	SF	25
Year 10 2007	Greywolf, Multi Family Area #4, Phase 1	on Greywolf Drive adjacent to 6th tee	Apr 07/Dec 07	TH	26
	Trapper's, Single Family Area #2	between lower and upper plateaus	Apr 07/Aug 07	SF	17
Year 11 2008	Greywolf, Multi Family Area #4, Phase 2	on Greywolf Drive adjacent to 6th tee	Apr 08/Dec 08	TH	26
	Trapper's, Single Family Area #1, Phase 3	on lower plateau	Apr 08/Aug 08	SF	12
	Trapper's, Multi Family Area #1	below hairpin turn to upper plateau	Apr 08/Dec 08	TH	28
	Trapper's, Condohotel	at hairpin turn to upper plateau	Apr 08/Apr 09	CH	115
Year 12 2009	Greywolf, Multi Family Area #7	on knoll between 7th hole and 14th hole	Apr 09/ Dec 09	TH	40
	Trapper's, Multi Family Area #2	in hairpin turn to upper plateau	Apr 09/ Dec 09	TH	16
	Trapper's, Single Family Area #3, Phase 1	on upper plateau	Apr 09/ Dec 09	SF	24
Year 13 2010	Trapper's, Multi Family Area #3, Phase 1	above hairpin turn to upper plateau	Apr 10/Dec 10	TH	44
	Trapper's, Single Family Area #3, Phase 2	on upper plateau	Apr 10/Dec 10	SF	28
Year 14 2011	Trapper's, Multi Family Area #3, Phase 2	above hairpin turn to upper plateau	Apr 11/Dec 11	TH	60
Potential Future	Greywolf, Multi Family Area #8	Parcel B		TH	61
	Greywolf, Single Family Area #8	on Loop Road adjacent to 13th hole		SF	6
TOTAL DEVELOPMENT					2,203

The magnitude and diversity of Panorama's recreational resources and associated activity and facility programme have spawned the Recreation Master Plan. The plan provides a format for the organization and staging of activities and related facilities. It also serves as the resort visitor's guide to use of these amenities. The major components of the Recreation Master Plan are:

1. The downhill ski operation and related Mountain Master Plan, depicting phased improvements to the alpine recreation area;

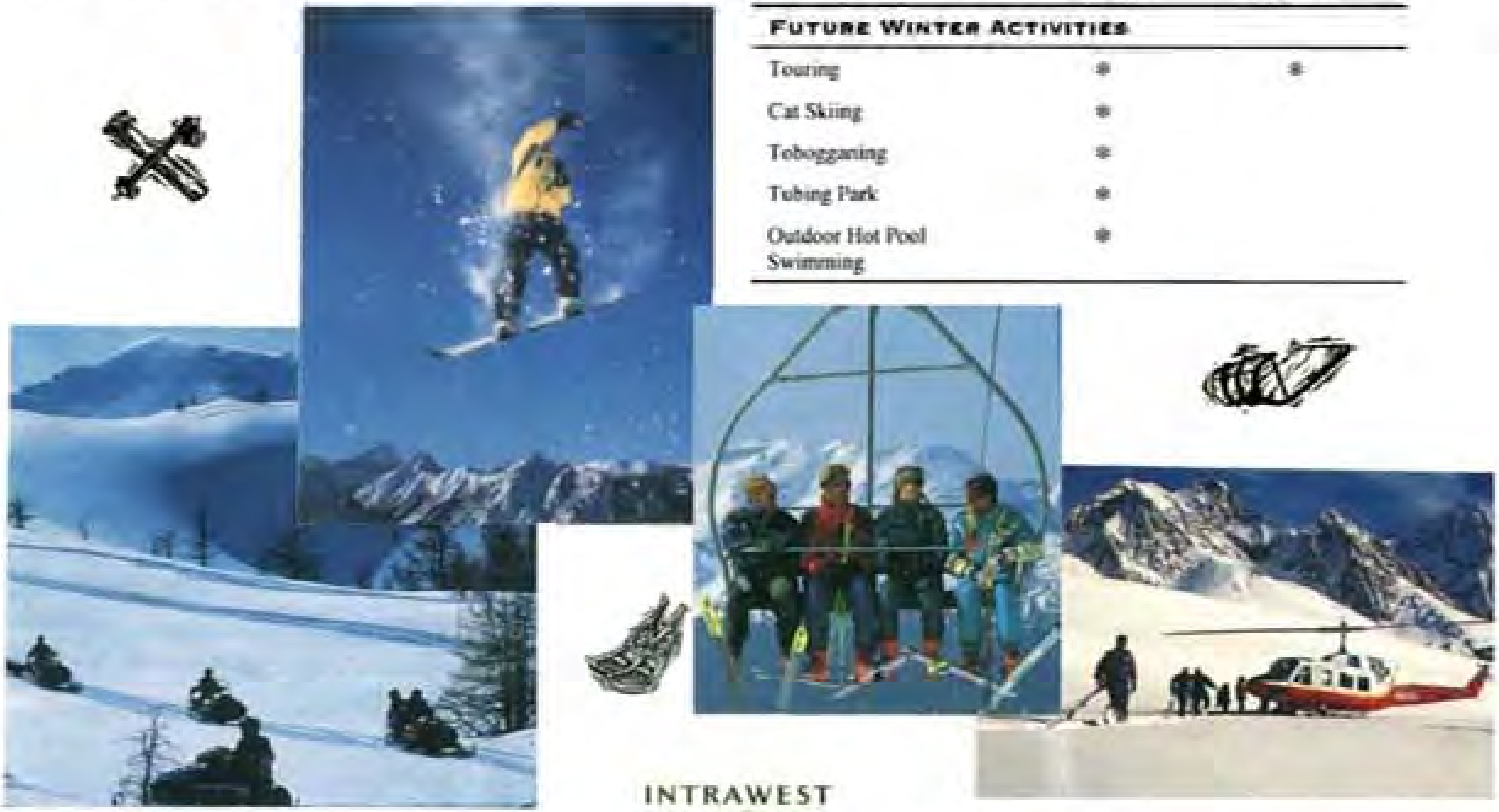
2. The Greywolf Golf Course and golf academy; and the Panorama Springs Aquatic Centre. These recreation amenities anchor winter and summer recreation seasons and thus reinforce year-round use of Panorama Mountain Village.

A summary of the different year-round recreational activities and associated facilities is shown in the accompanying table and Recreation Master Plan.

RECREATION MASTER PLAN PROGRAMME **TABLE I-3**

Activity	Additional Facilities Required	Improvement to Existing Facilities Required
EXISTING WINTER ACTIVITIES		
Alpine Skiing	*	*
Snowboarding	*	*
Nordic Skiing	*	*
Skiing Terrain Parks	*	*
Night Skiing	*	
Heli Skiing		
Snowmobile Tours		
Skating	*	
Sleigh Rides	*	*
Snowshoeing	*	
Winter Parasailing		
Dog Sledding	*	*
Outdoor Hot-Tubs		
Indoor Hot-Tubs		

Activity	Additional Facilities Required	Improvement to Existing Facilities Required
FUTURE WINTER ACTIVITIES		
Touring	*	*
Cat Skiing	*	
Tobogganing	*	
Tubing Park	*	
Outdoor Hot Pool Swimming	*	



RECREATION MASTER PLAN PROGRAMME

TABLE I-3 - CONTINUED

Activity	Additional Facilities Required	Improvement to Existing Facilities Required
EXISTING SUMMER ACTIVITIES		
Hiking	*	*
Mountain Biking	*	*
Horseback Riding	*	*
Equestrian Centre	*	*
Golf	*	*
Golf Mini-Putt	*	*
Rafting		*
Kayaking		
Fishing		
Tennis		*
Basketball		
Multi-Use Courts	*	*
Children's Play Area	*	*
Outdoor Swimming Pool	*	*
Outdoor Hot-Tubs		
Indoor Hot-Tubs		
Rollerblading	*	
Jeep Touring		
FUTURE SUMMER ACTIVITIES		
Golf Driving Range	*	
Golf Academy	*	
Pitch 'n Putt	*	
Heli-Hiking	*	
Panorama Valley Trail	*	
Triple Chair People Mover	*	
Climbing Wall	*	
Volleyball	*	
Water Adventure Park	*	
Fitness Centre	*	
Tot-Lot at Check-In	*	
Tot-Lot at Europa	*	
Fire Pit at Tennis Centre	*	
Conference Facility	*	*
Outdoor Amphitheatre	*	*

RECREATION MASTER PLAN FIGURE I-4

These are the initiatives and the vision which Intrawest has set for Panorama Mountain Village. The Comprehensive Development Plan is the vehicle which will deliver them. Through implementation of the CDP, Intrawest will provide, as promised, *"Access to the Inaccessible."*

ACCESS TO THE INACCESSIBLE

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1.0 INTRODUCTION

1.1 VISION STATEMENT

For the past ten years, Intrawest Corporation has effectively utilized the envisioning process in the planning, design, operation and marketing of its mountain resorts. Envisioning is defined as "the articulation of a shared vision." Envisioning looks five to ten years into the future to imagine how a project will look, feel and behave for all who experience it in the years to come. Envisioning establishes a vocabulary for a project - a common language for the many diverse teams and disciplines that must work together to bring the project to realization. It is a compass that everyone can refer to as work proceeds and as the resort grows. The envisioning process follows six major steps in achieving this end:

A. In the early stage of a project, the many possibilities, opportunities and "what ifs" are considered and explored informally on an ongoing basis for weeks to months, depending on the scale and complexity of the project.

B. The next step involves an envisioning workshop - a *charette* of one to two days in duration - where all members of the project team meet to compare notes and opinions on the project. At Panorama, this took place in the Summer of 1996.

C. The first draft of a Vision Statement is written, drawing on all of the information and feedback which have been gathered. The first draft is circulated for comment and input from the team members.

D. The final draft of the Vision Statement is prepared and distributed, containing a summary of: brief history of the resort; the architectural character of the resort; the ambience of the resort; features that will animate the resort; a possible range of amenities and attractions; distinguishing features of the resort, and; thematic lines and wording that encapsulate all of the above.

E. The Vision Statement might also take the form of a multi-image or video presentation depending on the scale and complexity of the resort. Music, narrative and evocative images are combined in a way to tell a story that appeals to the emotions of the viewer.

F. The Vision Statement will be updated once every 12 to 24 months so that the team members are always drawing on the most current "intelligence." *(May 1998)*

The above envisioning process has articulated the future look, feel and experience of Panorama Mountain Village: *Panorama will become "a mountain village with soul"; Panorama is the end of the road; Panorama is snow play in the extreme; Panorama is adventure beyond skiing; Panorama is adventure in the company of adventurers; Panorama is a year-round base camp; Panorama is pure; Panorama is "The Spirit of the Canadian West."*

These are selected phrases which encapsulate the type of place which Panorama will become. The vision for Panorama is a vision for uniting mountain residences, recreation and respect for the environment in one remarkable natural attraction.

The complete Vision Statement is contained in Appendix 7.1.

A MOUNTAIN VILLAGE WITH SOUL

1.2 GOALS AND OBJECTIVES OF THE COMPREHENSIVE DEVELOPMENT PLAN

The mountain village at Panorama is located in the Purcell Mountain Range, just west of the great Rocky Mountains. Panorama today is the best kept secret among North America's mountain resorts. In 1993, Intrawest Corporation, the premier ski resort owner in North America, purchased Panorama Resort. In the short time since this ownership change, Intrawest has already expanded the mountain's vertical skier access to over 1220 metres (4000 feet), one of the greatest descents in North America, has added 400 hectares (1000 acres) of new ski terrain and a 18-hole championship mountain golf course.

Over the next five to ten years, Intrawest will add more high speed detachable lifts, more than 800 hectares (2000 acres) of new ski terrain, a golf driving range to compliment the existing Greywolf golf facility, a major valley trail network known as "Panorama Valley Trail" linking resort neighbourhoods and amenities, a variety of year-round recreational facilities and, three distinct resort neighbourhoods situated at the mountain base. Among these will be Ski Tip Village, comprising a total of approximately 595 residential accommodation units and approximately 3200 square metres of commercial space.

Intrawest's vision combined with these ambitious initiatives, which have already begun to shape the future of this unique mountain village, must follow a well defined road map which will allow Panorama to reach its destination as "the small jewel hidden in the mountains."

The Comprehensive Development Plan (CDP) for Panorama Mountain Village consists of a three volume set: Vol. I - Land Use Strategy; Vol. II - Technical Background Report, and: Vol. III - Design Standards Manual. Together, these documents serve as the road map which will direct Panorama toward reaching its potential as a year round destination resort. The goals of the CDP are simple:

1. To establish a clear definition of the land use programme for Panorama as well as the organization and configuration of respective land uses and activities within the resort's land base that reflect Intrawest's vision and resort development mandate;

2. To provide the basis for establishment of land use policy governing development of the resort in the form of the Regional District of East Kootenay Official Community Plan;

3. To create a uniform format and document content which synthesizes all previous material and which establishes current and consistent base documentation which will guide all levels of government, as well as the resort Intrawest, with respect to future growth of Panorama;

4. To consolidate the method in which information about resort development is updated and distributed, and;

5. To create a set of uniform and consistent design and development standards which will allow the resort to achieve the required quality of resort experience and image.

In addition to the above goals, the Comprehensive Development Plan fulfils a number of key objectives which will allow Panorama to assert its position within the resort market. These are:

1. Maintaining respect for the spectacular natural environment and the many recreation opportunities which it affords, in order to preserve the very qualities which set Panorama apart in attracting visitors and residents to the area;

2. Providing a range of opportunities which improve local and regional access as well as enjoyment of the natural environment through creation of a diverse recreational and residential development programme;

3. Establishing a basis for integrating older existing resort development with new resort development;

4. Establishing the basis for consolidation of resort infrastructure services under a new authority which will own and operate the resort's infrastructure programme;

5. Satisfy policy and regulatory requirements of: the Regional District of East Kootenay; British Columbia Assets and Land Corporation (B.C.A.L.C.); Ministry of Transportation and Highways; Ministry of Environment, Lands and Parks, and; Ministry of Health.

6. Create a plan which balances economic feasibility of individual resort development projects with the physical opportunities and constraints of the resort lands , and;

7. Establish a plan which represents the ultimate long term vision for Panorama, which when implemented, ensures economic viability of the overall resort operation.

PANORAMA'S SPECTACULAR NATURAL MOUNTAIN ENVIRONMENT

1.3 THE COMPREHENSIVE DEVELOPMENT PLAN FORMAT

The Comprehensive Development Plan (CDP) is contained in a three volume set: Volume I - Land Use Strategy; Volume II - Technical Background Report, and; Volume III - Design Standards Manual. Together, these volumes serve as the master planning and design documents which will guide future development at Panorama. They represent a consolidation of the various physical planning documents for the resort and reflect the new vision which has been established for Panorama by Intrawest. The Comprehensive Development Plan documents contain information about the ultimate location, configuration, form and quality of development proposed, as well as specifications, design standards and methods of installation for the various development components.

VOLUME I
LAND USE STRATEGY

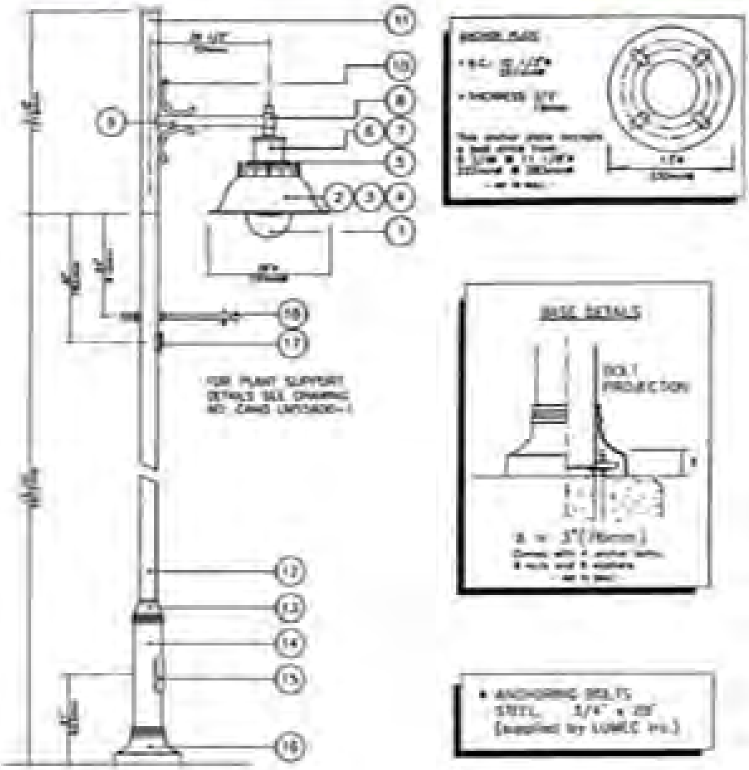
The Land Use Strategy is the primary document which presents an overall summary of technical aspects of the CDP as well as a detailed outline on the overall land use programme and related physical planning principles. Included within this volume, is graphic support in the form of illustrative plans, architectural renderings and character images depicting the scale, distribution and theme of future development at Panorama.

VOLUME II
TECHNICAL BACKGROUND REPORT

The Technical Background Report contains the detailed technical reports upon which resort planning and Official Community Plan policy is based. These reports address biophysical and environmental conditions, archaeological resources, geotechnical and hazard conditions, and visual qualities of the resort land base. In addition, an overall servicing strategy for Panorama has been prepared and is included within the Technical Background Report.

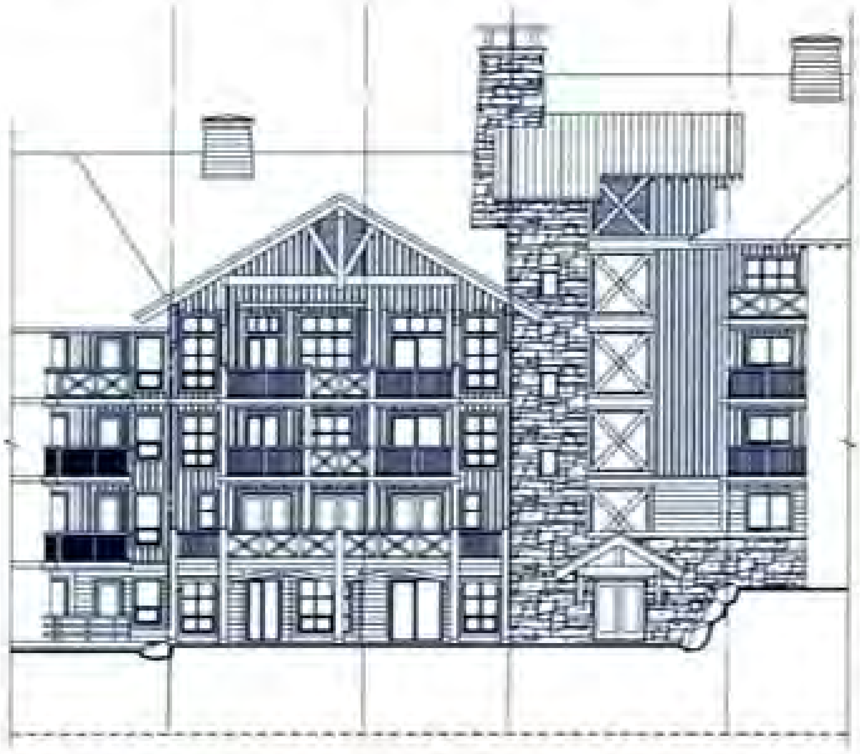
VOLUME III
DESIGN STANDARDS MANUAL

The Design Standards Manual contains information pertaining to implementation of various components which are integral to the Comprehensive Development Plan. This includes: design guidelines for the various resort neighbourhoods; design details related to construction of landscape and other common area site features such as lighting, signage, paving systems; site furnishings, and; standard specifications reinforcing the quality standards to be maintained in the implementation of these resort elements.



STANDARD LIGHTING DETAIL

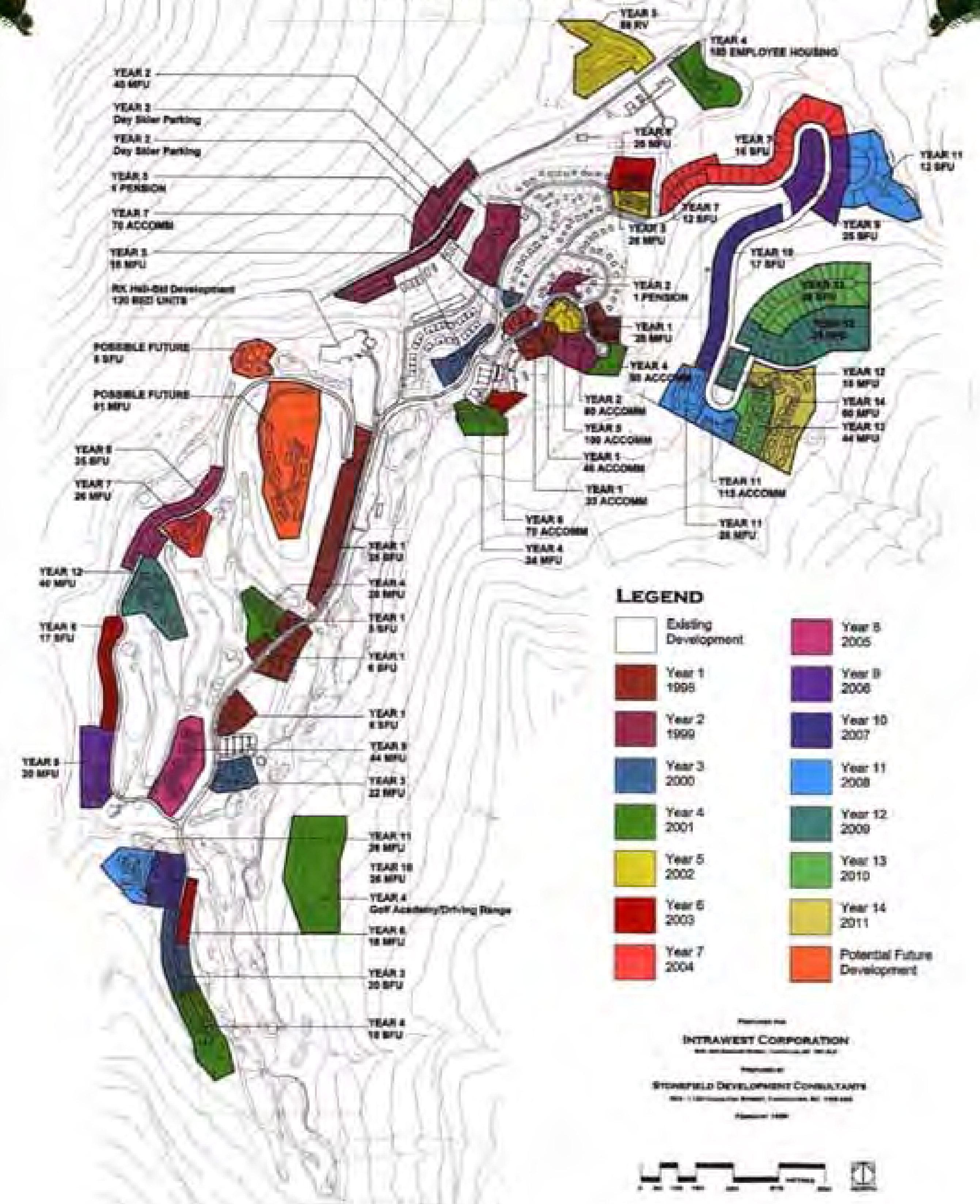
The Comprehensive Development Plan package replaces the previous 1989 Development Plan Amendment which, since that time, has served as the physical planning and programming document for the resort. The CDP establishes a new physical plan and associated design thresholds for Panorama and forms the basis for preparation of the new Panorama Official Community Plan which contains land use policy governing future development of Panorama.



COURT ELEVATION (LOBBY)

The Comprehensive Development Plan establishes a current terms of reference and common strategy which will guide all levels of government with respect to future growth of this mountain village through to "build-out", which is anticipated within the ensuing ten to fifteen year period.

Intrawest has embarked on the realization of a new and powerful vision for Panorama. The Comprehensive Development Plan provides the framework and principles to see that vision through to completion.



PANORAMA MOUNTAIN VILLAGE
PHASING PLAN FIGURE I-3

2.0 BACKGROUND

2.1 REGIONAL AND HISTORICAL CONTEXT

Panorama Mountain Village is located within the Purcell Mountain Range, a mountain range more ancient that the Rockies and one of several north-south mountain ranges which comprise the Columbia Mountains. The Purcells and the Rockies are separated by the Columbia Valley, the headwaters of the mighty Columbia River, the legendary "River of the West".

HISTORICAL PHOTO OF BATHERS AT RADIUM HOT SPRINGS

Panorama is situated approximately 18 kilometres southwest of the District of Invermere and 170 kilometres north of the City of Cranbrook. Calgary, Alberta is approximately 300 kilometres, and Banff approximately 150 kilometres to the northeast. Other nearby settlements include the Village of Radium Hot Springs located approximately 35 kilometres northeast of the resort, Windermere approximately 25 kilometres east and, Fairmont Hot Springs located approximately 50 kilometres southeast of Panorama. Major highway access to Panorama from the east and west is provided by the Trans-Canada Highway. Highways 93 and 95 serve as the main north/south access routes. Direct access to the resort from the surrounding major highway network is provided by Toby Creek Road from its intersection with Highway 93/95 at Athalmer.

HISTORICAL PHOTO OF INVERMERE - SOME18 KM FROM PANORAMA. NOTE TEEPEES ABOVE BLUFFS IN LOCATION OF PRESENT DAY INVERMERE TOWNSITE

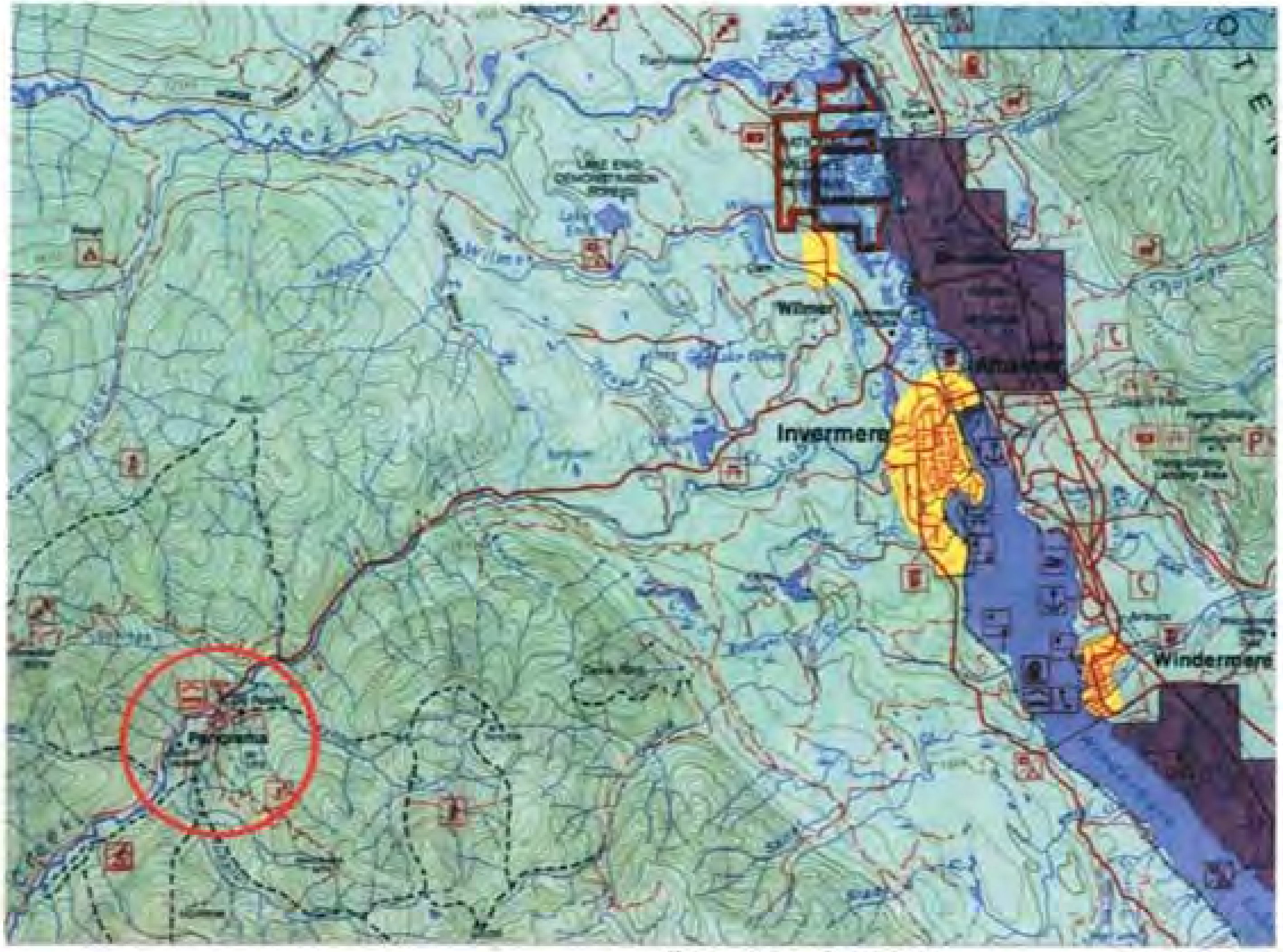
HISTORICAL PHOTO OF RADIUM BUNGALOWS

Over 10,000 years ago, just after the Great Ice Age, the Kootenays, or Ktunaxa, and Kinbasket nations would travel the great Trench hunting big game and catching the multitude of salmon whose sheer numbers once darkened the headwaters of the Columbia. Their heritage is still alive, with many descendants of the Ktunaxa still living in the Valley today.

Mining also made a great contribution to the history and settlement of the East Kootenay area. From the 1860's through to the 1950's, gold, silver, lead and zinc mining operations maintained a presence in the Toby Valley. Evidence of this old mining legacy still exists in the area surrounding the resort with the Paradise Mine site located high up Jackpine Bowl immediately north of the resort, and the old Mineral King mine approximately 14 kilometres northwest of the resort.

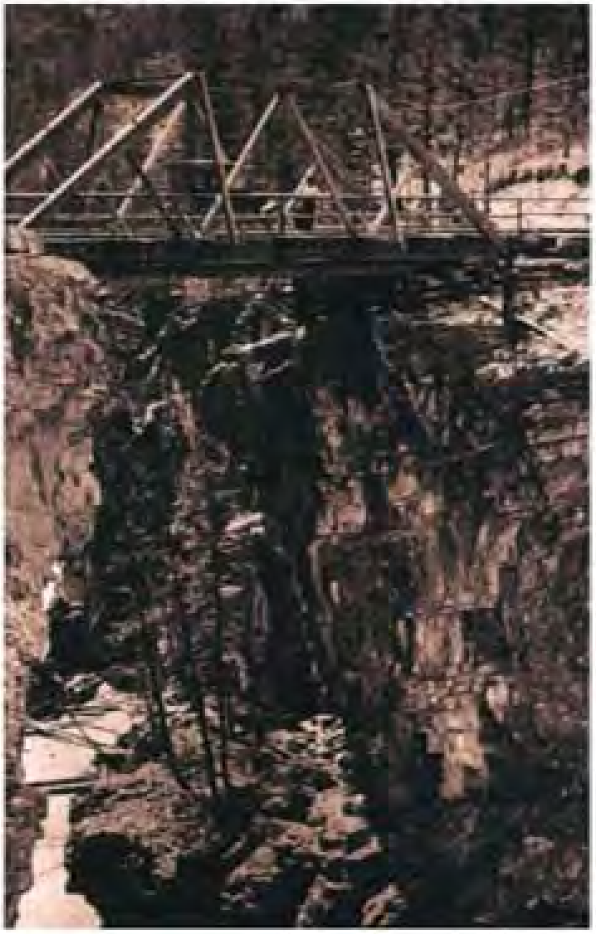
The long, natural corridor leading from Banff to Panorama is a place of unique and awe inspiring mountain peaks, old growth forests of Kootenay National Park and Sinclair Canyon which frames magnificent views of the Columbia Valley. The Panorama Mountain Village Plan Area is situated in Toby Creek Valley boxed by towering mountains in excess of 2500 metres (8200 feet) in elevation.

PROVINCIAL CONTEXT FIGURE 2-1



REGIONAL CONTEXT FIGURE 2-2

HISTORICAL PHOTO OF SINCLAIR CANYON



HISTORICAL PHOTO OF
TOBY CREEK CANYON BRIDGE

Major land features surrounding and within the Panorama Mountain Village Plan Area include: Lillian and Bunyan Lakes situated north of the Plan Area; Castle Rock, just northeast and outside of the Panorama Mountain Village Plan Area; Mt. Taynton, forming the northeast slope of Taynton Creek, which also serves as the northeast boundary of Panorama Mountain Village Plan Area; Mt. Goldie, located just outside of the Plan Area boundary to the east; Mt. Nelson, located outside of the Plan Area due west of the resort and; Panorama Mountain, the resort's central focus within the Panorama Mountain Village Plan Area, having an elevation of approximately 2375 metres (7800 feet) with the base area elevation at approximately 1150 metres (3800 feet).

The regional economy is largely driven by resource development, agriculture and of course tourism. Resource uses include forestry activities - selective logging, commercial thinning, horse logging, Christmas tree growing, wood lots and industrial forestry - as well as mining exploration and development. The predominant agricultural activity consists of ranching related uses. Tourism and commercial recreation play a key role in the economy of the region. This is reflected in the numerous resorts which exist within the Columbia River Valley and significant Protected Areas which have been designated by the provincial government to allow continued use of the natural environment for passive and wilderness related recreation. Major tourist recreational uses include skiing, heli-skiing, ski-touring, mountaineering, golfing, hunting, fishing and guide-outfit tours. The Valley has a year round population of approximately 6000, while the East Kootenays are home to about 60,000. Cranbrook is the transportation, commercial and administrative centre for the region.

Recognition of the recreation potential and natural beauty of the Panorama Mountain Village Plan Area stems back to the 1960's when a local ski club first explored the development of ski facilities at the present resort location. By 1968 Panorama had developed beyond the capabilities and finances of the volunteer ski club. A consortium of twelve local business people took over the operation.

The Panorama Ski Hill Company Ltd. constructed a base lodge, cleared a number of runs and installed a lift to service up to an elevation of 400 metres (1320 feet). Following this phase of construction, the Panorama Ski Hill Company required a further influx of capital to continue with expansion. This lead to the subdivision and sale of 77 residential lots at the base of the mountain. With this capital, additional runs were added and a double chair lift was installed from the top of the existing T-bar to service an additional 483 metres (1593 feet) of elevation.

EARLY PHOTO OF PANORAMA'S BEGINNINGS

VIEW OF ORIGINAL DAY LODGE

In 1978 the Panorama Ski Hill Company sold its interest in Panorama to the Cascade Group. In 1980 the Cascade Group, operating as Panorama Resort Ltd., commissioned a resort planning firm from Aspen, Colorado to prepare a Comprehensive Resort Development Plan to guide Panorama Resort in becoming a year-round destination resort. Utilizing this plan, the Cascade Group continued improvements at Panorama over the following years. This included additional ski runs and lifts, snow-making equipment, condominiums, a hotel and completion of the "East Village" (Toby Creek and Horsethief Lodges) infrastructure system.

Since that time, the recreation potential and vision for the resort have continued to grow in response to preferences and financial capacities of the resort market. In 1993, Intrawest Corporation (and its wholly owned subsidiaries) purchased Panorama Resort with the commitment and capability to realize Panorama's potential as a quality year-round destination resort. Intrawest has initiated significant improvements since purchasing Panorama. These include the addition of new ski terrain and chair lift capacity, a championship 18-hole golf course, a new day lodge, condominium hotels, townhouses, improvements to existing accommodation structures, new single family lot development, day skier parking and outdoor amenity areas.

Various planning documents and agreements have governed the direction and limits of resort growth since 1978. These are discussed further and put into perspective in the following sections. The Comprehensive Development Plan seeks to merge historical policy and resort programme definition into a consolidated and consistent format which will endure through build-out of Panorama Mountain Village.

2.2 LOCAL CONTEXT

The accompanying map (Figure 2-3, Local Context) shows the location of Panorama within the Purcell Mountain Range in context with the District of Invermere and surrounding area. Panorama is located in the Toby Creek Valley approximately 18 kilometres southwest of Invermere on Toby Creek Road.

Present land uses within the Toby Creek Valley and adjacent to the Panorama Mountain Village Plan Area range from natural forested slopes and valleys, to agricultural/ranch type rural uses. Toby Creek Road runs in a southwesterly orientation towards Panorama, crossing Toby Creek near its confluence with the Columbia River and after approximately two kilometres, rises approximately 80 metres to an initial plateau extending approximately five kilometres. This plateau consists mainly of grass range land dotted with a number of rural properties and ranches which are surrounded by indigenous forest, contained by Toby Creek Canyon to the south. The valley narrows and steepens as it extends towards Panorama, creating a natural, unspoiled approach to the resort for the last 10 kilometres.

Along this section of Toby Creek, the road parallels the creek exposing spectacular views of the creek's rugged banks.

Upon reaching the resort, the valley widens substantially, yielding tremendous recreational development potential and offering magnificent vistas of the surrounding mountain peaks. The areas immediately surrounding Panorama are comprised mainly of natural unspoiled wilderness which serves as an ideal backdrop for the nature of this resort. One minor exception to this scene exists approximately three kilometres to the northeast in the form of an extinct mine tailing site bordering Toby Creek Road.

LOCAL CONTEXT **FIGURE 2-3**

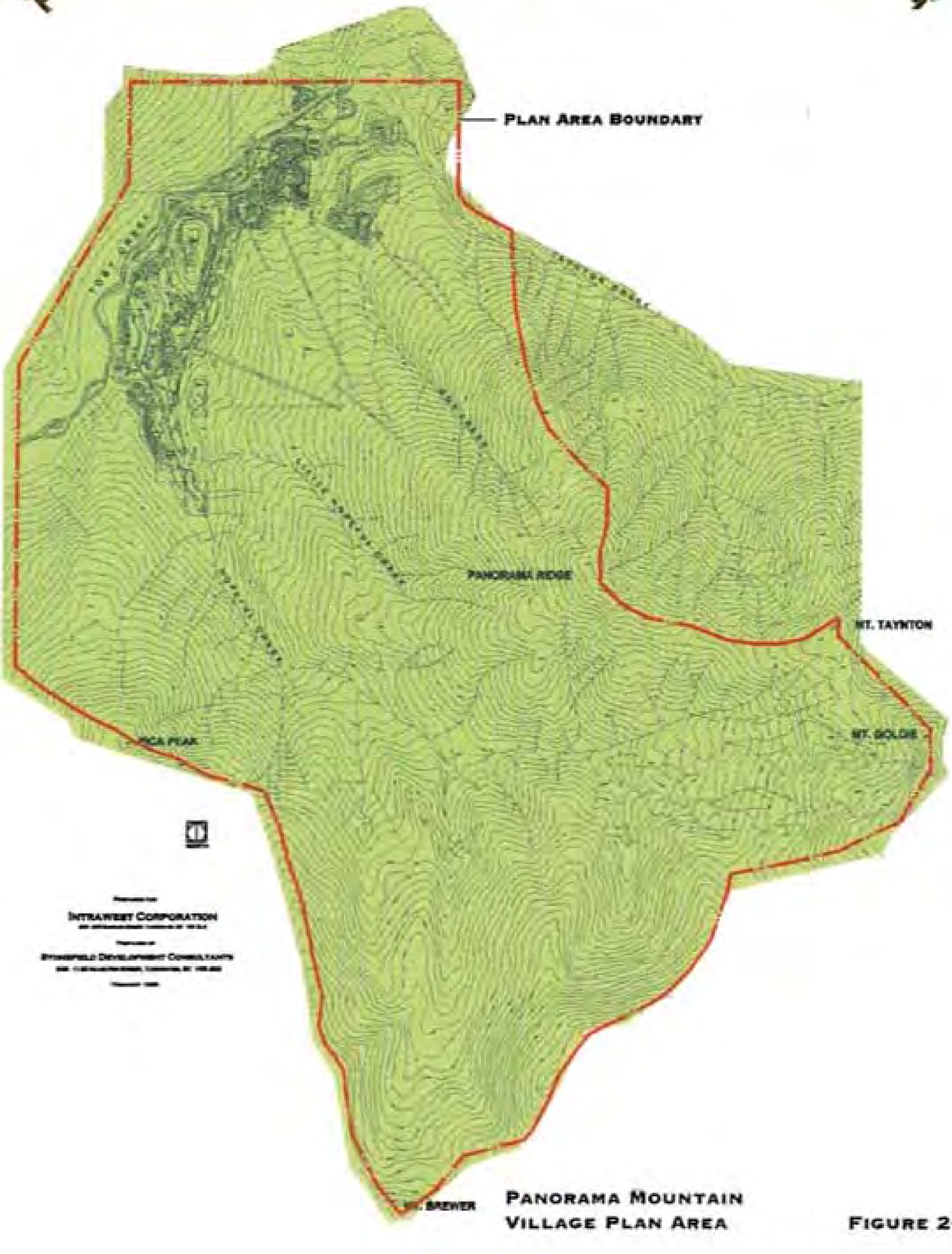
However, this site has been extensively graded and has begun to naturalize. Therefore, it does not diminish the overall natural landscape which predominates the area. The major portion of lands in and surrounding Panorama Mountain Village Plan Area consist of Crown land and as such are unlikely to be developed for intensive uses other than recreational type uses which form part of the Panorama Mountain Village Master Plan.

2.3 PANORAMA MOUNTAIN VILLAGE PLAN AREA

The Panorama Mountain Village Plan Area (See Figure 2-4) covers approximately 3076 hectares (7600 acres) of land. The Panorama Mountain Village Plan Area extends north of Toby Creek to the northern limit of District Lot 4609. Within this northern portion of the Panorama Mountain Village Plan Area, Toby Creek Road, the major resort access route, traverses in a northeast/ southwest orientation. The eastern boundary of the Panorama Mountain Village Plan Area is defined by the western border of the Taynton Creek drainage system. The south and west boundaries are defined by the height of land of the Hopeful Creek watershed. The main land base of the Panorama Mountain Village Plan Area is composed of Crown land within the Windermere Forest District, with only areas proposed for base area development to be converted to private ownership.

The Panorama Mountain Village Plan Area includes two other major drainage systems in addition to Taynton Creek. Toby Creek, which is of regional significance, extends from Toby Glacier, southwest of the resort in the Purcell Wilderness Conservancy, through the northern portion of the Panorama Mountain Village Plan Area in a northeast orientation, terminating at the Columbia River just north of Windermere Lake. On a more site specific scale, Hopeful Creek and the Hopeful Creek Valley extend in a southeast/northwest orientation from Mt. Goldie in the southeast, through the Panorama Mountain Village Plan Area between Panorama Mountain and Pica Peak, and terminating at Toby Creek in the base area.

Intensive resort uses, including golf course development are proposed for the northwest portion of the Panorama Mountain Village Plan Area. Ski facility development is spread across the central portion of the Panorama Mountain Village Plan Area. The southern portion of the Panorama Mountain Village Plan Area will be reserved for possible future expansion of recreation and ski facilities. Within the area designated for intensive use, base area development occupies approximately 237 hectares (586 acres). Base area development consists of a mix of residential and commercial accommodation, day use recreational functions, year-round recreational uses, parking and the resort physical plant. Within and surrounding both major use areas, are significant amounts of preserved natural open space. Included within the base area development is the Greywolf Golf Course and associated residential development southwest of Panorama Village (the resort core). The Greywolf neighbourhood occupies approximately 137.2 hectares (339 acres).



Panorama Mountain
Village Plan Area

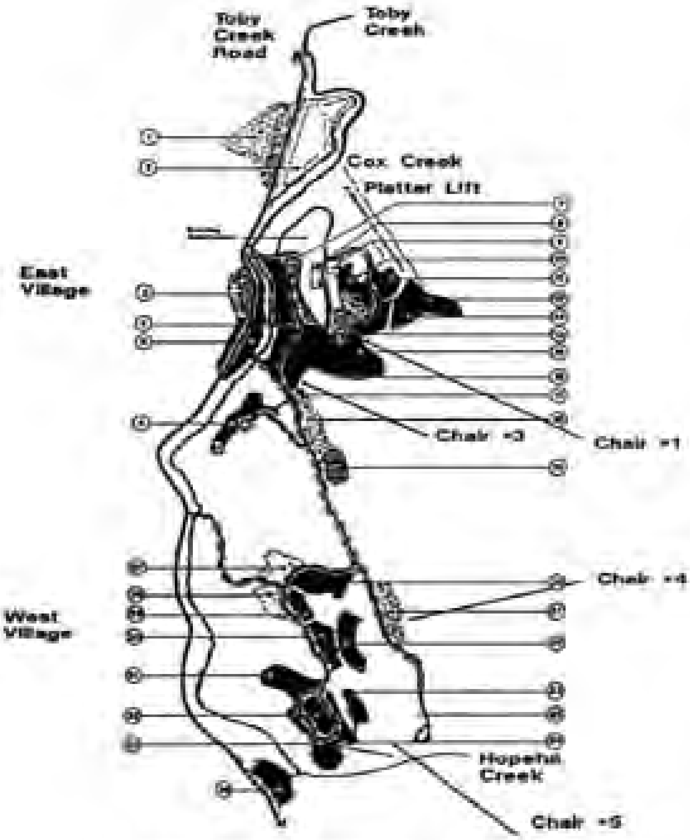
Figure 2-4

2.4 AGREEMENTS AND POLICIES AFFECTING RESORT DEVELOPMENT

There are a number of agreements and policies which affect development within the Panorama Mountain Village Plan Area. Some of these were entered into and are specific to Panorama, others affect all land owners in the area.

2.4.1 PANORAMA RESORT DEVELOPMENT PLAN 1980

The 1980 Panorama Resort Development Plan formed the basis for registration of a Land Use Settlement Contract between the Government of British Columbia and Panorama Resort. The Development Plan described the goals and objectives for Panorama Resort as of the early 1980's together with the design criteria, development programme, village core design, development phasing, services, employment forecast, and social services. The Development Plan dealt primarily with the development of a ski base area which is the current East Village. The Plan foresaw the need for a West Village in the long range to fulfil residential accommodation requirements. The area designated for Greywolf Golf Course/Residential neighbourhood is situated in the location of the West Village.



1980 PANORAMA RESORT MASTER PLAN **FIGURE 2-5**

2.4.2 COMPREHENSIVE SKI DEVELOPMENT AGREEMENT 1983

A Comprehensive Ski Development Agreement was established in 1983 between Panorama Resort Ltd. and the Province of British Columbia. The general goal of this agreement was to encourage ski resort development at Panorama and to allocate lands owned by the Province to this use where in the public interest. Specific objectives to be met in reaching this goal were:

1. To allow Panorama to construct and operate Recreation Improvements in accordance with accepted industry standards that would accommodate approximately 10,198 skiers per day (SCC formula) on the completion of the final phase of development. The development of Panorama should provide a balanced mix of residential and commercial uses which compliment the utilization of Recreation Improvements.

2. To allow the construction of Recreation Improvements in specific stages in accordance with the Panorama Development Plan and the Phasing Schedule.

3. To allow Panorama to purchase land, from the Crown, in stages that correspond to particular

Mountain Phases, for development in accordance with the land uses and densities specified in the Panorama Development Plan.

2.4.3 PANORAMA RESORT DEVELOPMENT PLAN AMENDMENT 1989

The Development Master Plan Amendment completed and approved in 1989 proposed changes to the original approved Master Plan prepared in 1980. The 1989 Plan Amendment makes reference to the 1980 master plan and indicates variances in the development schedule. A revised physical plan was not prepared.

Variances to the 1980 master plan and corresponding development schedule follow: (also see Figure 2-5, 1980 Panorama Master Plan for reference to parcel numbers)

West Village:	The West Village has been deleted and a 18 hole golf course has been substituted in its place.
Parcel 1:	Will not be RV parking as no significant demand for this facility has been demonstrated.
Parcel 3:	Will no longer be Residential Condominiums and Employee Accommodation as Toby Creek Road is to be rerouted through this area. Also, no development is permitted on the north side of Toby Creek Road under the by-laws of the Official Settlement Plan.
Parcel 4:	Will not be entirely Residential Condominiums due to flood plain restrictions.
Parcel 5:	Will not be Residential Condominiums as Toby Creek Road is to be re-routed through this area. Also, no development is permitted on the north side of Toby Creek Road as per the by-laws of the Official Settlement Plan.
Parcel 6:	Will not be the originally planned Residential Hotel as the Heli-plex has been constructed on this parcel.
Parcel 17:	The Day Lodge facility has been relocated to the new day skier parking.
Parcel 19:	The Ski Maintenance area has been relocated to Parcel 18 for better access.
Parcel 25:	The Recreation Parking and Bus Staging Area has been relocated to a designated area between Cox and Taynton Creeks. An interim bus drop off area has been located nearer the existing condominiums in Parcel 4.
Parcel 26:	The Equestrian Centre has been relocated to Parcel 19 for better pedestrian access.

(source: Panorama Resort Development Plan Amendment, 1989)

2.4.4 SKI AREA DEVELOPMENT AGREEMENT 1993

In 1993 Intrawest Corporation (through I.W. Resorts, a wholly owned subsidiary company) purchased Panorama Resort. Part of the purchaser's obligations included an amendment to the 1983 Comprehensive Ski Development Agreement. The amended agreement - Ski Area Development Agreement - was essentially the same document as the 1983 agreement with minor changes reflecting ownership status and responsibilities.

This Comprehensive Development Plan for Panorama replaces all previous plans and in doing so, forms the basis for revising the Ski Area Development Agreement to the current government format which will be known as "The Master Development Agreement." This is subject to adoption of the New Official Community Plan for Panorama, and Provincial approval of the Comprehensive Development Plan and associated Master Plan. It is intended that the Official Community Plan, the three volume Comprehensive Development Plan and the amended "Master" Development Agreement will endure through the ultimate "build-out" of Panorama Mountain Village.

2.4.5 EAST KOOTENAY LAND USE PLAN 1995

The Government of British Columbia delivered a land use plan for the Regional District of East Kootenay in March of 1995. According to the plan it will...

> *"help provide the stability needed to ensure a more sustainable economy and environment for the region. It clearly defines the land available for resource development, as well as the region's important wilderness areas that will be protected for the enjoyment of future generations."*

The plan has identified Resource Development Zones which are available for commercial resource use, Private Settlement Lands and Protected Areas.

The Resource Development Zone is divided into three categories: Integrated Resource Management Zone; Enhanced Resource Management Zone; and Special Resource Management Zone. All of these zones allow a full range of resource extraction with varying amounts of environmental protection required.

The lands surrounding, but outside the boundaries of, the Panorama Mountain Village Plan Area fall within the Integrated Resource Management zone and the Special Resource Management zone. To the south-west of Panorama Plan Area a newly protected area called East Purcells has been created which comprises approximately 34,300 hectares (84,750 acres) as an extension to the existing Purcell Wilderness Conservancy. Development within the Panorama Mountain Village Plan Area occurs, for the most part, on private land and therefore does not fall under the jurisdiction of the East Kootenay Land-Use Plan.

The plan does recognize the importance of tourism and commercial recreation in the local and provincial economy. The seven newly protected areas as well as all other zones are available for recreational activities including heli-skiing, hiking and snowcat skiing.

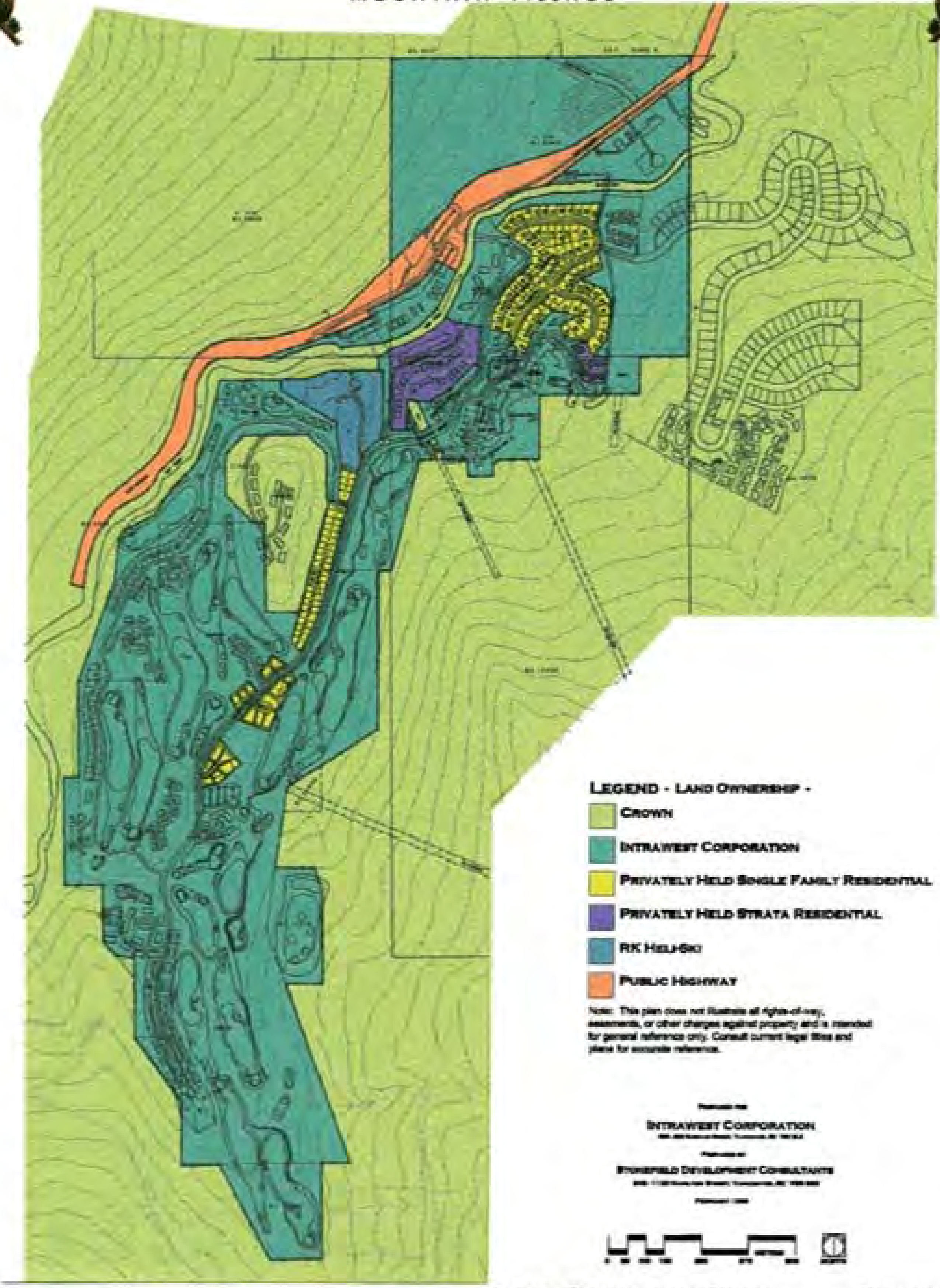
The East-Kootenay Land-Use Plan

EAST KOOTENAY LAND USE PLAN **FIGURE 2-6**

2.5 LAND OWNERSHIP STATUS

Ownership of the land base within the Panorama Mountain Village Plan Area is divided primarily between the Crown and Intrawest Corporation (and its subsidiaries). Generally, Intrawest Corporation owns the lands comprising Panorama Village (formerly Toby Village) base area and Greywolf golf course/residential neighbourhood, while the major areas designated for ski development and other recreational resource uses situated on outlying lands are titled to the Crown. Portions of Crown land will be purchased on a phased basis corresponding with development of Trapper's Ridge and minor portions of future residential development within the Greywolf neighbourhood.

Other land ownership is limited to single family home owners in the Toby Creek single family neighbourhood and the heli-plex which is owned by RK Heli-Ski. There are also a significant number of strata titled condominium units held privately but no land is associated with these strata titles except limited amounts of land immediately adjacent to the buildings which is held as common property. As Panorama continues to grow toward build-out, ownership will continue to change, reflecting the proposed subdivision and parcelization of land corresponding with phases of development.



LAND OWNERSHIP PLAN FIGURE 2-7

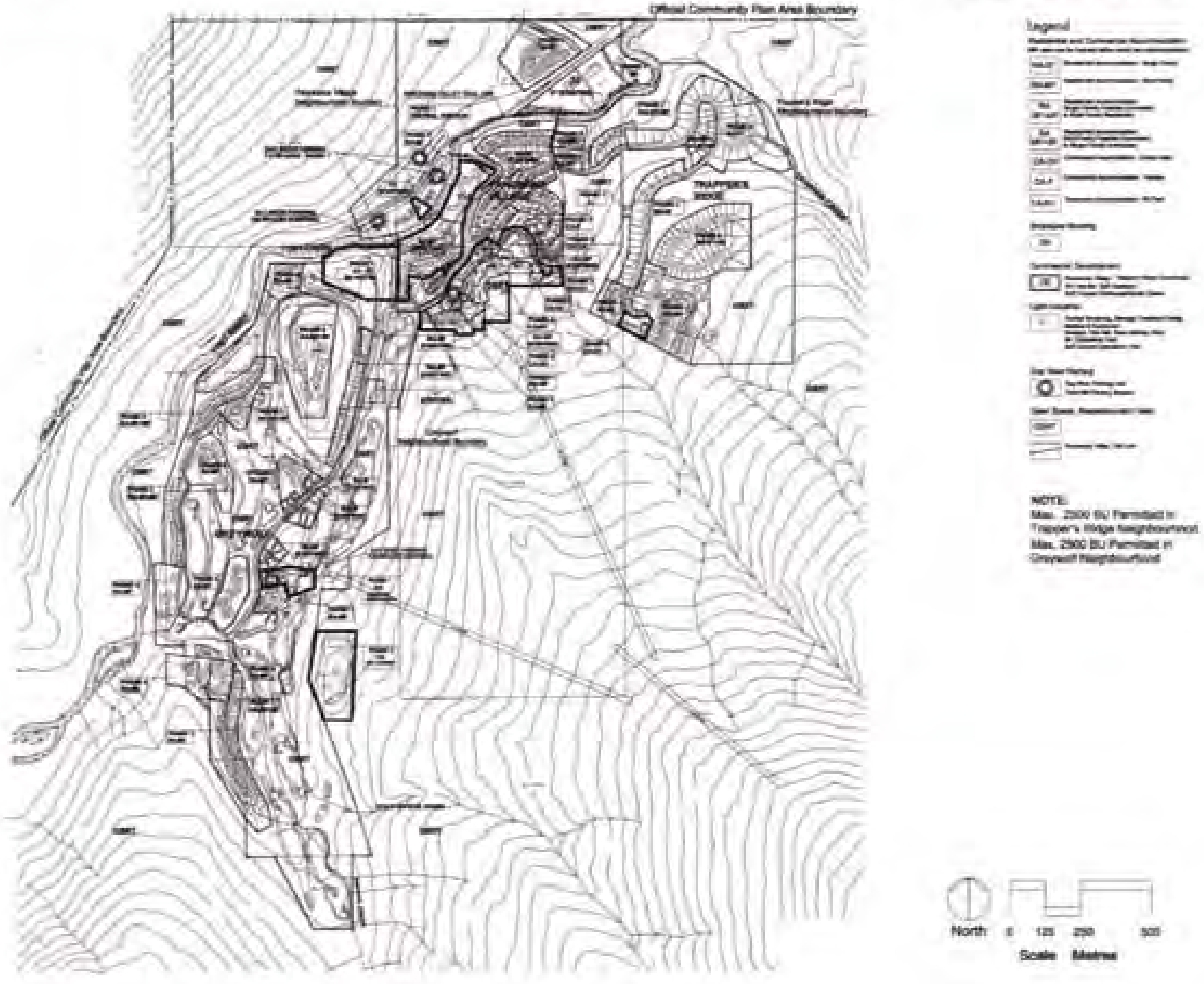
2.6 OFFICIAL COMMUNITY PLAN

The Regional District of East Kootenay has prepared a new Official Community Plan for Panorama Mountain Village corresponding with the land use strategy and development standards set out in the Panorama Comprehensive Development Plan. The Official Community Plan establishes land use policies which are consistent with the technical background data and planning rationale which have lead to the creation of a new physical master plan for Panorama. ***The major goals of the Official Community Plan are:***

1. *To establish a cooperative planning process between governmental agencies and private entities based upon a uniform and consistent set of policy and land use regulatory documents: the Official Community Plan; Comprehensive Development Plan (three volume document); the UCV Zoning Bylaw No. 900, and; Master Development Agreement;*
2. *To provide a context for implementation of policies, expenditure of public funds, disposition of public lands, and to allow controlled and organized change of land uses within the Plan Area;*
3. *To avoid natural hazards, minimize impacts on the natural environment, and to protect visually and ecologically important natural areas, including watersheds, creek riparian zones and wildlife corridors for their social and environmental values to the local and regional community;*
4. *To provide for tourist commercial development and for the commercial needs of resort residents;*
5. *To provide a quality recreation environment which is oriented toward the needs of the regional community, attracts year-round tourism, and in particular, improves access to both structured recreation and natural open space areas;*
6. *To ensure that land is put to aesthetically pleasing and environmentally responsible uses;*
7. *To provide an efficient land use pattern which places resort residents and visitors in close proximity to commercial and recreational facilities;*
8. *To establish a land use programme and associated site planning which respond to the site's natural capabilities and compliments the recreational attractions of the Columbia Valley;*
9. *To create community economic growth that contributes to the public fiscal base and local employment opportunities;*
10. *To ensure that sufficient community services are available to support the pattern of development and to protect the health of the residents and visitors of the resort;*
11. *To ensure the quality of development through implementation of a Development Permit process and appropriate design and development control guidelines;*
12. *To create a high quality residential development for those choosing to purchase a home within the plan area;*
13. *To integrate existing and future development in a manner that allows all interests to have access to the recreational and other resources of the resort;*
14. *To develop road and servicing infrastructure in conjunction with land use planning and to phase construction as required to ensure safe and efficient resort operation, and;*
15. *To encourage a land use pattern that is primarily pedestrian oriented allowing the creation of a destination resort community.*

Regional District of East Kootenay
PANORAMA MOUNTAIN VILLAGE
OFFICIAL COMMUNITY PLAN

Schedules A3 and A4
LAND USE & PHASING



OFFICIAL COMMUNITY PLAN
LAND USE PLAN

FIGURE 2-8

LAND USE DESIGNATIONS

The Official Community Plan defines policies related to the organization and implementation of future resort development at Panorama Mountain Village which are consistent with the land use strategy of the Comprehensive Development Plan based on specific land use designations shown in Table 2 - 1 below:

OCP LAND USE DESIGNATIONS — TABLE 2-1

- **Residential and Commercial Accommodation**
  - *Single Family Residential*
  - *Multi-Family Residential*
  - *Condominium Hotel*
  - *Pension*
  - *Temporary Accommodation - RV Park*
- **Employee Housing**
- **Commercial Development**
  - *Panorama Village*
  - *Trapper's Ridge Condo Hotel*
  - *RK Heli-plex*
  - *Golf Course Clubhouse/Nordic Centre*
- **Light Industrial**
- **Day Skier Parking**
- **Open Space, Recreation and Trails**

The OCP further defines the upper limit of development at Panorama based on total bed unit count and Skier Carrying Capacity (SCC). Presently, there exists a total of approximately 1701 bed units at Panorama. The maximum number of bed units which can be developed under the OCP is 7084. This also corresponds with the limit approved by the Provincial government under the Ski Area (Master) Development Agreement. That means an additional 5383 bed units can be developed in the future. In addition, the OCP acknowledges a Skier Carrying Capacity of 8000, based on a revised Mountain Master Plan (Mountain Master Plan updated 1998) which forms part of the overall Comprehensive Development Plan.

Bed units at Panorama are defined and calculated according to the following criteria as stipulated in the OCP: "**bed unit**" means a measure of a quantity of development intended to reflect servicing and facility requirements for one person, calculated as follows:

BED UNIT CALCULATION — TABLE 2-2

	Unit Size (sq. m.)	Number of Bed Units
Multiple Family Dwelling	0 - 55 55 - 100 100 +	2 3 4
Commercial Accommodation • *Guest Room, Dwelling Unit*	0 - 55 55 - 100 100 +	2 3 4
• *Tourist Pension*	N/A	8
• *Bed and Breakfast*	N/A	6
• *Campsite*	N/A	0
Detached Dwelling	N/A	6
Two Family Dwelling	N/A	12

(NOTE: Bed Units calculated based on the above formula, shall be applied to the resort's total maximum allowable bed units only for "market" type resort development. Bed Units associated with the employee housing located on the designated employee housing site (EH) shown on schedule A3, shall not be calculated into the resort's maximum allowable bed unit total.)

The Official Community Plan permits certain forms of residential development within the Plan Area indicated in Table 2-1 above. The Official Community Plan limits residential development in areas defined as natural hazards and floodplain zones. These areas have been identified based on the technical and environmental background data which was completed for the overall Plan Area. In addition, the OCP designates Development Permit areas with respect to form and character of development as well as protection of the natural environment, its ecosystems and biological diversity.

Commercial uses are encouraged to serve Panorama residents and guests and are to form an integral part of village development. These uses are confined to Panorama Village, RK Heli-plex, the Greywolf clubhouse and Trapper's Ridge condominium hotel.

Industrial development is not permitted within the Plan Area other than to provide for the resort's servicing infrastructure which includes sewage treatment and disposal facilities, snow making, machinery and equipment storage, maintenance functions and materials storage. These uses are to be contained within the Light Industrial zones indicated on OCP schedules.

The OCP encourages development of recreational and trail facilities which will augment year-round use and visitation at the resort and improve human access to the recreational resources of the Panorama Mountain Village Plan Area. Such development must also be balanced with initiatives for preservation and enhancement of the natural environment in order to ensure that the recreational, visual and wilderness values of the Plan Area are protected. This in turn will ensure that these values will continue to serve as valuable resources for the continued success of the resort operation.

The OCP also encourages ongoing development of skiing resources within the areas of designation on Panorama Mountain and Mt. Goldie in accordance with the Mountain Master Plan and the Ski Area (Master) Development Agreement.

2.7 ZONING

Panorama Mountain Village lies within the Regional District of East Kootenay and falls under the authority of the Upper Columbia Valley Zoning Bylaw (Bylaw No. 900). A number of different zoning designations apply to various development parcels within the Panorama Mountain Village Plan Area for both existing and proposed land uses. Land uses which conform to existing zoning designations are summarized as follows and as further illustrated in Figure 2-9, Existing Zoning Designations:

RESORT CORE RES-4

- Ski Tip Day Lodge
- Condominium Hotels including existing Residences at Ski Tip, Tamarack Lodge and Panorama Springs and future proposed buildings.
- The Hearth Stone Townhouses
- Pine Inn and Europa Hotel (Pine Inn Annex)
- Administration Building
- Ski Patrol Building
- Day Skier Parking
- Future Multi-Family

RESORT LODGE RES-3

- Horsethief Lodge
- Toby Creek Lodge
- RK Heli-Ski
- Riverbend Townhouses
- Central Check-In

Resort Recreation RES-2

- Tennis courts north of Toby Creek
- Ski runs and lifts

RESORT RECREATION GOLF RES-2G

- Greywolf golf course residential neighbourhood

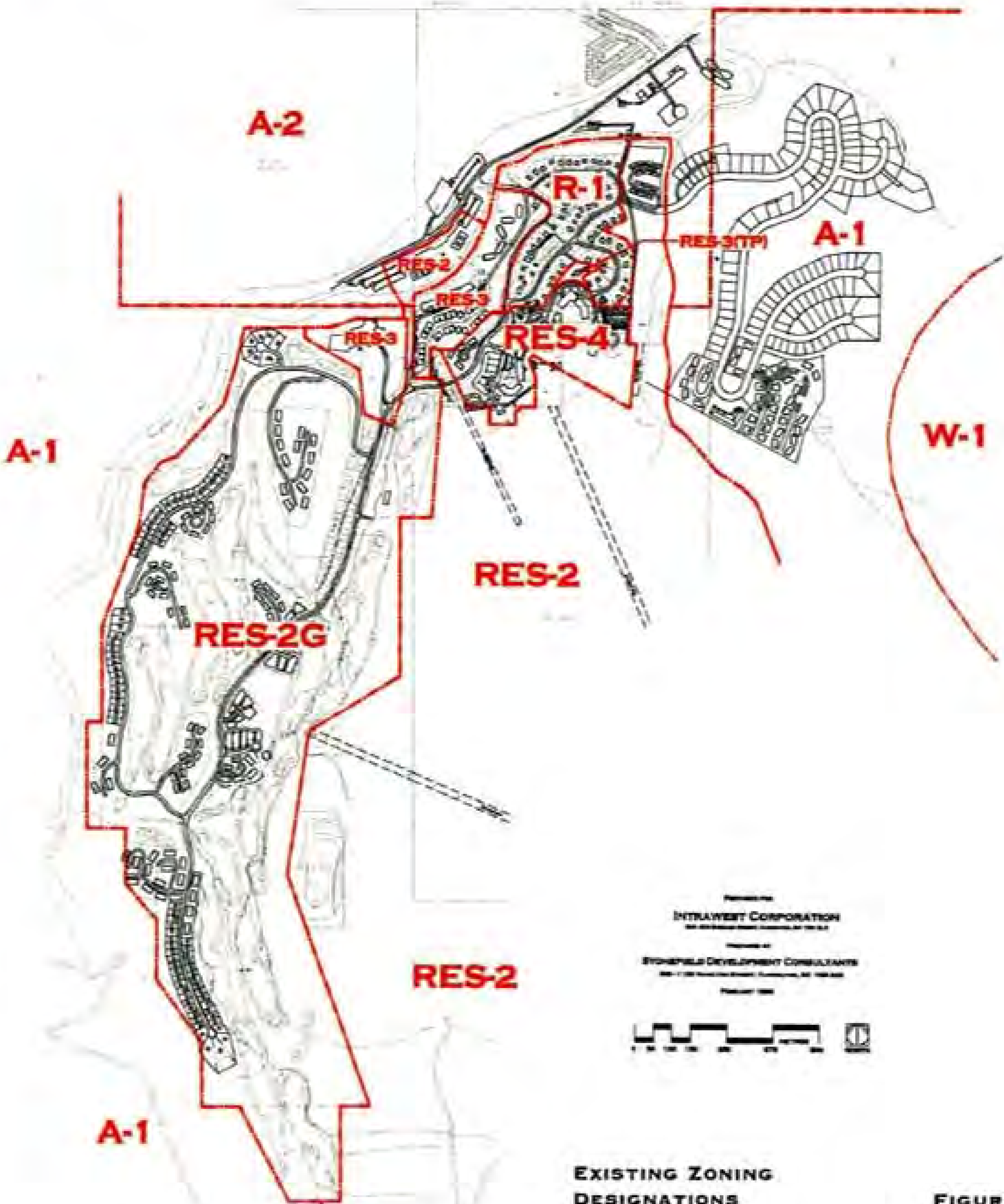
SINGLE FAMILY RESIDENTIAL R-1

- 77 Single family lot subdivision

TOURIST PENSION RES-3(TP)

- 0.4 ha (0.98 acre) Pension site

Areas surrounding the presently developed base lands are zoned Rural Resource (A-1) or Rural Residential (Country) (A-2). Various amendments to the zoning bylaw will be required as development progresses, in order to allow development of the Trapper's Ridge neighbourhood, the future Pension site, additional core development integral to Ski Tip Village and to allow construction of day skier parking in areas previously not contemplated for that use.

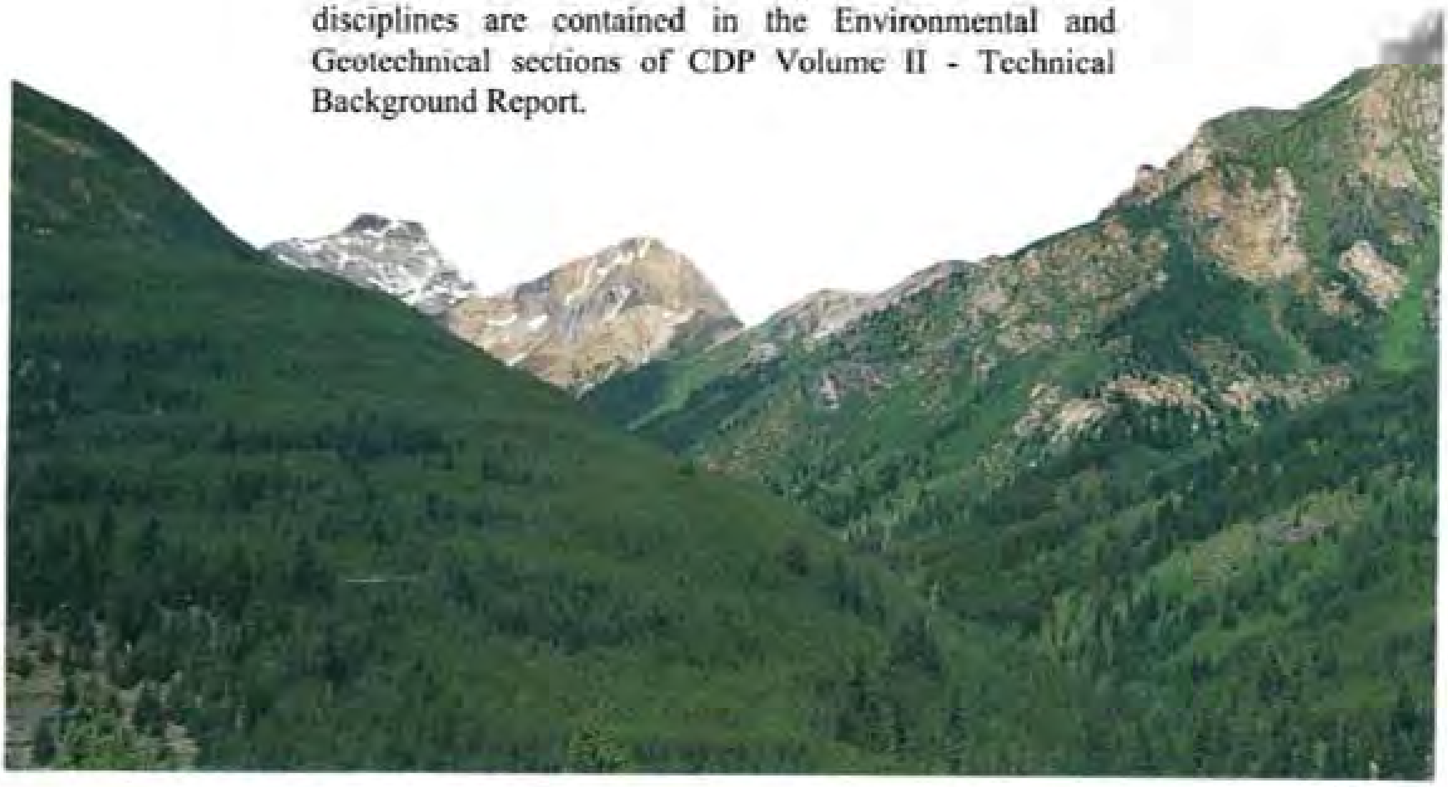


EXISTING ZONING DESIGNATIONS

FIGURE 2-9

3.0 PHYSICAL AND NATURAL ENVIRONMENT

Information in this section is based on an inventory and analysis of existing resort development and natural conditions within the Panorama Mountain Village Plan Area. Data related to the natural environment is derived predominantly from Government of British Columbia mapping, Canada Land Inventory mapping and the *Atlas of British Columbia - People, Environment and Resource Use* by A.L. Farley. As government mapping does not take social and economic factors, present land use and the additive effects of other wildlife species into account, additional research has been conducted into specific areas of concern by: EBA and Golder Associates with respect to geotechnical and related hazard conditions; grizzly bears and ungulates by Purcell River Odysseys Ltd., and; for aquatic habitat, detailed studies were conducted by GeoAlpine Environmental Consultants. Information has been verified and supplemented through extensive on-site field reconnaissance. Individual studies by the various consulting disciplines are contained in the Environmental and Geotechnical sections of CDP Volume II - Technical Background Report.



3.1 CLIMATE

Climate for the Panorama Mountain Village Plan Area can be generalized as having cold winters, warm dry summers and significant amounts of precipitation during winter months in the form of snowfall, especially in higher alpine environments. Due to the topography of the area, temperatures and rainfall vary significantly. The following statistics in Table 3-1 are from the weather station at the west gate of Kootenay National Park and representative of the Panorama area.

CLIMATIC DATA FOR PANORAMA MOUNTAIN VILLAGE AREA TABLE 3-1

TEMPERATURE			
	January	July	Year
Daily Maximum	- 5.9°C	25.2°C	10.6°C
Daily Minimum	- 12.3°C	10.6°C	- 0.1°C
Daily Mean	- 9.0°C	18.0°C	5.3°C

PRECIPITATION			
	January	July	Year
Rainfall	4.6 mm	44.3mm	303.2mm
Snowfall	29.9cm	0.0cm	110.8cm
Precipitation	34.5mm	44.3mm	414.1mm

FROST FREE DAYS		
First Frost (Spring)	Earliest April 29	Latest June 30
Last Frost (Fall)	Earliest Sept 16	Latest October 5
Longest	156 Days - April 30 to October 4	
Shortest	86 Days - June 30 to September 25	
Average	128 Days - May 18 to September 24	

DAYS WITH...			
	January	July	Year
Maximum Temperature >0°C	6	31	288
Measurable Rainfall	2	11	85
Measurable Snowfall	10	0	36
Measurable Precipitation	11	11	36

3.2 TOPOGRAPHY

The Panorama Mountain Village Plan Area falls within the Purcell Mountain Range and as such is characterized by extreme mountainous topography. Elevations within the Plan Area range from approximately 1150 metres (3800 feet) in base area and valley bottom lands, to 2375 metres (7800 feet) at the top of Panorama Mountain. Within this range of topographic conditions exist various benches, alluvial planes associated with creek valleys, fans and terraces along the Toby Creek flood plain. A series of higher peaks including Mt. Goldie reaching 2650 metres (8700 feet) and Mount Brewer at 2750 metres (9022 feet) frame the southern boundary of the Plan Area.

Slope analysis was carried out to determine overall development capabilities of the Panorama Mountain Village Plan Area for both base area development as well as ski terrain capacity - see fiigure 3 - 1. Slope categories were defined as follows relative to their degree of potential constraint to base area development: 0-8% - low constraint; 8-25% - low to medium constraint; 25-45% - medium to high constraint, and; greater than 45% - high to severe constraint.

This data was utilized in locating and organizing various land uses within the Plan Area. From the analysis it became evident that the significant vertical elevation and steeper slopes are obviously well suited to development of alpine ski facilities which are the primary focus of the resort. Also evident were various lower benches and alluvial planes or creek valley areas, offering potential for development of diverse forms of recreation and resort accommodation, and steeper sloped areas, largely bordering major creek channels (Hopeful Creek, Toby Creek, Taynton Creek) or sheer rock bluffs, which constitute non-developable or environmental preservation zones.

SLOPE ANALYSIS **FIGURE 3-1**

The analysis of topographic conditions yielded specific areas which have been proposed for base area development. These generally represent the least constrained topography within the overall Plan Area.

Four main development zones evolved:

1. Toby Creek Corridor
2. Hopeful Creek Valley
3. Panorama Benchlands
4. Cox/Taynton Benchlands

The Toby Creek corridor extends generally in a north/south orientation through the base area lands. At various points along this length, alluvial terraces offer favourable topographic conditions. This was confirmed during the original planning process for Panorama and hence development of the Toby Creek Area took place with construction of Toby Creek and Horsethief Lodges, the lower single family subdivision, tennis courts and community swimming pool facility. Adjacent to these existing developments, the Riverbend townhouses, the main day skier parking lots and RV park are proposed. The main entrance to Panorama is also located within the Toby Creek corridor off Toby Creek Road.

Hopeful Creek valley was also identified in earlier planning studies. The area was originally planned as the "West Village" and in 1989 this was substituted with an 18-hole golf course. Topographic analysis conducted as part of the Comprehensive Development Plan and Mountain Master Plan process has established Hopeful Creek valley as the site of the Greywolf golf course residential neighbourhood. The Greywolf golf course neighbourhood and the Sunbird day skier base are situated in this relatively flat valley bottom which is contained by steep slopes of the surrounding mountains and the steep banks of Toby Creek corridor.

Panorama Benchlands are situated at the base of Panorama Mountain at elevations ranging between 1135 metres and 1205 metres. The topographic configuration is well suited as the resort's major ski base area. Day skier parking, skier day lodge, major resort accommodation, and related commercial and administrative functions contained with Ski Tip Village are all uses which are contained within this topographic zone.

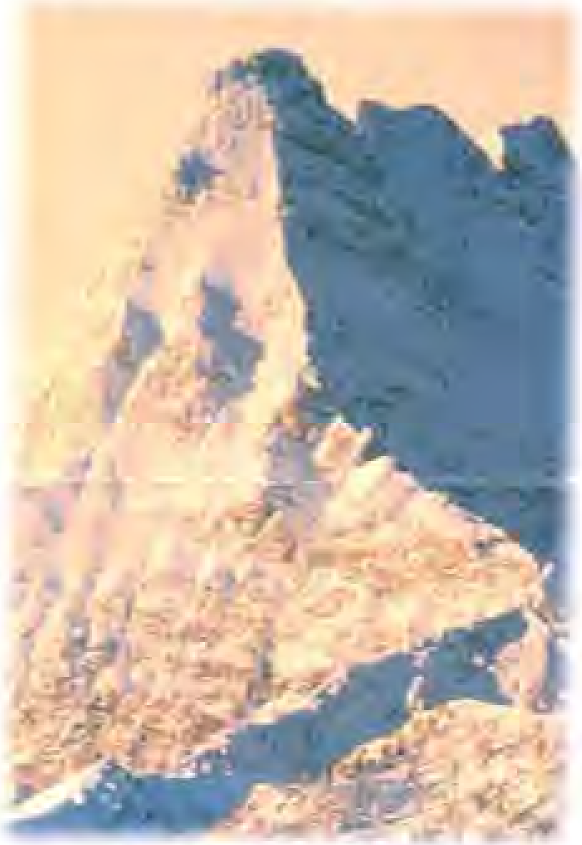
Cox/Taynton Benchlands consist of well defined benches which extend between these two creek corridors and up the base of Panorama Mountain. Two main benches exist: a lower bench located just above the steep banks of Toby Creek at elevations spanning between 1140 metres and 1220 metres, and; an upper bench bordering the future Trapper's Chair lift and ski run. This bench is situated at elevations ranging between 1260 metres and 1320 metres. The Cox/Taynton Benchlands yield topography suitable for development of ski-in/ski-out residential accommodation and thus have been proposed as the trapper's Ridge neighbourhood.

The remainder of the Panorama Mountain Village area is mountainous with few other significant flat areas. The area, including ski runs and outlying Crown land, ranges in elevation from a low of approximately 1150 metres elevation (3800 feet) on the edge of Toby Creek adjacent to the wastewater treatment plant to a high of 2375 metres (7800 feet) at the peak of Panorama Mountain.

3.3 GEOLOGY AND SOILS

Panorama Mountain Village is located in the Purcell Mountains, a mountain range which is 300 kilometres in length and up to 80 kilometres in width and which is part of the Columbia Mountains. The Purcell Mountains include some extremely high and rugged mountainous country, the highest peak, Mount Farnham, has an elevation of 3457 metres (11342 feet). By comparison, Panorama Mountain has an elevation of 2375 metres (7800 feet) and Mt. Goldie, the highest peak in the Panorama Mountain Village Plan Area, has an elevation of 2650 metres (8700 feet).

The Purcell Mountains are underlain by sedimentary and metamorphic rocks, largely of Proterozoic age but extending upward into the Lower Palaeozoic, which are intruded with batholiths of granite rocks. The sedimentary and metamorphic rocks comprise thick quartzite, argillaceous quartzite, argillite, and limestone members. The rocks are involved in overturned and frequently complex folds about axis which regionally have an arcuate plan.



MONUMENT PEAK - ONE OF THE MAJOR MOUNTAIN PEAKS LOCATED JUST SOUTH-WEST OF PANORAMA

The highest peaks in the Purcell Mountains projected above the Pleistocene ice-sheet, whose level lay at about 2130 metres (7000 feet) at Panorama. The peaks were shaped by intense cirque glaciation, and active cirque glaciers are still present on some of the highest peaks. The summits are separated by deep, steep-sided glaciated valleys, and interconnecting ridges are few and mostly serrate. Glacial striations, erratics and glacial debris occur at all elevations up to 2450 metres (8000 feet). Striations and roches moutonnées and similar phenomena indicate that the ice sheet moved in a generally southerly direction, but with a tendency to follow the main topographical features such as the Purcell Trench. The land surface overlain by the ice was one of high relief, with the principle ridges and valleys in much the same positions as they are today. As the ice thinned down the underlying topography assumed control and a stage of valley and alpine glaciation ensued. During this stage the ice sheet broke up into lobes which flowed down the principle valleys.

The Panorama Mountain Village Plan Area consists primarily of fluvial materials as deposited by rivers and streams. This includes sand, gravel and bouldery gravel in floodplains, alluvial fans and river terraces. Gravels are typically subangular to subrounded, moderately to poorly sorted and include blocks and boulders. Equally found within the Panorama Resort Plan Area is colluvium material deposited as a result of downslope movement from rockfalls, debris flows and rock creep. This colluvial material includes loosely packed, coarse, angular material with minor interstitial sand and silt in talus slopes, avalanche cones, rockslide debris and mantles of shattered bedrock as well as denser debris deposits in colluvial cones and fans. Outcrops of bedrock are found to a lesser extent throughout the site.

3.4 HYDROLOGY

There are numerous streams and creeks which occur within the Panorama Mountain Village Plan Area. Five of these creeks are considered to be significant watercourses, the remainder are tributaries to these creeks or small unnamed watercourses which are often ephemeral in nature.

TOBY CREEK

Toby Creek, a tributary of the Columbia River, is a fairly large system with a drainage area of about 684 square kilometres. Only a small portion of Toby Creek, approximately 4.5 kilometres, passes through the plan area. This section is contained within Reach 5 of the creek and may be characterized as follows:

TOBY CREEK VIEWING SOUTH-WEST FROM PANORAMA DRIVE BRIDGE TOWARDS PEDESTRIAN BRIDGE.

Reach 5 of Toby Creek is approximately 9.8 kilometres in length with an average gradient of 0.9%. The substrate is predominantly boulder (63%), with approximately 12% gravel. Flows are characterized as riffle (80%) with lesser amounts of run (20%). Total cover is estimated at 6%, primarily provided by boulder cover. On August 18, 1992 the average velocity was 1.9 m/s, with a water temperature of 10°C and visibility of about 10 cm (Fielden et al, 1993). During the site visit on May 7, 1996 the water temperature was found to be 2°C, with water clarity greater than 1.0 metre.

HOPEFUL CREEK

Hopeful Creek, a tributary of Toby Creek, is contained entirely within the Plan Area. From its confluence with Toby Creek, Hopeful Creek extends approximately 3.5 kilometres to a point where it separates into numerous small tributaries.

Observations during site inspections carried out on May 7/8, 1998 provided the following information: Reach 1 of Hopeful Creek extends from the confluence with Toby Creek upstream 316 metres to the main access bridge. At its confluence with Toby Creek, Hopeful Creek has a gradient of 24% for approximately 10 metres. The channel width during this short section is 2.5 metres with predominantly riffle flow over a cobbled boulder substrate. For the remainder of the reach the gradient ranged from 11 to 16% with a mean of six measurements of 15%. The average channel width is 3.9 metres with a wetted width of 2.1 metres. The channel is confined in a ravine ranging from 30 metres deep and 80 metres across near its mouth to 15 metres deep and 60 metres across at its upstream reach break. The flow was categorized as 70% riffle, 20% pool and 10% run over a gravely cobble substrate. Average maximum riffle depth was 15 cm with average maximum pool depth of 30 cm. Discharge measurements recorded 72 metres upstream of the mouth determined a surface flow of 0.17 m^3/s. The water temperature was 2°C with water clarity greater than 1.0 metre (May 7, 1996). There was some side channel development. Stream cover was estimated at 40%, being mainly provided by overstream vegetation, large organic debris and deep pool with lesser amounts of cutbank and a trace of boulder cover. Crown closure was estimated at 5%. Riparian vegetation consisted of a tree layer of trembling aspen, larch, lodge pole pine and Douglas fir, with a shrub layer of red-osier dogwood and alder. Ground cover was hard to assess due to the patchy snow cover at the time of the site visit.

Reach 2 of Hopeful Creek extends from the upstream boundary of Reach 1 approximately 1220 metres to the 1300 metre elevation contour. Within this reach Hopeful Creek has an average gradient of 10%, ranging from 5% to 15%. The average channel width is 3.4 metres, with a wetted width of 2.6 metres. The channel is occasionally confined by the mountain sides. The flow was categorized as 60% riffle, 30% pool and 10% run over a substrate ranging from predominantly gravels to gravelly

0.13m³/s near the upstream reach break. Average maximum riffle depth was 20 cm with average maximum pool depth of 40 cm. There was some side channel development. The waters were clear, with a temperature of 0.5°C. (May 7 & 8, 1996). As with the lower reach stream cover was estimated at 40%, being mainly provided by overstream vegetation, large organic debris and deep pool with lesser amounts of cutback. Boulder cover became more predominant in the upper reach. Crown closure ranged from 10 to 20%. Riparian vegetation consisted of a tree layer of trembling aspen, larch, lodge pole pine and Douglas fir, with a shrub layer of red-osier dogwood and alder. Ground cover was difficult to assess due to the patchy snow cover on site at the time of the visit.

HOPEFUL CREEK ADJACENT TO HOLE #5

LITTLE HOPEFUL CREEK

Little Hopeful Creek lies entirely within the plan area boundary. It has been divided into three reaches which cover the creek from its confluence with Toby Creek to its source on Panorama Mountain.

Reach 1 of Little Hopeful Creek extends from the creeks confluence with Toby Creek upstream 900 metres to the settling ponds excavated during golf course construction activities in 1989. The first 50 metres is somewhat steeper than the remaining portion of this reach, with an average gradient of 15% compared to the reach average of 4%. This first section has a channel width of 3 metres with a wetted width of 2 metres, confined in a small ravine. Flows were predominantly riffle with a small amount of plunge pool. The remainder of the reach has flows characterized as 50% riffle, 40% run and 10% pool. The average channel width was 1.7 metres with a wetted width of 1.4 metres. Total cover was estimated at 10%, provided by overstream vegetation and lesser amounts of cutbanks and pool cover. There was only a trace of large organic debris. Bed material is predominantly gravels and fines, with only a trace of small cobble. The stream was occasionally confined within a ravine. The water temperature was 5°C and the turbidity was less than 10cm visibility. Flows were high, overflowing the banks in locales. Discharge was measured at 0.03m³/s. Riparian vegetation consisted of a tree layer of trembling aspen, spruce, lodge pole pine and Douglas fir (crown closure 20%), with a sparse shrub layer of rose, willow, red-osier dogwood and alder. Ground cover was difficult to assess due to patchy snow cover. There are several culvert crossings within the first reach of Little Hopeful Creek. A settling pond built during golf course construction in 1989 marks the end of the first reach. Although these ponds have no culverts or surface outflow water can percolate through the porous cobble material that makes up the downstream end of the ponds.

Reach 2 extends from the settling ponds upstream 1230 metres. This reach has been significantly altered by past golf course construction activities. At its downstream end the creek consists of two settling ponds, each approximately 25 metres long and 15 metres wide. Through these ponds to the upstream limit of the reach the entire channel has been excavated to lower its bed. Little remains of the native riparian vegetation in this reach. For the most part tree, shrub and groundcover is non-existent along the channel. Substrate is comprised of gravel and fines with a small component of cobble. The overall gradient is about 8%. Flows are limited to riffle within the ditch. Average water depth is 10 cm within the 2 metre deep ditch. The measured discharge 340 metres upstream of the lower reach break was 0.03m³/s.

DRAINAGE IMPROVEMENTS TO LITTLE HOPEFUL CREEK IN CONJUNCTION WITH GOLF COURSE CONSTRUCTION.

Reach 3 extends from the upper limit of Reach 2 to Little Hopeful Creeks source on Panorama Mountain. This reach rapidly steepens to average gradients of 25%. The one metre wide channel (wetted width of 0.5 metres) is entrenched within a steep banked ravine. Substrate is well graded and almost equal parts larges, gravels and fines. The canopy cover was estimated at 25%, comprised almost exclusively of lodgepole pine. (Source: *Bio-Inventory of Hopeful Creek, Near Invermere, B.C., Panorama Resort*, GeoAlpine Environmental Consulting, May 1996)

COX CREEK

Cox Creek drains the northwest slope of Panorama Mountain. It has a total length of 3.4 kilometres with an overall gradient of 27%. The creek flows northwest from its headwaters at the 2060 metre level to its confluence with Toby Creek at approximately 1130 metre elevation. The watershed has an area of approximately 2.1 km². Cox Creek was realigned in the past in its lower reaches. Cox Creek's discharge was measured as 0.03 m³/s on June 27, 1997.

TAYNTON CREEK

The Taynton Creek watershed/drainage covers an area of approximately 15.3 km². The creek flows northwest for about 7 kilometres from its headwaters above the 2,350 metre elevation level to it confluence with Toby Creek at approximately 1,140 metre elevation. Taynton Creek has a gradient averaging 17.4% over its entire length. The creek rises steeply from its confluence with Toby Creek for approximately 70 to 100 metres, with gradients measured at 22 to 26%, before levelling off in its mid reaches for about 4.3 kilometres, to gradients ranging from 9 to 16%, averaging 14.7%. Within its upper reaches the gradient of Taynton Creek ranges from 20 to 50%. The discharge from its drainage was measured at 0.48 m^3/s near its mouth on June 23, 1997. (Source: *Trapper's Ridge, Initial Environmental Review*, GeoAlpine Environmental Consulting, March 1998)

The CDP planning process considered the conditions associated with these creek systems as well as the Upper Columbia Valley Floodplain Management bylaw in the location and organization of various land uses within the Plan Area. An example of the CDP approach is in its response to Hopeful Creek corridor. Previous site construction activities associated primarily with early development of the golf course in 1989 altered the natural conditions associated with Hopeful Creek, however recent completion of the golf course has significantly improved the creek's environmental qualities and hydraulic functions. Appropriate environmental and floodplain setbacks have been incorporated into the physical planning of the resort. Hopeful and Little Hopeful Creeks now sustain populations of Cutthroat and Bull Trout.

3.5 NATURAL HAZARDS

The Panorama Mountain Village Plan Area is not included within the limited area mapped for natural geological hazards by the B.C. Ministry of Highways.

Investigations into natural hazards were conducted during preparation of the Greywolf Golf Course Neighbourhood proposal and for other areas of development. As such, detailed information regarding natural hazards exists only for portions of the Plan Area, primarily areas of existing or proposed development, while areas which lie outside the boundaries of proposed resort development have not been extensively analysed.

AVALANCHE TRACKS

Several avalanche tracks were observed along the northwest Toby Creek Valley slope from 0.8 km to 1.5 km upstream of the existing bridge. None of these avalanche tracks pose any danger to existing or proposed development.

LANDSLIDE SCARPS

Arcuate features with vertical displacements were observed along Toby Creek upstream from the existing bridge. These are interpreted to be landslide scarps. Slope undercutting by Toby Creek along the outside channel bends is considered to be an important contributing factor. These features are located on the west side of Toby Creek outside of areas of existing or proposed development.

A "slide runout" zone has been identified upslope of the 5th Fairway single family residential cluster in the Greywolf neighbourhood. Detailed geotechnical investigations must be carried out and mitigative measures implemented prior to development of this residential enclave.

CONE FANS

Debris cone fans were observed where tributary creeks enter both Toby Creek and Hopeful Creek. The cone fan deposits are generally well-drained internally.

TERRACE

Terraces have developed along both sides of the Toby Creek floodplain. The terraces are typically composed of stratified sand and gravel. It isexpected that the local groundwater table generally reflects the water level in the adjacent creek. These areas do not pose a constraint to existing or proposed development.

MUDFLOW

The upper part of Hopeful Creek valley bottom (south end) is interpreted as a mudflow. Prior to construction of the Greywolf golf course, the mudflow ground surface sloped uniformly downstream parallel to the creek. Bifurcated drainage channels traversed across the mudflow. The groundwater table in the Hopeful Creek mudflow was close to ground surface and seepage was observed along the lower adjoining valley slopes. Planning of the site has responded to this condition in the location and distribution of proposed land uses. The recent construction of the golf course has significantly improved the water table and associated drainage qualities of the mudflow within the golf course area.

A minor mudflow hazard condition has also been identified adjacent to Springs Creek - site of the proposed RV park. Detailed studies and mitigative measures must be implemented prior to development of the RV park.

ALLUVIAL PLANES

The near-surface materials on the alluvial plain along the east branch of Hopeful Creek include organic soils, alluvial and slope-wash sediments and occasional boulders which were probably transported from the adjacent west slope of Panorama Ridge. The groundwater table across the alluvial plain was formerly near ground surface and heavy seepage was observed along its eastern edge. Drainage works carried out on the property at the time of clearing for the golf course and subsequent completion of golf course construction, have greatly reduced the watertable's proximity to the ground surface from 0.6 m previously to between 1.6 m and 2.7 m currently.

VIEW SOUTH OF HOPEFUL CREEK ALLUVIAL PLANE PRIOR TO CONSTRUCTION OF GREYWOLF GOLF COURSE

HUMMOCKY TERRAIN

This term is used to describe the hummocky land mass which exists between the east branch of Hopeful Creek and Toby Creek. It is considered to be a former rock slump which slid off the side of Panorama Ridge. The area is now considered to be stable and provides opportunities for development of various forms of residential accommodation within and surrounding the golf course.

BEDROCK KNOLLS AND OUTCROPS

Bedrock knolls and outcrops were observed within the hummocky terrain between Hopeful Creek and Toby Creek. These outcrops are interpreted as the Toby Creek Formation and require site specific consideration with respect to land use capability and configuration of potential development.

(Source: Golder Associates Geotechnical Appraisal Concerning Site Development, 1978; EBA Engineering Consultants Ltd., Geotechnical Evaluation, December. 1996; EBA Engineering Consultants Ltd., August 1996)

FLOODING CONSIDERATIONS

Runoff from snowmelt or rainfall alone is not considered to be the governing factor in determining the extent to which flooding may occur along Toby Creek. Rather, the possibility of blockage of Toby Creek by a mudflow or debris slide upstream of the development and the subsequent release of water from this blockage is considered to be of greater concern. It is not possible to calculate the locality, timing or magnitude of an upstream blockage and eventual release of impounded water. Regular inspections of Toby Creek and its tributaries for blockage should be undertaken.

Hopeful Creek channel has undergone significant improvements as part of the construction of Greywolf Golf Course. A minor localized avulsion hazard, however, remains in a location adjacent to the 5th Fairway. This will require minor flood control berming to eliminate this hazard. In addition a short section of Reach 2 in Cox Creek also exhibits potential avulsion characteristics. Therefore, flood control berming will also be required in this area prior to development of Trapper's Ridge.

FOREST FIRES

Although a major forest fire has not occurred in the Panorama area since the 1920's, a forest fire remains one of the most serious threats to resort development. Preventative measures should be taken to prevent forest fires including: bans on the use of fireplaces during dry periods, creation of firebreaks upwind from the development, and education of residents and visitors as to the danger of forest fires. Architectural and landscape design guidelines should promote the use of fire resistant or retarding building materials and details. An emergency response plan should be instituted so that in the event of a fire all in danger will be safely evacuated and the fire immediately suppressed.

3.6 VEGETATION

According to Government of British Columbia mapping, the Panorama Mountain Village Plan Area falls within the Dry Interior Region. The site can be further divided into three different zones.

1. That area within the Toby Creek valley up to approximately 1280 metres (4200 feet) elevation, which includes the Greywolf golf course neighbourhood and Panorama Village, falls within the Interior Rocky Mountain Douglas-fir Zone and the Lodgepole Pine Subzone. Vegetation in this zone is characterized by lodgepole pine with pine grass and soopolallie understorey in the young seral stage.

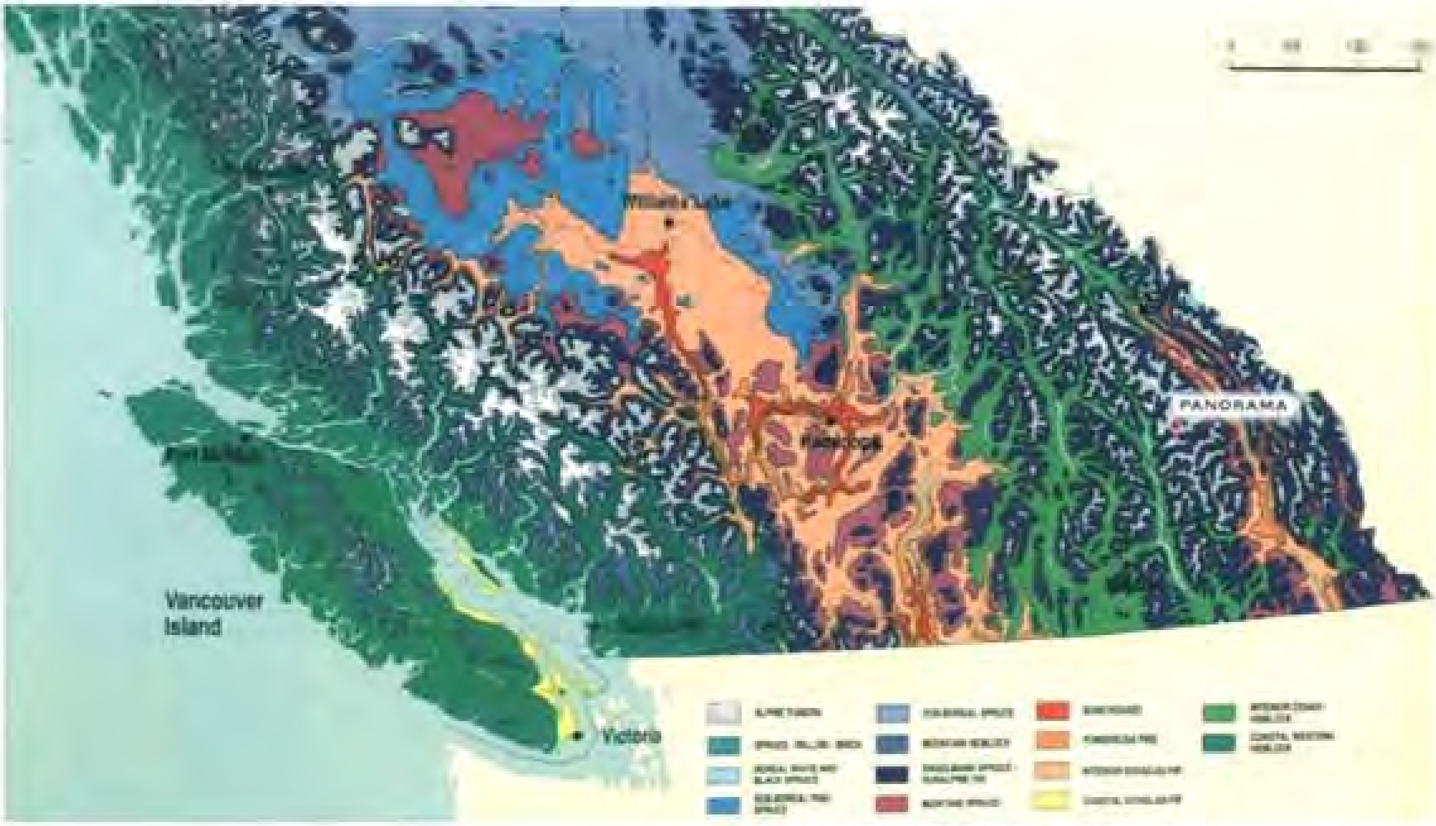
2. All land situated between approximately 1280 metres (4200 feet) elevation and 2280 metres (7500 feet) elevation falls within the Subalpine Engelmann spruce - alpine fir Zone. This zone is further divided into three subzones. These subzones are based on the vegetation types and are primarily determined by elevation. The three subzones, from lowest elevation to highest elevation are:

a) The Rocky Mountain Douglas-fir lodgepole pine subzone. This subzone is characterized by lodgepole pine with dwarf blueberry and Pacific menziesii at lower elevations and Rocky Mountain douglas-fir with common Saskatoon berry at higher elevations;

b) The lodgepole pine - whitebark pine subzone. This subzone is characterized by whitebark pine with grouseberry at lower elevations and by lodgepole pine with grouseberry on the middle elevations of the west face of Mount Goldie, and;

c) The Krummholz - parkland forest subzone. This subzone is characterized by the alpine fir - mountain heather complex and is located primarily at the middle to upper elevations of the west faces of Mount Goldie and Panorama Mountain.

3. Land situated above approximately 2280 metres (7500 feet) elevation falls within the Alpine tundra Zone. This zone is characterized by alpine rock, alpine heath and deglaciated pioneer species.



BIOGEOCLIMATIC ZONES OF BRITISH COLUMBIA **FIGURE 3-2**

3.7 WILDLIFE

UNGULATES

According to generalized Canada Land Inventory mapping the capability to support ungulates is rated as high along Toby Creek and medium throughout the remainder of the Plan Area. According to more detailed Ministry of Environment mapping lower elevations within the plan area are classified as having a moderate capability to support moose throughout the winter months; high capability to support elk, mule deer and white-tailed deer throughout the summer months, and; high-moderate capability to support caribou throughout the summer months. Higher elevations within the Plan Area are rated as having medium to high capability to support mule deer, elk, caribou, mountain goat and moose throughout the summer months with low capability to support these species during the winter months. The Panorama Mountain Village Plan Area is not included in the classifications for land use control priority areas.

Research by Purcell River Odysseys Ltd. has found that Toby Creek and Hopeful Creek corridors are important routes for moose and elk migration and that moose may also utilize cross-country ski trails as travel routes in winter. The creek corridors serve as valuable feeding habitat. Caribou however, tend to live at higher elevations than the proposed golf course/residential area and therefore would represent slightly less of a consideration in the site planning process.

GRIZZLY BEARS

The Panorama Mountain Village Plan Area is rated predominantly as low and medium for its ability to support grizzly bears. Generally, areas at lower elevations and within creek corridors are rated as medium and areas of higher elevation are rated as low. An area designated as having a high ability to support grizzly bears exists within the general location of the Greywolf Golf Course neighbourhood however, previous land clearing associated with 1989 golf course construction impacted this capability to a minor extent.

The Grizzly Bear Biophysical Capability Classification mapping does not take into account areas of human settlement and the impact this has on the bears use of the land. Grizzly bears have a natural tendency to avoid areas of human habitation. Therefore, although an area within the Greywolf golf course neighbourhood is rated as high, it is unlikely that grizzly bears will use the area as an abundance of other land exists surrounding this area which is completely uninhabited by humans and which is capable of supporting a grizzly bear population.

Current experience has found that grizzly bears do not frequent Panorama at this time although black bears have been known to visit the area. Through proper control of garbage and vegetation and, public education, the chances of bears visiting Panorama can be reduced. An explicit response plan will be instituted so all resort staff are aware of the procedure when a bear wanders onto or near the resort. Resort staff will be trained to close off affected areas of the golf course and other public open space, caution residents to remain indoors and specific staff would be trained in procedures for removing bears from the resort area through live trapping or other humane tactics. Visitors to Panorama will be educated about bears and other wildlife concerns through an environmental awareness centre to be implemented at the central guest check-in facility. As with ungulates, vast amounts of high quality habitat for grizzly and black bears use surround Panorama. Care should be taken to avoid damaging this habitat by limiting human access and controlling hunting.

WATERFOWL

The Panorama Mountain Village Plan Area has a low capability for waterfowl use as indicated by the Canada Land Inventory rating of 6 to 7 for the area. This is due primarily to the steep terrain, fast flowing creeks and heavy forest cover. The plan area was not included in mapping for present waterfowl use which indicates that it is not an important area for waterfowl.

3.8 AQUATIC HABITAT

As stated in earlier sections, there are a number of small streams and creeks throughout the Plan Area. These small water courses provide limited opportunity for aquatic habitat due to cold water temperature, low nutrient levels, steep grades, low water levels, very fast running water and the ephemeral nature of many of these streams and creeks. There are five larger watercourses within the plan area. These watercourses, Toby Creek, Hopeful Creek, Little Hopeful Creek, Cox Creek and Taynton Creek, provide greater opportunities for aquatic habitat. Portions of these water courses have been evaluated during previous studies which were undertaken in relation to proposed developments within the Plan Area.

HOPEFUL CREEK AT MOUTH (REACH 1)

HOPEFUL CREEK

Fish presence or absence in Hopeful Creek has not presently been established. The biophysical survey as presented above indicates that there is suitable habitat for a resident fisheries population of both Cutthroat and Bull Trout. In addition, there appears to be no major impediments to upstream fish movements from Toby Creek, with the possible exception of the steep grades encountered under low conditions at Hopeful Creek's mouth. When the waters of Toby Creek rise during freshet, it is likely that this barrier will be flooded, and fish could gain access into Hopeful Creek from Toby Creek.

HOPEFUL CREEK APPROXIMATELY 150 METRES UPSTREAM OF MOUTH (REACH 1)

LITTLE HOPEFUL CREEK

The aquatic biophysical survey indicates that potential fisheries habitat in Little Hopeful Creek is limited to that found in the first reach. However, the culvert located 50 metres upstream of its confluence with Toby Creek provides a significant barrier to fish movements as the culvert's gradient is set at approximately ten percent. The additional two culverts on this system may pose an additional barrier to fish movements. Given these impediments and the previous discussions with BC Ministry of Environment representatives (with Doug Ogilvy, Panorama Resort) that this system is unlikely to be fish bearing, it is assumed that this creek is barren.

CULVERT NEAR MOUTH OF LITTLE HOPEFUL CREEK (REACH 1)

TOBY CREEK

Bull trout (*Salvelinus confluentus*) are the only known fish to reside in Toby Creek within the reach adjacent to Panorama Resort (Fielden et al, 1993 & Carswell, 1979). Fielden et al (1993) noted cutthroat trout (*Oncorhynchus clarki lewsi*) in Jumbo Creek and Carswell (1979) reported finding cutthroat trout in Toby Creek at the mouth of Delphine Creek, approximately 16 kilometres and 6 kilometres upstream of the subject site respectively. It is possible therefore, that cutthroat trout may be present in Toby Creek and/or Hopeful Creek, in addition to the bull trout in the main stem. Kokanee (*Oncorhynchus nerka*) and mountain whitefish (*Prosopium williamsoni*) were also reported by Fielden et al (1993) in the first two reaches of Toby Creek, downstream of the cascades found in Reach 4. Rainbow trout (*Onchorhychus mykiss*) are known in the Toby Creek system only from Neave Creek and Lilian Lake where they are regularly stocked. (Source: *Bio-Inventory of Hopeful Creek, Near Invermere, B.C., Panorama Resort*, GeoAlpine Environmental Consulting, May 1996)

CUTTHROAT TROUT
(*ONCORHYNCHUS CLARKI LEWSI*)

COX CREEK

Reach 1 of Cox Creek rises steeply from its confluence with Toby Creek for a short 70 metre length. No fish were caught during electrofishing the entire reach (double pass, electrofisher on for 1,380 seconds and set at 600 volts, 80Hz). Under the Forest Practices Code of BC this reach is classified as an S6 non-fish bearing stream based on its width, the steep gradient and the lack of fish detected.

Reach 2 is approximately 425 metres in length with most of the reach in a severely disturbed state. No fish were captured during two electrofishing efforts over the entire reach. (electrofisher on for 1,680 seconds, set at 600 volts, 80 Hz). This reach is classified as an S6 non-fish bearing stream, under the Forest Practices Code of BC, based on its width and the lack of fish detected.

Reach 3 consists of the entire remainder of Cox Creek. Within this reach the creek is generally confined within a ravine. The channel gradient averaged 33% Electrofishing was not conducted due to the steep gradient. Cox Creek's third reach is classified as an S6 non -fish bearing stream based on the steep gradient and the channel widths of the downstream reaches.

TAYNTON CREEK

Taynton Creek consists of three reaches plus five main tributaries:

From its confluence with Toby Creek, Taynton Creek's first reach rises steeply for 70 metres. Electrofishing within this reach was not completed as Toby Creek is known to support bull trout (Salvelinus confluentus) and the electrofishing programme in Reach 2 upstream yielded numerous bull trout. Therefore, even though this is a fairly steep reach, it is presumed to be passable by fish. Under the Forest Practices Code of BC this first reach is classified as an S3 fish stream based on its width and presumed presence of fish.

Reach 2 of Taynton Creek extends for 4.3 kilometres, forming the majority of the streams length. Electrofishing was conducted on the lower 500 metres of the second reach of Taynton Creek. Eleven bull trout were captured during a single pass electrofishing effort. From this small sample, there appears to be two age classes, with 10 bull trout averaging 102.4 mm and one larger fish measuring 163 mm. Reach 2 of Taynton Creek is classified as a S3 fish stream based on its width and confined presence of fish, under the Forest Practices Code of BC.

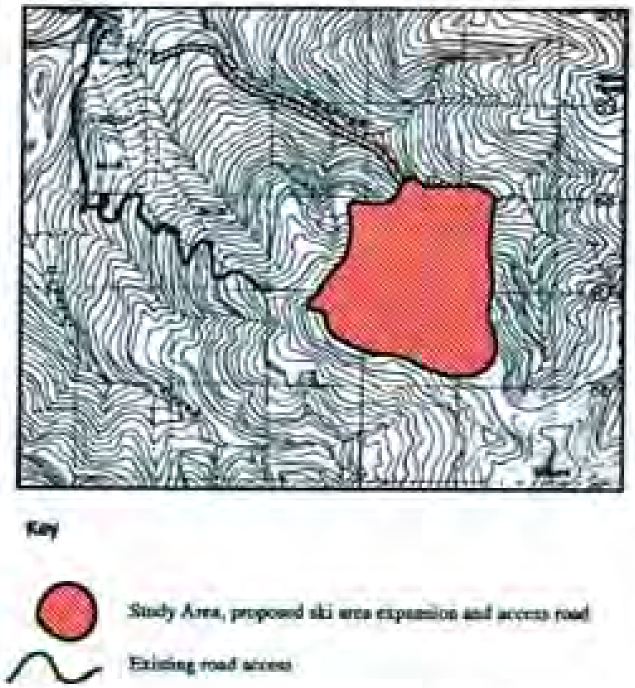
Taynton Creek's third reach consists of the creek's headwaters which drain the north flank of Mount Goldie, the southwest flank of Mount Taynton, and the ridge joining the two peaks. This reach has an average gradient of 23%, with ephemeral flows at its upper end. Because of the steep gradients and ephemeral nature of the upstream flows, reach 3 is assumed to be non-fish bearing. This reach is classified as a S5 non-fish bearing stream under the Forest Practices Code of BC. (Source: *Trapper's Ridge, Initial Environmental Review,* GeoAlpine Environmental Consulting, March 1998)

3.9 ARCHAEOLOGICAL RESOURCES

An overall archaeological survey of the entire Panorama Mountain Village Plan Area has not been completed. However, two studies have been completed in recent years - one in 1988 and the second in 1997. These studies focussed on specific areas to be considered for resort development - Greywolf golf course residential neighbourhood and Taynton Bowl for possible ski area expansion. The results of these studies indicated that a full EIA was not warranted due to the nature and limited occurrence of archaeological evidence of precontact human existence. The findings of these studies are summarized as follow:

1988 STUDY

An archaeological survey of the area proposed for the present Greywolf golf course and residential neighbourhood at Panorama Resort was carried out in October 1988 by Wayne T. Choquette (Consultant Archaeologist). No buried cultural deposits were found during the archaeological reconnaissance. One marginally retouched quartzite spall fragment was discovered on the edge of a bulldozed road on the southwest edge of the study area. It is thought that this item is probably an isolated find and not representative of the site. The archaeological report concluded that while sparse, but equivocal evidence of prehistoric human presence was found during the 1988 study, the Greywolf golf course and residential neighbourhood is not a threat to heritage resources.



1997 ARCHAEOLOGICAL STUDY AREA

1997 STUDY

An archaeological resource overview was conducted by Bison Historical Services Ltd. in September 1997 for a proposed ski area expansion into a natural topographic bowl northeast of Mt. Goldie. The study area measured in excess of 1200 hectares. Study of the area included a review of existing archaeological data, existing ethnographic data, existing geological data and reported traditional knowledge bearing on the proposed area of expansion. The study also involved a field visitation designed to identify areas of archaeological importance.

The background review found:

- No prehistoric sites are known for the study area or surrounding areas;
- Slopes and peaks are primarily used for hunting sheep and goats, quarries and vision quests. They are not typically settlement areas;
- Geological data suggests only a moderate potential of material suitable for "flint knapping";
- Areas suitable for prehistoric occupation or use are limited in scope;
- No references to the study area are available in the available ethnographic literature, and;
- References to traditional land use are limited to areas adjacent to Toby Creek and the lower reaches of Taynton and Hopeful Creeks.

The field visitation found:

- The study area is largely of low archaeological potential but that areas of low/moderate and moderate potential are present at the boundaries and adjacent to the study area;
- No prehistoric cultural material or features were observed in the course of the field study, and;
- Rock materials observed in the course of the field study are not suitable for prehistoric quarrying.

Both the 1988 and 1997 studies concluded that, in the opinion of the consultant archaeologists, Archaeological Impact Assessments were not required for the proposed projects.

VIEW NORTH-WESTWARD OF UPPER PART OF BOWL ILLUSTRATING CLIFF FACES

VIEW NORTHWARD ALONG CREST OF RIDGE FROM PEAK AT SOUTHWEST CORNER OF STUDY AREA

VIEW WESTWARD OF TOP OF PEAK AT SOUTH-WEST CORNER OF STUDY AREA

3.10 VISUAL RESOURCES

The Panorama Mountain Village Plan Area is not only surrounded by spectacular mountain scenery, it also possesses valuable visual resources within the Plan Area. The assemblage of geological features, topography and drainage systems in and surrounding the Plan Area yields significant views both within and outside of the Plan Area. Conversely, due to the location of Panorama, the configuration of its natural environment and the predominant wilderness setting, resort development does not pose potential for negative visual impacts to surrounding locations outside of the Plan Area.

SPECTACULAR VIEW OF MT. NELSON EMPHASIZES SENSE OF "THERENESS" IN THE SURROUNDING LANDSCAPE

EXTERNAL VIEWS

Significant views and vistas of areas outside the Plan Area are offered from various vantage points. This establishes a sense of "Thereness" which is defined by enclosure or edge conditions created by either natural landscape elements or a configuration of buildings. The quality of Thereness is dramatic in the sense that it is perpetually out of our reach, it is always "There." The importance of this type of perception is that it establishes the sense of vastness, wilderness and setting which makes Panorama truly feel like "the end of the road". Beyond is wild, unknown, uncharted with elements of danger. These are the qualities which attract, inspire, and relax those who live and visit Panorama Mountain Village.

EXAMPLE OF "THERENESS"
DISTANT VIEW OF MONUMENT PEAK REINFORCES SENSE OF VASTNESS OF WILDERNESS

On the approach to Panorama's main entrance from Toby Creek Road, a spectacular distant view of Monument Peak is offered looking southwest up the roadway corridor. This is one's introduction to the natural beauty of Panorama and it is emphasized once within the resort. External views range from distant vistas offered from wide open vantage points, to closed - framed views of nearer mountain landscapes from enclosed spaces. As one moves through the resort and experiences its varied terrain and associated facilities, these conditions and types of views are revealed.

LOOKING SOUTH OVER TOBY CREEK AND DISTANT MOUNTAINS FROM "CLIFFHANGER", THE 6TH HOLE (EXTERNAL VIEW - WIDE OPEN VANTAGE POINT)

VIEWING WEST TO MOUNT NELSON AND WATCH PEAK ALONG OLD FAIRWAY CLEARING (CLOSED-FRAMED VIEW)

TYPICAL CLOSED VIEW OVER THE TOBY CREEK AREA AND PANORAMA MOUNTAIN WHICH CONTAINS THE EAST VIEW SHED

The above are examples of the range of external views offered from the different types of vantage points discussed. The following photographs provide an understanding of the full range of external views from throughout the Plan Area. Generally, framed or closed views are afforded from lower elevations defined by nearness to exterior landscapes and enclosure created by configuration of the natural landscape. This typically means external views in either an easterly or westerly direction which are contained by the mountainous formations which define Toby Creek Valley. The Toby Creek Area and the Heli-plex generally have closed external views. Areas at higher elevations and "open valley" type formations within Panorama tend to offer both closed external views as well as vista or panoramic external views.

This results from the degree of exposure and related ability to view both up the Toby Creek valley in a north/south direction, and across the valley in an east/west direction. Examples of these views are shown above and following. Note that from the Ski Tip Village area one observes distant north/south views of Monument Peak as well as closed east/west views of Mt. Catherine, Sultana peak and Mt. Nelson. From high alpine locations on Panorama Mountain, magnificent views are afforded in all directions of both the landscape within the Plan Area as well as distant surrounding mountain peaks.

TYPICAL EXTERNAL WESTERLY VIEW ENCLOSED BY MT. NELSON

SKI TIP VILLAGE BASE AREA WITH QUAD CHAIR, PINE INN, SKI TIP LODGE AND TAMARACK LODGE

TYPICAL VIEW OF DISTANT MOUNTAINS FROM ALPINE SKI AREA

VIEW OF 1000 PEAKS GATHERING PLACE

INTERNAL VIEWS

The natural landscape within Panorama Mountain Village Plan Area establishes zones of enclosure which create a perception of "Hereness". It is the opposite sense from that above, in that the visual environment is close or in fact the individual is situated within and therefore it is within reach. This is important because we are allowed to experience a small part of what is believed to be in the vastness of wilderness beyond which may be perceived to be out of reach. Hence, the resort experience is complete and this is the reason why the visual resources of Panorama are so important to the overall mountain village experience.

INTERNAL VIEW OF TOBY CREEK LOOKING SOUTH FROM ENTRANCE TO PANORAMA

Upon arriving at the main entrance to Panorama, the bridge crossing over Toby Creek permits internal views of the creek and the sense of "Hereness" is immediately defined. Internal views of Toby Creek are also afforded at various points along its length extending through the Plan Area. From the lower elevations within the Toby Creek Area neighbourhood, including the single family subdivision, adjacent to Toby Creek, internal views include views of Toby Creek and the base of Mt. Nelson and Watch Peak to the west, closed views of the forested slope within and surrounding the single family subdivision and views of the base of Panorama Mountain to the southeast.

Moving up to Ski Tip Village, views of the Heli-plex and Toby Creek Area are revealed to the southwest while views of the ski runs are provided from Ski Tip and Tamarack Lodges to the east, northeast and southeast.

INTERNAL VIEW OF RK HELI-PLEX FROM TOBY CREEK AREA

VIEW FROM SKI TIP VILLAGE AREA OVER TOBY CREEK LODGE

Once within the Greywolf golf course residential neighbourhood, the Hopeful Creek valley unfolds, allowing views over the golf course as it wends its way through the valley. Internal views of Hopeful and Little Hopeful Creeks are revealed all along the length of their courses from Greywolf Drive and from various points on the golf course. Views of the Sunbird ski base area and runs are offered from the golf clubhouse area while forest views exist along the upper banks of Toby Creek at the south end of the golf course along its western perimeter.

Trapper's Ridge consists mainly of densely forested slopes and benchlands extending up the base of Panorama Mountain from Toby Creek. These conditions give way to internal views of dense Lodgepole Pine forest, which when cleared for residential development, will open the forest canopy and allow filtered views of Toby Creek from lower elevations and more distant internal views of the ski runs and Ski Tip Village from upper elevations.

VIEW OVER OLD GOLF COURSE CLEARING OF SKI RUNS AND SUNBIRD CHAIR FROM THE CLUBHOUSE LOCATION

LOOKING DOWN "HOPEFUL MEADOW" HOLE NO. 1 AT GREYWOLF

THE VIEW ALONG HOLE NO. 10 - "TRANQUILLITY"

3.11 SYNTHESIS - BIOPHYSICAL CONDITIONS

The information in the previous sections was compiled and analysed to determine the overall capability of the Panorama Mountain Village Plan Area to sustain various forms of recreation and resort development as well as the suitability of specific areas for specific land uses. The analysis considered physical and natural conditions as these would effect ski facility development associated with the Mountain Master Plan as well as base area development. The analysis which was conducted for ski facility development considered issues such as sun shadow effects, existing ski area development and slopes which would yield varied levels of ski terrain. This detailed analysis is contained in the Mountain Master Plan (CDP Volume II). For base area lands, zones were established with similar characteristics related to their land use potential. From this analysis, five major zones evolved for base area lands, predicated on their capabilities to support intensive forms of development typical for the resort's base area.

ZONE 1
PRESERVATION ZONE

Areas comprising: watershed reserves; riparian areas; and floodplain setback areas.

ZONE 2
SEVERELY LIMITED CAPABILITY

Areas with: slopes exceeding 45%; high alpine areas; difficult or lack of practical means to establish access; proximity to, and nature of identified hazards.

ZONE 3
LIMITED CAPABILITY

Areas with: slopes between 25% - 45%; localized constraints related to slope, soil/geologic conditions and natural hazards; difficulty in establishing access; poor proximity to major existing or possible expanded resort base and servicing infrastructure.

ZONE 4
MEDIUM CAPABILITY

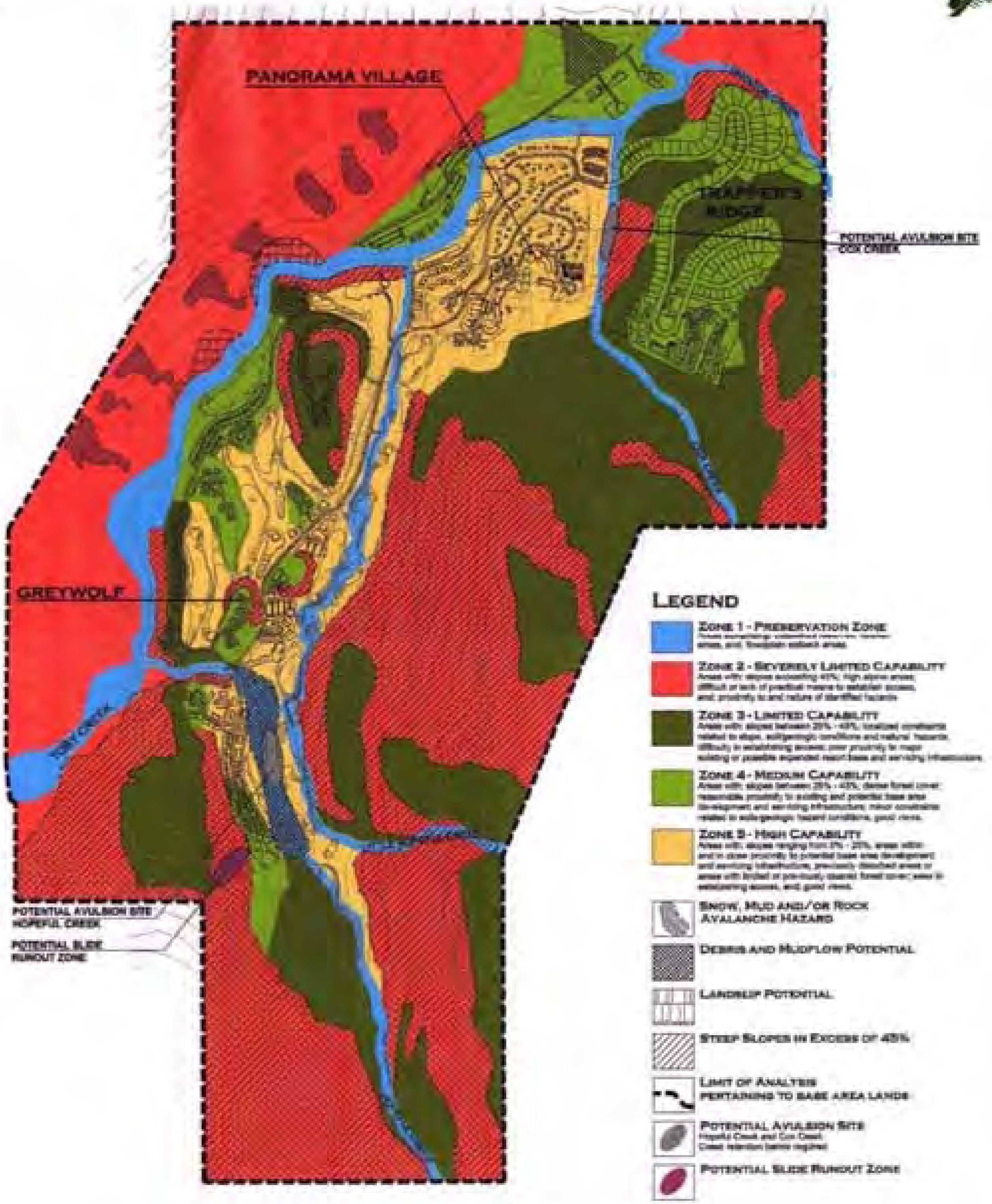
Areas with: slopes between 25% - 45%; dense forest cover; reasonable proximity to existing and potential base area development and servicing infrastructures; minor constraints related to soils/geologic hazard conditions; good views.

ZONE 5
HIGH CAPABILITY

Areas with: slopes ranging between 0% - 25%; areas within and in close proximity to existing and potential base area development and servicing infrastructure; previously disturbed areas or areas with limited or previously cleared forest cover; ease in establishing access, and; good views.

These zones and their respective characteristics establish a hierarchy of suitability and potential for various forms of resort and recreation development. Generally, the lower the assessed capability, the more limited the specific zone is in accommodating different scales and types of land uses. Figure 3.1 - Synthesis Plan, illustrates the location and extent of the five zones and the constraining factors associated with each zone.

Generally, portions of base area lands which are at higher elevations or high alpine conditions are limited to non-intensive uses such as alpine skiing, ski touring, hiking, mountain biking, snowmobiling and related support facilities, and structures of a minor scale - Zones 1 and 2. Typically, lower base area elevations with gentle to moderate slopes provide the capability for a more diverse range and intensive forms of land use such as: major road networks; golf course development; alpine village and related accommodation/commercial base; residential development; parking, and; intensive recreation development such as major chair lift stations, swimming pools, structured trails, volleyball courts, climbing walls and similar recreation uses and associated maintenance facilities. These land uses generally occur in Zones 4 and 5, and to a lesser extent Zone 3.



SYNTHESIS
BIOPHYSICAL CONDITIONS FIGURE 3-3

4.0 COMPREHENSIVE DEVELOPMENT PLAN OVERVIEW

For years, Panorama has lived in the shadow of Banff Resort. Banff was closer to the primary markets in Calgary and Edmonton. Recently, concern with over-development of one of Canada's most prized National Parks has lead to a halt in further development. In developing ski-in, ski-out real estate at the base of Panorama Mountain, Intrawest unlocks a tremendous differentiator with the nearby National Parks, one where ownership is possible.

The Comprehensive Development Plan represents a culmination of the historical evolution of Panorama Mountain Village, from a local ski hill into one of North America's premier all-season mountain resorts. Intrawest's vision for Panorama, "*a vision for uniting real estate, recreation and respect for the environment in one remarkable natural attraction*", has been translated into an overall physical plan for the resort - the Panorama Mountain Village Master Plan - which serves as the cornerstone of the Comprehensive Development Plan. Inherent in the Master Plan, is the resolution of a multi-faceted development strategy for Panorama which includes the ultimate distribution and configuration of land uses, details of implementation, servicing requirements and phasing strategy. These are the key elements which have contributed to the overall organization and content of the Comprehensive Development Plan.

The following sub-sections provide an overview of: the general mountain village land use programme; the major planning principles and land use policies which have been employed in creating the Panorama Mountain Village Master Plan; a summary of the major development areas which make up the Master Plan, and; key components of the Master Plan.

4.1 MASTER LAND USE PROGRAMME

The Panorama Mountain Village Master Plan stems from a general land use programme which was established based on existing development combined with capabilities of the land base to sustain various forms of resort expansion. The organization of programme components resulted from a process of translating the Regional District of East Kootenay's land use policies and zoning regulations into an overall form of development which responds to existing conditions while taking advantage of the outstanding physical potential and visual resources offered by the resort's land base.

Base area development is situated primarily on flatter, moderately sloped parts of the Plan Area where topography typically ranges between 0-25%. Steeper slopes - in excess of 45%, rocky landforms, watershed areas and riparian corridors associated with Toby, Hopeful, Little Hopeful, Cox and Taynton Creeks, and high alpine areas, combine to form the basis of a significant natural open space system and environmental preservation. Greywolf golf course is a key recreation amenity situated in the lower base area lands and contributes to the diversity of the overall open space experience.

The natural configuration of the land base inherently creates a sense of separation between development nodes and hence results in the creation of four major development areas:

1. Panorama Village (including existing single family subdivision and Toby Creek Area);
2. Greywolf ;
3. Trapper's Ridge;
4. Alpine Recreation Area.

These development areas are discussed further in Section 5.0.

The general land uses, recreation activities and associated physical facilities contained within the Panorama Mountain Village Master Plan are listed in Table 4.1 - Master Land Use Programme.

In order to establish the overall programme, investigations were made into: existing development; market conditions; permitted uses and densities under the Panorama Mountain Village Official Community Plan and Upper Columbia Valley Zoning Bylaw No. 900, and; land uses suitable for the physical conditions present. Numerous schematic concepts were prepared and reviewed amongst the development team prior to finalizing the overall land use programme and its organization and configuration within the Plan Area. The general land use programme evolved further, to include additional supplementary uses and facilities within each of the major development areas mentioned.

MASTER LAND USE PROGRAMME WITH BED UNIT BREAKDOWN **TABLE 4-1**

EXISTING DEVELOPMENT *(see note 1)*

AREA	ACCOMMODATION/ DWELLING UNITS		BED UNITS PER UNIT	TOTAL BED UNITS
	PUBLIC	PRIVATE		
Horsethief Lodge				
0 - 55 m^2	27	23	2	100
55 - 100 m^2	41	68	3	327
greater than 100 m^2	15	22	4	148
Toby Creek Lodge				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	48	10	3	174
greater than 100 m^2	0	0	4	0
Pine Inn & Pine Inn Annex				
0 - 55 m^2	107	0	2	214
55 - 100 m^2	0	0	3	0
greater than 100 m^2	0	0	4	0
Toby Creek Single Family Subdivision	0	77	6	462
RK Heli-Ski				
bed unit allotment *(see note 3)*	40	N/A	N/A	120
Sub-Total Existing Development	**278**	**200**		**1,545**

PROPOSED DEVELOPMENT - PANORAMA VILLAGE

TABLE 4-1 CONTINUED

AREA	ACCOMMODATION/ DWELLING UNITS		BED UNITS PER UNIT	TOTAL BED UNITS
	PUBLIC	PRIVATE		
The Hearth Stone				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	6	3	18
greater than 100 m^2	0	22	4	88
Pension #1	1	0	8	8
Pension #2	1	0	8	8
Trapper's Crossing				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	30	3	90
greater than 100 m^2	0	22	4	88
Ski Tip Lodge				
0 - 55 m^2	27	0	2	54
55 - 100 m^2	6	0	3	18
greater than 100 m^2	0	0	4	0
Tamarack Lodge				
0 - 55 m^2	40	0	2	80
55 - 100 m^2	6	0	3	18
greater than 100 m^2	0	0	4	0
Building C - Expedition Station				
0 - 55 m^2	68	0	2	136
55 - 100 m^2	41	0	3	123
greater than 100 m^2	0	0	4	0
Building D - Panorama Springs				
0 - 55 m^2	45	0	2	90
55 - 100 m^2	35	0	3	105
greater than 100 m^2	0	0	4	0
Building E - Taynton Lodge				
0 - 55 m^2	45	0	2	90
55 - 100 m^2	35	0	3	105
greater than 100 m^2	0	0	4	0
Building F - Condohotel located across Summit Drive from Tamarack Lodge				
0 - 55 m^2	39	0	2	78
55 - 100 m^2	31	0	3	93
greater than 100 m^2	0	0	4	0
Building G - Conference Centre Condominium Hotel				
0 - 55 m^2	39	0	2	78
55 - 100 m^2	31	0	3	93
greater than 100 m^2	0	0	4	0
Building H - Conference Centre Multiple Family				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	17	3	51
greater than 100 m^2	0	7	4	28
Building I -Multiple Family located at skier overpass				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	11	3	33
greater than 100 m^2	0	5	4	20
Riverbend				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	0	3	0
greater than 100 m^2	0	40	4	160
Employee Housing	0	150	0	0
Recreational Vehicle Park	0	89	0	0
Sub-Total Panorama Village Area	**490**	**399**		**1,753**

PROPOSED DEVELOPMENT - GREYWOLF

TABLE 4-1 CONTINUED

AREA	ACCOMMODATION/ DWELLING UNITS		BED UNITS PER UNIT	TOTAL BED UNITS
	PUBLIC	PRIVATE		
Single Family - Area #1	0	25	6	150
Single Family - Area #2	0	6	6	36
Single Family - Area #3	0	6	6	36
Single Family - Area #4	0	38	6	228
Single Family - Area #5	0	17	6	102
Single Family - Area #6	0	25	6	150
Single Family - Area #7	0	5	6	30
Single Family - Area #8	0	6	6	36
Multi-Family - Area #1				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	21	3	63
greater than 100 m^2	0	7	4	28
Multi-Family - Area #2				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	16	3	48
greater than 100 m^2	0	6	4	24
Multi-Family - Area #3				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	33	3	99
greater than 100 m^2	0	11	4	44
Multi-Family - Area #4				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	39	3	117
greater than 100 m^2	0	13	4	52
Multi-Family - Area #5				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	15	3	45
greater than 100 m^2	0	5	4	20
Multi-Family - Area #6				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	21	3	63
greater than 100 m^2	0	7	4	28
Multi-Family - Area #7				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	30	3	90
greater than 100 m^2	0	10	4	40
Multi-Family - Area #8				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	46	3	138
greater than 100 m^2	0	15	4	60
Multi-Family - Area #9				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	12	3	36
greater than 100 m^2	0	4	4	16
Sub-Total Greywolf Development	**0**	**439**		**1,779**

PROPOSED DEVELOPMENT - TRAPPER'S RIDGE

TABLE 4-1 CONTINUED

AREA	ACCOMMODATION/ DWELLING UNITS		BED UNITS PER UNIT	TOTAL BED UNITS
	PUBLIC	PRIVATE		
Single Family - Area #1	0	53	6	318
Single Family - Area #2	0	17	6	102
Single Family - Area #3	0	52	6	312
Single Family - Area #4	0	12	6	72
Multi-Family - Area #1				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	21	3	63
greater than 100 m^2	0	7	4	28
Multi-Family - Area #2				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	12	3	36
greater than 100 m^2	0	4	4	16
Multi-Family - Area #3				
0 - 55 m^2	0	0	2	0
55 - 100 m^2	0	78	3	234
greater than 100 m^2	0	26	4	104
Condohotel				
0 - 55 m^2	64	0	2	128
55 - 100 m^2	51	0	3	153
greater than 100 m^2	0	0	4	0
Sub-Total Trapper's Ridge	**115**	**282**		**1,566**

TOTAL DEVELOPMENT SUMMARY

TABLE 4-1 CONTINUED

AREA	ACCOMMODATION/ DWELLING UNITS		BED UNITS PER UNIT	TOTAL BED UNITS
	PUBLIC	PRIVATE		
Existing Development	278	200	N/A	1,545
Proposed Development - Panorama Village	490	399	N/A	1,753
Proposed Development - Greywolf	0	439	N/A	1,779
Proposed Development - Trapper's Ridge	115	282	N/A	1,566
TOTAL DEVELOPMENT	**883**	**1,320**	**N/A**	**6,643**

Notes:

1. Summary of existing dwelling units and bed units from Intrawest records (13/09/98).
2. Proposed multi-family units within Panorama Village are calculated according to the following product mix:
   0 - 55 m^2 = 0 %
   55 - 100 m^2 = 70 %
   greater than 100 m^2 = 30 %
3. Proposed multi-family units within Greywolf and Trapper's Ridge is calculated according to the following product mix:
   0 - 55 m^2 = 0 %
   55 - 100 m^2 = 75 %
   greater than 100 m^2 = 25 %
4. Proposed condominiunm hotel accommodation units are calculated according to the following product mix:
   0 - 55 m^2 = 56 %
   55 - 100 m^2 = 44 %
   greater than 100 m^2 = 0 %
5. Bed units for RK Heli-Ski include a 120 bed unit entitlement for a future hotel. This has been assumed at 40 dwelling units for the purposes of calculations in this table.
6. Each pension contains 1 principle dwelling unit with varying number of accommodation units. Bed unit allocation for pensions is defined in the OCP as maximum 8 bed units.

Within Panorama Mountain Village, a number of important commercial functions are accommodated. The existing commercial functions are summarized in Table 4-2 while the proposed commercial functions are summarized in Table 4-3.

EXISTING COMMERCIAL PROGRAMME **TABLE 4.2**

To Be Retained	Description	Location	Floor Space	Deck Space	Phase	Notes
SERVICE COMMERCIAL & RETAIL						
	Old Discovery Centre	Resort Entrance	110 m²		Existing	to become Central Check-In
	General Store	Toby Creek Lodge	100 m²		Existing	to be relocated to Admin Bldg 1st floor
	Post Office	Toby Creek Lodge	3 m²		Existing	to be relocated to new General Store
✓	Toby Boutique	Toby Creek Lodge	32 m²		Existing	remain unchanged
	Time Share Sales	Toby Creek Lodge	30 m²		Existing	to be Business Centre
	Central Check-In	Horsethief Lodge	75 m²		Existing	to be relocated to one half of Jackpine Pool Room
✓	Administration	Horsethief Lodge	146 m²		Existing	remain unchanged
✓	Video Arcade #1	Pine Inn	47 m²		Existing	remain unchanged
✓	Video Arcade #2	Tamarack Lodge	50 m²		Existing	remain unchanged
	Library - News Bar	Pine Inn Annex	30 m²		Existing	to be upgraded
	Kid's Kamp Store	Admin Building	167 m²		Existing	to be relocated to Pine Inn
✓	Conrad Kain Room	Admin Building	33 m²		Existing	remain unchanged
	Copper Crown	Admin Building	367 m²	94 m²	Existing	to be commercial retail
✓	Mountain Mercantile	Ski Tip Lodge	450 m²		Existing	remain unchanged
✓	Lusti's Rentals	Tamarack Lodge	280 m²		Existing	remain unchanged
✓	RK Heli-Ski	RK Heli-Ski	36 m²		Existing	remain unchanged
RECREATION COMMERCIAL						
	Exercise Facility	Pine Inn Annex	36 m²		Existing	to be relocated to Toby Creek Dining Room
	Fitness - Massage Facility	Tennis Facility	120 m²		Existing	to be relocated to Toby Creek Dining Room
✓	Greywolf Pro-Shop	Greywolf Clubhouse	56 m²		Existing	remain unchanged
✓	Tennis Facility	Tennis Facility	64 m²		Existing	remain unchanged
✓	Elkhorn Cabin		36 m²		Existing	Biledeau's Cabin
✓	RK Heli-Ski	RK Heli-Ski	36 m²		Existing	remain unchanged

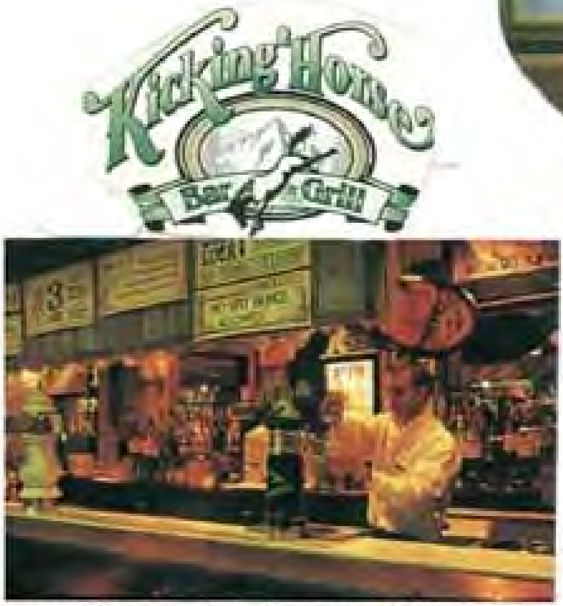
EXISTING COMMERCIAL PROGRAMME

TABLE 4.2 - CONTINUED

To Be Retained	Description	Location	Floor Space	Deck Space	Phase	Notes
FOOD SERVICE COMMERCIAL - RESTAURANTS, CAFES AND BARS						
	General Store	Toby Creek Lodge	94 m²		Existing	to become Exercise Facility
	Toby Creek Dining Room	Toby Creek Lodge	320 m²	150 m²	Existing	to become Exercise Facility
✓	Jackpine Pub	Horsethief Lodge	113 m²	60 m²	Existing	remain unchanged
✓	Glacier Pub	Admin Building	293 m²		Existing	remain unchanged
✓	Starbird Restaurant	Pine Inn	430 m²	212 m²	Existing	remain unchanged
✓	Kicking Horse	Pine Inn	231 m²	119 m²	Existing	remain unchanged
	Library	Pine Inn Annex	100 m²		Existing	to include new Coffee Shop
✓	Ski Tip Restaurant	Ski Tip Lodge	530 m²	92 m²	Existing	remain unchanged
✓	Club House Restaurant	Greywolf Clubhouse	110 m²	56 m²	Existing	remain unchanged
✓	RK Heli-Ski Restaurant	RK Heli-Ski	280 m²	140 m²	Existing	remain unchanged

Commercial uses noted as "remain unchanged" are to be retained as their current use in their current location. Commercial uses which are to be relocated to another location are not included in this table as "remain unchanged" but are included in the Proposed Commercial, Table 4.3.

GUEST SERVICES LOCATED IN SKI TIP LODGE



THE KICKING HORSE BAR AND GRILL LOCATED IN THE PINE INN

MOUNTAIN MERCANTILE RETAIL SHOP IN SKI TIP LODGE

PROPOSED COMMERCIAL PROGRAMME

TABLE 4.3

DESCRIPTION	LOCATION	FLOOR SPACE	DECK SPACE	YEAR	NOTES
SERVICE COMMERCIAL & RETAIL					
Member Lockers	Pine Inn	150 m^2		Existing	remain unchanged
Storage	Pine Inn Annex	30 m^2		2000	in Exercise Room location
Post Office	Toby Creek Lodge	4 m^2		Existing	in General Store location
Central Check-In	Old Discovery Centre	110 m^2		1999	in old Discovery Centre
Small Business Services	Toby Creek Lodge	32 m^2		2000	In Time Share Office
Conference Facilities	Bldg. G Ski Tip Village	1850 m^2		2001	
European Spa	Trapper's Condohotel	558 m^2		2009	
Laundry		110 m^2		2003	to be relocated to one half of the old Central Check-in
Kids Kamp		167 m^2		2003	to be relocated to Kids Kamp
Gift Shops/Photographic Film		8000 sq. ft.		2001	Ski Patrol Hotel
RECREATION COMMERCIAL					
Mountain Adventure Centre	Ski Tip Lodge	18 m^2		Existing	Guest Services Desk
Adventure Pavilion	Tennis Building	100 m^2		2002	More Day-Skier washrooms and lockers to be provided
Greywolf Golf Academy	Greywolf Driving Range	49 m^2		2002	
FOOD SERVICE COMMERCIAL - RESTAURANTS, CAFES AND BARS					
Chocolate Store	Pine Inn	32 m^2		1999	
Library Cafe	Pine Inn Annex	92 m^2		2004	
Lusti's Cappuccino Bar	Tamarack Lodge	23 m^2	56 m^2	1999	
Springs Restaurant	Panorama Springs	185 m^2	167 m^2	2000	
Greywolf Restaurant	Greywolf Clubhouse	110 m^2	56 m^2	1999	
The Beaches	On-Mountain, Top of First Ascent Chair Lift	300 m^2	74 m^2	2001	
V1K Restaurant	On-Mountain, Top of 1000 Peaks	110 m^2	74 m^2	2003	
Sunbowl Cabin		743.2 m^2		2004	
Summit Restaurant		111.48 m^2		1999	to be located at the top of Summit T-Bar
Adventure Pavilion	Tennis Centre	96 m^2	51 m^2	2000	Bubble Dome over Tennis Court 400m^2

4.2 LAND USE PLANNING CONSIDERATIONS

The resort's very nature implies consideration of certain physical and regulatory aspects which must be factored into the land use planning and implementation process. These considerations include: topography; terrain capability; heritage resources; environmental concerns; watershed management; land tenure; existing development pattern and infrastructure, and; agreements and policies of regulatory agencies.

TOPOGRAPHY

The Panorama Mountain Village Plan area encompasses significant areas of mountainous terrain, with elevations ranging from approximately 1150 metres in base area and valley bottom lands, to 2375 metres at the top of Panorama Mountain. Within this elevation range exist various benches, creek valleys and fan areas.

The significant vertical elevation is obviously well suited to alpine skiing uses which are the primary focus of the resort. Lower benches and creek valley areas offer potential for development of diverse forms of recreation and resort accommodation uses. Steeper sloped areas, largely bordering major creek systems or sheer rock bluffs, constitute non-developable or environmental preservation zones. The detailed response to these conditions in the site planning process determines the ultimate form, density and distribution of resort land uses. The appropriate response to topographic conditions results in a sensitive balance between the natural and built environments.

TERRAIN CAPABILITY

At Panorama, physical conditions relate to varying capabilities for sustaining different forms of resort development. Terrain capability is comprised of topography, discussed above, but also includes the composite set of conditions created by soils, geology, drainage systems, vegetation, and any hazards or major potential constraints associated with these subjects.

Panorama comprises a number of natural conditions which pose potential constraints or limitations to resort development. These include: areas subject to avalanche along northwest slope of Toby Creek Valley; landslip along Toby Creek upstream from main access bridge on the northwest side of Toby Creek channel; Springs Creek alluvial fan; terraces composed of stratified sand and gravel along both sides of the Toby Creek flood plain; channel sections of Hopeful and lower Cox Creeks requiring flow control berming, and; a potential slide runout zone on the upper northeast facing slope near the south end of Hopeful Creek valley.

The Panorama Mountain Village Master Plan evolved in response to terrain capabilities within the plan area. Intensive uses such as base area and golf course residential development are concentrated at the base of Panorama Mountain and in the Hopeful Creek valley. Within this context, the organization of various resort development components utilizes existing benches and valley corridors, which are generally configured to avoid hazardous conditions.

Steep slopes (in excess of 45%) or major riparian zones have been left largely undisturbed with the exception of ski terrain development. Certain areas have been designated for minor creek relocation or entrainment to control drainage and contain potential avulsion hazard conditions. In these areas, riparian edges shall be restored and enhanced, and drainage improved.

Resort accommodation has been clustered in a manner which best respects and preserves sensitive areas and to avoid human risk associated with natural hazards.

HERITAGE RESOURCES

Studies carried out between 1988 and 1997 provide valuable information about the heritage resources of Panorama Mountain Village. An archaeological survey conducted in October 1988 of the area designated for the Greywolf golf course residential neighbourhood found no buried cultural deposits. A marginally retouched quartzite spall fragment was discovered on the edge of a bulldozed road on the southwest edge of this part of the resort. Interpretation of this find indicates it was probably an isolated occurrence and not representative of the site. The report concluded that while sparse, but equivocal evidence of prehistoric human presence exists, development of the Panorama golf course residential neighbourhood poses no threat to heritage resources. No artifacts were unearthed during construction of the golf course.

More recent studies in the area designated for expansion of alpine skiing and base area development observed no evidence of archaeological features or artifacts and no lithic material suitable for "flint knapping". It concluded that potential for the presence of archaeological sites is generally moderate to low, and given the scale and locations of future resort expansion, archaeological potential is reduced to a category of low. The report recommended not to proceed with an Archaeological Impact Assessment.

ENVIRONMENTAL CONSIDERATIONS

Specific consideration must be given to these areas of concern. The varied mountainous topography, heavily vegetated slopes, numerous steep drainage channels and creek valleys and the potentially high runoff volumes associated with these conditions, collectively yield a sensitive development environment. Certain hazardous conditions may be emphasized with the disturbance or removal of vegetation, especially in steeply sloped areas.

The set of natural conditions present at Panorama carry certain implications with respect to wildlife habitat and watershed protection. Ungulates such as mule deer, elk and moose, utilize migratory corridors associated with Toby and Hopeful Creeks. Caribou rely on habitat value offered at the higher elevations while black bears benefit from the moderate to high habitat capability found within undisturbed parts of the Plan area to provide ample and suitable habitat for their survival. Grizzly Bears generally tend to be found to the west of the resort.

Investigations with respect to fish habitat revealed that the different creeks found within the Plan area offer varying qualities for fish rearing. No fish were captured during sampling procedures for Cox Creek. Based on the type of channel and level of previous disturbances, it is classified as an S6 stream with respect to habitat value. Taynton and Hopeful Creeks provide a limited amount of habitat value, while Little Hopeful Creek was recently enhanced as part of golf course construction work to offer additional fish habitat value which was lost in 1989 as a result of previous golf course construction activities. These creeks are all part of the Toby Creek system which supports moderate fish stocks including bull trout.

WATERSHED CONSIDERATIONS

The existing water supply for Panorama Mountain Village is based on the Hopeful Creek, Cox Creek, Taynton, and; Toby Creek watersheds. These watersheds represent significant resources to the resort as they serve the major water supply requirements for domestic, snowmaking and irrigation purposes as indicated in addition to providing important recreation, wildlife habitat and forest resources.

Resort planning has taken these issues into consideration. Intensive land uses such as residential and base area development are organized to avoid impacts to important natural systems while preserving major natural drainage and wildlife corridors associated with Toby and Hopeful Creeks and their tributary corridors. Watershed areas are protected through restriction of recreational uses and vegetation removal, and through implementation of community water and sewage systems which provide a major level of assurance with respect to protection of water supply and quality.

LAND TENURE

The major land base within Panorama Mountain Village Plan Area is owned by the Crown. This includes lands designated for development of ski terrain and some areas proposed for future residential use. The Ski Area (Master) Development Agreement between Intrawest Resort Corporation (or IWRLP) and the Province, provides a mechanism to allow the purchase of Crown land for the continued development and operation of the resort. This process has been in existence since the resort converted to private ownership and commenced operation of public day use facilities in conjunction with private bed unit development.

The balance of lands within the resort, mainly located in the alpine ski base and golf course residential areas are privately held fee simple and strata titled parcels. This includes: lands designated for golf course use and associated residential parcels; base area village and related residential/overnight accommodation uses; heli-ski base; strata townhouses and time-share units, and; summer related recreational use areas such as the tennis courts and riding stables.

The resort's growth, to "build-out", will require purchase of additional Crown land for base area development. On-mountain ski facilities will remain under Crown tenure with the exception of the "People Mover" lift in the Panorama Village area situated on Intrawest Resort Corporation (or IWRLP) lands.

EXISTING DEVELOPMENT PATTERN & INFRASTRUCTURE

At the time of the resort's ownership change to I.W. Resorts in 1993, approximately 1545 bed units existed, along with entitlement to develop up to a total of 5000 bed units, under the previous Official Settlement Plan. Existing bed units were made up of a number of strata condominiums located along the south side of Toby Creek, 77 single family lots and various lodge units contained within the Toby Creek Lodge and Pine Inn. In addition, a skier day lodge, heli-ski complex, administrative building, ski trails and chair lifts, maintenance and parking areas, outdoor summer recreation facilities and, community water and sewer systems also existed.

The collection of existing resort development and associated infrastructure, formed part of the previously approved 1989 Development Plan for the resort. It served as a framework, representing opportunities and constraints to future resort expansion.

The existing road network, sanitary sewer, water supply and location of built form represent important factors in shaping a new direction for future development of Panorama. The presence of these components impacts on the programming, configuration and phasing of expansion projects.

Many improvements have taken place since Intrawest's acquisition of the resort in 1993. These improvements include: upgrades to many existing condominiums in the Toby Creek Area;

construction of the Greywolf Golf Course; ski terrain expansion; upgrading of snow making facilities, and; major construction projects within the new Ski Tip Village, including Ski Tip Day Lodge and Tamarack Lodge, two new condohotel projects.

AGREEMENTS AND POLICIES

Development at Panorama Mountain Village is regulated by four main approval authorities: The Province of British Columbia Assets and Lands Corporation (B.C.A.L.C.); The Province of British Columbia - Ministry of Environment, Lands and Parks (M.O.E.L.P.); The Regional District of East Kootenay, and; the Provincial Ministry of Transportation and Highways. Each agency has its own set of regulatory criteria and associated requirements which must be met at various stages in the implementation of resort development projects.

B.C.A.L.C., through the Commercial Alpine Ski Policy and related terms and conditions of the Ski Area (Master) Development Agreement, regulate the phased purchase of Crown land, entitlement to bed unit and recreation facility development, and, the overall public function of the resort. The basis for this control relies on the OCP and Comprehensive Development Plan which were adopted in 1999.

The Regional District, through the OCP and Zoning Bylaw No. 900, regulate the various types of land uses within the Panorama Mountain Village Plan Area. The scale, form, and character, and overall density of resort development are controlled through these mechanisms. Development permits for form and character, together with building permits, ensure that regulations contained within these bylaws are adhered to.

Subdivision approval is controlled by the Provincial Ministry of Transportation and Highways (MoTH). Standards for road development are designated by MoTH while municipal infrastructure services must meet standards set by the Regional District of East Kootenay. Services other than roads, such as community water and sewer systems, require referral and approval by the Ministry of Environment, Lands and Parks, and Ministry of Municipal Affairs.

In addition flood control berming and creek crossings require approvals from B.C.A.L.C. and M.O.E.L.P. Water Management Branch.

4.3 PANORAMA MOUNTAIN VILLAGE MASTER PLAN

The Comprehensive Development Plan contains a physical master plan - Panorama Mountain Village Master Plan - which incorporates all the necessary components, both on and off the ski mountain, to transform this small mountain resort from being largely a winter place into a remarkable all-season destination resort - a true "Mountain Village". This transformation process began in 1993 with Intrawest's purchase of the resort and the significant improvements which have taken place since that time. The Master Plan provides a strategy for phasing resort improvements in order to ensure optimum response to both market forces and economic viability. The Panorama Comprehensive Development Plan provides the necessary vision and through its companion parts, serves as the guide to see Panorama through its final transformation.

The Panorama Mountain Village Master Plan contains a real estate programme which establishes the critical mass and complimentary land uses which will revitalize the "old" resort while sustaining overall viability of Panorama, through increased visitation on a year-round basis. The multi-phased programme has already been partially implemented through completion of Ski Tip Day Lodge, The Residences at Ski Tip - a condominium hotel, Tamarack Lodge - a condominium hotel, refurbishing of the existing Pine Inn, Administration Building and Toby Creek and Horsethief Lodge buildings, Renovations and relocation of Central Check-In, completion of Greywolf Golf Course, an 18-hole championship course, Greywolf single family subdivision, new road construction, servicing to support these developments, and significant landscape improvements as the finishing touches.

As indicated earlier, the Master Plan is comprised of four major development areas: 1) Panorama Village; 2) Greywolf; 3) Trapper's Ridge, and; 4) Alpine Recreation Area. Each of these areas represents a distinct neighbourhood, or in the case of the Alpine Recreation Area, a very specific form of resort development. The con-figuration of certain key components determines the overall form of development and functional aspects associated with various land uses within each of these major development areas. These are discussed in the following sub-sections.

PANORAMA MOUNTAIN VILLAGE
"THE END OF THE ROAD"

ILLUSTRATIVE MASTER PLAN

PANORAMA MOUNTAIN VILLAGE
MASTER PLAN FIGURE 4-1

4.3.1 ACCESS AND CIRCULATION

The main vehicular access to Panorama Mountain Village is via Panorama Drive over an existing bridge which crosses Toby Creek immediately adjacent to the intersection with Toby Creek Road. After crossing the bridge, Panorama Drive serves as the main public access road leading to major development areas within the resort.

EXISTING MAIN ENTRANCE TO PANORAMA

This main entry point offers an excellent opportunity to create a major arrival and entry node which incorporates the Central Check-In centre and establishes a "gatehouse" type function.

NATIONAL PARKS STYLE GATEHOUSE

After this point, a number of internal roads connect to Panorama Drive to provide access to individual neighbourhoods and development nodes. This internal road system consists of both public roads and private strata roads.

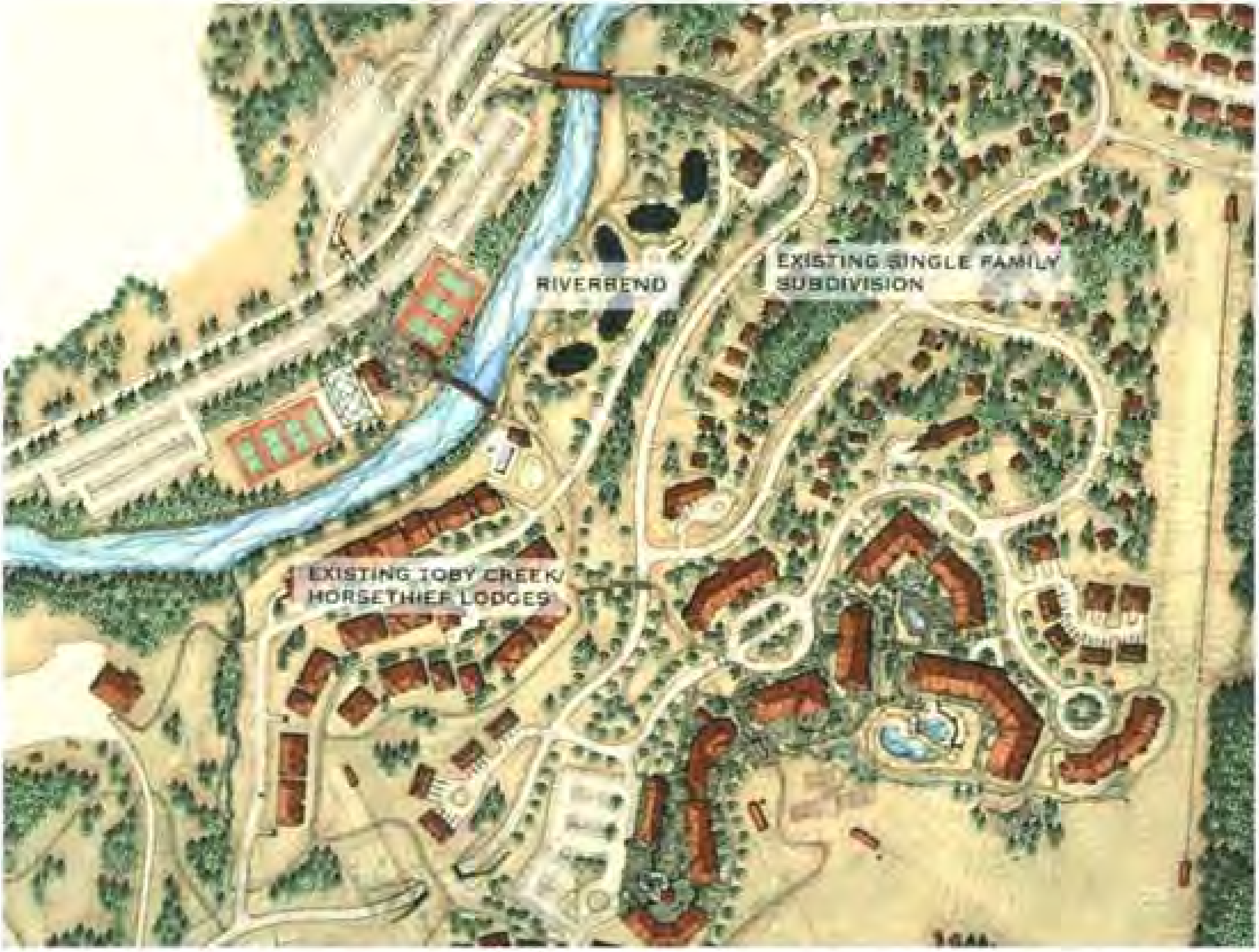
The public roadway network, which includes Panorama Drive and Panorama Place, winds through the existing Toby Creek single family subdivision in addition to providing access up the mountain base to Ski Tip Village. From Ski Tip Village, Panorama Drive continues south as a public road corridor towards the Greywolf neighbourhood and eventually becomes Greywolf Drive, the main public spine road carrying traffic through Greywolf neighbourhood. At Ski Tip Village, Panorama Drive intersects with a new public road called Summit Drive which provides direct access to the upper day skier parking lot and Ski Tip Village. Another spine road connected to lower Panorama Drive will serve as the main public access through the Trapper's Ridge neighbourhood to its upper elevations.

Private strata roads make up the balance of internal road network within the Panorama Mountain Village Master Plan. These include the main road serving the lower Toby Creek Area which contains Toby Creek Lodge, Horsethief Lodge and the Toby Creek recreation amenities. Greywolf contains a number of strata roads accessed off of Greywolf Drive to allow localized access to individual strata parcels. Trapper's Ridge also includes various strata roads serving this same function.

4.3.2 BUILT FORM

The built form component of the Master Plan consists of various buildings and structures which house diverse functions of the resort such as: residential accommodations; commercial uses; administrative functions; ski and golf operations; recreation centres, and; maintenance and storage functions. These are made up of both existing and proposed developments. The Master Plan successfully integrates existing built form with new and proposed projects. This is achieved in a sensitive manner through introduction of key infill projects such as the Riverbend townhouses in the Toby Creek Area, combined with upgrading of older existing buildings, such as the Pine Inn and Administration Building, in an effort to create a seamless transition between the past and the future.

The primary focus of built form development is the creation of mountain resort real estate which will establish the necessary critical mass to allow support uses such as commercial and recreational facilities to operate in an economically viable environment. The location, scale and density of built form vary relative to function and proximity to major recreational facilities and based on physical capabilities of the land base. Similarly, the character of built form throughout the resort is distinguished based on contextual setting within the Panorama Mountain Village Master Plan.



PORTION OF PANORAMA VILLAGE PLAN ILLUSTRATING INTEGRATION OF NEW INFILL PROJECTS WITH PREVIOUSLY EXISTING DEVELOPMENTS

4.3.3 RECREATION AND TRAILS

The recreation, open space and trail component of the Master Plan is predicated on the basis of existing facilities and operations combined with the potential of Panorama's land base to expand this component to increase year-round use and visitation of the resort. Two major recreation anchors within the Master Plan will achieve this result: 1) Resort Ski Operation and; 2) Greywolf 18 - hole championship golf course. While the existing alpine ski operation continues to be improved, the Mountain Master Plan sets a long term goal for increasing the Skier Carrying Capacity (SCC) from an existing 3600 SCC to 8000 SCC, over double its current skier capacity. This will successfully establish Panorama as a major ski destination and hence augment winter visitation of the resort.

The Greywolf Golf Course is hailed as one of the premier courses in Western Canada. The challenging configuration and its response to the natural environment, combined with a spectacular mountain setting, positions this course very favourably within the golf course market. A golf academy comprising a double ended driving range, practice golf holes and putting course will bolster the overall golfing programme, thus developing new golfers and attracting increased summer use of Panorama.

In addition to these significant drawing cards, a comprehensive trail network is planned which will facilitate all season use. "Panorama Valley Trail", will provide approximately five kilometres of paved trail which will loop around the golf course from Panorama Village and back again. It will have night lighting and therefore will be ideally suited for biking, rollerblading, walking and cross-country skiing. A major feature of Panorama Valley Trail will be the "People Mover" (Aerial Cable Conveyance System - A.C.C.S.), which will carry resort users between the upper Ski Tip Village area and the lower Toby Creek village area.

People Mover Lift

Panorama Valley Trail will function as Panorama's core trail network linking other recreation facilities such as swimming pools and the Panorama Springs Aquatic Centre, volleyball, climbing wall, skating, tennis and mini-golf, in addition to the main summer and winter attractions. A series of additional trails will connect into the Panorama Valley Trail to facilitate hiking, advanced mountain biking, cross-country skiing, snowmobiling, horseback riding, alpine touring and four-wheel drive tours.

The scope of Panorama's recreational development has spawned the need to develop a Recreation Master Plan. The Plan provides a comprehensive format for organization of all recreational uses and facilities at Panorama. It shows the location of major recreational staging areas and the uses and facilities located within them. It also includes locations and alignments of the resort's complete trail network, indicating access to wilderness areas and associated mountain recreation programming. The Recreation Master Plan is discussed in more detail in Section 4.4.

4.3.4 PARKING

The provision of adequate parking facilities to accommodate the wide range of year-round resort users is a major controlling factor in the organization of land uses within the Panorama Mountain Village Master Plan. The most significant parking requirement is the need to facilitate an ultimate Skier Carrying Capacity of 8000, stemming from the Mountain Master Plan ski development strategy. Based on parking calculation formulas relative to day-use skier parking requirements, a total of approximately 965 parking spaces must be provided for day skier use, independent of parking required for other resort uses. These relevant formulas and related detailed calculations are contained in Section 5.4 - Mountain Master Plan, nonetheless, the land area required for 965 parking spaces represents a significant factor in resolving appropriate solutions within the site planning process.

The location of existing and proposed ski lift facilities relative to suitable land base for development of required parking, has necessitated an innovative approach to resolving day skier parking concerns. The introduction of an A.C.C.S. people moving system to facilitate movement of skiers from lower base area elevations to the main Ski Tip Village lift base resolves a number of other key site planning issues. The A.C.C.S. has been integrated as a major component of the resort's overall trail system and establishes an important physical link between the older existing Toby Creek development and the upper main village of Ski Tip comprising the main ski lifts. This has allowed the bulk of day skier parking to be located on existing easily accessible flat terrain adjacent to the tennis courts on the west side of Toby Creek. A smaller day skier parking lot is located within Ski Tip Village. The Greywolf golf parking lot at the base of the Sunbird chairlift provides additional day skier parking.

With the major resort parking requirement resolved, individual developments are able to fulfil the balance of parking needs within their individual building programmes. This includes parking associated with residential and commercial uses and other smaller scale recreational uses. The seasonal nature of major recreation uses such as golf and alpine skiing facilitates a complimentary multi-use parking strategy which is summarized, as follows, in Tables 4-4 and 4-5. Figure 4-2 illustrates the strategy for accommodating day skier parking.

PARKING PROGRAMME

TABLE 4 - 4

AREA		ACCOMMODATION/ DWELLING UNITS		BED UNITS	PARKING	
PROJECT	YEAR	PUBLIC	PRIVATE		REQUIRED	PROVIDED
EXISTING DEVELOPMENT						
Horsethief Lodge		83	113	575	198	170
Toby Creek Lodge		48	10	174	60	84
Pine Inn and Pine Inn Annex		107	0	214	81	81
Toby Creek Single Family Subdivision		0	77	462	154	154
RK Heli-Ski		40	0	120	42	42
Sub-Total Existing Development		**278**	**200**	**1545**	**535**	**531**
PROPOSED DEVELOPMENT - PANORAMA VILLAGE						
The Hearth Stone	Year 1	0	28	106	56	56
Ski Tip Lodge	Year 1	33	0	72	25	41
Tamarack Lodge	Year 1	46	0	98	35	39
Riverbend	Year 2	0	40	160	80	80
Trapper's Crossing	Year 5 & 6	0	52	178	104	104
Pension #1	Year 2	1	0	8	10	10
Pension #2	Year 3	1	0	8	10	10
Building C - Expedition Station	Year 5	109	0	259	82	82
Building D - Panorama Springs	Year 2	80	0	195	60	80
Building E - Taynton Lodge	Year 4	80	0	195	60	80
Building F	Year 7	70	0	171	53	70
Building G - Conference Centre Condominium Hotel	Year 6	70	0	171	53	70
Building H - Conference Centre Multi-Family	Year 4	0	24	79	48	48
Building I	Year 3	0	16	53	32	32
Recreational Vehicle Park	Year 5	0	89	0	91	91
Sub-Total Proposed Development - Panorama Village		**490**	**249**	**1753**	**799**	**893**
PROPOSED DEVELOPMENT - TRAPPER'S RIDGE						
Single Family Area #1	Year 7, 9 & 11	0	53	318	106	106
Single Family Area #2	Year 10	0	17	102	34	34
Single Family Area #3	Year 12 & 13	0	52	312	104	104
Single Family Area #4	Year 7	0	12	72	24	24
Multi-Family Area #1	Year 11	0	28	91	56	56
Multi-Family Area #2	Year 12	0	16	52	32	32
Multi-Family Area #3	Year 13 & 14	0	104	338	208	208
Condohotel	Year 11	115	0	281	117	117
Sub-Total Proposed Development - Trapper's Ridge		**115**	**282**	**1,566**	**681**	**681**

AREA		ACCOMMODATION/ DWELLING UNITS		BED UNITS	PARKING	
PROJECT	YEAR	PUBLIC	PRIVATE		REQUIRED	PROVIDED
PROPOSED DEVELOPMENT - GREYWOLF						
Single Family Area #1	Year 1	0	25	150	50	50
Single Family Area #2	Year 1	0	6	36	12	12
Single Family Area #3	Year 1	0	6	36	12	12
Single Family Area #4	Year 3, 4	0	38	228	76	76
Single Family Area #5	Year 6	0	17	102	34	34
Single Family Area #6	Year 8	0	25	150	50	50
Single Family Area #7	Year 1	0	5	30	10	10
Single Family Area #8	Potential Future	0	6	36	12	12
Multi-Family Area #1	Year 4	0	28	91	56	56
Multi-Family Area #2	Year 3	0	22	72	44	44
Multi-Family Area #3	Year 8	0	44	143	88	88
Multi-Family Area #4	Year 10, 11	0	52	169	104	104
Multi-Family Area #5	Year 9	0	20	65	40	40
Multi-Family Area #6	Year 7	0	28	91	56	56
Multi-Family Area #7	Year 12	0	40	130	80	80
Multi-Family Area #8	Potential Future	0	61	198	122	122
Multi-Family Area #9	Year 6	0	16	52	32	32
Sub-Total Proposed Development - Greywolf		**0**	**439**	**1,779**	**878**	**878**
TOTAL DEVELOPMENT		**883**	**1,320**	**6,643**	**2,893**	**2,983**
PROPOSED DAY SKIER PARKING						
Ski Tip Village Parking Lot		N/A	N/A	N/A	N/A	100
Lower Toby Creek Parking Lot		N/A	N/A	N/A	N/A	455
Upper Toby Creek Parking Lot		N/A	N/A	N/A	N/A	260
Greywolf Clubhouse/Beckie Scott Nordic Centre Parking Lot		N/A	N/A	N/A	N/A	150
Total Day Skier Parking					**755**	**965**

PANORAMA MOUNTAIN VILLAGE DAY SKIER PARKING STRATEGY TABLE 4-5

According to Bylaw No. 900 one parking space is required for every three skiers. Using the 8,000 Skier Carrying Capacity, 2,667 parking spaces are required for skiers, less off-street parking spaces within 380 metres of a lift terminal. There are 1,912 off-street parking spaces within 380 m of a lift terminal. Therefore, 755 additional day-skier parking spaces must be provided. This is summarized in the following table:

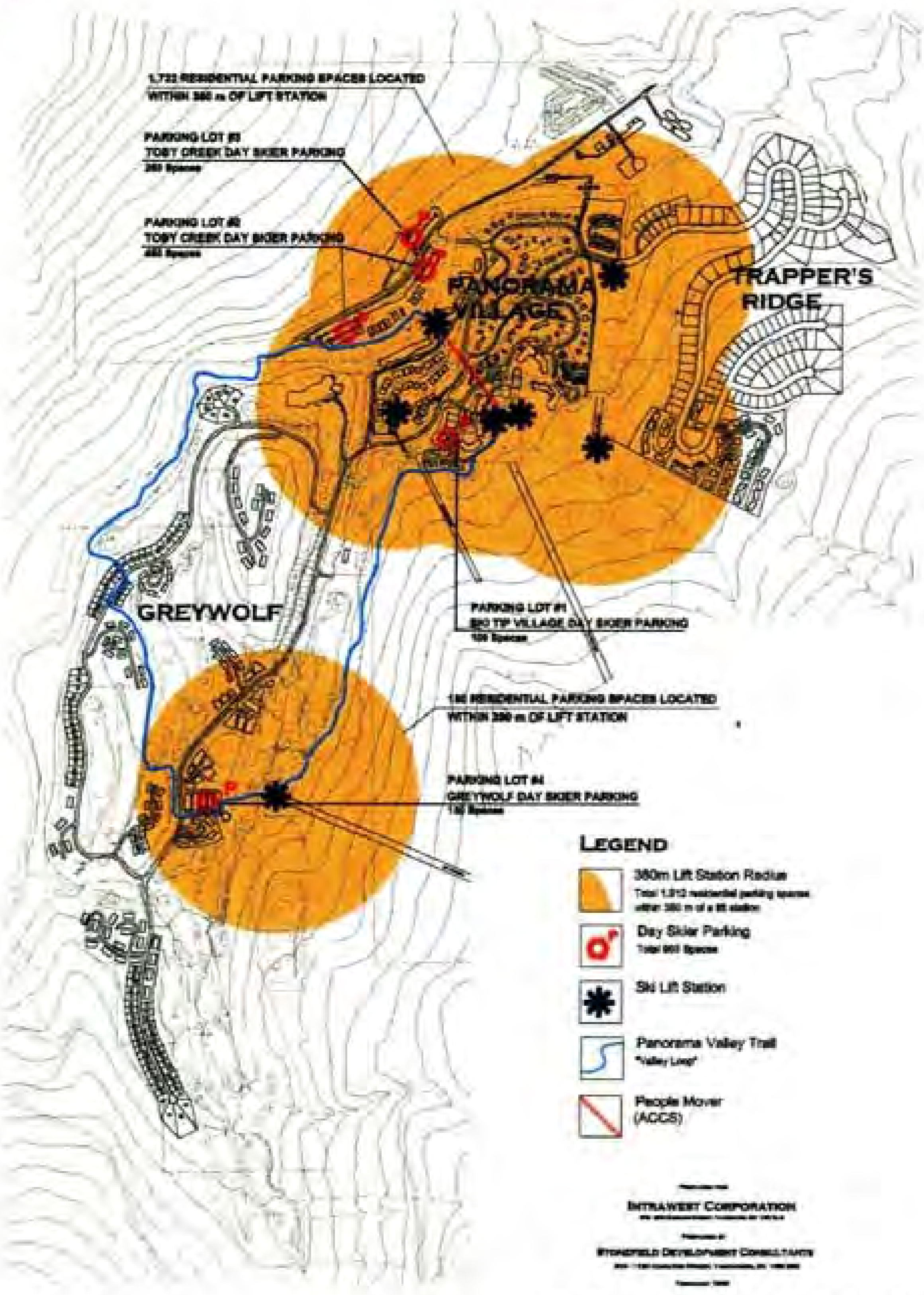
DAY-SKIER PARKING REQUIRED ACCORDING TO BYLAW NO. 900

Description	Parking Spaces
Day-Skier parking required per Bylaw No. 900	2,667
Less: Off-street parking provided for hotel, lodge and residential uses within 380 metres of any lift terminal	1,912
Day-Skier parking required which must be provided independent of hotel, lodge and residential uses.	755

This requirement for day-skier parking is satisfied through the creation of four major day-skier parking facilities strategically located across the resort. Two major lots are situated off of Toby Creek Road at the resort entrance. These lots will capture the bulk of day-skier parking prior to entering the resort's road system thereby significantly reducing vehicular impact at Panorama. The third major lot is located adjacent to the Administration Building in Panorama Village. This centrally located parking lot will satisfy parking requirements for the resort during off-season and off peak ski periods. The fourth lot is located at Greywolf Clubhouse/Beckie Scott Nordic Centre. This lot provides parking for the golf course facilities as well as for staging at the Sunbird Chair Lift and Nordic skiing during the winter season. The capacities of each of these lots is shown in the following table:

DAY-SKIER PARKING LOCATIONS

Day-Skier Parking Location		Parking Provided - Cars
Parking Lot #1	adjacent to Administration Building	100
Parking Lot #2	adjacent to Tennis Courts	455
Parking Lot #3	across Toby Creek Road	260
Parking Lot #4	at Greywolf Clubhouse/Sunbird Chair	150
Total Day-Skier Parking		965



**PANORAMA MOUNTAIN VILLAGE
DAY SKIER PARKING
STRATEGY PLAN** **FIGURE 4-2**

4.3.5 LANDSCAPE DEVELOPMENT

The approach to landscape development at Panorama is predicated on the desire to maintain a *"natural"* mountain experience. This is accomplished by employing two major fundamentals: 1) preservation of as much of the Panorama Mountain Village Plan Area as possible in an undisturbed natural state; 2) mitigate development impacts to the greatest extent possible but where impacts of development are unavoidable, restore disturbed and developed areas to a natural-like state. The first fundamental is achieved through various means, chief among them, the sensitive planning of land uses and design of built-form to minimize areas of disturbance, both on a comprehensive as well as site specific scale. The second fundamental is a achieved through sensitive design and application of landscape treatments.

INTEGRATION OF DEVELOPMENT TO MAXIMIZE NATURE PRESERVATION

Landscape development at Panorama draws its cues, as well as its resources, from nature. Landscape treatments are based on utilization of native plant species of trees, shrubs and groundcovers, with much of the actual plant materials being obtained from natural areas in and around the base area lands. A major landscape initiative involves the tagging, root pruning and extraction of indigenous plants from areas proposed for base area development and re-planting around newly developed areas to restore the natural mountain landscape which was previously altered. This approach results in an effective transformation from natural landscape to disturbed landscape and back to natural-like landscape, creating the impression and desired perception that the resort has literally grown out of the mountain.

The above strategy for soft landscaping is further reinforced by a similar approach in the use of other local on-site materials. The extensive use of on-site materials has two major benefits: 1) compensates for lack of commercially available materials required to achieve desired results, and; 2) provides cost savings to overall landscape programme resulting in more value for landscape budget expenditures.

USE OF NATURAL FOUND MATERIALS TO RECREATE NATURE

This is seen in the significant use of large native bedrock materials and indigenous soils. The creation of natural landforms from native soils, accented with strategic placement of large boulders, provides the ideal foundation for planting of native plants in random clusters.

Walking and bicycle paths are effectively incorporated within and through this landscape to facilitate functional requirements of people movement to and from various resort activities and uses. The goal is to achieve a seamless transition between preserved natural landscapes and newly restored landscapes in creating an overall landscape which is in context with the mountain environment.

Hard landscape elements punctuate the natural landscape theme throughout the resort. These include signage, lighting, furnishings, shelters and paving systems. The hard landscape elements perform varied functions within the overall landscape development.

Varied paving surfaces distinguish the nature and intensity of uses for pathways and plaza areas. Signage provides directional information as well as identification of specific resort facilities. Lighting performs specific safety functions related to vehicular and pedestrian movement, as well as providing ambience to pedestrian movement and highlighting of architectural and landscape features. The addition of colourful banners, provides a certain level of vitality to various areas throughout the resort. Shelters and benches not only perform their obvious functions, they also help to reinforce the overall theme and character of the landscape and the resort.

The complete specifications and details pertaining to landscape development at Panorama are contained in The Comprehensive Development Plan Volume III - Design Standards Manual.

4.3.6 ENVIRONMENTAL PRESERVATION

The Panorama Mountain Village Plan Area encompasses some 3076 hectares (7600 acres) of which 257 hectares (635 acres) is covered by the Panorama Mountain Village Master Plan. The balance of the Plan Area is comprised of large natural tracts which are surrounded by vast expanses of wilderness beyond the Plan Area. The major portion of land outside of the Master Plan contains the alpine ski runs and significant preserved natural open space.

The statistics alone confirm the significance of this component of the Master Plan. The great areas of preserved wilderness both within and outside the Master Plan consist mainly of dense forest cover, steep slopes and mountain drainage corridors. This composition not only provides valuable habitat to many species of mammals, birds and some species of fish, in doing so, it also establishes the context and setting which make Panorama unique and attractive. The preservation of these zones is important in delivering the desired resort experience and in protecting the values which will ensure the long term viability of Panorama Mountain Village.

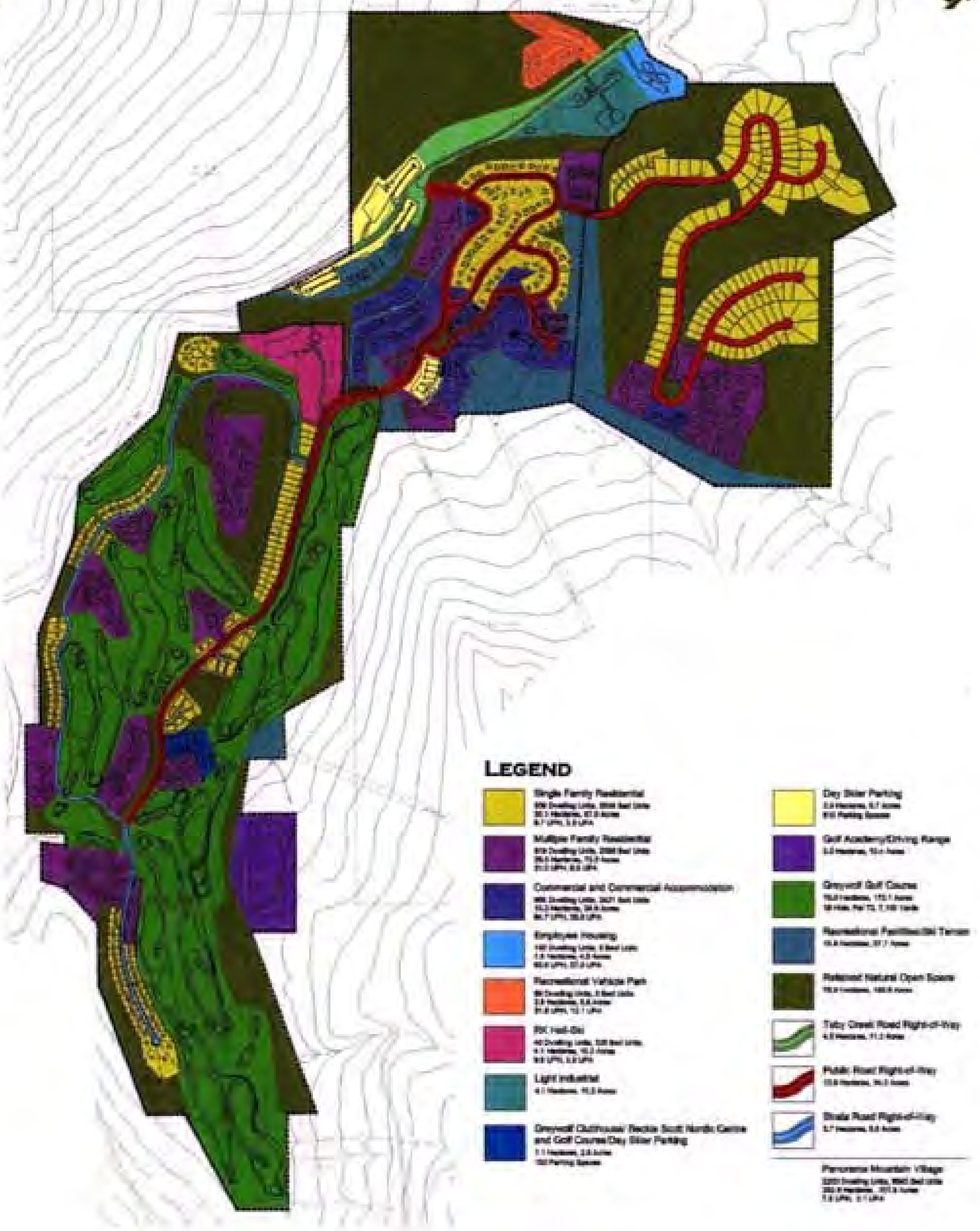
4.3.7 LAND USE SUMMARY

The Panorama Mountain Village Plan Area occupies a total of approximately 3,076 hectares (7,600 acres). Of this land base, approximately 437 hectares (1080 acres) are designated for existing and future expansion of the alpine recreation area and ski facility development, with base area development contained within the Panorama Mountain Village Master Plan occupying approximately 257 hectares (635 acres). Base area development is comprised of the other three major development areas previously described: Panorama Village - 76.6 hectares (186.8 acres); Greywolf - 131.9 hectares (326.1 acres), and; Trapper's Ridge - 58.6 hectares (145 acres). A detailed breakdown of areas occupied by various land uses within each major development area is provided in Table 4-6 and Figure 4-3, Land Use Summary Plan. These approximate areas will be confirmed by legal survey as part of phased subdivision and area subject to adjustment on a phase by phase basis.

PANORAMA MOUNTAIN VILLAGE LAND USE SUMMARY TABLE

TABLE 4-6

LAND USE	APPROXIMATE AREA	YIELD	DENSITY (AVERAGE NET DWELLING UNITS)
Single Family Residential	35.1 Hectares 87.0 Acres	339 Units 2034 Bed Units	9.7 UPH 3.9 UPA
Multiple Family Residential	29.5 Hectares 73.2 Acres	619 Units 2068 Bed Units	21.0 UPH 8.5 UPA
Commercial and Commercial Accommodation	10.2 Hectares 24.9 Acres	966 Units 2421 Bed Units	94.7 UPH 38.8 UPA
Employee Housing	1.6 Hectares 4.0 Acres	150 Units 0 Bed Units	93.8 UPH 37.5 UPA
Recreational Vehicle Park	2.8 Hectares 6.8 Acres	89 Units 0 Bed Units	31.8 UPH 13.1 UPA
RK Heli-Ski	4.1 Hectares 10.2 Acres	40 Units 120 Bed Units	9.8 UPH 3.9 UPA
Light Industrial	4.1 Hectares 10.2 Acres	N/A	N/A
Day Skier Parking	3.9 Hectares 9.7 Acres	N/A	N/A
Greywolf Clubhouse/Beckie Scott Nordic Centre and Golf Course/Day Skier Parking	1.1 Hectares 2.8 Acres	N/A	N/A
Golf Academy/Driving Range	5.0 Hectares 12.4 Acres	N/A	N/A
Greywolf Golf Course	70.0 Hectares 173.1 Acres	N/A	N/A
Recreational Facilities/Ski Terrain	15.4 Hectares 37.7 Acres	N/A	N/A
Retained Natural Open Space	78.9 Hectares 195.6 Acres	N/A	N/A
Toby Creek Road ROW	4.5 Hectares 11.2 Acres	N/A	N/A
Public Road ROW	13.9 Hectares 34.3 Acres	N/A	N/A
Strata Road ROW	3.7 Hectares 8.8 Acres	N/A	N/A
TOTAL Panorama Mountain Village	**283.8 Hectares 701.9 Acres**	**2203 Units 6643 Bed Units**	**7.8 UPH 3.1 UPA**



PANORAMA MOUNTAIN VILLAGE
LAND USE SUMMARY PLAN **FIGURE 4-3**

INTRAWEST CORPORATION

STONEFIELD DEVELOPMENT CONSULTANTS

4.4 RECREATION MASTER PLAN

The changing population characteristics and shrinking land base of Panorama's major resort market in Alberta, point to a multiplying demand for outdoor recreation opportunities associated with recreational property. The Panorama Mountain Village Master Plan is well positioned to meet these demands through its comprehensive recreation development programme. The magnitude and diverse nature of recreation activities and associated physical facilities at Panorama have lead to the establishment of a Recreation Master Plan as an integral part of the overall resort Master Plan. The Recreation Master Plan provides a format for the organization and staging of these activities and facilities, and serves as the resort visitor's guide to use of resort amenities. Table 4-7 provides a summary of the different year-round recreational activities and associated facilities which have been programmed into the Recreation Master Plan.

