

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HAT CREEK PROJECT

Ebasco Services of Canada Ltd., Environmental Consultants - Hat
Creek Project - Environmental Impact Assessment Report - December
1978 - (Tables).

ENVIRONMENTAL IMPACT STATEMENT REFERENCE NUMBER: 31c

HAT CREEK PROJECT
DETAILED ENVIRONMENTAL STUDIES
ENVIRONMENTAL IMPACT ASSESSMENT REPORT

GENERAL OUTLINE

VOLUME I

PART ONE - INTRODUCTION

- CHAPTER 1.0 - THE HAT CREEK PROJECT
- CHAPTER 2.0 - SUMMARY TERMS OF REFERENCE
- CHAPTER 3.0 - PURPOSE AND SCOPE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT
- CHAPTER 4.0 - ENVIRONMENTAL IMPACT ASSESSMENT REPORT FORMAT
- CHAPTER 5.0 - PROJECT HISTORY

PART TWO - DESCRIPTION OF THE HAT CREEK PROJECT

- CHAPTER 1.0 - INTRODUCTION
- CHAPTER 2.0 - THE POWERPLANT
- CHAPTER 3.0 - THE MINE
- CHAPTER 4.0 - OFFSITE SYSTEMS

PART THREE - ENVIRONMENTAL SETTING WITHOUT THE PROJECT

- CHAPTER 1.0 - INTRODUCTION
- CHAPTER 2.0 - BASELINE DATA COLLECTION METHODOLOGY
- CHAPTER 3.0 - RESOURCE INVENTORY
- CHAPTER 4.0 - RESOURCE PROJECTIONS WITHOUT THE PROJECT

VOLUME II

PART FOUR - IMPACTS OF PROJECT DEVELOPMENT

- CHAPTER 1.0 - INTRODUCTION
- CHAPTER 2.0 - ENVIRONMENTAL IMPACTS OF PRELIMINARY PRECONSTRUCTION ACTIVITIES
- CHAPTER 3.0 - ENVIRONMENTAL IMPACTS OF CONSTRUCTION ACTIVITIES
- CHAPTER 4.0 - ENVIRONMENTAL IMPACTS OF OPERATION
- CHAPTER 5.0 - ENVIRONMENTAL IMPACTS OF DECOMMISSIONING

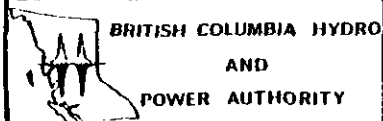
PART FIVE - MITIGATION, COMPENSATION AND MONITORING PROGRAMMES

- CHAPTER 1.0 - PLANNED MITIGATION MEASURES
- CHAPTER 2.0 - PLANNED COMPENSATION
- CHAPTER 3.0 - ENVIRONMENTAL MONITORING PROGRAMME

TABLES

FIGURES

APPENDIX	SUBJECT	CONSULTANTS NAME	REPORT TITLE
A-1	Physical Habitat & Range Vegetation	TERA Environmental Resource Analyst, Ltd. (TERA) Canadian Bio Resources Consultants, Ltd. (CBRC)	Physical Habitat and Range Vegetation Report
A-2	Wildlife	TERA I.R. Erickson & Associates	Wildlife Report
A-3	Forestry	Reid, Collins & Associates, Ltd. (RCA)	Forestry Report
A-4	Agriculture	CBRC	Agriculture Report, Vol. I - Inventory, Vol. II - Impact Assessment
A-5	Recreation	Bruce Howlett Inc. (bhi)	Recreation Report
A-6	Solid Waste Disposal and Coal Storage and Land Reclamation	Acres Consulting Services Ltd.	Solid Waste Disposal Coal Storage and Land Reclamation Report
B-1	Hydrology, Drainage, Water Quality and Water Use	Beak Consultants, Ltd.	Hydrology, Drainage, Water Quality and Use Report
B-2	Fisheries & Benthos	Beak Consultants, Ltd.	Fisheries and Benthos Report
B-3	Intake Study	Envirosphere Co.	Water Intake
C-1	Socio-Economic Studies	Strong, Hall & Associates (SHA)	Hat Creek Socio-Economic Studies
C-2	Socio-Economic Studies	SHA	Hat Creek Socio-Economic Studies
C-3	Resource Evaluation	SHA	Hat Creek Socio-Economic Studies
C-4	Archaeology & Historic Sites	UBC/Office of Provincial Archaeologist	Hat Creek Project: Preliminary Inventory, Assessment and Evaluation of the Cultural Heritage Resources
D	Air Quality	Environmental Research and Technology (ERT)	Air Quality and Climatic Effects of the Proposed Hat Creek Project
D-1	Meteorology & Air Quality Equipment	ERT Western Research and Development (WR&D)	Appendix II, Aerometric Monitoring
D-2	Ambient Air Quality	ERT	Appendix A, Meteorological & Air Quality Data Appendix B, Modelling Methodology Appendix D, Assessment of Atmospheric Effects and Drift Deposition Due to Alternate Cooling Tower Designs
D-3	Epidemiology	ERT; WR&D	Appendix C, Epidemiology
D-4	Climatic Assessment Study	ERT	Appendix E, Climatic Assessment
D-5	Meteorological Control Potential	ERT	Appendix C, Alternate Methods of Ambient Sulphur Dioxide Control
E-1	Noise Studies	Harford, Kennedy, Wakefield	Appendix E1 Noise
E-2	Minerals & Petroleum	B.C. Hydro	Minerals and Petroleum
E-3	Trace Elements	ERT	Appendix F, The Influence of the Project on Trace Elements in the Ecosystem
E-4	Aesthetics Study Coordination	Toby, Russell, Buckwell Ebasco Services of Canada Limited, Environmental Consultants	Appendix E4 Aesthetic Considerations