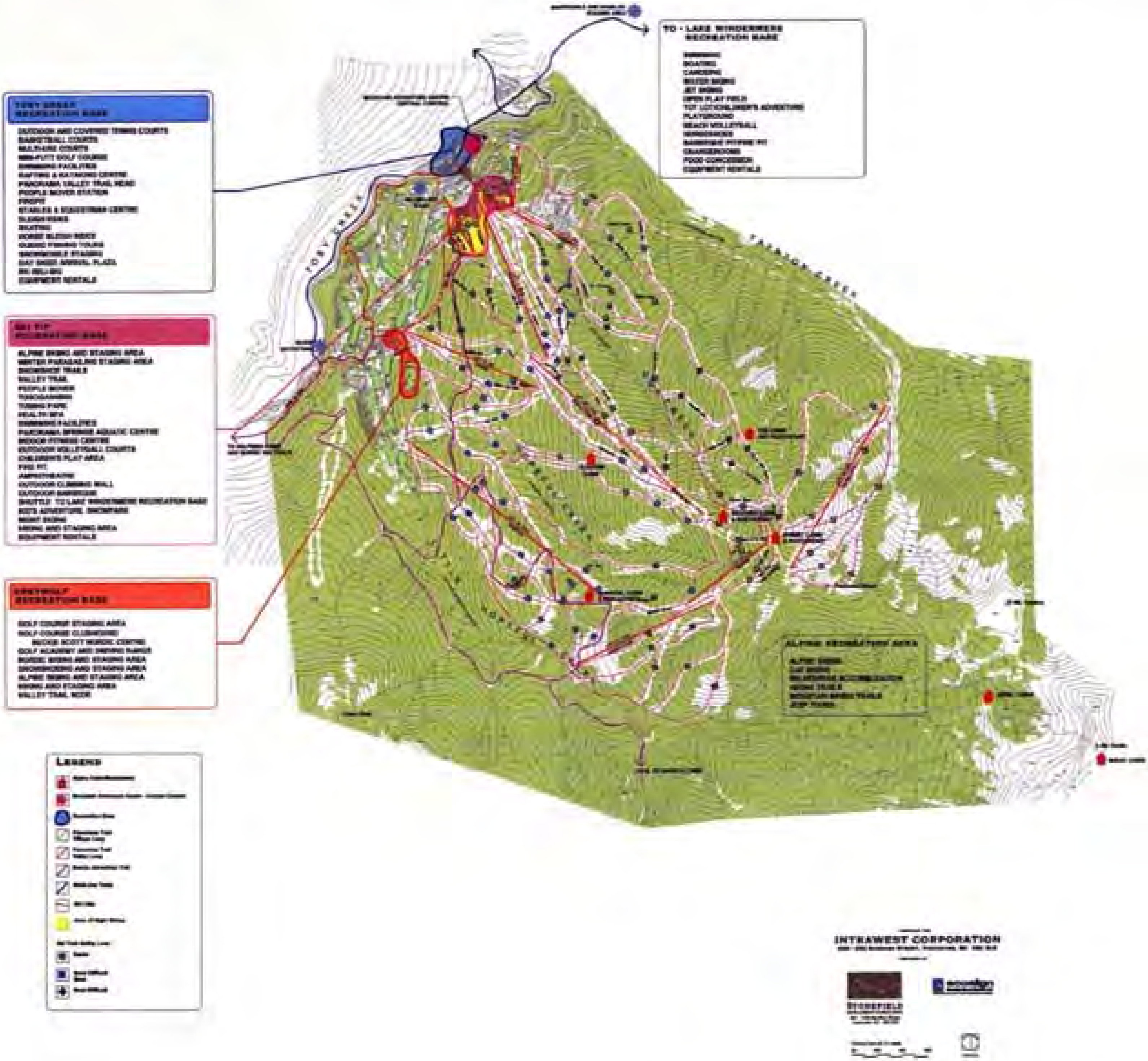
The Recreation Master Plan is composed of three major components: 1) Recreation Resources, consisting mainly of the land base and natural environment within and accessible to the Panorama Mountain Village Plan Area and the recreational opportunities which these afford to the resort user; 2) Recreation Bases which are in effect recreation staging zones resulting from a concentration of activities and facilities in specific locations within the Recreation Master Plan, and; 3) The Trail Network which links different areas, activities and points of interest throughout the Recreation Master Plan.

4.4.1 RECREATION RESOURCES

The location and natural environment of Panorama combined with availability of a significant land base, provide the resources necessary to allow Panorama to develop a comprehensive mountain recreation programme. The location of Panorama, within the Purcell Mountains and on the fringe of the Columbia Valley, yields a varied terrain with significant vertical elevation changes, a favourable climate and close proximity to Windermere Lake. This offers tremendous opportunities for development of numerous mountain based recreation facilities. While the primary focus of Panorama has always been downhill skiing, the Recreation Master Plan unlocks the true potential of Panorama's recreation resource base.

Panorama's natural environment possesses a wealth of scenic and natural attributes consisting of winding creeks and mountain streams, forested slopes and magnificent vistas. These attributes are combined with the expansive land base in and surrounding the Panorama Mountain Village Plan Area, and together provide the necessary assets to stage and develop other forms of recreation, ranging from large land based activities such as golf, cross-country skiing and snowmobiling to localized activities such as tennis, volleyball and ice skating.

The recreation resource base at Panorama is as well suited to active or structured forms of recreation as non-structured or passive recreation. Examples of such activities include downhill skiing and golf versus hiking and nature interpretation. Add to this, a well positioned waterfront staging area on Windermere Lake, and Panorama truly does have it all in terms of year-round recreational resources.



PANORAMA MOUNTAIN VILLAGE
RECREATION MASTER PLAN FIGURE 4-4

A significant land base and wilderness environment create the perfect setting for a mountain resort. The addition of waterfront lands within the Columbia Valley completes the range of recreation opportunities which can be developed. While various forms of recreation such as hiking, mountain biking and alpine touring permit greater exposure and contact with the natural environment of Panorama, other activities such as golf , tennis and swimming, which are concentrated in specific areas, allow one to experience the visual qualities, sense of scale and beauty of the mountain and valley environments. The recreation resources at Panorama are natural and diverse. From mountain to valley landscapes, Panorama offers a range of year-round recreation opportunities which is unmatched, either locally or regionally.

WINDERMERE LAKE RECREATION BASE

4.4.2. RECREATION BASES

The Recreation Master Plan contains four major Recreation Bases or activity staging areas: 1) Ski Tip Recreation Base; 2) Toby Creek Recreation Base; 3) Greywolf Recreation Base, and; 4) Windermere Lake Recreation Base. These nodes have evolved from the concentration of recreational activities and facilities which occur within a specific area. They are interlinked through the comprehensive network of trails which exist and are proposed for the Panorama Mountain Village Plan Area.

In the case of Windermere Lake Recreation Base, a shuttle service operating between Windermere Lake and the main resort using Toby Creek Road, will facilitate the desired link.

SKI TIP RECREATION BASE comprises the Ski Tip Village area and ski lift bases. Within this zone, numerous activities are staged. Primary among them, is Panorama's downhill skiing operation which includes: major chairlift stations; ski runs and snowboard park; day lodge, lift pass sales and ski rentals, and; ski patrol. Other staged recreation activities include: Panorama Valley Trail head and associated recreation activities; mountain bike touring; hiking; four-wheel drive alpine tours; ski touring, and; guided interpretive walks.

Within the Ski Tip Recreation Base, various recreation facilities exist which accommodate related activities within this zone. These include: outdoor volleyball courts; an aquatic centre facility including water slides, hot pools and swimming pool; skating rink; climbing wall; indoor fitness facilities and health club. These recreational uses require various support functions which are also contained within this recreation base. These include a central bookings centre, Kids Kamp and daycare facilities, equipment rentals and changing facilities.

Toby Creek Recreation Base encompasses a linear corridor on both sides of Toby Creek extending from the main access bridge at the north end, south to and including the heli-plex. Within this base zone, various summer and winter activities are either staged or take place "on site." Staged activities include: heli-skiing; helicopter site seeing tours; river rafting tours; stables and horseback riding excursions; snowmobiling, and; ATV tours. Activities for which facilities are located within the Toby Creek Recreation Base include: tennis; putting; mini-golf; basketball; RV camping; swimming, and; children's' playground. The main day skier parking lot is located within this zone, as well as the lower A.C.C.S. base station which facilitates the major physical connection between Toby Creek and Ski Tip Recreation Bases.

GREYWOLF RECREATION BASE constitutes an area containing the Greywolf clubhouse and Sunbird chairlift. Hence the major recreational activities which are staged out of this zone are golf, downhill skiing and nordic skiing. Facilities include the Sunbird chairlift and ski runs; the Greywolf clubhouse/Beckie Scott Nordic Centre; starting and finishing golf holes; driving range and golf learning academy; practice putting greens, and; a major Panorama Valley Trail node. Support uses and facilities include: a 150 vehicle parking lot serving golf functions during summer and day skier parking in winter, and; equipment rental facilities.

WINDERMERE LAKE RECREATION BASE will be an approximately one hectare (2.5 acre) area located on the shores of Windermere Lake. This base area provides recreational facilities and activities which cannot be accommodated at the main resort but for which a major demand exists. These are mainly summer uses which make the recreation experience of Panorama complete, and in doing so, set Panorama apart from its competition in the market place.

Recreation activities which are staged out of this base area include: swimming; waterskiing; jetskiing; boating; fishing, and para-sailing. Land based activities and facilities include sunbathing; beach volleyball; picnicking; mini-golf; children's play; open field play; adventure water park, and; horseshoes. Support facilities include parking, change rooms, barbecue pits, picnic shelters and concession stand.

4.4.3 TRAIL NETWORK

A comprehensive system of trails and open space perform a major role within the Recreation Master Plan in providing physical connections between recreational uses and facilities, and the wilderness beyond. Resort trails open up scenic, historic and recreation resources for visitor enjoyment on both private and public land within and surrounding the Panorama Mountain Village Plan Area.

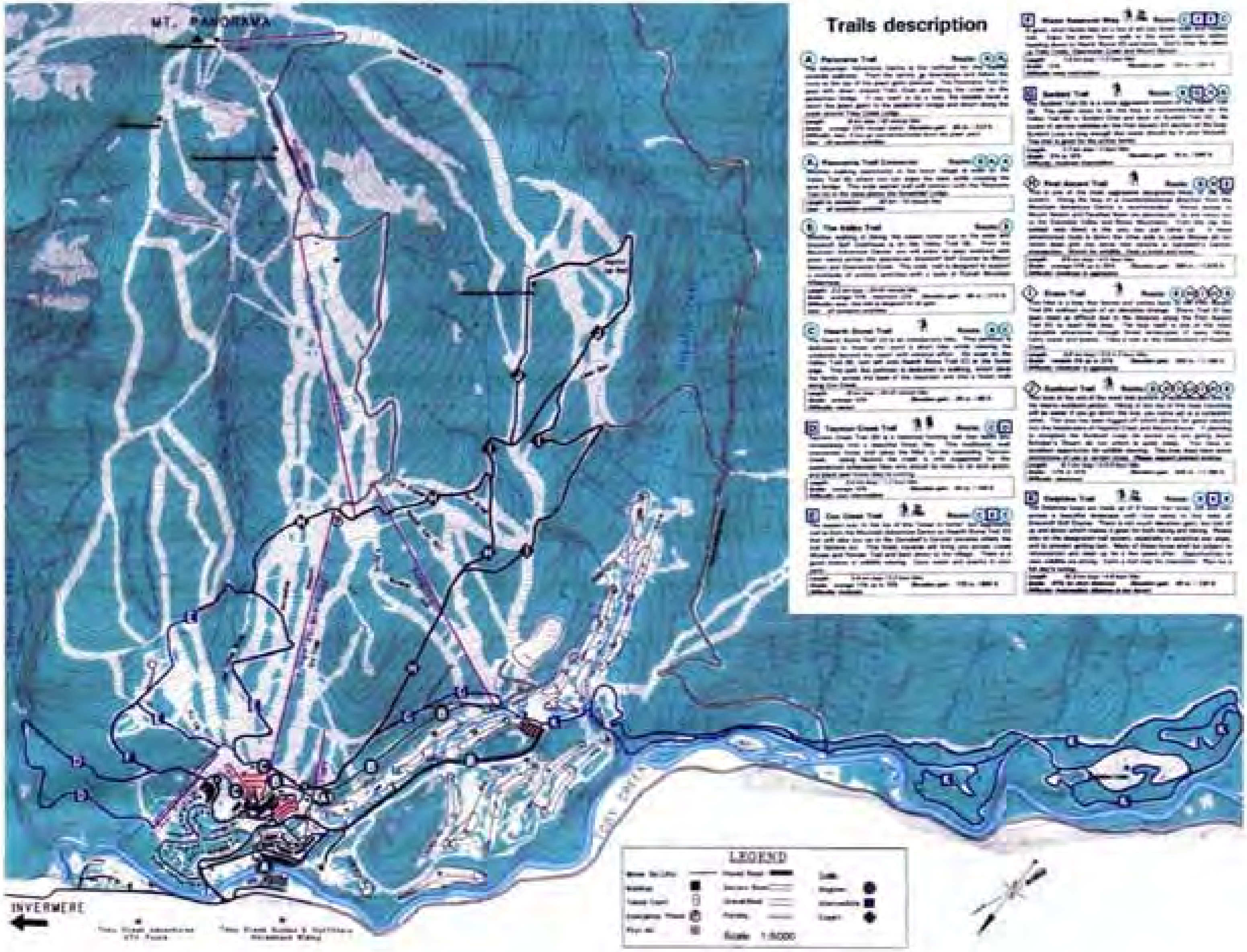
The trails at Panorama lead the visitor from their vehicle or resort accommodation to a waterfall, a scenic overlook, a geologic phenomenon, or perhaps a point of historic interest. They provide access from a recreation base or staging area to the recreation resources of the Plan Area. They are inviting because there is something interesting at the end to see and do. They are located respective of their proximity to recreation activities and facilities and vary in length and structure as the conditions require. Graded and finished, they serve as many persons as care to use them. The value of the recreation resources made available is the measure of the utility of Panorama's trails.

EQUESTRIAN TRAILS

The trails of Panorama serve a wide range of outdoor recreation activities. By their nature, they afford a low-concentration, dispersed type of recreation which Panorama can offer. Trails are in themselves, the means to some of the most beneficial forms of exercise - walking, hiking, horseback riding, cross-country skiing, rollerblading, running and mountain biking. They lead to areas prized by naturalists; they are used by artists and photographers; they help satisfy the craving many people have for solitude and the beauty of untrammelled lands and waters.

Visitors to Panorama will find pleasures varying from use of specific recreation facilities to viewing glaciers, mountaintops, waterfalls or creeks and streams. Trails open public wilderness areas to the visitor on foot, horseback, mountain bike or four-wheel drive vehicle. Hunters seek their quarry along trails and Fishers enjoy the thrill of trying a remote lake or stream accessed by a trail.

Panorama's trail network is comprised of a hierarchy of multi-purpose trails which can be grouped into three main categories: 1. the Panorama Valley Trail, a system which serves as the main core trail network of the resort; 2. Local Recreation Trails, and; 3. Scenic Wilderness Trails. The location, alignment and physical characteristics of these different trails is related to their nature and intensity of use. The hierarchy of trails described is illustrated in Figure 4-5 - Trail Systems of Panorama Mountain Village.



TRAIL SYSTEMS
OF PANORAMA

FIGURE 4-5

Backcountry Travel

When you go into the woods today...

Prevent uninvited dinner guests...

TOP OF THE WORLD TOURS

THE TRAILS AT PANORAMA

TOBY CREEK ADVENTURES

MOUNTAIN ADVENTURE TIPS

PURCELL RIVER ODYSSEYS

- Whitewater
- Rafting
- Kayaking
- Wildlife Viewing

TOBY CREEK GUIDE & OUTFITTERS

THE ALPINE ZONE

THE COLUMBIA VALLEY

MOUNTAIN CLIMATE AND WEATHER

THE MOUNTAIN ADVENTURE CENTRE

THE MOUNTAINS SHALL BRING PEACE TO THE PEOPLE

MOUNTAIN SAFETY AND RESPONSIBILITY CODE

WHAT'S ON YOUR BACK?

HUNTING SEASON

Grizzly Bear

Black Bear

YOU ARE IN BEAR COUNTRY

TRAIL SYSTEMS OF PANORAMA

FIGURE 4-6

THE PANORAMA VALLEY TRAIL system is a multi-purpose trail which serves as the main thread linking various resort neighbourhoods and recreation base areas. It originates out of the Ski Tip Recreation Base and is asphalt paved with relatively gentle grades. This permits usage by the full range of resort users, from families and elderly folks to serious fitness types. The total length of the Panorama Valley Trail is approximately five and a half (5.5 km) kilometres, with portions having lighting for night use. It is made up of two main loops: the "Village Loop" which encircles the resorts main core consisting of the Toby Creek and Ski Tip Recreation Bases, and; the "Valley Loop," which extends out further to the Greywolf Recreation Base and loops back to Panorama Village along Toby Creek. Both loops rely on the A.C.C.S. as the major physical link between the lower Toby Creek Recreation Base and the upper Ski Tip Recreation Base.

LOCAL RECREATION TRAILS consist of the series of trails which are accessed off of Panorama Valley Trail. These trails have evolved from old logging roads, game trails or mountain access roads. The trail beds are of earthen construction which has been compacted and established over many years. The typical uses associated with these trails are shorter localized excursions either on foot, mountain bike, cross-country skies or on horseback. They provide access to natural landscape features and outlooks in relatively close proximity to the main resort.

CONCEPTS FOR TRAIL FEATURES

SCENIC WILDERNESS TRAILS appeal to the spirit of adventure in the visitor to Panorama. Routed to open the scenic wonders of ridgelines, mountaintops, countryside, streams and lakeshores, and to provide access to scenes of historic significance, these trails offer varied and exciting experiences. They go further afield, even extending outside of the Panorama Mountain Village Plan Area, to the Paradise Mine site, to the tops of Panorama Mountain, Mt. Goldie and Mt. Brewer, to the peak of Mt. Nelson and Delphine Glacier. Built to harmonize with the natural areas they cross, they afford the visitor closeup instruction in nature and her ways. Healthful exercise and the opportunity to break away from the norm add to the values of extended hiking and riding experiences. Defined as extended trails which have natural, scenic or historic qualities that give them recreation use potential of local as well as regional significance, such trails might typically have overnight shelters at appropriate intervals and be interconnected with the other major trails to permit the enjoyment of extended hiking and riding experiences.

Panorama's trail development programme will be augmented through the incorporation and strategic placement of bridges, shelters and other similar structures including general information kiosks, place identification signs and, directional signs and trail markers. All of these elements reinforce a consistent theme and image for Panorama through the use of heavy timber, stone and other compatible materials assembled based on tasteful designs. The details and specifications of these elements are contained in Volume III of the Comprehensive Development Plan - the Design Standards Manual.

4.5 CORPORATE BRANDING AND THEMING OF PANORAMA

Intrawest resorts are among the most sought after recreation and lifestyle destinations in the world. Their renown stems from the commitment to provide a total resort experience founded on the qualities of local culture, natural environment and the visual resources present at an Intrawest resort. Whether it is the local distinct culture and language spoken by staff, a secluded valley or a spectacular mountain range, Intrawest resorts capture the essence of their surroundings. This is expressed through the architecture, signage and landscape treatments at the resort, through the resort's recreational programme, in the type of accommodation available, in the range of styles and foods served in restaurants, in the merchandise sold at retail shops and, through the character and quality of appointments in the resort's buildings and structures.

THE PANORAMA THEME
"SPIRIT OF THE CANADIAN WEST"

These are the characteristics which not only distinguish Intrawest resorts from the others, they also establish the individual trademark qualities of each Intrawest resort. These trademark qualities are captured and translated to create a resort's own unique "Theme". That theme becomes the resort's mark of distinction among Intrawest resorts. Applying this approach throughout all resorts, Intrawest has distinguished itself by establishing a high level of corporate expectation among its clients. This is continually reinforced through: the quality of accommodations, food services and, lifestyle offered at Intrawest resorts. It is this corporate standard which places the Intrawest "brand" on the resort.

Corporate resort branding is the application of the Intrawest trademark/logo to various resorts, hence creating the level of customer expectations described. Resort theming is the application of the individual resort's trademark/logo throughout a specific resort. This hierarchy, depending on context, emphasizes the relative significance between Intrawest as a corporation and the resort as the specific destination.

INTRAWEST

Merchandise labelling, logo applications, a uniform code of conduct and level of service provided at Intrawest resorts represent the subtle symbols of corporate branding. Merchandising schemes, architectural and interior design, hospitality theme and, food and beverage orientation, are the visible expressions of the resort's own particular Theme.

DAVID THOMPSON KOOTENAI HOUSE

Panorama Mountain Village possesses the necessary blend of natural, historical and man-made assets to establish a strong and notable Theme, not only among resorts in the Rocky Mountains, but within the international pool of Intrawest resorts. Its location in the Rocky Mountain area, the magnificent natural features such as Mount Nelson, Monument Peak and Toby Creek which surround and flow through the resort, the evolutionary history in pioneering and human settlement of the area - with the likes of David Thompson founding what is now a national historical site - Kootenai House - and the assemblage of recreational resources and amenities available at Panorama, provide it with a strong inventory of qualities which have helped create its Theme. These attributes evoke "The Spirit of the Canadian West" and hence are the root of the Panorama Theme.

"THE FIRST SETTLERS HAD A DREAM ABOUT THIS PLACE."

4.5.1 CORPORATE BRANDING AT PANORAMA

As with all Intrawest resorts, Panorama will bear the Intrawest signature in all facets of resort development and operation. During the developmental stages of various resort phases, the Intrawest logo will appear on construction signage, on signage announcing future developments, on marketing brochures and in various publications describing proposed land uses and timing of future projects at Panorama. This temporary use of the corporate trademark serves as the resort visitor's or purchaser's introduction to an Intrawest resort. It creates excitement, anticipation and a sense of future reward associated with the Intrawest name. It provides investor confidence in the overall resort programme. It also serves a transitional function with respect to Intrawest's ultimate presence at Panorama.

Upon completion of individual projects such as Ski Tip Lodge or Tamarack Lodge condo-minium hotels, the Intrawest name will take on a long-term presence. This will be conveyed in the management and operation of various facilities through level of service, code of conduct, administrative functions and ongoing marketing of Panorama Mountain Village.

Intrawest's long term corporate presence is sustained through the development and operation of year-round recreation programming which ties real estate and commercial development to recreational enjoyment. In this way, the Intrawest name goes beyond a logo, it makes the Intrawest name synonymous with a total resort quality and lifestyle.

4.5.2 THE PANORAMA MOUNTAIN VILLAGE THEME

The theme which has been established for Panorama reinforces Intrawest clients' corporate expectations. The Panorama Mountain Village Theme is inspired by a desire to capture the scale and splendour of Panorama's rugged natural setting and convey it in all facets of resort life. The depth and complexity of Panorama's theme comes from the translation of an historical perspective, echoing local pioneering history which perhaps best demonstrates the challenges and rewards that come with man's ambitions to live and play in nature - the mountains infuse a spirit of adventure, "The Spirit of the Canadian West".

THE RAILWAY AND RANCHING WHERE PART OF THE LOCAL PIONEERING HISTORY

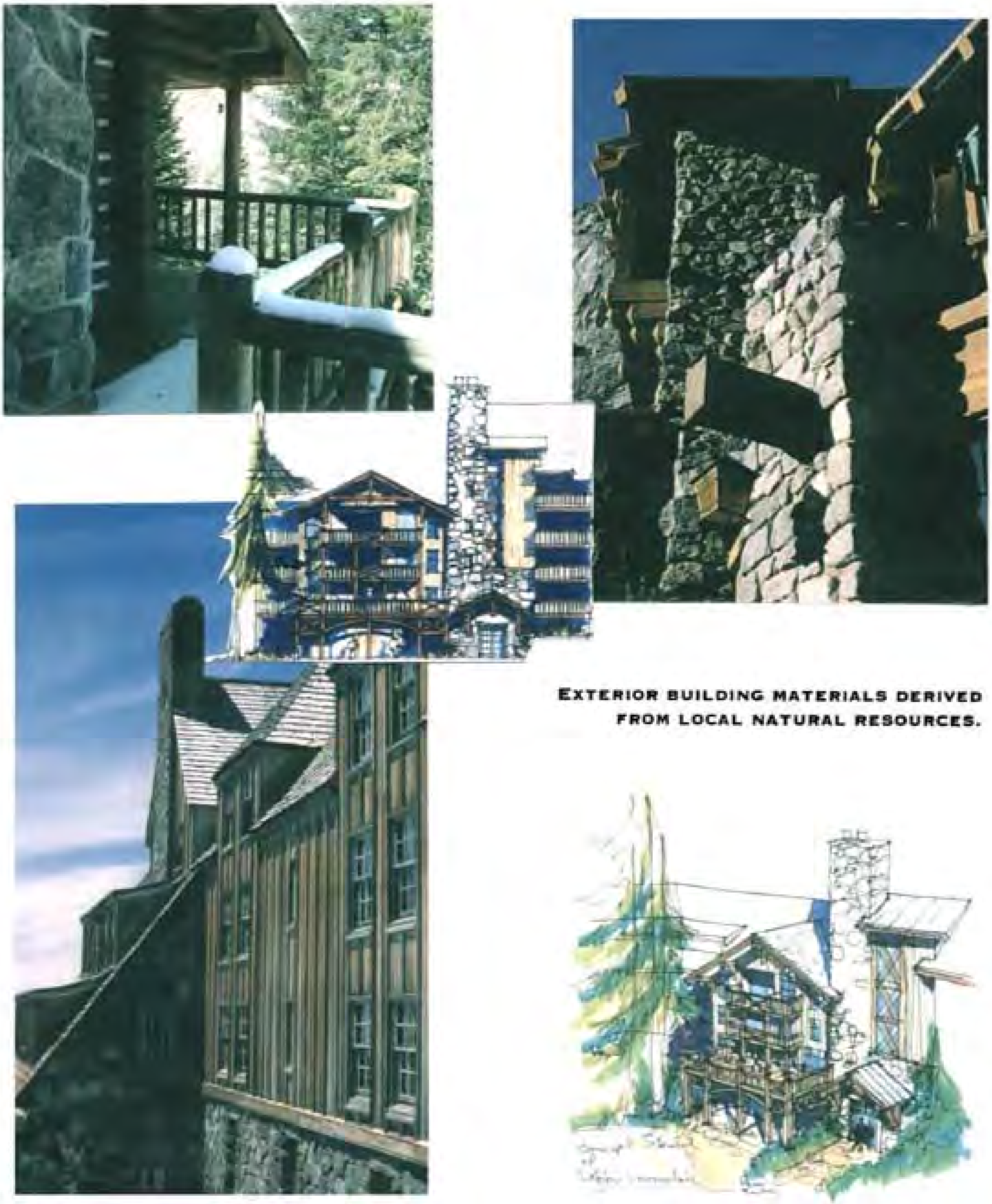
This theme is woven throughout life's experiences at Panorama, from arrival to a real wood burning fire at the main welcome centre, to souvenirs gathered during a stay at the resort - a total image is indelibly etched which reflects all that is Panorama Mountain Village. That image encapsulates the essence of the "Spirit of the Canadian West" theme which includes: early pioneering; mining; western railways development; and ranching in the west.

ARCHITECTURE AND THE LANDSCAPE

"Of the mountains and from the mountains" summarizes how the Panorama theme is captured in the architecture and landscape of Panorama. Stemming from historical roots, the architecture at Panorama reflects a form and character which combines the Adirondack influence with its western translation of Cascadian or "Big Stick Log-Style" vernacular, symbolic of the famous lodges and National Parks of the west.

The architectural style is made to blend as nearly as possible with the mountainside, through building form and materials which incorporate natural and locally found resources such as stone, large boulders, timber and log, and colours reflecting the local scenery. Buildings are designed to fit the land, with shapes and forms reminiscent of pioneering in the Rockies. Native plantings of mature trees, shrubs and groundcovers further harmonize Panorama architecture with the natural environment. Together, architecture and the landscape are made to become part of the land not an intrusion. This is the premise on which the Panorama Theme is based - a respect for nature and the past which has lead to Panorama's creation - "comfort and luxury coexist with the vague concept of roughing it".

"CASCADIAN" OR "BIG STICK LOG STYLE" ARCHITECTURAL THEME EXEMPLIFIED IN MANY NATIONAL PARK LODGES SUCH AS TIMBERLINE LODGE ON MOUNT HOOD, OREGON.



EXTERIOR BUILDING MATERIALS DERIVED FROM LOCAL NATURAL RESOURCES.

INTERIOR DESIGN

The design of building interiors and furnishings reinforces the theme and character conveyed in exterior building architecture, adding another level of depth to the Panorama theme. The same set of influences that produce a particular building design should have play in determining the furnishings and interior appointments of it. The furnishings and decorations of lodges, community buildings and residential buildings can have a great variety and contribute importantly to the use and the appearance of these buildings.

The feeling of the past is accentuated when items of skilled handcrafts associated with the early days are introduced. This is conveyed through principles of good furniture design: suitability to purpose; appeal to the eye and; adaptation of technique to materials at hand. Simplicity must be the keynote if furnishings are to appear appropriate in structures which themselves must be unpretentious to be successful in the natural setting of Panorama. Primitive and pioneer furnishings were extremely simple, as were the interpretations of transplanted historic styles developed by the earliest settlers. The varied use of wood, products of the loom, and the art of the blacksmith, all supply inspiration for details important to the creation of "atmosphere". **The Spirit of the Canadian West** will only attach to certain adaptations as long as they do not become utterly commonplace by reason of being too often used.

Pioneer images, Indian motifs, local artisan designs and derivatives from nature are visible on walls, in furniture and on floors throughout various buildings at Panorama. Rooms are the colours of the land - sepia, ochre, dusty green and burnt umber are assembled to mirror the outdoors - the earth, the pine trees and the rock found in local mountain landforms. Interiors are a logical extension of the exterior architecture and together, the synthesis embodies **The Spirit of the Canadian West**.

MERCHANDISING

The sale of dry goods, recreational equipment and accessories, and memorabilia commemorating a stay at Panorama stem from the established philosophy of reflecting the history, natural surroundings and context of Panorama in the Rockie Mountain area. While the interior design of the General Store recalls local history in its interior finishes such as wide board floors with rustic wall treatments and furnishings, the merchandise sold is also a product of the local environment. Food items include locally made products ranging from baked goods made daily, to fresh pasta and locally roasted coffees. Hardware, light bulbs, steaks, eggs, milk, bacon, BBQ beans and deli foods are all items which will be sold in a "Mountain Outfitter's" setting. From fresh and packaged items to prepared foods, to daily household needs, the General Store is a central gathering place to meet friends, have a cup of coffee or just browse and absorb the atmosphere.

Clothing and accessory items available at Panorama, not only satisfy functional requirements responding to the local climate, but also convey a style which is derived from "The Spirit of the Canadian West" motif. Heavy wools, fleeces, quilts, leather bags and boots provide winter warmth while cottons, linens and summer accessories convey the year-round life of Panorama Mountain Village.

Recreational equipment sold or rented from various outlets, ski shops and the golf course pro-shop, allow access to all of the activities provided in Panorama's recreational programme. State-of- the-art technology and variety of choice responding to weather and snow conditions are apparent in Alpine ski and nordic equipment and apparel. Available to the adventure enthusiast will be a Guide's Club as well as rental of key equipment like probes/avalanche transceivers, back packs, tents, sleeping bags, and mountaineering equipment. Gear for golfing, tennis, mountain biking and hiking are all synonymous with the message depicted by the Panorama Resort theme -rugged and functional yet refined and, in **The Spirit of the Canadian West.**

FOOD AND ENTERTAINMENT

When it comes to dining out or apres activity relaxation at Panorama Mountain Village, the belief is that fresh ingredients and locally brewed, just taste better. This applies not only to the fresh produce or food products sold at the General Store, but all food and entertainment services at Panorama. A consistent quality as well as food themes, blend with the settings in which they are served.

Dining experiences range from fine dining in a refined rustic setting, to outdoor BBQ's and cookouts celebrating special events and group outings. For those who still have reserved energy after an active day on the slopes or on the Greywolf Golf Course, Panorama offers a variety of nightlife, from the frontier mood of the Kicking Horse Saloon to the "locals" feel of the Jackpine Pub to the vibrant atmosphere of the Glacier Nightclub. There is sure to be something for everyone that reflects **The Spirit of the Canadian West**. The operative code is a laid-back, relaxed attitude throughout all venues, with service people have come to expect from an Intrawest resort.

RECREATION PROGRAMMING

Panorama is a place where life is loved. Every experience will make those who live and visit the little mountain village feel like this is all that matters. Whether you come to experience the rush of adrenaline that comes with some of the world's best skiing, or the excitement of surging down a wild set of rapids, or the enjoyment of a challenging round of golf on a spectacular mountain course, or to just take in the scenery, you will truly feel **The Spirit of the Canadian West** as if for the first time, every time.

The recreation programme at Panorama allows you to be intimate with nature from a distance or from up close. The only limit is your desire and imagination, and at Panorama, it's okay to just relax.

4.6 DEVELOPMENT SERVICING STRATEGY

This section provides a summary of the strategy for providing services to the major development areas including: roads; utilities, and; maintenance and operations functions. Planning for these functions has been undertaken in consideration of existing resort infrastructure balanced against future development demands and based on the requirements and standards of the Ministry of Transportation and Highways, the Regional District East Kootenay and the Ministry of Environment, Lands and Parks. The information in this section is derived from the Panorama Mountain Village Servicing Report prepared by Bel-MK Engineering which is contained in Volume II of the Comprehensive Development Plan - Technical Background Report.

TRANSPORTATION NETWORK

Vehicle access to the golf course/residential neighbourhood at Panorama Mountain Village will be along Toby Creek Road from Invermere, entering Panorama across Toby Creek on the existing Panorama Drive. Within the resort Panorama Drive, Panorama Crescent, Summit Drive, Greywolf Drive and Trapper's Ridge Road will be public roads. All other roads will be private strata roads.

The right-of-way width for public roads will be 20.0 m. This includes a pavement width of 7.0 m plus 0.5 m paved shoulders on each side with a maximum grade of 10%. Within Ski Tip Village, a section of the Summit Drive will be curb and gutter. The strata road right-of-way is 12.0 m. This also includes a pavement width of 7.0 m and a 0.5m gravel shoulder on each side of the road. The maximum grade for strata roads throughout the development is 12%. All roads will be constructed to MoTH Subdivision Standards and emergency response criteria.

An emergency access road, for summer use only, has been identified. It extends from the end of the public road near the 6th tees west along Hopeful Creek tributary to Toby Creek. A second minor crossing of Toby Creek will be required in order to connect with the existing Toby Creek Road.

Parking will be provided throughout the resort as required under Zoning Bylaw No.900 and the Panorama Mountain Village Area OCP. Generally, parking for each residential and resort accommodation use will be provided within the parcel upon which the use is located. Day-skier parking will be provided in four parking lots strategically located throughout the resort to provide convenient parking for users and to break-up the visual impact of large expanses of parking. The day-skier parking provided is:

- Ski Tip Village Lot (100 vehicles);
- Greywolf Clubhouse/ Sunbird Chair Lot (150 vehicles);
- Lower Toby Creek Road (Tennis Centre) Lot (455 vehicles), and;
- Upper Toby Creek Road Lot (260 vehicles).

(See Figure 4-2 Day Skier Parking Strategy Plan)

SEWAGE DISPOSAL

Panorama Mountain Village maintains a private treatment facility located adjacent Toby Creek Road near the resort entrance.

The gravity sewer system at Panorama feeds to a central low point near Toby Creek at the resort entrance. From here a lift station moves the material through a forcemain to the treatment facility. All components of the gravity sewer, pump station and forcemain are adequate to meet the ultimate demand of proposed development.

The sewage treatment plant and weeping tile field will require some upgrading to meet the ultimate requirements of the resort. Panorama has recently completed a study of the sewage treatment facility's capacity to determine the upgrading requirements. These are contained in the Bel-MK Servicing Report in CDP Volume II - Technical Background Report.

WATER SERVICE

The existing water reservoir which services the resort, is located high on a hillside in the Trapper's Ridge development, beyond Ski Tip Village. The raw water for the reservoir is drawn from three water licenses. The total volume which may be drawn under these licenses is 1,027 cu.m./day. It is anticipated that an increase in the water license volume will be required in 2001. The raw water pipeline which brings water from Taynton Creek to the reservoir is sufficient for the requirements of ultimate build-out as is the supply main and distribution system from the reservoir to the major development areas.

Irrigation for the golf course requires approximately 1.5 million litres per day. This is drawn from Hopeful Creek, which has a summer flow of approximately 20 million litres per day. Water supply for snow making is drawn from Toby Creek through additional licensing obtained from B.C.M.O.E.L.P.

STORM DRAINAGE

Storm drainage is generally handled overland to existing creeks which traverse the property. A piped storm sewer system will be constructed in Ski Tip Village and Toby Creek Area which will be designed to handle a 1:5 year storm event. Outfalls will be provided into Little Hopeful Creek (2 outfalls) and Toby Creek (1 outfall).

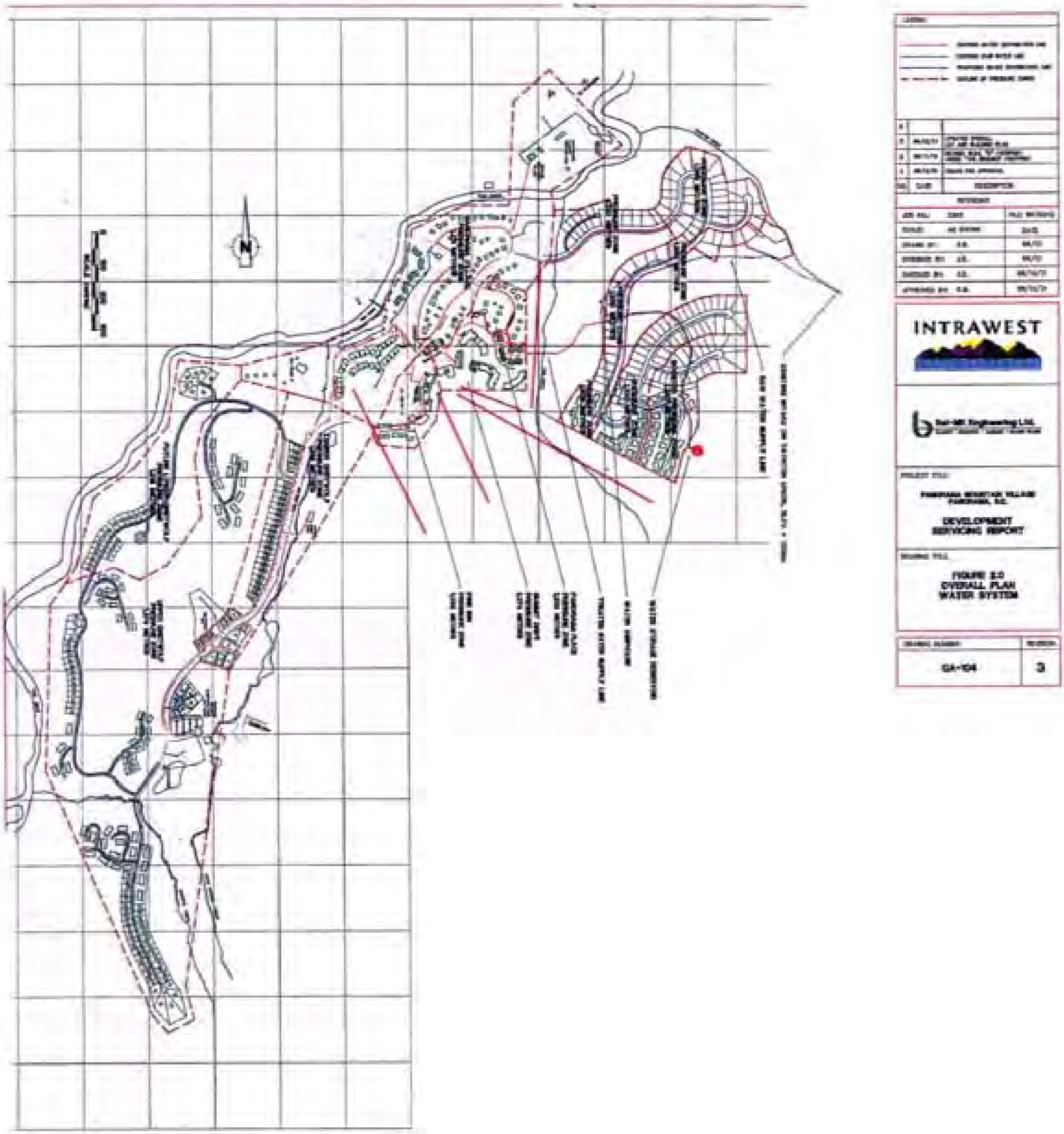
PUBLIC UTILITIES

Electrical power and telephone service will be supplied to the development via underground cables running in road rights-of-way or easements on private property. Overhead lines will be used only where not considered to be aesthetically intrusive.

PROPANE SERVICE

A propane system is installed at the resort to service the Administration Building, Pine Inn, Ski Tip Lodge, and Tamarack Lodge. The system is sized to provide service to all other resort accommodation buildings in Ski Tip Village. At present, a temporary tank farm exists on the Building "E" site but as the Village is developed the farm will be moved to a location across Toby Creek adjacent to the sewage treatment plant. This tank farm will also service Trapper's Ridge and Greywolf neighbourhoods.

Consideration may be given to installation of private propane tanks in Greywolf and Trapper's Ridge neighbourhoods however the preferred strategy would be to serve these areas from the central propane distribution centre. In any case, installation of private tanks will be in conformance with Design Guidelines to ensure that the tanks are not an eye-sore within the resort community.



Panorama Mountain Village Development Servicing Strategy **Figure 4-7**

5.0 MAJOR DEVELOPMENT AREAS

As previously discussed, the process of developing a Comprehensive Development Plan for Panorama involved preparation of The Panorama Mountain Village Master Plan which is based on the synthesis of existing physical and natural conditions and related land capabilities. The factors which contributed to the location and organization of land uses within the Master Plan have resulted in the evolution of four major development areas: 1) Panorama Village; 2) Greywolf; 3) Trapper's Ridge, and 4) Alpine Recreation Area. The overall Master Plan depicts the general location and physical relationship between development areas. A more precise image of the details associated with land use programming and site planning is shown on the individual master plans which have been prepared for each of the four major development areas. These plans show the physical organization and configuration of: roads; built form; recreation and trails; parking; landscape development, and; environmental preservation. A discussion and development summary for each of the major development areas follows.

MAJOR DEVELOPMENT AREAS FIGURE 5-1

5.1 PANORAMA VILLAGE

The following sub-sections provide a detailed summary of the main rationale and land uses associated with the Panorama Village core area development. Included is a description of the general planning concept, the specific components of the Master Land Use Programme which are contained within this major development area and, a summary of land use statistics pertaining to the relevant land base.

5.1.1. PLANNING SUMMARY

The lands occupied by this development area extend from the Toby Creek Area, situated along Toby Creek at lower elevations ranging from 1130 metres to 1150 metres, to Ski Tip Village, spanning between 1165 metres and 1205 metres elevation at the base of the First Ascent chair lift. The northeastern limit of this area extends as far as the single family subdivision just south of Cox Creek, while the southwest extent adjoins the northern edge of the Greywolf development area. This development area occupies the central position within the overall base area lands. All previously existing resort accommodations and ski operation functions are contained within this area, including the major access into Panorama. These include: the single family subdivision; tennis centre; pool; Horsethief Lodge; Toby Creek Lodge; heli-ski facility; Pine Inn and Europa Hotel annex; the Administration Building; main ski lifts; ski area maintenance yard; horse stables; day skier parking, and; sewage treatment and disposal facility.

Based on concentration of the above existing resort facilities within this general zone, the Panorama Village development area has historically functioned as the resort's core. However, the dispersed locations of the above uses and their proximity to each other has always lacked the elements of density and critical mass necessary to create a sense of vitality which is essential to success of the village core. The elevational separation between an "upper" and "lower" village, meant that the two areas tended to function independent of one another based on seasonal resort use. These circumstances had a major influence in planning for future resort expansion within the Panorama Village development area.

Predicated on the above established land uses and resort facilities, a basic framework existed for introduction of a form of "infill" development which would provide the necessary ingredients to harmonize core facilities and land uses in creating a vibrant and exciting village centre. Infill development includes a number of components which respond to the following issues: access and circulation; diversity and quality of accommodations, and; range and type of recreation opportunities. The location and organization of these improvements help to consolidate the resort core, improve the sense of arrival and orientation within the resort, and establish critical physical links between neighbourhoods.

The main access into Panorama is located within this development area via the bridge over Toby Creek off Toby Creek Road. At this location, a major entry feature consisting of entry monuments, extensive landscaping, special paving, signage and lighting, announces arrival at Panorama Mountain Village.

TYPICAL "NATIONAL PARK" ENTRANCE GATE

Proceeding into the resort, one passes through a symbolic gateway and arrives at the refurbished Central Check-In centre which is emphasized by special paving, lighting and banners combined with strategic placement of directional and identification signage. Parking for approximately 15 vehicles and a vehicle "drive-thru" are incorporated into the site planning for this area which begins to symbolize a gatehouse function akin to National Parks within the region. These additions, combined with significant road upgrades to Panorama Drive, both from a functional standpoint as well as aesthetic considerations, will improve visitor and resident orientation and access to major resort neighbourhoods.

In addition to the above improvements, another key element has been introduced within the Panorama Village development area which will significantly improve the physical and functional relationships between the upper and lower village. The People Mover - an aerial cable conveyance system - extends from a lower base station location, adjacent to the Toby Creek Lodge swimming pool, up the base of the mountain between Ski Tip Lodge and The Pine Inn, to an upper base station location immediately adjacent to the First Ascent chair lift base. This important physical link has been incorporated as a key component within the Panorama Valley Trail network. It serves as the major transporter of day skiers from the new principal day skier parking lots at Toby Creek, to the main chair lift base in Ski Tip Village. As part of the Panorama Valley Trail system, it also serves a year-round function in transporting people from the lower Toby Creek Recreation Base, uphill to the Ski Tip Recreation Base.

"PEOPLE MOVER" FROM
TOBY CREEK AREA TO SKI TIP VILLAGE

Relocation of the Toby Creek/Horsethief Lodge strata road, upslope and further east from Toby Creek, permits development of an important infill townhouse project known as "Riverbend." This development is located in the open field area which borders Toby Creek just south of the Central Check-In. The project fulfils a number of important objectives: it enhances the arrival sequence into the resort; integrates older accommodation with newer updated development; provides an introduction to the theme and character of future resort accommodation, and; provides additional creekside accommodation. The former strata road has been downsized and incorporated as a link to the Panorama Valley Trail network.

The Panorama Village development area contains Panorama's highest density in terms of residential accommodation and commercial uses. In addition, the major concentration of recreational activities, staging areas and related support facilities are located within this development area. This serves two functions: it ensures that the greatest number of resort users are located in close proximity to the main recreation facilities, and; establishes critical mass which is essential to the vitality and function of this core area as a focus for community gathering.

Significant expansion of the commercial and residential accommodation base within Ski Tip Village will augment mountain oriented use of the resort and thus balance the densities and levels of activity previously experienced in the Toby Creek Area. An increased recreational programme in Ski Tip Village will also balance seasonal use and help sustain a vibrant atmosphere in both upper and lower village areas.

ARTIST'S RENDERING OF OF "PANORAMA SPRINGS" CONDO-HOTEL

Building massing in Ski Tip Village is centred at the base of the main ski lifts in an area comprising the older existing mountainside accommodation, administration and day-skier parking functions. The road pattern, location and configuration of buildings and associated recreation facilities in Ski Tip Village, are organized in a manner which clusters building mass, assimilating older existing buildings - "the originals" - such as the Administration Building, The Pine Inn and Europa Hotel Annex into a contiguous village setting, similar to the approach taken in the Toby Creek Area.

The architectural character of new buildings will reinforce this approach while reflecting the natural surroundings through the use of heavy timber, logs, river rock and quarried stone, blended with exterior siding materials like board & batten and wood shingles. Refurbishing of the "originals" will bring them to a matching standard. The result is creation of a strong identifiable village character and focus for the Panorama Village area. The combination of upper and lower village development functions as the overall Mountain Village core; a place of local gathering and a major base for recreation activities and facilities.

A pedestrian atmosphere is created through the numerous pathways and plazas which link various village uses and facilities. "The Village Walk" is the main pathway which collects skiers off the mountain, as well as year-round seasonal resort users and leads them through Ski Tip Village to their desired destinations. It also provides for an enjoyable stroll through the village, which contributes to the overall animation and enjoyment of the village experience.

REFURBISHING OF EXISTING BUILDINGS TO CREATE A PEDESTRIAN FRIENDLY ATMOSPHERE

Other interconnecting paths serve specific functions, such as leading skiers from the day skier parking lot adjacent the Administration Building to Ski Tip Day Lodge, and facilitating pedestrian access from individual buildings to specific recreation facilities and staging areas.

The main trail head associated with Panorama Valley Trail intersects with the Village Walk near the upper People Mover base, thus reinforcing a strong link between Ski Tip Village, the Toby Creek Area and surrounding base area lands.

Day-skier parking, by function alone, represents the major potential physical conflict for ski area development. The Panorama Village Master Plan has taken careful consideration of this issue in designating size, location and configuration of parking within the overall base area lands. Day-skier parking mass has been broken down and distributed throughout the village core and to a limited extent in Greywolf, so that in all cases, parking is in close proximity to areas of intensive use. This serves to minimize the potential visual impacts associated with large expanses of parking while maintaining functional requirements and comfortable walking distances to specific use areas.

5.1.2. LAND USE PROGRAMME

The activities, associated facilities and land uses that are contained within the Panorama Village development area are presented in Table 5-1. The programme was developed in conjunction with analysis stages of the planning process. To establish the programme, land uses, recreation activities and facilities already existing in the Panorama Village development area and elsewhere within the resort were examined. Investigations were made into additional forms of residential accommodation, commercial uses and recreation activities that could potentially be accommodated within this specific site area. As well, various uses and activities were suggested by the natural features and historic uses of the site. A brief summary of the main land use programme components is provided below.

TOBY CREEK RESIDENTIAL MIXED USE is comprised of previously existing resort development combined with two infill townhouse projects. Existing development includes Horsethief Lodge - a 196 unit mixed use townhouse condominium, and Toby Creek Lodge - a 58 unit mixed use townhouse condominium, represent the major commercial residential components of previous development initiatives located adjacent to Toby Creek. These projects consist mainly of stacked townhouse product, and a limited amount of commercial, with a number of residential units available through a time-share sales format.

TOBY CREEK LODGE

Commercial uses include: the Jackpine Pub within Horsethief Lodge; the General Store; Toby Dining Room, and; a few small retail shops within Toby Creek Lodge. Community barbecue and hot tub facilities are also located within the Horsethief Lodge complex.

LEGEND

SKI TIP VILLAGE
595 Commercial Accommodation Units
1278 Bed Units

TOBY CREEK AREA
256 Commercial Accommodation Units
768 Bed Units

MULTIPLE FAMILY RESIDENTIAL
160 Dwelling Units
876 Bed Units

SINGLE FAMILY RESIDENTIAL
77 Dwelling Units
462 Bed Units

PENSIONS
2 Dwelling Units
16 Bed Units

VILLAGE WALK

EMPLOYEE HOUSING
152 Units

RECREATIONAL VEHICLE PARK
88 Campground Spaces

LIGHT INDUSTRIAL/CENTRAL RECEIVING

DAY SKIER PARKING
260 Parking Spaces - Upper Toby Creek Parking Lot
465 Parking Spaces - Lower Toby Creek Parking Lot
100 Parking Spaces - Ski Tip Village Parking Lot

RECREATIONAL FACILITIES/SKI TERRAIN
8.1 Hectares, 19.9 Acres

RETAINED NATURAL OPEN SPACE
24.3 Hectares, 60.2 Acres

TOTAL PANORAMA VILLAGE DEVELOPMENT
1,227 Accommodation/Dwelling Units
3,176 Bed Units

PANORAMA VILLAGE ILLUSTRATIVE MASTER PLAN FIGURE 5.2

PANORAMA VILLAGE LAND USE PROGRAMME

TABLE 5-1

LAND USE	RATIONALE & DESCRIPTIVE DATA
Main Resort Entrance Feature	□ Establish gateway and arrival sequence to Panorama Mountain Village. □ Aid in creation of resort identity and distinction. □ Establish the vision and image for the new Panorama.
Arrival/Departure Centre Central Check-In	□ National Parks type gatehouse feature. □ Welcome centre and resort orientation function. □ Interpretive/information centre for environmental and wildlife education.
Toby Creek Area • Toby Creek Lodge • Horsethief Lodge • 77 Single Family Lots • Trapper's Crossing • Riverbend Townhouses • Toby Creek Recreation Base • Day-Skier Parking	□ Integration of existing original resort development with new developments and new image for Panorama. □ Establish a recreation base integral to overall resort Recreation Master Plan that incorporates existing and proposed recreation facilities. □ Accommodate major day-skier parking to reduce vehicular impacts within main resort. □ Facilitate physical connection with Ski Tip Village through the People Mover. □ Provide access to visual and recreational values of Toby Creek. □ Provide supplementary commercial functions for lower village.
Ski Tip Village • Administration Building • Pine Inn & Europa Hotel • Ski Tip Lodge • Tamarack Lodge • Panorama Springs • Hearth Stone Townhouses • Pensions *and* • Additional Condohotels *and* • Multi-Family Development • Village Walk • Conference Centre • Aquatic Centre • Ski Tip Recreation Base • Panorama Valley Trail Head	□ Establish vital and exciting core for major resort operation functions. □ Accommodate main alpine ski uses. □ Provide major forms of accommodation and commercial uses not previously available. □ Provide major ski-in / ski-out real estate. □ Create an animated village atmosphere. □ Provide major new summer recreation focus in Aquatic Centre □ Provide central hub for staging resort wide recreational activities. □ Provide major pedestrian connection to other resort neighbourhoods through Panorama Valley Trail and People Mover.
RV Park	□ Provide opportunity for temporary alternative affordable accommodation. □ Provide location with least impact of RV vehicles to other main resort uses. □ Augment overall economic performance of resort revenue generation
Employee Housing	□ Provide adequate affordable housing for seasonal employees. □ Provide distinct location for privacy and social gathering.
Light Industrial/Central Receiving	□ Provide unobtrusive location for potentially conflicting land use. □ Provide location for critical resort operations functions in good proximity to road access and services. □ Segregate industrial functions from major resort recreation and accommodation uses.
Retained Natural Open Space/ Ski Terrain	□ Provide land base for development of ski runs and chair lifts. □ Avoid impact on sensitive site conditions. □ Provide for public access. □ Create diversity in open space recreation opportunities. □ Mitigate visual impact of development while contributing to resort character.
Public Roads	□ 20.0 metre R.O.W., maximum 10.0% grade. □ Provide public vehicle access through neighbourhood and to surrounding neighbourhoods.
Strata Roads	□ 12.0 metre R.O.W., maximum 12.0% grade. □ Provide vehicular access within residential enclaves.

The Hearth Stone Townhouses
at Ski Tip Village

The two infill projects contained within the Toby Creek Area are: Riverbend - a townhouse project located north of the above developments adjacent to Toby Creek, and; Trapper's Crossing - another townhouse project at the entrance to the Trapper's Ridge neighbourhood, south of Cox Creek. Riverbend consists of 40 dwelling units contained in five buildings, each oriented to take optimum advantage of their interface with Toby Creek. Trapper's Crossing contains 52 residential units housed within thirteen buildings. The architectural character of these buildings will blend with new buildings in Ski Tip Village and will generally distinguish themselves as Cascadian or "Big Stick Log Style" architecture reminiscent of the National Parks of western Alberta, Eastern British Columbia and Washington and Oregon States.

The original single family subdivision, containing 77 lots, extends from east of Panorama Drive in the Toby Creek Area, up to the northern perimeter of Ski Tip Village, providing a low density transition between lower and upper village precincts. Within this subdivision, two Pension sites have been incorporated to enhance density transition considerations. The Pension facilities provide a varying number of guest rooms together with a principal residence, allowing a form of low density guest accommodation which was previously not available at Panorama.

Ahwahnee Lodge in Yosemite National Park
is symbolic of Panorama's
architectural style

Possible pension style building

The balance of Toby Creek residential accommodation consists of employee housing located on the west bank of Toby Creek in the vicinity of the Light Industrial area. This consists of 150 employee dwelling units. West of this location, across Toby Creek Road, a more temporary type of accommodation exists in the form of an RV Resort. This provides a form of accommodation which appeals to many resort visitors based on affordability and lifestyle choice. Approximately 89 RV lots are provided.

SKI TIP VILLAGE MIXED USE development consists of a varied programme combining residential and commercial accommodation with support commercial uses. Residential accommodation includes: Hearth Stone - a 28 unit townhouse project located in the northeast corner of Ski Tip Village, and; Building "H" - a 24 unit townhouse project located in the south end of Ski Tip Village day-skier parking lot adjacent the Toby Creek Chair. Both projects offer prime ski-in/ski out real estate.

RECENTLY COMPLETED SKI TIP LODGE

Ski Tip Village is defined by a number of signature buildings which are imaginatively integrated with established buildings to create a recognizable mountain village core and a focus of the resort experience. The collection of established buildings and new programmed development provide significant ski-in/ski-out product.

Ski Tip Lodge is a 1555 m² (16,730 ft²) four storey building centred at the base of the First Ascent Chair and Red Rider Handle Tow. It houses the new skier day lodge and related skier services functions, a 300 seat dining facility, the Purcell Trading Post and 33 commercial accommodation units. Next to it, Tamarack Lodge, a 2265 m² (24,384 ft²) three storey condohotel building, contains 46 commercial accommodation units along with equipment rentals out of the Panorama Outfitters and Lusti's Cappuccino Bar. These two key buildings combine superior locale with quality features and an architectural style reflecting the "sumptuous rustic" feel which sets the standard and character for village buildings.

VIEW OF RECENTLY COMPLETED
TAMARACK LODGE

Expedition Station, Panorama Springs, Taynton Lodge and two other buildings - Building F and Building G (Conference Centre Hotel) - represent the balance of condohotel buildings within Ski Tip Village, offering a mix of commercial accommodation, retail and conference facilities. Expedition Station is a large condohotel building of approximately 6760 m² (72,731 ft²) containing 109 residential commercial accommodation units. This building anchors the north end of Ski Tip Village mountainside development. It wraps around this corner of the village, generally conforming to the alignment of Summit Drive, and creating a large open plaza which embraces the collection of other adjacent village buildings. A major water feature, which also serves as a skating rink attraction in winter, has been designed as the central plaza feature which will contribute significantly in animating this end of the village, providing an outdoor destination accessed by the Village Walk.

Panorama Springs, a 7,628 m^2 (82,111 ft^2), four storey building located just south of Expedition Station, serves as the major community recreation building in Ski Tip Village. It contains a major village restaurant known as "The Springs" which establishes an important indoor/outdoor functional relationship.

The Springs dining area spills onto an outdoor patio area facing Tamarack Lodge,anchoring the west end of the building. Its horseshoe type configuration creates another major outdoor plaza which contains an important community amenity. Known as the "Panorama Springs Aquatic Centre", this adventure waterpark provides a series of waterslides, a kids' splash pool, a family pool, a beach area, diving boards, floating raft, an island, outdoor spa pools, viewing decks and seating areas. These are all sensitively terraced into the mountainside and enhanced with a natural landscape treatment to simulate harmony with the natural surroundings.

Artist's concept of Panorama Springs - Ski Tip Villages's Marquis Building

Taynton Lodge, the Conference Centre Hotel (Building G) and Building F are additional condohotel buildings providing necessary critical mass to Ski Tip Village. These buildings vary in square footage, providing an additional 140 residential commercial accommodation units, and are arranged to integrate the established buildings of Ski Tip Village.

CHARACTER IMAGES OF FUTURE TAYNTON LODGE

The Conference Centre Hotel (Building G) has a prominent location anchoring the south end of Ski Tip Village. It houses a major conference centre for the resort as well as prime retail and ski-in/ski-out commercial accommodation uses. Its location and mixed uses serve as the catalyst necessary to revitalize and integrate the older existing part of Ski Tip Village with the new developments described. In addition, reprogramming and renovation of the administration building and the Pine Inn and Europa Hotel, to include ground orientated commercial, will further strengthen and animate this corner of the Village Walk. The enclosure created by the Conference Centre building configuration forms the conference centre plaza which, together with the new ground orientated uses, will result in the creation of a new pedestrian promenade critical to the overall success of the Village Walk experience within Ski Tip Village.

The impact of these buildings will contribute in establishing the ultimate critical mass, residential density, architectural massing, and animation necessary to achieve the desired village image in terms of form, character and vitality.

MOUNT HOOD'S TIMBERLINE LODGE PROVIDES ARCHITECTURAL INSPIRATION FOR THE FUTURE CONFERENCE CENTRE HOTEL.

RECREATIONAL USES AND FACILITIES in the Panorama Village development area cover the full range of seasonal activities. The Toby Creek Area of the village contains the "take out" and staging function for rafting and kayaking expeditions on Toby Creek . These are located on the west bank of the creek east of Toby Creek Road in the vicinity of the day skier parking lot. Across Toby Creek Road, the Stables and horse trail head are located in the other day skier parking lot. This facility allows staging of trail riding in summer and sleigh rides in winter, both of which are important to the overall resort and family experience. Further north, on the west side of Toby Creek Road, snowmobile staging and trail head facilities are located on the old mine tailings site.

HORSE STABLES IN TOBY CREEK AREA

The Toby Creek Area contains 8 tennis courts located across the pedestrian bridge on the west side of Toby Creek. These include one gallery court for tournaments and general viewing, and one court which also facilitates basketball in summer and hockey in winter. The original Toby Creek Lodge community swimming pool is also located here, at the north end of the lodge on the east side of Toby Creek. It provides swimming related activities to the lower village area. Additional hot tub and barbecue facilities are located in association with visitor use of Toby Creek Lodge and Horsethief Lodge.

TENNIS FACILITY ON WEST SIDE OF TOBY CREEK

Adjacent to the main pool, near the base of the People Mover station, a mini-golf and putting facility called Greypup are located, providing another important form of family recreation and entertainment related to the major summer golf use at Greywolf. A children's play area is located adjacent to the Central Check-In facility, in an effort to provide a more relaxed arrival experience as well as an indication of the family nature of Panorama. Both "Village" and "Valley Loop" segments of the Panorama Valley Trail network, along with the People Mover, serve as major pedestrian movement systems which link these uses and facilities.

The upper portion of the village contains major summer and winter recreation activities and facilities in Ski Tip Village. Summer facilities include the Panorama Springs community Aquatic Centre - a 3100 m² area containing two 35 metre long waterslides, a 325 m² lower adventure pool, a 200 m² upper family pool, two upper spa pools, and 1500 m² of viewing deck and seating area. This facility is located within the southwest facing plaza associated with the Panorama Springs condohotel building. It is contained on the north side of a man-made creek and waterfall system called Panorama

Spring, which descends from the lower reaches of Panorama Mountain and runs along the north perimeter of the village.

SQUAW CREEK RESORT, LAKE TAHOE, NEVADA WAS THE INSPIRATION FOR THE SPRINGS AQUATIC CENTRE

Located on the south side of Panorama Spring, summer recreation facilities include three volleyball courts and a climbing wall in an area in front of the day lodge extending up to the Panorama Springs building. These uses, combined with activities associated with the Panorama Springs Aquatic Centre, will create a lively and exciting summer ambience in the upper village. A child's playground located on the west side of the Europa Hotel supplements the family facility programme. Adding to the summer excitement, are special events like mountainside concerts and theatrical productions which will be staged within the mountain base area.

Winter recreation and associated facilities are focussed around the downhill ski operation which includes the People Mover, First Ascent chairlift base, the Red Rider handle tow and Kid's Kamp, tubing and snowplay park (kid's theme park), snowboarder park, the Toby Creek Chair, the Platter Lift and numerous ski runs which converge at the Ski Tip Village base area.

Panorama Valley Trail originates from Ski Tip Village at the People Mover base, and along with other localized trail links, helps to connect various facilities within the Ski Tip Village area as well as Toby Creek, Greywolf and Trapper's Ridge neighbourhoods.

5.1.3 LAND USE SUMMARY

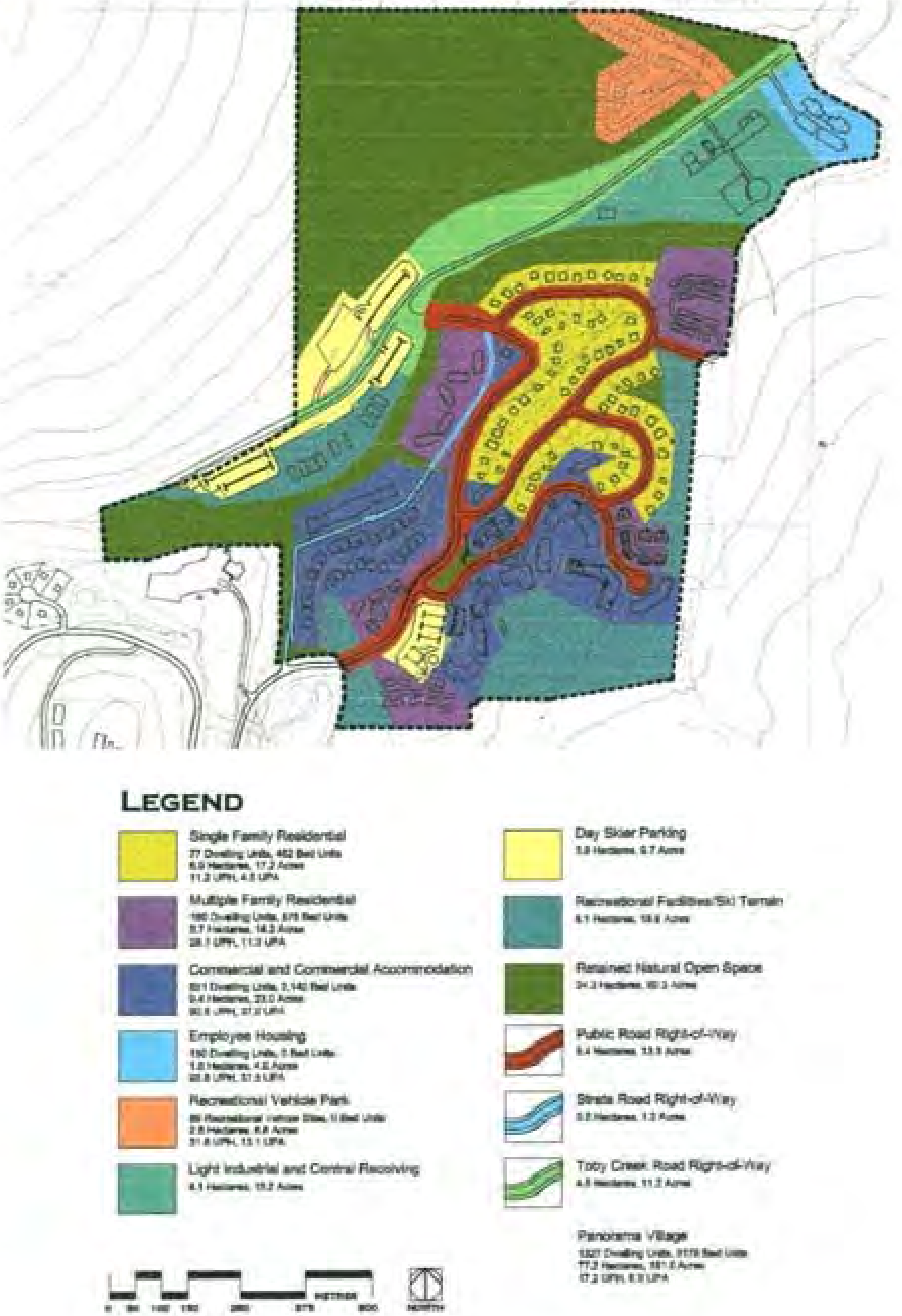
This section describes the detailed components and associated statistics contained within the Panorama Village Master Plan. Each land use component will be accommodated largely within existing zoning designations for this area.

The total land area occupied by the Panorama Village development area is approximately 77.2 hectares (191.0 acres). Of this, approximately 31.4 hectares (77.6 acres) has been designated for resort village development which includes commercial, commercial accommodation and residential uses. This includes the previously developed resort product that existed prior to Intrawest ownership. Structured recreation facility development occupies 8.1 hectares (19.9 acres), with day-skier parking covering another 3.9 hectares (9.7 acres), spread between upper and lower village locations. Retained natural open space accounts for 24.3 hectares (60.3 acres).

A more detailed breakdown of statistics and location of various land uses is shown in Table 5-2, Land Use Summary Table and Figure 5-3, Land Use Summary Plan. The land areas shown will be confirmed by legal survey and are subject to adjustment during subdivision approvals.

PANORAMA VILLAGE LAND USE SUMMARY TABLE **TABLE 5-2**

LAND USE	APPROXIMATE AREA		YIELD	DENSITY (AVERAGE NET DWELLING UNITS)
	HECTARES	ACRES		
Single Family Residential	6.9 hectares	17.2 acres	77 Units 462 BU	11.2 UPH 4.5 UPA
Multiple Family Residential	5.7 hectares	14.7 acres	160 Units 576 BU	28.1 UPH 11.3 UPA
Commercial and Commercial Accommodation	9.4 hectares	23.0 acres	851 Units 2140 BU	90.5 UPH 37.0 UPA
Employee Housing	1.6 hectares	4.0 acres	N/A	N/A
Recreational Vehicle Park	2.8 hectares	6.8 acres	N/A	N/A
Light Industrial	4.1 hectares	10.2 acres	N/A	N/A
Day-Skier Parking	3.9 hectares	9.7 acres	N/A	N/A
Recreational Facilities / Ski Terrain	8.1 hectares	19.9 acres	N/A	N/A
Retained Natural Open Space	24.3 hectares	60.3 acres	N/A	N/A
Public Road Right-of-Way (20 m)	5.4 hectares	13.3 acres	N/A	N/A
Strata Road Right-of-Way (12 m)	0.5 hectares	1.2 acres	N/A	N/A
Toby Creek Road Right-of-Way	4.5 hectares	11.2 acres	N/A	N/A
TOTAL	**77.2 hectares**	**191.0 acres**	**1327 Units 3178 BU**	**17.2 UPH 6.9 UPA**



PANORAMA VILLAGE
LAND USE SUMMARY PLAN **FIGURE 5-3**

5.2 GREYWOLF GOLF COURSE RESIDENTIAL NEIGHBOURHOOD

Panorama's next most important development area, for a number of reasons, is Greywolf. Within the Greywolf neighbourhood is Greywolf Golf Course - the major summer recreation anchor. Greywolf is a comprehensive mixed use neighbourhood which will contribute greatly in balancing the year-round use and visitation of Panorama Mountain Village. A summary of activities and land use statistics associated with the Greywolf neighbourhood follows.

GREYWOLF'S 4TH HOLE - "DESCENT"
VIEWING NORTH DOWN HOPEFUL CREEK VALLEY

5.2.1. PLANNING SUMMARY

The Greywolf neighbourhood evolved as a result of historical planning and subsequent development proposals considered for the Hopeful Creek Valley. Originally conceived as strictly a residential and commercial development, which was referred to as "The West Village" in the 1980 Panorama Resort Development Plan, the present Greywolf land base was not originally contemplated for development of a golf course. Subsequently, in 1989, a major Development Plan Amendment which introduced the golf course use, deleted any previously approved residential development in this area.

In 1996, a comprehensive zoning initiative was introduced by Intrawest, and was successful in creating the mixed use development which is depicted in the Greywolf Illustrative Master Plan. The Greywolf Master Plan successfully integrates golf course use with residential development and the previously existing day skier function.

The Greywolf Master Plan is a detailed graphic depiction of the land use programme for this major development area. It responds to the location and capability of the land base. A diverse residential mix and a variety of public access opportunities are provided. Greywolf is ski-in/ski-out, golf-in/golf-out resort living at its best. This is achieved through the integration of low density cluster development with various recreational uses over a broad land base. The intent is to create a resort neighbourhood which is sensitively integrated into the natural surroundings and with man-made recreational features, while minimizing environmental impacts of resort development. It is a goal of the Greywolf Master Plan to ensure that important natural features are retained and enhanced, thus making every component of the plan more valuable and attractive.

Greywolf satisfies an important physical interface concern between the Toby Creek Area at lower elevation, and Ski Tip Village at an upper elevation. Panorama Drive descends from Ski Tip Village, under the skier overpass where it turns into Greywolf Drive. At this point, a major visual gateway experience, which is inherent in the golf course routing design, is created through the deliberate extension of Greywolf Golf Course to the road's edge. This planning strategy not only accounts for a dramatic entrance to Greywolf development area from Ski Tip Village, it also serves to visually connect the Toby Creek Area with Greywolf, resulting in a harmonious merging of the three neighbourhoods.

GREYWOLF ILLUSTRATIVE MASTER PLAN **FIGURE 5-4**

INTRAWEST

The process of planning the Greywolf neighbourhood considered various options for: locations and densities of residential development; golf course routing; site access and circulation alternatives; site servicing requirements, and; recreational development and public access alternatives. Input from the Regional District of East Kootenay and members of the development team, combined with public consultation initiatives led to the final Greywolf Master Plan. Inherent in the Master Plan are the following main planning principles:

- location of the Greywolf Clubhouse in central proximity to the overall development at the base of the Sunbird Chairlift which also facilitates year-round use as a Nordic Centre;
- use of flatter valley bottom lands to create a substantial, visually appealing and environmentally responsive open space anchor in the form of Greywolf Golf Course;
- reduced site impacts through cluster development, resulting in significant preservation of the land base's natural features and visual resources;
- use of existing roads in developing site access, vehicular circulation and pedestrian trail network;
- use of gently sloped terrain pods for residential development, resulting in dispersed development and maximum neighbourhood overlook of golf and open space amenities, and;
- integration of lower slopes of mountain base and Toby Creek waterfront for establishment of major trail loop - the "Valley Loop" - associated with development of Panorama Valley Trail.

Evaluation of the land base's physical conditions and related capabilities, have identified the potential to situate residential development largely on the moderately sloped portions of land, leaving the open flatter areas available for development of the Greywolf Golf Course. This allows for a natural separation of residential enclaves, while increasing the view potential of all residential nodes. Localized physical conditions also contribute in determining the form and density of residential development within individual residential enclaves. This has resulted in a varied mix of single and multi-family residential accommodation dispersed throughout the Greywolf land base, giving the overall perception of a low density residential neighbourhood sensitively integrated with its natural and man-made open space environment.

Neighbourhood access takes advantage of old established internal circulation patterns which resulted in the realignment of upper sections of Panorama Drive in order to provide new access points to both Ski Tip Village and Greywolf. At Ski Tip Village, Panorama Drive begins to descend down into Greywolf where it turns into Greywolf Drive. Upon entering Greywolf neighbourhood, internal circulation has been determined primarily in response to topographic conditions combined with the golf course layout pattern. The result is the evolution of a main public spine road - Greywolf Drive - which passes through the centre of the golf course residential neighbourhood and extends to its southern extreme adjacent to the 5th tee box. This alignment of Greywolf Drive establishes a major link between the Panorama Village area and Greywolf neighbourhood. It also permits a an informal loop road pattern and network of local access lanes to connect into it at various points where localized access is required for individual development enclaves and the Greywolf Clubhouse and parking area.

The recreation and open space programme associated with Greywolf is anchored by the Greywolf Golf Course and teaching academy. The golf course which occupies a major portion of the Hopeful Creek Valley, not only serves as the main recreation focus, it also provides significant visual qualities and opportunities for development of ancillary recreation facilities. These include the "Valley Loop" section of Panorama Valley Trail which extends along the mountain base above the east perimeter of the golf course and loops back to Panorama Village along Toby Creek below the golf course. The location of Greywolf Clubhouse adjacent the Sunbird chairlift, also allows it to function as a nordic centre in winter months. This facilitates an expanded winter programme which includes cross-country skiing and snowshoeing on a broader trail network which is incorporated with Panorama Trail.

The land use programme and planning concept for Greywolf is multi-faceted and effective in attracting year-round visitation and recreational enjoyment of Panorama Mountain Village. The Greywolf neighbourhood successfully integrates new resort development with established uses and facilities to the benefit of both previous resort property owners and residents, as well as future residents, owners and guests.

5.2.2. LAND USE PROGRAMME

The land uses, activities and associated facilities contained in the Greywolf Master Plan are summarized in Table 5-3, Land Use Programme. In order to establish the land use programme for Greywolf, investigations were made into permitted uses and development regulations contained in the Official Community Plan, the Upper Columbia Valley Zoning Bylaw No. 900, and availability and type of land uses suggested by the physical conditions of the Greywolf land base. Initial programming was expressed in various preliminary concept alternatives which were discussed both internally amongst the development team as well as with Regional District planning staff, Ministry of Transportation & Highways and Ministry of Environment Lands and Parks staff. Input from this iterative process was used to further refine the ultimate land use programme and subsequent direction of land use planning.

The programme described, in conjunction with development analysis and land use policy requirements, was used to develop the Greywolf Master Plan which is presented herein. A brief summary of the main land use components which make up the Master Plan follows.

RESIDENTIAL DEVELOPMENT within the Greywolf development area is comprised of a mix of single family lots, multi-family parcels. A total of 479 residential dwelling units are dispersed throughout the Greywolf Golf Course and surrounding area, consisting of 128 single family lots, 311 multi-family units and 40 units at RK Heliski. A differentiation of neighbourhoods results from the response to slope conditions combined with the dedicated area and configuration of Greywolf Golf Course. This is accentuated through a variation in scale and density of the different residential housing forms. The residential mix will appeal to the year-round adventurer.

IMAGERY FOR MULTI-FAMILY DEVELOPMENT - GREYWOLF

GREYWOLF LAND USE PROGRAMME

TABLE 5-3

LAND USE	RATIONALE & DESCRIPTIVE DATA
Neighbourhood Entrance Feature	□ Main entry sign and landscape feature. □ Establish gateway to Greywolf neighbourhood. □ Aid in creation of neighbourhood identity and distinction.
Single Family Residential	□ Average lots range between 560 m^2 (6028 sq. ft.) minimum to 930 m^2 (10,010 sq. ft.). □ Optimize site density and economic performance. □ Respond to market demand. □ Respond to physical site conditions.
Multi-Family Residential	□ Varying square footage and number of units based on location - primarily townhouse product. □ Maximize bed units in 380 metre (1246.72 feet) proximity to ski lift. □ Balance optimum site density. □ Provide opportunities for housing and social mix responding to lifestyle and economic opportunities. □ Create community critical mass. □ Provide potential for future demands.
Golf Course	□ 18 hole, 6495 metre (7100 yard) par 72 championship course. □ Provide summer resort recreation focus based on anticipated regional growth □ Provide major visual attraction for real estate.
Clubhouse/Day Lodge	□ Provide golf course staging in summer, chair lift and Nordic ski staging in winter. □ Provide retail opportunity with Pro Shop and Restaurant. □ Establish neighbourhood distinction.
Day-Skier Parking	□ 150 parking stalls. □ Provide required parking for golf course use and a portion of required day-skier parking for skiing facility.
RK HeliSki	□ Provide heli-ski and heli-skiing opportunities
Retained Natural Open Space	□ Avoid impact on sensitive site conditions. □ Provide for public access. □ Provide trail access and lookouts including Panorama Valley Trail connection through Greywolf. □ Create diversity in open space recreation opportunities. □ Mitigate visual impact of development while contributing to resort character. □ Establish environmental/riparian preservation zones.
Public Road	□ 20.0 metre R.O.W., maximum 10.0% grade.
Strata Road	□ 12.0 metre R.O.W., maximum 12.0% grade.

Multiple family enclaves are strategically integrated both adjacent to and separate from single family clusters based on topographic conditions and resulting land use efficiency. The natural characteristics of landform within Greywolf dictates the consequential separation between residential nodes. This has the positive impact of not crowding the golf course while providing the desired qualities of privacy and seclusion sought after in a mountain resort setting.

IMAGERY FOR MULTI-FAMILY DEVELOPMENT

Single family residential clusters emerge in response to market forces as well as the localized conditions and context within the golf course environment. A range of lot sizes from 560 m² (6028 ft²) to 930 m² (10,000 ft²) are situated in clusters around the golf course, allowing the ability to physically respond to varying sloped terrain and maximizing land use efficiency. These irregular standards also offer different options in appealing to varied market preferences, while creating distinct neighbourhoods within the Greywolf development area. Lot sizes and configurations - minimum 18 metre (60 foot) frontages by 35 metre (115 foot) depths - are designed to provide ample separation between residences, ensuring privacy and minimizing visual impact of development.

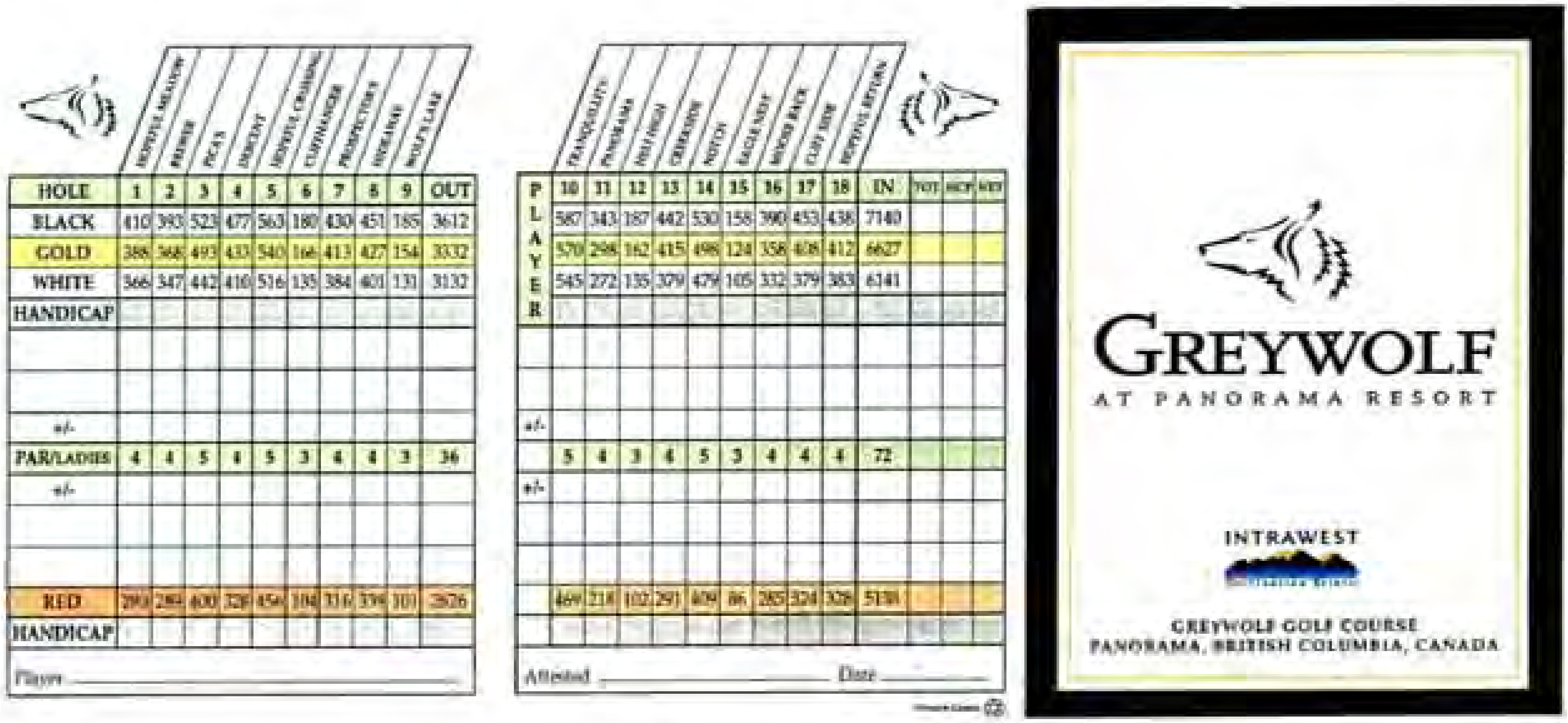
The architectural form and character of residences within Greywolf will blend with the natural surroundings and create a style which is distinctive while consistent with other developments in Ski Tip Village and Trapper's Ridge. Whenever possible, building materials will be indigenous to these mountains, assembled to reflect the architectural heritage seen in the historical lodges and cabins of the region and reinforcing the refined rustic "Spirit of the Canadian West" theme which is envisioned for Panorama. Design guidelines will support the creation of this vision and at the same time protect the interests of all who build and reside in Greywolf.

SINGLE FAMILY IMAGERY

GOLF COURSE development results in creation of the 18-hole, par 72 championship Greywolf Golf Course. This mountain resort course boasts a total of over 6495 metre (7100 yards) in length with water in play 14 of 18 holes. The course features wide bentgrass fairways and greens, winding through Hopeful Creek Valley, incorporating pristine natural pools filled with clear mountain water. Greywolf Golf Course is surrounded by dramatic vistas and mountain peaks, forested slopes, rivers and streams. The course has been designed to incorporate many exceptional natural features such as Hopeful Creek, Toby Creek and mature pine forest.

Of particular note is the 6th hole - "Cliffhanger" - perched on the cliffs which make up Hopeful Creek Canyon, this is the course's signature hole. It plays from a tee placement high above the creek, to a spectacular hanging green on the other side of the creek canyon. From both tee and green locations, magnificent views are offered, including the resort's signature panoramic view.

HOLE NO. 6 AT GREYWOLF - "CLIFFHANGER"



HOLE	1	2	3	4	5	6	7	8	9	OUT
BLACK	410	393	523	477	563	180	430	451	185	3612
GOLD	388	368	493	433	540	166	413	427	154	3332
WHITE	366	347	442	416	516	135	384	401	131	3132
HANDICAP	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
+/-										
PAR/LADIES	4	4	5	4	5	3	4	4	3	36
+/-										
RED	293	284	400	328	456	104	316	339	101	2626
HANDICAP										

Player ____________________

P L A Y E R	10	11	12	13	14	15	16	17	18	IN	TOT	HCP	NET
	587	343	187	442	530	158	390	453	438	7140			
	570	298	162	415	498	124	358	408	412	6627			
	545	272	135	379	479	105	332	379	383	6141			
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
+/-													
	5	4	3	4	5	3	4	4	4	72			
+/-													
	469	218	102	291	409	86	285	324	328	5138			

Attested ________________ Date ________

GREYWOLF
AT PANORAMA RESORT

INTRAWEST

GREYWOLF GOLF COURSE
PANORAMA, BRITISH COLUMBIA, CANADA

THE GREYWOLF SCORECARD

RECREATION AND TRAILS development within Greywolf includes approximately 21.1 hectares (52.5 acres) of retained natural open space, in addition to the 76.1 hectares (188.3 acres) occupied by the Greywolf Golf Course including the driving range and club house. Beyond these areas, the Greywolf development area is surrounded by the expansive wilderness areas which make up the overall Panorama Mountain Village Plan Area. This context serves as an ideal setting for the mountain resort golf course and provides opportunities for incorporation of other forms of recreation and trail development in conjunction with the major summer golf course use.

A major loop of Panorama Valley Trail - the "Valley Loop" - encircles the slopes above and below Greywolf Golf Course to allow an opportunity for all resort visitors and non-golfers to experience the beauty and recreational resources of both Hopeful Creek Valley and Toby Creek Valley. The expanded trail network which feeds into Panorama Valley Trail provides additional recreation opportunities of a more adventurous nature. These include cross-country skiing, snowshoeing, mountain biking, trail running and hiking. The location of Greywolf Clubhouse at the base of the Sunbird Chairlift allows it to function as a nordic centre in winter months as well as providing approximately 150 day skier parking spaces to offset demands within the Panorama Village area.

5.2.3. LAND USE SUMMARY

The detailed components and related land use statistics associated with the Greywolf Master Plan are summarized in Table 5-4, Land Use Summary Table. Each land use component conforms to the RES-2 and RES-2G zoning designations which cover the entire Greywolf development area.

The total land base occupied by the Greywolf development area consists of approximately 137.9 hectares (339.2 acres). Of this total area, approximately 76.1 hectares (188.3 acres) are designated for golf course use, 22.1 hectares (54.8 acres) will be retained as natural open space and recreational facilties/ski terrain, and 32.3 hectares (79.9 acres) are identified as being feasible for development of mixed residential use. As is evident in the land use statistics, the major portion of land base will be retained as either natural open space or programmed public open space in the form of the Greywolf Golf Course.

The land areas shown in Table 5-4 will be confirmed by legal survey and are subject to minor adjustments at the time of individual subdivision approvals.

GREYWOLF LAND USE SUMMARY TABLE **TABLE 5-4**

LAND USE	APPROXIMATE AREA		YIELD		DENSITY (AVERAGE NET DWELLING UNITS)	
	HECTARES	ACRES	UNITS	BU	UPH	UPA
Single Family Lots	10.9	26.9	128	768	11.7	4.8
Multi-Family Development	17.3	42.8	311	1011	17.3	42.8
RK Heli-Ski	4.1	10.2	40	120	9.8	3.9
Greywolf Golf Course	70.0	173.1	N/A		N/A	
Greywolf Golf Course Clubhouse , Beckie Scott Nordic Centre and Day-Skier Parking	1.1	2.8	N/A		N/A	
Recreational Facilities/Ski Terrain	1.0	2.3	NA		NA	
Golf Academy/Driving Range	5.0	12.0	NA		NA	
Retained Natural Open Space	21.1	52.5	N/A		N/A	
Public Road ROW (20 m)	3.4	8.4	N/A		N/A	
Strata Road ROW (12 m)	3.2	7.8	N/A		N/A	
TOTAL	**137.9 Hectares**	**339.2 Acres**	**479 Units**	**1899 BU**	**3.5 UPH**	**1.4 UPA**

GREYWOLF LAND USE
SUMMARY PLAN

FIGURE 5-5

5.3 TRAPPER'S RIDGE

Trapper's Ridge is Panorama's mountainside residential neighbourhood with an accent on snow. It is the best ski-in, ski-out real estate at Panorama. The Residences at Trapper's Ridge are right on the mountain, yet just a stone's throw from Ski Tip Village. Located approximately half of a kilometre north of Panorama Village (the village core), perched on benchlands forming the base of Panorama Mountain, Trapper's Ridge represents a quiet alternative to the excitement in nearby Ski Tip Village. At the same time, some of the best ski terrain around, passes right in front of its doorstep.

The specific details pertaining to land use planning and statistics associated with this neighbourhood are contained in the following sub-sections.

5.3.1 PLANNING SUMMARY

Trapper's Ridge occupies the benchland areas at the base of Panorama Mountain, north of the Panorama Village development area. It is situated on lands consisting of two main plateaux separated by a well defined slope adjacent to the Platter Lift. The Trapper's Ridge land base extends from a lower elevation of 1135 metres just above Toby Creek, to an upper elevation of 1320 metres just below the water reservoir. Cox Creek passes through the lower portion of lands but its alignment is generally contained south of the development area, while Taynton Creek defines the northern limits of development.

The residential pattern, density and mix of accommodation is defined mainly by topographic conditions and the ability to provide vehicular road access to upper and lower bench areas. This is achieved through design of the main access road - Trapper's Ridge Road - which is sensitively aligned to hug the natural contours and minimize the areas of disturbance typically associated with roads in difficult terrain. The road design meets Ministry of Transportation and Highways standards in providing a functional and safe public access route through the Trapper's Ridge development area to its upper elevations.

Grading conditions associated with roadway design yield varying capabilities with respect to feasibility of residential development. The results determine the mix, density distribution and overall yield of residential accommodation within Trapper's Ridge. Based on this major controlling factor, the lower plateau emerges as a low density single family node comprised of varying lot sizes designed to respond to localized topographic conditions, while the upper plateau is capable of accommodating a broader range of residential forms and densities adjacent to major ski runs.

The main access into Trapper's Ridge is off lower Panorama Drive at the northeastern perimeter of the single family subdivision. At this location, a major neighbourhood gateway feature is located at the start of Trapper's Ridge Road, signifying arrival into this distinct "on-mountain" neighbourhood. Passing through this gateway, access to Trapper's Crossing is provided to the west off Trapper's Ridge Road. Trapper's Crossing is a townhouse project which functions as a transition development, strengthening the interface between the established single family subdivision and new development of Trapper's Ridge.

This interface is further reinforced through the introduction of a series of small scale single family lots similar to those found in the subdivision and located below Trapper's Crossing above the banks of Toby Creek. The intent of these "limited edition" units is to continue the "cabin in the woods" feel which is achieved in the single family subdivision. It also provides a limited form of resort accommodation not provided elsewhere within the programme for new resort development.

Trapper's Ridge Illustrative Master Plan Figure 5-6

CABIN IN THE WOODS

Efficiency of land use dictates the predominance of single family lot development on the lower plateau. Trapper's Ridge Road contains a main switchback conforming to the shape of the lower plateau, prior to its ascent up the steep slope toward the upper plateau. This defines the form and land area available for residential development on the lower plateau. The context of this area in relation to Panorama Village and the ski area tend to define the development of a lower density more rural form of residential use. The presence of a dense pine forest cover further supports this direction.

On its ascent toward the upper plateau, Trapper's Ridge Road yields potential for a limited number of larger single family lots on the downslope. These take advantage of ski-in, ski-out location as well as views to Toby Creek, Watch Peak and Mt. Bruce to the northwest. Near the top of its main ascent, Trapper's Ridge Road switches back again to access the upper plateau. At this location, two major development sites emerge, offering prime ski-in, ski-out location. These sites extend south from Trapper's Ridge Road to the edge of major ski runs, revealing magnificent views of Ski Tip Village and Toby Creek Valley below, and a distant panorama which includes Mt. Nelson, Mt. Catherine and Monument Peak to the southwest.

The balance of the upper plateau consists mainly of slopes ranging between 5% to 35%, permitting development of a full range of resort accommodation. Included in the residential programme of the upper plateau is a mix of single family lots, multi-family parcels and a condominium hotel site on the edge of Ski Tip Way ski run. Planning of this mixed residential neighbourhood incorporates strategic alignment of ski-in and ski-out corridors to optimize access to nearby ski runs and lifts.

5.3.2 LAND USE PROGRAMME

The initial land use programme for Trapper's Ridge was established based on preliminary site reconnaissance and subsequent land capability analysis. Refinement of the final land use programme resulted from on-site verification of conceptual planning work combined with ongoing input from the development team. Table 5-5, Trapper's Ridge Land Use Programme, summarizes the land uses and associated physical development which is represented on the Trapper's Ridge Illustrative Master Plan.

TRAPPER'S RIDGE LAND USE PROGRAMME

TABLE 5-5

LAND USE	RATIONALE & DESCRIPTIVE DATA
Neighbourhood Entrance Feature	¤ Establish gateway and sense of arrival to Trapper's Ridge neighbourhood. ¤ Aid in creation of neighbourhood identity and distinction.
Single Family Residential	¤ Varying lot sizes with minimum 560 m² (6000 ft²) lots. ¤ Optimize site density and economic performance. ¤ Respond to market demand. ¤ Respond to physical site conditions. ¤ Balance economic performance of development. ¤ Provide major single family ski-in/ski-out real estate.
Multi-Family Residential	¤ Maximize bed units in 380 metre proximity to ski lift. ¤ Balance optimum site density. ¤ Provide opportunities for housing and social mix responding to lifestyle and economic opportunities. ¤ Create critical mass in proximity to ski-in / ski-out terrain. ¤ Provide potential for future demands.
Condominium Hotel	¤ Provide additional opportunity for commercial development outside of Panorama Village. ¤ Maximize bed units in proximity to ski lift. ¤ Opportunity for ski-in / ski-out condohotel. ¤ Create critical mass in proximity to ski-in / ski-out terrain. ¤ Provide potential for future demands. ¤ Create sense of vibrancy within slope-side developments. ¤ Establish architectural and massing relationship in balance with Ski Tip Village
Public Park	¤ Provide opportunity for neighbourhood recreation within Trapper's Ridge.
Retained Natural Open Space/ Ski Terrain	¤ Avoid impact on sensitive site conditions. ¤ Provide for public access and ski-in / ski-out corridors. ¤ Create diversity in open space recreation opportunities. ¤ Mitigate visual impact of development while contributing to resort character.
Public Road	¤ 20.0 metre R.O.W., maximum 10.0% grade.
Strata Road	¤ 12.0 metre R.O.W., maximum 12.0% grade.

RESIDENTIAL ACCOMMODATION is comprised of a mix of single family lots, multi-family parcels and a condominium hotel parcel. A total of 397 residential accommodation units are provided within the Trapper's Ridge neighbourhood. This consists of 134 single family lots, 148 multi-family units and 115 condohotel units. Single family lot development is distributed between the upper and lower plateau areas while multi-family and condominium hotel uses are concentrated solely within the upper plateau.

Single family lots are made up of a range of sizes and configurations designed to respond to the terrain conditions present. The smallest lots are the 12 cabin lots adjacent to Cox Creek in the lower plateau area having an average lot size of approximately 510 m² (5500 ft²) with minimum metre 17 metre (55 foot) frontages. These are envisioned to contain buildings with a maximum footprint of approximately 140 m² (1500 ft²), leaving ample separation between residential units.

POSSIBLE IMAGE OF TRAPPER'S RIDGE SINGLE FAMILY

Possible image of
Trapper's Ridge Single Family

Possible image of
Trapper's Ridge Multi-family

Generally larger lots with minimum 30 metre (100 foot) frontages are located on steep downslope conditions where the wider lot frontage permits a range of opportunities for lot access and slope adaptive building design. Lot depths in these cases consume the steeper portions of the downslope condition, which left undisturbed, help to minimize site impacts and provides for a more sensitive integration of built form with the natural environment. Medium size lots are typically located on the flatter portions of upper and lower plateau areas. These lots have an average size of approximately 840 m² (9000 ft²) with minimum frontages of 21 metres (70 feet) which allows for development of a range of housing types and sizes to fit within the mountainside setting.

It is anticipated that significant forest cover can be retained in conjunction with appropriate house designs, therefore ensuring the desired levels of privacy and seclusion which comes to be expected within this resort context.

Multi-family development is sensitively integrated within the upper plateau to facilitate a positive interface between the higher density forms of residential accommodation adjacent to the ski runs, and lower density single family uses.

The condohotel parcel is envisioned as the site of a Trapper's Ridge signature building in the category of a grand CP hotel. The site qualities in terms of location, orientation, views and proximity to Panorama Village and the recreation base, warrant this type of development. Contextually, this class of development would be perched high on the edge of a major prominence, above and overlooking the entire Panorama Village area, with a panoramic vista of the surrounding major mountain peaks.

The residences of Trapper's Ridge are almost hidden in the trees, yet they catch the sun and deliver magnificent views through the trees over the village. A number of the single family lots are envisioned to accommodate charming mountainside bed & breakfasts operated by recently retired professionals seeking a more idyllic existence in this mountain wilderness.

Possible image of Trapper's CondoHotel

The architecture of Trapper's Ridge will be consistent in theme and character with that of the other resort neighbourhoods. It is anticipated however, that the local conditions and contextual setting of Trapper's Ridge will allow this neighbourhood to establish its own sense of distinction within the broader resort theme and character. Design guidelines for Trapper's Ridge are contained in CDP Volume III - Design Standards Manual. They will ensure that the unique qualities of this development area are allowed to be revealed through specific architectural designs and landscape treatments.

RECREATION AND TRAIL development in Trapper's Ridge includes a series of ski-in/ski-out corridors which are integral to the planning of residential uses within Trapper's Ridge, taking advantage of this development area's key location next to major ski runs and chairlifts. A neighbourhood trail network connecting with Panorama Valley Trail, links this mountainside neighbourhood with Panorama Village and Greywolf.

This provides opportunities to access both internal recreation amenities as well as resort-wide recreational facilities. Internal recreation amenities include a 0.24 hectare (0.6 acre) neighbourhood park which has been incorporated into the upper plateau potion of Trapper's Ridge in order to accommodate family oriented recreation in a tranquil setting close to home

5.3.3. LAND USE SUMMARY

This section describes the detailed components and related land use statistics contained in the Trapper's Ridge Illustrative Master Plan. The land uses indicated are presently not accommodated within the Upper Columbia Valley Zoning Bylaw No. 900 and will require a zoning amendment to permit the form of development which is depicted.

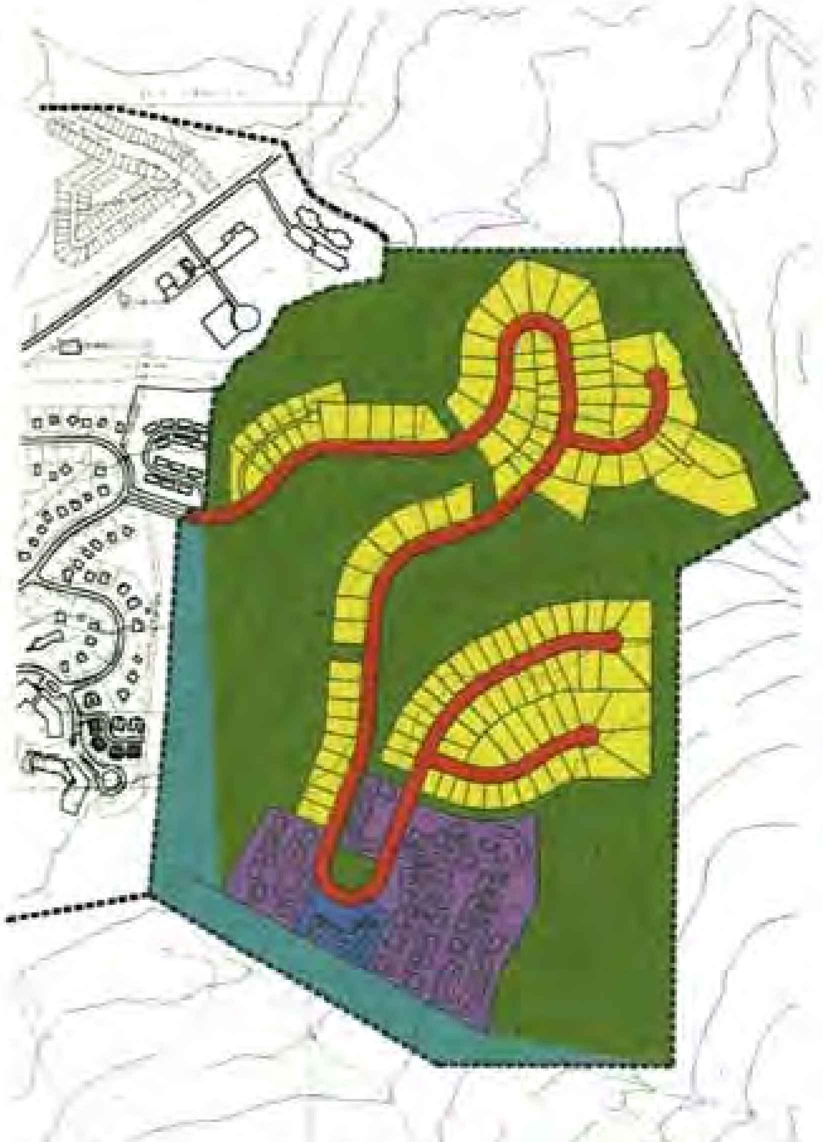
The total land area which is occupied by the Trapper's Ridge development area is approximately 58.6 hectares (145.0 acres). Of this, approximately 17.3 hectares (42.7 acres) have been designated for single family residential use, 6.6 hectares (16.4 acres) for multi-family use, and 0.8 hectares (1.9 acres) for development of the condominium hotel. The balance of the lands are to be preserved as natural areas and ski terrain surrounding the above land uses.

A more detailed breakdown of land use statistics is provided in Table 5-6, Land Use Summary Table. The land areas shown will be confirmed by legal survey and are subject to minor adjustment at the time of individual subdivision approvals.

TRAPPER'S RIDGE LAND USE SUMMARY TABLE

TABLE 5-6

LAND USE	APPROXIMATE AREA		YIELD		DENSITY (AVERAGE NET BED UNITS)	
	HECTARES	ACRES	UNITS	BU	UPH	UPA
Single Family Lots	17.3	42.7	134	804	47	19
Multi-Family Development	6.6	16.4	148	490	74	30
Condominium Hotel	0.8	1.9	115	237	296	125
Retained Natural Open Space	28.8	71.3	N/A		N/A	
Public Road ROW (20 m)	5.1	12.7	N/A		N/A	
TOTAL	**58.6 Hectares**	**145.0 Acres**	**382 Units**	**1531BU**	**6.5 UPH**	**10.6 UPA**



LEGEND

🟨 **Single Family Residential**
134 Dwelling Units, 804 Bed Units
17.3 Hectares, 42.9 Acres
7.8 UPH, 3.2 UPA

🟪 **Multiple Family Residential**
148 Dwelling Units, 481 Bed Units
6.5 Hectares, 16.2 Acres
22.8 UPH, 9.1 UPA

🟦 **Commercial and Commercial Accommodation**
115 Dwelling Units, 281 Bed Units
0.8 Hectares, 1.9 Acres
143.8 UPH, 60.5 UPA

🟦 **Recreational Facilities/Ski Terrain**
6.3 Hectares, 15.5 Acres

🟩 **Retained Natural Open Space**
33.5 Hectares, 82.8 Acres

🟥 **Public Road Right-of-Way**
5.1 Hectares, 12.6 Acres

Trapper's Ridge
397 Dwelling Units, 1566 Bed Units
69.5 Hectares, 171.9 Acres
5.7 UPH, 2.3 UPA

PREPARED FOR

INTRAWEST CORPORATION
[illegible]

PREPARED BY

STONEFIELD DEVELOPMENT CONSULTANTS
303 - 1130 HAMILTON STREET, VANCOUVER, BC [illegible]

FEBRUARY [illegible]

TRAPPER'S RIDGE
LAND USE SUMMARY PLAN FIGURE 5-7

5.4 MOUNTAIN MASTER PLAN

5.4.1 GOALS AND OBJECTIVES

Ecosign Mountain Resort Planners prepared the 1998 Panorama Mountain Village - Mountain Master Plan as an update to their previous Mountain Master Plan documentation. The 1998 update brings the Mountain Master Plan to a current status, consistent within the Comprehensive Development Plan's overall Master Plan for Panorama Mountain Village. The following sections are excerpts from the Ecosign Mountain Master Plan Document.

A winter resort area master plan involves planning the removal or replacement of existing equipment integrated with the addition of new facilities. It is important to have an overview of the complete project at build-out so that facilities can be balanced and capital effectively invested.

The objectives of the Panorama Mountain Master Plan are as follows:

- Optimize the use and operational efficiency of the existing physical plant;
- Provide skiers/snowboarders with a high quality experience including some of the best lifts, trails, and skier service facilities in western Canada;
- Balance lift and trail capacities;
- Provide adequate amount of skier services in appropriate zones of the mountain;
- Define goals to guide management and inform public agencies during the ensuing five to ten year period.

The following section proposes the installation of new equipment and the relocation and upgrading of existing equipment. Panorama must be prepared to invest capital to improve facilities and increase capacity to sustain market growth.

Ecosign utilized a number and letter code to indicate the type of lift installation proposed.

The coding is as follows:

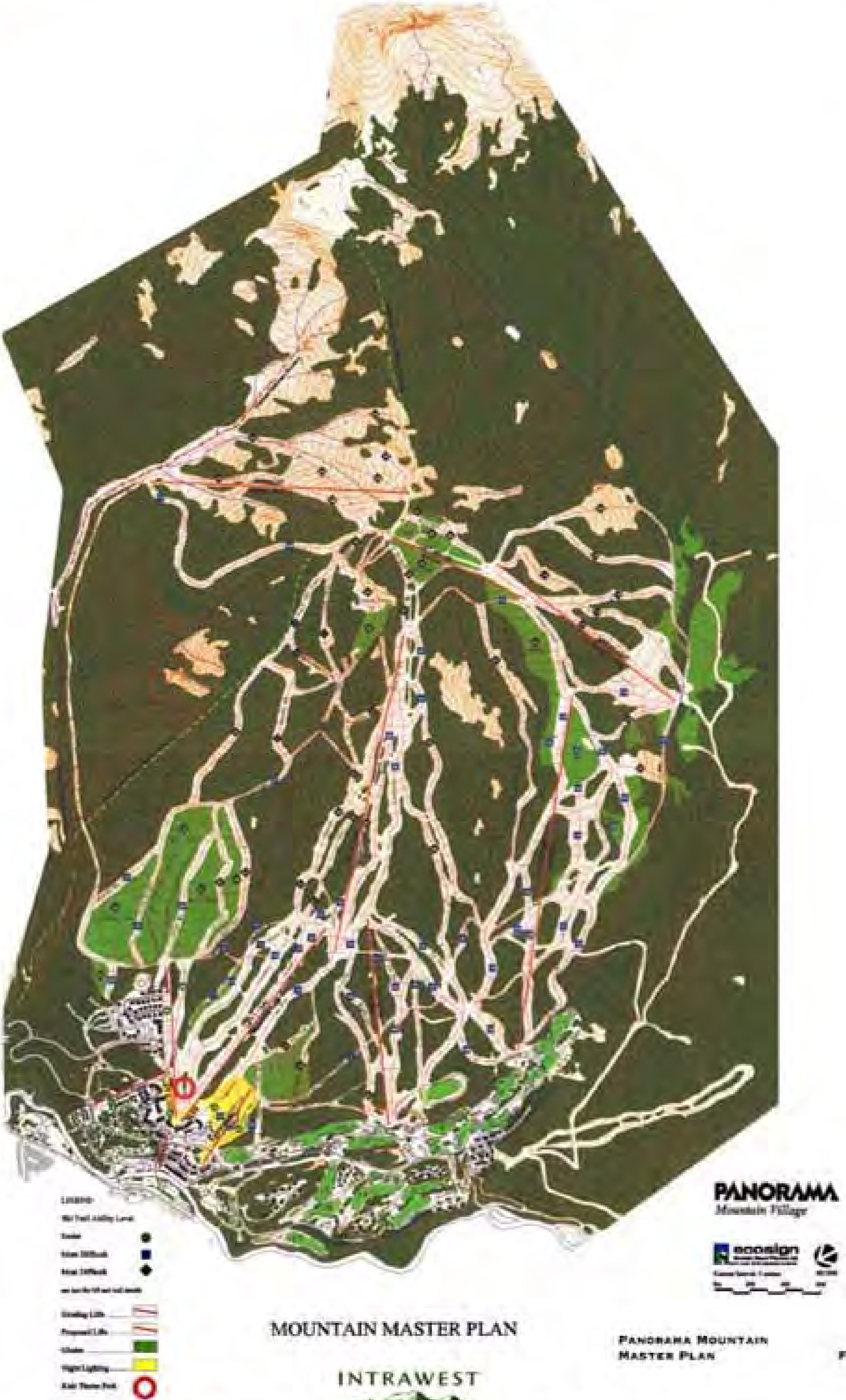
P	Platter Surface Lift
T-B	T-Bar Surface lift
2C	Double Chairlift
3C	Triple Chairlift
4C	Fixed Grip Quadruple Chairlift
Cab	Cabriolet Type Gondola People Mover
D4C	Detachable Grip Quadruple Chairlift
R	Replacement Lift (i.e. 2R)

The goal of the Mountain Master Plan is to renovate and modernize the mountain facilities at Panorama to make it a more desirable place to ski and snowboard and bring it up to, and beyond standards set by competitive destination resorts in western Canada.

This plan will provide facilities to increase the quality of the skier/snowboarder experience and the attractiveness of the area to both local and destination visitors. Physically, this plan will improve skier circulation in the existing area, speed up access to the upper mountain, as well as add new terrain.

5.4.2 MOUNTAIN MASTER PLAN SUMMARY

The Panorama Mountain Master Plan represents Intrawest's goals for renovating and modernizing Panorama's mountain. The plan will provide facilities to increase the quality of the skier/snowboarder experience and the attractiveness of the area to both local and destination visitors. Physically, the plan will improve skier circulation in the existing area, speed up access to the upper mountain, as well as add new terrain. The Mountain Master Plan is inserted as Figure 5-8.



MOUNTAIN MASTER PLAN

INTRAWEST

Panorama Mountain Master Plan **Figure 5-8**

Included in the Mountain Master Plan is the renovation and expansion of existing mountain facilities as well as new development which will consist of:

- The construction of several new lifts;
- Development of the Beckie Scott Nordic Centre/Greywolf Clubhouse and day-skier parking area;
- Construction of mid-mountain restaurants;
- Re-grading and construction of several new trails to alleviate bottlenecks which currently exist on the mountain;
- Fine (summer) grooming of ski trails;
- Installation of additional snowmaking;
- Construction of infrastructure.

5.4.3 MOUNTAIN FACILITIES AND PHASING

LIFTS - Currently, Panorama operates one detachable grip lift and 6 fixed grip lifts including one triple, two doubles, two T-Bars and one platter. In order to attract additional destination visitors, Panorama must join the leaders in the industry by providing additional high speed detachable chairlifts. This type of lift is now quite prevalent at leading destination resort areas, due to skier's preference for more comfortable loading and unloading. In addition, the speed of the lift results in an increase to the amount of skiing/snowboarding possible in one day. In fact, the number and size of detachable quadruple chairlifts offered at a winter resort area has become a very important factor when skiers/snowboarders make their decision on where to spend their day.

Vertical rise is also a very important factor in a skier's decision making process. The total amount of vertical serviced by high speed, detachable quad chairlifts available at the ski area, significantly affects the decision making process, as does the vertical rise on each individual lift, but to a lesser degree.

The Mountain Master Plan proposes the installation of three new detachable quadruple chairlifts, one beginner triple chairlift, one quadruple chairlift and an extension and replacement of the Summit T-Bar as a double chair. At completion of this Master Plan, the lift system will be able to stage guests from Ski Tip Village through the First Ascent Chair and the Toby/Sunbird lift system.

Lift 1, the First Ascent quad chair will be retained in its current configuration but will be upgraded to increase its capacity to 2,800 pph. The Sunbird, Toby, Red Rider Handle Tow and Silver Platter will also remain in their current configurations. Night skiing/ snowboarding will be added to the Toby Chair terrain.

The Mountain Master Plan envisions replacement of the existing Horizon Chairlift and Champagne T-bar with a high speed detachable quadruple chairlift. The top terminal of this new detachable lift will be located three-quarters of the way up the Champagne T-bar, about 120 vertical metres higher than the existing Horizon double chairlift, at the 2,160 metre elevation. The bottom terminal will be moved 29 vertical metres lower at the 1,527 metre elevation, just below the existing bottom terminal. This lift will be approximately 1,984 metres in length and will have a vertical rise of 633 metres. The lift would be installed with an hourly capacity of approximately 2,400 pph and would have a ride time of 6.6 minutes, running at 5.0 metres per top terminal, this lift will service return skiing on Schober's Dream, Hopeful Sun Bowl and the gladed areas on either side of Schober's Dream, which currently requires a total of three lift rides.

A mid-mountain restaurant is proposed to be constructed adjacent to the top of the new Lift 2R. The Horizon detachable quad will be able to accommodate 1,810 sliders per day.

The skiway from the top of the new Horizon detachable quad will merge with Schober's Dream near the 2,100 metre elevation, approximately 65 metres lower than the existing Summit T-Bar. In order to provide access to the summit, it is proposed that the Summit T-bar be replaced by a double chairlift with the bottom terminal relocated to the 2,085 metre elevation, adjacent to Schober's Dream. The new Summit chair will have a vertical of 279 metres and a carrying capacity of 190 skiers and snowboarders per day. This lift can be installed using the existing Horizon equipment when it is replaced. The extension of this lift to a lower elevation will allow the mountain to remove the Champagne T-Bar (resulting in less maintenance and operation costs) and will allow skiers to access the Summit with fewer lift rides.

First Ascent Quad

In order to provide additional beginner terrain, a triple chairlift (Lift 9) located between Ski Tip Village and the proposed Trapper's Ridge subdivision has been included in the Master Plan. When installed as a triple chairlift, this lift will allow two students to be accompanied by an instructor or adult on each chair. The Trapper's Chair will have an hourly capacity of 1,200 passengers per hour and a loading interval of nine seconds, which is very suitable for beginners. The lift will be able to accommodate 380 beginner skiers per day.

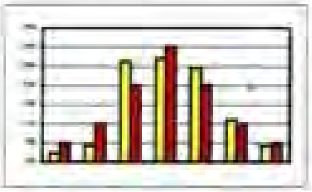
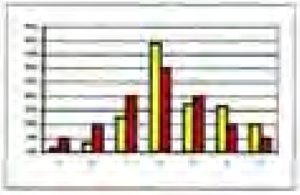
A fixed grip quadruple chairlift (Lift 10) is proposed to be installed on the north side of the summit, providing skier access in the northerly facing Taynton Valley. The chairlift, in this configuration, will have a vertical rise of 630 metres from its bottom terminal, at 1,740 metres, to the top terminal at the summit. The Taynton Bowl double chairlift will be able to accommodate approximately 530 sliders per day. This lift will provide a large expanse of skiing in the advanced and expert skill classes. Most of this steep terrain is naturally open or gladed, requiring minimal tree clearing for trail construction. A narrow trail will be constructed stretching from the bottom of the valley to the base area for emergency egress.

A detachable quadruple chairlift (Lift 11) starts in the Hopeful Creek Valley at the 1,645 metre elevation, and runs up to the 2,160 metre elevation, slightly above the bottom terminal of the Summit chair. This top terminal has been chosen to provide better and easier access to good skiing/snowboarding in the upper Hopeful Creek area and also to provide easy access to the Summit lift and Schober's run. The Hopeful Creek Quad will have a total vertical rise of 515 metres and a ride time of 4.6 minutes, based on a cable speed of 5.0 metres per second. The Hopeful Creek detachable quad will have a carrying capacity of 640 sliders per day. This lift, by itself or in conjunction with the Summit chair, will also service a huge expanse of "backcountry" terrain to the east of these lifts.

The Schober's detachable quadruple chairlift (Lift 12) starts at the 1,265 metre elevation in the Hopeful Creek Valley and terminates at the 1,850 metre elevation of Schober's Dream trail, a total of 585 metres of vertical. With a cable speed of 5.0 metres per second, this lift has an estimated ride time of 7.1 minutes. With a rated hourly capacityof 2,000 passengers per hour, this lift will have a capacity of 1,680 sliders per day. In addition to servicing return cycle skiing, this lift will provide an important second access route to the large amount of skiing terrain in the "back" of the ski area.

At completion of the Mountain Master Plan, the resort would be able to accommodate 8,000 skiers per day with 11 lifts. Detailed specifications for the proposed Mountain Master Plan lifts are listed in Table 5-8. Table 5-7 summarizes ski facility statistics associated with the Mountain Master Plan. A total of 437 hectares of ski trails have been designed to provide adequate trail capacity for the proposed 8000 SCC. The proposed trails will be able to accommodate 9,990 sliders per day. As a result of the trail capacity exceeding lift capacity, the overall average densities will be lower than the planning parameters resulting in higher quality snow conditions on the slopes as a result of less wear and tear.

MASTER PLAN SUMMARY **TABLE 5-7**

PHASE	LIFTS	NUMBER OF LIFTS	SCC	TRAILS	TRAIL BALANCE
EXISTING	Lift 1 - First Ascent - D4C - 1,992 pph Lift 2 - Horizon 2C - 994 Lift 3 - Toby - 2C - 1,217 pph Lift 4 - Sunbird - 3C - 1,700 pph Lift 5 - Champagne - T-Bar - 450 pph Lift 6 - Summit - T-Bar - 600 pph Lift 7 - Silver - Platter - 720 pph Lift 8 - Red Rider - Handle Tow - 720 pph	8	3,600	290.3 ha. 6,125 skiers/day	
Master Plan	Remove: Lift 2 - Horizon 2C - 994 Lift 5 - Champagne - T-Bar - 450 pph Lift 6 - Summit - T-Bar - 600 pph Install: Lift 2R - Horizon D4C - 2,400 Lift 6R - Summit 2C - 1,000 Lift 9 - Trapper's Beginner - 3C - 1,200 pph Lift 10 - Taynton Bowl - 4C - 1,200 pph Lift 11 - Hopeful Creek - D4C - 1,400 pph Lift 12 - Schober's D4C - 2,000 Increase Capacity: Lift 1 - First Ascent - D4C to 2,800pph Existing: Lift 3 - Toby - 2C - 1,217 pph Lift 4 - Sunbird - 3C - 1,700 pph Lift 7 - Silver - Platter - 720 pph Lift 8 - Red Rider - Handle Tow - 720 pph	11	8,000	436.9 ha. 9,990 skiers/day	

PANORAMA MASTER PLAN LIFT SPECIFICATIONS

TABLE 5.8

Lift Number	1	2R	3	4	6R	7
Lift Name	**First Ascent**	**Horizon Quad**	**Toby**	**Sunbird**	**Summit**	**Silver Platter**
Lift Type	**D4C**	**D4C**	**2C**	**3C**	**2C**	**P**
Top Elevation m.	1,563	2,160	1,273	1,596	2,364	1,223
Bottom Elevation m.	1,183	1,527	1,153	1,181	2,085	1,162
Total Vertical m.	380	633	120	415	279	61
Horizontal Distance m.	1,345	1,880	572	1,156	860	476
Slope Distance m.	1,400	1,984	584	1,230	904	480
Average Slope %	28%	34%	21%	36%	32%	13%
Rated Capacity	2,800	2,400	1,217	1,700	1,000	750
V.T.M./Hr.(000)	1,064	1,519	146	705	279	46
Rope Speed m/sec.	5.0	5.0	2.0	2.3	2.0	2.5
Trip Time min.	4.67	6.61	4.87	8.91	7.53	3.20
Operating Hr./Day	7.3	7.1	7.3	7.1	6.3	7.0
V.T.M. Demand/Day	3,583	5,043	2,827	4,099	6,799	1,069
Loading Eff. %	95%	95%	90%	85%	90%	80%
Access Reduction	30%	11%	50%	16%	19%	10%
SCC Skiers/Day	**1,430**	**1,810**	**170**	**870**	**190**	**220**
Cumulative Total	**1,430**	**3,240**	**3,410**	**4,280**	**4,470**	**4,690**

Lift Number	8	9	10	11	12	
Lift Name	**Red Rider**	**Trapper's Chair**	**Taynton Bowl**	**Hopeful Creek**	**Schober's**	
Lift Type	**HT**	**3C**	**4C**	**D4C**	**D4C**	**TOTAL**
Top Elevation m.	1,209	1,360	2,370	2,160	1,850	
Bottom Elevation m.	1,185	1,183	1,740	1,645	1,265	
Total Vertical m.	24	177	630	515	585	3,819
Horizontal Distance m.	164	880	1,460	1,280	2,040	
Slope Distance m.	166	898	1,590	1,380	2,122	12,737
Average Slope %	15%	20%	43%	40%	29%	32% Mean
Rated Capacity	720	1,200	1,200	1,400	2,000	16,387
V.T.M./Hr.(000)	17	212	756	721	1,170	6,636
Rope Speed m/sec.	1.8	2.2	2.5	5.0	5.0	
Trip Time min.	1.51	6.80	10.60	4.60	7.07	
Operating Hr./Day	7.0	7.0	5.5	6.0	6.5	6.7
V.T.M. Demand/Day	940	2,495	7,016	6,437	4,188	
Loading Eff. %	65%	80%	90%	95%	95%	
Access Reduction	10%	20%	0%	0%	3%	
SCC Skiers/Day	**80**	**380**	**530**	**640**	**1,680**	**8,000**
Cumulative Total	**4,770**	**5,150**	**5,680**	**6,320**	**8,000**	

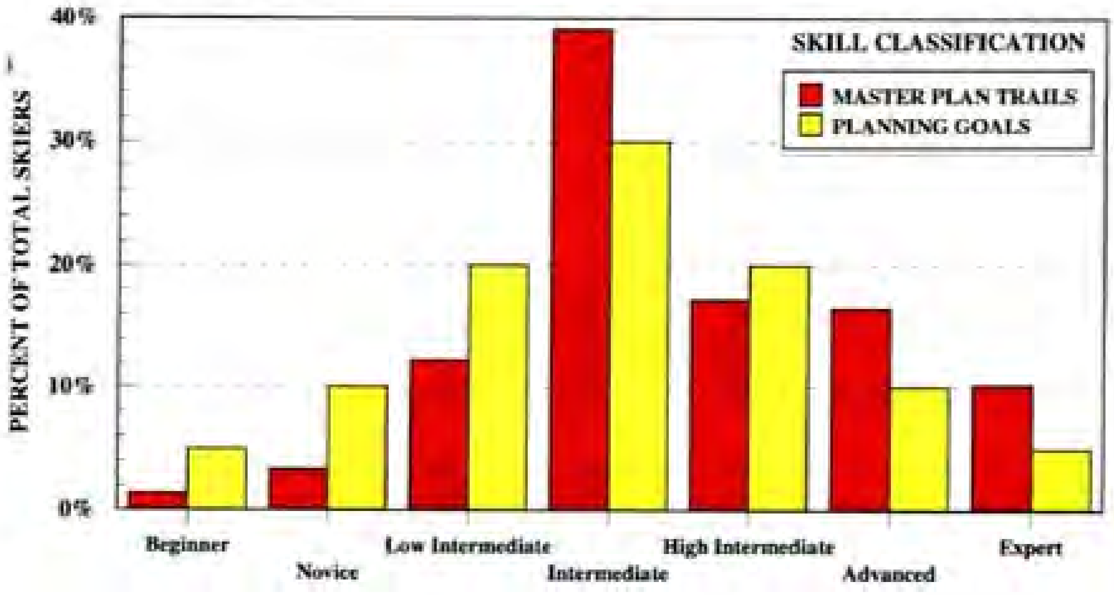
The Cumulative Trail Balance Statement (Table 5-9), illustrates that the proposed trails, are somewhat unbalanced as compared to the skier market. The beginner and novice skill class trails are able to service 5 percent of the market, as compared to the planning goal of 15 percent. The intermediate skill class trails service 68.6 percent of the market, compared to the planning goal of 70 percent. The intermediate skill class trails therefore are in good balance with the skier market. The advanced and expert skill class trails service 26.7 percent of the market compared to a planning goal of 15 percent. The skill class balance of terrain is graphically illustrated in Figure 5.9 and Table 5.9.

PANORAMA MASTER PLAN
CUMULATIVE TRAIL BALANCE STATEMENT **TABLE 5.9**

Skill Classification	Hectares	Skiers	Balance	Ideal
1 Beginner	2.8	140	1.4%	5%
2 Novice	6.6	330	3.3%	10%
3 Low Intermediate	30.8	1,230	12.3%	20%
4 Intermediate	100.3	3,905	39.1%	30%
5 High Intermediate	79.3	1,715	17.2%	20%
6 Advanced	134.5	1,650	16.5%	10%
7 Expert	82.8	1,020	10.2%	5%
TOTALS	**436.9**	**9,990**	**100%**	**100%**

Average Density =	18.3	Skiers/Hectare
Optimum Density =	32.6	Skiers/Hectare
Weighted Demand =	4,623	VTM/Skier/Day

PANORAMA MASTER PLAN
SKI TRAIL BALANCE **FIGURE 5.9**



The balance between lift and trail capacity is listed in Table IV.5 in CDP Volume II - Technical Background Report and graphically shown in Table 5.8. The most significant imbalances occur on the Silver Platter and the Red Rider handle tow beginner lifts, which only have 50 and 44 percent of the optimal amount of terrain. All of the other lift systems have adequate or more than adequate terrain to match the lift capacities.

SNOWMAKING - Since Panorama's inception, the need for snowmaking has been foreseen as important to supplement the natural snowpack in order to extend the season. Expansion of the snowmaking system is first slated for within the existing area. This snowmaking expansion would be installed in many steps over the duration of resort development. In anticipation of higher traffic volumes on the proposed new lifts, snowmaking would be installed on the new Horizon trails, World Cup Way and Schober's Dream. The lower mountain would see the installation of snowmaking on the Trapper's Ridge beginner area. Additional snowmaking would be phased with the construction of new trails. This new snowmaking will initially include the increase in pumping capacity of the River pumphouse to 2,700 GPM and the Booster pumphouse to 1,800 GPM. As the snowmaking areas are added to the system, additional pumping capacity will be required.

SKIER ACCOMMODATION, PARKING AND STAGING - Panorama Mountain Village relies on a combination of day skiers and overnight guests for their daytime ski business. The proportion of these types of guests varies over the season during different times of year, and varies over the long term with the availability of on-mountain accommodation, local and regional population growth, competing ski areas, etc.

Intrawest and Panorama staff have worked with the consultants to develop a plan for the development of accommodation within Panorama Village core and the surrounding lands, as well as a plan for parking and ski access for day skiers.

The accommodation plan includes a total of 7,084 beds spread throughout the resort, ranging from village condohotel units, units with golf course frontage and forested single family units with ski-in/ski-out access. All of these beds are located within walking distance of a staging lift and therefore, it is anticipated that these skiers will not use their cars to access the lifts. As listed below in Table 5.6, on a peak day, these beds will generate a total of approximately 3,733 skiers.

Day skier parking has been planned in four locations; one adjacent to the Administration building; one at the entrance to the resort on the west side of Toby Creek Road; one on the west bank of Toby Creek connected to the People Mover base station by a foot bridge; and one at the Greywolf Clubhouse/Beckie Scott Nordic Centre. As listed in Table 5-10 these lots will have a capacity of approximately 965 cars, accommodating a total of approximately 3,868 day skiers.

PROPOSED DAY SKIER PARKING TABLE **5.10**

	Cars	Skiers
Upper Toby Creek Lot	260	650
Lower Toby Creek Lot	455	1,138
Ski Tip Village Lot	100	250
Greywolf Lot	150	375
Total	965	2,413

Skiers per car: 2.5

Approximately 613 of these day skiers will be within a comfortable Skier Walking Distance (SWD) from the main lifts, while skiers from the Toby Creek lots will require a shuttle from the parking to the lifts, due to the distance and elevation difference. The Mountain Master Plan includes an Aerial Cable Conveyance System (People Mover) to provide a shuttle service from the parking to the Ski Tip Village base for these day skiers. This lift is proposed with an initial capacity of 514 passengers per hour and an ultimate capacity of 710 pph. Over a 2.5 hour staging period, this lift would initially be able to move approximately 1,285 skiers from the lower lots to the village and would be able to move 1,775 skiers at its ultimate capacity. Currently, the number of day skiers is significantly lower than the initial and ultimate capacity of the People Mover.

Another concern at Panorama is the staging of skiers onto the mountain after they have arrived. The SCC of the lifts beyond Panorama Village is about 5,720 and all these sliders should be staged within the industry accepted staging period of 2.5 hours. During the morning staging period, it is anticipated that approximately 60 percent of the seats on the First Ascent lift would be available for staging, and 40 percent for return cycle skiing. This would result in a staging capacity of 3,990 skiers. The remaining 1,730 sliders would be required to stage via the Toby and Sunbird chairs, which at 1,217 pph on Toby, would take approximately 1.6 hours.

6.0 IMPLEMENTATION

Implementation of the Panorama Mountain Village Comprehensive Development Plan and its major master plan components involves a multi-dimensional strategy. The implementation strategy must be incremental in response to market forces and multi-level government participation. It must be sensitive to the residents of the resort and the preferences of local and regional populations. Various components of the Panorama Mountain Village Master Plan will require public participation and formal public endorsement through the Official Public Hearing process, therefore a complete implementation strategy relies on public acceptance of the Comprehensive Development Plan and its companion parts. Public lands must be acquired in order to follow through with development of certain components of the Master Plan for Panorama. A uniform set of standards must be applied consistently in order to ensure continuity and quality of resort development through the course of the implementation strategy.

Partial implementation of Intrawest's vision and related master plan initiatives has already taken place in the form of new developments and improvements which include: refurbishing established facilities such as Toby Creek and Horsethief Lodges, the Pine Inn and Administration Building; construction of new Ski Tip Day Lodge and Ski Tip Residences; development of Tamarack Lodge in Ski Tip Village; completion of Hearth Stone townhouses in Ski Tip Village; completion of Greywolf Golf Course and Clubhouse; subdivision of 31 single family lots in Greywolf, and; major improvements to mountain ski area facilities. These improvements have contributed in establishing the qualities and standards which are expected in all future developments. They have been incorporated into record documents which are integral to the Comprehensive Development Plan and its implementation strategy.

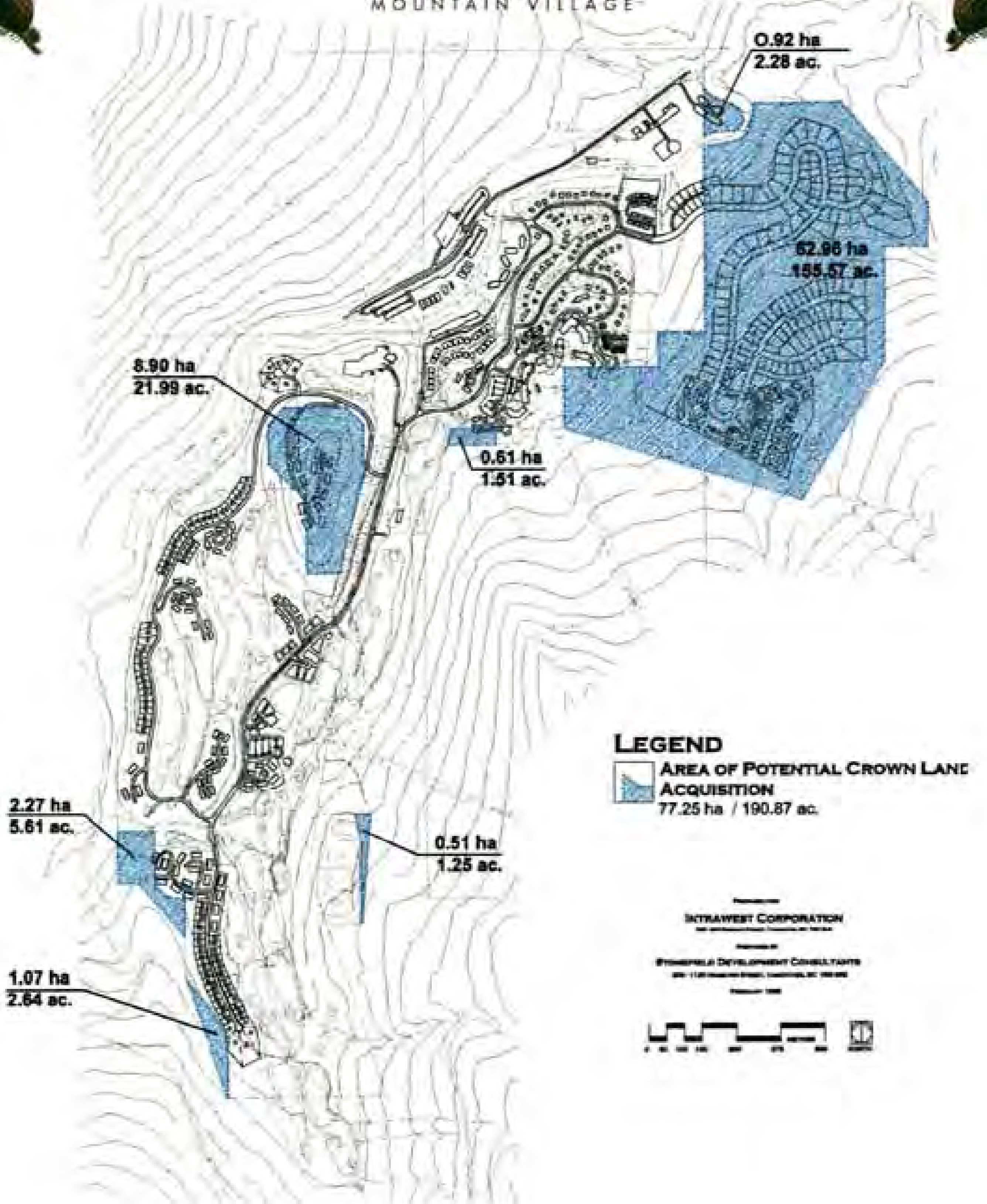
Development activity will intensify based on the resort improvement initiatives and strategy for implementation which is represented in the Comprehensive Development Plan. The main aspects associated with implementation of the Comprehensive Development Plan are summarized in this section. They include: Crown land acquisition; development phasing strategy; establishment of a Columbia Valley Resort Association to promote tourism in the Columbia Valley; establishment of a Mountain Resort Improvement District (M.R.I.D.) to own and operate Panorama's servicing infrastructure; enforcement of a Design Standards Manual for the resort, and; securing appropriate land use designations based on Regional District of East Kootenay land use policy and zoning regulations.

6.1 LAND ACQUISITION

The following are the main acquisitions of both Crown and private lands which will be necessary to fully implement the Panorama Mountain Village Master Plan as described in this Land Use Strategy:

- A high priority acquisition is the purchase of approximately 55 hectares (136 acres) of Crown land within District Lot 4596 and District Lot 16352 along the eastern Plan Area boundary in the vicinity Taynton Creek. This will permit development of the Trapper's Ridge neighbourhood, a critical ski-in/ski-out residential node, and development of important employee residences on the north side of Toby Creek in the vicinity of the Light Industrial parcel.

- Purchase of approximately 1.5 hectares (3.7 acres) for Panorama Springs and Taynton Lodge.



LAND ACQUISITION
PLAN

FIGURE 6-1

- The purchase of approximately 0.8 hectares (2.0 acres) of privately owned land with waterfront on Lake Windermere in the District of Invermere will permit development of the Lakeside Recreation Base, an important waterfront recreation activity and staging area which will complete the overall year-round recreation programme at Panorama.
- The lease or purchase of approximately 1.33 hectares (3.29 acres) of Highway R.O.W. bordering Toby Creek Road at the entrance to the resort will allow construction of an important day-use parking lot on the north side of Toby Creek Road.
- A long range acquisition, is the purchase of approximately 8.90 hectares (21.99 acres) of Crown land situated on a large knoll within the Greywolf development area. This purchase will permit development of approximately 61 multi-family dwelling units overlooking Greywolf Golf Course and Toby Creek Valley.
- And other potential minor purchases to complete already approved land uses in Greywolf.

Figure 6-1, the Land Acquisition Plan, indicates the areas of potential land acquisitions, and their locations.

6.2 PANORAMA PHASING STRATEGY

The development and phasing of major resort facility improvements in accordance with the Panorama Mountain Village Master Plan will be incremental in response to market demand and availability of funding. The Master Plan embodied in this Land Use Strategy document establishes a number of phases related to timing of resort development projects. The location of individual projects, along with detail of associated development statistics are summarized in Table 6-1 and Figure 6-2.

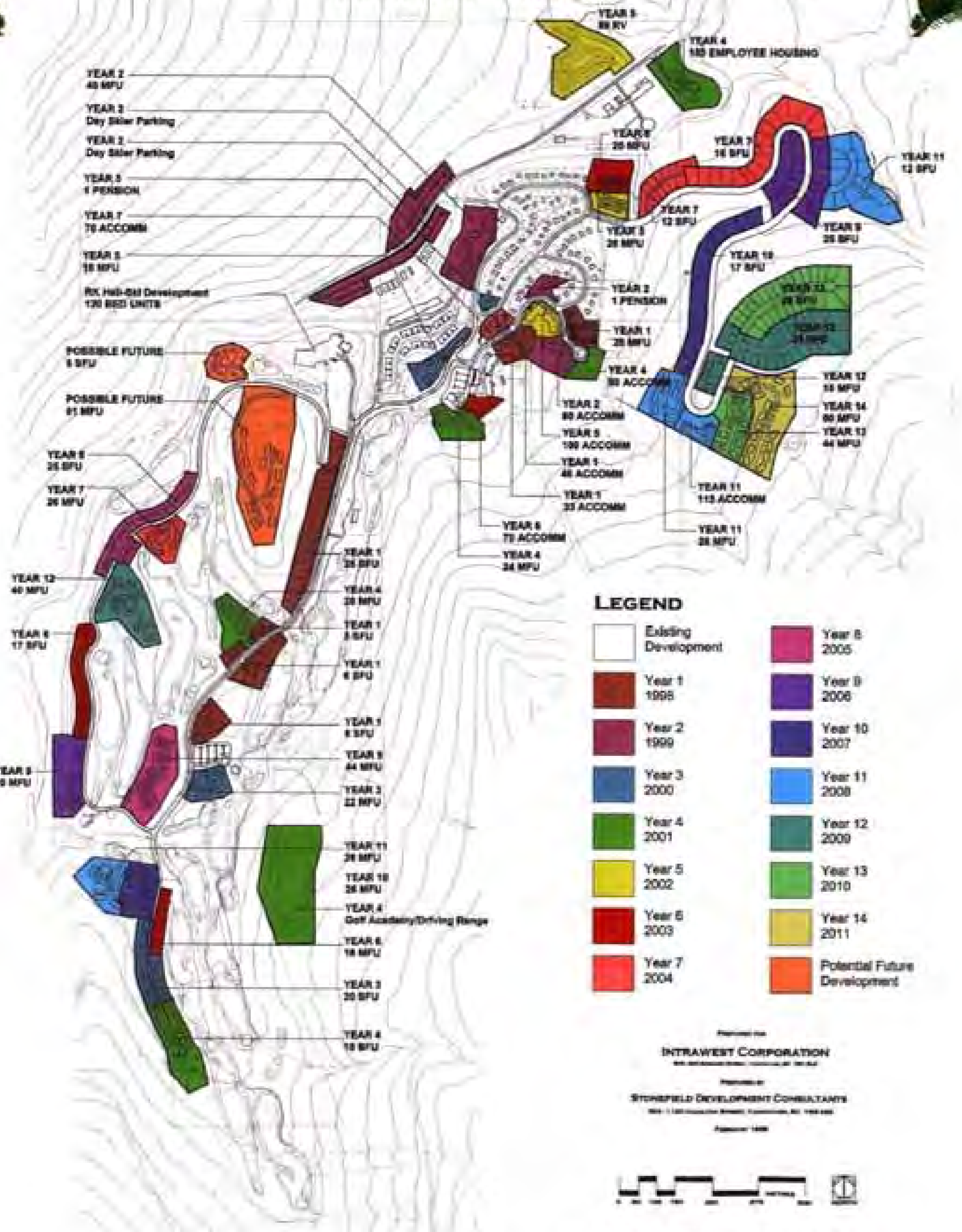
The Phasing Strategy (Figure 6-2) indicates a total of 14 phases over the same period in years, starting in 1998 and completing in the year 2011. Additional phases are indicated as Potential Future Development beyond this time horizon. These include the 61 unit townhouse project and 6 single family lots located in the northwest corner of the Greywolf development area. The first six phases of expansion to the year 2003, are concentrated mainly in Panorama Village and Greywolf. Development of Trapper's Ridge is scheduled to begin in 2004 with the 12 "cabin" lots, and the balance of Trapper's Ridge development intensifying after that period while other development areas diminish as they near build-out in 2009. By the end of the year 2011, it is expected that approximately 1626 residential accommodation units will be completed.

The development of residential accommodation as indicated in the Phasing Strategy will result in a maximum of 7084 residential bed units. This programme will be complimented by a phased mountain improvement schedule which will increase Skier Carrying Capacity to 8000 SCC as shown on a previous Figure 5-8, Mountain Master Plan.

PANORAMA MOUNTAIN VILLAGE DEVELOPMENT PHASING SCHEDULE

TABLE 6-1

Phase Year	Project	Project Location Description	Project Start/ Turn Over	Type and # of Units
Year 1 1998	The Hearth Stone		Apr 98/Dec 98	TH 28
	Ski Tip Lodge		Apr 97/Jan 98	CH 33
	Tamarack Lodge		Apr 97/May 98	CH 46
	Greywolf, Single Family Area #1	on Greywolf Drive adjacent to 11th hole	Jan 98/Aug 98	SF 25
	Greywolf, Single Family Area #2	on Greywolf Drive adjacent to 18th hole	Jan 98/Aug 98	SF 6
	Greywolf, Single Family Area #3	on Greywolf Drive adjacent to 18th hole	Aug 98/Apr 99	SF 6
	Greywolf, Single Family Area #7	on Greywolf Drive fronting "Cliffside"	Aug 98/Apr 99	SF 5
Year 2 1999	Panorama Springs		Apr 99/Apr 00	CH 80
	The Bridges		Apr 99/Dec 99	TH 40
	Pension Site #1		Apr 99/Dec 99	P 1
Year 3 2000	Greywolf, Single Family Area #4 - Phase 1	on Greywolf Drive adjacent to 5th hole	Apr 00/Aug 00	SF 20
	Greywolf, Multi Family Area #2	adjacent to Greywolf Clubhouse	Apr 00/Dec 00	TH 22
	Pension Site #2		Apr 00/Dec 00	P 1
	Building "I" (Multi-Family Townhouses)	adjacent to Skier Overpass	Apr 00/Dec 00	TH 16
Year 4 2001	Building "E"		Apr 01/Apr 02	CH 80
	Building "H" (Multi-Family Townhouses)	at Maintenance in Upper Parking Lot	Apr 01/Dec 01	TH 24
	Greywolf, Multi Family Area #1	on Greywolf Drive, "Cliffside"	Apr 01/Dec 01	TH 28
	Greywolf, Single Family Area #4, Phase 2	on Greywolf Drive adjacent to 5th hole	Apr 01/Aug 01	SF 18
	Employee Dormitory	adjacent to Light Industrial area	Apr 01/Dec 01	EH 150
Year 5 2002	Building "C"		Apr 02/Apr 03	CH 109
	Trapper's Crossing, Phase 1		Apr 02/Dec 02	TH 26
	Recreational Vehicle Park	adjacent to Light Industrial area	Apr 02/Aug 02	RV 89
Year 6 2003	Building "G"	at Ski Patrol in Upper Parking Lot	Apr 03/Apr 04	CH 70
	Trapper's Crossing, Phase 2		Apr 03/Dec 03	TH 26
	Greywolf, Multi Family Area #9	on Greywolf Drive adjacent to 5th hole	Apr 03/Dec 03	TH 16
	Greywolf, Single Family Area #5	On Loop Road adjacent to 7th hole	Apr 03/Aug 03	SF 17
Year 7 2004	Building "F"	across bus loop from Tamarack Lodge	Apr 04/Apr 05	CH 70
	Greywolf, Multi Family Area #6	on Loop Road adjacent to 16th green	Apr 04/Dec 04	TH 28
	Trapper's, Single Family Area #4	cabins	Apr 04/Aug 04	SF 12
	Trapper's, Single Family Area #1, Phase 1	on lower plateau	Apr 04/Aug 04	SF 16
Year 8 2005	Greywolf, Multi Family Area #3	on knoll adjacent to 8th hole	Apr 05/Dec 05	TH 44
	Greywolf, Single Family Area #6	on Loop Road adjacent to 13th hole	Apr 05/Aug 05	SF 25
Year 9 2006	Greywolf, Multi Family Area #5	on Loop Road adjacent to 6th green	Apr 06/Dec 06	TH 20
	Trapper's, Single Family Area #1, Phase 2	on lower plateau	Apr 06/Aug 06	SF 28
Year 10 2007	Greywolf, Multi Family Area #4, Phase 1	on Greywolf Drive adjacent to 6th tee	Apr 07/Dec 07	TH 26
	Trapper's, Single Family Area #2	between lower and upper plateaus	Apr 07/Aug 07	SF 17
Year 11 2008	Greywolf, Multi Family Area #4, Phase 2	on Greywolf Drive adjacent to 6th tee	Apr 08/Dec 08	TH 26
	Trapper's, Single Family Area #1, Phase 3	on lower plateau	Apr 08/Aug 08	SF 12
	Trapper's, Multi Family Area #1	below hairpin turn to upper plateau	Apr 08/Dec 08	TH 25
	Trapper's, Condohotel	at hairpin turn to upper plateau	Apr 08/Apr 09	CH 115
Year 12 2009	Greywolf, Multi Family Area #7	on knoll between 7th hole and 14th hole	Apr 09/ Dec 09	TH 40
	Trapper's, Multi Family Area #2	in hairpin turn to upper plateau	Apr 09/ Dec 09	TH 16
	Trapper's, Single Family Area #3, Phase 1	on upper plateau	Apr 09/ Dec 09	SF 24
Year 13 2010	Trapper's, Multi Family Area #3, Phase 1	above hairpin turn to upper plateau	Apr 10/Dec 10	TH 44
	Trapper's, Single Family Area #3, Phase 2	on upper plateau	Apr 10/Dec 10	SF 28
Year 14 2011	Trapper's, Multi Family Area #3, Phase 2	above hairpin turn to upper plateau	Apr 11/Dec 11	TH 60
Potential Future Development	Greywolf, Multi Family Area #8	Parcel B		TH 61
	Greywolf, Single Family Area #8	on Loop Road adjacent to 13th hole		SF 6



**PANORAMA MOUNTAIN VILLAGE
PHASING PLAN** **FIGURE I-3**

CDP - VOLUME I

6.3 COLUMBIA VALLEY RESORT ASSOCIATION

In order to promote the health and viability of tourism within the Columbia Valley, Intrawest has initiated the formation of a Resort Association for the Columbia Valley similar to the very successful Whistler Resort Association. The Association has two main functions: 1) marketing of resorts, and; 2) operation of resort information services; with the overall objective being to expose the tremendous recreational resources and facilities within the Columbia Valley, of which Panorama Mountain Village is a major component. The marketing mandate for the association involves the development of coordinated strategies in the areas of sales, advertising, media relations, and promotion of the entire Columbia Valley resort area. This responsibility includes the operations of resort information services and central reservation booking services. As well, the association may be responsible for the operation and sales associated with general conference facilities found within the Columbia Valley.

MARKETING

The marketing function of the Columbia Valley Resort Association encompasses six main categories of responsibility:

Resort Sales - responsible for raising the awareness of, and selling the Columbia Valley through direct sales at consumer and trade shows, sales calls to the travel trade and travel trade familiarization tours of the Columbia Valley;

Media Relations - actively seeks media editorial exposure from target markets in order to increase consumer and travel trade awareness of the Columbia Valley, and responsible for handling media requests for information, interviews and visitation;

Advertising and Promotion - is responsible for the planning, creation an placement/or distribution of advertising, collateral and promotions; to increase consumer and travel trade awareness and sales of the Columbia Valley;

Research - collection, production and dissemination of market-based intelligence to aid strategic decision-making in the placement and evaluation of marketing programmes;

Festivals and Events - the planning and production of festivals and special events that add ambience and value to the resort experience in the Columbia Valley, acts as a liaison for incoming independent events;

Central Reservations - selling hotel rooms and packages to callers telephoning the main reservations number with the mission to make it easy for guests to come to the Columbia Valley.

OPERATIONS

The Columbia Valley Resort Association is also responsible for operating conference facilities associated with meeting room and conference centres in the resorts. These facilities are necessary to provide the amenities to guests and increase the appeal of the Columbia Valley as a year-round holiday destination. Excess revenues from these operations are utilized to further marketing objectives of the Columbia Valley Resort Association.

6.4 MOUNTAIN RESORT IMPROVEMENT DISTRICT

The formation of a Mountain Resort Improvement District (M.R.I.D.) will improve the organizational structure for operating and maintaining the resort's servicing infrastructure. An M.R.I.D. is effectively a private utility company set up by the resort developer for the purpose of taking over construction, ownership and operation of community services and utilities. The Mountain Resort Improvement District replaces and expands the services currently provided through the Village Amenities agreement by designating a specialized entity experienced in the operation and maintenance of services and utilities. Responsibilities of the

M.R.I.D. include: operation, maintenance and expansion of the sewage treatment and disposal system; supply, operation and maintenance of the domestic water system; supply of power, cable and electrical system and maintenance; solid waste removal; strata road maintenance; operation and staffing of fire hall and fire fighting, and; snow removal.

The process of establishing an M.R.I.D. entails a somewhat complicated and cumbersome Provincial process, but once approved, makes the job of running the public works component of the resort much more efficient and streamlined. It also provides a mechanism for adding responsibilities to the M.R.I.D. body which might otherwise be difficult to consolidate.

6.5 DESIGN STANDARDS

The standards for design and construction of various residential uses, landscape components and feature elements are controlled through a uniform set of standards contained in Volume III of the Comprehensive Development Plan - Design Standards Manual. Included within this manual are design guidelines for various resort neighbourhoods, design details and specifications prescribing the type of exterior landscape and feature elements to be installed in conjunction with various resort improvements, and a list of native plant species to be used in landscape treatments throughout Panorama Mountain Village.

The Design Standards Manual contains a comprehensive set of design guidelines which will enforce the standards expected for residential and commercial building design in various neighbourhoods throughout Panorama Mountain Village. The design guidelines address: exterior building materials; roofing materials; exterior colours; signage associated with commercial buildings; building massing and facade articulation; fenestration; exterior lighting; fencing and enclosures; vehicle storage, and; landscaping requirements. Design details and specifications are provided for common areas and community facilities throughout the resort. These specify: light fixture types; signage design and standards; paving systems; trail standards; retaining systems; stair systems; types of landscape furnishings; and soft landscape plant material specifications.

The intent of the Design Standards Manual is to establish a uniform set of design standards which can be consistently applied through every phase of development. The standards have been developed in consideration of their lasting design qualities which will endure the life of the resort.

6.6 LAND USE DESIGNATIONS

The land uses depicted in the Panorama Mountain Village Master Plan generally conform to the historical and recently adopted zoning designations for the Plan Area. Resort core uses within Panorama Village fall under three main zoning designations: 1) RES-4 covers Ski Tip Village area 2) RES-3 applies to the Toby Creek Area, and 3) RES-2 covers the Toby Creek recreation complex on the north side of Toby Creek. The single family subdivision in Toby Creek has a R-1 single family zoning.

Outside of the Panorama Village area, existing zoning includes: the RES-2G zone which covers the entire Greywolf development area; the RES-3 zone which applies to the Heli-ski lands; RES-2 which covers the entire mountain recreation area, and ; A-1 & A-2 zones which are Rural Resource zones.

Future zoning amendments will be required to permit development of: the RV Resort near Springs Creek; the Employee Housing adjacent the Light Industrial site; the Trapper's Crossing townhouse project; Trapper's Ridge neighbourhood; minor areas within Ski Tip Village, and; the Toby Creek day-skier parking lots. Figure 6-3 illustrates these areas based on a composite of existing zoning and proposed land uses.

VISION STATEMENT

NOTE TO READER

Please remember that some of the concepts described in the Panorama Vision Statement are, at this stage in Panorama's development, simply ideas – possibilities that will be explored as the planning for the resort continues to evolve.

PANORAMA
RESORT

Panorama, British Columbia

INTRAWEST CORPORATION: THE ENVISIONING PROCESS

Envisioning is defined as "the articulation of a shared vision". For the past decade, envisioning has been a process used very effectively by Intrawest Corporation in the planning, design, operation and marketing of its mountain resorts.

Presentation materials used at envisioning sessions include architectural renderings and models, sketches, preliminary plans, bubble diagrams, photographs, current market data and historical information.

Envisioning looks five to ten years into the future to imagine how a project will look, will feel and will behave for all who come in contact with that project in years to come. Part art and part science, the preparation of a Vision Statement is equivalent to the writing of a financial plan - except the currency of envisioning is ideas instead of dollars.

Like a financial plan, Intrawest believes that the preparation of a Vision Statement is crucial to the eventual success of a project, whether that project is an entire resort or a single shop, restaurant or residence within that resort.

Envisioning establishes a vocabulary for a project - a common language for the many diverse teams and disciplines that must work together to bring a project to realization. The vision is the touchstone, the target, the "idea blueprint" for all who participate in the ongoing planning, design, marketing and operation of the project.

The Vision Statement becomes a briefing document for all future participants, as well as a background reference for the media. It is a compass that everyone can refer to as work proceeds and as the resort grows.

THE ENVISIONING PROCESS FOLLOWS THESE STEPS

Ⓐ In the early stage of the project, there is ongoing, informal discussion among the team members. The many possibilities, opportunities and "what ifs" are proposed, considered and explored informally. Depending on the size and complexity of the project, this incubation period will continue for a few weeks or many months.

Ⓑ The next step is to collect and distill these thoughts and ideas. At Intrawest, this happens at an envisioning workshop - a *charette* of one to two days in duration - where all the members of the project team meet to compare notes on the project. At Panorama, that *charette* took place in the Summer of 1996.

Ⓒ The first draft of a Vision Statement is written, drawing on all of the information that has been gathered during steps a) and b). This Vision Statement could be as few as 2 to 3 pages in length or as many as 20 to 25, again depending on the size and complexity of the project. The first draft of the Vision Statement is then circulated among the team members for their comments and additional input.

Ⓓ The final draft of the Vision Statement is prepared and distributed. What kind of information does a Vision Statement typically contain?

- a brief history of the resort and its environs
- the architectural character of the resort
- the ambiance of the resort
- features that will "animate" the resort - that will give it life
- a possible range of amenities and attractions within the resort
- distinguishing features or 'differentiators' of the resort that will set it apart from its competitors
- thematic lines and wording that encapsulate all of the above and which can be used in the ongoing marketing and promotion of the resort

Ⓔ Depending on the scale of the project, the Vision Statement might also take the form of a multi-image or video presentation, 10 to 12 minutes in duration. Through the years, we have found this style of presentation to be a highly effective way of communicating Intrawest's vision of a project. Music, narrative and evocative images are combined in a way to tell a story that appeals as much to the "heart" as it does to the mind of the viewer. Emotion, as everyone knows, is a powerful presentation tool - emotion ensures that the first impression of a project will be a lasting impression.

Ⓕ If it is a long-term project - for example the development of an entire resort - the Vision Statement will be updated once every 12 to 24 months so that the team members are always drawing on the most current "intelligence".

Eldon Beck, an internationally acclaimed resort planner, is a key contributor to the envisioning process.

WHY A VISION STATEMENT AT ALL?

Because there are so many variables in the planning, design and operation of a resort, a Vision Statement is used to gain consensus among the members of the team to ensure that conceptually the countless pieces of this giant organizational puzzle actually fit with one another. Literally millions of decisions by thousands of people over tens of years will be made within the context of this vision.

A Vision Statement is a permanent record of the belief system of the team members and is an easy-to-refer-to statement of the objectives for the project and the agreed-upon standards for its planning, design and operation.

WELCOME TO PANORAMA RESORT: PURE MOUNTAIN ADVENTURE

Panorama today is the best kept secret among North America's mountain resorts. Intrawest has already expanded the mountain's vertical to more than 4,000 feet, one of the greatest descents in North America, and has added 600 acres of new, mostly expert and gladed terrain, high alpine bowls and steep off-piste chutes. Over the next five to ten years, Intrawest will add more high-speed detachable lifts, more than 2,000 acres of new terrain, an 18-hole championship mountain golf course and three distinct resort neighbourhoods at the base including a rustic mountain village, comprising a total of 900 residential units and 35,000 square feet of commercial space.

With all this, Panorama Resort will achieve its goal of becoming a relatively small but flawless jewel hidden in the mountains. Panorama will become *"a mountain resort with soul"* – where winter, spring, summer and fall, adventurers can escape the clutches of the so-called civilized world that exists on the other side of the mountains.

Panorama will achieve this perfection by accentuating the differences between itself and other resorts in its Rocky Mountain market, and by recognizing, rewarding and building upon the passion for pure mountain adventure that is the foundation for its appeal today.

Panorama is the end of the road. Panorama is for those whose desire for unspoiled mountain adventure is strong enough to inspire them to drive three hours from Calgary or an hour-and-a-half beyond Banff to find it. Panorama is to Calgarians what Muskoka is to Torontonians and the Laurentians are to Montrealers – their own secret hiding place where, if they wish, the world can spin a little more slowly. But Panorama is also for those whose bodies refuse to listen to their minds – those who feel compelled to test their physical and psychological limits. Because here, the mountains range from friendly to formidable and the rivers run from tame to tumultuous.

Panorama is mine. In developing ski-in, ski-out real estate at the base of the mountain, Intrawest unlocks a tremendous differentiator with the nearby National Parks of Alberta and British Columbia, where ownership is impossible and emotional attachment to the grand, copper-roofed chateaus is fleeting. At Panorama, the staff feels it "owns" visitors with the same zeal that visitors feel they own THIS resort. And, aided by Intrawest's computerized data base and privilege programs, Panorama is small enough to ensure highly personalized, customized service for every one of its guests.

Panorama's hospitality is measured by the thousand little and sometimes unobserved things the staff does to provide each and every guest with a memorable experience of the mountain.

Panorama is snow play in the extreme. Where visitors to other resorts might spend three days out of five on the mountain, Panorama adventurers average almost five days. Clearly these are people who take their outdoor adventure seriously and who aim to find their long journey's reward on the mountain. Panorama's expanded terrain, encompassing high-speed lifts, half-pipes, jumps, glades, bowls, chutes and snowparks, ensures that all levels and all ages of 'sliders' can ski, snowboard, cross country, snowshoe, snowblade, toboggan and 'tube' to their heart's content, and beyond it, if they want. Great terrain variety, moonlight ski programs, access to the world's finest heli-skiing, and guided overnight mountain adventures ensure that as long as the body is willing, the mountain is always there.

Panorama is adventure beyond skiing. As high-speed chairs increase the maximum runs-per-day and as Intrawest's real-estate and resort amenities, like the golf course, expand the year-round use of the resort, even the most passionate skier or snowboarder is likely to "hit the wall". When that happens, Panorama is there with a variety of activities themed to the mountain and in keeping with the outdoor, active "rugged recreation" that brings people to this resort.

A series of small, rustic "guide cabins" strategically located atop and around the mountain offer simple, heartwarming fare and great camaraderie for well-earned breaks. With names like *"Wild Horse"*, *"Rosie's Ridge"*, *"Kinbasket"*, *"Ktunaxa"*, *"Radium"* and *"Bighorn Break"*, these cabins also serve as gathering and orientation areas for hikers during the summer months. A few cabins offer reserved overnight camping and, in winter, "first light" skiing from the top.

Timber logs, quarried stone and river rock will distinguish the architecture of the lodges and resort hotels at Panorama.

Extremity, a small, 24-person mountaintop lodge deep in the outback, is accessible only by helicopter and is world-renowned among winter AND summer adventurers for high cuisine and magnificent solitude. *Extremity* is truly the Everest of mountain lodges.

When even the most energetic skiers and snowboarders begin to run out of knees at Panorama, there are activities such as "flightseeing", "heli-hiking", tobogganing and tubing. Themed retail featuring distinctive Panorama signature gear and apparel, a Mountain Institute known as *"Talking Stick Lodge"*, and restaurants and pubs offering a new level of food-and-beverage service also beckon from the base.

Panorama is Adventure in the Company of Adventurers. Pure mountain adventure, at its best, is guided adventure. Even David Thompson, the surveyor-explorer who conquered these impregnable mountains in 1807 and then traveled the Columbia River from its source to its mouth, benefited from a guide. The tradition of "guiding" flourishes to this day at Panorama.

Guides will take you to the streams, rivers and lakes where the 'big ones' are biting.

Whether it's a highly trained back-country skiing guide, an inspired golf pro, a mountain naturalist leading a family-oriented University of Alberta summer program, or the "old guy" who knows just where and what the trout are taking today,

Panorama shares its secrets through the efforts of expert guides and a program of guided adventures that ensure the highest memory-to-mountain ratio. And after the sun goes down, modern-day explorers and landlopers can swap tales around the mammoth river rock fireplace in Panorama's rustic, 75-seat *"Guides' Club"*.

Go Deep. Range Far and Wide. Panorama is a year-round Base Camp. The essence of Panorama is pure mountain adventure. That adventure begins at the end of the road, but it isn't restricted to Panorama Mountain itself. The journey to Panorama means access to the inaccessible. The spirit of adventure that brings people here will inspire them to keep exploring. Their proximity to Panorama makes the resort the perfect home-base and departure point for day-long mountain explorations of the Purcells and Bugaboos, of Radium and Fairmont Hot Springs, of the Columbia Wetlands and Toby Creek Rapids. Helicopter, road and offroad access from Panorama to these previously inaccessible destinations are important year-round drivers of the resort's success.

Panorama is Pure. Think of Panorama as an anti-Disneyland. Everything here is authentic, natural and handmade. The planning, design and operation of the resort is guided by a respect for the pristine environment and for the cultural heritage of the area. Panorama takes leadership roles in energy use, waste management, landscaping, and wilderness and wildlife preservation and appreciation.

Panorama is the Power and the Glory. Panorama is located in the Purcells, a mountain range even more ancient than the Rockies. The Purcells and the Rockies are separated by The Trench, the largest dividing line between two mountain ranges in the world. The valley is the source of the mighty Columbia, the legendary River of the West. Over 10,000 years ago, just after the Great Ice Age, the Kootenays or Ktunaxa (pronounced Too-nah-hah) would travel the great Trench hunting big game and catching the huge salmon whose sheer numbers once darkened the headwaters of the Columbia. These people were distinct in language and culture from their Plains cousins. Their heritage is rich in stories of travels over fierce mountain passes in search of vast herds of buffalo, elk and deer. Descendants of the Ktunaxa still live in the Valley today.

The long, natural corridor leading from Banff to Panorama is a place of untouchable peaks, deep green labyrinths of the old growth forests of Kootenay National Park, and the fiery chasm of Sinclair Canyon that frames the unsurpassed beauty of the Columbia Valley. The nearby Wetlands are soaked in sunlight and basked in warmth.

Although the scenery along the way is also magnificent, the sight of Panorama, situated in a valley boxed by towering mountains, will still take your breath away.

Panorama is true Canada West. By Nature and by design, Panorama circa 2007 is the quintessential Canadian mountain resort – with its rustic architecture, splendid isolation, picturesque valley, roaring river, proximity to wilderness and abundance of wildlife, sun and snow, intimate scale and grand vistas.

Winter and summer, the architecture at Panorama Resort will blend into the majestic surroundings

Furthermore, Panorama is adjacent to not just one, but two of Canada's great mountain ranges – the majestic Canadian Rockies and the equally beautiful but even more ancient Purcells. If a feature film company was scouting the perfect location for a mountain adventure set at the beginning of Canada's 19th century, their search would lead them to Panorama.

Over the next decade, the planning, design, operation and marketing of Panorama Resort must focus on and magnify these attributes. For destination-travelers and Albertans alike, Panorama is true Canada West which may explain why, even today, people VISIT Banff and Lake Louise but SETTLE IN at Panorama.

THE NATURAL EVOLUTION OF ADVENTURE

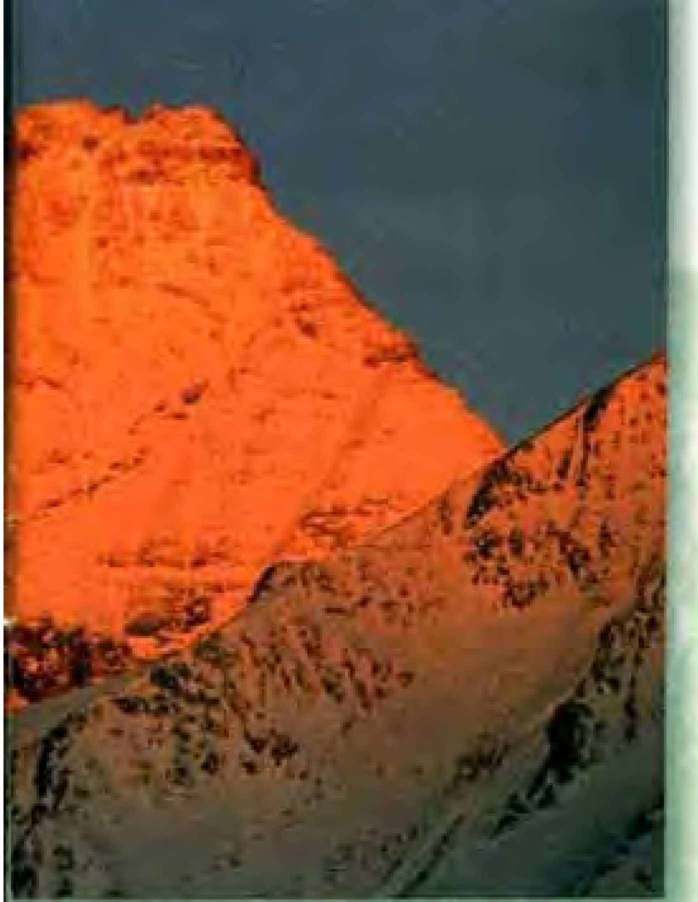
Squared log cabins, much like the Johnston homestead above, were typical of the homes built by the early prospectors and farmers who fell in love with the natural beauty of the land.

The modernday adventurer follows in the footsteps of a great tradition of adventurers, all of whom came to this region in search of the treasures to be found here. The Ktunaxa and Kinbasket Shuswap peoples treasured the salmon and elk and fertile wetlands. The fur traders treasured the lynx and fox, and mapped trade routes to the Pacific. Miners sought gold and silver, and some found their treasures in Wild Horse, Findlay and Toby Creeks.

For today's adventurers, the treasure is what they find in themselves when they encounter these mountains. They explore this valley and the mountaintops – hunting only experience, and taking with them only memories. The treasure is equally available in glade or on the glacier, on manicured greens or white water, on Christmas Day or Canada Day. Panorama is the natural evolution of mountain adventure. In its location, architecture, materials and activities, Panorama is the spirit, the very embodiment of rugged Canada West.

The buildings of Panorama circa 2007 are made of indigenous materials: smooth river-rock from Toby Creek, rough granite from the mountain, and peeled logs and hand-hewn timbers from the forests at hand. Buildings take their shapes, forms and structural details from the small Northwest Company trading posts and trappers' cabins of the mid to late nineteenth century, as well as from the beloved circa 1930's cottages of the nearby Lakes Region. 'Rustic', 'intimate' and 'cozy' are words one would use to describe the residences and lodges of Panorama.

Three distinct neighborhoods and the signature *Greywolf Golf Course* appear to grow out of the mountain itself. In shops and galleries, native arts co-exist with the crafts of mountain mining villages. There is weaving, woodcarving, glassblowing and blacksmithing. In the restaurants, much of the food comes from the land itself: salmon, trout, venison, duck, wild mushrooms and blueberries. Romantic icons like a mapmaker's sextant share wall space with an array of broken ski tips, and



a turn-of-the-century, cedar-strip canoe swings from the rafters. The flotsam and jetsam of Panorama's early days create opportunities for "found art" placed throughout the resort – a weathered steam donkey, a rusty mine cart, a portable sawmill with its single-cylinder cast-iron engine and huge double flywheels. History is respected here, but not overly revered. This is a casual place, a sanctuary, a place where everyone has permission to relax and become oneself.

As a resort, Panorama began in the 1960's by a group of dedicated, local skiing enthusiasts who ended their four-year-quest for the perfect ski mountain on a mountain that is blessed not only with fabulous terrain and light, dry snow, but also with abundant sunshine, breathtakingly beautiful vistas and "in your face" scenery.

For years, Panorama lived in the shadow of Banff Resort. Banff was closer to the major primary markets of Calgary and Edmonton. Banff was situated alongside both the Trans-Canada Highway and the transcontinental rail line – in the heart of Canada's most famous National Park. Through the years, Banff has been developed as an international destination for tourists of all stripes.

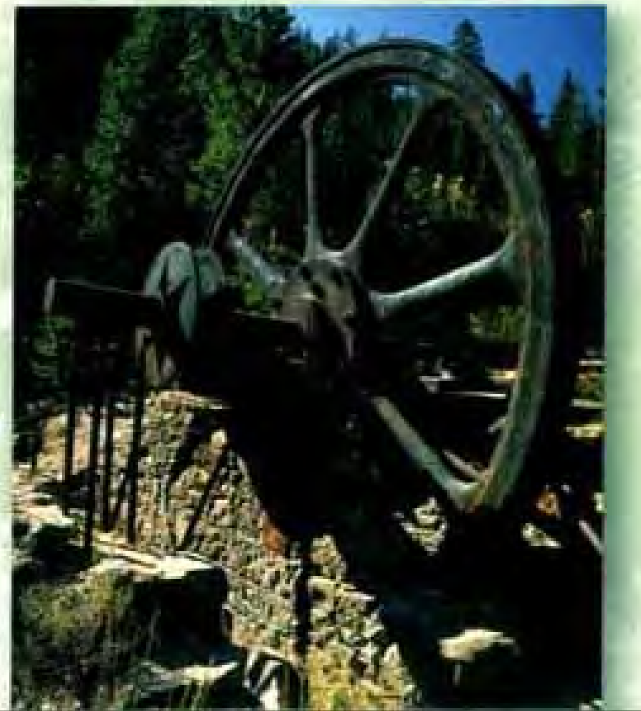
And yet, year after year, dedicated bands of adventurers have chosen to make a longer journey, to the end of the road, in order to enjoy less of what Banff and Jasper offered, and more of what the mountains promised: unspoiled, untainted, pristine encounters with wilderness, wildlife and with one's true self - liberated by spirited activity, clean air, and soul-stirring scenery.

NOT JUST IN THE MOUNTAINS, BUT OF THE MOUNTAINS

The vision for Panorama is a vision for uniting real-estate, recreation and respect for the environment in one remarkable natural attraction - a natural attraction that draws adventurers right through the Rockies, out of the park resorts, away from the glitz, and into the purity of mountain adventure.

Panorama will inspire and allow visitors to "take ownership" of the mountains in ways that are both deeper and broader than are possible in the other resorts within its market.

Miners journeyed to 'the end of the road' to set up camp and stake their claims.



Panorama's development is guided by a respect for and preservation of the natural ecosystem and the heritage of the region. Those who choose to make their way to Panorama will appreciate the sensitivity with which Intrawest plans, builds and operates its resort. By using indigenous materials, preserving wildlife habitats, matching human and natural scales, building within the landscape rather than landscaping, the resort as it grows will feel older and more natural, rather than newer and larger. Everyone at Panorama has a stake in the mountain's purity. It is our common ground.

Wherever possible, building materials will be indigenous to these mountains.

Panorama uniquely allows ownership of ski-in, ski-out accommodation. Ownership of ski-in, ski-out accommodation is impossible within the National Parks system and, therefore, ownership becomes one of Panorama's strongest, unique selling propositions among the Albertans who constitute the resort's major market. Panorama, as we envision it circa 2007, will be described as being "...what skiing at Banff could have been."

Only in Panorama can one make the kind of personal investment of time, resources and commitment that can truly bind individuals, families and friends to a resort. Visitors to Banff can't help but be treated more as transients than owners. All visitors to Panorama, by virtue of the efforts they go through to come here and in consideration of their emotional investment in the mountain, are entitled to be welcomed as family. Here, Intrawest welcomes purchasers as partners in the adventure of living in the mountains. Owners will tend to stay here longer and more fervently than at other resorts, and they will value their ownership more. Intrawest responds with a Panorama Privilege Program that stays in touch year round, in print and via email mailing lists, with interesting recreational news, stories of wilderness and wildlife, questions regarding development issues, invitations to attend focus groups, value-added accommodation offers for families bringing friends, and so much more.

Panorama is intimacy: service above and beyond. Panorama circa 2007 could be described as the "Cheers" of Mountain Resorts, simply because Panorama is a neighborhood *"where everybody knows your name."* Starting with 150,000 annual ski visits, Intrawest's goal is to grow to a maximum of just 250,000 visits. The lift lineups will always remain short – the steeps, deeps and glades uncrowded. Coupled with the fact that Panorama is primarily a destination resort, the opportunity exists here to build relationships, friendships and kinships that can last a lifetime and be passed from one generation to the next. Panorama has a resort staff with a wonderful memory for its regulars and an ability to provide lasting memories for all.

Panorama is an adventure playground. The development of more accommodation, and in particular of two and three bedroom unit condo-hotels, townhomes and single family mountain residences, will enable Panorama to truly come into its own as a place for year-round family adventure. From Canada's #1 ranked ski and snowboard school to the *Adventure Club*, kids will find adventure just for them, while ample mountainbiking, hiking, horseback riding, golf, tennis, flyfishing and the resort's Guiding Program provide plenty for the family to do together. A large water feature, sculpted out of the valley floor and reminiscent of a spring-fed mountain pool, becomes a popular, old-fashioned 'swimming hole'.

Intrawest will ensure that the new Panorama represents a NEW generation of four-seasons multisport resorts for the 21st century – and yet remains a place where visitors can lose all sense of civilization and all sense of time.

The ski and snowboard schools are among the finest in North America

Panorama is a learning centre where it's recess all day long. From its world-class ski and snowboard school to a mountain institute known as *Talking Stick*, Panorama will become a place where by discovering more about Nature we can individually and collectively learn more about ourselves. In The Discovery Centre at the main entrance to the resort, visitors can experience the Purcells, Kootenay National Park, the Great Trench and the Columbia Valley in a 50-seat, multi-sensory theatre that gives new meaning to the words 'breathtaking' and 'panorama'. In The Discovery Center, visitors can also explore real-estate opportunities, register in Wilderness School, confirm plans for heli-hiking, reserve a seat on the bow of a whitewater raft, or book tomorrow's tee-time at Greywolf. Every moment of every day, Panorama provides residents and visitors with the option of just laying back – or charging to the top. At Panorama, the adventure compass points in all directions.

In the Discovery Centre, audiences in the 50-seat theater will have an opportunity to experience the nature of the Canadian Rockies.

Conference, workshop and seminar facilities at Panorama, although relatively small in size, are as good as they get – complete with fiber-optic, satellite uplink and two-way teleconferencing connections to the outside world. The need for corporations, special-interest groups, thinktanks and envisioning groups to retreat from the cities and to be recharged by close encounters of Nature's kind, will always be extremely well served by Tamarack Lodge, the Greywolf Club House, and other meeting areas throughout the resort. On the mountaintop, there are sheltered places dedicated to both quiet reflection and inspired encounters.

Panorama 2007 is about tents and trails. Guides and grub. Winter's cold and summer's warmth. The sun and the stars. White-tail deer strolling across the golf course and the 'ohmygod' excitement and beauty of the mountains.

In life, real learning, like real adventure, begins at the end of the road.

SKI TIP VILLAGE. YOU'LL BE WANTING TO PARK THAT 4X4.

It's a big deal, relatively, to get here – so we make a big deal of people as they arrive. Log distance markers are located a kilometre apart as Toby Creek Road rises out of Invermere-on-the-Lake and climbs towards Panorama. As we enter the perimeter of the resort, we pass beneath an arched gateway constructed of river rock and timber. The sign overhead reads *"PANORAMA RESORT. Welcome To The End Of The Road."*

Just beyond the bridge that crosses Toby Creek, we come upon The Discovery Centre – a facility that allows visitors to register and, at the same time, provides them with all of the information they need to know about Panorama. The information includes the location of various lodges and advance news of resort real estate. Interactive StoryStations allow visitors to preview the adventures, entertainment and learning opportunities accessible to them during their stay. And, with the touch of a button, they will be able to make all of the necessary reservations.

Once inside the resort, the roads wind and narrow. Visitors are immediately embraced by the warmth of the village which, day and night, is the center of the resort's considerable energy. New development is imaginatively integrated with established buildings to create an area known in its totality as Ski Tip Village. Located in this mix of old and new structures is *The Guides' Club, Ski Tip Lodge*, which holds skier services, a 300 seat dining facility, and *Purcell Trading Post. Tamarack Lodge*, another building in Ski Tip Village, holds *Panorama Outfitters & Cappucino Bar. Adventure Club*, the resort's day care facility, is also located at Ski Tip Village.

The design of Tamarack Lodge at Panorama was strongly influenced by the historic lodge of the same name.

Visitors will satisfy their shopping desires at the many rustic retail shops located in the village.

At street-level, visitors to the village become aware that they have entered the quintessential Canada West resort – of no one time, of no one style and yet, all of a piece. Shops are intimately sized but big on quality, service and value. The garb and gear they sell are the genuine article – the "right stuff" – the kind that appeals to the purists, pioneers and adventurers who are naturally attracted to the end of the road. Merchants' signs, hand-carved from slabs of lodgepole pine and yellow cedar, beckon to passersby. Shop, gallery and restaurant facades are log and stone. Wayfinding signage, in the village and throughout the resort, is also deeply chiselled into wood. Brightly-colored flags and banners, hand-painted with portraits of wolves, deer, bear, marmots, eagles, lynx, bighorn sheep and other inhabitants of the nearby wilderness, flutter in the breeze and remind us that, at Panorama we are not only CLOSE to Nature, we as a species are inescapably ONE with Nature.

Chain-saw art, from the scarlet-coated, 20-foot high Mountie that welcomes visitors at the entrance to Panorama to the white lynx that watches over the village plaza, is also part of the "fabric" of the resort.

Winter and summer, indoors and out, guests of the resort 'take coffee', enjoy a BBQ smokey on a toasted square-cut bun (a local favourite) or just soak up the warmth of the sun – a sun which makes very frequent day-long appearances in the clear, blue skies above the resort. Windows, decks, verandas and porches are oriented to the sun and to year-long activities on the mountainside. There is a large outdoor firepit and an events plaza at the centre of the village. In a small outdoor carving shed and workshop, a "Speaker's mask" is taking shape at the same time as a 12-string guitar is being fashioned from straight-grain, air-dried Rocky Mountain white spruce considered to be Nature's most perfect material for making musical instruments.

The quaint, human-size village is designed as a place to see and be seen. A place perfect, pristine and pure. In Panorama it's never 'Monday', 'Tuesday' or 'Saturday'. It's simply 'today' – and nothing else matters.

Ski Tip Village, like each of the neighbourhoods in Panorama, provides convenient places to park your car – leaving it behind for the rest of your stay. There's also a hint, in the "wildness" of the peeled log lamp posts with their corrugated and enamelled tin shades, that it might be just as well that by the nature of the adventures from here on, it's time to leave even the 4X4 behind.

In the heart of Ski Tip Village, lie The Residences at Ski Tip and Tamarack Lodge, the first signature buildings in Panorama's signature location. Combining superior locale, beautiful quality features and an architectural style known as "sumptuous rustic," these studio, one and two bedroom homes will provide their owners with memorable mountain moments and the opportunity for excellent investment returns. For Panorama's newest founding families, the ambiance of village living, the attraction of ski-in-ski-out convenience and the in-your-face views of Panorama's towering peaks create an even stronger appeal to make purchasing in Ski Tip Village both a magical and logical decision.

At Panorama, new meets old. Ski Tip Village blends beautifully with the shops and accommodation of newly refurbished "originals" like Horsethief Lodge and Toby Creek Lodge.

GREYWOLF

Greywolf is the name of the region's only mountain golf course. Taking its character from the mountain, the course challenges with every rock and roll, and it also rewards the eye at every lie. The views are stunning, the play on the course is like no other. This is ski-in-ski-out, golf-in-golf-out resort living at its best.

And the homes at Greywolf, 125 single family homes and 200 townhomes, appeal to the year-round adventurer. Every home is blessed with at least one breathtaking view, and every season has its reason for being here. The homes at Greywolf appeal strongly to families. There's a sense of peace and tranquility, of being away from it all, yet so close to the company and activity in the village. *Paradise Trail*, named after the old mine located in the high alpine above and across from Panorama, is perfect for running, rollerblading and biking – both away from it all, and into the heart of things. Greywolf's clubhouse doubles as a base lodge for the Sunbird Chair and as a conferencing area for 25 to 150-person workshops and seminars. Greywolf gives you the space and it's up to you what you do with it.

TRAPPER'S RIDGE

If Ski Tip is social, and Greywolf is pastoral, then the homes at Trapper's Ridge are perfect for those whose passions burn the hottest in the snow. Arguably the best ski-in, ski-out real estate in North America, the Residences at Trapper's Ridge are right on the mountain, yet just a good yell from the heart of the village. 125 townhomes and 250 single family lots, these residences are almost hidden in the trees, yet they catch the sun and deliver magnificent views through the trees and over the village. Paradise Trail links Trapper's Ridge to Ski Tip and to Greywolf at the other end of the valley. At Trapper's Ridge, as throughout the village, the lights twinkle at night, incandescent not neon, and highlight the darkness, rather than try to banish it.

Initially at Blackcomb and Tremblant and more recently at destination resorts across North America, Intrawest has demonstrated an ability to provide residents and visitors alike with the finest in golf-in, golf-out resort life.

A number of the single-family lots at Trapper's Ridge have been allocated to charming, mountainside Bed & Breakfasts with names like *"Prospector Inn"*, *"Northwest Co."* and *"Little Wildcat Lodge"*. Most of these B & B's are owned and operated by recently retired professionals from Calgary and Edmonton seeking a more idyllic existence for themselves personally, as well as the opportunity to host the interesting kinds of people who are drawn to the resort.

PANORAMA. WILD BY NATURE.

The proposed icon of Panorama is the lynx – a compelling symbol of pure Canadian wilderness, of adventure and of adrenalin sports. Part of the East Kootenay ecosystem, the lynx is one of Nature's most perfectly designed predators and the ultimate 'powder hound'. Huge snowshoe-like paws allow it to pad effortlessly across deep snow that would stop all other animals its size. As a result, like skiers and snowboarders, the lynx easily occupies winter alpine regions.

NORTH ELEVATION

The resort plans to use a white lynx as the symbol of Panorama - an icon that captures the pure mystery and majesty that we find only in the mountains. The Canadian Lynx is the largest species of this family of North American wildcats. Ideal as a symbol for themed wilderness merchandise, the lynx can also be fashioned into a playful, 3-dimensional character.

Panorama's new identity must include the descriptor 'A Mountain Wilderness Resort'. As well, it must give meaning to the name Panorama and be symbolic of the valley and mountaintop vistas that embrace the resort.

It has been said by many a marketing expert that the worldwide appeal of Canada for destination visitors can be summarized in just three words – moose, mountains and Mounties. If the Banff to Panorama Corridor that includes Kootenay National Park, the Rocky Mountain Trench and the Columbia Valley Wetlands is marketed as a single entity, then in the hearts and the minds of visitors to this country, Panorama, the magical place at the end of the road, truly has it all.

PANORAMA. FOR THOSE WHO DON'T GO AROUND STUFF. THEY GO THROUGH IT.

Much of what makes Panorama special has to do with what it is not. It IS NOT spoiled, not crowded, not a park, not touristy. It IS beautiful. With its location in a box canyon at the end of the road, it IS the definitive mountain retreat. With plenty of sun and tons of snow, it IS the ideal multi-season, multi-sport resort with a matrix of year-round activities, amenities, events and programs to ensure that Panorama will always appeal to EVERY generation of skier, snowboarder, slider, adventurer, explorer and discoverer. It IS held in high esteem by a loyal following including families from Alberta and ski and snowboard aficionados from far away provinces such as Ontario. Because Panorama provides access to the inaccessible, it IS a destination for in-the-know visitors from Europe, Asia and the U.S. who come to Banff for sightseeing and then move on to Panorama for adventure.

Panorama IS, in the writers' collective opinion, the only true Canada West mountain resort.

Over the next decade, Intrawest will give Panorama the opportunity to grow into its identity as one of the last, best places on earth to find a pure, pristine mountain experience. This best-kept secret will become an exquisite, jewel-like resort by fulfilling its year-round potential with golf and other amenities, by growing its resident bed base, and by developing a mountain personality in its village core. At the juncture of not one but two of North America's most spectacular mountain ranges, Panorama offers a panoramic experience of epic proportions. The adventure has a beginning, a middle, but no end. Panorama is the natural evolution of a natural resource. Those who help it attain the next height and those who choose to visit here or to take up residence here will take the view a little further.

- PAUL, PAUL AND SHELAGH, 1997 -

PANORAMA
Mountain Village

COMPREHENSIVE DEVELOPMENT PLAN

VOLUME 2
TECHNICAL BACKGROUND REPORT

INTRAWEST

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1.0 FORWARD

Panorama Mountain Village has been evolving since the early 1960's when a ski club was formed in the Toby Creek Valley by the residents of Invermere. Over the years Panorama slowly expanded until 1968 when the club was sold to a group known as the Panorama Ski Hill Company Ltd. The Panorama Ski Hill Company Ltd. built the base lodge, cleared new runs and installed a lift to service up to 400 metres elevation. Following this on-mountain construction an influx of capital was required and to achieve this goal the single family residential at the base of the ski hill was developed. In 1978 Panorama was sold again, this time to the Cascade Group of Calgary. Under the Cascade Group new lifts were installed, runs were cut, townhouses and a hotel were built and the east village infrastructure system was completed. In 1993 Intrawest Corporation acquired Panorama Resort. Since Intrawest's acquisition of the resort Panorama has seen a building boom unlike anything in the resort's history. The Greywolf Golf Course has been constructed, Ski Tip Village has been completely redesigned and substantial new residential and accommodation development is planned for the village area, Greywolf, Toby Creek and an area above Ski Tip Village to be known as Trapper's Ridge. With this development will be substantial expansion of the ski hill and improvements to lifts and snow making capabilities.

All of this planning over the years has resulted in the creation of numerous technical reports by a number of different consultants from various disciplines. This Technical Background Report presents a number of these reports which have been completed since the inception of Panorama. The reports included here are generally all wide-ranging in scope and contain valuable information relevant to all future development at Panorama. Reports which have been completed over the life of Panorama which are specific to a particular development enclave or which are considered out of date have not been included in this Technical Background Report.

The reports which are contained in this document have been divided into five categories:

- Mountain Master Plan
- Development Servicing
- Environmental
- Geotechnical
- Archaeological

Future reports which are prepared for Panorama Mountain Village which are not site specific to a particular development enclave but which are more far reaching and general in scope should be added to this document. A record of revisions and updates is included at the back of the document.

PANORAMA
MOUNTAIN VILLAGE

MOUNTAIN MASTER PLAN

September 1998

INTRAWEST

PANORAMA
Mountain Village

MOUNTAIN MASTER PLAN UPDATE 1998

Prepared For: Panorama Resort
Panorama, B.C.

Prepared By: Ecosign Mountain Resort Planners Ltd.
Whistler, B.C.

August, 1998

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AREA LOCATION

01/1996

ecosign
Mountain Resort Planners Ltd.

I. INTRODUCTION

.1 Location and Regional Context

The city of Invermere is situated in the southeast portion of British Columbia, in the Regional District of East Kootenay. The Panorama Mountain Village, located in the Purcell Mountains, is approximately 17 kilometers west of Invermere in the Toby Creek Valley. Invermere is located on Highway 93/95 in the East Kootenays and is easily accessible from the major metropolitan center of Calgary via the Trans-Canada Highway through Banff National Park, and Highway 93 through Kootenay National Park. By car, the 292 kilometer trip from Calgary to Panorama takes approximately 3½ hours. Cranbrook, a two hour drive to the south, has a regional airport providing air connections to other regional centers as well as the Calgary and Vancouver international airports. The location of Panorama Mountain Village is graphically illustrated on the Area Location Map in Figure 1.

The existing ski area base and village lies between the 1,138 meter (3,734 foot) and 1,185 (3,888 feet) elevation, while the summit of Panorama has an elevation of 2,364 meters (7,756 feet). Panorama's total skiable vertical drop is 1,211 meters (3,973 feet).

.2 Historical Perspective

Interest in skiing in the Panorama area started in 1959 when the Windermere Valley Ski Club was formed by local residents looking for a place to downhill ski in close proximity to Invermere. What was thought to be a suitable site, located approximately eight miles from Invermere on an existing mining road, was later found to have an unreliable snowpack. The Club began looking for a more suitable site, which they discovered further up the valley, at the resort's current location. The original facilities, operated by volunteers, consisted of one rope tow, a warming hut and a parking lot. A platter lift was installed in 1964, providing lift service to 152 vertical meters (500 vertical feet) of skiing.

The Panorama Ski Hill Company was established in 1964 to permanently operate the mountain. In 1969, mountain facilities were upgraded to include the installation of a mile long T-Bar, one of the longest in North America, and a cafeteria. In 1974, single family lots were sold in the residential subdivision at the base of the mountain to finance the purchase of a double chairlift (Horizon Chair). Acquired in 1975, the new lift was placed above the T-Bar increasing Panorama's skiable vertical to 847 meters (2,779 feet).

The Cascade Group of Calgary, a Family Life Insurance Company, spent two years analyzing the potential to develop Panorama as a year-round resort and, in 1978, purchased the ski area. Over the next ten years, this Group would develop the ski area and allow it to evolve into a well established year-round resort. 1980 saw the construction of a second double chairlift (Toby Creek), several new ski trails and 254 condominiums. In 1981, a new triple chairlift (Sunbird) was installed and the development of the base area began. By 1981/82, a new hotel and a new daylodge were constructed, as was the infrastructure for the new "East Village". In 1983, snowmaking was installed, covering 140 acres and 3,200 vertical feet. The conference center was constructed in 1984 in conjunction with a 68 room hotel. In 1985, Panorama hosted the World Cup Men's Downhill and Super Giant Slalom races. The Champagne T-Bar was constructed to service the terrain above the Horizon Double Chair for this event, allowing racers to access the high elevation starting area. In 1988, a detachable quadruple chairlift was installed to replace the original T-bar, servicing 380 vertical meters of skiing directly above the village area.

In 1993, Intrawest Resorts Ltd. Partnership purchased Panorama from the Cascade Group. Intrawest is a major Canadian resort and real estate development company. The 1993/94 winter season saw the opening of the Summit T-Bar to the top of the mountain, which increased Panorama's lift serviced vertical drop to 1,211 meters (3,973 feet). Snowmaking has been upgraded and expanded gradually over the years, reaching 50 percent coverage by 1995. In 1997, the Ski Tip Lodge was completed and ski terrain was expanded with the development of the "View of 1,000 Peaks" trails. Further accommodation development took place in 1998 with the construction of the Tamarak condominiums.

Panorama is already one of Canada's major resorts, with excellent skiing/snowboarding in the winter, as well as exciting summer activities including whitewater rafting, horseback riding, heli-hiking and tennis. Part of Intrawest's strategy is to develop a master plan which will upgrade the lift and trail systems on the mountain to a level that is consistent with current "state of the art" mountain planning and development standards. In conjunction with the mountain development, Intrawest also plans to upgrade and expand the existing Panorama Mountain Village into a high quality year-round resort experience that includes a championship 18 hole golf course and single and multi family accommodation.

.3 Planning Issues

The successful design and operation of a mountain resort requires a solid footing on three separate pillars. The three critical resort elements, as illustrated in Plate I.1, are: physical, market and economic characteristics and factors.

CRITICAL RESORT ELEMENTS

PLATE I.1

The physical site characteristics include:

- environmental resources including water, air, soil, vegetation and wildlife
- terrain
- climate
- natural hazards
- visual resources
- recreational resources

The master planning process incorporates research by scientists, ecologists and recreational planners to document the physical characteristics of each individual site with air photos, topographical maps, three-dimensional computer models, on-site field work and surveying, and analytical planning technologies.

The next critical element necessary for a feasible mountain resort deals with the market characteristics including:

- access to the site
- the size and proximity of local, regional and destination markets
- population demographics such as: age, income and education
- population dynamics such as: growth, aging, and social trends, for example, fitness

Finally, there are economic factors and characteristics to be considered such as:

- resort capacity
- length of operating season (winter and summer)
- infrastructure cost and availability
- capital costs of facilities
- operating efficiency
- revenue sources and pricing
- human resources

Every resort possesses a different blend of these characteristics. It is very important to understand and document the balance between the physical, market and economic characteristics of each individual project.

A Master Development Plan is more than a physical layout of lifts, ski trails, restaurants, parking and village zones. A Master Plan is a flexible, responsive business plan which sets out physical and financial strategies which can respond to a variety of market scenarios including: growth, zero growth or declining growth. This report outlines a Master Planning Program supported by these three critical elements for the Panorama Mountain Village.

.4 Ski Industry Overview

Skiing is a relatively young sport and recreational pursuit, having a primary economic take-off point which occurred in the post World War II period. While the physical plant and participation in the sport grew moderately during the 1950's, the 1960's ushered in an explosive era of ski development in North America, which centered in the Northeast Corridor, the Rocky Mountains and the West. The participation growth was in excess of 15 percent per annum. While the North American average annual growth rate has leveled off during the past 20 years, some regions continue to experience substantial growth rates. Industry analysts have suggested that these growth regions (i.e. Colorado, California, Utah and British Columbia) have sustained their positive growth patterns through continued resort development; thereby substantiating the tenet that in the sport of skiing, supply creates demand. Other identifiable growth stimulators within the sport of skiing include: population growth, technological improvements of ski lifts, equipment, clothing and slope grooming techniques, the parabolic or shaped ski boom, snowboarding, airline deregulation, and cooperative packaging of lifts, equipment, transportation and accommodation.

Canada

In 1997, the Canadian Ski Council (CSC) indicated that between 1983 and 1988 the Canadian ski industry experienced a 7 percent annual growth in the active alpine skier market. In the two years that preceded 1990, there was a 5 percent downturn in this market, again the numbers resembled those of the early 1980's. During the 1990/91 season, the market began to recover with close to 2 million active skiers. By the 1993/94 the market peaked with over 2.2 million skiers.

The Print Measurement Bureau and Ski Canada Magazine have tracked active alpine skiers over the age of 12 years since 1983. Active skiers are defined as those who ski more than six times per year. Their results, as illustrated in Plate 1.2, shows that skiing peaked in 1988 at 2.1 million, and then slowly declined to the pre 1986 levels, until the 1991/92 season, where active skiers once again reached the 2.1 million level. Active Skier visitation levels have remained at the 2.1 million level for the past four seasons. In 1996, the Canadian Ski Council indicated that Ontario dominated the number of active skiers in Canada with 32 percent, followed by Quebec with 27 percent. British Columbia recorded 15 percent of Canada's active skiers, followed by Alberta at 12 percent.

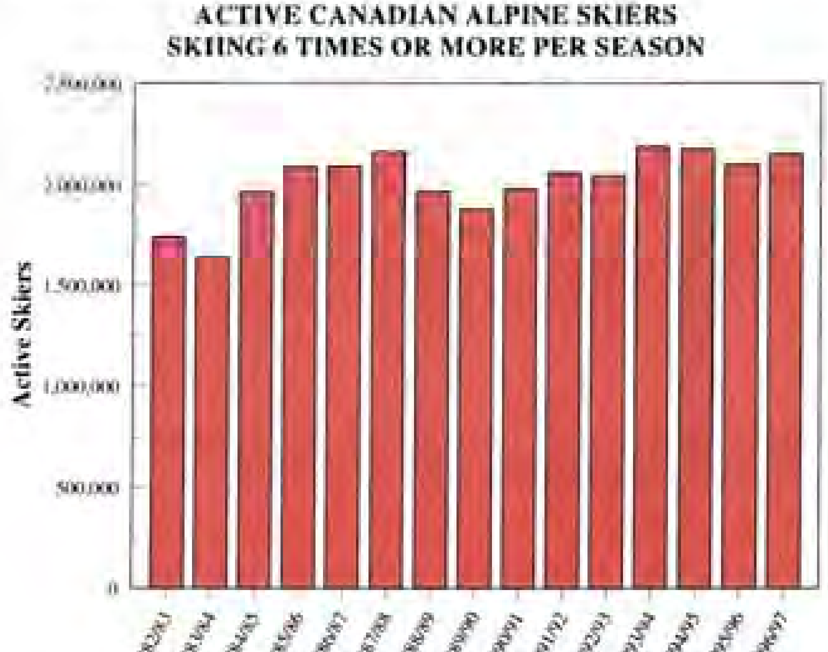


PLATE 1.2

The Print Measurement Bureau (1997) reports that out of the 4,511,000 Canadians over the age of twelve years, who ski and snowboard, 22 percent are snowboarding. The PMB also reports that snowboarders represent 4 percent of the entire population over the age of 12. Fourteen percent of Canadians over the age of 12 report that they alpine ski and 11.5 percent participate in cross-country skiing.

Table I.1 illustrates the Canadian Skier Visitation for the past six years. Quebec leads the provinces with 5.8 million skier visits, an increase from the previous year, followed by the B.C./Yukon region with 4.4 million skier visits. Prior to the 1994/1995 ski season, the Ontario Ski Resorts Association had calculated their skier visit numbers as alpine skier visits both inside and outside the province. During the 1994/1995 season, Ontario changed their method of accumulating numbers and began to record skier visits within the province. Due to this change, their skier visit numbers were recorded at 2.7 million for the 1994/95 season, and 2.8 million for 1995/96, well below Quebec and B.C. skier visit totals. The change in the manner in which Ontario recorded skier visitation explains the significant drop in the total Canadian skier visitation.

TABLE I.1
CANADIAN SKIER VISITATION
1990/91 TO 1996/97

PROVINCE	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
ONTARIO	7,900,000	8,000,000	8,500,000	8,600,000	2,799,000	2,839,000	2,689,000
QUEBEC	7,400,000	7,400,000	7,000,000	6,394,000	6,100,000	5,793,000	5,878,000
B.C./YUKON	3,400,000	3,500,000	3,900,000	4,100,000	4,605,000	4,182,275	4,488,539
ALBERTA	2,000,000	1,800,000	1,600,000	1,700,000	2,033,000	2,164,121	2,158,461
MAN/SASK.	236,000	280,000	160,000	172,000	233,000	240,876	150,000
NEW BRUNSWICK	230,000	212,000	202,000	190,000	180,000	*544,000	147,000
NOVA SCOTIA	219,000	338,000	322,000	241,000	239,000		233,000
NEWFOUNDLAND	140,000	172,000	156,000	159,000	161,000		120,000
P.E.I.	27,000	27,000	20,000	25,000	30,000		15,000
TOTAL	**21,552,000**	**21,729,000**	**21,860,000**	**21,581,000**	**16,380,000**	**15,219,272**	**15,879,000**

Source: Canada Ski Council (Regional Ski Areas Operator's Association)
* *All Atlantic Canada Areas*

The Canadian Ski Council reports that as visible minorities and their families continue to make up a large portion of the population and corresponding work force, they will become a target in marketing strategies. Along with the population increase, a trend of higher education levels accompany this group. Higher levels of education generally translate into higher levels of income, which, as studies have shown, is a consistent trait of a "typical skier".

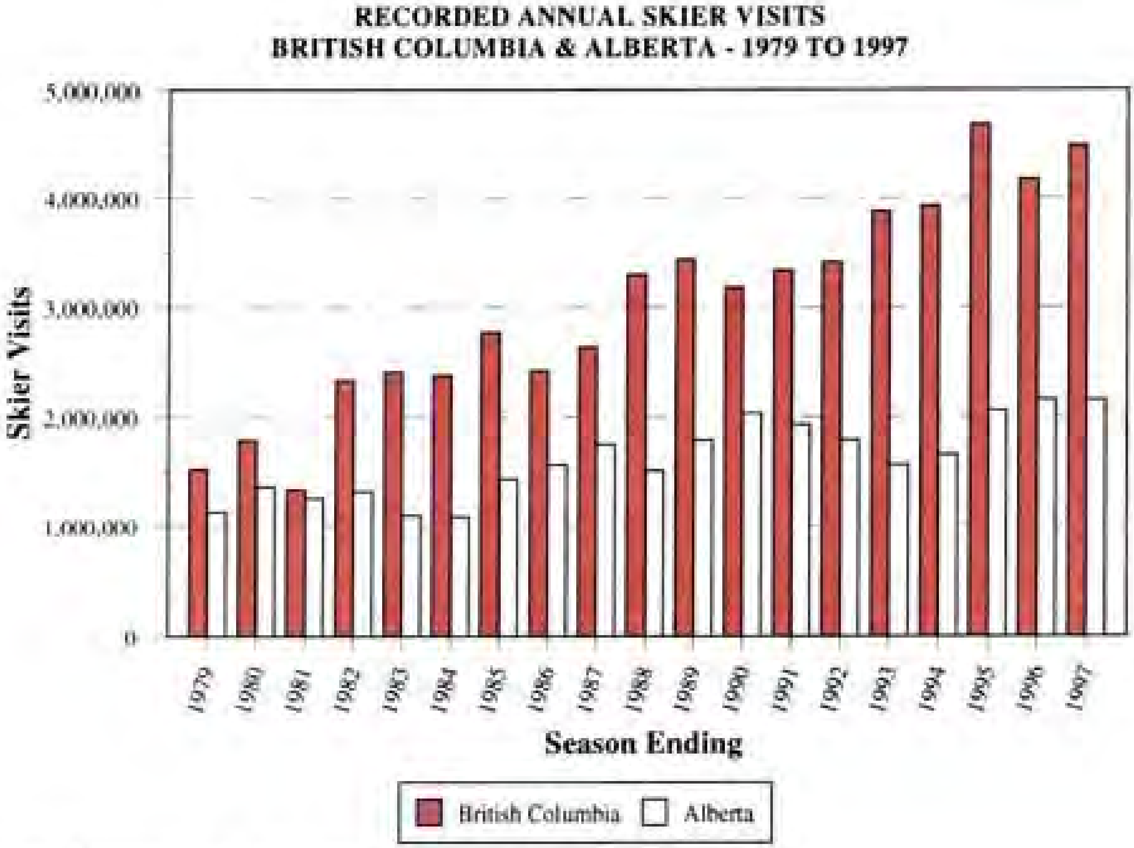
Western Canada

In Western Canada, the British Columbia skiing industry has grown very rapidly since the 1978/79 season, as illustrated in Table I.2 and Plate I.3. British Columbia's ski areas have aggressively expanded and improved their ski areas, assisted by favourable government policy and financial programs. Skier visitation at British Columbia resorts has tripled between 1979 and 1997, with an average annual compound growth rate of 6.1 percent. By contrast, Alberta's ski industry has had mixed results during the last eighteen years, with an average annual compound growth rate of only 3.9 percent. While visitation in Alberta improved between 1985 and 1990, there was a decline during the four year period up to 1994. During the 1995 and 1996 seasons, Alberta experienced a dramatic increase in skier visitation with more than 2 million, the highest number recorded since 1979. This was partly due to good snow and weather conditions, allowing some areas a longer operating season.

TABLE I.2
RECORDED ANNUAL SKIER VISITS
BRITISH COLUMBIA & ALBERTA - 1979 TO 1997

	BRITISH COLUMBIA		**ALBERTA**		**TOTAL**	
Season Ending	Skier Visits	% Change	Skier Visits	% Change	Skier Visits	% Change
1979	1,526,554		1,135,892		2,662,446	
1980	1,793,297	17.5%	1,368,143	20.4%	3,161,440	18.7%
1981	1,341,632	-25.2%	1,257,870	-8.1%	2,599,502	-17.8%
1982	2,341,439	74.5%	1,325,923	5.4%	3,667,362	41.1%
1983	2,419,969	3.4%	1,105,199	-16.6%	3,525,168	-3.9%
1984	2,391,710	-1.2%	1,089,080	-1.5%	3,480,790	-1.3%
1985	2,778,418	16.2%	1,439,569	32.2%	4,217,987	21.2%
1986	2,431,288	-12.5%	1,566,037	8.8%	3,997,325	-5.2%
1987	2,641,830	8.7%	1,754,774	12.1%	4,396,604	10.0%
1988	3,297,707	24.8%	1,517,373	-13.5%	4,815,080	9.5%
1989	3,446,613	4.5%	1,795,978	18.4%	5,242,591	8.9%
1990	3,185,475	-7.6%	2,037,577	13.5%	5,223,052	-0.4%
1991	3,344,166	5.0%	1,934,512	-5.1%	5,278,678	1.1%
1992	3,418,395	2.2%	1,795,891	-7.2%	5,214,286	-1.2%
1993	3,883,339	13.6%	1,566,174	-12.8%	5,449,513	4.5%
1994	3,930,034	1.2%	1,659,986	6.0%	5,590,020	2.6%
1995	4,684,398	19.2%	2,061,243	24.2%	6,745,641	20.7%
1996	4,182,275	-10.7%	2,164,121	5.0%	6,346,396	-5.9%
1997	4,488,539	7.3%	2,158,461	-0.3%	6,647,000	4.7%
Compound Growth	6.2%		3.6%		5.2%	

Source: Canada West Ski Areas Association



Source: Canada West Ski Areas Association

PLATE I.3

As discussed earlier, demand for skiing (skier visitation), historically responds to supply, and this has certainly been the case in Western Canada. As listed in Table I.3, the British Columbia ski industry has installed 152 ski lifts with a total of over 70 million vertical transport meters between 1969 and 1997. During the same period, the Alberta ski industry installed a total of 93 lifts with a total of over 24 million vertical transport meters per hour.

TABLE I.3
WESTERN CANADA
LIFT INSTALLATIONS

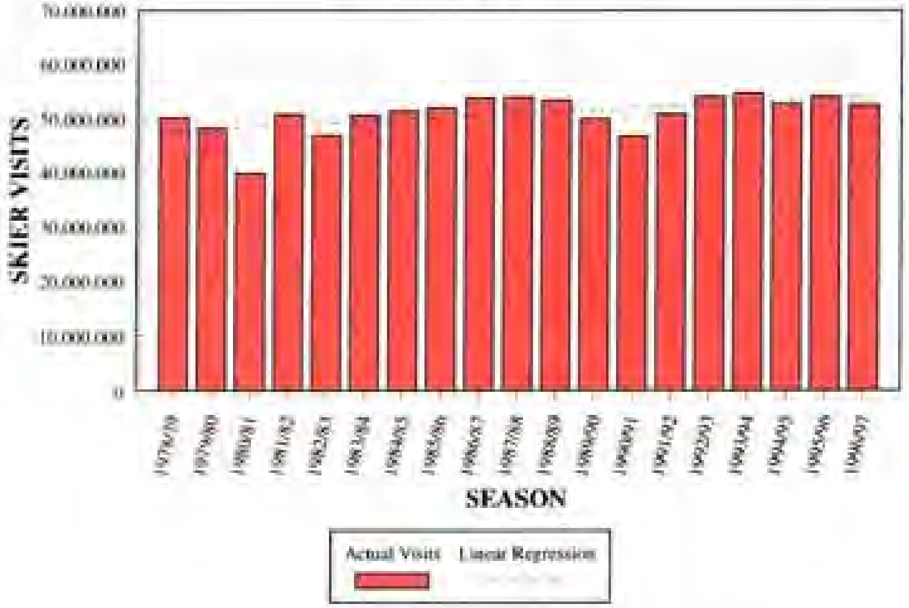
	British Columbia		Alberta	
Season Ending	Number Of Lifts	VTM/Hr. (000)	Number Of Lifts	VTM/Hr. (000)
1969	10	1,768	10	1,684
1970	9	1,468	2	123
1971	1	366	1	389
1972	4	1,245	6	1,199
1973	9	2,749	3	451
1974	6	975	3	330
1975	4	534	3	519
1976	12	2,751	5	81
1977	4	2,077	2	769
1978	4	1,545	3	334
1979	10	2,759	7	1,445
1980	10	3,005	7	1,446
1981	15	7,856	4	585
1982	1	628	3	366
1983	1	678	2	1,312
1984	1	582	3	301
1985	3	1,114	1	232
1986	4	1,033	3	727
1987	2	800	9	2,834
1988	7	5,814	2	1,057
1989	4	4,179	2	1,124
1990	4	3,621	2	2,080
1991	3	2,119	4	1,906
1992	6	5,911	1	892
1993	2	2,372	0	0
1994	4	1,324	2	230
1995	8	5,942	0	0
1996	2	1,362	1	1,289
1997	2	3,516	2	1,076
Total	152	70,093	93	24,781.0
% of Total	62%	74%	38%	26%

Source: Ski Area Management Magazine

A comparison between British Columbia and Alberta has indicated that since 1969, British Columbia has 74 percent of the total installed vertical transport meters per hour, which is substantially more than that of Alberta, at 26 percent. In terms of the number of lifts, British Columbia has installed 62 percent as compared to Alberta's 38 percent. This indicates that the lifts installed in British Columbia have a much greater capacity than those in Alberta.

The United States

In the latter part of the 1980's, growth in the North American skier market slowed considerably. Total skier visits in the United States remained at the 53 million level between 1986/87 and 1988/89, and dropped to 47 million by 1990/91. The 1991/92 season saw an increase in skier visitation, with the United States recording close to 51 million visits; an increase of 8.8 percent from the previous year, as illustrated in Plate 1.4.



TOTAL SKIER VISITS
UNITED STATES

PLATE I.4

This increase could be a reflection of several factors: the end of the Persian Gulf War; partial economic recovery; fairly good weather conditions for increased snowmaking efficiency; exposure and enthusiasm from the Winter Olympics; the continual upgrading and replacement of older chairlifts with high speed quads; increasing capacity, as well as concentrated efforts of technical and managerial staffs to market the product better. 1992/93 saw a further increase to a record of over 54.6 million skier visits, due mainly to a strong economy and a good snow year. In 1993/94, a 1.2 percent increase in skier visits was shown over the previous season, establishing a new record. However, with poor weather conditions throughout most of the western region, the 1994/95 ski season saw its first decline in skier visitation since the late 1980's. The 1995/96 season saw skier visits increase by approximately 2.48 percent, to close to the 54 million mark once again, the third highest total in the past 18 years. This increase was due primarily to good snow conditions throughout many areas. The northeast and southeast areas showed the most dramatic turnaround in skier visits, with increases of 22.7 and 20 percent respectively.

Preliminary estimates for the 1996/97 season indicate that total skier visits for the United States were recorded at 52.5 million, down slightly from 1995/96. While both the Rocky Mountain and Pacific West regions showed increases of 6 and 8.7 percent, respectively, skier visits for the Northeast and Southeast declined, due mostly to extreme weather conditions and lower than normal snowfalls.

In the late 1960's, the United States alone had about 1,400 ski areas, with a North American total of about 1,500. In 1977, the United States had 929 areas; in 1984, 727, and presently there are 519 ski areas operating, as illustrated in Plate I.5.

PLATE I.5

During the nine year period from 1978/79 to 1986/87, a study by Dr. Marvin Kottke indicated that 60 small ski areas went out of business, while another 40 small areas grew and moved out of the small area category. This finding corresponds with data which shows the average area lift capacity increased 53.9 percent over the same time period, suggesting that although there are fewer ski areas, the total skier capacity has actually increased. As illustrated in Plate I.6, the United States average visitation per area in 1978/79 was 60,990, in 1993/94, the average visitation per area increased to 105,886. This increase was a result of the rationalization of the smaller areas. In 1995/96, the average visitation per area was 104,013. Also illustrated in Plate I.6, is the average increase in skier visits per area which is growing, based on the linear regression line.

PLATE 1.6

Prominent industry analysts predict an increasing specialization in ski resorts as they attempt to create their own "niche" to attract new domestic and foreign markets. New domestic markets such as seniors, ethnic groups, special interest groups, snowboarders and echo boomers are now being targeted by aggressive ski area marketing programs.

The conclusion from this data is that the North American ski industry has entered a new stage in its development. The increasing competition in the winter recreation market means that resorts must be more efficient in terms of its operating equipment and plant, while at the same time provide a wide variety of activities and a high quality experience for guests.

As noted by Dr. Marvin Kottke, Ph.D., in his study Growth Trends of NSAA Ski Areas in the 1980's, "without courageous planning and investing by ski areas, the trend line in skier volume could easily have turned downward - instead it actually rose".

.5 Snowboarding

The emerging popularity and growth of snowboarding in the ski industry over the last six years is having a definite effect on various components of ski area operations. Snowboarding, initially viewed by many as an "alternate" or "anti-establishment" activity for mainly the younger, skateboarding crowd, has shown substantial rates of growth over the past six years. The increase in participation is due to several factors. In addition to interest by a "younger" generation (76 percent of participants are between the ages of 13-24), a growing number of advanced skiers, who because of sport burn-out or skiing associated injuries, have chosen to give snowboarding a try and, in many cases, are being converted. In addition, because of the perception that snowboarding is far less technical and therefore easier to learn and progress, snowboarding is much more appealing to those who may or may not have tried skiing. According to Mike Fabro, Editor of *Snowboard Canada* Magazine, snowboarders will outnumber skiers by the year 2000.

Although a number of guest information studies and surveys have been conducted at ski areas in the past, only recently has there been a closer look at what the snowboarders themselves think about their role in the winter sports industry. Due to the growing participation in snowboarding, there is a definite need to understand how the needs and wants of both groups can be achieved with minimal conflict. Most ski areas have constructed half-pipes and many are dedicating completely separate areas, or parks, with special spines and snowbirms for their snowboarding guests. Bear Mountain, California has successfully designed the "Outlaw Snowboard Park", a six acre, snowboard only area which has been rated number one in the United States by *TransWorld Snowboarding* Magazine. Many areas world-wide now have snowboard terrain parks. In 1994, snowboarders accounted for approximately 40 percent of sales at Bear Mountain. Adult only snowboard camps are also increasing in popularity at most North American resorts.

In the United States, there has been a continuous growth trend in the number of snowboarder winter visits. During the 1996/97 season, 18.0 percent of the alpine lift users were snowboarders. This represents an 18 percent increase from the 1995/96 season's (14 percent) estimated snowboarder participation rate. While there is growth in every region of Canada and the United States, there are variations in the percent of snowboarders in each region. The Pacific West region has one of the highest percentage of snowboarder visits in the country, with nearly 25 percent of the total winter lift visits by snowboarders. Table I.4 illustrates the change in the extent of snowboarding participation between 1993/94 and 1996/97, by region.

TABLE I.4
SNOWBOARDERS
AS PERCENT OF TOTAL WINTER VISITS

Snowboarders as a Percent of Total Visits					Change
REGION	1993/94	1994/95	1995/96	1996/97	Since 1993/94
Northeast	8.2%	9.1%	11.9%	17.0%	107.3%
Southeast	7.8%	9.3%	11.5%	14.8%	89.7%
Midwest	9.0%	11.4%	12.8%	16.9%	87.8%
Rocky Mtn.	10.0%	11.4%	13.2%	16.2%	62.0%
Pacific West	13.8%	17.8%	21.7%	24.9%	80.4%
TOTAL U.S.	9.8%	11.8%	14.2%	18.0%	84.0%

Source: Kottke National End of Season Survey 1996/97

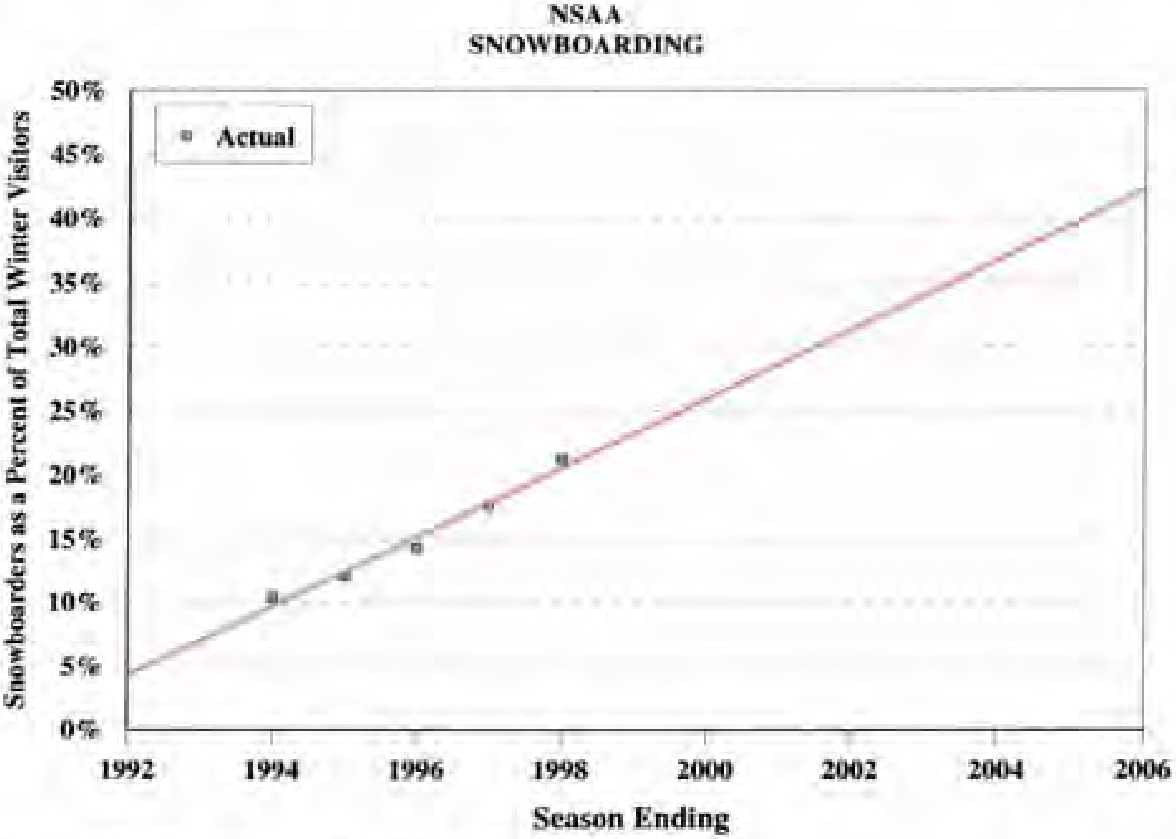
A comprehensive survey was sponsored by *TransWorld Snowboarding Business* magazine in conjunction with the NSAA and the Southern Oregon State College Graduate School of Business for the 1995/96 season. Surveys were sent by mail to the 519 resorts that offer skiing and snowboarding in the United States. The response rate was approximately 27 percent, with 143 surveys completed and returned for analysis.

Following, is an overview of some of the findings from that survey:

- Growth in snowboarding is projected to reach 65 percent over the next 5 years.
- 94 percent of resorts in the United States currently allow unlimited snowboarding.
- 87 percent of resorts report experiencing a "cross-over" of skiers to snowboarding, with many middle-aged and family members taking up snowboarding as another winter activity.
- 73 percent of areas reported using a specific snowboard marketing strategy, including the use of creative terrain parks and halfpipes, as well as featuring special photos of snowboarders of all ages in brochures and marketing publications.
- 83 percent of resorts in the Northwest region are involved in special events for snowboarding, including competitive racing (slalom and GS), as well as "fun" and innovative competitions for participants of all ages and abilities.
- 81 percent of resorts have managers and department heads who ride snowboards.

Canada

In Canada, snowboarding is at the top of the list among growth sports, followed by in-line skating and roller hockey. As illustrated below in Plate I.7, snowboarding is becoming a larger part of the total winter visits. According to the NSAA, snowboarding comprised about 10 percent of the total winter visits in the season ending 1994. By the 1997/98 season, snowboarding amounted to over 20 percent of the total winter visits. At the current rate of growth, snowboarding could exceed skier visits by the year 2010.



Source: Kottke National End of Season Survey 1996/97
PLATE I.7

.6 Glossary

The ski industry has a number of terms and technical jargon specific to ski area development, hence, a glossary is provided:

1. **Skier Visit** - One person visiting a ski area for all or part of a day or night for the purpose of skiing or snowboarding. This is the total number of lift tickets issued. Skier visits include a person holding a full-day, half-day, night, complimentary, adult, child, season, or any other ticket type that gives a skier the use of an area's facilities.

2. **Rated Uphill Capacity** - The manufacturer's rated number of skiers per hour a lift can transport to the top of the lift. An area's hourly capacity is the sum of the individual lifts

3. **VTM/Hour (000) - (Vertical Transport Meters Per Hour)** - The number of people lifted 1,000 vertical meters in one hour (vertical rise of a lift, times the lift capacity per hour, divided by 1,000). An area's total VTM, is the sum of VTM for all lifts.

4. **VTM Demand/Skier/Day** - The amount of vertical skied (demanded) each day by a skier.

5. **Skier (Comfortable) Carrying Capacity (SCC)** - The number of skiers that a given ski area can comfortably support on the slopes and lifts without overcrowding, or those that may be accommodated at one time and still preserve a congenial environment. A ski area's comfortable carrying capacity is a function of VTM demand per skier, VTM supplied per hour, difficulty of terrain and scope of support facilities.

6. **Utilization** - Is measured, as a percent, of skier carrying capacity. Comfortable Seasonal Capacity is the product of a ski area's daily skier carrying capacity times its days of operation. Utilization compares actual skier visits to calculated comfortable seasonal capacity.

7. **Terrain Pod** - a contiguous area of land deemed suitable for ski lift and trail development due to its slope gradients, exposure and fall line characteristics.

II. INVENTORY

.1 Introduction

The inventory stage includes the identification, analysis and mapping of all on-site and off-site factors which may affect the development potential of the ski area. The inventory data includes: the land status, climatic, biophysical, and physiographic characteristics of the study area, as well as an analysis of the existing ski area. Through an understanding of the site's existing conditions and natural process, environmentally sensitive areas can largely be avoided and natural development opportunities maximized.

As a prelude to discussing the mountain's characteristics, it is appropriate to familiarize the reader with the basic requirements of ski area development. Ski area development is generally considered to be a non-consumptive resource use of the land. The development of ski lifts and trails requires the use of approximately 50 percent of the area in small, heavily developed zones. Ski lift right-of-ways are generally 12 to 15 meters in width, while trails vary between 30 and 60 meters wide. Subsequent to rough grading by practices selected for each site, the trails require fine grooming and seeding to establish a grass cover. This grass cover prevents erosion and helps to minimize hazards and damage to skiers' equipment during low snowpack periods, and possible damage to the area's snow grooming fleet. Ski lifts are generally aerial cable systems with steel towers and concrete foundations every 45 to 75 meters.

Ski base area development generally includes a paved access road, parking lots, buildings for accommodation, a daylodge and a maintenance center. Additionally, appropriate power and water supply, and sewage disposal facilities are required to support any base area improvements.

The physical site characteristics discussed in this section all interact to aid the planning team when assessing the capability of the natural systems to support resort development.

.2 Physiography

The quality and feasibility of a winter sports site is highly dependent upon the topographic characteristics of each individual site. Physiographic features which substantially affect ski development in particular, include: aspect (exposure), slope gradients, fall line patterns and elevations. The study area identified for mountain planning purposes includes the current terrain and adjacent lands encompassing approximately 2,700 hectares. Figure 2 illustrates the Regional Context of Panorama Mountain Village.

Land Form

The Panorama Mountain Village is located within a large expanse of mountainous terrain in the Purcell Mountains, on the southeast side of Toby Creek. The most prominent landscape feature is the Hopeful Creek Valley, which is a large V-shaped valley with moderately steep sides. The Hopeful Creek Valley is approximately 8 kilometers long, forming a crescent around the southwestern part of the study area. This valley stretches from the peak of Mount Goldie, at the farthest southeastern portion of the study area, to Toby Creek, approximately 2 kilometers upstream of the Panorama base area.

The existing ski area is located on northwestern facing slopes to the north of the Hopeful Creek Valley. These slopes have a relatively uniform slope and exposure dissected by several valleys crossed by creeks, which run on a seasonal basis. This wide slope narrows and forms a ridge as it increases in elevation, converging to a peak (elevation 2,365 m, at the top of the Summit Chair) in the center of the study area. This peak is bounded on the north by a large bowl dissected by many creek valleys. Steep slopes to the south drain into Hopeful Creek. A narrow ridge to the east of this peak connects to the minor peak of Mount Goldie and eventually rises to form one of the radial ridges off the main peak of Mount Goldie. This ridge is bounded on the north by extremely steep slopes (greater than 70%) and on the south by moderately steep slopes (45-70%).

Exposures

Exposures within the study area fall within all quadrants. Exposures on the existing ski terrain fall generally in a northwesterly direction. Terrain up and down the Toby Creek drainage from the existing ski area also has similar exposures. Exposures on either side of the ridge that runs between the Summit lift and Mount Goldie are westerly on one side and northerly on the other side. Exposures on the south side of Hopeful Creek vary from northerly at the headwaters of the creek to easterly lower downstream.

Fall Line Patterns

The fall line patterns within the existing Panorama area generally flow to the north and the west from the ridge (Panorama Ridge) that runs to the northwest from the summit of Mount Goldie. The westerly flowing fall lines concentrate in the Hopeful Creek drainage. Fall line patterns flowing to the north from the Panorama Ridge concentrate in the Cox Creek drainage. A second ridge emanating from Mount Goldie to the east of the Panorama Ridge separates the Cox Creek drainage from the Taynton Creek drainage. Fall line patterns from this ridge flow either northwesterly into the Cox Creek drainage, or northerly into the Taynton Creek drainage.

Mount Brewster is situated to the west of Hopeful Creek. Fall line patterns on the eastern slopes of Mount Brewster generally flow in an easterly direction into the Hopeful Creek drainage.

A ridge runs between Mount Goldie and Mount Brewster at the head of Hopeful Creek. Fall line patterns on the northern side of this ridge tend to run in a northwesterly direction. Figure 7 shows the fall line patterns within the study area, as well as the primary and secondary concentration areas.

Elevation

The potential vertical drop available for lift serviced skiing plays an important role in site suitability since it determines the length of the trails and also the vertical transport meters (VTM) that can be supplied to the skiing and snowboarding public. Essentially, the more vertical the better, as many skiers and snowboarders use vertical rise as a basic yardstick of winter resort area desirability.

Elevations within the study area range from 2,652 meters, at the peak of Mount Goldie, to 1,130 meters in the Toby Creek valley in the northernmost portion of the study area. The total elevation difference is 1,522 meters (4,993 feet). The present skiable vertical is 1,211 meters (3,975 feet) stretching from the top of the Summit T-bar, at 2,364 meters (7,756 feet) to the bottom of the Toby Creek Chair, at 1,153 meters (3,783 feet). Significant increases in the skiable vertical will only be possible with the expansion into the upper reaches of the Hopeful Creek Valley.

.3 Solar Analysis

Most skiers are highly aware of the sun's influence on snow quality. While skiers prefer to ski in the sun, they will not do so if the snow is sticky or mushy due to intense solar radiation. As illustrated in Plate II.1, skiers will follow the sun throughout the day, skiing eastern exposures in the morning, southern exposures at noon and western exposures in the afternoon. As a general rule, southern slopes are the warmest, eastern and western slopes the next warmest and northern slopes the coolest. Snowpack retention is a critical concern for any skiing operation and for this reason, slopes and trails should naturally be located where the snowpack remains for the longest period of time.

SKI POINTER

IN SPRING, STAY AHEAD OF THE SUN

By John Fry
Contributing Editor

The trick to enjoyable spring skiing is to catch the snow as it becomes granular corn before it gets slushy. A good strategy is to keep one eye on the slopes and the other on the sun.

In the morning, after a frosty night, look for east-facing and southeast-facing slopes that catch the early sun. They will be the first to soften up.

As the sun climbs higher and moves into the southern sky, move with it. Ski the north-facing slopes early before they become sloppy.

Finally, move to the west-facing slopes in the afternoon to search for good corn snow.

Smart scrutiny of the weather and terrain will improve your day of skiing.

PLATE II.1

The site's angular relationship with the sun is a critical design parameter since it determines the time of day and for how long the sun's rays will bathe parking lots, mountain restaurants, ski slopes and the village. For this reason, a detailed solar analysis has been prepared to determine areas of topographic shading at 10:00 a.m., 12:00 noon and 3:00 p.m. on three selected days of the season. Figures 3a through 3e illustrate the sun/shadow relationship throughout the study area on three selected days.

Figure 3a illustrates the shading within the study area at 10 a.m. On December 22, the entire study area is shaded, except for the peak of Mount Goldie, the peak at the Summit T-Bar and the higher elevation, south facing terrain between these two peaks. The Champagne T-bar is also in the sunlight at this time. By January 22, the shading has receded slightly, but only in the mid and upper portions of the Hopeful Creek Valley and around the top of the ski area. Most of the ski area and all of the base area is under shadow at this time. By February 23 at 10 a.m., the shading has receded significantly, covering only approximately 30 percent of the study area. The most significant areas of shadow occur in several pockets, located on the steep, north facing terrain bounded by Hopeful Creek, in the valley to the north of the ski area and the upper reaches of Taynton Creek. At this time, the entire ski area is bathed in sunlight, except for very small portions of some trails on Lifts 1, 2, 3 and 4.

Figure 3b shows that about half of the study area is bathed in sunlight on December 22 at noon. The center third of the study area (running east-west) is almost exclusively sunny, while the northern and southern extents are shaded. Approximately half of the ski trails are in the sunlight at this time, as is the base area and the base of the Sunbird Chair. By January 22, the sun has risen enough to provide sunlight for much more of the study area. At this time, the only shading present occurs in several large pockets south of Hopeful Creek, in the basin directly north of the main ski trails, and on the north facing slopes of the Taynton Creek Valley. By February 23 at noon, only several very small pockets of shading remain in the same locations as on January 22.

On December 22 at 3 p.m., sunlight covers the center portion of the study area, as well as the lower elevations (near Toby Creek) and the flat ridge immediately north of the developed ski trails. Figure 3c illustrates that the base area, the bottom of the Sunbird Chair and most of the ski trails are bathed in sunlight at this time. Trails serviced by the First Ascent Chairlift and the lower portions of trails on the Sunbird Chairlift are shaded at this time. By January 22, the shadows have receded somewhat, leaving all the trails in sunlight, except for a band across the middle of the First Ascent Chairlift and a small portion of the "Downhill" ski run. By February 23 at 3 p.m., all of the existing ski area is bathed in sunlight. The areas of shading at this time are located south of Hopeful Creek, just north of the Champagne T-bar and in the Taynton Creek Valley.

Figures 3d and 3e illustrate the sun/shadow relationship at 10:00 a.m. and at 3:00 p.m. on December 22, in three-dimensional perspective view.

.4 Avalanche

Panorama staff provided the planning team with a detailed map outlining the known areas of avalanche activity within the existing ski area. Figure 4 illustrates the approximate locations and slide paths of the avalanche prone areas at Panorama. It does not denote the exact size, shape, runout distances, severity, or frequency of the avalanche concerns.

Avalanches within ski areas are generally divided into two categories:

1. Slopes which, under normal circumstances, present an avalanche hazard for part of the winter season and, with the proper preparation and control, can be used for ski terrain. These trails are steep, advanced and expert terrain which may be dangerous early in the winter but can usually be stabilized and opened for regular skiing.

2. The second category indicates the minority of avalanche prone slopes within the ski area which, due to their steepness and wind transport patterns, are capable of generating recurring avalanche problems throughout the entire winter season. These types of avalanches require continuous monitoring and control measures.

The main incline of avalanche starting zones is approximately 40 degrees (84 percent). While large avalanches are not common on slopes below 30 degrees (58 percent), given the right conditions, minor activity may be initiated by skiers on slopes as slight as 22 degrees (40 percent). Under certain conditions, therefore, we might expect a low intermittent hazard on advanced and expert terrain.

.5 Existing Mountain Facilities

Lifts

As of the 1997/98 ski season, Panorama Mountain Village owns and operates one detachable quad, one triple chair, two double chairs, two T-bars, one platter lift and one handle tow. Since the first handle tow was installed 33 years ago, these lifts have been installed in response to continued skier demand.

The layout of the present lift and trail system is graphically illustrated in plan view on the Existing Mountain Facilities Map (Figure 5) and in three-dimensional view in Figure 5a. A detailed inventory of the lifts, with technical specifications, appears in Table II.1. These 8 lifts have a total rated up-hill capacity of 8,423 passengers per hour and produce over 2.3 million vertical transport meters per hour (VTM/hr.). The current skiable vertical drop at Panorama is 4,047 feet (1,234 meters), stretching from a knoll near the top of the Summit T-bar, to the houses below the bottom of the Silver Platter.

It should be noted that the Toby Chair is capable of operating at 1,400 passengers per hour with a cable speed of 2.3 meters per second. Because this lift is currently servicing beginner terrain, Panorama has chosen to reduce the cable speed to 2.0 meters per second for the ease of loading beginner skiers. At this reduced speed, the lift has a capacity of 1,217 passengers per hour. In the event that the First Ascent Chair is not available for staging skiers to the upper mountain, the Toby Chair can be returned to the higher cable speed and used to relay skiers to the Sunbird Chair via Over Easy, where they can then stage up to the Horizon Chair.

TABLE II.1
PANORAMA MOUNTAIN VILLAGE
LIFT SPECIFICATIONS - EXISTING AREA - 1997/98 SEASON

Lift Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
Lift Name	**First Ascent**	**Horizon**	**Toby**	**Sunbird**	**Champagne**	**Summit**	**Silver Platter**	**Red Rider**	
Lift Type	**D4C**	**2C**	**2C**	**3C**	**T-B**	**T-B**	**P**	**HT**	**TOTAL**
Year Constructed	**1988**	**1975**	**1978**	**1980**	**1984**	**1993**	**1975**	**1981**	
Top Elevation m.	1,563	2,040	1,273	1,596	2,203	2,364	1,223	1,209	
Bottom Elevation m.	1,183	1,556	1,153	1,181	2,023	2,166	1,162	1,185	
Total Vertical m.	380	484	120	415	180	198	61	24	1,862
Horizontal Distance m.	1,345	1,320	572	1,156	703	613	476	164	
Slope Distance m.	1,400	1,409	584	1,230	731	651	480	166	6,650
Average Slope %	28%	37%	21%	36%	26%	32%	13%	15%	29% Mean
Rated Capacity	1,992	994	1,217	1,700	450	600	750	720	8,423
V.T.M./Hr.(000)	757	481	146	705	81	119	46	17	2,352
Rope Speed m/sec.	5.0	2.6	2.0	2.3	3.0	3.0	2.5	1.8	
Trip Time min.	4.67	9.03	4.87	8.91	4.06	3.61	3.20	1.51	
Operating Hr./Day	7.0	7.0	7.0	7.0	6.8	6.5	7.0	7.0	6.9

Ski Trail Inventory

In order to provide an accurate account of Panorama's ski trail system, the trails have been classified in concert with the International Ski Trail Standards (Table II.2), as well as the seven skier skill classification levels exhibited in Table II.3.

TABLE II.2
INTERNATIONAL TRAIL STANDARDS

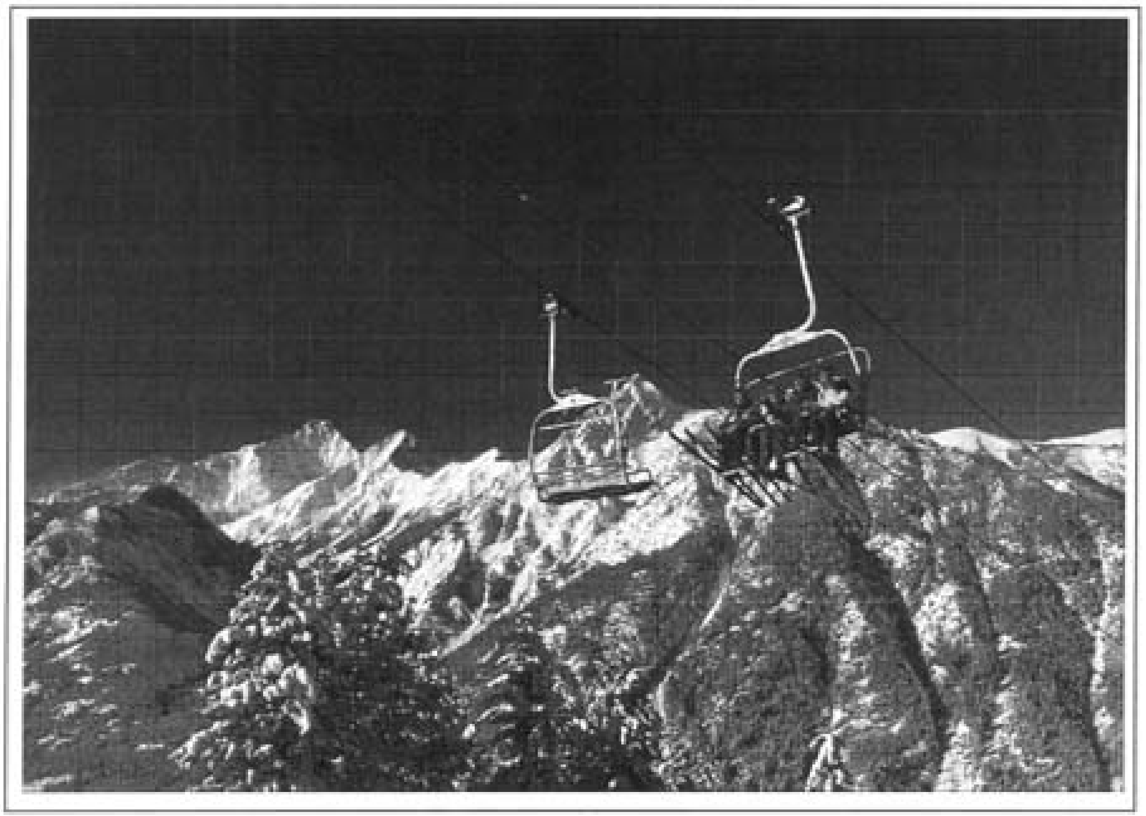
TRAIL DESIGNATION	SKIER ABILITY LEVELS
Easier	Beginner & Novice Skiers
More Difficult	Intermediate Skiers
Most Difficult	Advanced & Expert Skiers

Ski trails are classified via an evaluation of the following parameters: slope width, average gradient and the steepest 30 meter vertical pitch. Since the average slope gradient of a ski trail is generally much lower than the steepest 30 meter vertical pitch, trails are usually classified to ensure that the steepest 30 meter vertical pitch falls within five percent of the acceptable terrain gradients listed in Table II.3. Furthermore, a gentle novice ski trail cannot suddenly turn into an advanced ski trail for obvious reasons.

TABLE II.3
SKIER SKILL CLASSIFICATIONS

Skill Classifications		Acceptable Terrain Gradients	Maximum Gradient
1	Beginner	8 - 15%	20%
2	Novice	15 - 25%	30%
3	Low Intermediate	25 - 35%	40%
4	Intermediate	30 - 40%	45%
5	High Intermediate	35 - 45%	50%
6	Advanced	45 - 60%	65%
7	Expert	60% +	

The 1997/98 trail system has been plotted at a scale of 1:5,000 with 5 meter contours on the Existing Mountain Facilities Map (Figure 5). The presently developed ski trail system, as listed in Table II.4, includes 76 numbered and named ski/snowboard trails which cover a total of 290.3 hectares.



First Ascent Chair

TABLE II.4
PANORAMA MOUNTAIN VILLAGE
SKI TRAIL INVENTORY
EXISTING AREA - 1997/98

Trail Name		Trail No.	Skill Class	Elevation Top m.	Elevation Bottom m.	Total Vert. m.	Horz. Vert. m.	Slope Dist. m.	Percent Slope Avg.	Percent Slope Steep.	Avg. Width m.	Horz. Area m.	Slope Area ha.	Skiers At Area Density	Skiers At Area Total	
Lift 1																
Powder Trail		1A	4	1,515	1,250	265	980	1,015	27%	42%	54	5.30	5.49	40	220	snowmaking
Horseshoe		1B	3	1,563	1,183	380	1,535	1,581	25%	37%	62	9.56	9.85	40	395	snowmaking
Showoff		1C	3	1,525	1,190	335	1,260	1,304	27%	37%	55	6.90	7.14	40	285	snowmaking
		1D	3	1,563	1,490	73	215	227	34%	40%	49	1.05	1.11	40	45	snowmaking
Old Timer		1E	3	1,563	1,183	380	1,475	1,523	26%	36%	53	7.86	8.12	40	325	snowmaking
Hay Fever		1F	6	1,490	1,305	185	655	681	28%	55%	24	1.58	1.64	15	25	
Cliff Glade		1G	7	1,455	1,275	180	635	660	28%	60%	116	7.38	7.67	5	40	gladed
Upper Loose Moose		1H	4	1,495	1,437	58	245	252	24%	38%	16	0.39	0.40	40	15	
Lower Loose Moose		1I	4	1,415	1,267	148	555	574	27%	35%	12	0.64	0.66	40	25	
Campbell's Canyon		1J	2	1,425	1,380	45	345	348	13%	13%	13	0.45	0.45	50	25	
Stringer		1K	3	1,375	1,220	155	640	659	24%	33%	43	2.76	2.84	40	115	
Ski Tip Way		1L	2	1,365	1,220	145	720	734	20%	27%	31	2.26	2.31	50	115	
Dick's Cross/Strobl Strasse	p	2K	4	1,875	1,350	525	2,345	2,403	22%	43%	24	5.54	2.50	40	100	
Ostrander	p	2L	6	1,630	1,375	255	815	854	31%	50%	35	2.87	1.32	15	20	
Zehnder way	p	2M	5	1,690	1,360	330	935	992	35%	45%	37	3.42	1.60	30	50	
McIntosh Way	p	2N	4	1,565	1,350	215	1,110	1,131	19%	38%	34	3.80	1.70	40	70	
Trapper's Ridge	p	2O	4	1,360	1,160	200	960	981	21%	37%	24	2.28	0.96	40	40	
	p	G6	6	1,700	1,390	310	910	961	34%	50%	60	5.43	2.52	4	10	gladed
Joe C's Forest	p	G7	6	1,600	1,375	225	685	721	33%	41%	140	9.60	4.44	4	15	gladed
Dahlie Forest	p	G8	6	1,675	1,350	325	930	985	35%	53%	176	16.34	7.61	4	30	gladed
Gunner's Glade	p	G9	5	1,550	1,365	185	695	719	27%	38%	166	11.52	5.24	8	40	gladed
	p	G10	5	1,370	1,275	95	300	315	32%	37%	184	5.52	2.38	8	20	gladed
		G11	4	1,405	1,275	130	500	517	26%	37%	30	1.51	1.56	10	15	gladed
Messerli's Mile	p	L	6	1,960	1,785	175	415	450	42%	57%	53	2.20	0.73	15	10	
Total Lift 1		25 (not including trail L)						20,136 (not including trail L)					80.25		2,050	
Lift 2																
Downhill Right		2A	6	1,903	1,830	73	155	171	47%	57%	42	0.65	0.72	15	10	
Downhill		2B	6	2,040	1,605	435	1,070	1,155	41%	34%	51	5.42	5.85	15	90	
Tacky		2C	6	1,860	1,585	275	740	789	37%	50%	43	3.16	3.37	15	50	
Skyline		2D	4	2,040	1,556	484	1,370	1,453	35%	45%	50	6.85	7.26	40	290	snowmaking
Rollercoaster		2E	5	2,040	1,600	440	1,250	1,325	35%	47%	64	7.97	8.45	30	255	snowmaking
Cow's Face		2F	5	1,635	1,556	79	250	262	32%	44%	48	1.21	1.27	30	40	
Liftline		2G	5	2,005	1,680	325	895	952	36%	42%	17	1.53	1.63	30	50	
		2H	5	1,580	1,545	35	110	115	32%	32%	39	0.43	0.45	30	15	
Lower Downhill		2I	6	1,612	1,525	87	280	293	31%	48%	50	1.41	1.48	15	20	
Surf		2J	7	2,035	1,910	125	205	240	61%	73%	31	0.63	0.74	20	15	
Dick's Cross/Strobl Strasse	p	2K	4	1,875	1,350	525	2,345	2,403	22%	43%	24	5.54	3.18	40	125	
Ostrander	p	2L	6	1,630	1,375	255	815	854	31%	50%	35	2.87	1.69	15	25	
Zehnder way	p	2M	5	1,690	1,360	330	935	992	35%	45%	37	3.42	2.03	30	60	
McIntosh Way	p	2N	4	1,565	1,350	215	1,110	1,131	19%	38%	34	3.80	2.17	40	85	
Trapper's Ridge	p	2O	4	1,360	1,160	200	960	981	21%	37%	24	2.28	1.22	40	50	
	p	A	5	2,205	2,166	39	460	462	8%	8%	15	0.69	0.31	30	10	
Schober's Dream	p	B	5	2,165	1,379	786	2,875	2,981	27%	50%	37	10.71	4.98	30	150	
CFI	p	C	6	1,720	1,465	255	1,090	1,119	23%	50%	56	6.05	2.79	8	20	open bowl
Stamp Bowl	p	D	5	1,675	1,580	95	295	310	32%	42%	122	3.60	1.70	15	25	open bowl
Hopeful Sun Bowl	p	E	5	1,700	1,555	145	795	808	18%	30%	79	6.32	2.88	15	45	open bowl
Drainz	p	F	5	1,480	1,383	97	850	856	11%	15%	15	1.28	0.57	30	15	egress
Lower Bowl	p	G	5	1,570	1,430	140	435	457	32%	35%	57	2.46	1.16	30	35	
Last Chance	p	I	6	2,190	1,940	250	625	673	40%	59%	29	1.80	1.09	15	15	
View of 1000 Peaks	p	J	6	2,360	1,925	435	1,615	1,673	27%	55%	30	4.91	2.83	15	45	
Red's Bowl	p	K	7	2,090	1,940	150	345	376	43%	91%	36	1.25	0.76	20	15	
Messerli's Mile	p	L	6	1,960	1,785	175	415	450	42%	57%	53	2.20	0.93	15	15	
Hideaway	p	G1	7	2,160	1,850	310	815	872	38%	63%	124	10.12	4.86	5	25	gladed
Black Door	p	G2	4	1,850	1,745	105	485	496	22%	30%	54	2.64	1.21	10	10	gladed
Alive	p	G3	5	1,835	1,710	125	600	613	21%	33%	266	15.98	7.32	8	55	gladed
Lower Extreme Dream	p	G5	7	2,120	1,890	230	925	953	25%	58%	46	4.29	2.48	5	10	gladed
Joe C's Forest	p	G7	6	1,600	1,375	225	685	721	33%	41%	140	9.60	5.66	4	20	gladed
Dahlie Forest	p	G8	6	1,675	1,350	325	930	985	35%	53%	176	16.34	9.70	4	35	gladed
Gunner's Glade	p	G9	5	1,550	1,365	185	695	719	27%	38%	166	11.52	6.68	8	50	gladed
	p	G10	5	1,370	1,275	95	300	315	32%	37%	184	5.52	3.03	8	25	gladed
Total Lift 2		10 (not including partial trails)						6,757 (not including partial trails)					105.68		1,810	

TABLE II.4
PANORAMA MOUNTAIN VILLAGE
SKI TRAIL INVENTORY
EXISTING AREA - 1997/98

				Elevation		Total	Horz.	Slope	rcent Slope		Avg.	Horz.	Slope	Skiers At Area		
Trail		Trail	Skill	Top	Bottom	Vert.	Vert.	Dist.			Width	Area	Area			
Name		No.	Class	m.	m.	m.	m.	m.	Avg.	Steep.	m.	m.	ha.	Density	Total	
<u>Lift 3</u>																
New Timer		3A	4	1,273	1,153	120	515	529	23%	44%	31	1.71	1.76	40	70	snowmaking
Eagle Glide		3B	2	1,273	1,178	95	375	387	25%	30%	34	1.28	1.32	50	65	snowmaking
Workshop		3C	4	1,270	1,215	55	220	227	25%	44%	21	0.46	0.48	40	20	snowmaking
Hoggsflats		3D	2	1,273	1,172	101	430	442	23%	30%	30	1.29	1.33	50	65	snowmaking
Total Lift 3		4						1,584					4.89		220	
<u>Lift 4</u>																
Fritz's/Chicken's Choice		4A	4	1,596	1,181	415	1,535	1,590	27%	41%	36	5.58	5.78	40	230	snowmaking
Whiskey Jack		4B	3	1,475	1,300	175	540	568	32%	40%	43	2.32	2.44	40	100	snowmaking
Sunbird		4C	6	1,590	1,345	245	705	746	35%	45%	19	1.34	1.42	15	20	
Heaven Can Wait		4D	4	1,596	1,181	415	1,220	1,289	34%	45%	48	5.81	6.14	40	245	part snowm.
Little Dipper		4E	5	1,565	1,270	295	880	928	34%	46%	36	3.16	3.33	30	100	snowmaking
Out Rider Boomerang		4F	3	1,585	1,181	404	1,780	1,825	23%	40%	32	5.61	5.75	40	230	
Detour		4G	6	1,220	1,187	33	60	68	55%	55%	37	0.22	0.25	15	5	
Lower Fritz's		4H	6	1,275	1,190	85	180	199	47%	51%	54	0.98	1.08	15	15	snowmaking
	p	A	5	2,205	2,166	39	460	462	8%	8%	15	0.69	0.27	30	10	
Schober's Dream	*p*	B	5	2,165	1,379	786	2,875	2,981	27%	50%	37	10.71	4.27	30	130	
CFI	*p*	C	6	1,720	1,465	255	1,090	1,119	23%	50%	56	6.05	2.39	8	20	open bowl
Stump Bowl	*p*	D	5	1,675	1,580	95	295	310	32%	42%	122	3.60	1.45	15	20	open bowl
Hopeful Sun Bowl	*p*	E	5	1,700	1,555	145	795	808	18%	30%	79	6.32	2.47	15	35	open bowl
Draino	*p*	F	5	1,480	1,383	97	850	856	11%	15%	15	1.28	0.49	30	15	egress
Lower Bowl	*p*	G	5	1,570	1,430	140	435	457	32%	35%	57	2.46	0.99	30	30	
Hideaway	*p*	G1	7	2,160	1,850	310	815	872	38%	63%	124	10.12	4.16	5	20	gladed
Black Door	*p*	G2	4	1,850	1,745	105	485	496	22%	30%	54	2.64	1.04	10	10	gladed
Alive	*p*	G3	5	1,835	1,710	125	600	613	21%	33%	266	15.98	6.27	8	45	gladed
Total Lift 4		9 (not including partial trails)						9,652 (not including partial trails)					49.99		1,280	
<u>Lift 5</u>																
World Cup Way		5A	3	2,203	2,023	180	780	800	23%	39%	35	2.72	2.79	40	110	
Picture Perfect		5B	6	2,203	2,023	180	745	766	24%	52%	25	1.88	1.93	15	30	
Champagne Chute		5C	4	2,075	2,023	52	110	122	47%	47%	38	0.42	0.46	40	20	
	p	A	5	2,205	2,166	39	460	462	8%	8%	15	0.69	0.12	30	5	
Schober's Dream	*p*	B	5	2,165	1,379	786	2,875	2,981	27%	50%	37	10.71	1.85	30	55	
CFI	*p*	C	6	1,720	1,465	255	1,090	1,119	23%	50%	56	6.05	1.04	8	10	open bowl
Stump Bowl	*p*	D	5	1,675	1,580	95	295	310	32%	42%	122	3.60	0.63	15	10	open bowl
Hopeful Sun Bowl	*p*	E	5	1,700	1,555	145	795	808	18%	30%	79	6.32	1.07	15	15	open bowl
Draino	*p*	F	5	1,480	1,383	97	850	856	11%	15%	15	1.28	0.21	30	5	egress
Lower Bowl	*p*	G	5	1,570	1,430	140	435	457	32%	35%	57	2.46	0.43	30	15	
Last Chance	*p*	I	6	2,190	1,940	250	625	673	40%	59%	29	1.80	0.41	15	5	
View of 1000 Peaks	*p*	J	6	2,360	1,925	435	1,615	1,673	27%	55%	30	4.91	1.06	15	15	
Red's Bowl	*p*	K	7	2,090	1,940	150	345	376	43%	91%	36	1.25	0.28	20	5	
Messerli's Mile	*p*	L	6	1,960	1,785	175	415	450	42%	57%	53	2.20	0.35	15	5	
Elmo	*p*	M	7	2,315	2,185	130	295	322	44%	81%	35	1.03	0.53	20	10	
Hideaway	*p*	G1	7	2,160	1,850	310	815	872	38%	63%	124	10.12	1.81	5	10	gladed
Black Door	*p*	G2	4	1,850	1,745	105	485	496	22%	30%	54	2.64	0.45	10	5	gladed
Alive	*p*	G3	5	1,835	1,710	125	600	613	21%	33%	266	15.98	2.72	8	20	gladed
Upper Extreme Dream	*p*	G4	7	2,360	2,075	285	950	992	30%	64%	66	6.30	3.13	5	15	gladed
Lower Extreme Dream	*p*	G5	7	2,120	1,890	230	925	953	25%	58%	46	4.29	0.92	5	5	gladed
Total Lift 5		20						16,101					22.20		370	
<u>Lift 6</u>																
Outer Limits		6A	7	2,360	2,260	100	230	251	43%	60%	40	0.92	1.00	5	5	gladed
Roy's Run		6B	6	2,364	2,166	198	670	699	30%	56%	38	2.53	2.64	15	40	
Tight Spots		6C	7	2,360	2,175	185	525	557	35%	57%	85	4.46	4.73	5	25	gladed
Tree Time		6D	7	2,360	2,175	185	530	561	35%	64%	85	4.50	4.77	5	25	gladed
Top of the World		6E	6	2,364	2,210	154	330	364	47%	63%	42	1.40	1.54	15	25	
Last Chance	*p*	I	6	2,190	1,940	250	625	673	40%	59%	29	1.80	0.45	15	5	
View of 1000 Peaks	*p*	J	6	2,360	1,925	435	1,615	1,673	27%	55%	30	4.91	1.17	15	20	
Red's Bowl	*p*	K	7	2,090	1,940	150	345	376	43%	91%	36	1.25	0.31	20	5	
Messerli's Mile	*p*	L	6	1,960	1,785	175	415	450	42%	57%	53	2.20	0.38	15	5	
Elmo	*p*	M	7	2,315	2,185	130	295	322	44%	81%	35	1.03	0.59	20	10	
Upper Extreme Dream	*p*	G4	7	2,360	2,075	285	950	992	30%	64%	66	6.30	3.45	5	15	gladed
Lower Extreme Dream	*p*	G5	7	2,120	1,890	230	925	953	25%	58%	46	4.29	1.02	5	5	gladed
Total Lift 6		5 (not including partial trails)						2,432 (not including partial trails)					22.03		185	

TABLE II.4
PANORAMA MOUNTAIN VILLAGE
SKI TRAIL INVENTORY
EXISTING AREA - 1997/98

Trail Name		Trail No.	Skill Class	Elevation Top m.	Bottom m.	Total Vert. m.	Horz. Vert. m.	Slope Dist. m.	Percent Slope Avg.	Steep.	Avg. Width m.	Horz. Area m.	Slope Area ha.	Skiers At Area Density	Total
Lift 7															
Beginner		7A	1	1,223	1,162	61	495	499	12%	13%	41	2.03	2.05	50	100
Trapper's Ridge	p	2O	4	1,360	1,160	200	960	981	21%	37%	24	2.28	0.15	40	5
	p	G10	5	1,370	1,275	95	300	315	32%	37%	184	5.52	0.38	8	5
Total Lift 7		3						1,794					2.59		110
Lift 8															
Hwy 1		8A	1	1,209	1,185	24	180	182	13%	13%	56	1.00	1.01	50	50
Total Lift 8		1						182					1.01		50
Other Trails															
Schober's Egress		H	5	1,335	1,275	60	2,050	2,051	3%	18%	8	1.64	1.64	30	50
Total Other Trails		1						2,051					1.64		50
Total All Trails		76						60.7 km					290.3 Ha		6,125

.6 Mountain Capacity Analysis

Planning Parameters

The determination of an area's Skier Carrying Capacity (SCC) is perhaps the most critical step in ski area planning. Often referred to as the "comfortable carrying capacity" or the "skiers at one time" (SAOT), this figure represents the number of skiers that can be safely supported by an area's lift and trail system while providing a quality experience to each skier ability level. The skier carrying capacity is determined via an integration of lift capacity, acceptable slope densities, slope gradients, skier skill classifications and vertical meters of lift serviced terrain.

During the past several years, Ecosign has undertaken and reviewed substantial research dealing with skiing demand, skier skill distribution and skier densities. Each skier ability level places different demands upon an area's lift and trail system. Empirical observations have determined that each skier ability level will ski a relatively constant number of vertical meters per day.

Skier Skill Class Distribution

These reviews have also continued to support the bell curve distribution of skier skill levels, as illustrated in Plate II.2.

SKIER/SNOWBOARDER
SKILL CLASS DISTRIBUTION

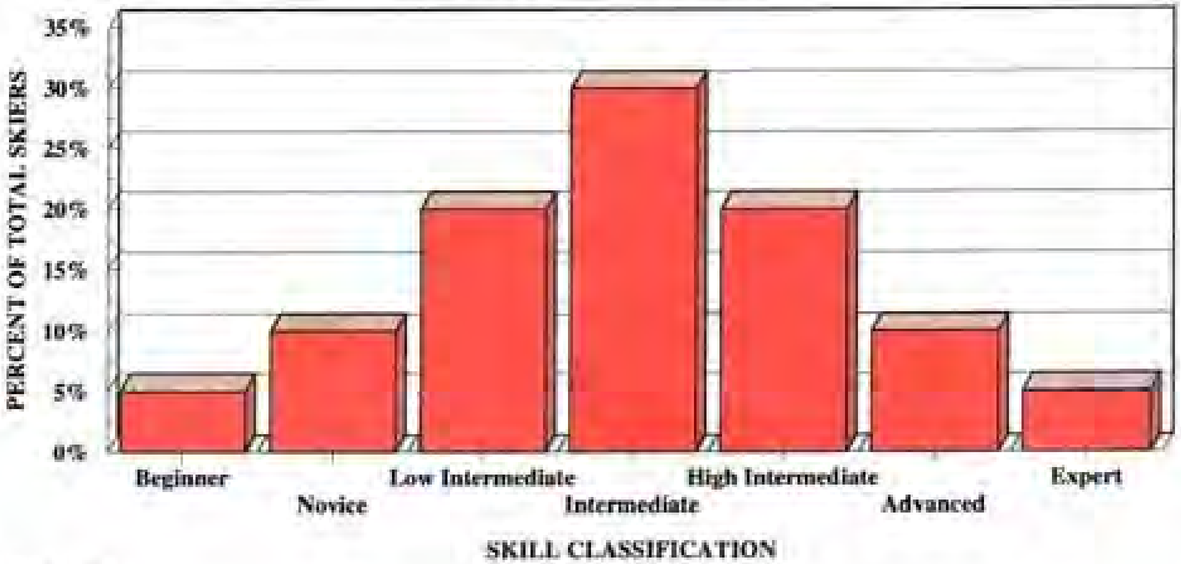


PLATE II.2

Vertical Transport Meters

As a general rule, as the proficiency of the skier/snowboarder increases, the demand for vertical meters increases. Three general levels of VTM demand are listec in Table II.5. In western Canada and the western USA, experience has indicated that the high level of VTM demand is appropriate. For evaluation of the existing facilitie and planning future facilities, Ecosign will use the industry high level of vertical skiing demand.

TABLE II.5
SKIING DEMAND BY SKILL CLASSIFICATION

Skill Classification	**Planning Goals**	**Skier Demand VTM per Day**		
		Low	**Average**	**High**
Beginner	5%	610	705	940
Novice	10%	1,370	1,595	2,120
Low Intermediate	20%	1,830	2,125	2,825
Intermediate	30%	2,440	2,440	3,770
High Intermediate	20%	3,290	3,290	5,085
Advanced	10%	3,840	3,840	5,935
Expert	5%	5,485	5,485	8,475
Weighted Average		**2,582**	**3,001**	**3,989**

Based on five hours skiing for skill classes 1 to 5 and six hours skiing for skill classes 6 and 7.

The amount of VTM demanded is also higher due to the new technology in lifts, especially detachable high speed chairlifts. Ecosign has found, after evaluating many winter resort areas before and after the installation of these high speed lifts, that skiers/snowboarders using high speed chairlifts tend to consume approximately 20 percent more vertical meters than they did on the previous fixed grip lifts.

Skier/Snowboarder Densities

From the above mentioned review of various studies, we estimated densities which provide skiers/snowboarders with a high quality, comfortable experience, resulting in good memories and the likelihood of return visits. Densities used for planning winter resort areas in different parts of the world vary widely, due to the facilities the local skier has been conditioned to accept and the local land base, as illustrated in Plate II.3. In areas such as Europe, western Canada and the western United States, densities are relatively low compared to the densities found in ski areas in Japan or Australia, where skiers have been historically conditioned to higher densities. Densities in Japan are generally triple the densities in western North American destination resorts.

SKIER DENSITY
WORLD WIDE COMPARISON

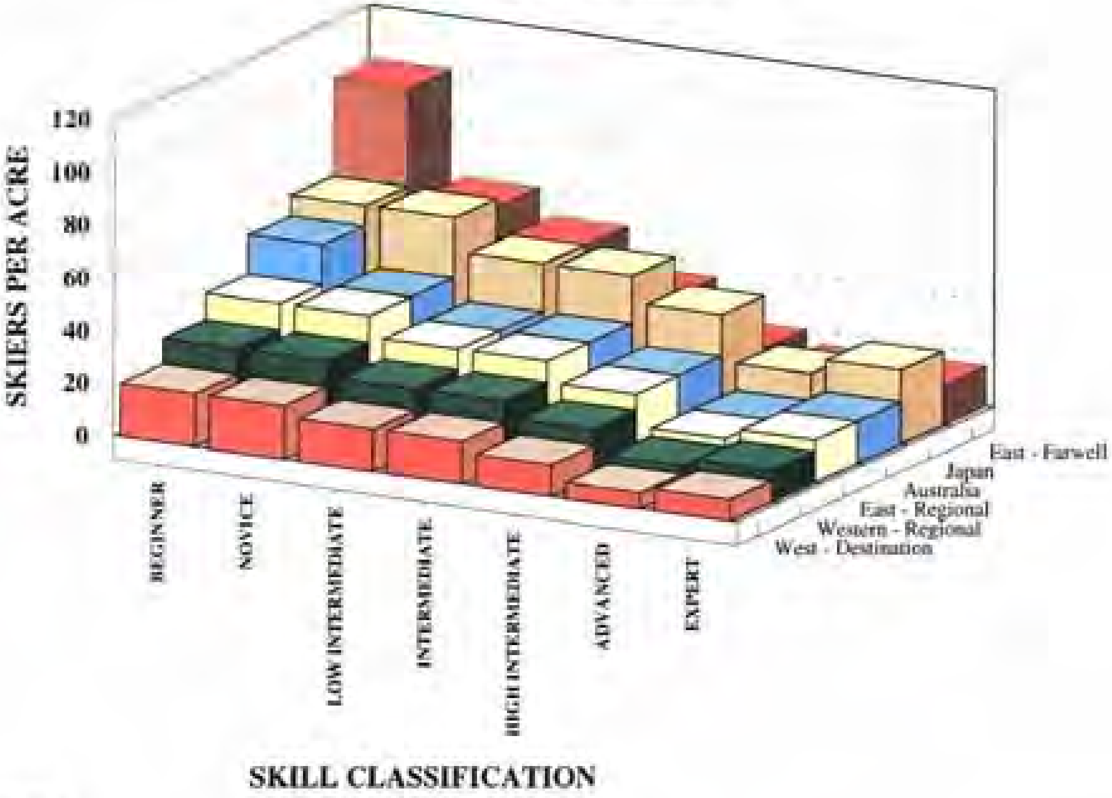


PLATE II.3

As shown in Table II.6, acceptable slope densities tend to decrease as the proficiency of the skier/snowboarder increases. The lower density for better skiers occurs due to their increased speed, and therefore longer stopping distances, and the general increase in space needed to avoid obstacles and other skiers. As listed, the exception to this rule is that slope densities increase slightly on expert terrain since these steep, ungroomed slopes dictate controlled, short radius turns. Under these conditions, expert skiers have slower speeds and require less space for safe skiing.

Listed in Table II.6 are the "SAOT" (Skiers At One Time) or "At Area" densities, which are based on the total number of skiers at the ski area, including skiers in lift queues, riding lifts, in restaurants and on the trails. "On-Slope" densities are significantly lower and take into account only those skiers/snowboarders actually on the trails at any given time. The densities shown will be used both in the evaluation of the existing and proposed trail capacities and the potential terrain carrying capacity of the additional slopes adjacent to the presently developed area. One important point to realize here is that even though all skiers pay the same rate, it is more costly for an operator to provide an expert with adequate lifts and terrain than a novice or intermediate skier. The Planning Parameters used for Panorama are listed in Table II.6.

TABLE II.6
PANORAMA MOUNTAIN VILLAGE
PLANNING PARAMETERS

Skill Classification	Skill Mix	Acceptable Terrain Gradients	Skier Demand VTM / Day	Skier Densities Skiers per Ha. At Area	On Slope
1 Beginner	5%	8 – 15%	940	50	20
2 Novice	10%	15 - 25%	2,120	50	20
3 Low Intermediate	20%	25 - 35%	2,825	40	15
4 Intermediate	30%	30 - 40%	3,770	40	15
5 High Intermediate	20%	35 - 45%	5,085	30	12
6 Advanced	10%	45 - 60%	5,935	15	7
7 Expert	5%	60% +	8,475	20	10

.7 Panorama SCC Analysis

Lift Capacity Analysis

Utilizing the high industry skier vertical demand, we have calculated the skier/snowboarder carrying capacity (SCC) of Panorama's existing lift facilities, as listed in Table II.7. Based upon this analysis, we estimate that the 1997/98 lift system can comfortably accommodate approximately 3,600 skiers per day. The capacity analysis assumes that the waiting time for a lift is equal to the ride time (wait time is double the ride time on detachable lifts) and the VTM demand on each lift is determined by the terrain balance of the trails serviced by that lift.

TABLE II.7
PANORAMA MOUNTAIN VILLAGE
SKIER/SNOWBOARDER CARRYING CAPACITY - EXISTING AREA(1997/98)

Lift No.	Lift Name	Lift Type	Hourly Capacity	Vertical Meters	VTM/Hr (000)	VTM Demand	Loading Effic.	Access Reduc.	SCC
1	First Ascent	D4C	1,992	380	757	3,399	95%	13%	**1,290**
2	Horizon	2C	994	484	481	4,967	90%	3%	**590**
3	Toby	2C	1,217	120	146	2,795	90%	25%	**250**
4	Sunbird	3C	1,700	415	705	4,097	85%	0%	**1,020**
5	Champagne	T-B	450	180	81	4,886	95%	3%	**100**
6	Summit	T-B	600	198	119	7,171	95%	0%	**100**
7	Silver Platter	P	750	61	46	1,257	80%	10%	**180**
8	Red Rider	HT	720	24	17	940	65%	11%	**70**
Total			**8,423**		**2,352**				**3,600**

.8 Ski Trail Balance Statement

To accurately portray the terrain balance of the mountain complex, we computed the terrain available to each of the seven skier skill classifications and then multiplied by the densities exhibited in Table II.6. This exercise is often referred to as "area balancing" and provides management and the planning team with the data necessary to compare the mountain trail development with the apparent proportions of the skier market.

The Trail Balance By Lift System (Table II.8 and Plate II.4) portrays the relationship between each lift and trail system, as well as the proportionate amount of terrain available to each skill level on each lift.

Overall, the lift and trail capacities at Panorama are poorly balanced, with most lift/trail systems underlifted. The terrain serviced by the First Ascent Chair is underlifted, with a trail to lift capacity ratio of 158 percent. The Horizon Chair has substantially more terrain than it requires when trails such as Dream, Stump Bowl, Draino, Extreme Dream, etc. are taken into account. The Toby Chair trails are fairly well balanced with the lift, supplying approximately 117 percent of the lift's capacity. The terrain serviced by the Sunbird Chair is slightly underlifted, with trails that are able to comfortably service 124 percent of the lift's capacity.

The Champagne T-Bar is severely underlifted when remote terrain such as Schober's Dream, Extreme Dream, etc. serviced by a combination of lifts, including Lift 5 are taken into account. The Summit T-Bar is also underlifted in terms of lift to trail capacity. The Silver Platter terrain has the potential to be over lifted by a factor of 1.6 times. Higher trail densities and overcrowding on these beginner trails can detract from the skiing experience and create safety concerns. High trail densities, and therefore, excessive use of the snow surface, tends to wear out the snow quickly and hence, requires extra time and attention when snow grooming.

TABLE II.8
PANORAMA MOUNTAIN VILLAGE
TRAIL BALANCE BY LIFT SYSTEM
EXISTING AREA - 1997/98

Lift No.	1	2	3	4	5	6	7	8	
Lift Name	First Ascent	Horizon	Toby	Sunbird	Champagne	Summit	Silver Platter	Red Rider	
Lift Type	D4C	2C	2C	3C	T-B	T-B	P	HT	
Lift Capacity	1,290	590	250	1,020	100	100	180	70	Skiers/Day
Trail Capacity	2,050	1,810	220	1,280	370	185	110	50	Skiers/Day
Trails:Lifts	159%	307%	88%	125%	370%	185%	61%	71%	
Average Density	16.1	5.6	51.1	20.4	4.5	4.5	69.6	69.3	Skiers/Hectare
Optimum Density	38.4	29.8	45.9	35.5	29.8	17.4	48.6	50.0	Skiers/Hectare
Demand VTM	3,399	4,967	2,795	4,097	4,886	7,171	1,257	940	VTM/Skier/Day
Balance									
Beginner	0%	0%	0%	0%	0%	0%	91%	100%	
Novice	7%	0%	59%	0%	0%	0%	0%	0%	
Low Intermediate	57%	0%	0%	26%	30%	0%	0%	0%	
Intermediate	24%	31%	41%	38%	7%	0%	5%	0%	
High Intermediate	5%	46%	0%	30%	34%	0%	5%	0%	
Advanced	5%	20%	0%	5%	18%	51%	0%	0%	
Expert	2%	4%	0%	2%	12%	49%	0%	0%	
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	

PANORAMA MOUNTAIN VILLAGE
LIFT VERSUS TRAIL CAPACITY
EXISTING AREA 1997/98

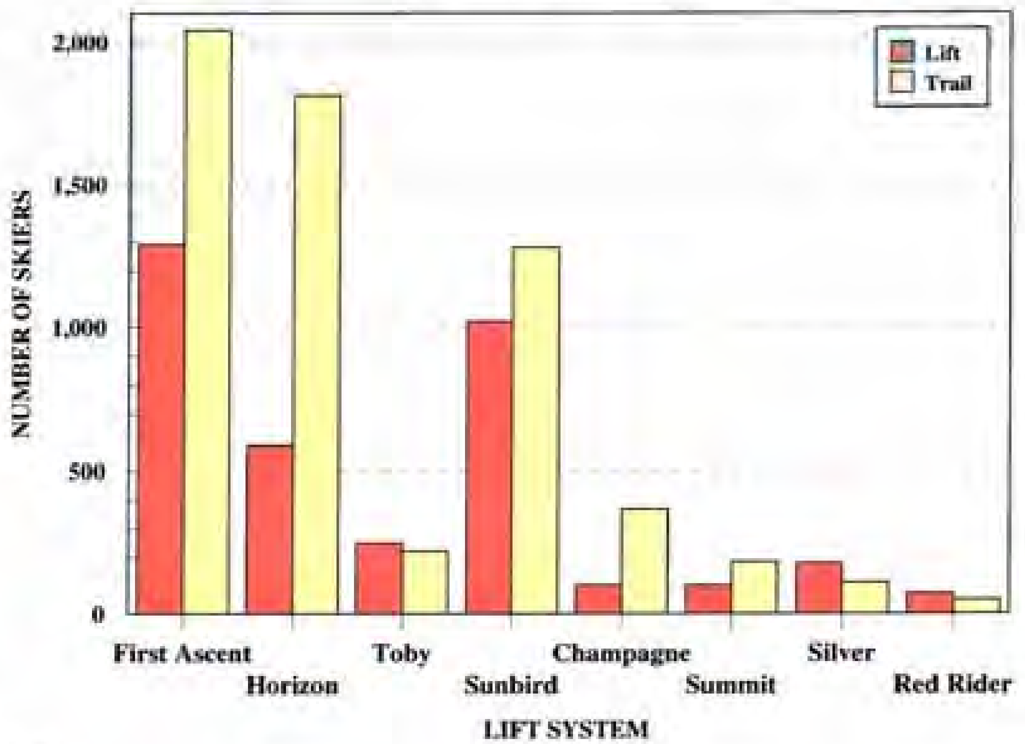


PLATE II.4

Low trail densities result in a better quality experience, but also result in higher operational costs for grooming, snowmaking, patrolling, etc. The majority of the Panorama trails and lift systems have lower densities compared to the industry standards due to underlifting. During the master planning design, increased lift capacity will provide the optimal density on these currently underlifted trails.

The Cumulative Ski Trail Balance Statement for the existing area, as of the 1997/98 season, is listed in Table II.9. Plate II.5 indicates that the presently developed terrain at Panorama, when compared to the apparent skill distribution of the market, is somewhat unbalanced. The advanced terrain provides the desired capacity for the skier/snowboarder market. Panorama has an excess of low intermediate, intermediate and high intermediate terrain, and a large shortage of terrain in the beginner and novice skill classes. There is only a slight shortage of expert terrain. The overall beginner and novice trails (green circle) service approximately 7.3 percent of skier market, compared to an ideal of 15 percent. The green circle trails, therefore, only service half of the market within this skill classification. The intermediate skill classes which are denoted by the blue square trails, supply terrain for 77.9 percent of the market, as compared to the ideal of 70 percent. The advanced and expert terrain service approximately 14.7 percent of the market, compared to the ideal of 15 percent.

TABLE II.9
PANORAMA MOUNTAIN VILLAGE
CUMULATIVE TRAIL BALANCE STATEMENT

Lift SCC = 3,600

Skill Classification		**Hectares**	**Skiers**	**Balance**	**Ideal**
1	Beginner	3.1	150	2.4%	5%
2	Novice	5.4	270	4.4%	10%
3	Low Intermediate	40.0	1,605	26.2%	20%
4	Intermediate	44.6	1,650	26.9%	30%
5	High Intermediate	80.3	1,505	24.6%	20%
6	Advanced	73.7	685	11.2%	10%
7	Expert	43.2	260	4.2%	5%
	TOTALS	**290.3**	**6,125**	**100%**	**100%**

Average Density = 12.4 Skiers/Hectare
Optimum Density = 34.6 Skiers/Hectare
Weighted Demand = 4,145 VTM/Skier/Day

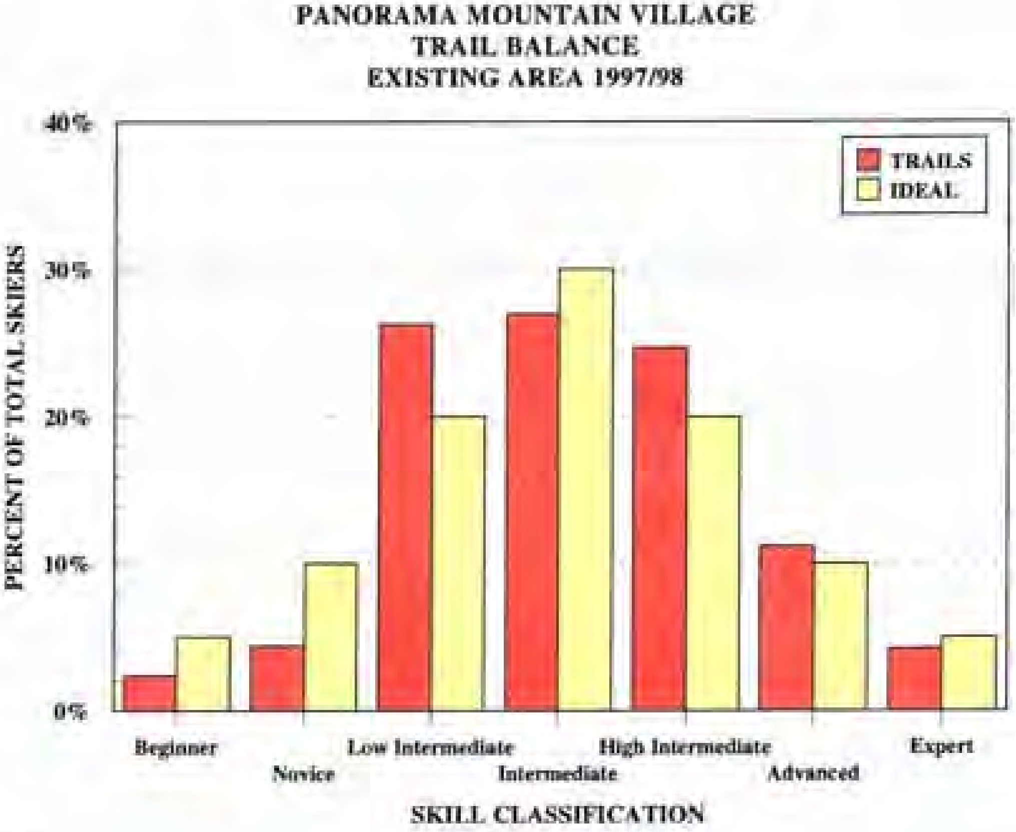


PLATE II.5

.9 Mountain Staging and Circulation

The efficient staging of skiers/snowboarders is a complex operation which requires sufficient facilities both on and off the mountain to allow visitors to park, dine, buy tickets, rent equipment and other necessities, and subsequently be distributed throughout the mountain's lift and trail systems. Large mountain complexes inevitably require several staging areas to handle peak traffic flows during the morning and afternoon staging periods. Staging to the ski/snowboard area is somewhat analogous to pipelines (lifts) pumping (skiers) up the mountain to fill reservoirs (lift and trail systems).

The Panorama staging system is quite linear, with one staging portal and one main transport route up the front side of the mountain. Lift 1, the First Ascent Detachable Quadruple Chairlift, provides the main staging route to all other lifts (except the beginner lifts in the base area). With a rated capacity of 1,992 pph and an effective capacity of 1,892 pph (taking into account loading and operational inefficiencies), Lift 1 will be able to stage 4,731 skiers to the upper mountain, and Sunbird terrain, in an industry accepted 2.5 hour morning staging period. Lift 3, the Toby chair, can act as a second route to the Sunbird terrain and the upper mountain (via the Sunbird Chair) if the detachable cannot operate for any reason.

.10 Snowmaking

Panorama has a very sophisticated high pressure air/water snowmaking system with a computerized monitoring and control system. The system has a total of 237 hydrants spaced at 45 meter (150 foot) intervals. Panorama owns a total of 69 snow guns, comprised of 20 Alberg Jets, 10 Omichron Whisperguns, 9 Double Omichron Whisperguns mounted on towers and 30 McKinney type tower mounted guns. The compressor station is located in the base area adjacent to Toby Creek. Snowmaking water is taken directly from Toby Creek. On average, the system operates 1,255 hours per season using 185 million litres (49 million U.S. gallons) of water to produce 318,600 cubic meters (258 acre feet) of snow. Panorama has a water license for the use of 5 cubic feet per second, which at 1,255 hours would amount to a potential of 515 acre feet of snow. A total of 13 staff are required to operate the system. The snowmade trail inventory is listed in Table II.10.

The snowmaking system covers 69.31 hectares of ski trails which can accommodate 2,690 skiers at one time. The Cumulative Ski Trail Balance Statement for the trails serviced by snowmaking during the 1997/98 season, is listed in Table II.10 and illustrated in Plate II.6. The snowmade ski terrain at Panorama, when compared to the apparent skill distribution of the skier market, is unbalanced, with large excesses of terrain in the low intermediate and high intermediate skill classes and significant shortages in the intermediate, advanced and expert skill classes. Figure 6 illustrates the Existing Snowmaking Plan at Panorama.

TABLE II.10
PANORAMA MOUNTAIN VILLAGE
SNOWMADE TRAIL INVENTORY - 1997/98

Trail Name	Trail No.	Skill Class	Elevation		Total Vert. m.	Horz. Vert. m.	Slope Dist. m.	Percent Slope		Avg. Width m.	Horz. Area m.	Slope Area ha.	Skiers At Area	
			Top m.	Bottom m.				Avg.	Steep.				Density	Total
Lift 1														
Powder Trail	1A	4	1,515	1,250	265	980	1,015	27%	42%	54	5.30	5.49	40	220
Horseshoe	1B	3	1,563	1,183	380	1,535	1,581	25%	37%	62	9.56	9.85	40	395
Showoff	1C	3	1,525	1,190	335	1,260	1,304	27%	37%	55	6.90	7.14	40	285
	1D	3	1,563	1,490	73	215	227	34%	40%	49	1.05	1.11	40	45
Old Timer	1E	3	1,563	1,183	380	1,475	1,523	26%	36%	53	7.86	8.12	40	325
Total Lift 1	5						5,651					31.71		1,270
Lift 2														
Skyline	2D	4	2,040	1,556	484	1,370	1,453	35%	45%	50	6.85	7.26	40	290
Rollercoaster	2E	5	2,040	1,600	440	1,250	1,325	35%	47%	64	7.97	8.45	30	255
Total Lift 2	2						2,778					15.71		545
Lift 3														
New Timer	3A	4	1,273	1,153	120	515	529	23%	44%	33	1.71	1.76	40	70
Eagle Glide	3B	2	1,273	1,178	95	375	387	25%	30%	34	1.28	1.32	50	65
Workshop	3C	4	1,270	1,215	55	220	227	25%	44%	21	0.46	0.48	40	20
Hoggsflats	3D	2	1,273	1,172	101	430	442	23%	30%	30	1.29	1.33	50	65
Total Lift 3	4						1,584					4.89		220
Lift 4														
Fritz's/Chicken's Choice	4A	4	1,596	1,181	415	1,535	1,590	27%	41%	36	5.58	5.78	40	230
Whiskey Jack	4B	3	1,475	1,300	175	540	568	32%	40%	43	2.32	2.44	40	100
Little Dipper	4E	5	1,565	1,270	295	880	928	34%	46%	36	3.16	3.33	30	100
Lower Fritz's	4H	6	1,275	1,190	85	180	199	47%	51%	54	0.98	1.08	15	15
Total Lift 4	4						3,285					12.63		445
Lift 7														
Beginner	7A	1	1,223	1,162	61	495	499	12%	13%	41	2.03	2.05	50	100
Total Lift 7	1						499					2.05		100
Lift 8														
Hwy 1	8A	1	1,209	1,185	24	180	182	13%	13%	56	1.00	1.01	50	50
Total Lift 8	1						182					1.01		50
Total All Trails	17						14.0 km					68.0 Ha		2,630

TABLE II.11
PANORAMA MOUNTAIN VILLAGE
SNOWMADE SKI TRAIL BALANCE
1997/98

Skill Classification	Hectares	Skiers	Balance	Ideal
1 Beginner	3.1	150	5.7%	5%
2 Novice	2.7	130	4.9%	10%
3 Low Intermediate	28.7	1,150	43.7%	20%
4 Intermediate	20.8	830	31.6%	30%
5 High Intermediate	11.8	355	13.5%	20%
6 Advanced	1.1	15	0.6%	10%
7 Expert	0.0	0	0.0%	5%
TOTALS	**68.0**	**2,630**	**100%**	**100%**

Optimum Density =	39.6 Skiers/Hectare
Weighted Demand =	3,304 VTM/Skier/Day

PANORAMA MOUNTAIN VILLAGE
TRAIL BALANCE - SNOWMAKING
EXISTING AREA 1997/98

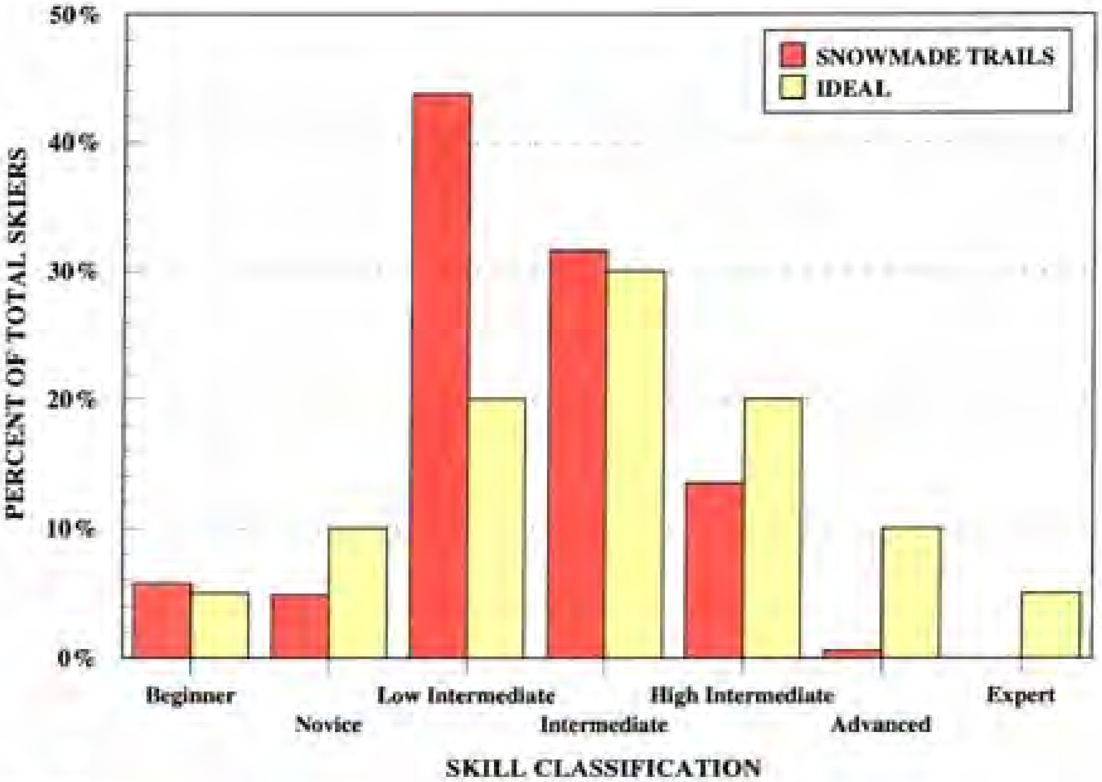


PLATE II.6

.11 Snow Grooming Equipment

Machine grooming (snowfarming) of trails is an essential component of mountain operations, with new grooming techniques revolutionizing many aspects of today's winter resort business. Present industry guidelines recommend the grooming of all trails with beginner to high intermediate skill classifications. Swing, or night shift grooming has become the rule in the industry, as it allows a longer period for groomed trails to cure (set up) while eliminating hazardous conflicts between skiers and machines. An effective summer grooming program (seeding and mulching) can save appreciable wear and tear on expensive snow grooming equipment, as well as produce earlier opening dates and lower snowmaking costs. Modern snow grooming machines come with many features, and a selection of implements are available for optimizing the quality of grooming and the time required to groom the slopes. Quick change hydraulic couplings and attachment fasteners have reduced the time and manpower required to change implements, allowing the groomer to use the right implement for the job, even in changing snow conditions during a single shift.

Grooming requirements change over time due to climatic conditions and the extent of skier/snowboarder traffic on the trail, therefore, a good selection of grooming implements, such as all-way blades, power tillers, compactor bars and powder makers are necessary to increase the efficiency of the grooming fleet and provide skiers with an ideal snow surface every day.

During the 1997/98 ski season, Panorama operated a total of five grooming machines. One of these machines is equipped with a winch for grooming steep slopes. The grooming machine inventory, as of June 1998, is listed in Table II.12.

TABLE II.12
PANORAMA MOUNTAIN VILLAGE
GROOMING EQUIPMENT INVENTORY

Machine Number	Make	Model	Year	Hours Operated	Equipment	Machine Equivalent
1	Bombardier	BR 400	1992	8,835	Tiller	1.20
2	Bombardier	BR 400	1995	5,859	Tiller, C-Bar	1.20
3	Bombardier	BR 400	1995	5,899	Tiller	1.20
4	Bombardier	BR 400	1989	5,980	Tiller, Winch	0.25
5	Kassbohrer	PB 280	1997	1,557	Tiller, C-Bar	1.20
Fleet Average				**5,626**		**1.01**
Total						**5.05**

Source: Panorama Mountain Village - June 1998

Due to the fact that grooming machines have different horsepower ratings and grooming widths, they are capable of covering different amounts of terrain on an hourly basis. We have set a standard of one machine equivalent to the LMC 3700 C, or a Pisten Bully 200. Groomers with less power, such as the Pisten Bully 170, have a machine equivalent rating of 0.9. Grooming machines with more power, such as the BR400+ or the Pisten Bully 240, have machine equivalents of 1.2. Winch cats are very good for grooming steep slopes, however, their hourly capacity is very low due to the nature of their work. Additionally, many times they also require a "tail hold" machine as an anchor. For this reason, we have rated the winch cat at 0.25 machine equivalent.

It is recommended that one fully operable grooming machine, at one machine equivalent, be available each nightly shift for every 20 hectares of groomable terrain in skill classes 1 through 5. Terrain in skill classes 6 and 7 are not included as groomed terrain. Additionally, gladed terrain and terrain in Stump Bowl and Hopeful Sun Bowl are considered non-groomable trails.

Groomable Terrain Skill Classes 1-5	/	20 Hectares Machine	/	Availability	=	Machine Equivalents Required
164.6	/	20	/	90%	=	7.4 Machine Equivalents

Based on this calculation, Panorama is short 2.4 machines to adequately groom the terrain in skill classes 1 to 5.

The total number of skiers/snowboarders serviced by the present grooming fleet can be calculated as follows, assuming 90 percent availability and single shifting.

No. of Machines	X	Avg. Machine Equivalent	X	Availability	X	20 Hectares	X	Skill Classes 1-5 Density	+	Non-Groomed Trails	=	Total Skiers Serviced
5	X	1.01	X	90%	X	20	X	34.6	+	945	=	4,090

It is recommended that as snow grooming machines approach the 6,000 hour mark, they are traded-in, so that the average age of the fleet is below the 3,000 hour level. Panorama has one machine that has far exceeded this threshold, and an additional three machines which may soon fit into this trade-in category. The average fleet operating time per machine is 5,626 hours.

.12 Building Inventory and Analysis

A detailed inventory of the buildings and structures presently in use at Panorama was performed by Ecosign staff in conjunction with Panorama personnel. This inventory was updated in the spring of 1998. Table II.13 lists the floor area by skier service function for the Ski Tip Daylodge, the Tamarack, the Pine Inn and the Toby Creek Lodge. These primary skier service buildings have been estimated to include approximately 2,754 square meters of indoor guest service space excluding storage/mechanical and circulation walls and waste.

TABLE II.13
PANORAMA MOUNTAIN VILLAGE
EXISTING BUILDING INVENTORY
1997/98

Staging Facilities	**Ski Tip Daylodge (Sq.M.)**	**Tamarack (Sq.M.)**	**Ski Patrol (Sq.M.)**	**Admin. Bldg. (Sq.M.)**	**Staff Room (Sq.M.)**	**Resort Admin. (Sq.M.)**	**Pine Inn (Sq.M.)**	**Toby Creek Lodge (Sq.M.)**	**Total (Sq.M.)**
Ticket Sales	24	-	-	-	-	-	-	-	24
Public Lockers	30	79	-	-	-	-	-	-	109
Equipment Rental & Repair	278	-	-	-	-	-	-	-	278
Ski School	32	-	-	32	-	-	-	-	64
Nursery/ Daycare	-	-	-	-	-	100	-	-	100
Retail Sales	-	201	-	-	-	-	-	192	393
Sub Total	**365**	**280**	**-**	**32**	**-**	**100**	**-**	**192**	**969**
Commercial Facilities									
Food Service Seating	326	-	-	-	-	-	458	94	877
Kitchen & Food Storage	206	-	-	-	-	-	234	41	481
Rest Rooms	77	-	-	-	-	-	87	17	181
Sub Total	**609**	**-**	**-**	**-**	**-**	**-**	**778**	**152**	**1,538**
Operational Facilities									
Administration	-	-	-	94	-	-	-	-	94
Employee Lockers	-	-	-	-	64	-	-	-	64
First Aid & Ski Patrol	-	-	89	-	-	-	-	-	89
Sub Total	**-**	**-**	**89**	**94**	**64**	**-**	**-**	**-**	**247**
Storage/ Mechanical	-	-	-	-	-	-	-	63	63
Circulation/ Walls/ Waste	261	-	-	-	-	-	-	-	261
Grand Total	**1,234**	**280**	**89**	**126**	**64**	**100**	**778**	**407**	**3,078**
Day Skier Food Service Seats	350	-	-	-	-	-	285	90	725

In 1977, the United States Forest Service (U.S.F.S.) performed a detailed inventory of skier service facilities at western United States resorts. This inventory was tabulated and broken down into 15 skier service functions. Further to this, Ecosign has since updated this data base using the U.S.F.S. format to provide floorspace areas of Canadian, American, European and Japanese resorts. Based upon this extensive data base, we have calculated our recommended floorspace for the different skier service functions and compared these with Panorama's present 1997/98 season facilities. Table II.14 illustrates this comparison.

Based on the Skier Carrying Capacity of 3,600 skiers, our analysis reveals that Panorama's facilities average 0.78 square meters per unit of comfortable capacity or 84 percent of Ecosign's recommended design standard before storage/mechanical and circulation walls and waste are accounted for. If the total built space were utilized based on Ecosign's recommendations, Panorama's present facilities would be able to comfortably accommodate 3,047 skiers per day.

During the top ten days of the 1997/98 ski season, Panorama averaged 2,530 skiers per day. Based on this level of utilization, Panorama's built space supplied

1.11 of the floorspace per skier of 120 percent of Ecosign's recommended design standards. It appears that Panorama's skier service facilities are somewhat undersized for the Carrying capacity of the lift system but more than adequate for the average top ten days. As summarized in Table II. 14 and illustrated in Plate II.7, Panorama is short in ticket sales, public lockers and ski patrol. Because the resort has a high percentage of guests staying in the overnight accommodation, the shortage in ticket sales space is not so critical, as many of these guest are skiing on multi-day tickets and hence, do not need to visit the ticket window daily. Additionally, these overnight guests also do not need locker space the way day guests would, as they store most of their equipment in their hotel or condominium and can easily return to their accommodation should they require something.

The food service has a total of 725 seats available for those guests using the slopes. Based on three turns per seat, this seating can service 2,175 guest which is slightly less than the average of the top ten days.

TABLE II.14
PANORAMA MOUNTAIN VILLAGE
SPACE USE ANALYSIS
TOP TEN DAYS 1997/98

Skier Zone	**Recommended Sq. Meters Per Skier**	**Village Base**		
		Existing (Sq.M.)	Required (Sq.M.)	Percent Required
Staging Facilities	**Skiers Staged= 2,530**			
Ticket Sales	0.014	24	35	69%
Public Lockers	0.075	109	190	57%
Equipment Rental & Repair	0.100	278	253	110%
Ski School	0.026	64	66	97%
Nursery/ Daycare	0.050	100	127	79%
Retail Sales	0.041	393	104	379%
Sub Total	**0.306**	**969**	**774**	**125%**
Commercial Facilities	**Top 10 Days= 2,530**			
Food Service Seating *	0.370	877	936	94%
Kitchen & Food Storage	0.139	481	352	137%
Rest Rooms	0.069	181	175	104%
Sub Total	**0.578**	**1,538**	**1,462**	**105%**
Operational Facilities	**100% Of Total = 2,530**			
Administration	0.028	94	71	132%
Employee Lockers	0.030	64	76	84%
First Aid & Ski Patrol	0.058	89	145	61%
Sub Total	**0.116**	**247**	**292**	**84%**
Grand Total	**0.999**	**2,754**	**2,528**	**109%**

* *Note: Village commercial restaurants may double as food service seating during skiing hours.*

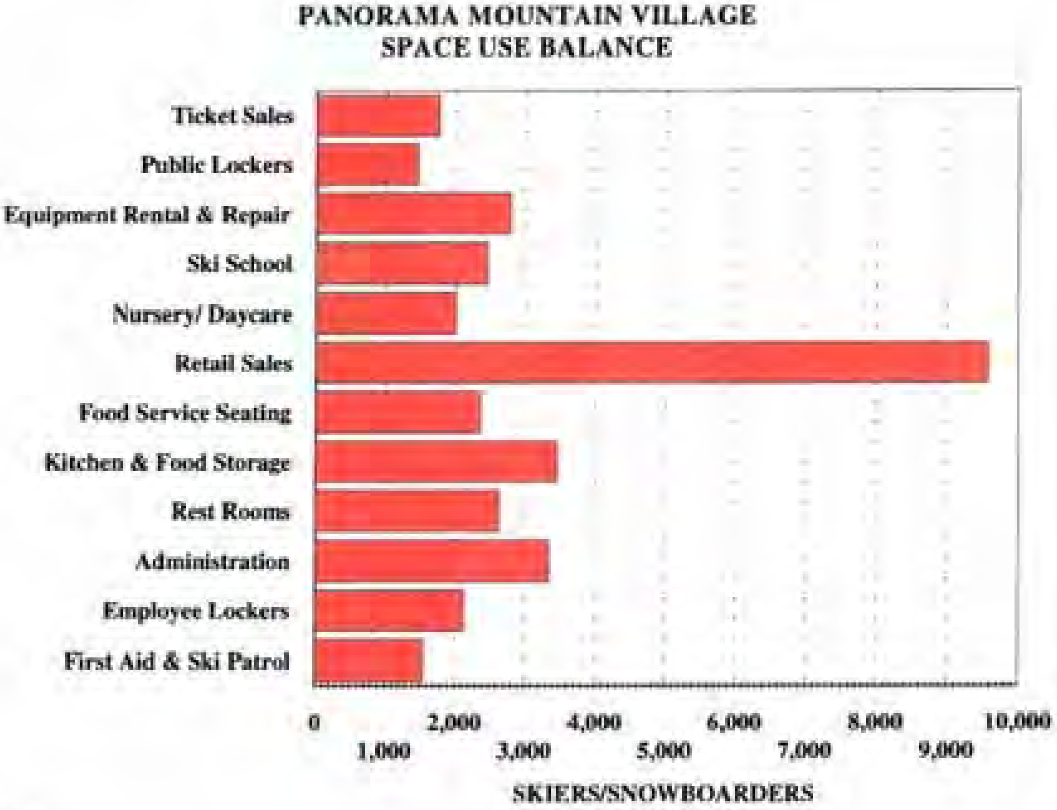


PLATE II.7

.13 Parking and Accommodation

Accommodation

When evaluating the base area's capacity to stage skiers/snowboarders on to the mountain (by either accommodating visitors on site or parking them in day lots), it is important to realize that not all resort visitors will be skiers and some skiers may not ski every day that they are at the resort. Therefore, when calculating the skier yield from the resort's bed base, it is important to factor in accommodation requirements for non-skiers, as well as skiers. Our research has found that there are two factors which affect skier yields from a resort's bed base; pillow utilization and percent of overnight guests that are skiers. Although every unit in a resort may be occupied, not all of the pillows will be utilized. This is a result of units being occupied by less than their potential capacity. We have estimated that the Panorama public beds will have a 70 percent utilization rate and private beds will have a 50 percent utilization rate.

Additionally, some non-skiers will occupy beds that otherwise would accommodate skiers and some skiers may elect not to ski every day. We estimate that on peak days, public beds that are occupied will have 95 percent of the occupants as skiers on any given day and that private occupied beds will be made up of 90 percent skiers, on any given day.

To calculate the skier yield from Panorama's bed base, Panorama supplied Ecosign with a bed base inventory of the developed real estate parcels, as listed in Table II.15. Panorama currently has 765 public bed units located in the Ski Tip Lodge, Tamarack Lodge, Pine Inn, Horsethief Lodge and Toby Creek Lodge. Panorama has an additional 936 private beds located in the Hearth Stone Lodge, Horsethief Lodge, Toby Creek Lodge and in single family chalets.

TABLE II.15
PANORAMA MOUNTAIN VILLAGE
BED BASE INVENTORY
1997/98

Parcel	**Public Units**	**B.U.s/ Unit**	**Public B.U.s**	**Private Units**	**B.U.s/ Unit**	**Private B.U.s**	**Guests**	**Skiers**
Hearth Stone								
0 - 55 sq.m.	0	2	0	0	2	0	0	**0**
55 - 100 sq.m.	0	3	0	6	3	18	9	**8**
100 sq.m. +	0	4	0	22	4	88	44	**40**
Ski Tip Lodge - 1998								
0 - 55 sq.m.	27	2	54	0	2	0	38	**36**
55 - 100 sq.m.	6	3	18	0	3	0	13	**12**
100 sq.m. +	0	4	0	0	4	0	0	**0**
Tamarack Lodge - 1998								
0 - 55 sq.m.	40	2	80	0	2	0	56	**53**
55 - 100 sq.m.	6	3	18	0	3	0	13	**12**
100 sq.m. +	0	4	0	0	4	0	0	**0**
Pine Inn & Annex 1982 - 1985								
0 - 55 sq.m.	107	2	214	0	2	0	150	**142**
55 - 100 sq.m.	0	3	0	0	3	0	0	**0**
100 sq.m. +	0	4	0	0	4	0	0	**0**
Horsethief Lodge - 1980								
0 - 55 sq.m.	27	2	54	23	2	46	61	**57**
55 - 100 sq.m.	41	3	123	68	3	204	188	**174**
100 sq.m. +	15	4	60	22	4	88	86	**80**
Toby Creek Lodge - 1979								
0 - 55 sq.m.	0	2	0	0	2	0	0	**0**
55 - 100 sq.m.	48	3	144	10	3	30	116	**109**
100 sq.m. +	0	4	0	0	4	0	0	**0**
Single Family Lots - 1978								
	0	6	0	77	6	462	231	**208**
Total Existing	**317**		**765**	**228**		**936**	**1,004**	**930**

Assumptions	Public Beds	Private Beds
Pillow Utilization	70%	50%
Percent Skiers	95%	90%

Parking

An inventory of Panorama's existing parking lots is presented in Table II.16. Our parking analysis assumes an average occupancy of 2.8 skiers per car. We have also made allocations for employee and overnight accommodation. Panorama has inventoried a total of 640 stalls which can accommodate 1,792 skiers.

TABLE II.16
PANORAMA MOUNTAIN VILLAGE
PARKING INVENTORY
1997/98

Lot	Car Stalls	Skiers Parked
Main Admin Lot	**250**	700
Building D	**50**	140
Building C	**40**	112
Ski Tip	**40**	112
Horsethief North	**60**	168
Club House	**150**	420
Discovery Center	**50**	140
Total	**640**	**1,792**

TABLE II.17
PANORAMA MOUNTAIN VILLAGE
BASE AREA CAPACITY

Day Skiers	1,792
Overnight Skiers	1,012
Total Skiers	**2,804**
Percent Day Skiers	64%
Percent Overnight Skiers	36%

.14 Area Facilities Balance

Throughout the previous sections, we have inventoried all of Panorama's existing facilities and subsequently analyzed the daily capacity of the following operational elements: lifts, trails, grooming equipment, buildings, food service, accommodation and parking.

We have prepared a graphic representation of Panorama's overall area balance in Plate II.8, which portrays an area that is fairly well balanced.

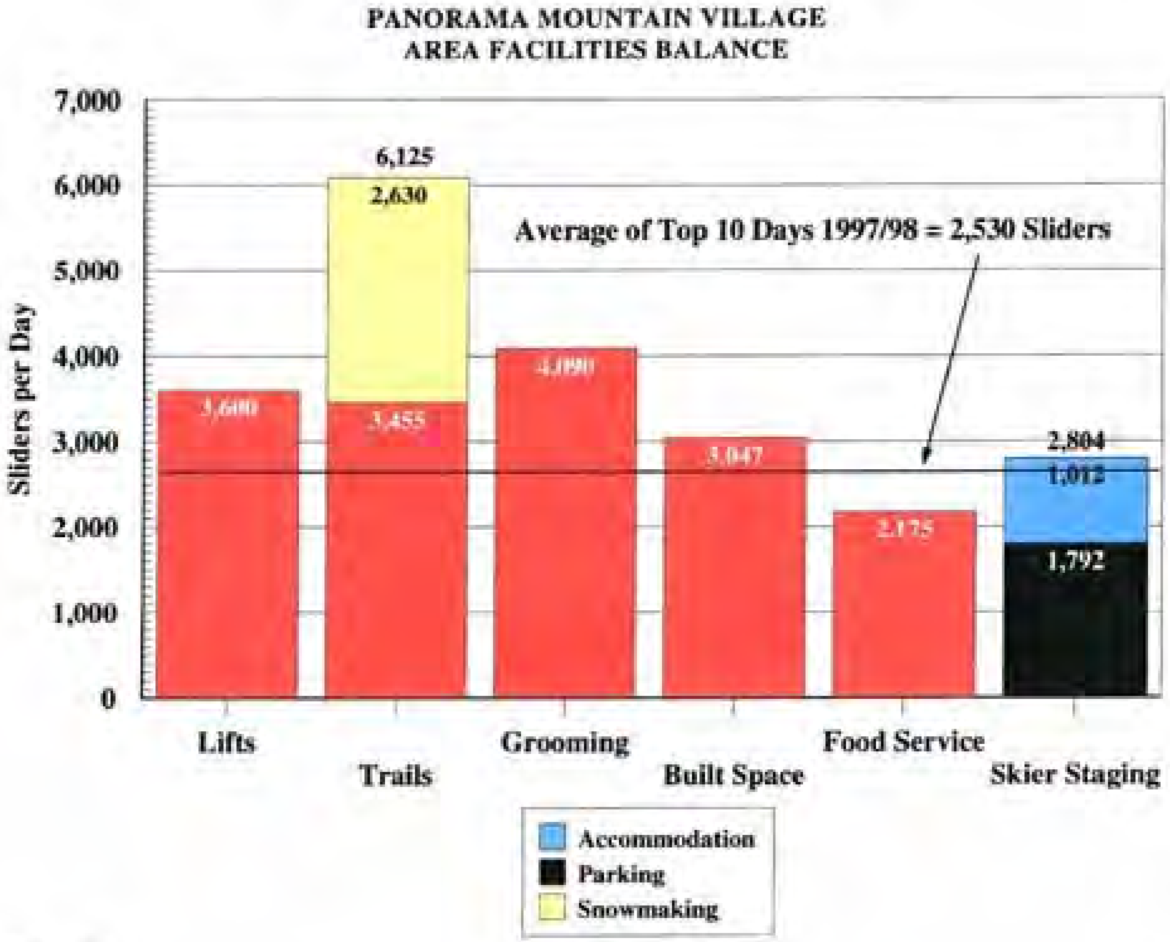
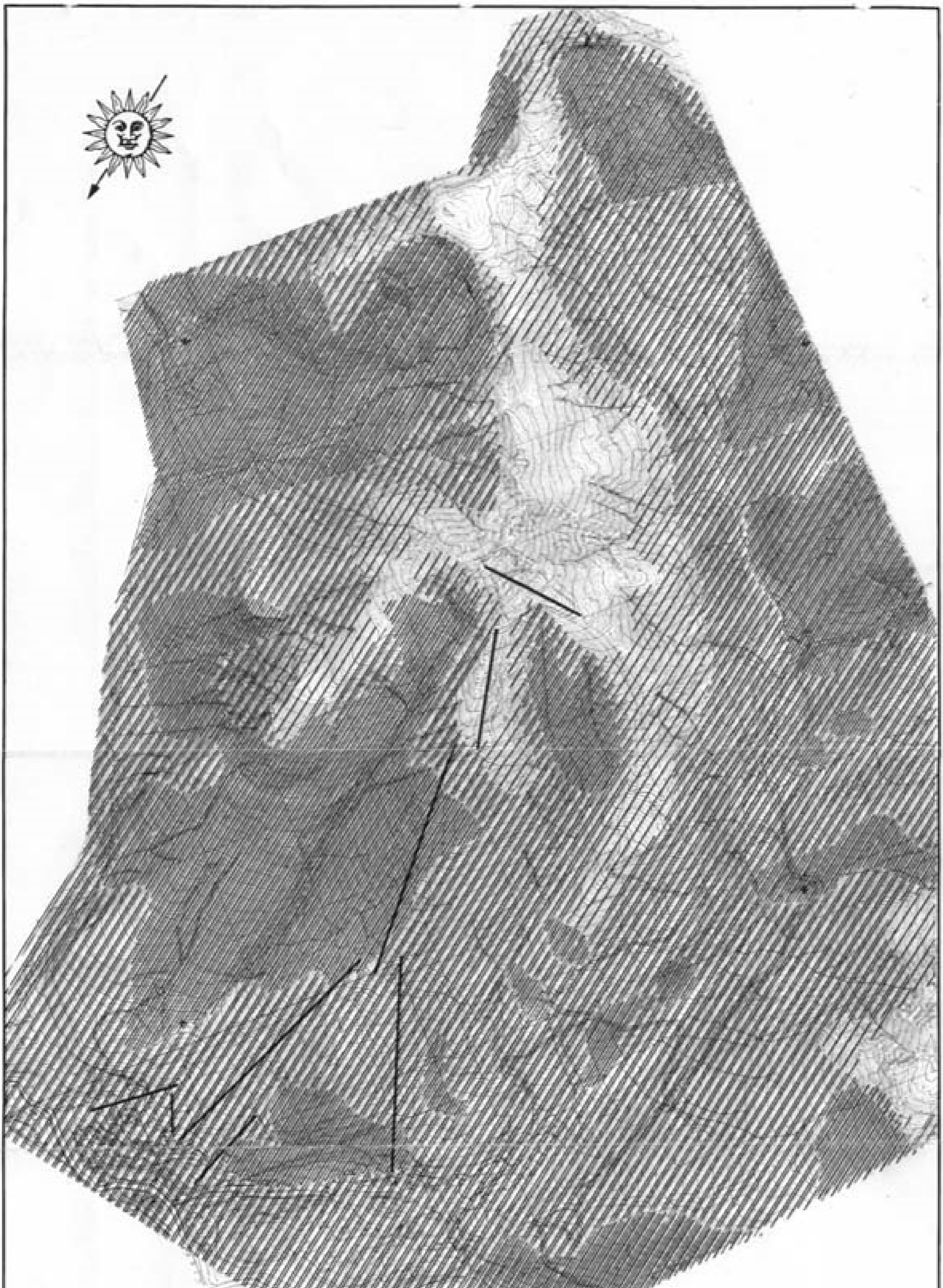


PLATE II.8

Lift capacity (3,600 sliders) exceeds the average top ten skier visitation days (2,530) by 42 percent. Trail capacity (6,125 sliders) exceeds the lift capacity by 70 percent. Grooming capacity (4,090 sliders) is somewhat lower than the trail capacity but well balanced with the lift capacity. Built space can accommodate 3,047 guests which exceeds the average top ten days and is slightly lower than the lift capacity. Food service seating, in terms of the actual number of seats, is capable of accommodating 2,175 skiers and snowboarders. The food service seating is slightly short in capacity when compared to the average of the top ten days and substantially short in capacity when compared to the carrying capacity of the lift system. The combined capacity of parking (1,792) and accommodation facilities (1,012) is normally the most critical limiting factor, in that it limits the number of skiers that can use the resort at one time. Based on this capacity, it is not unreasonable to expect peak skier visitation days not to exceed 2,900 skiers and snowboarders unless additional parking is found or accommodation constructed.

REGIONAL CONTEXT



LEGEND

Solar Shading

December 22	▨
January 22	▨
February 23	▨
Existing Lifts	▬

December 22 @ 10:00h.
Sun's Azimuth: 142.6°
Sun's Altitude: 7.7°

SOLAR ANALYSIS / 10:00 am.
MOUNTAIN STANDARD TIME

PANORAMA
Mountain Village
ecosign

3a

LEGEND

Solar Shading

December 22............................ ▨
January 22.............................. ▨
February 23............................. ▨
Existing Lifts .... ▬

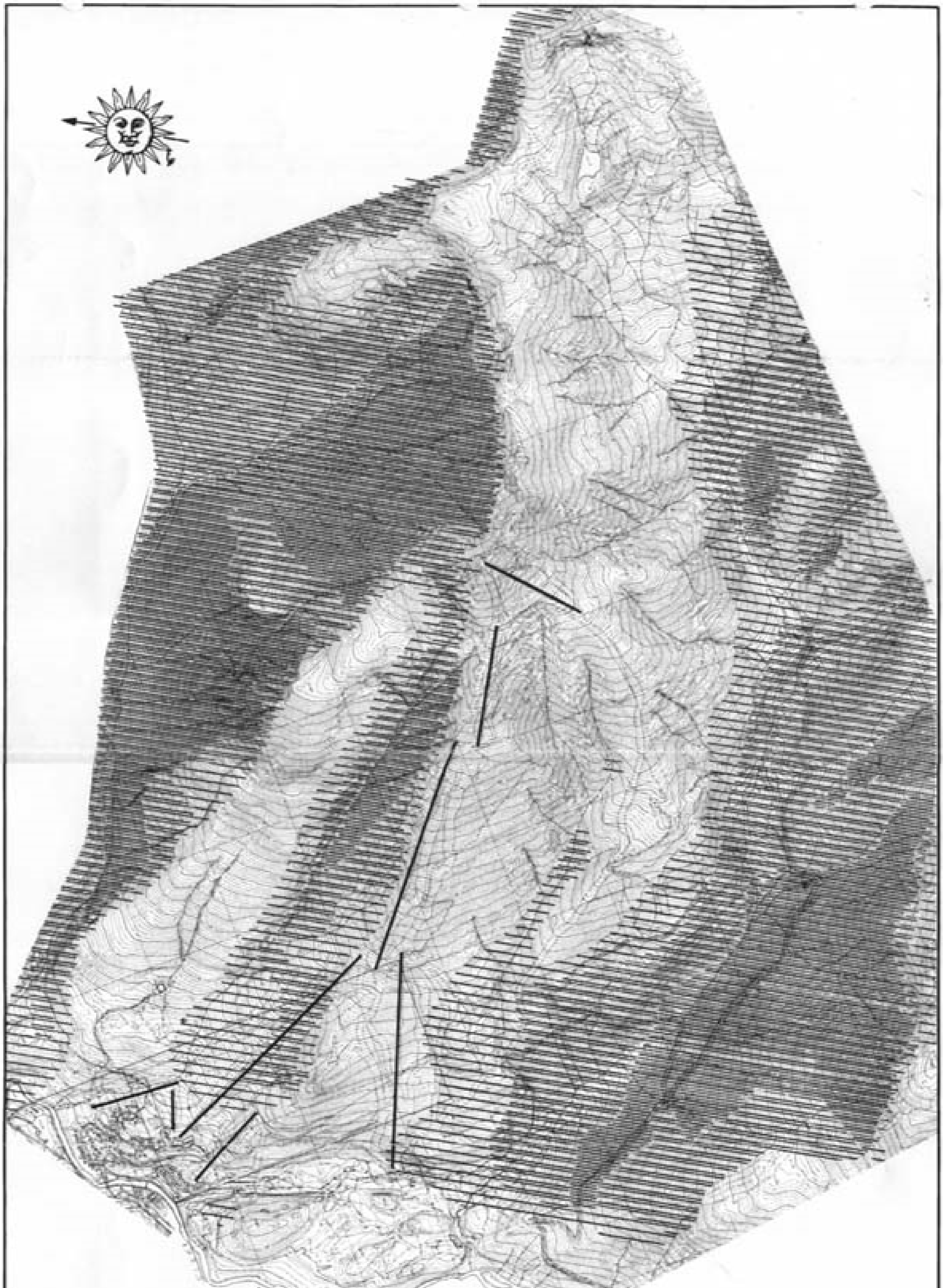
December 22 @ 12:00h.
Sun's Azimuth: 169.5°
Sun's Altitude: 15.4°

SOLAR ANALYSIS / 12:00
MOUNTAIN STANDARD TIME

PANORAMA
Mountain Village

ecosign

3b



LEGEND

Solar Shading

December 22	▨
January 22	▨
February 23	▨
Existing Lifts	▬

December 22 @ 15:00h.
Sun's Azimuth: 211.4°
Sun's Altitude: 10.2°

SOLAR ANALYSIS / 3:00 pm.

MOUNTAIN STANDARD TIME

PANORAMA
Mountain Village
ecosign

3c

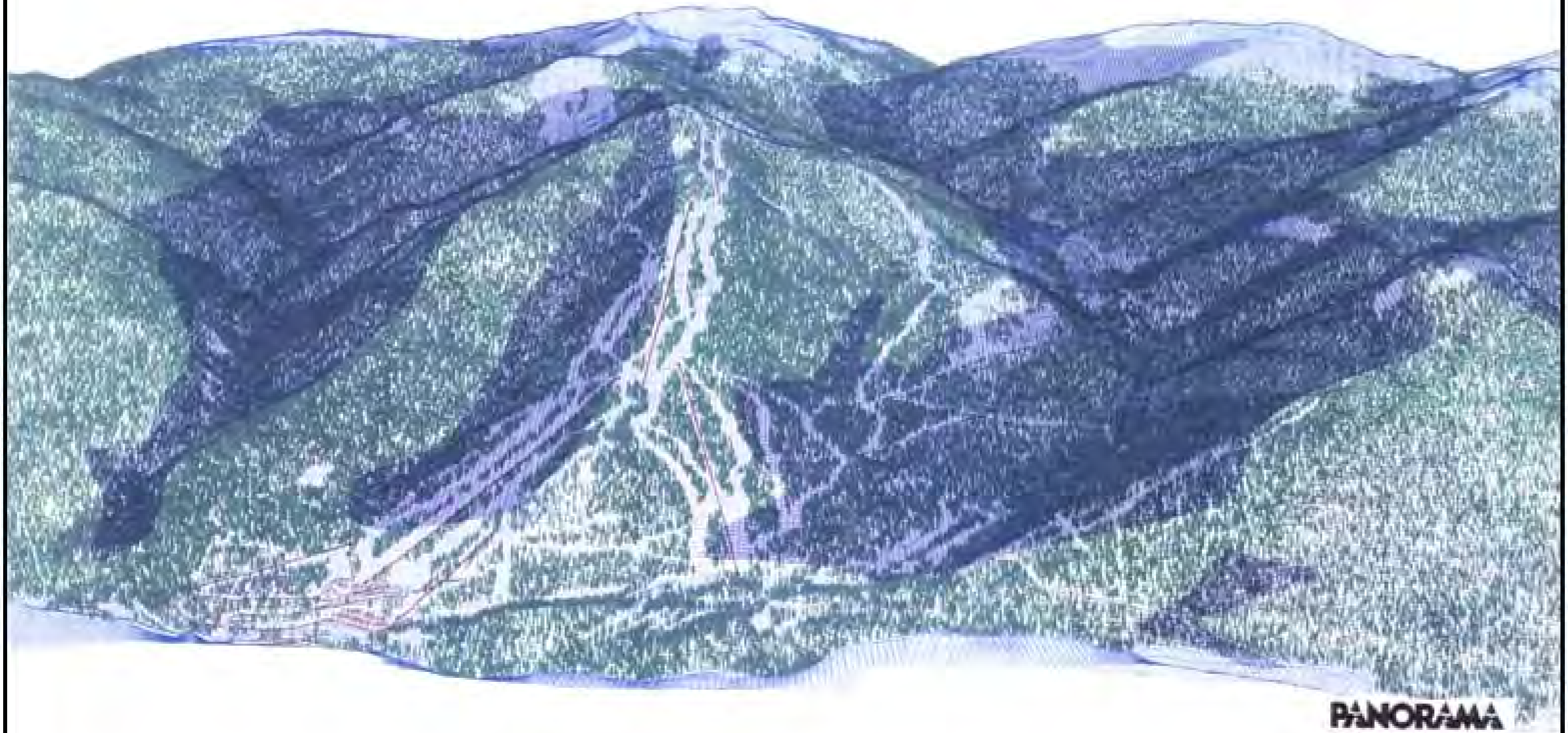
PANORAMA

Mountain Village

TERRAIN MODEL: Southeast View
Centerline Azimuth: 125

SOLAR ANALYSIS / 12/22/10:00 am.

SKIPLAN ecosign



SOLAR ANALYSIS / 12/22/3:00 pm.

PANORAMA

Mountain Village

TERRAIN MODEL: Southeast View
Centerline Azimuth: 125°
10/1995

SKIPLAN® ecosign

3e

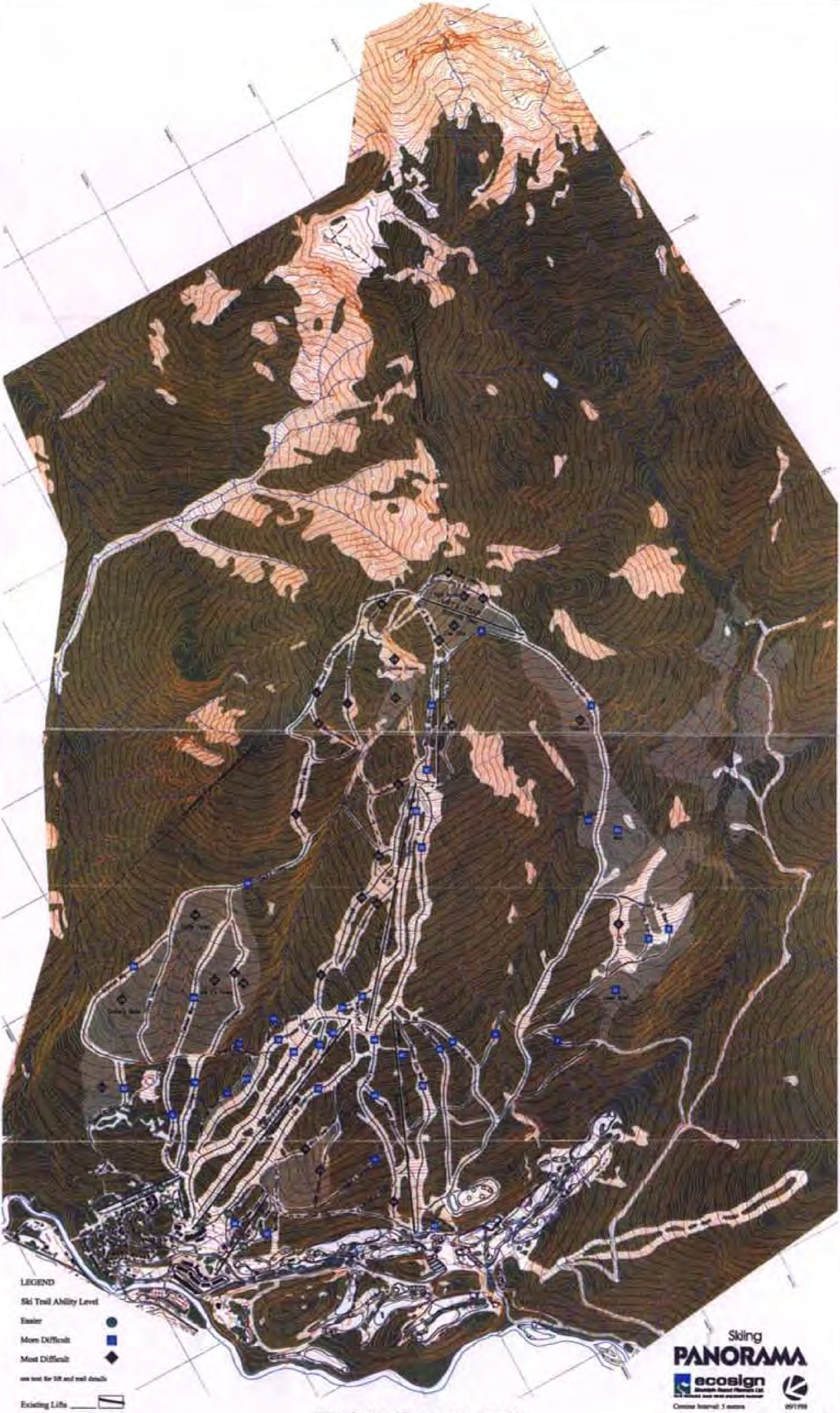
PANORAMA

Mountain Village

ecosign

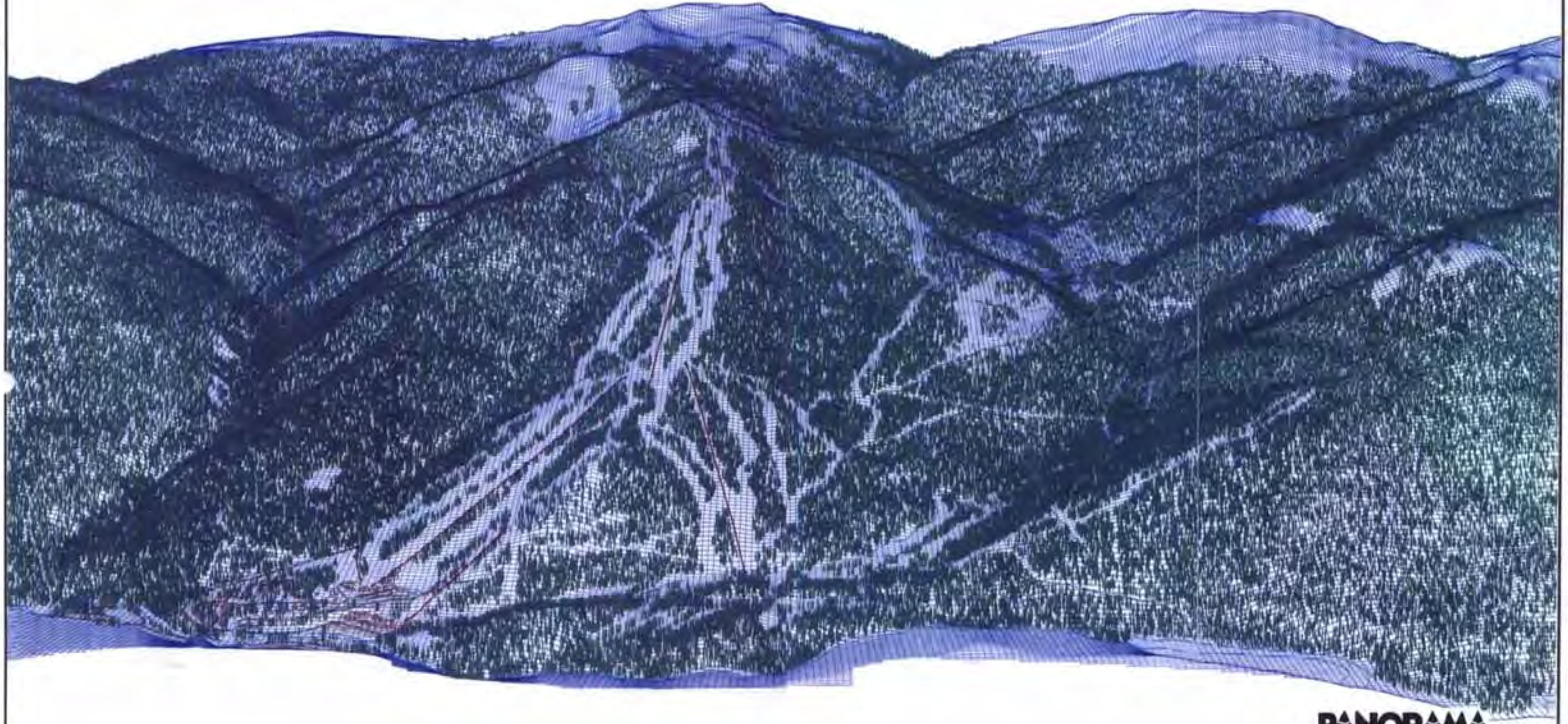
AVALANCHE HAZARD

4



EXISTING FACILITIES

5



EXISTING MOUNTAIN FACILITIES

PANORAMA

Mountain Village

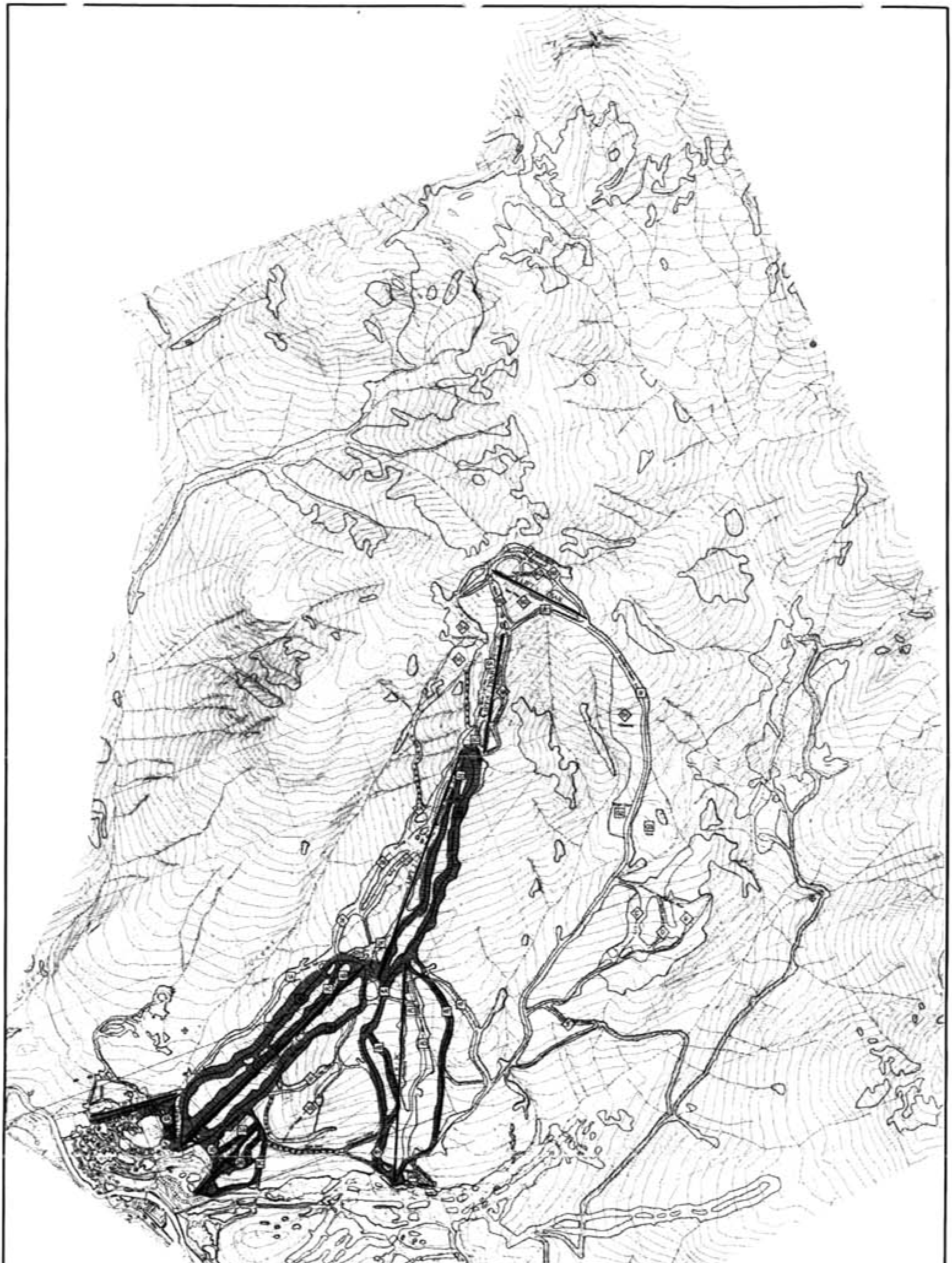
TERRAIN MODEL: Southeast View
Centerline Azimuth:: 125 °

12/1995

SKIPLAN®

ecosign

5a



EXISTING SNOWMAKING

PANORAMA
Mountain Village
ecosign

III. DEVELOPMENT ANALYSIS

The purpose of the development analysis section is to blend the information and/or constraints identified in the inventory section with acceptable ski industry planning and design parameters. Specifically, the constraints imposed by climate (natural snowpacks, wind, solar exposure), surficial geology (depth to bedrock, potential hazards, high water table) and visual quality objectives have "shrunk" the overall size of the potential development area.

.1 Planning Parameters

The advent of detachable lift technology has had a significant impact on winter resort area design and operation. Detachable chairs come off the cable in the terminal for comfortable loading of up to six persons at a relatively slow speed (0.76 meters/second) and then re-grasp the cable for the high speed (5 + meters/second) ride, twice as fast as conventional fixed grip chairs. At the top terminal, the chair comes off the cable and decelerates to the slow speed (0.76 meters/second) for convenient and safe off loading. These lifts can also be equipped with lexan bubbles to protect riders from the elements. The bubble provides warmth and protection, and unlike gondolas, guests do not have to remove their equipment.

During the past decade, ski area planners determined that approximately 70 percent of visitors were actively skiing at one time. Of these active skiers, approximately 38 percent were on the trails, while 62 percent were waiting in line or riding a chairlift.

Fixed grip chairlifts effectively "store" between 27 percent (double chair) and 37 percent (quad chair) of the active skiers by hanging them in the air where they are presumably satisfied. Detachable grip chairlifts, on the other hand, store only one-half of the skiers on the line when compared to fixed grip chairlifts of equal capacity.

A detachable chairlift rated at 2,800 pph with a loading efficiency of 95 percent is capable of delivering 2,660 people per hour to the top terminal. A fixed grip chairlift rated at 2,400 pph and 80 percent loading efficiency can only deliver 1,920 pph to the top terminal. The detachable chairlift is, therefore, more efficient and is capable of increasing the number of skiers on the trails by approximately 38 percent over the number supplied by the fixed grip chairlift. With this new technology, it is necessary to change assumptions and the planning parameters.

Historically, resorts have considered that a comfortable or acceptable "lift wait time" was a period equal to the lift's "ride time". We believe it is "fair" to alter this axiom when designing for high speed detachable lifts. In the hypothetical lifts listed in Table III.1, a skier must wait 9.8 minutes to ride a double chair with a ride time of 9.8 minutes for a total trip time of 19.6 minutes (Column A). On the detachable quad chair with an equivalent capacity (Column D), a skier's total trip time is halved to under 5 minutes.

TABLE III.1
DISTRIBUTION OF SKIERS WITH DIFFERENT TYPES OF LIFTS

	Fixed Grip Lifts						**Detachable Grip Lift**					
COLUMN	**A**		**B**		**C**		**D**		**E**		**F**	
Lift Type	2C		3C		4C		D2C		D4C		D4C	
Top Elevation (m.)	1,930		1,930		1,930		1,930		1,930		1,930	
Bottom Elevation (m.)	1,505		1,505		1,505		1,505		1,505		1,505	
Total Vertical (m.)	425		425		425		425		425		425	
Horizontal Distance (m.)	1,430		1,430		1,430		1,430		1,430		1,430	
Slope Distance (m.)	1,492		1,492		1,492		1,492		1,492		1,492	
Average Slope %	30%		30%		30%		30%		30%		30%	
Hourly Capacity	1,200		1,800		2,400		1,200		2,400		2,400	
VTM/Hour (000)	510		765		1,020		510		1,020		1,020	
Rope Speed (M./sec.)	2.5		2.3		2.0		5.0		5.0		5.0	
Trip Time (min.)	9.8		10.9		12.2		5.0		5.0		5.0	
Drive Horsepower	243		364		485		296		566		566	
Operating Hours/Day	7		7		7		7		7		7	
VTM Demand/Day	3,050		3,050		3,050		3,050		3,050		3,660	
Loading Efficiency	90%		85%		80%		95%		95%		95%	
SCC (Skiers/Day)	**1,053**		**1,492**		**1,873**		**1,112**		**2,224**		**1,853**	
Skiers/Carrier	2		3		4		2		4		4	
Space Between Chairs (m.)	15		45		40		98		98		98	
Number of Chairs	196		217		245		99		99		99	
Total Skiers	1,053		1,492		1,873		1,112		2,224		1,853	
70% Active Skiers	737		1,044		1,311		778		1,557		1,297	
Skiers on Line	196	27%	326	31%	490	37%	99	13%	198	13%	198	15%
Skiers in Lineup	196	27%	326	31%	490	37%	198	25%	396	25%	396	31%
Skiers On Trails	345	47%	393	38%	331	25%	481	62%	963	62%	703	54%

Note: *Examples "E" and "F" are similar lifts, however, the VTM demand has been increased by 20% in example "F".*

It has been observed that skiers will wait in line for a detachable quadruple chairlift on a peak day at least the same length of time as for a fixed grip lift, with the knowledge that the ride time will be approximately one-half that of a fixed grip. This being the case, it is appropriate to assume that on peak days it is acceptable for active skiers to wait two times the ride time for a detachable chairlift.

The second assumption affected by detachable grip lifts is vertical transport meters skied per day. Empirical studies have observed that VTM per day, per skier has increased during the past decade, due largely to better grooming and trail design. This trend will continue with detachable lifts, due to shorter ride times and longer lifts. Ecosign's research indicates that skiers riding high speed detachable chairlifts will have approximately 20 percent higher VTM demand than the design standards for fixed grip lifts.

The assumptions used for evaluating Panorama Mountain Village are as follows:

- MAINTAIN "ON-SLOPE" DENSITIES OF 7 TO 20 SKIERS/HECTARE (i.e. "AT AREA" DENSITIES OF 15-50 SKIERS/HECTARE)
- INCREASE VTM/SKIER/DAY ABOVE THE DESIGN LEVELS BY 20 PERCENT FOR DETACHABLE GRIP LIFTS
- LIFT LINE-UP IS TWO TIMES RIDE TIME ON DETACHABLE GRIP CHAIRLIFTS
- ALL SKIERS SHALL BE STAGED TO OUTLYING AREAS WITHIN 2.5 HOURS

The appropriate Panorama skier densities and VTM/skier/day planning parameters are listed in Table III.2.

**TABLE III.2
PANORAMA MOUNTAIN VILLAGE
PLANNING PARAMETERS**

Skill Classification	Skill Mix	Acceptable Terrain Gradients	Skier Demand VTM / Day	Skier Densities Skiers per Ha. At Area	On Slope
1 Beginner	5%	8 - 15%	705	50	20
2 Novice	10%	15 - 25%	1,595	50	20
3 Low Intermediate	15%	25 - 35%	2,125	40	15
4 Intermediate	25%	30 - 40%	2,830	40	15
5 High Intermediate	20%	35 - 45%	3,820	30	12
6 Advanced	15%	45 - 60%	4,460	15	7
7 Expert	10%	60% +	6,370	20	10

.2 Mountain Design Analysis

Accurate topographic mapping is a prerequisite for good mountain planning. During the technical assessment phase, the planning team utilized topographic mapping at a scale of 1:5,000 with 5 meter contour intervals. This was prepared by McElhanney Geosurveys Ltd., based on aerial photography taken in July 1995. The 1:5,000 map encompasses approximately 2,700 hectares, covering the existing ski area, the base area and potential expansion areas.

Utilizing the July 1995 1:5,000 topographic mapping, the two most critical analysis maps for the ski area design and evaluation process were prepared: the Fall Line Analysis Map (Figure 7) and the Slope Analysis Map (Figure 8). Natural routes of descent were analyzed by use of the Fall Line Analysis Map which delineates major drainages, fall line patterns, and primary and secondary fall line concentration areas. The concentration areas suggest potential lift terminals and hence, suitable base facility locations, as well as trail intertie points.

The Slope Analysis Map delineates the areas that can be negotiated by the various skier ability levels, as well as areas that are considered too flat or too steep for skiing. The natural slope gradients were carefully measured and colour coded into the following five classifications:

Slope Gradients	Colour	Type of Skiing
0 - 8%	white	flats, marginal skiing
8 - 25%	green	beginner and novice skiing
25 - 45%	yellow	intermediate skiing
45 - 70%	blue	advanced and expert skiing
70% +	red	extreme skiing, safety zones

These maps were utilized in the evaluation of the terrain and play a critical role in developing conceptual alternatives. A three-dimensional computer perspective of the Terrain Slope Analysis, Figures 9a and 9b, is also provided.

.3 Terrain Capacity Analysis

We have analyzed the natural terrain within the Panorama Mountain Village Study Area which possesses good ski potential to accurately establish the area's overall ski development potential. The Terrain Capacity Analysis Map (Figure 9) graphically illustrates major terrain "pods" within the study area which possess good potential for ski development. The pods were selected by consulting the Slope Analysis Map and observing the following criteria:

- continuous fall line skiing from top to bottom
- suitable upper and lower lift terminal locations (e.g., 0.2 hectares less than 25 percent slope)
- good slope continuity to allow interesting skiing from top to bottom for one or more skier ability levels
- natural slope gradients primarily greater than eight percent and less than 70 percent

Within each terrain pod, the upper and lower points are joined to establish the total vertical rise, horizontal distance, straight line slope and steepest 30 meter vertical pitch. The total pod area was calculated and major unskiable areas (slopes greater then 70 percent, local knolls, etc.) were subtracted. The above data comprises the inputs to our ski terrain capacity computer program. The final program input is a judgement which identifies the "primary" skier skill classification for each terrain pod. The program outputs are as follows:

SKI TERRAIN - net developable ski terrain within the pod. It varies between 40 and 75 percent of the usable terrain within the pod, depending on topography, vegetation and previous development in the pod.

TOTAL SKIERS - in pod at acceptable skier densities.

DEMAND VTM (000) - vertical transport meters required to service the total skiers.

LIFT CAPACITY/HR. - the net hourly lift capacity necessary to maximize the development of each pod.

SHELTER SQ. METERS - the approximate amount of built floor space required to adequately handle the number of skiers.

The Terrain Capacity Analysis Map and program printout (Table III.3) provide a reliable indication of the maximum development potential of each pod, the shelter and base terrain required to support the build-out of the mountain, and the lift capacity necessary to balance with the terrain.

TABLE III.3
PANORAMA
TERRAIN CAPACITY ANALYSIS

Terrain Pod	A	B	C	D	E	F	G	H	I	J	K	L	M
Top Elevation m.	1,597	1,327	1,564	1,227	1,210	1,315	1,210	1,888	1,613	1,973	2,208	1,855	1,340
Bottom Elevation m.	1,133	1,227	1,203	1,183	1,147	1,153	1,153	1,525	1,232	1,522	1,880	1,407	1,219
Total Vertical m.	464	100	361	44	63	162	57	363	381	451	328	448	121
Horizontal Distance m.	1,715	515	1,250	290	540	635	330	860	1,090	1,035	1,120	1,650	1,050
Slope Distance m.	1,777	525	1,301	293	544	655	335	933	1,155	1,129	1,167	1,710	1,057
Average Slope %	27%	19%	29%	15%	12%	26%	17%	42%	35%	44%	29%	27%	12%
Max. 30 M. Slope %	36%	25%	42%	17%	13%	31%	21%	57%	60%	56%	43%	45%	14%
Skill Class	4	2	3	1	1	3	1	5	4	6	3	4	1
Skier Density/Ha.	40	50	40	50	50	40	50	30	40	15	40	40	50
VTM Demand/Day	2,830	1,595	2,125	705	705	2,125	705	3,820	2,830	4,460	2,125	2,830	705
Total Area Ha.	92.6	10.3	42.3	4.1	5.0	10.6	4.4	32.4	71.4	43.3	19.0	95.3	12.1
Unusable Terrain	2.7	0.0	0.0	0.0	0.0	0.1	0.0	1.1	0.6	1.3	0.1	2.3	0.0
% Ski Terrain Available	40%	40%	40%	75%	75%	60%	50%	40%	40%	40%	60%	40%	40%
Available Ski Terrain	36.0	4.1	16.9	3.0	3.8	6.3	2.2	12.5	28.3	16.8	11.3	37.2	4.9
Total Skiers	**1,440**	**210**	**680**	**150**	**190**	**250**	**110**	**380**	**1,130**	**250**	**450**	**1,490**	**250**
Demand VTM (000)	647	53	229	17	21	84	12	230	508	177	152	669	28
Lift Capacity Hr.	1,394	532	635	381	337	521	216	635	1,332	392	463	1,494	231
Shelter Sq. Meter	2,560	370	1,210	270	340	450	200	680	2,010	450	800	2,650	450
Parking Area Ha.	1.77	0.26	0.84	0.18	0.23	0.31	0.14	0.47	1.39	0.31	0.55	1.84	0.31
Staging Area Ha.	2.29	0.33	1.08	0.24	0.30	0.40	0.18	0.60	1.79	0.40	0.71	2.37	0.40
Cumulative Total	2.3	2.6	3.7	3.9	4.2	4.6	4.8	5.4	7.2	7.6	8.3	10.7	11.1

Terrain Pod	N	O	P	Q	R	S	T	U	V	W	X	Y	TOTAL
Top Elevation m.	2,365	2,233	2,123	1,808	1,645	2,117	1,925	2,212	2,430	2,273	2,483	2,323	
Bottom Elevation m.	2,203	2,123	1,645	1,645	1,523	1,779	1,643	2,015	2,027	2,009	2,228	2,113	
Total Vertical m.	162	110	478	163	122	338	282	197	403	264	255	210	6,327
Horizontal Distance m.	320	460	1,170	800	520	890	880	635	1,130	1,030	730	680	
Slope Distance m.	359	473	1,264	816	534	952	924	665	1,200	1,063	773	712	22,315
Average Slope %	51%	24%	41%	20%	23%	38%	32%	31%	36%	26%	35%	31%	
Max. 30 M. Slope %	63%	35%	64%	33%	28%	55%	38%	41%	70%	54%	56%	48%	
Skill Class	6	3	6	3	3	7	5	4	6	4	6	4	
Skier Density/Ha.	15	40	15	40	40	20	30	40	15	40	15	40	
VTM Demand/Day	4,460	2,125	4,460	2,125	2,125	6,370	3,820	2,830	4,460	2,830	4,460	2,830	
Total Area Ha.	10.5	5.6	58.0	7.7	6.2	43.4	36.0	9.4	46.1	43.9	16.1	16.5	742.2
Unusable Terrain	0.0	0.0	1.8	0.0	0.0	0.0	2.5	0.2	0.0	0.4	0.7	0.2	13.9
% Ski Terrain Available	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Available Ski Terrain	4.2	2.3	22.5	3.1	2.5	17.3	13.4	3.7	18.4	17.4	6.2	6.5	300.8
Total Skiers	**60**	**90**	**340**	**120**	**100**	**350**	**400**	**150**	**280**	**700**	**90**	**260**	**9,920**
Demand VTM (000)	42	30	241	40	34	354	243	67	198	314	64	117	
Lift Capacity Hr.	262	276	504	248	276	1,047	860	342	492	1,191	250	556	14,869
Shelter Sq. Meter	110	160	610	210	180	620	710	270	500	1,250	160	460	17,680
Parking Area Ha.	0.07	0.11	0.42	0.15	0.12	0.43	0.49	0.18	0.34	0.86	0.11	0.32	12.2
Staging Area Ha.	0.10	0.14	0.54	0.19	0.16	0.56	0.63	0.24	0.44	1.11	0.14	0.41	15.8
Cumulative Total	11.2	11.3	11.9	12.1	12.2	12.8	13.4	13.6	14.1	15.2	15.3	15.8	

NOTE:

1.78 SQ. M. PER SKIER SHELTER AREA
2.5 SKIERS PER CAR
30.8 SQ. M. SURFACE AREA PER CAR

The terrain in the Panorama Mountain Village study area includes 25 pods suitable for ski development covering 742 hectares. These pods have a potential of supporting approximately 9,920 skiers on 300 hectares of developed terrain, at the design densities shown in Table III.2. The Terrain Capacity Analysis also reveals that if the terrain at Panorama was fully developed, a total of 17,680 square meters of skier service space would be required to provide the industry average level of service to the 9,920 skiers.

The Terrain Capacity Analysis also provides an indication of the general balance of the developable terrain. The Terrain Pod Balance Statement (Table III.4 and Plate III.1) reveals that the natural terrain at Panorama is moderately well balanced, with shortages of terrain in the novice and high intermediate skill classifications and a significant surplus of terrain in the intermediate and expert skill classifications. When the terrain balance is compared to the international trail classifications, (green, blue, black) the balance is approximately 6 percent short in the beginner and novice skill classes, 7 percent over in the intermediate skill classes and only 1.2 percent short in the advanced and expert skill classes. The detailed design of new trails will incorporate terrain at various skill classifications and attempt to ensure a ski area with trails that are well balanced with the skier market.

TABLE III.4
PANORAMA
TERRAIN POD BALANCE STATEMENT

Skill Classification	Hectares	Skiers	Balance	Ideal
1 Beginner	13.9	700	7.1%	5%
2 Novice	4.1	210	2.1%	10%
3 Low Intermediate	42.4	1,690	17.0%	20%
4 Intermediate	129.1	5,170	52.1%	30%
5 High Intermediate	25.9	780	7.9%	20%
6 Advanced	68.1	1,020	10.3%	10%
7 Expert	17.3	350	3.5%	5%
Total	**300.8**	**9,920**	**100%**	**100%**

Optimum Density = 36.9 Skiers/Hectare
Weighted Demand = 2,904 VTM/Skier/Day

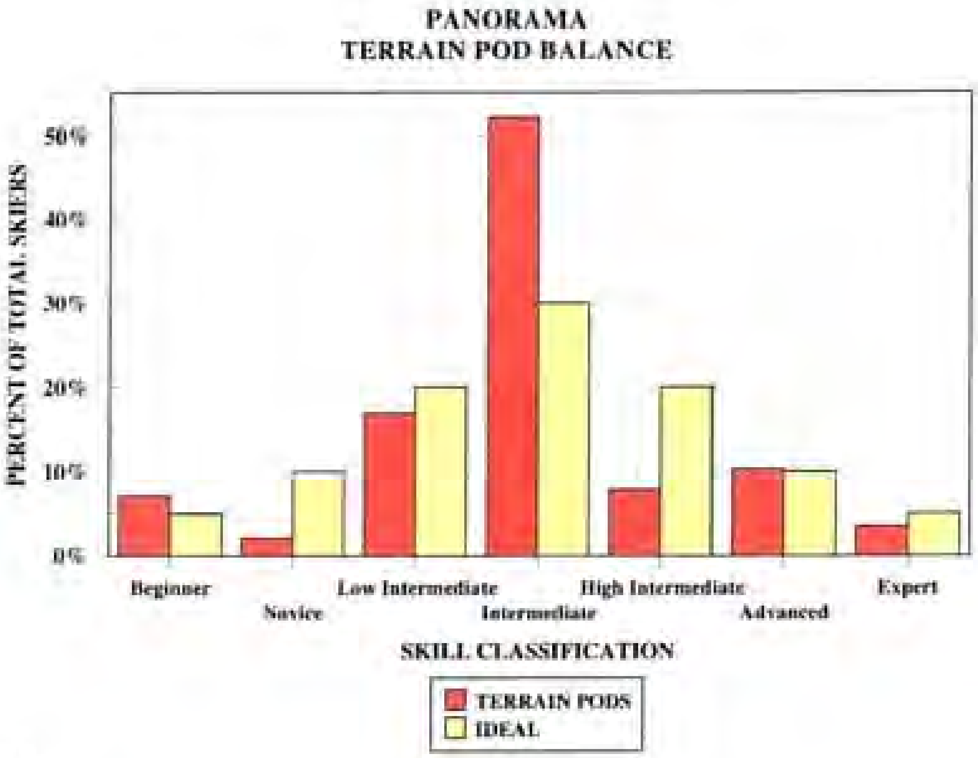


PLATE III.1

.4 Base Area Design Analysis

A base area's expansion and development potential is dependent upon the location of existing facilities, in conjunction with the location of proposed ski lifts and trails, as well as the biophysical limitations and opportunities of the site.

When planning for the movement of vehicles, pedestrians and skiers, as well as planning for the location of new facilities, there are design considerations unique to mountain resort development which must be addressed in addition to traditional design rationale. The following design criteria have been identified as considerations for the Panorama development.

1. The main base should respond to the needs of the visitor. Base improvements must be completed in conjunction with the upgrading of mountain facilities. Improvements should complement the site and, where possible, maintain existing grades and vegetation to minimize site disturbance.

2. The base area structures should be aligned in conjunction with an access road to create a sense of arrival, and act as a visible landmark in guiding first-time visitors to Panorama Mountain Village.

3. Morning sun should be maximized and co-ordinated with arrival activities.

4. Afternoon sun should be maximized and co-ordinated with lunch time and afternoon activities.

5. The site's spectacular views and vistas should be maximized where possible.

6. Pedestrian areas must be well defined, interconnect the parking lots to base structures, and focus pedestrian traffic through a centralized transition area that maximizes commercial opportunities.

7. Skier movement should flow easily away from base structures to lift terminals, and from ski runs back to the structures with negligible slope gradients.

8. Large vertical transitions should be minimized where possible, although small vertical displacements can effectively be utilized to separate and define specific areas and activities.

9. Pedestrians should not be forced to cross major vehicular roadways, and walkways should be provided to interconnect the parking lots and base area structures.

10. A drop-off and pick-up zone is required for both cars and buses.

11. Parking lots should be designed to fill from the closest proximity to the base structures outward, in order to minimize vehicular-pedestrian conflict.

12. The parking lots should be visually unobtrusive, both from a distance and at close proximity.

13. The most distant parking stalls should not exceed comfortable skier walking distances (450 meters, reduced by 100 meters for every 25 meters of vertical climbed).

14. Parking lot grades should not exceed 5 percent longitudinally, or 3 percent cross-slope in order to facilitate easy pedestrian and vehicular movement on snow or ice.

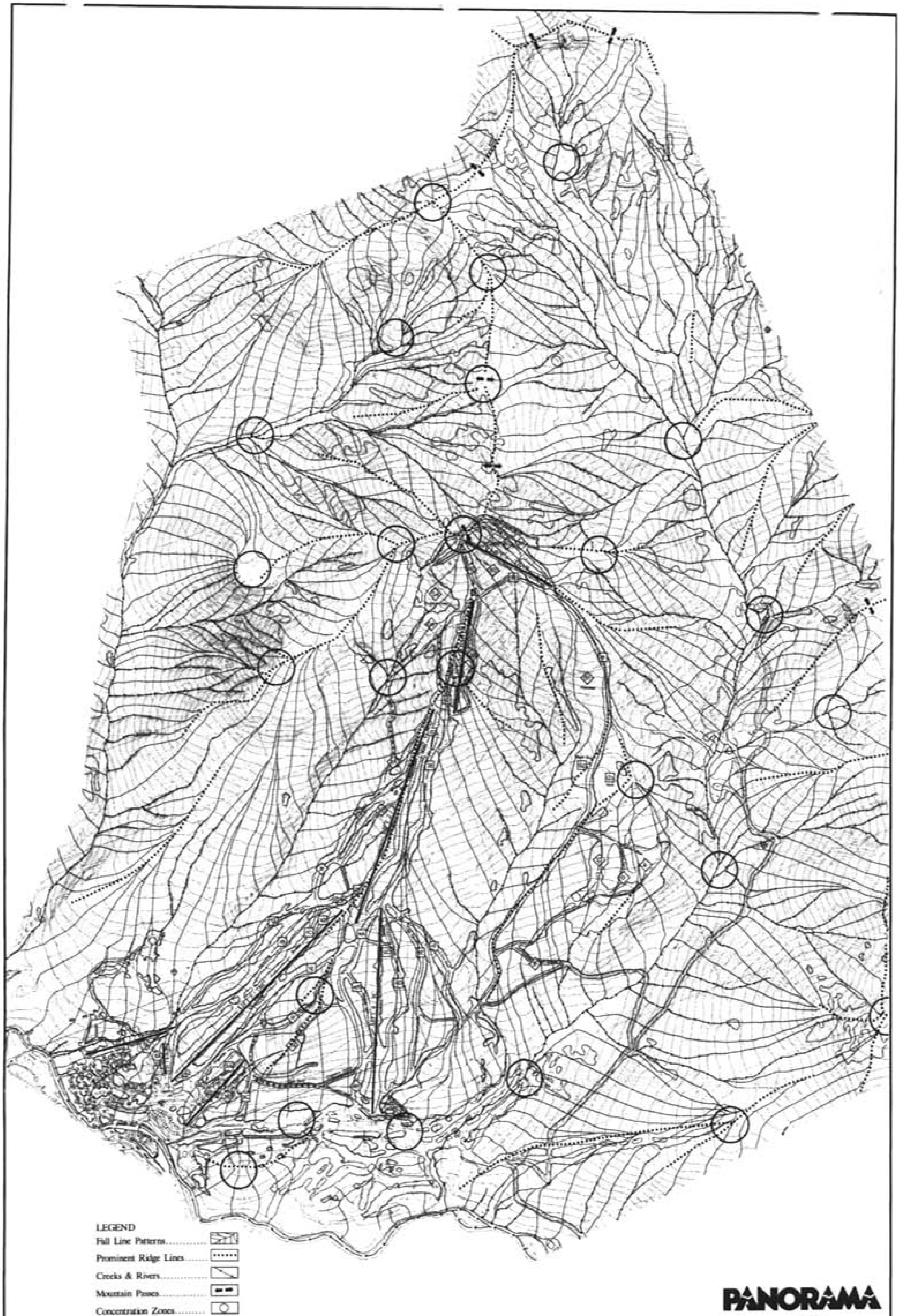
Walking Distances

As previously mentioned, it is important to provide all services, parking and recreational opportunities within a comfortable walking distance to the lifts. Research has indicated that up to 450 meters is a reasonable distance to expect people to walk with equipment on ground level. Every 25 meters vertical change shortens these distances by 100 meters. These boundaries have shaped the overall land use concept of the Panorama baselands. If the resort is to be "pedestrian oriented", most development should lie within this circumference.

Slope Analysis

A Slope Analysis Plan was completed by Ecosign at a scale of 1:1,000 with a contour interval of 1 meter for Panorama's east baselands. The following slope zones are identified on the Base Area Slope Analysis Map (Figure 10):

White	0 - 8%	Optimum: considered essentially "level" for roads, parking and larger structures.
Yellow	8 - 15%	Desirable; usable for roads, parking and larger structures but with major terrain modification.
Blue	15 - 30%	Less desirable; too steep for most development but best suited for single family development.
Red	30% +	Too steep for development.



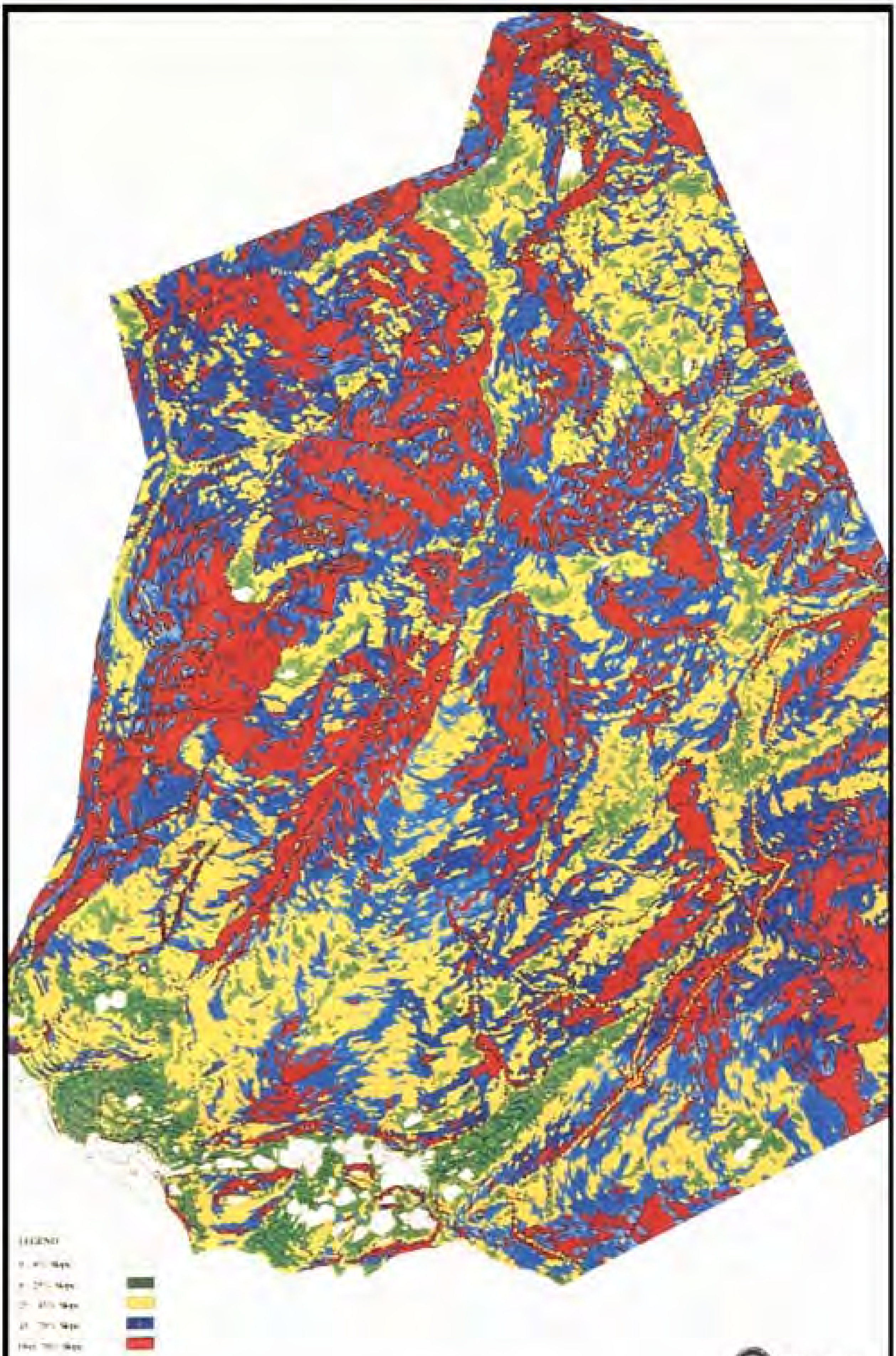
PANORAMA
Mountain Village

ecosign

Contour Interval: 5 metres

FALL LINE ANALYSIS

7

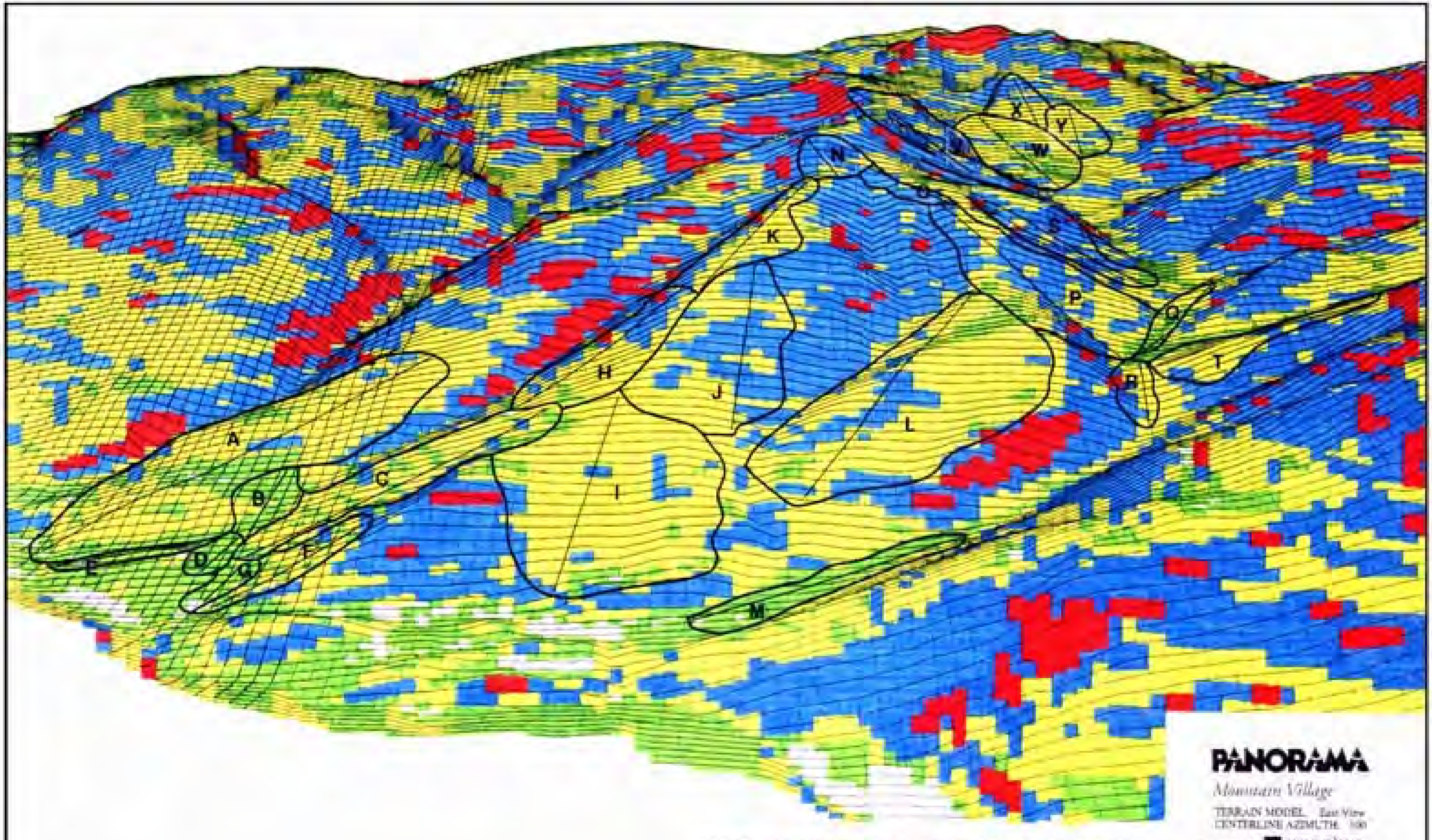


PANORAMA

ecosign

SLOPE ANALYSIS /

8/



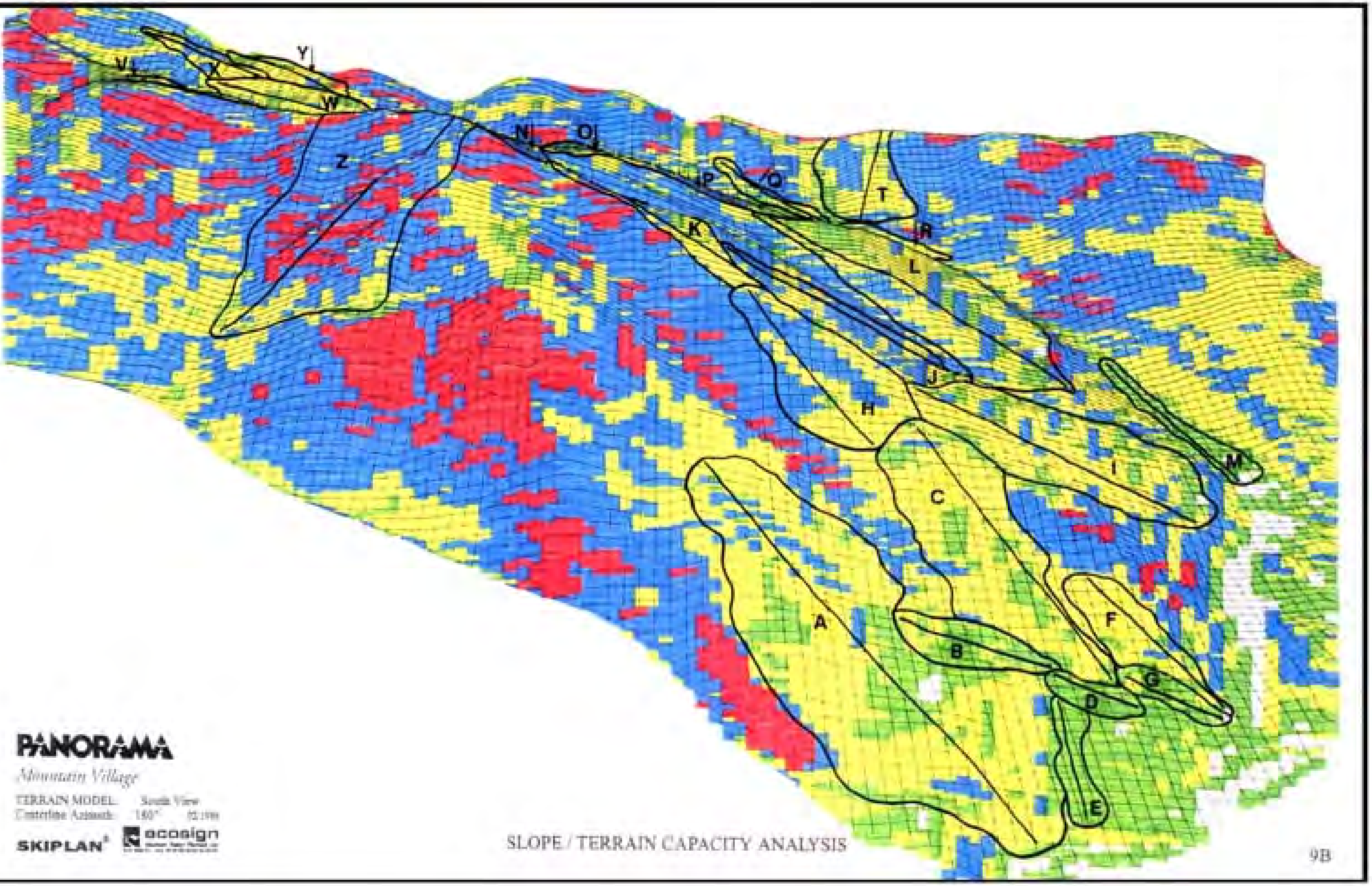
PANORAMA

Mountain Village

TERRAIN MODEL East View
CENTERLINE AZIMUTH 100

SLOPE ANALYSIS / TERRAIN CAPACITY ANALYSIS

SKIPLAN® ecosign



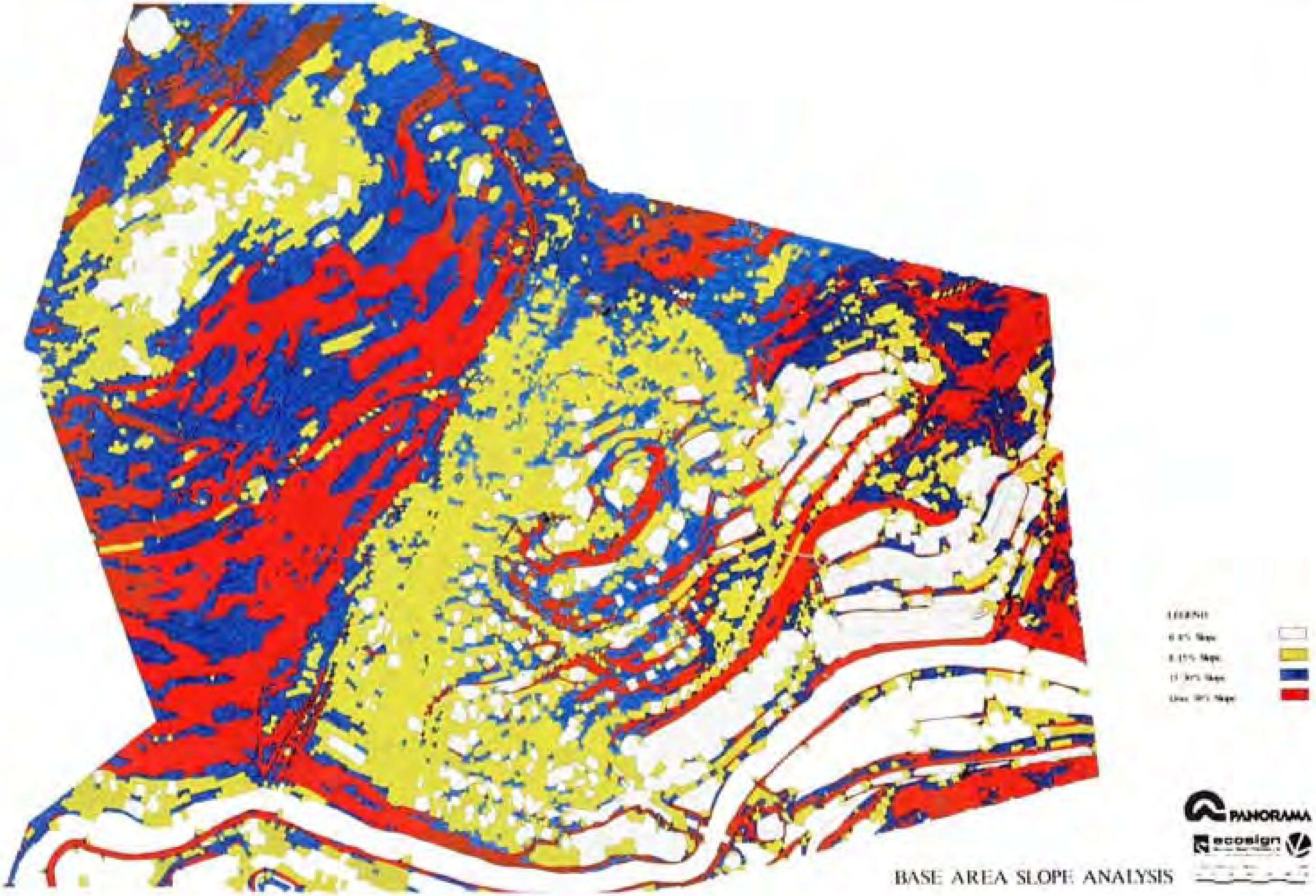
PANORAMA

Mountain Village

TERRAIN MODEL: South View
Centerline Azimuth: 180° 02.1998

SKIPLAN ecosign

SLOPE / TERRAIN CAPACITY ANALYSIS



BASE AREA SLOPE ANALYSIS

10

IV. MOUNTAIN FACILITIES

.1 Goals and Objectives

A winter resort area master plan involves planning the removal or replacement of existing equipment integrated with the addition of new facilities. It is important to have an overview of the complete project at build-out so that facilities can be balanced and capital effectively invested.

The objectives of the Panorama Mountain Village Master Plan are as follows:

- Optimize the use and operational efficiency of the existing physical plant
- Provide skiers/snowboarders with a high quality experience including some of the best lifts, trails, and skier service facilities in western Canada
- Balance lift and trail capacities
- Provide adequate amount of skier services in appropriate zones of the mountain
- Define goals to guide management and inform public agencies during the ensuing 5 - 10 year period.

The following section proposes the installation of new equipment and the relocation and upgrading of existing equipment. Panorama must be prepared to invest capital to improve facilities and increase capacity to sustain market growth.

We have utilized a number and letter code to indicate the type of lift installation proposed. The coding is listed below:

P	Platter Surface Lift
T-B	T-Bar Surface lift
2C	Double Chairlift
3C	Triple Chairlift
4C	Fixed Grip Quadruple Chairlift
Cab	Cabriolet Type Gondola People Mover
D4C	Detachable Grip Quadruple Chairlift
R	Replacement Lift (i.e. 2R)

.2 Mountain Master Plan

The Panorama Mountain Village Master Plan is presented in Figure 11. The objectives of the Master Plan are to renovate and modernize Panorama to make it a more desirable place to ski and snowboard and bring it up to, and beyond standards set by competitive destination resorts in western Canada.

This plan will provide facilities to increase the quality of the skier/snowboarder experience and the attractiveness of the area to both local and destination visitors. Physically, this plan will improve skier circulation in the existing area, speed up access to the upper mountain, as well as add new terrain. The Mountain Village Master Plan is summarized in Table IV.1.

The Mountain Village Master Plan includes the development of a championship 18-hole golf course, development of residential accommodation surrounding the golf course and upgrading of the Panorama Village.

Also included in the Master Plan, is the renovation and expansion of the mountain facilities to provide guests with a high quality experience. Development will consist of the construction of several new lifts, construction of a mid-mountain restaurant, re-grading and construction of several new trails to alleviate bottlenecks, fine (summer) grooming of ski trails, installation of additional snowmaking and construction of infrastructure.

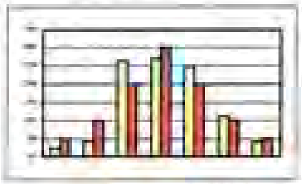
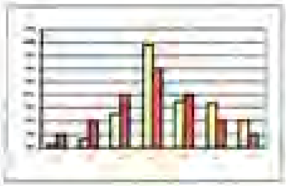
Lifts

Currently, Panorama operates one detachable grip lift and 6 fixed grip lifts including one triple, two doubles, two T-Bars and one platter. In order to attract additional destination visitors, Panorama must join the leaders in the industry by providing additional high speed detachable chairlifts. This type of lift is now quite prevalent at leading destination resort areas, due to skier's preference for more comfortable loading and unloading, not to mention the speed of the lift and the opportunity to increase the amount of skiing/snowboarding possible in one day. In fact, the number and size of detachable quadruple chairlifts offered at a winter resort area has become a very important factor when skiers/snowboarders make their decision on where to spend their day.

Vertical rise is also a very important factor in a skier's decision making process. The total amount of vertical serviced by high speed, detachable quad chairlifts available at the ski area significantly affects the decision making process, as does the vertical rise on each individual lift, but to a lesser degree.

The Master Plan proposes the installation of three new detachable quadruple chairlifts, one beginner triple chairlift, one quadruple chairlift and an extension and replacement of the Summit T-Bar as a double chair. At completion of this Master Plan, the lift system will be able to stage guests from the Village through the First Ascent Chair and the Toby/Sunbird lift system.

TABLE IV.1
MASTER PLAN SUMMARY

PHASE	LIFTS	NUMBER OF LIFTS	SCC	TRAILS	TRAIL BALANCE
EXISTING	Lift 1 - First Ascent - D4C - 1,992 pph Lift 2 - Horizon 2C - 994 Lift 3 - Toby - 2C - 1,217 pph Lift 4 - Sunbird - 3C - 1,700 pph Lift 5 - Champagne - T-Bar - 450 pph Lift 6 - Summit - T-Bar - 600 pph Lift 7 - Silver - Platter - 720 pph Lift 8 - Red Rider - Handle Tow - 720 pph	8	3,600	290.3 ha. 6,125 skiers/day	
Master Plan	Remove: Lift 2 - Horizon 2C - 994 Lift 5 - Champagne - T-Bar - 450 pph Lift 6 - Summit - T-Bar - 600 pph Install: Lift 2R - Horizon D4C - 2,400 Lift 6R - Summit 2C - 1,000 Lift 9 - Trapper's Beginner - 3C - 1,300 pph Lift 10 - Taynton Bowl - 4C - 1,200 pph Lift 11 - Hopeful Creek - D4C - 1,400 pph Lift 12 - Schober's D4C - 2,000 Increase Capacity: Lift 1 - First Ascent - D4C to 2,800pph Existing: Lift 3 - Toby - 2C - 1,217 pph Lift 4 - Sunbird - 3C - 1,700 pph Lift 7 - Silver - Platter - 720 pph Lift 8 - Red Rider - Handle Tow - 720 pph	11	8,000	436.9 ha. 9,500 skiers/day	

Lift 1, the First Ascent quad chair will be retained in its current configuration but will be upgraded to increase its capacity to 2,800 pph. The Sunbird, Toby, Red Rider Handle Tow and Silver Platter will also remain in their current configurations. Night skiing/snowboarding will be added to the Toby Chair terrain.

The Master Plan envisions the replacement of the existing Horizon Chairlift and Champagne T-bar with a high speed detachable quadruple chairlift. The top terminal of this new detachable lift will be located three-quarters of the way up the Champagne T-bar, about 120 vertical meters higher than the existing Horizon double chairlift, at the 2,160 meter elevation. The bottom terminal will be moved 29 vertical meters lower at the 1,527 meter elevation, just below the existing bottom terminal. This lift will be approximately 1,984 meters in length and will have a vertical rise of 633 meters. The lift would be installed with an hourly capacity of approximately 2,400 pph and would have a ride time of 6.6 minutes, running at 5.0 meters per second. This lift would use the existing Horizon trails, as well as several more to be constructed between these trails and Schober's. With the construction of a skiway to the southwest from the top terminal, this lift will service return skiing on Schober's Dream, Hopeful Sun Bowl and the gladed areas on either side of Schober's Dream, which currently requires a total of three lift rides. A mid-mountain restaurant is proposed to be constructed adjacent to the top of the new Lift 2R. The Horizon detachable quad will be able to accommodate 1,810 sliders per day.

The skiway from the top of the new Horizon detachable quad will merge with Schober's Dream near the 2,100 meter elevation, approximately 65 meters lower than the existing Summit T-Bar. In order to provide access to the summit, it is proposed that the Summit T-bar be replaced by a double chairlift with the bottom terminal relocated to the 2,085 meter elevation, adjacent to Schober's Dream. The new Summit chair will have a vertical of 279 meters and a carrying capacity of 190 skiers and snowboarders per day. This lift can be installed using the existing Horizon equipment when it is replaced. The extension of this lift to a lower elevation will allow the mountain to remove the Champagne T-Bar (resulting in less maintenance and operation costs) and will allow skiers to access the Summit with fewer lift rides.

In order to provide additional beginner terrain, a triple chairlift (Lift 9) located between the Village and the proposed Trapper's Loop subdivision has been included in the Master Plan. When installed as a triple chairlift, this lift will allow two students to be accompanied by an instructor or adult on each chair. The Trapper's Chair will have an hourly capacity of 1,200 passengers per hour and a loading interval of nine seconds, which is very suitable for beginners. The lift will be able to accommodate 380 beginner skiers per day.

A fixed grip quadruple chairlift (Lift 10) is proposed to be installed on the north side of the summit, providing skier access in the northerly facing Taynton Valley. The chairlift, in this configuration, will have a vertical rise of 630 meters from its bottom terminal, at 1,740 meters, to the top terminal at the summit. The Taynton Bowl double chairlift will be able to accommodate approximately 530 sliders per day. This lift will provide a large expanse of skiing in the advanced and expert skill classes. Most of this steep terrain is naturally open or gladed, requiring minimal tree clearing for trail construction. A narrow trail will be constructed stretching from the bottom of the valley to the base area for emergency egress.

A detachable quadruple chairlift (Lift 11) starts in the Hopeful Creek Valley at the 1,645 meter elevation, and runs up to the 2,160 meter elevation, slightly above the bottom terminal of the Summit chair. This top terminal has been chosen to provide better and easier access to good skiing/snowboarding in the upper Hopeful Creek area and also to provide easy access to the Summit lift and Schober's run. The Hopeful Creek Quad will have a total vertical rise of 515 meters and a ride time of 4.6 minutes, based on a cable speed of 5.0 meters per second. The Hopeful Creek detachable quad will have a carrying capacity of 640 sliders per day. This lift, by itself or in conjunction with the Summit chair, will also service a huge expanse of "backcountry" terrain to the east of these lifts.

The Schober's detachable quadruple chairlift (Lift 12) starts at the 1,265 meter elevation in the Hopeful Creek Valley and terminates at the 1,850 meter elevation of Schober's Dream trail, a total of 585 meters of vertical. With a cable speed of 5.0 meters per second, this lift has an estimated ride time of 7.1 minutes. With a rated hourly capacity of 2,000 passengers per hour, this lift will have a capacity of 1,680 sliders per day. In addition to servicing return cycle skiing, this lift will provide an important second access route to the large amount of skiing terrain in the "back" of the ski area.

At the completion of the Master Plan, the resort would be able to accommodate 8,000 skiers per day with 11 lifts. Detailed specifications for the proposed Master Plan lifts are listed in Table IV.2. A total of 437 hectares of ski trails have been designed to provide adequate trail capacity for the proposed SCC. The proposed trails will be able to accommodate 9,990 sliders per day. As a result of the trail capacity exceeding lift capacity, the overall average densities will be lower than the planning parameters resulting in higher quality snow conditions on the slopes as a result of less wear and tear. The detailed ski trail alignments are graphically illustrated in Figure 11 and the specifications are listed in Table IV.3.