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DETAILED ENVIRONMENTAL STUDY PARTICIPANTS

Rev. 1 Feb. 1979.

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 1.0-1
PART ONE

Site

Location: Near Harry Lake in Trachyte Hills east of Hat Creek Valley, at elevation 1410 m

Site Area: 92 ha

Operating Manpower

Average for operating and maintenance 225

Building

Total length of powerhouse 290 m
Total width of powerhouse 92.5 m
Height of boiler room roof 94.0 m
Height of turbine room roof 34.0 m

Chimney

Number of chimneys 1
Number of flues 4
Height of chimney Impact assessments are being made for a chimney of height in the range of 244-366 m

Diameter of inner flues 7 m
Inside diameter of stack 21.3 m

Flue gas exit velocity (max) 27.4 m/s @ 148.9°C at 560 MW turbine generator rating

Electrical Power Output

Net plant output 2000 m @ 560 MW guaranteed gross turbine output

Generator voltage 24 kV
Transmission 500 kV
Frequency 60 Hz

Performance at Guaranteed
560 MW Gross T-G Rating

Steam Generator (per unit)

Steam output 464.8 kg/s
Superheater outlet pressure 17,582 kPa
Superheater outlet temperature 532°C

Prepared by: Integ-Ebasco 1/



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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants

TECHNICAL SUMMARY

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 2.1-1
Sheet 1 of 3
PART TWO

Reheat steam temperature	104.63 kg/s
Number of pulverizers	8 per unit (tentative)
Water temperature to economizer	246°C
Flue gas flow at heater outlet	747.60 kg/s
Flue gas temperature leaving air heater	148.9°C
Assumed excess air after air heater	30%

Auxiliary Fuel Oil

For main boiler ignition, diesel generators and auxiliary boilers	<u>No. 2 fuel oil</u>	<u>No. 6 fuel oil</u>
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Number of fuel tanks	2	2
Capacity of tank	477 m ³	795 m ³
Reheat temperature	538°C	
Condenser vacuum - summer (design point)	11.85 kPa	
Condenser vacuum - winter (avg conditions)	5.8 kPa	
Number of extraction points for feedwater heating	7	

Turbine heat rate including BFP turbine at 560 MW output	8452 kJ/kWh 11.95 kPa 0% makeup
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Guaranteed rating	560 m @ 5.1 kPa 0% makeup and 7 stages of feedwater heating including extraction steam to boiler feed pump turbine drives
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Boiler Feed Pumps

Number of main pumps/unit	One steam driven 100% capacity main plus one motor driven 100% capacity booster plus one start-up/topping 10% capacity
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Capacity of the main and booster pump @ MCR (without capacity allowance)	530 l/s
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Discharge pressure @ MCR (without head allowances)	1040 m
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BEF turbine rating @ MCR	10,675 m
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Coal Handling

Capacity of overland conveyors (2 @ 100% duty) based on worst acceptable coal. Total for 2 conveyors	1211 kg/s
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Silo Storage (one per mill)	8 hrs minimum with worst coal
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Note: MCR = max continuous rating = 560 MW gross unit output

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TABLE 2.1-1
Sheet 2 of 3
PART TWO

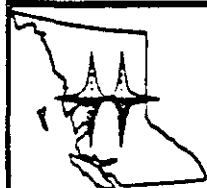
Coal, Ash & Flue Gas Flow @ 560 MW
Turbine Generator Output

Plant Auxiliary Loads - kW

Based on a gross unit output of 560 MW and auxiliary loads per unit as following, the next output will be 500 MW.