The Cumulative Trail Balance Statement (Table IV.4), illustrates that the proposed trails, are somewhat unbalanced as compared to the skier market. The beginner and novice skill class trails (green circle) are able to service 5 percent of the market, as compared to the planning goal of 15 percent. The intermediate skill class trails (blue square) service 68.6 percent of the market, compared to the planning goal of 70 percent. The intermediate skill class trails therefore are in good balance with the skier market. The advanced and expert skill class trails (black diamond) service 26.7 percent of the market compared to a planning goal of 15 percent. The skill class balance of terrain is graphically illustrated in Plate IV.1

TABLE IV.2
PANORAMA MASTER PLAN
LIFT SPECIFICATIONS

Lift Number Lift Name Lift Type	1 First Ascent D4C	2R Horizon Quad D4C	3 Toby 2C	4 Sunbird 3C	6R Summit 2C	7 Silver Platter P
Top Elevation m.	1,563	2,160	1,273	1,596	2,364	1,223
Bottom Elevation m.	1,183	1,527	1,153	1,181	2,085	1,162
Total Vertical m.	380	633	120	415	279	61
Horizontal Distance m.	1,345	1,880	572	1,156	860	476
Slope Distance m.	1,400	1,984	584	1,230	904	480
Average Slope %	28%	34%	21%	36%	32%	13%
Rated Capacity	2,800	2,400	1,217	1,700	1,000	750
V.T.M./Hr.(000)	1,064	1,519	146	705	279	46
Rope Speed m/sec.	5.0	5.0	2.0	2.3	2.0	2.5
Trip Time min.	4.67	6.61	4.87	8.91	7.53	3.20
Operating Hr./Day	7.3	7.1	7.3	7.1	6.3	7.0
V.T.M. Demand/Day	3,583	5,043	2,827	4,099	6,799	1,069
Loading Eff. %	95%	95%	90%	85%	90%	80%
Access Reduction	30%	11%	50%	16%	19%	10%
SCC Skiers/Day	**1,430**	**1,810**	**170**	**870**	**190**	**220**
Cumulative Total	**1,430**	**3,240**	**3,410**	**4,280**	**4,470**	**4,690**

Lift Number Lift Name Lift Type	8 Red Rider HT	9 Trapper's Chair 3C	10 Taynton Bowl 4C	11 Hopeful Creek D4C	12 Schober's D4C	TOTAL
Top Elevation m.	1,209	1,360	2,370	2,160	1,850	
Bottom Elevation m.	1,185	1,183	1,740	1,645	1,265	
Total Vertical m.	24	177	630	515	585	3,819
Horizontal Distance m.	164	880	1,460	1,280	2,040	
Slope Distance m.	166	898	1,590	1,380	2,122	12,737
Average Slope %	15%	20%	43%	40%	29%	32% Mean
Rated Capacity	720	1,200	1,200	1,400	2,000	16,387
V.T.M./Hr.(000)	17	212	756	721	1,170	6,636
Rope Speed m/sec.	1.8	2.2	2.5	5.0	5.0	
Trip Time min.	1.51	6.80	10.60	4.60	7.07	
Operating Hr./Day	7.0	7.0	5.5	6.0	6.5	6.7
V.T.M. Demand/Day	940	2,495	7,016	6,437	4,188	
Loading Eff. %	65%	80%	90%	95%	95%	
Access Reduction	10%	20%	0%	0%	3%	
SCC Skiers/Day	**80**	**380**	**530**	**640**	**1,680**	**8,000**
Cumulative Total	**4,770**	**5,150**	**5,680**	**6,320**	**8,000**	

TABLE IV.3
PANORAMA MASTER PLAN
TRAIL SPECIFICATIONS

Trail Name		Trail No.	Skill Class	Elevation		Total Vert. Meters	Horz. Dist. Meters	Slope Dist. Meters	Percent Slope		Avg. Width Meters	Horz. Area Ha.	Slope Area Ha.	Skiers At Area		Lift at Area
				Top Meters	Bottom Meters				Avg.	Steep.				Density	Total	
<u>Lift 1</u>																
Powder Trail		1A	4	1,515	1,240	275	1,095	1,129	25%	42%	54	5.89	6.07	40	245	
Horseshoe		1B	3	1,563	1,183	380	1,470	1,518	26%	37%	66	9.70	10.02	40	400	snowmaking
Showoff		1C	3	1,525	1,215	310	1,120	1,162	28%	37%	52	5.84	6.06	40	240	snowmaking
		1D	3	1,560	1,485	75	215	228	35%	40%	33	0.70	0.74	40	30	snowmaking
Old Timer		1E	3	1,563	1,205	358	1,475	1,518	24%	36%	46	6.78	6.98	40	280	snowmaking
Hay Fever		1F	6	1,490	1,305	185	655	681	28%	55%	31	2.04	2.12	15	30	
Cliff Glade		1G	7	1,455	1,275	180	635	660	28%	60%	152	9.65	10.03	5	50	gladed
Upper Loose Moose		1H	4	1,495	1,437	58	245	252	24%	38%	16	0.39	0.40	40	15	
Lower Loose Moose		1I	4	1,415	1,267	148	555	574	27%	35%	12	0.64	0.66	40	25	
Campbell's Canyon		1J	2	1,425	1,380	45	345	348	13%	13%	13	0.45	0.45	50	25	
Deck's Cross/Strobl Strasse	partial	2K	4	1,875	1,350	525	2,345	2,403	22%	43%	24	5.54	2.13	40	85	
Ostrander	partial	2L	6	1,630	1,375	255	815	854	31%	50%	35	2.87	1.13	15	15	
Zehnder way	partial	2M	5	1,690	1,360	330	935	992	35%	45%	37	3.42	1.36	30	40	
McIntosh Way	partial	2N	4	1,565	1,350	215	1,110	1,131	19%	38%	34	3.80	1.45	40	60	
Trapper's Ridge	partial	2O	4	1,360	1,160	200	935	956	21%	37%	21	1.97	0.71	40	30	
	partial	2V	6	1,590	1,530	60	200	209	30%	36%	35	0.69	0.27	15	5	
	partial	G6	6	1,700	1,390	310	910	961	34%	50%	60	5.43	2.15	4	10	gladed
Joe C's Forest	partial	G7	6	1,600	1,375	225	685	721	33%	41%	140	9.60	3.79	4	15	gladed
Duthie Forest	partial	G8	6	1,675	1,350	325	930	985	35%	53%	176	16.34	6.49	4	25	gladed
Gunner's Glade	partial	G9	5	1,550	1,365	185	695	719	27%	38%	166	11.52	4.47	8	35	gladed
	partial	G10	5	1,370	1,310	60	185	194	32%	37%	68	1.25	0.46	8	5	gladed
Messerli's Mile	partial	L	6	1,960	1,785	175	415	450	42%	57%	53	2.20	0.70	15	10	
	partial	N	6	2,060	1,685	375	970	1,040	39%	65%	39	3.77	1.19	15	20	
Total Lift 1		10 (no partial trails included)						8,070 (no partial trails included)					69.85		1,695	1,430
<u>Lift 2</u>																
Downhill Right		2A	6	1,903	1,830	73	155	171	47%	57%	42	0.65	0.72	15	10	
Downhill		2B	6	2,040	1,605	435	1,070	1,155	41%	54%	55	5.86	6.33	15	95	
Tacky		2C	6	1,860	1,585	275	740	789	37%	56%	43	3.16	3.37	15	50	
Skyline		2D	4	2,160	1,527	633	1,985	2,083	32%	45%	56	11.12	11.67	40	465	
Rollercoaster		2E	5	2,065	1,590	475	1,360	1,441	35%	47%	63	8.59	9.10	30	275	
Cow's Face		2F	5	1,625	1,550	75	235	247	32%	44%	55	1.30	1.36	30	40	
Liftline		2G	5	2,005	1,680	325	895	952	36%	42%	25	2.24	2.38	30	70	
		2H	5	1,580	1,545	35	110	115	32%	32%	39	0.43	0.45	30	15	
Lower Downhill		2I	6	1,612	1,525	87	280	293	31%	48%	50	1.41	1.48	15	20	
Surf		2J	7	2,035	1,910	125	205	240	61%	73%	31	0.63	0.74	20	15	
Deck's Cross/Strobl Strasse	partial	2K	4	1,875	1,350	525	2,345	2,403	22%	43%	24	5.54	3.55	40	140	
Ostrander	partial	2L	6	1,630	1,375	255	815	854	31%	50%	35	2.87	1.88	15	30	
Zehnder way	partial	2M	5	1,690	1,360	330	935	992	35%	45%	37	3.42	2.27	30	70	
McIntosh Way	partial	2N	4	1,565	1,350	215	1,110	1,131	19%	38%	34	3.80	2.42	40	95	
Trapper's Ridge	partial	2O	4	1,360	1,160	200	935	956	21%	37%	21	1.97	1.18	40	45	
		2P	5	2,160	2,075	85	320	331	27%	50%	33	1.06	1.10	30	35	
		2Q	5	2,100	2,005	95	335	348	28%	52%	41	1.38	1.43	30	45	
	partial	2R	6	1,890	1,460	430	1,135	1,214	38%	58%	48	5.42	3.50	15	55	
	partial	2S	6	2,020	1,500	520	1,400	1,493	37%	60%	40	5.65	3.64	15	55	
	partial	2T	6	2,105	1,615	490	1,605	1,678	31%	53%	33	5.23	3.31	15	50	
	partial	2U	5	2,155	1,855	300	1,305	1,339	23%	50%	29	3.84	2.38	30	70	
	partial	2V	6	1,590	1,530	60	200	209	30%	36%	35	0.69	0.45	15	5	
Last Chance	partial	I	6	2,190	1,940	250	625	673	40%	59%	29	1.80	1.35	15	20	
View of 1000 Peaks	partial	J	6	2,260	1,925	335	1,300	1,342	26%	55%	34	4.43	3.17	15	50	
Red's Bowl	partial	K	7	2,090	1,940	150	345	376	43%	91%	36	1.25	0.94	20	20	
Messerli's Mile	partial	L	6	1,960	1,785	175	415	450	42%	57%	53	2.20	1.17	15	20	
Elmo	partial	M	7	2,315	2,185	130	295	322	44%	81%	35	1.03	0.78	20	15	
	partial	N	6	2,060	1,685	375	970	1,040	39%	65%	39	3.77	1.98	15	30	
Hideaway	partial	G1	7	2,160	1,850	310	815	872	38%	63%	120	9.82	6.35	5	30	
Upper Extreme Dream	partial	G4	7	2,360	2,075	285	950	992	30%	64%	66	6.30	4.57	5	25	
Lower Extreme Dream	partial	G5	7	2,120	1,890	230	925	953	25%	58%	46	4.29	3.07	5	15	
	partial	G6	6	1,700	1,390	310	910	961	34%	50%	60	5.43	3.59	4	15	
Joe C's Forest	partial	G7	6	1,600	1,375	225	685	721	33%	41%	140	9.60	6.31	4	25	
Duthie Forest	partial	G8	6	1,675	1,350	325	930	985	35%	53%	176	16.34	10.82	4	40	
Gunner's Glade	partial	G9	5	1,550	1,365	185	695	719	27%	38%	166	11.52	7.45	8	55	
	partial	G10	5	1,370	1,310	60	185	194	32%	37%	68	1.25	0.77	8	5	
Total Lift 2		36						31,038					117.03		2,115	1,810

TABLE IV.3
PANORAMA MASTER PLAN
TRAIL SPECIFICATIONS

Trail Name		Trail No.	Skill Class	Elevation Top Meters	Bottom Meters	Total Vertical Meters	Horz. Distance Meters	Slope Distance Meters	Percent Slope Avg.	Steep.	Avg. Width Meters	Horz. Area Hectares	Slope Area Hectares	Skiers At Area Density	Total	Lift at Area
Lift 3																
New Timer		3A	4	1,273	1,153	120	515	529	23%	44%	33	1.71	1.76	40	70	
Eagle Glade		3B	2	1,273	1,153	120	525	539	23%	30%	34	1.81	1.86	50	95	
Workshop		3C	4	1,270	1,155	115	585	596	20%	46%	21	1.22	1.24	40	50	
Hoggflats		3D	2	1,273	1,172	101	430	442	23%	30%	30	1.29	1.33	50	65	
Total Lift 3		4						2,105					6.19		280	170
Lift 4																
Fritz's/Chicken's Choice		4A	4	1,596	1,181	415	1,520	1,576	27%	41%	38	5.84	6.05	40	240	
Whiskey Jack		4B	3	1,475	1,300	175	520	549	34%	40%	52	2.69	2.84	40	115	
Sunbird		4C	6	1,585	1,375	210	610	645	34%	45%	27	1.62	1.71	15	25	
Heaven Can Wait		4D	4	1,580	1,435	145	390	416	37%	45%	42	1.64	1.75	40	70	
Little Dipper		4E	5	1,495	1,270	225	630	669	36%	46%	43	2.71	2.88	30	85	
Out Rider		4F	4	1,596	1,220	376	1,435	1,483	26%	37%	53	7.66	7.92	40	315	
		4G	4	1,490	1,181	309	905	956	34%	41%	60	5.40	5.71	40	230	
Lower Fritz's		4H	6	1,275	1,200	75	165	181	45%	55%	55	0.90	0.99	15	15	
		4I	4	1,580	1,380	200	755	781	26%	42%	43	3.24	3.35	40	135	
	partial	2R	6	1,890	1,460	430	1,135	1,214	38%	58%	48	5.42	2.30	15	35	
	partial	2S	6	2,020	1,500	520	1,400	1,493	37%	60%	40	5.65	2.39	15	35	
	partial	2T	6	2,105	1,615	490	1,605	1,678	31%	53%	33	5.23	2.16	15	30	
	partial	2U	5	2,155	1,855	300	1,305	1,339	23%	50%	29	3.84	1.56	30	45	
Hideaway	partial	G1	7	2,160	1,850	310	815	872	38%	63%	120	9.82	4.16	5	20	
Total Lift 4		9 (no partial trails included)						7,257 (no partial trails included)					45.77		1,395	870
Lift 6																
Outer Limits		6A	7	2,360	2,260	100	230	251	43%	60%	63	1.45	1.58	5	10	
Roy's Run		6B	6	2,364	2,085	279	1,000	1,038	28%	56%	37	3.74	3.88	15	60	
Tight Spots		6C	7	2,360	2,175	185	670	695	28%	57%	64	4.29	4.45	5	20	
Tree Time		6D	7	2,360	2,175	185	525	557	35%	64%	87	4.57	4.85	5	25	
Top of the World		6E	6	2,364	2,165	199	725	752	27%	63%	27	1.99	2.06	15	30	
		6F	6	2,260	2,130	130	305	332	43%	54%	36	1.11	1.21	15	20	
Upper Extreme Dream	partial	G4	7	2,360	2,075	285	950	992	30%	64%	66	6.30	2.01	5	10	
Lower Extreme Dream	partial	G5	7	2,120	1,890	230	925	953	25%	58%	46	4.29	1.35	5	5	
Last Chance	partial	I	6	2,190	1,940	250	625	673	40%	59%	29	1.80	0.59	15	10	
View of 1000 Peaks	partial	J	6	2,260	1,925	335	1,300	1,342	26%	55%	34	4.43	1.40	15	20	
Red's Bowl	partial	K	7	2,090	1,940	150	345	376	43%	91%	36	1.25	0.42	20	10	
Messerli's Mile	partial	L	6	1,960	1,785	175	415	450	42%	57%	53	2.20	0.52	15	10	
Elmo	partial	M	7	2,315	2,185	130	295	322	44%	81%	35	1.03	0.34	20	5	
	partial	N	6	2,060	1,685	375	970	1,040	39%	65%	39	3.77	0.87	15	15	
Total Lift 6		6 (no partial trails included)						3,624 (no partial trails included)					25.53		250	190
Lift 7																
Beginner		7A	1	1,223	1,162	61	495	499	12%	13%	42	2.06	2.08	50	105	
Trapper's Ridge	partial	2O	4	1,360	1,160	200	935	956	21%	37%	21	1.97	0.11	40	5	
	partial	G10	5	1,370	1,310	60	185	194	32%	37%	68	1.25	0.07	8	0	
Total Lift 7		1 (no partial trails included)						499 (no partial trails included)					2.27		110	220
Lift 8																
Hwy 1		8A	1	1,209	1,185	24	180	182	13%	13%	38	0.68	0.69	50	35	
Total Lift 8		1						182					0.69		35	80
Lift 9																
		9A	2	1,360	1,220	140	655	670	21%	27%	44	2.86	2.92	50	145	
		9B	3	1,360	1,183	177	945	961	19%	33%	43	4.06	4.13	40	165	
Total Lift 9		2						1,631					7.05		310	380

TABLE IV.3
PANORAMA MASTER PLAN
TRAIL SPECIFICATIONS

Trail Name	Trail No.	Skill Class	Elevation Top	Bottom	Total Vertical	Horz. Distance	Slope Distance	Percent Slope		Avg. Width	Horz. Area	Slope Area	Skiers At Area		Lift at Area
			Meters	Meters	Meters	Meters	Meters	Avg.	Steep.	Meters	Hectares	Hectares	Density	Total	
Lift 10															
	10A	5	2,370	1,740	630	2,185	2,274	29%	49%	32	6.90	7.18	30	215	
	10B	7	2,330	1,740	590	1,415	1,533	42%	67%	47	6.63	7.18	20	145	
	10C	7	1,975	1,785	190	345	394	55%	67%	45	1.55	1.77	20	35	
	10D	7	2,250	1,985	265	470	540	56%	75%	129	6.06	6.96	20	140	
	10E	7	2,370	2,100	270	460	533	59%	75%	111	5.09	5.90	20	120	
	10F	6	2,365	1,745	620	1,525	1,646	41%	64%	56	8.60	9.28	15	140	
	10G	6	2,370	2,075	295	890	938	33%	65%	51	4.52	4.76	15	70	
Total Lift 10	7						7,858					43.03		865	530
Lift 11															
	11A	6	1,800	1,660	140	425	447	33%	52%	41	1.73	1.82	15	25	
	11B	5	1,960	1,645	315	865	921	36%	50%	83	7.22	7.68	30	230	
	11C	6	2,050	1,645	405	975	1,056	42%	63%	59	5.76	6.24	15	95	
	11D	6	2,160	1,645	515	1,465	1,553	35%	53%	55	8.01	8.49	15	125	
	11E	6	1,965	1,755	210	515	556	41%	49%	49	2.54	2.74	15	40	
	11F	7	2,160	1,965	195	630	659	31%	70%	58	3.66	3.83	20	75	
	11G	6	2,160	1,658	502	1,835	1,902	27%	60%	31	5.78	5.99	15	90	
	11H	7	2,095	1,783	312	1,010	1,057	31%	80%	80	8.11	8.49	20	170	
Total Lift 11	8						8,152					45.28		850	640
Lift 12															
	12A	4	1,850	1,383	467	2,000	2,054	23%	42%	51	10.27	10.55	40	420	
	12B	4	1,360	1,270	90	355	366	25%	36%	44	1.57	1.62	40	60	
	12C	6	1,383	1,265	118	350	369	34%	64%	54	1.88	1.98	15	30	
	12D	6	1,620	1,515	105	265	285	40%	57%	47	1.25	1.34	15	20	
	12E	5	1,510	1,420	90	280	294	32%	46%	61	1.72	1.81	30	50	
	12F	4	1,540	1,465	75	485	491	15%	18%	32	1.57	1.59	40	60	
	12G	5	1,720	1,505	215	670	704	32%	50%	74	4.93	5.18	30	160	
	12H	4	1,770	1,690	80	385	393	21%	36%	49	1.88	1.92	40	80	
	12I	4	1,850	1,265	585	2,325	2,397	25%	42%	52	12.17	12.55	40	500	
	12J	4	1,530	1,285	245	890	923	28%	45%	44	3.95	4.10	40	160	
	12K	4	1,680	1,620	60	205	214	29%	34%	69	1.41	1.47	40	60	
	12L	4	1,740	1,520	220	875	902	25%	42%	59	5.17	5.33	40	210	
	12M	7	1,750	1,635	115	245	271	47%	78%	111	2.73	3.02	20	60	
Hopeful/Schober's	12P	6	1,670	1,645	25	1,075	1,075	2%	8%	8	0.86	0.86	15	10	
Black Door	G2	4	1,850	1,745	105	485	496	22%	30%	54	2.64	2.70	10	25	
Alive	G3	5	1,835	1,710	125	600	613	21%	33%	266	15.98	16.32	8	120	
Total Lift 12	16						11,648					72.34		2,025	1,680
Other Trails															
Upper 41		4	1,612	1,580	32	90	96	36%	36%	29	0.26	0.28	40	10	
Schober's Egress	H	5	1,335	1,275	60	2,050	2,051	3%	18%	8	1.64	1.64	30	50	
Total Other Trails	2						2,146					1.92		60	
Total All Trails	102						84.4 km					436.9 Ha		9,990	8,000

TABLE IV.4
PANORAMA MASTER PLAN
CUMULATIVE TRAIL BALANCE STATEMENT

Skill Classification		Hectares	Skiers	Balance	Ideal
1	Beginner	2.8	140	1.4%	5%
2	Novice	6.6	330	3.3%	10%
3	Low Intermediate	30.8	1,230	12.3%	20%
4	Intermediate	100.3	3,905	39.1%	30%
5	High Intermediate	79.3	1,715	17.2%	20%
6	Advanced	134.5	1,650	16.5%	10%
7	Expert	82.8	1,020	10.2%	5%
	TOTALS	**436.9**	**9,990**	**100%**	**100%**

Average Density = 18.3 Skiers/Hectare
Optimum Density = 32.6 Skiers/Hectare
Weighted Demand = 4,623 VTM/Skier/Day

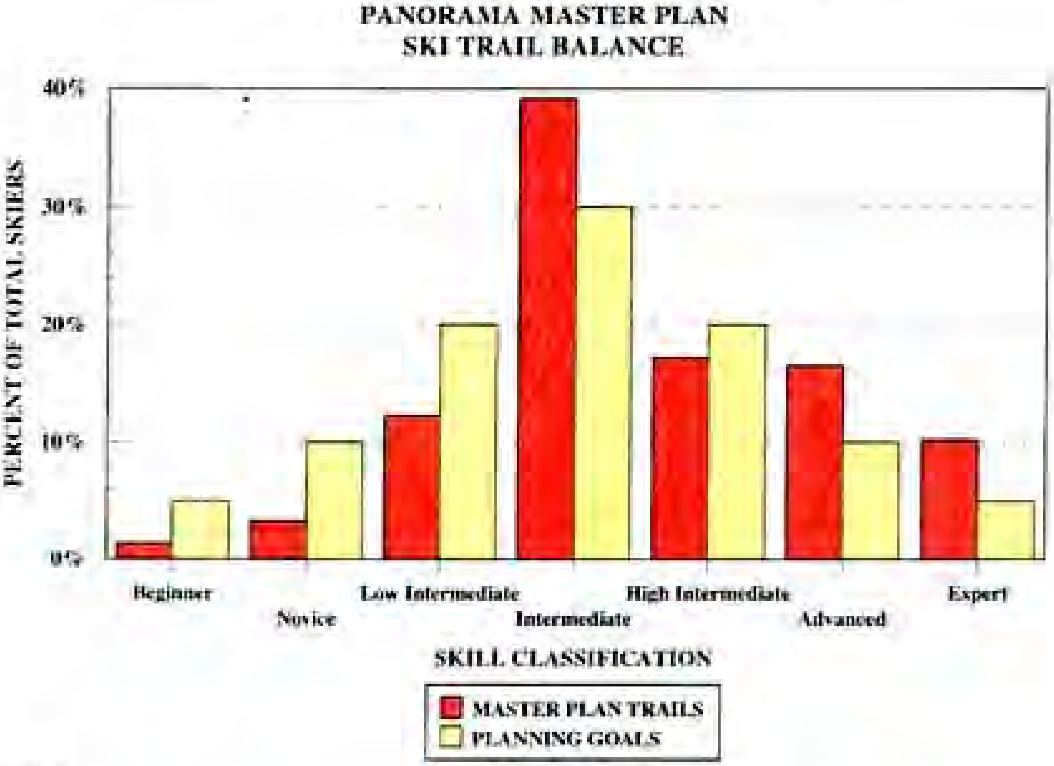


PLATE IV.1

The balance between lift and trail capacity is listed in Table IV.5 and graphically shown in Plate IV.2. The most significant imbalances occur on the Silver Platter and the Red Rider handle tow beginner lifts, which only have 50 and 44 percent of the optimal amount of terrain. All of the other lift systems have adequate or more than adequate terrain to match the lift capacities.

TABLE IV.5
PANORAMA MASTER PLAN
LIFT VERSUS TRAIL BALANCE STATEMENT

Lift No.	**1**	**2R**	**3**	**4**	**6R**	**7**	
Lift Name	**First Ascent**	**Horizon Quad**	**Toby**	**Sunbird**	**Summit**	**Silver Platter**	
Lift Type	**D4C**	**D4C**	**2C**	**3C**	**2C**	**P**	
Lift Capacity	1,430	1,810	170	870	190	220	Skiers/Day
Trail Capacity	1,695	2,115	280	1,395	250	110	Skiers/Day
Trails:Lifts	119%	117%	165%	160%	132%	50%	
Average Density	20.5	15.5	27.5	19.0	7.4	97.0	Skiers/Hectare
Optimum Density	37.2	28.9	45.7	36.3	16.7	49.5	Skiers/Hectare
Demand VTM	3,583	5,043	2,827	4,099	6,799	1,069	VTM/Skier/Day
Balance							
Beginner	0%	0%	0%	0%	0%	95%	
Novice	1%	0%	57%	0%	0%	0%	
Low Intermediate	56%	0%	0%	8%	0%	0%	
Intermediate	27%	35%	43%	71%	0%	5%	
High Intermediate	5%	32%	0%	9%	0%	0%	
Advanced	8%	27%	0%	10%	66%	0%	
Expert	3%	6%	0%	1%	34%	0%	
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	

Lift No.	**8**	**9**	**10**	**11**	**12**	
Lift Name	**Red Rider**	**Trapper's Chair**	**Taynton Bowl**	**Hopeful Creek**	**Schober's**	
Lift Type	**HT**	**3C**	**4C**	**D4C**	**D4C**	
Lift Capacity	80	380	530	640	1,680	Skiers/Day
Trail Capacity	35	310	865	850	2,025	Skiers/Day
Trails:Lifts	44%	82%	163%	133%	121%	
Average Density	115.9	53.9	12.3	14.1	23.2	Skiers/Hectare
Optimum Density	50.0	44.7	21.3	20.5	37.0	Skiers/Hectare
Demand VTM	940	2,495	7,016	6,437	4,188	VTM/Skier/Day
Balance						
Beginner	100%	0%	0%	0%	0%	
Novice	0%	47%	0%	0%	0%	
Low Intermediate	0%	53%	0%	0%	0%	
Intermediate	0%	0%	0%	0%	78%	
High Intermediate	0%	0%	25%	27%	16%	
Advanced	0%	0%	24%	44%	3%	
Expert	0%	0%	51%	29%	3%	
Total	**100%**	**100%**	**100%**	**100%**	**100%**	

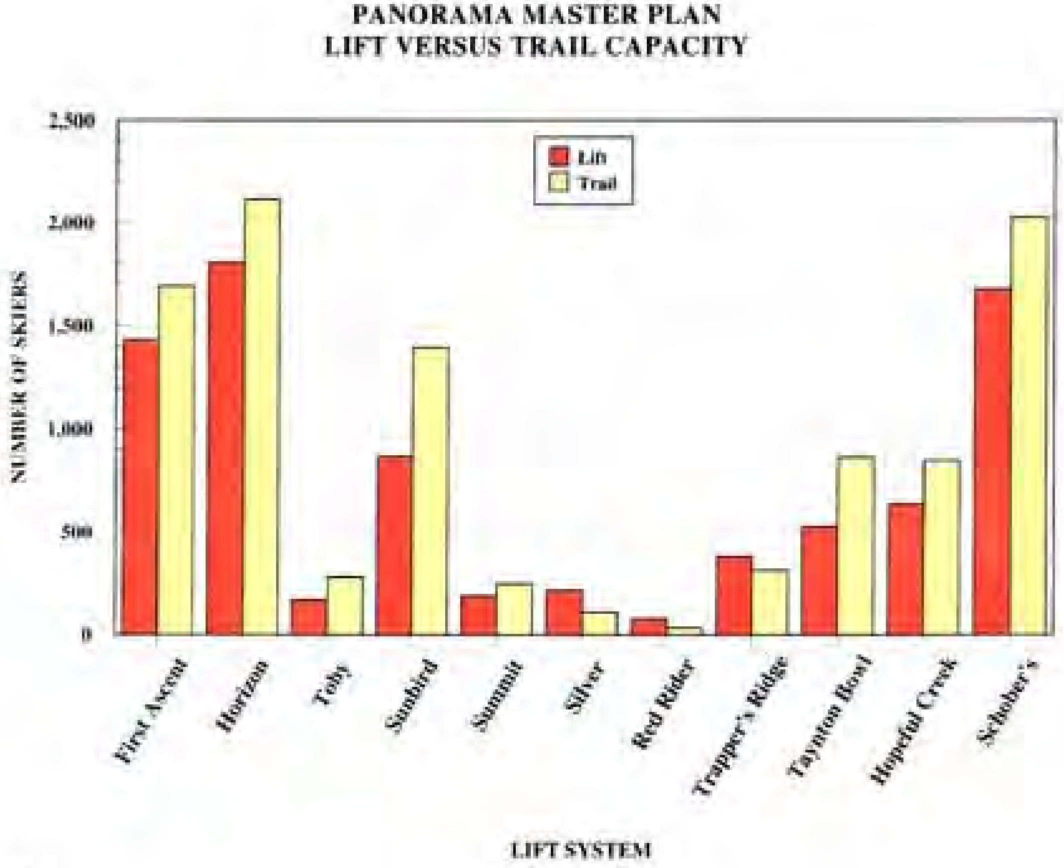


PLATE IV.2

.3 Snowmaking

Since Panorama's inception, the need for snowmaking has been foreseen as important to supplement the natural snowpack in order to extend the season. Expansion of the snowmaking system is first slated for within the existing area. This snowmaking expansion would be installed in many steps over the duration of the Village development. In anticipation of higher traffic volumes on the proposed New lifts, snowmaking would be installed on the new Horizon trails, World Cup Way and Schober's Dream. The lower mountain would see the installation of snowmaking on the Trapper's Ridge beginner area. Additional snowmaking would be phased with the construction of new trails. This new snowmaking will initially include the increase in pumping capacity of the River pumphouse to 2,700 GPM and the Booster pumphouse to 1,800 GPM. As the snowmaking areas are added to the system additional pumping capacity will be required.

.4 Skier Accommodation, Parking and Staging

Panorama Mountain Village relies on a combination of day skiers and overnight guests for their daytime ski business. The proportion of these types of guests varies over the season during different times of year, and varies over the long term with the availability of on-mountain accommodation, local and regional population growth, competing ski areas, etc.

Intrawest and Panorama staff have worked with consultants to develop a plan for the development of accommodation within the Village core and the surrounding lands, as well as a plan for parking and ski access for day skiers.

The accommodation plan includes a total of 7,084 beds spread throughout the resort, ranging from Village condohotel units, units with golf course frontage and forested single family units with ski-in/ski-out access. All of these beds are located within walking distance of a staging lift and therefore, it is anticipated that these skiers will not us their cars to access the lifts. As listed below in Table IV.6, on a peak day, these beds will generate a total of approximately 3,733 skiers.

TABLE IV.6
PROPOSED OVERNIGHT ACCOMMODATION

	Beds	% Occupancy	Total Guests	% Skiers	Total Skiers
Private Beds	4,710	50%	2,355	95%	2,237
Public Beds	2,374	70%	1,662	90%	1,496
Total Beds	7,084		4,017		3,733

Day skier parking has been planned in three locations; one adjacent to the Administration building; one at the entrance to the resort on the east side of the river and one on the west side of the river connected to the east side parking lot by a foot bridge. As listed in Table IV.7, these lots will have a capacity of approximately 965 cars, generating a total of approximately 2,413 day skiers.

Approximately 613 of these day skiers will be within a comfortable Skier Walking Distance (SWD) from the lifts, while skiers from the Toby Creek lots will require a shuttle from the parking to the lifts due to the distance and elevation difference. The Master Plan includes an aerial cable conveyance to provide a shuttle service from the parking to the Village base for these day skiers. This lift is proposed with an initial capacity of 514 passenger per hour and an ultimate capacity of 710 pph. Over a 2.5 hour staging period, this lift would initially be able to move approximately 1,285 skiers from the lower lots to the village and would be able to move 1,775 skiers at its ultimate capacity. Currently, the number of day skiers is significantly lower than the initial and ultimate capacity of this lift.

TABLE IV.7
PROPOSED DAY SKIER PARKING

	Cars	Skiers
Upper Toby Creek Lot	260	650
Lower Toby Creek Lot	455	1,138
Ski Tip Village Lot	100	250
Greywolf Lot	150	375
Total	965	2,413

Skiers per car: 2.5

Another concern at Panorama is the staging of skiers onto the mountain after they have arrived in the Village. The SCC of the lifts beyond the Village is about 5,720 and all these sliders should be staged within the industry accepted staging period of 2.5 hours. During the morning staging period, it is anticipated that approximately 60 percent of the seats on the First Ascent lift would be available for staging, and 40 percent for return cycle skiing. This would result in a staging capacity of 3,990 skiers. The remaining 1,730 sliders would be required to stage via the Toby and Sunbird chairs, which at 1,217 pph on Toby, would take approximately 1.6 hours. Table IV.8 lists these staging conditions.

TABLE IV.8
LIFT STAGING CAPACITIES

	Rated Capacity	Effective Capacity	Sliders Staged	Staging Time
TOTAL			**5,720**	
First Ascent Quad	2,800	1,596	3,990	2.5
Toby Chair	1,217	1,095	1,730	1.6

Note: 60% of First Ascent's seats are used for return cycle skiing during morning staging

.5 Winter Activities

Although alpine skiing/snowboarding is the chief form of recreation at Panorama Resort, many other activities can and will be offered to Panorama's guests in order to provide a full winter recreation experience. Some of these activities are already available, while many others can be added with little or no extra facilities required over and above the existing facilities. Some of the additional activities will require construction of special facilities. These additional winter activities are listed and described below.

Night Skiing

Night skiing is available on the Toby chairlift. This site is also the location of the snowboard half pipe and terrain garden which is used both during the day and at night.

Cross Country Skiing

The existing ski area includes a Nordic Center with a 22 kilometer cross country trail system featuring fully groomed freestyle and classic track set loops. The resort currently provides cross country instruction and equipment rentals. The existing cross country trail network is located in an area proposed for development of the new 18-hole championship golf course, therefore, management intends to develop an extensive multi-purpose trail network along with the development of the golf course for cross country skiing, mountain biking and walking. Ultimately, this trail network will provide 30 km of looped trails for cross country skiing. It is anticipated that approximately 5 km of trails will be provided in and around the golf course. Management is working with the Ministry of Forests to obtain approval to develop trail systems for winter and summer use that extend beyond the resort area boundaries. One of the areas proposed is along the Toby Creek Valley, west of the proposed golf course.

Heli-Skiing

Panorama Mountain Village is located on the edge of the Bugaboos, part of the largest and most well known heli-skiing areas in the world. R.K. Heli-Skiing operates from a heli-plex facility in Panorama Village and has access to over 1,700 square kilometers of spectacular heli-skiing terrain, including expansive glaciers and sheltered glade skiing.

Telemark and Backcountry Skiing

Telemark skiing can take place on the alpine ski facilities, utilizing the alpine lift and trail systems. Backcountry skiing is also available in the area.

Flightseeing

Flightseeing trips could take place out of the existing heli-plex facility in Panorama Village. Scenic helicopter flights allow resort visitors to get aerial views of the ski area development and the surrounding forest land. Fixed wing flights could be offered from the nearby airstrip at Invermere.

Paragliding

The sport of paragliding is increasing in popularity and currently available at many resorts both during winter (wearing skis) and summer. Panorama presently offers this sport to licensed paragliders and has identified suitable take-off and landing sites. This sport is offered in tandem (strapped to a qualified instructor/guide) or in lessons leading to a paragliding license. This activity can also take place during summer operation.

Ice Skating

Panorama has an illuminated skating rink on the lower village area adjacent to the existing condominiums. This rink is used by hotel and condominium guests in the evening, as well as day guests and members of skiing groups that do not wish to ski on a particular day. The resort management indicated a desire for an ice skating rink in a more central location and consequently a central water feature in the new Village core will be designed to accommodate ice skating.

Cat Skiing

There are opportunities for cat skiing in the area, which would provide another alternate activity, at or near the resort.

Sleigh Rides

Currently, Panorama provides complimentary sleigh rides in the winter. These rides travel on a half-hour circuit through the resort. On special evenings, a longer sleigh ride is available for a fee, culminating with a bonfire and hot refreshments. This service could be expanded to include more extensive trips, including cook-outs, as demand warrants.

Snowshoeing

Snowshoeing can take place in the woods surrounding the ski resort. Rental of snowshoe equipment is presently available at Panorama. The development of the resort will not affect the snowshoeing potential of the surrounding trails and woods.

Evening Programs

Panorama offers a range of evening programs and activities coordinated through the Activity Centre, which houses a nine-hole mini golf course and a video games room. Current offerings include pool and dart tournaments, wine tasting, dinner theatre, children and teen programs, bingo, snow volleyball, night-on-the-town shuttles and casino nights.

Outdoor Pool and Spas

The existing outdoor pool, located adjacent to the tennis courts on the other side of Toby Creek, is not operated during the winter. A heated outdoor pool with hot tubs that can be operated year-round is proposed for construction adjacent to the new central pedestrian village.

Hot Springs

Panorama Resort is located just 35 minutes by car (32 km) from the historic Radium Hot Springs. Since the hot springs facility is open until 10 p.m., aprés-ski trips and day visits are possible. The Fairmont Hot Springs Resort is 45 minutes (50 km) from Panorama. Visits to the hot springs are a popular year-round activity and Panorama offers tours for those wishing to visit in groups.

Snowmobile Tours

Full day guided snowmobile tours are currently offered through an operator based at Panorama. These tours offer a popular day trip and partial day trip alternative to skiing.

.6 Summer Activities

Summer activities are extremely important to the success of the recreational facility. These activities make use of the infrastructure and accommodation facilities in place for the winter recreation. The area surrounding Lake Windermere is a very popular summer destination area for Calgary residents who enjoy boating and swimming. The nearby attractions of Kootenay National Park and Radium and Fairmont Hot Springs bring many tourists into the area. Campgrounds along the Columbia River and Windermere and Columbia Lakes are used extensively by summer tourists. Historically, Panorama Resort has offered a relatively diversified summer activity program which includes mountain biking, tennis, whitewater rafting, horseback riding and children's day camp. As development continues, the resort will need to increase the variety of summer activities in order to appeal to a wider market of summer visitors.

During the summer of 1989, Marktrend Research Inc. was commissioned by the Whistler Resort Association to complete a profile of summer visitors to Whistler. The study, which included interviews of approximately 1,000 guests, showed that the most popular activities among summer visitors to Whistler were going to restaurants (66%), shopping (65%), sightseeing (63%) and watching street entertainment (57%). Other outdoor activities such as mountain biking, golfing tennis, canoeing/kayaking, and horseback riding had participation rates of 15 percent or less. Peak season visitors tended to participate in more activities than shoulder season visitors. While the survey of Whistler summer visitors to some extent reflects the activities, facilities and programs available at Whistler during the time of the study, Ecosign has drawn the following conclusions that are relevant to the planning for Panorama Resort:

1. Dining, shopping and sightseeing around a village are a predominant activity of summer visitors at mountain resorts.

2. About one half of summer visitors are likely to be attracted by street entertainment.

3. Multi-purpose trails are important for nature walks, hiking, biking and connecting accommodations with the village and natural areas.

4. Approximately 10 percent of summer visitors will use tennis courts.

5. Conference facilities are required to attract visitors during the spring and fall seasons.

The following section describes anticipated summer activities for the Panorama Resort:

Golf

There are five golf courses located in the surrounding area, however, an on-site golf course is an essential facility for the development of a four-season destination resort. As well as complementing the other summer activities, golf can be played into the shoulder seasons. An 18-hole championship golf course will open in the spring of 1999.

Mountain Biking

Panorama currently offers a variety of mountain biking activities. As part of the development of the new golf course, the resort intends to develop a new mountain biking and pedestrian trail network around the area. In addition, there are a number of old mining and forestry roads which can be used by more adventurous mountain bikers. Day excursions to Jumbo Creek, Glacier Dome, Paradise Mine and Delphine are a few of the many possibilities.

Guided Interpretive Walks and Hikes

Short duration hiking trails in the alpine and around the base area can be marked and signed to assist guests in finding their way around the mountain. Signage can identify flora and fauna that is seen on the trails, as well as provide identification of unique geological features. Guided hikes could be offered for those guests wishing for a more interactive experience.

Horseback Riding and Wagon Rides

Horseback riding is currently offered by an outfitter operating from the stables located near the Tennis Center. With the development of the new golf course, the stables are proposed to be relocated alongside Toby Creek, adjacent to the tennis/activity center. An extensive network of abandoned mining and logging roads in the area provides unlimited opportunities for trail rides of varying duration. Short overnight trail rides to mountain wilderness areas have also been growing in popularity throughout B.C. and the eastern Rockies and are another activity that could be considered at Panorama.

Camping

As previously stated, the surrounding area is quite popular for campers. By providing a site for recreational vehicles at the resort, Panorama can attract this group of tourists to the summer activity programs offered by the resort.

Heli-Hiking

The use of helicopters has made the spectacular alpine environment in B.C. accessible to a wide group of participants who don't have the time or the fitness level necessary to get to the high alpine terrain by hiking up from the valleys. Canadian Mountain Helicopters has been successfully operating heli-hiking excursions from its heli-skiing bases in B.C. for over seven years. The clientele varies from people just wanting a lift up to a mountain peak for lunch, to active day hikers wanting a head start to the scenic or inaccessible terrain. With the heli-plex facility located right in Panorama Village and the beauty of the surrounding Bugaboo and Purcell Mountain ranges, heli-hiking is a summer activity that could be developed without the need for additional facilities.

Fishing

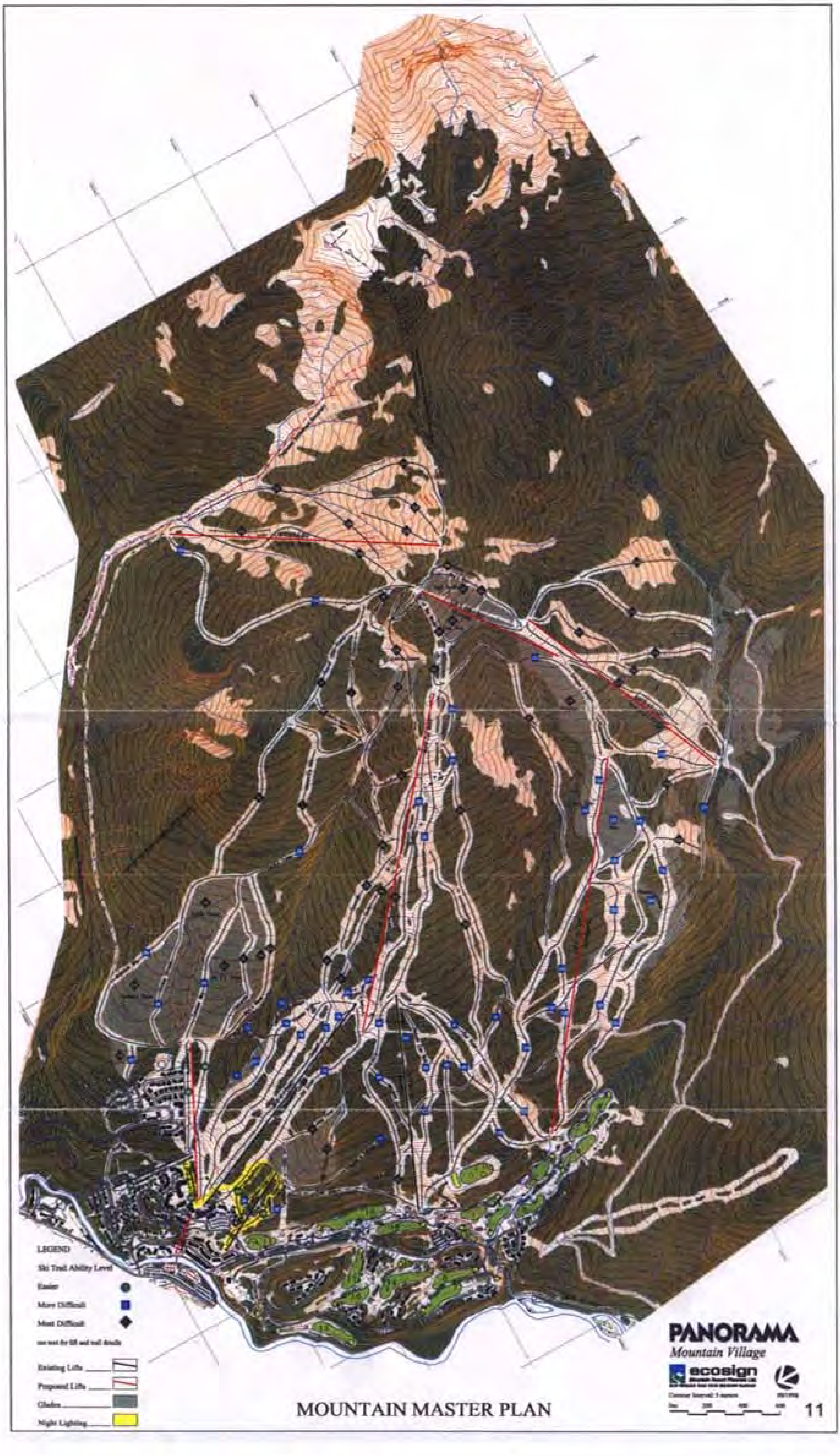
There are several good opportunities for fishing in the area, with some excellent fly fishing streams. Fishing guides are currently available in Invermere, although as yet there is no one offering rentals of fishing equipment. This is one activity that could easily be developed at Panorama.

Dining/Shopping/Entertainment

The new pedestrian village has been designed with retail and restaurant space on the ground floors of the buildings surrounding the central plaza. The central pedestrian square will be a natural location for street entertainment. As previously stated, these are very popular activities for summer visitors.

Conference Facilities

Panorama currently offers conference facilities for groups of up to 300.



MOUNTAIN MASTER PLAN

PANORAMA
MOUNTAIN VILLAGE

DEVELOPMENT SERVICING

September 1998

INTRAWEST

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1.0 WATER AND WASTEWATER FLOW PROJECTIONS

Future domestic water supply and wastewater generation rates have been estimated based upon the following assumptions.

- Water consumption and wastewater generation rates for an overnight guest is 350 litres per capita per day (lpcd). Because maximum daily flows are expected to occur during the winter ski season, at a time when lawn watering would not be taking place, it has been assumed for this analysis that wastewater flows will equal water consumption.
- Water consumption and wastewater generation rates for a day user is 100 lcpd.
- Proposed ultimate development size as provided by Stonefield Development Consultants (Stonefield).
- The proposed RV Park is assumed to have 3.25 public beds per RV stall.
- Proposed ratio of public beds/private beds as provided by Stonefield.
- 70% pillow usage for public beds (pillow count) on peak days.
- 50% pillow count for private beds on peak days.
- 95% of public and 90% of private users are skiers.
- Ultimate capacity of Panorama of 8,000 skier carrying capacity.
- Ultimate development of Panorama is reached in the year 2011.
- Growth from 1996 to 2011 as projected by Stonefield.

The results of the analysis are presented in Table 1.0. At ultimate development, the maximum day water demand and wastewater generation is estimated at 1,715 cubic metres per day.

2.0 WATER SYSTEM

2.1 General

Key features of the existing water system are as follows:

1. Intake works in Taynton Creek consisting of; a diversion weir and two timber weirs controlling the water level in a side channel to the main creek, infiltration gallery laying on the bottom of the side channel, second infiltration gallery in the gravel bed beside the side channel, and a concrete chamber with valves and fittings allowing flow selection from either or both of the infiltration galleries. The capacity of the intake system is unknown.

2. Raw water pipeline between the intake works and the pump station. This pipeline is a 150-mm diameter cement mortar lined ductile iron pipe. The average slope from the intake works to the pump station is 11%. Thus the capacity of the raw water pipeline is estimated at 53 litres per second.

3. Pump station consisting of: an underground reinforced concrete reservoir with a capacity of 181 cubic metres, two vertical turbine pumps each capable of pumping 15 litres per second, a disinfection system using a sodium hypochlorite solution, and flow meter. This system feeds the main water storage reservoir and is designed for one pump to operate at a time. The water level is maintained in the reservoir by an altitude valve mounted on the raw water pipeline.

4. A water storage reservoir consisting of; a membrane lined truncated conical earthwork depression, 3.0 metre high insulated steel walls and a flexible cover membrane. The capacity of the reservoir is calculated at 4,545 cubic metres. Level control is maintained by a pressure switch mounted on the reservoir overflow line, which activates the pumps in the pump station.

5. Gravity supply main from the water storage reservoir to the distribution system. The main is a 400-mm diameter cement mortar lined ductile iron pipe.

6. Distribution system throughout Panorama Mountain Village. The system is divided into several pressure zones controlled by pressure reducing stations. The distribution system consists of a combination of ductile iron pipe installed in the early 1980's and PVC pipe installed in the past few years.

The general layout of the Panorama Water System is in shown in Figure 2.0.

Golf course irrigation and snowmaking are handled by a separate water supply, pumping and distribution system. The system draws surface water from Toby Creek. It is not shown on Figure 2.0.

2.2 Intake Works

Panorama Mountain Village has three licenses from the BC Ministry of Environment, Lands and Parks (BC MELP) to divert and use water from Taynton Creek.

License #	Water Volume	
109104	93,000 IGPD	422 cu.m./day
109107	96,500 IGPD	439 cu.m./day
109109	36,500 IGPD	166 cu.m./day
Total	**226,000 IGPD**	**1,027 cu.m./day**

There are additional licenses from BC MELP to draw surface water from Toby Creek for the golf course irrigation and snowmaking systems.

Hydrotech Consulting Ltd. (Hydrotech) performed a hydraulic assessment of Taynton Creek in 1990. A conservative analysis was performed because of the lack of previous flow measurements for Taynton Creek. Hydrotech estimated the low flow from Taynton Creek at 361,000 IGPD (1,640 cu.m./day). However, the report recommends comprehensive data be gathered so that their analysis could be refined. Flow measurements taken by Panorama staff from 1994 to 1996 estimate the low flow to be much higher (3,887 cu.m./day during Feb/Mar/Apr 1995).

Using the current growth scenario it is estimated that the licensed volume to divert and use water will be reached in the year 2001. In anticipation of this milestone Intrawest has commissioned a study to review the flow measurements gathered by Panorama staff over the past few years and recalculate the estimated low flow volume. This revised report should be used as support documentation for an application to BC MELP to increase the licensed volume of water.

Maintenance items, which should be addressed, include:

- Review slope stability of Taynton Creek's bank immediately upstream of intake works.
- Cut and remove leaning trees that may fall and interfere with creek flow.
- Perform an engineering investigation of the intake function, condition and effectiveness immediately after spring run-off. One of the two infiltration galleries may not be fully functional.
- Install an improved flow measurement system for Taynton Creek.

2.3 Raw Water Pipeline

The capacity of the raw water pipeline exceeds the requirements for ultimate development at Panorama Mountain Village. Thus no upgrading is required to meet future demand. However there are a few maintenance items, which should be addressed.

- The pipe profile undulates through several small valleys and ridges. This results in sags and peaks in the water line. There are manual air releases at some of the peaks in the line. These should be replaced with automatic air release at all the peaks.
- Provision for sediment flushing at sags in the line is unknown. Flush points should be installed at all sags.

2.4 Pump Station

Using the current growth scenario it is estimated that the capacity of the pump station will be exceeded in the year 2005. Installation of a third pump and associated controls should be completed in 2005. This would permit the pump station to operate two pumps during maximum day demand, while the third pump remains as a standby unit (i.e. 50% standby capacity).

Maintenance items, which should be addressed, include:

- There is no provision to automatically alternate the pumps. The controls should be updated to permit automatic alternation.
- A flow meter was installed last year. However it has not been connected to the chemical injection pump for the disinfection system. Connecting the injection pump to the flow meter will permit more precise control of the chlorine residual in the water.
- Controls for the standby generator should be ratified for proper operation.
- An annual program should be started for flushing of sediment out of the storage reservoir at the pump station.

2.5 Water Storage Reservoir

No upgrading of the water storage reservoir is required to meet ultimate development. A security fence should be installed around the reservoir to deter unauthorized entry.

2.6 Supply Main

No upgrading of the supply main is required to meet ultimate development. It is recommended that a meter chamber with data recorder is installed on this line. This would permit Panorama Mountain Village to record maximum day and peak hour flow rates as well as total consumption.

2.7 Distribution System

The distribution system is of adequate size and in good enough condition to meet ultimate development. Water breaks and exterior corrosion has not been reported. However there are a few maintenance items, which should be addressed.

- The conditions inside some of the older pressure reducing stations is suspect. A review of these stations should be performed to ascertain if any valves or control valves need servicing.
- An annual program of main flushing should be implemented.
- Evaluate major thrust block on 400-mm diameter supply main leaving reservoir.

A booster station must be built to service the upper pressure zone of Trappers Ridge. Development in this area is anticipated to occur sometime after 2005.

3.0 WASTEWATER SYSTEM

3.1 General

Key features of the wastewater system are as follows:

1. Panorama Mountain Village is serviced by a system of gravity sewers, which drain to a common point at the entrance to the development at Toby Creek. The collection system consists of a combination of asbestos cement pipe installed in the early 1980's and PVC pipe installed in the past few years. The existing houses in the Toby Creek Subdivision are serviced by septic tank/weeping tile systems.

2. Sewage lift station with standby generator, located at the entrance to the development. The capacity of the lift station is reported at 53 litres per second. The wet well consists of a metal chamber with entrance tube, housing two submersible pumps. The controls and standby generator are housed in a separate at grade building.

3. A 200-mm diameter sewage forcemain between the lift station and the sewage treatment plant. The capacity of this forcemain, before friction losses become excessive, is calculated at 90 litres per second.

4. A sewage treatment plant located on the north side of Toby Creek. The equipment inside the plant includes; screening, biochemical oxygen demand reduction by twin rotating biological contactors (RBC), gravity clarification, rapid sand filtration and aerobic sludge digestion. One disc is missing on RBC #2. The licensed capacity of the sewage treatment plant is 1,090 cubic metres per day (BC MELP Permit # PE05193). The design capacity according to the Operating and Maintenance Manual is 982 cubic metres per day. The theoretical capacity with the damaged RBC unit is calculated at 845 cubic metres per day.

5. Weeping tile system installed along the north bank of Toby Creek, consisting of two subsurface tile fields. Each tile field covers an area of approximately 3,000 square metres. The weeping tile system is included under the license for the sewage treatment plant. Thus they are licensed for 1,090 cubic metres per day. However BC MELP states the capacity of the weeping tile system is 589 cubic metres per day.

The general layout of the Panorama Wastewater System is in shown in Figure 3.0.

3.2 Gravity Sewer System

No upgrading of the gravity sewer system is required to meet ultimate development. The East Kootenay Health Unit requests that Panorama Mountain Village tie in the septic tank/weeping tile systems in the Toby Creek Subdivision as new sewer mains are installed.

A small lift station may be required on the Greywolf Loop Road to service the lower areas of residential development.

3.3 Sewage Lift Station

No upgrading of the sewage lift station is required to meet ultimate development. Maintenance items, which should be addressed, include:

- Install continuous ventilation system for wet well.
- Sandblast and repaint interior of wet well.
- Excavate and install sacrificial anodes on wet well.
- Repairs controls to permit automatic alternation of the two pumps.

3.4 Sewage Forcemain

No upgrading of the sewage forcemain is required to meet ultimate development.

3.5 Sewage Treatment Plant and Weeping Tile Field

Using the current growth scenario it is estimated that the capacity of the sewage treatment plant will be exceeded in the year 1999. Panorama Mountain Village plans to repair the damaged RBC #2 in May 1999. These repairs will increase the capacity of the plant to enable it to service up to the year 2001. In 2001 both the design capacity and licensed capacity of the plant would be exceeded.

In anticipation of this milestone, Panorama Mountain Village has hired a consultant to review the feasibility of installing an Alum/Phosphorus removal module to the existing sewage treatment plant. This report should be completed in early 1999.

The licensed capacity of the weeping tile fields will be exceeded in the year 2001. The hydraulic capacity of the weeping tile fields exceeds the estimated maximum day flow at ultimate build out. However, the current limiting factor of the weeping tile fields is their ability to remove Phosphorus. The addition of an Alum/Phosphorus removal module to the sewage treatment plant will eliminate this limiting factor.

4.0 STORM WATER MANAGEMENT

4.1 General

Three drainage basins flow through Panorama Mountain Village: Cox Creek, Hopeful Creek and Little Hopeful Creek. Another drainage basin located to the east of Panorama Mountain Village (Taynton Creek) is used as the potable water supply for the resort. These four drainage basins run into Toby Creek, which is located along the north side of Panorama Mountain Village. The locations of these creeks and storm water flow directions are shown in the attached Figure 4.0.

4.2 Cox Creek

Cox Creek empties into Toby Creek at a point immediately east of the Toby Creek subdivision. The proposed Trappers Ridge subdivision is located on the slope to the east of Cox Creek. The remainder of Panorama is located to the west of Cox Creek.

The Cox Creek Drainage Basin is approximately 400 hectares in area and rises 1,200 metres from its confluence with Toby Creek to its highest elevation at 2,345 metres. The basin has an average gradient of 30% and is generally covered with a combination of natural alpine meadow, forested area and cleared ski runs. The percentage of open or clear area is estimated at 22%.

BC Environment Fishery Branch "considers Cox Creek to be non fish bearing" (Reference # 11).

The resulting overall runoff coefficient coupled with the relatively steep slope and low permeability shallow soil results in a storm hydrograph yielding a relatively large runoff with short duration. A hydraulic analysis, performed in 1996, estimates the 1:200 year flow at the Trappers Ridge road crossing to be 6.3 cubic metres per second.

In the hydraulic analysis it was recommended that a berm be constructed to prevent Cox Creek from overflowing its bank in a 1:200 year flow and draining through Ski Tip Village and the Toby Creek Subdivision. The upper section of berm, preventing Cox Creek from reverting to its original channel, was constructed in 1997. A study is currently underway to review the berm requirements for the lower section of Cox Creek. This study will identify the needs for any further berm extensions.

4.3 Hopeful Creek

The Hopeful Drainage Basin is approximately 1,695 hectares in area and rises 1,280 metres from its confluence with Toby Creek to its highest elevation at 2,440 metres. The gradient of the basin varies from approximately 28% in the upper reaches to 7% before its confluence with Toby Creek. The lower part of the catchment area is generally covered with a combination of natural alpine meadow, forested land and cleared ski runs. The upper part of the catchment area has generally been left in its natural state. The 1:200 year flow is calculated at 23.1 cubic metres per second.

In 1989 Panorama Mountain Village redirected Hopeful Creek from its original course heading north, to an abandoned channel heading west. This realignment left only Little Hopeful Creek running north adjacent to the residential lots along Greywolf Drive and adjacent to Horsethief Lodge/Toby Creek Lodge. Hopeful Creek channel was constructed to prevent avulsion into Little Hopeful Creek. A study, completed in 1998, recommended raising the left bank of Hopeful Creek in certain areas to provide additional freeboard from flooding of the #5 fairway lots. This work will be completed concurrently with development of the lots. All residential lots will be graded to elevations above the calculated 1:200 year flood level.

4.4 Little Hopeful Creek

The Little Hopeful Creek drainage basin is approximately 375 hectares in area and rises 1,220 metres from its confluence with Toby Creek to its highest elevation at 2,350 metres. The lower part of the catchment area is generally covered with a combination of natural alpine meadow, forested land, cleared ski runs and golf course fairways. The upper part of the catchment area has generally been left in its natural state. The 1:200 year flow is calculated at 6.1 cubic metres per second.

The creek flows through the existing golf course and past Horsethief Lodge/Toby Creek Lodge prior to entering Toby Creek. A storm water study has been completed on Little Hopeful Creek and all residential development will be graded to above the calculated 1:200 year flood level.

4.5 Toby Creek

Toby Creek is the major stream cutting across the north side of the Panorama site. It is also the main catchment basin for the valley. Its source is at Jumbo Glacier, west of Panorama Mountain Village. Toby Creek flows east, eventually draining into the Columbia River. The drainage area for Toby Creek above the Panorama Bridge is estimated at 837 square kilometres. The 1:200 year flood at the bridge is estimated at approximately 165 cubic metres per second.

Panorama Mountain Village is planning to construct townhomes at the southwest corner of the intersection of Panorama Drive and Horsethief. As a result Intrawest has commissioned a hydraulic analysis of Toby Creek adjacent to the townhome site. All habitable space on the townhome site will be above the calculated 1:200 year flood level, as per BC MELP water management requirements.

4.6 Piped Storm System

A piped storm sewer system has been constructed throughout Ski Tip Village, Horsethief Lodge and Toby Creek Lodge. The system also intercepts runoff from the ski slopes immediately uphill from Ski Tip Village. When the area is fully developed, the system can easily accommodate the 1:5 year storm event. There are three outfalls in this system, two into Little Hopeful Creek and one into Toby Creek.

Roadside ditches will handle all storm water runoff in the Greywolf Subdivision. Storm water runoff from Trappers Ridge will be handled by a combination of pipes and roadside ditches. The pipe system should be designed to handle the 1:5 year (minor) storm event and will outfall into Cox Creek and Taynton Creek. Major storm events (1:100 year) will be handled by overland/ditch flow into Cox Creek, Taynton Creek and Toby Creeks.

5.0 ROADS

5.1 General

Primary access to Panorama Mountain Village is via the existing two-lane bridge over Toby Creek from Toby Creek Road. Current road alignments are shown on Figure 5.0.

When development in the Greywolf Subdivision reaches 1,600 bed units a single lane bridge must be provided over Toby Creek from the Greywolf neighborhood. This bridge will be used as an emergency summer egress route only. When 2,000 bed units is reached in the Greywolf Subdivision, the existing trail between Hopeful Creek and the Toby Creek bridge location must be upgraded.

A preliminary design for the Trappers Ridge road has been completed. Construction of Greywolf Drive is completed up to the Clubhouse.

Panorama Drive, Greywolf Drive, Trappers Ridge and the Toby Creek Subdivision will be public roads maintained by BC Transportation and Highways. Either Panorama Mountain Village or the strata corporations will maintain private roads.

5.2 Standards

Panorama Drive, Greywolf Drive and Trappers Ridge are considered collector roads. They will be constructed with a minimum 3.5 metre wide travel lane, plus a 0.5 metre wide gravel shoulder. A short section of Panorama Drive, near Ski Tip Village will have curb and gutter on one side only. Road construction will meet current BC Transportation and Highway Standards.

Private roads will meet BC Transportation and Highway, Subdivision Standards where possible.

5.3 Road Grades

Grades on Greywolf Drive vary from 0.57% to 10.00%. Grades on Summit Drive will not exceed 8.00%. With the exception of a short 100 metre +/- section in the middle, all grades on Trappers Ridge will not exceed 10.00%.

Private road grades range from 0.60% to 12.00%. All road grades at intersections range from 1.00% to a maximum of 4.00% to help with ease of stopping and starting conditions on the steeper roads.

5.4 Sidewalks

Sidewalks are provided in the Ski Tip Village area as required to facilitate loading and unloading of vehicles. Otherwise, paths are incorporated into the landscaped areas as required to allow convenient movement of pedestrians throughout the village area and to provide convenient connections to adjacent areas. Golf cart paths will not be used as pedestrian access (safety conflict). Valley Trail, a 2.4 metre wide asphalt path, connects the village to the golf course and to the north side of Toby Creek via a triple-chair from Toby Creek Lodge to between Ski Tip and Pine Inn.

5.5 Parking

On street parking will not be permitted along the collector roads Panorama Drive, Greywolf Drive and Trappers Ridge. Due to the large number of tour buses anticipated, parking will also not be permitted along Summit Drive. All strata lots and condo-hotel sites are responsible for providing sufficient on-site parking for their needs as per zoning regulations.

Day users will park in one of the two major lots situated off the Toby Creek Road at the resort entrance. These lots will handle most of the day-use parking. Day users will then cross the footbridge and ride the triple-chair up to Ski Tip Village.

The existing lot adjacent to the administration building will satisfy the parking requirements during off-season periods. Another lot located at the Greywolf Clubhouse will provide parking for the golf course facilities and parking for the Sunbird chair during the ski season.

Bylaw No. 900 requires one parking space for every three skiers. These stalls must be located within 380 metres of a lift terminal. Thus at ultimate development a minimum of 2,667 parking stalls are required. It is estimated that hotel, lodge and residential units will provide approximately 60% of these stalls. The remainder of the stalls will be provided by the four parking lots mentioned above.

5.6 Signage and Lighting

Street identification signs will be installed at all intersections. The signs will match the new style proposed for Panorama Mountain Village. Road regulatory signs will be installed in accordance with BC Ministry of Transportation and Highway and local requirements.

Panorama Mountain Village wishes to maintain low level (i.e. rural style) road light levels. Single streetlights will be installed at major intersections and driveways. No lighting is planned between intersections. Lights will be metal halide (i.e. white light) and photocell controlled. The single family subdivision design guidelines require each homeowner to install one light at the end of their driveway.

6.0 SHALLOW UTILITIES

6.1 Power

There are currently two power grids within Panorama Mountain Village.

1. The Panorama System, which is owned by Intrawest Corporation. This system purchases power in bulk from BC Hydro and distributes it throughout Ski Tip Village, Horsethief Lodge, Toby Creek Lodge and the mountain operations (i.e. lifts and snowmaking). This system was inherited by Intrawest when they purchased the resort. It has recently been expanded in the Ski Tip Village area to avoid crossing lines with BC Hydro. Intrawest is not interested in expanding this system to service all of Panorama Mountain Village.

   The power grid is a 25,000-volt, three-phase system.

   The main service drop for the Panorama System is near the Sewage Lift Station on the north side of Toby Creek. The line runs overhead, across Toby Creek and up the Platter Tow to the rear of the Hearth Stone Condominiums. From this point the lines go underground, through the Hearth Stone Condominiums and down Summit Drive. An underground line then crosses Panorama Drive to service the Horsethief Lodge and Toby Creek Lodge.

   The system is in generally good shape. Since there are no plans to expand it, major upgrading will not be required.

2. The BC Hydro System, which services the Toby Creek Subdivision, the lots constructed in 1998 along Greywolf Drive and the golf course facilities. All future expansion will be serviced by BC Hydro.

   BC Hydro's main feed crosses Toby Creek overhead at the bridge. The line continues overhead up Panorama Drive to Panorama Crescent, where it goes underground. Three-phase service is currently extended to the Golf Clubhouse and water booster station immediately adjacent to the Clubhouse. The lines will be extended underground to service all of Greywolf. All the single family lots and most of the multi-family lots in Greywolf will have electric heat; thus three-phase service is required.

   Another three-phase line will extend underground up Trappers Ridge to service development in this area. Propane service will be provided up Trappers Ridge, thus the residential lots will not require three-phase service for heating purposes. However three-phase service will be required for the condo-hotel sites.

   Power service to the Toby Creek subdivision is overhead. There are no plans to bury these lines.

All future servicing will be handled by BC Hydro with developer contributions.

A report has been recently completed, considering the impact all future development at the resort has on the existing BC Hydro 25 KV radial feeder along Toby Creek Road. This report concludes the existing 25 KV line does not require upgrading over the next ten years. Peak demand is estimated at 8.5 MVA in the year 2007. Whereas the feeder capacity is approximately 15 MVA.

However the BC Hydro substation near Invermere has an estimated capacity of 7.5 MVA. Thus it will require upgrading around the year 2002.

6.2 Telephone

BC Tel provides telephone service to Panorama Mountain Village. Their main feed crosses Toby Creek overhead at the bridge. The line then goes underground and heads to the Horsethief Lodge and Toby Creek Lodge. The line then heads uphill to Summit Drive and down Greywolf Drive.

All Panorama managed buildings and condo-hotels are on the main Panorama switchboard. This switchboard will be expanded to service the future buildings in Ski Tip Village.

BC Tel will provide telephone service for all expansion along Greywolf Drive and up Trappers Ridge. All expansion will be underground. Telephone service to the Toby Creek subdivision is overhead. There are no plans to bury these lines.

6.3 Cable TV

Panorama Mountain Village has their own cable TV service. The existing system may be transferred to a private cable service provider, who would handle all future expansion. Future expansion will be paid for on a cost sharing basis with developer contributions.

6.4 Propane

A propane system is installed along Summit Drive. This system currently services the Administration Building, Pine Inn, Ski Tip and Tamarack. The system is being expanded in 1998 to service the Hearth Stone Condominiums. The system is sized to service all future buildings along Summit Drive. A temporary tank farm servicing all of Summit Drive is installed next to Tamarack.

Trappers Ridge will also have propane service. A tank farm will be installed on the north side of Toby Creek, near the sewage treatment plant. A propane line will run underneath Toby Creek and up the Trappers Ridge Road. A branch line will run up the Platter Tow to Summit Drive and connect into the Summit Propane System. When this line is installed the temporary tank farm beside Tamarack will be removed.

7.0 REFERENCES

1. "Panorama Resort Ltd., Infrastructure Study", January 1993, prepared by Delcan.

2. "Intrawest Corporation, Panorama Resort, Water, Wastewater and Solid Waste Assessment", May 1997, prepared by Stanley Environmental.

3. Letter to BC Environment M.E.L.P. regarding "Panorama Resort Wastewater Treatment Plant", dated September 3, 1997, written by Stanley Environmental.

4. "Panorama Village Project, Study For Master Plan of Surface Water Management", dated November 1980, prepared by Morgan Stewart and Company Limited.

5. RDEK bylaw 1285, Item 20, which amends RDEK bylaw 368, Section 3.7.

6. Letter report to Intrawest regarding "Hopeful Creek Hydraulic Analysis", dated June 23, 1998, written by Stanley Urban Land.

7. Memorandum to Intrawest regarding "Hopeful Creek/Little Hopeful Creek Avulsion Issue"" dated June 24, 1998, written by GeoAlpine Environmental Consulting Ltd.

8. Letter report to Intrawest regarding "Hopeful Creek Design Flows", dated July 26, 1996, written by IMC Consulting Group.

9. Letter report to Geo-Alpine Environmental regarding "Hopeful-Little Hopeful Creeks", dated August 16, 1996, written by IMC Consulting Group.

10. Bylaw 1284, Item 3.7.11, which identifies phasing criteria for Emergency Summer Egress Route.

11. Letter to Panorama Resort regarding "Culvert Installation, Cox Creek", dated July 28, 1997, written by B.C. Environment, M.E.L.P.

12. "Panorama Resort, Power Distribution Study", dated November 1998, written by Stanley Buildings.

TABLE 1.0
PANORAMA MOUNTAIN VILLAGE
WATER AND WASTEWATER FLOW PROJECTIONS

Year	Proposed Development Schedule								Estimated Water Consumption			Estimated Wastewater Generation		
	Dwelling Units		Bed Units		Pillow Count (3) On Peak Day	Total Skiers (4) From Bed Units	Day Capacity Of Panorama	Day Skiers	Max. Day (cu.m.) (5)	Fire Flow Storage (cu.m.)	Required Storage (cu.m.)	Max. Day (cu.m.) (5)	Peak Factor	Peak Flow (lps)
	Public	Private	Public	Private										
1996	238	200	595	768	801	741	4,650	3,909	650	1,035	1,685	650 (6)	2.0	15
1997	278	200	715	830	916	849	4,650	3,801	677	1,035	1,712	677	2.0	16
1998	357	270	885	1,188	1,214	1,123	4,650	3,527	746 (9)	1,035	1,781	746	2.0	17
1999	446	310	1,088	1,352	1,438	1,332	5,500	4,168	883	1,035	1,918	883 (7)	2.0	20
2000	455	368	1,096	1,596	1,565	1,447	5,500	4,053	912	1,035	1,947	912	2.0	21
2001	535	588	1,291	1,873	1,840	1,701	6,000	4,299	1,025	1,035	2,060	1,025 (8)	2.0	24
2002	733	614	1,846 (1)	1,958	2,271	2,109	6,000	3,891	1,127 (10)	1,035	2,162	1,127	2.0	26
2003	803	673	2,017	2,196	2,510	2,330	6,500	4,170	1,233	1,035	2,268	1,233	2.0	29
2004	873	729	2,188	2,455	2,759	2,560	6,500	3,940	1,290	1,035	2,325	1,290	2.0	30
2005	873	798	2,188	2,748	2,906	2,692	7,000	4,308	1,373 (11)	1,035	2,408	1,373	2.0	32
2006	873	846	2,188	2,981	3,022	2,796	7,000	4,204	1,399	1,035	2,434	1,399	2.0	32
2007	873	889	2,188	3,168	3,116	2,881	7,500	4,619	1,470	1,035	2,505	1,470	2.0	34
2008	988	955	2,469	3,415	3,436	3,179	7,500	4,321	1,545	1,035	2,580	1,545	2.0	36
2009	988	1,035	2,469	3,741	3,599	3,325	8,000	4,675	1,631	1,035	2,666	1,631	2.0	38
2010	988	1,107	2,469	4,052	3,754	3,465	8,000	4,535	1,666	1,035	2,701	1,666	2.0	39
2011	988	1,167	2,469	4,247	3,852	3,553	8,000	4,447	1,688	1,035	2,723	1,688	2.0	39
Future	988	1,234	2,620 (2)	4,754 (2)	4,211	3,882	8,000	4,118	1,771 (12)	1,035	2,806	1,771	2.0	41
Ultimate Development	**988**	**1,234**	**2,620**	**4,754**	**4,211**	**3,882**	**8,000**	**4,118**	**1,771** (13)	**1,035**	**2,806** (14)	**1,771**	**2.0**	**41** (15)

Notes:

(1) For water and wastewater flow projections the RV Park is assumed to have 3.25 public beds per RV stall (290 bed units).

(2) Ultimate build-out of 7,084 bed units plus an allowance of 290 bed units for the RV park.

(3) Assumes a 70% pillow usage for public beds and 50% pillow usage for private beds.

(4) Assumes 95% of public and 90% of private pillow count are skiers.

(5) Assumes 350 litres per capita day (lpcd) for overnight guests and 100 lpcd for day users.

(6) Weeping tile field exceeds capacity stated by BC MOE (589 cu.m./day). However does not exceed design capacity as stated in O&M Manual (982 cu.m/day) or licensed capacity (1,090 cu.m./day). Must come to an immediate agreement with BC MOE as to capacity of weeping tile field.

(7) Must repair damaged disc on RBC #2 to bring sewage treatment plant up to design capacity. With damaged disc capacity is 845 cu.m./day.

(8) Exceeds maximum capacity of sewage treatment plant (982 cu.m./day). Must upgrade plant and increase licensed capacity.

(9) Latest start for monitoring flows from Taynton Creek in anticipation of increasing license to divert (Note # 9, below).

(10) Exceeds all three licenses to divert and use water from Taynton Creek (1,027 cu.m./day). Must increase license(s).

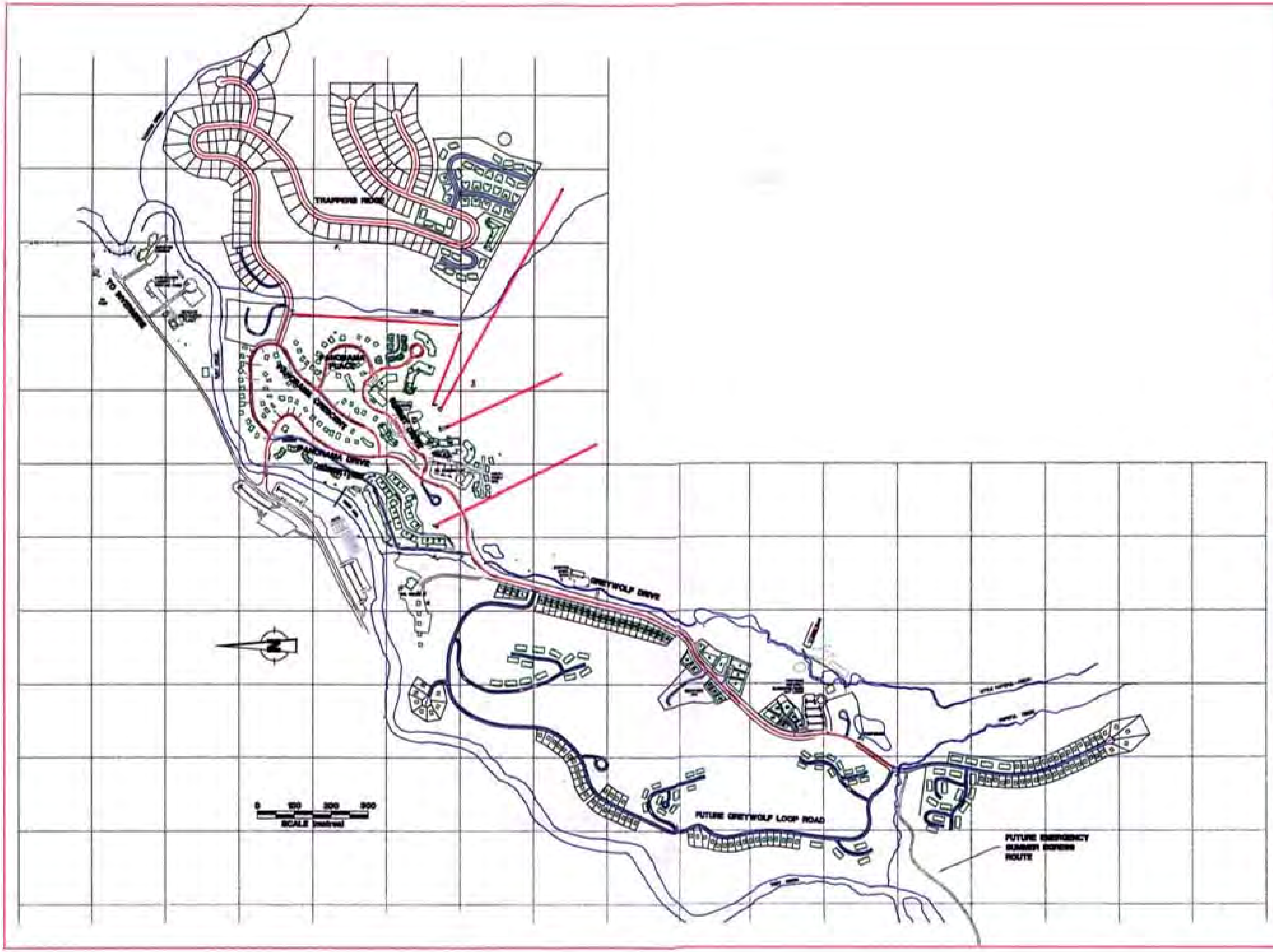
(11) Exceeds raw water pumping capacity, with 100% standby (1,309 cu.m./day). Must upgrade pumps.

(12) Exceeds hydraulic assessment of Taynton Creek as performed by Hydrotech.

(13) Does not exceed capacity of raw water pipeline (4,579 cu.m/day).

(14) Does not exceed capacity of treated water reservoir (4,545 cu.m.).

(15) Does not exceed capacity of sewage lift station (53 lps).



STAMPS

LEGEND

🟥	PUBLIC ROAD
🟦	STRATA ROAD

NO.	DATE	DESCRIPTION
4		
3	99/02/13	UPDATED OVERALL LOT AND BUILDING PLAN
2	98/11/26	REVISED BLDG. "D" FOOTPRINT ADDED "THE BRIDGES" FOOTPRINT
1	98/10/21	ISSUED FOR APPROVAL

REVISIONS

JOB NO.:	2965	FILE:ROADSCH2
SCALE:	AS SHOWN	DATE
DRAWN BY:	J.B.	98/10
DESIGNED BY:	J.B.	98/10
CHECKED BY:	J.B.	98/10/21
APPROVED BY:	K.M.	98/10/21

INTRAWEST

Bel-MK Engineering Ltd.

PROJECT TITLE:

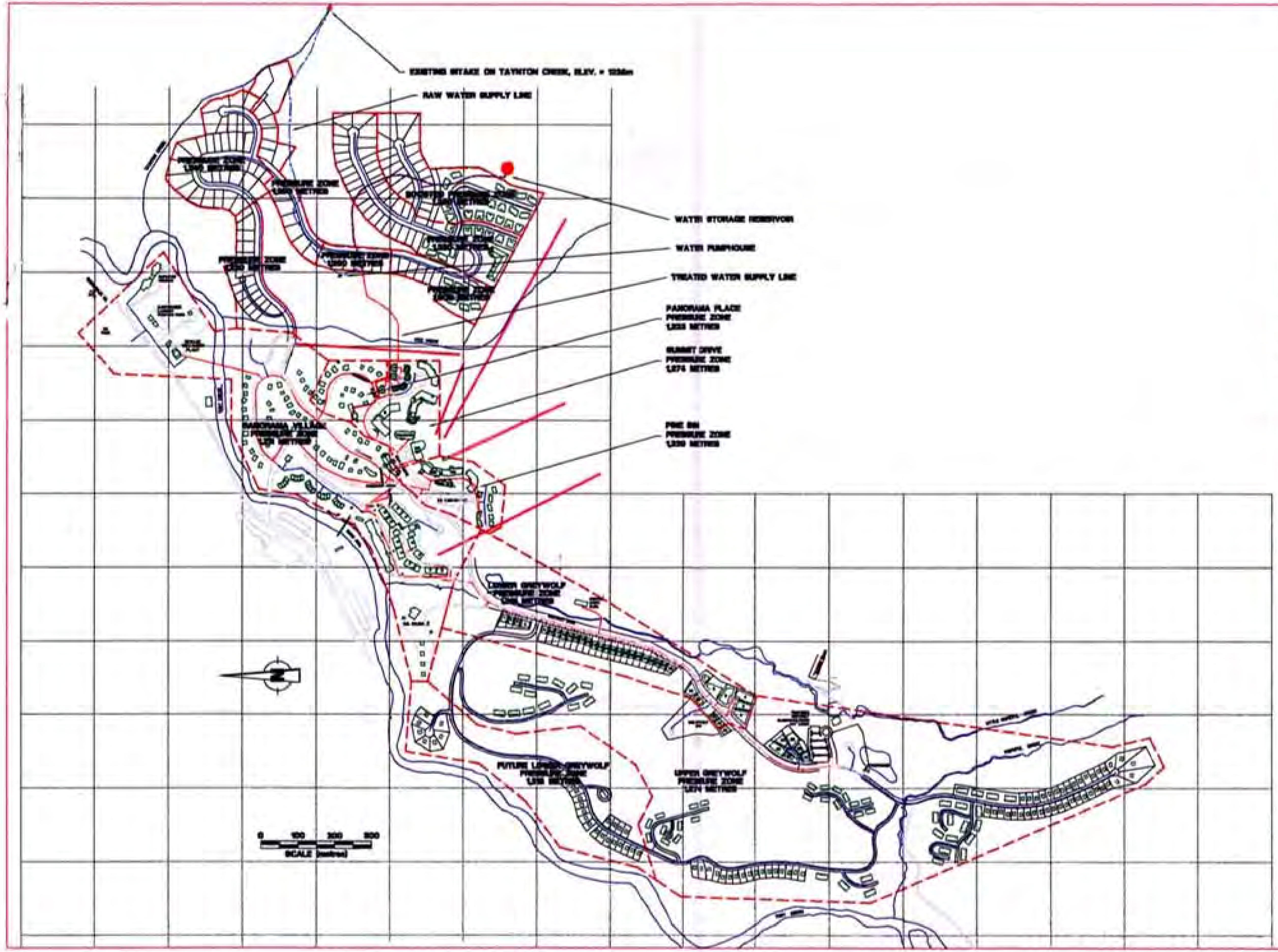
PANORAMA MOUNTAIN VILLAGE
PANORAMA, B.C.

DEVELOPMENT
SERVICING REPORT

DRAWING TITLE:

FIGURE 5.0
OVERALL PLAN
ROAD SYSTEM

DRAWING NUMBER:	REVISION:
GA-107	3



STAMPS

LEGEND

🟥	EXISTING WATER DISTRIBUTION LINE
─ · ─	EXISTING RAW WATER LINE
──	PROPOSED WATER DISTRIBUTION LINE
– – –	OUTLINE OF PRESSURE ZONES

NO.	DATE	DESCRIPTION
4		
3	99/02/13	UPDATED OVERALL LOT AND BUILDING PLAN
2	98/11/18	REVISED BLDG. "F" FOOTPRINT ADDED "THE BRIDGES" FOOTPRINT
1	98/10/21	ISSUED FOR APPROVAL

REVISIONS

JOB NO.:	2965	FILE: WATSCH2
SCALE:	AS SHOWN	DATE
DRAWN BY:	J.B.	98/10
DESIGNED BY:	J.B.	98/10
CHECKED BY:	J.B.	98/10/21
APPROVED BY:	K.M.	98/10/21

INTRAWEST

Bel-MK Engineering Ltd.

PROJECT TITLE:

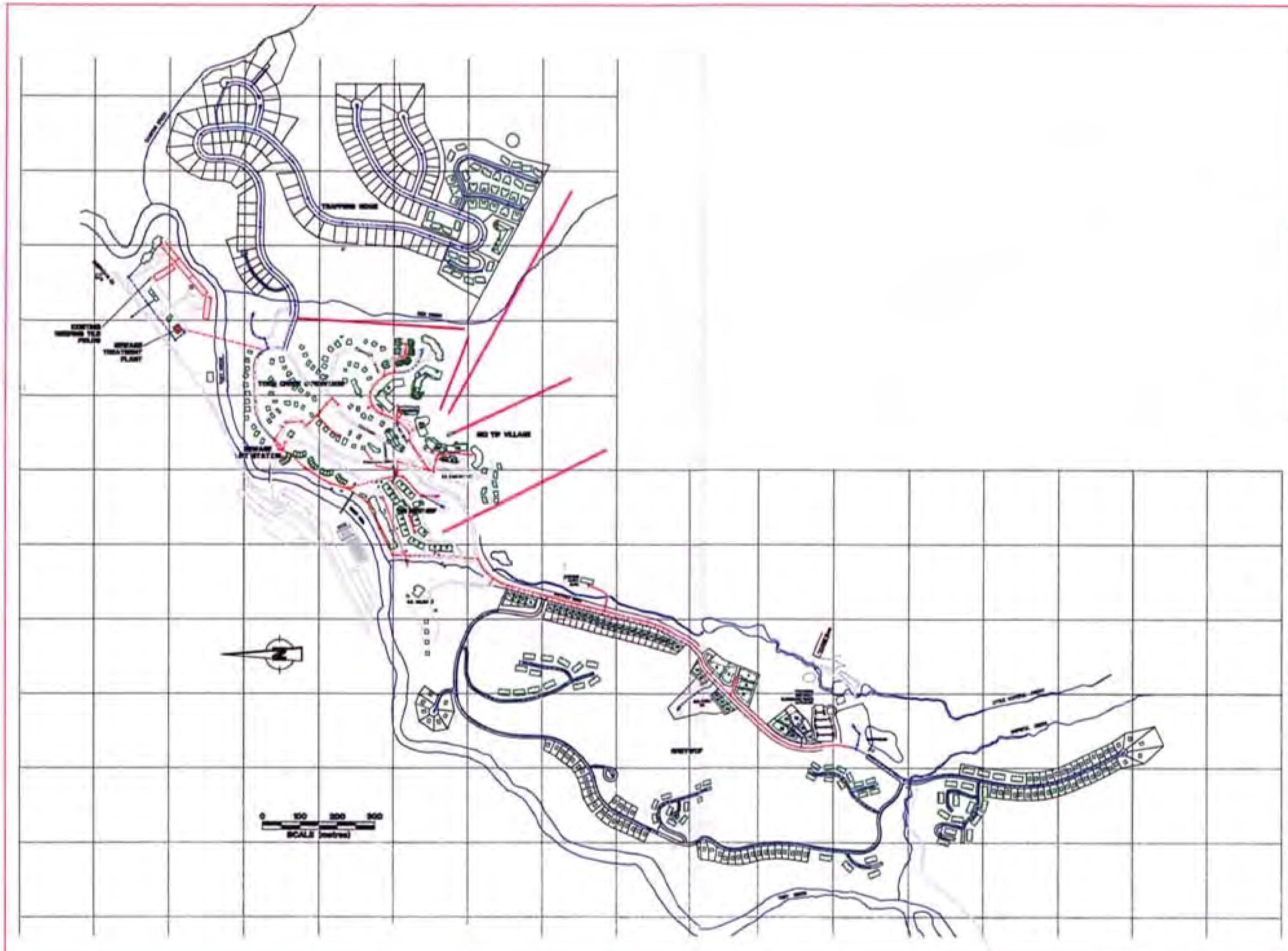
PANORAMA MOUNTAIN VILLAGE
PANORAMA, B.C.

DEVELOPMENT
SERVICING REPORT

DRAWING TITLE:

FIGURE 2.0
OVERALL PLAN
WATER SYSTEM

DRAWING NUMBER:	REVISION:
GA-104	3



STAMPS

LEGEND

- EXISTING SANITARY SEWER LINE
- EXISTING SANITARY SEWER MANHOLE
- EXISTING SANITARY SEWER FORCEMAIN
- PROPOSED SANITARY SEWER LINE
- PROPOSED SANITARY SEWER MANHOLE

NO.	DATE	DESCRIPTION
4		
3	99/03/12	UPDATED OVERALL LOT AND BUILDING PLAN
2	98/11/18	REVISED BLDG. "D" FOOTPRINT ADDED "THE BRIDGES" FOOTPRINT
1	98/10/21	ISSUED FOR APPROVAL

REVISIONS

JOB NO.:	2965	FILE: SANSCH2
SCALE:	AS SHOWN	DATE
DRAWN BY:	J.B.	98/10
DESIGNED BY:	J.B.	98/10
CHECKED BY:	J.B.	98/10/21
APPROVED BY:	K.M.	98/10/21

INTRAWEST

Bel-MK Engineering Ltd.

PROJECT TITLE:

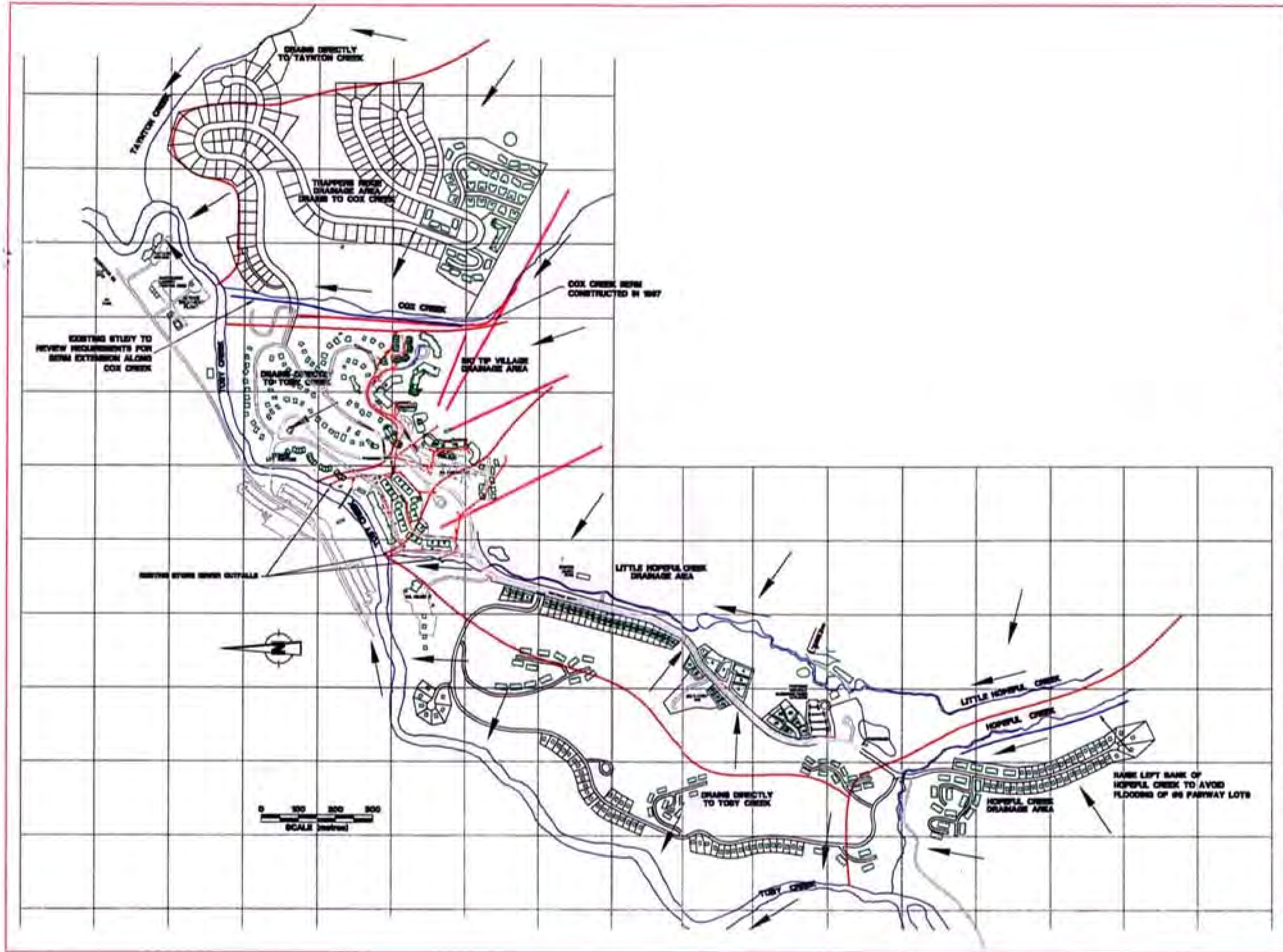
PANORAMA MOUNTAIN VILLAGE
PANORAMA, B.C.

DEVELOPMENT
SERVICING REPORT

DRAWING TITLE:

FIGURE 3.0
OVERALL PLAN
WASTEWATER SYSTEM

DRAWING NUMBER:	REVISION:
GA-105	3



STAMPS

LEGEND

EXISTING STORM SEWER LINE
EXISTING STORM SEWER MANHOLE
EXISTING CULVERT
EXISTING INLET OR OUTLET
PROPOSED STORM SEWER LINE
PROPOSED STORM SEWER MANHOLE
PROPOSED CULVERT
CATCHMENT AREA BOUNDARIES

NO.	DATE	DESCRIPTION
4		
3	99/03/12	UPDATED OVERALL LOT AND BUILDING PLAN
2	98/11/18	REVISED BLDG. "F" FOOTPRINT ADDED "THE SMOKEY" FOOTPRINT
1	98/10/21	ISSUED FOR APPROVAL

REVISIONS

JOB NO.:	2985	FILE: STMSCH2
SCALE:	AS SHOWN	DATE
DRAWN BY:	J.B.	98/10
DESIGNED BY:	J.B.	98/10
CHECKED BY:	J.B.	98/10/21
APPROVED BY:	K.M.	98/10/21

INTRAWEST

Bel-MK Engineering Ltd.

PROJECT TITLE:

PANORAMA MOUNTAIN VILLAGE
PANORAMA, B.C.

DEVELOPMENT
SERVICING REPORT

DRAWING TITLE:

FIGURE 4.0
OVERALL PLAN
STORM SYSTEM

DRAWING NUMBER:	REVISION:
GA-108	3

BIOPHYSICAL OVERVIEW

4.0 BIOPHYSICAL OVERVIEW

Information in this section is based on an inventory and analysis of existing resort development and natural conditions within the Panorama Mountain Village Plan Area. Data related to the natural environment is derived predominantly from Government of British Columbia mapping, Canada Land Inventory mapping and the *Atlas of British Columbia - People, Environment and Resource Use* by A.L. Farley. As government mapping does not take social and economic factors, present land use and the additive effects of other wildlife species into account, additional research has been conducted into specific areas of concern by: EBA and Golder Associates with respect to geotechnical and related hazard conditions; grizzly bears and ungulates by Purcell River Odysseys Ltd., and; for aquatic habitat, detailed studies were conducted by GeoAlpine Environmental Consultants. Information has been verified and supplemented through extensive on-site field reconnaissance. Individual studies by the various consulting disciplines are contained in the Environmental and Geotechnical sections of CDP Volume II - Technical Background Report.

CLIMATE

Climate for the Panorama Mountain Village Plan Area can be generalized as having cold winters, warm dry summers and significant amounts of precipitation during winter months in the form of snowfall, especially in higher alpine environments. Due to the topography of the area, temperatures and rainfall vary significantly. The following statistics in Table 3-1 are from the weather station at the west gate of Kootenay National Park and representative of the Panorama area.

CLIMATIC DATA FOR PANORAMA MOUNTAIN VILLAGE AREA

TEMPERATURE

	January	July	Year
Daily Maximum	- 5.9°C	25.2°C	10.6°C
Daily Minimum	- 12.3°C	10.6°C	- 0.1°C
Daily Mean	-9.0°C	18.0°C	5.3°C

PRECIPITATION

	January	July	Year
Rainfall	4.6 mm	44.3mm	303.2mm
Snowfall	29.9cm	0.0cm	110.8cm
Precipitation	34.5mm	44.3mm	414.1mm

FROST FREE DAYS

First Frost (Spring)	Earliest April 29	Latest June 30
Last Frost (Fall)	Earliest Sept 16	LatestOctober 5
Longest	156 Days - April 30 to October 4	
Shortest	86 Days - June 30 to September 25	
Average	128 Days - May 18 to September 24	

DAYS WITH...

	January	July	Year
Max Temperature >0°C	6	31	288
Measurable Rainfall	2	11	85
Measurable Snowfall	10	0	36
Measurable Precipitation	11	11	36

TOPOGRAPHY

The Panorama Mountain Village Plan Area falls within the Purcell Mountain Range and as such is characterized by extreme mountainous topography. Elevations within the Plan Area range from approximately 1150 metres (3800 feet) in base area and valley bottom lands, to 2375 metres (7800 feet) at the top of Panorama Mountain. Within this range of topographic conditions exist various benches, alluvial planes associated with creek valleys, fans and terraces along the Toby Creek flood plain. A series of higher peaks including Mt. Goldie reaching 2650 metres (8700 feet) and Mount Brewer at 2750 metres (9022 feet) frame the southern boundary of the Plan Area.

Slope analysis was carried out to determine overall development capabilities of the Panorama Mountain Village Plan Area for both base area development as well as ski terrain capacity. Slope categories were defined as follows relative to their degree of potential constraint to base area development: 0-8% - low constraint; 8-25% - low to medium constraint; 25-45% - medium to high constraint, and; greater than 45% - high to severe constraint.

This data was utilized in locating and organizing various land uses within the Plan Area. From the analysis it became evident that the significant vertical elevation and steeper slopes are obviously well suited to development of alpine ski facilities which are the primary focus of the resort. Also evident were various lower benches and alluvial planes or creek valley areas, offering potential for development of diverse forms of recreation and resort accommodation, and steeper sloped areas, largely bordering major creek channels (Hopeful Creek, Toby Creek, Taynton Creek) or sheer rock bluffs, which constitute non-developable or environmental preservation zones.

The analysis of topographic conditions yielded specific areas which have been proposed for base area development. These generally represent the least constrained topography within the overall Plan Area.

Four main development zones evolved:

1. Toby Creek Corridor
2. Hopeful Creek Valley
3. Panorama Benchlands
4. Cox/Taynton Benchlands

The Toby Creek corridor extends generally in a north/south orientation through the base area lands. At various points along this length, alluvial terraces offer favourable topographic conditions. This was confirmed during the original planning process for Panorama and hence development of the Toby Creek Area took place with construction of Toby Creek and Horsethief Lodges, the lower single family subdivision, tennis courts and community swimming pool facility. Adjacent to these existing developments, the Riverbend townhouses, the main day skier parking lots and RV park are proposed. The main entrance to Panorama is also located within the Toby Creek corridor off Toby Creek Road.

Hopeful Creek valley was also identified in earlier planning studies. The area was originally planned as the "West Village" and in 1989 this was substituted with an 18-hole golf course. Topographic analysis conducted as part of the Comprehensive Development Plan and Mountain Master Plan process has established Hopeful Creek valley as the site of the Greywolf golf course residential neighbourhood. The Greywolf golf course neighbourhood and the Sunbird day skier base are situated in this relatively flat valley bottom which is contained by steep slopes of the surrounding mountains and the steep banks of Toby Creek corridor.

Panorama Benchlands are situated at the base of Panorama Mountain at elevations ranging between 1135 metres and 1205 metres. The topographic configuration is well suited as the resort's major ski base area. Day skier parking, skier day lodge, major resort accommodation, and related commercial and administrative functions contained with Ski Tip Village are all uses which are contained within this topographic zone.

Cox/Taynton Benchlands consist of well defined benches which extend between these two creek corridors and up the base of Panorama Mountain. Two main benches exist: a lower bench located just above the steep banks of Toby Creek at elevations spanning between 1140 metres and 1220 metres, and; an upper bench bordering the future Trapper's Chair lift and ski run. This bench is situated at elevations ranging between 1260 metres and 1320 metres. The Cox /Taynton Benchlands yield topography suitable for development of ski-in/ski-out residential accommodation and thus have been proposed as the trapper's Ridge neighbourhood.

The remainder of the Panorama Mountain Village area is mountainous with few other significant flat areas. The area, including ski runs and outlying Crown land, ranges in elevation from a low of approximately 1150 metres elevation (3800 feet) on the edge of Toby Creek adjacent to the wastewater treatment plant to a high of 2375 metres (7800 feet) at the peak of Panorama Mountain.

GEOLOGY AND SOILS

Panorama Mountain Village is located in the Purcell Mountains, a mountain range which is 300 kilometres in length and up to 80 kilometres in width and which is part of the Columbia Mountains. The Purcell Mountains include some extremely high and rugged mountainous country, the highest peak, Mount Farnham, has an elevation of 3457 metres (11342 feet). By comparison, Panorama Mountain has an elevation of 2375 metres (7800 feet) and Mt. Goldie, the highest peak in the Panorama Mountain Village Plan Area, has an elevation of 2650 metres (8700 feet).

The Purcell Mountains are underlain by sedimentary and metamorphic rocks, largely of Proterozoic age but extending upward into the Lower Palaeozoic, which are intruded with batholiths of granite rocks. The sedimentary and metamorphic rocks comprise thick quartzite, argillaceous quartzite, argillite, and limestone members. The rocks are involved in overturned and frequently complex folds about axis which regionally have an arcuate plan.

The highest peaks in the Purcell Mountains projected above the Pleistocene ice-sheet, whose level lay at about 2130 metres (7000 feet) at Panorama. The peaks were shaped by intense cirque glaciation, and active cirque glaciers are still present on some of the highest peaks. The summits are separated by deep, steep-sided glaciated valleys, and interconnecting ridges are few and mostly serrate. Glacial striations, erratics and glacial debris occur at all elevations up to 2450 metres (8000 feet). Striations and roches moutonnées and similar phenomena indicate that the ice sheet moved in a generally southerly direction, but with a tendency to follow the main topographical features such as the Purcell Trench. The land surface overlain by the ice was one of high relief, with the principle ridges and valleys in much the same positions as they are today. As the ice thinned down the underlying topography assumed control and a stage of valley and alpine glaciation ensued. During this stage the ice sheet broke up into lobes which flowed down the principle valleys.

The Panorama Mountain Village Plan Area consists primarily of fluvial materials as deposited by rivers and streams. This includes sand, gravel and bouldery gravel in floodplains, alluvial fans and river terraces. Gravels are typically subangular to subrounded, moderately to poorly sorted and include blocks and boulders. Equally found within the Panorama Resort Plan Area is colluvium material deposited as a result of downslope movement from rockfalls, debris flows and rock creep. This colluvial material includes loosely packed, coarse, angular material with minor interstitial sand and silt in talus slopes, avalanche cones, rockslide debris and mantles of shattered bedrock as well as denser debris deposits in colluvial cones and fans. Outcrops of bedrock are found to a lesser extent throughout the site.

HYDROLOGY

There are numerous streams and creeks which occur within the Panorama Mountain Village Plan Area. Five of these creeks are considered to be significant watercourses, the remainder are tributaries to these creeks or small unnamed watercourses which are often ephemeral in nature.

TOBY CREEK

Toby Creek, a tributary of the Columbia River, is a fairly large system with a drainage area of about 684 square kilometres. Only a small portion of Toby Creek, approximately 4.5 kilometres, passes through the plan area. This section is contained within Reach 5 of the creek and may be characterized as follows:

Reach 5 of Toby Creek is approximately 9.8 kilometres in length with an average gradient of 0.9%. The substrate is predominantly boulder (63%), with approximately 12% gravel. Flows are characterized as riffle (80%) with lesser amounts of run (20%). Total cover is estimated at 6%, primarily provided by boulder cover. On August 18, 1992 the average velocity was 1.9 m/s, with a water temperature of 10°C and visibility of about 10 cm (Fielden et al, 1993). During the site visit on May 7, 1996 the water temperature was found to be 2°C, with water clarity greater than 1.0 metre.

HOPEFUL CREEK

Hopeful Creek, a tributary of Toby Creek, is contained entirely within the Plan Area. From its confluence with Toby Creek, Hopeful Creek extends approximately 3.5 kilometres to a point where it separates into numerous small tributaries.

Observations during site inspections carried out on May 7/8, 1998 provided the following information: Reach 1 of Hopeful Creek extends from the confluence with Toby Creek upstream 316 metres to the main access bridge. At its confluence with Toby Creek, Hopeful Creek has a gradient of 24% for approximately 10 metres. The channel width during this short section is 2.5 metres with predominantly riffle flow over a cobbled boulder substrate. For the remainder of the reach the gradient ranged from 11 to 16% with a mean of six measurements of 15%. The average channel width is 3.9 metres with a wetted width of 2.1 metres. The channel is confined in a ravine ranging from 30 metres deep and 80 metres across near its mouth to 15 metres deep and 60 metres across at its upstream reach break. The flow was categorized as 70% riffle, 20% pool and 10% run over a gravely cobble substrate. Average maximum riffle depth was 15 cm with average maximum pool depth of 30 cm. Discharge measurements recorded 72 metres upstream of the mouth determined a surface flow of 0.17 m^3/s. The water temperature was 2°C with water clarity greater than 1.0 metre (May 7, 1996). There was some side channel development. Stream cover was estimated at 40%, being mainly provided by overstream vegetation, large organic debris and deep pool with lesser amounts of cutbank and a trace of boulder cover. Crown closure was estimated at 5%. Riparian vegetation consisted of a tree layer of trembling aspen, larch, lodge pole pine and Douglas fir, with a shrub layer of red-osier dogwood and alder. Ground cover was hard to assess due to the patchy snow cover at the time of the site visit.

Reach 2 of Hopeful Creek extends from the upstream boundary of Reach 1 approximately 1220 metres to the 1300 metre elevation contour. Within this reach Hopeful Creek has an average gradient of 10%, ranging from 5% to 15%. The average channel width is 3.4 metres, with a wetted width of 2.6 metres. The channel is occasionally confined by the mountain sides. The flow was categorized as 60% riffle, 30% pool and 10% run over a substrate ranging from predominantly gravels to gravelly cobble with some boulder. The surface discharge was found to be $0.13m^3/s$ near the upstream reach break. Average maximum riffle depth was 20 cm with average maximum pool depth of 40 cm. There was some side channel development. The waters were clear, with a temperature of 0.5°C. (May 7 & 8, 1996). As with the lower reach stream cover was estimated at 40%, being mainly provided by overstream vegetation, large organic debris and deep pool with lesser amounts of cutback. Boulder cover became more predominant in the upper reach. Crown closure ranged from 10 to 20%. Riparian vegetation consisted of a tree layer of trembling aspen, larch, lodge pole pine and Douglas fir, with a shrub layer of red-osier dogwood and alder. Ground cover was difficult to assess due to the patchy snow cover on site at the time of the visit.

LITTLE HOPEFUL CREEK

Little Hopeful Creek lies entirely within the plan area boundary. It has been divided into three reaches which cover the creek from its confluence with Toby Creek to its source on Panorama Mountain.

Reach 1 of Little Hopeful Creek extends from the creeks confluence with Toby Creek upstream 900 metres to the settling ponds excavated during golf course construction activities in 1989. The first 50 metres is somewhat steeper than the remaining portion of this reach, with an average gradient of 15% compared to the reach average of 4%. This first section has a channel width of 3 metres with a wetted width of 2 metres, confined in a small ravine. Flows were predominantly riffle with a small amount of plunge pool. The remainder of the reach has flows characterized as 50% riffle, 40% run and 10% pool. The average channel width was 1.7 metres with a wetted width of 1.4 metres. Total cover was estimated at 10%, provided by overstream vegetation and lesser amounts of cutbanks and pool cover. There was only a trace of large organic debris. Bed material is predominantly gravels and fines, with only a trace of small cobble. The stream was occasionally confined within a ravine. The water temperature was 5°C and the turbidity was less than 10cm visibility. Flows were high, overflowing the banks in locales. Discharge was measured at $0.03m^3/s$. Riparian vegetation consisted of a tree layer of trembling aspen, spruce, lodge pole pine and Douglas fir (crown closure 20%), with a sparse shrub layer of rose, willow, red-osier dogwood and alder. Ground cover was difficult to assess due to patchy snow cover. There are several culvert crossings within the first reach of Little Hopeful Creek. A settling pond built during golf course construction in 1989 marks the end of the first reach. Although these ponds have no culverts or surface outflow water can percolate through the porous cobble material that makes up the downstream end of the ponds.

Reach 2 extends from the settling ponds upstream 1230 metres. This reach has been significantly altered by past golf course construction activities. At its downstream end the creek consists of two settling ponds, each approximately 25 metres long and 15 metres wide. Through these ponds to the upstream limit of the reach the entire channel has been excavated to lower its bed. Little remains of the native riparian vegetation in this reach. For the most part tree, shrub and groundcover is non-existent along the channel. Substrate is comprised of gravel and fines with a small component of cobble. The overall gradient is about 8%. Flows are limited to riffle within the ditch. Average water depth is 10 cm within the 2 metre deep ditch. The measured discharge 340 metres upstream of the lower reach break was 0.03m³/s.

Reach 3 extends from the upper limit of Reach 2 to Little Hopeful Creeks source on Panorama Mountain. This reach rapidly steepens to average gradients of 25%. The one metre wide channel (wetted width of 0.5 metres) is entrenched within a steep banked ravine. Substrate is well graded and almost equal parts larges, gravels and fines. The canopy cover was estimated at 25%, comprised almost exclusively of lodgepole pine. (Source: *Bio-Inventory of Hopeful Creek, Near Invermere, B.C., Panorama Resort*, GeoAlpine Environmental Consulting, May 1996)

COX CREEK

Cox Creek drains the northwest slope of Panorama Mountain. It has a total length of 3.4 kilometres with an overall gradient of 27%. The creek flows northwest from its headwaters at the 2060 metre level to its confluence with Toby Creek at approximately 1130 metre elevation. The watershed has an area of approximately 2.1 km². Cox Creek was realigned in the past in its lower reaches. Cox Creek's discharge was measured as 0.03 m³/s on June 27, 1997.

TAYNTON CREEK

The Taynton Creek watershed/drainage covers an area of approximately 15.3 km². The creek flows northwest for about 7 kilometres from its headwaters above the 2,350 metre elevation level to it confluence with Toby Creek at approximately 1,140 metre elevation. Taynton Creek has a gradient averaging 17.4% over its entire length. The creek rises steeply from its confluence with Toby Creek for approximately 70 to 100 metres, with gradients measured at 22 to 26%, before levelling off in its mid reaches for about 4.3 kilometres, to gradients ranging from 9 to 16%, averaging 14.7%. Within its upper reaches the gradient of Taynton Creek ranges from 20 to 50%. The discharge from its drainage was measured at 0.48 m³/s near its mouth on June 23, 1997. (Source: *Trapper's Ridge, Initial Environmental Review*, GeoAlpine Environmental Consulting, March 1998)

The CDP planning process considered the conditions associated with these creek systems as well as the Upper Columbia Valley Floodplain Management bylaw in the location and organization of various land uses within the Plan Area. An example of the CDP approach is in its response to Hopeful Creek corridor. Previous site construction activities associated primarily with early development of the golf course in 1989 altered the natural conditions associated with Hopeful Creek, however recent completion of the golf course has significantly improved the creek's environmental qualities and hydraulic functions. Appropriate environmental and floodplain setbacks have been incorporated into the physical planning of the resort. Hopeful and Little Hopeful Creeks now sustain populations of Cutthroat and Bull Trout.

NATURAL HAZARDS

The Panorama Mountain Village Plan Area is not included within the limited area mapped for natural geological hazards by the B.C. Ministry of Highways.

Investigations into natural hazards were conducted during preparation of the Greywolf Golf Course Neighbourhood proposal and for other areas of development. As such, detailed information regarding natural hazards exists only for portions of the Plan Area, primarily areas of existing or proposed development, while areas which lie outside the boundaries of proposed resort development have not been extensively analysed.

AVALANCHE TRACKS

Several avalanche tracks were observed along the northwest Toby Creek Valley slope from 0.8 km to 1.5 km upstream of the existing bridge. None of these avalanche tracks pose any danger to existing or proposed development.

LANDSLIDE SCARPS

Arcuate features with vertical displacements were observed along Toby Creek upstream from the existing bridge. These are interpreted to be landslide scarps. Slope undercutting by Toby Creek along the outside channel bends is considered to be an important contributing factor. These features are located on the west side of Toby Creek outside of areas of existing or proposed development.

A "slide runout" zone has been identified upslope of the 5th Fairway single family residential cluster in the Greywolf neighbourhood. Detailed geotechnical investigations must be carried out and mitigative measures implemented prior to development of this residential enclave.

CONE FANS

Debris cone fans were observed where tributary creeks enter both Toby Creek and Hopeful Creek. The cone fan deposits are generally well-drained internally.

TERRACE

Terraces have developed along both sides of the Toby Creek floodplain. The terraces are typically composed of stratified sand and gravel. It is expected that the local groundwater table generally reflects the water level in the adjacent creek. These areas do not pose a constraint to existing or proposed development.

MUDFLOW

The upper part of Hopeful Creek valley bottom (south end) is interpreted as a mudflow. Prior to construction of the Greywolf golf course, the mudflow ground surface sloped uniformly downstream parallel to the creek. Bifurcated drainage channels traversed across the mudflow. The groundwater table in the Hopeful Creek mudflow was close to ground surface and seepage was observed along the lower adjoining valley slopes. Planning of the site has responded to this condition in the location and distribution of proposed land uses. The recent construction of the golf course has significantly improved the water table and associated drainage qualities of the mudflow within the golf course area.

A minor mudflow hazard condition has also been identified adjacent to Springs Creek - site of the proposed RV park. Detailed studies and mitigative measures must be implemented prior to development of the RV park.

ALLUVIAL PLANES

The near-surface materials on the alluvial plain along the east branch of Hopeful Creek include organic soils, alluvial and slope-wash sediments and occasional boulders which were probably transported from the adjacent west slope of Panorama Ridge. The groundwater table across the alluvial plain was formerly near ground surface and heavy seepage was observed along its eastern edge. Drainage works carried out on the property at the time of clearing for the golf course and subsequent completion of golf course construction, have greatly reduced the watertable's proximity to the ground surface from 0.6 m previously to between 1.6 m and 2.7 m currently.

HUMMOCKY TERRAIN

This term is used to describe the hummocky land mass which exists between the east branch of Hopeful Creek and Toby Creek. It is considered to be a former rock slump which slid off the side of Panorama Ridge. The area is now considered to be stable and provides opportunities for development of various forms of residential accommodation within and surrounding the golf course.

BEDROCK KNOLLS AND OUTCROPS

Bedrock knolls and outcrops were observed within the hummocky terrain between Hopeful Creek and Toby Creek. These outcrops are interpreted as the Toby Creek Formation and require site specific consideration with respect to land use capability and configuration of potential development. (Source: Golder Associates Geotechnical Appraisal of Panorama Ski Area, 1978)

FLOODING CONSIDERATIONS

Runoff from snowmelt or rainfall alone is not considered to be the governing factor in determining the extent to which flooding may occur along Toby Creek. Rather, the possibility of blockage of Toby Creek by a mudflow or debris slide upstream of the development and the subsequent release of water from this blockage is considered to be of greater concern. It is not possible to calculate the locality, timing or magnitude of an upstream blockage and eventual release of impounded water. Regular inspections of Toby Creek and its tributaries for blockage should be undertaken.

Hopeful Creek channel has undergone significant improvements as part of the construction of Greywolf Golf Course. A minor localized avulsion hazard, however, remains in a location adjacent to the 5th Fairway. This will require minor flood control berming to eliminate this hazard. In addition a short section of Reach 2 in Cox Creek also exhibits potential avulsion characteristics. Therefore, flood control berming will also be required in this area prior to development of Trapper's Ridge.

FOREST FIRES

Although a major forest fire has not occurred in the Panorama area since the 1920's, a forest fire remains one of the most serious threats to resort development. Preventative measures should be taken to prevent forest fires including: bans on the use of fireplaces during dry periods, creation of firebreaks upwind from the development, and education of residents and visitors as to the danger of forest fires. Architectural and landscape design guidelines should promote the use of fire resistant or retarding building materials and details. An emergency response plan should be instituted so that in the event of a fire all in danger will be safely evacuated and the fire immediately suppressed.

VEGETATION

According to Government of British Columbia mapping, the Panorama Mountain Village Plan Area falls within the Dry Interior Region. The site can be further divided into three different zones.

1) That area within the Toby Creek valley up to approximately 1280 metres (4200 feet) elevation, which includes the Greywolf golf course neighbourhood and Panorama Village, falls within the Interior Rocky Mountain Douglas-fir Zone and the Lodgepole Pine Subzone. Vegetation in this zone is characterized by lodgepole pine with pine grass and soopolallie understorey in the young seral stage.

2) All land situated between approximately 1280 metres (4200 feet) elevation and 2280 metres (7500 feet) elevation falls within the Subalpine Engelmann spruce - alpine fir Zone. This zone is further divided into three subzones. These subzones are based on the vegetation types and are primarily determined by elevation. The three subzones, from lowest elevation to highest elevation are:

   a) The Rocky Mountain Douglas-fir lodgepole pine subzone. This subzone is characterized by lodgepole pine with dwarf blueberry and Pacific menziesii at lower elevations and Rocky Mountain douglas-fir with common Saskatoon berry at higher elevations;

   b) The lodgepole pine - whitebark pine subzone. This subzone is characterized by whitebark pine with grouseberry at lower elevations and by lodgepole pine with grouseberry on the middle elevations of the west face of Mount Goldie, and,

   c) The Krummholz - parkland forest subzone. This subzone is characterized by the alpine fir - mountain heather complex and is located primarily at the middle to upper elevations of the west faces of Mount Goldie and Panorama Mountain.

3) Land situated above approximately 2280 metres (7500 feet) elevation falls within the Alpine tundra Zone. This zone is characterized by alpine rock, alpine heath and deglaciated pioneer species

WILDLIFE

UNGULATES

According to generalized Canada Land Inventory mapping the capability to support ungulates is rated as high along Toby Creek and medium throughout the remainder of the Plan Area. According to more detailed Ministry of Environment mapping lower elevations within the plan area are classified as having a moderate capability to support moose throughout the winter months; high capability to support elk, mule deer and white-tailed deer throughout the summer months, and; high-moderate capability to support caribou throughout the summer months. Higher elevations within the Plan Area are rated as having medium to high capability to support mule deer, elk, caribou, mountain goat and moose throughout the summer months with low capability to support these species during the winter months. The Panorama Mountain Village Plan Area is not included in the classifications for land use control priority areas.

Research by Purcell River Odysseys Ltd. has found that Toby Creek and Hopeful Creek corridors are important routes for moose and elk migration and that moose may also utilize cross-country ski trails as travel routes in winter. The creek corridors serve as valuable feeding habitat. Caribou however tend to live at higher elevations than the proposed golf course/residential area and therefore would represent slightly less of a consideration in the site planning process.

GRIZZLY BEARS

The Panorama Mountain Village Plan Area is rated predominantly as low and medium for its ability to support grizzly bears. Generally, areas at lower elevations and within creek corridors are rated as medium and areas of higher elevation are rated as low. An area designated as having a high ability to support grizzly bears exists within the general location of the Greywolf Golf Course neighbourhood however, previous land clearing associated with 1989 golf course construction impacted this capability to a minor extent.

The Grizzly Bear Biophysical Capability Classification mapping does not take into account areas of human settlement and the impact this has on the bears use of the land. Grizzly bears have a natural tendency to avoid areas of human habitation. Therefore, although an area within the Greywolf golf course neighbourhood is rated as high, it is unlikely that grizzly bears will use the area as an abundance of other land exists surrounding this area which is completely uninhabited by humans and which is capable of supporting a grizzly bear population.

Current experience has found that grizzly bears do not frequent Panorama at this time although black bears have been known to visit the area. Through proper control of garbage and vegetation and, public education, the chances of bears visiting Panorama can be reduced. An explicit response plan will be instituted so all resort staff are aware of the procedure when a bear wanders onto or near the resort. Resort staff will be trained to close off affected areas of the golf course and other public open space, caution residents to remain indoors and specific staff would be trained in procedures for removing bears from the resort area through live trapping or other humane tactics. Visitors to Panorama will be educated about bears and other wildlife concerns through an environmental awareness centre to be implemented at the central guest check-in facility. As with ungulates, vast amounts of high quality habitat for grizzly and black bears use surround Panorama. Care should be taken to avoid damaging this habitat by limiting human access and controlling hunting.

WATERFOWL

The Panorama Mountain Village Plan Area has a low capability for waterfowl use as indicated by the Canada Land Inventory rating of 6 to 7 for the area. This is due primarily to the steep terrain, fast flowing creeks and heavy forest cover. The plan area was not included in mapping for present waterfowl use which indicates that it is not an important area for waterfowl.

AQUATIC HABITAT

As stated in earlier sections, there are a number of small streams and creeks throughout the Plan Area. These small water courses provide limited opportunity for aquatic habitat due to cold water temperature, low nutrient levels, steep grades, low water levels, very fast running water and the ephemeral nature of many of these streams and creeks. There are five larger watercourses within the plan area. These watercourses, Toby Creek, Hopeful Creek, Little Hopeful Creek, Cox Creek and Taynton Creek, provide greater opportunities for aquatic habitat. Portions of these water courses have been evaluated during previous studies which were undertaken in relation to proposed developments within the Plan Area.

HOPEFUL CREEK

Fish presence or absence in Hopeful Creek has not presently been established. The biophysical survey as presented above indicates that there is suitable habitat for a resident fisheries population of both Cutthroat and Bull Trout. In addition, there appears to be no major impediments to upstream fish movements from Toby Creek, with the possible exception of the steep grades encountered under low conditions at Hopeful Creek's mouth. When the waters of Toby Creek rise during freshet, it is likely that this barrier will be flooded, and fish could gain access into Hopeful Creek from Toby Creek.

LITTLE HOPEFUL CREEK

The aquatic biophysical survey indicates that potential fisheries habitat in Little Hopeful Creek is limited to that found in the first reach. However, the culvert located 50 metres upstream of its confluence with Toby Creek provides a significant barrier to fish movements as the culvert's gradient is set at approximately ten percent. The additional two culverts on this system may pose an additional barrier to fish movements. Given these impediments and the previous discussions with BC Ministry of Environment representatives (with Doug Ogilvy, Panorama Resort) that this system is unlikely to be fish bearing, it is assumed that this creek is barren.

TOBY CREEK

Bull trout (*Salvelinus confluentus*) are the only known fish to reside in Toby Creek within the reach adjacent to Panorama Resort (Fielden et al, 1993 & Carswell, 1979). Fielden et al (1993) noted cutthroat trout (*Oncorhynchus clarki lewsi*) in Jumbo Creek and Carswell (1979) reported finding cutthroat trout in Toby Creek at the mouth of Delphine Creek, approximately 16 kilometres and 6 kilometres upstream of the subject site respectively. It is possible therefore, that cutthroat trout may be present in Toby Creek and/or Hopeful Creek, in addition to the bull trout in the main stem. Kokanee (*Oncorhynchus nerka*) and mountain whitefish (*Prosopium williamsoni*) were also reported by Fielden et al (1993) in the first two reaches of Toby Creek, downstream of the cascades found in Reach 4. Rainbow trout (*Onchorhychus mykiss*) are known in the Toby Creek system only from Neave Creek and Lilian Lake where they are regularly stocked. (Source: *Bio-Inventory of Hopeful Creek, Near Invermere, B.C., Panorama Resort,* GeoAlpine Environmental Consulting, May 1996)

COX CREEK

Reach 1 of Cox Creek rises steeply from its confluence with Toby Creek for a short 70 metre length. No fish were caught during electrofishing the entire reach (double pass, electrofisher on for 1,380 seconds and set at 600 volts, 80Hz). Under the Forest Practices Code of BC this reach is classified as an S6 non-fish bearing stream based on its width, the steep gradient and the lack of fish detected.

Reach 2 is approximately 425 metres in length with most of the reach in a severely disturbed state. No fish were captured during two electrofishing efforts over the entire reach. (electrofisher on for 1,680 seconds, set at 600 volts, 80 Hz). This reach is classified as an S6 non-fish bearing stream, under the Forest Practices Code of BC, based on its width and the lack of fish detected.

Reach 3 consists of the entire remainder of Cox Creek. Within this reach the creek is generally confined within a ravine. The channel gradient averaged 33% Electrofishing was not conducted due to the steep gradient. Cox Creek's third reach is classified as an S6 non - fish bearing stream based on the steep gradient and the channel widths of the downstream reaches.

TAYNTON CREEK

Taynton Creek consists of three reaches plus five main tributaries:

From its confluence with Toby Creek, Taynton Creek's first reach rises steeply for 70 metres. Electrofishing within this reach was not completed as Toby Creek is known to support bull trout (Salvelinus confluentus) and the electrofishing programme in Reach 2 upstream yielded numerous bull trout. Therefore, even though this is a fairly steep reach, it is presumed to be passable by fish. Under the Forest Practices Code of BC this first reach is classified as an S3 fish stream based on its width and presumed presence of fish.

Reach 2 of Taynton Creek extends for 4.3 kilometres, forming the majority of the streams length. Electrofishing was conducted on the lower 500 metres of the second reach of Taynton Creek. Eleven bull trout were captured during a single pass electrofishing effort. From this small sample, there appears to be two age classes, with 10 bull trout averaging 102.4 mm and one larger fish measuring 163 mm. Reach 2 of Taynton Creek is classified as a S3 fish stream based on its width and confined presence of fish, under the Forest Practices Code of BC.

Taynton Creek's third reach consists of the creek's headwaters which drain the north flank of Mount Goldie, the southwest flank of Mount Taynton, and the ridge joining the two peaks. This reach has an average gradient of 23%, with ephemeral flows at its upper end. Because of the steep gradients and ephemeral nature of the upstream flows, reach 3 is assumed to be non-fish bearing. This reach is classified as a S5 non-fish bearing stream under the Forest Practices Code of BC. (Source: *Trapper's Ridge, Initial Environmental Review*, GeoAlpine Environmental Consulting, March 1998)

ARCHAEOLOGICAL RESOURCES

An overall archaeological survey of the entire Panorama Mountain Village Plan Area has not been completed. However, two studies have been completed in recent years - one in 1988 and the second in 1997. These studies focussed on specific areas to be considered for resort development - Greywolf golf course residential neighbourhood and Taynton Bowl for possible ski area expansion. The results of these studies indicated that a full EIA was not warranted due to the nature and limited occurrence of archaeological evidence of precontact human existence. The findings of these studies are summarized as follow:

1988 STUDY

An archaeological survey of the area proposed for the present Greywolf golf course and residential neighbourhood at Panorama Resort was carried out in October 1988 by Wayne T. Choquette (Consultant Archaeologist). No buried cultural deposits were found during the archaeological reconnaissance. One marginally retouched quartzite spall fragment was discovered on the edge of a bulldozed road on the southwest edge of the study area. It is thought that this item is probably an isolated find and not representative of the site. The archaeological report concluded that while sparse, but equivocal evidence of prehistoric human presence was found during the 1988 study, the Greywolf golf course and residential neighbourhood is not a threat to heritage resources.

1997 STUDY

An archaeological resource overview was conducted by Bison Historical Services Ltd. in September 1997 for a proposed ski area expansion into a natural topographic bowl northeast of Mt. Goldie. The study area measured in excess of 1200 hectares. Study of the area included a review of existing archaeological data, existing ethnographic data, existing geological data and reported traditional knowledge bearing on the proposed area of expansion. The study also involved a field visitation designed to identify areas of archaeological importance.

The background review found:

- No prehistoric sites are known for the study area or surrounding areas;
- Slopes and peaks are primarily used for hunting sheep and goats, quarries and vision quests. They are not typically settlement areas;
- Geological data suggests only a moderate potential of material suitable for "flint knapping";
- Areas suitable for prehistoric occupation or use are limited in scope;
- No references to the study area are available in the available ethnographic literature, and;
- References to traditional land use are limited to areas adjacent to Toby Creek and the lower reaches of Taynton and Hopeful Creeks.

The field visitation found:

- The study area is largely of low archaeological potential but that areas of low/moderate and moderate potential are present at the boundaries and adjacent to the study area;
- No prehistoric cultural material or features were observed in the course of the field study, and;
- Rock materials observed in the course of the field study are not suitable for prehistoric quarrying.

Both the 1988 and 1997 studies concluded that, in the opinion of the consultant archaeologists, Archaeological Impact Assessments were not required for the proposed projects.

REPORT SUMMARIES

5.0 REPORT SUMMARIES

ENVIRONMENTAL

LEFT BANK HOPEFUL CREEK AVULSION

Prepared by: GeoAlpine Environmental Consulting
3132 Alta Vista Road
Whistler, British Columbia V0N 1B3

Report Date: June 1998

Report Summary: It was noted in hydraulic analyses conducted by Stanley Urban Land that although the left bank (looking down stream) contained the 1:200 year flood event there was insufficient freeboard at some locations along the creek. A number of recommendations have been made to remedy this situation.

RIGHT BANK HOPEFUL CREEK AVULSION

Prepared by: GeoAlpine Environmental Consulting
3132 Alta Vista Road
Whistler, British Columbia V0N 1B3

Report Date: June 1998

Report Summary: This letter report addressed the issue of Hopeful Creek avulsing into Little Hopeful Creek channel. In conjunction with this report flow studies were completed by Stanley Urban Land and stream cross-sections were prepared by Jim Sharpe, surveyor. The summary findings of this report are that the currently upgraded bank between the two creeks is sufficient to contain the 1:200 flood event.

TRAPPER'S RIDGE, INITIAL ENVIRONMENTAL REVIEW

Prepared by: GeoAlpine Environmental Consulting
3132 Alta Vista Road
Whistler, British Columbia V0N 1B3

Report Date: February 1999

Report Summary: The subject lands, (Trappers Ridge), are currently unsurveyed Crown land. and in order to obtain development approval Panorama must satisfy the requirements of the Ministry of Environment Lands and Parks. As a basis for site planning Panorama was required to provide information pertaining to the existing environmental conditions on the site. To achieve this objective GeoAlpine Environmental Consulting Ltd. was retained to conduct and Initial Environmental Review (IER). The purpose of the review is to provide an overview assessment of the existing environmental conditions on the subject site. It is also intended to identify environmentally sensitive areas, ecologically significant habitat and environmental constraints to development.

ENVIRONMENTAL REVIEW OF TAYNTON BOWL

Prepared by: GeoAlpine Environmental Consulting
3132 Alta Vista Road
Whistler, British Columbia V0N 1B3

Report Date: February 1998

Report Summary: Panorama operates downhill and cross-country ski facilities within a Controlled Recreation Area that is located on Crown Leased Lands under the Provincial Ski Area Agreement. The resort plans to expand its terrain in the high alpine to increase skiing opportunities. These plans include the development of additional lands within the area identified as Taynton Bowl. As part of the planning process for possible boundary adjustment and recreational development, Panorama retained GeoAlpine to conduct an Environmental Review of the site. This report represents the results of inventory work and analysis completed in 1997.

LITTLE HOPEFUL AND HOPEFUL CREEK FINAL STREAM DESIGN

Prepared by: GeoAlpine Environmental Consulting
3132 Alta Vista Road
Whistler, British Columbia V0N 1B3

Report Date: August 1996

Report Summary: As part of the proposed development of the golf course at Panorama Resort, Intrawest plans to relocate approximately 275 metres of Hopeful Creek and 1080 metres of Little Hopeful Creek. In addition, approximately 310 metres of Hopeful Creek and 2300 metres of Little Hopeful Creek that have been previously disturbed will be enhanced to take advantage of their full biophysical potential.

This document deals with the rehabilitation of Hopeful Creek with emphasis on the disturbed and relocated sections. This rehabilitation consists of fish habitat enhancement strategies and erosion protection schemes. The undisturbed sections of Hopeful Creek are covered mainly from an erosion protection standpoint.

HOPEFUL CREEK, PRELIMINARY STREAM RELOCATION DESIGN

Prepared by: GeoAlpine Environmental Consulting
3132 Alta Vista Road
Whistler, British Columbia V0N 1B3

Report Date: June 1996

Report Summary: As part of the proposed development of the golf course at Panorama Resort, Intrawest plans to relocate approximately 275 metres of Hopeful Creek and 1080 metres of Little Hopeful Creek. In addition, approximately 310 metres of Hopeful Creek and 2300 metres of Little Hopeful Creek that have been previously disturbed will be enhanced to take advantage of their full biophysical potential.

This document deals with the rehabilitation of Hopeful Creek; specifically the disturbed and relocated sections. Issues relating to the undisturbed sections of Hopeful Creek will be dealt with in future reports.

BIO-INVENTORY OF HOPEFUL CREEK, NEAR INVERMERE, BC

Prepared by: GeoAlpine Environmental Consulting
3132 Alta Vista Road
Whistler, British Columbia V0N 1B3

Report Date: May 1996

Report Summary: This report was prepared in response to questions from BC Ministry of Environment in conjunction with Intrawest's seeking to purchase two additional parcels of land for golf course construction beyond the land already owned for the golf course. BC Environment raised concerns about the fisheries capability of Hopeful Creek. The purpose of the report was to fill information voids thereby allowing BC Environment to respond to the development proposal put forward by Intrawest by:

- conducting an aquatic biophysical (fisheries) assessment of Hopeful Creek
- documenting the present biophysical status of Little Hopeful Creek
- presenting options for enhancement opportunities on Hopeful Creek
- presenting a rationale for establishing fisheries sensitive zones (setbacks) on Hopeful and Toby Creeks.

CONSTRUCTION GUIDELINES AND ENVIRONMENTAL MANAGEMENT SYSTEM

Prepared by: GeoAlpine Environmental Consulting
3132 Alta Vista Road
Whistler, British Columbia V0N 1B3

Report Date: May 1996

Report Summary: Preservation of the natural environment is recognized as a necessary component of Panorama Resort's success. Furthermore, it is recognized that as development occurs, ecosystems will be altered. The goal of this environmental management system is preservation of sensitive habitat. To achieve this goal these environmental guidelines were developed to encourage the preservation of natural vegetation within the preserved areas and to mitigate the impacts of development in a way that enhances the retained habitat, while minimizing the losses associated with altered ecosystems.

The guidelines are intended to give contractors direction in constructing their projects in an environmentally sensitive manner. An effort shall be made to preserve as much of the aquatic and riparian habitat on the site as possible.

HABITAT MAP REVIEW FOR PANORAMA RESORT GOLF COURSE

Prepared by: Shelagh Wrazej
Invermere, British Columbia

Report Date: November 1994

Report Summary: This report briefly reviews map data and details some information that may be considered when implementing development. The maps analyzed assess various aspects of the Toby Creek drainage to support a variety of wildlife and recreation. The maps are based on Entech Environmental Consultants 1978 Initial Evaluation for the Kootenay River Diversion project and 1988 Purcell Wilderness Conservancy and Adjacent Area study.

TAYNTON AND HOPEFUL CREEKS LOW FLOW HYDROLOGY REPORT

Prepared by: Hydrotech Consulting Ltd.
10536 - 67 Avenue
Edmonton, AB T6H 1Z5

Report Date: June 1990

Report Summary: Hydrotech Consulting was retained to conduct a hydrology study pertaining to water availability requirements for an expanded Panorama Resort Water Utility. The purpose of the study is to fulfil the requirements of the Comptroller of Water Rights under the Water Utility Act as outlined by the Ministry of Environment and Parks of the Province of British Columbia in its letter of November 1, 1989. The requirements set forth by the Ministry may be summarized as follows:

"to conduct a hydrology study to confirm whether flows in Taynton Creek are adequate to supply the present and proposed developments during a moderate drought described as a one-in-ten years low flow. A design maximum day demand for the full development to be served by the utility is also to be determined"

The study was extended to include Hopeful Creek, since preliminary findings have shown that Taynton Creek alone could not meet all the future water requirements of the resort. Due to the growing demand during the summer, the study has included the analysis of low flow water availability and demand for both the winter and summer months.

GEOTECHNICAL

GEOTECHNICAL HAZARDS STUDY

Prepared by: EBA Engineering Consultants Ltd.
6111 - 36th Street SE
Calgary, AB T2C 3W2

Report Date: December 1996

Report Summary: EBA Engineering conducted a geotechnical hazards study to assist in the overall planning and preliminary design of the proposed Panorama Resort expansion project. The purpose of the study was to identify and/or evaluate the current terrain and geological conditions at the site for possible geotechnical hazards. Based on findings of site reconnaissance work and office studies, comments and engineering recommendations are provided for the safe development of the site. The evaluation focussed primarily on risk to residential development with non-residential property and infrastructure receiving less critical attention.

GEOTECHNICAL EVALUATION

Prepared by: EBA Engineering Consultants Ltd.
6111 - 36th Street SE
Calgary, AB T2C 3W2

Report Date: August 1996

Report Summary: This report presents the results of the geotechnical evaluation conducted by EBA Engineering Consultants Ltd. regarding future development within the boundaries of Panorama Resort. The objective of this evaluation is to assess the general subsoil and groundwater conditions at the site for the design and construction of the proposed development. This report presents the data acquired from the field testpitting program and geotechnical recommendations for development. Areas of testing have been divided into the following individual site areas:

- Cox Creek development area
- Ski Village and parking lot
- Residential Cell #1 (Phase 1 - 25 lot subdivision at Greywolf)
- Golf course roadways and residential development
- Golf course clubhouse and parking lot

TESTPITTING INVESTIGATION, PANORAMA MOUNTAIN RESORT GOLF COURSE

Prepared by: Artech Consulting Ltd.
229 Industrial Road. F,
Cranbrook, BC V1C 6N4

Report Date: November 1995

Report Summary: Artech Consulting were contracted to undertake a testpitting investigation for the proposed Panorama Resort golf course. The objective of the work was to identify and record the occurrence of sub-surface soil types at various locations throughout the project site. A total of eight test pits were dug to a maximum depth of 3 metres. In some areas the pits were shallower due to the occurrence of rock.

PRELIMINARY STABILITY EVALUATION FOR A PROPOSED ACCESS ROAD TO A FUTURE GOLF COURSE AT PANORAMA RESORT

Prepared by: Stewart-EBA Consulting Ltd.
#2 - 1420 Hunter Court,
Kelowna, BC V1X 6E6

Report Date: May 1991

Report Summary: This letter report presents the results of a preliminary evaluation by Stewart-EBA Consulting Ltd. for Panorama Resort for the geotechnical stability of terrain around an existing access road (road now fronts Phase 1 - 25 lot residential development at Greywolf) to a future golf course at Panorama. The purpose of the evaluation was to have sufficient surficial field and laboratory work completed to provide geotechnical recommendations pertaining to the stability of the road and/or describing further work required to fulfil the requirements of the objective.

GEOTECHNICAL APPRAISAL CONCERNING SITE DEVELOPMENT

Prepared by:	Golder Associates 5915 - 3rd Street SE Calgary, AB T2H 1K3
Report Date:	August 1978
Report Summary:	In February 1978 Golder Brawner & Associates prepared a letter report dealing with a preliminary assessment of geotechnical hazards at Panorama. In June 1978, Golder Associates were contracted by Cascade Builders Ltd. to complete a more detailed geotechnical evaluation for the proposed development. This report contains Golder & Associates' general geotechnical assessment of the Panorama area and recommendations concerning site development. Special consideration has been given to natural hazards which occur across the site.

ARCHAEOLOGICAL

ARCHAEOLOGICAL RESOURCE OVERVIEW PROPOSED PANORAMA EXPANSION

Prepared by: Bison Historical Services Ltd.
#3, 227 - 14th Street NW
Calgary, AB T2N 1Z6

Report Date: September 1997

Report Summary: Panorama Resort proposes to expand ski operations south toward Mount Goldie. In view of this proposal Panorama retained Bison Historical Services Ltd. (Stanley Van Dyke, M.A.) to conduct an archaeological resource overview. The primary objective of the overview is to determine if there are sufficient grounds to warrant an Archaeological Impact Assessment. The report provides a brief review of existing data bearing on the archaeological potential and sensitivity of the area proposed for the expansion. Where applicable, the report follows the guidelines set out in the British Columbia Archaeological Impact Assessment Guidelines.

HERITAGE IMPACT ASSESSMENT OF THE PROPOSED GOLF COURSE

Prepared by: Wayne Choquette, Consultant Archaeologist
Box 25
Yahk, BC V0B 2P0

Report Date: October 1988

Report Summary: This report presents the methods and results if the archaeological survey of a golf course proposed by Panorama. The field reconnaissance was carried out in October 1988 by Wayne Choquette. The entire area of the proposed golf course was surveyed by foot traverse during which all subsurface exposures were examined. These included roads and trails, road backdirt, road and stream cutbanks and tree throw. A detailed examination of aerial photographs resulted in the targeting of several areas for more detailed inspection which included examination of soil profiles and sediment sequences, plus spot-trowelling through the duff layer and underlying postglacial sediments. One 50cm square shovel test was excavated on a terrace on the south side of Hopeful Creek. No buried cultural deposits were found during the reconnaissance.

PANORAMA
MOUNTAIN VILLAGE

ENVIRONMENTAL

RIGHT BANK HOPEFUL CREEK AVULSION

June 1998

INTRAWEST

GEOALPINE
ENVIRONMENTAL CONSULTING LTD.

MEMORANDUM

DATE: June 24, 1998

TO: John Morely, Construction Manager, PANORAMA RESORT

CC: Dwaine Boyer, MOELP
Ed Shaw, MOELP
Bill Hargraves, STANLEY

FROM: Michael JB Cole, P.Eng., Geoscience Engineer

RE: Hopeful Creek/Little Hopeful Creek Avulsion Issue

FILE #: GEC 014/01/03

The following memo addresses the issue of Hopeful Creek avulsing into the little Hopeful Creek channel (across the Right Bank). GeoAlpine Environmental Consulting Ltd., in conjunction with Stanley Urban Land of Calgary, have been involved with the water management aspects of this project since May of 1996.

Figure 1 shows the location of Hopeful Creek and the potential avulsion site in relation to Little Hopeful Creek.

Stanley has conducted flow studies, which indicate that the upgraded bank between the two creeks will contain the 1:200 year flood event. Further work by GeoAlpine indicates that the channel has been sufficiently armoured to withstand the flows related to the design event.

Appended to this memo is the hydraulic analysis of Hopeful Creek (dated June 23, 1998) issued by Rick Carnduff of Stanley. As a basis for the hydraulic modelling, Jim Sharpe, surveyor, conducted a stream survey in May 1998 based on the criteria set out by Stanley. This survey included a stream profile and cross sections taken every 15-m within the study area.

Correspondence from Dwaine Boyer, Water Management, MELP regarding the avulsion issue dated November 25, 1996 is also enclosed for reference.

GEOALPINE ENVIRONMENTAL CONSULTING Ltd.
3132 Alta Vista Road, Whistler, BC VON 1B3
Phone (604) 938-1949 Fax (604) 938-1247 email address: GeoAlpine@whistler.net

SITE HISTORY

Circa 1989, the previous owners of Panorama Resort redirected Hopeful Creek from its original course to the north (the present Little Hopeful alignment) to flow with an abandoned channel heading to the west (the present channel alignment) into Toby Creek. This re-alignment left only Little Hopeful Creek running north adjacent to the ski lodgings, thereby greatly reducing the flows in the channel. This alignment has been entrenched in the present golf course design. The area between the two existing channels (i.e. the old channel) is considered the potential avulsion site.

Over the past two years BMR constructed berming in the area of the potential avulsion as stated in the Final Stream Design (GeoAlpine, August 1996). As a result of site visits by GeoAlpine these works have been upgraded to bring the channel inline with the design. GeoAlpine notes these revisions in the year-end monitoring reports for 1996 and 1997.

SITE VISITS

Mike Cole, P.Eng of GeoAlpine and Rick Carnduff, P.Eng of Stanley most recently observed the state of the Hopeful Creek on May 27, 1998. Over the past two years site visits were conducted by Mike Cole, P.Eng., and Dave Williamson, B.E.S., to monitor erosion protection works, stream alignment and cross-sectional characteristics.

Construction monitoring was conducted during the snowfree months of May through September by Shelagh Wrazej, B.Sc.. The purpose of these visits was to ensure protection of Hopeful Creek and Little Hopeful Creek as well as the surrounding environment during the construction of the Grey Wolf Golf Course.

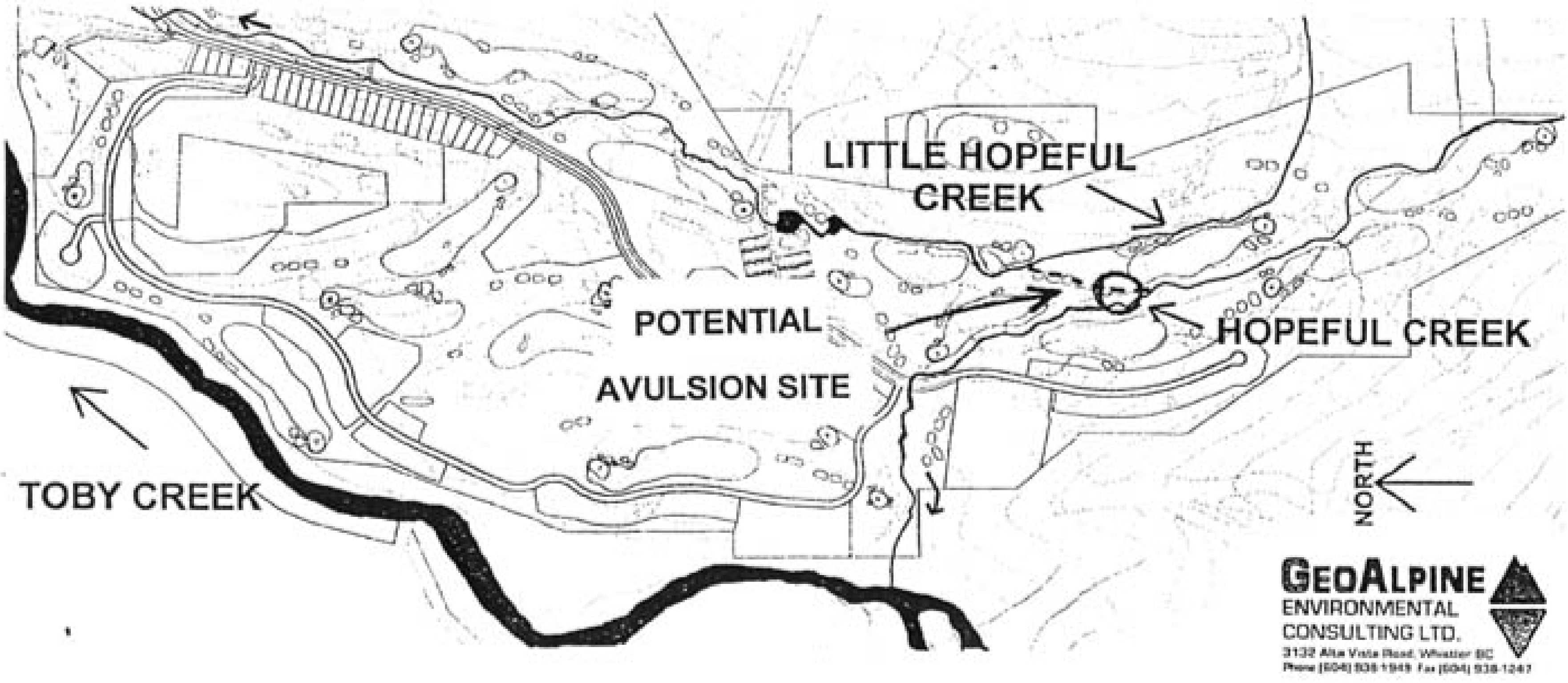
SUMMARY

To satisfy the November 25, 1996 memo from Dwaine Boyer for subdivision approval, "construction works to prevent avulsions of Hopeful Creek have been built…[to withstand the 1:200 design flood event]".

Based on the model results by Stanley, Hopeful Creek will be contained within the existing channel. There is no indication of concern along the avulsion site along the Right Bank (in the vicinity of Section 226). The analysis indicates that freeboard on the Left Bank should be increased in a few locations, which should not affect the result along the Right Bank.

If there are any questions please do not hesitate to call.

GREY WOLF GOLF COURSE AT PANORAMA RESORT



GEOALPINE
ENVIRONMENTAL
CONSULTING LTD.
3132 Alta Vista Road, Whistler BC
Phone (604) 938-1949 Fax (604) 938-1247

Province of
British Columbia
MINISTRY OF ENVIRONMENT
LANDS AND PARKS

BC
Environment

#401 -333 Victoria Street
Nelson, British Columbia
V1L 4K3
Telephone:(604)354-6333
Main Fax: (604)354-6332
EP Fax: (604)354-6367

File: A4001120

November 25, 1996

Fax: 938-1247

GeoAlpine Environmental Consulting
3132 Alta Vista Road
Whistler BC V0N 1B3

Attn: Michael J.B. Cole, P. Eng, Geoscience Engineer

Dear Michael Cole:

Re: <u>Hopeful and Little Hopeful Creeks</u>

This is a follow up to my letter dated September 25, 1996. A statement in that letter requires clarification. In my letter, I stated, “If there is any risk of Hopeful Creek avulsing and flowing into Little Hopeful Creek and there is a subdivision proposal for areas affected by Little Hopeful Creek that could be affected, then protection can be provided by...” The statement should have been, “If there is a risk of a one in two hundred year flood event, on Hopeful Creek, causing an avulsion into Little Hopeful Creek and if there is a subdivision proposal for areas affected by Little Hopeful Creek, then protection can e provided by:

1. construction works to prevent avulsions of Hopeful Creek or
2. enlarging culvert(s) and channel capacity to accommodate the avulsion into Little Hopeful Creek

I hope this provides the necessary clarification.

Yours truly,

J. W. Dyck

for Dwain Boyer, P. Eng.
Engineering Section Head

DCB:lp

Stanley Consulting Group Ltd.
500 - 1122 - 4th Street S.W.
Calgary AB
Canada T2R 1M1

Ph: (403) 716-8000
Fax: (403) 716-8059
e-mail: land.calg@stantech.com
www.stantech.com

Stanley
Urban Land

23 June, 1998
File: 16408474

COPY

Intrawest Corporation
c/o Panorama Resort
Panorama, British Columbia
V0A 1T0

Attention: **Mr. John R. Morely, P.Eng.**
Construction Manager

Dear Sir:

Reference: **Hopeful Creek Hydraulic Analysis**

On behalf of Intrawest Corporation, Stanley Urban Land has undertaken a hydraulic analysis of Hopeful Creek where it passes through the Grey Wolf golf course. We understand that this analysis will support a comprehensive report that is being prepared by GeoAlpine Environmental Consulting.

Figure 1.0 illustrates the reach of channel included in the study area.

On Thursday, 28 May, 1998 Stanley Urban Land undertook an inspection of the site in accompaniment with Mr. Michael Cole, P.Eng. of GeoAlpine Environmental Consulting. As explained by Mr. Cole, the purpose of the analysis was to determine if the Hopeful Creek Channel is capable of accommodating the 1:200 year event. Two specific concerns are as follows:

1. Potential overtopping of the right (east) bank which would cause evulsion into Little Hopeful Creek and potential overtopping of the left (west) bank which would cause water to cross the golf course and spill into the proposed residential development.
2. Erosion damages to the golf course.

Our analysis comprised computer model simulations using the HEC-2 model for computation of water surface elevations. Field survey cross-section data was gathered by J.W. Sharpe and Associates on behalf of Intrawest Corporation and provided to Stanley Urban Land for use in the analysis. Shown on **Figure 2.0**, eighteen (18) cross section locations were selected to represent the Hopeful Creek Channel. An additional cross-section referred to as Section 154 was used repeatedly to represent the cart path (bridge) crossing. The 1:200 year event discharge rate used was 23.1 m^3/s, which was taken from a previous hydrologic analysis by Stanley Urban Land (August 1996).

The HEC-2 computer model calculations show that the reach of Hopeful Creek Channel within the study area contains the 1:200 year event discharge rate. **Figure 3.0** shows the Channel and 1:200 year event water surface and Table 1.0 summarizes the pertinent hydraulic results.

At cross-section locations 347 and 245 the 1:200 year event water surface is at the top of the left bank. These sections are shown on **Figures 4.1 and 4.2.** As a protective measure, it is recommended that the appropriate bank in these areas be built-up or a berm constructed to provide a minimum freeboard of 0.6 m. This can be done as part of the golf course landscaping. Details of the berm can be provided by GeoAlpine as part of their report.

At cross-section 492 the 1:200 year event water surface is at the top of the right bank. However, if overtopping of this bank were to occur the resulting flow would spill into a side drainage course which would discharge back into Hopeful Creek about 25 m downstream of the section. Constructing a berm for freeboard purposes is not warranted at this location.

Table 1.0
Summary of 1:200 Year Event Results

Section No.	Depth (m)	Water Surface Elevation	Channel Velocity (m/s)
585	1.50	1250.20	2.63
521	0.53	1244.02	5.66
492	1.01	1242.36	3.16
451	1.12	1237.90	4.06
406	1.07	1232.97	4.61
347	1.25	1228.60	3.35
305	1.13	1224.43	5.10
287	1.06	1221.99	4.02
245	1.44	1218.53	2.81
226	0.89	1215.46	5.84
199	1.02	1214.09	4.61
154.2 (bridge)	1.24	1210.96	3.70
147	0.58	1209.56	4.74
118	0.92	1205.84	3.42
94	1.22	1203.41	4.22
76	1.11	1201.25	4.52
57	0.96	1198.46	4.09
41	0.98	1194.51	4.41
24	1.65	1192.75	4.21

As shown on **Figure 4.2**, the 1:200 year event water surface is above the left bank and floodplain. However, upon review of **Figure 2.0**, it appears that this is merely a reflection of the skewed angle that the section was surveyed relative to the direction of flow. Had the survey extended further to the left (west), it would have shown that the left floodplain rises above the 1:200 water level.

Immediately upstream of Section 147, a cart path crosses over Hopeful Creek as shown on **Figure 2.0.** The upstream face of the bridge is referred to as Section 154.2 and the downstream face is referred to as Section 154.3. **Figure 4.3** shows the creek crossing at section 154.2. The 1:200 year event water surface is about 1.0 m below the bottom of the bridge.

Please call us if you require further information or clarification of the analysis results.

Sincerely,

STANLEY URBAN LAND

R.D. (Rick) Carnduff, M.Eng., P.Eng.
Senior Associate

Enclosure

cc: Mr. M. Cole, GeoAlpine Environmental Consulting
Mr. B. Hargrave, Stanley Urban Land

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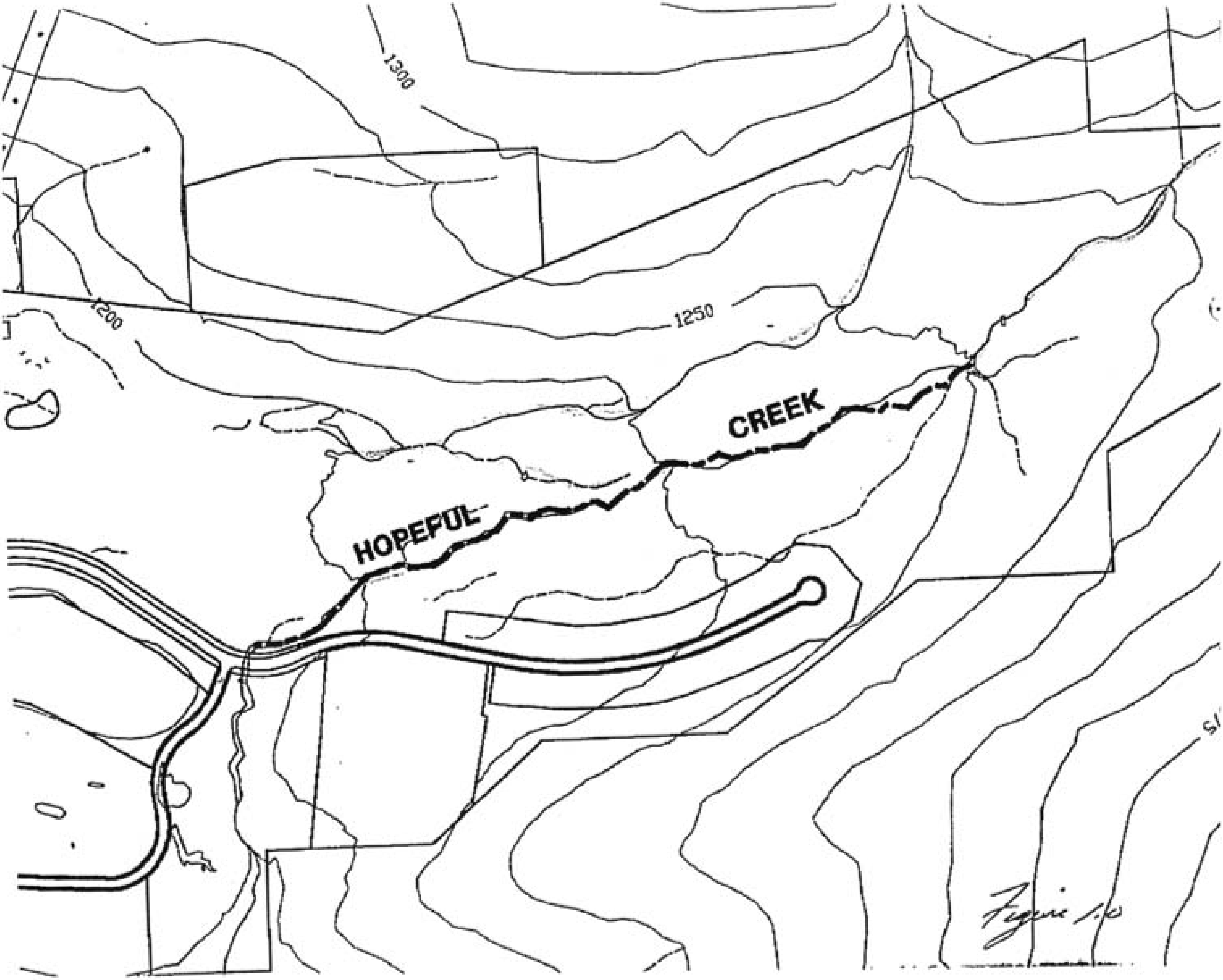


Figure 1c

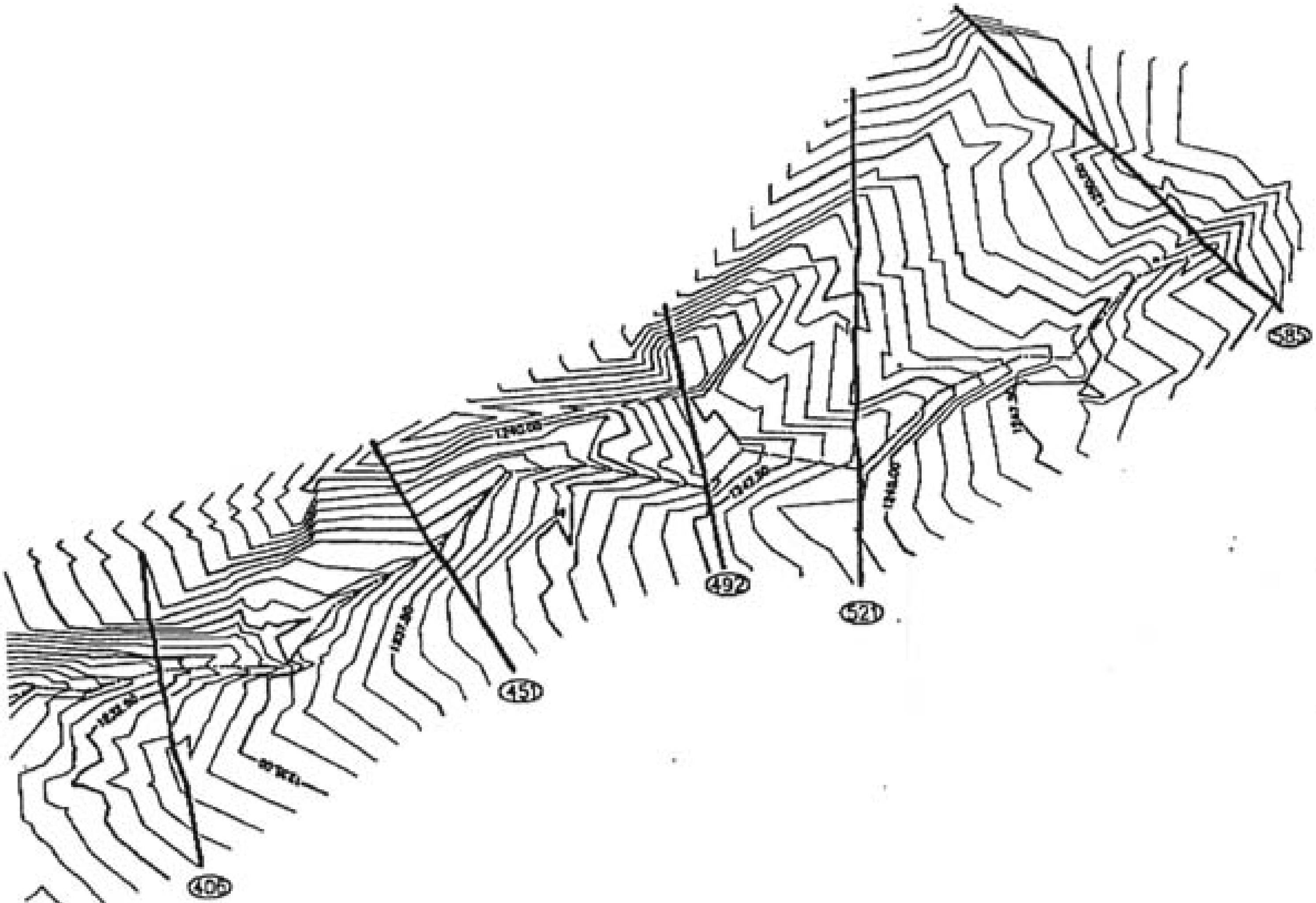
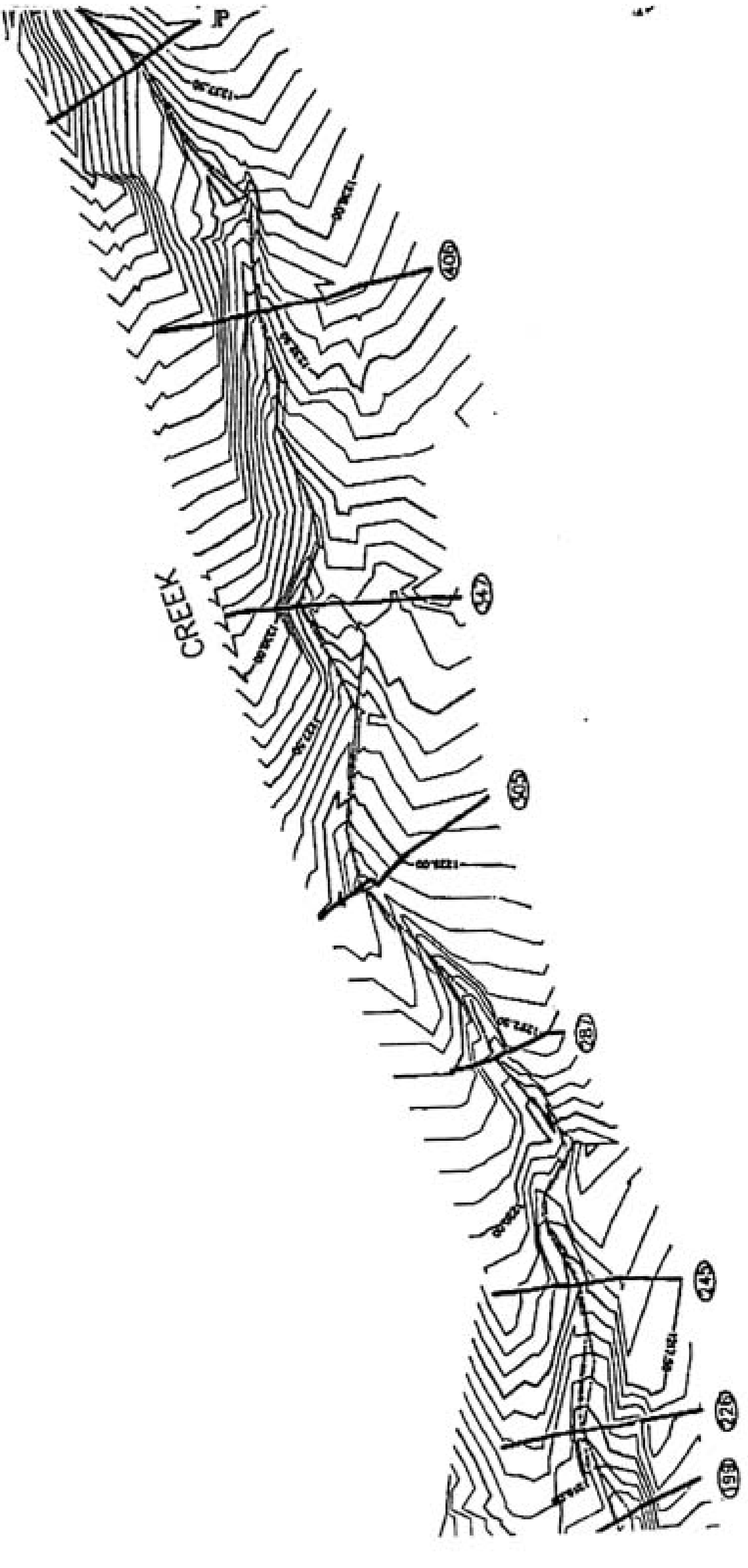


Figure 2.0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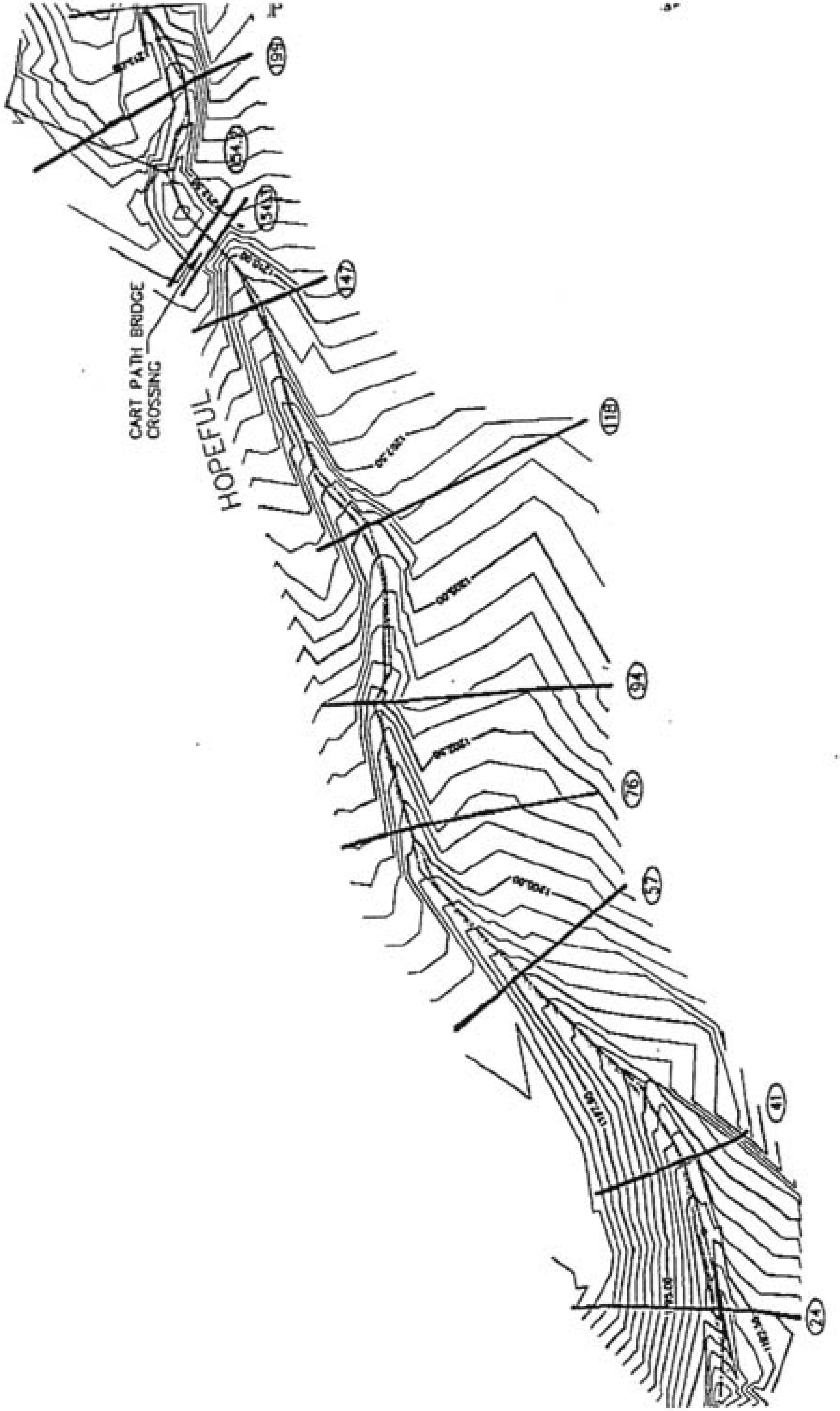
CART PATH BRIDGE CROSSING
HOPEFUL
199
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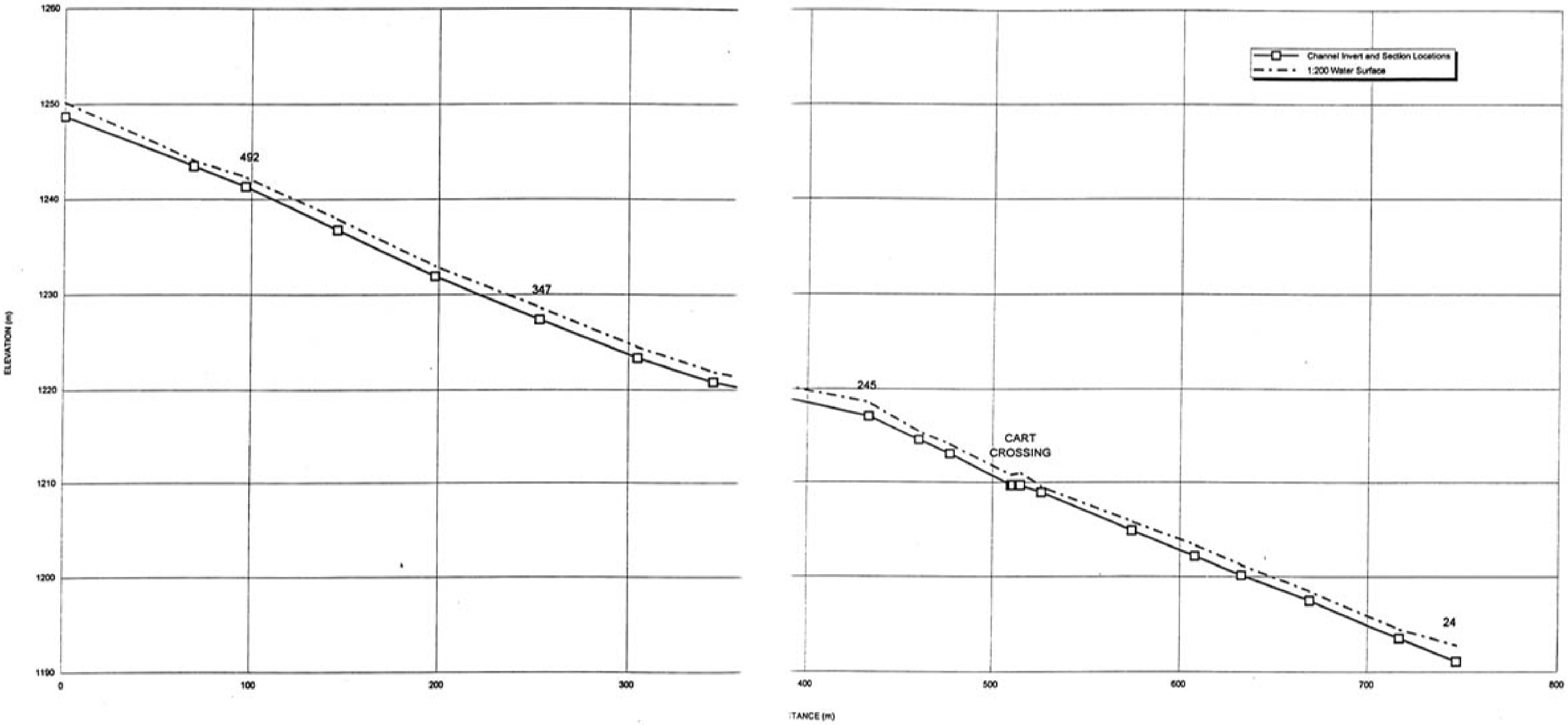
41
24



Stanley Urban Land

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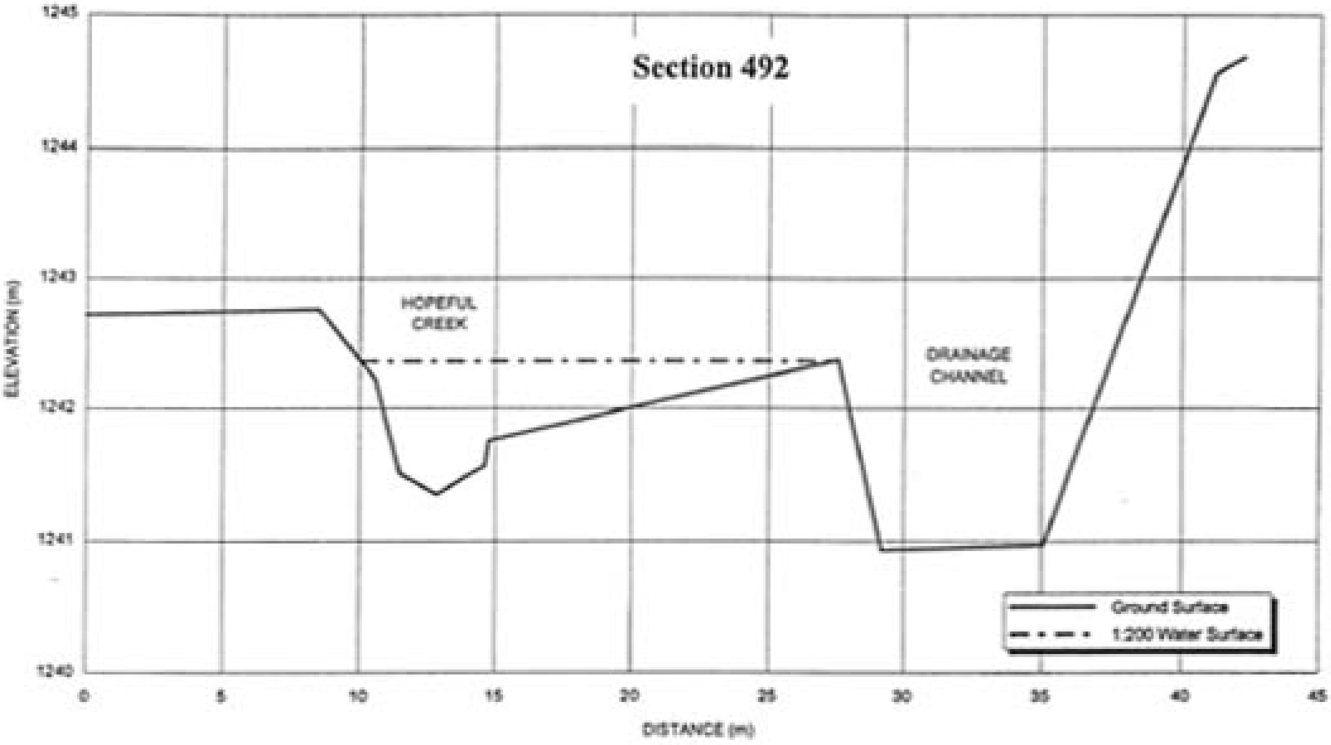
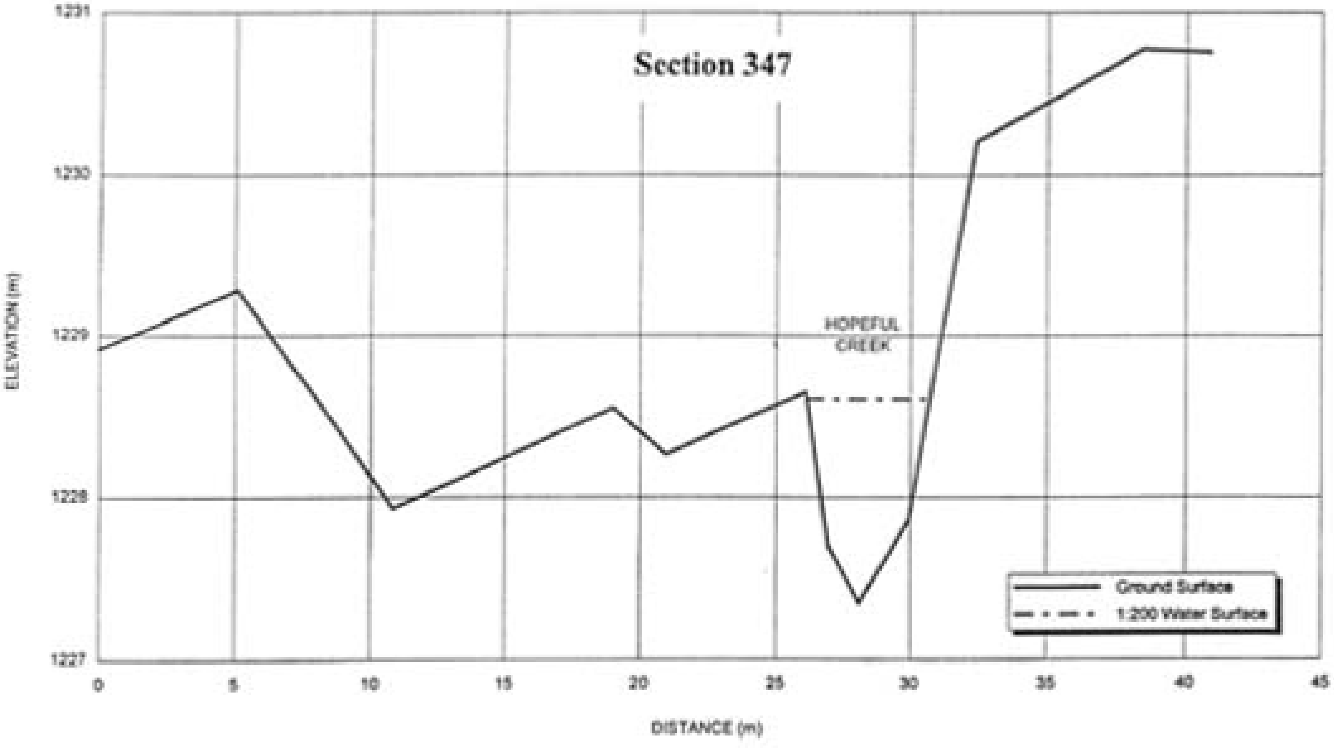
INTRAWEST
PANORAMA DEVELOPMENT

FIGURE 3.0
Hopeful Creek Profile





Stanley
Urban Land

INTRAWEST
PANORAMA DEVELOPMENT

FIGURE 4.1
Hopeful Creek Sections

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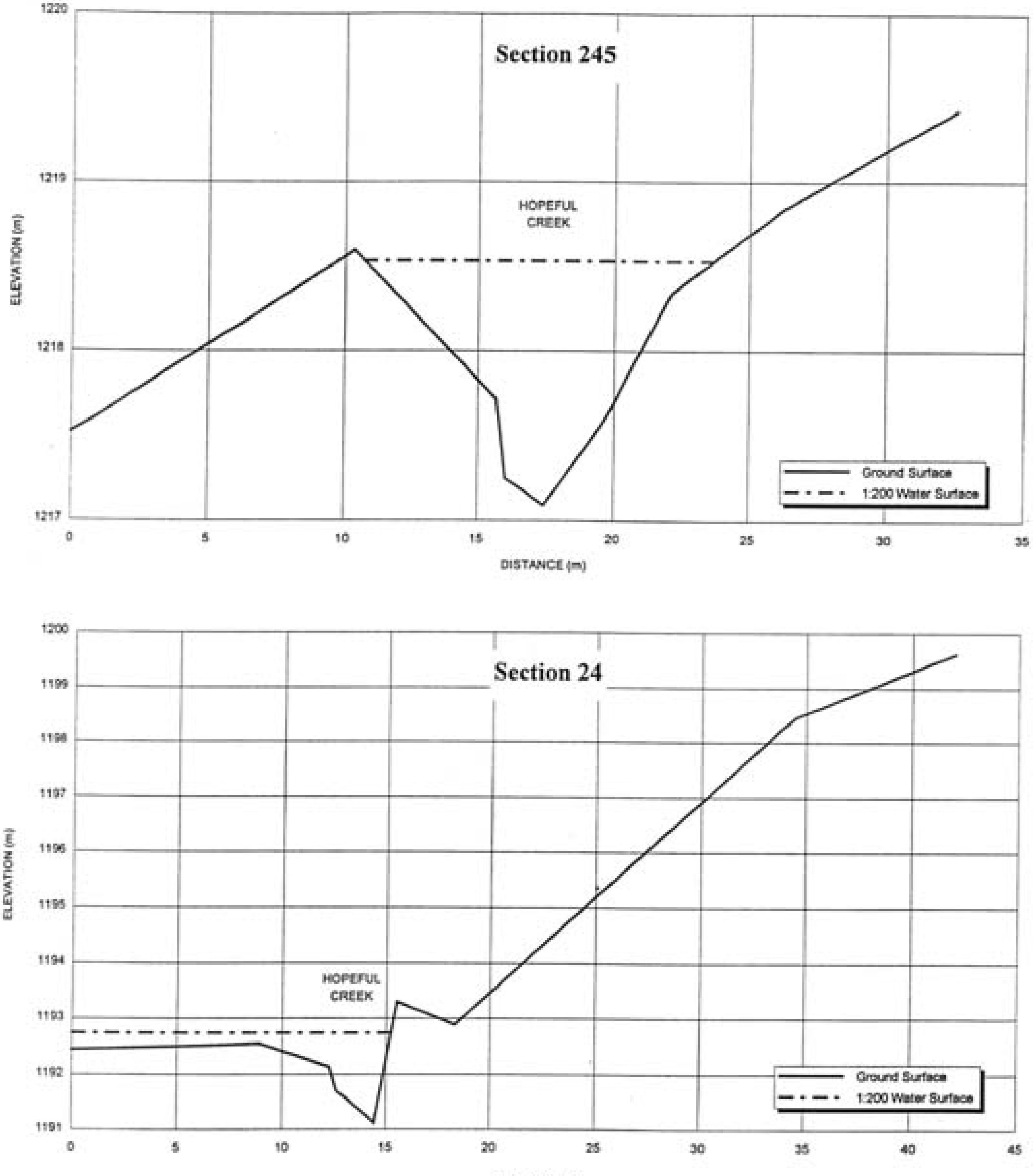

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PANORAMA DEVELOPMENT

FIGURE 4.2
Hopeful Creek Sections

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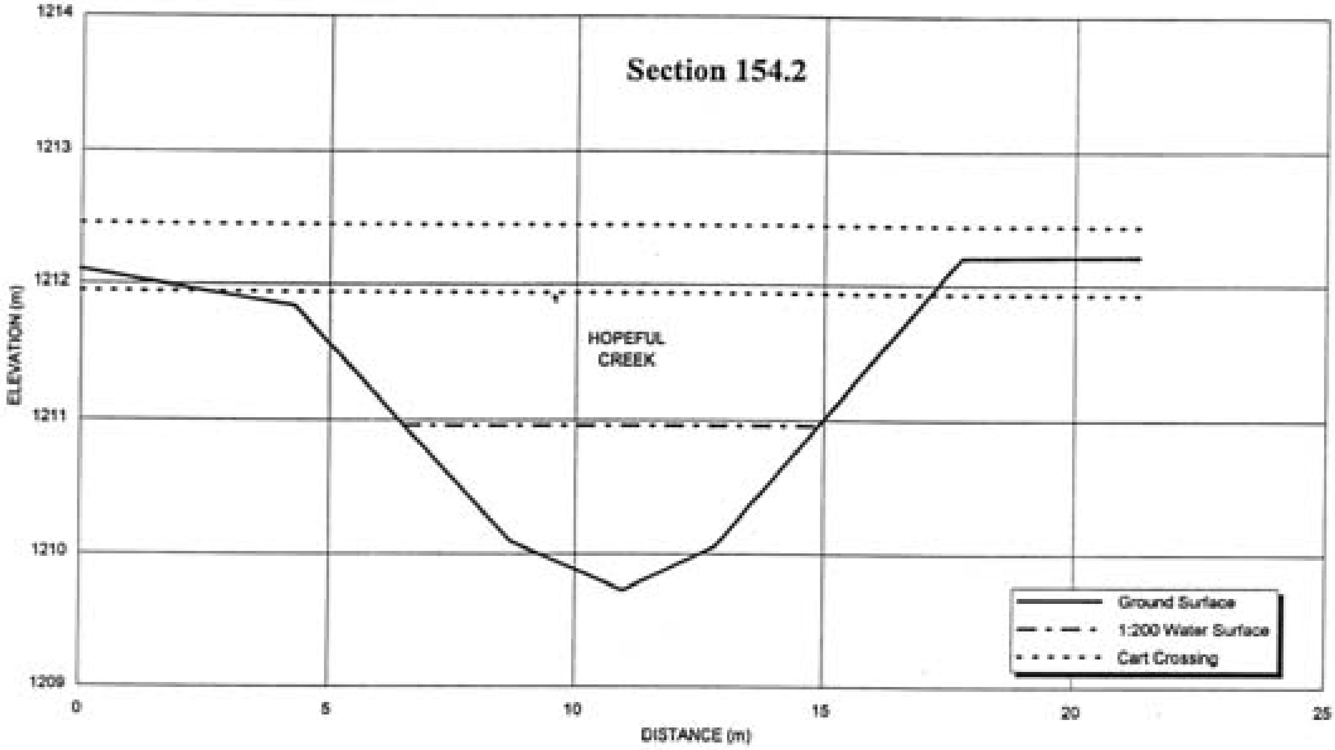

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INTRAWEST
PANORAMA DEVELOPMENT

FIGURE 4.3
Hopeful Creek Sections

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PANORAMA
MOUNTAIN VILLAGE

ENVIRONMENTAL

LEFT BANK HOPEFUL CREEK AVULSION

June 1998

INTRAWEST

GEOALPINE
ENVIRONMENTAL CONSULTING LTD.

MEMORANDUM

DATE: June 30, 1998

TO: John Morely, Construction Manager, PANORAMA RESORT

CC:

FROM: Michael JB Cole, P.Eng., Geoscience Engineer

RE: Greywolf Golf Course – Left Bank Hopeful

FILE #: GEC 014 01 03

Further to the hydraulic analyses conducted by Stanley Urban Land (originally enclosed in the June 24 memo) please find the following comments relating to freeboard conditions along the left banks along with some excerpts from the Stanley report.

Rick Carnduff P.Eng noted in the hydraulic analyses that although the left bank contained the 1:200 year design flood event there was insufficient freeboard at some locations including Sections 347 and 245.

To remedy this situation we believe that the cartpath along the left bank should be raised and armoured by placing and compacting structural fill (6" minus) in the areas of concern. The minimum recommended lift thickness is 1.0 m. The lifts should extend from the upstream and downstream section either side of Sections 347 and 245. The streamside face of the placed fill should be lined with boulders (D_{50} = 350 mm). The ground level on the fairway side of the cartpath should be raised to meet the cartpath as a safety precaution.

No intrusions into the wooded section is required or recommended. The streamside toe of the cartpath should not be shifted into the riparian zone while placing the lifts.

If there are any questions please call.