Plant Auxiliaries	44.0 MW
Thompson River Pipeline Pumping Load	3.7 MW
Mining Load	3.7 MW
Overland Conveyor Load	1.6 MW
Excitation & Transformer Loss	4.5 MW
Contingency	2.5 MW
Total	60.0 MW

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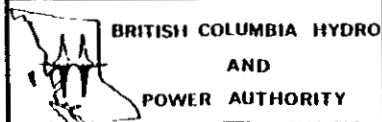
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 2.1-1
Sheet 3 of 3
PART TWO

Mining Stage	Surficials				Pit and Segregated Waste				Conditioned Ash		Total to Dumps	
	Bm ³ x 10 ⁶		Lm ³ x 10 ⁶		Bm ³ x 10 ⁶		Lm ³ x 10 ⁶		Lm ³ x 10 ⁶		Lm ³ x 10 ⁶	
	Zero Swell	15% Swell	Stage	Cum	Pit Waste	Seg Waste	Stage Total	Cum	Stage	Cum	Stage	Cum
1	5	9	15	15	3	0	7	7	0	0	19	19
2	9	0	9	24	5	2	8	12	7	7	21	41
3	24	5	31	55	28	5	43	55	13	17	86	127
4	55	22	80	135	86	11	129	184	29	46	238	365
5	6	50	64	200	69	5	99	282	15	61	178	543
6	0	50	57	257	83	3	115	397	8	70	181	724
7 (part)	0	28	31	288	59	2	80	477	5	74	116	840
Total	99	164	288	-	332	27	477	-	74	-	840	-

Bm³ - Bulk Cubic Metres
Lm³ - Loose Cubic Metres

Prepared by: B.C. Hydro 1/



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VOLUMES OF SPOIL BY MINING STAGES

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TABLE 3.3-1
PART TWO

<u>Location</u>	<u>Surficials</u>	<u>Segregated and Pit Waste</u>	<u>Ash</u>	<u>Totals</u>
<u>Production</u>				
Openpit No. 1 to year 2021/2	288	477	74	840
<u>Disposal</u>				
North Valley Dump	9	-	-	9
Houth Meadows				
Bund No. 1	45	-	-	-
Bund No. 2	10	-	-	-
Bund No. 3	15	-	-	-
Underdrain	14	-	-	-
General	-	383	-	-
Sub Total	84	383	-	467
Medicine Creek				
Bund No. 4	28	-	-	-
Bund No. 5	1.5	-	-	-
Underdrain	12	-	-	-
General	154	94	74	-
Sub Total	195	94	74	363
Total	288	477	74	840

Prepared by: B.C. Hydro 1/



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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants
PROPOSED FINAL DISTRIBUTION OF WASTE VOLUMES
(10⁶ LOOSE CUBIC METRES)
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-2
PART TWO

<u>Station</u>	<u>Elevation (m MSL)</u>	<u>Direction from Site</u>	<u>Distance (km)</u>
B.C. Hydro Mechanical Weather Stations			
WS 1	762	NNW	6.4
WS 2	823	W	6.4
WS 3	853	W	8.0
WS 4	945	WSW	4.8
WS 5	1006	WSW	6.4
WS 6	2012	SSE	11.2
WS 7	1402	N	1.4
WS 8	2042	NW	25.6

Atmospheric Environment
Service Observation Stations

Surface:

Alta Lake	668	SW	12
Ashcroft*	336	ESE	18
Dog Creek	655	NNW	96
Kamloops**	378	E	77
Kelowna	418	SE	166
Lytton**	259	S	54
Penticton	341	SE	176
Squamish*	6	SW	154
Williams Lake	942	NNW	141

Upper Air (RAOB)

Prince George	677	NNW	352
Vernon	555	ESE	160

*Wind data obtained through B.C. Hydro

**Complete observations obtained through B.C. Hydro

Prepared by: Environmental Research & Technology, Inc. 1/



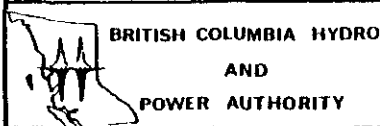
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Locations of Meteorological Observation
Stations Relative to Proposed Generating
Station Site
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TABLE
2.2-1
PART THREE

Instrument	Manufacturer	Model	Supplier	Location	Valley	Plant	Mountain	Mobile	No. To Be Purchased
1. Dew Point & Air Temperature	EG&G	110	EG&G	Boston	1	2	-	1	4
2. Differential Temperature	WR&D	1500	WR&D	Calgary	-	1	-	-	1
3. Precipitation Sensor	Fischer and Porter	35B1558ND13BC2	Fischer and Porter	Warminster, Penn.	1	1	1	1	4
4. Evaporation Sensor	Science Associates	No. 242, 582, 246	Science Associates	Princeton, N.J.	-	1	-	-	1
5. Barometric Pressure	Science Associates	No. 363 & No. 364	Science Associates	Princeton, N.J.	-	1	-	-	1
6. Air Temperature Sensor	Science Associates	No. 190 & No. 174-1	Science Associates	Princeton, N.J.	-	-	1	-	1
7. Wind Speed and Direction	WR&D	Windflo 540	WR&D	Calgary	1	2	-	1	5
8. U-V-W Anemometer	Gill U-V-W	No. 454	Science Associates	Princeton, N.J.	-	1	-	-	1
9. Light Intensity	Eppley	No. 645-48	Science Associates	Princeton, N.J.	Existing	-	-	-	-
10. Visibility (Haze)	Nephelometer	MRI 1550	Extech	Vancouver	1	-	-	1	2
11. Visibility (Fog)	Fog Visometer	MRI 1580	Extech	Vancouver	1	-	-	-	1
	Videograph	B	Sperry Gyroscope	Ottawa	1	-	-	-	1
12. Sulphur Dioxide	Phillips	9755	Phillips	Edmonton	1	-	-	Existing	1
13. Oxides of Nitrogen	Monitor Labs	8440R	Galvanic	Calgary	1	-	-	Existing	1
14. Ozone	Monitor Labs	8410R	Galvanic	Calgary	1	-	-	Existing	1
15. Carbon Monoxide	Bendix	8501	Aviation Electric	Montreal	-	-	-	Existing	-
16. High-Volume Sampler	Sierra Instruments	Ultra - Vol 3	Extech	Vancouver	Existing	1	-	1	2
17. Dustfall		1 qt plastic containers	Western Industrial	Edmonton	1	1	1	1	16
18. Sulphation		Sulphation Plates	Western Industrial	Edmonton	1	1	1	1	16
19. Atmospheric Corrosion	WR&D		WR&D	Calgary	1	1	1	1	8
20. Calibrator	Monitor Labs	8500R	Galvanic	Calgary	1	-	-	1	3
21. Instrument Shelter	ATCO	12' x 8' x 16' x 8'	ATCO	Calgary	1	1	Existing	-	2
22. Instrument Trailer	Bridge Trailer	16' x 8'	Bridge Trailer	Calgary	-	-	-	1	1
23. Tower - 100 m guyed	LeBlanc & Royle	LR24 (no elevator)	LeBlanc & Royle	Vancouver	-	1	-	-	1
24. Tower - 10 m guyed	LeBlanc & Royle	LR10	LeBlanc & Royle	Vancouver	1	-	1	-	2
25. Tower - 10 m telescopic	LeBlanc & Royle	Crank-up & guyed	LeBlanc & Royle	Vancouver	-	-	-	1	1
26. Recorders - meteorological	Chessel	301E 2-Channel	Galvanic	Calgary	4	5	2	3	14
27. Recorders - analyzers	Soltec	VP-6232S 2-Channel	Soltec	Sun Valley, Calif.	2	-	-	3	5
28. Recorders - U-V-W	Esterline Angus	E1104 4-Channel	Science Associates	Princeton, N.J.	-	1	-	-	1