Stanley Consulting Group Ltd.
500 - 1122 - 4th Street S.W.
Calgary AB
Canada T2R 1M1

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e-mail: land.calg@stantech.com
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Stanley
Urban Land

23 June, 1998
File: 16408474

COPY

Intrawest Corporation
c/o Panorama Resort
Panorama, British Columbia
V0A 1T0

Attention: **Mr. John R. Morely, P.Eng.**
Construction Manager

Dear Sir:

Reference: **Hopeful Creek Hydraulic Analysis**

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Sincerely,

STANLEY URBAN LAND

R.D. (Rick) Carnduff, M.Eng., P.Eng.
Senior Associate

Enclosure

cc: Mr. M. Cole, GeoAlpine Environmental Consulting
Mr. B. Hargrave, Stanley Urban Land

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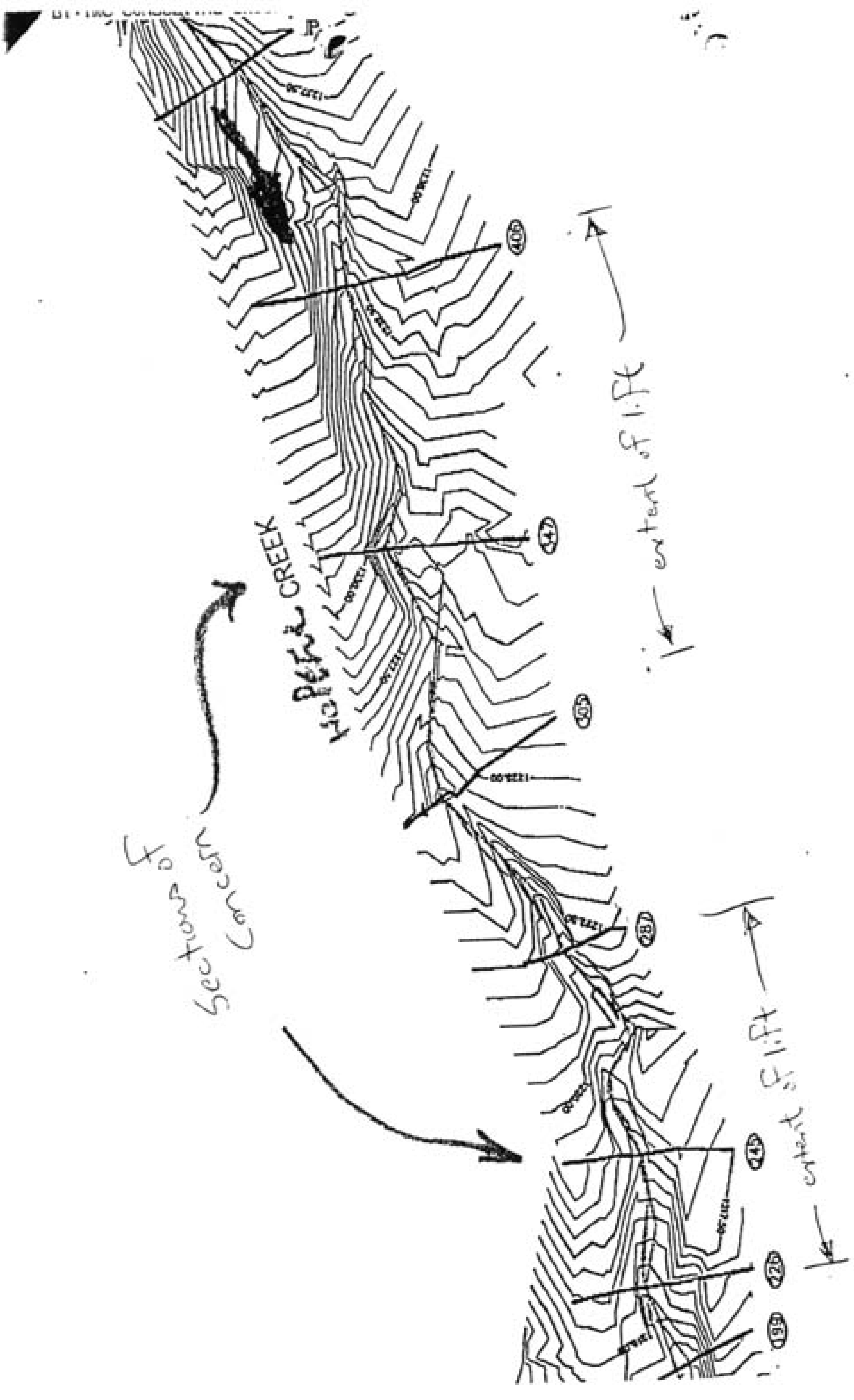
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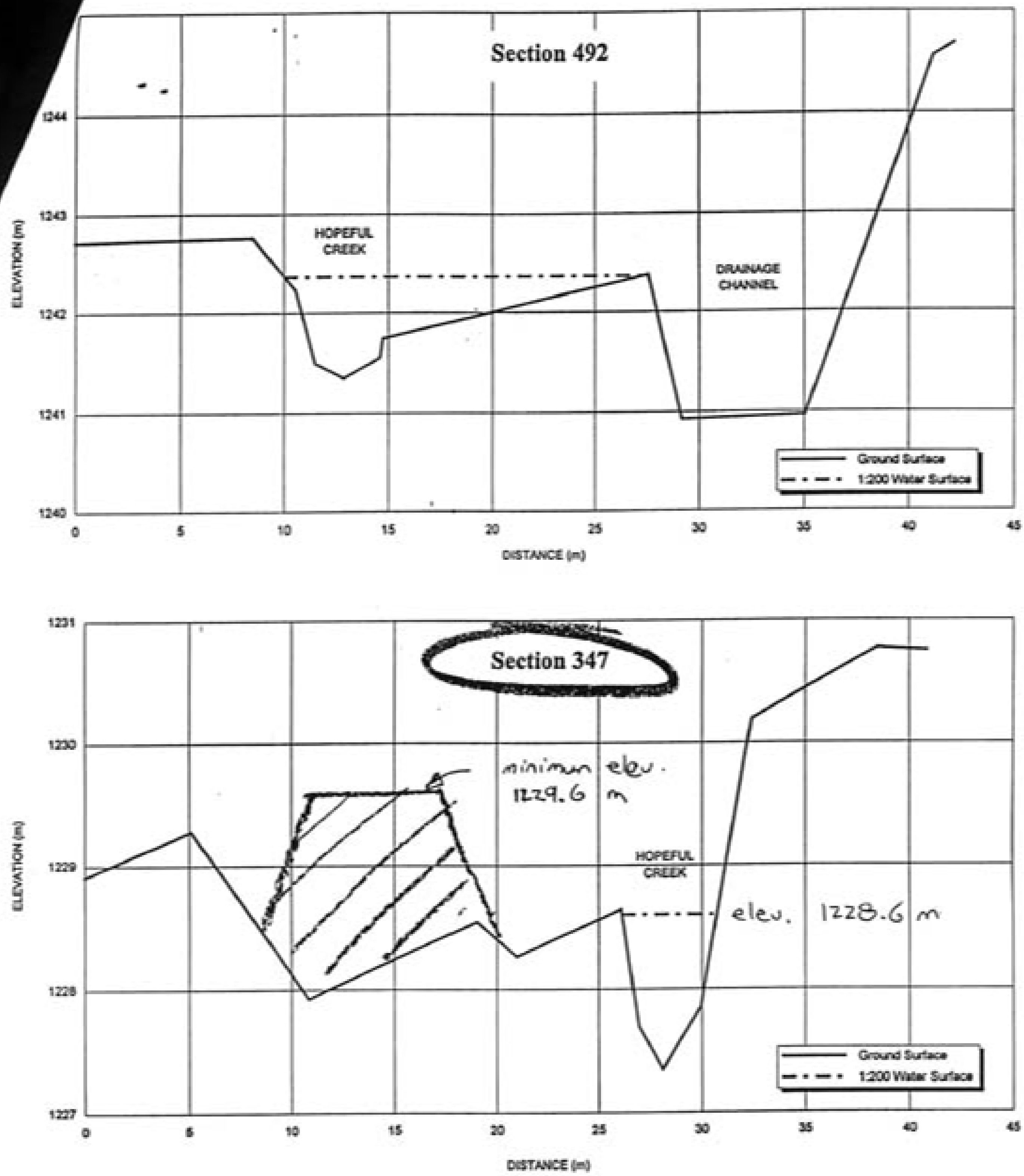

Stanley
Urban Land

INTRAWEST
PANORAMA DEVELOPMENT

FIGURE 4.1
Hopeful Creek Sections

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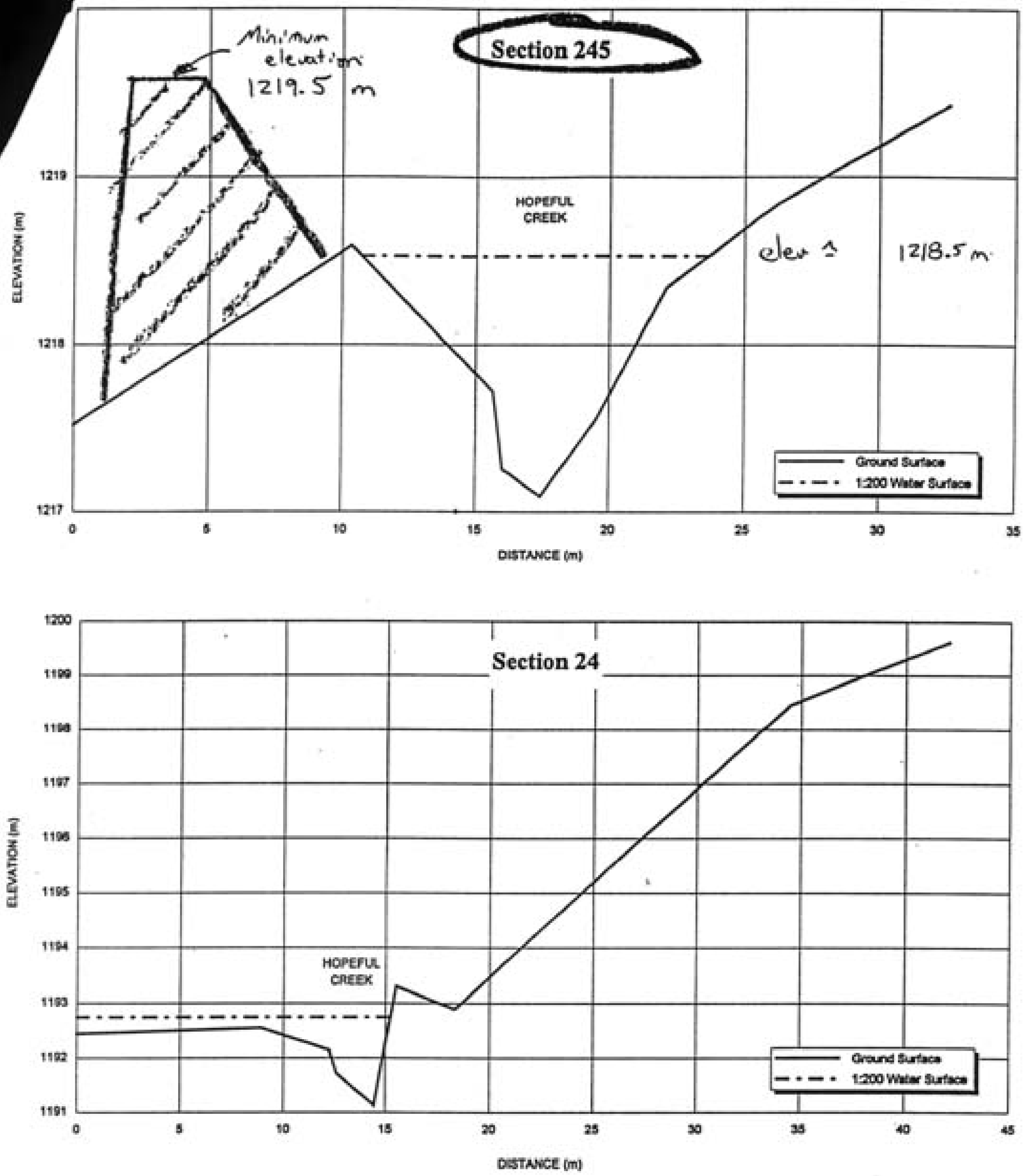

Stanley
Urban Land

INTRAWEST
PANORAMA DEVELOPMENT

FIGURE 4.2
Hopeful Creek Sections

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ENVIRONMENTAL

TRAPPERS RIDGE, INITIAL ENVIRONMENTAL REVIEW

February 1999

Trapper's Ridge

Initial Environmental Review

GEC 014/01/05

Produced for:

Panorama Mountain Village
Panorama, BC
V0A 1T0

Produced by:

GEOALPINE
ENVIRONMENTAL CONSULTING LTD.
3232 Alta Vista Road,
Whistler, B.C. V0N 1B3

February 1999

Table of Contents

List of Maps and Tables

STATEMENT OF LIMITATIONS

This Document was prepared by **GeoAlpine Environmental Consulting Ltd.** for the account of **Panorama Mountain Village**.

Neither all nor part of the contents of this report should be used by any party, other than the client, without the express written consent of GeoAlpine Environmental Consulting Ltd. If such consent is granted, a surcharge may be rendered. Should this report contain an error or omission then the liability, if any, of GeoAlpine Environmental Consulting Ltd. should be limited to the fee received by GeoAlpine Environmental Consulting Ltd. for the preparation of this Document. Recommendations contained in this report reflect GeoAlpine Environmental Consulting Ltd.'s judgement in light of information available at the time of study. The accuracy of information provided to GeoAlpine Environmental Consulting Ltd. is not guaranteed. Any use made of this report by a Third Party, or any reliance upon decisions made based on this Document, are the responsibility of such Third Parties. GeoAlpine Environmental Consulting Ltd. accepts no responsibility for damages suffered by any Third Party because of decisions made or actions taken based on this Document.

This Document should not be construed to be:

- A Phase 1 - Environmental Site Assessment (as per the Contaminated Sites Regulations of the Waste Mgt. Act);
- A Stage 1 - Site Investigation (precursor to the Phase 1 - Environmental Site Assessment); nor shall it be construed to be
- An Environmental Impact Assessment.

1.0 INTRODUCTION

Panorama Mountain Village wishes to expand its development approval into an area of lands described as Trapper's Ridge. The subject lands are presently unsurveyed Crown Land and in order to obtain development approval Panorama Mountain Village must satisfy the requirements of the Ministry of Environment, Lands and Parks (MELP). As a basis for site planning, Panorama Mountain Village was required to provide information pertaining to the existing environmental conditions on the subject site. To achieve this objective GeoAlpine Environmental Consulting Ltd. was retained to conduct an Initial Environmental Review (IER). The purpose of the review is to provide an overview assessment of the existing environmental conditions on the subject site. It is also intended to identify environmentally sensitive areas, ecologically significant habitat and environmental constraints to development. To this end, GeoAlpine produced an IER for Trapper's Ridge in draft form, on April 19, 1997, and submitted the report to Panorama Mountain Village for review. At that time it was determined that further study and an expanded scope of work would be appropriate. GeoAlpine was retained to expand the study and produce an Environmental Review of the lands, hereafter referred to as the Subject Site. Although outside the original scope of this report, the client has requested comment on a proposed employee housing building to be located across Toby Creek from the study. A final draft report was submitted for review by Panorama Mountain Village in March 1998.

1.1 The Project Team

Dave Williamson, B.E.S. and Shelagh Wrajez, B.Sc., conducted the initial site investigation and Dave Williamson prepared the EIR. Dave Williamson returned to the site with Mike Cole, P.Eng., and Mike Nelson, R.P.Bio. to complete the expanded study.

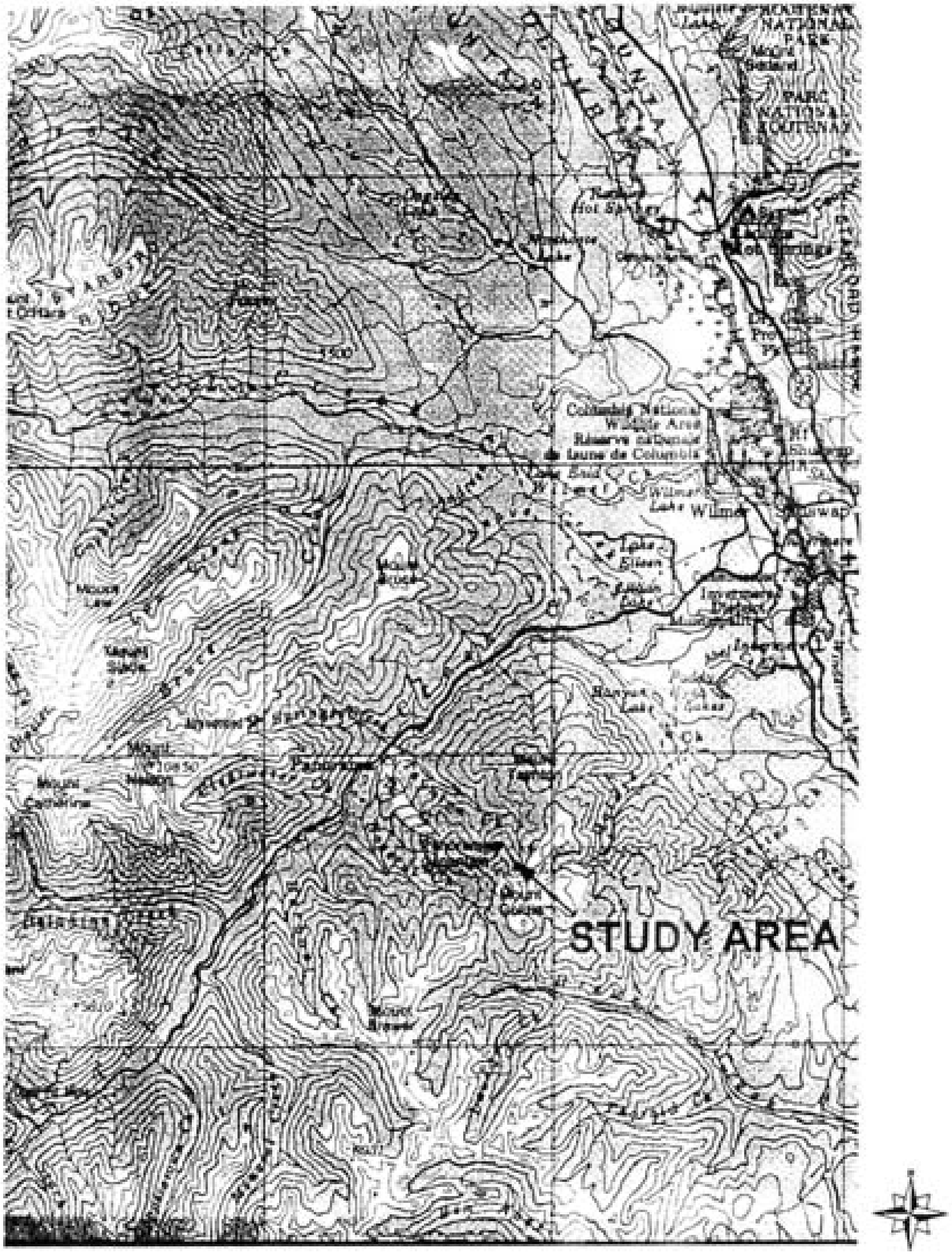
1.2 Methodology

Site visits were conducted on October 17, 1996 and within the week of June 23-27, 1997. During the site visits a cursory survey was conducted by walking through the subject site and making visual observations. The visit was video taped for reference in the production of this report. Local hydrology, geomorphology, vegetation, wildlife, and wildlife habitat information were visually assessed. Fish habitat information was collected using the DFO/MOE Stream Survey Forms and methodology (DFO, 1989, BC Environment, 1996), and a program of electro-fishing and trapping was undertaken to determine fish presence near the study area.

1.3 Description of Location

Panorama Mountain Village is located approximately 20 km west of the town of Invermere in the Purcell Mountains (see Map 1). For the purposes of this study an area of approximately 73 ha was delineated (See Map 2). The subject site is located on the northwest slope of Panorama Mountain, and is bounded by the existing ski slopes and a subdivision development to the west, Toby Creek to the north, Taynton Creek to the east and the water reservoir at an approximate elevation of 1325 m asl to the south. The study area also includes a lower bench at approximately 1200 m asl. Access to the site is provided via a 4WD dirt track.

Map 1 Study Area Location



Scale 1: 250000

2.0 EXISTING ENVIRONMENTAL CONDITIONS

2.1 Cultural Environment

2.1.1 Heritage

No heritage features were identified on the site. Evidence of past cutting was observed in the form of old stumps.

2.1.2 Recreation

An outfitters trail traverses the entire site. Mountain bikers and hikers probably share this track in the summer, and cross-country skiers in the winter. The 4WD dirt track provides mountain bike access through the site. Skiing occurs on the adjacent trails and may take place through the site during the winter. Low levels of use by hikers may occur.

2.2 Physical Environment

2.2.1 Climate

The study area lies in the Eastern Purcell Mountain Ecosection (EPM) of the Columbia Mountain Highlands Ecoregion (Campbell et al., 1990). The ecosection is a mountainous area with high valleys located on the leeward side of the Purcell Ranges. There is a distinct rain-shadow, with strong precipitation and temperature gradients. AES climate stations are lacking in the immediate area, and it is difficult to extrapolate from more distal stations such as Golden, Canal Flats and Kimberly as those stations tend to be at lower elevations in the Rocky Mountain trench. At these valley-based stations, mean daily temperatures are lowest in January, ranging from -8.6 to -11.0 °C, and highest in July, ranging from 17.4 to 18.6 °C. Precipitation peaks in December and January, mainly falling as snow. The precipitation distribution in the other months is fairly even. Total precipitation at these stations range from 369.1 mm at Canal Flats to 660.3 mm at Kimberly, with 40 to 50 % falling as snow (Environment Canada, 1981).

Climatic data for Panorama Lodge (elevation 1572 m) is available for the period 1970 to 1990 from the Atmospheric Environment Service (AES) of Environment Canada. Mean annual precipitation for the period of record is 985 mm, of which 38% falls as rain (May to September) and 62% fall as snow (October to April).

2.2.2 Geology

Bedrock formations in the Taynton Creek drainage consist of Upper Proterozoic units (of the Hadrynian epoch – approximately 590 million years ago) of the Windermere Supergroup (Stanley, 1986). The deposits (including tillites) likely represent late Proterozoic glaciation. The subgroup represented in the study area is Toby Formation (uPT) consisting of conglomerate, siltstone and shale (MEMPR Minfile 082KSE, 1996)

The abandoned Paradise and Silver Belt Mines in the same formation across valley showed occurrences of Lead/Zinc/Silver/Gold and Silver/Lead/Zinc, respectively. Adjacent mining claims (Green Ridge and Hat) in the same formation, across the valley indicates the occurrence of Copper/Gold/Silver and Barite/Copper, deposits respectively (Stanley, 1986).

Small pockets of exposed bedrock units are present in most locations of the study area. Highly fractured shales are ubiquitous units with lesser amounts of quartz conglomerates (sandstones) occurring around the site. The dip/strike of sedimentary units varies greatly across the site showing its high degree of structural deformation.

2.2.3 Geomorphology

The site is described as a small plateau, or bench located on a north aspect slope of Panorama Mountain. The meso slope position of the bench is middle slope, with a straight to concave surface shape. Local surficial materials appear to consist of glacial tills and colluvial deposits. The site slopes to the north at a moderate gradient.

Overall, the site is comprised of thin blankets of weathered bedrock in the upper sections and thicker colluvial units in the lower, basin areas. The study area can be described as a bedrock-controlled ridge intersected by a series of gullies or depressional troughs.

Mineral soils consisted of thin veneers of sandy silts to silty gravels derived from weathered parent material. Surface erosion in steeper areas (>35%) appears to be controlled by the coarse texture of the units. The majority of the surficial units are free draining depending on slope.

Several geotechnical studies have been conducted on the general area. A November 1996 Geotechnical Hazards report from EBA Engineering Consultants Inc. refers to the "Cox Creek Development Area" which corresponds to the Trappers Ridge subdivision. In general, no special restraints were seen for the abovementioned development however it was recommended that final layout be reviewed with respect to locally steep terrain and setbacks from the streams and gullies present (EBA, 1996). A preliminary evaluation of the general snow avalanche hazards was carried out and none were identified.

MOF 1:20 000 Terrain Stability Intensity Level D (TSIL-D) mapping was conducted based on air photo interpretation and subsequent field checks (Terratech, 1995). This mapping indicates areas of unclassified, potentially unstable, and unstable terrain. This classification indicates evidence of natural landslide activity and a high likelihood of landslide initiation due to construction of roads or trails. No areas were listed as potentially unstable or unstable and as such, the study area contains polygons that were unclassified.

The unclassified polygons occur in areas that are relatively flat or gently sloping. Based on conversations with the terrain mappers (Terratech, per comm., 1997), the location of the polygons and their non-classified status, it is assumed that these polygons are considered "Stable Terrain' (i.e., are not initiation zones of landslides).

2.2.4 Hydrology

The site is transected by Cox Creek in the western portion of the study, with Taynton Creek forming the eastern subject site boundary. Both Creeks flow into Toby Creek, which forms the northern boundary of the study area. Toby Creek in turn drains into the Columbia River near Invermere B.C. Water Survey of Canada records indicate that a stream gauging station was maintained on Toby Creek at Athalmer (Station No. 08NA012) from 1912 to 1915 and 1943 to 1984. WSC stream-flow data for Cox and Taynton Creeks is not available.

Cox Creek drains the northwest slope of Panorama Mountain. It has a total length of 3.4 km, with an overall gradient of 27 %. The creek flows northwest from its headwaters at the 2,060 m level to its confluence with Toby Creek at approximately 1,130 m elevation. The watershed has an area of approximately 2.1 km^2. Cox Creek was realigned in the past in its lower two reaches. Cox Creek's discharge was measured as 0.03 m^3/s on June 27, 1997.

The Taynton Creek watershed/drainage covers an area of approximately 15.3 km^2. The creek flows northwest for about 7 km, from its headwaters above the 2,350 m elevation level to its confluence with Toby Creek at approximately 1,140 m elevation. Taynton Creek has a gradient averaging 17.4% over its entire length. The creek rises steeply from its confluence with Toby Creek for approximately 70 to 100 m, with gradients measured at 22 to 26 %, before levelling off in its mid reaches for about 4.3 km, to gradients ranging from 9 to 16 %, averaging 14.7 %. Within its upper reaches the gradient of Taynton Creek ranges from 20 to 50 %. The discharge from this drainage was measured at 0.48 m^3/s near its mouth during the site visit on June 23, 1997.

Toby Creek, a tributary of the Columbia River, is a fairly large system with a drainage area of about 684 km^2. It flows in a northeast direction at the base of Panorama Mountain, outside of the study area. Over the 23 years of gauging by Water Survey of Canada near its mouth (WSC, 1991), Toby creek had a mean annual flow of 12.8 m^3/s. Flows usually peak in June and July, with mean monthly flows during those months of 42.1 and 39.5 m^3/s, respectively. Low flows typically occur during winter months, with a minimum mean monthly flow of 2.09 m^3/s recorded for February.

2.3 Terrestrial Environment

2.3.1 Soils

Developed soils consist of Orthic Eutric Brunisols, below 1150 m, and a combination of Orthic Eutric Brunisols and Orthic Dystric Brunisols above 1150 m. These two soil types are closely related displaying the same profiles. The eutric soils have a high degree of base saturation and lack a well-defined mineral/organic horizon and occur in parent material under a forest or shrub vegetation. The dystric soils also lack a well-defined mineral/organic horizon and occur in parent material under forest vegetation.
They are both comprised of well to rapidly drained deep, medium textured colluvium as well as moderately coarse texture glacio-fluvial deposits.

2.3.2 Vegetation

Biogeoclimatic Zone Classification (MSdk)

The study area is situated within the Dry Cool Montane Spruce biogeoclimatic subzone (MSdk) of the Southern Interior Mountains Ecoprovince. The MSdk subzone generally occurs on lower slopes on the eastern side of the Purcell Mountains. The elevational range of the MSdk subzone is 1100 to 1650 m (Braumandl and Curran, 1992). Zonal (BEC site series 01, TEM symbol: SG, name: Sxw-Soopolallie-Grouseberry) MSdk is described as hybrid white spruce and subalpine fir dominated forest with minor occurrences of Douglas fir. The shrub understorey consists primarily of false azalea, Utah honeysuckle, and soopolallie. Much of the study area is composed of seral lodgepole pine forest.

Vegetation Associations

The subject site is dominated by a mature seral lodgepole pine (*Pinus contorta*) forest approximately 70 years of age. Anecdotal information indicates the site was burned over in the late 1920's (pers. comm. S. Wrajez, 1997). Shrub species identified on site include soopollalie (*Shepherdia canadensis*) and labrador tea (*Ledum groenlandicum*). Heavily browsed shrubs observed on site may be black huckleberry (*Vaccinium membranaceum*), which is found more commonly in association with subalpine fir (*Abies lasiocarpa*) and common juniper (*Juniperus communis*) in the ESSFdk subzone. While some mosses were observed in the boggy areas, the groundcover of the site consisted generally of grasses (spp. unknown) and spare forbs.

Table 1 Terrestrial Ecosystem Unit Areas

Terrestrial Ecosystem Unit	Area (m^2)
SS6	15728.72
SH6	8392.23
SG6	5311.82
SG6	13860.83
SG6	2154.72
8SGk6, 2SS6	251695.75
8LP5, 2SG6	2709.98
SB3	1045.47
SB3	185790.31
8SG6, 2LP5	14868.51
SG6	45556.97
6SS5, 4SS3	35556.97
SGk6	35553.97
6SG6, 4LP5	122473.94
CF	12109.72
Total Area	**752809.91**

In addition to the zonal sites observed in the upland forests of the study area an additional dry site series was classified. Site series 04 (TEM symbol: LP, Lodgepole pine – Oregon grape – Pinegrass) occurs on the well drained soils of the lower bench and is differentiated from zonal sites by the lodgepole pine dominated forest and the presence of saskatoon, common juniper, and tall Oregon grape in the shrub layer. The young (stand class 5) lodgepole pine forest composed of 20 cm dbh (diameter breast height), 20 m tall canopy height, had a crown closure of approximately 70%.

The remaining sites were wetter than zonal with a site series classification of 05 (TEM symbol: SS, Hybrid white spruce – soopolallie – Snowberry) assessed to the riparian forests of Taynton and Cox Creeks. This mature (stand class 6) forested unit contained Douglas-fir, Engelmann spruce, hybrid white spruce, trembling aspen, and northern black cottonwood often exceeding 25 m in height. Trees up to 50 cm dbh were observed in the forest with a crown closure of approximately 50%. Common snowberry dominated the sparse shrub layer.

A wet receiving area below the existing T-bar and to the east of the existing subdivision was assessed as site series 06 (TEM symbol: SH, Hybrid white spruce – Dogwood - Horsetail). Within the open canopied mature forest (crown closure 10%), examples of hybrid white spruce and subalpine fir up to 50 cm dbh and 25 m tall were observed. In addition trembling aspen and northern black cottonwood were noted. A significant shrub layer was also present consisting of willows, mountain alder, Labrador tea, and red-osier dogwood. Wetland indicator herb species, such as streambank butterweed and green-flowered bog orchid, were also observed

A small bog was identified on the lower bench as site series 07 (TEM symbol: SB, Hybrid white spruce – scrub birch – Sedge) although the presence of organic soils could not be confirmed. In addition to orchids, fringed grass-of-Parnassus, shrubby cinquefoil, kinnikinnick, pink wintergreen, Nootka rose and common juniper were noted. Shrubs in the small clearing were heavily browsed.

Table 2 Trapper's Ridge Study Area Plant List

Common Name	*Latin Name*
Trees	
Subalpine fir	*Abies lasiocarpa*
Douglas maple	*Acer glabrum*
Engelmann spruce	*Picea engelmannii*
Lodgepole pine	*Pinus contorta*
Northern black cottonwood	*Populus balsamifera*
Trembling aspen	*Populus tremuloides*
Douglas-fir	*Pseudotsuga menziesii*
Shrubs	
Sitka alder	*Alnus sitchensis*
Mountain alder	*Alnus tenuifolia*
Saskatoon	*Amelanchier alnifolia*
Red-osier dogwood	*Cornus stolonifera*
Common juniper	*Juniperus communis*
Black twinberry	*Lonicera involucrata*
Black gooseberry	*Ribes lacustre*
Nootka rose	*Rosa nutkana*
Thimbleberry	*Rubus parviflorus*
Willow	*Salix sp.*
Soopolallie	*Shepherdia canadensis*
Birch-leaved spirea	*Spiraea betulifolia*
Common snowberry	*Symphoricarpos albus*
Oval-leaved blueberry	*Vacinium ovalifolium*
Highbush-cranberry	*Viburnum edule*
Herbs	
Yarrow	*Achillea millefolium*
Baneberry	*Actaea rubra*
Bluebunch wheatgrass	*Agropyron spicatum*
Wild sarsaprilla	*Aralia nudicaulis*
Kinnikinnick	*Arctostaphylos uva-ursi*
Heart-leaved arnica	*Arnica cordifolia*
Pinegrass	*Calamagrostis rubescens*
Common red paintbrush	*Castilleja miniata*
Prince's pine	*Chimaphila umbellata*
Bunchberry	*Cornus canadensis*

Table 2 Trapper's Ridge Study Area Plant List (continued)

Common Name	*Latin Name*
Fireweed	*Epilobium angustifolium*
Wild strawberry	*Fragaria virginiana*
Northern bedstraw	*Galium boreale*
Sweet-scented bedstraw	*Galium triflorum*
Twinflower	*Linnaea borealis*
One-sided wintergreen	*Orthilia secunda*
Streambank butterweed	*Senecio pseudaureus*
Rosy twistedstalk	*Streptopus roseus*
Common dandelion	*Taraxacum officinale*
Western meadowrue	*Thalictrum occidentale*
One-leaved foamflower	Tiarella trifoliata ver. Unifoliata
Grouseberry	*Vacinium scoparium*
Canada violet	*Viola canadensis*

Table 3 Trapper's Ridge Plant List Exclusive to Wet Sites
(Site Series 06, 07)

Common Name	*Latin Name*
Shrubs	
Labrador tea	*Ledum groenlandicum*
Shrubby cinquefoil	*Potentilla fruticosa*
Short-fruited willow	*Salix brachycarpa*
Tea-leaved willow	*Salix planifolia*
Herbs	
Mountain ladyslipper	*Cypripedium montanum*
Horsetail	*Equisetum spp.*
Fringed grass-of-Parnassus	*Parnassia fimbriata*
Bracked lousewort	*Pedicularis bracteosa*
Green-flowered bog orchid	*Platanthera hyperborea*
Round-leaved rein-orchid	*Plantanthera orbiculata*
Pink wintergreen	*Pyrola asarifolia*
Star-flowered false Soloman's-seal	*Smilacina stellata*

2.2.3 Wildlife

A detailed wildlife survey was not conducted on the subject site as part of this investigation. Wildlife (ungulate) capability mapping for the area identifies two polygons that roughly delineate the upper and lower benches (Demarchi, 1989). The lower bench is classified as moderate capability winter habitat for moose (X3), very high capability to support elk in the spring, summer and early fall (e3), very high capability to support mule deer in the spring, summer and early fall (m3), very high capability to support white-tailed deer in the spring, summer and early fall (w3), high-moderate capability to support caribou in the spring, summer and early fall (c4). The upper bench had the same capability ratings for ungulates as the lower bench with the exception of caribou that was rated as low for spring, summer, and early fall (c5).

Numerous ungulate tracks, scats and browsing signs were observed on the subject site. Cavity nesting opportunities were not abundant as the trees of the site are generally too small to be suitable for cavity nesting habitat. Three mule deer (*Odocoileus hemionus*) were observed near the subject site during the October 17, 1996 site visit. The subject site appeared to be typical in levels of wildlife utilisation for habitats on the lower slopes of Panorama Mountain in the Toby Creek drainage. Based on signs observed during the site visits in two different seasons, the subject site was experiencing use by wildlife, particularly mule deer, moose (*Alces alces*) and elk (*Cervus canadensis*).

According to the developer, the concept behind the layout of the Trapper's Ridge Development Proposal is to maximise greenspace opportunities within the development parcel and creating a "porosity" of tree preservation areas. Map 2 indicates the "porosity" of the development by identifying a number of potential wildlife movement corridors that would be maintained with the existing concept. This represents a marked departure from the form of the original village. The original village, by its density and layout effectively blocks wildlife movement with urban development.

2.4 Aquatic Environment

2.4.1 On Site Waterbodies

Cox Creek
Cox Creek drains the northwestern slope of Panorama Mountain. It has a total length of 3.4 km, which was divided into 3 reaches. The first two reaches have been significantly disturbed, with the channel having been relocated sometime in the past. Upstream of the creek is confined in a ravine.

Reach 1

Cox Creek rises steeply from its confluence with Toby Creek, within this short, 70 m long, reach. The gradient averages 25%, ranging from 12 to 38 %. The mean channel width and mean wetted width both averaged 0.76 m, on June 27, 1997. The flow was predominantly riffle, with limited pool and glide flows. Cover was estimated at about 30%, provided by overstream vegetation, with limited amounts of cutbank, large woody debris (LWD), and deep pools. The bed material was predominantly larges, with some gravels. The water was clear, with visibility greater than 100 cm. The water temperature was 7 °C, while the conductivity was 490 µs/cm. No fish were caught during electrofishing the entire reach for 1,380 seconds (double pass, electrofisher set at 600 volts, 80 Hz). Under the Forest Practices Code of B.C. (MOF, 1995), this reach is classified as a S6 non-fish stream based on its width, the steep gradient and the lack of fish detected.

Reach 2

Reach 2 is approximately 425 m long, with most of the reach in a severely disturbed state. An approximate 100 m section of the stream has down-cut into its bed to a depth between 1 and 3 m below the natural substrate. Its flow was measured at 0.03 m^3/s, with flows characterised as 75% riffle, 20% glide and 5 % pool. The stream had an average channel width of 1.25 m, with an average wetted width of 0.95 m. Cover was estimated at 30%, consisting of almost equal amounts of overstream vegetation, cutbank, deep pool, and LWD. The bed material consisted of fines and gravels, with little larges. There were numerous small obstructions, generally log controlled, ranging from 0.5 to 0.7 m in height. One falls located 277 m upstream from the creek's mouth, was about 2.5 m high. No fish were captured during two past electrofishing efforts over the entire reach (electrofisher on for 1,680 minutes, set at 600 volts, 80 Hz). This reach is classified as a S6 non-fish stream, under the Forest Practices Code (MOF, 1995), based on its width and the lack of fish detected.

Reach 3

Reach 3 consists of the entire remainder of the Cox Creek. Within this reach, the creek is generally confined within a ravine. The channel gradient averaged 33%. Electrofishing was not conducted due to the steep gradient. As this reach lies upstream of the study area, no additional details were gathered. Cox Creek's third reach is classified as an S6 non-fish stream (MOF, 1995), based on the steep gradient and the channel widths of the downstream reaches.

2.4.2 Adjacent Waterbodies

Taynton Creek forms the eastern subject site boundary, while Toby Creek is located immediately north at the valley bottom elevation of 1125 m.

Taynton Creek

Taynton Creek consist of three reaches, plus five main tributaries, with the portions of the first two reaches adjacent to the study area. From its confluence with Toby Creek, Taynton Creek's first reach rises steeply for a short distance out of the Toby Creek valley. The second reach has a moderate gradient, and forms the majority of the stream length. The third reach of Taynton Creek consists of steep, ephemeral headwaters.

Reach 1

This short reach, 70 m in length, rises steeply from Taynton Creek's confluence with Toby Creek, with gradients ranging from 22 to 26 % (average gradient 24%). The stream channel width averaged 3.5 m, as did the wetted width. Other than the relatively steep gradient, no barriers to fish migration were evident. There was approximately 40% fish cover provided primarily by over-stream vegetation, with lesser amounts of deep pool, boulder and cut-bank cover and a trace of large organic debris (LWD.). Riparian vegetation consisted of willow, rose, Saskatoon, high-bush cranberry, thimbleberry, black twinberry, Sitka alder, and mountain alder. The canopy closure was estimated at 30 % including lodgepole pine, Douglas fir, and Engelmann spruce. The substrate consisted mainly of cobbles and boulders with little gravel or fines. The water was quite clear with visibility greater than 100 cm. The conductivity was 295 µs/cm and the water temperature was 6°C on June 23, 1997. Flow conditions were moderate to high, consisting overwhelmingly of riffle and small falls. The stream's discharge was measured as 0.5 m^3/s. Electrofishing was not conducted on this reach, as Toby Creek at its confluence with Taynton Creek is known to support bull trout (*Salvelinus confluentus*), and the electrofishing program in Reach 2 upstream yielded numerous bull trout. Therefore, even though this reach is fairly steep, it is presumed to be passable for fish. Under the Forest Practices Code of B.C. (MOF, 1995), this reach of Taynton Creek is classified as a S3 fish stream based on its width and presumed presence of fish.

Reach 2

Taynton Creek's second reach is 4.3 km long, forming the majority of the stream's length. This reach had gradient measurements ranging from 9 to 16 %, with an average gradient of 14.7 %. The stream channel and wetted widths both averaged 4.6 m. There were small debris controlled falls though the section of stream surveyed, none of which posed a barrier to fish movement. Stream fish cover was estimated at 30 %, provided mainly by over-stream vegetation, with some deep pool, LWD and cut-bank cover also present. Riparian vegetation was similar to that observed downstream, and included red-osier dogwood, willow, oval-leaved blueberry, rose, Saskatoon, thimbleberry, Sitka alder, Douglas maple, bunchberry, wild strawberry, common horsetail, and fireweed. The canopy over the stream was fairly open, with the canopy closure estimated at 15 %. Trees within the canopy were mostly lodgepole pine, with lesser amounts of trembling aspen. The substrate consisted of gravels, with lesser quantities of fines and cobbles.

Boulders were generally lacking in the lower portions of this reach. Water quality parameters were the same as for Reach 1. Flow conditions (during the site visit on June 23, 1997) were moderate to high. Flows were characterised as 60 % riffle, 20 % pool and 20 % run. The stream's discharge was measured as 0.6 m^3/s.

Electrofishing was conducted on the lower 500 m of this reach. Eleven bull trout were captured during a single pass electrofishing effort, with 5 of those fish being captured in the lower 100 m section of this reach. Within this small sample, there appears to be two age classes, with 10 bull trout ranging in fork length from 95 to 114 mm, averaging 102.4, and one larger fish 163 mm in fork length. Fielden et al. (1993) found that bull trout captured from Toby, Dutch and Horsethief Creeks, and several of their tributaries, had similar growth rates. If this hypothesis holds true for the fish captured in Taynton Creek, then the fish represent age classes 2+ and 3+. Taynton creek's second reach is classified as a S3 fish stream based on its width and confirmed presence of fish, under the Forest Practices Code of B.C. (MOF, 1995).

Reach 3

Taynton Creek's third reach is located upstream of the study area. This portion of the stream consists of the creek's headwaters, draining the north flank of Mount Goldie, the southwest flank of Mount Taynton, and the ridge joining those peaks. This reach has an average gradient of 23%, with ephemeral flows at its upper end. Because of the steep gradients and ephemeral nature of the upstream flows, reach 3 is assumed to be non-fish bearing. The reach is classified as a S5 non-fish bearing stream under the Forest Practices Code of B.C. (MOF, 1995a).

Toby Creek

Toby Creek, a tributary of the Columbia River, is a fairly large system with a drainage area of about 684 km^2. It flows in a northeast direction at the base of Panorama Mountain outside the study area. This creek was not surveyed as part of this investigation, as it lies immediately outside the study area and has been studied by others (Fielden et al., 1993 & Carswell, 1979). In the most recent study, Fielden et al. (1993), divided Toby Creek into 12 reaches, with the portion nearest the study area, into which Cox and Taynton Creeks flows, being reach 5. Toby Creek's second reach, located approximately 8.9 km downstream of Taynton Creek's mouth, consists of a canyon with a series of cascades that the authors of that report believe form a barrier to upstream fish movements, with the possible exception of bull trout.

Toby Creek's fifth reach is located 19.9 km to 29.7 km upstream of the creek's confluence with the Columbia River. This reach is 9.8 km long and has an average gradient of 0.9 %. The average channel width was 26.8 m, with a wetted width of 25.1 m, on August 18, 1992 (Fielden et al., 1993). The substrate is predominantly boulder (63%), with approximately 12 % gravel. Flows are characterised as riffle (80 %) with lesser amounts of run (20 %). Total cover is estimated at 6 %, overwhelmingly provided by boulder cover. On August 18, 1992, the average velocity was 1.9 m/s, with a water temperature of 10 °C and visibility of about 10 cm (Fielden et al., 1993). During a site visit on May 7, 1996, by the study team, the water temperature was found to be 2 °C, with water clarity greater than 1 m. The stream is classified as an S1 fish stream within this reach, as the channel width is greater than 20 m and it is known to support a fish population, under the Forest Practices Code of B.C. (MOF, 1995).

2.5 Wetland Environment

Two small wetlands were observed on the lower bench of the study area. The larger of the two is located at the base of the beginner ski hill, east of the existing neighbourhood. The second site is a small open wetland within the lodgepole pine forest. The upper bench is wet and contains a number of seepages, which appear to be too small to merit wetland preservation designation.

3.0 ENVIRONMENTAL CONSTRAINTS

3.1 Cultural Environment

3.1.1 Heritage

Constraints associated with First Nations heritage interests in the area are currently unidentified. No other constraints associated with heritage resources or features are identified on the subject site.

3.1.2 Recreation Use

The subject site falls within the existing Ski Area Lease for Panorama Mountain Village. As such, no constraints associated with recreation use are identified.

3.2 Physical Environment

3.2.1 Climate

There are no environmental constraints to development associated with climatic factors.

3.2.2 Geology

Geotechnical constraint analysis falls outside the scope of this report and as a result no constraints relating to geological conditions were identified on the site.

3.2.3 Geomorphology

Cox Creek and Taynton Creek both contain evidence of active gully development and may present a constraint to development. Further study would be required to determine the level of constraint each of the creeks present.

The December, 1996 Geotechnical Hazards Report (EBA, 1996) identifies potential hazards relating to the previous development configuration.

3.2.4 Hydrology and Flooding

The Cox Creek is degrading through a section that transects the subject site. The deposition of this transported material could lead to avulsions in the lower section of reach 2, if left uncontrolled.

Tanyton Creek is located in a large ravine, and Toby Creek is located in the lower valley adjacent to the site. Hydrological constraints would only involve in channel and/or in "ravine" works.

3.3 Terrestrial Environment

3.3.1 Soils

The identification of constraints associated with soils on the subject site should be undertaken in a separate geotechnical study.

3.3.2 Vegetation

Forest Cover Mapping identifies the area as having high environmental sensitivity caused by severe regeneration problems that relate to geoclimatic factors (MOF, 82K.049, 1995). However the polygon extends beyond the bench and therefore, the assessment of sensitivity does not appear to be limited to the conditions found on the subject site. Further, the sensitivity assessment is directed toward forest stand health and does not necessarily consider ecosystem health. Removal of a portion of this vegetation unit from the forest inventory does not appear to be constraining for ecological reasons.

3.3.3 Wildlife

Wildlife use of the subject site appears to be high and is consistent with use in the surrounding area. Constraints associated with development on Trapper's Ridge relate the anthropogenic impediments to terrestrial fauna movement through the site. Wildlife migration corridors identified in Map 2 should be protected and managed to ensure viability in the future. While all development should be considered constraining to wildlife use, lower density development with greenspace should be less constraining. If the density of the original development is considered a barrier to wildlife movement, then a goal for the Trapper's Ridge project should be to facilitate movement, not prevent it. Bear management should be a key component of planning and design, along with domestic pet management and control. Other than issues relating to density and wildlife management, there does not appear to be site specific constraints associated with the study area. The forest habitat observed within the study area appears to be typical of the forest found within the Toby Creek drainage.

3.4 Aquatic Environment

3.4.1 On Site Waterbodies

Cox Creek should be regarded as a constraint to development. Appropriate setbacks should be established to protect riparian habitat and water quality of Cox Creek and Toby Creek, downstream. Furthermore, the degrading portion of the channel needs to be addressed.

The lower section of Cox Creek, above the access road to Trapper's Ridge, displays downcutting of the channel due to interception of the streambed with a silt layer of undetermined depth. This condition of downcutting causes a narrowing trough through which the water flows, providing minimal habitat value as well as contributing considerable amounts of sediment to the stream reaches below the roadway. To rehabilitate this reach, coarse material would be added along the watercourse to provide armouring of the bed. Coarse material should range in size from gravels to cobbles with no material being larger than 300 mm ∅.

Rehabilitation works in this area would be difficult as this area is wooded and access to the stream may require removing an appreciable amount of tree-cover. Two options exist for adding material without damaging the tree-cover excessively: cut access roads intermittently through the trees to place material and then revegetate and; attempt to introduce material at an upstream reaches with adequate access. In both cases, it is assumed that material would be transported downstream some distance based on the particle sizes used.

Flood-proofing of Cox Creek will be required for development approval of the Trapper's Ridge project. It is the consultants understanding that an extension to the existing, upstream berm is being considered. The berm would be located at the edge of the cleared ski run and would not require further tree removal.

3.4.2 Adjacent Waterbodies

Both Taynton and Toby Creeks support populations of bull trout, a blue listed species (BC CDC, 1997). These creeks therefore require adequate fisheries buffer zones to protect the stream and its associated riparian areas.

3.5 Wetland Environment

There are two identified small wetlands on the subject property. These wetlands should be considered to present low to moderate constraints to development. The small size of the two wetland units makes them of lesser significance at a regional level and they should not necessarily preclude development.

3.6 Employee Housing Proposal Site

The employee housing site is proposed to be located on the north side of Toby Creek on a bench on the inside of the prominent meander of the creek (see Map 2). This development will be high density housing and will therefore be constrained by the Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al, 1993). The guidelines recommend a minimum setback of 30 from the top of bank. The site may also be constrained by restrictions associated with flooding and soils.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The subject site falls within the developable lands of the Ski Area Lease and as a result was subjected to an Initial Environmental Review to assist in determination of suitability. Findings of this IER indicate that the identified site represents an acceptable candidate for development as option lands. Based on the scope and terms of reference of this study, rezoning or development approval can be recommended subject to the following measures:

1. Native vegetation should be retained wherever possible for its wildlife habitat values and to provide visual screening of the development.

2. Design and development of the site should address identified concerns associated with ephemeral drainage, and seepage areas on the property.

3. Wildlife management should be integrated with site planning for the project. Layout of development parcels should encourage preservation of habitat values and maintenance of wildlife corridors to allow for continued wildlife use of the surrounding lands. All waste storage should be bear proof.

4. The detailed site survey listed in the recommendations of the geotechnical hazards report completed in 1996 (EBA, 1996) should be completed to address issues pertaining to geology, soils and drainage. Specifically, setbacks from steep banks, gullies and streams need to be addressed.

5. A hydrologic report should be completed to assess the proposed and recommended mitigation works for Cox Creek.

6. The top of bank for Taynton Creek should be established and delineated. A minimum 15 m vegetated buffer should then be established from the top of bank along Taynton Creek, as per the Land Development Guidelines for the protection of Aquatic Habitat (Chilibeck et al, 1992). Protection of these areas will retain breeding and foraging areas for wildlife, provide corridors for wildlife moving or migrating through the site as well as protecting the resident and downstream fisheries and aquatic resources of the stream. Preservation of the vegetation will also provide bank stability along the gully/ravine walls of the watercourse.

7. The integrity of the water quality, habitat values and downstream fisheries values of Cox Creek should be protected by the establishment of a 15 m wide riparian buffer zone on each side of the creek. Industrial uses should respect a minimum buffer of 30 m from the top of bank for Cox Creek.

8. Setbacks from <u>Toby Creek</u> should be a minimum of 30 m from the top of bank, where town homes are to be sited, and a minimum of 15 m from top of bank if single family lots are to be developed (Chilibeck et al., 1992).

9. Any proposed intrusion into the fisheries sensitive zones (recommended setbacks) of these creeks should be subject to MELP approval on a site specific basis.

10. All proposed works in and about watercourses on the site should have approval under the Water Act. Water quality in Toby, Cox and Taynton Creeks should be protected.

11. A qualified environmental monitor should be retained during the construction period.

12. In addition to the MELP monitoring requirements associated with works in and about <u>Cox Creek</u>, assessment of the works should be conducted approximately 4 times over the first year to determine relative success of the channel stabilisation works.

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PANORAMA
MOUNTAIN VILLAGE

ENVIRONMENTAL

ENVIRONMENTAL REVIEW OF TAYNTON BOWL

February 1998

INTRAWEST

Tayton Bowl
Environmental Review

GEC 014/01/06

Produced for:

Panorama Mountain Village
Panorama, B.C.
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STATEMENT OF LIMITATIONS

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- ◊ An Environmental Impact Assessment.

1.0 INTRODUCTION

The Panorama Mountain Village operates downhill and cross-country ski facilities within a Controlled Recreation Area (CRA) that is located on Crown Leased Lands under the Provincial Ski Area Agreement. The resort plans to expand its terrain in the high alpine to increase skiing opportunities. These plans include the development of additional lands within the area identified as Taynton Bowl. The proposed development would require adjustments to the ski area boundary to include a portion of the Taynton Creek drainage, hereafter referred to as Taynton Bowl. As part of the planning process for possible boundary adjustment and recreational development, Panorama Mountain Village has retained GeoAlpine Environmental Consulting Ltd. to conduct an Environmental Review of the site. This report presents the results of inventory work and analysis performed in 1997.

1.1 Study Area Location

The study area, hereafter referred to as Taynton Bowl, is located on the west side of Taynton Creek and is immediately adjacent to the existing eastern boundary of Panorama Mountain Village lands. Panorama is approximately 20 km southwest of Invermere. Figure 1 contains a location map of Panorama Mountain Village and the study area.

1.2 Project Team

Field studies were conducted by a GeoAlpine project team consisting of:

◊ Dave Williamson, B.E.S.
◊ Mike Cole, P.Eng.
◊ Mike Nelson, R.P.Bio.

Shelagh Wrazej, B.Sc., contributed to the study, conducting independent wildlife studies under direct contract with Panorama Mountain Village.

Additional technical support, analysis and report preparation was provided by Martin Gebauer, M.Sc., R.P.Bio., and Karina Andrus, B.A., representing GeoAlpine.

1.3 Project Scope

Panorama Resort Inc. updated their Resort Development Plan in 1995. As part of that process Ecosign Resort Planners Inc. updated the Master Plan (Ecosign 1995) The Master Plan was again updated in 1998. The review identified a portion of Taynton Bowl to be potentially suitable for the development of skiing. Coincidentally, a local heli-ski operator currently uses this same site for that purpose. In order to obtain a Crown Lease for the

Taynton Bowl area Panorama Mountain Village was required by the Ministry of Environment, Lands and Parks to conduct a number of studies to prove out the viability of the proposed use of the lands. In partial response to those requirements, Panorama Mountain Village retained GeoAlpine Environmental Consulting Ltd. to conduct an environmental inventory and review of the subject site. The primary objectives of this undertaking (hereafter referred to as the Environmental Review) are to identify and delineate ecosystem units, environmentally sensitive areas, and ecologically significant habitats within the study area.

1.4 Methodology

The study area landscape was stratified into map units based on ecological criteria such as climate, surficial geology and topography, soil, and vegetation. Recently established terrestrial ecosystem mapping principles (Resources Inventory Committee, 1995) were employed to identify and delineate distinct ecosystem units, and show their distribution within the study area. Terrestrial ecosystem mapping integrates both abiotic and biotic components to provide an ecological framework for land use and resource management. Specifically, it also serves to:

1. Identify sensitive wetlands and riparian areas;
2. Identify forest types and vegetation cover;
3. Produce wildlife capability and suitability mapping for the following species: Deer, Black Bear, Grizzly Bear, Cavity Nesters, Bats, Amphibians.

At the outset of the study, a literature review was conducted to collect pertinent data and identify information gaps. Maps and aerial photographs of the study area were analyzed to develop preliminary distinctions between ecosystem units, based on terrain and forest cover. These tentatively delineated polygons were mapped for field use and ground-truthing during site investigations.

Reconnaissance level field investigations were conducted during the week of June 22, 1997 and in September 1997. Ecosystem Field Forms [FS 882(1) HRE 96/4] were used to collect and record information to describe the site, soils, vegetation, and mensuration/wildlife in each polygon of the study area. A Global Positioning System (GPS) was employed during field investigation to provide accurate geo-referencing of sample sites. Fish habitat information was collected using the DFO/MOE Stream Survey Forms and methodology, and a program of electrofishing and trapping was undertaken to determine fish presence near the study area.

Wildlife habitat assessment field investigations were conducted on September 4, 21, and 27, 1997. Wildlife Plot locations, established with GPS survey equipment in the initial field investigations, were determined based on rough approximations using a 1:5000 trim map. A video camera was used to collect and record information to describe the wildlife capability of the given plots.

The collected field data and other information constitute a baseline environmental inventory that identifies the main ecological systems and processes that occur in the study area. In the final phase of the study, an analysis of the inventory information was performed to identify constraints to development in the study area.

Further detail on methodology is included under separate section headings.

Figure 1 Location Map of Study Area

Scale 1 : 250 000

2.0 EXISTING CONDITIONS

2.1 Cultural Environment

No archeological or heritage features were identified in the study area. Most of the study area is densely forested and undulating in topography, with poor access. While there are no known disputes or claims concerning this area currently administered by the Ministry of Environment, Lands, and Parks, it should be noted that land claims issues are yet to be resolved with First Nations throughout the province.

The only evident anthropogenic activities in the area relate to recreational uses. During the site visits a number of cut trees were observed in the alpine elevations. It would appear that the cutting was carried out to produce gladed helicopter skiing runs for a local commercial backcountry recreation (CBR).

A number of horse trails were also observed at various elevations in the study area. A local outfitter actively uses the trail system for guiding. The horseback riding activity includes both spring and fall hunting as well as limited recreational riding in the summer.

The upper ridge top of the study area bounds on the existing CRA of Panorama Mountain Village. According to anecdotal evidence, the study area is actively skied in the winter as an "out of bounds area".

2.2 Physical Environment

2.2.1 Climate

The study area lies in the Eastern Purcell Mountain Ecosection of the Columbia Mountain Highlands Ecoregion (Campbell et al., 1990). The ecosection is a mountainous area with high valleys located on the leeward side of the Purcell Ranges. There is a distinct rain-shadow, with strong precipitation and temperature gradients. AES climate stations are lacking in the immediate area, and it is difficult to extrapolate from more distal stations such as Golden, Canal Flats and Kimberly as those stations tend to be at lower elevations in the Rocky Mountain trench. At these valley based stations, mean daily temperatures are lowest in January, ranging from -8.6 to -11.0 °C, and highest in July, ranging from 17.4 to 18.6 °C. Precipitation peaks in December and January, mainly falling as snow. The precipitation distribution in the other months is fairly even. Total precipitation at these station ranges from 369.1 mm at Canal Flats to 660.3 mm at Kimberly, with 40 to 50 % falling as snow (Environment Canada, 1981).

Climatic data for Panorama Lodge (elevation 1572 m) is available for the period 1970 to 1990 from the Atmospheric Environment Service (AES) of Environment Canada. Mean annual precipitation for the period of record is 985 mm, of which 38% falls as rain (May to

September) and 62% fall as snow (October to April).

2.2.2 Geology

Bedrock formations in the Taynton Creek drainage consist of Upper Proterozoic units (of the Hadrynian epoch – approximately 590 million years ago) of the Windermere Supergroup (Stanley, 1986). The deposits (including tillites) likely represent late Proterozoic glaciation. Two subgroups are represented in this region:

1. The Upper Horsethief Creek Group (uPHC): Slates, quartz pebble conglomerate, sandstone, siltstone and limestone, and;
2. Toby Formation (uPT): Conglomerate, siltstone and shale (MOELP Minfile 082KSE, 1996)

Within the study area, the uPHC formation occurs above 1770 m extending in a radial pattern that covers most of the Taynton Creek subdrainages. The lower section of the drainage consists of the uPT formation. Field observations confirmed those units listed above.

The abandoned Paradise and Silver Belt Mines in the same formation across valley showed occurrences of Lead/Zinc/Silver/Gold and Silver/Lead/Zinc, respectively. Adjacent mining claims (Green Ridge and Hat) in the same formation, across the valley indicates the occurrence of Copper/Gold/Silver and Barite/Copper, deposits respectively (Stanley, 1986).

Small pockets of exposed bedrock units are present in most locations of the study area. Highly fractured shales are ubiquitous units with lesser amounts of quartz conglomerates (sandstones) occurring around the site. The dip/strike of sedimentary units varies greatly across site showing its high degree of structural deformation.

2.2.3 Geomorphology & Surficial Materials

Overall, the site is comprised of thin blankets of weathered bedrock in the upper sections and thicker colluvial units in the lower, basin areas. The study area can be described as a bowl-shaped drainage basin, consisting of a series of bedrock-controlled gullies or depressional troughs.

Observed parent material included friable shales degrading into very angular moderately durable small gravels. Mineral soils consisted of thin veneers of sandy silts to silty gravels derived from weathered parent material. Surface erosion in steeper areas (> 35%) appears to be controlled by the coarse texture of the units. The majority of the surficial units are free draining depending on slope.

MOF 1:20 000 Terrain Stability Intensity Level D (TSIL-D) mapping was conducted recently based on air photo interpretation and subsequent field checks (Terratech, 1995). Approximately 80% of the study area contain polygons classified as "Unstable terrain". This classification indicates evidence of natural landslide activity and a high likelihood of landslide initiation due to construction of roads or trails. The remaining 20% of the study area contain polygons that were unclassified.

Within these classified polygons, thirteen landslides are noted. The landslides in the mid- and lower sections occur as sloughing of morainal units along gully walls. The three noted landslides tend to be moderately sized (covering 0.1 to 1 ha), of varying age (recent to old) and occurring with initiation zones along gully walls of the secondary channels. These types of landslides also occurred along the channel walls of Taynton creek. The landslides in the upper sections (10 noted) tend to be moderately sized debris flows and rock falls, which are recently occurring with initiation zones near ridge tops.

The 20% of the study area containing polygons that were unclassified occurred in areas that were relatively flat or gently sloping either on rounded ridge tops or in the bottom of Taynton Bowl. Based on conversations with the terrain mappers (Terratech, per comm., 1997), the location of the polygons and their non-classified status, it is assumed that these polygons are considered "Stable Terrain' (i.e., are not initiation zones of landslides). However, some of these these locations are downslope of steep areas and are likely deposition zones for both landslides and snow avalanches, and as such, are not considered "Hazard-Free" (Photo below).

Photo 1 Evidence of snow avalanche in deposition zones of Stable Terrain (Plot # 9)

Photo 3 Head scarp of active slump block (Plot # 8)

Photo 4 Side scarp of previous slump block (Plot # 8)

Field Visits verify the unstable nature of the surficial materials and, to some extent, the upper bedrock units. The upper ridge wall to the west, near the proposed top chairlift station, shows evidence of large-scale slumping with large deposits downslope (Photo above). These failures appear to be based in the upper units of the weathered sedimentary bedrock (typically shales). In the steep upper sections to the south (>45% slope), several recent slides were observed in the upper mineral layers. Existing slumps (blocks which had not yet released) head scarps were 2-3 m high, and blocks extended 20 m downslope and 60 m across slope (Photo above). Tension cracks in the surrounding terrain extended 75 m in a up/downslope orientation. Conical debris piles (2-5 m high) at the base of this steep terrain indicate previous episodes of mass movement.

The proposed bottom (onload) chairlift station is situated near the midsection of Taynton Creek, at the confluence of several side channels of the southeast arm. The confluence exists as a debris cone averaging 35%, which appears to be deposited by rapid mass movement. Material consists of 20% cobbles, 20 % large gravels and 60% smaller fractions. The area downstream of this confluence exhibits linear debris piles (5 m high, 5 m wide and 100 m long) along the channel floor (flood plain) which also appears to deposited by rapid mass movement.

2.2.4 Hydrology

The study area is located entirely within the Taynton Creek watershed. Taynton Creek flows into Toby Creek which in turn drains into the Columbia River approximately 20 km downstream, near Invermere B.C. Water Survey of Canada records indicate that a stream gauging station was maintained on Toby Creek at Athalmer (Station No. 08NA012) from 1912 to 1915 and 1943 to 1984. WSC stream-flow data for Taynton Creek is not available.

Taynton Creek

The Taynton Creek watershed/drainage covers an area of approximately 15.3 km^2. The study area falls exclusively within the Taynton Bowl portion of the upper Taynton Creek watershed, accounting for 29 % of the total watershed. The creek flows north-west for about 7 km, from its headwaters above the 2,350 m elevation level to its confluence with Toby Creek at approximately 1,140 m elevation. Taynton Creek has a gradient averaging 17.4% over its entire length. The creek rises steeply from its confluence with Toby Creek for approximately 70 to 100 m, with gradients measured at 22 to 26 %, before levelling off in its mid reaches for about 4.3 km, to gradients ranging from 9 to 16 %, averaging 14.7 %. Within its upper reaches the gradient of Taynton Creek ranges from 20 to 50 %.

The discharge from this drainage was measured at 0.48 m^3/s near its mouth during the site visit on June 23, 1997.

Toby Creek

Toby Creek, a tributary of the Columbia River, is a fairly large system with a drainage area of about 684 km^2. It flows in a north-east direction at the base of Panorama Mountain, outside of the study area. Over the 23 years of gauging by Water Survey of Canada near its mouth (WSC, 1991), Toby creek had a mean annual flow of 12.8 m^3/s. Flows usually peak in June and July, with mean monthly flows during those months of 42.1 and 39.5 m^3/s, respectively. Low flows typically occur during winter months, with a minimum mean monthly flow of 2.09 m^3/s recorded for February.

2.3 Terrestrial Environment

The terrestrial environment is described using an ecological approach used for Terrestrial Ecosystem Mapping. Information was gathered with the assistance of Describing Ecosystems in the Field (Luttmerding, et. al., 1990) and the rough draft of the Field Manual for Describing Terrestrial Ecosystems (RIC, 1996). Ecosystem Field Forms (FS 882(1) HRE 96/4 and Visual Inspection forms) were use to collect general site information as well as more detailed information on soils, vegetation, mensuration and wildlife.

2.3.1 Pedologic Soils

Soil and Landform mapping undertaken by the provincial government at a reconnaissance level as shown on Map 82 K/8 (Wittneben, 1979). This mapping indicates that the following soils are likely to occur within the study area:

- Orthic Regosols O.R (Yahk Creek soils) – weakly developed soils with thin to moderate Ah horizons due to instability of materials (i.e., slope mass wasting); rapidly to well drained;
- Orthic Eutric Brunisols O.EB (Spillimacheen soils) – moderately developed soils with a thin Ah and distinct Bm horizons; well to imperfectly drained;
- Orthic Dystric Brunisol O.DYB (Brennan & Coubrey soils) – moderately developed soils with a thin Ah and distinct Bm/Bfj horizons; rapidly to well drained; and
- Degraded Melanic Brunisols MB (Radium soils) – moderately developed soils with distinct Ah and Bm/Bfj horizons; well to imperfectly drained.

The Spillimacheen soils are found in the lower elevations (below 1675 m) in colluvium and glacial till (basal) in very steep terrain. The Coubrey soils are an intermediary between the Spillimacheen and Brennan soils and are found in the low and mid-elevations (below 1950 m) in glacial till and colluvium over bedrock in very steep to extremely steep terrain. The Brennan & Coubrey soils are found in the mid-elevations (1675-1950 m) in colluvium over bedrock in very steep to extremely steep terrain. The Radium and Yahk Creek soils are found in the upper portions of the drainage (above 1950 m) in thin colluvium and talus cone environments. Typical soil profiles are shown in the photos below.

Photo 5 Orthic Regosol
Yahk Creek Grouping (Plot # 7)

Photo 6 Orthic Dystric Brunisol
Coubrey Grouping (Plot # 12)

These abovementioned soils were verified in several soil pits. Soil interpretations were developed based on field descriptions of soil morphology at non-random, representative sample sites. Apparent diagnostic processes and properties were noted and later interpreted using the Canadian Soil Classification System. Given the uncertainty associated with the taxonomic distinction (made in the field) between the Orthic Eutric Brunisolic soils and Orthic Dystric Brunisolic soils, there is the possibility that Spillimacheen and Coubrey soils were cross-identified in the field. The use of chemical analysis to differentiate between these morphologically similar soils is beyond the scope and budget of this study.

Table 1 Sample Plot Soils

SAMPLE PLOT #	SOIL CLASSIFICATION	ABBREVIATION	SOIL UNIT SYMBOL (see Map 1)
1	Degraded Melanic Brunisols	MB	RA
2	Orthic Dystric Brunisol	O.DYB	BB
3	Orthic Dystric Brunisol	O.DYB	CB
4	Orthic Dystric Brunisol	O.DYB	CB
5	Orthic Eutric Brunisol	O.EB	SP
6	Degraded Melanic Brunisols	MB	RA
7	Orthic Regosol	O.R	YK
8	Orthic Regosol	O.R	YK
9	Orthic Dystric Brunisol	O.DYB	CB
10	Orthic Dystric Brunisol	O.DYB	CB
11	Orthic Dystric Brunisol	O.DYB	BB
12	Orthic Dystric Brunisol	O.DYB	CB
13	Orthic Dystric Brunisol	O.DYB	CB

Soils of the Brunisolic order (Degraded Melanic, Orthic Dystric, and Orthic Eutric) are widely distributed in the study area, with Regosolic soils occurring in the upper alpine areas. Organic soils appear in this study area as both Humisols and Fibrisols. These are often referred as peat, muck, or bog. They occur in poorly drained depressions or level areas, and are saturated with water throughout much or all of the year.

Table 2 Terrestrial Ecosystem Polygon Areas

Polygon Identification	Ecosystem Unit Area (m^2)	BGC Zone Area (ha)	BGC Zone	Sub-zone
1	76456.59		MS	'dk
2	23216.55	99673.14	MS	'dk
3	124217.81		ESSF	'dk
4	244791.12		ESSF	'dk
5	389514.38		ESSF	'dk
6	4196.92		ESSF	'dk
7	272629.12		ESSF	'dk
8	481626.19		ESSF	'dk
9	132694.53		ESSF	'dk
10	101051.78		ESSF	'dk
11	111178.69		ESSF	'dk
12	280590.14		ESSF	'dk
13	293267.94	2187374.63	ESSF	'dk
14	323105.50		AT	N/A
15	87529.33		AT	N/A
16	268160.62		AT	N/A
17	427795.94		AT	N/A
18	146238.50		AT	N/A
19	127222.91		AT	N/A
20	27600.17		AT	N/A
21	44883.95	1700920.91	AT	N/A
Total Area (Ha):	**398.80**			

Additional site specific species information can be found on the Ecosystem Field forms (Appendix G) and are cross referenced with the Plant Species List (Table 3). The following sections contain general descriptions of the map polygons organized by biogeoclimatic (BGC) subzone.

Biogeoclimatic Subzone MSdk

The northwestern corner of the study area lies within the dry Cool Montane Spruce subzone. This subzone occupies approximately 9.9 ha of the study area. Two ecosystem polygons were defined within this subzone and two site series (01,05) were described. The MSdk subzone generally occurs on lower slopes on the eastern slopes of the Purcell Mountains. The elevational range of the MSdk subzone is 1100 to 1650 m (Braumandl and Curran, 1992). Zonal (BEC site series 01, TEM symbol: SG, name: Sxw-Soopolallie-Grouseberry) MSdk is described as hybrid white spruce and subalpine fir dominated forest with minor occurrences of Douglas fir. Seral stands of lodgepole pine are common. The shrub understorey consists primarily of false azalea, Utah honeysuckle, and soopolallie. No sample plots were taken from the MSdk subzone. However, the terrestrial ecosystem units were traversed on June 25, 1997 and are described herein.

Polygons 1 and 2
The two polygons are differentiated by the presence of a terrain unit that contains colluvial material, rather than specific variation in vegetation. Both the zonal site series described above and the moister, cooler site series 05 (TEM symbol: SS, name: Sxw-Soopolallie-Snowberry) are evident in these polygons. Site series 05 occurs on lower slopes in receiving areas. Observed forest vegetation included hybrid white spruce with sub-dominant lodgepole pine and Douglas-fir. In addition to snowberry, soopolallie and tall Oregon-grape, twinflower was noted in abundance. Yellow columbine was also noted.

A number of minor vegetation associations were observed, but the units were too small for inclusion in the mapping. Groves of trembling aspen were encountered. Douglas maple was observed in avalanche and landslide paths. Red osier dogwood, typically associated with site series 7 (TEM symbol: SB, name: Sxw-Falsebox-Featherbox), was periodically noted in moist draws.

Photo 7 Ecosystem Polygon1 MSdk, SG

Biogeoclimatic Subzone ESSFdk
The Dry Cool Engelmann Spruce / Sub-alpine Fir subzone generally ranges from 1550 - 2100 m in the eastern Purcell Mountains. Climax forest in zonal plant communities (BEC site series 01, TEM symbol: FA, name: Bl-Azalea-Foamflower) is typically subalpine fir and Engelmann spruce (Braumandl and Curran, 1992). The shrub understorey consists dominantly false azalea, with lesser occurrences of black huckleberry and black gooseberry. More than half the study area is composed of ESSFdk (approximately 218.7 Ha).

Polygon 3
Polygon 3 is located on a steep, northeastern slope with a number of wet gullies acting as receiving areas for the uplands. The wetlands were classified as site series 07 (TEM symbol WS, name: Willow-Sedge), while the drier component was classified as site series 02 (TEM symbol DM, name: Fd-Douglas maple-Soopolallie). The polygon has an open canopy of lodgepole pine and Engelmann spruce dominated forest. The wet receiving areas have a dense shrub layer of scrub birch, and willows. The drier portions of the site contained Douglas maple in the forest canopy openings. Ground cover contained sphagnum moss in the wetter locations, as well as, sedges, roundleafed orchids, and Labrador tea. The drier areas between the receiving sites were described as zonal and 04 (TEM symbol FS, name: Bl–Azalea-Soopalallie).

Polygon 4
Polygon 4 is located uphill of Polygon 3 and is geomorphologicly separated from Polygon 3 by the absence of colluvium. Vegetation is similar in that the forest is dominantly young lodgepole pine. This higher, drier ecosystem polygon is composed of site series 04 (FS) and 03 (TEM symbol FG, name: Bl–Azalea-Gooseberry). In addition a significant portion of the polygon is classified by MOF Forest Cover (see Map 1) mapping as non-forested. The non-forested portion is the result of significant gully erosion and represents a disclimax plant community of low shrubs grasses and forbs.

Polygon 5
Polygon 5 occupies the lower flank of the prominent shoulder in the Taynton Bowl study area. This shoulder is characterized by thin morainal soil over bedrock. The this soils yield drier site series' and a reduced forest canopy. Forest cover is dominated by lodgepole pine with significant occurrence of Engelmann spruce on the upper levels and Douglas-fir in the Taynton Creek riparian zone.

Visual sample plot # 5 was located in an avalanche chute in Terrestrial Ecosystem Polygon 5, of the ESSFdk subzone at approximately 1655 m asl. Site series for the plot was assessed as 04 (FS). The plot was situated midslope on a moderate (30%) SE aspect slope. The site had well drained silty soils over weathered shale yields a sub-xeric moisture regime. Soil nutrient regime was estimated to be permesotrophic. The sample plot was a mature forest with a structural stage class of 6 (80 – 140 years), with a crown closure of approximately 5%. Dominant tree species was lodgepole pine, with Douglas fir, Engelmann spruce and occasionally trembling aspen also occurring. Sitka alder and false azalea were the dominant shrubs, but willow red elderberry, and kinnikinnick was noted as well.

Photo 8 Ecosystem Polygon 5 ESSFdk, FS

Polygon 6

Polygon 6 is a predominantly non-forested gully. Thin soils on steep slopes have resulted in unstable conditions that will not support forest cover. This disclimax vegetation unit is classified as site series 04 (FS). Vegetation is limited to willow, mountain alder, and red elderberry. Surrounding the gully on more stable soils is the lodgepole pine forest, with Engelmann spruce on the lower gully walls and whitebark pine occurring above the headwall.

Polygon 7

Polygon 7 is differentiated from Ecosystem Polygon 5 by the presence of colluvium in the overburden. The vegetation community is a continuation of that found in Polygon 5 as corroborated by information gathered at three sample plots, presented below:

Detailed sample plot # 2 was located in Ecosystem Polygon 7, of the ESSFdk subzone at approximately 1970 m asl. Site series for the plot was assessed as 03 (FG). The plot was situated on the convex upper slope of a moderately steep (45%) NE aspect slope. A thin layer (30 cm) of fine soils over weathered shale produced imperfect drainage and a sub-zeric to sub-mesic moisture regime. Soil nutrient regima was estimated to be permesotrophic. The sample plot was open with a crown closure of approximately 10%, with a young seral forest with a structural stage class of 5 (40 – 80 years). Dominant tree species was lodgepole pine, up to 15 m in height with no other trees in the plot. Estimated age of the largest tree in the plot, based on a core sample, was 45 years. Emergent lodgepole pine, whitebark pine, subalpine fir and Engelmann spruce were noted in the tall shrub layer. Low shrubs included common juniper, white-flowered rhododendron, and false azalea, with black huckleberry and grouseberry. Ground cover was sparse but heart-leaved arnica, fireweed, one-sided wintergreen, yarrow and aster observed. Lichens were uncommon, but noted. Wildlife habitat trees in the plot were on the ground.

Photo 9 Cow moose in Polygon 7 ESSFdk, FS

Visual sample plot # 3 was located in Terrestrial Ecosystem Polygon 7, of the ESSFdk subzone at approximately 1825 m asl. Site series for the plot was assessed as 04 (FS). The plot was situated midslope on a moderate (25%) N aspect slope. A moderately well drained, thin layer (19 cm) of silty loam soils over weathered shale yields a sub-mesic moisture regime. Soil nutrient regime was estimated to be permesotrophic. The sample plot was a young seral sapling pole forest with a structural stage class of 4 (20 – 80 years), with a crown closure of approximately 30%. Dominant tree species was lodgepole pine, up to 15 m in height with no other trees in the plot. Willow spp. and Sitka alder were noted in the tall shrub layer. Low shrubs included common false azaela, scopolallie, white-flowered rhododendron, black gooseberry, black huckleberry, Utah honeysuckle and grouseberry, with emergent Engelmann spruce. Ground cover was sparse but included heart-leaved arnica, fireweed, pink wintergreen, and showy aster.

Visual sample plot # 4 was located in Terrestrial Ecosystem Polygon 7, of the ESSFdk subzone at approximately 1775 m asl. Site series for the plot was assessed as 07 (WS). The plot was situated midslope on a moderate (25%) N aspect slope. A poorly drained, layer of silty loam soils, with up to 60% coarse fragment content, yields a sub-hydric moisture regime. Soil nutrient regime was estimated to be permesotrophic. The sample plot was a disclimax low shrub thicket with a structural stage class of 3a. Dominant tall shrub species was Sitka alder although emergent Engelmann spruce and lodgepole pine were noted. Low shrubs included common trapper's tea, Labrador tea, tea-leaved willow, scrub birch, crowberry. Ground cover was composed of sedges, common horsetail, and white marsh marigold.

Polygon 8

Ecosystem Polygon 8 is a receiving site for colluvial deposits from upslope. Site series for this polygon is assessed as 04 (FS). Forest cover is dominantly lodgepole pine, with Douglas-fir sub-dominant. The lower half of the polygon is mature forest (see Map 1); possibly indicating it was not affected by the last major fire event in Taynton Bowl. With the exception of some of the AT subzone forest at the top of Taynton Bowl, this forest unit is the largest contiguous mature forest in the study area.

Photo 10 Taken from Plot #4, across Ecosystem Polygon 9 EFFdk, WS, with Polygon 8, ESSFdk, FS in background

Polygon 9
Polygon 9 occupies the lower portion of the main gully of the south branch of Taynton Creek. The site series assessed to this polygon is 01 (FA), with occurrences of 07 (WS) in the wetter bottom of the gully. This non-forested disclimax unit occupies the landslide/avalanche runout and deposition zone for this major gully system. Vegetation cover is sparse on the drier gully walls with shrubs dominating in the gully floor. Shrub species include Sitka alder, willows, and false azalea.

Polygon 10
Polygon 10 is defined by a steeply sloping, large bedrock outcropping with variable thin soils and very little forest cover. Site series for this edaphic ecological unit is assessed as 02 (DM). Ground cover consists of grouseberry, pink heather, mosses, lichens, grasses and northwestern sedge. Shrubs are sparse and limited to juniper and false azalea. This ecosystem unit is best presented by the following photograph.

Polygon 11
Polygon 11 occupies the ridgetop of the shoulder between the existing Panorama lands and the proposed Taynton Bowl expansion area in the ESSFdk subzone. Site series for this unit is assessed as 03 (FG). Forest cover is dominantly young lodgepole pine with occasional Engelmann spruce, subalpine fir and whitebark pine emerging in the understory. Ground cover is sparse with shrubs dominating in the form of grouseberry and black huckleberry.

Polygon 12
Polygon 12 occupies the upper reaches of the gully system of the south fork of Taynton Creek. Two deeply incised gullies provide warm and cool slopes with assessed site series' of 02 (DM) and 03 (FG) respectively. The vegetation conditions encountered on the warm slopes may be an edaphic response to the steep slopes and thin soils of the site, which coupled with the increased solar exposure of the warm slopes, will not sustain forest cover. The following sample plot summaries describe the conditions encountered on the cool slopes.

Visual sample plot # 11 was located in the ESSFdk subzone at approximately 1950 m asl. Site series for the plot was assessed as 03 (FG). The plot was situated midslope on a steep (70%) NE aspect slope. A moderately well drained, variable layer (0 - 200 cm) of silty loam soils with 80% coarse fragment content, over weathered shale yields a sub-xeric moisture regime. Soil nutrient regime was estimated to be permesotrophic. The sample plot was a young forest with a structural stage class of 5 (40 – 80 years), with a crown closure of approximately 40%. Dominant tree species was lodgepole pine, with sub-dominant whitebark pine and occasional Douglas fir as well as alpine larch. Shrubs included willows, false azaela, white-flowered rhododendron, black huckleberry, and grouseberry. Ground cover included heart-leaved arnica, yarrow, and lichens.

Detailed sample plot # 12 was located in the ESSFdk subzone at approximately 2035 m asl. Site series for the plot was assessed as 03 (FG). The plot was situated midslope on a steep (60%) N aspect slope. A moderately well drained, layer (40 cm) of silty loam soils over weathered shale yields a sub-xeric moisture regime. Soil nutrient regime was estimated to be permesotrophic. The sample plot was a young seral sapling pole forest with a structural stage class of 4 (20 – 80 years), with a crown closure of approximately 10%. Dominant tree species was lodgepole pine (up to 14 m in height, 24 cm dbh, and 45 years old). While the lodgepole pine dominated the canopy, whitebark pine dominated the tall shrub layer and is emerging as the climax forest species. Alpine larch, subalpine fir, Engelmann spruce and lodgepole pine were also noted in the shrub layers. Low shrubs included false azalea, white-flowered rhododendron, black huckleberry, and grouseberry. Ground cover was 85% covered with mosses and lichens. No forbes grasses or sedges were observed within the plot.

Photo 11 View from Plot # 12, Polygon 12, across the gully to Polygon 10.

Polygon 13

Polygon 13 represents a small extension of the forest unit that extends up into the AT subzone. The ecosystem polygon is composed of a warm slope forest unit and a cool slope forest unit. The warm slope is characterized by an open, young, mixed coniferous forest of whitebark pine, alpine larch, subalpine fir and Engelmann spruce. The cool slope is characterized by an old growth subalpine fir, alpine larch, Engelmann spruce forest. Both units were assessed a site series of 03 (FG), although it should be noted that proximity to the AT subzone makes accurate TEM classification difficult.

Polygon 14

Polygon 14 is an area of considerable landslide and snow avalanche activity. As a result, most of the site is non-forested disclimax shrubland. Shrub species include Sitka willow, Sitka alder, False azalea, white-flowered rhododendron, and juniper. The forested portions of the site are discontinuous, but dominated by lodgepole pine, with whitebark pine and subalpine fir occurring at the upper elevations and Engelmann spruce and Douglas-fir found at the lower levels of the polygon. Site series was assessed as 07 (WS) in the wet gullies and depressions; 04 (FS) in the lower forested portions of the site; and 03 (FG) on upper forest units.

Detailed sample plot # 10 was located in Terrestrial Ecosystem Polygon 14, of the ESSFdk subzone at approximately 1950 m asl. Site series for the plot was assessed as 04 (FS). The plot was situated midslope on a level, flat plateau. A well drained, thin layer (24 cm) of silty loam soils over weathered shale yields a xeric moisture regime. Soil nutrient regime was estimated to be permesotrophic and described as orthic dystric brunisol. The sample plot represented a young seral sapling pole forest with a structural stage class of 4 (20 – 80 years), and a crown closure of approximately 5%. The dominant tree species was lodgepole pine (up to 35 cm dbh, 47 years old and 15 m in height), with alpine larch sub-dominant. Emergent tree species in the shrub layers were limited mainly to lodgepole pine, with minor occurrences of subalpine fir and Douglas-fir. Low shrubs included common false azaela, white-flowered rhododendron, black huckleberry, common juniper, black gooseberry, soopolallie, western mountain ash, black twinberry, Saskatoon, kinnikinnick, and grouseberry. Ground cover forbs included heart-leaved arnica, fireweed, common paintbrush, yarrow, pearly everlasting, wild strawberry, northwestern sedge, and pinegrass. Lichens and mosses were observed within the plot, but were not plentiful.

Photo 12 View down the main gully of Polygon 12

Photo 13 View across Polygon 14 to Sample Plot # 10 located beyond and to the right of the snow patches

Biogeoclimatic Subzone AT
The Alpine Tundra subzone is one of the most extensive in the Nelson Forest Region and it occupies a significant portion of the study area. However, due to the relatively low elevation of the summit ridge of the study area (2365 m), much of the area identified as AT on the Forest Service mapping may in fact be considered AT-ESSFdkp (parkland or krummholz). Rock, talus, snow and ice generally characterize the AT subzone. Vegetation consists of willows, stunted western larch, whitebark pine, buttercups, saxifrages, pussytoes, Sitka valerian, and mountain heathers. The AT biogeoclimatic subzone occupies approximately 170 ha in the study area. Unfortunately, AT is not yet classified by site series and is therefore not coded for Terrestrial Ecosystem Mapping. In an effort to accurately describe the conditions encountered in the AT subzone, 6 sample plots were set up and are described in this section.

Polygon 15
Polygon 15 is an extension of a vegetation unit described in ecosystem polygon 15 as whitebark pine-subalpine fir-lodgepole pine dominated forest (site series n 04 (FS)).

Polygon 16
Polygon 16 occupies a non-forested vegetation unit. It is characterized by steep rocky thin soils. Shrub vegetation cover dominates but is discontinuous.

Polygon 17
Polygon 17 occupies the headwall of the eastern branch of the south Taynton Creek gully system. It contains three sample plots, which provide a description of the conditions occurring within.

Detailed sample plot # 7 was located in the AT subzone at approximately 2325 m asl. The plot was situated on the upper slope of a steep (70%) N aspect windswept slope. A moderately well drained, thin layer (45 cm) of silty loam soils over weathered shale yields a xeric moisture regime. Soil nutrient regime was estimated to be permesotrophic. The sample plot was a remnant alpine larch dominated old growth forest with a structural stage class of 7 (300+ years of age, 46 cm dbh, 14 m tall), with a crown closure of approximately 5%. Emergent trees occupying the tall shrub layer consisted of alpine larch, whitebark pine, and subalpine fir, ranging in age to 60 years (12 – 14 cm dbh, 6 – 7 m tall). A significant number of fire burned standing alpine larch snags were assessed as wildlife trees. Ground cover was dominated by grouseberry with mosses and lichens also common. Globeflower was recorded within the sample plot.

Visual sample plot # 8 was located in the AT subzone at approximately 2225 m asl. The plot was situated on a steep (70%) NE aspect upper slope. A rapidly to well drained, variable layer (0 –200 cm) of silty loam soils over weathered shale yields a xeric moisture regime. Soil nutrient regime was estimated to be permesotrophic. The sample plot was a young forest with a structural stage class of 5 (40 – 80 years), with a crown closure of less than 5%. Dominant tree species was whitebark pine, with occasional lodgepole pine noted.

Photo 14 Polygon 16 Looking up slope

Photo 15 Polygon 17 AT subzone

Low shrubs included common juniper, grouseberry, white-flowered rhododendron, and black huckleberry. Ground cover was sparse but included heart-leaved arnica, common red paintbrush, white and pink heathers.

Photo 16 View from Plot # 7, Polygon 17, alpine larch wildlife trees.

Visual sample plot # 9 was located in the AT-ESSFdkp transitional subzone at approximately 2010 m asl. The plot was situated midslope on a moderately steep (40%) N aspect slope. A well drained, variable layer (0-200 cm) of silty loam soils with up to 80% coarse fragment content over weathered shale yields a sub-mesic moisture regime. Soil nutrient regime was estimated to be permesotrophic. The sample plot represented a shrub thicket community with a structural stage class of 3a (20 – 100 years), with a crown closure of approximately 2%. Dominant tree species were whitebark pine, alpine larch and subalpine fir ranging in height from 4 to 8 m. Low shrubs included common juniper, false azalea, white-flowered rhododendron, and grouseberry. Ground cover was sparse but included heart-leaved arnica, fireweed, northwestern sedge, and sub-alpine buttercup.

Polygon 18
Polygon 18 represents the AT subzone extension of ESSFdk Ecosystem Polygon 9. It occupies the headwall of the western branch of the south Taynton Creek gully system.

Visual sample plot # 6 was located in the AT subzone at approximately 2360 m asl. The plot was situated on a steep (70%) NE aspect upper slope. A well drained, variable layer (0 - 200 cm) of silty loam soils with up to 90% coarse fragments over weathered shale yields a sub-xeric moisture regime. Soil nutrient regime was estimated to be permesotrophic. The sample plot was an old growth forest with a structural stage class of 7 (>140 years), with a crown closure of approximately 5%. Dominant tree species was alpine larch (core samples exceeding 300 years of age) and Douglas fir. Shrubs were limited to grouseberry. Ground cover was dominantly heathers, mosses, and lichens, on predominantly exposed mineral soils and loose shale. Groundcover forbs included yarrow, dwarf hawksbeard, sub-alpine daisy, western groundsel, wooly pussytoes, and bracted lousewort.

Polygon 20
Polygon 20 is an AT-ESSFdkp extension of the pine forest unit described for Ecosystem Polygon 11. The primary difference is that this mature forest unit is dominated by whitebark pine with lodgepole pine also co-dominant, instead of reversed order as occurs in Polygon 11, at the lower elevations.

Polygon 21
Polygon 21 also occupies the head of two major gullies associated with the south Taynton Creek gully system. Two sample plots were include in the survey of this ecosystem unit and are described herein.

Visual sample plot # 1 was located in the AT subzone at approximately 2360 m asl. The plot was situated on the crest of a steep (60%) NE aspect slope. Fine soils of variable thickness over weathered shale produced imperfect drainage and a sub-zeric moisture regime. Soil nutrient regime was estimated to be permesotrophic. The sample plot was open with a crown closure of approximately 10%, with a mature forest structural stage of class 6 (80 – 140 years). Dominant tree species was alpine larch with minor occurrences of whitebark pine and subalpine fir. Ground cover was dominated by heathers and lichens with grasses and sedges commonly occurring. Grouseberry was observed but scarse. Forbs observed within the plot were limited to bracted lousewort, alpine pussytoes and northwestern goldenrod.

Photo 17 Polygon 18 View of cliffs, potential goat habitat

Photo 18 Polygon 18, AT subzone

Visual sample plot # 13 was located in the AT subzone at approximately 2125 m asl. The plot was situated on a steep (70%) NE aspect upper slope. A moderately well drained, variable layer (0 - 200 cm) of silty loam soils over weathered shale yields a sub-xeric moisture regime. Soil nutrient regime was estimated to be permesotrophic. The sample plot was young seral transitional sapling pole to young forest with a structural stage class of 4 - 5 (20 – 80 years). Crown closure was estimated to be approximately 5%. Dominant tree species was whitebark pine, with minor occurrences of lodgepole pine and alpine larch. No discernible understorey was observed. Low shrubs were limited to common juniper and grouseberry (60% of total ground cover). Ground cover was sparse but included heart-leaved arnica, yarrow, common paintbrush, pink heather, lichens, grasses and northwestern sedge.

Rare and Threatened Plants and Plant Communities

The B.C. Conservation Data Center (CDC) lists one rare plant community for the subject area. Western pasqueflower (*Anemone occidentalis*) – black alpine sedge (*Carex nigricans)* communities are red listed in the AT and ESSFdkp subzones. These species were not observed during the field investigation, nor was the plant association noted in any of the sample plots. However, the due to the level of investigation conducted, it is not possible to rule out the potential occurrence of this plant community within the study area.

No known rare, endangered or threatened (Red Listed), or vulnerable (Blue Listed) plant species were observed in the study area (CDC Oct. 1, 1997). However, based on the documented occurrence of several species in close proximity and in similar conditions it is possible the following plants may occur within the study area (CDC, 1997):

- Slender Paintbrush *Castilleja Gracilla* Blue List
- Smooth Willowherb *Epilobium glaberrium ssp fastigiatum* Blue List
- Wooly Daisy *Erigeron lanatus* Blue List
- Common Twinpod *Physaria didymocarpa ver. Didymocarpa* Blue List

Due to the complexity of plant taxonomy and identification (particularly within the AT subzone of the study area), red or blue listed plant occurrence cannot be ruled out.

Table 3 Plant Species List for Portion of Taynton Bowl

CODE	*LATIN NAME*	COMMON NAME
	TREES	
Bl	*Abies lasiocarpa*	Subalpine Fir
La	*Larix lyallii7*	Alpine Larch
Se	*Picea engelmannii*	Engelmann Spruce
Sxw	*Picea engelmannii x glauca*	Hybrid White Spruce
Pa	*Pinus albiculis*	Whitebark Pine
Pl	*Pinus contorta*	Lodgepole Pine
At	*Populus tremuloides*	Trembling Aspen
Fd	*Pseudotsuga menziesii*	Douglas-fir
	SHRUBS	
AcGl	*Acer glabrum*	Douglas Maple
ALIN	*Alnus incana*	Mountain Alder
AlSi	*Alnus sitchensis*	Sitka Alder
AmAl	*Amelanchier alnifolia*	Saskatoon
ARUV	*Arctostaphylos uva-ursi*	Kinnikinnick
BeGl	*Betula glandulosa*	Scrub Birch
CaMe	*Cassiope mertensiana*	White Mountain-heather
ChUm	*Chimaphila umbellata*	Prince's Pine
CoSt	*Cornus stolonifera*	Red-osier Dogwood
EMNI	*Empetrum nigrum*	Crowberry
JUCO	*Juniperus communis*	Common Juniper
LeGl	*Ledum glandulosum*	Trapper's Tea
LEGR	*Ledum groenlandicum*	Labrador Tea
LiBo	*Linnaea borealis*	Twinflower
LoIn	*Lonicera involucrata*	Black Twinberry
LoUt	*Lonicera utahensis*	Utah Honeysuckle
MAAQ	*Mahonia aquifolium*	Tall Oregon-Grape
MEFE	*Menziesia ferrunginea*	False Azalea
PhEm	*Phyllodoce empetriformis*	Pink Mountain-heather
RhAl	*Rhododendron albiflorum*	White-flowered Rhododendron
RiLa	*Ribes lacustre*	Black Gooseberry
RiVi	*Ribes viscosissimum*	Sticky Currant
SaBr	*Salix brachycarpa*	Short-fruited Willow
SaSc	*Salix scouleriana*	Scouler's Willow
SAPL	*Salix plantifolia*	Tea-leaved Willow
SARA	*Sambucus racemosa*	Red Elderberry
ShCa	*Sheperdia canadensis*	Soopolallie
SOMU	*Solidago multiradiata*	Northern Goldenrod
SoSc	*Sorbus scopulina*	Western Mountain-Ash
SPBE	*Spiraea betulifolia*	Birch-leaved Spiraea
VaMe	*Vaccinium membranaceum*	Black Huckleberry
VaSc	*Vaccinium scoparium*	Grouseberry
		(Continued next page)

Table 3 Plant Species List for Portion of Taynton Bowl (continued)

	HERBS	
AcMi	*Achilla millefolium*	Yarrow
AmRo	*Amerorchis rotundifolia*	Round-leaved Orchis
AnMa	*Anaphalis margaritacea*	Pearly Everlasting
AnAl	*Antennaria alpina*	Alpine Pussytoes
AnLa	*Antennaria lanata*	Wooly Pussytoes
AqFl	*Aqilegia flavescens*	Yellow Columbine
ArCo	*Arnica cordifolia*	Heart-leaved Arnica
AsCo	*Aster conspicuus*	Showy Aster
CaRu	*Calamagrostis rubescens*	Pinegrass
Ca	*Carex spp.*	Sedges
CaCo	*Carex concinnoides*	Northwestern Sedge
CaLe	*Caltha leptosepala*	White Marsh Marigold
CaMi	*Castilleja miniata*	Common Red Paintbrush
ClOc	*Clematis occidentalis*	Blue Clematis
CoCa	*Cornus canadensis*	Bunchberry
CrNa	*Crepis nana*	Dwarf Hawksbeard
CyMo	*Cypripedium montanum*	Mountain Ladyslipper
EpAn	*Epilobium angustifolium*	Fireweed
Erpe	*Erigeron peregrinus*	Sub-alpine Daisy
FrVi	*Fragaria virginiana*	Wild Strawberry
GoOb	*Goodyera oblongifolia*	Rattlesnake Plantain
HeLa	*Heracleum lanatum*	Cow-parsnip
OrSe	*Orthilia secunda*	One-sided Wintergreen
PeBr	*Pedicularis bracteosa*	Bracted Lousewort
PoPr	*Poa pratensis*	Kentucky Bluegrass
PyAs	*Pyrola asarifolia*	Pink Wintergreen
RaEs	*Ranunculus eschscholtzii*	Subalpine Buttercup
SaLy	*Saxifraga lyallii*	Red-stemmed Saxifrage
SeIn	*Senecio integerrimus*	Western Groundsel
SeTr	*Senecio triangularis*	Arrow-leaved Groundsel
TaOf	*Taxaxacum officinale*	Common Dandelion
ThOc	*Thalictrum occidentale*	Western Meadowrue
	FERNS, HORSETAILS	
Eq	*Equisetum spp.*	Horsetail (Common)
	MOSSES, LICHENS, LIVERWORTS	
	Sphagnum spp.	Sphagnum spp.
PeAp	*Peltigera aphthosa*	Freckle Pelt
StPa	*Sterocaulon paschale*	Common Coral Lichen

2.3.3 Wildlife and Wildlife Habitat

Methodology
A reconnaissance level wildlife and wildlife habitat inventory was conducted which focused on wildlife species of regional concern, namely ungulates (moose, elk, mountain goat, white-tailed deer and mule deer), both species of bear (grizzly and black), small carnivores (lynx and pine marten) and squirrels (the *Selkirki* subspecies of the least chipmunk - *Tamias minimus selkerki*), amphibians, cavity nesters, and bats. The methodology involved collecting information on wildlife use during site traverses and terrestrial ecosystem mapping plots. Direct contacts with wildlife and evidence of wildlife occurrence (i.e., 'sign' such as scats, tracks, trails, burrows, nests, bones, feathers, and various kinds of feeding sign) were recorded. Wildlife were observed with the aid of 8X36 binoculars. The primary objective of the surveys was to identify valued ecosystem components (VECs) such as important nest sites, wildlife trees and feeding areas, and environmentally sensitive areas including habitats of high value to wildlife.

The Conservation Data Centre was contacted to investigate known rare wildlife occurrences within Taynton Bowl. However, no rare wildlife occurrences are currently mapped in the study area. Wildlife observed on the subject property, and wildlife that is expected to occur, are described in more detail below.

Birds
Because of the late summer timing of the field survey, many of the breeding birds expected to occur on the site were not observed. Table 4 provides a list of bird species known or expected to occur on the site. Because a full bird survey was not completed, the attached list is based on general habitat associations and may not cover all species that may occur in the Taynton Bowl.

Species observed during the survey included American robin (see Table 4 for scientific names), boreal chickadee, common raven, ruby-crowned kinglet, ruffed grouse, mountain bluebird, Clark's nutcracker, hairy woodpecker and white-crowned sparrow.

No rare or endangered bird species are expected to occur within the study area.

Table 4 Bird species known or expected to occur in the Study Area.
References include Campbell *et al.* 1990.

Common Name	Scientific Name
NO DUCKS OR GEESE expected	
HAWKS	
Northern Harrier	*Circus cyaneus*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Northern Goshawk	*Accipiter gentilis*
Red-tailed Hawk	*Buteo jamaicensis*
Golden Eagle	*Aquila chrysaetos*
Merlin	*Falco columbarius*
GROUSE	
White-tailed Ptarmigan	*Lagopus leucurus*
Blue Grouse	*Dendragapus obscurus*
Ruffed Grouse	*Bonasa umbellus*
Spruce Grouse	*Dendragapus canadensis*
OWLS	
Great Horned Owl	*Bubo virginianus*
Northern Hawk-Owl	*Surnia ulula*
Northern Pygmy-Owl	*Glaucidium gnoma*
Barred Owl	*Strix varia*
Boreal Owl	*Aegolius funereus*
Great Gray Owl	*Strix nebulosa*
Northern Saw-whet Owl	*Aegolius acadicus*
HUMMINGBIRDS	
Calliope Hummingbird	*Stellula calliope*
Rufous Hummingbird	*Selasphorus rufus*
WOODPECKERS	
Red-naped Sapsucker	*Sphyrapicus nuchalis*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Three-toed Woodpecker	*Picoides tridactylus*
Black-backed Woodpecker	*Picoides arcticus*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
FLYCATCHERS	
Say's Phoebe	*Sayornis saya*
Olive-sided Flycatcher	*Contopus borealis*
Western Wood-Pewee	*Contopus sordidulus*
Hammond's Flycatcher	*Empidonax hammondii*
	(Continued next page)

Table 4 Bird species known or expected to occur in the Study Area. (continued)

CORVIDS	
Steller's Jay	*Cyanocitta stelleri*
Gray Jay	*Perisoreus canadensis*
American Crow	*Corvus brachyrhynchos*
Clark's Nutcracker	*Nucifraga columbiana*
Common Raven	*Corvus corax*
CHICKADEES	
Black-capped Chickadee	*Parus atricapillus*
Boreal Chickadee	*Parus hudsonicus*
Mountain Chickadee	*Parus gambeli*
NUTHATCHES/CREEPERS	
Red-breasted Nuthatch	*Sitta canadensis*
Brown Creeper	*Certhia americana*
WRENS	
Winter Wren	*Troglodytes troglodytes*
KINGLETS/THRUSHES	
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus calendula*
Townsend's Solitaire	*Myadestes townsendii*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Mountain Bluebird	*Sialia currucoides*
Varied Thrush	*Ixoreus naevius*
PIPITS	
American Pipit	*Anthus rubescens*
WAXWINGS	
Bohemian waxwing	*Bombycilla garrulus*
Cedar Waxwing	*Bombycilla cedrorum*
VIREOS	
Solitary Vireo	*Vireo solitarius*
Warbling Vireo	*Vireo gilvus*
WARBLERS	
Orange-crowned Warbler	*Vermivora celata*
Yellow-rumped Warbler	*Dendroica coronata*
Townsend's Warbler	*Dendroica townsendii*
MacGillivray's Warbler	*Oporornis tolmiei*
SPARROWS	
Western Tanager	*Piranga ludoviciana*
Chipping Sparrow	*Spizella passerina*
Song Sparrow	*Melospiza melodia*
Fox Sparrow	*Passerella iliaca*
Brewer's Sparrow	*Spizella breweri*
	Continued next page)

Table 4 Bird species known or expected to occur in the Study Area. (continued)

SPARROWS (Continued)	
White-crowned Sparrow	*Zonotrichia atricapilla*
Dark-eyed Junco	*Junco hyemalis*
FINCHES	
Pine Grosbeak	*Pinicola enucleator*
Rosy Finch	*Leucosticte arctoa*
Red Crossbill	*Loxia curvirostra*
White-winged Crossbill	*Loxia leucoptera*
Pine Siskin	*Carduelis pinus*
Evening Grosbeak	*Coccothraustes vespertinus*

Mammals

Rare or endangered wildlife that may occur on the site include wolverine (*Gulo gulo*) (blue-listed), grizzly bear (*Ursus arctos*) (blue-listed), woodland caribou (*Rangifer tarandus*) (blue listed), least chipmunk (*Tamias minimus selkerki*) (red listed) and badger (*Taxidea taxus*) (blue-listed). Habitat preferences and distribution of these and other mammal species known or expected to occur on the site are described in more detail below.

Bear sign observed on the field surveys included diggings, tree scrapes, and feeding sign. Some lower bark stripping on lodgepole pine, indicative of bears feeding on the soft cambium layer, was noted. Because both species of bear, grizzly and black bear (*Ursus americanus*) are believed to utilize Taynton Bowl, it was difficult to distinguish what species was responsible for the above mentioned sign, unless associated with tracks.

Black bears are expected to be common residents of the study area, especially in the spring when forbs and herbs are attractive food sources. Huckleberries, oval-leafed blueberry, thimbleberry and soopallalie provide foraging opportunities in the fall. Black bear have been regularly seen on Panorama Mountain. This fall (1997), a black bear became habituated to garbage in Panorama Village, within two kilometres of the study area. A black bear den is located along the horse trail in the lower Taynton drainage.

Grizzly bear, a blue-listed species, is known to occur regularly in Taynton Bowl (anecdotal information from a number of local hunters). Grizzly tracks were sighted on the first field day along the horse trail and in the lower riparian area of the Taynton Bowl. A grizzly was sighted by the hunting-guide outfitter, Lyle Barsby, in mid-September, 1997 and by Scott Barsby on October 22, 1997. Recent evidence of foraging on gooseberries was observed in Taynton Bowl riparian habitats, along with fresh tracks. Ground squirrels in the slide paths and a variety of berries throughout the Taynton Bowl area provide foraging opportunities for grizzly bear. Fresh grizzly bear excavations (i.e., in ground squirrel area) were observed in the Bowl in summer 1994. Grizzly have been sighted on Panorama Mountain over the years (anecdotal information from local residents) and in Panorama Village in May 1992.

Moose (*Alces alces*) pellet groups and tracks were noted throughout one of the small wetlands and on ridges. In one area, where excellent foraging opportunities existed for both elk and moose, recent, congealed large ungulate droppings were observed. However, it was difficult to determine if they were from elk or moose. Moose are expected to occur throughout the year. A cow moose was sighted near Sample Plot 3 on June 26, 1997. The sighting occurred at approximately 1825 m asl and was near a small wetland. Although not seen during these field surveys, a bull moose was sighted in the Taynton Bowl in July 1995. On October 22, 1997, Scott Barsby, of Toby Creek Outfitters, reported sighting a grizzly bear feeding on a bull moose near Sample Plot 3. Dense shrub vegetation adjacent to wetlands provides good spring, summer, fall and early winter foraging opportunities. Willow (*Salix* spp.) in the Taynton riparian and in the upper wetland areas showed evidence of heavy browse activity, both recent and old. Late winter foraging opportunities may be limited by significant slide activity.

Elk (*Cervus canadensis*) tracks and pellets were noted throughout the study area, with a greater concentration of activity in the lower riparian zone and wetlands. Two "group" bedding areas were noted in the grassy areas at the base of two separate avalanche chutes. Nearby shrubs showed evidence of recent browse, presumably from the elk. Ungulate antler rubs of various ages were noted throughout the study area.

Numerous tracks were observed at the base of one of the cliff bands that occur on the upper slopes of Taynton Bowl. The tracks were in shale so it was impossible to distinguish what animal species was responsible, however, due to the terrain, it is likely that of mountain goat (*Oreamnos americanus*). A mineral lick, frequented by mountain goats, is apparently located along the Taynton Ridge (Scott Barsby, Toby Creek Outfitters, pers. comm. 1997). Mountain goat have been observed recently walking along the Taynton Ridge (Scott Barsby, Toby Creek Outfitters, pers. comm. 1997). Significant goat populations are found just west of Taynton, along the Brewer-Mineral King Ridge (Trevor Kinley, Sylvan Consulting, pers. comm. 1997). Brewer-Mineral King Ridge is contiguous with Taynton Ridge and would be easily accessible.

Mule deer (*Odocoileus hemionus hemionus*) are common residents of the study area. High snow depths likely limit utilization of the site in the winter. Forbs found in the run out zones of the slide paths would provide excellent grazing opportunities. Deer tracks were noted on some of the game trails in the forested areas. A fresh deer antler rub was noted in one of the plots (tracks visible in surrounding soil). Due to the habitat and elevation, the rub was likely created by a mule deer.

White-tailed Deer (*Odocoileus virginianus*) are not as abundant as mule deer on the site. White-tailed deer typically inhabit dense areas adjacent to creeks or in valley bottoms whereas mule deer are more typically found in open, higher elevation areas in summer.

The nearest known mountain caribou (*Rangifer tarandus*) populations are on the slopes west of the Bugaboos and in the Findlay Creek drainage (Trevor Kinley, Sylvan Consulting. pers comm. 1997). There are no known sedentary populations in the Toby and Horsethief Creek drainage, however, sporadic sightings have been reported which allows for the possibility that a yet undiscovered herd exists (Trevor Kinley, Sylvan Consulting. pers comm. 1997). The most recent local sighting occurred in the summer of 1996 and was approximately 17 kilometers west of Panorama Mountain Village, on the Toby Creek Road (Alison Candy, Osprey Communications, pers. comm. 1996).

Red squirrel (*Tamiasciurus hudsonicus*) sign and individuals were observed on numerous occasions. Sign included cone scales, large and extensive middens and calls. The predominance of cone-bearing trees on the site provides an abundance of foraging opportunities. Columbian groundsquirrel (*Spermophilus columbianus*) occur in open, disturbed areas on the site (they are common at Panorama Village nearby). Northern flying squirrel (*Glaucomys sabrinus*), a nocturnal squirrel, likely inhabits forested regions. In addition, several chipmunks were sighted in the upper extremities of Taynton Bowl. These may have been the red listed *Selkirki* subspecies of the least chipmunk, which is vulnerable due to its restricted range, or the more widely distributed yellow-pine chipmunk (*Tamias amoenus*). Hoary marmots (*Marmota caligata*) are expected to occur in subalpine and alpine habitats of the subject property. Common pika (*Ochotona princeps*) was heard calling from the talus slopes on the property.

Water shrews (*Sorex palustris*) are expected to occur in creek and wetland habitats throughout the site. However, some of the creeks dry up in the summer and would not be suitable for this species. Other shrew species expected to occur on the site include common (*Sorex cinereus*) and dusky shrew (*S. monticolus*).

The availability of snags and wetlands on the site provides roosting and foraging opportunities for bats. Panorama falls within the known distribution of several bat species. These species include California myotis (*Myotis californicus*), western long-eared myotis (*M. evotis*), little brown myotis (*M. lucifugus*), long-legged myotis (*M. volans*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*) and big brown bat (*Eptesicus fuscus*). However, with the exception of the little brown myotis that has been found to 2300 m, most records for other bat species listed above are from below approximately 1200 m (Nagorsen and Brigham 1993). Generally, very little is known of the altitudinal distribution of bats in the province.

Although snowshoe hares (*Lepus americanus*) were not observed during the field survey, they are expected to be relatively common on the site, especially in denser, mature forests.

Porcupine (*Erethizon dorsatum*) was not observed during the field survey but lodgepole pine, located in the lower elevations of the study area, exhibited bark scrapings indicative of porcupine feeding sites. Scat was observed.

Southern red-backed vole (*Clethrionomys gapperi*) is expected to inhabit forested regions whereas deer mouse (*Peromyscus maniculatus*) likely occurs in most habitats. Other small rodent species that may occur include bushy-tailed woodrat (*Neotoma cinerea*), northern bog-lemming (*Synaptomys borealis*), water vole (*Microtis richardsoni*), heather vole (*Phenacomys intermedius*), meadow vole (*Microtis pennsylvanicus*) and western jumping mouse (*Zapus princeps*). Fresh tracks of microtines were observed in the snow (fallen from the night before the field survey day) at the higher elevation plots. Lower elevation plots were below the snow line so tracks were not visible.

Habitats of the subject property are suitable for canid species. Coyote (*Canis latrans*) is likely the most abundant species followed by gray wolf (*Canis lupus*) and red fox (*Vulpes vulpes*). Gray wolves are expected to be of occasional occurrence within the study area.

Cougars (*Felis concolor*) may be occasional predators on the ungulates found in the bowl. Lynx (*Lynx canadensis*) have been sighted on the Panorama Golf Course in winter 1995/96. Since it is expected that snowshoe hare would be found in the lower elevation forests of the Taynton Bowl, it is likely that lynx may be found there too. Bobcat (*Lynx rufus*) have been sighted on the lower reaches of the "Toby Canyon", approximately 8 km east of the Resort along the main road. It is unlikely they would be found in Taynton Bowl during winter due to high snow levels.

Marten (*Martes americana*) prefer closed mature forest stands but may be found in the lower elevations of the Taynton Bowl. A marten has been observed on the Champagne T-bar (approximately 2316 m asl), which cuts through an open lodgepole pine forest. Apparently, a marten was accepting food from staff at the upper Patrol Hut and this may explain why it was found in less typical marten habitat. Ermine (*Mustela erminea*) are expected to be relatively common residents of the subject property, and long-tailed weasel (*Mustela frenata*) also likely occur. Red squirrels, pika and small rodents provide an abundance of prey. Wolverine have been sighted in the Toby drainage, approximately nine kilometers upstream from Panorama Mountain Village (Chris Wrazej, Panorama Mountain Village, pers. comm. 1994). Therefore, it is likely that wolverine utilize Taynton Bowl. Occurrence of striped skunk (*Mephitis mephitis*) is not known.

Although Panorama occurs within the known range of badger, a species blue-listed by BC Environment, the status of this species on the subject property is not clearly understood. One of the key prey items of badgers are Columbian groundsquirrels which are present in large colonies nearby. An informal oral history study, completed by Kootenay National Park, notes badger sightings at Panorama Mountain Village. Although considered montane-grassland predators, a radio-tagged badger has been tracked at 2400 m asl in the Skookumchuck drainage, south of Invermere (Nancy Newhouse, Sylvan Consulting, pers. comm. 1997).

Amphibians

Several frogs, tentatively identified as the spotted frog (*Rana pretiosa*), were observed in wetlands at lower elevations on Panorama Mountain Village lands. In addition, western toad (*Bufo boreas*), Pacific treefrog (*Hyla regilla*), and wood frog (*Rana sylvatica*) may also occur around wetlands and in adjacent habitats at lower elevations. Within the subject site, however, the steep terrain generally precludes the formation of ponds required by these species. The subject site is within the known range of the red listed northern leopard frog (*Rana pipiens*) (Green and Campbell 1984), however, as previously mentioned, there is a generally lack of pond habitat within Tayton Bowl, that is required by this species. The only salamander species that may occur on the site is long-toed salamander (*Ambystoma macrodactylum*)(Green and Campbell 1984).

Reptiles
A common garter snake (*Thamnophis sirtalis*), was observed during the June site investigations. Western terrestrial garter snake (*T. elegans*) may also occur at the site. Although Panorama is within the known distribution of the blue-listed rubber boa (Charina bottae), it is not known whether this species occurs at this elevation (Gregory and Campbell 1984).

2.3.4 Wildlife Capability and Suitability Ratings

Wildlife capability and suitability ratings for all ecosystem units and structural stages located on the subject property are summarized in Appendix E. Comments on habitat capability for each of the species or species groups of concern are provided below.

Grizzly Bear
Taynton Bowl is likely utilized by grizzly bear in the spring, summer and fall for foraging. In a biophysical capability classification, Demarchi (1990) rates the Taynton Bowl with high summer and fall capability for grizzly. Avalanche and rock slide paths and open wetland areas are abundant with berry-producing shrubs such as grouseberry, huckleberry, soopallalie, black gooseberry, and elderberry creating high suitability habitat for both grizzly and black bear. The open, dry habitat of the upper slide paths, which had Columbian groundsquirrel colonies along with herbs and forbs, is rated moderate to high for grizzly bear habitat. Small cliff bands and large boulders may offer denning opportunities.

Black Bear
Because of the presence of herbs, grasses and berry-producing shrubs in early seral stages and disclimax stands, these habitats were rated moderately high. Drier sites received lower ratings, with the exception of sites with a good cover of berry producing shrubs such as soopolallie and grouseberry. Wetlands were also rated highly because of the presence of sedges and other herbaceous plants which are preferred forage items for bears.

Least chipmunk
A British Columbia red-listed sub-species of the least chipmunk *(Tamias minimus selkerki)* was identified at Paradise Mine in a McTaggart-Cowan study in the 1940's. Paradise Mine is located at elevations ranging from 2377 m – 2500 m asl, directly north of Toby Creek from the Taynton drainage. Habitat conditions of Paradise Mine are similar to Taynton Bowl and elevations are similar (2134 m – 2438 m asl). Chipmunks were observed on all three field survey days in the Taynton study area. However; it is impossible to determine if the chipmunks were *T. minimus selkerki* or the common and more widely distributed yellow-pine chipmunk (*Tamias amoenus)* by simple field observations. A live trapping program would be required to determine if the least chipmunks in Taynton Bowl are *T. minimus selkerki*.

Moose

Dense shrub (mainly *Salix spp.*) and herb layers bordering Taynton Creek are of high value to moose in late spring, summer, fall and early winter. Small stands of shrubs were found in the avalanche paths, particularly in the run out zones. Upper slide paths were of low suitability due to the lack of a shrub layer. Shrub development was also absent along the edge of the mature lodgepole pine stands bordering the avalanche paths. Significant avalanche activity in the upper Taynton Creek riparian zone in late winter may reduce the capability of the habitat for moose at that time of year.

Elk

Elk track and sign were visible throughout Taynton Bowl. Along the Taynton Creek riparian zone, a well developed herb and shrub layer made this area of high value to elk in late spring, summer and fall. Run out areas of the slide paths and the wetlands are abundant with grasses and would be of high value to elk in the summer and fall. During winter, elk migrate down to the Columbia Wetlands and would not utilize Taynton Bowl.

Mule and White-tailed Deer

Mule and white-tailed deer are widespread on the subject property. Early seral stage habitats generally have well developed herb and shrub layers and are of moderate to high value to deer, especially in spring and summer. Both dry and moist sites were suitable for deer because of an extensive herb layer in moister sites, and the dominance of ground forage species on drier sites. Mid-aged forest stands (i.e., age class 4 and 5) were generally of low suitability for deer because of reduced understorey shrub and herb vegetation. Older seral stage forests were rated moderate due to the limited extent of herbaceous plant species available in the understorey. Demarchi *et al.* (1983) provides detailed information on the wildlife capability classification system for ungulates in British Columbia.

Bats

Bats are known to forage extensively over open areas such as wetlands and cleared areas (i.e. early seral stages). Open, dry forest sites may also be utilized by bats for foraging. Since habitats with a high abundance of snags and large trees provide roosting opportunities for bats, later seral stage forests were also considered to be important. Open wetlands with adjacent mature forests are the most suitable for bats because they provide both highly productive foraging sites and adjacent forested habitats for roosting.

Cavity Nesters

Cavity nesters such as woodpeckers, chickadees, nuthatches and brown creeper require snags or mature trees for nesting. Snags of the study area are dominated by alpine larch with the occasional mature Douglas fir, balsam and pine. Older growth forests also provide excellent foraging opportunities for woodpeckers. Small owls such as northern saw-whet owl and northern pygmy-owl have similar nesting habitat requirements to woodpeckers. Thus, older forests received the highest suitability ratings.

Amphibians
Wetland habitats are extremely important for many breeding amphibians. Mature, moist forests with a good volume of course woody debris are also utilized by pond-breeding amphibians at other times of the year. These habitats receive the highest suitability ratings.

2.3.5 Valued Ecosystem Components

Bear Denning
Rocky cliff bands and outcrops in Taynton Bowl would provide suitable denning sites for bears. With the high summer and fall habitat rating for the Taynton Bowl for bears, denning is a possibility. As noted, a grizzly was sighted feeding on a moose kill in late October. The site was close to suitable denning habitat.

Ungulate Rutting
Many lodgepole pines exhibited bark scrapes indicative of ungulate antler rubs, both old and recent (current season). The open forest with dense shrub and herb layers appears to be utilized as spring and summer foraging areas by all the ungulates. It is not clear whether deer, elk and moose make use of the subject site during the rutting season. Availability of forage and cover are generally the most important habitat features required during the rutting season.

Wildlife Corridors
Mountain goats may use the Taynton ridge in winter to access a mineral lick. Activity from the ski development may deter goats from using the ridge during the construction phase and once the winter ski operation commences. However, it should be noted that there is presently a ski lift and associated trail system utilizing a small section of the ridge top and west face.

Based on anecdotal information from hunters, it is unknown if Taynton is part of the migration route used by elk in the spring and fall. Further discussion with guide outfitters and local hunters may assist in the determination of the value of the Taynton drainage as a migration corridor.

Far-ranging carnivores, such as the grizzly, probably move from the Taynton drainage to adjacent high and moderate capability drainages such as Brewer and Hopeful.

Ephemeral streams and associated riparian habitats are potentially important wildlife movement corridors. The most significant corridor appears to be the main stem of Taynton Creek. Deer and elk may utilize Taynton to ultimately access the Rocky Mountain Trench winter habitat. Corridors become increasingly important as upland forests are disturbed by development activity.

Game trails were noted throughout the study area. From some of the trails, it appears that large mammals (such as elk and bear) wander between Taynton Bowl and adjacent high capability habitat drainages, such as Brewer and Hopeful Creeks (Demarchi *et al.*, 1983) Mountain goat travel along the Taynton Ridge to access a mineral lick. Lynx tracks have been sighted along the Taynton Ridge in winter 1995/96.

Diversity of Habitat

Due to the significant slide and avalanche activity in Taynton Bowl, the area is a natural, disturbed forest with a variety of habitats.

Wildlife Trees

Wildlife trees include significant standing snags, veteran trees, and trees with broken tops. A dead wildlife tree could be considered to be of greater habitat value than a living tree. These trees are important as perching areas for raptors such as red-tailed hawk, and foraging and nesting sites for woodpeckers, small owls and other cavity nesters. Snags are also important habitat for small mammals such as mice, voles, chipmunks and squirrels. Larger trees provide dens for pine marten, weasel and ermine (Alison Candy, Osprey Communications, pers. comm. 1997). The majority of the subject property is dominated by second growth forest as a result of fire and important wildlife snags are scattered throughout.

Clark's nutcracker and hairy woodpeckers were frequently observed throughout the study area utilizing alpine larch snags. Large snags may also be used as roosting areas for bats, especially adjacent to important foraging areas over wetlands, ridge crests and other open habitats.

Ephemeral Streams and Riparian Areas

A portion of Taynton Creek and its tributaries, many of which are dry during the summer months, occur within the subject site. Riparian and ravine habitats associated with these watercourses are dominated by vegetation such as willows, alders, scrub birch and lodgepole pine. These habitats provide high structural heterogeneity and plant species diversity compared to the more adjacent uniform coniferous forests, and are attractive to numerous bird, mammal and amphibian species. Ephemeral streams are also natural wildlife movement corridors.

Ephemeral stream and pool habitats are utilized as drinking and preening areas for wildlife, and possibly breeding areas for frogs, toads and salamanders.

Wetlands

Wetlands not only provide breeding habitats for amphibians such as spotted frog and western toad, but also provide foraging opportunities for ungulate species and bear. Bear and ungulate sign was evident in wetlands surveyed during the site reconnaissance. Wetlands are utilized as foraging areas for bats and songbirds, which are attracted to the open nature of the site and the high insect populations. Snags adjacent to these wetlands are utilized as roost sites by bats.

2.4 Aquatic Environment

2.4.1 Aquatic Biophysical

Methodology
An aquatic biophysical inventory and fisheries survey was conducted for the waters draining Taynton Bowl and eastern portions of Panorama Mountain. The inventory and survey, conducted by Mike Nelson, R.P. Bio. and Mike Cole, P.Eng., conforms to the criteria set out in Fish -Stream Identification Guidebook, Forest Practices Code of British Columbia (MOF, 1995a), the Stream Survey Field Guide (DFO/MOELP, 1989), and the Lower Mainland Region Stream Inventory/Assessment Methods, Fifth Draft (Bech, 1994), except as noted in the text.

Prior to conducting the field work, GEC reviewed available information concerning the fish presence and distribution in the drainages both within the project area and in the surrounding area. The fisheries records for Taynton Creek, which drains the study area, were not readily available, however, Toby creek into which Taynton Creek flows has been studied in some detail in the past (Fielden et al., 1993 & Carswell, 1979).

Taynton Creek
Taynton Creek consist of three reaches, plus five main tributaries including one that drains Taynton Bowl, the study area. From its confluence with Toby Creek, Taynton Creek's first reach rises steeply for a short distance out of the Toby Creek valley. The second reach has a moderate gradient, and forms the majority of the stream length. The third reach of Taynton Creek consists its steep, ephemeral headwaters.

Reach 1
This short reach, 70 m in length, rises steeply from Taynton Creek's confluence with Toby Creek, with gradients ranging from 22 to 26 % (average gradient 24%). The stream channel width averaged 3.5 m, as did the wetted width. Other than the relatively steep gradient, no barriers to fish migration were evident. There was approximately 40% fish stream cover provided primarily by over-stream vegetation, with lesser amounts of deep pool, boulder and cut-bank cover and a trace of large organic debris (L.O.D.). Riparian vegetation consisted of willow (*Salix sp.*), rose (*Rosa sp.*), Saskatoon (*Amelanchier alnifolia*), high-bush cranberry (*Viburnum edule*), thimbleberry (*Rubus parviflorus*), black twinberry (*Lonicera involucrata*), Sitka alder (*Alnus crispa*), and mountain alder (*A. incana*). The canopy closure was estimated at 30 % with examples lodgepole pine (*Pinus contorta latifolia*), Douglas fir (*Pseudotsuga menziesii*), and Engelmann spruce (*Picea engelmannii*). The substrate consisted mainly of cobbles and boulders with little gravel or fines. The water was quite clear with visibility greater than 100 cm. The conductivity was 295 μs/cm and the water temperature was 6°C on June 23, 1997 (other water quality conditions can be found in Section 2.4.2). Flow conditions were moderate to high, consisting overwhelmingly of riffle and small falls. The stream's discharge was measured as 0.5 m^3/s. Electrofishing was not conducted on this reach, as Toby Creek at its confluence with Taynton Creek is known to support bull trout (*Salvelinus confluentus*), and the elctrofishing program in Reach 2

upstream yielded numerous bull trout. Therefore, even though this reach is fairly steep, it is presumed to be passable for fish. Under the Forest Practices Code of B.C. (MOF, 1995a), this reach of Taynton Creek is classified as a S3 fish stream based on its width and presumed presence of fish.

Reach 2

Taynton Creek's second reach is 4.3 km long, forming the majority of the stream's length. This reach had gradient measurements ranging from 9 to 16 %, with an average gradient of 14.7 %. The stream channel and wetted widths both averaged 4.6 m. There were small debris controlled falls though the section of stream surveyed, none of which posed a barrier to fish movement. Stream fish cover was estimated at 30 %, provided mainly by over-stream vegetation, with some deep pool, LOD and cut-bank cover also present. Riparian vegetation was similar to that observed downstream, and included red-osier dogwood (*Cornus stolonifera*), willow (*Salix sp.*), oval-leaved blueberry (*Vaccinium ovalifolium*), rose (*Rosa sp.*), Saskatoon (*Amelanchier alnifolia*), thimbleberry (*Rubus parviflorus*), Sitka alder (*Alnus crispa*), Douglas maple (*Acer glabrum*), bunchberry (*Cornus canadensis*), wild strawberry (*Fragaria virginiana*), common horsetail (*Equisetum arvense*), and fireweed (*Epilobium angustifolium*). The canopy over the stream was fairly open, with the canopy closure was estimated at 15 %. Trees within the canopy were mostly lodgepole pine (*Pinus contorta latifolia*), with lesser amounts of trembling aspen (*Populus tremuloides*). The substrate consisted of gravels, with lesser quantities of fines and cobbles. Boulders were generally lacking in the lower portions of this reach. Water quality paramters were the same as for Reach 1. Flow conditions (during the site visit on June 23, 1997) were moderate to high. Flows were characterized as 60 % riffle, 20 % pool and 20 % run. The stream's discharge was measured as 0.6 m^3/s.

Electrofishing was conducted on the lower 500 m of this reach. Eleven bull trout were captured during a single pass electrofishing effort, with 5 of those fish being captured in then lower 100 m section of this reach. Within this small sample, there appears to be two age classes, with 10 bull trout ranging in fork length from 95 to 114 mm, averaging 102.4, and one larger fish 163 mm in fork length. Fielden et al. (1993) found that bull trout captured from Toby, Dutch and Horsethief Creeks, and several of their tributaries, had similar growth rates. If this hypothesis holds true for the fish captured in Taynton Creek, then the fish represent age classes 2+ and 3+. Taynton creek's second reach is classified as a S3 fish stream based on its width and confirmed presence of fish, under the Forest Practices Code of B.C. (MOF, 1995a).

Reach 3

Taynton Creek's third reach is located upstream of the study area. This portion of the stream consists of the creek's headwaters, draining the north flank of Mount Goldie, the south-west flank of Mount Taynton, and the ridge joining those peaks. This reach has an average gradient of 23%, with ephemeral flows at its upper end. Because of the steep gradients and ephemeral nature of the upstream flows, reach 3 is assumed to be non-fish bearing. The reach is classified as a S5 non fish bearing stream under the Forest Practices Code of B.C. (MOF, 1995a).

Taynton Bowl Tributary

Drainage from Taynton Bowl enters Taynton Creek via a tributary stream at the 1640 m level. This tributary consists of a braided channel obscured by a dense growth of Sitka alder, Barclay's willow (*Salix barclayi*) and other willow species. The tributary has a gradient of 20% for its first (lower) 500 m before splitting into two sub-tributaries. These sub-tributaries have gradients of up to 50% and greater. As with the main tributary, their downstream portions are braided and obscured by dense riparian vegetation. Upstream of the 1950 m elevation level, both sub-tributaries and their many inlet drainages were dry at the time of the site visit.

Due to their ephemeral nature, the high altitude, and their steep gradient, a fish sampling program was not conducted on these headwater drainages, as they are assumed to be non-fish bearing. The tributary and sub-tributaries are considered to be S5 and S6 non fish bearing streams, respectively, under the Forest Practices Code of B.C. (MOF, 1995a).

Toby Creek

Toby Creek, a tributary of the Columbia River, is a fairly large system with a drainage area of about 684 km^2. It flows in a north-east direction at the base of Panorama Mountain outside the study area. This creek was not surveyed as part of this investigation, as it lies outside the study area and has been studied by others (Fielden et al., 1993 & Carswell, 1979). In the most recent study, Fielden et al. (1993), divided Toby Creek into 12 reaches, with the portion nearest the study area, into which Taynton Creek flows, being reach 5. Toby Creek's second reach, located approximately 8.9 km downstream of Taynton Creek's mouth, consists of a canyon with a series of cascades that the authors of that report believe form a barrier to upstream fish movements, with the possible exception of bull trout.

Taynton Creek's fifth reach is located 19.9 km to 29.7 km upstream of the creek's confluence with the Columbia River. This reach is 9.8 km long and has an average gradient of 0.9 %. The substrate is predominantly boulder (63%), with approximately 12 % gravel. Flows are characterized as riffle (80 %) with lesser amounts of run (20 %). Total cover is estimated at 6 %, overwhelmingly provided by boulder cover. On August 18, 1992, the average velocity was 1.9 m/s, with a water temperature of 10 °C and visibility of about 10 cm (Fielden et al., 1993). During a site visit on May 7, 1996, by the study team, the water temperature was found to be 2 °C, with water clarity greater than 1 m.

2.4.2 Water Quality

A water-quality sampling program was initiated to elucidate baseline water quality flowing out of the study area. A single sampling station was established on Taynton Creek at the 1210 m elevation level, with the water sample collected on June 27, 1997. The site was selected at this lower elevation due to accessibility problems for future sampling (if the sample site was located further upstream on the creek).

Parameters sampled for include pH, electrical conductivity, total dissolved solids, calcium, magnesium, sodium, potassium, iron, manganese, sulphate, total phosphorus, phosphate, chloride, nitrate, carbonate, bicarbonate, alkalinity and hardness. Results of the analyses are listed in Appendix ?.

All of the water sample met the guidelines for drinking water for the parameters sampled (Health Canada, 1996) and meet the suggested guidelines for the protection of aquatic life (Pommen, 1991). The waters can be considered moderately hard, with moderate alkalinity. The waters were clear, with visibility greater than 100 cm. Nutrient concentrations (nitrogen, phosphorus and potassium) are generally fairly low.

2.5 Wetland Environment

2.5.1 Delineation

A number of small wetlands were identified within the study area. Generally, the wet areas were associated with streams and are considered either spring swamps or stream swamps according to the Canadian Wetland Classification System (NWWG, 1987) sphagnum moss was prevalent). Formation of the stream swamp type wetlands appears to be a function of reduced gradients on alluvial fans. Permeable soils forming the stream banks allow exfiltration of waters. Spring swamps are typically found in lower slope depressions in the study area.

2.5.2 Functionality

The wetlands were subjected to a cursory assessment of functionality using a 7 point system of evaluation that includes the following functions (Bond et al. 1992):

Life-support
- ◊ Regulation / Absorption
- ◊ Ecosystem Health

Social / Cultural
- ◊ Science / Information
- ◊ Aesthetic / Recreational
- ◊ Cultural / Psychological

Production
- ◊ Subsistence Production
- ◊ Commercial Production

The primary functions provided by these small wetlands appear to include aesthetics, recreation (nature viewing), and ecosystem health as it applies to habitat biodiversity and subsistence production for wildlife. Of secondary significance although of potentially equal importance is the potential for the occurrence of red or blue listed plants. No Red or Blue Listed species were identified; however, there remains some potential for occurrence within these wetlands.

Low value functions and functions not provided by these wetlands include commercial production, regulation / absorption, science / information, and cultural / psychological functions.

3.0 ENVIRONMENTAL CONSTRAINTS

3.1 Cultural Environment

Constraints due to heritage interests in the area are currently unidentified. Based on cursory observations made in the field, there appear to be no development constraints associated with archeological or heritage interests in the study area.

3.1.1 Recreation and Land Use

An outfitter and a helicopter skiing company currently utilize Taynton Bowl for commercial activity. These existing uses of the land may pose constraints to development in the study area.

3.2 Physical Environment

3.2.1 Climate

Climatic conditions are well documented from the ski activities occurring at Panorama Mountain Village. No climatic constraints are noted.

3.2.2 Geology

Exposed bedrock across the study area occurs frequently in steep areas and does pose a geologic hazard such related to slope failures from weathered, highly fractured units. Constraints, therefore, are noted in relation to the stability of these units.

3.2.3 Geomorphology & Surficial Materials

The study site includes many areas of observed landslide and snow avalanche activity. Constraints, therefore, are noted in relation to the stability of these materials.

3.2.4 Hydrology

The study area lies within the mid- and upper reaches of Taynton Creek. There are several major side channels within this area that exhibit steep terrain with high snow loading and are likely associated with mass movement events during spring runoff. Consequently, hydrologic constraints exist.

3.3 Terrestrial Environment

3.3.1 Pedologic Soils

The widely distributed Brunisols and Regosols in the study area are generally well drained soils which are associated with no known constraints to recreational development. The limited organic soils, which occur in poorly drained areas, however, are associated with wetlands. Development constraints associated with wetlands are discussed in Section 3.4.

3.3.2 Vegetation

Much of the forest in the study area is less than 80 years old due historic natural wildfire events. However, occasional veterans, particularly alpine larch, were observed near the summit ridge. Two sample plots (Plot #6 and Plot #7) were identified as structural stage 7 with cores taken from alpine larch exceeding 300 years of age. Plot #5 was estimated to be a structural stage 6 forest with an age range from 80 to 140 years. Ecosystem Polygons 13 and 17 contain an old growth forest component, while Polygons 1, 8, 17, and 21 have mature forests. Older trees are less tolerant of the potential impacts that may arise from development. Accordingly, any forested polygon of structural stage 6 or 7 should be considered constraining to development. However, it should be noted that the age range covered by the mature forest class (structural stage 6) is 80 to 140 years, and as a result site specific conditions will affect the degree of impact.

No specific constraints are associated with the various tree or plant species noted within the study area. No rare, endangered, or threatened terrestrial plants or plant communities were observed within the study area. It should be assumed that red and blue listed species may occur within the site and as such all sites entailing ground disturbance should be subjected to a detailed survey prior to construction approval.

Vegetation associated with the AT and the ESSFdkp subzones are by nature fragile and sensitive to impacts associated with development. Therefore, the vegetation found in the alpine (AT) subzone and the upper elevations of the ESSF subzone, should be considered constraining to some types of development. It should be noted that development of the high alpine for ski resort use could be conducted in an environmentally sensitive manner, with limited adverse impact.

While no rare or endangered plants were identified within the wetlands, the reconnaissance level of survey precluded identification of all plants to the level of species. Consequently, wetland vegetation should be considered constraining due to the potential presence of rare or endangered plant species.

3.3.3 Wildlife and Valued Ecosystem Components

Diversity of Habitat
In a closed canopy lodgepole pine forest that is managed to prevent natural disturbances such as fire, it may be argued that cutting ski runs can enhance foraging habitat for ungulates and other animals. However, due to the significant slide and avalanche activity, Taynton Bowl is a natural, disturbed forest with a variety of habitats. In developing and maintaining ski runs, densely shrubbed areas, generally located in moister soils, are cleared by hand (Brad Brush, Panorama Mountain Village Mountain Operations, pers. comm. 1997). Continual compacting of snow due to skier use may also decrease the likelihood of future shrub growth. Typically, these shrub areas are composed of a variety of plant species and are of very high value to birds and many animals, including moose, elk and bear. Mitigation of impacts to habitat may be difficult as the base of the proposed ski area encompasses the highest capability habitat.

Bear Denning
Rocky cliff bands and outcrops would provide suitable denning sites for bears. With the high summer and fall habitat rating for the Taynton Bowl, denning is a possibility and should be considered constraining. Potential sites should be identified and any development in these areas should be avoided from the planning stage.

Ungulate Rutting
Because utilization of the subject property by ungulates (namely moose, elk and deer) during the rutting season is poorly understood, it is difficult to recommend options for mitigating potential impacts. Ski operations may overlap with the ungulate rut (October - mid-December) and should be considered constraining to anthropogenic activity.

Wildlife Trees
Areas with high snag densities need to be retained to maintain nesting, denning and foraging opportunities for woodpeckers, small owls, bats, cavity nesting passerines and small mammals. Large snags in upland areas with known nesting activity should not be removed unless absolutely necessary from a development design perspective. Care must be taken in cutting new ski runs to provide adequate forested buffers along the runs, so that important nest and forage trees/snags are less vulnerable to windthrow. Approximately 60-70% of resident bird species in British Columbia are cavity nesters and use cavities to roost in winter (Millikan 1994).

Ephemeral streams and Riparian Areas
Ephemeral streams and adjacent riparian areas should not be disturbed. These habitats are very important as feeding, drinking, and breeding sites for numerous wildlife species. These habitats also act as natural movement corridors for wildlife across the site, especially following intensive land use activities.

Open Wetlands
Because wetlands are relatively uncommon in upland ecosystems of Taynton Bowl, the

integrity of all existing wetlands should be considered constraining to development. Wetlands are important foraging areas for many animals including bear, moose and bats and provide breeding areas for amphibians. Wetland areas attract an abundance of insects and are important habitat for songbirds.

Wildlife Movement Corridors
Drainages accessible to Taynton, such as Brewer and Hopeful, are rated by Demarchi *et al.* (1990) with moderate to high biophysical capability for ungulates and grizzly. Wildlife movement corridors maintain the connectivity of adjacent habitats and need to be provided for wildlife moving across or through the site. Ephemeral streams and riparian areas are natural corridors and should be maintained as such.

3.4 Aquatic Environment

3.4.1 Aquatic Biophysical

Taynton Creek
The aquatic biophysical assessment and fish sampling program conducted for this study indicates that the Taynton Creek tributary within Taynton Bowl is likely non fish bearing. This tributary does, however, flow into the second reach of Taynton Creek, which was found to support a population of bull trout. It is important, therefore, to retain the riparian vegetation to protect the stream banks from erosion which could lead to downstream siltation. In addition, the riparian vegetation help maintain lower water temperatures in summer, and provides a potential food source for downstream fish (i.e. terrestrial insects falling into the stream). (see also section 3.2.3 and 3.2.4)

Toby Creek
While Toby Creek lies at some distance from the study area, it could be affected by development within Taynton Bowl should the waters of its tributary, Taynton Creek, not be protected. Measures taken to protect Taynton Creek will be suffice to protect Toby Creek as well.

3.4.2 Water Quality

Water quality of the Taynton Creek and its tributaries draining the study area is of particular concern to downstream water users, including Panorama Mountain Village itself, as they have a water intake on the creek. It is in the proponents best interest, therefore, to protect the water quality in the creek and its tributaries, through appropriate siting of project components, and construction and operation techniques if the project proceeds.

3.5 Wetland Environment

3.5.1 Delineation

All wetlands and associated watercourses of the subject site should be considered constraining to development. Avoidance of wetlands and watercourses should be attainable through design of ski lifts, ski trails, and siting of ancillary facilities.

4.0 Recommendations and Conclusions

4.1 General

1. Geotechnical data suggests that wide spread instabilities exist in the surficial deposits as well as the upper bedrock units. Rock and slope instabilities are not uncommon in ski resorts, particularly those occupying the tops of mountains, however, these factors warrant further study prior to proceeding with lift and run design.

2. The integrity of the water quality, habitat values and downstream fisheries values of all waterbodies should be protected by the establishment of riparian buffer zones. In general, buffers should be as specified in the Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al., 1992) or the Forest Practices Code Riparian Management Area Guidebook (MOF, 1995b), whichever is more stringent.

3. The oldest and most significant forest vegetation in the study area is associated with the ESSFdkp and AT subzones near the summit ridge of Panorama Mountain. Any proposed development in this area should maximize preservation opportunities by avoiding destruction of plant communities and minimizing ground disturbance.

4. Issues relating to other CBR users of the study area may need to be resolved prior to inclusion of Taynton Bowl into the controlled recreation area of Panorama Mountain Village.

5. An attempt should be made to preserve all wetlands within the study area. In order to protect the functional values associated with the wetlands preservation buffers should be incorporated into the plans. Any wetlands potentially impacted by future developments should be subjected to detailed assessment to identify all plant species prior to development approval.

6. Retain an on-site environmental monitor to be present during all development activity.

4.2 Wildlife and Wildlife Habitat

4.2.1 Construction Windows

1. The study area may be used by moose, elk and deer during the fall rut. In the absence of further study, development activity and future use of the site should be restricted between 15 October and 15 December.

2. To avoid contravention of the Wildlife Act, land clearing activity should not be undertaken between 01 May and 31 July, the sensitive nesting period for breeding birds and other wildlife without specific permission from MOELP. Under Section 35 of the Wildlife Act, it is an offense to destroy nests occupied by a bird, its eggs or its young.

3. The subject property maintains the high to moderately high habitat value in summer and fall. Construction should be sensitive to disturbance of all types of wildlife by reducing length of day worked and where possible, noise levels.

4.2.2 Habitat Protection

1. Areas with high densities of snags should be retained. A minimum 15 m vegetated buffer on either sides of creeks and wetlands should be retained. In areas where windthrow is a risk, wider buffer zones to 30 m should be set aside. Protection of these areas will retain wildlife trees, breeding and foraging areas for wildlife and provide corridors for wildlife moving or migrating through the site.

2. Large snags in upland areas should be retained within the development plan wherever possible. Widespread clearing of the subject property should not be permitted. Ski runs should be developed to utilize existing forest openings as much as possible to maintain closed second growth forest and alpine old growth forest.

3. Wetlands should be retained intact and undisturbed. Disturbances such as infilling or

redirection of runoff into wetlands should not occur. A 30 m vegetated set-back should be established adjacent to wetlands to protect the unique plant and wildlife values of the wetland and adjacent riparian areas. Often wildlife trees important to bats and other wildlife species will are located within the 30 m setback area.

4. Wildlife movement corridors will be provided if retention zones along streams are designated as recommended above. Road and trail crossings of these ephemeral streams should be designed so that wildlife movement is not impeded or discouraged. The number of stream crossings should be minimized. Bridges rather than culverts or fords are preferred. Planting of additional native, riparian shrubs and trees may be necessary.
5. Nests of raptors such as northern goshawk and great horned owl found during land clearing activity must be adequately protected by forested buffer while the nest is occupied.
6. All areas protected for wildlife habitat, should be flagged and enclosed by temporary fence or continuous 2" flagging along the protection boundary prior to initiation of work on the site. Panorama should take necessary steps to ensure that skiers and staff do not enter protected areas.
7. To protect the sub-nivian habitat from destruction by compacting of snow, skiers should be restricted to using the designated runs.
8. Recreational and ski operation maintenance should be greatly restricted during summer and fall when the subject property has the most significant habitat value to many wildlife species.

4.2.3 Habitat Enhancement

1. To enhance habitat along the runs cut in the second growth lodgepole pine forest, native shrubs such as false azalea, soopallalie and red osier dogwood could be planted.
2. Run width could be cut based on ungulate preference for closed forest/open foraging area.
3. Studies indicate that grizzly bears are negatively impacted by human disturbance. However, it is difficult to quantify the level of disturbance required to reduce the suitability of habitat for grizzly. Access to Taynton (recreational and operational) should be restricted during spring, summer and fall to reduce the chance of bear-human conflict and to maintain the high to moderately high suitability rating of the area.

4.3 Additional Studies

1. Grizzly bear is a blue listed species in the East Kootenay region of British Columbia. Further study into actual use and importance of Taynton Bowl for grizzly bear may be warranted.

2. A live trapping program should be conducted to determine if the species of chipmunk found on site is *T. minimus selkerki.*

3. A wildlife habitat management plan should be developed and implemented. The management plan will detail why, where, when and how lands with a designated wildlife function on or adjacent to the ski resort development will be managed over a given time period (usually 5 years).

4. In light of the fact that Taynton Bowl is an important part of a larger ecosystem, and that wildlife migration occurs from Taynton to adjacent high habitat capability drainages, further wildlife studies to assess the overall impact of the proposed development on wildlife movement studies on a larger area would be beneficial.

5. Further geotechnical studies are required to determine the feasibility of building a lift station in an area with such geologic hazards. These studies should incorporate an evaluation of the initiation zones of landslides and snow avalanches, the deposition zones from such events, the potential of deeper seated bedrock instabilities, and their association with the site hydrology.

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7.0 Appendices

A: Habitat Capability Rating Scheme

for three levels of knowledge about a species use of habitat. Ratings are based on the habitat's potential (i.e., the carrying capacity under optimal conditions) to support a particular species and reflect the animal's use of the best habitat (i.e., ecosection, biogeoclimatic unit or ecosystem unit) in the province. Species use is determined by the number of each species using one square kilometer of habitat for a month (# animals/km2/month).

Carrying Capacity (under optimal conditions)	**Detailed Knowledge** Mule Deer White-tailed Deer Black Bear		**Intermediate Knowledge** Amphibians Cavity Nesters		**Limited Knowledge** Bats	
	Rating	**Code**	**Rating**	**Code**	**Rating**	**Code**
100-75%	High	1	High	H	Present	P
75-50%	Moderately High	2	Moderate	M		
50-25%	Moderate	3				
25-5%	Low	4	Low	L		
5-0%	Very Low	5	Nil	N	Absent	A
0%	Nil	6				

B: Wildlife Capability Ratings

for ecosystem units and structural stages in Taynton Bowl at Panorama (Rating system based on Demarchi 1995 - see Appendix B above). Structural stages currently occurring are shaded.

MSdk – Ecosystem Units and Structural Stages

	SG (01) – Sxw – Soopolallie – Grouseberry								**SS (05) – Sxw – Soopolallie – Snowberry**							
Wildlife Species	1	2	3a	3b	4	5	6	7	1	2	3a	3b	4	5	6	7
Elk	6	2	2	2	3	4	3	3	6	3	3	4	4	4	3	3
Moose	6	3	3	4	4	4	3	3	6	2	2	3	4	4	3	3
Grizzly Bear	6	2	2	3	5	5	4	4	6	4	4	4	5	5	4	4
Bats	X	U	U	U	X	X	X	U	X	U	U	U	X	X	X	U
Cavity Nesters	N	N	N	N	L	L	L	M	N	N	N	N	L	L	L	M
Amphibians	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

	SB (07) – Sxw – Water Birch?							
Wildlife Species	1	2	3a	3b	4	5	6	7
Elk	6	2	2	2	3	3	3	3
Moose	6	2	2	2	4	4	3	3
Grizzly	6	3	3	4	5	5	4	4
Bats	X	U	U	U	X	X	X	U
Cavity Nesters	N	N	N	N	L	L	L	M
Amphibians	N	N	N	N	N	N	N	N

ESSFdk – Ecosystem Units and Structural Stages

	FA (01) – Bl – Azalea – Foamflower								DM (02) - Fd – Douglas maple – Soopolallie							
Wildlife Species	1	2	3a	3b	4	5	6	7	1	2	3a	3b	4	5	6	7
Elk	6	2	2	3	4	4	4	3	6	2	2	3	4	4	3	3
Moose	6	3	3	4	4	4	3	3	6	3	3	3	4	4	3	3
Grizzly Bear	6	3	3	3	4	4	4	4	6	4	4	4	5	5	5	5
Bats	X	U	U	U	X	X	X	U	X	U	U	U	X	X	U	U
Cavity Nesters	N	N	N	N	L	L	L	L	N	N	N	N	L	L	L	L
Amphibians	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

ESSFdk - Ecosystem Units and Structural Stages

	FG (03) – Bl – Azalea – Grouseberry								FS (04) – Bl – Azalea - Soopolallie							
Wildlife Species	1	2	3a	3b	4	5	6	7	1	2	3a	3b	4	5	6	7
Elk	6	2	2	2	4	4	3	3	6	2	2	3	4	4	3	3
Moose	6	3	3	4	4	4	3	3	6	3	3	3	4	4	3	3
Grizzly Bear	6	3	3	3	4	4	4	4	6	2	2	2	3	3	3	3
Bats	X	U	U	U	X	X	X	U	X	U	U	U	X	X	U	U
Cavity Nesters	N	N	N	N	L	L	L	M	N	N	N	N	L	L	M	M
Amphibians	N	N	N	N	N	N	N	N	N	N	N	N	N	L	L	L

ESSFdk – Ecosystem Units and Structural Stages

	WS (07) – Willow Sedge							
Wildlife Species	**1**	**2**	**3a**	**3b**	**4**	**5**	**6**	**7**
Elk	6	2	2	2	2	2	2	2
Moose	6	2	2	2	2	2	2	2
Grizzly Bear	6	2	2	2	2	2	2	2
Bats	X	U	U	U	X	X	U	U
Cavity Nesters	N	N	N	N	L	L	M	M
Amphibians	N	N	N	N	N	L	L	L

AT - Ecosystem Units and Structural Stages

	N/A							
Wildlife Species	**1**	**2**	**3a**	**3b**	**4**	**5**	**6**	**7**
Elk	6	2	2					
Moose	6	3	3					
Bear	6	2	2					
Bats	X	U	U	U	X	X	U	U
Cavity Nesters	N	N	N	N	L	L	M	M
Amphibians	N	N	N	N	N	L	L	L
Mountain Goat	2	2	2					

PANORAMA
MOUNTAIN VILLAGE

ENVIRONMENTAL

LITTLE HOPEFUL AND HOPEFUL CREEK FINAL STREAM DESIGN

August 1996

INTRAWEST

Little Hopeful and Hopeful Creek
Panorama Resort

Final Stream Design

Prepared for:

Intrawest Development Corporation
Panorama Resort
Panorama, B.C. V0A 1T0

August 1996

Prepared by:

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Hopeful Creek - Panorama Resort
Final Stream Design

Job # 014/01/03

08/05/96

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Little Hopeful and Hopeful Creek - Panorama Resort
Final Stream Design

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1.0 Introduction

As part of the proposed development of the golf course at Panorama Resort, Intrawest Corporation plans to relocate approximately 275 m of Hopeful Creek and 1080 m of Little Hopeful Creek. *In addition, approximately 310 m of Hopeful Creek and 2300 m of Little Hopeful Creek that have been previously disturbed will be enhanced to take advantage of their full biophysical potential.* This present document is based on the Preliminary Stream Relocation Design (GEC, July 1996). The aquatic conditions of these creeks have been described in "Bio-Inventory of Hopeful Creek, Near Invermere, B.C." commissioned by Intrawest Development Corporation (GEC, May 1996).

Dave Williamson, B.E.S, Mike Nelson, R.P.Bio., Ethan Askey, M.R.M. and Mike Cole, M.A.Sc., P.Eng. collaborated in the production of this report. Field data, and photographic records were collected during several site visits conducted in the preparation of this report as well as for the bio-inventory.

This document deals with the rehabilitation of Hopeful Creek with emphasis on the disturbed and relocated sections. This rehabilitation consists of fish habitat enhancement strategies and erosion protection schemes. The undisturbed sections of Hopeful Creek are covered mainly from an erosion protection standpoint.

Similar comments for Little Hopeful Creek appear in this report. The scope of work for Little Hopeful Creek is less than that of Hopeful Creek since no fish inventories were conducted at the request of Intrawest.

1.0.1 Mapping

The mapping shown in Section 6.0 is based on original mapping from other consultants (IMC and Carrick Design Inc.) and provides locations of erosion protection and fish habitat enhancement opportunities.

- Drawing H-2, (1:2 000) provides the locations of the two creeks along with locations of fish and water sampling locations.
- Drawings H-3 through H-7 (1:750) provide detailed channel protection and enhancement information for Hopeful Creek.

1.1 Stream Hydrology

The preliminary stream hydrology study, detailed in the Preliminary Stream Location Design (GEC, July 1996) provides peak flow values and riprap sizing for the two creeks. This hydrology report has been updated by I.M.C. Consulting Group Inc. (IMC) (Appendix I) who have reduced the estimated peak flow values (and hence erosion protection requirements) by calibrating local rainfall data and local stream data. Peak flows and riprap sizings for Hopeful and Little Hopeful Creek are provided below as supplied by IMC.

Design flows for Hopeful Creek are based on a 100-year return period. No residential units are proposed along the banks of this stream and flooding would primarily impact the golf course. Residential development are proposed along the lower reaches of Little Hopeful Creek and design flows are based on a 100-year return period.

		Hopeful	**Little Hopeful**
P	Return Period	100	100
Q_p	Peak Flows (m^3/s)	18.3	4.8
V_p	Peak Velocities (m/s)	3.4	2.7
D_{50}	Riprap Sizing* (mm)	400	250

* - riprap sizing applies to the channel bottoms in stream with gradients no greater than 7%, in straight sections.

1.2 Aquatic Habitat Assumptions

The fish bearing status of Hopeful Creek has recently been established based on the last site visit (July 18, 1996). Toby Creek, into which both the subject creeks flow is noted to contain bull trout, and is suspected to contain cutthroat trout, in the vicinity of Panorama Resort. The Bio-Inventory indicates that the conditions in Hopeful Creek are conducive to a population of cutthroat trout although none were found.

Little Hopeful Creek has been subject to considerable disturbances in the past, including several culverts and in stream settling ponds, which have no surface outlet. It is therefore assumed to be barren at present. In an appended report Little Hopeful Creek will similarly be designed to reflect the habitat requirements of cutthroat trout, even though it is considered barren. This design will ensure that the fisheries potential of the creek is retained and enhanced, so that if access problems are rectified, Little Hopeful Creek may become fish bearing.

2.0 General Design Requirements

2.1 Erosion Protection and Training Works

Bank protection in sensitive sections of the two creeks is required to ensure that streams remain in their present courses. Riprap provides economical erosion protection in and along river sections exposed to constant flow. Training berms, in conjunction with riprap, are recommended in areas where braided channels exist and in areas of potential avulsion. Gabions were originally specified in the originally report (GEC, July 1996) but have been omitted based on site visits to the sites in question.

The channel can be reinforced with strategic armoring to reduce the possibility of channel meandering or avulsion. Normally, riprap is placed along the outside of stream bends and as inlet outlet protection for features such as bridges and culverts. IMC has suggested that armouring cover the bottom of low flow channels and side walls up to a height of 1 m,

Bridge crossings should be designed as full span structures (across tops of bank) with no constriction of the channel. Log cribs could be used tied into the creek banks at 45° from the channel alignment. The bridge stringers should not protrude more than 0.45 m below the top surface of the bridge deck. A minimum clearance of 2.0 m is suggested from the bottom of the bridge stringers above the low water level. Riprap should also be placed along the interior walls of the bridge cribbing as well as along the banks for 5 m both upstream and downstream of the structure.

2.2 Habitat Enhancement

The stream sections to be relocated will incorporate habitat for the bull trout population. The stream gradients within the proposed diversion areas are more conducive to providing rearing habitat than spawning habitat. However, a portion of the gravel that is suitable for spawning will accumulate downstream of the proposed step pool structures. The existing non-disturbed sections of Hopeful Creek will be used as a model for the diverted and enhanced areas. To this end, the sequence of pool-glide-riffle complexes present in the natural channel will be emulated in the relocations. This will be accomplished by establishing a series of wedge dams (reverse "V" log weirs) at approximately 40 m spacings (see Appendix II for sketches of stream channel complexing features).

A low to moderate flow channel should be established within a larger high water channel. The low/moderate flow channel would meander somewhat within the larger channel. This would be accomplished by using either rock wing deflectors or log wedges (kicker logs) to establish meander bends at distances separated by approximately 7 to 10 stream widths.

Created habitat features should include:

- cutbank cover, using logs secured to the bank and floating logs anchored to large boulders (riprap);
- LOD (large organic debris) such as stumps and trees anchored to large rocks; and
- establishing boulder cover in clusters.

Appropriate riparian vegetation should also be planted in areas adjacent to the channel and within the channel between the low/moderate flow channel and the high water channel.

2.3 Installation Constraints

- All instream works should be conducted in accordance with the terms and conditions of approval under Section 7 of the Water Act.
- All channel works should halt during storm events.

3.0 Hopeful Creek Design Requirements

The entire section of Hopeful Creek from the upper property boundary to the bridge below the fifth green requires varying degrees of erosion protection and training works. In contrast, two areas along Hopeful Creek are designated for vegetation works:

- Third Fairway Relocation (Section 3.2)
- Fifth Fairway Rehabilitation (Section 3.3)

3.1 Sensitive Channel Reaches

From the field visit and contour mapping, Hopeful Creek appears to have a moderate to high risk of avulsion in several locations. The consequences of avulsion are covered separately in Section 3.1.

Two potential avulsion locations are shown on Drawing H-2. Both locations are entrance points of previous channels. Although regrading of the surrounding terrain will be completed as part of fairway construction, it is believed that further protection is required to preserve the present stream course. These two potential avulsion locations must be protected to reduce the possibility that Hopeful Creek will flow overland and occupy the Little Hopeful Creek channel. Such an event could cause large-scale damage to the proposed fairways as well as residential units downstream. Erosion protection and training works for these sites are discussed in the following sections.

3.2 Third Fairway - Upper Reach

During the July 18 1996 site visit flow in the Hopeful Creek during the site visit was approximately 0.5 to 1.0 m^3/s. The stream carries a considerable quantity of fine sediments which presumably come from erosion of fractured bedrock units at higher elevations. Dwg. H-7 show proposed training works.

3.2.1 Channel Requirements

Just upstream of the property line the channel becomes braided at a break in slope but is confined to a section of the valley floor by a 5-6 m high natural levee. The levee continues approximately 200 m upstream to a point where the valley floor narrows. The braided section continues through a shrub thicket at a point approximately 90 m downstream of the property line. The braided section covers a swath approximately 20 m wide.

Flows appear to be supplemented by springs daylighting across the 3rd fairway. The springs appear to be the result of groundwater surfacing under the influence of a thinning till layer (bedrock daylights some 75 m downslope). These springs are to be intercepted by tiling the fairway. This procedure should assist in confining the stream channel. Due to the high cumulative flows noted from the springs (Q ~ 25 l/s) tile diameter should be upgraded from 6" to 10" or 12". A supplementary tile field should be considered as shown in Dwg. H-7. Perforated drainage pipe should be used in all locations as opposed to closed wall pipe.

Once stream flows subside in Hopeful Creek and the secondary channels dry out a supplementary berm should be constructed which is keyed into existing levee (or berm) and continued downstream some 25 m. This berm should extend across the present wetland area (~20 m) inslope to the pink/orange flagged station. Armouring should be placed along the interior of the berm.

The moderately steep north bank of Hopeful Creek is composed of highly fractured shales which provides natural erosion protection. There are no major concerns of slope failure where the stream contacts the base of the exposed bedrock.

3.3 Third Fairway - Stream Relocation

The present plan calls for the relocating Hopeful Creek which currently flows through the fairway's first landing area. It is proposed to relocate a 200 m section of stream to between the landing area and the tees. This arrangement will lengthen the stream to 275 m, resulting in a gradient reduction from 10 % to 7 %. The alignment of the repositioned channel has been altered slightly to respond to certain hydraulic considerations. Total proposed channel width (across tops of bank) is 8 m.

The proposed channel, shown in Figure 1 will consist of 2.5 m to 3 m wide, by 0.3 m deep low/moderate flow channel, within a 8 m wide by 2 m deep, high flow channel/vegetated bar. This configuration will allow the high flow bar to be planted with riparian shrub cover. Shrubs and trees should be planted between the 3rd fairway and the stream's top of bank. The minimum distance from the top of bank to the edge of the fairway will be 5 m (Drawing H-3). Figure 1 shows a typical cross-section of the constructed channel for Hopeful Creek.

3.3.1 Channel Requirements

A 5 m setback is recommended from the break in slope of the main hillside to the top of bank of the channel. Slope materials consist of highly fractured shale and could potentially contribute high sediment loads to Hopeful Creek. Remediation of such eroding banks would also be difficult due to their location.

Riprap should be located as listed on Drawing H-3 and detailed in Section 2.1. These areas cover the outside bends and the up and downstream sections of the bridge. Riprap should also be placed along the interior walls of the bridge cribbing. The bridge should be a clear span unit with log cribs tied into the creek slopes as described in Section 2.1.

3.3.2 Riparian Vegetation

Suitable species for use in the riparian replanting program and for use on the vegetated bar are shown below in Table 1. The precise planting scheme has not as yet been developed, but will include low growing shrubs and a suitable ground cover on the vegetated bar and in areas between the 3rd fairway and the stream's top of bank where lines of site are required for golf course play. Shrubs would typically be planted on 0.5 to 1 m centres. Trees will also be planted in the riparian strip, between the golf course and the stream's top of bank, where sight lines do not come into play. Trees will generally be planted on 3 - 4 m centres.

A suitable ground cover will be determined under consultation with the golf course architect, as it is likely that typical reclamation mixes will not be compatible with the adjacent golf course use (typical reclamation mixes contain a blend of various grasses and clovers which are undesirable on the golf course fairways).

3.3.3 Habitat Enhancement

Several complexing structures (as discussed in Section 2.2) have been incorporated into the design of the relocated stream channel. These include three log or rock wing deflectors, to encourage the low/moderate flow channel to meander within the high flow channel, five log wedge dams to provide for stepping of the channel and encourage the formation of plunge pools at their downstream end, four logs placed for undercut bank habitat, placement of boulders in clusters at the distal end of the pools formed at three of the sedge dams, and placement of numerous anchored stumps in the channel for LOD cover. Approximate locations of the complexing structures are found on Drawing H-3.

Figure 1 Hopeful Creek - Typical Cross-section of Relocated Channel

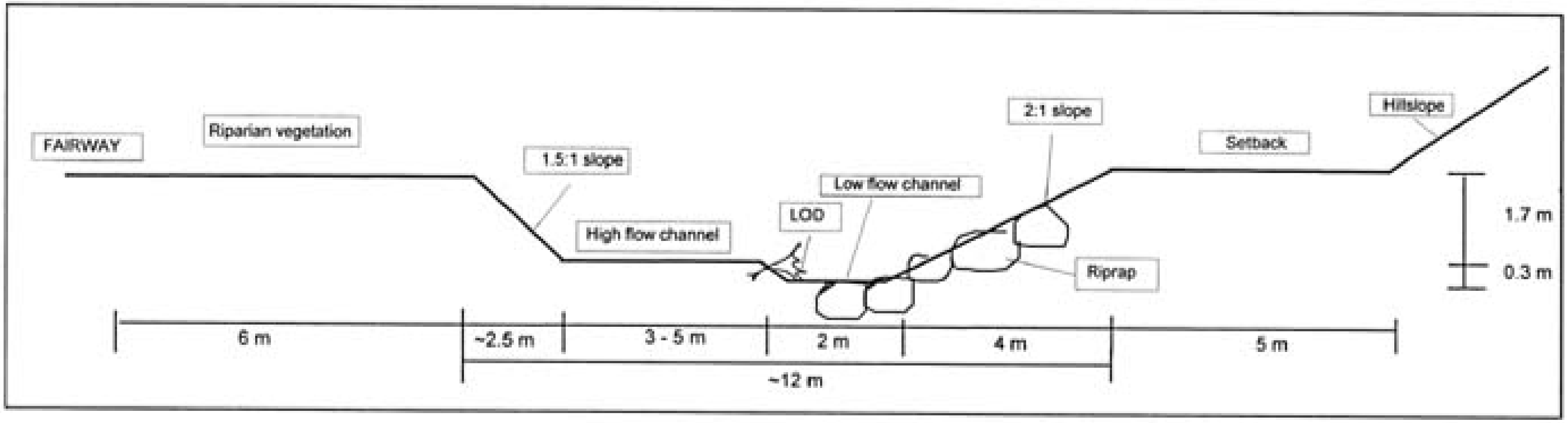


Table 1 Riparian Vegetation Planting List

Common Name	Botanical Name	Size	Quantity		Totals
Deciduous Trees					
Paper Birch	*Betula papyrifera*	#1 / #5			
Sitka Alder	*Alnus sinuata*	#1			
Trembling Aspen	*Populus tremuloides*	#1 / #5			
Coniferous Trees					
Interior Douglas Fir	*Pseudotsuga menziesii*	#1 / #5			
Limber Pine	*Pinus flexilis*	#1 / #2			
Lodgepole Pine	*Pinus contorta*	#1 / #5			
Shrubs					
Alpine Current	*Ribes alpinum*	#1 / #2			
Arctic Willow	*Salix arctica*	#1			
Canada Blueberry	*Vaccinium myrtilloides*	#1 / #2			
Elderberry	*Sambucus racemosa*	#1 / #2			
Labrador Tea	*Ledum groenlandicum*	#1			
Prickly Rose	*Rosa aciculais*	#1			
Pussy Willow	*Salix discolor*	#1			
Red-osier Dogwood	*Cornus stolonifera*	#1 / #2			
Sandbar Willow	*Salix exigua*	#1			
Saskatoon berry	*Amelanchier alnifolia*	#1 / #2			
Sitka Mountain Ash	*Sorbus sitchensis*	#1			
Soopolallie	*Shepherdia canadensis*	#1 / #3			
Tall Oregon-grape	*Mahonia aquifolium*	6 cm			
Thimbleberry	*Rubus parviflorus*	#1 / #2			
Wood's Rose	*Rosa woodsii*	#1			

3.3 Third to Fifth Fairway - Intermediate Reach

3.3.1 Channel Requirements

This stream section, as shown in Dwg's H-4 and H-5 consists of a natural channel bordered, for the most part, by trees on both banks. Two potential avulsion sites are noted due to low banks and remnant channels. These banks should be built up with training berms to a height of approximately 1.5 m above channel bed. Riprap should be placed along the berm toe to a height of 1 m. The berms upper slope should be revegetated and treed to enhance erosion protection.

Although two cart bridges are shown in Dwg. H-5, neither of these are to be installed at present (pers. comm. D. Ogilvy) and therefore no erosion protection is required for abutments. All cart paths are to presently to be constructed as "tee-to-green".

3.4 Fifth Fairway - Stream Rehabilitation in Disturbed Area

3.4.1 Channel Requirements

The basic cross-sectional profile is similar to the upper section of Hopeful Creek as illustrated in Figure 1. Since the existing stream bed will not be altered with these works, all channel bank works should take place outside the wetted perimeter of the stream.

Riprap should be located as listed on Drawing H-6 and detailed in Section 2.1. These areas cover the outside bends and the up and downstream sections of the bridge. Riprap should also be placed along the interior walls of the bridge cribbing. The bridge should be a clear span unit with log cribs tied into the creek slopes.

Gabions were originally specified in the originally report but have been omitted based on site visits to the sites in question.

3.4.2 Riparian Vegetation

As with the riparian replanting program of the 3rd Fairway relocation, replanting of the 5th Fairway riparian zone should comprise species listed in Table 1. Shrubs would typically be planted on 0.5 to 1 m centres. Trees will also be planted in the riparian strip, between the golf course and the stream's top of bank, where sight lines do not come into play. Trees will generally be planted on 3 - 4 m centres.

3.4.3 Habitat Enhancement

In addition to the channel bank works a number of complexing structures should be installed as Habitat Enhancement. These include eight log or rock wing deflectors, to encourage the low/moderate flow channel to meander within the high flow channel, seven log wedge dams to provide for stepping of the channel and encourage the formation of plunge pools at their downstream end, five logs placed for undercut bank habitat, placement of boulders in clusters at the distal end of the pools formed at four of the wedge dams, and placement of at least four anchored stumps in the channel for LOD cover. Approximate locations of the complexing structures are found on Drawing H-6

4.0 Little Hopeful Creek Design Requirements

4.1 Sensitive Channel Reaches

No sensitive reaches were identified since the water course presently exists in a heavily modified state.

4.2 Stream Relocation and Rehabilitation

4.2.1 Channel Requirements

Riprap requirement for Little Hopeful Creek will be finalized pending final design of the stream alignment and pond locations. Figure 2 provides a typical cross section.

Riprap should be installed in the following locations:

- along the outside banks at stream bends - to a height of 1 m above the channel bottom
- along the channel bottom at the outlet of ponds - coverings a section 5 m into the pond and 5 m into the stream
- along the banks at bridge crossings - for 5 m both up and downstream of the structure as well as lining the abutments

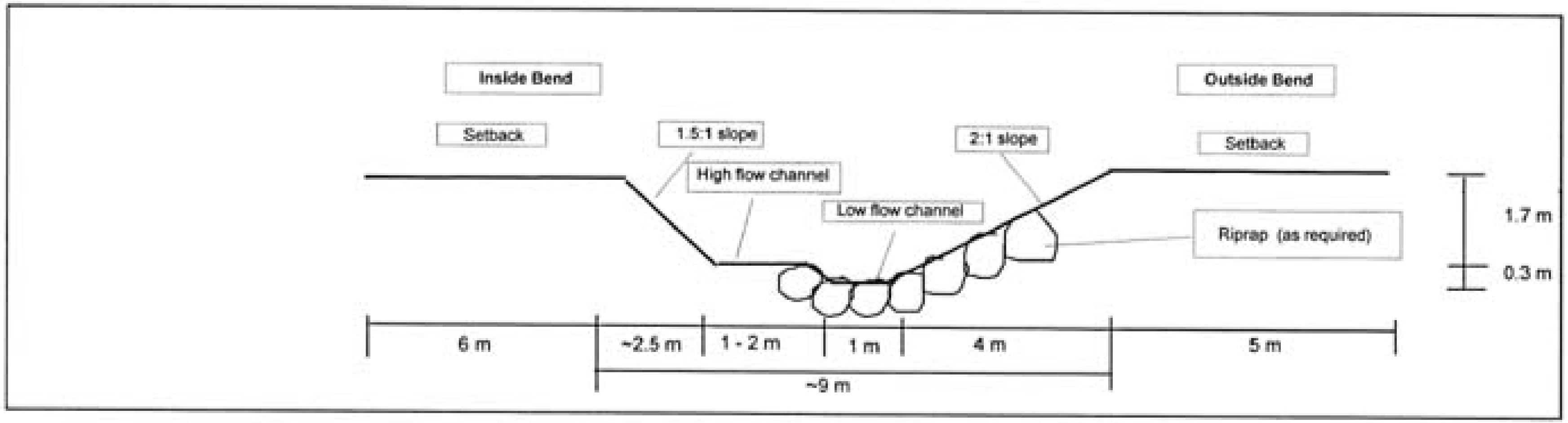
4.2.2 Riparian Vegetation

This will be covered in an appended document.

4.2.3 Habitat Enhancement

This will be covered in an appended document.

Figure 2 Little Hopeful Creek - Typical Channel Cross-section



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6.0 Drawings

Appendix I - IMC Hydrology Report

IMC
Consulting
Group

COPY

26 July, 1996
File: C1-0844-3

Intrawest Corporation
Suite 800 - 200 Burrard Street
Vancouver, BC
V6C 3L9

Attention: **Mr. Douglas Ogilvy**

Dear Sir:

Reference: **Panorama Resort**
Hopeful Creek Design Flows

IMC Consulting Group is pleased to submit this letter report which addresses the results of our hydrologic analysis relative to the proposed Hopeful Creek and Little Hopefull Creek relocations. Relocations will be undertaken in conjunction with proposed golf course construction at Panorama Resort.

Figure 1 shows the watershed drainage boundary for Hopeful Creek at its confluence with Toby Creek, which is based on existing 1:50,000 scale topographic mapping (National Topographic System). The drainage areas are 16.95 km² for Hopeful Creek itself and 3.75 km². for Little Hopeful Creek.

Two methods were used to identify design flows:

1. Streamflow Analysis
2. Rainfall Analysis

In both cases, the one in one hundred (1:100) year return period was used as the design basis.

The stream flow analysis, which considers primarily runoff from snow melt, involved frequency analysis of historic streamflow data for nearby locations. The closest active stream gauge stations are located on the Palliser River system about 45 km to the east, and on the Fry Creek system about 50 km to the south west. The stations used are described as follows:

Station 08NF005	(Albert River at 1310 m Contour) - period of record from 1973 to 1995 - contributing drainage area is 69.7 km^2
Station 08NF006	(Palliser River in Lot SL49) - period of record from 1973 to 1994 -contributing drainage areas is 653 km^2
Station 08NH130	(Fry Creek below Carney Creek) - period of record from 1973 to 1995 - contributing drainage area is 461 km^2
Station 08NH131	(Carney Creek below Pambrun Creek) - period of record from 1973 to 1995

In all case, the maximum instantaneous discharges were used. Some years did not have maximum instantaneous discharge recorded, so estimates were made using the maximum daily discharges for that particular year.

The results of the frequency analysis yield estimates of the 1:100 year event discharges ranging from 0.3 to 0.6 $m^3/s/km^2$. Using a unit discharge of 0.6 $m^3/s/km^2$, the 1:100 year event discharges are 10.2 m^3/s for Hopeful Creek and 2.3 m^3/s for Little Hopeful Creek.

The rainfall analysis involved estimating the runoff resulting from a 1:100 year event design storm for the Panorama area. Using the rainfall data provided in the "Rainfall Frequency Atlas for Canada" (Hogg and Carr, 1985) a design storm with the Chicago distribution was derived. The variation of intensity versus time (hydrograph) for this design storm is illustrated by Figure 2, which shows the intensities at increment of 30 minutes.

The OTTHYMO Computer model (Version 1989) was used to compute runoff from the Hopeful Creek watershed. This model is commonly used throughout Canada, which utilizes the instantaneous unit hydrograph technique for determining runoff from a single storm event.

The 1:100 year event peak discharges as determined by the rainfall analysis are 18.3 m^3/s for Hopeful Creek and 4.8 m^3/s for Little Hopeful Creek. Experience has shown that runoff from rainfall tends to govern for small watersheds such for Hopeful Creek and Little Hopeful Creek. It is therefore our recommendation that the 1:100 design flows as determined by the rainfall analysis be used for design purposes.

According to the preliminary design report prepared by Geo-Alpine, the Hopeful Creek relocation will result in a compound channel section such as that shown by Figure 3 with a longitudinal slope of about 7.0 %. We estimate that the 1:100 year event flow depth and velocity will be 0.83 m and 3.4 m/s respectively. Accordingly, we recommend the following rip-rap requirements for erosion protection of the channel:

100 % smaller than 600 mm dia.
at least 20 % larger than 500 mm dia.
at least 50 % larger than 400 mm dia.
at least 80 % larger than 300 mm dia.

This armour should extend up the side slopes to an elevation of 1.0 m above the bottom of the low flow channel, as well as continuously throughout the bed of the low flow channel itself.

A smaller channel section was also considered which involved a 3m wide high flow channel. In this case the flow depths and velocities are only marginally increased to 0.88 m and 3.6 m/s respectively. The above rip-rap requirements are still applicable.

A simple trapezoidal channel geometry for Little Hopeful Creek was considered, with a slope of 7.0 % and bottom width of 3.0 m. The 1:100 year event depth of flow and velocity are estimated to be 0.46 m and 2.7 m/s respectively. The following rip-rap requirements are recommended:

100 % smaller than 400 mm dia.
at least 20 % larger than 300 mm dia.
at least 50 % larger than 250 mm dia.
at least 80 % larger than 200 mm dia.

We trust this will be satisfactory, and will be pleased to discuss the results further with Intrawest or Geo-Alpine.

Sincerely,

IMC CONSULTING GROUP INC.

Rick D. Carnduff, M. Eng., P. Eng.
Associate

Enclosure

cc: Mr. M. Cole, Geo-Alpine

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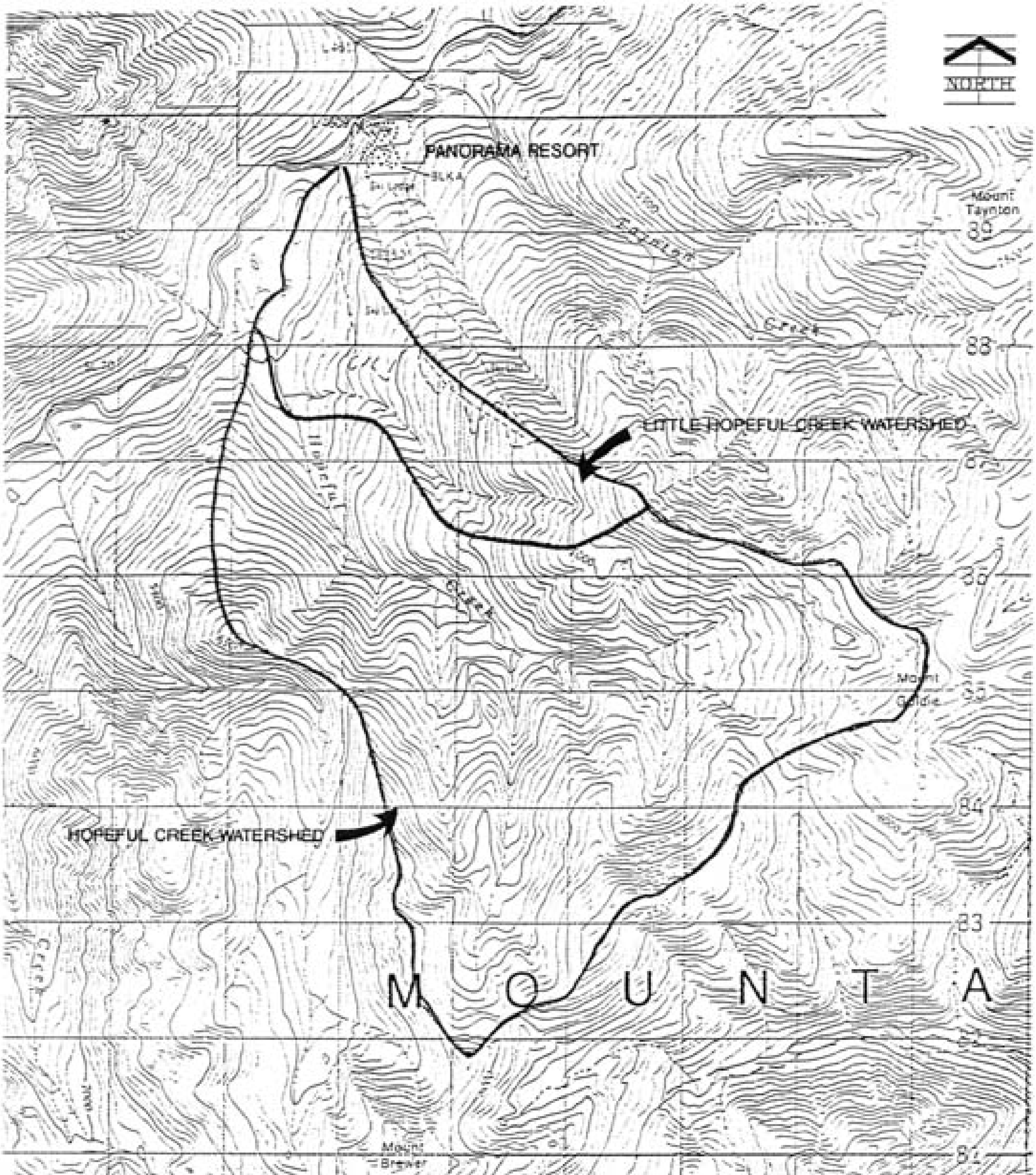

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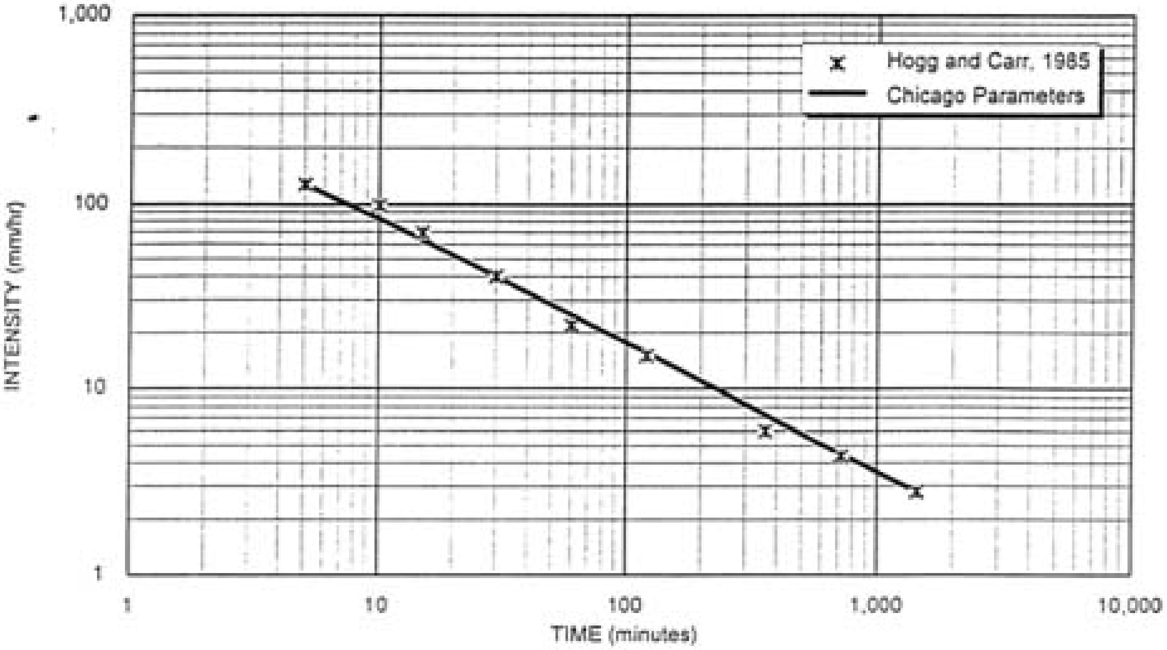
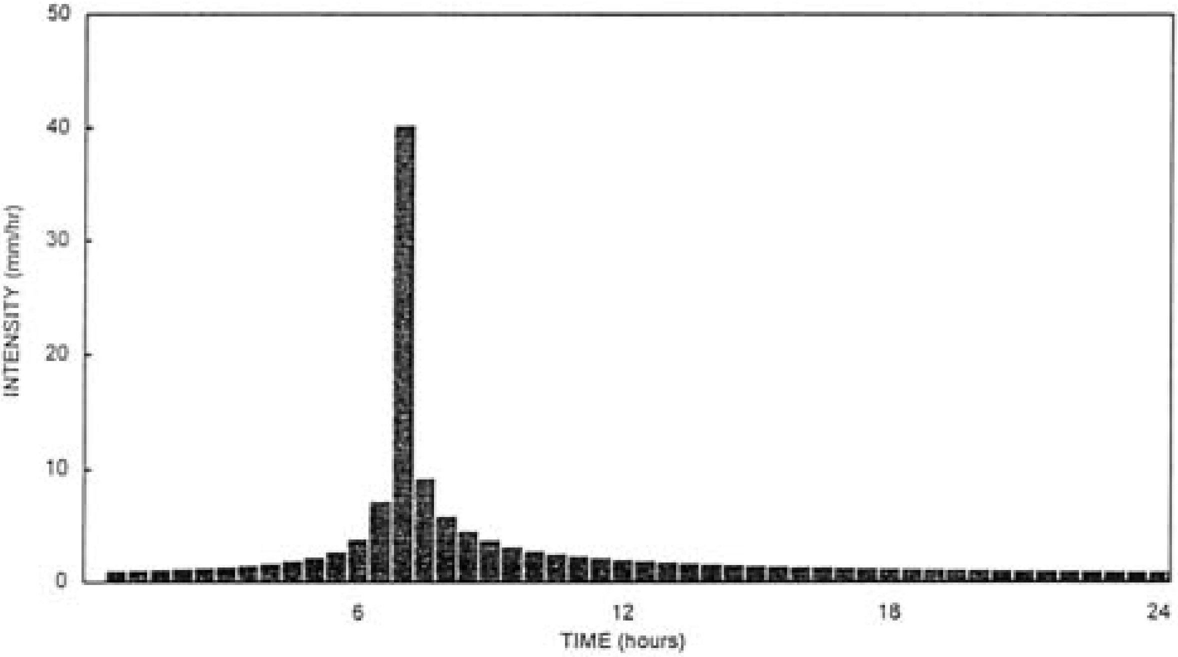
PANORAMA RESORT - HOPEFUL CREEK RELOCATION

HOPEFUL CREEK WATERSHED BOUNDARY

Figure 1



(a) Intensity-Duration Relationship



(b) Distribution of Intensity Versus Time

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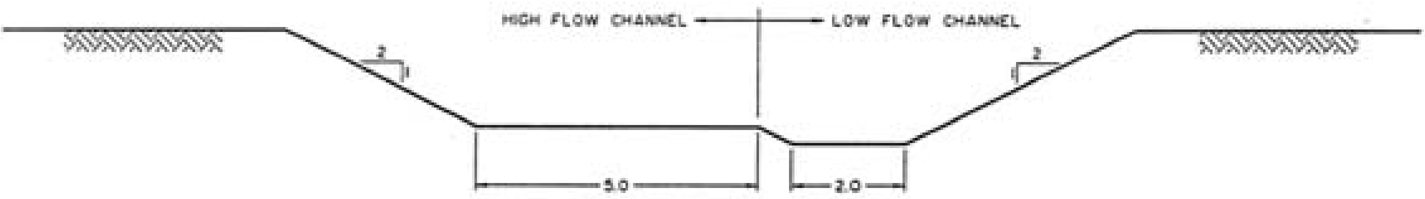
PANORAMA RESORT - HOPEFUL CREEK RELOCATION

1:100 YEAR CHICAGO DESIGN STORM

Figure 2



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PANORAMA RESORT - HOPEFUL CREEK RELOCATION

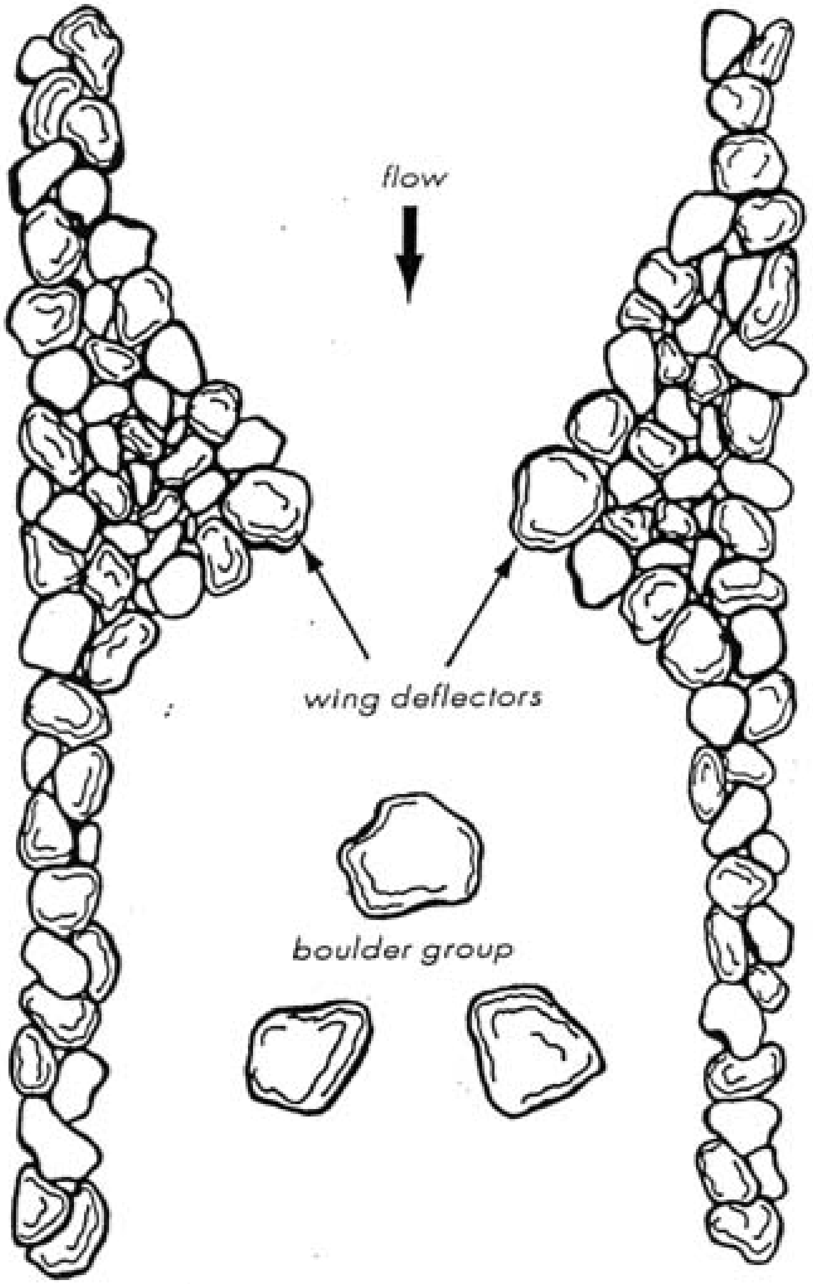
TYPICAL CHANNEL SECTION

Figure 3

Appendix II - Stream Channel Habitat Structures

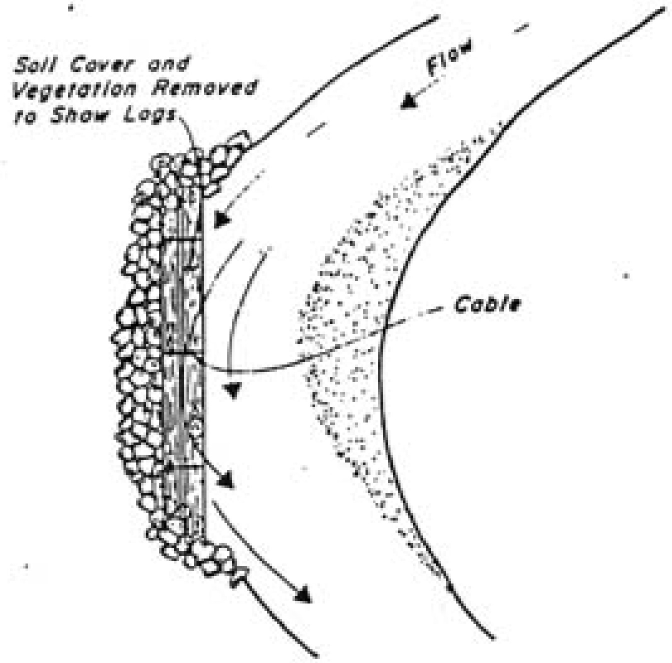
Examples of Typical Complexing Structures taken from Hunter, 1991, KWL and Lister, 1980 and Envirowest, 1990

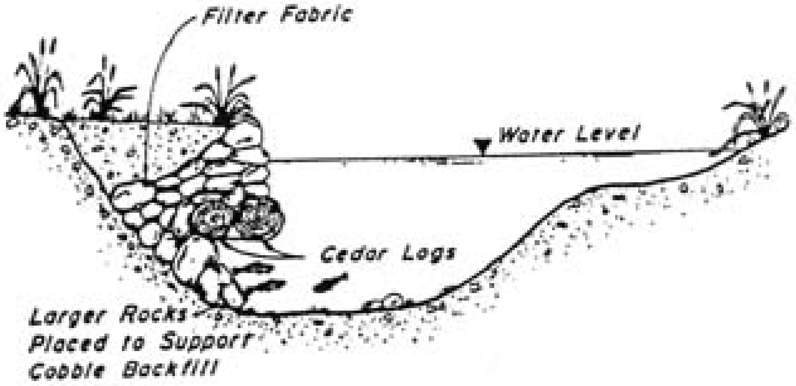
Examples of Typical Complexing Structures taken from Hunter, 1991, KWL and Lister, 1980 and Envirowest, 1990

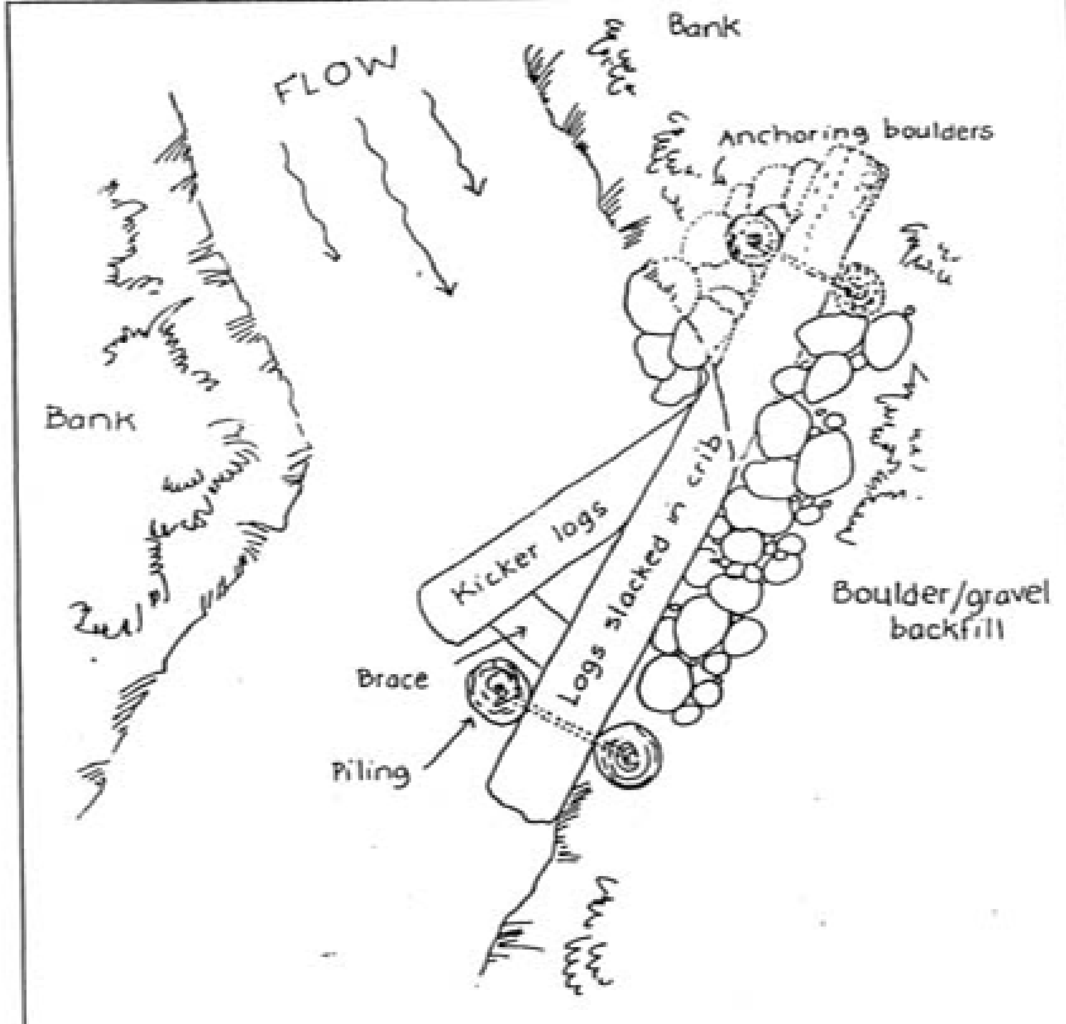


Hopeful Creek - Panorama Resort
Preliminary Stream Relocation Design

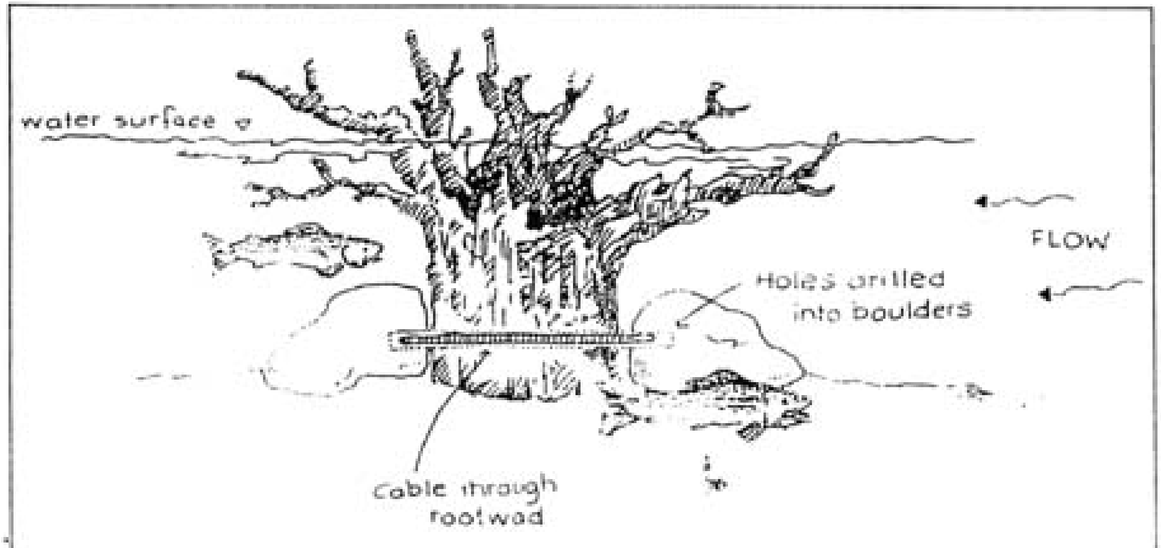
Job # 014.0103







7.22 Log-crib bank protection. *Aerial view of a log-crib structure designed to protect a rapidly eroding stream bank near a campground.*



7.19 Boulder grouping. *Side view of a boulder group with an attached root wad to provide cover.*

ENVIRONMENTAL

HOPEFUL CREEK, FINAL STREAM RELOCATION DESIGN

June 1996

Hopeful Creek - Panorama Resort

Preliminary Stream Relocation Design

Prepared for:

Intrawest Development Corporation
Panorama Resort
Panorama, B.C. V0A 1T0

July 1996

Prepared by:

GEOALPINE
ENVIRONMENTAL CONSULTING
3132 Alta Vista Road, Whistler, BC V0N 1B3

Hopeful Creek - Panorama Resort
Preliminary Stream Relocation Design

Job # 014.0103 02/07/96

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Hopeful Creek - Panorama Resort
Preliminary Stream Relocation Design

Limitations

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1.0 Introduction

As part of the proposed development of the golf course at Panorama Resort, Intrawest Corporation plans to relocate approximately 275 m of Hopeful Creek and 1080 m of Little Hopeful Creek. In addition, approximately 310 m of Hopeful Creek and 2300 m of Little Hopeful Creek that have been previously disturbed will be enhanced to take advantage of their full biophysical potential. The present conditions of these creeks have been recently described in the report "Bio-Inventory of Hopeful Creek, Near Invermere, B.C." commissioned by Intrawest Development Corporation (GEC,1996). Dave Williamson, B.E.S, Mike Nelson, R.P.Bio., Ethan Askey, M.R.M. and Mike Cole, P.Eng. collaborated in the production of this report. Field data, and photographic records were collected by Mike Nelson during site visits conducted in the preparation of the bio-inventory.

This document deals with the rehabilitation of Hopeful Creek; specifically the distrurbed and relocated sections. Issues relating to the undisturbed sections of Hopeful Creek should be dealt with in future reports.

Although references to Little Hopeful Creek appear in this report, similar issues relating to Little Hopeful Creek will be dealt with in a separate document when channel alignments are finalized.

Map H-2, appended to this report, shows the present location of the two creeks. Drawings H-3 through H-6 provide detailed channel protection information for Hopeful Creek. Drawings H-3 and H-6 identify the proposed relocations and the enhancement details for Hopeful Creek. Pending further investigation, streambank protection works covered in Drawings H-4 and H-5 will be appended to this report.

1.1 Stream Hydrology

1.1.1 Available Data

Peak flow values provided herein are based on empirical equations and regional rainfall data provided in the Rainfall Frequency Atlas of Canada Atlas (1985). The values presented are preliminary values for use in calculating channel configurations and riprap sizing. It is the belief of GeoAlpine that these values are conservative. Further site-specific studies into the hydrology of Panorama and the associated watercourses could provide more precise hydrologic values and, hence, potentially reduce construction costs by reducing required stream protection. Furthermore, GeoAlpine engineering staff were not able to visit the study site before the time of issue of this report. Information regarding channel and bank morphology as well as slope composition would greatly increase the utility of the report.

It is understood that a more detailed and pending hydrological analysis, conducted by I.M.C. Consulting Group, will attempt to calibrate local stream data from watersheds with similar characteristics.

1.1.2 Return Periods

To assist in the determination of channel sizing and habitat enhancement works, design flows were calculated according to the following rationale
:

Return periods for Hopeful Creek and Little Hopeful Creek within this study have been designated based on the consequences of flooding of the respective watercourses.

Design flows for Hopeful Creek are based on a 50-year return period. No residential units are proposed along the banks of this stream and flooding would primarily impact the golf course. Designing to a 50-year return period peak flow will provide a moderate degree of assurance that the landscaping will be protected from stream erosion.

Due to the proposed residential development along the lower reaches of Little Hopeful Creek, design flows for were based on a 100-year return period.

1.1.3 Peak Flow Calculations

Peak flows ,Q_p, for the two catchments are based on the following parameters for the rational formula method (MOE, 1991):

		Hopeful	Little Hopeful
I	Rainfall Intensity (mm/hr)	determined below	determined below
A	Catchment Area (km^2)	17	1.7
R	Runoff Factor	0.70	0.70

Rainfall intensity is based on the time of concentration ,T_c , for a particular basin. Time of concentrations were calculated using the Hathaway formula (MOE, 1991), based on the following parameters:

		Hopeful	Little Hopeful
L	Catchment length (m)	7000	4300
n	roughness coefficient	0.70	0.70
S	Basin slope	20%	29%

From these data, time of concentrations of approximately 2.0 and 1.3 hours and were determined for Hopeful and Little Hopeful, respectively. From the Rainfall Frequency Atlas of Canada Atlas (1985), cumulative rainfall depths of 25.4 mm and 25 mm were determined for the design events, for Hopeful and Little Hopeful, respectively.

		Hopeful	Little Hopeful
T_c	Time of concentration (hr)	2.0	1.3
	Return Period	50	100
I	Rainfall Intensity (mm/hr)	12.7	19.2
Q_p	Peak flows (m^3/s)	**42.3**	**6.4**

Based on these rainfall intensities, peak flows of 42.3 and 6.4 m^3/s were calculated for Hopeful and Little Hopeful, respectively.

Please note that the peak flow for Hopeful Creek represents a very significant quantity of water. In the event of such a flow, it is likely that the creek will overtop its banks and flow overland. Although details of recommended erosion protection are listed below in Section 2.1, a preliminary hydraulic study cannot predict the behaviour of this creek under a design flow event.

1.2 Aquatic Habitat Assumptions

The fish bearing status of Hopeful and Little Hopeful Creeks has not been established conclusively. Toby Creek, into which both the subject creeks flow is noted to contain bull trout, and is suspected to contain cutthroat trout, in the vicinity of Panorama Resort. The Bio-Inventory indicates that the conditions in Hopeful Creek are conducive to a population of cutthroat trout. A fisheries sampling program is planned for Hopeful Creek in July of 1996. Until that time, the creek will be considered as fish bearing, with the design reflecting the habitat requirements of a cutthroat trout population.

Little Hopeful Creek, however, has been subject to considerable disturbances in the past, including several culverts and in stream settling ponds, which have no surface outlet. It is therefore considered to be barren. In the pending report Little Hopeful Creek will similarly be designed to reflect the habitat requirements of cutthroat trout, even though it is considered barren. This design will ensure that the fisheries potential of the creek is retained and enhanced, so that if access problems are rectified, Little Hopeful Creek could become fish bearing.

2.0 Design Requirements

2.1 Erosion Protection

Bank protection in sensitive sections of Hopeful Creek is extremely important due to the high design flows. Both riprap and gabions are recommended to be used under different circumstances. Riprap provides economical erosion protection in and along river sections exposed to constant flow. Gabions (wire-mesh baskets) provide erosion protection in river sections exposed to periodic high flows. Gabions are less resilient than riprap to long-term hydraulic exposure but perform well under high flow conditions due to their interconnected nature. Gabions are recommended as a secondary line of defence in areas of high potential bank erosion.

From the contour mapping provided to GeoAlpine, it appears that Hopeful Creek has a moderate to high risk of avulsion. The consequences of avulsion are covered separately in Section 3.1.

2.1.1 Riprap

The present channel can be reinforced with strategic armoring to reduce the possibility of channel meandering or avulsion. Normally, riprap is placed along the outside of stream bends and as inlet outlet protection for features such as bridges and culverts. Riprap for Hopeful Creek should be defined in the detailed engineering report to follow.

2.1.2 Gabions

Gabions are designated in areas where it is essential to retain the stream in its designated course. Gabions are to be placed above the normal stream level and may be built into embankments and vegetated.

Specific basket dimensions are not provided herein although the 1x1x3 m baskets should be used for the main training works, stacked to a maximum of two units high. Gabions are susceptible to toppling failure due to their interconnected nature and, hence, baskets should be placed with an appropriate foundation layer of large riprap or of 0.3x1x3 m baskets.

2.1.3 Bridge Crossings

Crossings should be designed as full span structures (across tops of bank) with no constriction of the channel. Log cribs could be used tied into the creek banks at 45° from the channel alignment. The bridge stringers should not protrude more than 0.45 m below the top surface of the bridge deck. A minimum clearance of 2.0 m is suggested from the bottom of the bridge stringers above the low water level. Riprap should also be placed along the interior walls of the bridge cribbing as well as along the banks for 5 m both upstream and downstream of the structure.

2.2 Habitat Requirements

The stream relocations will provide habitat for a potential cutthroat population. Habitat features and structures should be incorporated into the relocation designs. The stream gradients within the proposed diversion areas are more conducive to providing rearing habitat than spawning habitat. However, a portion of the gravel that is suitable for spawning will accumulate downstream of the proposed step pool structures. The existing non-disturbed sections of Hopeful Creek will be used as a model for the diverted and enhanced areas. To this end, the sequence of pool-glide-riffle complexes present in the natural channel will be emulated in the relocations. This will be accomplished by establishing a series of wedge dams (reverse "V" log weirs) at approximately 40 m spacings (see Appendices for sketches of stream channel complexing features).

A low to moderate flow channel should be established within a larger high water channel. The low/moderate flow channel would meander somewhat within the larger channel. This would be accomplished by using either rock wing deflectors or log wedges (kicker logs) to establish meander bends at distances separated by approximately 7 to 10 stream widths.

Created habitat features should include:
- cutbank cover, using logs secured to the bank and floating logs anchored to large boulders (riprap);
- LOD (large organic debris) such as stumps and trees anchored to large rocks; and
- establishing boulder cover in clusters.

Appropriate riparian vegetation should also be planted in areas adjacent to the channel and within the channel between the low/moderate flow channel and the high water channel.

2.3 Installation Constraints

- All instream works should be conducted in accordance with the terms and conditions of approval under Section 7 of the Water Act.
- All channel works should halt during storm events.

3.0 Hopeful Creek Design Requirements

Two areas along Hopeful Creek are designated for protection and vegetation works:
- Third Fairway Relocation (Section 3.2)
- Fifth Fairway Rehabilitation (Section 3.3)

3.1 Sensitive Channel Reaches

Two potential avulsion locations are readily apparent as shown on Drawing H-2. Both locations are entrance points of previous channels. Although reshaping of the land will be completed as part of fairway construction, it is believed that protection is required. These two locations must be protected to reduce the possibility that Hopeful Creek will flow overland and occupy the Little Hopeful Creek channel. This could cause large-scale damage to the proposed fairways as well as residential units downstream. Erosion protection and training works for these sites are discussed in the following sections.

Drawing H-3

Hopeful Creek - Panorama Resort
Preliminary Stream Relocation Design

Job # 014.0103

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Drawing H-6

Hopeful Creek - Panorama Resort
Preliminary Stream Relocation Design

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02/07/96

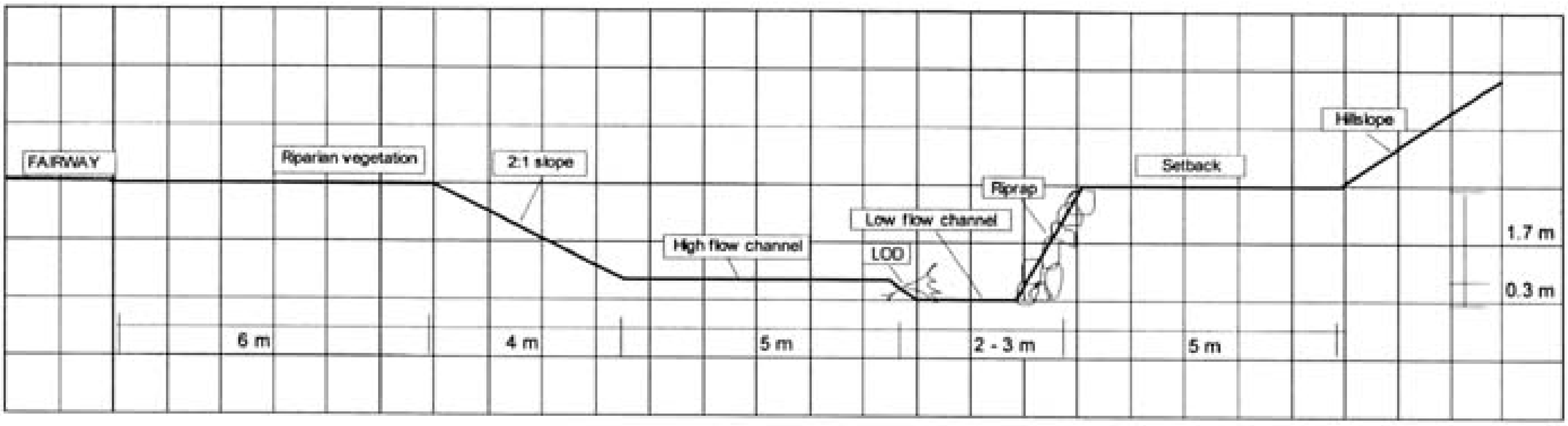

Figure 1 Hopeful Creek Typical Channel Cross-sectional Profile

3.2 Third Fairway - Relocation

The first area of channel works is located along the 3rd Fairway (see Drawing H-3).

3.2.1 Channel Requirements

The present plan calls for the relocating Hopeful Creek which currently flows through the fairway's first landing area. It is proposed to relocate this 200 m section of stream to between the landing area and the tees. This arrangement will lengthen the stream to 275 m, resulting in a gradient reduction from 10 % to 7 %. The alignment of the repositioned channel has been altered slightly to respond to certain hydraulic considerations. Total proposed channel width (across tops of bank) is 8 m.

The proposed channel, shown on Drawing H-3 will consist of 2.5 m to 3 m wide, by 0.3 m deep low/moderate flow channel, within a 8 m wide by 2 m deep, high flow channel/vegetated bar. This configuration will allow the high flow bar to be planted in a riparian shrub cover. Shrubs and trees should be planted between the 3rd fairway and the stream's top of bank. The minimum distance from the top of bank to the edge of the fairway will be 5 m (Drawing H-3). Figure 1 shows a typical cross-section of the constructed channel for Hopeful Creek.

A 5 m setback is recommended from the break in slope of the main hillside to the top of bank of the channel. Slope materials are unknown at present and could potentially pose concerns such as retrogressive failure etc. This would contribute high sediment loads to Hopeful Creek. Remediation of such eroding banks would also be difficult do to their location.

Riprap should be located as listed on Drawing H-3 and detailed in Section 2.1.1. These areas cover the outside bends and the up and downstream sections of the bridge. Riprap should also be placed along the interior walls of the bridge cribbing. The bridge should be a clear span unit with log cribs tied into the creek slopes as described in Section 2.1.1.

Gabions should be located along the drop in slope below the final tee on the third hole as listed on Drawing H-3. The purpose of this line of gabions is to deflect overland flow from Hopeful Creek from entering the Little Hopeful channel. The baskets should be placed into the slope and stacked 2 units high. A foundation layer should also be provided as described in Section 2.1.2.

3.2.2 Habitat Requirements

Suitable species for use in the riparian replanting program and for use on the vegetated bar are shown below in Table 1. The precise planting scheme has not as yet been developed, but will include low growing shrubs and a suitable ground cover on the vegetated bar and in areas between the 3rd fairway and the stream's top of bank where lines of site are required for golf course play. Shrubs would typically be planted on 0.5 to 1 m centres. Trees will also be planted in the riparian strip, between the golf course and the stream's top of bank, where sight lines do not come into play. Trees will generally be planted on 3 - 4 m centres.

A suitable ground cover will be determined under consultation with the golf course architect, as it is likely that typical reclamation mixes will not be compatible with the adjacent golf course use (typical reclamation mixes contain a blend of various grasses and clovers which are undesirable on the golf course fairways).

3.2.3 Instream works

Several complexing structures (as discussed in Section 2.2) have been incorporated into the design of the relocated stream channel. These include three log or rock wing deflectors, to encourage the low/moderate flow channel to meander within the high flow channel, five log wedge dams to provide for stepping of the channel and encourage the formation of plunge pools at their downstream end, four logs placed for undercut bank habitat, placement of boulders in clusters at the distal end of the pools formed at three of the sedge dams, and placement of numerous anchored stumps in the channel for LOD cover. Approximate locations of the complexing structures are found on Drawing H-3.

Table 1 Riparian Vegetation Planting List

Common Name	Botanical Name	Size	Quantity		Totals
Deciduous Trees					
Paper Birch	*Betula papyrifera*	#1 / #5			
Sitka Alder	*Alnus sinuata*	#1			
Trembling Aspen	*Populus tremuloides*	#1 / #5			
Coniferous Trees					
Interior Douglas Fir	*Pseudotsuga menziesii*	#1 / #5			
Limber Pine	*Pinus flexilis*	#1 / #2			
Lodgepole Pine	*Pinus contorta*	#1 / #5			
Shrubs					
Alpine Current	*Ribes alpinum*	#1 / #2			
Arctic Willow	*Salix arctica*	#1			
Canada Blueberry	*Vaccinium myrtilloides*	#1 / #2			
Elderberry	*Sambucus racemosa*	#1 / #2			
Labrador Tea	*Ledum groenlandicum*	#1			
Prickly Rose	*Rosa aciculais*	#1			
Pussy Willow	*Salix discolor*	#1			
Red-osier Dogwood	*Cornus stolonifera*	#1 / #2			
Sandbar Willow	*Salix exigua*	#1			
Saskatoon berry	*Amelanchier alnifolia*	#1 / #2			
Sitka Mountain Ash	*Sorbus sitchensis*	#1			
Soopolallie	*Shepherdia canadensis*	#1 / #3			
Tall Oregon-grape	*Mahonia aquifolium*	6 cm			
Thimbleberry	*Rubus parviflorus*	#1 / #2			
Wood's Rose	*Rosa woodsii*	#1			

3.3 Fifth Fairway - Rehabilitation

The second area of channel works is located near the 5th Fairway (see Drawing H-6).

3.3.1 Channel Requirements

The basic cross-sectional profile is similar to the upper section of Hopeful Creek as illustrated in Figure 1. Since the existing stream bed will not be altered with these works, all channel bank works should take place outside the wetted perimeter of the stream.

Riprap should be located as listed on Drawing H-6 and detailed in Section 2.1.1. These areas cover the outside bends and the up and downstream sections of the bridge. Riprap should also be placed along the interior walls of the bridge cribbing. The bridge should be a clear span unit with log cribs tied into the creek slopes.

Gabions should be located as listed on Drawing H-6 along the potential avulsion site. The purpose of this line of gabions is to deflect any overflow from Hopeful Creek from entering the previous channel alignment towards Little Hopeful Creek. The baskets should be placed into the slope and stacked 2 units high. A foundation layer should also be provided.

3.3.2 Habitat Requirements

As with the riparian replanting program of the 3rd Fairway relocation, replanting of the 5th Fairway riparian zone should comprise species listed in Table 1. Shrubs would typically be planted on 0.5 to 1 m centres. Trees will also be planted in the riparian strip, between the golf course and the stream's top of bank, where sight lines do not come into play. Trees will generally be planted on 3 - 4 m centres.

3.3.3 Instream Works

In addition to the channel bank works a number of complexing structures should be installed as instream works. These include eight log or rock wing deflectors, to encourage the low/moderate flow channel to meander within the high flow channel, seven log wedge dams to provide for stepping of the channel and encourage the formation of plunge pools at their downstream end, five logs placed for undercut bank habitat, placement of boulders in clusters at the distal end of the pools formed at four of the wedge dams, and placement of at least four anchored stumps in the channel for LOD cover. Approximate locations of the complexing structures are found on Drawing H-6

4.0 References

Department of Fisheries and Oceans & the Ministry of Environment, Lands and Parks (MOELP & DFO) (1993). *Land Development Guidelines for the Protection of Aquatic Habitat.*

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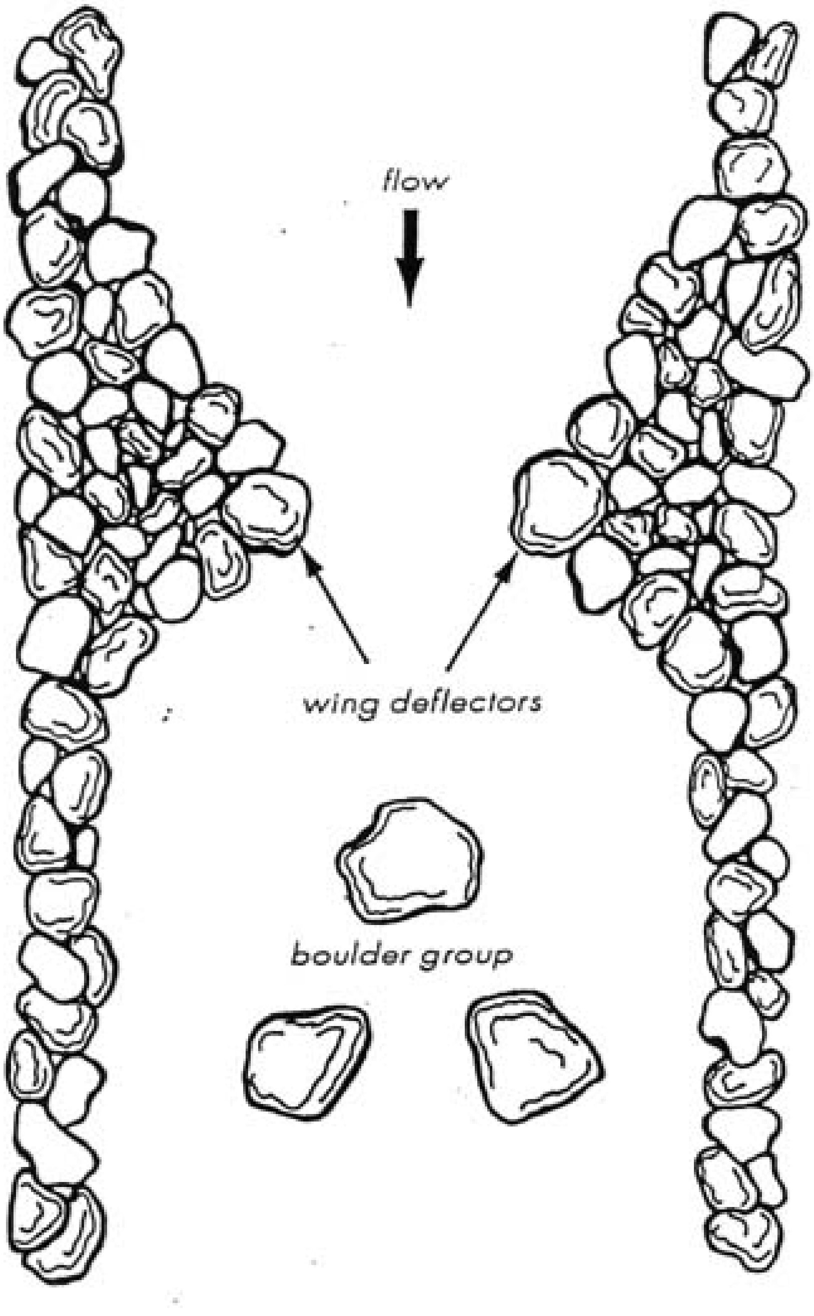
5.0 Appendices

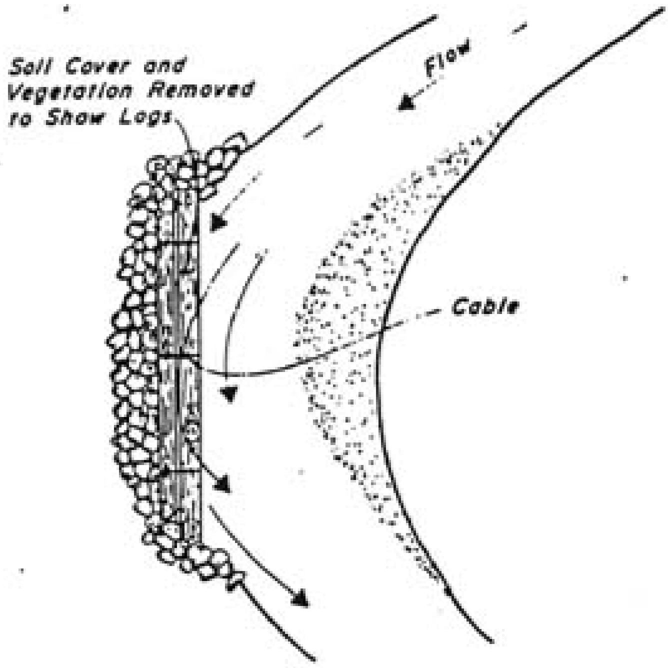
Examples of Typical Complexing Structures taken from Hunter, 1991, KWL and Lister, 1980 and Envirowest, 1990

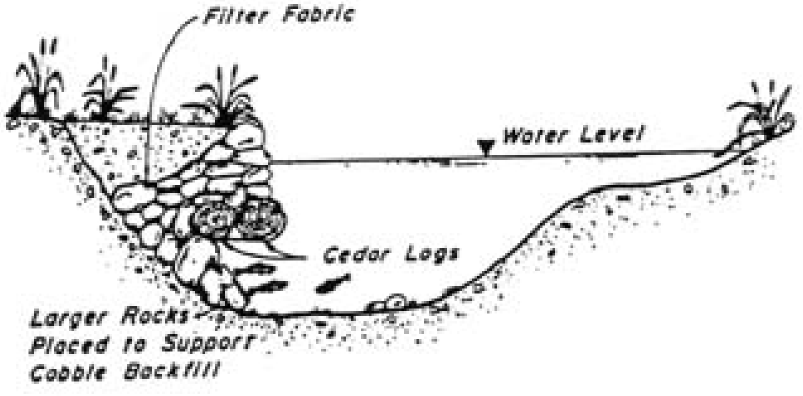
Examples of Typical Complexing Structures taken from Hunter, 1991, KWL and Lister, 1980 and Envirowest, 1990

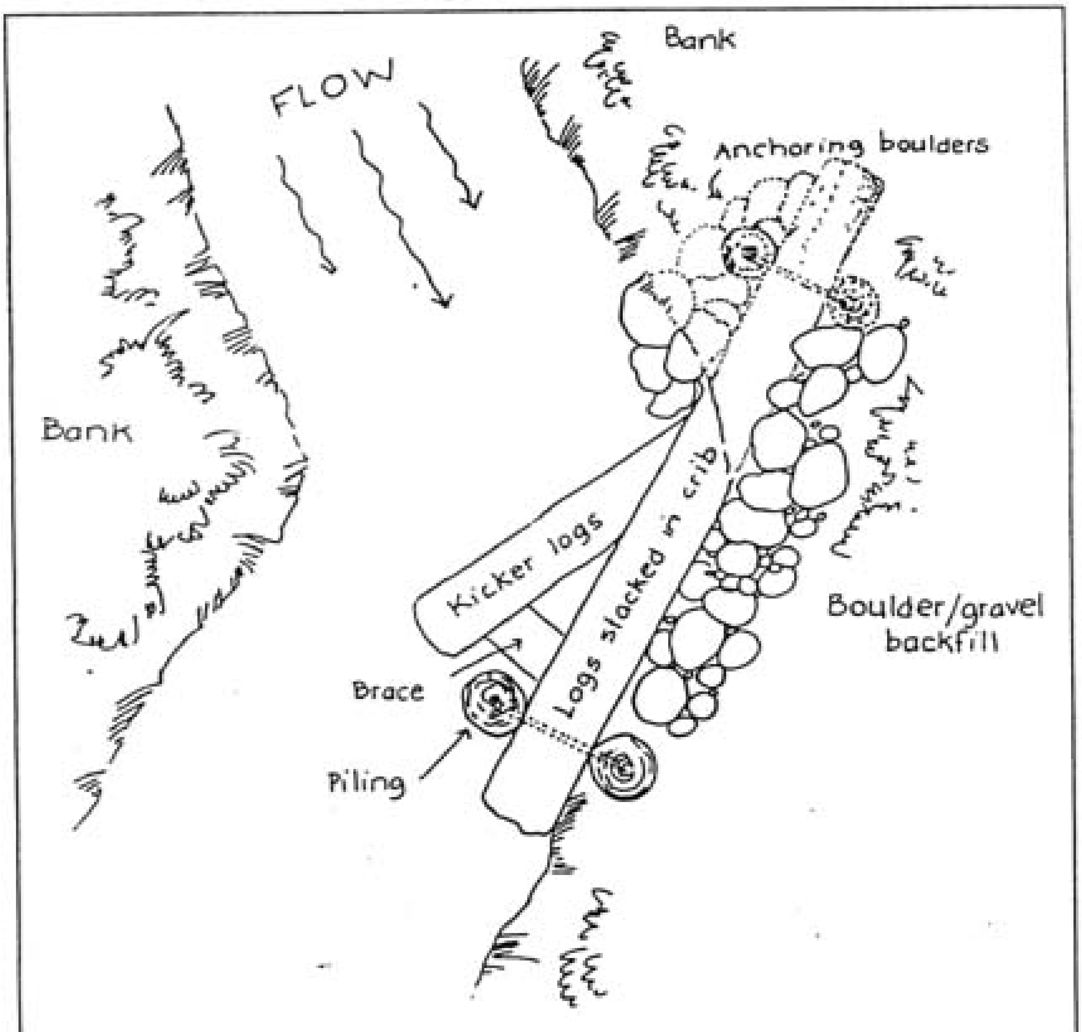


Hopeful Creek - Panorama Resort
Preliminary Stream Relocation Design

Job # 014.0103







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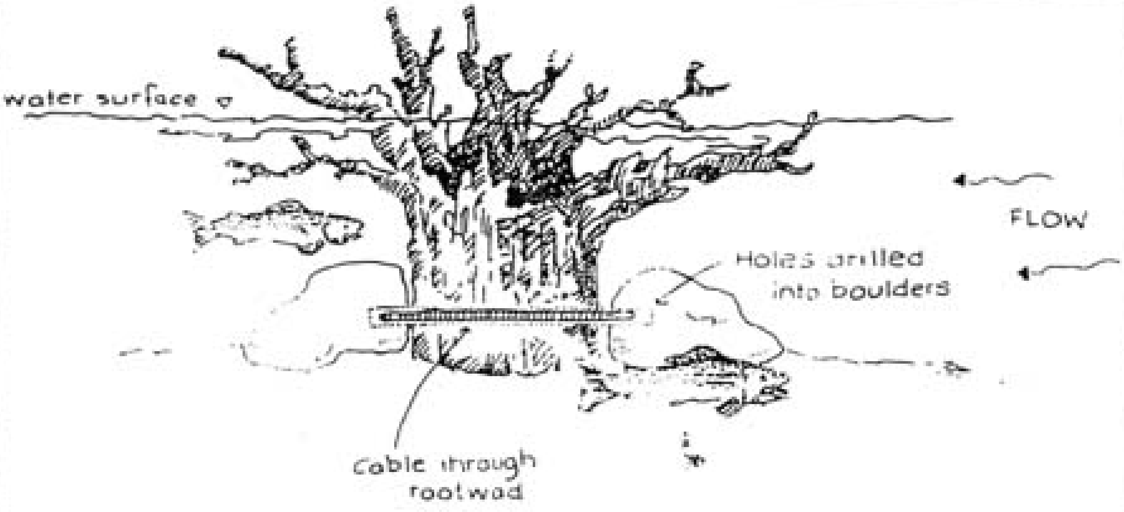

7.19 Boulder grouping. *Side view of a boulder group with an attached root wad to provide cover.*

PANORAMA
MOUNTAIN VILLAGE

ENVIRONMENTAL

BIO-INVENTORY OF HOPEFUL CREEK

May 1996

INTRAWEST

Bio-Inventory
of
Hopeful Creek, Near Invermere, B.C.

Panorama Resort

Prepared for:

Intrawest Development Corporation
Panorama Resort
Panorama, B.C. V0A 1T0

May 1996

Prepared by:

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3132 Alta Vista Road, Whistler, BC V0N 1B3

Bio-Inventory - Hopeful Creek, Near Invermere, B.C.
Panorama Resort,

Job # 014.0102

28/05/96

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Bio-Inventory - Hopeful Creek, Near Invermere, B.C.

Panorama Resort

1.0 Introduction

The Intrawest Corporation is planning to expand their recreational facilities at Panorama Resort, by construction of a golf course. The golf course was initially planned by the previous owner of Panorama Resort, who conducted the initial clearing and grubbing in 1989. Work was halted on construction of the course in that same year, and the golf course has remained in an unfinished state. Intrawest staff have revisited the old plans and have redesigned the golf course, taking advantage of the past clearing efforts. The present plans call for a full length 18 hole course, with a residential component. The present golf course plans call for five holes to be in close proximity to Hopeful Creek, with three of those five crossing the creek. In addition, two holes will be located along Toby Creek. Seven holes will be located in the vicinity of Little Hopeful Creek, which has been substantially altered by past "drainage improvements". Little Hopeful Creek will require rerouting in the present plan. Some of the residential component of the development is also in close proximity to Toby Creek (Map H1).

While permission was granted in 1989 to construct the initial golf course, an additional 38 ha of crown land, in two parcels, is required for the revised golf course layout. Intrawest are presently seeking to purchase these additional lands from the crown. BC Lands, through the referral process have asked for comments concerning the purchase from BC Environment. The proponent (Douglas Ogilvy, Intrawest) met with representatives from BC Environment (Doug Martin & Peter Holmes) to discuss there concerns in a meeting on May 2, 1996. In that meeting it was agreed that it was unlikely that Little Hopeful Creek would be fish bearing, while the fisheries capability of Hopeful Creek was not known. The purpose of this report, therefore, is to fill information voids to allow BC Environment to respond to the development by:

- conducting an aquatic biophysical (fisheries) assessment of Hopeful Creek,
- documenting the present biophysical status of Little Hopeful Creek,
- presenting options for enhancement opportunities on Hopeful Creek, and
- presenting a rationale for establishing fisheries sensitive zones (setbacks) on Hopeful and Toby Creeks.

2.0 Aquatic biophysical Habitat Assessment

Aquatic biophysical information was collected using standard DFO/MOELP Stream Survey forms by Mr. Mike Nelson, R.P. Bio., on May 7 and 8, 1996. The data was collected in accordance with the Stream Survey Field Guide (DFO, 1989) and BC Environment's Lower Mainland Region Stream Inventory/Assessment Methods (Bech, 1994). Fish collection was not conducted during the May site visit due to less than ideal electrofishing conditions in Hopeful Creek (i.e. cold temperatures) A future field trip is planed for late spring or early summer to elucidate fish presence in this system. Fish collection efforts will be conducted in accordance with the Fish-Stream Identification

Guidebook (BC Environment & BC Forest Service, 1985). If the fish collection efforts confirm absence of fish in Hopeful Creek, it may be possible to relax the guidelines (Chilibeck, 1992, Barnard, 1992).

2.1 Hopeful Creek

Within the golf course area, Hopeful Creek can be divided into two reaches based on the morphological characteristics of the stream. Reaches upstream of the proposed golf course were not explored. Fisheries and Oceans Canada/BC Environment Stream Survey forms for both reaches are attached in Appendix 1.

Reach 1

Location: Confluence with Toby Creek upstream 316 m to access bridge.

Description: At its confluence with Toby Creek, Hopeful creek has a gradient of 24 % for approximately 10 m (Photo 1). The channel width during this short section of this reach is 2.5 m, with predominantly riffle flow over a cobbley boulder substrate. For the remainder of the reach (Photo 2), the gradient ranged from 11 to 16 %, with a mean of six measurements of 15 %. The average channel width is 3.9 m, with a wetted width of 2.1 m. The channel is confined in a ravine ranging from 30 m deep and 80 m across near its mouth, to 15 m deep and 60 m across at its upstream reach break. The flow was categorized as 70 % riffle, 20 % pool and 10 % run over a gravely cobble substrate. Average maximum riffle depth was 15 cm with average maximum pool depth of 30 cm. Discharge measurements recorded 72 m upstream of the mouth determined a surface flow of 0.17 m^3/s. The water temperature was 2 °C, with water clarity greater than 1 m (May 7, 1996). There was some side channel development.

Stream cover was estimated at 40 %, being mainly provided by overstream vegetation, large organic debris (LOD), and deep pool, with lesser amounts of cutbank and a trace of boulder cover. Crown closure was estimated at 5%. Riparian vegetation consisted of a tree layer of trembling aspen, larch, lodge pole pine and Douglas fir, with a shrub layer of red-osier dogwood and alder. Ground cover was hard to assess due to the patchy snow cover.

Past anthropogenic impacts to this reach appear to be slight, although an old access road is located parallel to the entire reach, approximately 5 to 10 m from the creek's left bank. Other than the steep portion of the creek at its mouth, this reach does not appear to have any barriers to fish movements, and could provide a reasonable amount of plunge pool rearing habitat. The short high gradient section of this creek would pose a barrier to fish movements during low flows. During higher flows in Hopeful Creek and higher water levels in Toby Creek, this short section of creek would not be a significant fish barrier.

Reach 2

Location: Upper boundary of Reach 1 to the 1,300 m elevation contour.

Description: This reach is approximately 1,220 m long, extending from the access bridge at its lower reach through the entire golf course (Photos 3 & 4). Hopeful creek has an average gradient to 10 % in this reach (mean of 11 measurements), ranging from 5 to 15 The average channel width is 3.4 m, with a wetted width of 2.6 m. The channel is occasionally confined by the mountain sides. The flow was categorized as 60 % riffle, 30 % pool and 10 % run over a substrate ranging from predominantly gravels to gravely cobble with some boulder. The surface discharge was found to be 0.13 m^3/s near the upstream reach break. Average maximum riffle depth was 20 cm with average maximum pool depth of 40 cm. There was some side channel development. The waters were clear, with a temperature of 0.5 °C (May 7 & 8, 1996).

As with the lower reach, stream cover was estimated at 40 %. The cover was mainly provided by overstream vegetation, LOD, and deep pool, with lesser amounts of cutbank. Boulder cover became more prominent in the upstream portion of the reach. Crown closure ranged from 10 to 20 %. Riparian vegetation was similar to reach 1, consisted of a tree layer of trembling aspen, larch, lodge pole pine and Douglas fir, with a shrub layer of red-osier dogwood and alder. Ground cover was difficult to assess due to snow cover.

From the lower reach break to a point upstream 310 m, the creek and its associated riparian vegetation have been significantly altered by past golf course construction (Photo 5). The forest canopy has been removed in this area, as has been the shrub layer. The creek channel appears to have been "cleaned out", as there is almost no LOD. The channel is also wider than that found upstream, with banks at or steeper than the angle of repose, probably due to past excavation activity. Within this section, the flows are dominated by riffles, with little pool complexing.

The riparian vegetation was also cleared during past golf course construction adjacent to the creek from a point 740 m to 800 m upstream of the lower reach break. An access road crosses the creek at this clearing, with a 1200 mm diameter, 2.5 m long culvert (CSP - corrugated steel pipe). There is a 20 cm drop at the end of the culvert.

2.2 Little Hopeful Creek

Little Hopeful Creek can be divided into two reaches within the golf course area, and one reach upstream of the proposed golf course, based on the morphological characteristics of the stream. The Stream Survey form for reach 1 can be found in Appendix 1. Stream Survey forms for reach 2 and 3 were not completed, as reach 2 has been significantly altered by past ditching and reach 3 is very steep. Never-the less, a brief description of these sections of creek are described in the following section.

Reach 1

Location: Confluence with Toby Creek upstream 900 m to the settling ponds excavated during past golf course construction activity.

Description: The first 50 m of Little Hopeful creek (Photo 6) is somewhat steeper than the remaining portion of this reach, with an average gradient of 15% compared to the reach average of 4 %. This first section has a channel width of 3 m, with a wetted width of about 2 m, confined in a small ravine. The flows were predominately riffle, with a small amount of plunge pool. The remainder of the reach has flows characterized as 50 % riffle, 40 % run and 10 % pool (Photo 7). The average channel width was 1.7 m with a wetted width of 1.4 m. Total cover was estimated at 10 %, provided by overstream vegetation and lesser amounts of cutbanks and pool cover. There was only a trace of LOD. Bed material is predominately gravels and fines, with only a trace of small cobble. The stream was occasionally confined within a ravine. The water temperature was 5 °C and the turbidity was less than 10 cm visibility. The flows were high, overflowing the shallow banks in locales. The discharge was measured at 0.03 m^3/s. Riparian vegetation consisted of a tree layer of trembling aspen, spruce, lodge pole pine and Douglas fir (crown closure 20 %), with a sparse shrub layer of rose, willow, red-osier dogwood and alder. Ground cover was hard to assess due to the patchy snow cover.

There were several culvert crossing of Little Hopeful Creek within this reach, the most significant being 50 m upstream of the creek's confluence with Toby Creek. This CSP culvert was 900 mm in diameter and 6 m long. It facilitates a sewage main and a foot path crossing of the creek. It is set at a gradient of 10 %. A second CSP culvert is located 260 m upstream from the creek's mouth. That culvert is a 900 mm diameter CSP, 6 m long. It has a slope of 2 %. A third culvert is located at the heliport access Road. This is a concrete pipe, 750 mm inside diameter, 20 m long, set at a slope of about 3 - 5 %. Reach 1 ends at the settling ponds excavated during the past golf course construction. These ponds have no culverted or surface outflow. Water does, however, percolate through the porous cobble material that makes up the downstream end of the ponds (Photo 8).

Reach 2

Location: The settling ponds at the upper boundary of Reach 1 to 1,230 m upstream of the mouth.

Description: The entire 1,230 m length of this reach has been significantly altered by past golf course construction activity (Photo 9). At its downstream end, the creek consists of two settling ponds, each approximately 25 m long and 15 m wide. Through these ponds to the upstream reach break, the entire channel has been excavated to lower its bed. There are also numerous ditches excavated to drain the golf course area, that flow into this system.

Little remains of the native riparian vegetation in this reach. At the location where the Stream Survey Form was completed, there was no tree canopy, and no shrubs. Ground cover was also absent from within the ditches. The substrate was gravels and fines with a small component of cobble. The overall gradient is about 8 %. Flows within the main channel are exclusively riffle within the ditch. The average water depth is 10 cm within the 2 m deep ditch. The measured discharge 340 m upstream of the lower reach break was 0.03 m^3/s.

Reach 3

Location: Upper boundary of Reach 2 to its source on Panorama Mountain.

Description: This reach rapidly steepens to average gradients in excess of 25 %. The 1 m wide channel (wetted width of 0.5 m) is entrenched within a steep banked ravine. The substrate is well graded with almost equal amounts of larges, gravels and fines. The canopy cover was estimated at 25 %, comprised almost exclusively of lodgepole pine. Only approximately 100 m of the lower portion of this reach was surveyed.

2.3 Toby Creek

Toby Creek, a tributary of the Columbia River, is a fairly large system with a drainage area of about 400 km2. It flows in a northeast direction at the base of Panorama Mountain, and forms the northwestern boundary of the area proposed for the Panorama Resort golf course and residential development. This creek was not surveyed as part of this investigation, as it has been studied in some detail in the past (Fielden et al, 1993 & Carswell, 1979). The information below is derived from these two cited reports.

Reach 5

Location: 19.9 km to 29.7 km upstream of confluence with the Columbia River.

Description: Panorama Resort, and the proposed golf course and residential development are located adjacent to the fifth reach of Toby Creek as defined by Fielden et al. (1993). This reach is 9.8 km long and has an average gradient of 0.9 %. The substrate is predominantly boulder (63%), with approximately 12 % gravel. Flows are characterized as riffle (80 %) with lesser amounts of run (20 %). Total cover is estimated at 6 %, overwhelmingly provided by boulder cover. On August 18, 1992, the average velocity was 1.9 m/s, with a water temperature of 10 °C and visibility of about 10 cm (Fielden et al., 1993). During the site visit on May 7, 1996, the water temperature was found to be 2 °C, with water clarity greater than 1 m.

3.0 Fish Presence

3.1 Hopeful Creek

Fish presence or absence in Hopeful Creek has not presently been established. The biophysical survey as presented above indicates that there is suitable habitat for a resident fisheries population. In addition, there appears to be no major impediments to upstream fish movements from Toby Creek, with the possible exception of the steep grades encountered under low conditions at hopeful Creek's mouth. When the waters of Toby Creek rise during freshet, it is likely that this barrier will be flooded, and fish could gain access into Hopeful Creek from Toby Creek. It is the intention of the proponent to conduct a fisheries sampling program on this system as soon as conditions in the creek are more optimal for collection (i.e. when the water temperature rises).

3.2 Little Hopeful Creek

The aquatic biophysical survey indicates that potential fisheries habitat in Little Hopeful Creek is limited to that found in the first reach. However, the culvert located 50 m upstream of its confluence with Toby Creek provides a significant barrier to fish movements as the culvert's gradient is set at approximately 10 %. The additional two culverts on this system may also pose a barrier to fish movements. Given these impediments and the previous discussions with BC Environment representatives with Douglas Ogilvy (pers comm.) that this system is unlikely to be fish bearing, it is assumed that this is creek barren. There are no plans to conduct a fisheries survey on this creek by the proponent.

3.3 Toby Creek

Bull trout (*Salvelinus confluentus*) are the only known fish to reside in Toby Creek within the reach adjacent to Panorama Resort (Fielden et al., 1993 & Carswell, 1979) (Carswell actually reported finding Dolly Varden char. Bull trout and the anadromous Dolly Varden char were at that time both classified as Dolly Varden - *Salvelinus malma*. In the 1980s, however, bull trout were reclassified as a separate species from its anadromous cousin.) Fielden et al. (1993), however, noted cutthroat trout (*Oncorhynchus clarki lewsi*) in Jumbo Creek and Carswell (1979) reported finding cutthroat trout in Toby Creek at the mouth of Delphine Creek, approximately 16 km and 6 km upstream of the subject site respectively. It is possible , therefore, that cutthroat trout may be present in the Toby Creek and/or Hopeful Creek, in addition to the known presence of bull trout in the main stem. Kokanee (*Oncorhynchus nerka*) and mountain whitefish (*Prosopium williamsoni*) were also reported by Fielden et al (1993) in the first two reaches of Toby Creek, downstream of the cascades found in reach 4. Rainbow trout (*Onchorhynchus mykiss*) are known in the Toby Creek system only from Neave Creek and Lillian Lake, where they are regularly stocked.

4.0 Golf Course and Residential Development Creek Setbacks

Leave strips or setbacks will be required adjacent to Hopeful and Toby Creeks "to protect the riparian zone, which is critical to the maintenance of a healthy aquatic environment" (Chilibeck et al., 1992). The functions provided by the leave strips include: provision of a food source, provision of a source of large organic debris, maintenance of water temperature, stream buffering functions such as interception of runoff, provision of stream cover, and stream bank stability. To assist developers in the design of their respective projects, Fisheries and Oceans Canada, and BC Environment have developed two sets of guidelines which are applicable to this project. These are:

- Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al., 1992), and
- Guidelines to Protect, Maintain and Enhance Fish and Wildlife Habitat on and Adjacent to Proposed Golf Course Developments and Existing Course Re-Developments on Lowland Areas (Barnard, 1992).

The former is more applicable to the proposed residential development, while the latter is more applicable to the proposed golf course, however there is some overlap.

4.1 Golf Course Creek Setbacks

The Guidelines to Protect, Maintain and Enhance Fish and Wildlife Habitat on and Adjacent to Proposed Golf Course Developments and Existing Course Re-Developments on Lowland Areas (Barnard, 1992) stipulate that primary stream, those utilized directly by fish, should be protected by providing leave strips that extend 15 horizontal metres landward from the high water mark of the stream where the creek is unconfined, and extend 15 horizontal metres from the top of the ravine where stream are confined in ravines. For secondary streams, the guidelines stipulate that the leave strips extend 5 horizontal metres landward from the high water mark of streams where they are unconfined, and extend 5 horizontal metres from the top of the ravine bank where streams are confined by ravines. Toby Creek is known to contain a fish population, and therefore, leave strips applicable to primary streams. Hopeful Creek, however, is more ambiguous, in that there is suitable fisheries habitat but the presence of fish has not be elucidated. For the purpose of this review it is assumed to be fish bearing (a primary stream), with setbacks applicable to that designation.

Of the 18 holes of golf proposed at Panorama Resort, five would be located adjacent or cross Hopeful Creek (hole # 2, 3, 4, 5 & 6), six are near or cross Little Hopeful Creek (hole # 1, 2, 3, 10, 11 & 18) and two lie in close proximity to Toby Creek (hole # 12 & 13).

4.1.1 Hopeful Creek

The 2nd fairway parallels Hopeful Creek, with only a minor intrusion into the 15 metre leave strip. This intrusion occurs along a length of about 50 metres, where the setback is reduced to a minimum of 8 metres in one local. While this setback would be adequate for a secondary stream, it is recommended that the fairway either be narrowed or be shifted away from the creek in this area. In addition, the proposed golf course path route has two extra stream crossings. Consideration should be given to a more environmentally sensitive path route design that respects the integrity of the riparian leave strips.

The 3rd fairway crosses Little Hopeful and Hopeful Creeks, and then parallels Hopeful Creek. The landing area also occurs in a seepage area (wetland), whose vegetation showed significant browse activity by ungulates. It is recommended that the fairway be shifted north or reduced in width upstream of the landing zone to respect the leave strip. Compensation should be offered for the loss of approximately 150 m of habitat due to the relocation of Hopeful Creek at the landing zone. Opportunities exist within the relocated creek bed and on the 5th fairway as discussed below. In addition, the present culvert crossing of Hopeful Creek should be removed, and replaced with a free-spanning bridge for the permanent golf cart access. All cart path crossings of watercourses should be by bridges as opposed to culverts.

The 4th fairway parallels Hopeful Creek, and generally respects the leave strips. The one exception is along the right side of the fairway where the leave strip is reduced, by up to 6 metres, for approximately 60 m along the creek. A slight adjustment of the fairway could correct this conflict.

The 5th fairway parallels Hopeful Creek, crosses it then parallels it again. Before the crossing, the 15 m leave strip is respected. After the crossing of the creek, however, the leave strip is reduced to about 7 m in width. This distance would be acceptable for a secondary stream but is considered too narrow for a fish bearing, primary stream. Consideration should be given to shifting the fairway, and the green in particular, away from the creek. The creek at the fairway crossing has been significantly impacted by past golf course construction activity. At this locale, riparian vegetation is generally lacking, and stream complexing and typical poll riffle run sequences area absent. An enhancement strategy should be developed for this section of creek, which could potentially compensate for golf course construction and habitat loss elsewhere. In any case, a suitable leave strip should be left at the creek crossing. This area should be revegetated with both a ground cover and a shrub layer to protect and enhance fisheries and aquatic habitat values.

The 6th fairway crosses Hopeful Creek while the creek is confined in a ravine. The crossing will be from top of ravine to top of ravine. No modifications to either the stream or the riparian vegetation with 15 m of the creek need to be made, however, some trees will have to be removed from the ravine slopes for sight lines. While the golf course guidelines (Barnard, 1992) call for a 15 m setback from the top of the ravine, it is proposed to construct the tees and greens in close proximity to the ravines crest. Since all golf construction will be at a distance of 40 metres or greater from the creek, it is felt that this buffer strip is adequate. All golf course drainage, both surface and subsurface, however, should be directed away from the creek to protect its water quality.

4.1.2 Little Hopeful Creek

The entire length of Little Hopeful Creek within the golf course development area has been significantly impacted by past golf course construction activity. Presently, the creek consists of two sedimentation ponds and numerous ditches within this area. The present proposal calls for re-establishing this creek in a more "natural" configuration (i.e. not-ditched), and construction of an on-line golf course pond (a second off-stream pond is also to be constructed).

As this creek is assumed to be non-fish bearing, the re-established creek will require 5 m leave strips long its entire length. Side-slopes should be more gentle than those presently provided by the ditches. A revegetation plan will have to be developed to address reclamation concerns along this stream. The plan should include provision for suitable ground cover, shrub layer and trees, appropriate to the area. A plan will also have to be developed to deal with the treatment of the ponds. The plan should include provision for establishing emergent vegetation within 20 % of the pond area, and submergent vegetation within 30 % of the pond area. The remaining open water portion of the pond should be a minimum of 3 m deep. While Barnard (1992) calls for 75 % of pond surfaces to be screened from adjacent activities, this end will be extremely difficult to achieve. A more realistic goal is perhaps 40 %.

4.1.3 Toby Creek

The green of the 12th hole is located at a distance of about 40 m from Toby Creek. While the riparian vegetation will be retained with a buffer strip of this size, it is recommended that all drainage from this high maintenance area be directed away from the creek.

The present location of the 13th fairway is along the banks of Toby Creek. While all golf course construction will be at a distance of greater than 30 metres, there is potential that construction and runoff during operations could adversely affect the creek. Environmentally sound construction techniques, such as utilization of silt fences, sedimentation ponds etc., will have to be employed to ensure that construction of the hole does not adversely impact on the water quality of Toby Creek. As the hole is located on the side-hill above the creek, it will be difficult, if not impossible to direct drainage away from the creek. A suitable collection system will have to be developed, possibly utilizing activated charcoal as a water quality improvement measure.

4.2 Residential Development Creek Setbacks

Riparian setback zones, of leave strips are generally required adjacent to fish bearing waters and waters leading into fish bearing waters, to protect the aquatic habitat values. The Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al., 1992) set out guidelines for establishment of the fisheries sensitive zones and minimum leave strips depending on the density of development. For Residential/low density areas these are:

- 15 m from the high water mark for well-defined banks, and
- 15 m from the first significant and regular break in slope for creeks confined in a ravine or with steep-sloped banks.

For Commercial/high density areas (such as townhouse developments) the 15 m distances above would be 30 m.

4.2.1 Hopeful Creek

Two townhouse developments are proposed on the knolls either side of Hopeful Creek, approximately 250 metres upstream from its mouth. On the left bank (south), the proposed four townhouse units are located 30 m back from the top of bank of the Hopeful Creek ravine, and at a total distance of about 70 m from the creek itself. These setbacks comply with the guidelines established by Chilibeck et al. (1992).

On the right bank (north), the single townhouse unit is located from 50 to 100 m from Hopeful Creek, above the ravine. At the closest point, the townhouses will be within 10 m of the top of the ravine. The valley bottom within the ravine at this local is fairly wide, at about 20 m. A subdivision access road is also proposed between the townhouse unit and the creek. The road will roughly parallel the creek at a distance ranging from 15 to 50 m at this local, with a stream crossing located approximately 315 m upstream of Hopeful Creek's mouth. While this distance from the townhouse unit to the top of the ravine bank is not the 30 m from change in slope, as set out for high density development in Chilibeck et al. (1992), the residential development will be on the far side of the road servicing the subdivision, and located well back from the creek itself.

4.2.2 Little Hopeful Creek

The present proposal calls for re-alignment of approximately 500 m of the first reach of Little Hopeful Creek to facilitate the location of six townhouse units and 12 single family lots. Assuming that Little Hopeful Creek is non-fish bearing, maintenance of water quality within the creek and downstream in Toby Creek along with provision of nutrient transport to Toby Creek are the primary factors to be dealt with. A stream relocation and compensation plan should be developed for this system, or the extent of the development will have to be re-assessed.

4.2.3 Toby Creek

Residential development near or adjacent to Toby Creek consists of four townhouse units near confluence with Hopeful Creek, and three groups of single family lots between the afore mentioned townhouses and Little Hopeful Creek. The two northern most units lie at a distance of 30 m from the change in slope of Toby Creek's banks, or approximately 60 to 70 m from the creek itself. The eastern most townhouse unit also lies at some distance from the creek (80 to 100 m) and will not impinge upon the riparian zone. The southwestern most townhouse unit lies at the top of the bluff adjacent to the confluence of Toby and Hopeful Creeks. These units are located at a distance of 10 to 15 m back from the top of the bluff, or approximately 55 to 75 m back from Toby Creek. As there is a bench approximately 30 to 70 m wide a the base of the bedrock cliffs that will not be developed in this area, it is felt that leave strips in this area comply with the land development guidelines (Chilibeck et al., 1992).

The southern most (upstream) group of single family lots is, for the most part set back further than 30 m from the top of Toby Creek's banks. There is not a pronounced change of slope on the creeks banks near the most southerly six lots in this group in which to define the start of the 30 m fisheries sensitive zone, as is required under the land development guidelines (Chilibeck et al., 1992). A restrictive covenant should be placed on these lots so that a leave strip of 15 m from the top of bank (change in slope) cannot be developed, and has to be left in its natural state. It should be noted that these lots are 70 to 90 m back from the creek on a well vegetated slope.

The middle group of single family lots is generally upslope from the 12th fairway. Again, at the southern end of this group, the top of bank as defined in the change of slope becomes less well defined. The most southerly two lots may have to be eliminated from the development plan, and the next two lots may require restrictive covenants so that a 15 m buffer strip can be retained in its natural state.

The northern most (downstream) group of lots are located above a bench beside Toby Creek. Again the top of bank becomes harder to define at both the most upstream and downstream lot. Once again, restrictive covenants may be required so that the 15 m leave strip from the break in slope is retained.

5.0 Conclusions and Recommendations

The bio-inventory conducted on Hopeful Creek, the physical measurements conducted on Little Hopeful Creek and the review of existing information on Toby Creek was compiled in this report and compared to the proposed development plans. In general, the golf course proposed can be accommodated without compromising the environmental integrity of the creeks, with the exception of the 3rd hole, for which a habitat compensation plan will have to be developed.

Residential development also generally complies with the Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al., 1992), with the exception noted in the text, and the conflicts with Little Hopeful Creek. The proposal calls for diversion of Little Hopeful Creek, which will address compensation through design.

Based on the information reviewed and the conditions observed, the following recommendations are made to minimize potential negative environmental impacts on the site arising from development:

1. A pesticide/fertilizer management plan including a water quality sampling program should be developed as part of the Environmental Management System to address concerns related to golf course use of pesticides and fertilizers. A baseline water sampling program was set up by GeoAlpine Environmental Consulting during the May 7-8 site visit. The program involves sampling for pH, conductivity, ammonia, nitrate, nitrite, total Keldahl nitrogen, sulfate, ortho-phosphate, total phosphorus, calcium, potassium, iron, copper, zinc, manganese, boron, total suspended solids, and total dissolved solids. The sampling sites include Toby Creek upstream of development, Toby Creek downstream of Little Hopeful Creek, Toby Creek downstream of the Panorama Resort sewage treatment plant, Hopeful Creek upstream of the 3rd fairway, Hopeful Creek at its mouth, Little Hopeful Creek upstream of the 3rd fairway, and Little Hopeful Creek at its mouth.

2. A fisheries sampling program should be completed on Hopeful Creek as planned.

3. Fisheries enhancement and revegetation plans should be developed for Hopeful Creek at the 5th fairway crossing. This latter plan could also be developed for partial compensation for habitat lost with the 3rd fairway in its present configuration.

4. A stream relocation, compensation, enhancement and revegetation plan has to be developed for Little Hopeful Creek to recreate habitat lost in 1989. Approximately 500 m of this creek will be relocated under the present proposal.

5. An environmental construction plan including a construction drainage plan should be prepared.

6. A plan should be devised to address the treatment of the golf course ponds. If properly developed, these ponds could provide compensation for habitat lost elsewhere.

6.0 References

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Appendix A

Photographs

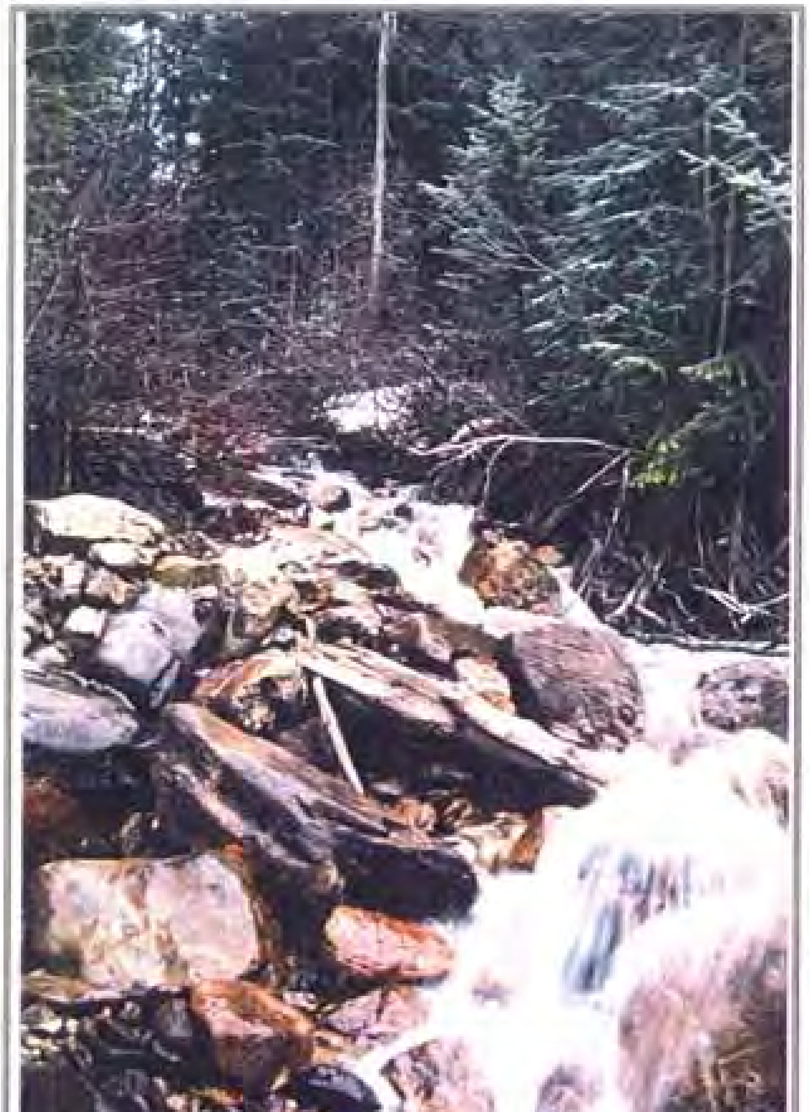


Photo 1 Hopeful Creek at mouth (Reach 1) May 7, 1996.

Photo 2 Hopeful Creek approximately 70 m upstream of mouth (Reach 1) May 7, 96.

Photo 3 Hopeful Creek between 2nd and 5th fairways (Reach 2) May 7, 96.

Photo 4 Hopeful Creek near 3rd green (Reach 2) May 7, 1996.

Photo 5 Disturbed portion of Hopeful Creek at 5th fairway crossing (Reach 2) May 7, 1996.

Photo 6 Culvert near mouth of Little Hopeful Creek (Reach 1) May 8, 1996.

Photo 7 Little Hopeful Creek appr. 150 m upstream of mouth (Reach 1) May 8, 1996.

Photo 8 Settling ponds on Little Hopeful Creek (Reach 1/2 break) May 8, 1996.

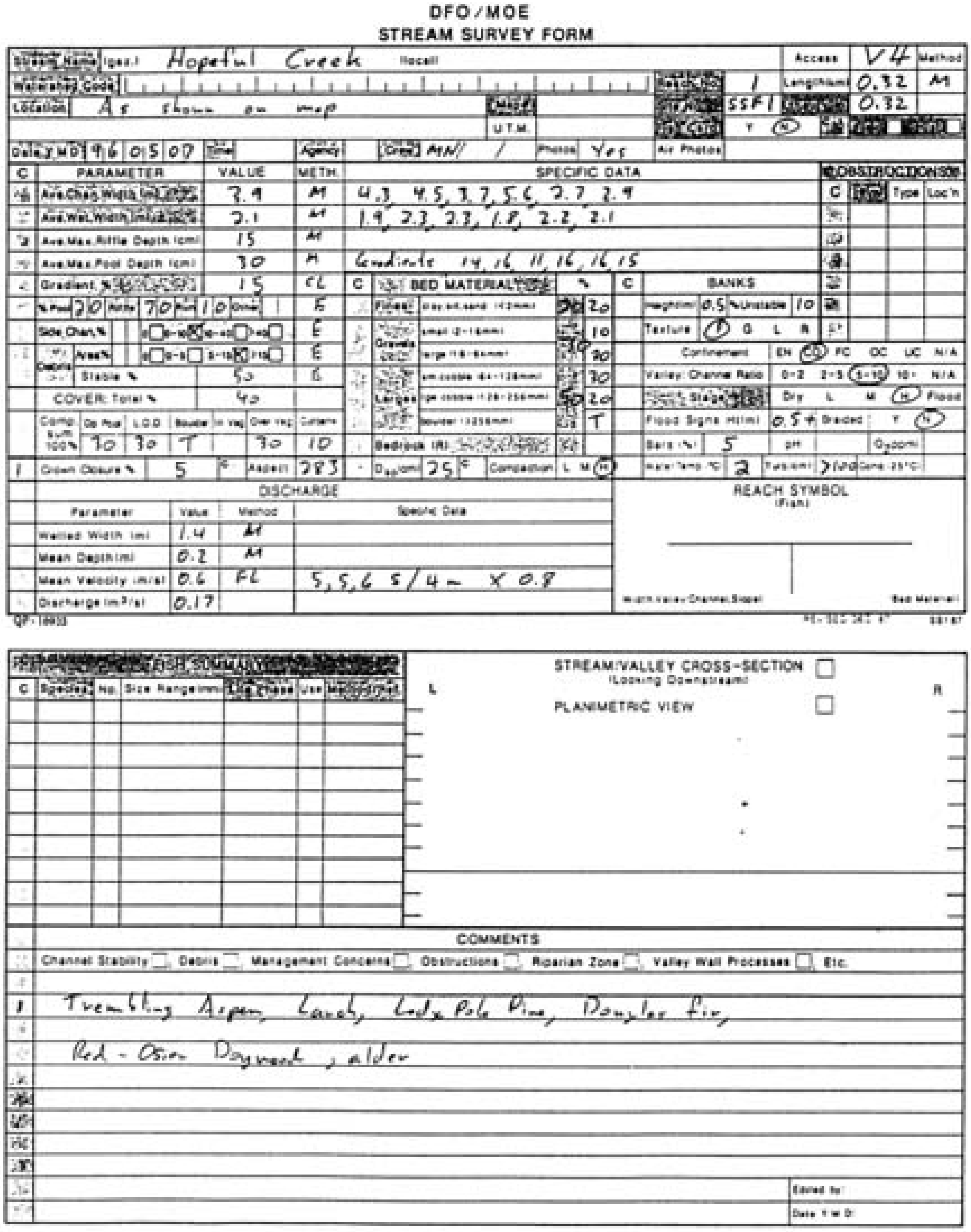
Photo 9 Channelized portion of Little Hopeful Creek (Reach 2) May 8, 1996.

Photo 10 Hopeful Creek upstream of 3rd tees (Reach 3) May 8, 1996.

Appendix B

Stream Survey Forms

SSF-1 Hopeful Creek Reach 1



DFO / MOE
STREAM SURVEY FORM

Stream Name (gaz.) Hopeful Creek (local) | Access V4 | Method
Watershed Code | Reach No. 1 | Length(km) 0.32 | M
Location As shown on map | SSF1 | 0.32
U.T.M. | Y [✓ N]
Date Y M D 96 05 07 | Time | Agency | Crew MN/ / | Photos Yes | Air Photos

C	PARAMETER	VALUE	METH.	SPECIFIC DATA
	Ave.Chan.Width (m)	3.9	M	4.3, 4.5, 3.7, 5.6, 2.7, 2.9
	Ave.Wet.Width (m)	2.1	M	1.9, 2.3, 2.3, 1.8, 2.2, 2.1
	Ave.Max.Riffle Depth (cm)	15	M	
	Ave.Max.Pool Depth (cm)	30	M	Gradients 14, 16, 11, 16, 16, 15
	Gradient, %	15	CL	
	% Pool 20 Riffle 70 Run 10 Other		E	
	Side Chan.%	0☐ 0-10☒ 10-40☐ >40☐	E	
	LWD Area%	0☐ 0-5☐ 5-15☒ >15☐	E	
	Debris Stable %	50	E	
	COVER: Total %	40		

Comp. Sum 100%	Dp Pool	L.O.D.	Boulder	In Veg	Over Veg	Cutbank
	30	30	T		30	10

C	PARAMETER	VALUE	METH.		
1	Crown Closure %	5	E	Aspect	283

C	BED MATERIAL		%
	Fines	clay,silt,sand (<2mm)	20
	Gravels	small (2-16mm)	10
		large (16-64mm)	30
	Larges	sm.cobble (64-128mm)	30
		lge cobble (128-256mm)	20
		boulder (>256mm)	T
	Bedrock (R)		
	D90(cm) 25 E	Compaction	L M [✓ H]

C	BANKS			
	Height(m)	0.5	%Unstable	10
	Texture	[✓ F] G L R		

Confinement	EN [✓ CO] FC OC UC N/A
Valley: Channel Ratio	0-2 2-5 [✓ 5-10] 10+ N/A
Stage	Dry L M [✓ H] Flood
Flood Signs Ht(m)	0.5+ Braided Y [✓ N]
Bars (%)	5 pH O2 (ppm)
Water Temp °C	2 Turb(cm) >100 Cond 25°C

C		Type	Loc'n
OBSTRUCTIONS			

DISCHARGE

	Parameter	Value	Method	Specific Data
	Wetted Width (m)	1.4	M	
	Mean Depth(m)	0.2	M	
	Mean Velocity (m/s)	0.6	FL	5, 5, 6 s/4m X 0.8
	Discharge (m³/s)	0.17		

REACH SYMBOL
(Plan)

Width Valley:Channel,Slope | Bed Material

QP-16933

C	Species	No.	Size Range(mm)	Life Stage	Use	Method/Ref.

STREAM/VALLEY CROSS-SECTION ☐
(Looking Downstream)
L R
PLANIMETRIC VIEW ☐

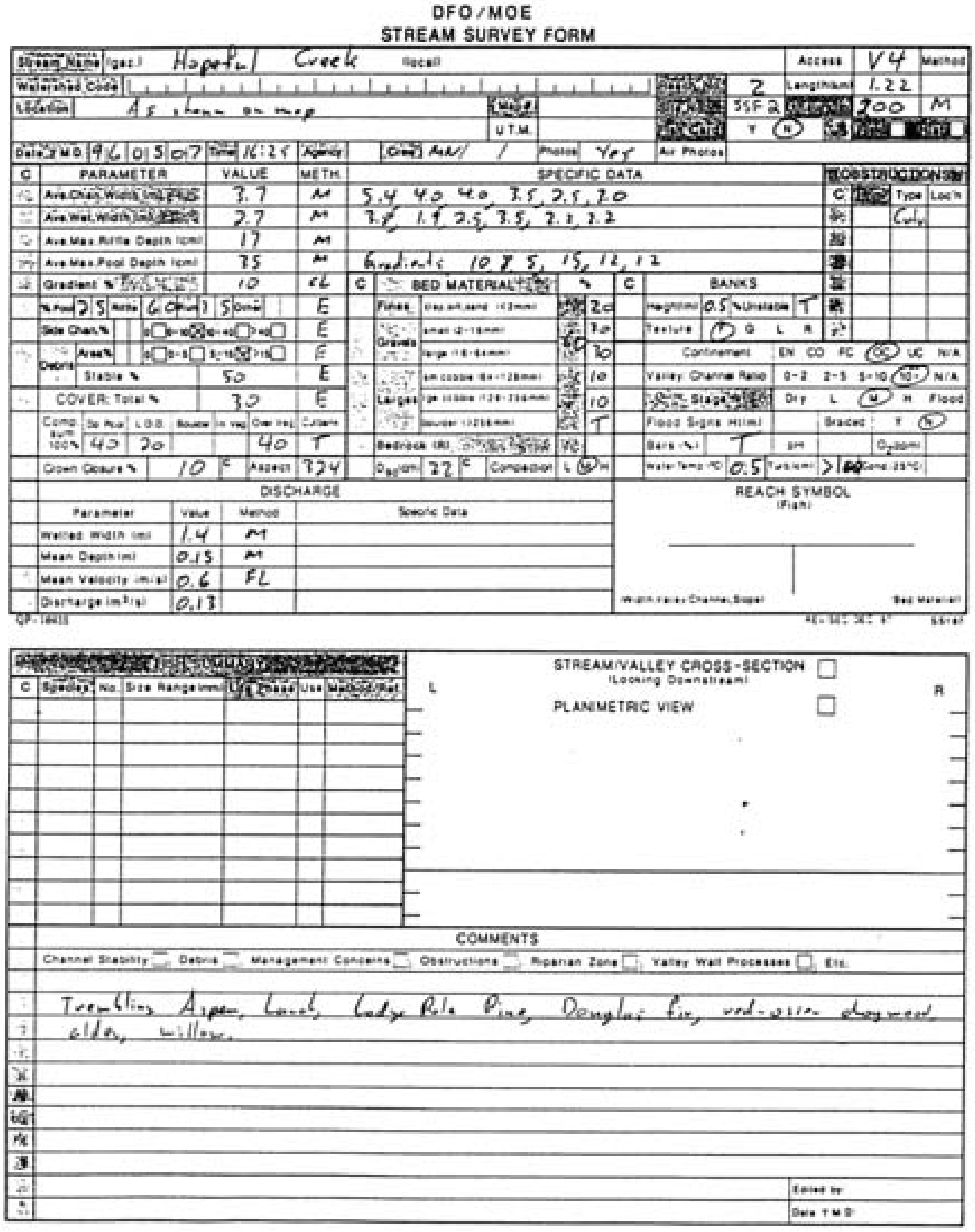
COMMENTS

Channel Stability ☐, Debris ☐, Management Concerns ☐, Obstructions ☐, Riparian Zone ☐, Valley Wall Processes ☐, Etc.

1 Trembling Aspen, Larch, Lodge Pole Pine, Douglas fir,
Red-Osier Dogwood, alder

Edited by:
Date Y M D

SSF-2 Hopeful Creek Reach 2



DFO / MOE
STREAM SURVEY FORM

Stream Name (gaz.)	Hopeful Creek (local)		Access	V4	Method
Watershed Code		2	Length(km)	1.22	
Location	As shown on map Map #	SSF 2		200	M
	U.T.M.	Y [✓ N]			
Date Y M D 96 05 07	Time 16:25	Agency	Crew AW/ /	Photos Yes	Air Photos

C	PARAMETER	VALUE	METH.	SPECIFIC DATA
	Ave.Chan.Width (m)	3.7	M	5.4 4.0 4.0, 3.5, 2.5, 2.0
	Ave.Wet.Width (m)	2.7	M	3.4, 1.9, 2.5, 3.5, 2.1, 2.2
	Ave.Max.Riffle Depth (cm)	17	M	
	Ave.Max.Pool Depth (cm)	35	M	Gradients 10, 8, 5, 15, 12, 12
	Gradient %	10	CL	
	% Pool 25 Riffle 60 Glide 15 Other		E	
	Side Chan.% 0☐ 0-10☒ 10-40☐ >40☐		E	
	Debris Area% 0☐ 0-5☐ 5-15☒ >15☐		E	
	Debris Stable %	50	E	
	COVER: Total %	30	E	

Comp. Sum 100%	Dp Pool	L.O.D.	Boulder	In Veg	Over Veg	Cutbank
	40	20			40	T

Crown Closure % 10 E | Aspect 324

C	BED MATERIAL		%
	Fines	clay, silt, sand (<2mm)	20
	Gravels	small (2-16mm)	30
	Gravels	large (16-64mm)	30
	Larges	sm cobble (64-128mm)	10
	Larges	lge cobble (128-256mm)	10
	Larges	boulder (>256mm)	T
	Bedrock (R)		

D_{90} (cm) 32 E | Compaction L [✓ M] H

C	BANKS			
	Height (m) 0.5	% Unstable T		
	Texture [✓ F] G L R			
	Confinement	EN CO FC [✓ OC] UC N/A		
	Valley Channel Ratio	0-2 2-5 5-10 [✓ 10+] N/A		
	Stage	Dry L [✓ M] H Flood		
	Flood Signs Ht (m)		Braided	Y [✓ N]
	Bars (%) T	pH		O_2 (ppm)
	Water Temp (°C) 0.5	Turb (m) > 60	Cond. (25°C)	

OBSTRUCTIONS			
C		Type	Loc'n
		Culv.	

DISCHARGE

Parameter	Value	Method	Specific Data
Wetted Width (m)	1.4	M	
Mean Depth (m)	0.15	M	
Mean Velocity (m/s)	0.6	FL	
Discharge (m^3/s)	0.13		

REACH SYMBOL
(Fish)

Width (Valley Channel, Slope) Bed Material

QF-18403

C	Species	No.	Size Range (mm)	Life Phase	Use	Method/Ref

STREAM/VALLEY CROSS-SECTION ☐
(Looking Downstream)
PLANIMETRIC VIEW ☐
L R

COMMENTS

Channel Stability ☐ Debris ☐ Management Concerns ☐ Obstructions ☐ Riparian Zone ☐ Valley Wall Processes ☐ Etc.

Trembling Aspen, Larch, Lodge Pole Pine, Douglas fir, red-osier dogwood
alder, willow.

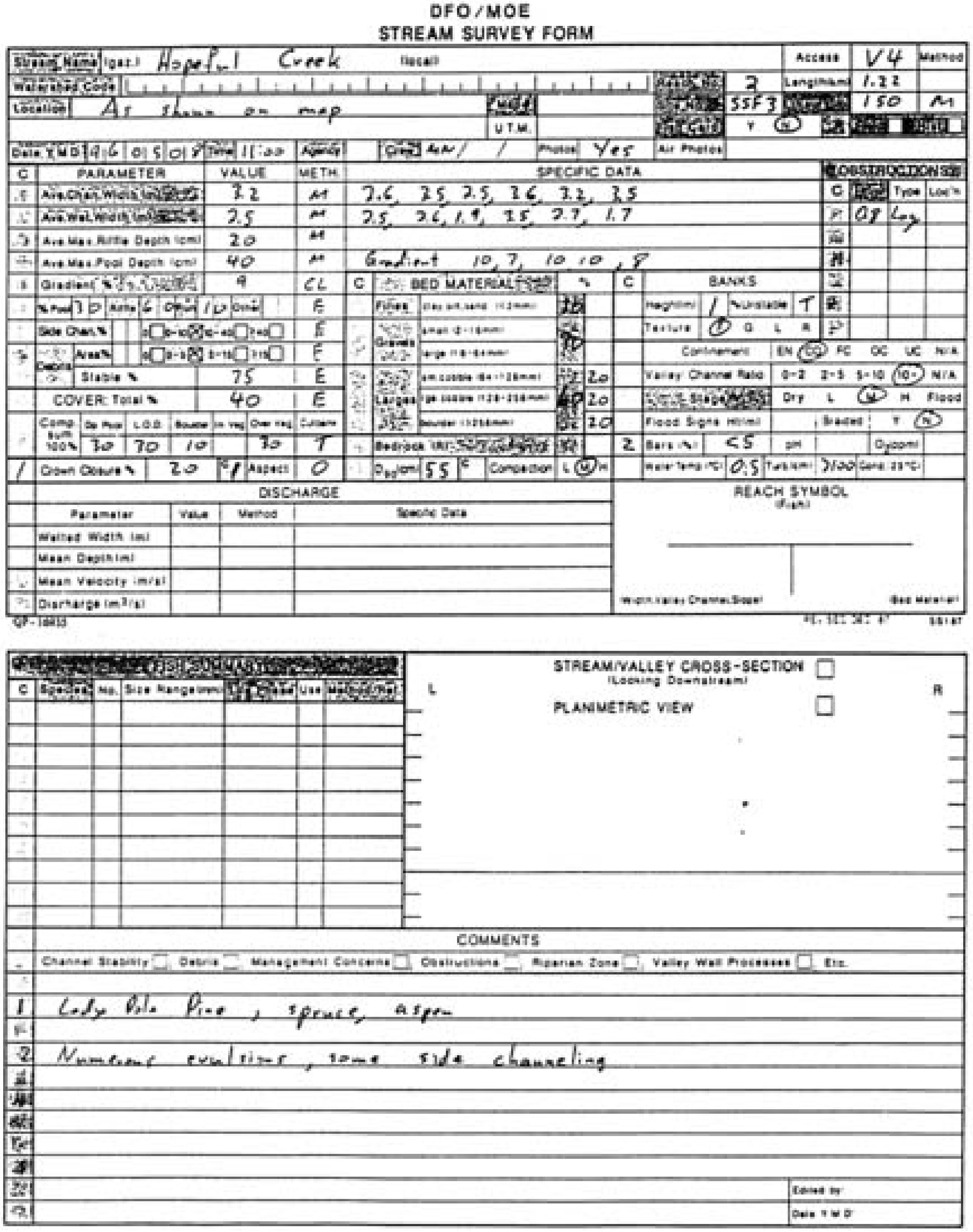
Edited by:
Date Y M D:

Bio-Inventory - Hopeful Creek, Near Invermere, B.C.
Panorama Resort,

Job # 014.0102

28/05/96

SSF-3 Hopeful Creek Reach 2



DFO / MOE
STREAM SURVEY FORM

Stream Name (gaz.) Hopeful Creek (local)

Access V4 Method

Watershed Code

[illegible] 2 Length(km) 1.22

Location As shown on map

Map

U.T.M.

[illegible] SSF 3 [illegible] 150 m

[illegible] Y [✓ N]

Date Y M D 9 6 0 5 0 8 Time 11:00 Agency Crew AW / / Photos Yes Air Photos

C	PARAMETER	VALUE	METH.	SPECIFIC DATA
	Ave.Chan.Width (m)	3.2	M	2.6, 3.5, 2.5, 3.6, 3.2, 3.5
	Ave.Wet.Width (m)	2.5	M	2.5, 2.6, 1.9, 3.5, 2.7, 1.7
	Ave.Max.Riffle Depth (cm)	20	M	
	Ave.Max.Pool Depth (cm)	40	M	Gradient 10, 7, 10 10, 8
	Gradient (%)	9	CL	
	% Pool 30 Riffle 6 Other 10 Glide		E	
	Side Chan.%	0☐ 0-10☒ 10-40☐ >40☐	E	
	Debris Area%	0☐ 0-5☒ 5-15☐ >15☐	E	
	Debris Stable %	75	E	
	COVER: Total %	40	E	

Comp. Stuff 100%	Dp Pool	L.O.D.	Boulder	In Veg	Over Veg	Cutbank
	30	70	10		30	T

Crown Closure % 20 P/ Aspect 0

C	BED MATERIAL		%
	Fines	clay,silt,sand (<2mm)	
	Gravels	small (2-16mm)	
		large (16-64mm)	
	Larges	sm.cobble (64-128mm)	20
		lg cobble (128-256mm)	20
		boulder (>256mm)	20
	Bedrock		

D_{90}(cm) 55 Compaction L [✓ M] H

C	BANKS					
	Height(m)	1	% Unstable	T		
	Texture	[illegible]	G	L	R	
	Confinement	EN	[✓ CO]	FC	OC	UC	N/A
	Valley Channel Ratio	0-2	2-5	5-10	[✓ 10+]	N/A
	Stage	Dry	L	[✓ M]	H	Flood
	Flood Signs Ht(m)		Braided	Y	[✓ N]	
2	Bars (%)	<5	pH		Cyanom	
	Water Temp (°C)	0.5	Turb(cm)	>100	Cond. 25°C	

OBSTRUCTIONS			
C	[illegible]	Type	Loc'n
	08	Log	

DISCHARGE

	Parameter	Value	Method	Specific Data
	Wetted Width (m)			
	Mean Depth (m)			
	Mean Velocity (m/s)			
	Discharge (m^3/s)			

REACH SYMBOL
(Right)

(Width/Valley Channel/Slope) (Bed Material)

QF-1 [illegible]

FISH SUMMARY

C	Species	No.	Size Range(mm)	[illegible]	Use	Method/Ref.

STREAM/VALLEY CROSS-SECTION ☐
(Looking Downstream)

PLANIMETRIC VIEW ☐

L R

COMMENTS

Channel Stability ☐ Debris ☐ Management Concerns ☐ Obstructions ☐ Riparian Zone ☐ Valley Wall Processes ☐ Etc.

1 Lodge Pole Pine, spruce, aspen

2 Numerous cut-slopes, some side channeling

Edited by:

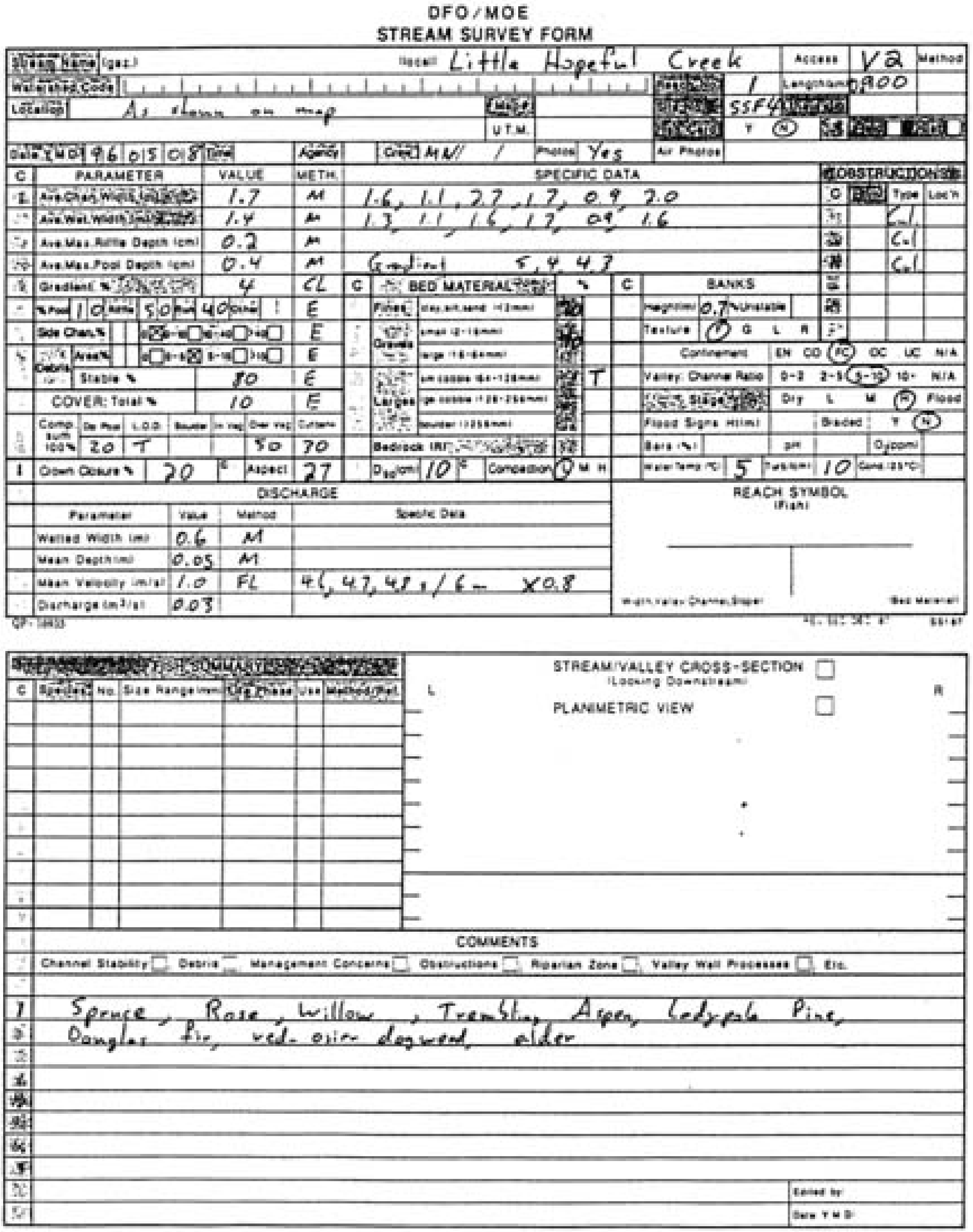
Date Y M D

Bio-Inventory - Hopeful Creek, Near Invermere, B.C.
Panorama Resort,

Job # 014.0102

28/05/96

SSF-4 Little Hopeful Creek Reach 1



DFO / MOE
STREAM SURVEY FORM

Stream Name (gaz.) (local) Little Hopeful Creek
Access V2
Method
Watershed Code
Reach 1
Length 0800
Location As shown on map
UTM
SSF4
Y [✓ N]
Date Y M D 96 05 08
Agency
Crew M N / /
Photos Yes
Air Photos

C	PARAMETER	VALUE	METH.	SPECIFIC DATA
	Ave.Chan.Width (m)	1.7	M	1.6, 1.1, 2.7, 1.7, 0.9, 2.0
	Ave.Wet.Width (m)	1.4	M	1.3, 1.1, 1.6, 1.7, 0.9, 1.6
	Ave.Max.Riffle Depth (cm)	0.2	M	
	Ave.Max.Pool Depth (cm)	0.4	M	Gradient 5, 4, 4, 3
	Gradient %	4	CL	
	% Pool 10 Riffle 50 Run 40		E	
	Side Chan.%		E	
	Debris Area %	5-10	E	
	Debris Stable %	80	E	
	COVER: Total %	10	E	
	Comp. sum 100%: Dp Pool 20, L.O.D. T, Over Veg 50, Cutbank 70			
	Crown Closure %	20		Aspect 27

OBSTRUCTIONS

	Type	Loc'n
	Cul.	
	Cul	
	Cul	

BED MATERIAL

	%
Fines clay,silt,sand (<2mm)	
Gravels small (2-16mm)	
Gravels large (16-64mm)	
Larges sm cobble (64-128mm)	T
Larges lge cobble (128-256mm)	
Larges boulder (>256mm)	
Bedrock (R)	

D_{90} (cm) 10
Compaction [✓ L] M H

BANKS

Height (m) 0.7 % Unstable
Texture [✓ F] G L R
Confinement EN CO [✓ FC] OC UC N/A
Valley: Channel Ratio 0-2 2-5 [✓ 5-10] 10+ N/A
Stage Dry L M [✓ H] Flood
Flood Signs Ht (m)
Braided Y [✓ N]
Bars (%)
pH
O_2 (ppm)
Water Temp (°C) 5
Turb (cm) 10
Cond. (25°C)

DISCHARGE

Parameter	Value	Method	Specific Data
Wetted Width (m)	0.6	M	
Mean Depth (m)	0.05	M	
Mean Velocity (m/s)	1.0	FL	46, 47, 48 s / 6 m × 0.8
Discharge (m^3/s)	0.03		

REACH SYMBOL
(Fish)

Width:Valley Channel,Slope
Bed Material

FISH SUMMARY

C	Species	No.	Size Range (mm)	Life Phase	Use	Method/Ref.

STREAM/VALLEY CROSS-SECTION ☐
(Looking Downstream)
L R
PLANIMETRIC VIEW ☐

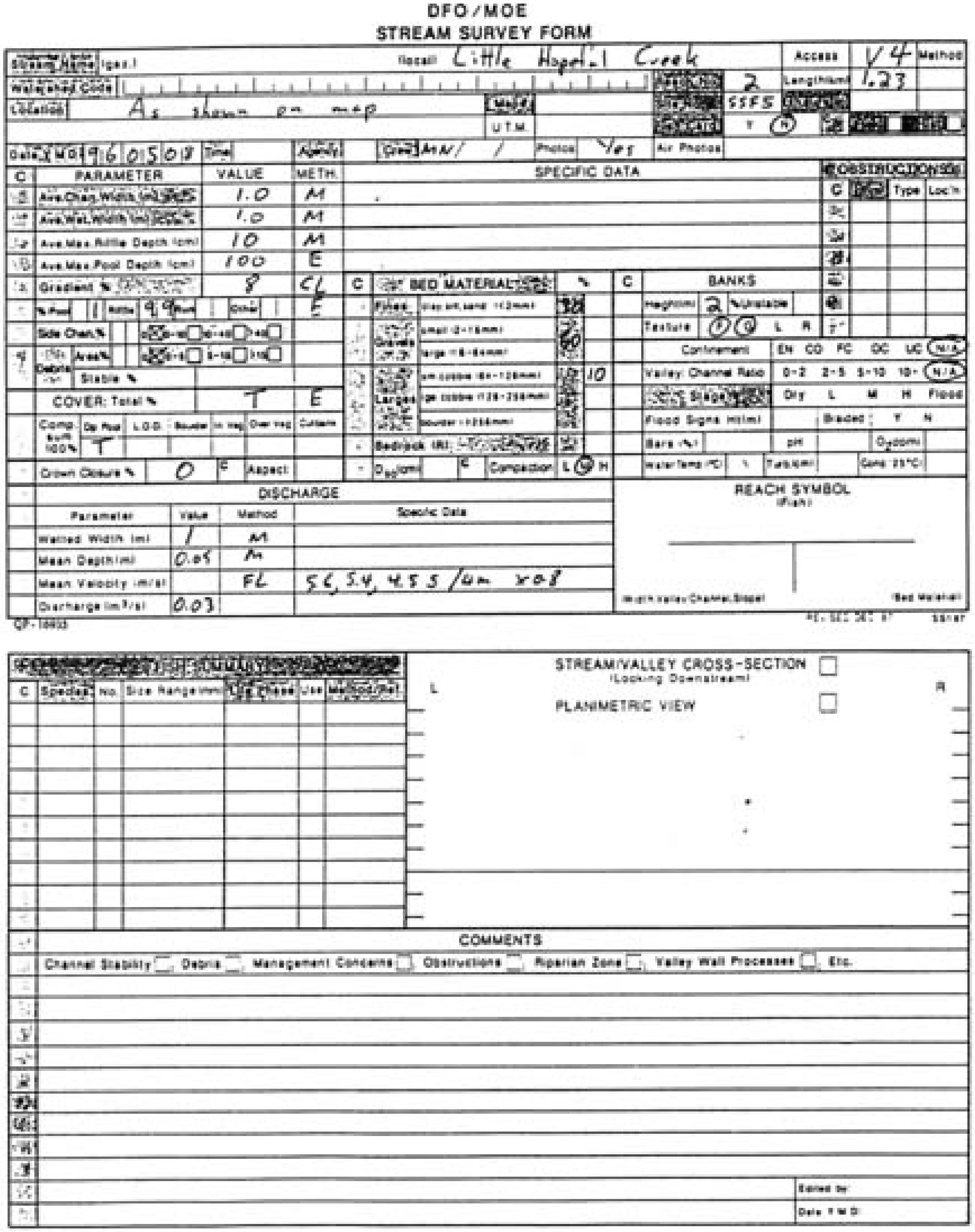
COMMENTS

Channel Stability ☐ Debris ☐ Management Concerns ☐ Obstructions ☐ Riparian Zone ☐ Valley Wall Processes ☐ Etc.

Spruce, Rose, Willow, Trembling Aspen, Lodgepole Pine,
Douglas fir, red-osier dogwood, alder

Edited by:
Date Y M D:

SSF-5 Little Hopeful Creek Reach 2



DFO / MOE
STREAM SURVEY FORM

Stream Name (gaz.)
(local) Little Hopeful Creek
Access Y 4
Method
Watershed Code
2
Length(km) 1.23
Location As shown on map
SSF5
UTM
Y [✓ N]
Date Y M D 96 05 08
Time
Agency
Crew AKN / /
Photos Yes
Air Photos

C	PARAMETER	VALUE	METH.	SPECIFIC DATA
	Ave.Chan.Width (m)	1.0	M	
	Ave.Wet.Width (m)	1.0	M	
	Ave.Max.Riffle Depth (cm)	10	M	
	Ave.Max.Pool Depth (cm)	100	E	
	Gradient %	8	CL	
	% Pool 1, Riffle 9, Run 9, Other		E	
	Side Chan.%			
	Debris Area%			
	Stable %			
	COVER: Total %	T	E	
	Comp. Sum 100%: Dp Pool T, L.O.D., Boulder, In Veg, Over Veg, Cutbank			
	Crown Closure %	0	E	Aspect

BED MATERIAL

C			%
	Fines	clay,silt,sand (<2mm)	
	Gravels	small (2-16mm)	
		large (16-64mm)	
	Larges	sm cobble (64-128mm)	10
		lge cobble (128-256mm)	
		boulder (>256mm)	
	Bedrock (R)		
	D_{90}(cm)	E	Compaction L [✓ M] H

BANKS

Height(m) 2 %Unstable
Texture ○ ○ L R
Confinement EN CO FC OC UC [✓ N/A]
Valley: Channel Ratio 0-2 2-5 5-10 10+ [✓ N/A]
Stage Dry L M H Flood
Flood Signs Ht(m)
Braided: Y N
Bars (%)
pH
O_2(ppm)
Water Temp (°C)
Turb(cm)
Cond. 25°C

OBSTRUCTIONS

C		Type	Loc'n

DISCHARGE

Parameter	Value	Method	Specific Data
Wetted Width (m)	1	M	
Mean Depth(m)	0.05	M	
Mean Velocity (m/s)		FL	56, 54, 455 /4m x 0.8
Discharge (m³/s)	0.03		

REACH SYMBOL
(Fish)

Width:Valley:Channel,Slope
Bed Material

CP-18033

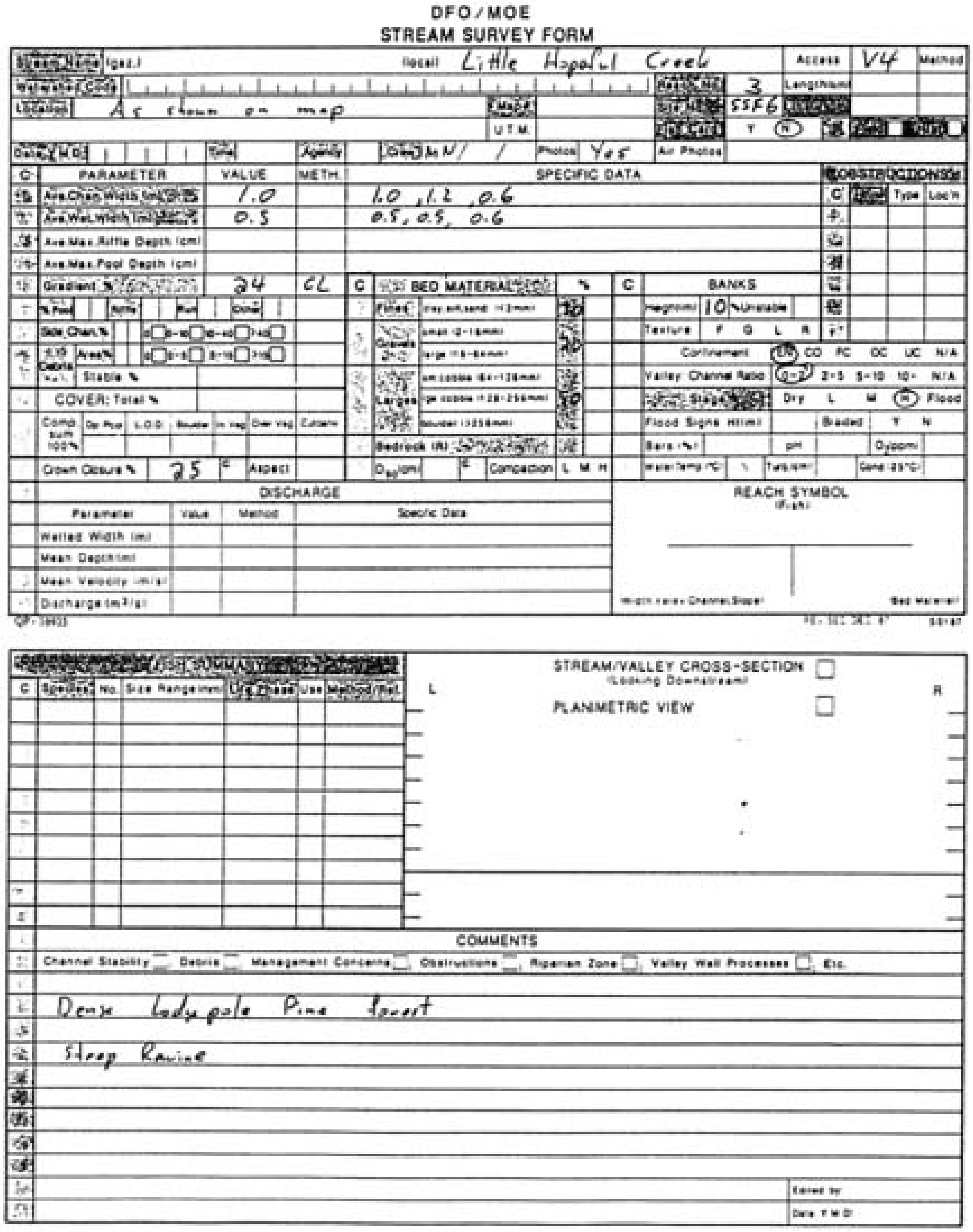
C	Species	No.	Size Range (mm)	Life Phase	Use	Method/Ref.

STREAM/VALLEY CROSS-SECTION ☐
(Looking Downstream)
L
R
PLANIMETRIC VIEW ☐

COMMENTS
Channel Stability ☐ Debris ☐ Management Concerns ☐ Obstructions ☐ Riparian Zone ☐ Valley Wall Processes ☐ Etc.

Edited by:
Date Y M D:

SSF-6 Little Hopeful Creek Reach 3



DFO / MOE
STREAM SURVEY FORM

Stream Name (gaz.) (local) Little Hopeful Creek Access V4 Method
Watershed Code Reach No. 3 Length (km)
Location As shown on map Map # Site No. SSF6
UTM Y (N)
Date Y M D Time Agency Crew MN / / Photos Yes Air Photos

C	PARAMETER	VALUE	METH.	SPECIFIC DATA
	Ave.Chan.Width (m)	1.0		1.0 , 1.2 , 0.6
	Ave.Wet.Width (m)	0.5		0.5, 0.5, 0.6
	Ave.Max.Riffle Depth (cm)			
	Ave.Max.Pool Depth (cm)			
	Gradient %	24	CL	

% Pool | Riffle | Run | Other
Side Chan.%
Debris Area%
Stable %
COVER: Total %
Comp. Suff. 100% Dp Pool L.O.D. Boulder In Veg Over Veg Cutbank
Crown Closure % 25 Aspect

BED MATERIAL %
Fines clay,silt,sand (<2mm)
Gravels small (2-16mm)
large (16-64mm)
Larges sm.cobble (64-128mm)
lge cobble (128-256mm)
boulder (>256mm)
Bedrock (R)
D (cm) Compaction L M H

BANKS
Height(m) 10 % Unstable
Texture F G L R
Confinement [✓ EN] CO FC OC UC N/A
Valley Channel Ratio [✓ 0-2] 2-5 5-10 10+ N/A
Stage Dry L M [✓ H] Flood
Flood Signs Ht(m) Braided Y N
Bars (%) pH O₂(ppm)
Water Temp (°C) Turb.(cm) Cond.(25°C)

OBSTRUCTIONS
C Type Loc'n

DISCHARGE

Parameter	Value	Method	Specific Data
Wetted Width (m)			
Mean Depth (m)			
Mean Velocity (m/s)			
Discharge (m³/s)			

REACH SYMBOL (Fish)
Width Valley Channel Slope Bed Material

FISH SUMMARY
C Species No. Size Range (mm) Life Phase Use Method/Ref.

STREAM/VALLEY CROSS-SECTION ☐ (Looking Downstream)
PLANIMETRIC VIEW ☐
L R

COMMENTS
Channel Stability ☐ Debris ☐ Management Concerns ☐ Obstructions ☐ Riparian Zone ☐ Valley Wall Processes ☐ Etc.

Dense lodgepole Pine forest

Steep Ravine

Edited by:
Date Y M D

PANORAMA
MOUNTAIN VILLAGE

ENVIRONMENTAL

CONSTRUCTION GUIDELINES AND ENVIRONMENTAL MANAGEMENT SYSTEM

May 1996

INTRAWEST

Construction Guidelines and Environmental Management System

Panorama Resort

Prepared for:

Intrawest Development Corporation
Panorama Resort
Panorama, B.C. V0A 1T0

May 1996

Prepared by:

GEOALPINE
ENVIRONMENTAL CONSULTING
3132 Alta Vista Road, Whistler, BC V0N 1B3

TABLE OF CONTENTS

GEOALPINE ENVIRONMENTAL CONSULTING

Job# 014.0101

28/05/96

Construction Guidelines and Environmental Management System
Panorama Resort

LIMITATIONS

This Document was prepared by **GeoAlpine Environmental Consulting** for the account of **Intrawest Development Corporation**.

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INTRODUCTION

Preservation of the natural environment is recognized as a necessary component of Panorama Resort's success. Furthermore, it is also recognized that as development occurs, ecosystems will be altered. The goal of this environmental management system is preservation of sensitive habitat. To achieve this goal these environmental guidelines were developed to encourage the preservation of natural vegetation within the preserved areas and to mitigate the impacts of development in a way that enhances the retained habitat, while minimizing the losses associated with altered ecosystems.

The guidelines are intended to give contractors direction in constructing their projects in an environmentally sensitive manner. An effort shall be made to preserve as much of the aquatic and riparian habitat on site as possible.

Panorama Resort shall consider the following goals:

- Maximize tree preservation.
- Enhance the natural, preserved environment.
- Avoid negative impacts to surrounding lands and waters as a result of development of the site.
- Achieve high levels of environmental quality associated with the development of the site.

In the future, when Panorama Resort is completed, wildlife may continue to utilize the retained habitat for cover, foraging, nesting, and migration. At the same time, visitors to the resort will appreciate the aesthetic value of the preservation and enhancement.

1.0 GENERAL

1.1 Description

1. The Construction Guidelines and Environmental Management System, hereafter referred to as the Guidelines, specified in this document refer to all matters related to protection of the environment, during construction of Panorama Resort. This includes, but is not limited to, protection of streams and watercourses, protection of air and water quality, protection of wildlife and wildlife habitats, protection of vegetation, protection of social, cultural and historic resources and restoration.

2. The Guidelines includes provisions for suitable waste disposal means, including, but not limited to, disposal of construction wastes, sanitary wastes, process wastes and any other waste materials generated during the construction of Panorama Resort or incidental thereto.

3. The Guidelines require adherence to all applicable MOELP, Provincial and Federal Legislation, Regulations, Orders, Standards and Guidelines.

4. The Guidelines require that all necessary Permits, Permissions, Allowances and Licenses issued by governing bodies for the construction of Panorama Resort be obtained and their provisions complied with.

1.2 Definitions

1. ENVIRONMENT means all natural physical, chemical and biological components and all social, cultural and historic components of the world.

2. ECOSYSTEM means the interaction of all environmental components.

3. WATERBODY shall mean rivers, creeks, and ditches that convey running water in all or part of the year, and lakes, ponds, sloughs, swamps and bogs with an area greater than 0.1 hectare.

4. MOELP means the Ministry of Environment, Lands and Parks through their designate in the Habitat Protection Section.

5 PANORAMA means Panorama Resort and their agents responsible for construction of Panorama Resort.

6. MONITORING PROGRAM shall mean the Environmental Monitoring Program as defined Sections 4.2.

7. ENVIRONMENTAL MONITOR means the person or persons responsible for undertaking the Monitoring Program.

8. ENVIRONMENTAL CONSTRUCTION PLAN means the site specific plan detailing design for environmental protection and construction site drainage.

9. ENVIRONMENTAL ASSESSMENT shall mean the prior environmental studies conducted on the site, including, but not limited to the Hopeful Creek Bio-Inventory, prepared for Intrawest Development Corporation, dated May 1996.

10. PRESERVATION AREAS means the areas identified as the riparian zones, fisheries sensitive zones (FSZ) and associated wetlands, recommended for preservation.

1.3 Submittals

1. Panorama Resort shall submit the following prior to starting the work or engaging in new aspects of the work to the Environmental Monitor for his review and acceptance:
   - Emergency response plans for protection of the environment.
   - The names of all responsible parties to the work and how these persons may be contacted at any time.

2. Submit the following from time to time as requested by the Environmental Monitor:
   - Evidence of valid Licenses, Permits, permissions and Approvals.
   - Changes of a substantial nature to the design and layout of the network road and service corridor in the Resort shall be required to be reviewed and approved by both the MOELP and the Environmental Monitor. Substantial changes are defined as alterations in the network road or service corridor layout that would result in change to the Preservation areas as presented on the latest site plan, or increases in fill quantities that would result in elevation increases in the proposed grade exceeding 1 m above those shown on the latest plan.
   - Changes of a minor nature to the development plan, that will not alter the intent of the ENVIRONMENTAL CONSTRUCTION PLAN or the design and layout of the Resort shall be reviewed on-site by the Environmental Monitor. Changes of a minor nature would include alterations in the Resort layout that would impinge by less than 2 m into the natural preservation areas. The total area of the natural preservation areas shall not be diminished. The Environmental Monitor shall refer the changes to the MOELP for their review if the Environmental Monitor deems the changes to be substantive. The Environmental Monitor shall not be liable for costs or delays caused by such action.

2.0 PRODUCTS

2.1 Quality Control

The following products used by Panorama Resort at the direction of the Environmental Monitor shall conform to the standards as set out below.

1. Plastic, 10 mil (0.25 mm) or approved equal.
2. Straw, clean wheat or flax straw tied with twine or approved equal.
3. Geotextile, "Amoco 4538" or approved equal.
4. Soil binding spray, "deci 162" or approved equal.
5. Tree wound dressing, "Braco" or approved equal.
6. Oil absorbent, "Oil-sorb", "Metasorb", or approved equal.
7. Silt fencing, "Amoco 2125 Silt Stop" sediment control fabric, or approved equal.

3.0 ENVIRONMENTAL PROTECTION CONSTRUCTION GUIDELINES

3.1 Habitat Protection

1. Preservation areas setback lines shall be flagged prior to the clearing phase of the development. Panorama Resort shall not conduct clearing, grubbing or other construction activity within the flagged setback and preservation areas without the expressed permission of the Environmental Monitor and the MOELP (as required). Flagging shall occur prior to permission to clear the site. Minimal brush clearing is permitted to ease access into the site.

2. Panorama Resort shall flag or fence the aforementioned setback lines in accordance with the approved clearing plan. Panorama Resort shall not proceed with the clearing phase of the project until the setback lines and the appropriate flagging is approved by both the Environmental Monitor and the MOELP (as required). The preservation process should entail:
    - Upon completion of flagging, MOELP sign-off of the flagging is required.
    - Upon MOELP sign-off of flagging, the site may be cleared. Immediately after completion of clearing, continuous flagging around the Preservation areas is required. The flagging shall be minimum 5 cm in width, and printed with the words Tree Preservation Area.
    - Upon completion of preservation area flagging, MOELP inspection and sign-off is required.
    - Upon MOELP sign-off of preservation area flagging, and all other required approvals, the Contractor will be permitted to clear the site. The Contractor shall ensure trees are felled away from Preservation areas.
    - If a reclamation area is identified at the outflow of the pond, limited transplanting activity will occur inside the preservation area flagging under the supervision of the Environmental Monitor.

3. The feathering and scalloped appearance of the forest edge shall be maintained and, where appropriate, enhanced to create maximum edge between ecological units.

4. Disturbed soils adjacent to the natural or enhancement areas shall be reseeded or replanted immediately after construction to help trap sediment and reduce surface runoff.

5. Plant species utilized in reseeding and/or replanting in the environmental setback, natural, and enhancement areas shall be selected in accordance with the recommendations of the Environmental Monitor.

6. Panorama Resort shall take all reasonable precautions to avoid damaging trees that abut the construction area, including those in the preservation areas. Any trees damaged, however so caused, shall be treated by Panorama Resort to the satisfaction of the Environmental Monitor, or be replaced.

7. Brush piles and wind thrown logs shall be maintained as much as is possible within the natural and enhancement areas of the development to create runways and microclimates for small mammals.

3.2 Tree Preservation

1. Ground disturbance around preserved trees should not be within 3 m of the tree stem, nor should it extend into the zone of influence delineated by the tree's drip line. Setbacks should be marked with flagging tape at regular intervals and in accordance with the Environmental Monitor and the MOELP.

2. No construction activities shall be carried out within habitat preservation areas, nor shall the areas be subjected to the impacts arising from traffic, or materials storage. Panorama Resort shall not remove or modify the vegetation within the preservation areas without the prior approval of the Environmental Monitor and the MOELP.

3. Activities within the preservation areas shall be limited to the following:

i) Surveying

Surveying shall consider the intent of the preservation areas and should avoid all unnecessary impacts to the trees and understory vegetation. No trees of a diameter of exceeding 10 cm shall be cut. No shrubs or trees under 2 m in height shall be cut. Instead, offsets shall be used to obtain sitings around trees. No trees shall be limbed, nor shall the bark be removed from the trees within the preservation areas.

ii) Hazard Trees Identification and Removal

Unsafe trees should not be a concern within the preservation areas. If dangerous trees are identified as posing a potential hazard to Panorama Resort or its occupants, they must be brought to the attention of the Environmental Monitor and the MOELP. Subject to the approval of the Environmental Monitor and the MOELP, unsafe trees may be dealt with in the following ways, listed in order of preference:

- If possible the trees should be modified to become standing wildlife trees,
- Felled, cleaned, and left to become wildlife trees on the ground,
- Felled, bucked into rounds, and removed by hand.

iii) Pathways

Pathways should not be constructed within the preservation areas at this time. There may be some opportunity for limited pathway development within the preservation areas pending completion of the design studies.

iv) Servicing

Servicing will not be allowed within the preservation areas. Service corridors outside the preservation areas shall be revegetated with approved native plant species and returned to a natural state.

3.3 Clearing, Grubbing, and Filling

1. Panorama Resort shall submit clearing plans to the MOELP and the Environmental Monitor for their approval.
2. Clearing limits will be adequately flagged prior to each phase of clearing.
3. All woody vegetation within the cleared area shall be cut no more than thirty (30) cm above the soil. Merchantable timber shall be removed from the site for subsequent utilization.
4. Non-merchantable timber, that has a diameter larger than 15 centimetres, shall be utilized as a source of firewood, where feasible.
5. Grubbing, to remove stumps, shall be conducted with a minimum disruption to the soil. Stumps shall be handled in such a manner that entrained soil is removed.
6. Topsoil and all organically enriched soil material requiring excavation shall be salvaged and stockpiled in a suitable location identified by the Environmental Monitor for later use as topdressing. Topdressing materials shall not be wasted or otherwise rendered unsuitable for use.
7. Burning of woody materials shall not be allowed except with the express written consent of the Environmental Monitor (See subsection 3.9).
8. The source of all fill material will be identified by Panorama Resort. The fill source shall be inspected by a competent soils specialist, paid for by Panorama Resort. Any analytical test required by the soils specialist shall be carried out and paid for by Panorama Resort. The criteria used for determining suitability shall be Level "A" standards as defined in the Criteria For Managing Contaminated Sites In British Columbia (MOE, 1989).
9. The burial of stumps and other woody debris will be not be allowed on site, unless approved by the Environmental Monitor and MOELP.

3.4 Erosion Control

1. Exposed, erodable soils shall be protected from erosion by one or more of the following methods:
   - covering with a suitable material such as plastic, straw, or geotextile;
   - installation of erosion bars, straw bale dykes, silt fences, stone check dams and water diversion structures;
   - establishment of a temporary cover of vegetation;
   - application of a soil binding spray.

2. Ditches and waterways shall be protected from erosion by one or more of the following methods:
   - lining with an erosion resistant material;
   - provision of straw bale check dams;
   - construction of silt fences using suitable geotextile;
   - diversion of water around erosive areas using flexible pipe, corrugated steel pipe or other suitable conduit.

3. Erosion protection measures shall be undertaken under the direction of the Environmental Monitor.

4. Completed sites shall be protected from erosion through the prompt revegetation of exposed soils. Revegetation shall be in accordance with the Environmental Monitor's recommendations.

3.5 Watercourse Environmental Protection

1. A Watercourse Environmental Protection Zone shall exist within fifty (50) meters of the high water mark of all waterbodies.

2. Activities undertaken within the Watercourse Environmental Protection Zone shall be limited to that absolutely necessary for the conduct of the work. The following activities shall be prohibited within the Watercourse Environmental Protection Zone:
   - fueling or servicing equipment;
   - washing of construction equipment, including, but not limited to fill transport, spreading and grading equipment, and all concrete equipment;
   - disposal of waste materials, including, but not limited to, waste rock and soil, construction wastes, or any other materials.

3. Work undertaken within the Watercourse Environmental Protection Zone shall be conducted as expeditiously as possible.

4. No fuels, oils, grease, or any other substance, including, but not limited to, paints, solvents, chemicals, cement, grouts or building materials may be stored within the Watercourse Environmental Protection Zone.

5. With the exception of pre-approved locations, the minimum setback for development will be 15 metres from the normal high water mark of watercourses. Any construction activity in these areas will be conducted under the supervision of the Environmental Monitor. Natural areas shall be revegetated with native species in accordance with the recommendations of the Environmental Monitor.

6. Work within the wetted perimeter of a waterbody shall be conducted under the inspection and with the approval of the Environmental Monitor and the regulatory authority where required. Plans and methods for such work shall be submitted to the Environmental Monitor for approval prior to undertaking such work.

7. Suitable diversions, coffer dams, curtains, and other structures shall be established prior to any work within the wetted perimeter of a waterbody.

8. Panorama Resort shall ensure that no substances deleterious to aquatic habitat enter a waterbody or are placed in such a location that they could enter a waterbody.

3.6 Water Quality Protection

1. Panorama Resort shall detain, treat or otherwise process all waters leaving the construction area to ensure that suspended solids, sediments, concrete and/or grout washwater, oil and grease, or any other material is removed.

2. Panorama Resort shall control all water flowing through the area of work to ensure such water does not become contaminated as a result of the work. Panorama Resort's responsibility for cleanup will be limited to contamination originating within the subject property.

3. Panorama Resort shall be responsible to ensure that all water leaving the area of work meets or exceeds Federal, and Provincial water quality standards for the activities being undertaken.

3.7 Air Quality Protection

1. Panorama Resort shall control dust emissions from construction and incidental activities to the satisfaction of the Environmental Monitor.

2. All equipment shall be fitted with standard emission control devices appropriate to the equipment and in compliance with Federal, and Provincial regulations and standards.

3.8 Wildlife and Wildlife Habitat Protection

1. Panorama Resort shall avoid disturbance of wildlife and/or disruption of wildlife habitat by establishing the aforementioned Preservation areas. Panorama Resort shall not infringe upon this area.

2. Panorama Resort shall provide "bear proof" garbage disposal containers for all food scraps, lunchroom scraps and other wastes which might attract wildlife.

3. Feeding of wildlife, including, but not limited to, bears, birds and small mammals, shall not be permitted.

4. Bird nests, wildlife denning sites and other areas of wildlife habitation shall not be disturbed while occupied.

3.9 Burning

1. Burning of any material, except fuels in a piece of equipment designed to burn fuels, shall not be permitted except with the express written consent of the Environmental Monitor and the Ministry of Forests (MOF).

2. All burning, as permitted above, shall be under the supervision of a responsible party at all times, and will be allowed only when atmospheric temperature inversions are not present.

3. Panorama Resort shall have on site suitable fire fighting equipment as approved by the Environmental Monitor and the MOF.

4. All burning shall be as specified by Provincial and MOF authorities. Valid permits and authorizations shall be obtained from the appropriate authorities and a copy of such shall be submitted to the Environmental Monitor and the MOF for any and all burning.

5. Burning shall not take place within the Watercourse Environmental Protection Zone.

3.10 Petroleum Storage

1. Petroleum storage, including propane storage, fuel storage, lubricant storage, storage of other petroleum products and fuel storage associated with diesel and/or gasoline generator plants shall be designed to meet or exceed the existing safety regulations of the appropriate Provincial Petroleum Association, the National Fire Code and the Workers' Compensation Board.

2. Underground storage of petroleum products shall not be permitted.

3. Petroleum storage facilities shall be located above the flood level for the creeks of the site. Storage facilities shall be located at a minimum distance of 50 metres from any watercourse.

4. Gravity feed storage tanks shall not be permitted. The staff will be instructed to hand hold the fuel nozzel rather than lock the nozzel open, to help minimize the chance of any fuel spillage.

5. All fuel storage facilities shall receive certification from government safety inspectors. Proof of certification will be provided to the Environmental Monitor before fuel storage filling commences.

6. Proper foundations and impervious catch basin dykes (BC Fire Code 4.3.7.4(1)), to contain 110 percent of the maximum capacity of fuel storage tanks, shall be provided (BC Fire Code 4.3.7.3(1)).

7. A spill response plan to deal with spillage or leakage of fuel shall include an on-site spill response kit with a supply of oil absorbent material. These shall be approved in writing by the Environmental Monitor prior to the movement of petroleum products onto the area of work.

8. Any spill of petroleum products greater than 1000 ml (1.0 litre) shall be reported immediately to the Environmental Monitor and the Conservation Officer. Clean up of such spills shall commence immediately. Reporting of petroleum spills to authorities shall be as set out in the appropriate legislation and regulations. Such reporting is the responsibility of Panorama Resort. Panorama Resort is also responsible for reporting all spills larger than 100 litres of flamable liquids to the Provincial Emergency Program (PEP) of the Ministry of the Solicitor General. Where it is not practical to report to PEP within a reasonable time, the spill shall be reported to the nearest detachment of the Royal Canadian Mounted Police.

9. Waste fuel, oil, solvents, and other petroleum products shall be disposed of off site at a location which has been approved by the regulatory authorities.

3.11 Pesticide and Fertilizer Storage and Handling

1. All fertilizers and potentially toxic materials such as insecticides, herbicides, fungicides, fertilizers, but not excluding others, shall be stored in locked floodproof building(s) located above the flood level. The storage buildings shall be located a minimum of 50 metres from any watercourse.

2. All pesticides/herbicides shall be handled and applied by licensed applicators.

3. All empty fertilizer bags, and empty insecticide, detergent, herbicide, and other toxic material containers shall be disposed of off site in accordance with Provincial regulations.

4. A ten (10) metre wide pesticide free zone shall be established adjacent to waterbodies, including ditches, rivers, creeks, open marshes, lakes, and any manmade waterbodies, as well as dry stream beds (Adams, 1992).

5. A buffer zone shall be established adjacent to the pesticide free zone so as to prevent drift, surface runoff, and leaching of pesticide into the pesticide free zone. The minimum width of the buffer zone will be as specified in Table 30 of the Handbook For Pesticide Applicators And Dispensers (Adams, 1992).

6. Fertilizers shall not be applied prior to heavy rain warnings issued by the Atmospheric Environment Service of Environment Canada. A pesticide and fertilizer program incorporating an integrated pest management strategy shall be developed by Panorama Resort prior to operation of the Resort.

7. Panorama Resort shall comply with all pesticide handling and storage guidelines in the Handbook For Pesticide Applicators And Dispensers (Adams, 1992).

3.12 Social, Cultural and Historical Protection

1. Panorama Resort shall conduct construction activities so that social, cultural and historical resources are protected.

2. No archeological sites or other sites of historic or cultural significance have been identified on the site. The Environmental Monitor shall be notified of any artifacts uncovered. Disturbance of such sites in any manner shall not be permitted except with the express written consent of the Environmental Monitor and the responsible governing body.

3. Panorama Resort shall observe all regulations concerning public health and is responsible for providing sanitation facilities as required. Sanitary waste shall be taken to an approved disposal site.

4. Working hours shall be in accordance with any Noise Bylaw and other applicable legislation.

5. Panorama Resort shall provide adequate site security.

3.13 Restoration and Cleanup

1. Panorama Resort shall ensure that all debris, garbage and other waste materials not naturally found at the site are removed at the completion of the work and that the site is left in a neat and tidy condition satisfactory to the Environmental Monitor and the MOELP. This requirement refers to existing dumped debris as well as waste material generated as a result of construction.
2. All temporary structures shall be removed at the completion of the work.
3. Soils and/or other materials contaminated by petroleum products, chemicals or other undesirable materials shall be cleaned up to the satisfaction of the Environmental Monitor. Materials so fouled shall be excavated and hauled off site to an approved disposal area.
4. Sediments collected in sediment control structures shall be removed as required for proper functioning or at the completion of the work. Sediment control traps shall be similarly removed unless otherwise directed by the Environmental Monitor. These materials shall be disposed of in a manner satisfactory to the Environmental Monitor and the MOELP.

4.0 ENVIRONMENTAL MONITORING PROGRAM

4.1 Environmental Monitor

The Environmental Monitor shall be retained by Panorama Resort, whose responsibilities include:

1. Preparation of a SITE SPECIFIC MONITORING PROGRAM, hereafter referred to as the Monitoring Program, in accordance with the MOELP's requirements.
2. Monitor all project development related activities and their effects on biophysical resources within and adjacent to the site in accordance with the approved Monitoring Program.
3. Review and submit monitoring reports to the MOELP and Panorama Resort on the monitoring results in accordance with a predetermined schedule and format (Subsection 4.3).
4. Impose temporary work stoppages for noncompliance with the Monitoring Program.
5. Amend the Monitoring Program, undertake additional resource assessments, and implement mitigative measures if requested by the MOELP.

6. Make recommendations to the MOELP and Panorama Resort for changing construction and operating procedures and methods deemed necessary to ensure protection of the environment.

The Environmental Monitor shall be a qualified independent professional. The Environmental Monitor may be dismissed by either Panorama Resort or the MOELP for not adequately enforcing the Guidelines. Furthermore, the MOELP has the ability to impose a stop work order on construction should the developer fail to comply with the requirements for environmental protection.

4.2 Environmental Monitoring Program

1. The Environmental Monitor shall be on-site at all times he/she or the MOELP deems necessary for the protection of the environment. The Environmental Monitor shall be present daily during the critical construction period.

2. The Environmental Monitor shall ensure that all construction activities associated with the construction of Panorama Resort adhere to the guidelines contained in this document.

3. The Environmental Monitor shall take turbidity measurements on the waterbodies of the site on a regular basis both upstream and downstream of the development. These measurements shall be conducted more frequently when working within fifteen (15) metres of the waterbodies or within their wetted widths.

4. The Environmental Monitor shall conduct, or have conducted on his behalf, any water and air quality measurements and soil analyses required by Provincial government for fulfillment of any permits or authorizations.

5. The Environmental Monitor shall ensure that all water leaving the construction site comply with the "Approved and Working Criteria for Water Quality" (Pommen, 1991), "Land Development Guidelines for the Protection of Aquatic Habitat" (DFO/MOELP 1992), or the "Canadian Water Quality Guidelines" (CCREM, 1991), whichever is more stringent.

6. Panorama Resort shall conduct, or have conducted on their behalf, an ongoing groundwater monitoring program. This program shall monitor groundwater levels within the development area during the summer and autumn, to ensure that construction and operation of the Resort does not interfere with the groundwater regime in that area. The program shall be ongoing throughout construction. The program should be continued during the first two years of operations. The monitoring program shall then be reviewed, with any modifications subject to the mutual agreement of Panorama Resort and the MOELP.

4.3 Reporting

1. The Environmental Monitor shall submit written reports simultaneously to both Panorama Resort and the MOELP. During the initial construction of the network road, the monitoring reports shall be submitted on a regular basis. The reporting schedule may be modified, as construction progresses, upon mutual consent of Panorama Resort and the MOELP.

2. The environmental monitoring reports shall be brief, and shall include:
   - A brief description of construction activities since the last reporting period.
   - Any non-compliance activities, and subsequent work stoppages, mitigative actions and/or rectifying measures.
   - Unexpected environmental concerns and potential mitigation strategies.
   - Laboratory and field analysis results as they become available.

PANORAMA
MOUNTAIN VILLAGE

ENVIRONMENTAL

HABITAT MAP REVIEW FOR PANORAMA RESORT GOLF COURSE

November 1994

INTRAWEST

Habitat Review

The following maps assess various aspects of the Toby Creek drainage to support a variety of wildlife and recreation. The maps are based on Entech Environmental Consultants 1978 Initial Evaluation for the Kootenay River Diversion project and 1988 Purcell Wilderness Conservancy and Adjacent Area study.

This report briefly reviews map data and details some information that may be considered when implementing development.

Some factors to be considered when reviewing the maps:

1. The Biophysical Capability (1989, 1990) maps for ungulates and grizzly bears do not take social and economic factors, present land use and the additive effects of the other wildlife species using the given area in a given time.

2. The Kootenay River Diversion Project would have had the greatest affects on the Rocky Mountain Trench (Columbia River Wetlands, Columbia Lake and Lake Windermere). The Entech Environment (1978) maps include part of the Toby Creek drainage. Details for the drainages are sketchy and inconclusive, even though the proposed Golf Course area is included in the Study Core Area.

3. The Kootenay River Diversion Maps (1978) do not qualify the basis of the wildlife use and habitat classifications.

4. Ecosystem-based management requires that the 'big picture' be assessed; not just a small area. In the map analyses, the proposed golf is evaluated along with surrounding areas. Ecosystem-based planning is imperative when impacts on big game are to be considered.

GRIZZLY BEAR
BIOPHYSICAL CLASSIFICATION

FROM: D. Demarchi, 1990

From the Map Notes:
Factors considered to compose the biophysical capabilities of a given unit of land are:

1. Surfical Materials
2. Bedrock Geology
3. Land forms
4. Soil Parameters
5. Climate
6. Vegetation Parameters

MAP - FOOD AND SHELTER -"the fundamental needs of wildlife"
- capability of land to support grizzlies is the long term ability to meet habitat requirements

Grizzly habitat use can be divided into four seasons

1. SPRING HABITAT	- used immediately after hibernation - high quality succulent vegetation in a snow free zone
2. SUMMER RANGE	- moisture rich habitat such as flood plains, wetlands, avalanche tracts (run out zone), and alpine meadows - provide abundant rodent prey heavily used
3. FALL RANGE	- high energy foods such as berries and spawning fish - moisture rich montane-spruce and S. Interior Cedar-Hemlock
4. DENNING	- deeper soils on cooler aspects - consistent snow cover throughout winter

Food and Cover Requirements
- ratings based on optimum vegetational (successional) stage that can be maintained for the good of the species.

Management prescriptions limited to:
1. Prescribed burning or grazing.
2. Prescribed logging and slashing.
3. Protection of land use from all detrimental practices.

Grizzly Bear Carrying Capability Values
- based on the square kilometre area in a given site required to support one grizzly bear
- the greater the area required; the decreased habitat capability

Synopsis of Map Area - Panorama and Vicinity

One of the most recognized necessities of grizzly bear habitat is limited human disturbance. This Biophysical Capability Assessment does not account for human disturbance and therefore, does not give a complete picture of the area as grizzly bear habitat. Further studies should attempt to assess current grizzly use and the impacts of human disturbance (hunting, hiking, etc.) on grizzlies.

There have been grizzlies sighted and harvested within some of the below listed areas. Riparian areas can be defined as the 30 m area surrounding a watershed; creek, lake or pond. The Map demonstrates that riparian areas are considered important habitat for grizzlies, along with rodent (prey) rich avalanche chutes. Grizzlies require very large areas to survive.

- (slope based on topographical location not aspect)

1. **Proposed Golf Course** - high annual capability

Notes: - healthy riparian areas around Hopeful and Toby Creek
- human disturbance very significant factor

2. **Ski Area** - moderate annual capability
Summit - low summer (through to Mt. Goldie)

Notes:

- ski runs would imitate avalanche habitat - excellent ground squirrel (prey) habitat
- human disturbance significant with recent terrain development. No hunting restrictions for ski area will reduce disturbance mainly by reducing road access.
- grizzlies are less likely to habituate to human garbage than black bears, but it is important to make garbage inaccessible. Garbage has a higher caloric value than berries, forbs etc. and bears prefer it once exposed to it. Panorama has had problems with black bears. Education and common sense will significantly reduce any human-bear conflicts.
- minimal food or cover on Goldie ridge (may use for travel)

3.Taynton Basin

East Slope	- high annual with moderate annual near confluence with Toby
	- moderate annual capability, moderate spring and fall capability
Riparian Area	- high spring and fall capability
	- high spring and moderate fall near valley cirque
West Slope	- low summer capability
	- upper avalanche chutes moderate capability in spring
Peak (ridge)	- high summer capability

Notes:

- avalanche chutes are excellent ground squirrel (prey) habitat
- human disturbance may be very significant in hunting seasons (spring bear harvest) as local guide outfitter has temporary hunting shelter in Taynton basin.
- human recreational traffic (outside hunting) minimal due to steep terrain
- may use ridge to travel to other high capability habitats

4. Hopeful Basin

East Slope	- moderate annual capability mixed with low spring and summer capability
West Slope	- low spring capability all the way down the slope (logging road) to Toby Creek

Notes:

- closed forest of lodgepole pine at lower elevations and sub-alpine larch at higher elevation; excellent cover with reduced food opportunities
- human disturbance may be significant in hunting season
- recent logging disturbance

5. Watch Peak	- front face above 5000' - moderate summer and denning capability - lower face (just above riparian area 4000' - 5000') high annual capability

Notes:

- excellent cover with diverse forest types to provide ample food opportunities
- has a high annual capability corridor through the Clearwater Basin in which to travel
- human disturbance not significant due to steep terrain; hunting guide outfitter may use Clearwater Basin trail
- Toby Creek Road and Panorama may act as a barrier to bears trying to travel into Taynton Basin and south Toby Creek riparian areas (also reduces human-bear conflicts)

6. Clearwater

Front Face	- high annual capability
Riparian	- to base of Mt. Nelson- high annual capability
Northwest Slope	- low summer
Avalanche Chutes	- to Paradise lower annual capability
Watch Peak	- from road to entrance of Clearwater Valley - medium annual capability
Ridge	- no capability

7. Toby Riparian Area	- high annual capability

Notes:

- very large tract of habitat (all the way up Toby Creek)
- human disturbance significant near Panorama Resort
- Toby Creek road may reduce level of capability up to the Purcell Wilderness Conservancy; it crosses Toby Creek twice, dividing the habitat tract.
- increased road traffic would increase vulnerability of grizzly bears that use the Toby Riparian area

8. Paradise Basin

Tailings	- low annual capability
North Slope	- in cirque (Watch Peak) - low summer capability with a small moderate spring and fall capability
South Slope	- moderate annual capability
Town site	- moderate annual capability with a high spring capability at the back of the cirque

Notes:

- human disturbance significant: road access to sub-alpine and alpine areas

OVERALL

Toby Creek Riparian - high annual capability
Panorama and Drainages - generally low annual capability
Watch Peak and Drainages - moderate to high annual capability

CAPABILITY INDEX

High - 5 km^2/ grizzly bear
Moderate - 15 km^2/grizzly bear
Low - 45 km^2/ grizzly bear
Nil - unsuitable grizzly bear habitat

Panorama Resort; the Village and proposed golf course have high annual biophysical capability. Grizzly bears naturally avoid areas with high human disturbance; therefore, it is unlikely that grizzlies would utilize these areas. For this reason, development of the golf course would probably have minimal impacts on grizzly bear use. However; it is recommended that habitat surrounding these developed areas are maintained for grizzlies: limit access to the ski area and summit (close roads and do not offer chairlift access above Quadzilla), reduce potential human-bear conflicts by proper garbage management and educate people about the surrounding area's important wildlife habitat.

WILDLIFE (UNGULATE) BIOPHYSICAL CAPABILITY CLASSIFICATION

FROM: D. Demarchi 1989

From the Map Notes:

Factors considered to compose the biophysical capabilities of a given unit of land are:

1. Surfical Materials
2. Bedrock Geology
3. Land forms
4. Soil Parameters
5. Climate
6. Vegetation Parameters

WILDLIFE CAPABILITY

- each unit considered separately for each species
    - it identifies the capability of each unit for each species. That is; it is not considered what affect each species has on another species' habitat capabilities.
    - often, optimum seral stage that is suitable for one species is not so for another
    - ratings are not additive; therefore, can give no indication as to potential standing crop of ungulates to be supported
- carrying capacity expressed as hectares/animal/month (DENSITY/TIME)
    - reflects the number of hectares required to support one animal of each species for one month on a sustained basis
    - as the number of hectares required to support one animal increases, the capability decreases

1 = highest capability
6 = lowest capability

- does not take into account social and economic factors
- the map lists winter use before summer us and the highest values for each season are labeled first

SEASONAL RANGES AND THEIR USE

Winter Range

- density highest as snow restricts movement of mule and white-tailed deer and elk. Will use southern, windswept slopes
- moose can tolerate moderate depth of snow and will use floodplains
- caribou can walk on snow and will eat arboreal (in tree) lichens and litter fall

Elk, Mule and White-tailed Deer

- in the autumn, migrate to the Rocky Mountain Trench (Columbia Valley)
- Toby riparian area is an important migration route - from summer range to winter range

Mountain Goats

- go higher in the winter on south facing slopes in the Eastern Purcells

Caribou

- sub-alpine fir and spruce old growth forest
- most of their habitat has been logged or burned
- slight slopes

Moose

- floodplains and lower south facing slopes of major Purcell Valleys

Other Range Seasons

- spring, summer, early fall and migration habitats
- forage quality during this period does not limit or restrict numbers
  - low density in summer due to high forage availability
  - habitats in summer used for shorter periods due
  - no restriction of movement due to snow depth
  - best summer ranges include moisture-rich sites such as flood plains, wetlands, avalanche chutes (run out areas) and alpine meadows

7. UNGULATE (WILDLIFE): CAPABILITY

FROM: Entech Environmental Assessment Map 1978

-slopes based on topographical location not aspect

- Toby Creek riparian areas considered high (CLI - Class 1 to 3) from approximately 3750' - 5750' near the north side of the opening of the Toby Canyon (southern aspect)
    - on the south side, the Class 1 area extends to approximately 4000 ' (northern aspect)

- adjacent slopes have moderate (CLI - Class 4 -5) capability
    - north side - Clearwater basin
        - Spring Creek almost to Paradise
    - south side - Panorama Ski Area
        - Hopeful basin with corridor over saddle to Brewer Valley including west side of Mt. Goldie

- Columbia Valley - high capability (includes Toby Benches)

- Toby Riparian Area
    - important corridor for migration
    - has greater capability than the Horsethief drainage (north) and Brewer drainage (south)
        - Horsethief has high capability but does not encompass as large an area
        - Brewer has moderate capability
    - less capability than Dutch drainage (south near Fairmont)

8. UNGULATE (WILDLIFE): PRESENT USE

FROM: Entech Environmental Assessment Map 1978

- important corridor for moose and elk migration
- low ungulate capability

Notes:

- based on the Study Core area, the map rates the Toby drainage as having low ungulate capability. This is completely opposite from both Capability Maps (1978 and 1989). It is likely that the area around Panorama was not assessed as the Environmental Assessment was for the Kootenay River Diversion proposal.

10. UNGULATE (WILDLIFE): LAND USE CONTROL-PRIORITY AREAS

FROM: Entech Environmental Assessment Map 1978

- map outlines proposed management priorities and control

- the Toby Creek area near Panorama has not been assessed for land use control-priority

- Toby Benches IIL,Cf2M2gx
    - secondary control priority
    - based on low present use factor and control feasibility considered secondary
    - moderate gains from management
    - techniques include grazing and Christmas Tree farms

WILDLIFE (UNGULATE) BIOPHYSICAL CAPABILITY CLASSIFICATION

This map represents the biophysical capability of a given unit to support a given species of wild ungulate (even-toed mammals in the Cervidae (deer) and Bovidae (goats) families). Biophysical capabilities are based on the basic needs of the species; food and cover.

Present land use is not reflected unless it has been permanently altered. Social and economic factors are not considered. The map only reflects the potential of a given unit to support a given species over a given time period. It does not represent the actual ecosystem (the interactions between all living organisms, their physical surroundings and the forces that act upon that area).

It has been documented in many scientific studies that ungulates will avoid humans. High capability habitat exposed to high human traffic will be less used than moderate habitat with no human traffic. This is particularly evident when the human traffic has negative stimuli, such as hunting or loud noise. However, ungulates may enter areas of high human traffic if they are not exposed to negative human stimuli, can access an excellent food source and if surrounding habitat adverse conditions. For example, the elk in Banff town site; the elk are not hunted within a very large area and have habituated to other human harassment, there is a lot to eat (hedges, flowers etc.) and the wolves, an elk predator, will not come into Banff.

In general, riparian areas are very important ecological areas. The moisture-rich areas are typified by lush vegetation, essential to many species of herbivores and omnivores. In the spring, these areas provide nutritious food, and in winter, the shrubby vegetation is important winter food for moose.

SSF - spring summer and early fall

1. **Proposed Golf Course** X3e3m3w3c4
    - winter moose habitat with moderate capability
    - summer elk habitat with very high SSF capability
    - summer mule deer habitat with very high SSF capability
    - summer white-tailed deer habitat with very high SSF capability
    - summer caribou habitat with moderate to high capability

Notes:

- encompasses two riparian areas (Hopeful Creek and Toby Creek); important ungulate habitat
- the course, in it's current state, offers good grazing opportunities with open grassy areas surrounded by lodgepole pine forest (cover)
- human disturbance significant
- in winter, cross country `skate' trails may be used as travel routes by moose
- population assessments would confirm actual winter use
- Woodland Caribou (*Rangifer tarandus*) generally move above the timberline in the summer and drop into the sub-alpine (approximately 4500' - 7000') forest in the winter, feeding on arboreal lichens. The proposed golf course does not fit this general habitat description.
- no hunting restrictions, set by the Resort, may positively impact the populations by reduced access, although it is too small an area to affect ungulate behaviour. That is, it is doubtful the ungulates would recognize it as a `safe' area as it is believed they do in the National Parks.

2. **Panorama Village** X3e3m3w3c4

- same habitat capability as proposed golf course for all species

Notes:

- moose and both species of deer have been observed in the Village area.
- human disturbance significant. Some ungulates may habituate to harassment if the habitat benefits outweigh the negative impacts of harassment. Individual moose appear to have habituated to any harassment at Panorama, and access habitat around Resort quite readily. Habitat may be enhanced by access to compost heaps, stables and salt lick.

3. **Ski Area** X3e3m3w3c5

- for moose, elk, mule and white-tailed deer the habitat capability is the same as the proposed Golf Course
- has no capability to support caribou

Notes:

- the ski area imitates avalanche chute habitat; open areas with good grazing opportunities surrounded by forest cover
- hunting restrictions may positively impact populations due to reduced hunter access

4. Nordic Trails (west of Hopeful Creek) e4m4w4x4c4

- elk, mule and white tailed deer, moose and caribou SSF range of high to moderate capability

Notes:

- it is flood plain with more shrubby areas than proposed golf course, has better cover and less human disturbance
- may have potential for habitat enhancement, if surrounding habitat is altered

5. Lower Hopeful Basin e4m4w4x4c4

- same as Nordic Trails

Notes:

- habitat has water birch in Hopeful riparian area surrounded by lodgepole pine/douglas fir forest and is more closed than the Nordic Trail habitat (west of the Golf Course)

6. Watch Peak - north side of Toby Creek, across from Panorama X2M4G4e3w3

- very high capability as winter moose habitat
- low capability as winter mule and mountain goat habitat

Notes:

- small avalanche chutes, with small aspen groves, and good forest cover
- Toby Creek Road is probably used as moose winter travel route from Watch Peak habitat over to Toby Creek riparian areas. Roadside vegetation may be used by moose for winter food.

OVERALL:

The Resort and surrounding area provide very high to moderate biophysical capability for most ungulates (excluding Mountain Goats and Caribou). The riparian area is probably the most important montane (ecoregion below approximately 4500') habitat for moose, mule deer, white-tailed deer and elk. The Toby Creek riparian is significant, from the Toby Creek Canyon west into the Purcell Wilderness Conservancy.

Elk, mule deer and white-tailed deer appear to migrate to the Columbia Valley wetlands in the late fall and return to the Toby Valley in the spring, using the riparian area as a travel route. Mountain goats winter in the alpine and it is extremely unlikely that caribou live near Panorama.

Moose winter in the large riparian area around Panorama. There are trails for easier winter travel around Panorama; the Toby Creek Road, the nordic trails and ski area trails. Vegetation surrounding trails are suitable winter moose browse, making these areas more attractive.

Moose are typically shy of people, although some moose have partially habituated to humans in Panorama Village. As the number of people increase, this habituation behaviour may change. Further studies should assess moose population dynamics and actual use of habitat (rather than potential as the Biophysical Capability Maps show) of the proposed golf course and Panorama Village.

For your information, I thought you may be interested in the following recommendations.

From *'Kananaskis Country; Planning Document #4. The Impacts of Recreation on Fish and Wildlife with Emphasis on Kananaskis Country: A Literature Review and Partial Bibliography'*

Prepared by: B. Cornish, J. Van Camp and M. McNicholl
Alberta Energy and Natural Resources, Fish and Wildlife Division. May, 1980

The research sited in this review is mainly from the 1970's. There is more sophisticated and recent studies that have been completed; however, this review gives an idea of some considerations for the proposed development. Below are some mitigative measures recommended to reduce negative environmental impacts with alpine development and ski resorts, applicable to the proposed golf course development for Panorama:

1. "Powerlines and communication lines should be built underground (Klock, 1973)."
2. "Large scale use of tractors and bulldozers should be avoided (Watson et al. 1970)..."
3. "Buffer strips should be left along rivers, lakes, streams and other areas used extensively by wildlife and/or fish (Sullivan and Stelfox, 1974)."
4. "..rehabilitation of soil-damaged areas can be carried out through use of soil stabilizers and sods (Watson et al. 1970). Only plants native to the area should be used in reseeding attempts."
5. "Uninformed feeding of wildlife should be prohibited, with strong enforcement. In no case, should large mammals should be fed."
6. "Use of snowmobiles should be forbidden in sensitive....areas (Trottier 1972) "
7. "Summer recreational use of the area should be channeled to less sensitive areas through use of formal, prepared paths (Watson et al. 1970; Willard and Marr 1970). Where chairlifts are operational in summer only return tickets could be sold (Watson et al. 1970) with people not allowed to disembark into sensitive areas. [In my own opinion, chairlift hiking should be restricted to Quadzilla to reduce the impacts of human disturbance on noted grizzly and ungulate habitat]."

8. "The Man and Biosphere report (Hodgson 1974) emphasized the need for studies to determine the carrying capacity of the ecosystems involved and to identify fragile ecosystems. Some of the pre-development studies that were suggested are: impact of trampling; successional stages after soil and vegetational disturbances; and building techniques which would reduce impacts of slope stability and on run-off patterns which affect stream siltation and fish populations, and on wildlife movements."

9. "Maintain the consumer (visitor) population below the maximum carrying capacity [of the environment] (Willard and Marr 1970). Carrying capacity should be predicted from available information and the area monitored for potential overuse, with provision for revision if necessary."

10. "Educational programmes and warning signs to decrease littering and other undesirable behaviour would probably be successful because visitors are not intentionally destructive (Willard and Marr 1970)."

11. "Landscape features, including planting of shrubbery and retention of brush piles beneficial to wildlife should be incorporated into all developments."

12. "Closures of trails and sensitive areas near developments should be implemented during critical periods."

<u>*Literature Sited in section of Kananaskis Country Report:*</u>

Hodgson, G.W. (Ed.). 1974. The mountain environment and urban society: the Kananaskis Study. Univ. Calgary Comm. for Man and the Biosphere, Kananaskis Environment Sci Centre.

Klock, g. 1973. Mission Ridge - a case history of soil disturbance and revegetation of a winter sport area development. U.S.D.A. Forest Serv. Res. Note PNW-199

Sullivan, J.P. and J.G. Stelfox, 1974. Wildlife food habits and seasonal ranges in Jasper Townsite area. Can. Wildl. Serv., Edmonton. MS rept.

Trottier, G.C. 1972. Ecology of the alpine vegetation of Highwood Pass, Alberta. M.Sc. Thesis, Univ. Calgary, Calgary.

Watson, A., N. Bayfield and S. M. Moyes. 1970. Research on human pressures on Scottish mountain tundra, soils and animals. IUCN. New Ser. 16: 256-266

PANORAMA
MOUNTAIN VILLAGE

ENVIRONMENTAL

TAYNTON AND HOPEFUL CREEKS HYDROLOGY REPORT

June 1990

INTRAWEST

HYDROTECH
CONSULTING LTD.

WATER RESOURCES
HYDROTECHNICAL

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TELEPHONE: (403) 437-1924

June 21, 1990

Mr. Pat Hess
Panorama Resort Ltd.
P.O. Box 7000
Invermere, B.C.
V0A 1K0

A-136

Dear Mr. Hess:

SUBJECT: Taynton & Hopeful Creeks Hydrology Report

Following our meeting of 3 May 1990 and your subsequent request for a low flow evaluation of Taynton and Hopeful Creeks, we are pleased to submit our attached final report.

If you have any question regarding this report, please let me know.

Yours very truly,

HYDROTECH CONSULTING LTD.

J. Penel

Jacques Penel P. Eng.
Senior Water Resources Consultant

TABLE OF CONTENT

1.0 OVERVIEW

1.1 Study Objectives

HYDROTECH CONSULTING has been retained by Panorama Resort Ltd. to conduct a hydrology study pertaining to water availability requirements for an expanded Panorama Resort Water Utility. The purpose of the study is to fulfill the requirements of the Comptroller of Water Rights under the Water Utility Act as outlined by the Ministry of Environment and Parks of the Province of British Columbia in its letter of November 1st, 1989. The requirements set forth by the Ministry may be summarized as follows:

> "to conduct a hydrology study to confirm whether flows in Taynton Creek are adequate to supply the present and proposed developments during a moderate drought described as a one-in-ten years low flow. A design maximum day demand for the full development to be served by the utility is also to be determined."

The study was extended to include Hopeful Creek, since preliminary findings have shown that Taynton Creek alone could not meet all the future water requirements of Panorama Resort. Due to the growing water demand during the summer, the study has included the analysis of low flow water availability and demand for both the winter and the summer periods.

1.2 Previous Studies

Several hydrology studies were previously conducted on Taynton and Hopeful Creeks, concentrating on the existing and proposed developments of Panorama. A summary of those studies is given below:

- Morgan Steward and Company, Panorama Village Project. Study for Master Plan of Domestic Water Supply and Distribution, September 1980.

  The report includes the following points that are of interest to this study:

  <u>Taynton Creek:</u>
  1) a brief description of Taynton Creek watershed,
  2) an estimates of the minimum Taynton Creek discharge of 0.8 cfs based on soil transmissivity.
  3) a graph showing spot flow measurement taken on Taynton Creek during the 1979-80 period. Lowest

winter flow during that period was 0.8 cfs measured in January 1980 out of a total of 8 spot measurements. Lowest summer measurement was 7.8 cfs in early September 1980 out of a total of three spot measurements.

4) a recommended Taynton Creek winter low flow of 0.8 cfs that can be maintained for a period of over 200 days. Metric equivalent is shown wrongly at 0.074 m³/s, should be 0.023 m³/s.

<u>Hopeful Creek:</u>

5) a brief description of Hopeful Creek watershed,
6) an estimates of the minimum Hopeful Creek discharge of 1.85 cfs based on soil transmissivity.
7) a graph showing flow measurement taken on Hopeful Creek during the 1979-80 period. Lowest winter flow during that period was 1.5 cfs measured in March 1979 out of a total of only 3 spot measurements. Lowest summer flow was 4.7 cfs in late August 1980, out of a total of only two spot measurements.
8) a recommended Hopeful winter low flow of 1.85 cfs that can be maintained for a period of over 200 days. Metric equivalent is shown wrongly at 0.17 m³/s, should be 0.052 m³/s.

<u>Water Consumption and Distribution System:</u>

9) a Table showing design or measured daily water consumption at seven ski resorts in North America. Values between 78 and 100 U.S. gallons are given.
10) Recommended daily water consumption for various activities related to the ski area. Values vary between 62.5 for hotel beds to 75 IGPD for condominium beds.
11) Description of the water intake and storage/ distribution system. Pumping system is designed to deliver 200 IGPM to a 860,000 IG upper reservoir.

Panorama Resort Development Plan Amendments, February 1989

This study includes the following:

1) present maximum diversion rate under License is 226,000 IGPD,
2) 1987 monthly water consumption varies from a high of 3,969,600 IG to a low of 1,985,850 IG in October,
3) indication that Panorama has entered into an agreement with the Water Management Branch to commence a monitoring program on Taynton Creek in order to establish the amount of domestic water which can be safely diverted from the drainage.

1.3 Site Description

Taynton Watershed:

Taynton Creek total drainage basin extends from Mount Taynton at elevation 7850' (2390 m) to Mount Goldie at elevation 8800' (2680 m). The creek discharges into Toby Creek at an elevation of 3650' (1110 m). According to Morgan Stewart, 1980, the water diversion is done at elevation 4,057 feet Geodetic (1240 m). Most of the watershed is heavily covered with trees except for a very small area above the treeline elevation of 7500' (2300 m). Taynton drainage area at the water diversion point has been delineated and measured at 14.7 km^2, similar to the 1500 ha reported by Morgan Steward, 1980.

Hopeful Creek Watershed:

Hopeful Creek total drainage basin extends from near Mount Brewer at an elevation of 8300' (2530 m) to Mount Goldie at an elevation of 8800' (2680 m) down to Toby Creek at an elevation of 3750' (1140 m). Most of the watershed is heavily covered with trees except for a small area located above treeline. Hopeful Creek watershed lays south of Taynton Creek with a common boundary near the headwater. Hopeful Creek drainage area at the water diversion point has been delineated and measured at 19.0 km^2.

Both Taynton Creek and Hopeful Creek drainage basins are shown on Figure 1. All above mentioned elevations are approximate.

Taynton Creek Water Diversion System Description:

Water is diverted from a side channel of Taynton Creek using perforated pipes buried in the stream bed gravel. The diverted water is then piped by gravity down to a lower water storage reservoir with an approximate capacity of 35,000 IG. From there it is pumped using one or two 200 IGPM pumps through an 8 inch (200 mm) pipe to an upper reservoir with a capacity of 850,000 IG . Water distribution to the village is done through an 16 inch (400 mm) pipe discharging from the upper reservoir.

1.4 Existing Flow Measurements Systems

Water Consumption:

Water consumption at Panorama is measured indirectly by recording the daily number of hours of pumping from the lower water storage reservoir to the upper reservoir and using a pump capacity of 200 IGPM. The daily pumping record has been

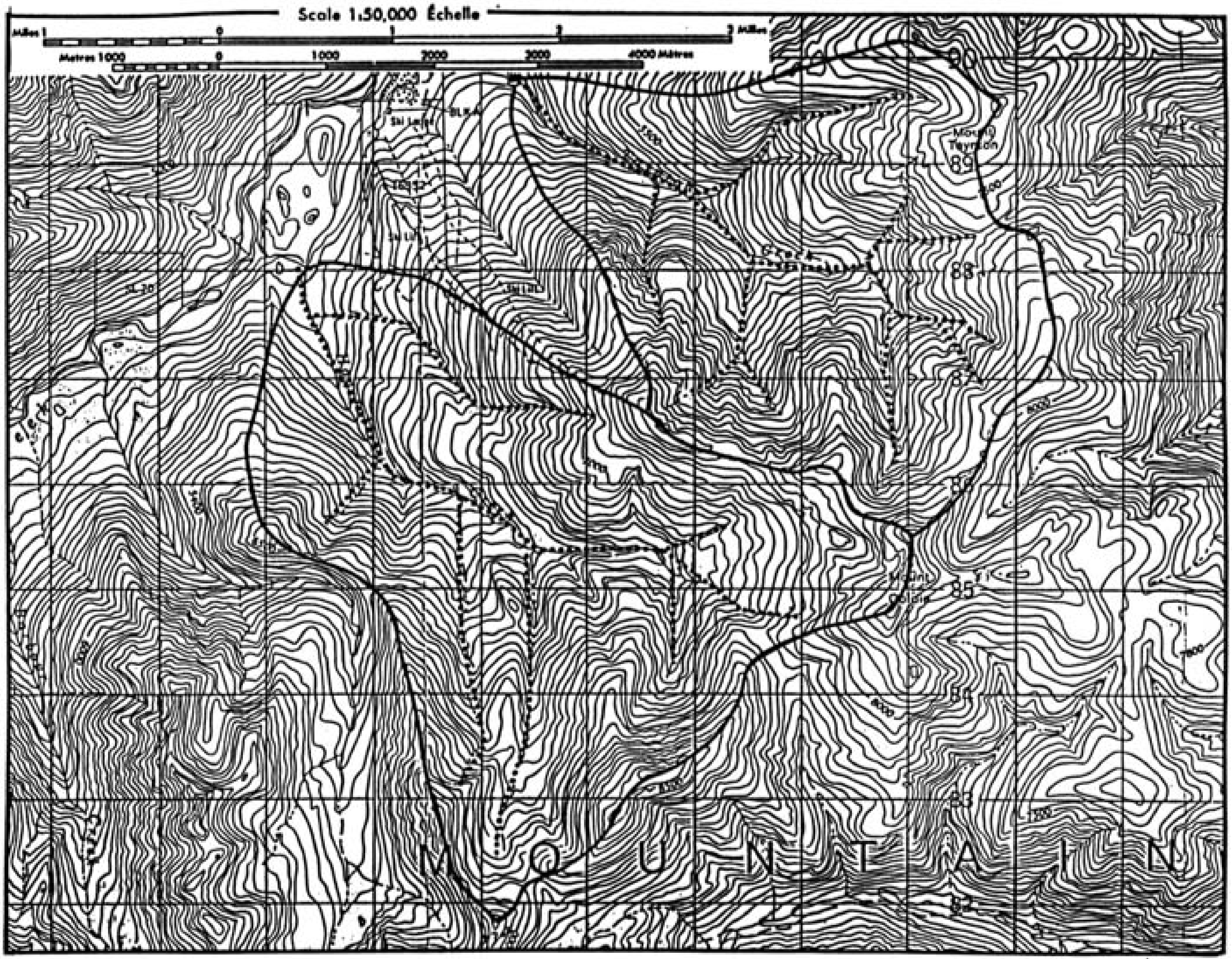


FIGURE 1 TAYNTON AND HOPEFUL CREEKS DRAINAGE BASIN

processed and tabulated by HYDROTECH and is shown on Table A1 of Appendix A.

Taynton Creek Discharge:

During the 1979-80 period, a few spot measurements were undertaken on Taynton Creek by Morgan Steward and Water Right Branch personnel.

Starting in July 1988, flow measurements were undertaken on Taynton Creek using a 24 inch sharp crest rectangular weir equipped with a staff gauge. Layout of the weir and intake schematic is shown on Figure 2. The flow measurement is done on a side channel of Taynton Creek and therefore does not represent the total creek flow value. Flow distribution between the main channel and the side channel is controlled by placing or removing boulders at the confluence. This is done to insure that sufficient flow is available over the water intake at pumping time. Panorama personnel have recognized the problem associated with flow measurements on a side channel and have attempted to correct it by indicating in a few instances on the recording chart the estimated percentage of the total flow that is being diverted toward the weir. Estimated over-the-weir diversions range from 10 to 75% of the total creek flow. Over-the-weir daily discharge was calculated applying an appropriate discharge table provided by the Ministry. Calculated discharges have been tabulated on Table A2 of Appendix A.

Hopeful Creek Discharge:

During the 1979-80 period, a few spot measurements were undertaken on Taynton Creek by Morgan Steward and Water Right Branch personnel.

No flow measuring device has been installed on Hopeful Creek.

2.0 WINTER LOW FLOW ANALYSIS

2.1 Taynton Creek - Winter Low Flows Measurements

The following winter flows values have been obtained on Taynton Creek:

Discharge Measurements: A total of eight spot flow measurements collected during the 1979-80 winter period with values between 0.8 and 3.2 cfs (0.023 and 0.91 m^3/s). Most measurements were undertaken using a method called current and cross-section. No indications are given on how current was measured.

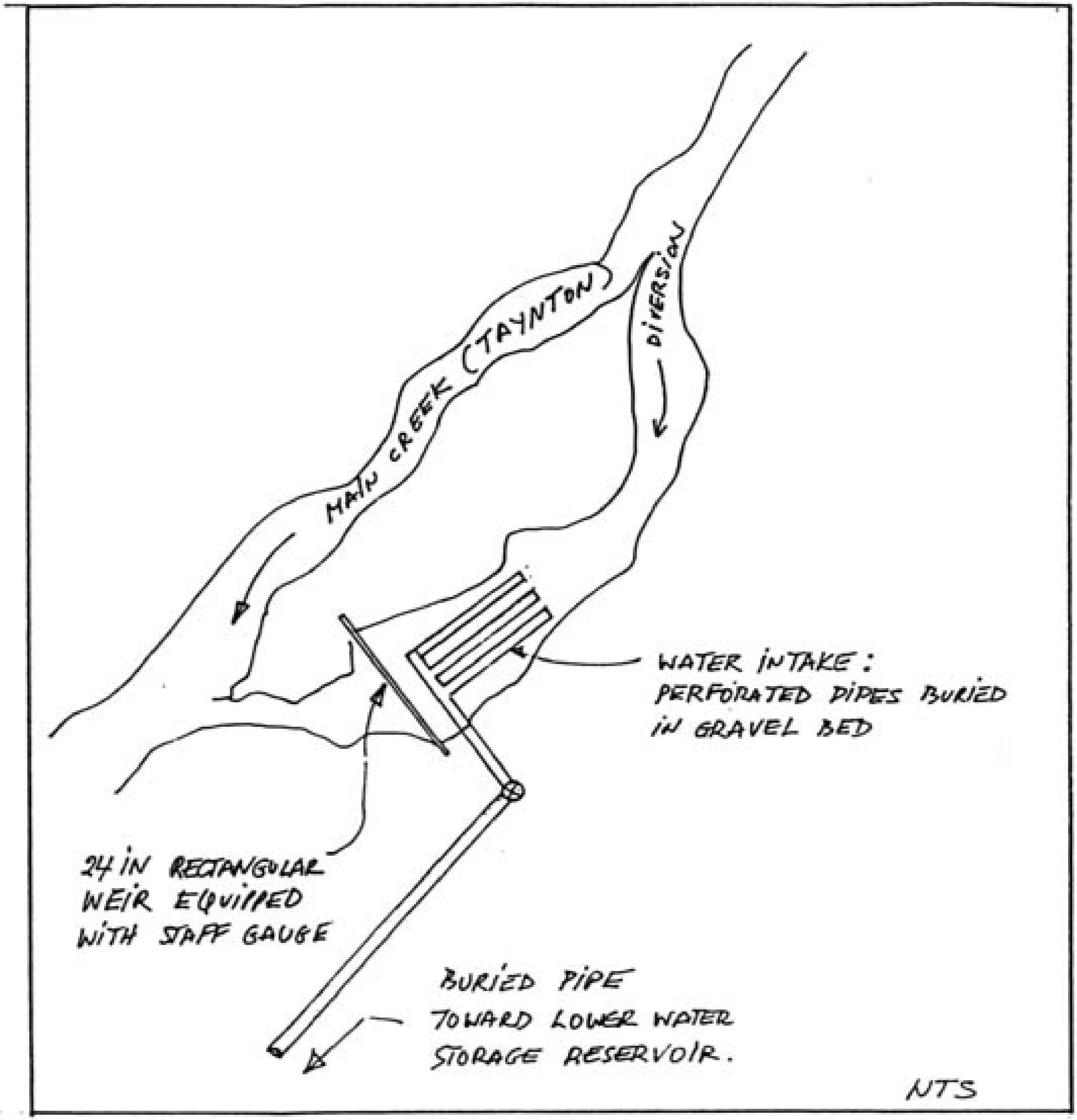


FIGURE 2 TAYNTON CREEK DIVERSION SCHEMATIC

Weir Measurements: Weir measurement were started in July 1988. The staff gauge is read four to six times a month on the average. Processed flow data presented on Table A2 indicates a minimum over-the-weir discharge of 0.021 m^3/s in winter 1988-89 (out of four spot measurements) and of 0.013 m^3/s in winter 1989-90 (out of 13 spot measurements). As indicated in Section 1.4, weir measurement on Taynton Creek at the diversion point does not represent the true flow of the creek but rather an absolute lower limit of the creek discharge. Actual creek flow is expected to be higher since at no time was the entire creek diverted toward the weir (communication of Mel Thesen, in charge of the data collection for Panorama Resorts).

2.2 Hopeful Creek - Winter Low Flows Measurements

The following winter low flows have been measured on Hopeful Creek:

Discharge Measurements: A total of only three flow measurements all obtained in March 1980 with values varying between 1.5 and 1.8 cfs (0.042 and 0.051 m^3/s).

2.3 Regional Analysis - Winter Flows

Due to the scarcity of the winter flow measurements on Taynton and Hopeful Creeks, a winter low flow regional analysis was undertaken using nearby Water Survey of Canada stations located within a 50 km radius of Panorama in the Kootenay Area.

A total of eight stations with drainage areas between 21.2 and 684 km^2 and record durations between five and 23 years were selected for the regional analysis. Low flow frequency analyses were applied to the stations using an in-house developed computer program to calculate the Log Pearson III and the Log Normal frequency distributions. One-in-ten-year low flow unit runoff was found to vary between .0010 and 0.0036 $m^3/s/km^2$ with an average value of 0.0020 $m^3/s/km^2$. Results are detailed in Table 1. As expected unit runoffs are not directly related to drainage area size.

Regional analysis results, when applied to Taynton and Hopeful Creeks, yields the following 1:10 year low discharges:

TABLE 1 REGIONAL ANALYSIS

TAYNTON CREEK WINTER LOW FLOW ANALYSIS

NAME:	RECORD YEARS	DRAINAGE AREA (km2)	Q10 DISCHARGE (m3/s)	10 YEAR UNIT RUNOFF (m3/s/km2)
Windermere Cr. Winderm	20	84.2	0.300	0.0036
Toby Cr. Athalmer	14	684	1.290	0.0019
Stoddart Cr. Athalmer	10	21.2	0.043	0.0020
Horsethief Cr. Wilmer	7	606	1.050	0.0017
Frances Cr. Wilmer	5	225	0.497	0.0022
Sinclair Cr. Radium	23	94.3	0.187	0.0020
Templeton R. Brisco	5	170	0.176	0.0010
Bugaboo Cr. Spillimach	14	381	0.490	0.0013
			AVERAGE:	0.0020

TAYNTON CREEK SUMMER LOW FLOW ANALYSIS

NAME:	RECORD YEARS	DRAINAGE AREA (km2)	Q10 DISCHARGE (m3/s)	10 YEAR UNIT RUNOFF (m3/s/km2)	RATIO SUMMER/ WINTER LOW FLOW
Windermere Cr. Winderm	15	84.2	0.410	0.0049	1.37
Stoddart Cr. Athalmer	12	21.2	0.079	0.0037	1.84
Sinclair Cr. Radium	14	94.3	0.469	0.0050	2.51
Wilmer Cr. near Wilmer	5	6.73	0.017	0.0025	0 Flow in Winter
Carbonate Cr. McMurdo	11	8.03	0.057	0.0071	N/A
			AVERAGE:	0.0046	

	Range: (m^3/s)	Average: (m^3/s)
Taynton Creek:	0.015-0.053	0.029
Hopeful Creek:	0.019-0.068	0.038

2.4 Selected Winter Low Flows

2.4.1 Taynton Creek Winter Low Flow Selection

Taynton Creek low flows as estimated by various methods are summarized as follows:

Measurement/ Analysis:	Minimum Discharge: (m^3/s)	Comments:	Taynton Creek Winter Low Estimates: (m^3/s)
1979-80 Flow Measurements:	0.023	Adjusted for 1:10 year low flow using Toby Cr.:	0.019
1988-89 Weir:	0.021		
1989-90 Weir:	0.013	Adjusted assuming 70% of flow goes over weir:	0.017
Regional Analysis:	0.015 - 0.053	Average value: 0.029 m^3/s	0.015 - 0.053
<u>SELECTED VALUE:</u>			0.019 M^3/S (361,000 IGPD)

The following comments may be made from the above results:

- The 1979-80 minimum flow measurement may be influenced by the following uncertainties:
    - minimum value of 0.023 m^3/s measured in late January 1980 was obtained from only nine spot discharge measurements mostly all obtained during a single winter season. However, winter flow are not expected to fluctuate widely and it is likely that 0.023 m^3/s reflects accurately the 1979-80 low flow condition on Taynton Creek.
    - review of low flow data on Toby Creek indicates that late January 1980 was not a particularly low flow period (minimum of 1.50 m^3/s compared to a calculated one-in-ten-year low flow of 1.29 m^3/s).

Using Toby Creek as in indicator for the 1980 low flow condition, a 1.29/1.50 = 0.86 ratio was applied leading to a one-in-ten-year Taynton Creek low flow estimate of 0.019 m^3/s.

- The 1988-89 weir measurements may be affected by the following shortcomings:
  - measurements represent a lower limit of discharge for the period, actual flows are larger since at no time was the entire Taynton Creek flow diverted toward the weir. It may be assumed safely that the 1988-89 low flows on Taynton Creek were at least 0.017 m^3/s assuming that, at most, 70% of the Taynton Creek flow was diverted toward the weir.
  - these measurements represent only two years of low flows. No assessment of drought conditions for the 1988-89 period was undertaken since Toby Creek Station was no longer in operation in 1988-89.
- The Regional Analysis yields results consistent with Taynton Creek flow measurements.

Selected Taynton Creek winter low flow value of 0.019 m^3/s is on the conservative side. Flow data on Taynton Creek, if/when available, will permit refinement of reliable yield estimates for the watershed.

2.4.2 Hopeful Creek Winter Low Flow Selection

Hopeful Creek low flows as estimated by various methods are summarized as follows:

Measurement/ Analysis:	Minimum Discharge: (m^3/s)	Comments:	Hopeful Creek Winter Low Estimates (m^3/s)
1979-80 Flow Measurements:	0.042	Adjusted for 1:10 year low flow using Toby Cr.:	0.030
Regional Analysis:	0.019 - 0.068	Average value: 0.038 m^3/s	0.019 - 0.068
Runoff Transposition using Taynton Creek:	0.025	Area transposing of Taynton Creek low flow	0.025
SELECTED VALUE:			0.025 m^3/S (475,000 IGPD)

The following comments may be drawn from the above results:

- The 1979-80 minimum flow measurement may be influenced by the following uncertainties:
  - minimum value of 0.042 m³/s was obtained in March 1979, from only three spot discharge measurements during a single winter season. It is not too likely that the lowest seasonal flow on Hopeful Creek has been capture with only three seasonal flow measurement.
  - review of low flow data on Toby Creek indicates that March 1979 was not a particularly low flow period with a minimum flow of 1.78 m³/s compared to a one-in-ten-year low flow of 1.29 m³/s). Using Toby Creek as in indicator for the 1979 low flow condition, a 1.29/1.78 = 0.72 ratio was applied leading to a one-in-ten-year low flow estimate of 0.030 m³/s.

- Selected 1:10 low runoff for Taynton Creek of 0.019 m³/s was transposed to Hopeful Creek using drainage area ratio.

Low flow values estimated by the various above mentioned methods yield results within the same range. A conservative 1:10 year low flow of 0.025 m³/s was selected. If/when additional discharge points on Hopeful Creek are available, the design value may likely be revised upward.

3.0 SUMMER LOW FLOW ANALYSIS

3.1 Taynton Creek - Summer Low Flows Measurements

The following summer flows, representing the June to August period, have been measured on Taynton Creek:

<u>Discharge Measurements:</u> During the summer of 1979 and 1980, a total of only three spot measurements were undertaken on Taynton Creek by Morgan Steward and Water Right Branch personnel. Lowest flow measurement was 7.8 cfs (0.22 m³/s) in early September 1980.

<u>Weir Measurements:</u> Processed flow data presented on Table A2 indicates minimum summer over-the-weir discharges of 0.038 m³/s in August 1988 and of 0.021 m³/s in July and in August 1989. Actual creek flow is expected to be higher since at no time was the entire creek diverted toward the weir.

3.2 Hopeful Creek - Summer Low Flows Measurements

The following summer low flows have been measured on Hopeful Creek:

Discharge Measurements: Only two spot measurement, taken in the summer of 1980 have been taken on Hopeful Creek. Lowest flow measurements is 4.7 cfs (0.133 m^3/s) obtained in late August 1980.

3.3 Regional Analysis - Summer Flow

Due to the scarcity of summer flow measurement on Taynton and Hopeful Creeks, a regional analysis on June to August monthly low flow was undertaken using nearby Water Survey of Canada stations located within a 50 km radius of Panorama in the Kootenay Area.

A total of five stations with drainage areas between 6.7 and 94.3 km^2 and record durations between five and 15 years were selected for the regional analysis. Low flow frequency analyses were applied to the five stations for the month of June, July and August using the Log Pearson III and Log Normal frequency distributions. Lowest flows were found to occur in August at all selected stations except Windermere Creek near Windermere where June was found to be more critical. One-in-ten-year low flow unit runoff was found to vary between .0025 and 0.0071 $m^3/s/km^2$ with an average value of 0.0046 $m^3/s/km^2$. Results are detailed in Table 1.

Regional analysis results, when applied to Taynton and Hopeful Creeks, yields the following one-in-ten-year low flows:

	Range: (m^3/s)	Average: (m^3/s)
Taynton Creek:	0.037-0.104	0.068
Hopeful Creek:	0.048-0.135	0.087

3.4 Selected Summer Low Flows

3.4.1 Taynton Creek Summer Low Flow Selection

Taynton Creek summer low flows as estimated by various methods are summarized as follows:

Measurement/ Analysis:	Minimum Discharge: (m^3/s)	Comments:	Taynton Creek Summer Low Estimates: (m^3/s)
1979-80 Flow Measurements:	0.22	Result obtained in early September 1980.	Unknown
1988-89 Weir:	0.038		
1989-90 Weir:	0.021	Adjusted assuming 70% of flow goes over weir:	0.030
Regional Analysis:	0.037 - 0.104	Average value: 0.068 m^3/s	0.037 - 0.104
Regional winter to summer low flow transposition	0.027 - 0.047	Summer/Winter Flow Ratio varies between 1.37 and 2.5 (from Regional Analyse)	0.027 - 0.047
<u>SELECTED VALUE:</u>			0.027 M^3/S (513,000 IGPD)

The following comments may be made from the above mentioned results:

- The 1980 minimum flow measurement of 0.22 m^3/s is unlikely to be a representative low flow for the season. In addition, the regional analysis has shown that summer runoff mechanism for Toby Creek and Taynton Creek are not similar and therefore Toby Creek cannot be used for comparison purpose.

- The 1988-89 weir measurements represent a lower limit of discharge for the period, actual flows are larger since at no time was the entire Taynton Creek flow diverted toward the weir. Assuming that at most 70% of Taynton Creek flow was diverted toward the weir, Taynton Creek minimum 88-89 flow was at least 0.030 m^3/s. However, these measurements represent only two years of low flow.

- The winter and summer regional analyses were used to calculated summer to winter low flow ratios. Ratio values between 1.37 and 2.5 were obtained as shown on Table 1. Those ratios were applied to Taynton Creek selected winter low flow leading to estimates of the summer low flow on Taynton Creek ranging between 0.026 and 0.047 m^3/s.

Results using the winter to summer flow transposition yield low flow values that are somewhat smaller than the one obtained from the regional analyse. A conservative summer low flow of 0.027 m^3/s was selected. Flow data on Taynton Creek, if/when available, will permit refinement of reliable yield estimates for the watershed.

3.4.2 Hopeful Creek Summer Low Flow Selection

Hopeful Creek summer low flows as estimated by various methods are summarized as follows:

Measurement/ Analysis:	Minimum Discharge: (m^3/s)	Comments:	Hopeful Creek Summer Low Estimates (m^3/s)
1979-80 Flow Measurements:	0.133	Result obtained in late August 1980.	Unknown
Regional Analysis:	0.048 - 0.135	Average value: 0.087 m^3/s	0.048 - 0.135
Regional Winter to Summer low flow transposition	0.034 - 0.063	Summer to Winter Low Flow Ratio varies between 1.37 and 2.5	0.034 - 0.063
SELECTED VALUE:			0.034 M^3/S (646,000 IGPD)

The following comments may be made from the above mentioned results:

- The 1980 minimum flow measurement of 0.133 m^3/s, obtained out of three spot measurement only, is unlikely to represent a summer low flow.
- The regional summer to winter low flow method has been detailed in Section 2.4.1.

The regional summer/winter low flow method used to transpose Hopeful Creek winter low flow yield results that are somewhat smaller than the regional analysis results. A conservative summer low flow of 0.034 m^3/s was selected. Flow data on Hopeful Creek, if/when available, will permit refinement of reliable yield estimates for the watershed.

4.0 WATER CONSUMPTION

4.1 Data Review

4.1.1 Overview

Water consumption at Panorama is recorded indirectly from the daily pumping rate record. This record was reviewed and appears to be in good order. However the following questions arise from using pumping records as a water consumption indicator:

a) Pumping rates delivered by the pump must be verified to insure that proper water volumes are calculated.

b) pumping time is not an exact indicator of the daily water consumption, since under the present manual operation, the reservoir is not necessarily filled to the same level each day.

4.1.2 Pump Capacity

The capacity of the pumps utilized at Panorama was verified. In this regard, the pump curve for a 6M, 7000 Fairbanks Morse Vertical Turbine Pump with a 4.08 impeller was obtained and the static head and line losses were calculated. Based on the manufacturer's pump curve, each pump in its present configuration is designed to discharge between 201 and 202 IGPM which is very close to the design value of 200 IGPM. For all practical purposes a value of 200 IGPM was used. However uncertainty remains to whether the pumps are still functioning at their design capacity.

4.1.3 Pumping Time

In order to eliminate the daily water consumption errors indicated in Section 4.1.1-b, water consumption has been calculated based on a five day running average pumping time. Five day average pumping times have been plotted on Figures 3 to 5 for the period of record between January 1989 to March 1990. Results have also been tabulated in Table A1 of Appendix A.

4.2 Winter Maximum Consumption

4.2.1 Present Winter Consumption

Results show a large fluctuation of the seasonal water consumption. Lowest consumption is found in November and largest consumption is found during the December to April

FIGURE 3 PUMPING RECORD
JAN – JUL 1989

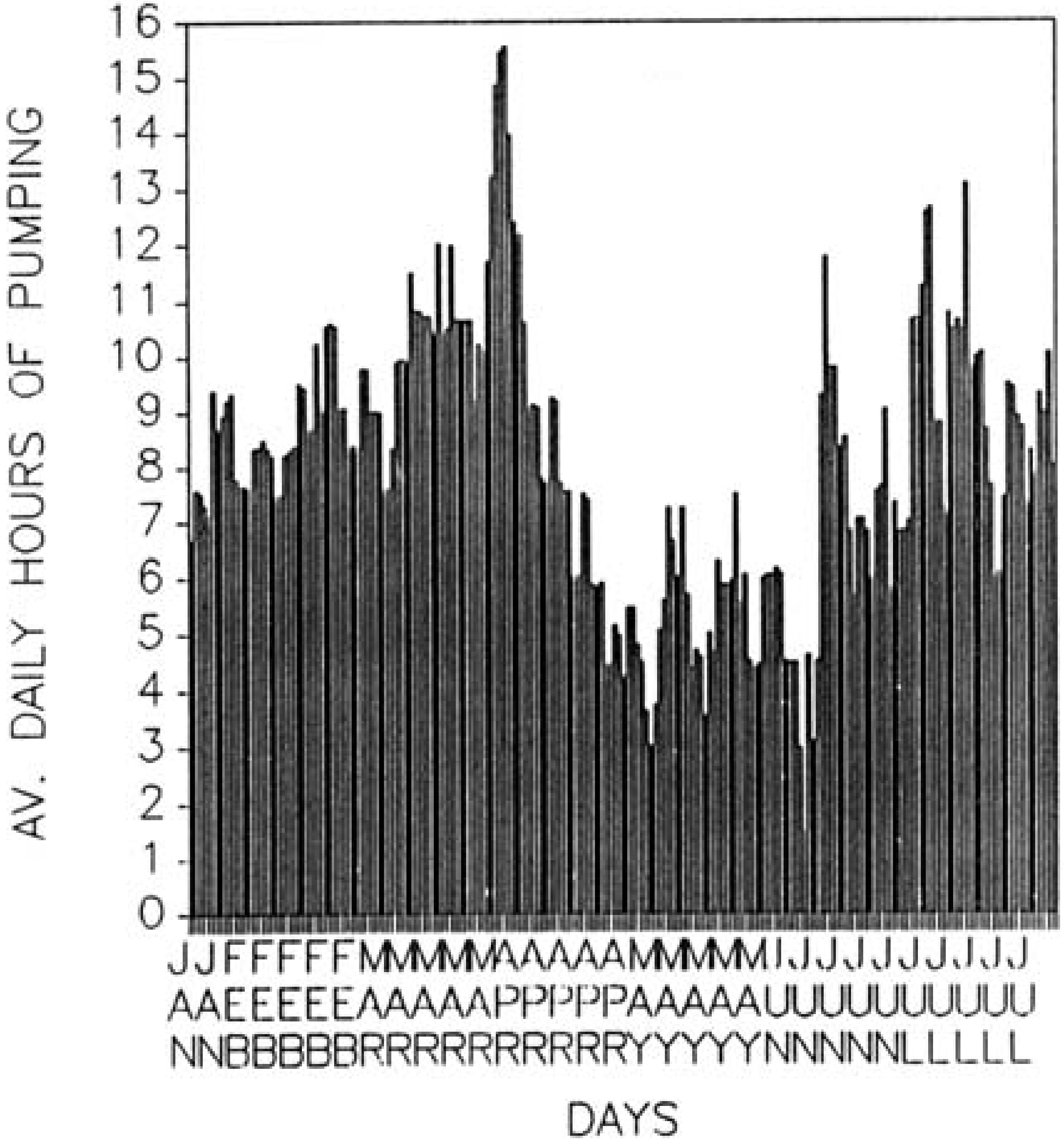


FIGURE 4 PUMPING RECORD
AUG 1989 – JAN 90

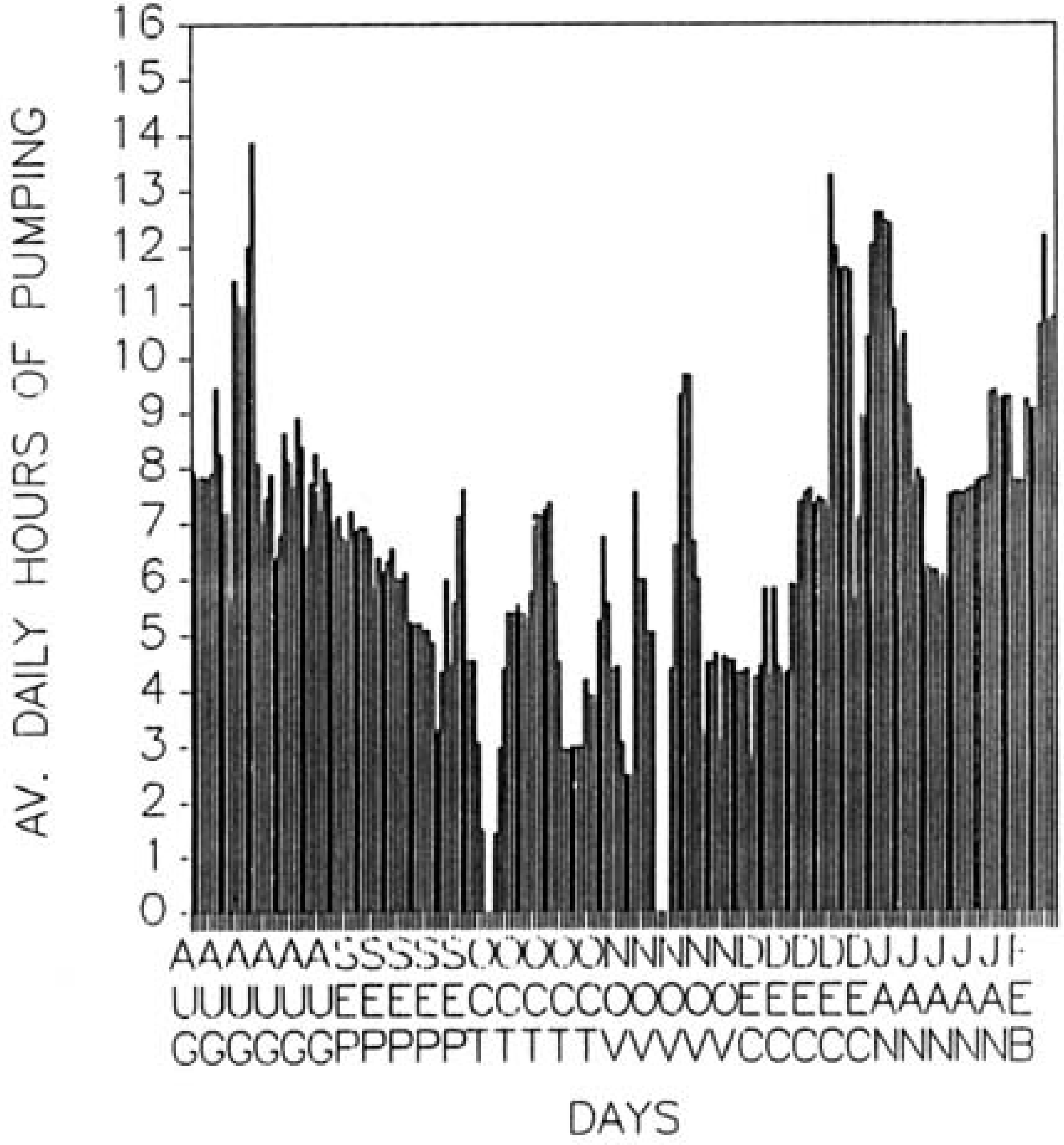
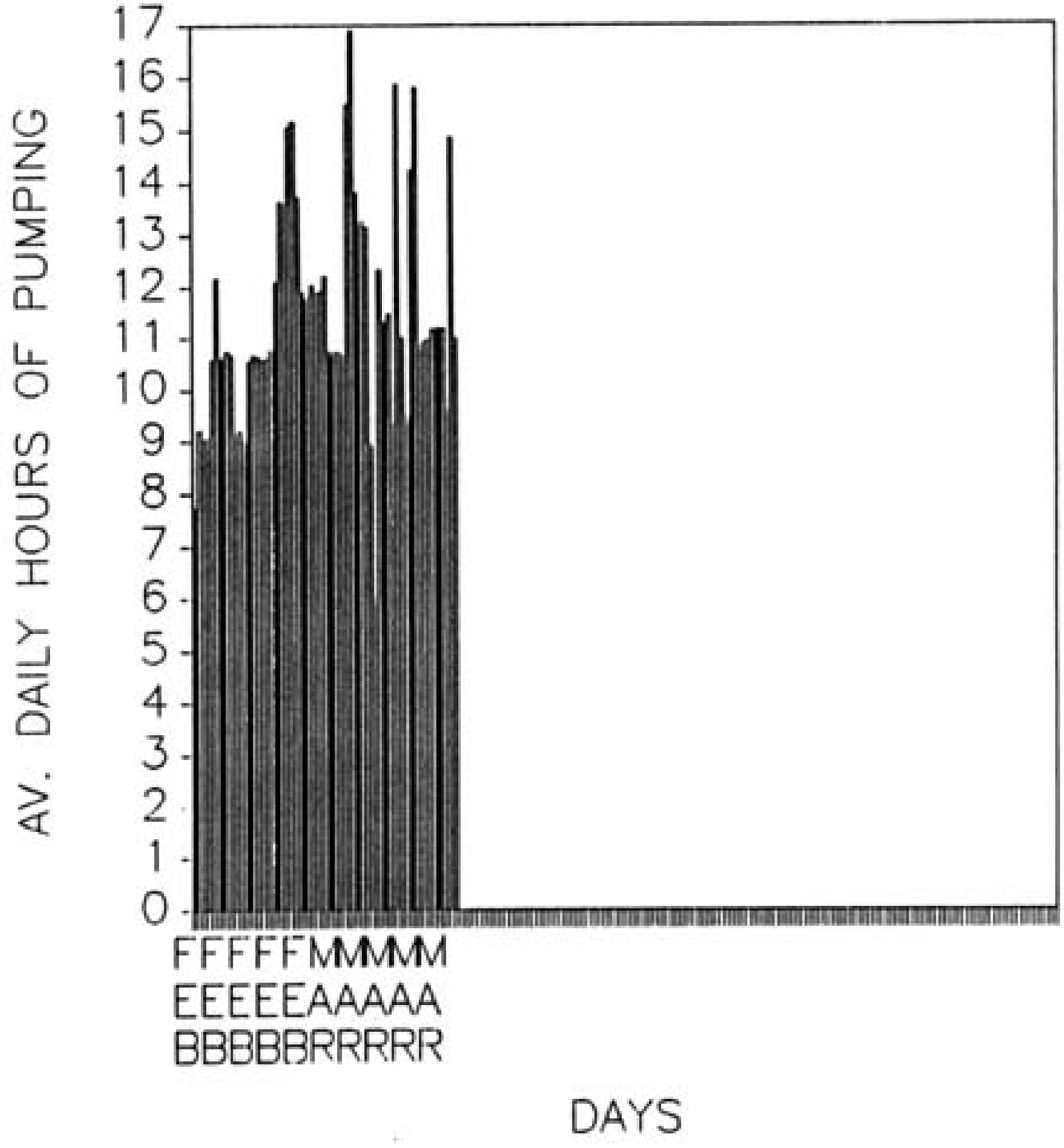


FIGURE 5

PUMPING RECORD
FEB – MARCH 90



period of skiing. The following highest winter pumping times and water consumptions were recorded during the 1989-90 period:

	Max. 5 Day Av. Pumping Time (hrs)	Possible Max Daily Water Consumption (IGPM)
March 31, 1989:	15.57	187,000
March 8, 1990:	16.89	203,000

Per Capita Daily Water Consumption:

The maximum capacity of Panorama Resort at the present is as follows (numbers provided verbally by Panorama Resorts):

- 1200 people (including staff) in hotels and condominium
- 55 houses in subdivision
- 2200 day skiers
- Heliplex day lodge (skier plus staff)

Assuming an average of 6 people per house during the peak season and 100 persons per day at the Heliplex, the following number of people are consuming water at peak demand:

- 1560 overnight users
- 2300 day users

The following per capita water consumption is required to meet the maximum daily water consumption of 203,000 IGPM:

Overnight Users:	95 IGPD
Day User:	23 IGPD
Combined Overnight/Day User:	130 IGPD

Those numbers are somewhat higher than the 75 IGPD for condominium beds used in the 1980 Master Plan and the 78 to 100 USGPD (65 to 83 IGPD) surveyed by Morgan Stewart in 1980 at various ski areas.

4.2.2 Future Winter Consumption

The maximum number of beds projected by Panorama Resort is 9250 with an occupancy rate of 70%. This bring the projected total number of people at one time in the resort to 6475 persons. Occupancy growth from 1560 to 6475 person is equal to a 4.15 time increase over the present conditions. Assuming that future per-capita water consumption remains at present level, a maximum daily water demand of 842,000 IGPD is projected.

4.3 Summer Consumption

4.3.1 Present Summer Consumption

Results show that summer water consumption fluctuates greatly. The lowest consumption is found in May and the largest during the July-August period of summer recreational activities. The following highest pumping times/possible water consumptions were found for the 1989-90 period:

	Max. 5 Day Av. Pumping Time (hrs)	Possible Max Daily Water Consumption (IGPM)
July 1989:	13.1	157,000
August 1989:	13.9	166,000

The summer water consumption also includes lawn watering.

4.3.2 Future Summer Consumption

Future domestic water consumption has been estimated assuming that summer growth for Panorama Resort will follow the same pattern as the winter growth, namely that future demand will be 4.15 time the present demand. This leads to an estimated future domestic water consumption of 690,000 IGPD.

In addition to domestic water consumption, water demand for irrigation of the golf course is projected to be 400,000 IGPD.

5.0 WATER AVAILABILITY & DEMAND

5.1 Winter Water Availability & Demand

The critical water availability versus demand during the winter season is as follows:

Taynton Creek 1:10 year Low Flow:	361,000 IGPD
Hopeful Creek 1:10 year Low Flow:	475,000 IGPD
Total 1:10 Year Water Available:	836,000 IGPD

Present Max Daily Water Demand (Mar 1990) 203,000 IGPD

Present Max Daily Water Demand (Mar 1990)	203,000 IGPD
Projected Maximum Daily Water Demand:	842,000 IGPD

From these results the following conclusions may be drawn:

- Taynton Creek alone will provide water for future development up to a maximum level of approximately 2,800 beds at full capacity. This represents a nearly 80% increase over the present maximum capacity at Panorama.
- Future development past the 2,800 bed capacity will be met by combining the flow of Taynton and Hopeful Creeks.

5.2 Summer Water Availability & Demand

The critical water availability versus demand during the summer season is as follows:

Taynton Creek 10 Year Summer Low Flow:	513,000 IGPD
Hopeful Creek 10 Year Summer Low Flow:	646,000 IGPD
Total 1:10 Year Summer Water Available:	1,159,000 IGPD
Present Max Domestic Water Demand -Aug 89	166,000 IGPD
Projected Max. Domestic Water Demand:	690,000 IGPD
Projected Max. Golf Irrigation Demand:	400,000 IGPD
Projected Total Max. Future Water Demand:	1,090,000 IGPD

These results show that Taynton and Hopeful Creeks will be able to provide sufficient water for projected summer development (domestic and golf course irrigation) under a moderate drought condition.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Results of the study indicate the followings:

- Under winter conditions, low flow discharges and maximum water requirements are as follows:

Total 1:10 Year Water Available from Taynton and Hopeful Creeks:	836,000 IGPD

Projected Max. Daily Water Demand: 842,000 IGPD

Under summer conditions, low flow discharges and maximum water requirements are as follows:

Total 1:10 Year Water Available from Taynton and Hopeful Creeks:	1,159,000 IGPD
Projected Max. Daily Water Demand:	1,090,000 IGPD

The above mentioned results indicate that Taynton and Hopeful Creeks will meet all the projected winter and summer water demand of Panorama Resort Ltd associated with a development level of 9,250 beds (at an occupancy rate of 70% and assuming that the per-capita water consumption stays at present level). Taynton Creek alone will be sufficient to meet the domestic water requirements up to a level of approximately 2800 bed. Above that level, Hopeful Creek will also be required to provide domestic water supply for Panorama.