Prepared by: Western Research and Development, Ltd. 14/



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EQUIPMENT LIST FOR FULL-SCALE MONITORING PROGRAMME

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TABLE 2.2-2
PART THREE

SURFACE WATER SAMPLING PROGRAMME*

1976

1977

PROGRAMS

July Aug Sept Oct Nov Dec Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

Hat Creek,
Bonaparte River,
Thompson River

3 4 1 3 3

Goose & Finney Lakes

3 4 1 3 3

Pit Hydrology
Study

2

Power Plant Site
Study

3 4 1 2

Freshet Study

3,4 2

Thompson River
Intake StudyBulk Sample
Programme

4 2,4 2,4 1,3 1 2

GROUNDWATER SAMPLING PROGRAMME

PROGRAMS

Domestic Wells

4 1 3,4

Artesian Springs

4 3

Pit Hydrology
Study

2 2

Power Plant Site
Study

2

Coal Seam

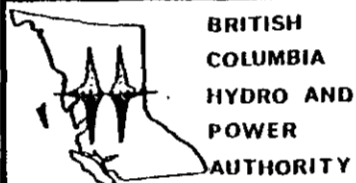
3

Bulk Sample
Programme

1,3 1,3 1 2

NOTE: Week 1 - 1-7, Week 2 - 8-14, Week 3 - 15-21, Week 4 - >21

* All numbers indicate the time when discrete grab samples were obtained.



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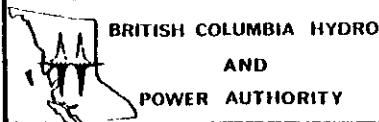
WATER QUALITY MONITORING FREQUENCIES
(Prepared by: Beak Consultants Ltd. 4/)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 2.3-1

PART THREE

PARAMETER	Domestic Wells	Artesian Springs	Pit Hydrology Study	Power Plant Site Study	Coal Seam	Bulk Sample Program
<u>CATIONS - Trace Metals</u>						
Aluminum (Al)	x		x		x	x
Arsenic (As)	x		x		x	x
Cadmium (Cd)	x		x	x	x	
Chromium (Cr)	x		x		x	x
Copper (Cu)	x	x	x	x	x	x
Iron (Fe)	x	x	x	x	x	x
Lead (Pb)	x		x	x	x	x
Mercury (Hg)	x	x			x	x
Molybdenum (Mo)	x		x		x	
Selenium (Se)	x	x	x		x	x
Vanadium (V)	x	x	x	x	x	x
Zinc (Zn)	x	x	x	x	x	x
<u>CATIONS - Alkali Earths & Metals</u>						
Calcium (Ca)	x	x	x	x	x	x
Lithium (Li)	x	x	x		x	x
Magnesium (Mg)	x	x	x	x	x	x
Potassium (K)	x		x	x	x	
Sodium (Na)	x	x	x	x	x	x
Strontium (Sr)	x	x	x	x	x	x
<u>ANIONS - General</u>						
Boron (B)	x	x	x		x	x
Chloride (Cl)	x	x	x	x	x	x
Fluoride (F)	x	x	x		x	x
Sulphate (SO ₄)	x	x	x	x	x	x
<u>ANIONS - Nutrients</u>						
Total Kjeldahl Nitrogen (N)	x		x		x	
Nitrate Nitrogen (NO ₃ -N)	x		x		x	
Nitrite Nitrogen (NO ₂ -N)	x		x		x	
Total Orthophosphate Phosphorous (P)	x	x	x		x	x
<u>ORGANIC, NONIONIC, & CALCULATED VALUES</u>						
COD	x					
TOC	x	x			x	x
Phenol	x					
Total Hardness (CaCO ₃)	x	x	x	x	x	x
Total Alkalinity (CaCO ₃)	x	x	x	x	x	x
<u>PHYSICAL DATA</u>						
pH (units)	x	x	x	x	x	x
Specific Conductance (umhos/cm @ 25°C)	x	x	x	x	x	x
True Colour (Pt-Co Units)	x				x	
Turbidity (NTU)	x				x	
Temperature (°C)	x				x	
<u>PHYSICAL DATA - Residues</u>						
Total Residue	x	x			x	x
Filterable Residue	x	x	x		x	x
Nonfilterable Residue	x	x			x	x
Fixed Total Residue	x				x	
Fixed Filterable Residue	x		x		x	
Fixed Nonfilterable Residue	x				x	
<u>BIOCHEMICAL, DISSOLVED GASES & RELATED MEASUREMENTS</u>						
BOD						
D.O.					x	
% Saturation					x	



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GROUNDWATER PARAMETERS ANALYZED
(Prepared by: Bank Consultants Ltd. 4/)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 2.3-2

PART THREE

<u>STATION (MAP DESIGNATION)</u>	<u>LOCATION</u>	<u>ORIGIN</u>	<u>SAMPLING NOTES</u>
DW 1	Hydro Camp - 3 m from Hat Creek	Hat Creek & Groundwater	-Galvanized culvert -Sampled at 1m (Van Doorn)
DW 2	50 m south of Hydro camp along old (low) road	Artesian	-Collected from reservoir -Seeping from Western hillside
DW 3	1.5 km south of Hydro camp - low road	Artesian (Finney Creek)	-Collected from irrigation -Possibly Finney Lake origin
DW 4	3 km south of Hydro camp - low road (south of proposed pit area)	Groundwater	-Sampled from tap -Well located about 20 m west of Hat Creek
DW 5	3/4 km north of old & new road southern junction on old road	Groundwater	-Hand pump well -15 m from Hat Creek
DW 6	1.5 km north of DW 5 on old road	Hat Creek	-Not sampled
DW 7	3/4 km south of old & new road southern junction and west 3/4 km.	Hat Creek	-Not sampled
DW 8	2 km south of DW 7	Groundwater	-Sampled from tap -15 m from Hat Creek
DW 9	3/4 km south of DW 8 and east from road (near landing strip)	Artesian	-Sealed reservoir -Sampled from tap
DW 10	2 km south of DW 9 & 100 m west of road	Groundwater	-Sealed well -6 m from Hat Creek -Collected from tap
DW 11	1.5 km south of DW 10 turnoff west	Hat Creek	-Not sampled
DW 12	3/4 km south of DW 11 turnoff west	Groundwater	-New residence -Sampled from tap



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LIST OF DOMESTIC WELL SITES IN
THE HAT CREEK VALLEY
(Prepared by: Beak Consultants Ltd. 4/)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 2.3-3

PART THREE

PARAMETER	Hat Creek	Bonaparte River	Thompson River	Pit Hydrology Study	Bulk Sample Program	Power Plant Site Study	Freshet Study	Thompson R. Intake Study	Goose/Fish Hook Lake	Finney Lake
CATIONS - Trace Metals										
Aluminum (Al)	x	x	x		x	x			x	x
Arsenic (As)	x	x	x		x	x			x	x
Cadmium (Cd)	x	x	x		x	x			x	x
Chromium (Cr)	x	x	x		x	x			x	x
Copper (Cu)	x	x	x		x	x			x	x
Iron (Fe)	x	x	x	x	x	x			x	x
Lead (Pb)	x	x	x			x			x	x
Mercury (Hg)	x	x	x		x	x			x	x
Molybdenum (Mo)	x	x	x			x			x	x
Selenium (Se)	x	x	x		x	x			x	x
Vanadium (V)	x	x	x		x	x			x	x
Zinc (Zn)	x	x	x		x	x			x	x
CATIONS - Alkali Earths & Metals										
Calcium (Ca)	x	x	x	x	x	x			x	x
Lithium (Li)	x	x	x		x	x			x	x
Magnesium (Mg)	x	x	x	x	x	x			x	x
Potassium (K)	x	x	x	x					x	x
Sodium (Na)	x	x	x	x	x	x			x	x
Strontium (Sr)	x	x	x		x	x			x	x
ANIONS - General										
Boron (B)	x	x	x		x	x			x	x
Chloride (Cl)	x	x	x	x	x	x			x	x
Fluoride (F)	x	x	x		x	x			x	x
Sulphate (SO ₄)	x	x	x	x	x	x			x	x
ANIONS - Nutrients										
Total Kjeldahl Nitrogen (N)	x	x	x			x			x	x
Nitrate Nitrogen (NO ₃ - N)	x	x	x			x			x	x
Nitrite Nitrogen (NO ₂ - N)	x	x	x			x			x	x
Total Orthophosphate Phosphorous (P)	x	x	x		x	x			x	x
ORGANIC, NONIONIC, & CALCULATED VALUES										
COD	x	x	x			x			x	x
TOC	x	x	x		x	x			x	x
Phenol	x	x	x			x			x	x
Total Hardness (CaCO ₃)	x	x	x	x	x	x			x	x
Total Alkalinity (CaCO ₃)	x	x	x	x	x	x			x	x
PHYSICAL DATA										
pH (units)	x	x	x	x	x	x			x	x
Specific Conductance (µmhos/cm @ 25°C)	x	x	x	x	x	x	x		x	x
True Colour (Pt-Co Units)	x	x	x			x			x	x
Turbidity (NTU)	x	x	x			x	x		x	x
Temperature (°C)	x	x	x			x			x	x
PHYSICAL DATA - Residues										
Total Residue	x	x	x		x	x			x	x
Filterable Residue	x	x	x		x	x			x	x
Nonfilterable Residue	x	x	x		x	x	x	x	x	x
Fixed Total Residue	x	x	x			x			x	x
Fixed Filterable Residue	x	x	x		x				x	x
Fixed Nonfilterable Residue	x	x	x			x			x	x
BIOCHEMICAL, DISSOLVED GASES & RELATED MEASUREMENTS										
BOD	x	x	x						x	x
D.O.	x	x	x			x			x	x
% Saturation	x	x	x						x	x