Several factors may affect the results of the analysis:

. Due to the lack of existing low flow data on Taynton and Hopeful Creeks, the minimum flow was estimated in a conservative manner based on a regional analysis and on a few incomplete flow measurements. The availability of actual field data on Taynton and Hopeful Creeks will allow for a more in-depth low flow analysis, likely leading to an upward revision of the low flow estimates.

. The supply demand analyse has assumed that the 1:10 year low flow coincides exactly with the peak demand. Such a condition represents a conservative assumption likely above the 1:10 year return period.

. Calculated per-capita daily water consumption at Panorama at the present time appears to be higher than anticipated. This may be due to causes that can be corrected, reducing the future water demand. The following reasons may account for the high water consumption:
  - the pumps may no longer be discharging at their design capacity of 200 IGPM, thereby overestimating the true water consumption,
  - water leak in the distribution system may increase the per-capita water consumption.

6.2 Recommendations

. In order to be in a position to review and refine Taynton Creek reliable yield in the future when the resort will require additional water above the 2,800 beds level, it is recommended that an appropriate weir be installed on Taynton Creek itself and that measurements be carried out on a regular basis. A water measuring device on Hopeful Creek, although not as essential will also be useful.

Water consumption at the resort is presently calculated using pumping time as a meter. This report has confirmed that each pump was designed to discharge 200 IGPM. However factors such as the condition of the pipe and pump efficiency may lead to an overestimation of the pumping rate and therefore of the water consumption at the village. Also pumping time does not reflect accurately the daily consumption at the village. In order to improve water consumption monitoring, the installation of a meter on the pipe supplying the village although not essential is recommended. Other alternative consists in undertaking tests to verify the pump capacity.

Causes of high water consumption need investigation, they may be due to factors such as pumping efficiency, water leaks, running faucets etc..

APPENDIXE A1

30/04/90

TABLE 1 PUMPING / WATER CONSUMPTION RECORD
1989-90

YEAR	MONTH	DAY	P1 PUMPING METER	P2 PUMPING METER	P1 PUMPING (HOURS)	P2 PUMPING (HOURS)	P1+P2 PUMPING (HOURS)	5 DAY AV. PUMPING (HOURS)	AV. WATER CONSUMPTION (IGPD)
1989	JAN	14		779.49					
1989	JAN	15	95.86						
1989	JAN	16		786.12	0.00	6.63	6.63		
1989	JAN	17	102.84		6.98	0.00	6.98		
1989	JAN	18		793.82	0.00	7.70	7.70		
1989	JAN	19	110.70		7.86	0.00	7.86		
1989	JAN	20	114.90		4.20	0.00	4.20	6.67	80,088
1989	JAN	21	118.41	801.41	3.51	7.59	11.10	7.57	90,816
1989	JAN	22		808.10	0.00	6.69	6.69	7.51	90,120
1989	JAN	23	125.08		6.67	0.00	6.67	7.30	87,648
1989	JAN	24		815.10	0.00	7.00	7.00	7.13	85,584
1989	JAN	25	132.70	822.88	7.62	7.78	15.40	9.37	112,464
1989	JAN	26		830.62	0.00	7.74	7.74	8.70	104,400
1989	JAN	27	140.59		7.89	0.00	7.89	8.94	107,280
1989	JAN	28		838.62	0.00	8.00	8.00	9.21	110,472
1989	JAN	29	148.19		7.60	0.00	7.60	9.33	111,912
1989	JAN	30		846.33	0.00	7.71	7.71	7.79	93,456
1989	JAN	31	155.24		7.05	0.00	7.05	7.65	91,800
1989	FEB	1	163.14		7.90	0.00	7.90	7.65	91,824
1989	FEB	2	170.98		7.84	0.00	7.84	7.62	91,440
1989	FEB	3	174.33	854.23	3.35	7.90	11.25	8.35	100,200
1989	FEB	4	182.07		7.74	0.00	7.74	8.36	100,272
1989	FEB	5		861.93	0.00	7.70	7.70	8.49	101,832
1989	FEB	6	189.28		7.21	0.00	7.21	8.35	100,176
1989	FEB	7		869.04	0.00	7.11	7.11	8.20	98,424
1989	FEB	8	196.87		7.59	0.00	7.59	7.47	89,640
1989	FEB	9		876.93	0.00	7.89	7.89	7.50	90,000
1989	FEB	10	204.62	880.49	7.75	3.56	11.31	8.22	98,664
1989	FEB	11	212.24		7.62	0.00	7.62	8.30	99,648
1989	FEB	12		888.05	0.00	7.56	7.56	8.39	100,728
1989	FEB	13	220.10	893.34	7.86	5.29	13.15	9.51	114,072
1989	FEB	14	227.61		7.51	0.00	7.51	9.43	113,160
1989	FEB	15		900.83	0.00	7.49	7.49	8.67	103,992
1989	FEB	16	235.41		7.80	0.00	7.80	8.70	104,424
1989	FEB	17	242.87	908.62	7.46	7.79	15.25	10.24	122,880
1989	FEB	18	250.31		7.44	0.00	7.44	9.10	109,176
1989	FEB	19	257.77	916.00	7.46	7.38	14.84	10.56	126,768
1989	FEB	20		923.66	0.00	7.66	7.66	10.60	127,176

TABLE 1 PUMPING / WATER CONSUMPTION RECORD
(CONTINUED..) 1989-90

	MONTH	DAY	P1 PUMPING METER	P2 PUMPING METER	P1 PUMPING (HOURS)	P2 PUMPING (HOURS)	P1+P2 PUMPING (HOURS)	5 DAY AV. PUMPING (HOURS)	AV. WATER CONSUMPTION (IGPD)
1989	FEB	21	265.47		7.70	0.00	7.70	10.58	126,936
1989	FEB	22	273.08		7.61	0.00	7.61	9.05	108,600
1989	FEB	23	280.66		7.58	0.00	7.58	9.08	108,936
1989	FEB	24	284.12	931.58	3.46	7.92	11.38	8.39	100,632
1989	FEB	25	291.80		7.68	0.00	7.68	8.39	100,680
1989	FEB	26		939.25	0.00	7.67	7.67	8.38	100,608
1989	FEB	27	298.84	946.82	7.04	7.57	14.61	9.78	117,408
1989	FEB	28	306.43		7.59	0.00	7.59	9.79	117,432
1989	MAR	1		954.33	0.00	7.51	7.51	9.01	108,144
1989	MAR	2	314.13		7.70	0.00	7.70	9.02	108,192
1989	MAR	3		961.87	0.00	7.54	7.54	8.99	107,880
1989	MAR	4	321.81		7.68	0.00	7.68	7.60	91,248
1989	MAR	5		969.56	0.00	7.69	7.69	7.62	91,495
1989	MAR	6	329.33	973.22	7.52	3.66	11.18	8.36	100,296
1989	MAR	7	337.07	980.97	7.74	7.75	15.49	9.92	118,992
1989	MAR	8	344.81		7.74	0.00	7.74	9.96	119,472
1989	MAR	9		988.66	0.00	7.69	7.69	9.96	119,496
1989	MAR	10	352.55	996.38	7.74	7.72	15.46	11.51	138,137
1989	MAR	11	360.33		7.78	0.00	7.78	10.83	129,984
1989	MAR	12	367.96	4.16	7.63	7.78	15.41	10.82	129,792
1989	MAR	13	375.25		7.29	0.00	7.29	10.73	128,712
1989	MAR	14	382.95		7.70	0.00	7.70	10.73	128,736
1989	MAR	15	390.00	11.45	7.05	7.29	14.34	10.50	126,048
1989	MAR	16	397.67	19.15	7.67	7.70	15.37	12.02	144,264
1989	MAR	17		26.75	0.00	7.60	7.60	10.46	125,520
1989	MAR	18	405.33		7.66	0.00	7.66	10.53	126,408
1989	MAR	19	412.77	34.32	7.44	7.57	15.01	12.00	143,952
1989	MAR	20	420.46		7.69	0.00	7.69	10.67	127,992
1989	MAR	21	428.03	42.01	7.57	7.69	15.26	10.64	127,728
1989	MAR	22	435.64		7.61	0.00	7.61	10.65	127,752
1989	MAR	23	443.34		7.70	0.00	7.70	10.65	127,848
1989	MAR	24	451.10		7.76	0.00	7.76	9.20	110,448
1989	MAR	25	456.29	49.57	5.19	7.56	12.75	10.22	122,592
1989	MAR	26	463.74	57.03	7.45	7.46	14.91	10.15	121,752
1989	MAR	27	471.48	64.76	7.74	7.73	15.47	11.72	140,616
1989	MAR	28	479.16	72.39	7.68	7.63	15.31	13.24	158,880
1989	MAR	29	487.14	80.40	7.98	8.01	15.99	14.89	178,632
1989	MAR	30	494.94	88.24	7.80	7.84	15.64	15.46	185,568
1989	MAR	31	502.70	95.90	7.76	7.66	15.42	15.57	186,792
1989	APR	1	510.24		7.54	0.00	7.54	13.98	167,760
1989	APR	2		103.45	0.00	7.55	7.55	12.43	149,136
1989	APR	3	517.74	110.83	7.50	7.38	14.88	12.21	146,472
1989	APR	4	525.53		7.79	0.00	7.79	10.64	127,632
1989	APR	5	533.20		7.67	0.00	7.67	9.09	109,032
1989	APR	6	540.93		7.73	0.00	7.73	9.12	109,488

TABLE 1
(CONTINUED..)

PUMPING / WATER CONSUMPTION RECORD
1989-90

	MONTH	DAY	P1 PUMPING METER	P2 PUMPING METER	P1 PUMPING (HOURS)	P2 PUMPING (HOURS)	P1+P2 PUMPING (HOURS)	5 DAY AV. PUMPING (HOURS)	AV. WATER CONSUMPTION (IGPD)
1989	APR	7	548.33		7.40	0.00	7.40	9.09	109,128
1989	APR	8		118.57	0.00	8.54	8.54	7.83	93,912
1989	APR	9	555.87		7.54	0.00	7.54	7.78	93,312
1989	APR	10	563.45	125.96	7.58	7.39	14.97	9.24	110,832
1989	APR	11	571.00		7.55	0.00	7.55	9.20	110,400
1989	APR	12			0.00	0.00	0.00	7.72	92,640
1989	APR	13	578.71		7.71	0.00	7.71	7.55	90,648
1989	APR	14	586.23		7.52	0.00	7.52	7.55	90,600
1989	APR	15		133.46	0.00	7.50	7.50	6.06	72,672
1989	APR	16	593.78		7.55	0.00	7.55	6.06	72,672
1989	APR	17	600.95		7.17	0.00	7.17	7.49	89,880
1989	APR	18		140.67	0.00	7.21	7.21	7.39	88,680
1989	APR	19			0.00	0.00	0.00	5.89	70,632
1989	APR	20	608.26		7.31	0.00	7.31	5.85	70,176
1989	APR	21	616.07		7.81	0.00	7.81	5.90	70,800
1989	APR	22			0.00	0.00	0.00	4.47	53,592
1989	APR	23		148.02	0.00	7.35	7.35	4.49	53,928
1989	APR	24	619.40		3.33	0.00	3.33	5.16	61,920
1989	APR	25	622.73	151.06	3.33	3.04	6.37	4.97	59,654
1989	APR	26	627.03		4.30	0.00	4.30	4.27	51,230
1989	APR	27	633.01		5.98	0.00	5.98	5.47	65,582
1989	APR	28	640.35		7.34	0.00	7.34	5.46	65,558
1989	APR	29			0.00	0.00	0.00	4.80	57,566
1989	APR	30		155.99	0.00	4.93	4.93	4.51	54,120
1989	MAY	1			0.00	0.00	0.00	3.65	43,800
1989	MAY	2	643.26		2.91	0.00	2.91	3.04	36,432
1989	MAY	3	646.51	163.67	3.25	7.68	10.93	3.75	45,048
1989	MAY	4		170.24	0.00	6.57	6.57	5.07	60,816
1989	MAY	5	654.20		7.69	0.00	7.69	5.62	67,440
1989	MAY	6		178.37	0.00	8.13	8.13	7.25	86,952
1989	MAY	7			0.00	0.00	0.00	6.66	79,968
1989	MAY	8	662.00		7.80	0.00	7.80	6.04	72,456
1989	MAY	9	667.00	185.99	5.00	7.62	12.62	7.25	86,976
1989	MAY	10			0.00	0.00	0.00	5.71	68,520
1989	MAY	11	668.58		1.58	0.00	1.58	4.40	52,800
1989	MAY	12		187.55	0.00	1.56	1.56	4.71	56,544
1989	MAY	13	675.78		7.20	0.00	7.20	4.59	55,104
1989	MAY	14		195.14	0.00	7.59	7.59	3.59	43,032
1989	MAY	15	682.93		7.15	0.00	7.15	5.02	60,192
1989	MAY	16			0.00	0.00	0.00	4.70	56,400
1989	MAY	17	692.48		9.55	0.00	9.55	6.30	75,576
1989	MAY	18		200.26	0.00	5.12	5.12	5.88	70,584
1989	MAY	19	700.07		7.59	0.00	7.59	5.88	70,584
1989	MAY	20		207.80	0.00	7.54	7.54	5.96	71,520
1989	MAY	21	707.71		7.64	0.00	7.64	7.49	89,856

TABLE 1 PUMPING / WATER CONSUMPTION RECORD
(CONTINUED..) 1989-90

	MONTH	DAY	P1 PUMPING METER	P2 PUMPING METER	P1 PUMPING (HOURS)	P2 PUMPING (HOURS)	P1+P2 PUMPING (HOURS)	5 DAY AV. PUMPING (HOURS)	AV. WATER CONSUMPTION (IGPD)
1989	MAY	22			0.00	0.00	0.00	5.58	66,936
1989	MAY	23		215.26	0.00	7.46	7.46	6.05	72,552
1989	MAY	24			0.00	0.00	0.00	4.53	54,336
1989	MAY	25	714.71		7.00	0.00	7.00	4.42	53,040
1989	MAY	26		223.16	0.00	7.90	7.90	4.47	53,664
1989	MAY	27	722.38		7.67	0.00	7.67	6.01	72,072
1989	MAY	28		230.83	0.00	7.67	7.67	6.05	72,576
1989	MAY	29			0.00	0.00	0.00	6.05	72,576
1989	MAY	30	729.97		7.59	0.00	7.59	6.17	73,992
1989	JUN	1		238.23	0.00	7.40	7.40	6.07	72,792
1989	JUN	2	730.00		0.03	0.00	0.03	4.54	54,456
1989	JUN	3		245.75	0.00	7.52	7.52	4.51	54,096
1989	JUN	4			0.00	0.00	0.00	4.51	54,096
1989	JUN	5			0.00	0.00	0.00	2.99	35,880
1989	JUN	6			0.00	0.00	0.00	1.51	18,120
1989	JUN	7	745.56		15.56	0.00	15.56	4.62	55,392
1989	JUN	8			0.00	0.00	0.00	3.11	37,344
1989	JUN	9		252.88	0.00	7.13	7.13	4.54	54,456
1989	JUN	10	769.34		23.78	0.00	23.78	9.29	111,528
1989	JUN	11	775.00	259.67	5.66	6.79	12.45	11.78	141,408
1989	JUN	12	780.69		5.69	0.00	5.69	9.81	117,720
1989	JUN	13			0.00	0.00	0.00	9.81	117,720
1989	JUN	14			0.00	0.00	0.00	8.38	100,608
1989	JUN	15	805.26		24.57	0.00	24.57	8.54	102,504
1989	JUN	16		263.65	0.00	3.98	3.98	6.85	82,176
1989	JUN	17			0.00	0.00	0.00	5.71	68,520
1989	JUN	18	811.97		6.71	0.00	6.71	7.05	84,624
1989	JUN	19			0.00	0.00	0.00	7.05	84,624
1989	JUN	20		287.18	0.00	23.53	23.53	6.84	82,128
1989	JUN	21			0.00	0.00	0.00	6.05	72,576
1989	JUN	22	819.51		7.54	0.00	7.54	7.56	90,672
1989	JUN	23		294.40	0.00	7.22	7.22	7.66	91,896
1989	JUN	24	826.40		6.89	0.00	6.89	9.04	108,432
1989	JUN	25		301.95	0.00	7.55	7.55	5.84	70,080
1989	JUN	26	833.95		7.55	0.00	7.55	7.35	88,200
1989	JUN	27	838.81		4.86	0.00	4.86	6.81	81,768
1989	JUN	28		309.30	0.00	7.35	7.35	6.84	82,080
1989	JUN	29		317.03	0.00	7.73	7.73	7.01	84,096
1989	JUN	30	857.80	323.79	18.99	6.76	25.75	10.65	127,776
1989	JUL	1	865.55		7.75	0.00	7.75	10.69	128,256
1989	JUL	2		331.54	0.00	7.75	7.75	11.27	135,192
1989	JUL	3	872.45	338.59	6.90	7.05	13.95	12.59	151,032
1989	JUL	4	880.59		8.14	0.00	8.14	12.67	152,016
1989	JUL	5	887.23		6.64	0.00	6.64	8.85	106,152
1989	JUL	6		346.11	0.00	7.52	7.52	8.80	105,600

TABLE 1 (CONTINUED..) PUMPING / WATER CONSUMPTION RECORD 1989-90

	MONTH	DAY	P1 PUMPING METER	P2 PUMPING METER	P1 PUMPING (HOURS)	P2 PUMPING (HOURS)	P1+P2 PUMPING (HOURS)	5 DAY AV. PUMPING (HOURS)	AV. WATER CONSUMPTION (IGPD)
1989	JUL	7			0.00	0.00	0.00	7.25	87,000
1989	JUL	8	918.84		31.61	0.00	31.61	10.78	129,384
1989	JUL	9		352.92	0.00	6.81	6.81	10.52	126,192
1989	JUL	10	926.11		7.27	0.00	7.27	10.64	127,704
1989	JUL	11		359.82	0.00	6.90	6.90	10.52	126,216
1989	JUL	12	931.19	367.66	5.08	7.84	12.92	13.10	157,224
1989	JUL	13	938.90	375.38	7.71	7.72	15.43	9.87	118,392
1989	JUL	14		382.91	0.00	7.53	7.53	10.01	120,120
1989	JUL	15	946.44		7.54	0.00	7.54	10.06	120,768
1989	JUL	16			0.00	0.00	0.00	8.68	104,208
1989	JUL	17		390.73	0.00	7.82	7.82	7.66	91,968
1989	JUL	18	953.55		7.11	0.00	7.11	6.00	72,000
1989	JUL	19		398.73	0.00	8.00	8.00	6.09	73,128
1989	JUL	20	961.00	405.55	7.45	6.82	14.27	7.44	89,280
1989	JUL	21	966.24	410.61	5.24	5.06	10.30	9.50	114,000
1989	JUL	22	973.72		7.48	0.00	7.48	9.43	113,184
1989	JUL	23		415.18	0.00	4.57	4.57	8.92	107,088
1989	JUL	24	980.73		7.01	0.00	7.01	8.73	104,712
1989	JUL	25		422.70	0.00	7.52	7.52	7.38	88,512
1989	JUL	26	988.38	430.01	7.65	7.31	14.96	8.31	99,696
1989	JUL	27	993.67		5.29	0.00	5.29	7.87	94,440
1989	JUL	28	0.18	435.30	6.51	5.29	11.80	9.32	111,792
1989	JUL	29	5.50		5.32	0.00	5.32	8.98	107,736
1989	JUL	30	13.07	440.61	7.57	5.31	12.88	10.05	120,600
1989	JUL	31	17.91		4.84	0.00	4.84	8.03	96,312
1989	AUG	1		445.44	0.00	4.83	4.83	7.93	95,208
1989	AUG	2	22.27	452.33	4.36	6.89	11.25	7.82	93,888
1989	AUG	3	27.54		5.27	0.00	5.27	7.81	93,768
1989	AUG	4	35.13	457.60	7.59	5.27	12.86	7.81	93,720
1989	AUG	5	40.38		5.25	0.00	5.25	7.89	94,704
1989	AUG	6	47.81	462.83	7.43	5.23	12.66	9.46	113,496
1989	AUG	7	53.03		5.22	0.00	5.22	8.25	99,024
1989	AUG	8			0.00	0.00	0.00	7.20	86,376
1989	AUG	9		468.06	0.00	5.23	5.23	5.67	68,064
1989	AUG	10	80.74	474.27	27.71	6.21	33.92	11.41	136,872
1989	AUG	11	85.97	479.50	5.23	5.23	10.46	10.97	131,592
1989	AUG	12	91.24		5.27	0.00	5.27	10.98	131,712
1989	AUG	13		484.77	0.00	5.27	5.27	12.03	144,360
1989	AUG	14	98.22	492.19	6.98	7.42	14.40	13.86	166,368
1989	AUG	15	103.32		5.10	0.00	5.10	8.10	97,200
1989	AUG	16		497.28	0.00	5.09	5.09	7.03	84,312
1989	AUG	17	110.79		7.47	0.00	7.47	7.47	89,592
1989	AUG	18		504.56	0.00	7.28	7.28	7.87	94,416
1989	AUG	19	118.09		7.30	0.00	7.30	6.45	77,376
1989	AUG	20		511.32	0.00	6.76	6.76	6.78	81,360

TABLE 1 (CONTINUED..)

PUMPING / WATER CONSUMPTION RECORD 1989-90

	MONTH	DAY	P1 PUMPING METER	P2 PUMPING METER	P1 PUMPING (HOURS)	P2 PUMPING (HOURS)	P1+P2 PUMPING (HOURS)	5 DAY AV. PUMPING (HOURS)	AV. WATER CONSUMPTION (IGPD)
1989	AUG	21	125.04	518.71	6.95	7.39	14.34	8.63	103,560
1989	AUG	22	129.97		4.93	0.00	4.93	8.12	97,464
1989	AUG	23		523.64	0.00	4.93	4.93	7.65	91,824
1989	AUG	24	136.78	530.32	6.81	6.68	13.49	8.89	106,680
1989	AUG	25	140.96		4.18	0.00	4.18	8.37	100,488
1989	AUG	26		536.17	0.00	5.85	5.85	6.68	80,112
1989	AUG	27	151.18		10.22	0.00	10.22	7.73	92,808
1989	AUG	28		543.66	0.00	7.49	7.49	8.25	98,952
1989	AUG	29	159.70		8.52	0.00	8.52	7.25	87,024
1989	AUG	30		551.43	0.00	7.77	7.77	7.97	95,640
1989	AUG	31	164.44		4.74	0.00	4.74	7.75	92,976
1989	SEP	1		558.21	0.00	6.78	6.78	7.06	84,720
1989	SEP	2	172.18		7.74	0.00	7.74	7.11	85,320
1989	SEP	3		564.95	0.00	6.74	6.74	6.75	81,048
1989	SEP	4	179.63		7.45	0.00	7.45	6.69	80,280
1989	SEP	5		572.24	0.00	7.29	7.29	7.20	86,400
1989	SEP	6	184.75		5.12	0.00	5.12	6.87	82,416
1989	SEP	7		580.20	0.00	7.96	7.96	6.91	82,944
1989	SEP	8	191.52		6.77	0.00	6.77	6.92	83,016
1989	SEP	9	198.25		6.73	0.00	6.73	6.77	81,288
1989	SEP	10	200.96		2.71	0.00	2.71	5.86	70,296
1989	SEP	11	208.58		7.62	0.00	7.62	6.36	76,296
1989	SEP	12		587.16	0.00	6.96	6.96	6.16	73,896
1989	SEP	13	216.06		7.48	0.00	7.48	6.30	75,600
1989	SEP	14		595.05	0.00	7.89	7.89	6.53	78,384
1989	SEP	15			0.00	0.00	0.00	5.99	71,880
1989	SEP	16	223.62		7.56	0.00	7.56	5.98	71,736
1989	SEP	17		602.68	0.00	7.63	7.63	6.11	73,344
1989	SEP	18	226.66		3.04	0.00	3.04	5.22	62,688
1989	SEP	19		610.43	0.00	7.75	7.75	5.20	62,352
1989	SEP	20			0.00	0.00	0.00	5.20	62,352
1989	SEP	21	233.66		7.00	0.00	7.00	5.08	61,008
1989	SEP	22		618.04	0.00	7.61	7.61	5.08	60,960
1989	SEP	23		620.00	0.00	1.96	1.96	4.86	58,368
1989	SEP	24			0.00	0.00	0.00	3.31	39,768
1989	SEP	25		625.09	0.00	5.09	5.09	4.33	51,984
1989	SEP	26	248.91		15.25	0.00	15.25	5.98	71,784
1989	SEP	27			0.00	0.00	0.00	4.46	53,520
1989	SEP	28	256.45		7.54	0.00	7.54	5.58	66,912
1989	SEP	29	264.16		7.71	0.00	7.71	7.12	85,416
1989	SEP	30		632.55	0.00	7.46	7.46	7.59	91,104
1989	OCT	1			0.00	0.00	0.00	4.54	54,504
1989	OCT	2			0.00	0.00	0.00	4.54	54,504
1989	OCT	3			0.00	0.00	0.00	3.03	36,408
1989	OCT	4			0.00	0.00	0.00	1.49	17,904

TABLE 1 (CONTINUED..) PUMPING / WATER CONSUMPTION RECORD 1989-90

	MONTH	DAY	P1 PUMPING METER	P2 PUMPING METER	P1 PUMPING (HOURS)	P2 PUMPING (HOURS)	P1+P2 PUMPING (HOURS)	5 DAY AV. PUMPING (HOURS)	AV. WATER CONSUMPTION (IGPD)
1989	OCT	5			0.00	0.00	0.00	0.00	0
1989	OCT	6			0.00	0.00	0.00	0.00	0
1989	OCT	7	271.42		7.26	0.00	7.26	1.45	17,424
1989	OCT	8	279.00		7.58	0.00	7.58	2.97	35,616
1989	OCT	9	286.11		7.11	0.00	7.11	4.39	52,680
1989	OCT	10	291.07		4.96	0.00	4.96	5.38	64,584
1989	OCT	11			0.00	0.00	0.00	5.38	64,584
1989	OCT	12	299.00		7.93	0.00	7.93	5.52	66,192
1989	OCT	13	305.87		6.87	0.00	6.87	5.37	64,488
1989	OCT	14	312.57		6.70	0.00	6.70	5.29	63,504
1989	OCT	15	319.83		7.26	0.00	7.26	5.75	69,024
1989	OCT	16	326.78		6.95	0.00	6.95	7.14	85,704
1989	OCT	17		640.46	0.00	7.91	7.91	7.14	85,656
1989	OCT	18		647.83	0.00	7.37	7.37	7.24	86,856
1989	OCT	19	334.12		7.34	0.00	7.34	7.37	88,392
1989	OCT	20	0.00		0.00	0.00	0.00	5.91	70,968
1989	OCT	21			0.00	0.00	0.00	4.52	54,288
1989	OCT	22			0.00	0.00	0.00	2.94	35,304
1989	OCT	23	341.42		7.30	0.00	7.30	2.93	35,136
1989	OCT	24	348.98		7.56	0.00	7.56	2.97	35,664
1989	OCT	25			0.00	0.00	0.00	2.97	35,664
1989	OCT	26			0.00	0.00	0.00	2.97	35,664
1989	OCT	27	355.00		6.02	0.00	6.02	4.18	50,112
1989	OCT	28	360.94		5.94	0.00	5.94	3.90	46,848
1989	OCT	29	368.48		7.54	0.00	7.54	3.90	46,800
1989	OCT	30	375.26		6.78	0.00	6.78	5.26	63,072
1989	OCT	31	382.73		7.47	0.00	7.47	6.75	81,000
1989	NOV	1			0.00	0.00	0.00	5.55	66,552
1989	NOV	2			0.00	0.00	0.00	4.36	52,296
1989	NOV	3	390.54		7.81	0.00	7.81	4.41	52,944
1989	NOV	4			0.00	0.00	0.00	3.06	36,672
1989	NOV	5	395.22		4.68	0.00	4.68	2.50	29,976
1989	NOV	6			0.00	0.00	0.00	2.50	29,976
1989	NOV	7	420.38		25.16	0.00	25.16	7.53	90,360
1989	NOV	8			0.00	0.00	0.00	5.97	71,616
1989	NOV	9			0.00	0.00	0.00	5.97	71,616
1989	NOV	10			0.00	0.00	0.00	5.03	60,384
1989	NOV	11			0.00	0.00	0.00	5.03	60,384
1989	NOV	12			0.00	0.00	0.00	0.00	0
1989	NOV	13			0.00	0.00	0.00	0.00	0
1989	NOV	14			0.00	0.00	0.00	0.00	0
1989	NOV	15	442.28		21.90	0.00	21.90	4.38	52,560
1989	NOV	16	453.48		11.20	0.00	11.20	6.62	79,440
1989	NOV	17	467.01		13.53	0.00	13.53	9.33	111,912
1989	NOV	18	468.71		1.70	0.00	1.70	9.67	115,992

TABLE 1 (CONTINUED..) PUMPING / WATER CONSUMPTION RECORD 1989-90

	MONTH	DAY	P1 PUMPING METER	P2 PUMPING METER	P1 PUMPING (HOURS)	P2 PUMPING (HOURS)	P1+P2 PUMPING (HOURS)	5 DAY AV. PUMPING (HOURS)	AV. WATER CONSUMPTION (IGPD)
1989	NOV	19			0.00	0.00	0.00	9.67	115,992
1989	NOV	20	475.64		6.93	0.00	6.93	6.67	80,064
1989	NOV	21	483.43		7.79	0.00	7.79	5.99	71,880
1989	NOV	22			0.00	0.00	0.00	3.28	39,408
1989	NOV	23	491.21		7.78	0.00	7.78	4.50	54,000
1989	NOV	24			0.00	0.00	0.00	4.50	54,000
1989	NOV	25	498.88		7.67	0.00	7.67	4.65	55,776
1989	NOV	26			0.00	0.00	0.00	3.09	37,080
1989	NOV	27	506.38		7.50	0.00	7.50	4.59	55,080
1989	NOV	28	513.94		7.56	0.00	7.56	4.55	54,552
1989	NOV	29			0.00	0.00	0.00	4.55	54,552
1989	NOV	30	520.41		6.47	0.00	6.47	4.31	51,672
1989	DEC	1			0.00	0.00	0.00	4.31	51,672
1989	DEC	2	528.16		7.75	0.00	7.75	4.36	52,272
1989	DEC	3			0.00	0.00	0.00	2.84	34,128
1989	DEC	4	535.04		6.88	0.00	6.88	4.22	50,640
1989	DEC	5	542.57		7.53	0.00	7.53	4.43	53,184
1989	DEC	6	549.45		6.88	0.00	6.88	5.81	69,696
1989	DEC	7			0.00	0.00	0.00	4.26	51,096
1989	DEC	8	557.16		7.71	0.00	7.71	5.80	69,600
1989	DEC	9			0.00	0.00	0.00	4.42	53,088
1989	DEC	10	563.98		6.82	0.00	6.82	4.28	51,384
1989	DEC	11	571.22		7.24	0.00	7.24	4.35	52,248
1989	DEC	12		655.46	0.00	7.63	7.63	5.88	70,560
1989	DEC	13	578.82		7.60	0.00	7.60	5.86	70,296
1989	DEC	14	586.46		7.64	0.00	7.64	7.39	88,632
1989	DEC	15	594.04		7.58	0.00	7.58	7.54	90,456
1989	DEC	16	601.55		7.51	0.00	7.51	7.59	91,104
1989	DEC	17	607.89		6.34	0.00	6.34	7.33	88,008
1989	DEC	18	616.00		8.11	0.00	8.11	7.44	89,232
1989	DEC	19	623.48		7.48	0.00	7.48	7.40	88,848
1989	DEC	20	630.59		7.11	0.00	7.11	7.31	87,720
1989	DEC	21		661.69	31.10	6.23	37.33	13.27	159,288
1989	DEC	22	638.16		0.00	0.00	0.00	12.01	144,072
1989	DEC	23	644.23		6.07	0.00	6.07	11.60	139,176
1989	DEC	24	651.82		7.59	0.00	7.59	11.62	139,440
1989	DEC	25	658.69		6.87	0.00	6.87	11.57	138,864
1989	DEC	26	666.53		7.84	0.00	7.84	5.67	68,088
1989	DEC	27	673.69		7.16	0.00	7.16	7.11	85,272
1989	DEC	28	681.47	669.12	7.78	7.43	15.21	8.93	107,208
1989	DEC	29	688.87	676.49	7.40	7.37	14.77	10.37	124,440
1989	DEC	30	696.57	684.09	7.70	7.60	15.30	12.06	144,672
1989	DEC	31	701.88	689.38	5.31	5.29	10.60	12.61	151,296
1990	JAN	1	709.01		7.13	0.00	7.13	12.60	151,224
1990	JAN	2	716.34	696.53	7.33	7.15	14.48	12.46	149,472

TABLE 1
(CONTINUED..)

PUMPING / WATER CONSUMPTION RECORD
1989-90

	MONTH	DAY	P1 PUMPING METER	P2 PUMPING METER	P1 PUMPING (HOURS)	P2 PUMPING (HOURS)	P1+P2 PUMPING (HOURS)	5 DAY AV. PUMPING (HOURS)	AV. WATER CONSUMPTION (IGPD)
1990	JAN	3	723.66	703.75	7.32	7.22	14.54	12.41	148,920
1990	JAN	4	731.25		7.59	0.00	7.59	10.87	130,416
1990	JAN	5	738.84		7.59	0.00	7.59	10.27	123,192
1990	JAN	6	746.71		7.87	0.00	7.87	10.41	124,968
1990	JAN	7	754.77		8.06	0.00	8.06	9.13	109,560
1990	JAN	8	762.25		7.48	0.00	7.48	7.72	92,616
1990	JAN	9	770.93		8.68	0.00	8.68	7.94	95,232
1990	JAN	10	777.74		6.81	0.00	6.81	7.78	93,360
1990	JAN	11			0.00	0.00	0.00	6.21	74,472
1990	JAN	12	785.38		7.64	0.00	7.64	6.12	73,464
1990	JAN	13	792.91		7.53	0.00	7.53	6.13	73,584
1990	JAN	14	800.72		7.81	0.00	7.81	5.96	71,496
1990	JAN	15	808.04		7.32	0.00	7.32	6.06	72,720
1990	JAN	16	815.25		7.21	0.00	7.21	7.50	90,024
1990	JAN	17	823.07		7.82	0.00	7.82	7.54	90,456
1990	JAN	18		711.30	0.00	7.55	7.55	7.54	90,504
1990	JAN	19	830.70		7.63	0.00	7.63	7.51	90,072
1990	JAN	20	838.31		7.61	0.00	7.61	7.56	90,768
1990	JAN	21	845.81		7.50	0.00	7.50	7.62	91,464
1990	JAN	22	854.22		8.41	0.00	8.41	7.74	92,880
1990	JAN	23	862.00		7.78	0.00	7.78	7.79	93,432
1990	JAN	24	869.83		7.83	0.00	7.83	7.83	93,912
1990	JAN	25	877.53	718.92	7.70	7.62	15.32	9.37	112,416
1990	JAN	26	885.18		7.65	0.00	7.65	9.40	112,776
1990	JAN	27	892.79		7.61	0.00	7.61	9.24	110,856
1990	JAN	28	900.76		7.97	0.00	7.97	9.28	111,312
1990	JAN	29	908.65		7.89	0.00	7.89	9.29	111,456
1990	JAN	30	916.31		7.66	0.00	7.66	7.76	93,072
1990	JAN	31	923.93		7.62	0.00	7.62	7.75	93,000
1990	FEB	1	931.51		7.58	0.00	7.58	7.74	92,928
1990	FEB	2	939.18	726.59	7.67	7.67	15.34	9.22	110,616
1990	FEB	3	946.24		7.06	0.00	7.06	9.05	108,624
1990	FEB	4	954.04		7.80	0.00	7.80	9.08	108,960
1990	FEB	5	962.22	733.60	8.18	7.01	15.19	10.59	127,128
1990	FEB	6	970.01	741.32	7.79	7.72	15.51	12.18	146,160
1990	FEB	7	977.67		7.66	0.00	7.66	10.64	127,728
1990	FEB	8	985.16		7.49	0.00	7.49	10.73	128,760
1990	FEB	9	992.68		7.52	0.00	7.52	10.67	128,088
1990	FEB	10	0.30		7.62	0.00	7.62	9.16	109,920
1990	FEB	11	8.27	749.02	7.97	7.77	15.74	9.21	110,472
1990	FEB	12	15.36		7.09	0.00	7.09	9.09	109,104
1990	FEB	13	23.03	756.16	7.67	7.14	14.81	10.56	126,672
1990	FEB	14	31.06		8.03	0.00	8.03	10.66	127,896
1990	FEB	15	38.53		7.47	0.00	7.47	10.63	127,536
1990	FEB	16	46.06	764.09	7.53	7.93	15.46	10.57	126,864

TABLE 1
(CONTINUED..)

PUMPING / WATER CONSUMPTION RECORD
1989-90

	MONTH	DAY	P1 PUMPING METER	P2 PUMPING METER	P1 PUMPING (HOURS)	P2 PUMPING (HOURS)	P1+P2 PUMPING (HOURS)	5 DAY AV. PUMPING (HOURS)	AV. WATER CONSUMPTION (IGPD)
1990	FEB	17	53.38		7.32	0.00	7.32	10.62	127,416
1990	FEB	18	61.74	771.34	8.36	7.25	15.61	10.78	129,336
1990	FEB	19	68.82	778.98	7.08	7.64	14.72	12.12	145,392
1990	FEB	20	76.46	786.48	7.64	7.50	15.14	13.65	163,800
1990	FEB	21	84.20	794.11	7.74	7.63	15.37	13.63	163,584
1990	FEB	22	91.09	801.74	6.89	7.63	14.52	15.07	180,857
1990	FEB	23	99.55	809.28	8.46	7.54	16.00	15.15	181,800
1990	FEB	24	107.21		7.66	0.00	7.66	13.74	164,856
1990	FEB	25	113.26		6.05	0.00	6.05	11.92	143,040
1990	FEB	26	120.84	816.81	7.58	7.53	15.11	11.87	142,416
1990	FEB	27	128.48	824.57	7.64	7.76	15.40	12.04	144,535
1990	FEB	28	136.18	832.19	7.70	7.62	15.32	11.91	142,896
1990	MAR	1	143.87		7.69	0.00	7.69	11.91	142,968
1990	MAR	2	151.48		7.61	0.00	7.61	12.23	146,712
1990	MAR	3	159.27		7.79	0.00	7.79	10.76	129,144
1990	MAR	4	166.90	839.83	7.63	7.64	15.27	10.74	128,832
1990	MAR	5	174.49	847.43	7.59	7.60	15.19	10.71	128,520
1990	MAR	6	182.01		7.52	0.00	7.52	10.68	128,112
1990	MAR	7	213.71		31.70	0.00	31.70	15.49	185,928
1990	MAR	8	220.99	854.94	7.28	7.51	14.79	16.89	202,728
1990	MAR	9			0.00	0.00	0.00	13.84	166,080
1990	MAR	10	228.84	859.49	7.85	4.55	12.40	13.28	159,384
1990	MAR	11	235.80		6.96	0.00	6.96	13.17	158,040
1990	MAR	12	246.41		10.61	0.00	10.61	8.95	107,424
1990	MAR	13			0.00	0.00	0.00	5.99	71,928
1990	MAR	14	278.09		31.68	0.00	31.68	12.33	147,960
1990	MAR	15	285.57		7.48	0.00	7.48	11.35	136,152
1990	MAR	16	293.23		7.66	0.00	7.66	11.49	137,832
1990	MAR	17			0.00	0.00	0.00	9.36	112,368
1990	MAR	18	325.68		32.45	0.00	32.45	15.85	190,248
1990	MAR	19	333.16		7.48	0.00	7.48	11.01	132,168
1990	MAR	20			0.00	0.00	0.00	9.52	114,216
1990	MAR	21	364.62		31.46	0.00	31.46	14.28	171,336
1990	MAR	22	372.21		7.59	0.00	7.59	15.80	189,552
1990	MAR	23	380.07		7.86	0.00	7.86	10.88	130,536
1990	MAR	24	387.94		7.87	0.00	7.87	10.96	131,472
1990	MAR	25			0.00	0.00	0.00	10.96	131,472
1990	MAR	26	420.42		32.48	0.00	32.48	11.16	133,920
1990	MAR	27	428.10		7.68	0.00	7.68	11.18	134,136
1990	MAR	28	435.99		7.89	0.00	7.89	11.18	134,208
1990	MAR	29			0.00	0.00	0.00	9.61	115,320
1990	MAR	30	462.24		26.25	0.00	26.25	14.86	178,320
1990	MAR	31	475.45		13.21	0.00	13.21	11.01	132,072

APPENDIXE A

TABLE A2 TAYNTON CREEK
OVER THE WEIR FLOW MEASUREMENTS
1989-90

	DATE	GAUGE READING (M)	EQUIVALENT Q (CMS)	% OF TOTAL FLOW (ESTIMATED)	ESTIMATED TOTAL Q (CMS)
	25-Jul-88	0.165	0.070		
	27-Jul-88	0.165	0.070		
	29-Jul-88	0.115	0.041		
	01-Aug-88	0.110	0.038		
	03-Aug-88	0.175	0.076		
	05-Aug-88	0.175	0.076		
	07-Aug-88	0.165	0.070		
	09-Aug-88	0.175	0.076		
	11-Aug-88	0.165	0.070		
	13-Aug-88	0.160	0.067		
	15-Aug-88	0.170	0.073		
	17-Aug-88	0.170	0.073		
	19-Aug-88	0.165	0.070		
	23-Aug-88	0.170	0.073	0.20	0.37
	25-Aug-88	0.166	0.070		
	27-Aug-88	0.155	0.064		
	31-Aug-88	0.170	0.073		
	02-Sep-88	0.162	0.068		
	05-Sep-88	0.140	0.055		
	07-Sep-88	0.140	0.055		
	13-Sep-88	0.150	0.061		
	15-Sep-88	0.150	0.061		
	17-Sep-88	0.150	0.061		
	21-Sep-88	0.170	0.073		
	24-Sep-88	0.170	0.073		
	27-Sep-88	0.165	0.070		
	30-Sep-88	0.166	0.070		
	05-Oct-88	0.162	0.068		
	09-Oct-88	0.165	0.070		
	16-Oct-88	0.170	0.073		
	19-Oct-88	0.170	0.073		
	22-Oct-88	0.164	0.069		
	09-Nov-88	0.140	0.055		
	22-Nov-88	0.125	0.046		
WINTER/SPRING	04-Dec-88	0.100	0.033		
WINTER/SPRING	17-Dec-88	0.080	0.024		
WINTER/SPRING	06-Apr-89	0.074	0.021		
WINTER/SPRING	12-Apr-89	0.082	0.024		
	18-Apr-89	0.025	0.004	0.10	0.04
	26-Apr-89	0.025	0.004		
	04-May-89	0.044	0.010		
	09-May-89	0.084	0.025		
	26-May-89	0.050	0.012		

TABLE A2 (CONTINUED) TAYNTON CREEK
OVER THE WEIR FLOW MEASUREMENTS
1989-90

	DATE	GAUGE READING (M)	EQUIVALENT Q (CMS)	% OF TOTAL FLOW (ESTIMATED)	ESTIMATED TOTAL Q (CMS)
	16-Jun-89	0.100	0.033		
	21-Jun-89	0.042	0.009		
	26-Jun-89	0.050	0.012		
	12-Jul-89	0.062	0.016	0.10	0.16
	19-Jul-89	1.000	1.042		
	26-Jul-89	0.075	0.021		
	02-Aug-89	0.075	0.021		
	12-Aug-89	0.750	0.677		
	30-Aug-89	1.000	1.042	0.25	4.17
	07-Sep-89	1.000	1.042		
	19-Sep-89	0.860	0.831	0.25	3.32
	26-Sep-89	0.860	0.831		
	13-Oct-89	0.800	0.746		
	25-Oct-89	0.150	0.061	0.75	0.08
	25-Oct-89	0.092	0.029	0.33	0.09
	10-Nov-89	1.112	1.222	0.25	4.89
WINTER/SPRING	28-Dec-89	0.062	0.016		
WINTER/SPRING	10-Dec-89	0.066	0.018		
WINTER/SPRING	04-Jan-90	0.062	0.016		
WINTER/SPRING	11-Jan-90	0.062	0.016		
WINTER/SPRING	22-Jan-90	0.062	0.016		
WINTER/SPRING	02-Feb-90	0.062	0.016		
WINTER/SPRING	07-Feb-90	0.062	0.016		
WINTER/SPRING	16-Feb-90	0.062	0.016		
WINTER/SPRING	23-Feb-90	0.062	0.016		
WINTER/SPRING	02-Mar-90	0.062	0.016		
WINTER/SPRING	09-Mar-90	0.054	0.013		
WINTER/SPRING	19-Mar-90	0.054	0.013		
WINTER/SPRING	22-Mar-90	0.062	0.016		
	01-May-90	0.070	0.019		

GEOTECHNICAL

GEOTECHNICAL HAZARDS STUDY

December 1996

INTRAWEST

EBA Engineering Consultants Ltd.

GEOTECHNICAL HAZARDS STUDY
PANORAMA RESORT
PANORAMA, BRITISH COLUMBIA

DECEMBER 1996

0304-30357

6111 - 36th Street S.E. Calgary, Alberta T2C 3W2
• Telephone (403) 236-9700 • FAX (403) 236-7033 •

EBA Engineering Consultants Ltd.

GEOTECHNICAL HAZARDS STUDY
PANORAMA RESORT
PANORAMA, BRITISH COLUMBIA

SUBMITTED TO:

Intrawest Corporation
c/o IMC Consulting Group Inc.
Calgary, Alberta

PREPARED BY:

EBA Engineering Consultants Ltd.
Calgary, Alberta

0304-30357

DECEMBER 1996

6111 - 36th Street S.E. Calgary, Alberta T2C 3W2
• Telephone (403) 236-9700 • FAX (403) 236-7033 •

December 2, 1996

Intrawest Corporation
c/o IMC Consulting Group Inc.
500, 1122 - 4 Street SW
Calgary, Alberta
T2R 1M1

EBA File: 0304-30357

Attention: Mr. Bill Hargrave, P.Eng.

Dear Sir:

Subject: Geotechnical Hazards Study
Panorama Resort
Panorama, British Columbia

1.0 INTRODUCTION

As requested, EBA Engineering Consultants Ltd. (EBA) has conducted a geotechnical hazards study to assist in the overall planning and preliminary design of the proposed Panorama Resort expansion project. The purpose of the study was to identify and/or evaluate the current terrain and geological conditions at the site for possible geotechnical hazards. Based on findings of site reconnaissance work and office studies, comments and engineering recommendations are provided for the safe development of the site.

The evaluation focussed primarily towards risk to life (i.e. residential lots) with risk to non-residential property and infrastructure (golf course, parking lots and access roads) receiving less critical attention.

2.0 PROJECT DETAILS

The existing Panorama Resort is located approximately 21 km southwest of Invermere, British Columbia. The Resort currently consists of a ski lodge, hotel facilities and is bounded to the north by a subdivision of single family homes. A golf course is currently under construction to the southeast of the resort area.

The proposed expansion project is understood to comprise additional residential housing units, a golf clubhouse and related access roadways, parking lot and underground services. The development has been divided into the following site areas, as shown on Figure 1.

- Cox Creek Development Area
- Ski Village and Parking Lot
- Residential Cell #1
- Golf Course Residential Development Area and Roadways
- Golf Course Clubhouse and Parking Lot

3.0 SCOPE OF WORK

3.1 Review of Previous Geotechnical Hazards Reports

The following previous geotechnical reports for the Panorama area were reviewed as part of the present hazards study:

- Golder Geotechnical Consultants Ltd. report titled "A Report to Cascade Builders Limited Providing Geotechnical Appraisal Concerning Site Development at the Proposed Panorama Ski Area, Invermere, British Columbia" dated August 1978, File #C78732.

- Stewart-EBA Consulting Ltd. report titled "Natural Hazards Assessment Above Proposed Subdivision of Blocks A, B &C, D.L. 16352 K.D. and Part of Lot 1, Plan 8935, D.L. 4609, K.D., Panorama Resort, near Invermere, B.C." dated August 1991, File #0808-88090.

- Golder Associates Ltd. report titled "Geotechnical Review, Inspection and Recommendations Cox Creek Fan Panorama Resort, Invermere, B.C." dated October 20, 1995, File #952-1163.

- EBA Engineering Consultants Ltd. report titled "Geotechnical Evaluation, Panorama Resort, Panorama, British Columbia" dated August 1996, File #0304-30213.

3.2 Airphoto Interpretation

A preliminary airphoto interpretation was carried out to identify any terrain and/or geological features that may pose potential natural hazards including areas of slope instability, erosion and rock fall. The following airphotos were reviewed:

- 1:35,000 scale black and white aerial photographs dated July 17, 1996 (No. FF95017 L1 #1 to 6)

- 1:10,000 scale black and white aerial photographs dated July 17, 1996 (No. FF95017 L2 #9 to 17).

3.3 Field Reconnaissance

Field reconnaissance and geologic/geotechnical mapping of the site was carried out on October 7 and 8, 1996, by Mr. Nigel Skermer, P.Eng. of the EBA Vancouver office and Ms. Lara Percival, P.Eng. of the EBA Calgary office. The inspection was used to verify, identify and/or evaluate the current terrain and geological conditions across the site for possible geotechnical hazards. A foot traverse was made across the various development areas and a vehicle traverse was carried out along the access road on the west side of the Toby Creek. The traverse paths and general geological/geotechnical observations are presented on Figures 2 and 3. Observations were recorded and photographed. Select photographs of the site are presented in Appendix A.

3.4 Hazard Report

The findings of the site reconnaissance were used for identifying the nature and extent of possible terrain or geological hazards, for which the level of hazard was noted. In addition, a preliminary evaluation of the general snow avalanche hazard was carried out; however, none was identified. Recommendations are presented below for land use and development including setback distances, restrictions and/or possible mitigate measures to minimize the risk of natural hazards impacting the proposed development.

4.0 SITE GEOLOGY

The general geology of the Panorama Resort area is documented in the 1978 report by Golder Associates Geotechnical Consultants Ltd. and is not repeated herein. Reference to this report should be made for discussion of the site surficial and bedrock geology.

5.0 OBSERVATIONS AND RECOMMENDATIONS

The following subsections summarize the findings of the site reconnaissance, identify the nature and extent of any possible terrain or geological hazards in the various development areas, and provide recommendations for preliminary layout purposes. Site-specific investigations by a qualified geotechnical engineer may be required for final layout of some of the residential lots.

5.1 Cox Creek Development Area

The Cox Creek Development area, which is located to the west of the existing Panorama Resort area, consists of three development blocks (Block 1, 2 and 3) as shown in Figure 2.

5.1.1 Block 1

The Block 1 development area is located on a north-south trending bench. The ground surface generally slopes gently to the west at less than 15° with the exception of the northern portion of the development area where the ground surface slopes steeply at 35° to 40° to the north. West of the Block 1 bench area, the ground surface drops steeply some 75 to 100 m to Cox Creek. To the east, the ground surface steepens forming the lower reaches of Panorama Ridge. Approximately 25 m upslope of the Block 1 development area, the Panorama Resort reservoir is located on a bench formed by cut and fill. The Block 1 site is currently covered in large conifers with the exception of some areas located in the central portion of the site which contain lowlying wetland vegetation. In this area, there is some ponded water believed to be caused by upslope surface runoff.

Based on a recent geotechnical investigation, the area is inferred to be covered by a surficial layer of clayey silt overlying sand and gravel deposits.

There is no visual evidence of shallow slope movement or surficial failure within the existing slopes and these slopes are considered to be stable with respect to deep-seated or large scale slope instability.

The following recommendations are presented for design and construction of Block 1.

- Within the northern portion of the site, the layout of residential lots and the access road should be reassessed considering the locally steep terrain.
- Access road cuts into the existing slopes should be kept to a minimum to reduce the risk of causing instability of the upper slopes within the Block 1 development area.
- Within the northern portion of the site in the vicinity of the steep slopes, shown in Figure 2, top of slope development setbacks are required for safe development.
- Site-specific slope stability assessments, by a qualified geotechnical engineer, and a more detailed site survey are required to determine setback distances.
- In the drainage ditch for controlling surficial seepage from above the reservoir area, erosion control measures may be required to prevent possible surficial slope instability.

5.1.2 Block 2

The Block 2 development lots are located on an east-west trending bench which slopes gently to the north and west. To the south, the ground surface rises steeply to the proposed access road and the Block 1 development area. To the west, the ground surfaces steepens dropping some 75 m to Toby Creek below. To the east, the ground surface steepens dropping down to a localized drainage gully.

To the east of the overall site is the Taynton Creek ravine which has banks typically 10 m to 15 m high sloping at 45°. The Taynton Creek channel locally is filled with timber debris and gravel deposits. It is believed that debris transport recently has caused some migration of the creek channel within the ravine. Although there was no visual evidence of significant slope movement or failures on the west bank of Taynton Creek along the eastern boundary of the development site, curvature of the tree trunks along the slope indicate ongoing local surficial creep and downslope movement. The existing vegetated western banks are considered marginally stable with respect to surficial slope instability under current conditions. Similarly, erosion or undercutting of the west bank, adjacent to Block 2, would lead to slope instability. Therefore, it is recommended that development of residential lots and access roads adjacent to the ravine area be restricted.

EBA's inspection of the remaining slopes within the Block 2 development area found no evidence of slope movement or failures. These slopes are considered to be stable with respect to deep seated or large scale slope stability. However, it is recommended that the overall layout of the Block 2 development to be reassessed considering the locally steep terrain identified during field reconnaissance. In the vicinity of steep slopes, setbacks distance will be required for development.

5.1.3 Block 3

Site conditions within the vicinity of the proposed Block 3 residential area are documented in the Golder 1978, Stewart-EBA 1991 and Golder 1995 reports. Also, these reports have previously provided geotechnical hazards assessments of the Cox Creek Area. Therefore, the following comments are limited to the area along the Cox Creek fan in the vicinity of the proposed Block 3 development.

The proposed Block 3 residential development is to be located within the lower reaches of Cox Creek fan just upstream of its intersection with Toby Creek. Cox Creek crosses through the development area at a slope gradient typically less than 10°. To the east and south of the development site, the ground surface rises gently to the existing ski lift and residential subdivision. To the west, the ground surface slope breaks and drops steeply down to Toby Creek.

Upstream of Block 3, there is an approximate 30 m stretch of Cox Creek which is deeply incised (see Figure 2 and Photo 1). In this section, the creek banks are near vertical and extend up to some 3 m below the original creek channel level. Although outside of the development area, the channel bed instability may impact the lower reaches of the fan. It appears this deep erosion was not a result of natural creek flow activities but is a result of water discharge from the pump station located upslope to the east (Figure 2). Some erosion control and channel stabilization is required to stabilize this area and protect the downstream Block 3 development. Consideration may be given to the use of check dams using concrete rip rap or gabions.

Within the proposed Block 3 residential development area, it is recommended that the residential development grades and setbacks be reviewed with respect to possible flood conditions both within Cox Creek and Toby Creek. It is recommended that a hydrologist be consulted to determine flood levels and assess requirements for channel stabilization within and above the Block 3 area.

It appears the above-noted erosion along Cox Creek is related to the recent debris slide and gully erosion of the slope between Cox Creek and the pumphouse (Figure 2 and Photo 2). The slide gully varies from 1.5 to 2 m in depth and from 2 to 6 m in width and extends approximately 100 m on a slope ranging from 25° to 30°. The depositional material fan contains timber and granular soil material typically 0.3 m or less in diameter. It appears that discharged water from the pumphouse outfall pipes saturated the overburden soils thereby initiating the debris slide. The discharged water continued down the slope and then into Cox Creek causing the channel erosion noted above. Discharge of concentrated runoff may reactivate the landslide area and ultimately lead to more serious erosion of the Ox Creek channel. It is recommended that no further discharge of water through the outfall pipes be allowed to take place. It is anticipated that natural revegetation of the landslide area will stabilize the area.

5.1.4 Summary

In general, no specific restraints due to geotechnical hazards are seen for development of the Cox Creek development area, including Blocks 1, 2 or 3; however, final layouts must be reviewed with respect to locally steep terrain and the need for setback distances. Additional site surveys will be required to accurately assess siting of residential lots and detailed slope stability analyses will be required to quantify slope setback requirements. Also, some analyses and design measures are required to prevent further downcutting and erosion of Cox Creek.

5.2 Ski Village and Parking Lot

EBA's recent visual inspection of the proposed ski village and parking lot did not identify any significant geotechnical hazards in or impacting the site.

5.3 Residential Cell #1

The Residential Cell #1 development area is located to the south of the existing ski lodge facilities. Within the Cell #1 development area, the ground surface slopes gently to the north. Hopeful Creek currently parallels the eastern boundary of the Cell and part of the golf course is located across the creek. The west side of the Cell is adjacent to steeply rising talus slopes and rock bluffs (see Figure 3 and Photo 3).

EBA is concerned about the proposed location of Residential Cell #1 because of potential rockfalls. Several boulders up to approximately 2 m diameter were observed within the proposed development area and access road right-of-way, within the existing heavily forested area to the east and near the foot of the existing talus slope. Such rockfall distribution is not unusual where certain blocks tumble more efficiently than others and gathering enough momentum to travel beyond the toe of the slope into what is termed the rockfall shadow zone. A preliminary evaluation indicates the rockfall shadow zone extends to the west side of the existing access road at or near the toe of the talus slope (Photo 3). Although some of these large boulders lie outside the rockfall shadow zone, these are interpreted to have been moved by glaciation. All of these blocks appear to be highly weathered and are partially buried within the overburden surface. This suggests that these blocks are not the result of existing rockfall conditions.

In order to identify the rockfall shadow zone, it is recommended that an accurate survey be carried out to locate the rock bluffs and talus slope in relation to the proposed development lots. The residential building envelopes should not be located within the rockfall shadow zone. However, the risk of locating the residential lots within the rockfall shadow zone may be acceptable provided some protective measures are taken. Possible protection measures may include:

- removal of rock bluffs by blasting.

- stabilization of rock bluffs using rock bolts and mesh or Gesbrug rockfall netting.

The location and extent of such protective measures can be determined once the accurate site survey has been complete.

5.4 Golf Course Residential Development

The Golf Course Residential Development Area is located to the east of the existing Panorama Resort area and is distributed throughout the golf course development as shown in Figure 3. For reporting purposes, the development blocks in which terrain or geological concerns were identified during the field reconnaissance, have been designated with Block

1 through 5 on Figure 3. Those parts of this development area where no significant geotechnical concerns were identified during the site reconnaissance are not discussed herein.

5.4.1 Block 1

The proposed Block 1 area is located on a north-south trending relatively flat topped ridge. To the east and west of the ridge, the ground surface slopes down typically at 20° to 35°. Localized rock outcrops were observed across the site. Along the northern boundary subvertical rock bluffs with underlying talus slopes are present.

No evidence of significant slope instability was observed on the existing soil or rock slopes, although the steeper rock slopes will be subject to ongoing ravelling or sloughing of the weathered rock. The rock bluffs pose a minor rock fall hazard to non-residential areas to the north. In the vicinity of the steep rock and soil slopes, setback distances will be required for development.

5.4.2 Block 2

The proposed Block 2 area is located near the south end of the golf course. It is bound to the east by the golf course and to the west by a mountain ridge. The ground surface within the development area slopes up gently to the west at angles of up to 15° towards a much steeper heavily forested mountain side. At the crest of the slope a series of abandoned logging roads cross the mountain side, running approximately parallel to the proposed development.

Boulders up to 3 m in diameter were noted within the proposed development area and access road right-of-way. These blocks are located in a heavily forested area, are deeply weathered and are partially buried in the overburden surface. There are no existing rock outcrops or bluffs to the west from which these rock blocks could have fallen. Similarly, there was no evidence to suggest they came from construction of a forestry pilot road at the crest of the slope. EBA interprets that these blocks probably were deposited by glacial processes and the rockfall hazard in this area is very low.

EBA has identified an area of unstable ground (slump) and seepage upslope of the southern end of the proposed residential development near the end of the forestry pilot road (Figure 3). The surficial slump area which had visible surface water seepage measured approximately 20 m long by 10 m to 15 m in height. Further inspection indicated tension cracks at the head scarp and curvature in the trunk of the trees' "pistol butt", signs of slope creep or movement. The slope appears to consist of silty sand and gravel with considerable cobble to boulder size material. The presence of tuffa rock indicates that the area may be a natural spring. Based on visual observations, the landslide hazard here is high. In general, soil creep or slumps reach a critical stage of instability due to increased saturation as a result of increased spring seepage or concentrated surface runoff resulting in a high probability of slope failure. We believe that if a landslide does occur, the potential landslide debris runout zone could impact the proposed residential lots along the southern end of Block 2. While it is possible to make calculations to estimate the potential landslide debris run out zone, such estimates tend to be approximate only. A preliminary interpretation of the potential landslide runout zone is indicated in Figure 3. In order to better assess the slide runout zone, it is recommended that an accurate survey be carried out to locate the slump area as well as local slope topography relative to the proposed development.

If the site survey indicates that the rock slump area may impact the development area, remedial measures may be considered to stabilize the area. Remedial measures may include groundwater control and/or soil stabilization.

Above the landslide area, there is an abandoned forestry logging road which includes a series of water bars to redirect surface water runoff. The runoff is directed onto the existing slope above the proposed residential development area and may lead to future instability. Therefore, some measures are required to redirect the water away from the slope. The Ministry of Forestry should be contacted regarding the restoration of this forestry road.

5.4.3 Block 3

The proposed Block 3 area is located on a north-south trending ridge overlooking Toby Creek to the west (Photo 4). In general, the ridge rises gently to the south; however, locally slopes of up to 35° are present within the residential lots to the north. To the west of the ridge crest, the ground surface drops at slope gradients of 40° to 45° some 50 m to Toby Creek. Locally subvertical rock bluffs are present along the crest of the ridge. Based on previous geotechnical investigations, the area is covered by a surficial layer of sandy silt underlain at shallow depth by bedrock.

There is no evidence of significant (deep) slope instability or failures in the existing soil and rock slopes. There is a thin veneer of sliding and ravelling of a small section of Toby Creek's bank adjacent to the southern portion of the site. This localized erosion is not expected to impact the stability of the development area above.

In general, the bedrock controlled slopes are considered stable with respect to deep seated or large scale slope instability. Some ravelling or sloughing of the weathered subvertical rock bluffs should be expected over time. Along the western property line in the vicinity of the steep rock and soil slopes some setbacks are required for development. Site-specific slope stability assessments, by a qualified engineer, are required to determine setback distances.

The layout of the northern portion of the development area should be reassessed considering a small area of locally steep terrain indicated on Figure 3. Based on our site inspection, no other significant geotechnical hazards are considered to be present on or impacting the site.

5.4.4 Block 4

The proposed Block 4 area will be located on a north-south trending ridge overlooking Toby Creek to the west (Photo 4). In general, the ground surface drops some 15 m to 25 m to the west at slopes of typically 20° but locally up to 40°. EBA's geotechnical investigation indicates the area is covered by a surficial layer of silt underlain at shallow depths by bedrock.

There is no evidence of significant (deep) slope instability or failures in the existing slopes. Toby Creek has undercut the east creek bank below the southern portion of the site; this erosion is not expected to significantly impact the stability of the area above.

In general, the bedrock controlled slopes are considered stable with respect to deep seated or large scale slope instability; however, some top of slope setback distance may be required. Furthermore, site layout should be reassessed considering the area of locally steep terrain indicated on Figure 3. No other significant geotechnical hazards have been identified to be present on or impacting the site.

5.4.5 Block 5

The proposed Block 5 area is situated on a north-south trending ridge which rises gently to the south. To the west the ground surface drops at slopes of 20° to 25°. To the east and north, subvertical bedrock bluff with talus slopes are present below the proposed development area.

No evidence was observed of significant slope instability or failures in the existing soil and rock slopes. In general, the bedrock controlled slopes are considered stable with respect to deep seated or large scale slope instability; however, in the vicinity of the steep rock soil slopes, setback distances may be required.

5.5 Golf Course Clubhouse and Parking Lot

EBA's reconnaissance of the proposed golf course and parking lot areas did not find any evidence of significant geotechnical hazards presented in or impacting these areas.

6.0 GENERAL RECOMMENDATIONS

The following general recommendations are summarized from site reconnaissance and site evaluation work discussed above.

- Site-specific slope stability analyses are required to define top of slope setback distances for many areas of the site.
- Setback distances of 15 m from the edge of rock bluff should be used for preliminary planning of site layout. The crest of slope is defined as ______________________.
- The existing topography which is understood to be derived from airphotos is not accurate. As a result, accurate surveys to better define the crest of slopes, locally steep terrain, talus slopes, rock slump, rock bluffs etc. are required in the proposed development area. With this survey data, setback distances, slide run out zones, rockfall shadow zones, etc. can be more accurately assessed. EBA will provide a separate figure showing the areas where such surveys are needed.
- Ravelling of exposed rock or sloughing and erosion of surficial soils may result from removal of surface vegetation and tree cover near slopes. It is strongly recommended that tree clearing and removal of vegetation be kept to a minimum on all portions of the site where slopes exceed 30°.
- Where development will require removal or disturbance of the existing vegetation, drainage and erosion control may be required.
- Provision should be made for long-term control of surface runoff and groundwater seepage using suitable grading and drains discharging away from natural and excavated slopes.

7.0 CLOSURE

Conclusions and recommendations presented herein are based on a visual inspection of the areas mentioned in the report. This report has been prepared for use by Intrawest Corporation which includes distribution as required for purposes for which the assessment was commissioned. The assessment has been carried out in accordance with generally accepted engineering and geoscientific practice. Engineering and geomorphologic judgement has been applied in developing the recommendations in this report. No other warranty is made, either expressed or implied.

Respectfully submitted,

EBA Engineering Consultants Ltd.

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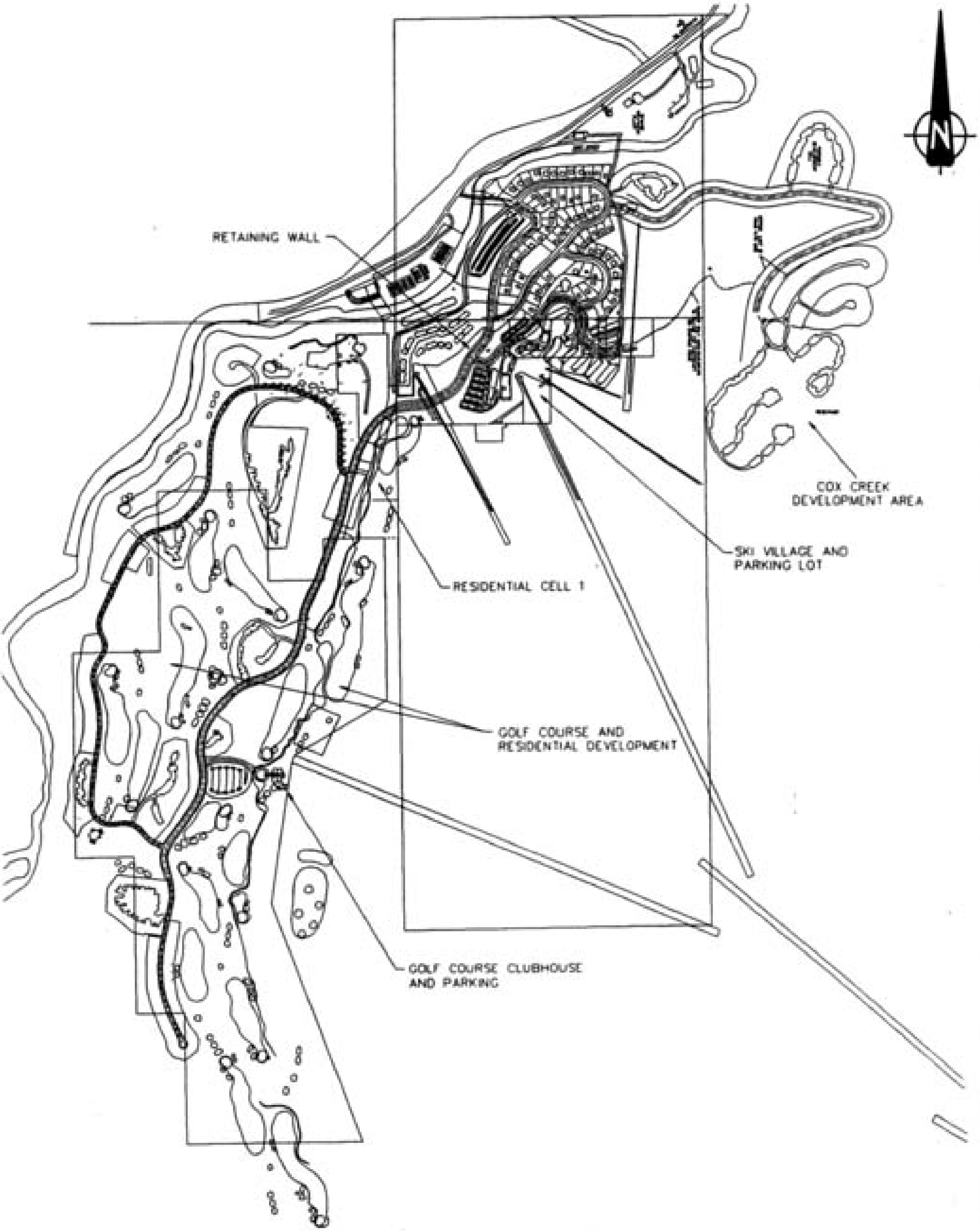
Reviewed by:

Neil R. MacLeod, P.Eng.
Senior Engineering Geologist

LMP:NS:NRM:kdb

FIGURES



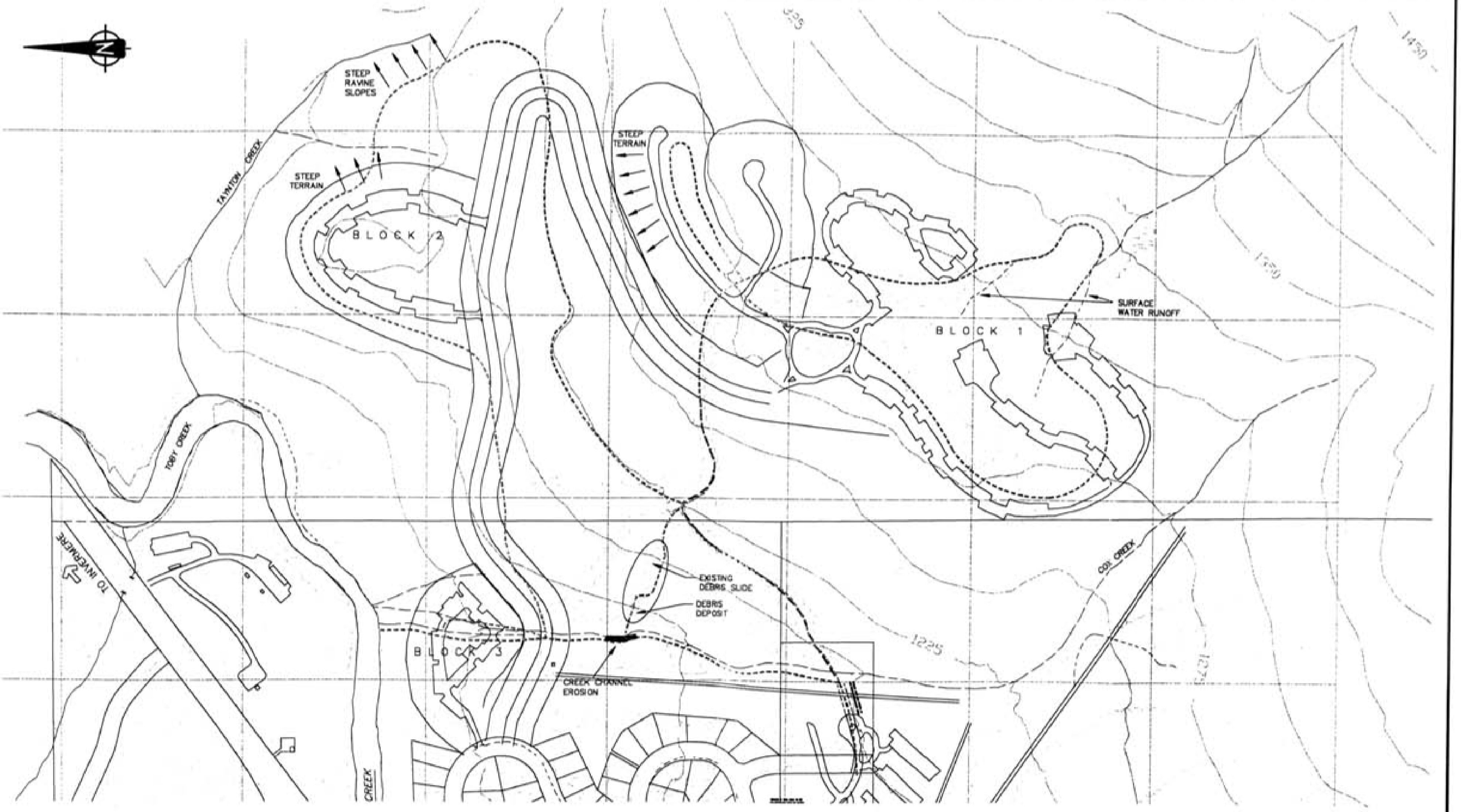
CLIENT: INTRAWEST CORPORATION

PROJECT: PANORAMA RESORT

TITLE: GENERAL LAYOUT PLAN

EBA Engineering Consultants Ltd.

DATE:	DRAWN BY:	CHECKED BY:	DRAWING NO.:
96/09/19	LCH	LMP	FIGURE 1
SCALE:	PROJECT NO.:	CAD FILE NO.:	
N.T.S.	0304-96-30357	30357MAP	



LEGEND

------- PATH OF FOOT TRAVERSE

CLIENT: INTRAWEST CORPORATION

PROJECT: PANORAMA RESORT

TITLE: COX CREEK DEVELOPMENT AREA

EBA Engineering Consultants Ltd.

DATE: 96/11/19

DRAWN BY: LCH

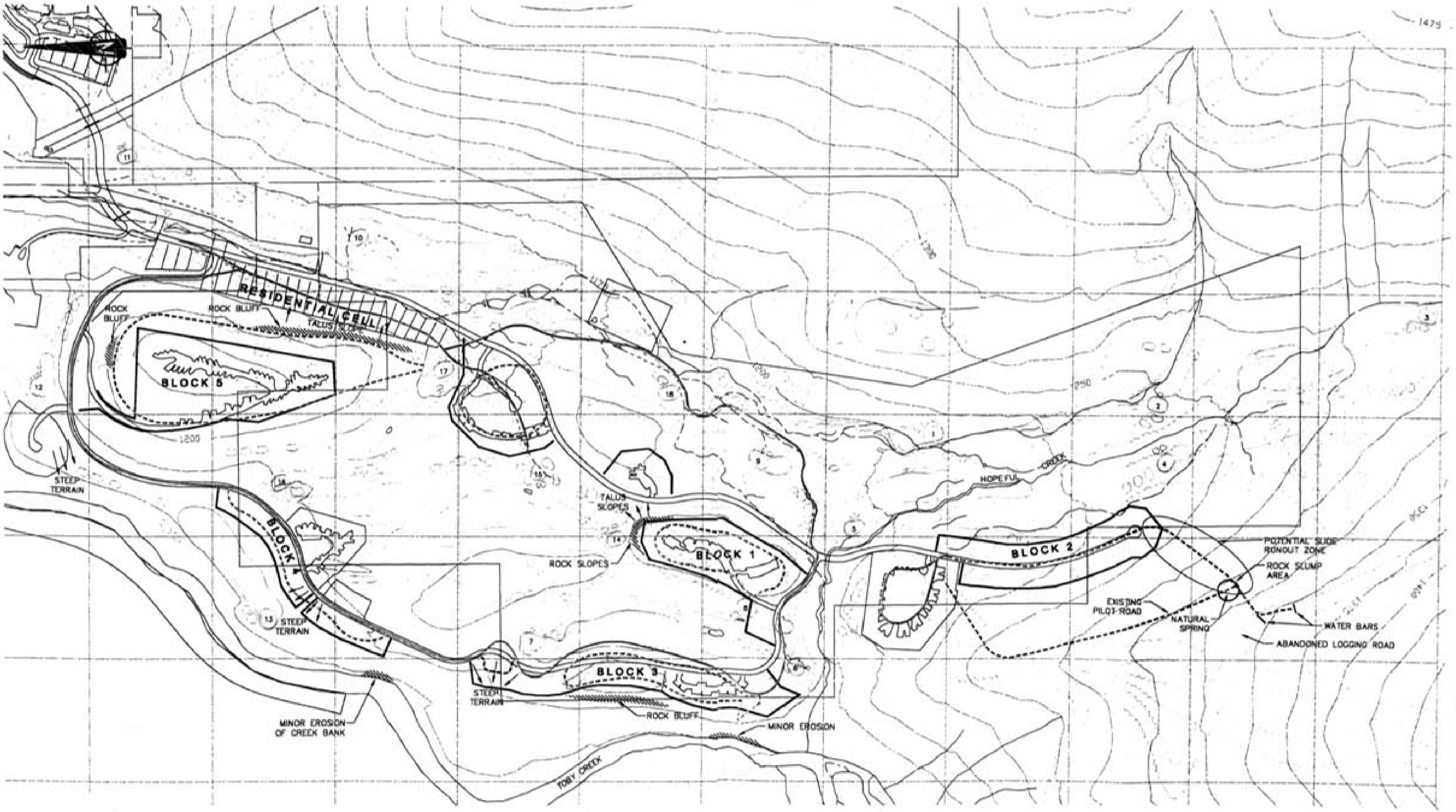
CHECKED BY: LMP

DRAWING NO.: FIGURE 2

SCALE: N.T.S.

PROJECT NO.: 0304-96-30357

CAD FILE NO.: 30357SIT



CLIENT:
INTRAWEST CORPORATION
PROJECT:
PANORAMA RESORT
TITLE:
RESIDENTIAL CELL #1 AND GOLF COURSE RESIDENTIAL

EBA Engineering Consultants Ltd.

DATE: 96/11/19	DRAWN BY: LCH	CHECKED BY: LMP	DRAWING NO.: FIGURE 3
SCALE: N.T.S.	PROJECT NO.: 0304-96-30357	CAD FILE NO.: 30357ST2	

APPENDIX A

SITE PHOTOGRAPHS

PHOTO 1: Cox Creek channel erosion.

PHOTO 2: Debris slide and gully erosion.

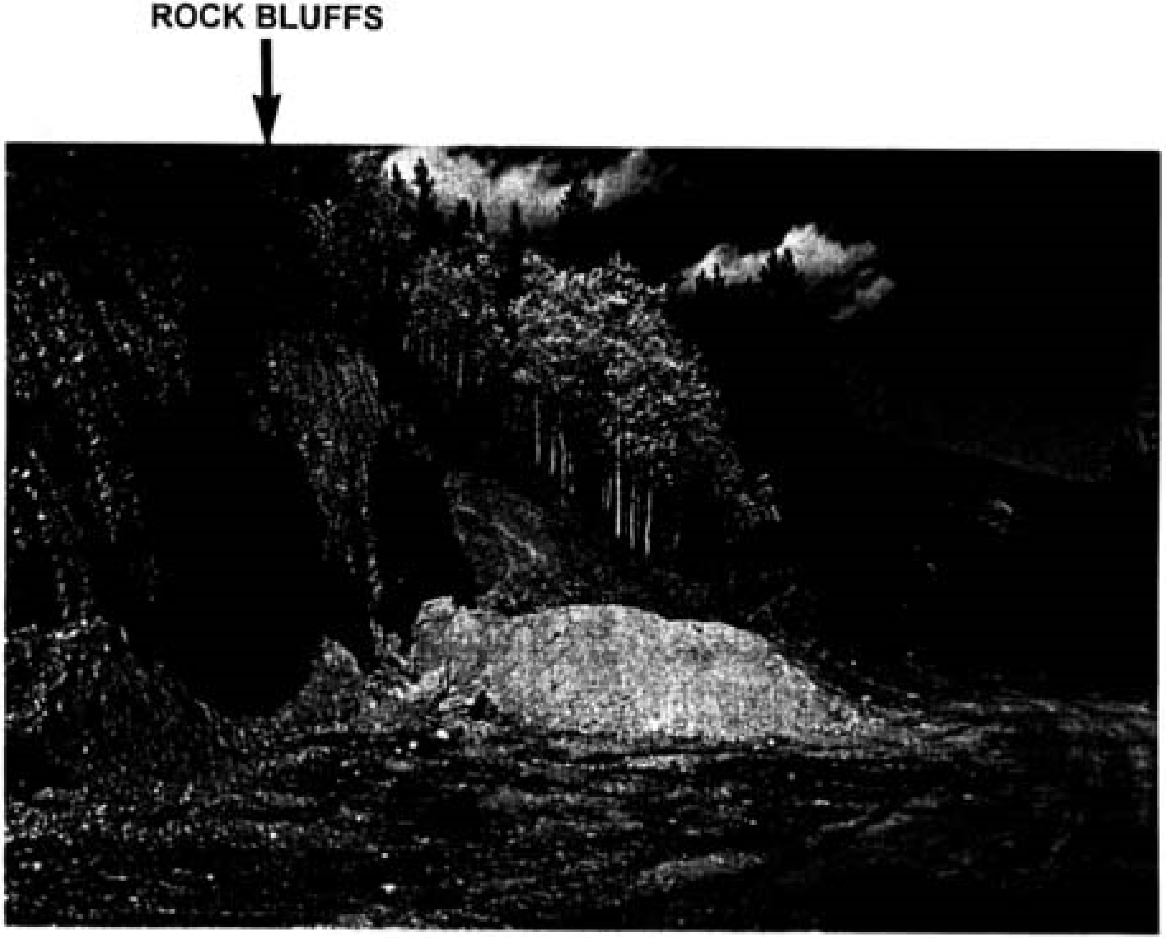


PHOTO 3: Rock bluffs and talus slope, Residential Cell 1.

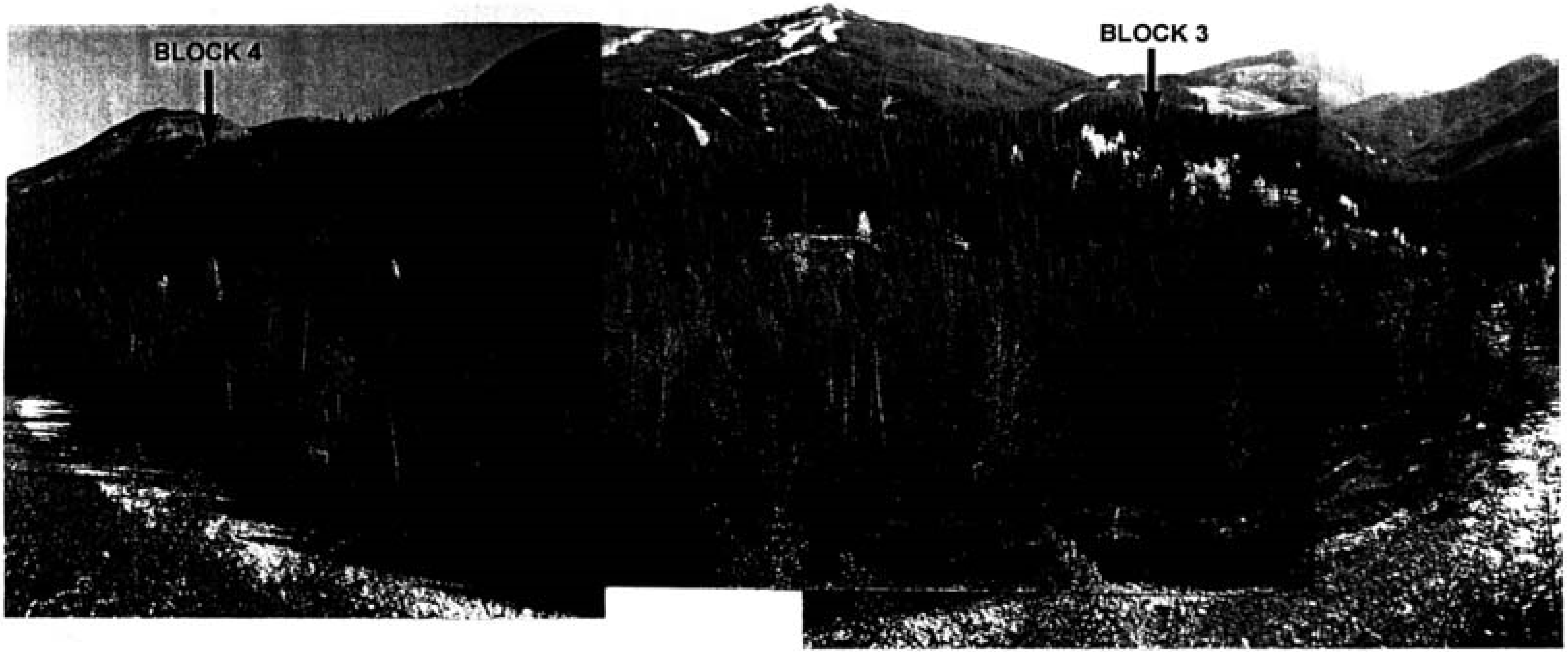


PHOTO 4: Toby Creek Ridge block 3 and 4 golf course residential development.

GEOTECHNICAL

GEOTECHNICAL EVALUATION

August 1996

EBA Engineering Consultants Ltd.

GEOTECHNICAL EVALUATION
PANORAMA RESORT
PANORAMA, BRITISH COLUMBIA

SUBMITTED TO:

Intrawest Corporation
c/o IMC Consulting Group Inc.
Calgary, Alberta

PREPARED BY:

EBA Engineering Consultants Ltd.
Calgary, Alberta

0304-30213

AUGUST 1996

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EBA Engineering Consultants Ltd.

GEOTECHNICAL EVALUATION
PANORAMA RESORT
PANORAMA, BRITISH COLUMBIA

AUGUST 1996

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1.0 INTRODUCTION

This report presents the results of the geotechnical evaluation conducted by EBA Engineering Consultants Ltd. (EBA) regarding the future development within the boundaries of Panorama Resort.

The objective of this evaluation is to assess the general subsoil and groundwater conditions at the site for the design and construction of the proposed development. This report presents the data acquired from the field testpitting program and geotechnical recommendations for development.

This report has been prepared in accordance with the request for proposal prepared by the IMC Consulting Group Inc. (IMC) dated May 6, 1996.

2.0 PROJECT DETAILS

The project is understood to comprise the design and construction of residential housing units, a golf club and related access roadways, retaining walls, parking lots and underground services. The development has been divided into the following individual site areas as shown on the attached plan (Figure 1).

- Cox Creek Development Area
- Ski Village and Parking Lot
- Residential Cell #1
- Golf Course Roadways and Residential Development Area
- Golf Course Clubhouse and Parking Lot

It is EBA's understanding that the majority of site grading is planned within the Ski Village and Parking Lot Area to include the removal of the Knoll area and development of a roadway network to the proposed Golf Course Clubhouse and Parking Lot.

The development of each of the other areas will require some site grading, installation of sewer, water and storm underground utilities and the construction of internal paved access roads. No further details are available at this planning stage.

3.0 FIELD PROGRAM

A total of 47 testpits were excavated to refusal between June 4 and June 7, 1996 using a Caterpillar Model E120 hoe provided by the Panorama maintenance facility.

The testpit locations were chosen by EBA personnel in consultation with IMC Consulting Group Inc. (IMC). Testpit locations in some instances were altered in the field by Mr. R.G. Gifford, E.I.T. due to accessibility restrictions and conflicts with underground utilities. Testpit locations were generally selected along the access roads to minimize disruption to standing trees.

A total of five testpits were excavated along the proposed retaining wall alignment within the Ski Village Area on July 22, 1996 using a 266 track hoe contracted from Max Helmer Construction of Invermere, British Columbia.

The soil conditions within each of the testpits were logged in the field and slotted PVC standpipes were installed in selected testpits to allow for future monitoring of groundwater levels.

4.0 SUBSURFACE SOIL CONDITIONS

4.1 Cox Creek Development Area

The testpit locations within this area are presented in Figure 2 attached. The subsurface soil conditions encountered in the Cox Creek Development Area were generally uniform in nature and depth. The stratigraphy generally consisted of topsoil overlying an unsorted well graded coarse textured soil. The topsoil was sandy and ranged in thickness from 25 mm to 300 mm. The underlying soil contained gravel, sand, some silt and a trace of clay with intermixed cobbles and boulders. The soil was dense and moist. Refusal occurred when large cobbles or boulders were encountered which could not be excavated by the backhoe. Photos 1 and 2, Appendix B, show typical soil conditions encountered in the testpits within the Cox Creek Development area. Photos 3 and 4 show the view of the bank along the access road leading to the northwest residential area.

Most of the proposed Cox Creek development area is well drained due probably to the relatively high relief and nature of the subsoil. However, a couple of poorly drained areas were observed in the vicinity of Testpits 4, 5 and 6. These wet areas are believed to be caused by ground surface runoff combined with low relief and a low plastic clayey silt subsoil encountered beneath the topsoil in Testpit 6. As a result, Testpits 4 and 5 showed high groundwater levels.

The following summarizes the subsurface soil conditions encountered in each of the testpits.

Testpit	Depth (m)	Description
Testpit 1	0.0 - 0.3	Topsoil, sandy to gravel
	0.3 - 4.0	Gravel/sand, some silt, trace clay, damp, cobbles and boulders intermixed.
	4.0	Refusal on cobbles and standpipe installed (96-06-10).
		Testpit dry.
Testpit 2	0.0 - 1.5	Gravel/sand, some silt, trace clay, cobbles and boulders.
		Water infiltration at -0.75 m.
	1.5	Refusal on cobbles and boulders.
		No standpipe installed.
Testpit 3	0.0 - 1.7	Gravel/sand, some silt, trace clay.
	1.7	Refusal on cobbles and boulders
Testpit 4	0.0 - 0.025	Topsoil, sandy
	0.025 - 2.5	Silt, clayey, trace gravel, trace sand, moist, firm, low plastic, olive, mottled.
		Occasional cobble and boulder.
		Water seepage at -1.0 m.
	2.5	Refusal on boulders.
		Standpipe installed water at surface on 96-06-10 (runoff).
Testpit 5	0.0 - 0.025	Topsoil
	0.025 - 1.8	Silt, clayey trace gravel, trace sand, low plastic, occasional cobbles and boulders.
	1.8 - 2.5	Sand/gravel, some silt, trace clay.
		Water seepage.
	2.5	Refusal on boulders.
		Standpipe installed.
		Water level at -0.8 m 96-06-10. Dry on July 22, 1996.

Testpit	Depth (m)	Description
Testpit 6	0.0 - 0.050	Topsoil
	0.050 - 1.5	Silt, clayey some sand trace gravel occasional cobble and boulders.
		Moist, low plastic.
	1.5 - 2.0	Sand/gravel some silt, cobble and boulders.
	2.0	Refusal on cobble and boulders.
		No standpipe installed.
Testpit 7	0.0 - 0.075	Topsoil
	0.075 - 1.6	Sand/gravel, some silt, trace clay, occasional cobbles and boulders.
		Shale fragments.
	1.6	Refusal on cobble and boulders.
		No standpipe installed.

4.2 Ski Village and Parking Lot

The testpit locations within this area are presented in Figure 3, attached. The subsurface soil conditions encountered in the Ski Village and Parking Lot Area were generally consistent in nature.

The stratigraphy consisted of silty topsoil that ranged in thickness from 0 to 150 mm. The underlying soil contained gravel, sand, some silt and a trace of clay. Cobbles and boulders were intermixed throughout the soil. This soil was generally dense and moist. Photos 1 and 2, enclosed in Appendix B, show typical soil conditions encountered within this area of development. Surficial gravel fills were encountered in Testpits 1, 2, 4 and 5. This fill is the granular base material within the gravel parking areas. Slate bedrock was encountered in Testpits 1, 2, 3, 4, 5 and 6 at depths which ranged from 1.2 m to 3.0 m. Bedrock out crops were also visible within the Knoll area and are shown in Photo 5. The rippability of the bedrock could not be accurately determined with the excavation equipment provided for testpitting.

All testpits were dry upon completion. Standpipes were installed in Testpits 3, 4, 5, 7, 10 and 11 and were subsequently measure on 96-06-10. All testpits were dry on June 10, 1996, however, Testpit 5 showed a water level depth at 1.3 m below ground. It is our opinion, that this water level is attributed to surface water entering the testpit location and does not represent the elevation of the local groundwater. A subsequent water level measurement taken on July 22, 1996 indicated that TP-5 was dry to 3 m. This is anticipated to better represent the local groundwater conditions. In addition, Testpit 1 had saturated surficial soil that was located in an area of ponding water.

The following summarizes the subsurface soil conditions encountered in each of the testpits.

Testpit	Depth	Description
Testpit 1	0.0 - 0.3	Gravel (fill), parking area.
	0.3 - 2.0	Silt, trace clay, saturated, layered, olive brown, sloughing.
	2.0	Refusal on bedrock, shale.
		No standpipe installed.
Testpit 2	0.0 - 0.6	Gravel (fill), sandy, trace silt, moist, bedrock fragments.
	0.9 - 1.2	Bedrock, shale, weathered.
	1.2	Refusal on shale bedrock.
		No standpipe installed.
Testpit 3	0.0 - 2.7	Gravel, sandy, some silt, trace clay, trace cobbles and boulders, bedrock fragments, moist.
	2.7	Refusal on bedrock - shale/slate.
		Standpipe installed.
		Dry on 96-06-10.
Testpit 4	0.0 - 0.150	Gravel (fill).
	0.150 - 2.0	Silt, trace clay, trace gravel, olive, layered, moist.
	2.0	Refusal on boulder.
		Standpipe installed.
		Dry on 96-06-10.
Testpit 5	0.0 - 0.3	Gravel (fill) road area.
	0.3 - 3.0	Silt, trace clay, bedrock fragments, firm and moist. Trace gravel and boulders, layered.
	3.0	Refusal on bedrock, shale.
		Standpipe installed.
		Water level at -1.3 m on 96-06-10. Dry on July 22, 1996.

Testpit	Depth	Description
Testpit 6	0.0 - 1.2	Silt, sandy, some gravel.
	1.2 - 1.5	Shale, bedrock, weak, weathered.
	1.5	Refusal on shale bedrock.
		No standpipe installed.
Testpit 7	0.0 - 0.3	Topsoil.
	0.3 - 1.3	Gravel, sandy, trace to some silt occasional cobble, boulders and slab fragments moist.
	1.3 - 2.0	Increase in size of gravel, almost exclusively boulders and cobbles.
	2.0	Refusal on boulders and cobbles.
		Standpipe installed.
		Dry on 96-06-10.
Testpit 8	0.0 - 0.3	Topsoil, sandy.
	0.3 - 2.0	Sand/gravel, trace silt, boulders and cobbles.
		Very hard to excavate.
	2.0	Refusal on interlocked cobbles and boulders.
		No standpipe installed.
Testpit 9	0.0 - 0.075	Topsoil.
	0.075 - 1.95	Gravel/sand, some silt, occasional cobbles and boulders.
	1.95	Refusal on cobble and boulder matrix.
		No standpipe installed.
Testpit 10	0.0 - 0.150	Topsoil.
	0.150 - 3.1	Sand, some gravel, trace clay, trace cobble and boulders.
	3.1	Refusal on boulders and cobbles.
		Standpipe installed.
		Dry on 96-06-10.

Testpit	Depth	Description
Testpit 11	0.0 - 0.050	Topsoil.
	0.050 - 3.0	Sand/gravel, trace clay, trace silt intermixed with cobbles and boulders.
	3.0	Refusal on cobbles and boulders.
		Standpipe installed.
		Dry on 96-06-10.
Testpit 12	0.0 - 0.050	Topsoil.
	0.050 - 2.6	Sand/gravel, some silt, trace clay, intermixed with cobbles and boulders.
	2.6	Refusal on cobbles and boulders.
		No standpipe installed.

4.2.1 Retaining Wall Testpit Program

The testpit locations along the proposed retaining wall alignment are presented in Figure 4, attached.

The subsurface soil conditions along the proposed retaining wall alignment were generally consistent in nature.

The stratigraphy within Testpit 1R through Testpit 3R, located along the northern half of the proposed wall alignment, consisted of silty sand to sandy silt that ranged in thickness from 1.2 m to 1.7 m. The surficial deposit was generally compact and contained a trace to some gravel and occasional cobbles and boulders.

Underlying the silty soils, where present, all of the testpits (i.e., 1R to 5R) encountered a deposit of gravel and sand containing some silt and a trace clay. Cobbles and boulders were intermixed throughout the soil. The soil was generally dense and moist.

Testpits 2R, through 4R, inclusive, encountered refusal on bedrock or boulders at depths of 2.7 m to 3.2 m.

All testpits were dry upon completion and there was no evidence of groundwater during excavation of the testpits.

The following summaries the subsurface soil conditions encountered in each of the testpits.

Testpit	Depth	Description
TP-1R	0.0 - 1.7	Sand, silty, some gravel, trace organics, cobbles, moist, compact to dense.
	1.7 - 4.4	Sand, some gravel, some silt, cobbles and boulders, moist, compact to dense.
		No standpipe installed.
TP-2R	0 - 0.15	Topsoil.
	0.15 - 1.3	Sand, silty trace gravel, moist, compact to dense.
	1.3 -2.7	Sand, some gravel, some silt, cobbles, moist, dense to very dense.
	2.7	Refusal on bedrock or boulder.
		No standpipe installed.
TP-3R	0 - 1.2	Silt, trace sand, clay and gravel, cobbles and boulders, moist, compact.
	1.2 - 3.2	Sand, some gravel, trace to some silt, cobbles, moist, dense to very dense.
	3.2	Refusal on bedrock or boulders.
		No standpipe installed.
TP-4R	0 - 2.7	Sand, some gravel, trace to some silt, cobbles and boulders, moist, compact to very dense.
	2.7	Refusal on bedrock or boulders.
		No standpipe installed.
TP-5R	0 - 0.5	Sand, some gravel, silt, trace to some organics, cobbles, moist, compact.
	0.5 - 3.2	Sand, some silt and gravel, cobbles and boulders, moist, compact to very dense.
		No standpipe installed.

4.3 Residential Cell #1

The testpit locations within this area are presented in Figure 5, attached. The subsurface soil conditions encountered within the residential Cell #1 were variable in nature and depth.

The stratigraphy generally consisted of fill overlying silt. The fill encountered in Testpit 1 consisted of a silty gravel to a depth of 1.3 m below existing ground. The fill encountered in Testpit 2 consisted of a silt mixed with organics and loam to a depth of 2.6 m. The silt underlying the fill was firm, low plastic with a trace of clay and extended to a depth of 5.0 m in Testpits 1 and 2. No fill was encountered in Testpit 3. The soil stratigraphy encountered in Testpit 3 consisted of silt overlying slate bedrock. This bedrock was encountered at a depth of 3.2 m and the hoe was unable to rip the bedrock.

Seepage was encountered in Testpit 1 at the interface of the silty gravel fill and the underlying native silts. A standpipe was installed in Testpit 2 and was dry when measured on 96-06-10.

Testpit Number	Depth	Description
Testpit 1	0.0 - 1.3	Gravel (fill), silty trace sand.
		Water infiltration at bottom of gravel.
	1.3 - 2.0	Silt, trace clay, low plastic, damp, olive.
	2.0 - 5.0	Silt, trace clay, low plastic, grey.
	5.0	End of testhole.
		No standpipe installed.
Testpit 2	0.0 - 2.6	Silt (fill), organics, loam.
	2.6 - 4.0	Silt, firm, trace clay, grey.
	4.0 - 5.0	Silt, firm, trace clay, grey, low plastic.
	5.0	End of testhole.
		Standpipe installed.
		Dry on 96-06-10.
Testpit 3	0.0 - 3.2	Silt, firm, trace clay, trace sand, moist occasional cobble.
	3.2	Refusal on slate bedrock.
		No standpipe installed.

4.4 Golf Course and Residential Development

The testpit locations within this area are presented in Figure 6, attached. The subsurface soil conditions encountered within the boundaries of the Golf Course and Residential Development area were highly variable.

Fill up to 2.6 m in depth was encountered in Testpits 2, 4, 5, 6, 9 and 11. It is believed that the fill was placed during previous partial landscaping done for the golf course in the late 1980s and/or early 1990s. In these testpits, the fill was generally placed over the existing topsoil and/or organics.

Testpit 6 located in the vicinity of the proposed clubhouse indicated that a burn pile of cleared trees had been buried to a depth of 2.5 m below existing ground surface. Photo 10 shows the fill and debris encountered.

Testpits 3 and 7 in the area of the proposed clubhouse parking lot could not be excavated due to standing water and saturated soil conditions in the area.

Bedrock varied in depth below existing surface within this area. Bedrock outcrops were visible throughout the area (Photos 7 and 8) and are generally located in the proposed residential development.

Photo 6 of Testpit 21, which contained silt overlying a sandy gravel shows the highly variable materials encountered throughout this area.

The following table summarizes the subsurface materials as encountered.

Testpit	Depth	Description
Testpit 1	0.0 - 1.6	Silt, trace clay, trace sand, trace gravel, firm, moist.
	1.6	Refusal on shale/slate bedrock.
		No standpipe installed.

Testpit	Depth	Description
Testpit 2	0.0 - 0.6	Silt (fill), some gravel, trace sand.
	0.6 - 0.7	Topsoil, organics rootlets.
	0.7 - 1.2	Gravel/sand, intermixed boulders and cobbles, trace clay.
	1.2 - 5.0	Silt, trace gravel, trace clay, trace sand, firm, mottled, moist.
	5.0	End of testhole (limit of hoe).
		No standpipe installed.
Testpit 3	Unable to excavate due to saturated conditions.	
Testpit 4	0.0 - 0.100	Topsoil, silty.
	0.100 - 0.50	Silt (fill), some gravel, sandy
	0.5 - 2.6	Silt and organics, grey and black layers.
	2.6 - 3.0	Gravel, wet, sandy, water seeping into excavation.
	3.0	Refusal on cobbles and boulders.
		Standpipe installed.
		Water at -1.7 m on 96-06-10.
Testpit 5	0.0 - 1.5	Gravel (fill), cobbles and boulders, wood pieces.
	1.5 - 3.3	Sand/gravel, some silt, trace clay, occasional cobble.
		Water at -3.0 m.
	3.3	Refusal on boulders.
		Standpipe installed.
		Water at -2.1 m on 96-06-10.
Testpit 6	0.0 - 2.5	Gravel (fill), sandy burned wood debris (LOGS)
	2.5 - 2.6	Gravel, sandy, (water seeping in) intermixed with cobbles and boulders.
	2.6	Refusal on boulders and cobbles.
		No standpipe installed.
Testpit 7	Inaccessible with track hoe due to saturated conditions.	

Testpit	Depth	Description
Testpit 8	0.0 - 0.025	Topsoil.
	0.025 - 2.7	Gravel, silty, some sand, trace clay, moist, intermixed with cobbles and boulders.
	2.7	Refusal on boulders.
		No standpipe installed.
Testpit 9	0.0 - 0.075	Topsoil, silty.
	0.075 - 0.350	Silt (fill), organics, wood pieces.
	0.350 - 0.650	Topsoil, silty.
	0.650 - 2.0	Silty, sandy, some clay, firm.
	2.0 - 3.0	Gravel, trace clay, trace silt, some cobbles and boulders, saturated.
	3.0	Refusal on boulders.
		Standpipe installed.
		Water at -1.2 m on 96-06-10.
Testpit 10	0.0 - 0.150	Topsoil, silty.
	0.150 - 0.300	Silt, trace sand, trace clay.
	0.300 - 1.5	Gravel/sand, occasional cobbles and boulders, saturated, water seeping, sloughing.
	1.5	End of testhole due to sloughing, groundwater at approximately -1.0 m below existing surface.
		No standpipe installed.
Testpit 11	0.0 - 0.25	Topsoil, wood fragments.
	0.025 - 0.30	Silt (fill), trace sand, trace clay.
	0.30 - 0.325	Topsoil layer.
	0.325 - 3.0	Gravel, sandy, some silt, trace clay, occasional cobbles and boulders.
		Water at -2.7 m.
	3.0	End of testhole due to sloughing in.
		No standpipe installed.

Testpit	Depth	Description
Testpit 12	0.0 - 0.150	Topsoil, silty.
	0.150 - 0.650	Silt, trace sand, trace gravel, trace clay.
	0.650 - 1.5	Fossilized corral.
	1.5 - 2.9	Gravel/sand, trace silt, occasional cobble and boulders.
		Water level at -2.9 m.
	3.0	End of testhole due to sloughing in.
		No standpipe installed.
Testpit 13	0.0 - 0.30	Topsoil, silty.
	0.30 - 1.9	Silt, sandy, trace clay, trace gravel, moist occasional cobble and bedrock fragments.
	1.9	Refusal on shale bedrock.
		No standpipe installed.
Testpit 14	not excavated	Testpit located on top of shale bedrock outcrop.
Testpit 15	0.0 - 0.050	Topsoil.
	0.050 - 1.5	Silt, sandy, some gravel, trace, clay, bedrock fragments.
	1.5	Refusal on shale bedrock.
		No standpipe installed.
Testpit 16	not excavated	Testpit located on top of bedrock outcrop.
Testpit 17	0.0 - 0.05	Topsoil.
	0.05 - 1.3	Silt, sandy, trace clay, occasional bedrock fragments.
	1.3 - 1.5	Shale bedrock, weak weathered.
	1.5	Refusal on bedrock.
		No standpipe installed.
Testpit 18	0.0 - 0.05	Topsoil.
	0.05 - 1.5	Silt, clayey, trace sand, trace gravel, firm, moist.
	1.5 - 3.8	Clay, silty, sand lenses, firm, moist, low plastic.
	3.8	End of testhole due to limit of hoe.
		No standpipe installed.

Testpit	Depth	Description
Testpit 19	0.0 - 0.30	Sand, silty, moist.
	0.30	Bedrock, shale refusal.
		No standpipe installed.
Testpit 20	0.0 - 2.5	Silt, sandy, trace clay moist.
	2.5	Bedrock shale/slate refusal.
		No standpipe installed.
Testpit 21	not excavated	inaccessible area.
Testpit 22	0.0 - 0.05	Topsoil.
	0.05 - 2.1	Silty, trace sand, trace clay, low plastic, moist.
	2.1 - 3.4	Gravel, sandy, well graded, trace silt.
	3.4	Refusal on boulders.
		Standpipe installed.
		Dry on 96-06-10.
Testpit 23	0.0 - 3.0	Silt, clayey, trace sand, trace gravel, damp, low plastic.
	3.0	Refusal on shale bedrock.
		No standpipe installed.
Testpit 24	0.0 - 0.05	Topsoil, silty.
	0.050 - 2.1	Sand, trace silt, trace gravel.
	2.1 - 2.6	Gravel/sand, trace silt, trace clay, occasional cobbles and boulders.
	2.6	Refusal on boulder.
		Standpipe installed.
		Dry on 96-06-10.
Testpit 25	0.0 - 0.3	Silt, trace clay, trace sand.
	0.3 - 3.3	Gravel, sandy, trace silt, well graded.
	3.3	Refusal on cobble and boulders.
		No standpipe installed.

5.0 RECOMMENDATIONS AND CONSIDERATIONS

It should be noted that geological conditions are innately variable. At the time of preparation of this report, information on the subsurface stratigraphy is available only at discrete testpit locations, visual inspection and from the review of previous geotechnical data and reports. In order to develop recommendations from this information, it is necessary to make some assumptions concerning conditions other than at borehole locations. Adequate inspection should be provided during construction to check that these assumptions are reasonable.

As stated in previous reports and confirmed by the testpitting program, varying strata will be encountered across the proposed development. This strata will include well-graded, compact silty gravels intermixed with cobbles and boulders, compact firm, silts, fill material, fill over undesirable organics and bedrock at varying depths and degrees of rippability.

5.1 Cox Creek Development Area

5.1.1 Foundation Recommendations

Spread and/or strip footing are considered feasible to support structural loads for the proposed residential development. Driven or bored piles are considered to be impractical due to the numerous large cobbles and boulders which were encountered.

The allowable stratic bearing pressure for the design of spread and/or strip footings may be taken as 190 kPa, subject to the recommendations in this report. All footing elements should be placed on native, inorganic undisturbed native soil or on engineered fill, as defined in Appendix C. It is expected that the native soil in this area will be a silty gravel with cobbles and boulders as indicated by the testpit logs.

5.1.2 Bedrock/Groundwater Mitigation

Bedrock is expected to be highly variable in depth and rippability. Although not encountered in any of the testpits, bedrock outcrops were visible nearby, and is likely to be encountered during the installation of underground utilities, services and residential foundations. It is recommended that the rippability of the bedrock should be assessed once the final design layout is completed.

During testpitting and subsequent monitoring, groundwater was not encountered, with the exception of Testpit 5. It is our opinion, that, the groundwater observed in Testpit 5 was present as a result of surface water infiltration. Although not encountered, there is a potential for spring activity in the area that may be encountered during construction. Control of any potential surface water infiltration can be achieved through the control and design of the overland drainage. Low lying areas should be dewatered by the use of cut-off ditches before construction is undertaken. It is recommended that the site grading design should take advantage of the natural relief of the area to direct water to areas remote from the proposed residential development. We do not anticipate that problems will be encountered with the installation of underground utilities and residential foundations provided surface runoff is adequately controlled. Furthermore, should underground water be encountered during service and residential basement installation, it is anticipated that this groundwater can be controlled by measures developed in the field.

5.1.3 Slope Stability

No indications of slope instability were noted during a visual inspection of the Cox Creek Development area. EBA should be given the opportunity to review the site grading drawings in terms of slope stability once the grades have been established.

5.2 Ski Village and Parking Lot

5.2.1 Foundations Recommendations

Spread and/or strip footings are considered feasible to support structural loads for this proposed development area. Driven or bored piles are considered to be impractical due to the numerous large cobbles and boulders which were encountered during testpitting.

The allowable static bearing pressure for the design of spread and/or strip footings may be taken as 190 kPa, subject to the recommendations in this report. All footing elements should be placed on the native inorganic undisturbed soil or on engineered fill as defined in Appendix C.

It is expected that the native soil in this area will be a silty gravel with cobbles and boulders as indicated by the testpit logs.

5.2.2 Bedrock/Groundwater Mitigation

Bedrock is expected to be highly variable in depth and rippability. Although not encountered in any of the testpits, bedrock outcrops were visible nearby, and it is likely to be encountered during the installation of underground utilities, services and foundations. It is recommended that the rippability of the bedrock should be defined once the final design layout is completed.

During testpitting and subsequent monitoring, groundwater was not encountered. Control of any surface water infiltration can be achieved through the design and control of the overland drainage. It is recommended that the design of the site grading take advantage of the natural relief of the area to direct water to areas remote from the proposed development. We do not anticipate the problems will be encountered during the installations of underground utilities, residential and commercial foundations provided surface runoff is adequately controlled. It is anticipated that any subsurface water encountered can be controlled by measures developed during construction.

5.2.3 Slope Stability

Visual observations throughout the Ski Village and Parking Lot Development area showed no indications of natural slope instability. There was, however, some evidence of soil slippage within the underground utility trench that was located within a cut slope in the vicinity of the Testpit 5. It is our opinion that these movements are the result of the surface runoff and infiltration into the utility trench backfill.

The existing slope in the vicinity of the proposed access road retaining wall is 8 m to 10 m in height and slopes northward at angles which vary from 18 to 26 degrees, and more locally. A series of multi-level condominiums are located at the toe of the slope. The slope is presently covered in low lying grass with several clumps of coniferous and deciduous tree growth.

Visual examination of the slope between the proposed retaining wall and condominiums provides no evidence of deep seated or major slope movements or failures. The presence of tree growth on the slope provide confirmation that no significant slope instability has occurred on this slope for a period in excess of 15 years.

Preliminary slope stability analyses carried out considering the proposed retaining wall configuration and grades have a factor of safety greater than 1.5 indicating that the post development slope is stable.

5.2.4 Access Road Retaining Wall Recommendations

In order to raise the grades along the proposed access road, it is understood that a 1 m to 4 m high retaining wall approximately 120 m in length will be constructed at the crest of the existing slope at the location shown in Figure 4. It is understood that three retaining wall systems are currently being considered including:

- Reinforced Earth
- Allan block reinforced with geogrid
- Reinforced Soil Slope System

Based on the subsurface soil conditions and our preliminary slope stability assessment, it is anticipated that a retaining wall system, as indicated above, can be constructed at this location.

Some of the preliminary geotechnical recommendations for retaining wall construction are presented as follows. During testpitting, some fill material was encountered. This surficial loose to compact silty fill soil extends to depths of 1.7 m or possibly more locally and is not suitable for subgrade support of the proposed retaining wall. These silty soils should be removed to expose the underlying dense to very dense natural sand and/or gravel and replaced with a suitable compacted granular fill prior to placement of the retaining wall. The soils should be compacted in accordance with the recommendations for a general engineered fill presented in Appendix C.

It is recommended that EBA be involved during detailed design process to assist in determining the most suitable and cost effective retaining wall system.

5.2.5 Building Retaining Wall Recommendations

It is understood that the current grading plan requires a drop in site grade in the northern corner of the existing conference centre building.

In order to protect the foundation from frost penetration, consideration is being given to installing a 35 m long retaining wall ($\cong 1$ m high) along the northwest corner of the building. If the retaining wall will be limited to heights less than 1.2 m, it is considered a landscaped wall and does not require engineering design.

Alternatively, the site grades may be lowered adjacent to the building provided the foundations are adequately insulated from frost penetration using rigid board insulation.

5.3 Residential Cell #1

5.3.1 Foundation Recommendations

Within the Residential Cell #1 development area two out of the three testpits showed nonengineered fill ranging in depth from 1.3 m to 2.6 m. The existing fill as delineated by testpitting is not suitable for foundation support, however, the underlying native silty soils are suitable for foundation support. During the detailed design process the limits of the existing fill within the proposed building envelopes and roadway rights-of-way should be accurately defined. Once the extent of this nonengineered fill has been defined, the following options can be undertaken:

- Excavate the existing nonengineered fill within the building envelope and roadway right-of-way and replace with a suitable general engineered fill as defined in Appendix C. This is usually undertaken during site grading activities to facilitate fill removal and placement.
- Allow the removal of the existing nonengineered fill and placement of a suitable general engineered fill within the building envelope to be the responsibility of the lot purchaser through a disclosure clause in the purchase agreement.

Strip and/or spread footings are therefore considered feasible to support structural loads for the proposed residential development. The allowable static bearing pressure for the design of spread and/or strip footings placed on the native silty soils can be taken as 95 kPa, subject to the recommendations in this report. Should the footings be placed on a suitable general engineered fill that is selected and compacted, as noted above, the bearing pressure can be taken as 190 kPa.

5.3.2 Bedrock/Groundwater mitigation

Bedrock was encountered in Testpit 3 at a depth of 3.2 m below existing ground surface. It is expected that the bedrock will be highly variable in depth and may be encountered during development. Rippability of the bedrock can also be expected to be variable and dependant on the dip angle of the layered strata. Once the final design layout is established, the presence of rippability of the bedrock, if impacting on the underground and residential housing construction, should be investigated.

Seepage was encountered in Testpit 1 at the interface of the fill and native soil. Thus temporary dewatering will be required during fill removal and placement in this development area.

5.3.3 Slope Stability

Visual observations throughout the Residential Cell #1 Development area showed no indications of natural slope instability. The topography within this area is relatively flat.

5.4 Golf Course and Remaining Residential Development

5.4.1 Foundation Recommendations

Variable depths of nonengineered fill, up to 1.0 m, was encountered within the testpit locations in the building sites. The existing fill is not suitable for foundation support, however; the underlying native silty soils are suitable for foundation. During the detailed design process, the limits of the existing fill within the proposed building envelopes and roadway rights-of-way can be accurately defined. Once the extent of existing nonengineered fill has been defined, the following options can be undertaken:

- Excavate the existing nonengineered fill within the building envelope and roadway right-of-way and replace with a suitable general engineered fill as defined in Appendix C. This is usually undertaken during site grading activities to facilitate fill removal and placement.
- Allow the removal of the existing nonengineered fill and placement of a suitable general engineered fill within the building envelope to be the responsibility of the lot purchaser through a disclosure clause in the purchase agreement.

Spread and/or strip footing are considered feasible to support structural loads for the proposed residential development within the Golf Course area. The allowable static bearing pressure for the design of spread and/or strip footings may be taken as 190 kPa for footings founded on the native silty gravel or a suitable general engineered fill and 95 kPa for footings founded on the native silts. It is expected that the strata at footing grade may include a mixture of in situ soils and the footings should be designed to the soil with the minimum bearing capacity encountered.

5.4.2 Bedrock/Groundwater Mitigation

Bedrock is expected to be highly variable in depth and rippability. Bedrock outcrops were visible throughout the site and appear situated such that residential development and utility construction will surely encounter it.

Groundwater was encountered during testpitting and subsequent monitoring within the residential development in Testpits 11 and 12 at a depth of -2.7 m and -2.9 m respectively. Temporary dewatering of construction excavations may be necessary in these and other areas depending on-site grading which is not available at this time. Control of surface water infiltration can be achieved through the control and design of the overland drainage. It is recommended that the site grading and design take advantage of the natural relief of the area to direct water to areas remote from the proposed residential development.

5.4.3 Slope Stability

No indications of slope instability were noted during a visual inspection of the Golf Course Development area. However details of the proposed site grading, and golf course layout which are not available at this time should be reviewed. Recommendations could be presented at that time regarding minimum setback distances.

5.5 Club House and Parking Lot Area

5.5.1 Foundation Recommendations

The testpits encountered up to 2.5 m of nonengineered fill within the Club House area. Within the Club House location the existing fill should be removed and replaced with the local granular soil as a suitable general engineered fill. Spread and/or strip footings are considered feasible to support structural loads for the proposed development under this condition. Driven or bored piles are considered to be impractical due to the numerous large cobbles and boulders which were encountered.

The allowable static bearing pressure for the design of spread and/or strip footings may be taken as 190 kPa, subject to the recommendations in this report. All footing elements would be placed on native inorganic undisturbed native soil or on engineered fill as defined in Appendix C.

It is expected that the native soil in this area will be the silty gravel with cobbles and boulders as indicated by the testpit logs.

5.5.2 Bedrock/Groundwater Mitigation

Bedrock was not encountered in any of the testpits in the vicinity of the proposed Club House structure. However if encountered it can be expected to be variable in rippability.

Groundwater seepage was encountered at a depth of -2.6 m below existing ground surface in Testpits 4 and 6 and was later measured at -1.7 m on June 10, 1996. Temporary dewatering during construction and installation of underground utilities can be achieved through the use of cut-off ditches and sumps.

Permanent dewatering measures including water proofing of basement walls and installation of a weeping till drain may be required. During the detailed design process, the most suitable and cost effective permanent dewatering measures should be determined.

5.5.3 Slope Stability

No indications of slope instability were noted during a visual inspection of the Golf Course Club House area. However details of the proposed site grading, and building layout which are not available at this time should be reviewed.

5.5.4 Parking Lot Area

Due to standing water and saturated soil conditions no testpits could be excavated within this area. Dewatering of this area must be completed before construction is undertaken. Recommendations for the parking lot structure given in Section 5.6.2 are based on the inferred soil conditions and must be confirmed during the detailed design process.

5.6 General

5.6.1 Site Preparation

All organic topsoil, vegetation and unengineered fill should be removed from area under the proposed building and pavement. Backfill to bring the site to subgrade level should be general engineered fill as defined in Appendix C.

The on-site silt encountered is not considered to be a suitable general engineered fill and should not be used as backfill beneath buildings or pavements. To minimize the potential for frost heave damage to pavement structures founded on this material we have recommended the use of granular base pavement with positive subgrade drainage to catch basin weeping tile connections.

5.6.2 Foundation Bearing Inspections

It is recommended that all excavations for foundation support should be inspected by a qualified geotechnical engineer prior to pouring of any foundation elements and a bearing certificate should be issued.

5.6.3 Pavements

The following designs for pavement sections are provided. The pavement structures have been designed based on the Province of British Columbia Highway Engineering Design Manual prepared by the Ministry of Transportation and Highways. Subgrade soils range from a gravelly clay/silt till (GC) to sandy silts (SM). Also, it is our opinion that groundwater and frost penetration should not affect these pavement structures. Car and light truck usage has been assumed for residential streets and parking area (Daily Traffic Number (DTN) = 5) and delivery and garbage disposal truck usage for the collector streets (DTN = 50).

	Recommended Minimum Thickness (mm)	
Material	**Residential Streets and Parking Area**	**Collector Streets**
Equivalent Single Axle Loads (ESALs)	<100,000	100,000 - 1,000,000
Asphaltic Pavement	50	75
25 mm Crushed Base Course	225	150
75 mm Crushed Base Course	-	150
Select Granular Sub-base	150	150

The above recommendations are subject to review and confirmation during final design.

The subgrade should be prepared as described in Appendix C and graded to drain towards catch-basin locations. Additional recommended guidelines for design and construction of parking lots and roadways are to be found in Appendix C of this report.

Asphaltic mixes for residential streets should be designed to a maximum aggregate size of 19 mm and 25 mm for collector streets. The mix designs for the asphaltic concrete should comply with current local standards and be approved by the Ministry Representative prior to construction.

5.6.4 Backslopes

Backslopes constructed in native silty gravel may be designed at 1.5:1 (H:V). Backslopes constructed in native sandy silts and general engineered fill may be designed at 2:1 (H:V).

6.0 DESIGN AND CONSTRUCTION GUIDELINES

Recommended general design and construction guidelines are provided in Appendix C, under the following headings:

- Backfill Materials and Compaction
- Construction Excavations
- Pavements
- Proof-Rolling
- Shallow Foundations

These guidelines are intended to present standards of good practice. Although supplemental to the main text of this report, they should be interpreted as part of the report. Design recommendations presented herein are based on the premise that the guidelines will be followed. The design and construction guidelines are note intended to represent detailed specifications for the works, although they may proved useful in the preparation of such specifications.

In the event of any discrepancy between the main text of this report and Appendix C, the main test should govern.

7.0 REVIEW OF DESIGN AND CONSTRUCTION

It is recommended that EBA be involved during the detailed design process to confirm that the geotechnical aspects of this projects are in agreement with the recommendations outlined in our report and to assist in selecting the most cost effective options to site specific design challenges.

Bearing surfaces, foundation installation and subgrade and base course preparation for slabs-on-grade and pavement areas should be inspected by qualified geotechnical personnel during construction. EBA will provide these services, if requested.

8.0 LIMITATIONS

Recommendations presented herein are based on a geotechnical evaluation of the findings in 52 testpits. The conditions encountered during the field work are considered to be reasonably representative of the site. If, however, conditions other than those reported are noted during subsequent phases of the project, EBA should be notified and given the opportunity to review our current recommendations in light of new findings. Recommendations presented herein may not be valid if an adequate level of inspection is not provided during construction or if relevant Building Code requirements are not met.

This report has been prepared for the exclusive use of Intrawest Corporation for specific application to the development described in Section 2.0 of this report. It has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty is made, either expressed or implied.

Engineering judgement has been applied in developing the recommendations in this report, in an attempt to strike a reasonable balance between risk of failure and economic factors. Beyond a certain level of cost, increments of security are attained only by disproportionate increases in cost. In many design situations, a more conservative approach could be adopted in return for increased design and construction costs. Conversely, less conservative designs could be developed if the owner is willing to accept increased risk.

For further limitations, reference should be made to the General Conditions in Appendix A of this report.

9.0 CLOSURE

We trust this report meets your present requirements. We would be pleased to provide any further information that may be needed during design and to advise on the geotechnical aspects of specifications for inclusion in contract documents. Should you require any additional information or inspection services, please do not hesitate to contact our office.

Respectfully submitted,

EBA Engineering Consultants Ltd.

96/08/16

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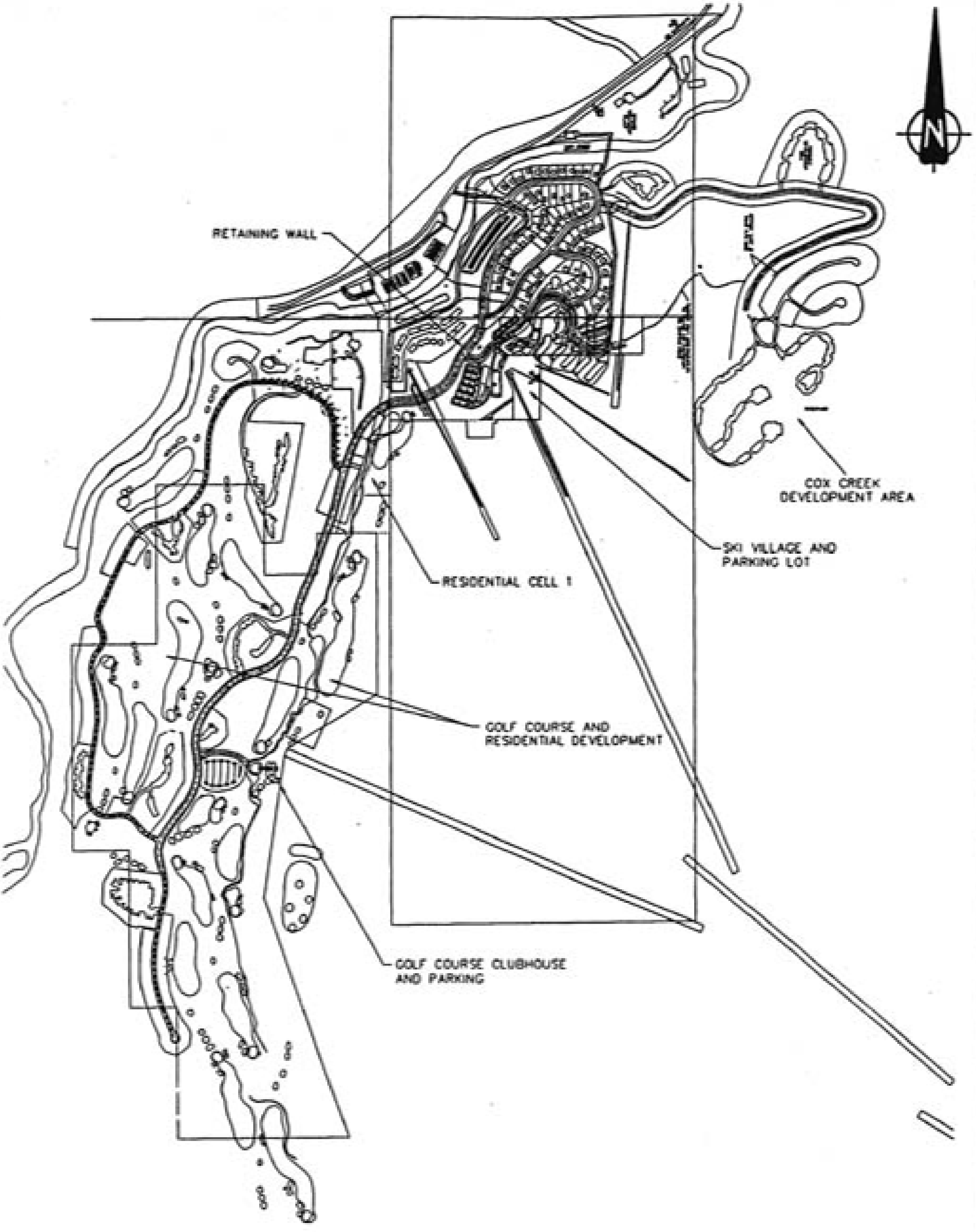
PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
Signature
Date 96-8-16
PERMIT NUMBER: P 245
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

LMP:AWM:NSL:mvd

FIGURES



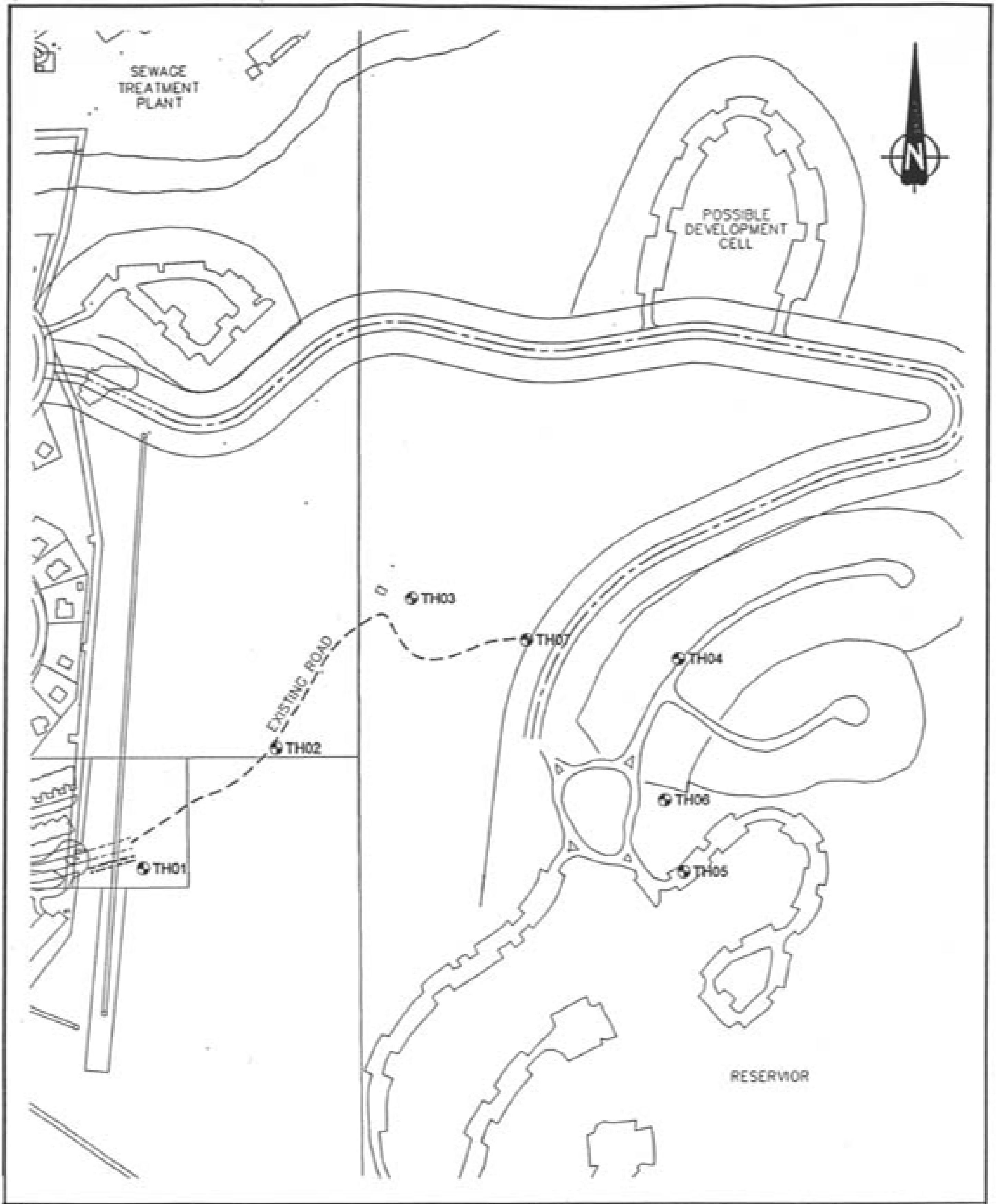
CLIENT:
INTRAWEST CORPORATION

PROJECT:
PANORAMA RESORT

TITLE:
GENERAL LAYOUT PLAN

EBA Engineering Consultants Ltd.

DATE: 96/08/12	DRAWN BY: LCH	CHECKED BY: LMP	DRAWING NO.: FIGURE 1
SCALE: N.T.S.	PROJECT NO.: 0304-96-30213	CAD FILE NO.: 30213MAP	



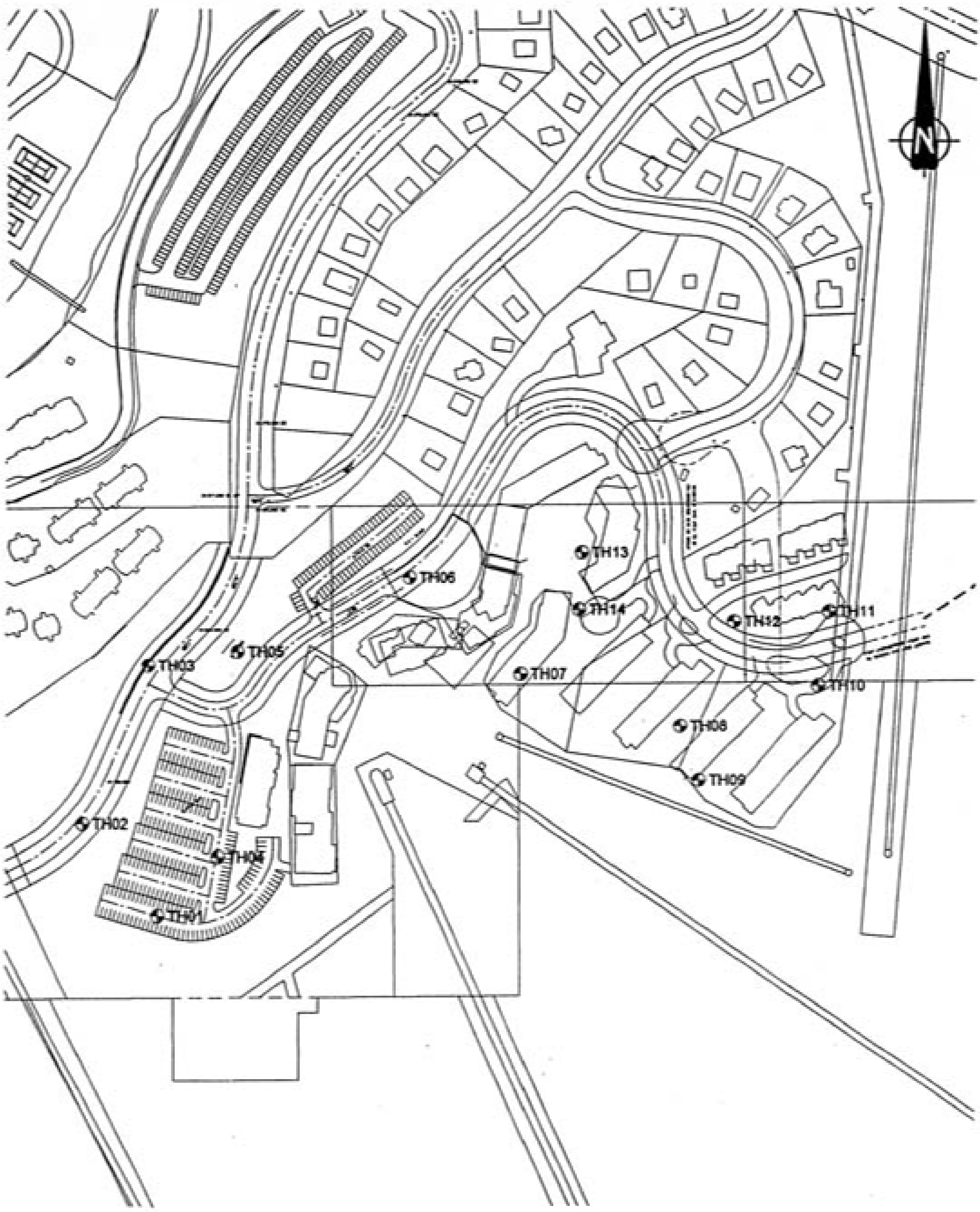
CLIENT:
INTRAWEST CORPORATION

PROJECT:
PANORAMA RESORT

TITLE:
COX CREEK DEVELOPMENT AREA

EBA Engineering Consultants Ltd.

DATE: 96/08/16	DRAWN BY: LCH	CHECKED BY: LMP	DRAWING NO.: FIGURE 2
SCALE: N.T.S.	PROJECT NO.: 0304-96-30213	CAD FILE NO.: 30213ST1	



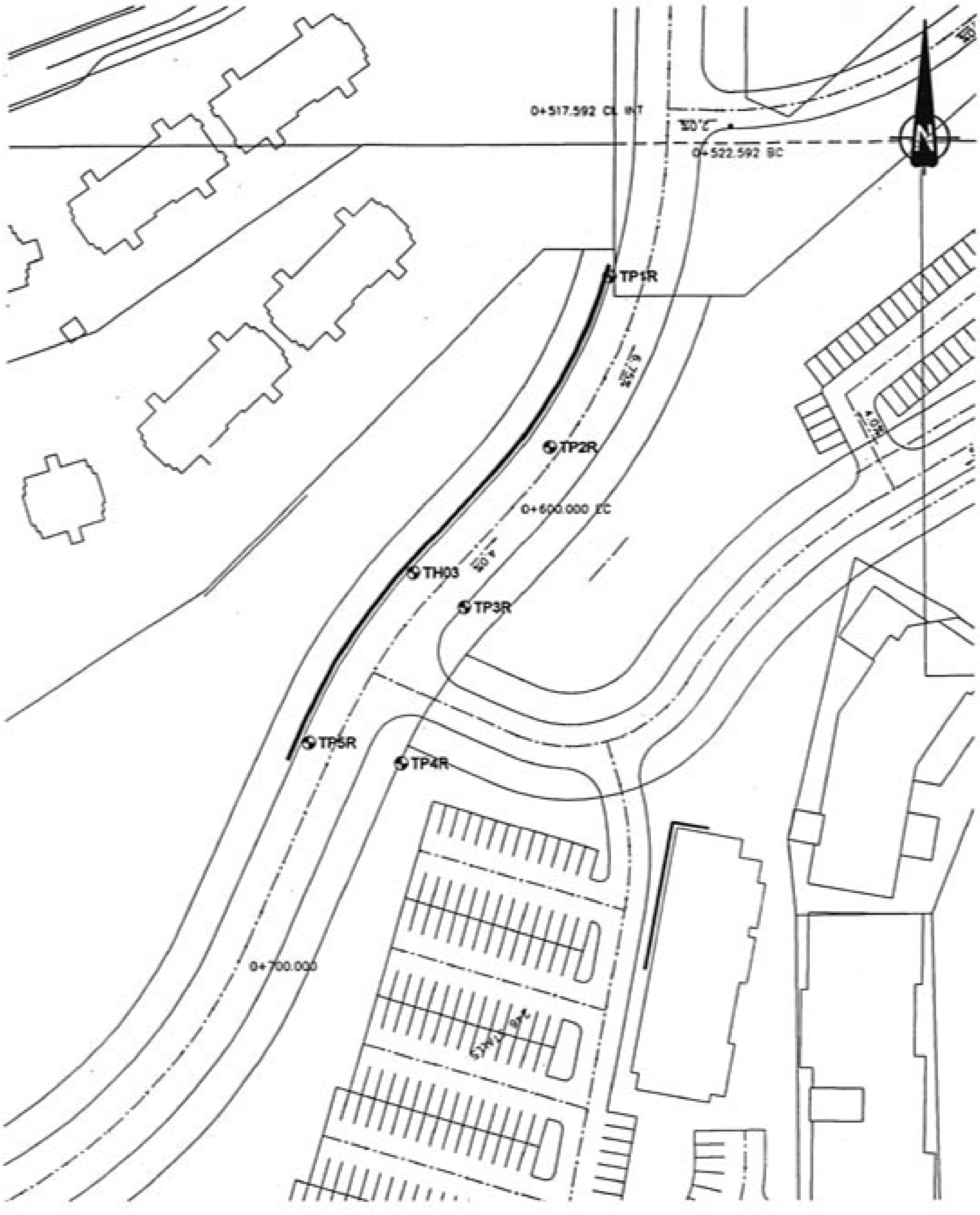
CLIENT:
INTRAWEST CORPORATION

PROJECT:
PANORAMA RESORT

TITLE:
SKI VILLAGE AND PARKING LOT

EBA Engineering Consultants Ltd.

DATE: 96/08/16	DRAWN BY: LCH	CHECKED BY: LMP	DRAWING NO.: FIGURE 3
SCALE: N.T.S.	PROJECT NO.: 0304-96-30213	CAD FILE NO.: 30213ST2	



CLIENT: INTRAWEST CORPORATION

PROJECT: PANORAMA RESORT

TITLE: RETAINING WALL

EBA Engineering Consultants Ltd.

DATE: 96/08/16

DRAWN BY: LCH

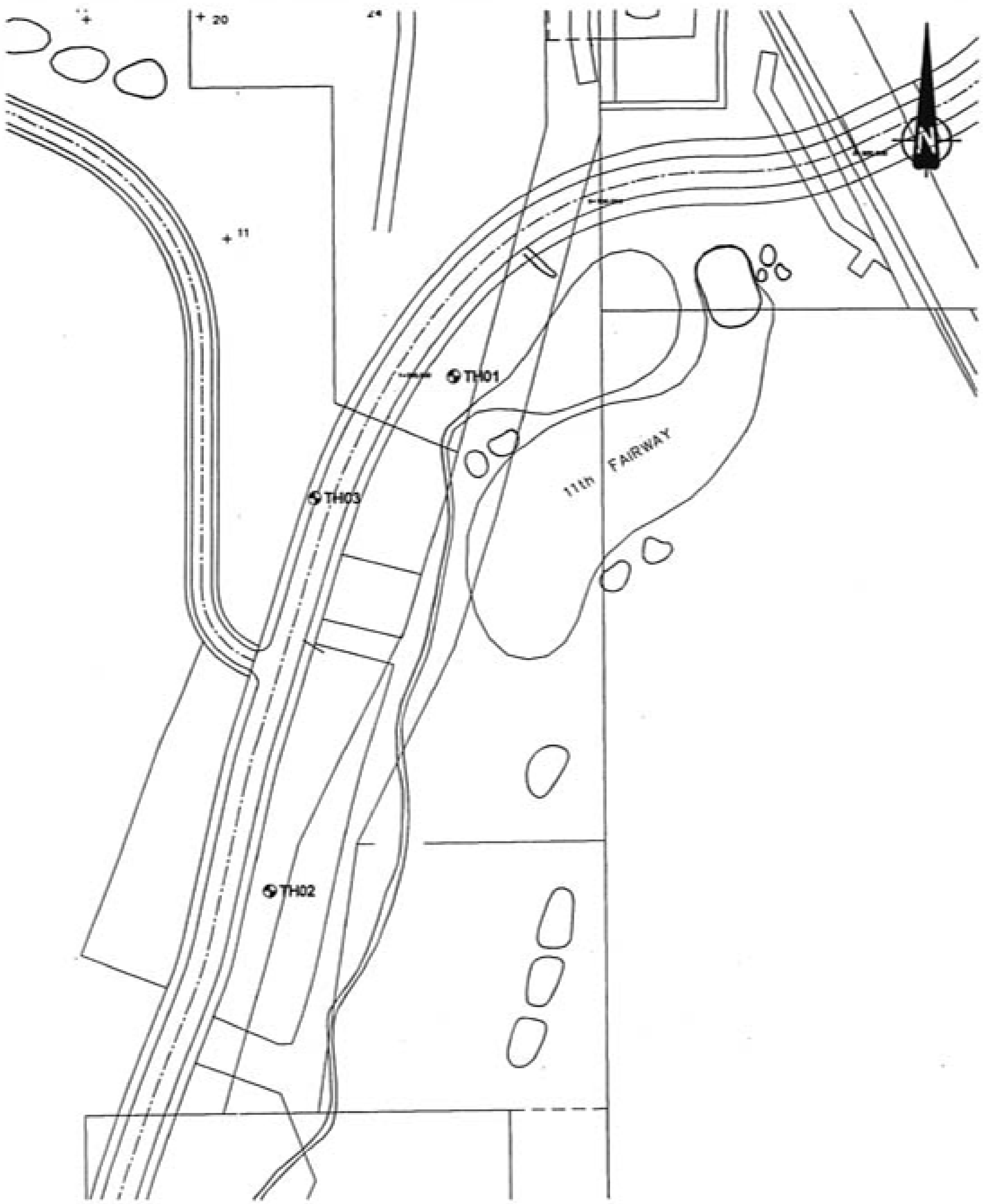
CHECKED BY: LMP

DRAWING NO.: FIGURE 4

SCALE: N.T.S.

PROJECT NO.: 0304-96-30213

CAD FILE NO.: 30213ST3



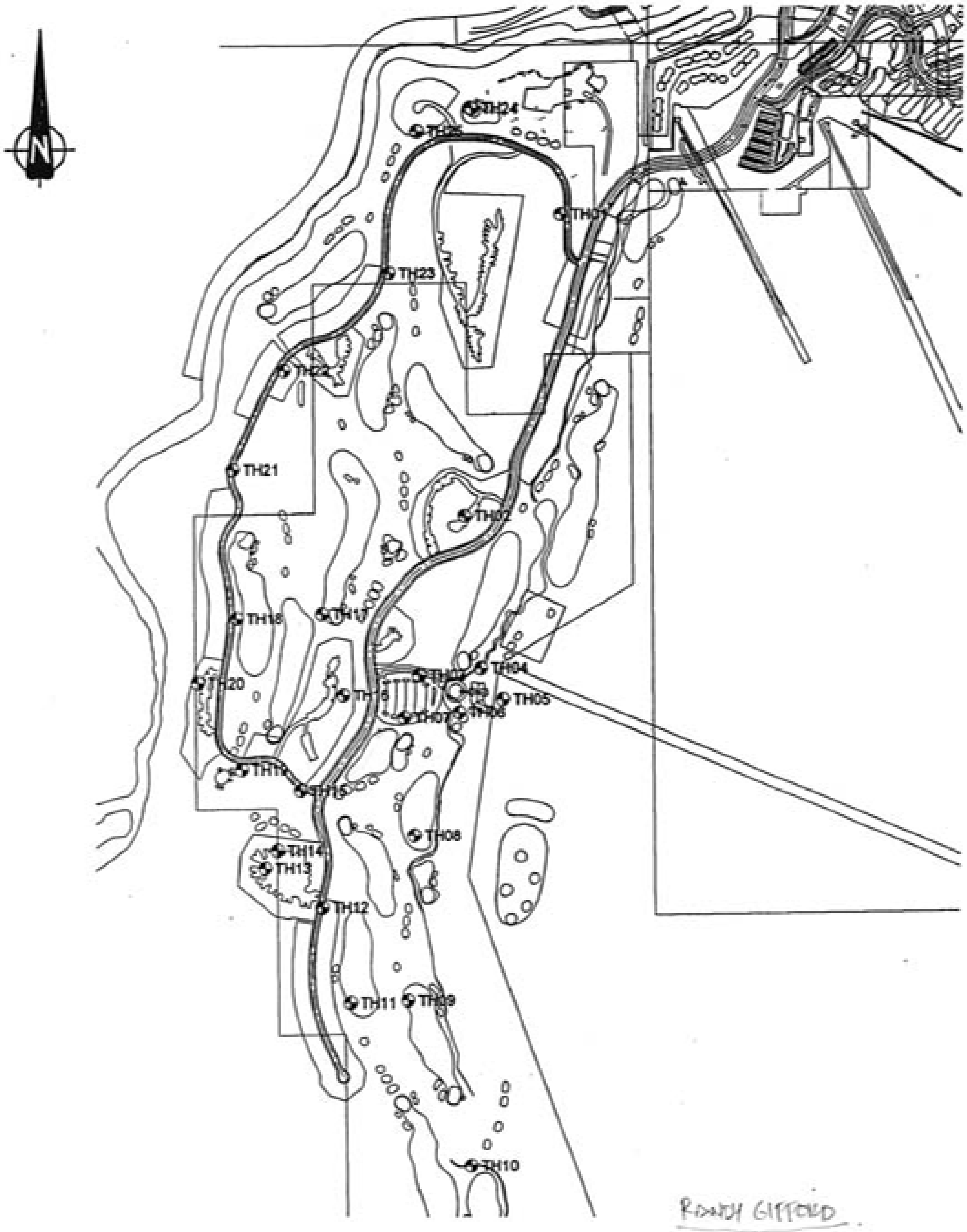
CLIENT: INTRAWEST CORPORATION

PROJECT: PANORAMA RESORT

TITLE: RESIDENTIAL CELL 1

EBA Engineering Consultants Ltd.

DATE:	DRAWN BY:	CHECKED BY:	DRAWING NO.:
96/08/16	LCH	LMP	FIGURE 5
SCALE:	PROJECT NO.:	CAD FILE NO.:	
N.T.S.	0304-96-30213	30213ST4	



RANDY GIFFORD

CLIENT: INTRAWEST CORPORATION

PROJECT: PANORAMA RESORT

TITLE: GOLF COURSE AND RESIDENTIAL DEVELOPMENT

EBA Engineering Consultants Ltd.

DATE: 96/08/12
DRAWN BY: LCH
CHECKED BY: LMP
DRAWING NO.: FIGURE 6
SCALE: N.T.S.
PROJECT NO.: 0304-96-30213
CAD FILE NO.: 30213S15

APPENDIX A

TERMS AND CONDITIONS

EBA ENGINEERING CONSULTANTS LTD.

GEOTECHNICAL REPORT
GENERAL CONDITIONS

A.1 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site and development. It is not applicable to adjacent sites nor is it valid for types of development other than that to which it refers. Any variation from the site, or development, necessitates a geotechnical review in order to determine the validity of the design concepts evolved herein.

This report is not to be reproduced in part or in whole without consent in writing from EBA Engineering Consultants Ltd. (EBA). Additional copies of the report, if required, may be obtained upon request. Isolated information, logs of borings, or profiles are not to be reproduced, copied or transferred.

A.2 NATURE AND EXACTNESS OF SOIL DESCRIPTION

Classification and identification of soils are based upon commonly accepted methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system prevail, they are specifically mentioned.

Classification and identification of soil and geologic units are judgmental in nature as to both type and condition. EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

A.3 LOGS OF BORINGS

The boring logs are a compilation of conditions and classification of soils as obtained from field observations and laboratory testing of selected samples. Soil zones have been interpreted. Change from one geologic zone to the other, indicated on the logs as a distinct line, is in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil zone transition elevations may require special evaluation.

A.4 STRATIGRAPHIC AND GEOLOGIC SECTIONS

The stratigraphic and geologic sections indicated on drawings contained in this report are evolved from logs of borings. Stratigraphy is known precisely only at the locations of the borings. Actual geology and stratigraphy between borings may vary from that shown on these drawings. Natural variations in geologic conditions are inherent and a function of historic environment. EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of exact locations of geologic units is necessary, it is cautioned that such determination requires special attention.

A.5 GROUNDWATER CONDITIONS

Groundwater conditions represented in this report refer only to those observed at the times recorded on logs of borings, and/or within the text of this report. These conditions vary with geologic detail between borings; annual, seasonal and special meteorologic conditions; and with construction activity. Where instruments have been established to record groundwater variations on an ongoing basis, the records will be specifically referred to. Interpretation of groundwater conditions from observations and records is judgmental and constitutes an evaluation of circumstances as influenced by geology, meteorology and construction activity. Deviations from these observations, may occur. No other warranty, express, or implied, is made by EBA.

A.6 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geologic materials to meteorological elements. Many geologic materials deteriorate rapidly upon exposure to climatic elements. Severe deterioration of materials may be caused by precipitation and/or the action of frost on exposures. Unless otherwise specifically indicated in this report, walls and floors of excavations must be protected from elements, particularly all forms of moisture, desiccation from arid conditions and frost action.

A.7 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise advised, support of excavation walls, ground adjacent to anticipated construction activity and of structures adjacent to the construction, must be provided. The support of ground and structures adjacent to the anticipated construction, with preservation of adjacent ground and structures from the adverse impact of construction activity, is therefore required.

A.8 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and adjacent structural performance. The influence of all anticipated construction activities should by considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known. EBA provides no warranty in respect to adverse circumstances resulting from construction activity.

A.9 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geologic deposits, the judgmental character of the art of soil and foundation engineering, as well the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations then may serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein to the benefit of the project.

A.10 DRAINAGE SYSTEMS

Where drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwised specified, it is a condition of this report that effective drainage systems are required and that they must be considered in relation to project purpose and function.

A.11 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil type and soil condition. Construction activity and environmental circumstances can materially change a soil condition. The elevation at which a soil type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geologic materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil conditions assumed in this report exist in fact.

A.12 SAMPLES

EBA will retain all soil and rock samples for 30 days. Further storage or transfer of samples can be made at owner expense upon written request.

A.13 STANDARD OF CARE

Services performed by EBA for this report are conducted in a manner consistent with that level and skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty, express or implied, is made.

THE ASSOCIATION OF
PROFESSIONAL ENGINEERS
OF ALBERTA
PERMIT NUMBER
P 245
E B A ENGINEERING
CONSULTANTS LTD.

APPENDIX B

PHOTOGRAPHS

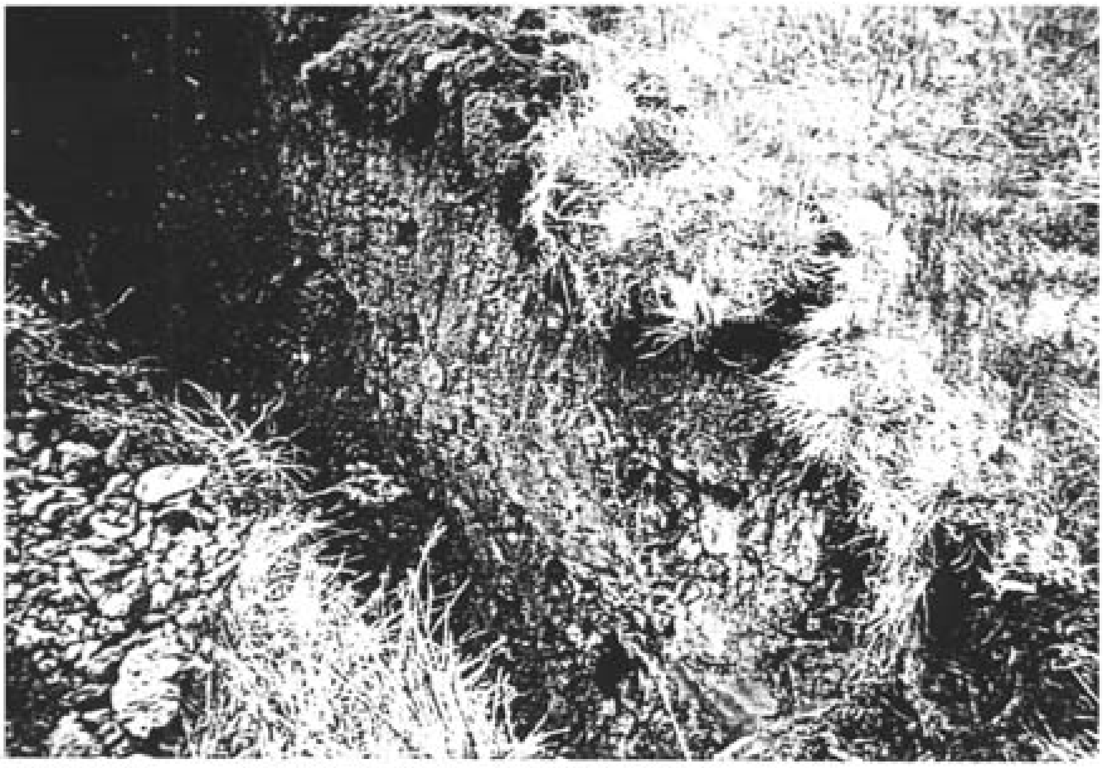


PHOTO 1: Typical testpit showing gravel/silt and cobbles.

PHOTO 2: Typical testpit showing gravel/silt and cobbles.

PHOTO 3: Cox Creek Residential, view of bank along access road.

PHOTO 4: Cox Creek Residential, view of bank along access road.

PHOTO 5: View of bedrock outcrop on knoll area.

PHOTO 6:

Golf Course area, northwest side, view of river gravel overlain by silt.

PHOTO 7: Golf Course Residential, view of bedrock outcrops.

PHOTO 8: Golf Course Residential, view of bedrock outcrops.

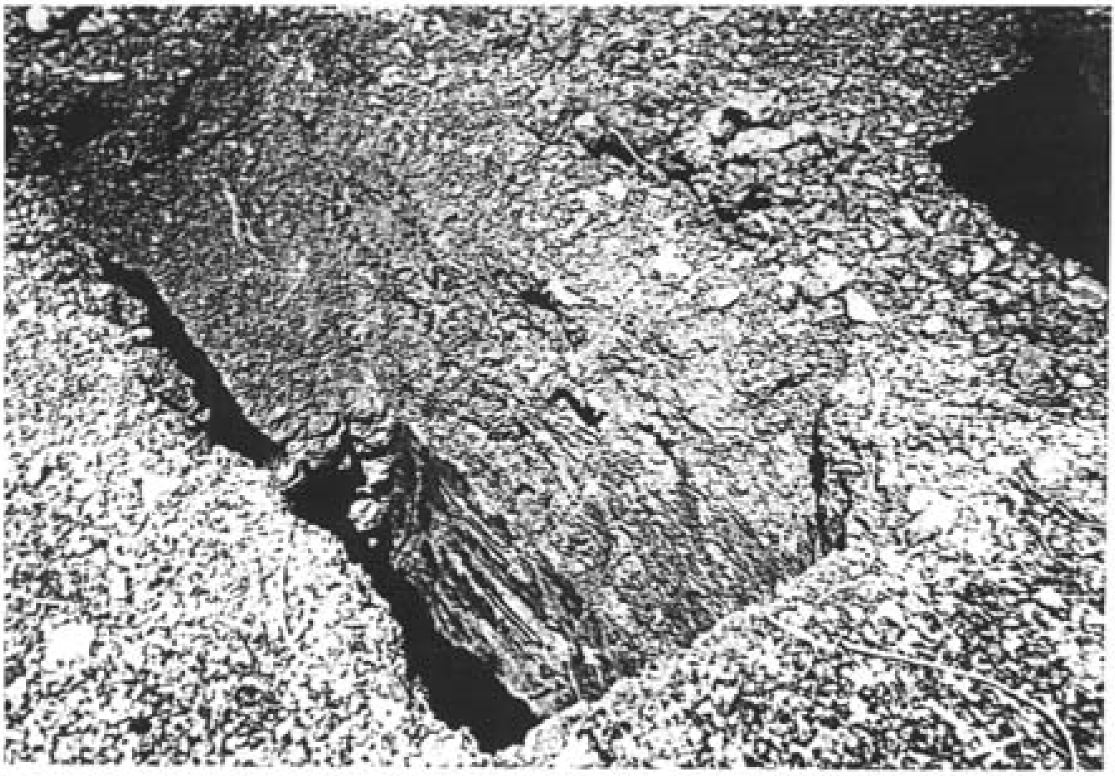


PHOTO 9: Golf Course Residential, view of testpit showing gravel/silt overlying silt.

PHOTO 10:

Golf Course Clubhouse area, view of testpit showing buried clearing material and burn pile.

APPENDIX C

CONSTRUCTION GUIDELINES

BACKFILL MATERIALS AND COMPACTION

Maximum density, as used in this section, means Standard Proctor Maximum Dry Density (ASTM Test D698) unless specifically noted otherwise. Optimum moisture content is as defined in this text.

"General engineered fill" materials should comprise clean, well-graded granular soils or inorganic, low-plastic cohesive soils. Such material should be placed in compacted lifts not exceeding 200 mm and compacted to not less than 95% of maximum density, at a moisture content at or slightly above optimum.

"Structural fill" materials should comprise clean, well-graded inorganic granular soils. Such fill should be placed in compacted lifts not exceeding 150 mm and compacted to not less than 100% of maximum density, at a moisture content at or slightly (0 to 3%) above optimum.

"Landscape fill" material may comprise soils without regard to engineering quality. Such soils should be placed in compacted lifts not exceeding 300 mm and compacted to a density of not less than 90% of maximum density.

Backfill adjacent to and above footings, abutment walls, basement walls, grade beams and pile caps or below highway, street or parking lot pavement sections should comprise general engineered fill materials as defined above.

Backfill supporting structural loads should comprise structural fill materials as defined above.

Backfill adjacent to exterior footings, foundation walls, grade beams and pile caps and within 300 mm of final grade should comprise low-plastic cohesive general engineered fill as defined above. Such backfill should provide a relatively impervious surface layer to reduce seepage into the sub-soil.

Backfill should not be placed against a foundation structure until the structure has sufficient strength to withstand the earth pressures resulting from placement and compaction. During compaction, careful observation of the foundation wall for deflection should be carried out continuously. Where deflection is apparent, the compactive effort should be reduced accordingly. In order to reduce potential compaction induced stresses, only hand held compaction equipment should be used in the compaction of fill within 500 mm of retaining walls or basement walls.

Backfill materials should not be placed in a frozen state or placed on a frozen subgrade. All lumps of materials should be broken down during placement.

Where the maximum-sized particles in any backfill material exceed 50% of the lift thickness or minimum dimension of the cross-section to be backfilled, such particles should be removed and placed at the other more suitable locations on site or screened-off prior to delivery to site.

Bonding should be provided between backfill lifts, if the previous lift has become desiccated. For the fine-grained materials, the previous lift should be scarified to 75 mm in depth followed by proper moisture conditioning and recompaction.

Recommendations for the specifications for various backfill types are presented below.

"Pit-run gravel" should conform to the following grading:

Sieve Sizes (Square Openings)	Percent Passing By Weight
200 mm	100 of Total Sample
150 mm	96 - 100 of Total Sample
75 mm	60 - 80 of Total Sample
25 mm	70 - 100 of Material Passing 75 mm Sieve
4.75 mm	25 - 63 of Material Passing 75 mm Sieve
1.18 mm	14 - 41 of Material Passing 75 mm Sieve
0.60 mm	7 - 30 of Material Passing 75 mm Sieve
0.15 mm	3 - 18 of Material Passing 75 mm Sieve
0.075 mm	2 - 9 of Material Passing 75 mm Sieve

Any grading variation from the above should be at the discretion of the Engineer; however, the percent of material passing the 0.075 mm sieve should not exceed 2/3 of the material passing the 0.6 mm sieve. The pit-run gravel should be free of any form of coating and any gravel containing clay, loam or other deleterious materials should be rejected. No oversized material should be tolerated.

"Crushed gravel" should conform to the following grading:

Sieve Sizes (Square Openings)	Percent Passing by Weight		
	Nominal Gravel Size		
	100 mm	50 mm	25 mm
100 mm	100	—	—
75 mm	90 - 100	—	—
50 mm	—	100	—
40 mm	60 - 80	90 - 100	—
25 mm	—	—	100
20 mm	40 - 66	50 - 75	95 - 100
10 mm	25 - 54	25 - 52	60 - 80
4.75 mm	15 - 43	15 - 40	40 - 60
2.36 mm	10 - 35	10 - 33	28 - 48
0.60 mm	5 - 23	5 - 23	13 - 29
0.30 mm	—	—	9 - 21
0.15 mm	3 - 12	2 - 14	6 - 15
0.075 mm	2 - 10	1 - 10	4 - 10

Gravel:

100 mm Crushed Gravel: At least 13% by weight of the material retained on the 4.75 mm sieve should have two more fractured faces.

50 mm Crushed Gravel: At least 13% by weight of the material retained on the 4.75 mm sieve should have two more fractured faces.

25 mm Crushed Gravel: At least 50% by weight of the material retained on the 4.75 mm sieve should have two more fractured faces.

Any gravel containing deleterious material should be rejected.

"Coarse gravel" for bedding and drainage should conform to the following grading:

Sieve Sizes (Square Openings)	Percent Passing By Weight (Nominal Gravel Size)	
	50 mm	**40 mm**
50 mm	100	—
40 mm	90 - 100	100
25 mm	—	95 - 100
20 mm	35 - 70	—
15 mm	—	25 - 60
10 mm	10 - 30	—
4.75 mm	0 - 5	0 - 10
2.36 mm	—	0 - 5

"Coarse sand" for bedding and drainage should conform to the following grading:

Sieve Sizes (Square Openings)	Percent Passing By Weight
10 mm	100
4.75 mm	95 - 100
2.36 mm	80 - 100
1.18 mm	50 - 85
0.60 mm	25 - 60
0.30 mm	10 - 30
0.15 mm	2 - 10

"Lean-mix concrete" should be low strength concrete having a minimum 28-day compressive strength of 3.5 MPa.

CONSTRUCTION EXCAVATIONS

Construction should be in accordance with good practice and comply with the requirements of the responsible agencies.

All excavations greater than 1.5 m deep should be sloped or shored for worker protection.

Shallow excavations up to 3 m depth may use temporary side slopes of 1H:1V. A flatter slope of 2H:1V should be used if groundwater is encountered. Localized sloughing can be expected from these slopes.

Deep excavations or trenches may require temporary support if space limitations or economic considerations preclude the use of sloped excavations.

For excavations greater than 3 m depth, temporary support should be designed by a qualified geotechnical engineer. The design and proposed installation and construction procedures should be submitted to EBA for review.

The construction of a temporary support system should be monitored. Detailed records should be taken of installation methods, materials, in-situ conditions and the movement of the system. If anchors are used, they should be load tested. EBA can provide further information on monitoring and testing procedures, if required.

Attention should be paid to structures or buried service lines close to the excavation. For structures, a general guideline is that if a line projected down at 45° from a horizontal, from the base of foundations of adjacent structures, intersects the extent of the proposed excavation, then these structures may require underpinning or special shoring techniques to avoid damaging earth movements. The need for any underpinning or special shoring techniques and the scope of monitoring required can be determined when details of the service ducts and vaults, foundation configuration of existing buildings and final design excavation levels are known.

No surface surcharges should be placed closer to the edge of the excavation than a distance equal to the depth of the excavation, unless the excavation support system has been designed to accommodate such surcharge.

PAVEMENTS

The following recommended procedures for pavements have been based on the use of the area generally by cars with some light truck traffic, as is normal for parking lot areas and access roadways. Recommendations for heavy truck access areas are also presented. These recommendations are intended as minimums only for subgrades having design bearing capacities of 3% CBR or higher, under saturated conditions.

"Maximum density" as used in this section means Standard Proctor Maximum Dry Density (ASTM Test Method D698), unless specifically noted otherwise.

The parking area and roadway subgrade should be brought to required grades by scarifying and recompacting to a depth of not less than 150 mm below the surface. The subgrade should be graded to drain towards catch basin locations. The upper 150 mm of subgrade should be compacted to not less than 100% of maximum density. Proof-rolling of the entire surface area under pavement sections should be carried out to detect any local soft spots. Soft spots detected as a result of Proof-rolling should be excavated and backfilled with general engineered fill. Recommended procedures for proof-rolling and general engineered fill are presented under a separate heading.

The parking area and roadways sub-base course should comprise a layer of compacted pit-run gravel placed over the prepared subgrade. The sub-base should be compacted to not less than 100% maximum density.

The parking area and roadways base course should comprise a layer of compacted crushed gravel of nominal size equal to 25 mm placed on top of the compacted sub-base. The base course should have a compacted thickness of not less than 50 mm. The base course should be compacted to not less than 100% of maximum density.

The asphalt thickness is dependent on asphalt mix specifications and should be reviewed when details of the mix are available. Minimum surface lift thickness in multiple-lift construction should be not less than 50 mm.

The sub-base course should be graded to drain to perforated catch basins completely surrounded by coarse gravel. The catch basin should be connected to open-jointed or perforated underdrains constructed so as to remove surface and sub-surface water from the parking areas and roadways and maintain the granular sub-base and base course in a drained condition. The coarse gravel surrounding the catch basins should be interconnected with the base and sub-base courses.

Perforated pipes or open-jointed pipe installations should be surrounded continuously or at joint sections, respectively with a drainage gravel section enveloped in a suitable geotextile, Texel 7607, Penroad 50, or equal. Positive drainage directing surface water away from all structures to the drainage system at a minimum 2% gradient should be provided for all eaves troughs, down-spouts and external water sources.

Preparation of the subgrade should be carried out within restricted areas. This is to avoid loosening of the prepared areas by site traffic before compaction of the subgrade and placement of the granular material have been completed. Protection of the prepared subgrade against precipitation and frost should be undertaken.

Observation of compaction and asphalt laying operations should be carried out by staff of EBA Engineering Consultants Ltd. (EBA).

Where there is risk of gasoline or diesel oil spillage, such as in the vicinity of pump islands, concrete pavements are preferred to asphalt.

PROOF-ROLLING

Proof-rolling is a method of detecting soft areas in an "as-excavated" subgrade for fill, pavement, floor or foundations or detecting non-uniformity of compacted embankment. The intent is to detect soft areas or areas of low shear strength not otherwise revealed by means of testholes, density testing or visual examination of the site surface and to check that any fill placed or subgrade meets the necessary design strength requirements.

Proof-rolling should be observed by qualified geotechnical personnel.

Proof-rolling is generally accomplished by the use of a heavy (15—60 tonne) rubber-tired roller having four wheels abreast on independent axles with high contact wheel pressures [inflation pressures ranging from 550 kPa (80 psi) up to 1,030 kPa (150 psi)].

A heavily-loaded truck may be used in lieu of the equipment described in the paragraph above. The truck should be loaded to approximately 10 tonnes (22,000 lbs) per axle and a minimum tire pressure of 550 kPa (80 psi).

Ground speed to be maximum of 8 km/hr (133 m/min) (5 mph) (400 ft/min). Recommended speed is 4 km/hr (65 m/min) (2.5 mph) (200 ft/min).

The recommended procedure is two complete coverages with the Proof-rolling equipment in one direction and a second series of two coverages made at right angles to the first series; one "coverage" means that every point of the proof-rolled surface has been subjected to the tire pressure of a loaded wheel. Less rigorous procedures may be acceptable under certain conditions subject to the approval of an engineer.

Any areas of soft, rutted or displaced materials detected should be either recompacted with additional fill or the existing material removed and replaced with general engineered fill or properly moisture conditioned as necessary.

The surface of the grade under the action of the proof-rolled should be observed, noting visible deflection and rebound of the surface or shear failure in the surface of granular soils as ridging between wheel tracks.

If any part of an area indicates significantly more distress than other parts, the cause should be investigated, by, for example, shallow auger holes.

In the case of granular subgrades, distress will generally consist of either compression due to insufficient compaction or shearing under the tires. In the first case, proof-rolling should be continued until no further compression occurs. In the second case, the tire pressure should be reduced to a point where the subgrade can carry the load without significant deflection and subsequently, gradually increased to its specified pressure as the subgrade increases in shear strength under this compaction.

SHALLOW FOUNDATIONS

Design and construction of shallow foundations should comply with relevant Building Code requirements.

The term "shallow foundations" includes strip and spread footings, mat slab and raft foundations.

Minimum footing dimensions in plan should be 0.45 m and 0.9 m for strip and square footings, respectively.

No loose, disturbed or sloughed material should be allowed to remain in open foundation excavations. Hand cleaning should be undertaken to prepare an acceptable bearing surface. Recompaction of disturbed or loosened bearing surface may be required.

Foundation excavation and bearing surfaces should be protected from rain, snow, freezing temperatures, drying and the ingress of free water, during and after footing construction.

Footing excavations should be carried down into the designated bearing stratum.

After the bearing surface is approved, a mud slab should be poured to protect the soil and provide a working surface for construction, should immediate foundation construction not be intended.

All constructed foundations should be placed on unfrozen soils, which should be at all times protected from frost penetration.

All foundation excavations and bearing surfaces should be observed by a qualified geotechnical engineer to confirm that the recommendations contained in this report have been followed and that soil conditions are consistent with those assumed in the design.

Where over-excavation has been carried out through a weak or unsuitable stratum to reach into a suitable bearing stratum or where a foundation pad is to be placed above stripped natural ground surface, such over-excavation may be backfilled to subgrade elevation utilizing either structural fill or lean-mix concrete. These materials are defined under the separate heading "Backfill Materials and Compaction."

PANORAMA
MOUNTAIN VILLAGE

GEOTECHNICAL

TESTPITTING INVESTIGATION
PANORAMA MOUNTAIN RESORT GOLF COURSE

November 1995

INTRAWEST

ARTECH
CONSULTING LTD

Materials Testing / Environmental Studies
229 Industrial Rd. F, Cranbrook, B.C. V1C 6N4
Phone (604) 489-1940 Fax (604) 489-1667

November 15, 1995
Morgan Stewart and Company Limited
1055 Seymour Street
Vancouver, BC.
V6B 3M3
Attn: Mike Walsh, P. Eng.

RECEIVED
NOV 21 1995

Re: <u>Panorama Mountain Resort Golf Course</u>

Dear Sir:

As requested in your letter of October 18, 1995, Artech has undertaken a testpitting investigation for the above project. The objective of the work was to identify and record the occurence of sub-surface soil types at various locations throughout the project site.

On November 7, 1995 a total of eight test pits were excavated using a track mounted excavator (Cat E120B) at locations as shown on the accompanying drawings. In order to expedite the digging program, the areas were pre-located by George Duncan (Panorama Resort) according to a site plan provided by Morgan Stewart. Some of the preliminary site locations were moved to allow for access considerations. As instructed, the test pits were limited to a depth of three meters. In some areas the pits were shallower due to the occurence of rock.

The soils identified during the investigation are described in the accompanying test hole logs. Some general site features are noted as follows:

- All test holes within the general floodplain of both mainstem Hopeful Creek and diversions (TH 2, 3, 5 and 6) have a watertable established at between 1600 and 2700mm. No water was encountered in any of the other pits.
- Rock was encountered between 1700mm and 2900mm depth in pits 1, 4, 7 and 8. Due to the proximity of rock outcrops it is assumed that the rock encountered in the test pits is bedrock. In most cases the rock appeared to be sound. Rippability of this rock is questionable.
- The predominant soil type throughout the site appears to be silt or silt/clay mixtures. In some areas the soil could be described as till incorporating varying amounts of gravel, cobble and boulders. Some of these materials may be usable as bulk fills for construction but can be expected to be difficult to work with, as well as moisture and frost sensitive.
- Three test pits in the alluvial floodplain (TH 2, 3 and 5) had bands of medium graded gravel which could serve as granular fills for construction. The practicality of removing these

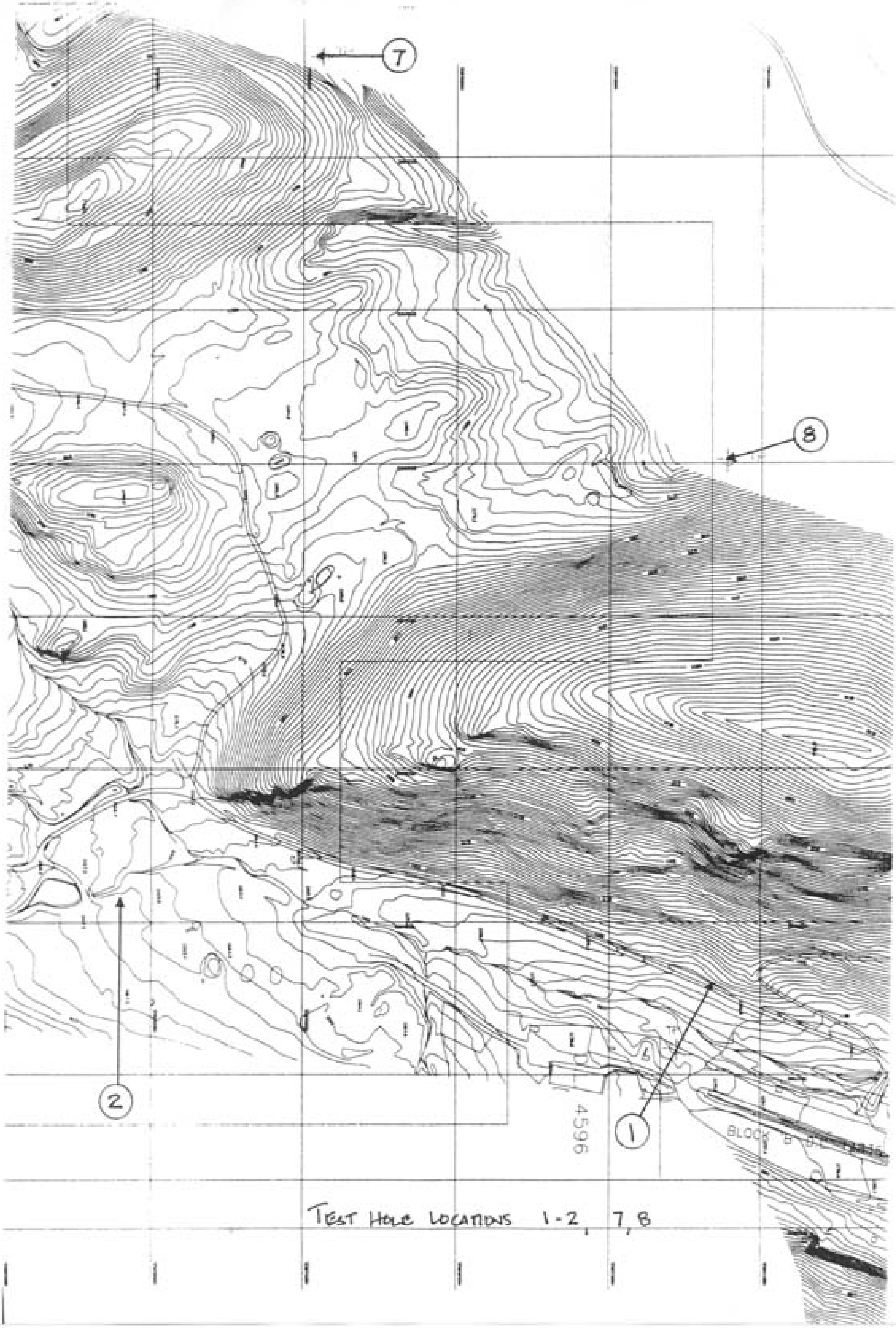
materials without contamination by the adjacent silts and clays may prove difficult in practise. It is also noted that for the most part these materials were encountered within the influence of groundwater which could also make them difficult to remove.

- All test holes had a surface layer of silty soil containing vegetation roots. This layer tended to be less than 150mm in most areas. Test hole 6 was the only area in which peat was encountered. This material consisted primarily of fibrous organics with an exceptionally high moisture content. The peat layer occurred between 600 and 1000mm depth and appeared to be somewhat inconsistent in thickness.
- Moisture content throughout the site tended to be damp near the surface, increasing with depth. Due to groundwater the lower depths of testholes near the creek were saturated.

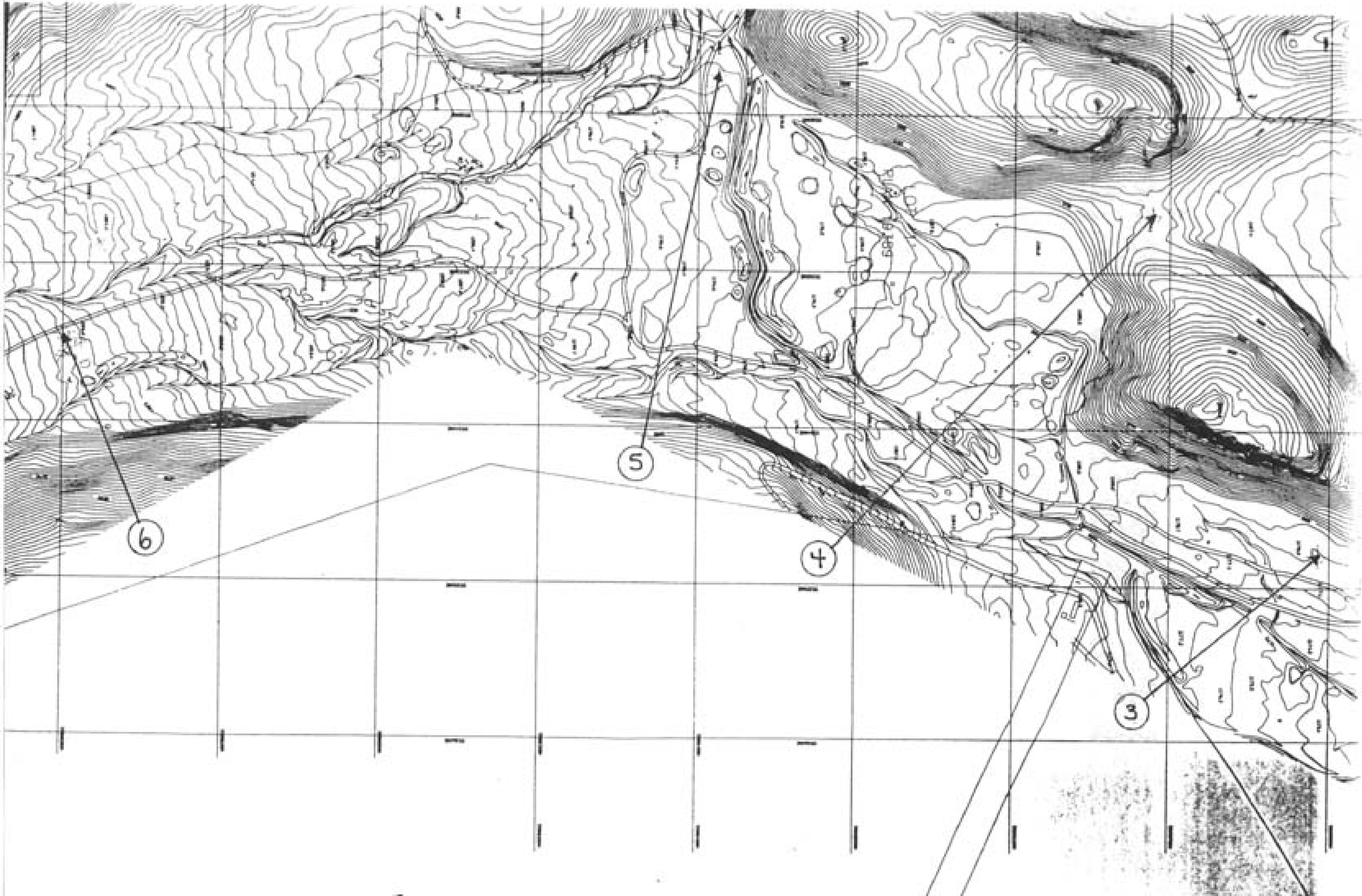
We trust that we have provided the information which you require at this time. Please call if you have any questions or require further information.

Yours truly,
Artech Consulting Ltd

Brian Phillips
President



TEST HOLE LOCATIONS 1-2, 7,8



TEST HOLE LOCATIONS 3 - 6

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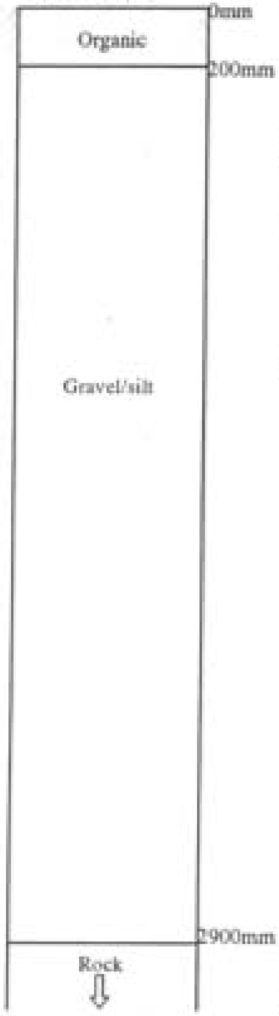
TEST HOLE LOGS Panorama Mountain Resort Golf Course - November 7, 1995

Test Pit #1



Rooted vegetation (open forest)

Gravelly Silt (till)
Some cobble and fractured rock
Medium density. Non-plastic.
Damp.

Sample 1 - 1.

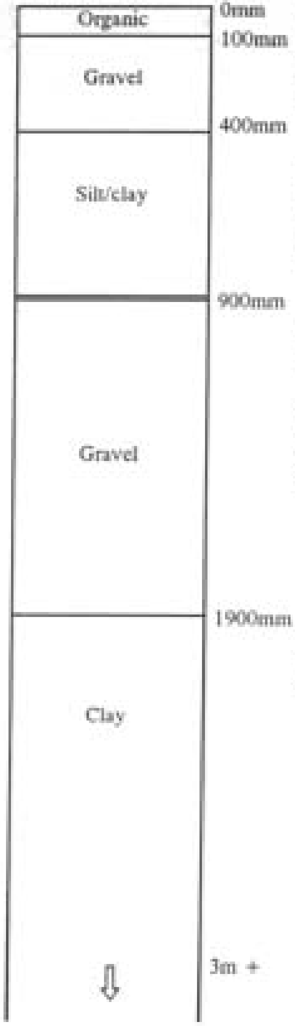
Large boulders or bedrock (cannot distinguish)
Unable to dig further

NOTES:

Water table not encountered. Excavation discontinued at 2900mm as excavator unable to dig further in rock.

Test hole located on upper side of access road embankment.

Test Pit #2



Rooted vegetation. (grassy area)
Medium gravel. Medium dense.
Damp.

Mottled light brown/tan silt-clay.
Firm. Medium plastic.
Damp-moist.

Water infiltrating at 900mm.
Medium gravel with some cobble and small boulder. Medium dense.
Saturated. (10.8% moisture)
Sample 2 - 1.

Grey clay. Firm, medium plastic.
Moist - wet (near liquid limit)

NOTES:

Test hole located adjacent to the Hopeful Creek diversion.

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TEST HOLE LOGS Panorama Mountain Resort Golf Course - November 7, 1995

Test Pit #3

Rooted vegetation (grassy area)

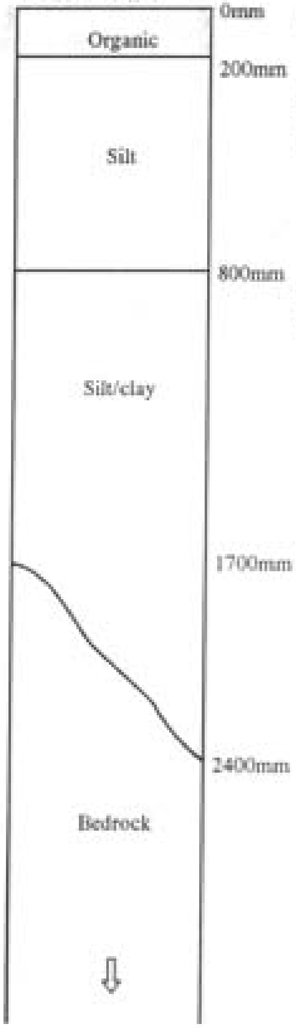
Medium silty gravel.
Medium dense. Moist (8.1%).

Sample 3 - 1.

Mottled tan/dark brown silt-clay.
Firm Medium plastic.
Damp - moist (above 1500mm).

Water infiltration at 1500mm.

Test Pit #4



Rooted vegetation. (grassy area)

Light brown silt. Firm.
Non-plastic. Damp.

Brown silt/clay. Firm.
Medium plastic. Damp.

Bedrock.

NOTES:

Test hole situated next to Hopeful Creek diversion.

NOTES:

Excavation discontinued at 2400mm due to bedrock encountered.

No water table encountered.

Test hole situated on elevated knoll.

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TEST HOLE LOGS Panorama Mountain Resort Golf Course - November 7, 1995

Test Pit #5

Organic	0mm 150mm	Rooted vegetation (treed area)
Silt/clay		Brown gravelly silt/clay. Some cobble and boulders. Medium dense. Low plasiticity. Damp - moist - wet (with depth)
Gravel	1600mm	Medium silty gravel. Loose. Wet to saturated. (Below 2400mm) Sample 5 - 1.
	2400mm	Water table.
⇩	3m+	

Test Pit #6

Organic	0mm	Rooted vegetation. (open field)
Silt/organic	150mm	Dark brown silt with organics.
Peat	600mm	Black peat. Wet. Sample 6 - 1.
Silt/clay	1000mm	Mottled orange - grey silt/clay. Some cobble and boulder. Firm. Medium plastic. Wet.
	2700mm	Water table encountered.
⇩	3m +	

NOTES:
Extreme sloughing below 1600mm.
Test hole located between Hopeful Creek and diversion trench in alluvial plain.

NOTES:
Test hole adjacent to upper Hopeful Creek.

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TEST HOLE LOGS Panorama Mountain Resort Golf Course - November 7, 1995

Test Pit #7

0mm	Organic	Rooted vegetation (forest)
200mm	Silt	Light brown silt. Non-plastic. Soft. Damp.
1600mm	Silt/clay	Light brown silt/clay. Soft. Medium plastic. Damp.
2400mm	Bedrock ⇩	Bedrock.

NOTES:
No water table encountered.
Test hole located on uphill side of embankment immediately adjacent to access road.

Test Pit #8

0mm	Organic	Rooted vegetation. (forest)
400mm	Silt	Light brown silt. Some fractured rock. Firm. Non-plastic. Damp.
1300mm	Silt/clay	Brown silt/clay. Some gravel, cobble and fractured rock. Firm. Low plasticity. Damp.
2800mm	Bedrock ⇩	Fractured bedrock.

NOTES:
No water table.
Test hole on uphill side of embankment immediately adjacent to access road.

PRELIMINARY STABILITY EVALUATION FOR A PROPOSED ACCESS ROAD TO A FUTURE GOLF COURSE AT PANORAMA RESORT, INVERMERE, B.C.

PANORAMA
MOUNTAIN VILLAGE

GEOTECHNICAL

PRELIMINARY STABILITY INVESTIGATION FOR A PROPOSED ACCESS ROAD TO A FUTURE GOLF COURSE AT PANORAMA RESORT

May 1991

INTRAWEST

Stewart-EBA Consulting Ltd.

Civil, Geotechnical, Materials and Mining Engineers

May 10, 1991 S-EBA File: 0808-88068

Panorama Resort Ltd.
c/o R-DAC Group
Box 2709
Invermere, B.C.
V0A 1K0

Attention: Mr. William E. Lloyd, M.Sc.
President

Fax: 342 - 4491

Dear Sir,

Subject: Preliminary Stability Evaluation for a Proposed Access Road to a future Golf Course at Panorama Resort, Invermere, B.C.

1.0 INTRODUCTION

This letter report presents the results of a preliminary evaluation by Stewart-EBA Consulting Ltd. (S-EBA) for Panorama Resort Ltd. (PRL) for the geotechnical stability of terrain around an existing access road (A-road) to a future golf course at Panorama Resort about 18 km west of Invermere, B.C.

The purpose of this evaluation was to have sufficient surficial field and laboratory work carried out in order to provide geotechnical recommendations pertaining to the stability of the A-road, and/or describing further work required to fulfil the requirements of this objective. Subsequent discussions with Mr. William E. Lloyd, M.Sc. of the R-DAC Group (R-DAC) late in the day on April 23, 1991 led to a requirement of a further evaluation pertaining to the stability of a slope on a 'Lot 2'.

The enclosed recommendations are based on the information obtained from four (4) test pits (TP's) completed on April 23, 1991, a site visit on the same date, and subsequent laboratory testing.

Stewart-EBA Consulting Ltd. (S-EBA) was authorized in a fax letter by Mr. W.E. Lloyd of R-DAC dated on April 18, 1991 to undertake the above captioned project.

2.0 PROJECT DETAILS

2.1 LEGAL DESCRIPTION

We understand that District Lots including, although possibly not limited to 5533, 168946, 14836, 16947 and 16948 will be sub-divided to Lots 1, 2 and 3.

The legal description of this area is shown on a plan prepared by Morgan, Stewart and Company dated the 1st of October 1990 (File: 2871-89-02).

2.2 STABILITY ISSUE

From discussions on April 23, 1991 with Mr. Lloyd of R-DAC, it was understood that the stability of the A-road (which will be Lot 3) over its entire length was to be addressed.

From a telephone conversation on the same date with the Ministry of Transportation and Highways District Highways Manager, Mr. L.T. Patterson, A.Sc.T. (MOTH), it is our understanding that the MOTH has expressed a concern about the impact of the stability of a slope along the eastern edge of the proposed Lot 2 on the A-road, in view of seepage observed at the base of this slope.

3.0 SITE DESCRIPTION

3.1 LOCATION

The proposed A-road is located on the east side of Hopeful Creek, which according to Map 82 K/8 (Ref. No.), flows generally from south to north. The location of the A-road is shown by Figure 1 in Appendix A.

Another road was observed on the west side of the Creek. This road is denoted as 'B-road' on Figure 1.

In the future, it is planned that access at the Toby Creek end of the A-road will be by a bridge spanning over Toby Creek.

3.2 HELI-PLEX

'Heli-plex' is understood to mean a complex consisting of a helicopter landing pad and an adjacent (guest) building.. This complex is situated at the top of a slope in Lot 2, whereby the building is located closest to Hopeful Creek.

The heli-plex is serviced by a septic field understood to be located somewhere on Lot 2, and by several underground (U/G) utility lines crossing the Creek at various locations.

4.0 FIELD AND LABORATORY WORK

4.1 SURFICIAL CONDITIONS

4.1.1 General

On April 23, 1991, the surficial features such as vegetation and terrain in the vicinity of the A-, B- and C-roads were, as shown by Plates P-1 to P-17 in Appendix A. The orientation of these plates is shown by Figure 2 (Appendix A).

A cut slope exposure west of the Creek indicates silty soils above the Creek level.

4.1.2 Lot 2 Hillslope

Surficial failure features were observed at various locations on the proposed Lot 2.

A cut slope for a road (denoted as C-road on Fig. 1) leading up to the heli-plex exhibited retrogressive failure features (at about N-1 on Figure 1). It is estimated that the cut initially had an inclination of 30 degrees, and that the natural slope was about 15 degrees.

Some tension cracks were observed on the shoulder of C-road on the downhill side at N-1.

A trail (understood to be a temporary winter ski trail and therefore denoted as S-trail on Figure 1) beneath C-road leading from the heli-plex building to the base of the Creek, also showed signs of slumping in a cut slope on the uphill side. Melt water had created a sink hole near the top of this trail. Brown (melt) water was observed to be emanating from the base of a snowpack beside the Creek.

4.2 FIELD WORK

Site work was carried out on April 23, 1991 utilizing a track-mounted backhoe. Excavations supervision and TP logging was performed by S-EBA's field representative, Mr. C. Mordhorst, P.Eng. Four TP's were advanced to depths of 3.5 to 8 ft (1.1 to 2.4 m). The TP locations are shown on Figure 1.

Disturbed bulk samples were taken at intervals to the full depth of the TP's. The field results are summarized on TP logs in Appendix B.

4.3 LABORATORY PROGRAM

Classification and index tests were subsequently performed in the laboratory on select samples collected from the TP's. Laboratory testing included moisture contents and visual classifications, and Atterberg Limits.

The results of the laboratory tests are summarized on the TP logs provided in Appendix B.

5.0 SUBSURFACE CONDITIONS

In general, the soil enocuntered can be defined as silt extending to the bottom of the TP's.

Fill was encountered at the ground surface in TP's 1, 2 and 4.

6.0 GROUNDWATER CONDITIONS

TP 1 was observed to have seepage. Melt water was observed to be flowing into TP 3.

On April 23, 1991, the creek was observed to contain flowing water.

It should be noted that the groundwater conditions may fluctuate seasonally and in response to climatic conditions.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Specific recommendations applying to this project are given in the following sub-sections for the A-road, the B-road, the slope on Lot 2 (Heli-plex site), proposed bridge location, and site grading and drainage.

7.1 A-ROAD

At one location (see Plate P-6), this road appears to be experiencing a minor shoulder failure. It is believed, due to the presence of a manhole and alignment of patching in the road, that this location is consistent with an U/G utility servicing the heli-plex. Excavating of existing fill and proper placement of fill as described by a backfilling reference sheet in Appendix C should solve this deficiency.

Further south, this road appears to proceed along the edge of an existing parking lot or a storage surface near a barn. With the excavation of existing fill (if required) and proper placement of fill as described by the appropriate reference sheet, minor instabilities that may typically occur along such an edge should be avoided.

In general this road is considered to be stable.

7.2 SLOPE ON LOT 2 (HELI-PLEX SITE)

The source of earlier seepage detected by MOTH personnel is believed to have been seepage from a septic field understood to have been installed in the vicinity of, and servicing, the heli-plex building. We were advised by Mr. W.E. Lloyd on May 6, 1991, that the heli-plex has since been hooked up to the PRL sewer system. This may explain why no seepage was observed to be flowing of the base of the hillslope, although the presence of snow cover at the time of the site visit precluded a more detailed examination.

Until a more detailed geotechnical evaluation is undertaken, we recommend no further structures be constructed on this slope or at the top of this slope. It is recommended that geotechnical involvement be considered, prior to making and, during maintenance improvements of the service road to the heli-plex (C-road).

7.3 SITE GRADING AND DRAINAGE

A large amount of surficial melt water was observed to be running over the ground at various locations. It is important that such groundwater that may occur on a seasonal basis be adequately intercepted and drained.

We recommend the site layout ensure drainage away from buildings, driveways, and slopes. Minimum gradients of 1.5% are recommended to reduce the risk of ponding in localized areas.

Preferably, perimeter drainage systems should be placed at or slightly below all road surfaces on the uphill sides and connected to ensure positive drainage. Where drainage systems are buried, they should be enclosed by preferably a minimum of 150 mm (6 in.) of clean drain gravel enclosed in filter fabric.

8.0 REVIEW OF DESIGN AND CONSTRUCTION

A qualified geotechnical consultant should be given the opportunity to review details of the specifications related to geotechnical aspects of this project, prior to construction, and on-site inspection and testing by a qualified geotechnical consultant should be carried out during construction.

9.0 LIMITATIONS

Recommendations presented herein are based on a geotechnical evaluation of findings in four TP's, and on general observations made during a site visit which are therefore general by nature. If, however conditions other than those presented herein are noted during subsequent phases of the project, Stewart-EBA should be notified and given the opportunity to review our current recommendations in light of new findings.

10.0 CLOSURE

Stewart-EBA Consulting Ltd. would be pleased to provide further assistance during design and construction phases and to advise on geotechnical aspects of specifications for inclusion in contract documents. Should you need additional information, please do not hesitate to contact us.

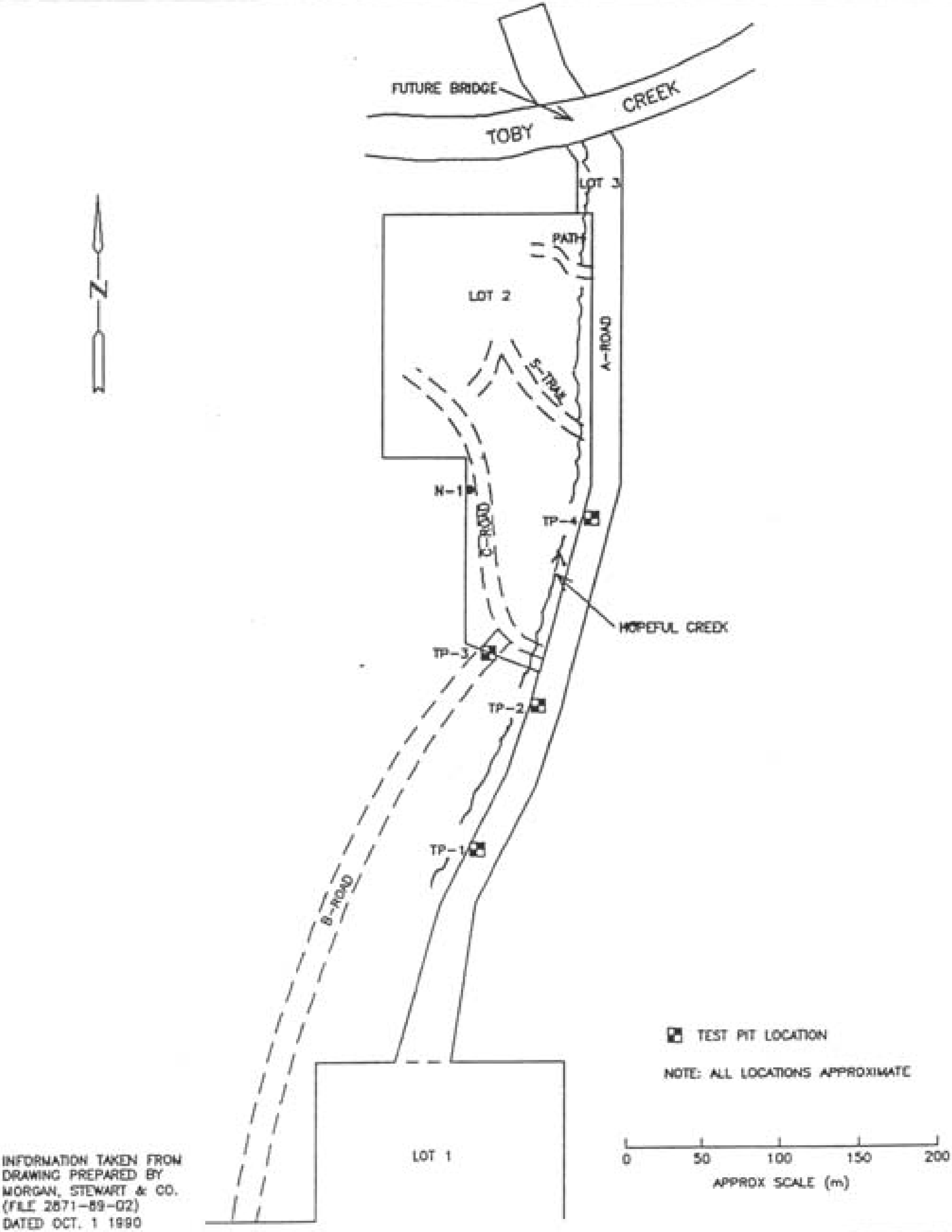
Yours truly,
STEWART-EBA CONSULTING LTD.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
CHRISTIAN MORDHORST
10 May 1991

Christian Mordhorst, D.I.C., P.Eng.
Senior Geotechnical Engineer

CM:bi

cc: D.J. Bazett, D.I.C., P.Eng.
P. Chiu, P.Eng.



INFORMATION TAKEN FROM
DRAWING PREPARED BY
MORGAN, STEWART & CO.
(FILE 2871-89-02)
DATED OCT. 1 1990

FILE COPIES

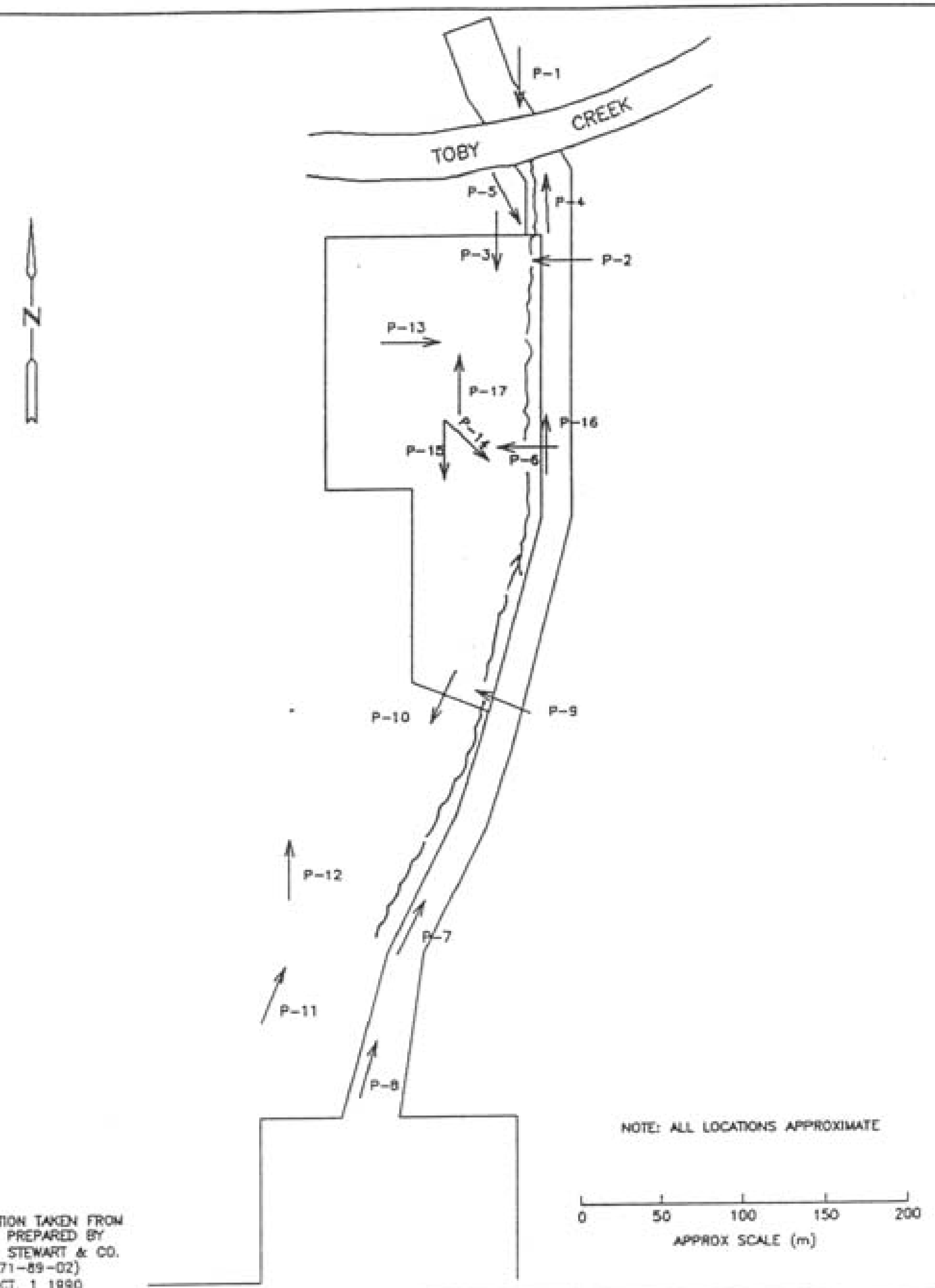
Stewart-EBA Consulting Ltd.

PROJECT
PROPOSED ACCESS ROAD EVALUATION

CLIENT
PANORAMA RESORTS LTD.
c/o R-DAC GROUP

TITLE
LOCATION PLAN

DATE 1991 05 06	DWN. ARC	CHKD. CM	FILE NO. 88068001	FIGURE 1



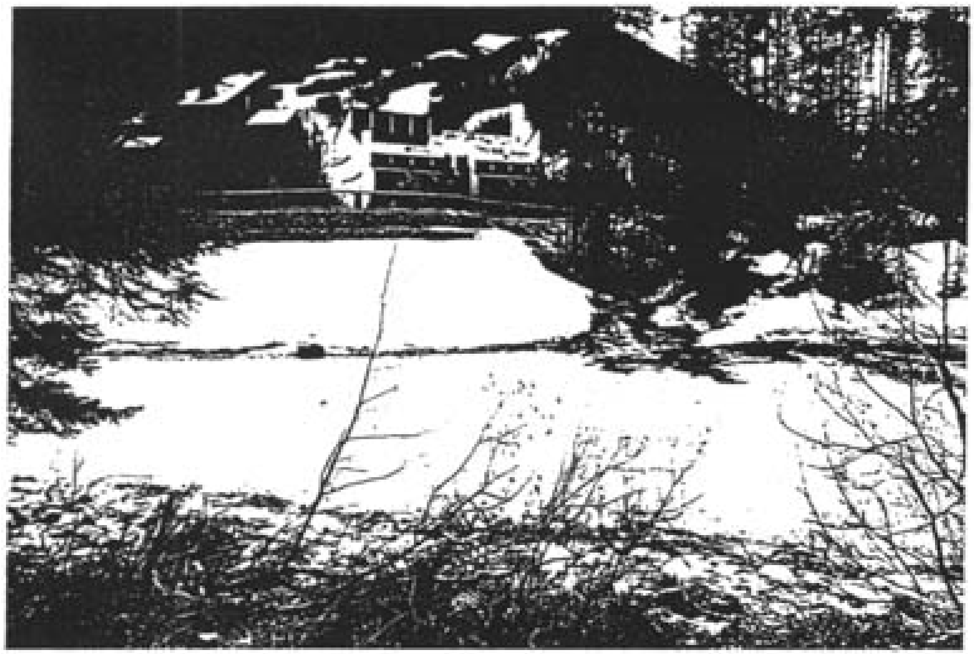
NOTE: ALL LOCATIONS APPROXIMATE

INFORMATION TAKEN FROM
DRAWING PREPARED BY
MORGAN, STEWART & CO.
(FILE 2871-89-02)
DATED OCT. 1 1990

Stewart–EBA Consulting Ltd.	PROJECT PROPOSED ACCESS ROAD EVALUATION
CLIENT PANORAMA RESORTS LTD. c/o R–DAC GROUP	TITLE PHOTOGRAPH ORIENTATION

DATE	1991 05 06	DWN.	ARC	CHKD.	CM	FILE NO.	88068002

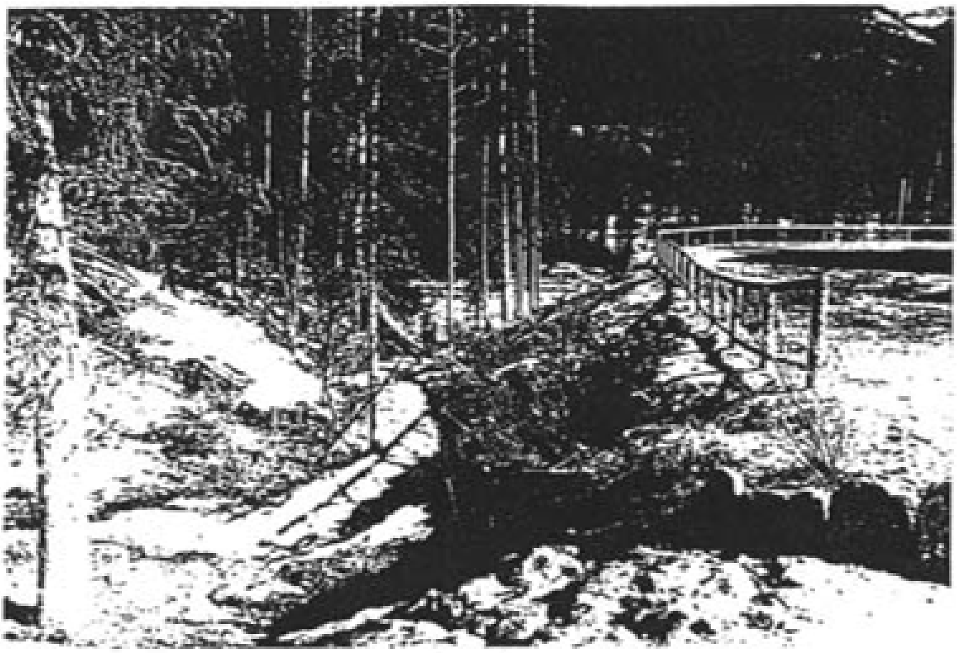
FIGURE 2



P - 1

P - 2 PATH

P - 3



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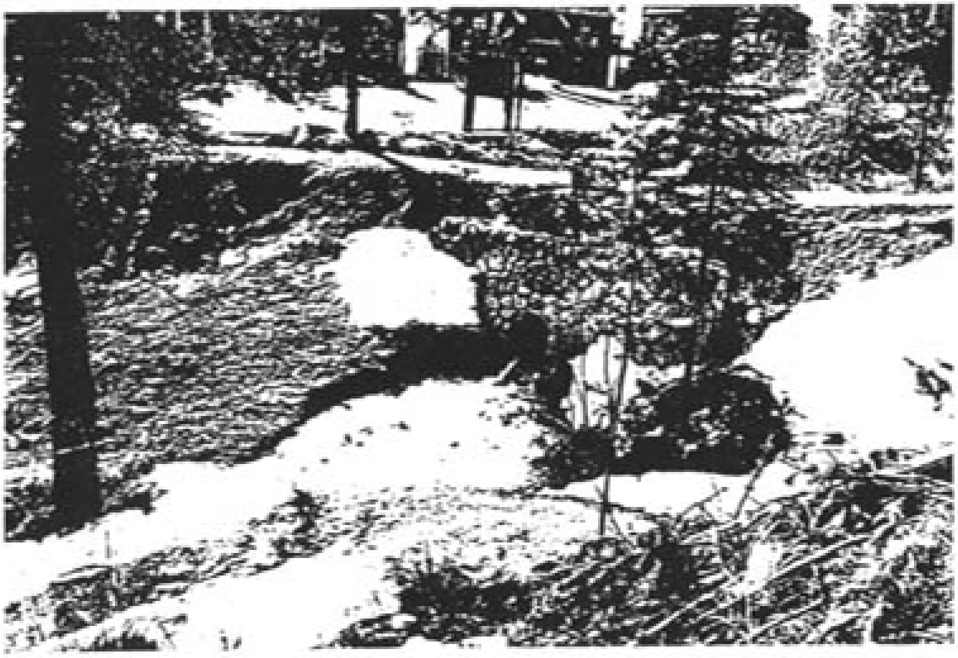

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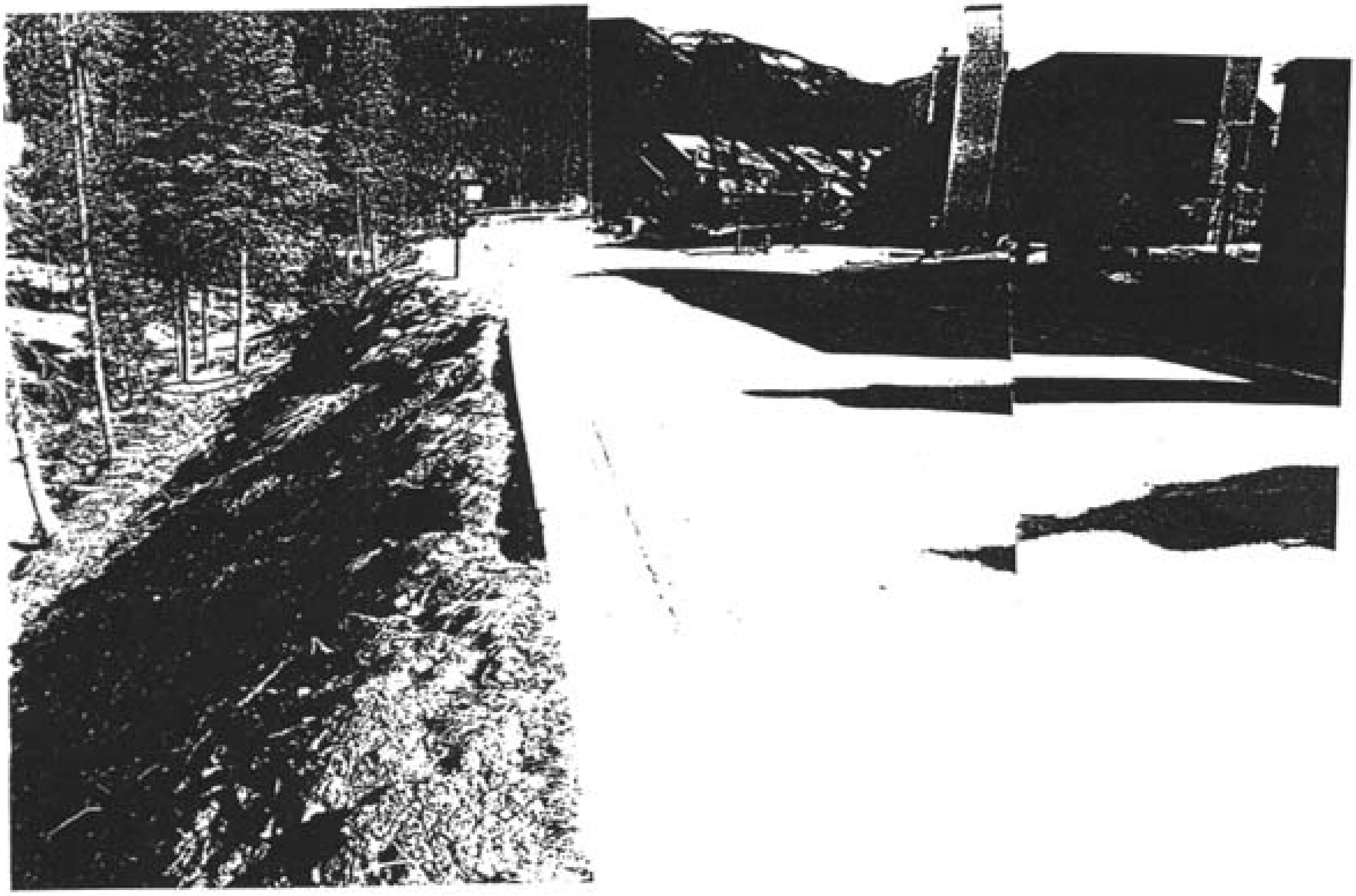
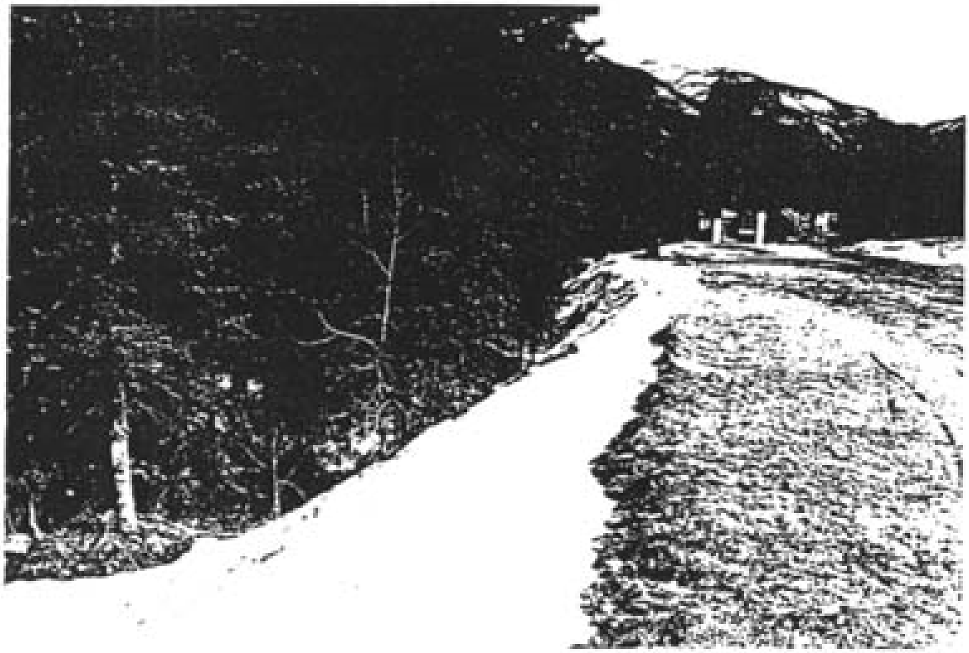


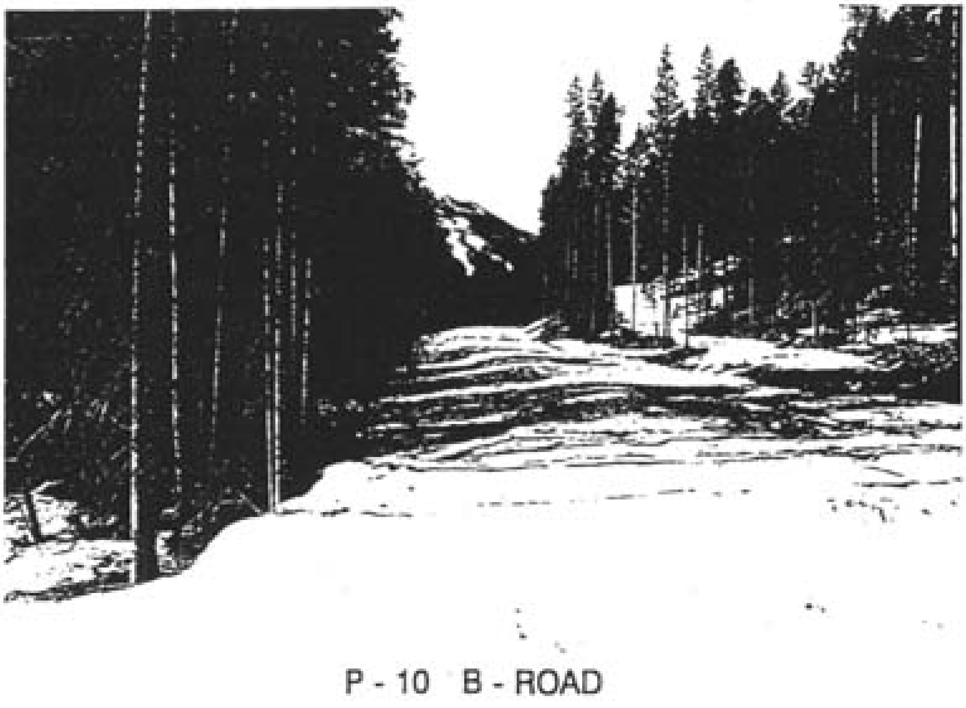
P - 6 DISTRESS ON BANK COINCIDES WITH ASPHALT PATCH ON A - ROAD



P - 7 A - ROAD

P - 8

P - 9 C - ROAD



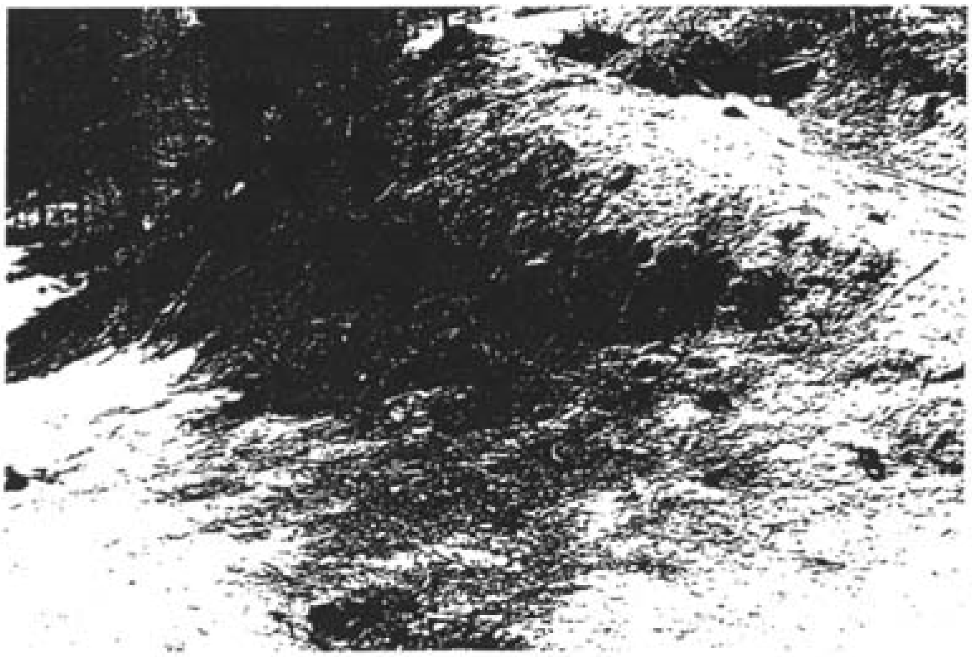
P - 10 B - ROAD

P - 11 B - ROAD

P - 12 B - ROAD

P - 13 VIEW EAST OF HELI-PLEX

P - 14 S - TRAIL



P - 15 S - TRAIL

P - 16 S - TRAIL

P - 17

TEST PIT LOGS

TP - 1 South End of existing parking lot.

0 - 0.8 m	GRAVEL FILL; dense, some sand, trace clay, trace organics, slabs of asphalt, small boulders (300 mm x 300 mm x 200 mm).
0.8 - 0.9 m	Organics; black.
0.9 - 2.1 m	SILT; stiff, some clay, brown.

End of hole at 2.1 m.
Seepage at 1.5 m.

TP - 2 Near intersection of A- & B-roads.

0 - 0.6 m	GRAVEL (FILL); some sand, compact.
0.6 - 0.9 m	SILT; very dense, brown.

End of hole at 0.9 m.
Dry at completion.

TP - 3 Near intersection of B- & C-roads.

0 - 0.2 m	Snow.
0.2 - 1.8 m	SILT; stiff, trace clay, brown, upper 300 mm contained ice lenses up to 15 mm thick.

End of hole at 1.8 m.
Water from snow layer flowing into hole.

TP - 4 On A-road at northern end of parking lot.

0 - 0.2 m	Granular FILL.
0.2 - 0.6 m	SILT (FILL); firm, brown, distinction of pieces.
0.6 - 2.1 m	SILT; firm, brown.
2.1 - 2.4 m	GRAVEL; sandy, trace silt, very dense, brown.

End of hole at 2.4 m.
Dry at completion.

Notes: 1. Depths are in metres (m), as measured from the ground surface.

BACKFILL MATERIALS AND COMPACTION

Maximum density as used in this section means Standard Proctor Maximum Dry Density (ASTM Test Method D698) unless specifically noted otherwise. Optimum moisture content is as defined in this test.

Backfill adjacent to or below highway, street or parking lot pavement sections and base courses should comprise 'general engineered fill' consisting of clean, well-graded granular soils (a maximum of 5% by weight passing the No. 200 sieve). Fill should be placed in layers not exceeding 200 mm (8 in.) in loose thickness. General engineered fills should be compacted to a density comparable to 98 percent of maximum density.

Granular soils used for general engineered fills should consist of relatively clean, well graded, mixture of sand and gravel (maximum size 75 mm (3 in.)).

Backfill materials should not be placed in a frozen state, or placed on a frozen subgrade. All lumps of materials should be broken down during placement.

Where the maximum-sized particles in any backfill material exceed 50% of the minimum dimension of the cross-section to be backfilled, such particles should be removed and placed at other more suitable locations on-site or screened off prior to delivery to site.

Bonding should be provided between backfill lifts, if the previous lift has become desiccated. For granular materials, the surface of the previous lift should be scarified to about a 75 mm (3 in.) depth followed by proper moisture-conditioning and recompaction.

Should pit-run gravel be utilized, it should be free of any form of coating. Any gravel containing clay, loam or other deleterious materials should be rejected. No oversize material should be tolerated.

PANORAMA
MOUNTAIN VILLAGE

GEOTECHNICAL

GEOTECHNICAL APPRAISAL CONCERNING SITE DEVELOPMENT

August 1978

INTRAWEST

Golder Associates
CONSULTING GEOTECHNICAL ENGINEERS

A Report to
CASCADE BUILDERS LIMITED
Providing
GEOTECHNICAL RECOMMENDATIONS
concerning the
PROPOSED PHASE 1 DEVELOPMENT
PANORAMA SKI AREA
Invermere British Columbia

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Calgary, Alberta

July 1978

C78730

Golder Associates
CONSULTING GEOTECHNICAL ENGINEERS

July 7, 1978
Our File No. C78730

Mr. R.S. Girardau, P. Eng.
General Manager
Cascade Builders Ltd.
Second Floor, 912 - 6th Avenue S.W.
Calgary, Alberta
T2P 0V6

Re: Geotechnical Investigation - Phase 1
Panorama Ski Area - Invermere, B.C.

Dear Sir:

Further to our June 28th, 1978 proposal and your verbal authorization to proceed, this letter presents the results of the requested site investigation and provides engineering recommendations concerning the proposed Phase 1 development at the Panorama Ski Area near Invermere, B.C. Our information is described in further detail under the following report sections.

1. SITE DESCRIPTION

The proposed 14 hectare Phase 1 site is located about 21 kilometers southwest of Invermere, B.C. along the east side of Toby Creek and immediately downstream from the confluence of Hopeful Creek with Toby Creek (refer to Figure 1). The site lies along the lower slope of the existing Panorama Ski Area between the existing access road and Toby Creek (refer to Figure 2).

It is understood that the proposed Phase 1 development will consist mainly of multiple townhouse dwellings, up to 4 storeys in height, and with basements and underground garage parking. It is also understood that some light commercial buildings are to be constructed at the southern end of the Phase 1 area. The proposed development will include the installation of sewer and water facilities, site grading and the construction of an internal paved access road to service the townhouse and commercial development. No further detail is available at this planning stage.

The ground surface of the Phase 1 area slopes upward from about El. 24 (local assumed datum) near the existing bridge to about El. 57 on the access road in the southeast corner of the site, for a total relief of more than 30 m. The ground surface slopes sharply downward to the northwest from the existing access road to the terrace which comprises most of the site and which lies between about El. 24 to El. 36. Local exposures along Toby Creek indicate that the terraces are composed mainly of sand, gravel, cobbles and boulders which were deposited during post-glacial valley infilling (refer to Figures 3 and 4). Although a few surficial boulders up to about 1.5 m diameter were observed along the base of the access road slope, no bedrock outcrops were observed at the Phase 1 site.

Toby Creek is presently downcutting its channel through the gravel terrace deposits and is actively eroding the 4 to 5 m high channel bank from Hopeful Creek to about 250 m downstream. The local gradient of Toby Creek is about 1 per cent and the observed 2 m per second turbulent stream velocity indicates high erosion potential along the stream bank.

Uniform silt deposits which were observed near the southern end of the site and also along local exposures on the existing access road indicate that the deposition of fine-grained sediments has also occurred in a glacial lake environment.

It is considered that the glacial deposits and/or slide debris which originally formed the lower valley slope were removed during post-glacial time as Toby Creek developed its channel. The terrace deposits were formed simultaneously along the previously eroded lower valley slope. Toby Creek is presently downcutting its channel through these terrace deposits on both sides of the Phase 1 area.

The Phase 1 site is undeveloped except for a small sewage disposal field which is located immediately north of Test Pit 5 (refer to Figure 2). The forest cover consists mainly of mature pine with occasional poplar and fir.

No evidence of a recent slope instability was observed along the steep eastern slope immediately below the existing access road. No springs or heavy seepages were observed at ground surface and this suggests that the sub-surface soils are relatively permeable and are also laterally continuous beneath the site.

2. FIELD AND LABORATORY PROGRAM

a) Field Program

Seven test pits were dug on June 28th, 1978 using a John Deere Model 450 track-mounted backhoe owned and operated by Cascade Builders Ltd. (refer to Figure 2). The pit locations were chosen by the writer and a Golder Associates junior engineer logged the test pits, recovered representative samples, and made groundwater observations. Representative chunk samples were obtained for later detailed inspection and for selected laboratory testing.

The test pit logs are included in Appendix I and the samples are now in storage at Golder Associates' Calgary laboratory.

The test pit survey was provided by EPEC Consulting Ltd.

b) Laboratory Program

The laboratory program included testing of selected samples for moisture content, soluble sulphate, grain size distribution, plasticity and compaction. The laboratory test results are presented on the test pit logs and on Figures 6 to 8 inclusive.

3. SOIL AND GROUNDWATER CONDITIONS

The soil conditions have been inferred from the data which was obtained from 7 widely-spaced test pits ranging in depth from 3.0 to 3.7 m and thus there is some risk of undetected changes across the site. However, we consider that the test pit program was adequate for the intended purpose and in view of the broad stratigraphic consistency revealed across the site.

In test pits 1, 2 and 3, the silt and fine sand stratum was underlain by bouldery gravel up to 2.2 m in thickness (refer to Figures 5 and 6). In test pit 4, the upper silt and sand stratum was not encountered and the topsoil was underlain directly by the bouldery gravel stratum. The gravel was generally well-graded and contained cobbles and boulders up to 0.75 m in diameter. The bottom of the stratum was not penetrated in the 3.0 to 3.6 m deep test pits. The observed texture of the gravel stratum was similar to the soil which is exposed along the Toby Creek bank (refer to Figures 3 and 4).

The grain size distribution test results for the 3 inch minus fraction of a selected gravel stratum sample obtained from test pit 3 between 1.0 and 3.2 m depth are presented on Figure 6 and these results confirm the well-graded texture of this deposit.

From the grain size distribution test results, we would estimate the in-situ permeability of the gravel stratum to be relatively high and in the order of 4 cm per second.

The zero per cent soluble sulphate test result which was obtained on a selected sample from test pit 3 at 1.6 m depth indicates that there should be no sulphate attack on concrete foundations which are constructed in the gravel stratum. A similar soluble sulphate test result was obtained for the 1.5 m depth sample from test pit 5.

The grain size distribution test results indicate that the gravel is not susceptible to serious frost heaving provided that both sub-surface drainage and surface drainage are adequate.

The moisture-density relationship test results for the 3 inch minus fraction of a selected ground sample are presented on Figure 7. These test results indicate that, with respect to site grading and foundation backfill compaction, the gravel has a maximum standard Proctor density of 2.24 tonnes per cubic metre at an optimum moisture content of 9.4 per cent.

Light brown to grey <u>silt</u>, 3.2 m in thickness, was encountered below 0.12 m of topsoil in test pit 5 where the bottom of the silt stratum was not penetrated in the 3.4 m deep test pit (refer to Figures 5 and 6). The uniform, non-plastic silt was typically stratified, fissured and exhibited firm to stiff consistency. The natural moisture content test result on a selected sample was 28 per cent and it was apparent by inspection that moisture content tended to increase with depth.

The grain size distribution test results which are presented on Figure 6 verify the observed uniform predominantly silt texture of this stratum. These test results also indicate that the silt will be highly susceptible to frost heaving.

The moisture-density relationship test results presented on Figure 8 indicate a maximum standard Proctor dry density of 1.79 tonnes per cubic metre at a 20.7 per cent optimum moisture content. It is noted that the natural moisture contents in the silt stratum below 1.5 m depth are about 7 per cent higher than the indicated optimum compaction moisture content.

Using the grain size distribution test results, we estimate that the in-situ permeability of the silt stratum will be relatively low and in the order of 10^{-5} cm per sec.

Test pits 6 and 7 were located along the existing access road (refer to Figure 2). In test pit 6, 0.9 m of light grey surficial silt was encountered which was similar to the silt in test pit 5. The silt stratum was underlain by a 1.2 m thick stratum of yellow brown sand and gravel which contained occasional cobbles and boulders up to 0.3 m in diameter. The sand and gravel was in turn underlain by a 1.2 m thick grey-brown silt stratum which was similar in texture to the surficial silt stratum.

In test pit 7, brown sand and gravel containing cobbles and boulders up to 0.6 m in diameter was encountered below 2.4 m thick bouldery gravel fill material.

b) Groundwater Conditions

No seepage or caving was observed in Test Pits 2 to 7 inclusive. However, the groundwater table was observed to be 2.5 m below ground surface near the top of the bouldery gravel stratum in T.P. 1. No springs or seepages were observed along Toby Creek bank or along the steep slope which is adjacent to the existing access road. The predominantly pine forest cover and the absence of seepage suggests that the site is underlain by the highly permeable bouldery gravel stratum which was encountered in test pits 1 to 4 inclusive and which is exposed along the Toby Creek bank.

4. ENGINEERING RECOMMENDATIONS

a) General

The following engineering recommendations are made with reference to the Phase 1 site-specific information which was obtained from the field program. We consider that, in addition to the following engineering recommendations, an evaluation should be made of slope stability in the general Panorama Ski Area and also of the probable flooding potential of Toby Creek. Anomolous material accumulations, suspected of being debris flows or slides, have been identified along Toby Creek. Similar future accumulations which could temporarily dam Toby Creek would have serious consequences for the proposed ski area development. Furthermore, large Toby Creek flood discharges and associated high creek levels may also restrict the feasible lower limit of development aside from the foregoing debris blockage considerations. The following Phase 1 site-specific recommendations are therefore made subject to modification as a result of conclusions reached from separate evaluation of general slope stability and Toby Creek flooding potential in the Panorama area.

b) Slope Stability

The following comments and recommendations are made with specific reference to the existing slopes within the proposed Phase 1 development and also for slopes which may be constructed within this development.

Inspection of the 8 to 13 m high slope along the existing access road indicates that no recent slope movement has occurred on slopes which are inclined at 33 to 35 degrees above horizontal. This observation suggests that the materials which form this slope are predominantly competent soils which are capable of developing high shearing resistance and also that the slope is internally well-drained. Our test pit information and the absence of local seepage supports this conclusion.

The internal access road alignment should be selected so that the slope below the existing access road is not undercut. The internal access road excavations should not exceed 1.5 m in depth and the excavation slopes should not be steeper than 2 horizontal to 1 vertical.

With reference to the minimum set-back distance from the Toby Creek bank to the nearest edge of the proposed townhouse development, it is noted that this distance depends upon details of the proposed site grading, creek flooding constraints, and building construction which are not presently available at this planning stage. With respect to creek bank slope stability, we recommend that the west lot line for the development should be set back from the creek bank by not less than a horizontal distance of 2 times the elevation difference between creek bottom and the chosen site grade. We also recommend that the western edge of the townhouse buildings be not less than 15 m inside the above-described lot line.

The low-lying northern portion of the site may be subject to flooding during high creek flows. Proposed development protection against creek flooding and erosion should be evaluated by others competent in this field before development limits and site grades are chosen. Creek erosion will reduce the creek bank stability along the western edge of the site and erosion protection will therefore be necessary. Locally available riprap which is dumped upon a gravel filter layer appears to be the most economical method of providing the necessary creek erosion protection. Detailed recommendations concerning riprap and filter gradations and thickness require further project detail concerning site grading, expected flood elevations and channel velocities.

c) Bearing Capacity

We consider that footings will provide a suitable foundation for the proposed townhouse and light commerical structures.

The allowable net bearing pressure for footing foundations for the proposed townhouse and light commercial development depends upon the site grading details and the expected maximum groundwater elevation. Most of the site is underlain by the highly permeable bouldery gravel stratum and we would therefore expect the groundwater table in this stratum to fluctuate in accordance with water level changes in the nearby creek. Predicted maximum creek elevations should therefore be used as a guide for selecting the minimum site grade and for foundation elevations.

We consider that settlement considerations rather than ultimate bearing capacity will govern the allowable footing pressures. We recommend the following allowable net bearing pressures provided that the bottom of the footings will be located at an elevation which is not less than twice the footing width above the expected maximum creek level:

Foundation Stratum	Net Allowable Bearing Pressure	
	Tons per sq.ft.	KPa
Silt and sand	1.5	140
Silt	1.0	95
Bouldery gravel	2.0	190

It is expected that the foregoing bearing pressures will limit the total settlements to less than 2.5 cm and that differential settlements will be about 1/2 of the total settlement.

Undetected soft compressible soils which may be encountered at the foundation elevation should be removed and replaced with compacted gravel fill.

We recommend the use of perforated plastic drainage pipe with gravel filter backfill around the outside perimeter of footings and also a gravel filter layer below the floor slab where foundations are to be constructed in the less permeable silt or silt and sand strata. The gravel drainage layer below the floor slab should be at least 13 cm (5 inches) thick and should contain not more than 5 per cent by weight passing the No. 200 sieve. The similarly-graded gravel filter around the perforated pipe should be not less than 15 cm (6 inches) thick.

The grain size distribution test results indicate that both the silt and the silt and sand strata will be susceptible to frost heaving. In order to prevent frost heave damages to foundations which are constructed in these strata, we recommend that not less than 2 m of backfill be provided over the bottom of the footings. The local silt is considered to be extremely susceptible to frost heaving and should not be used for foundation backfill.

d) Site Grading

Topsoil is unsuitable fill material and should be removed from areas where embankments or foundations are to be constructed.

The silt and sand stratum and the bouldery gravel stratum are both considered to be suitable site grading soils, provided that they are compacted to not less than 95 per cent standard Proctor density. The compaction test results which were obtained for the 3 inch minus fraction of a typical gravel sample are presented on Figure 7. These test results indicate a maximum 2.24 tonne per cubic metre dry density at a 9.4 per cent optimum moisture content. We expect that difficulty will be encountered in trench and foundation excavations in this stratum because of numerous boulders (refer to Figures 4 and 5).

We recommend that the grey silt stratum not be used for site grading in areas below structure foundations, nor for the internal access road or for foundation backfill. The laboratory test results on a typical sample indicate a 20.7 optimum moisture content for compaction (refer to Figure 8). However, the natural moisture content test results on selected samples are in the order of 27 to 28 per cent which is about 6 to 7 per cent above the optimum moisture content. Considerable drying effort, using discers or scarifiers, would be required to reduce the moisture content of this frost-susceptible soil to the optimum moisture content.

We recommend that the local gravel soils be used for internal road construction in order to reduce the required pavement thickness.

e) Sulphate Attack

The laboratory test results indicate that there was an undetectable amount of soluble sulphate in the two samples tested and we therefore recommend that normal Portland cement be used in the concrete for building foundations.

f) Pavement Thickness

The grain size distribution test results indicate that the gravel stratum materials will provide the most economical pavement thickness for the internal road and that base course will not be required for the expected light traffic.

With reference to asphaltic concrete pavement, we recommend that the top 6 inches of the gravel subgrade be compacted to not less than 100 per cent of the maximum standard Proctor density. We consider that a minimum 5 cm (2 in) thickness of asphaltic concrete would be adequate for this light traffic. Alternatively, it should be feasible to apply a cut-back asphalt prime coat to the prepared subgrade, followed by a 2.5 cm (1 in) thick cold mix of crushed gravel and asphalt. The latter road surfacing would provide the desired dust palliative at less cost.

We strongly recommend that, after site grades and foundation elevations are established, we be permitted to review the proposed layout with reference to the design recommendations which have been presented in this report. Please contact us if you need further elaboration of these recommendations.

Yours very truly,

GOLDER GEOTECHNICAL CONSULTANTS LTD.

B.W. Mickleborough, P. Eng.

H.G. Gilchrist, P. Eng.

BWM/HGG/ba

LIST OF ABBREVIATIONS

The abbreviations commonly employed on each "Record of Borehole," on the figures and in the text of the report, are as follows:

I. SAMPLE TYPES

AS	auger sample
CS	chunk sample
DO	drive open
DS	Denison type sample
FS	foil sample
RC	rock core
ST	slotted tube
TO	thin-walled, open
TP	thin-walled, piston
WS	wash sample

II. PENETRATION RESISTANCES

Dynamic Penetration Resistance: The number of blows by a 140-pound hammer dropped 30 inches required to drive a 2-inch diameter, 60 degree cone one foot, where the cone is attached to 'A' size drill rods and casing is not used.

Standard Penetration Resistance, *N*: The number of blows by a 140-pound hammer dropped 30 inches required to drive a 2-inch drive open sampler one foot.

WH sampler advanced by static weight—weight, hammer

PH sampler advanced by pressure—pressure, hydraulic

PM sampler advanced by pressure—pressure, manual

III. SOIL DESCRIPTION

(a) *Cohesionless Soils*

Relative Density	*N, blows/ft.*
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) *Cohesive Soils*

Consistency	c_u, *lb./sq. ft.*
Very soft	Less than 250
Soft	250 to 500
Firm	500 to 1,000
Stiff	1,000 to 2,000
Very stiff	2,000 to 4,000
Hard	over 4,000

IV. SOIL TESTS

C	consolidation test
H	hydrometer analysis
M	sieve analysis
MH	combined analysis, sieve and hydrometer[1]
Q	undrained triaxial[2]
R	consolidated undrained triaxial[2]
S	drained triaxial
U	unconfined compression
V	field vane test

NOTES:

[1] Combined analyses when 5 to 95 per cent of the material passes the No. 200 sieve.

[2] Undrained triaxial tests in which pore pressures are measured are shown as $\bar{Q}$ or $\bar{R}$.

LIST OF SYMBOLS

I. GENERAL

$\pi = 3.1416$

e = base of natural logarithms 2.7183

$\log_e a$ or $\ln a$, natural logarithm of a

$\log_{10} a$ or $\log a$, logarithm of a to base 10

t	time
g	acceleration due to gravity
V	volume
W	weight
M	moment
F	factor of safety

II. STRESS AND STRAIN

u	pore pressure
σ	normal stress
σ'	normal effective stress ($\bar{\sigma}$ is also used)
τ	shear stress
ϵ	linear strain
ϵ_{xy}	shear strain
ν	Poisson's ratio (μ is also used)
E	modulus of linear deformation (Young's modulus)
G	modulus of shear deformation
K	modulus of compressibility
η	coefficient of viscosity

III. SOIL PROPERTIES

(a) *Unit weight*

γ	unit weight of soil (bulk density)
γ_s	unit weight of solid particles
γ_w	unit weight of water
γ_d	unit dry weight of soil (dry density)
γ'	unit weight of submerged soil
G_s	specific gravity of solid particles $G_s = \gamma_s/\gamma_w$
e	void ratio
n	porosity
w	water content
S_r	degree of saturation

(b) *Consistency*

w_L	liquid limit
w_P	plastic limit
I_P	plasticity index
w_S	shrinkage limit
I_L	liquidity index $= (w - w_P)/I_P$
I_C	consistency index $= (w_L - w)/I_P$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
D_r	relative density $= (e_{max} - e)/(e_{max} - e_{min})$

(c) *Permeability*

h	hydraulic head or potential
q	rate of discharge
v	velocity of flow
i	hydraulic gradient
k	coefficient of permeability
j	seepage force per unit volume

(d) *Consolidation (one-dimensional)*

m_v	coefficient of volume change $= -\Delta e/(1+e)\Delta\sigma'$
C_c	compression index $= -\Delta e/\Delta \log_{10} \sigma'$
c_v	coefficient of consolidation
T_v	time factor $= c_v t/d^2$ (d, drainage path)
U	degree of consolidation

(e) *Shear strength*

τ_f	shear strength	
c'	effective cohesion intercept	in terms of effective stress $\tau_f = c' + \sigma' \tan \phi'$
ϕ'	effective angle of shearing resistance, or friction	
c_u	apparent cohesion*	in terms of total stress $\tau_f = c_u + \sigma \tan \phi_u$
ϕ_u	apparent angle of shearing resistance, or friction	
μ	coefficient of friction	
S_t	sensitivity	

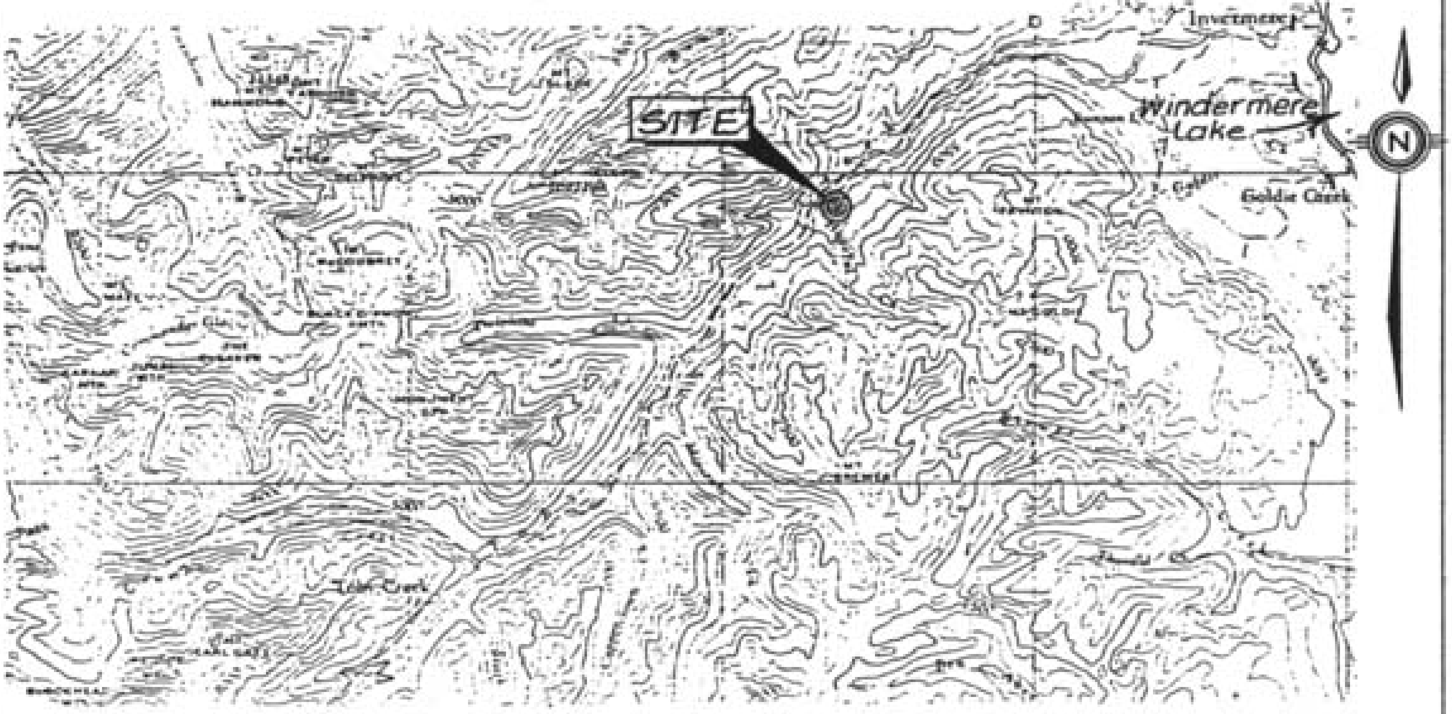
*For the case of a saturated cohesive soil, $\phi_u = 0$ and the undrained shear strength $\tau_f = c_u$ is taken as half the undrained compressive strength.

KEY MAP & LOCATION PLAN

Figure 1

KEY MAP

SCALE: 1 cm. to 24 km. (approx.)



LOCATION PLAN

SCALE: 1:250,000 Contour Interval : 500 ft.

Project No. C78730 Drawn RK Reviewed Date 6 July 78

Golder Associates

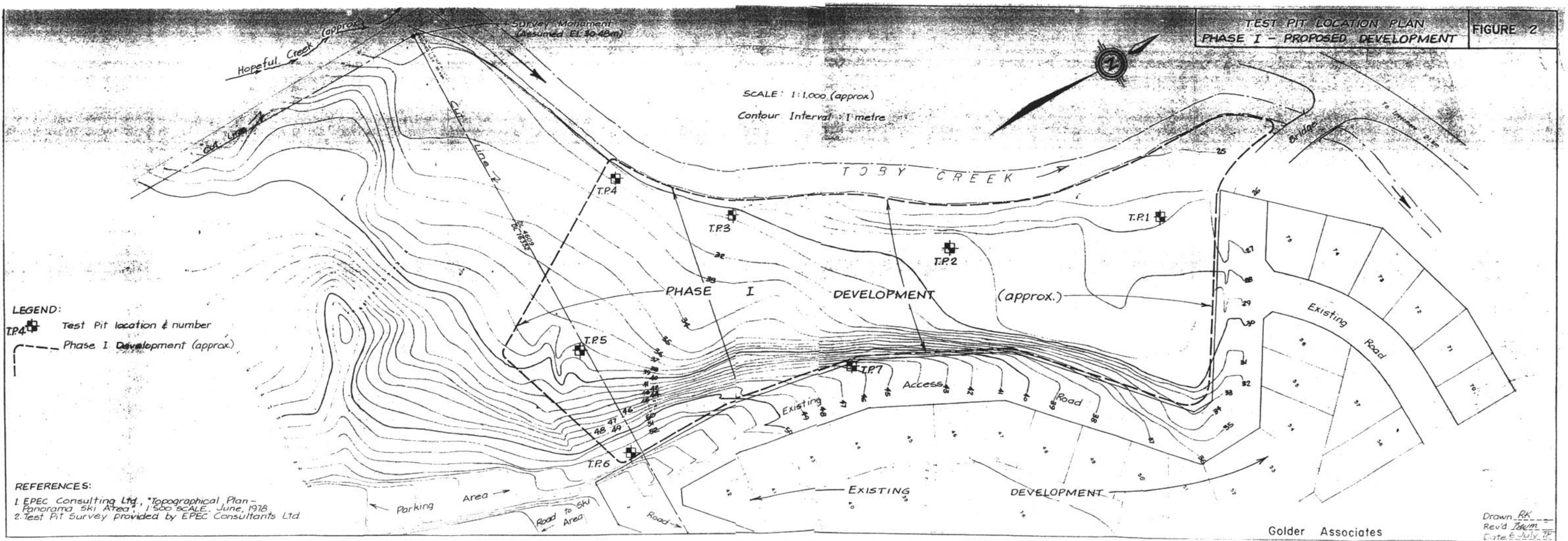


FIGURE 2

TEST PIT LOCATION PLAN
PHASE I – PROPOSED DEVELOPMENT

SCALE: 1:1,000 (approx.)
Contour Interval: 1 metre

LEGEND:
T.P.4 ✚ Test Pit location & number
– – – Phase I Development (approx.)

REFERENCES:
1. EPEC Consulting Ltd., "Topographical Plan – Panorama Ski Area", 1:500 SCALE, June, 1978
2. Test Pit Survey provided by EPEC Consultants Ltd

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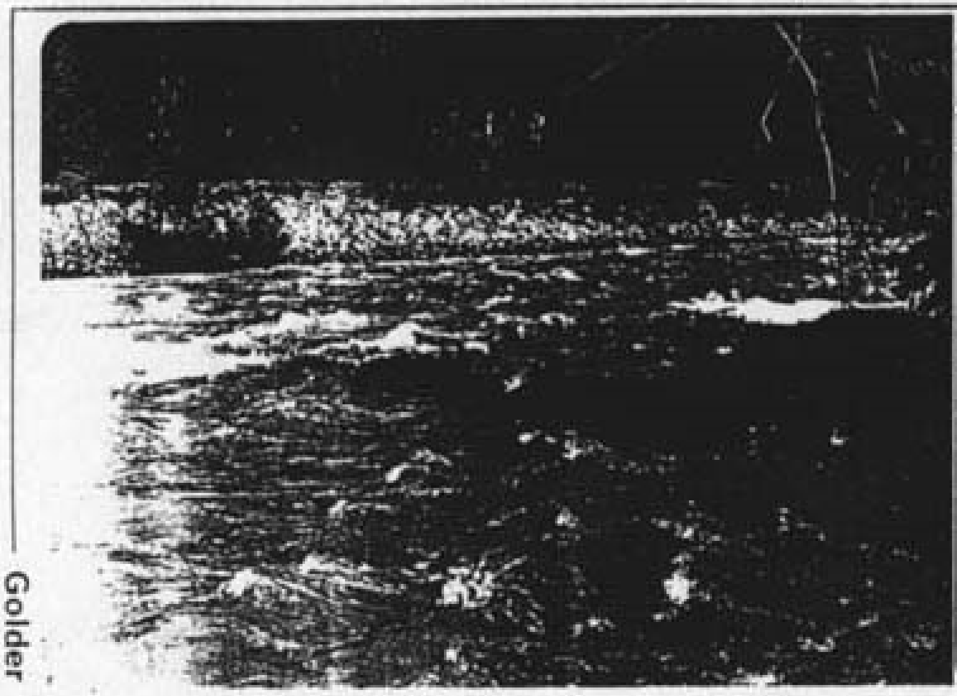

TOP LEFT: West bank of Toby Creek opposite T.P.2 showing exposed gravel, cobble & boulders

TOP RIGHT: Viewing upstream on Toby Creek from T.P.1 vicinity. Phase I site is on left side of creek. See Figure 4 for exposure at Ⓐ in T.P.4 vicinity

BOTTOM LEFT: Viewing north along existing access road. Phase I site is to left of access road. Vehicle is parked near T.P.7

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SITE PHOTOGRAPHS

Figure 3

SITE PHOTOGRAPHS

Figure 4

Exposure along Toby Creek bank between T.P.4 and Hopeful Creek Note 0·3m. pick for scale

T.P. 1 showing upper 2·1m silt & sand containing some cobbles & boulders. Note water table at 2·5m. depth.

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SITE PHOTOGRAPHS

Figure 5

Gravel, cobbles & boulders excavated from T.P.2

T.P. 5 showing excavation in silt

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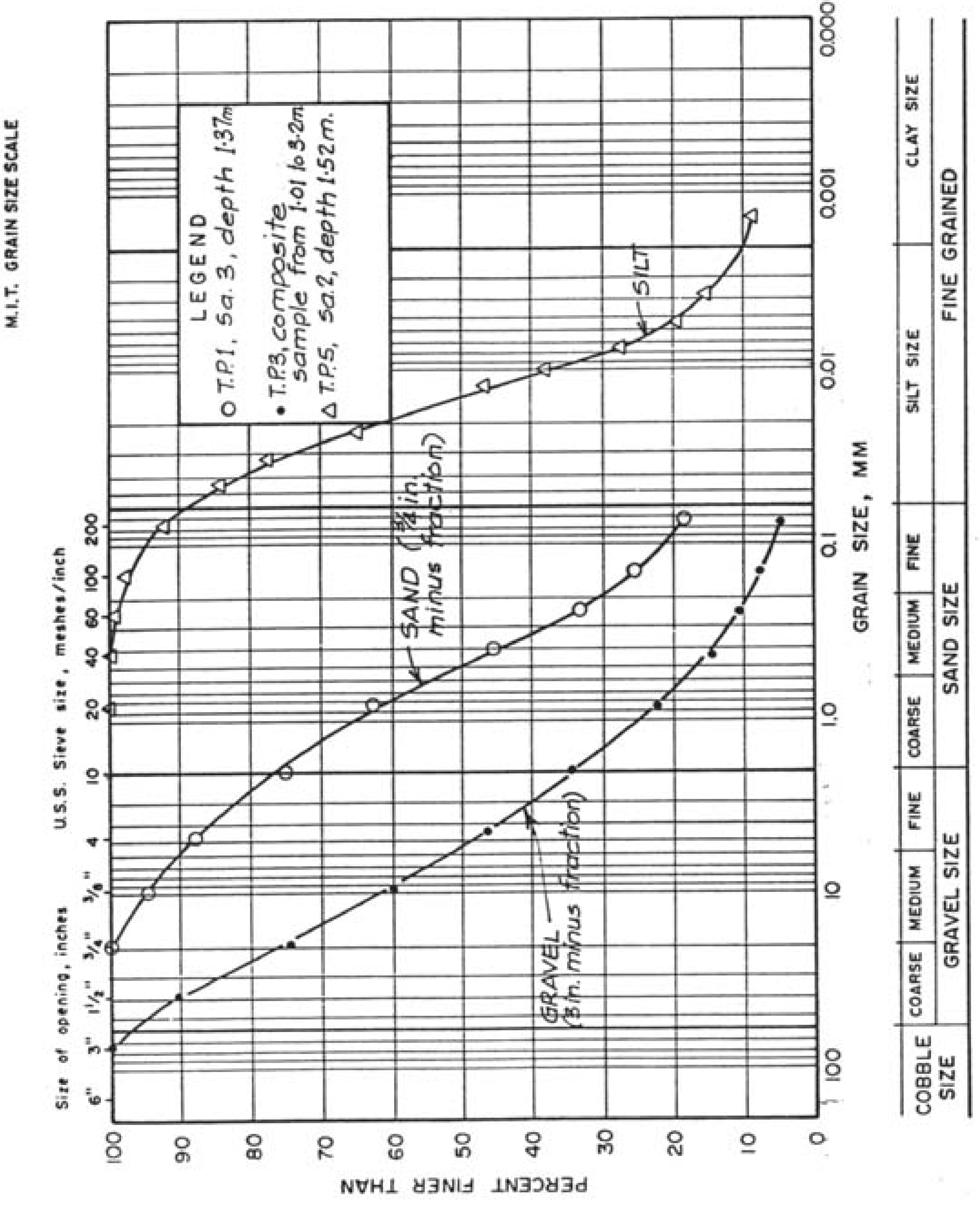
GRAIN SIZE DISTRIBUTION

FIGURE 6



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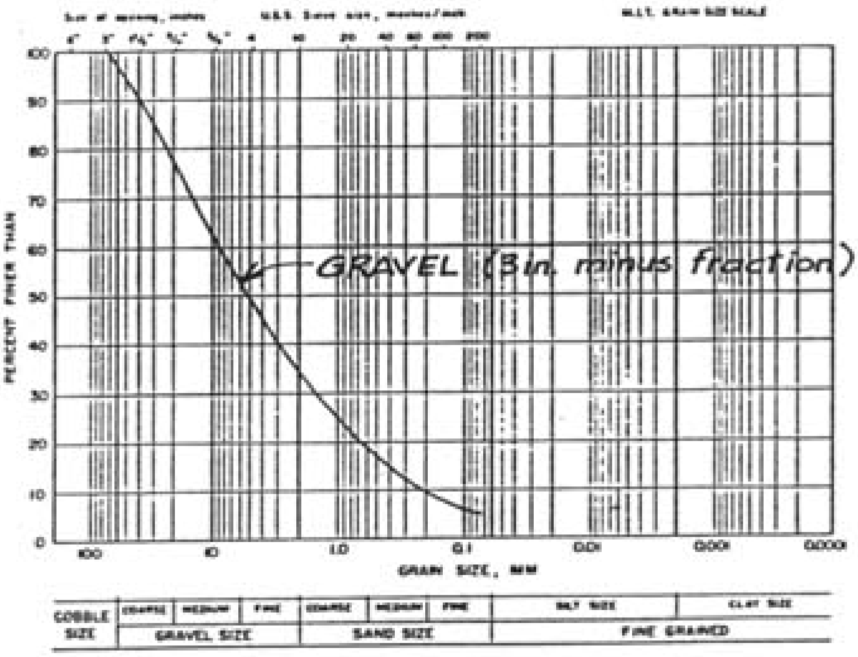
MOISTURE- DENSITY RELATIONSHIP FOR GRAVEL

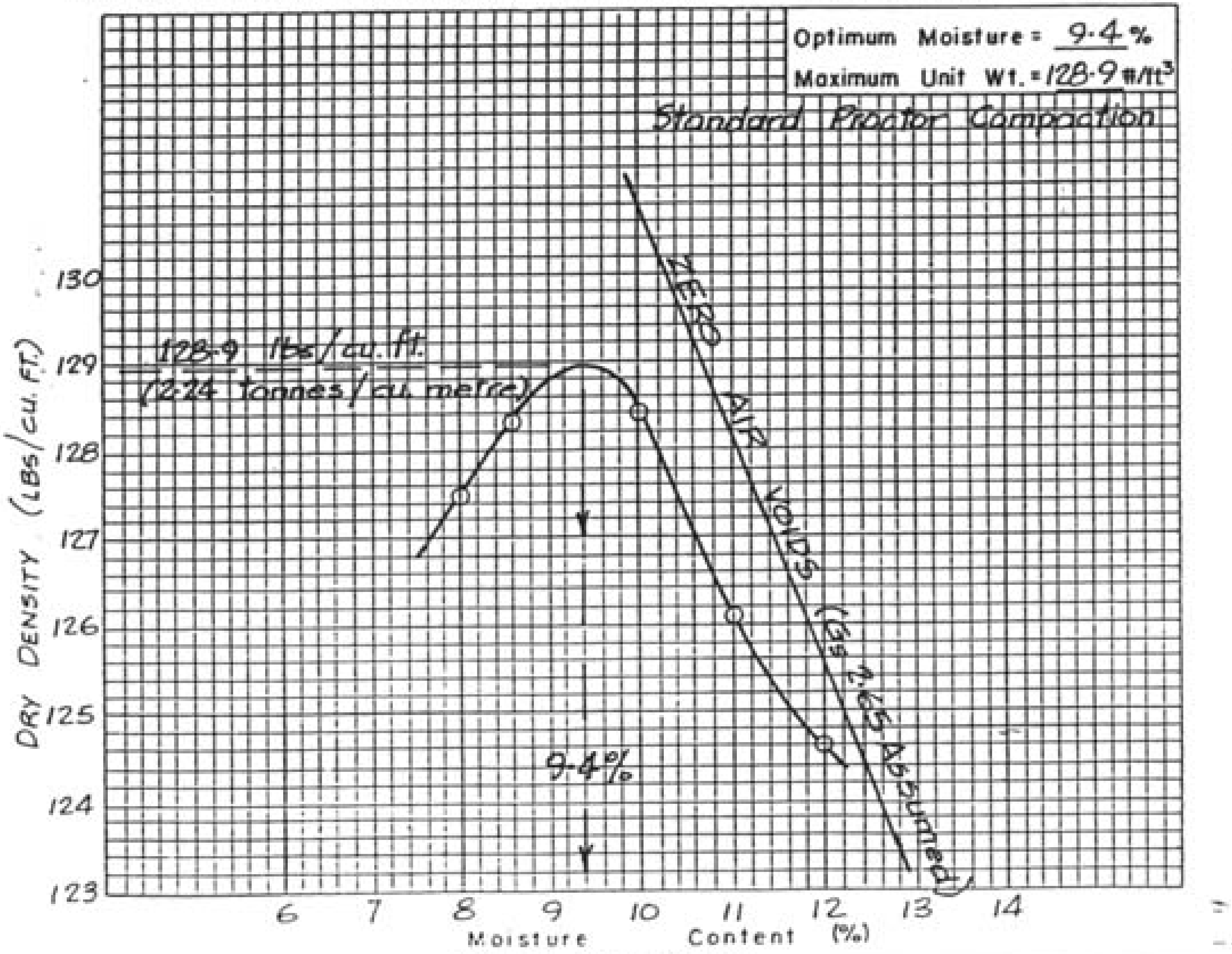
Figure 7

Test Pit 3, sample 8
(composite) — from
1·01 m. To 3·20m.
Unified Soil
Classification: GW-GM
Atterberg Limits:
non- plastic
Estimated Permeability:
higher than 10^{-2} cm./sec.

GRAIN SIZE DISTRIBUTION



MOISTURE- DENSITY RELATIONSHIP (ASTM D698)



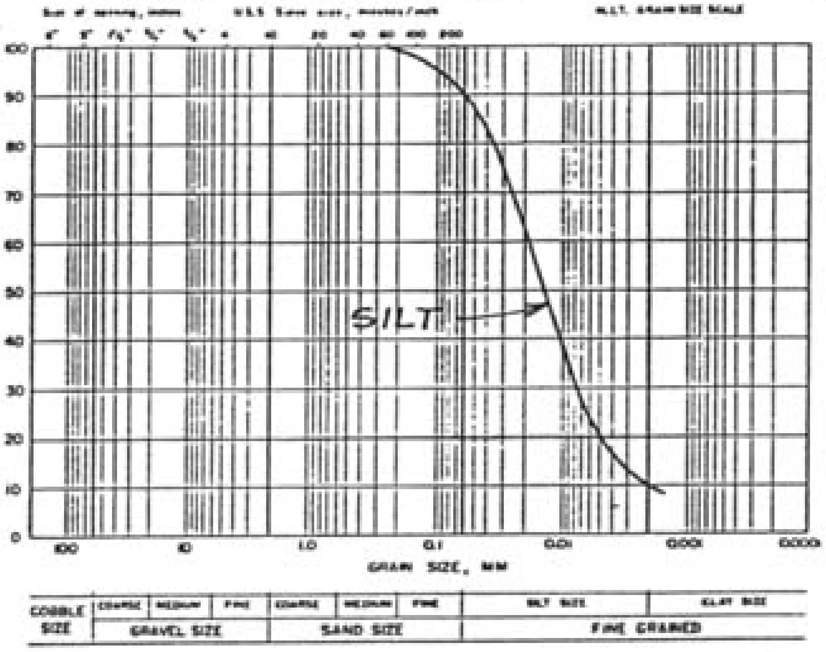
C78130 RK 5July 78

MOISTURE - DENSITY RELATIONSHIP FOR SILT

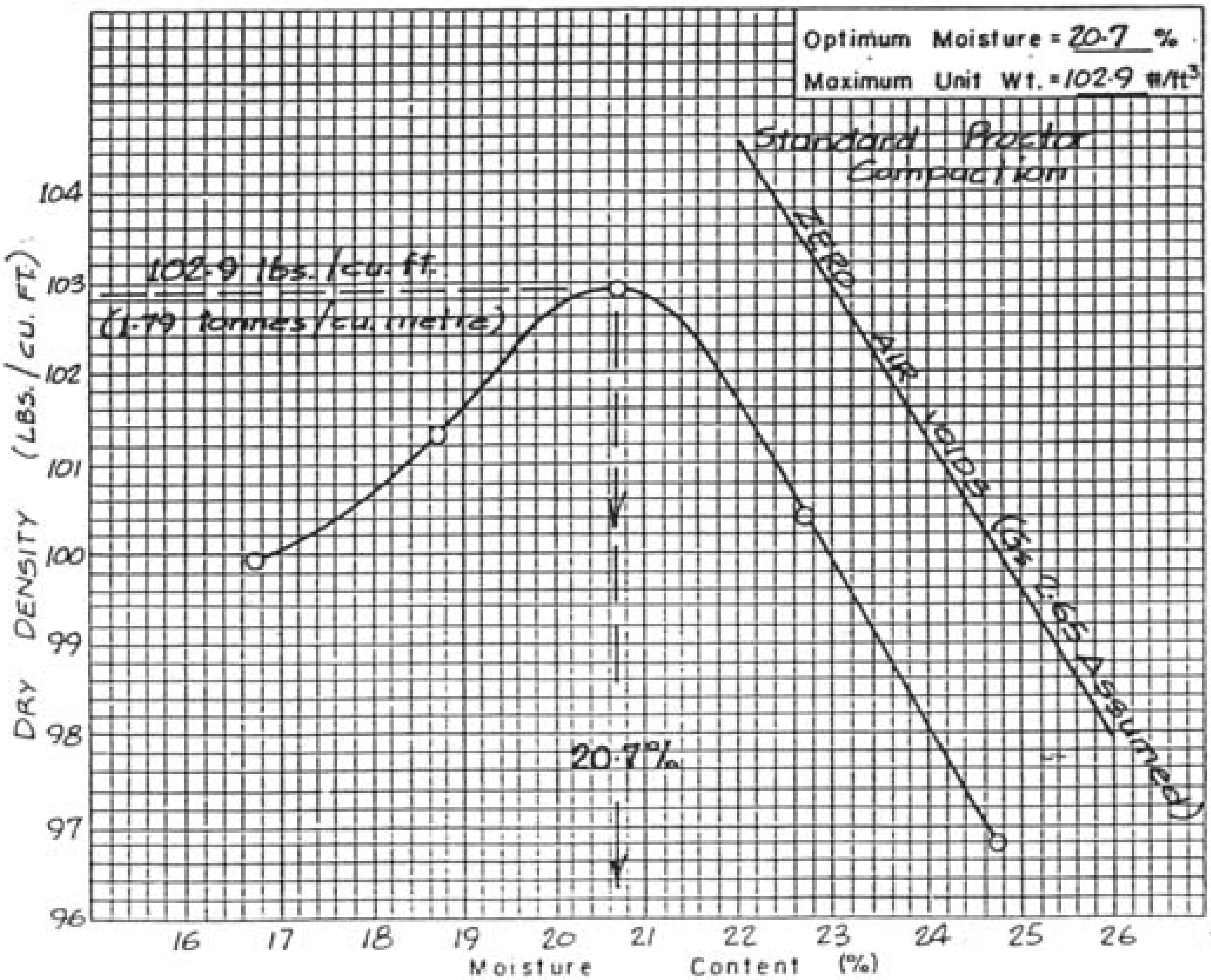
Figure 8

Test Pit 5, sample 2,
depth 1·52 m.
Unified Soil Classification = ML
Atterberg Limits:
non-plastic
Estimated Permeability:
Less than 10^{-5} cm./sec.

GRAIN SIZE DISTRIBUTION



MOISTURE - DENSITY RELATIONSHIP (ASTM D698)



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Project No. C78130 Drawn RK Reviewed Date 5 July 78

Project No. C78130

RECORD OF TEST PIT T.P. 1

LOCATION (See Figure 2) DATE 29 June 1978 DATUM Project

METHOD OF EXCAVATION John Deere 450 backhoe PROJECT Panorama Mtn. Development

ELEVN. / DEPTH (m.)	DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE NUMBER	SAMPLE TYPE	ELEVATION SCALE	WATER CONTENT, PERCENT W_P W W_L	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
26.73	Ground surface							
0.00 26.58	Dark brown organic TOPSOIL							
0.15	Brown SILT & fine SAND, oxidized, trace organics, trace grey clay, cohesionless, occ. boulder up to 0.6 m. Loose to compact, damp		1 2	C.S. C.S.	26			
25.36 1.37	Grey fine to coarse SAND, trace silt & fine gravel, occ. boulder up to 0.6 m., well-graded, compact		3	C.S.	25		M	
24.75 1.98	Grey SILT, trace sand & gravel, some boulders up to 0.6 m. firm, damp		4	C.S.				
24.44 2.29	Grey SAND & GRAVEL, some silt, well-graded, some boulders up to 0.6 m., compact, wet		5 6 7	C.S. C.S. C.S.	24			W.L. ▽ 2.50 m. (29 Jun 78)
	Gap-graded							
23.07 3.66	End of Test Pit		8	C.S.	23			

VERTICAL SCALE 1:25

Golder Associates T.P. 1

DRAWN RK

CHECKED

Project No. C78130

RECORD OF TEST PIT T.P. 2

LOCATION (See Figure 2) DATE 29 June 1978 DATUM Project

METHOD OF EXCAVATION John Deere 450 backhoe PROJECT Panorama Mtn. Development

SOIL PROFILE								
ELEVN. / DEPTH (m)	DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE NUMBER	SAMPLE TYPE	ELEVATION SCALE	WATER CONTENT, PERCENT W_P — W ○ — W_L 10 20 30 40	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
29.20 0.00	Ground surface Dark brown organic TOPSOIL							
0.12	Light grey fine SAND & SILT, trace rootlets, slight iron-staining, oxidized, damp, compact				29			
			1	C.S.				
					28			
27.68 1.52	↑ boulders		2	C.S.		○ I		
	Brown SAND & GRAVEL, some cobbles & boulders up to 0.6m, damp, cohesionless, compact		3	C.S.		NOTE: W_L=31.6% W_P=31.6%		
					27			
	] boulder, 0.9m. dia.		4	C.S.				
			5	C.S.				
					26			
25.91 3.29	End of Test Pit		6	C.S.				No seepage or sluffing
					25			

VERTICAL SCALE 1:25

Golder Associates T.P. 2

DRAWN RK

CHECKED

Project No. C78730

RECORD OF TEST PIT T.P. 3

LOCATION (See Figure 2) DATE 29 June 1978 DATUM Project

METHOD OF EXCAVATION John Deere 450 backhoe PROJECT Panorama Mtn. Development

SOIL PROFILE								
ELEVN. / DEPTH (m)	DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE NUMBER	SAMPLE TYPE	ELEVATION SCALE	WATER CONTENT, PERCENT W_P — W — W_L 10 20 30 40	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
30.47	Ground surface							
0.00 30.17	Dark brown organic TOPSOIL							
0.30	Grey, mottled rust brown SILT, trace rootlets, trace fine sand, stratified, fissured, non-plastic firm to stiff, damp				30			
			1	C.S.		o	-	
29.46 1.01	↥-cobble layer							
	Yellow brown SAND & GRAVEL, some silt, some cobbles & boulders up to 0.75m compact, damp, gap-graded		2	C.S.	29			
						o *	M	Soluble sulphate-0%
			3	C.S.				
			4	C.S.				
	as above, but increasing boulder content below 2.1 m		5	C.S.	28			
			6	C.S.				
27.27			7	C.S.				No seepage or sluffing
3.20	End of Test Pit							
					27			

* - Composite: Sample 8, from 1.01 m. to 3.20 m.

VERTICAL SCALE 1:25

Golder Associates T.P. 3

DRAWN RK

CHECKED

Project No. C78730

RECORD OF TEST PIT T.P. 4

LOCATION (See Figure 2) DATE 29 June 1978 DATUM Project

METHOD OF EXCAVATION John Deere 450 backhoe PROJECT Panorama Mtn. Development

SOIL PROFILE								
ELEVN. DEPTH (m)	DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE NUMBER	SAMPLE TYPE	ELEVATION SCALE	WATER CONTENT, PERCENT W_P W W_L	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
31.67	Ground surface							
0.00	Dark brown organic TOPSOIL							
0.12	Dark grey to grey brown SAND & GRAVEL, some silt, some cobbles, well-graded, cohesionless damp		1	C.S.	31			
	cobbles up to 0.15 m. dia.							
	boulders up to 0.6 m. dia. below 1.5 m.		2	C.S.	30			
			3	C.S.				
			4	C.S.				
			5	C.S.				
	as above with less silt				29			
			6	C.S.				
28.67			7	C.S.				
3.00	End of Test Pit							No seepage or sluffing
					28			

VERTICAL SCALE 1:25

Golder Associates T.P. 4

DRAWN RK

CHECKED

Project No. C78730

RECORD OF TEST PIT T.P. 5

LOCATION (See Figure 2)
DATE 29 June 1978
DATUM Project
METHOD OF EXCAVATION John Deere 450 backhoe
PROJECT Panorama Mtn. Development

SOIL PROFILE								
ELEV'N. DEPTH (m)	DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE NUMBER	SAMPLE TYPE	ELEVATION SCALE	WATER CONTENT, PERCENT Wp W WL 10 20 30 40	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
38.87 0.00	Ground surface							
0.12	Dark brown organic TOPSOIL							
	Light brown to light grey SILT, trace organics, trace fine sand, damp. non-plastic, firm to stiff		1	C.S.	38			
	Becoming light grey mottled rust brown SILT, trace carbonaceous silt, stratified, fissured, damp		2	C.S.		o	MH	soluble sulphate-0%
					37			
	-as above, trace oxidization							
			3	C.S.				
	as above but higher moisture content							
					36			
			4	C.S.				No seepage or sluffing
35.52 335	End of Test Pit		5	C.S.				
					35			

VERTICAL SCALE 1:25

Golder Associates T.P. 5

DRAWN RK

CHECKED

Project No. C78730

RECORD OF TEST PIT T.P. 6

LOCATION (See Figure 2) DATE 29 June 1978 DATUM Project

METHOD OF EXCAVATION John Deere 450 backhoe PROJECT Panorama Mtn. Development

SOIL PROFILE								
ELEVN. / DEPTH (m)	DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE NUMBER	SAMPLE TYPE	ELEVATION SCALE	WATER CONTENT, PERCENT W_P W W_L 10 20 30 40	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
52.00	Ground surface				52			
0.00	Grey SILT, trace fine sand, fissured, non-plastic, damp, firm		1	C.S.				
51.09 0.91	Yellow brown SAND & GRAVEL, some silt, occ. cobble & boulders up to ·3m. dia, dry, compact		2	C.S.	51			
			3	C.S.				
	as above, becoming damp at 2 m.		4	CS	50			
49.87 2.13	Light grey brown SILT, occ. pebble/cobble, occ. pocket/layer fine sand, trace organics, fissured, stratified, stiff, wet		5	C.S.				
			6	C.S.	49			
			7	C.S.		o		
48.65 3.35	End of Test Pit		8	C.S.				No seepage or sluffing
					48			

VERTICAL SCALE 1:25

Golder Associates T.P.6

DRAWN RK

CHECKED

Project No. C78730

RECORD OF TEST PIT T.P. 7

LOCATION (See Figure 2) DATE 29 June 1978 DATUM Project

METHOD OF EXCAVATION John Deere 450 backhoe PROJECT Panorama Mtn. Development

SOIL PROFILE								
ELEVN. DEPTH (m)	DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE NUMBER	SAMPLE TYPE	ELEVATION SCALE	WATER CONTENT, PERCENT W_P W W_L	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
45.59	Ground surface							
0.00	Rust brown SAND & GRAVEL, some silt, cobbles & boulders to 1.8m. dia. (FILL MATERIAL)							
					45			
			1	C.S.				
			2	C.S.				
			3	C.S.	44			
			4	C.S.				
43.15 2.44	Brown SAND & GRAVEL, some silt, some boulders up to 0.6 m. dia.		5	C.S.				
					43			
42.54 3.05	End of Test Pit		6	C.S.				No seepage or sluffing
					42			

VERTICAL SCALE 1:25

Golder Associates T.P.7

DRAWN RK

CHECKED

PANORAMA
MOUNTAIN VILLAGE

ARCHAEOLOGICAL

ARCHAEOLOGICAL RESOURCE OVERVIEW
PROPOSED PANORAMA EXPANSION

September 1997

INTRAWEST

FINAL REPORT
ARCHAEOLOGICAL RESOURCE OVERVIEW
PROPOSED PANORAMA EXPANSION

Prepared for:

Panorama Resort
A Division of IW Resorts Partnership
Panorama, British Columbia
V0A 1T0

by

Stanley Van Dyke, M.A.
Bison Historical Services Ltd.
#3, 227 - 14th Street N.W.
Calgary, Alberta T2N 1Z6

September 30, 1997

EXECUTIVE SUMMARY

On behalf of Panorama Resort, Bison Historical Services Ltd. Carried out an archaeological resource overview of a proposed ski area expansion south of the present development. The proposed development will involve the construction of an access road, a ski lift and related facilities in a natural topographic bowl northeast of Mount Goldie. The study area measures in access of 1200 ha.

Studies involved a review of existing archaeological data, existing ethnographic data, existing geological data and reported traditional knowledge bearing on the proposed area of expansion. Studies also involved a field visitation designed to identify areas of archaeological potential. Background studies were carried out over a period of time in September. Field studies were carried out September 22, 1997 by Stanley Van Dyke, M.A. And Don Hanna, M.A.

Background information suggests

- No prehistoric sites are known for the study area or surrounding areas,
- The archaeological literature for the Rocky Mountains suggests that use of mountain slopes and peaks are used principally for, where available, the hunting of sheep and goat, quarries, and vision quests,
- The geological data suggests only a moderate potential for material suitable for 'flint knapping',
- Areas suitable for prehistoric occupation or use are limited in scope,
- No references to the study area are available in the available ethnographic literature,
- References to traditional land use are limited to areas adjacent to Toby creek and the lower reaches of Taynton and Hopeful creeks.
- Field visitation indicate that the study area is largely of low archaeological potential but that areas of low/moderate and moderate archeological present are present at the boundaries and adjacent to the study area.
- No prehistoric cultural material or features were observed in the course of the field study.
- Rock materials observed in the course of field study are not suitable for prehistoric quarrying.

Based on the information obtained in the course of this study and in consideration of the observations made in the course of the field visitation, it is our opinion that an Archaeological Impact Assessment is not required.

CREDITS

Senior Investigator: Stanley Van Dyke, M.A.

Assistant: Don Hanna, M.A.

Acknowledgements:

I would like to take this opportunity to thank Mr. Graham Wood (Vice President and General Manager) and Mr. Brad Brush (Director of Mountain Operations) for their assistance in the conduct of this project. I would also like to thank Ms. Lillian Rose (Aboriginal Liaison Office, Ministry of Forests) and Chief Gayle Michel of the Columbia Lake Band for their assistance in obtaining traditional land use information for the study area.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

The Panorama Resort of Panorama, British Columbia, proposes to expand their ski operations southward toward Mount Goldie. In view of this proposal, Panorama Resort retained Bison Historical Services Ltd. to conduct an archaeological resource overview. The primary objective of the overview is to determine if there are sufficient grounds to warrant an Archaeological Impact Assessment.

The archaeological resource overview was carried out in September of 1997 by Stanley Van Dyke, M.A. A preliminary field reconnaissance was carried out on September 22, 1997 by Stanley Van Dyke with the assistance of Don Hanna, M.A.

The following report provides a brief review of existing data bearing on the archaeological potential and sensitivity of the area proposed for the expansion. Where applicable, the report follows the guidelines set out in the British Columbia Archaeological Impact Assessment Guidelines (Ministry of Small Business, Tourism and Culture 1992:20-22).

PROPOSED PROJECT

The proposed expansion will involve the construction of an access road on the west bank of Taynton Creek, and a ski lift and related facilities in a natural bowl located northwest of Mount Goldie (Figure 1). The proposed access road will be approximately 2.9 km in length. The future lift will be approximately 1.5 km in length.

The natural bowl is drained by a number of steep unnamed tributaries of Taynton Creek and measures approximately 3.5 by 3.5 km (in excess of 1.2 square miles)(Figure 2). These channels form a series of avalanche chutes. The southwest boundary of the natural bowl is bounded by a ridge which forms the watershed between Taynton Creek and Hopeful Creek. The southeastern boundary follows the ridge line northward into the Taynton Creek valley. The northeastern boundary follows Taynton Creek northwestward. The northwestern boundary also follows a ridge line into the Taynton Creek valley.

The natural bowl is surrounded by cliffs, steep slopes, and talus slopes. With the exception of peaks and related features along the mountain crest, slopes are steep and can approach greater than 30°[1]

---

[1] Examination of the available topographic mapping indicates that it was computer generated. As a result, contour information is interpolated to form a gradient. Cliffs and similar rapid changes in slope are poorly expressed. Our impression of the topography suggests that many areas are considerably steeper than maps would indicate while others offer flats not generally expressed in the available mapping.

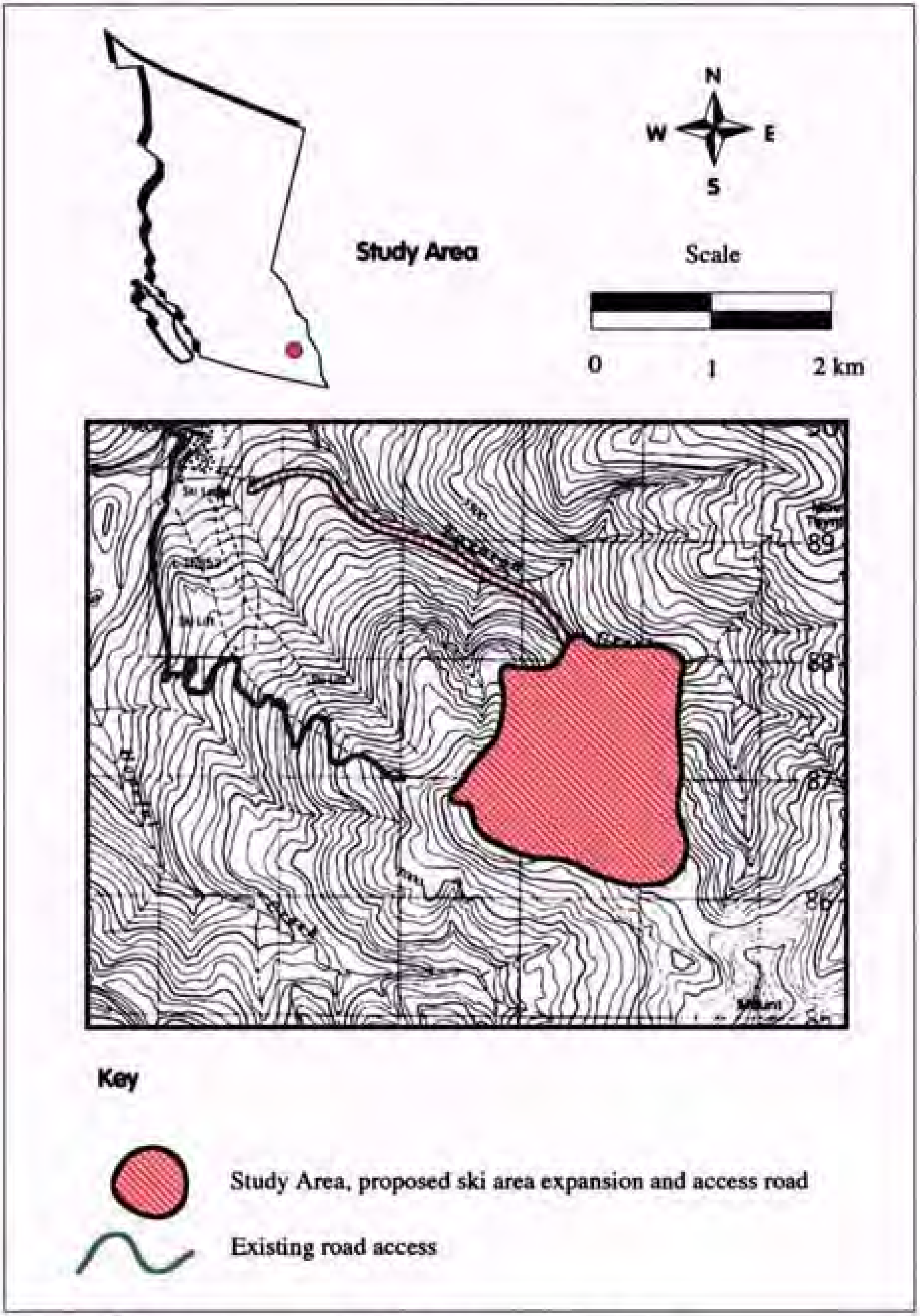

Figure 1. Proposed Panorama Ski Resort Expansion, Study Area

Figure 2. View west, northwest (upslope) into the ski bowl

POTENTIAL IMPACTS

Development of proposed facilities related to the expansion of the Panorama Ski Resort would, in general, result in minimal impacts to the study area at large. Construction of the access road would require impacts to the side slope southwest of Taynton Creek. Development within the ski area would involve some preparation of the ski slope, the construction of lift pylons and the construction of facilities for access and egress from the lift.

Scheduling and alternative project designs or locations are not considered. For the purpose of this report, the archaeological potential and sensitivity of the entire study area is considered.

STUDY AREA

The study area is situated in the Purcell Mountains of southeastern British Columbia. Elevations range from 1219 to 2469 m. The study area is drained via Taynton Creek and Toby Creek into the upper Columbia River drainage. The study area occupies the Engelmann Spruce-Subalpine Fir (4,200' to 7.500') and Alpine Tundra zones (>7,500')(Krajina 1969, Meidinger and Pojar 1991). These are comparable to the Canadian, Hudsonian and Arctic-Alpine Zones used by Schaeffer (1940). Given the altitudinal range exhibited in the study area, the climatic regime would be expected to range widely. But in general terms one would expect cold wet winters and hot dry summers modified by microclimatic factors introduced by the slope and aspects exhibited throughout the bowl.

In the past, however, the climatic regime may have been very different. The early post glacial environment was characterized by steppe tundra (a unique cold grassland). During the period between following glaciation (9,000 to 7,000 B.P.) aridity increased (Choquette 1997:6). During the period forest composition was simpler. Between 7000 B.P. and 5000 B.P. there was a marked trend to dryer and milder conditions, particularly on the lee slopes of the various ranges. Over the past 5,000 years the trend has been again towards a cooler climate

Geological formations of the study area are assignable to the Purcell System (Reesor 1973), a proterozoic era series of rocks which is exposed widely throughout the region. This series of rocks originated in seas which were present in the study area some 800 million years ago. The study area includes exposures of the Windermere Period including outcrops of the Horsethief Group (upper sediments) and the Toby formation (lower sediments).

Glaciation in the region ended some 12,000 years ago. Many of the surrounding mountains formed nunataks during the Pleistocene and were little affected by glacial processes. "Frost and stream action combined with slump and creep of material down valley walls are the active agents shaping and modifying the present landforms" (Reesor 1973:9).

Abundant or common species of animals found in the Canadian, Hudsonian and Arctic-Alpine (4,000 to 8,000') include Big Horn Sheep (Ovis canadensis canadensis), Black Bear (Ursus americanus), Bobcat (Lynx rufus pallescens), Cougar (Felis concolor missoulensis), Elk (Cervus canadensis nelsoni), Mountain goat (Oreamnos americanus missoulae), and Mule Deer (Odocoileus hemionus hemionus) (Smith 1984:129-130). Smaller mammals include Beaver (Castor canadensis leucodonta), Coyote (Canis latrans incolatus), Hoary marmot (Marmota caligata cascadensis), Pika (Ochotona princeps cuppes), Porcupine (Erethizon dorsatum), and Snowshoe rabbit (Lepus americanus pineus)(Smith 1984:129-130).

Due to the context, there is no significant fishery in the study area. Bird life, while not significant, is one element of prehistoric and traditional subsistence resources.

Waterfowl are particularly important with cranes, ducks and geese considered to be good food (Turney-High 1941). Waterfowl would not be an expected resource in the study area.

Plants were an important element of prehistoric subsistence. Root crops, berries, seeds and nuts, greens, cactus and trees all provided useful food, teas, smoking substances, and sources of medicine. The availability of these resources within the study area can only surmised. Their availability in sufficient quantities to warrant a basis for exploitation is doubted. More easily accessible sources surely occur.

METHODOLOGY

"The archaeological resource overview is intended to identify and assess archaeological resource potential or sensitivity within a proposed study area" (Ministry of Small Business, Tourism and Culture 1992). The archaeological Resource Overview involves the preparation of background information, documentary research, consultation and preliminary field reconnaissance.

Background information collected for purposes of this study includes a review of secondary geological sources (Reesor 1973), available ethnographic sources (Boas 1918; Smith 1984; and Turney-High 1974), and archaeological database records for Borden Block[2] EcQb and surrounding blocks. As I was particular interested in the range of high altitude prehistoric sites known, a separate search was carried out for all prehistoric sites situated in the 82 K and 82 G map sheets. The search was requested on September 2, 1997 and obtained September 8, 1997.

In addition to the above, an archaeological overview assessment of the Invermere Forest district (Choquette 1997) was consulted along with the results of the Traditional Use Site Inventory, Phase I and II, which was prepared for the Invermere Forest District (Rose 1997:personal communication).

A preliminary field reconnaissance of the study area was carried out by myself and Don Hanna, M.A. on September 22, 1997.

OVERVIEW ASSESSMENT

The overview assessment of the proposed Panorama Ski area expansion is based on a consideration of the physical potential of the landscape to contain and preserve

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[2] A borden block is an area measuring 10' latitude by 10' longitude and is the primary means of recording prehistoric site locations. Within each block, sites are assigned sequential numbers (Borden 1952).

archaeological deposits (integrity), known patterns of archaeological distribution, and traditional patterns of use.

BACKGROUND STUDIES

As noted above the study area contains rock outcrops, cliffs, areas of steep slopes, talus, and avalanche chutes. The archaeological potential of this landscape is limited. The high energy environments of the avalanche chutes and Taynton Creek, and the steep slopes (> 30°) surrounding the topographic bowl are unsuitable to known patterns of residential settlement. Based on existing information drawn from southeastern British Columbia and elsewhere in the Canadian Rockies and Rocky Mountains of the United States suggests that prehistoric use of high altitude environments is generally restricted to, in an archaeological context, hunting, travel corridors and quarries (Frison 1985, Husted 1974). In a traditional context, high altitude environments are known be the site of vision quests and similar features (see Dormaar and Reeves 1993).

PHYSICAL POTENTIAL OF THE LANDSCAPE TO CONTAIN PREHISTORIC SITES OF VALUE

Archaeological sites are concentrations of cultural material and, or, features resulting from past human occupation and use. As cited above, high altitude habitats are useful for specialized hunting of game, particularly sheep or goats, for the quarrying of desirable lithic materials, for movement between basins or along mountain crests between watersheds and, rarely, for use as vision quest sites.

Given the steep slopes, the high energy environments, the evidence for erosion, creep and slumping, almost all areas of the study area would have been altered subsequent to prehistoric use or occupation. Of remaining concern is the potential for trails along and across the watershed, and the potential for hunting sites (e.g., drives, shooting pits) and lithic quarries. These concerns are addressed below.

ARCHAEOLOGICAL PATTERNS OF SITE DISTRIBUTION

A examination of the available information concerning known sites within the immediate region of the study (the EcQb Borden block) indicates that no recorded sites have been identified in this Borden Block. Indeed, no prehistoric sites have been previously identified in the area of the Toby Creek (82 K/8) map sheet. Of the surrounding

Borden Blocks only EdQa has yielded known prehistoric sites (n = 83). Almost all are associated with the Rocky Mountain Trench. In fact of the 106 prehistoric localities previously recorded on the Radium Hot Springs (82 K/9) map sheet, all are associated with the Rocky Mountain Trench.

In an attempt to cast a wider net to identify the known types of sites which might occur at high altitude, a data search was undertaken for all sites in the 82 K and 82 G NTS zone above 1800 m (≈ 6000'). The total number of prehistoric sites was 43 ranging in elevation from 1829 m to 3139 m. These include lithic scatters (n = 27), isolated finds (n = 5), cairns (n = 2), campsites (n = 2), quarries (n = 2), trails (n = 2), a rock shelter, a campsite and a cache. All except four were found to be surface finds. Three lithic scatters and a campsite were found to contain subsurface deposits.

As the potential for quarries was considered to be possible or probable, the geological literature was examined (Reesor 1973). According to the mapping provided by Reesor (1973), the Mount Goldie vicinity exhibits outcrops of the Horsethief Group and Toby Formation, both members of the Windermere Period series of rocks.

The Horsethief Group consists of "Grey, black and green slate and argillite, quartz pebble conglomerate, quartzite feldspathic quartzite and grit, red shale and arenaceous shale, minor blue grey and black limestone; equivalent mica schist, schistose quartzite and grit (Reesor 1973). The Toby Formation consists of pebble, cobble and boulder polymictic conglomerate and breccia (matrix variously of quartzite, argillite and limestone)((Reesor 1973). According to Reesor (1973:27), "the pebbles in the conglomerate of the Horsethief Creek Group are predominately of white vein quartz and vary from 1/4" to 1". Notwithstanding, slate and argillite, and metamorphic equivalents are the dominant rock within the group. Even in coarse clastic sequences, slate is 50% of the total rock (1973:29).

Evidence for lithic materials suitable for prehistoric "flint knapping" is not reported.

PATTERNS OF TRADITIONAL USE

In an attempt to identify the potential for traditional sites in or near the study area, the existing ethnographic literature was reviewed for, initially, place names for locations in the vicinity of the study area (e.g., Mount Goldie, Hopeful Creek, Taynton Creek, Toby Creek. Secondly, the literature was reviewed for citations of high Altitude use. The principal sources were Schaeffer (1940), Smith (1984) and Turney-High (1941).

Although no citations for the study area were identified, Schaeffer does address seasonal patterns of land use.

According to Schaeffer (1940) plant collecting activities were restricted to the lower Canadian zone habitats. Hunting, along with plant collecting and fishing was a principal occupation in prehistoric times. In the spring, deer and elk were driven, while in summer individual hunting was practiced or, among more southerly groups, groups would travel to the plains to hunt bison. In the fall, fishing resumed importance and in the winter some hunting of deer was practiced.

Game species particular to high altitudes (e.g., goats and sheep) are cited as being hunted in September (Smith 1984:107). Sheep were also taken in winter by driving them downward into snow drifts (Smith 1984:108) and in summer they were taken by driving them into brush and timber where their horns would become entangled (Schaeffer 1940:29). Sheep would also be taken at salt licks (Schaeffer 1940:29) and by driving over cliffs (Ray 1942:117). It is known that in prehistoric times sheep could also be hunted communally during the fall (Frison 1985).

No specific references to very high altitude hunting of sheep or goats is described in the existing ethnographic literature.

In a further attempt to identify potential traditional uses of the study area, the Phase I and II Traditional Use Site Inventory was consulted (Rose 1997:personal communication). The study area falls within a Traditional Use Inventory unit designated as Panorama (#37) with the Ktunaxa name *qatmuk* . This traditional land use unit encompasses Toby Creek, and the lower reaches of Taynton and Hopeful creeks. It is described as being used for food harvesting and material harvesting. Food harvesting locations are defined as places or areas "where food products for human consumption are obtained" (Ministry of Forests 1996:61). Food harvesting is further divided "into activities reflecting major place type distinctions in activities concerning the collection and processing of food" (Ministry of Forests 1996:61).

With the exception of the lowest reaches of Taynton Creek, the study area does not involve the development of identified units of Traditional Land Use.

PRELIMINARY RECONNAISSANCE

Using background information based on:

- The lithological potential of the study area for the presence of quarries,
- Known patterns of archaeological site distribution,
- Known patterns for archaeological use of high altitude zones,
- Available ethnographic information for use of the study area and its environs,
- Available ethnographic information for the use of high altitude environments, and

- Available information regarding traditional land use of the study area,

it was concluded that the potential for the preservation of archaeological or traditional use sites in the study area is limited. Consideration of these same factors also led to our concluding that the nature and location of potential prehistoric sites would be quite limited.

In order to assess the archaeological potential of the study area from a real perspective, a preliminary reconnaissance was carried out.

The objectives of this study were to identify and examine areas of archaeological potential including flat to gentle sloping lands along the ridge crest, the area of the peak at the southwest corner of the study area, potential site locations along ridges, on benches in the valley and to assess the nature of the Taynton Creek valley. It was also our intent to make observations of the lithic quality of the exposed outcrops with a specific interest in identifying tourmalinite chert, black or khaki tourmalinites, silicious dolomites or siltstones, fine-grained quartzites, argillite or exotics such as Top-of-the World Chert, all of which are known to be used in prehistoric "flint knapping" (Choquette 1997).

FIELD STUDY

Field studies were undertaken on September 22, 1997 by Stanley Van Dyke, M.A. and Don Hanna, M.A. (Figure 3). Panorama personnel kindly provided transportation to the top of the existing lift at the northwest corner of the study area. From there we preceded southeastward along the crest of the ridge between the watersheds of Taynton and Hopeful creeks. Areas on and adjacent to the trail were examined for evidence of existing archaeological resources (e.g., areas of rock outcrop, depressions, lithic scatters, etc.). At the southwest corner of the study area the large flat to gently sloping open area of alpine tundra was examined extensively along with the col southwest of the study area. We then preceded down the ridge to the east about 700 m. From there we preceded northwestward along the contour across areas of steep stabilized slopes and across talus slopes at the base of existing cliffs as far as a ridge which serves to divide the basin into two areas. This spur was followed down and eastward. We then crossed over the south of two drainages into a small basin and from there followed the edge of slope and benches along the south bank of the avalanche chute to an area near the base of the chute. The break in slope on the north side of the chute was then examined for evidence of landforms suitable for prehistoric sites.

The valley of Taynton Creek was examined at the confluence and for a short distance downstream but was determined to be too steep to be suitable for occupation or use. The study area was exited along an existing horse trail which followed the contour on the valley wall east of the creek. The trail then dropped rapidly into the valley and crossed

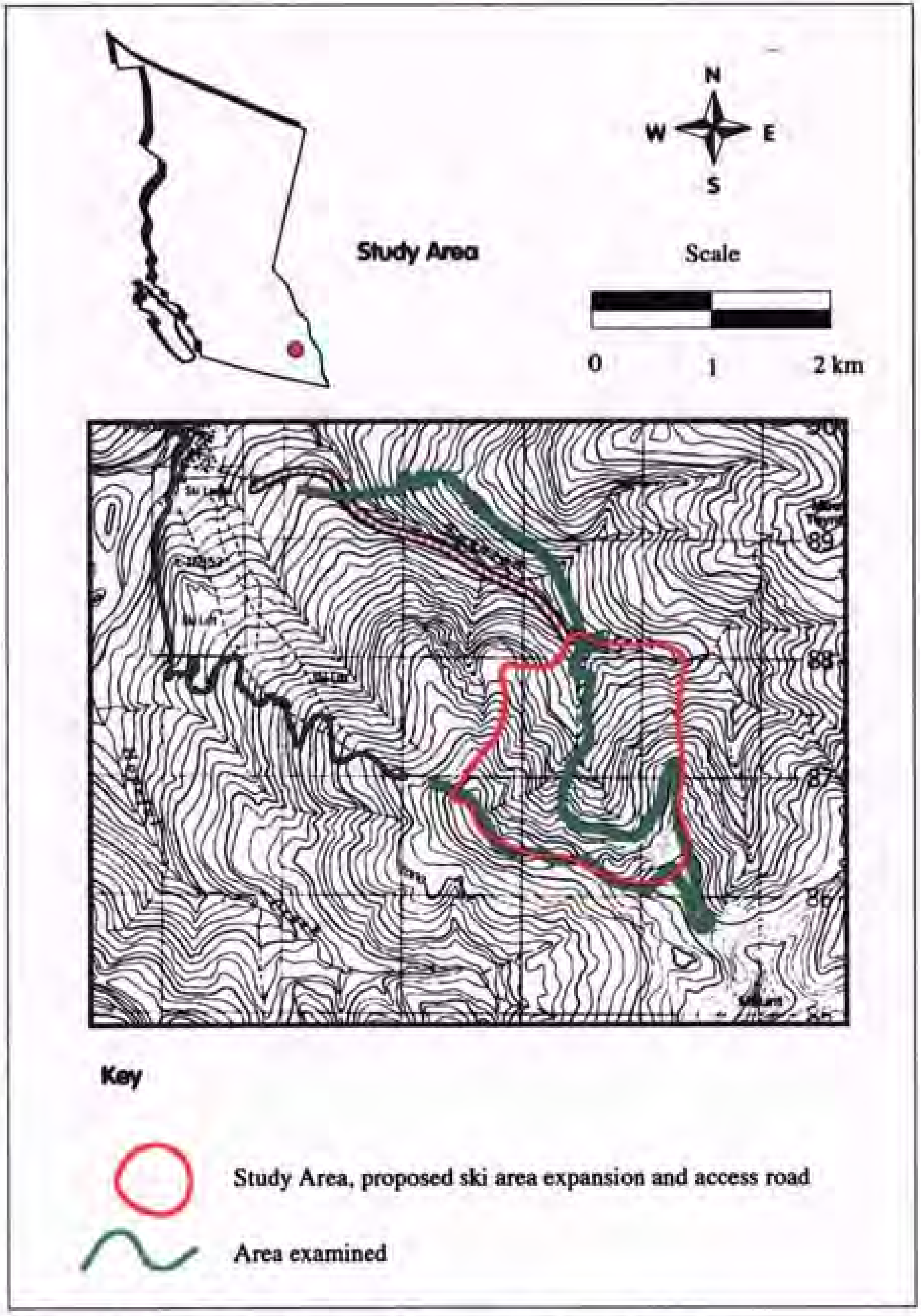

Figure 3. Area examined, proposed Panorama Ski Resort Expansion

Taynton Creek. The area where the trail crosses the creek was examined for areas of archaeological potential and then followed to its end near the base of an existing ski lift in the Panorama resort.

OBSERVATIONS

The crest of the ridge between the watersheds of Taynton and Hopeful creeks consists of gentle to moderate slopes and subalpine vegetation (Figure 4). Understory plants are limited. The surface in many places consists of a continuous cover of highly degraded grey shales. This provided excellent surface exposure. A trail is present along the crest.

The peak of the crest at the southwest corner of the study area is rounded and exhibits flat to gentle sloping surfaces (Figure 5). Vegetation is limited and Alpine-tundra in character. Highly degraded shales form a veneer everywhere across this surface. Surface exposures were excellent. The surface continues into a saddle southwest of the study area, which in turn is situated above a mapped lake. The area of the col was examined briefly for the presence of artifacts, shooting pits or other features as was the area of the peak.

The areas on the peak and in the col examined appear to have been minimally impacted by the last glaciation.

No archaeological features or artifacts were observed along the crest, in the col or on the peak. The area of the lake is clearly outside of the study area and was not examined.

Areas below the ridge along the south boundary consisted of felsenmeer changing to a stabilized slope downhill. The talus along the upper part of the bowl and at the base of cliffs appeared to consist of conglomerate containing rounded clasts of a white vein quartz (Figure 6).

No lithic material suitable for 'flint knapping' was observed on the talus slope.

The slope along the ridge which divides the basin offered little exposure. Notwithstanding the slope exhibited no localized bench features which would be suitable for camping. The drainage systems were observed to be clogged with shrubs and exhibited no areas of surface exposure nor areas suitable for campsite activities.

The valley walls along the lower reaches of the drainage just west of the confluence exhibited a break in slope between the moderately steep tree covered mountain side into the steep walled drainage channel. Gently sloping bench-like landforms were present east and south (upstream) of the confluence, but these lay outside of the study area. Downstream of the confluence, the valley walls range from moderately steep to very steep.

Figure 4. View northward along crest of ridge from peak at SW corner of the study area

Figure 6. View westward of top of peak at SW corner of study area

Figure 6. View northwestward of upper part of bowl illustrating cliff faces

No evidence of artifacts or cultural features was observed at the confluence or downstream in the vicinity of the confluence.

The Taynton creek drainage was not examined below the confluence but map data and observations from above the creek valley suggest that areas suitable for prehistoric activities were not present over much of its course. Flat to gently sloping lands occur only in the lower reaches of the valley. The proposed road along this portion of the study area would involve cutting of the side slope and would, therefore, not likely impact landforms suitable for prehistoric activities.

CONCLUSIONS AND RECOMMENDATIONS

Based on the background information available for the study area and in consideration of observations made in the course of a site visitation, it is our opinion that the potential for the presence of archaeological sites is moderate to low (Figure 7). Areas of moderate to low archaeological potential exist along the mountain crest between the Taynton and Hopeful creek drainages. Areas of moderate potential are associated with the col and the lake to the southwest of the col, both outside of the study area.

The scale of the proposed development must also be considered. Given the area of the proposed development, the scope of proposed developments is low. Areas proposed for development are generally of low archaeological potential; the avalance chute, the top and base of the chute and the side slope along the west bank of Taynton Creek.

In consideration of the above, we would not recommend that an Archaeological Impact Assessment be carried out of the study area.

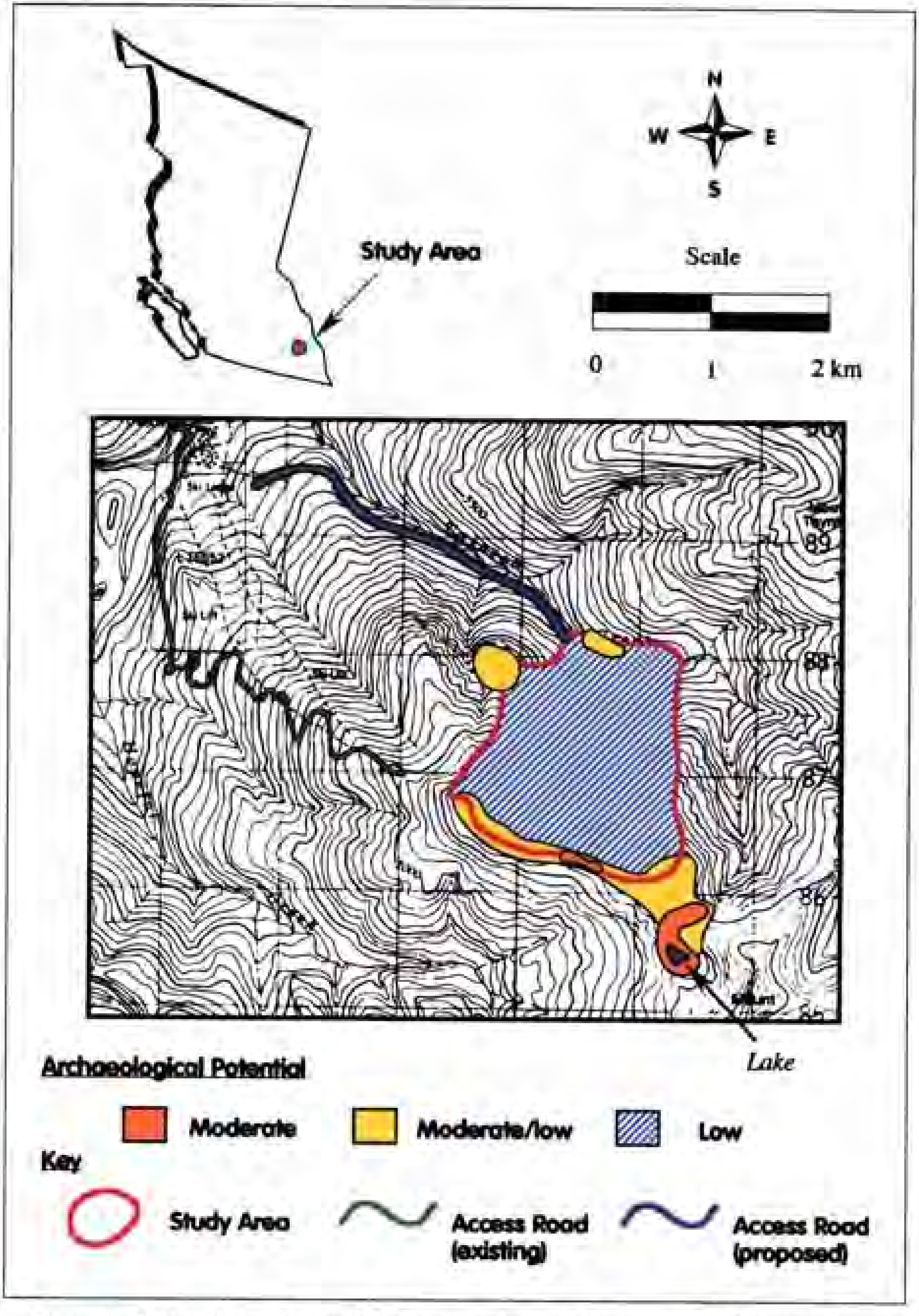

Figure 7. Archaeological potential of proposed area of Panorama Ski Expansion

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PANORAMA
MOUNTAIN VILLAGE

ARCHAEOLOGICAL

HERITAGE IMPACT ASSESSMENT OF THE PROPOSED PANORAMA RESORT GOLF COURSE

1998

INTRAWEST

OCT 3 1 1988

Box 25
Yahk, B.C. V0B 2P0
October 28, 1988

Mus Hadade
President,
Panorama Resort Ltd.
Box 7000,
Invermere, B.C.

Dear Mus,

Enclosed please find a report of the results of my reconnaissance of Panorama's proposed golf course. Even though the archaeological return of this endeavour was very limited, there is heritage potential there that will not be impaired by immediate construction of the golf course and which represents some future opportunities for interpretation. In addition, 'negative' land use evidence is also important in assessing the overall patterns of prehistoric activity in the region.

I have also enclosed an almost current curriculum vita, a copy of a recent article, and a copy of a paper I presented at an interpretation conference several years ago. In it I outline a proposal for the development of the Kootenay Region's outstanding heritage resources within the context of global tourism. The total development of the Kootenay Ecomuseum is projected over about twenty years and we have made some progress already on a variety of fronts. I have been very active in public interpretation of regional heritage and have taken the opportunity during several of my excavations to make them publicly accessible, something that is very popular. I have also taken the advantage of the recent times of fiscal 'restraint' to publish much of the scientific documentation of what will be interpreted for the general public, something I consider to be very important since a big part of the appeal of regional heritage is that it's real. We were also able to open the doors of the old mission building to the public this year with the creation of a history gallery in the chapel of the old St. Eugene's Mission school.

I must say that I find your enlightened attitude towards the environment and interest in heritage to be very gratifying, since I have had considerable prior frustration with such things as the destruction of a number of archaeological sites by developments at the Springs golf course and at Fairmont Hot Springs. Panorama has a great opportunity to play a major leadership role in developing and making accessible the regional heritage, although I'm not sure exactly how much archaeological evidence is in place there. Only a detailed archaeological reconnaissance would indicate that.

I look forward to meeting with you to discuss the potential for heritage resource development at Panorama and thank you for the opportunity already presented in evaluating your golf course. I learn something from every project I conduct and because I am devoted to this region as my home as well as my heritage, I can incorporate each project's experience into the corpus of knowledge I've already accumulated.

The big challenge is to share this knowledge with as many people as possible.

Yours sincerely,

Wayne

Wayne Choquette

HERITAGE IMPACT ASSESSMENT OF THE PROPOSED PANORAMA RESORT GOLF COURSE, TOBY CREEK VALLEY, B.C.

by

Wayne T. Choquette
Consultant Archaeologist

October 28, 1988

Yahk, B.C.

1. Introduction

This report presents the methods and results of the archaeological survey of a golf course proposed by Panorama Resort, Ltd. The field reconnaissance was carried out on October 14 and 17, 1988 by the writer, who acknowledges the assistance of Melanie McGillivry and Kathy Brown of the Invermere office of the B.C. Ministry of Forests and Lands in making available excellent air photo coverage of the project area.

2. Background

2.1 Biogeography

The locality consists of an area of bedrock outcrops mantled by glacial till situated at the confluence of Hopeful and Toby Creeks (Figure 1). The outcrops themselves are composed of conglomerate with quartzite clasts encased within a shaley sedimentary matrix. The bedrock strikes roughly north-south, perpendicular to the axis of the main valley and dips strongly, forming steep cliffs in several places. During the late Pleistocene, these outcrops were overridden by valley glaciation originating at the crest of the Purcell Mountains. A thick mantle of morainal debris was draped over the bedrock, creating a more gently undulating topography surrounding the bedrock which protrudes as knolls. Subsequent modification by running water has produced several minor channels and fine sediments have been deposited at lower elevations in small alluvial fans. Hopeful Creek built a larger alluvial fan of poorly stratified subangular gravels and sands in the southeast part of the locality. Hopeful and Toby creeks have downcut through the till, carving terraces to the south and west of the outcrops. This erosion has produced the presently plateau-like character of the landscape.

Situated as it is at the intersection of two valleys and having considerable relief and physiographic variability, the area of the proposed golf course has a broad range of topographic aspects. This is reflected in a relatively diverse vegetal cover. The accumulation of fine, till-derived sediments in channel bottoms and hollows has created areas of poor drainage and organic soils where labrador tea, mesophytic grasses, and scattered spruce occur. Deciduous vegetation occupies the riparian zone adjacent to the branches of Hopeful Creek. The elevated southeast-, south-, and west-facing slopes support open-canopy montane coniferous forest of lodgepole pine with a well-developed understory of pine grass, buffaloberry, wild rose, and oregon grape. Brunisolic soils occur in these areas. As solar exposure decreases with increasingly northerly aspect, the composition of the forest changes. North-facing slopes have closed canopy subalpine spruce-fir forests underlain by podsolic soils. This same relationship of open canopy montane forest on slopes exposed to the sun and closed canopy subalpine forest on shaded slopes holds for the surrounding valley walls. At higher elevations, the forest gives way to alpine grasslands.

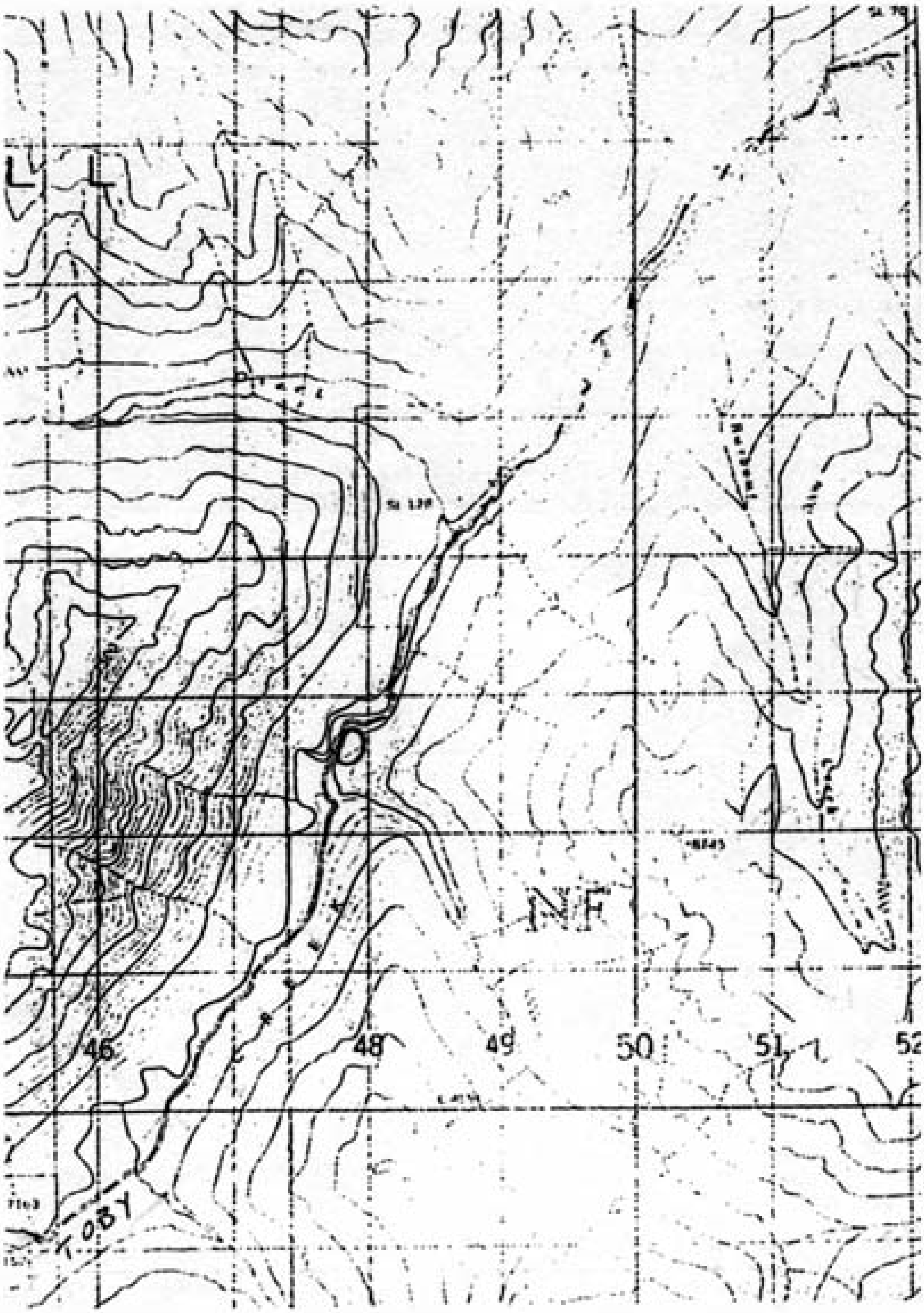

Figure 1. Location of study area. Scale: 1: 50.000.

The open canopy forests represent moderate to high quality ungulate range and elk droppings were observed at several places during this study. Similarly high quality ungulate range is also present on the surrounding south- and southwest-facing valley walls and the high elevation grasslands also represent seasonally important habitat range. Noteworthy also are packrat nests in small caves overlooking Hopeful Creek at the south end of the study area.

2.2 Cultural Context

The study area lies within the aboriginal territories of both the Kootenay and Kinbasket Shuswap people. The former are a linguistically and culturally distinct population who still reside in the region. The archaeological record and their own traditions indicate that the Kootenay have occupied the region that now bears their name since it became habitable after deglaciation more than 10,000 years ago. The Kootenay were nomadic hunter-gatherers who lived by exploiting a wide range of seasonally abundant game, fish, bird, and plant resources. In late prehistoric times, they were organized into a number of bands which coalesced at times into larger groups and fragmented at other times into smaller units of variable composition determined by the nature of the activity taking place. Flexibility in subsistence practices and social organization plus an intimate knowledge of the geological and biotic resources around them allowed the Kootenay to prosper throughout postglacial times in a region characterized by a very dynamic environment.

The Kinbasket Shuswap, on the other hand, are relatively recent arrivals. This group is named after Chief Kenpesket who, after making annual hunting forays into the upper Columbia River valley for many years, migrated there from the Thompson drainage around 1840 with 50-60 of his friends and relatives (Teit 1909, Borden 1956). The Kinbasket band were culturally allied with other speakers of the Salish language who were centred on the salmon fishery of the Fraser drainage. In earlier prehistoric times, the upper Columbia Valley was sporadically occupied by other Salish groups, whose presence and disappearance are probably related to climatically-induced fluctuations in the Columbia's salmon carrying capacity (Choquette 1985).

3. The Present Study

3.1 Methods

The entire area of the proposed golf course was surveyed by foot traverse, during which all subsurface exposures were examined. These included roads and trails, rodent backdirt, road and stream cutbanks, and tree throw.

A detailed examination of aerial photographs resulted in the targetting of several areas for more detailed inspection which included examination of soil profiles and sediment sequences, plus spot-trowelling through the duff layer and underlying postglacial sediments. One 50 cm square shovel test was excavated on a terrace on the south side of Hopeful Creek.

3.2 Results

No buried cultural deposits were found during the reconnaissance.

One possible artifact, a marginally retouched quartzite cobble spall (Figure 2), was surface collected from the western edge of a bulldozed road at a terrace margin near the southwest end of the study area. It was observed that some of the clasts in the conglomerate are of a quartzite suitable for manufacture into stone tools. While this object may be the result of bulldozer fracturing of one of these clasts after it had become incorporated into the glacial till, other pieces of this particular cobble were not observed nearby. In addition, the fractured surfaces are not fresh-looking; instead, they exhibit a similar amount of oxidized Bf horizon clay clinging to their surfaces as occurs on the cobble cortex.

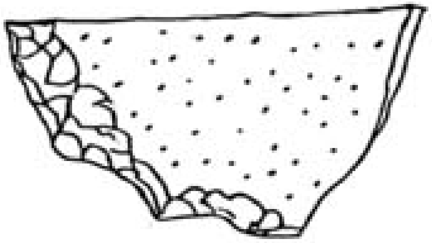

Figure 2. Marginally retouched quartzite spall fragment. (actual size)

4. Heritage Impact Assessment: Discussion and Recommendations

Toby Creek heads at two passes across the Purcell Mountains, Jumbo and Earl Grey, both of which provide direct access from the Rocky Mountain Trench to the north end of Kootenay Lake and from there via the Lardeau River valley to the Columbia River at the north end of Arrow Lake. This represents the most direct route of travel connecting high prehistoric population centres in the Rocky Mountain and Selkirk trenches with those in the Thompson River drainage. Borden (1956) suggested that this was the route taken by Kenpesket to gain access to the headwaters of the Columbia in 1844.

That at least the route between Kootenay Lake and the Rocky Mountain Trench was used in prehistoric times is indicated by finds of artifacts of Kootenay Argillite at sites near Stoddart Creek in Kootenay National Park (Choquette 1988). The source of this distinctive stone is near present-day Kaslo (Choquette 1981).

Panorama Resort is on this aboriginal travel route. Furthermore, it is situated where confluent valleys create a 'hole' in the mountains and where extensive southerly slopes and high elevation grasslands comprise good ungulate range. It is expectable that sites of prehistoric and protohistoric aboriginal activity should occur here. However, as no other potentially culturally modified objects were found besides the marginally retouched quartzite cobble spall, this object should be considered as an isolated find. It may have been a tool used for primary butchery of an ungulate prior to transport of selected portions of the carcass to a nearby camp.

There is one area of level west-facing, grassy terrace along the western edge of the proposed number 6 fairway that has some archaeological potential. Nothing cultural was observed in the subsurface exposures in the terrace's interior or along eroded sections of the terrace margin. However, there is a considerable expanse of undisturbed terrace margin here that could contain evidence of short-term human utilization in its surficial deposits, if such did occur. The plan of the golf course provided to the consultant shows the number 6 fairway in the interior of the terrace. It is recommended that this terrace margin be left in its present undisturbed condition and if any excavation or modification of the surficial deposits is undertaken, that this be monitored by a professional archaeologist who could salvage any buried cultural deposits that may be encountered.

No definite evidence was found of human use of any of the small caves and rockshelters at the base of the cliff at the south end of the study area, although the largest and most easterly cave did have what appeared to be smoke blackening on its roof. As mentioned earlier, several of these overhangs contain packrat nests, which represent a potential repository of evidence of changes in vegetation in this locality through time. These animals collect a 'sample' of the surrounding vegetation and store it in caves and rockshelters, the dry, sheltered microenvironments of which have been known to preserve such palaeoenvironmental records for centuries, and even millenia. For example, alder twigs from a rat's nest in a cave above Stanley Creek in Kootenay National Park yielded a radiocarbon date of 1030 ± 120 before present (GX-6563) (Ballard 1980). Since the caves in the study area were apparently carved by Hopeful or Toby creek during downcutting, the deposits in the rat's nests could contain material that could help to date the evolution of the local landscape as well as providing a record of some of its vegetation changes. At present, they are undisturbed. However, evidence (part of a camera case) was found of recreational use of this very scenic part of the Panorama Resort so it is well to bear in mind that these rats' nests are natural heritage resources that are worthy of protection, as well as having some very interesting interpretive potential.

5. Conclusion

While sparse, but equivocal evidence of prehistoric human presence was found during the present study, the Panorama golf course as presently proposed is not a threat to heritage resources. Panorama Resort, Ltd. is to be commended for their responsibility as stewards of these resources.

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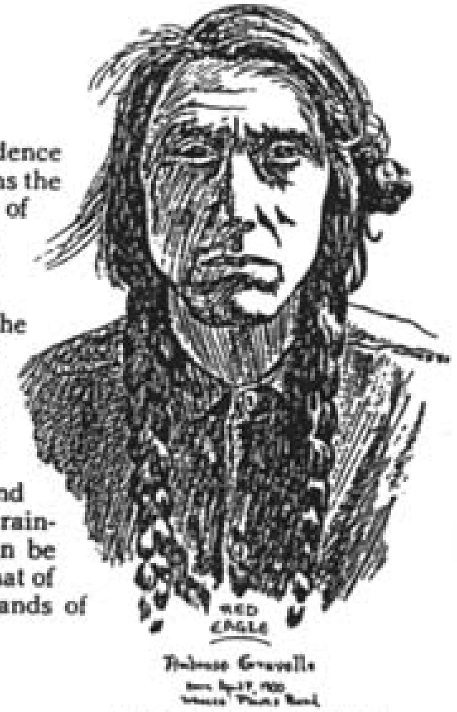
KOOTENAY MOSAIC: THE FIRST PEOPLE

by Wayne Choquette

THE AREA KNOWN as the Kootenay Region is a naturalist's paradise. Evidence of the story of our evolving planet is all around—in the bedrock that forms the region's towering mountains and in the materials found in the depths of lakes. Some rocks contain fossilized representatives of almost the entire evolutionary sequence of life. Others record volcanic outpourings and mountain-building upheavals of long ago times.

Later, the great glaciers scoured the valleys and sheared off all but the highest peaks, lingering in slow melt to form the basins in which the Arrow, Slocan, Kootenay, Duncan and Moyie lakes were born. In postglacial times, the rivers have done their work, carving the landscape into terraces and carrying loads of silt into the lakes to form fertile deltalands.

The richness of the land is expressed everywhere in an abundance and diversity of plants and wildlife. Some valleys are cloaked with coastal rainforests of cedar and hemlock, while over the next mountain range can be found cactus and sagebrush. The diversity in vegetation is paralleled by that of wildlife—from the big game species of the East Kootenay to the thousands of winged visitors that come annually to the Creston area.



ILLUSTRATIONS BY BOB INWOOD

THE STORY OF human presence in this region reflects the dynamic unfolding of the living tapestry that cloaks this rugged terrain. This story is one of contrasting adaptive strategies—the different ways people found to live here. It begins early in postglacial time, more than 10,000 years ago, when the lakes were even larger and expanses of tundra grasslands blanketed the mountainsides.

Into this new land came the ancestors of today's Kootenay Indians, from the drying lakes to the south where they had lived for hundreds of years as hunters and gatherers while northern North America lay locked in ice. These first inhabitants left their traces at camps and activity areas: chips of stone and large spearpoints, now found deep in forests which once were open range for caribou and mammoths. Life was not easy, but the people prospered and gradually they spread throughout the region.

We will come back to these hardy and industrious people, but first, let's look at a very different kind of existence, one made possible by an economic focus on the yearly Pacific salmon runs.

Salmon Fishers

PREHISTORY

SOME TIME AFTER the glaciers retreated 10,000 years ago, the salmon began to ascend the upper Columbia River. At first, they got as far as what is now Kootenay Lake, but the postglacial wearing-down of the landscape eventually exposed the falls on the lower Kootenay River below today's Nelson. The falls blocked the salmon's ascent, trapping some in Kootenay

Lake where they evolved into the Kokanee or landlocked salmon. Below these falls, the salmon continued to run into the Slocan Valley, and into the Arrow Lakes and beyond to the headwaters of the Columbia.

The people who arrived in the area 9,000 years ago had a technology specialized to exploit aquatic resources, like salmon. These people can be traced archaeologically by the kind of stone they used and by the distribution of their "microblade" technology, a highly specialized industry which produced slim razors of stone used as knife and harpoon blades. Dates for this microblade technology indicate that its bearers entered North America via the Bering land bridge at the end of the last ice age.

Some of these people centred themselves at Kettle Falls, in present-day Washington, and co-existed with the ancestors of the Kootenays for many centuries. But at the peak of a long drought that began 8,300 years ago, the Columbia River fishery was no longer able to sustain their way of life. We don't know what happened to these people. Did they die out? Did they leave? Or were they absorbed into the Kootenay Nation, who continued to survive by maintaining its diversified economic base?

When the drought ended and the climate began to cool 6,000 years ago, the rivers grew larger and salmon increased in abundance. The specialized human focus on salmon was renewed again and again over the next 6,000 years as successive waves of people moved in. But this focus appears to have always been restricted by the effects of climatic fluctuations on the Columbia River's flow.

The salmon resource is a fragile one, depending on stable conditions in a river whose source is glacial meltwater. At times, the cooling was sufficient to promote glacial conditions—in fact, scientists call the last 5,000 years the "Neoglacial" or new glaciation. The last 350 years were so severe that they've been called the "Little Ice Age." Whenever the Columbia's waters were locked up in ice or filled with silt from melting glaciers, the salmon declined.

By 3,500-4,000 years ago, a more efficient technology and social organization had been developed which allowed the catching, processing and storage of enough salmon to allow the people to live in relatively permanent settlements of underground houses near the major fishing stations. The remains of these abandoned pithouses are mute testimony to the salmon specialization along the upper Columbia River. Some of them have been excavated by archaeologists and their contents reveal that the Arrow Lakes area and the falls on the lower Kootenay River were prehistoric human population centres 3,000-4,000 years ago.

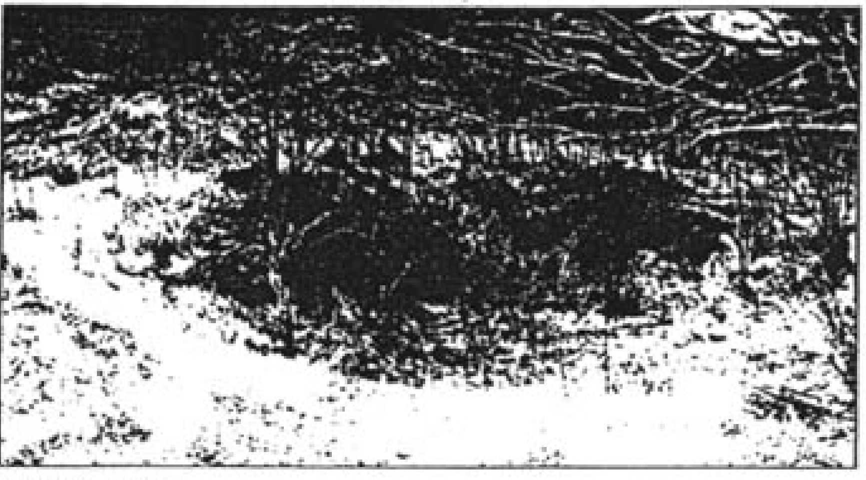


PHOTO: WAYNE CHOQUETTE

Site of a pithouse.

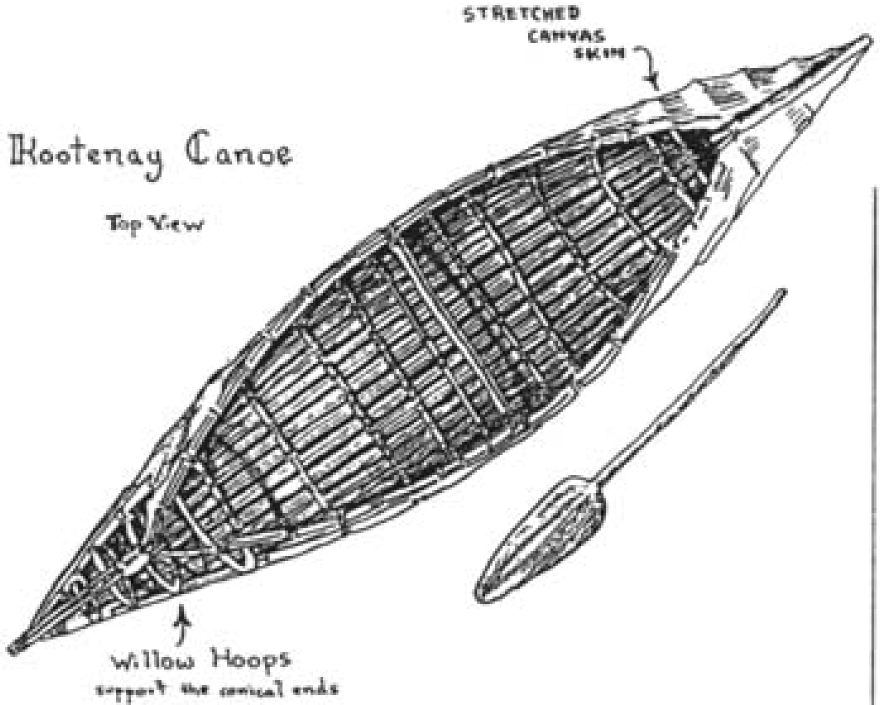
However, as the flow of the Columbia became increasingly locked up in ice, some of the people migrated from the region; their descendants are the Kalispel, Pend d'Oreille and Flathead People. Those who remained shifted their focus further downriver to Kettle Falls. Their descendants are called the Colville Indians in the historic literature; they spoke a variant of the Okanagan language, related to other Salish languages.

An offshoot of this group, the Lakes Salish Indians, expanded back into the West Kootenay when the salmon fishery recovered more than 1,000 years ago but the glaciation of the Little Ice Age again disrupted their economy.

EUROPEAN CONTACT

THE VITALITY OF the Lakes' culture was dealt a further blow when their population was decimated by epidemic diseases such as smallpox. By the time of contact with Europeans in the early 1800s, the Lakes Indians comprised several small bands who were focussed in summer at the Kettle Falls salmon fishery but spent much of the rest of the year dispersed along the Columbia River to the north. Attempts to have reserves established for the Lakes Indians in Canada met with little assistance from the governments of the time and most of the Lakes People were obliged to abandon their lands and settle on the Colville Reservation in the U.S.

The Columbia Valley in the Rocky Mountain Trench to the northeast witnessed similar population booms and busts due to the salmon fishery's fragility. The arrival of the Kinbasket Shuswap at the end of the Little Ice Age represents a repetition of a dynamic pattern thousands of years old, but we know next to nothing about the former occupants of the hundreds of abandoned pithouses between Canal Flats and Golden. The final chapter in this story of the salmon fishery was its loss to Canada by the construction of the Grand Coulee Dam in Washington.



The Kootenay People

PREHISTORY

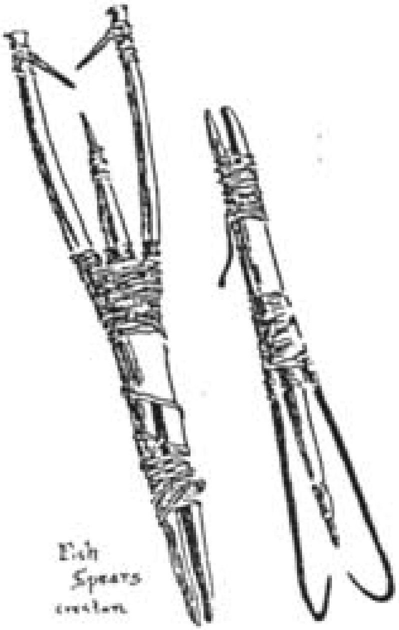
RETURNING NOW TO the Kootenay People, we find that their prehistory is just as dynamic, but their strategy for survival has been different. The key has been flexibility: they responded to changes in the distribution of nature's resources by diversifying their economy and by rearranging the patterns of their settlement across the landscape. Instead of leaving or dying out, they found ways of adapting their lifestyle and technology that allowed them to stay in the region that now bears their name.

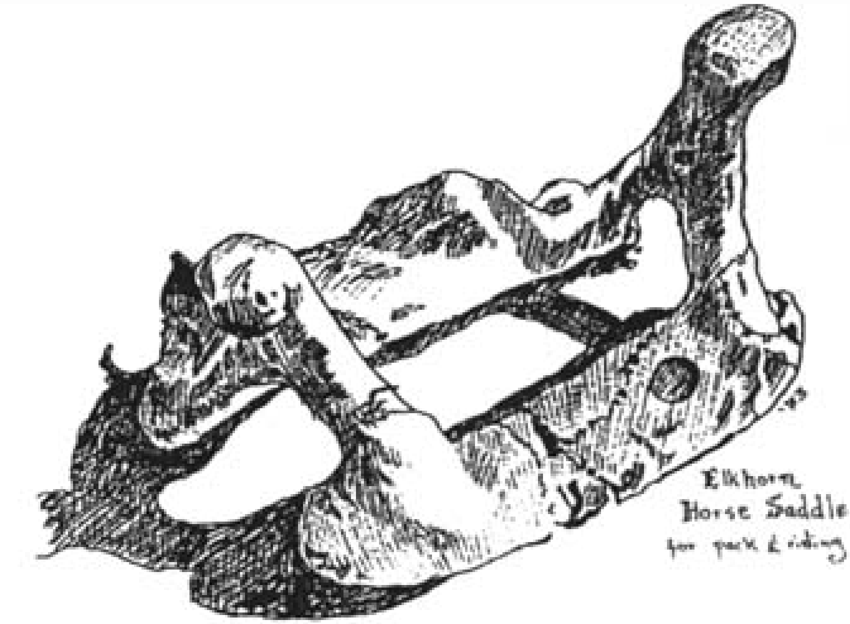
When the climate became warm enough 10,000 years ago, coniferous forests expanded into the tundra grasslands, and the evolution of today's natural communities was underway. Conditions were drier than they are today between 8,300 and 7,000 years ago. Fires were frequent, and the forests were more open.

While the salmon specialists were suffering the loss of their staple resource, the Kootenay People were still making a successful living by hunting and gathering. They followed a seasonal cycle between winter camps in the valley bottoms and summer pastures in the mountains. Ancient rock cairns on alpine ridges mark drive lanes used in communal sheep hunts. The knowledge of landscape use gained here may have been applied later in the invention of large bison jumps such as Alberta's Head-Smashed-In. The mountainsides are also dotted with mine shafts tunnelled thousands of years ago into tourmalinite, the hardest stone in Canada.

By 6,000 years ago, the westerly winds had begun to sweep regularly across the region, bringing the ocean's moisture to the mountainsides. Game populations west of the Purcell Mountains declined, but the increased available moisture created new habitats for fish and waterfowl. Over succeeding millenia, the people living there adapted their lifestyle to the changing conditions, and broadened their economic base. They developed a distinctive style of canoe that provided better access to the resources of the rivers, lakes and marshlands. New ways were invented for securing the abundant useful and edible natural products that were found all around them.

Within the last 2,000 years, the great delta at the south end of Kootenay Lake became a major focus for the Lower Kootenay People's livelihood as the river began a seasonal rise and fall that created a natural fishtrap





90 km long. Imagine being able to catch a fish longer than your canoe, with just a line! In spring and fall, the same area attracted thousands of ducks and geese. The Kootenay People developed special social institutions to ensure the fair and sustainable distribution of the harvest they reaped through the use of traps, nets and decoys, all skillfully made from locally available plant materials.

To the east in the Rocky Mountain Trench, hunting continued to be the most important economic activity, but the people did not ignore the increased bounty that the Maritime climatic influence added to their land. Evidence of fishing and plant-gathering becomes more common in the archaeological record after 6,000 years ago. The evolution of the region's ecology continued its trend towards increasing diversity and so did the cultural adaptation of the local residents. The environmental contrast between the moist West Kootenay and the semi-arid East Kootenay is reflected in the cultural divergence between the Upper and Lower Kootenay People, a distinction that began to emerge some 2,000 years ago.

EUROPEAN CONTACT

THE KOOTENAY, TOO, suffered the disastrous effects of the diseases that accompanied the Europeans' crossing of the Atlantic. The Plains Kootenay, who had lived year-round in the eastern foothills of the Rocky Mountains in present-day Alberta and Montana, were reduced by epidemics to a surviving few who crossed the mountains to join their relatives west of the Continental Divide. This is undoubtedly the source of the modern belief that the Kootenay were originally a Plains people and are relatively recent arrivals in the Kootenay Region. As we have seen, however, the archaeological record indicates that they have actually inhabited the Kootenay River drainage area since it was freed from the glaciers' icy grip more than 11,000 years ago. The word Kootenay itself derives from the name of these Plains Kootenay, who were called the kTuna.xa by the Peigan (Blackfoot) and who were the first Kootenay People to be encountered by the light-skinned strangers from the east.

With the exception of the epidemics, the impact of the arrival of Western European culture was not disruptive at first (*see following article, ed.*). A major contribution was horses. They are actually indigenous to North America, but had become extinct 10,000 years ago and were reintroduced by the Spaniards in the 16th century. The native population was quick to make use of these new animals, which spread northward through trade and theft, reaching the Kootenays via the Flathead Indians around 1730.

Horses made greater trade and communication possible and resulted in increases in the size of individual dwellings and settlements. Social organization became more complex. The influence of horses on the Indians' lifestyle is a significant chapter in North American history that has yet to be completely written. It is fascinating to speculate on the cultural advances that might have been made had the rest of European influence not overtaken the North American natives.

The 19th century witnessed the invasion of traditional Kootenay territory by successive waves of fur traders, missionaries and prospectors. As was their custom, the Kootenay shared the wealth of their lands. Explorers such as David Thompson were saved from starvation more than once by receiving donations of fish and vegetable foods. The early contacts were thus characterized by friendship and mutual respect. The Kootenay became very productive fur trappers and, under the influence of the traders, they began to settle down. The records of the Hudson's Bay Company show that for a generation, the Kootenay operated a number of highly successful farms, producing potatoes, grain and dairy cattle.

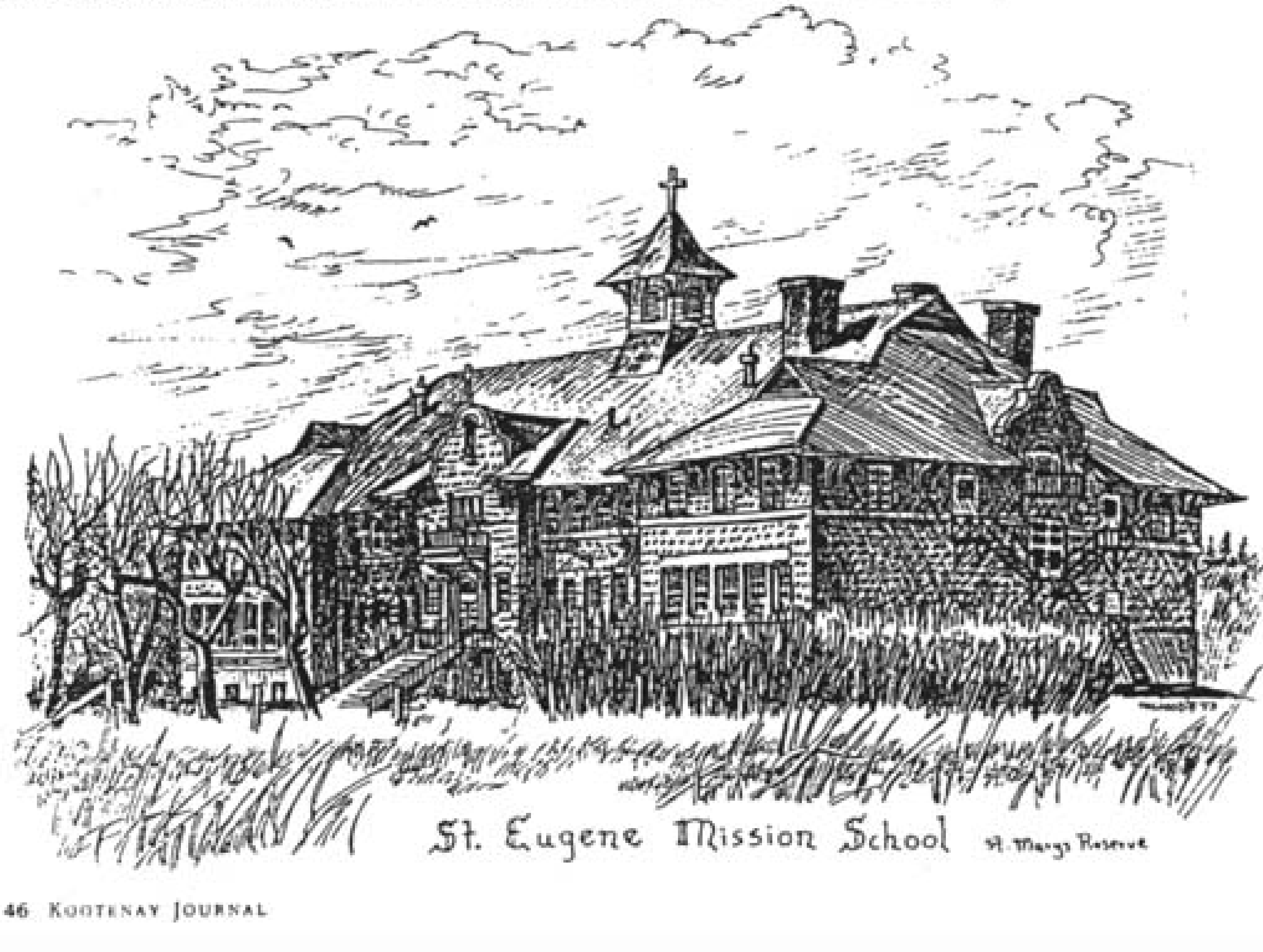
Later European arrivals were not so supportive of native culture. The missionaries were intent on "civilizing the savages" and the miners just wanted wealth. It was in the best interests of both to have the Indians under control and so reservations at Tobacco Plains and near Windermere, Invermere, Creston and Cranbrook were created in 1887.

The St. Eugene Mission was established by the Oblate order of the Roman Catholic Church on the St. Mary River (near Cranbrook) in 1874. The two-story log building constructed at that time served at first as a residence and later as a hospital. A log church was built next and was used until it was replaced in 1897, when both a new hospital and a new church were constructed.

This "building boom" was made possible in part by the discovery of the St. Eugene orebody, which gave Cominco its start. The find was made in 1893 by Pierre, a Kootenay Indian who brought news of his discovery to Father Coccola at the St. Eugene Mission. For his discovery, Pierre received $300 and a new frame house. Father Coccola sold the claim to James Cronin, a mining promoter, for $12,000 and used the money to construct a church at Moyie and the beautiful St. Eugene Church which still graces the mission site today. Cronin in turn sold his share for half a million dollars and the mine that was subsequently developed produced $10 million in its first 10 years of operation.

Interestingly enough, the name of the discoverer of the St. Eugene orebody was Pierre, French for "stone," but we shouldn't be surprised that the Kootenay People were so well versed in the region's geology. They had been successful prospectors and miners for thousands of years, making use of tourmalinite, chert and other hard stone for tools, and iron oxide for pigment used in the paintings still found today on rock faces throughout the region. With the infusion of capital, the St. Eugene Mission became a large self-supporting complex, even producing and milling its own grain. In 1912, the Federal Government constructed a large residential school there which was run by the Oblates until 1970.

Another significant development was the Oregon Treaty of 1846 which extended the Canada – U.S. boundary along the 49th parallel from the Rocky Mountains to the Pacific Ocean. This line ran right through the middle of the land on which the Kootenay People had lived and travelled for thousands of years, and it split families between the two newly-created countries. Canadian Kootenay Indians still travel frequently to visit and participate in cultural events with their relatives in Idaho and Montana. Every year the courts see Kootenay Indians defending themselves for the "crime" of entering their reserve at Tobacco Plains after midnight when the port of entry on the highway has closed.



PRESENT TIME

ONE SHOULD NOT expect cultures that survived thousands of years of environmental change to vanish without a trace, although this has been known to happen elsewhere in the world. In the Kootenays, however, remnants of both the Salish and Kootenay cultures survive and even show promising signs of growth.

The Kinbasket Shuswap band (Salish people) fared a bit better than the Lakes People. Today they number about 150 and occupy a 900-hectare reserve south of Radium, where they operate a profitable sand and gravel business and obtain additional revenue through land leases. The Shuswap band maintain cultural ties with their relatives in the Thompson River drainage and are allied both politically and socially with their Kootenay neighbours. They are one of five bands that comprise the Kootenay Indian Area Council.

Each band in the Kootenay Indian Area Council is independently governed via a chief and two to four councillors, elected for terms of two to four years. The Area Council is an administrative body that promotes the political and developmental interests of its membership. The Council also provides services that include financial and agricultural advice, community planning, and alcohol and drug abuse counselling.

Besides the Shuswap band, the Area Council consists of the St. Mary's, Columbia Lakes, Tobacco Plains and Lower Kootenay bands. The St. Mary's band are centred near Cranbrook. The band has a population of 152 and a total land base of 8,800 hectares including a 240-hectare cattle ranch. They are also involved in forestry, Christmas tree production and fur trapping. The Columbia Lake band, population 170, occupy a reserve of approximately 3,500 hectares near Windermere. Christmas tree production is a primary economic activity here; other enterprises include ranching and a trail ride business.

The Tobacco Plains band at Grasmere number 97 and their land base is 4,200 hectares. Current business ventures include a restaurant and gasoline bar, a campground and a Christmas tree operation. The Lower Kootenay band occupy 2,400 hectares south of Creston and have a population of 120. They are currently negotiating a specific land claim for reserve lands "cut off" in 1908. Lower Kootenay band members operate a shoe repair and crafts shop and a thriving berry farm on the reserve, and earn additional revenue through land leases, cultivation and grazing. They operate their own school which services grades one through 12.

The Kootenay People are currently moving towards self-government with the dignity they have always maintained as one of the world's distinctive and independent cultural groups. ☐

WAYNE CHOQUETTE *is an archaeologist with 20 years experience in the Upper Columbia River. He's a specialist in Kootenay prehistory.*

DEVELOPING A KOOTENAY ECOMUSEUM

by

Wayne Choquette

Kootenay Cultural Heritage Centre

presented at

The First World Congress on Heritage
Presentation and Interpretation

The Banff Centre

October 3, 1985

Background

Interest in the past as a key to understanding the present and the future has reached unprecedented levels in recent years. The past decade has seen enactment of protective legislation such as the American National Archaeological and Historic Preservation Act, the Canadian Cultural Property Export Act, and the British Columbia Heritage Conservation Act. Recognition of significant Heritage values has lead to the designation of World Heritage Sites by UNESCO.

In Canada, mitigation of anticipated loss of archaeological values has preceded some developments, but somewhat greater emphasis to date has been placed on architectural Heritage. The Heritage Canada Foundation, established with a $12 million endowment, and the B.C. Heritage Trust, supported by lottery funds, have made great progress in the preservation of the built environment. Their respective Main Street and Heritage Area Revitalization Programs represent the vanguard of an approach which emphasizes the importance of the context of Heritage structures and objects as a key to greater appreciation of their value. The growing awareness of the tremendous cultural and educational resource represented by the preservation of Heritage values and provision of public access to the Heritage experience is well demonstrated by the publicity associated with the National Parks Centenary this year and the Heritage for Tomorrow Canadian Assembly on National Parks and Protected Areas. The First World Congress on Heritage Interpretation and Presentation provides a clear indication of the status now held by the Heritage movement.

Museums, of course, have been with us for centuries and continue today to be important cultural centres. Increasing awareness of the interrelationship between natural and cultural heritage has given rise to a new kind of Heritage experience, the Ecomuseum. Jacques Dalibard, the Executive Director of Heritage Canada Foundation, writes in the October-November 1984 issue of Canadian Heritage Magazine:

> An ecomuseum describes an area in which residents decide jointly on the significance of local Heritage resources - interpretation is provided using some of the devices employed by museologists: research and collection of artifacts, displays in well-travelled public spaces, structured presentations on aspects of local heritage. Ecomuseums mark the beginning of a new stage in our understanding of the potential of Canada's Heritage resources.

Dalibard focusses on Historic residential/industrial districts and, indeed, the greatest advances in Ecomuseum development have been in conjunction with architectural preservation and restoration projects. In its truest sense, though, an Ecomuseum is the interpretation through museological devices of the relationships between culture and nature incorporating the dimension of time. As such, the Kootenay Region represents an ideal setting for an ecomuseum.

The Kootenay Ecomuseum

The region drained by the Kootenay River is notable forits scenic beauty, and is one of the most environmentally diverse areasin Canada. The geologic record spans most of known time and the rocks bear dramatic witness to such major events as the evolution of lifeforms, mountain building, and glaciation. The Purcell Mountains bisect the region, forming a climatic divide between dominance by Maritime and Continental influences. To the west are deep, densely forested valleys containing long narrow lakes, the remnants of extensive late Pleistocene proglacial water bodies. In the southern Purcell Trench is the forty mile long, seasonally inundated freshwater "littoral zone" of the Creston Flats. The broad till plain of the Rocky Mountain Trench lies on the leeward side of the Purcells. Here is a semi-arid parkland that contains many now-extinct water courses. The extremes characteristic of continentality are responsible for a rangeof vegetation from cactus to tundra, the latter covering extensive areas. A distinctive xeric community, thought to be a relic of the Pleistocene steppe-tundra, survives as high elevation islands on peaks and ridges in the southern Purcells due to the dessicating influence ofa subsidence inversion of Pacific subtropical anticyclone origin.

Obviously a tremendous diversity of vegetal resources grows here, but the topography of such rugged terrain restricts the occurrance of most species to less than super- abundance. Similarly, faunal species are not characterized by such huge populations as were present in the salmon rivers of the Plateau or on the great bison plains tothe east. This is not to say that biomass was lower, however: the region's world ranking game ranges have been likened to the Serengeti. An arm of the Pacific Flyway extends over both the Purcell and Rocky Mountain trenches, and the abundant migratory waterfowl population has earned the Creston vicinity the name "Valley of the Swans". Pacific salmon ascended the Kootenay River only a relatively short distancebut they ran up the Columbia River to within 15 km of the Kootenay's headwaters. A variety of other native fishes are present including trout, Kokanee (landlocked salmon), charr, whitefish, cod, and sturgeon. World record rainbow trout have been caught in Kootenay Lake.

The conversion of such ecological diversity into biomass yields figures that contradict certain historical and anthropological accounts purporting that resources here were somehow 'marginal' and incapable of supporting aboriginal populations. An alternative and more ecologically justifiable perspective would view the existence of such diversity as highly desirable to people employing a generalized hunting and gathering subsistence strategy since vulnerability to failures or pronounced changes in fish and game migrations would be buffered by the existence of ample backup resources. While neighbouring areas offered great rewards to specialist economies, they demanded much greater subservience to the vagaries of resource fluctuations. Indeed, archaeological research at bison jumps east of the Rockies and at the second most important fishery on the Columbia River indicate~~s~~ major cultural hiatuses and replacements, ~~while~~ On the other hand, the archaeological record of the Kootenay region extends back as early as, or even earlier than that of any other part of the Province and demonstrates remarkable continuity for a lifeway that may have its roots in the generalized economy of the late Pleistocene pluvial lakes cultures of the Intermontane basins to the south.

At the time of historic contact, this diverse environment was inhabited by a distinctive and unique cultural group who have come to be called the Kootenay People. Their language is not closely related to any other, and certain unique aspects of their religion, folklore, social organization, and technology also indicate that they have lived in relative isolation for a great span of time. Linguistic, ethnohistoric, and archaeological evidence all point to the conclusion that the neighboring Salish, Algonkian, Assiniboine, and Athapaskan groups are relative newcomers to this area compared to the Kootenay.

The prehistoric Kootenay (or Kutenai as they are known in the ethnographic literature) were completely self-sufficient, living by hunting, fishing, fowling, and the gathering of plant foods. The degree of intimacy of adaptation to diversity of natural resources is provided by the language which has names for more than forty different edible roots alone, while the hunting methods employed were specific not only to the prey species but also to particular topographic situations and weather patterns. While their nomadic lifeway was not compatible with a high level of development of material art or architecture,the ideal of craft was highly realized. Kootenay technology included a diverse range of industries and their products were of very high quality. Archaeological studies show that the Kootenay were skilled mineral prospectors. They located bedrock sources of superlative tool stock, including the hardest stone in Canada, and prehistoric mine shafts abandoned after thousands of years of use are among the numerous outstanding Heritage sites that still remain today. Several of the most productive historic mines in the region, including the St. Eugene which gave Cominco its start, were developed as a result of mineral occurrances reported by the Kootenays to missionaries and White prospectors in the latter half of the last century. The Kootenay are known in the historic literature for their honesty and spirituality, and for their sense of humour. They have a rich and distinctive folklore which includes an origin myth and a unique Culture Hero. Many of the features of the regional landscape figure in their myths and legends. The Kootenay lifeway reflected a very long-standing adaptation to the distribution of natural resources in this fascinating part of the world, and an Ecomuseum represents an incomparable medium for interpreting the natural and cultural Heritage of the Kootenay Region.

In the past, the limited development of native architecture and material arts resulted in a de-emphasis on the region's Heritage resources within the framework of the traditional museums approach. This is probably the most significant historical factor responsible for the absence of a major museum in a region whose seasonal tourist population rivals that of its year round inhabitants. However, when one considers the significance of the lengthy record of continuous cultural adaptation to a dynamic and challenging mountain environment, much of the evidence of which still exists in place, the outstanding natural beauty of the region, and the fact that a tourist market already exists here, the concept of an Ecomuseum seems tailor-made. The numerous recreational opportunities and the extensive vehicle access disperse tourists throughout the region during most of the year. The regional geology has structured the highway system so that the only paved route between the East and West Kootenays passes through Cranbrook; this highway is also a major route to the U.S. As conceived of here, an Ecomuseum centred at Cranbrook but articulating with interpretive foci throughout the region represents an unparallelled opportunity for providing a high-quality cultural experience which would enhance visitor appreciation of existing attractions instead of competing with them.

Themes identified and developed on a broad, regional level at the central repository would be more fully interpreted on tape cassettes and pamphlets, and at on-site displays which would focus attention on the Heritage resources in their natural settings. Visits to the Creston Valley Wildlife Management Area, North Star Mountain, Fairmont Hot Springs, or Fort Steele Historic Park, to name just a few destinations, would be greatly enhanced by increased awareness and knowledge of the surroundings developed via the Ecomuseum's interpretive programs. Heritage resource appreciation within the Ecomuseum framework can range from what can be observed from a car or at a stop of interest to several hour excursions to selected locales and visits to the Ecomuseum central galleries or to displays at local museums and resorts. For those who desire a more profound Heritage experience, collections and archival materials will be accessible at the central repository, while guided archaeological tours modelled after existing hunting operations could provide the ultimate "hands-on" experience foreseen to have great appeal to a discerning, educated, world-wide clientele. The consistently enthusiastic response that has greeted public interpretive presentations and the large number of visitors to archaeological excavations conducted in the region are indications of a tremendous potential for enhancing visitors' holidays through Heritage appreciation.

Clearly the potential for development on a regional scale is great. A major advantage is that the "structure" of a Kootenay Ecomuseum (presented schematically in Figure 1) is compatible with the distribution of significant Heritage resources as well as with already-established patterns of tourist mobility and dispersal. By networking with present tourist foci, the Ecomuseum interpretive programs and facilities will reach tourists dispersed throughout the region (the present pattern) while at the same time attracting additional visitors from outside the region. The development of an Ecomuseum has a very high potential for regional economic enhancement in terms of the direct and spin-off benefits of tourist industry growth. For example, the Cranbrook area at present lacks significant drawing attractions to change visitation patterns from single day

KOOTENAY ECOMUSEUM INTERPRETIVE FRAMEWORK

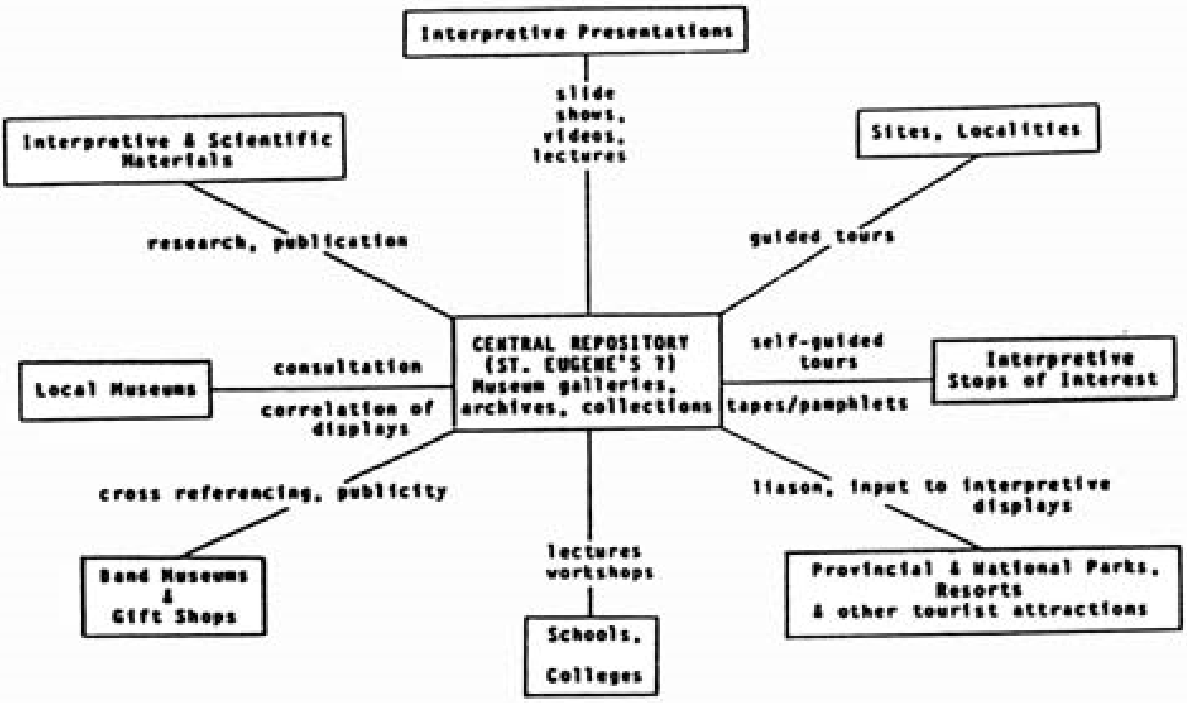


Figure 1.

transient to multiple day excursive (a series of excursions from a temporary base). There already exists at Cranbrook an ideal building to serve as a central repository and interpretive centre. The St. Eugene mission school is located on the St. Mary's Reserve outside Cranbrook on the old airport road. Built in 1912, it is a masonry structure of some 90,000 square feet that served as a Catholic residential school until 1970. A study conducted by Public Works Canada in March 1983 found reuse of the building to be entirely feasible. In addition to its ample space and certain facilities already in place that make it ideal for a museum and cultural centre, the building itself stands as a monument to segments of both Indian and non-Indian history.

The Heritage resources of the Kootenay Region, then, are of world-class significance and, if developed appropriately, can be as significant a factor in attracting visitors as the existing tourist facilities. The Kootenay Ecomuseum represents an avenue of minimal impact enhancement and expansion of the tourism industry, widely recognized as being a major component of the future economy as primary resource extraction declines.

The Ecomuseum and Heritage Resource Management

The outstanding natural Heritage values of the Kootenay Region were recognized some time ago and a number of natural preserves have been set aside. Kootenay, Yoho, Glacier, and Mount Revelstoke National Parks contain large areas of pristine mountain terrain while a larger number of Provincial Parks and park reserves are scattered throughout the region. These latter range from just a few hectares to areas rivalling the size of the National Parks and occupy a broad range of environmental settings. Several ecological reserves have been created to preserve certain other areas having distinctive ecologies and the Kootenay Wildlife Heritage Fund and the Creston Valley Wildlife Management Area protect much significant habitat as well.

Cultural heritage resources have not fared as well. In spite of being nominally protected by law, archaeological and historic sites have not received sufficient attention by the Federal or Provincial governments to ensure their continued existence. Government fiscal policies have seen fit to relegate Heritage preservation to a very low priority. Indeed, I am struck by the similarity in the level of government support for Heritage values in British Columbia compared to "Third

World" countries as indicated by speakers at this congress. The overlap of Heritage sites with private lands is also great and their numbers are constantly diminishing due to erosion and especially due to modern land use practices. Management of these resources from a distance has not proven successful and it must be concluded that new measures be developed to more effectively preserve Heritage sites. Time is of the essence, for if the present rate of Heritage site attrition is not reduced, we will be impoverished of this resource before its significance is widely recognized as being more than ideological or aesthetic. By this is meant that, as has been discussed previously, Heritage resources can benefit the entire community through tourism but this will hardly be possible if the Heritage resource base has already been destroyed. Heritage resources are by their very nature non-renewable.

The concept of an Ecomuseum provides a framework within which Heritage resources can be more effectively managed. Previously, Heritage sites have been treated primarily as pieces of land whose future was determined on the basis of the economic priorities of the competing land uses. In this context, land use conflicts with Heritage resources are inevitable and almost always Heritage values have suffered because of the difficulty in evaluating them against the supposedly more important concerns of economic development. It would of course be wonderful if these sites could be saved because of their intrinsic worth, but in these recession-plagued times it seems that everything has to be valued in monetary terms to be considered worthy of attention. An alternate approach is possible within the context of an Ecomuseum. Heritage sites are important educational facilities as well as being economically valuable resources to the tourist industry. The sites are viewed primarily as being repositories of information instead of just as patches of ground. By assessing the information value of a given site, it becomes possible to determine the degree of compatibility a given land use has with the preservation of Heritage values and to make decisions that take into account the potential for Heritage resource development. Some land uses are highly destructive and exclusive of other types of use while some sites owe much of their significance to their context - their settings contribute greatly to the interpretation of their Heritage values. An example would be a rock art site offering a view of distinct natural features that are depicted in the motifs themselves. Obviously in this case there is a need for preservation in place of the significant components of the landscape, and the site could be sensitively developed to allow for its appreciation by visitors. In other cases where setting is not as important, the need for preservation in place can be evaluated within the context of what is known about the prehistory and history of the locality in question and in terms of its capability to contribute to gaps in our knowledge. Several alternative management strategies present themselves. The information can be retrieved prior to commencement of the development with interpretation being done at the central repository, the traditional museum approach. In other situations, development of the land for certain purposes ~~are~~ is compatible with development of the Heritage resource for interpretation. Tourist, recreation, and housing developments are examples where certain Heritage values can be exposed or reconstructed and interpreted on-site to the benefit of the patrons of the development. Another scenario involves the occurrance of a Heritage resource whose characteristics lend themselves to preservation in place with certain unrelated developments also being allowed to be undertaken provided steps are taken to minimize impact. An example of this would be a significant, but deeply buried archaeological or palaeontological deposit in a locality where the proposed development involves disturbance of the surface only. In all of these situations, the critical ingredient is involvement of knowledgeable Heritage resource managers in the planning process and the inclusion of interpretation as an important end-product.

The key aspects of this alternative approach to managing Heritage resources are the greater familiarity with the nature of the Heritage resource and the commitment to public interpretation that are possible within the Ecomuseum framework. Heritage sites cannot be managed as generic entities - their value lies in the unique contributions each can make to the experiences of living beings. The Ecomuseum is a means of improving the effectiveness of managing significant parts of our common natural and cultural Heritage without necessarily precluding other forms of land use. A basic tenet is that preservation of the Heritage resources of the Kootenay Region is much more likely to be accomplished by cooperation than by threats of legal action. The Kootenay Ecomuseum holds great promise for being a major new attraction to the region, of benefit to visitors and local residents alike. If agencies and individuals having jurisdiction over lands of Heritage value are made aware of their significance in terms of what may be lost to everyone, it should be possible to enlist their support in preserving this non-renewable resource.

Ecomuseum Development: Problems and Prospects

The Kootenay Ecomuseum has existed as an integrative framework for archaeological investigation for more than a decade. Over the years a very large volume of information has been accumulated beyond that required for basic Heritage resource inventory purposes and a number of potential interpretive sites have been identified. Also during this time, government funding for Heritage declined and a privatization policy was implemented. In response to the need for local involvement to assist in Heritage resource management, and to take a concrete step towards the development of a Kootenay Cultural Heritage Centre, an archaeological resource management agency was formed in 1983. An informal partnership between the writer and the Kootenay Indian Area Council, this agency represents an innovative step in Heritage resource management in that it places archaeological and palaeoecological investigation within the context of a cultural centre and applies its 'profits' as a consulting firm to Heritage interpretation. Over one hundred thousand dollars worth of contract work has been done to date. Employment and on-the-job training are provided to band members as they become better aquainted with their cultural past. Another benefit that is already apparent is the amount of relevant information that has been forthcoming from studies that have previously been relatively unproductive when conducted by private consultants. The two major salvage excavations conducted in 1984 were noteworthy for the contributions they have made to the archaeological record and a provincial park Heritage resource management study has operationalized the concept of information value discussed in this paper. In addition to meeting management objectives and increasing our knowledge of the people who inhabited the sites, these studies have yielded new insights into the salmon fishery's capability to support prehistoric societies and into environmental factors affecting the big game carrying capacity of the alpine zone. Public presentations continue and a number of scientific reports and articles are being prepared for publication.

At present, there is only a small core of Ecomuseum workers operating out of offices in the St. Eugene mission school that are heated by a wood stove. Funding is sporadic, making planning difficult. Lack of funding is a concern that has been frequently voiced at this congress. Considerable capital will be required to develop the various interpretive foci and to produce the range of informative displays and materials and especially to renovate the St. Eugene mission school building, but this problem is self-evident. We are greatly optimistic because there are a number of potential sources which would represent a very worthwhile investment in human resources as well as in the development of a clean and relatively lucrative enterprise of benefit to the entire community.

There is an equally serious, but more immediate problem that faces the full development of the Kootenay Ecomuseum, and that is that present administrative mechanisms, both public and private, are not well suited to the functioning of a holistic entity like this. Not only is the definition of Heritage itself inconsistent from one administration to the next, but there is a welter of different jurisdictions dealing with segments of Heritage. Since aboriginal Kootenay territory extended south of 49° N. Latitude, two federal governments are involved: Canada and the United States. The range of different U.S. government agencies concerned with Heritage is very wide, plus state, county, and private agencies are involved as well. The administrative difficulties connected with working in the U.S. as Canadians are at present almost totally restrictive, although information is willingly shared between the Kootenay Cultural Heritage Centre and a number of American institutions. In Canada, the Department of Indian Affairs and Northern Development of course has extensive involvement in the lives of the Kootenay People and its minister, David Crombie, has shown encouragement towards this project. Archaeological sites on Indian Reserves are nominally the responsibility of the National Museum of Canada while numerous Kootenay Heritage sites lie within the mountain national parks. Another Canadian federal government bureaucracy, Parks Canada with its own archaeological research unit, is involved. Outside of the national parks, Heritage resources are managed by the respective provincial governments. B.C. archaeological site forms are used for recroding appropriate information there and in Mt. Revelstoke, Glacier, Yoho, and Kootenay National Parks while Alberta forms are filled out for sites in that province plus those in Banff, Jasper, and Waterton Lakes National Parks.

The administration of Heritage sites is thus undertaken by more than a dozen separate government agencies whose jurisdictions crosscut the aboriginal territory of the Kootenay People. To make matters worse, the researching, management; and interpretation of Heritage is segmented and spread out among further administrative subdivisions. The Universities of Alberta, British Columbia, Calgary, and Victoria plus Simon Fraser University have all conducted archaeological research in the Kootenay Region at one time or another, virtually none of which is publicly interpreted. The B.C., Alberta, and Glenbow Museums interpret Kootenay Heritage to a very limited degree, and do not conduct in depth research here. Parks Canada is in a good position to interpret those aspects of Kootenay Heritage which they research and manage but they are restricted geographically. The Archaeological Survey of Alberta has probably progressed the furthest of any of the governmental agencies of relevance here regarding the integration of research and management and have taken steps towards public education as well. Unfortunately, most Kootenay

Heritage sites are not in Alberta. British Colmubia's deplorable level of financial support for Heritage has been alluded to, and the fragmentation of Heritage administration is extreme. Besides the Provincial Museum in Victoria, the only agency with a mandate for cultural and natural Heritage interpretation is the Parks and Outdoor Recreation Division who have no archaeologists and who are limited to Provincial Parks which comprise only about 5% of the province's area. The forests of the Kootenay Region are extensive, but the B.C. Forest Service interprets the Forest Act to include recreation in its multiple use mandate but deliberately eschews conservation, passing that off as the responsibility of the pathetically underfunded Heritage Conservation Branch. The latter is unable to respond to the scale of the forest industry's impacts on the land in additon to those of the myriad other development agencies. Heritage interpretation is these forests gets completely lost in the shuffle. The Heritage Conservation Branch is involved with interpretation of cultural Heritage to some degree, although history has tended to receive the most attention, and again, fiscal constraints are severe. Management of Heritage resources in B.C. is completely the domain of the Heritage Conservation Branch and in Alberta, the better funded Archaeological Survey of Alberta handles this task. In both provinces, and in the national parks to a lesser degree, most Heritage resource inventory, impact assessment, and mitigation is done by private consultants. The universities have grown reluctant to participate in this sphere of endeavour while the lack of a research orientation of the client-oriented consultants has reduced the productivity of Heritage investigation to a saddeningly low level. Interpretation is virtually a non-existent component of this work. The lack of involvement of Heritage researchers and managers in public interpretation is well illustrated by the fact that of the dozens of archaeologists connected directly or indirectly with the host of government administrations, universities, and consulting firms within a day's drive of Banff, only the writer has attended this Congress.

It is apparent, then, that none of the presently existing Heritage-related agencies integrates Heritage research, management, and interpretation to the extent that the general public, the ultimate "consumers" of this resource, get much value for their dollars. The Kootenay Ecomuseum represents a serious attempt to rectify this situation for this region at least, but as might be expected, the maze of jurisdictions which must be dealt with represents a tremendous administrative burden.

The recent trend to privatization has created new avenues of potential success for giving people greater access to their Heritage, but there are serious problems in the way this is being undertaken. The present system involves the awarding of contracts to perform various Heritage-related services, let by the different bureaucracies. Because of the fragmentation of Heritage amongst these agencies, the contracts do not provide for a balance of research, management, and interpretation. Most are management-related and, as mentioned previously, research and interpretation frequently fall by the wayside. Furthermore, the criteria for awarding the contracts are neither uniform nor objective. Administrative expediency and even personal preference have been almost as significant factors as cost. Competition for contracts on a cost basis has given rise to a serious ethical dilemma. Heritage values accrue through sharing - if an individual knows a lot about the past but doesn't tell anyone, can that be called Heritage? By its very definition, Heritage is a part of our common cultural background. Unfortunately, competition for contracts, which essentially involve "selling" knowledge, has caused a serious breakdown in communication among archaeologists - pooling one's knowledge with your peers eliminates your competitive edge. Furthermore, this trend to privatization has fragmented the archaeological and biological community into numerous small businesses, only one of whom tends to be awarded a given contract, even though the skills and expertise to maximize the information yield are spread over a number of such firms. There isn't space here to go into the consequences of the lack of multiple inputs and progressive critique necessary for scientific progress to be made. In short, it would appear that Heritage and free enterprise competition are mutually exclusive. This becomes even more readily apparent when one considers quality control of this process: those who pay for the product, the general public, have no control over the quality of that product. Given the lack of emphasis on interpretation, they seldom even see the product!

It is this writer's opinion that the public must be allowed to have far more involvement in Heritage-related work andinterpretation represents an important component of this process. "Information value" is relevant here again, for the competitive edge should go to those who maximize Heritage data yield per dollar spent and who most effectively communicate the knowledge gained to the public. Without this strong commitment to the maximum appreciation of a quality end-product, entities like the Kootenay Ecomuseum will find it very difficult to fulfill their great promise. It is important to emphasize that the money is already being spent on Heritage now; it's just not being put to its optimum use.

A final aspect of this situation is that since each agency defines its goals regarding Heritage according to its own objectives, independently of other agencies in most cases, Heritage consulting firms are reduced to a reactive role. The most adaptive at meeting the exigencies of bursts of contracts let on very short notice are large centralized consulting firms who bid on every project and send their staff all over Western Canada. But this is volume business, based on quick turnover, and it is the very antithesis of the thoughtful approach of those who are genuinely interested and committed to the discovery of particular segments of the past before the evidence is destroyed forever, and communicating their knowledge to the public. With each agency having its own scheduling and priorities, little communication between agencies, and Heritage being fragmented, it is very difficult for consultants to do the kind of long term planning that good research and effective interpretive programs require. If the agencies won't do it, and the consultants can't, who will? There is no reason why Heritage research and interpretation can't be integrated with management; in fact, why else is Heritage resource management being done? The problem lies in the priority of administration over the subject matter. If the present state of affairs persists, it runs the very real risk of becoming a rather meaningless circular process of jumping through bureaucratic hoops, gravely endangered when budget-cutting occurs.

As an alternative to the above, the Kootenay Ecomuseum is founded upon the belief that the sharing of a common Heritage (such as is represented by the hunter-gatherer stage through which all societies have passed) is one of the more important aspects of our identities. As such, this endeavour cannot fail in spirit. To make it a fully appreciated reality will require a level of cooperation that is sure to bring out the best in all of us.

Wayne T. Choquette

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Education

B.A. (Archaeology, Zoology), 1971, University Of Calgary
M.A. candidate (all but thesis), Anthropology, University of Idaho.

Professional Experience

1984 to present:

Staff Archaeologist and interim Curator, Kootenay Cultural Heritage Centre

1981 to present:

Instructor (part time) of Archaeology and Physical Anthropology, East Kootenay Community College. Courses: Introduction to Archaeology and Physical Anthropology, Human Evolution, Anthropological Archaeology, Prehistory of Canada, Archaeological Laboratory Methods.

1984

Analyst of selected lithic artifacts from DiQi-1, Vallican, B.C.

Panelist and planning committee member, Parks Canada Heritage for Tomorrow Canadian Assembly.

1983

Consultant to B.C. Heritage Conservation Branch and Department of Highways, proposed Sparwood weigh scale.

Consultant, Heritage impact assessment of two proposed realignments of B.C. Hydro's Cranbrook - Alberta boundary transmission line.

Consultant, aerial photograph assessment of Heritage potential on B.C. Hydro's proposed Stikine-Iskut transmission line, for Points West Heritage Consulting, Ltd. Langley

Consultant on research design for salvage data retrieval from Department of Highways Alexis Creek realignment, for Points West Heritage Consulting, Ltd.

1982

Project director, salvage excavation of DgQa-6, Yahk, under contract with B.C. Heritage Conservation Branch

Archaeologist, Heritage site survey of B.C. Hydro's proposed Kelley Lake-Cheekye transmission line, for Points West Heritage Consulting, Ltd.

Consultant to B.C. Provincial Parks Branch, Kootenay Region, on human history interpretive programs.

Archaeologist, Heritage site survey of Utah Mines Ltd. proposed Carbon Creek Mine, for Points West Heritage Consulting Ltd.
Consultant to Archaeological and Historical Services, Eastern Washington University, on B.P.A. Libby Integration transmission line.

Consultant to James Baker, Okanagan College, on Heritage impact assessment of B.C. Hydro's proposed Murphy Creek hydroelectric project.

1981

Project Archaeologist, Bonneville Cultural Resources Group, Northwest Institute for Advanced Studies, Eastern Washington University.

Consultant Archaeologist to Stahly Engineering and Associates, Kalispell on the City of Kalispell proposed sludge management system.

Consultant Archaeologist to Flathead County Parks and Recreation, Kalispell on proposed P.P.L. Park.

Consultant Archaeologist to City of Kalispell, Montana.

1980

Project Archaeologist, Laboratory of Archaeology and History, Washington State University.

1979

Analyst of prehistoric cultural material from 10BR94 test excavation, for Cultural Resource Consultants, Sandpoint.

Project Archaeologist, Washington Archaeological Research Centre, Washington State University.

Field Assistant, excavation of DjPq-1, Lifeways of Canada, Ltd., Calgary.

Archaeologist, archaeological survey of proposed Gulf Oil Canada Alberta Products Pipeline expansion, for Lifeways of Canada, Ltd.

1977-1979

Field Director, University of Idaho Libby Archaeological Project.

1977
Archaeologist, Kootenay Regional Survey, for A.S.A.B.

Analyst of chipped stone debitage and quartzite tools from three prehistoric sites at Kettle Falls, Washington.

1976-1977

Instructional Assistant, Department of Sociology and Anthropology, University of Idaho. Courses: Introduction to Archaeology and Physical Anthropology, Aboriginal North American Indians, Introduction to Sociology.

Analyst of chipped stone debitage from three prehistoric sites at Kettle Falls, Washington.

1976

Project Director, heritage impact assessment of three proposed coal mines in the B.C. Rocky Mountains, for A.S.A.B.

Field Director and Consultant Archaeologist, archaeological survey of Kananaskis Provincial Park, Alberta, for Aresco, Ltd., Calgary.

1975

Advisor to Vancouver Community College (Langara) Archaeology Field School, Kootenay Region, B.C.

Consultant to Lifeways of Canada, Ltd. on heritage impact assessment of proposed Alberta Natural Gas Co. pipeline system expansion, Crowsnest to Kingsgate, B.C.

1974

Archaeologist, heritage impact assessment of Inland Natural Gas Co. East Kootenay Link Pipeline, for A.S.A.B.

Field Director, archaeological survey of East Kootenay Provincial Parks, for A.S.A.B.

1973

Consultant to Dr. B.O.K. Reeves and Canada Arctic Gas Study Ltd., preliminary heritage impact assessment of proposed Alaska Highway gas pipeline system.

Field Supervisor and analyst, Canadian Libby Reservoir Archaeological Salvage Project, for A.S.A.B.

Field Director, archaeological survey of middle Elk River drainage area, B.C. for Dr. B.O.K. Reeves and Archaeological Survey of Canada.

1972

Analyst of artifacts from EfQu-3, Scotch Creek Provincial Park, B.C., for Archaeology Division, B.C. Provincial Museum.

Field Supervisor, Libby Reservoir archaeological salvage project, for A.S.A.B.

Field Director, archaeological survey of Kootenay National Park, for University of Victoria.

1971

Field Director, Canadian Libby Reservoir Archaeological Salvage Project, for A.S.A.B.

Project Director, archaeological survey of the southern Rocky Mountain Trench, B.C., supported by a grant from the University of Calgary.

Field Director, archaeological reconnaissance of the Fairmont Hot Springs vicinity, B.C.

Cataloguer, Archaeology Division, B.C. Provincial Museum

1970-1971

Cataloguer (part time), National Parks archaeology projects, for Dr. B.O.K. Reeves, University of Calgary.

1970

Senior Field Assistant, archaeological survey of Jasper and Banff National Parks, for W.J. Elliott, University of Calgary.

1969

Senior Field Assistant and Faunal Analyst, Cypress Hills Historical Archaeology Project, for W.J. Elliott, University of Calgary.

Senior Field Assistant on recovery of Pleistocene vertebrate fossils, Mitchell Bluffs, Alberta, for Dr. A.MacS. Stalker, Geological Survey of Canada.

1968

Field Assistant, Waterton Lakes National Park Archaeological Project, for Dr. B.O.K. Reeves, University of Calgary.

Field Assistant, Pleistocene vertebrate recovery and archaeological test excavations, South Saskatchewan River, Alberta, for Dr. A. MacS. Stalker, Geological Survey of Canada and R. Getty, University of Calgary.

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