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SURFACE WATER PARAMETERS ANALYZED
(Prepared by: Beak Consultants, Ltd. 4/)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 2.3-4

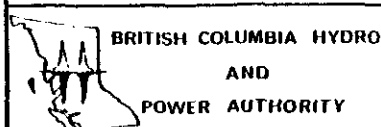
PART THREE

NAME	OPERATOR	TYPE	PERIOD OF OPERATION	LOCATION LAT./LONG.	DRAINAGE AREA (km ²)	COMMENT
Ambusten Creek	BEAK	Manual	12 Sept. 1976 - 9 June, 1977	55 44 00 121 33 48	28.7	# NAT.
Anderson Creek	BEAK	Manual	16 Sept. 1976 - 10 June, 1977	50 42 39 121 37 46	31.9	# NAT.
Finney Creek	BEAK	Manual	17 May, 1977 - 10 June, 1977	50 45 06 121 37 12	9.8	# REG.
Hat Creek near Ashcroft	W.S.C.	Manual	1911-1922	50 36 44 121 34 09	72.5	S REG.
Hat Creek near Cache Creek	W.S.C.	Manual	1911-13, 1960-74	50 53 03 121 29 55	666.0	C REG.
Hat Creek near Carguile	W.S.C.	Manual	1911	50 53 05 121 29 55	603.5	S REG.
Hat Creek above Marble Canyon	W.S.C.	Manual	1921, 23, 34	50 47 30 121 36 40	349.7	S REG.
Hat Creek near Upper Hat Creek	W.S.C.	Manual	1960-1977	50 45 22 121 35 18	349.7	C REG.
Hat Creek - Hammond diversion	W.S.C.	Manual	1912-22	50 37 15 121 34 10	82.5	S REG.
Houth Creek	BEAK	Manual	18 Oct. 1976 - 9 June, 1977	50 47 24 121 36 18	28.2	# NAT.
Medicine Creek	BEAK	Manual	15 Sept. 1976 - 8 June, 1977	50 45 30 121 33 50	40.9	# REG.
Medicine Creek diversion	BEAK	Manual	13 May, 1977 - 28 May, 1977	50 45 45 121 26 50	15.0	# REG.
Bonaparte River near Cache Creek	W.S.C.	Manual	1960-1974	50 54 57 121 24 21	4092.2	C REG.
Bonaparte River below Cache Creek	W.S.C.	Manual	1911-21, 1972-77	50 48 05 121 19 15	5024.6	C REG.

W.S.C. - Water Survey of Canada
- miscellaneous measurement
C - continuous measurement

S - seasonal measurement
NAT. - natural flow
REG. - flow affected by storage and/or diversion

Prepared by: Beak Consultants, Ltd. 4/



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STREAMFLOW RECORDS IN HAT CREEK DRAINAGE AREA

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 2.3-5

PART THREE

Habitat	Ungulate Pellet Transect	Small Mammal Live Trapping	Small Mammal Snap Trapping	Breeding Bird Survey	Upland Game Bird Survey	Owl Survey	Incidental Wildlife Observation
Subalpine Krummholtz			X				X
Engelmann Spruce - Lodgepole Pine	X		X				X
Douglas-fir/Pinegrass	X	X		X	X	X	X
Ponderosa Pine - Douglas-fir/ Bunchgrass	X	X		X	X	X	X
Aspen		X		X	X	X	X
Riparian		X		X			X
Open Ranges	X	X		X	X	X	X
Alpine and High Elevation Grassland	X						X
Mid Elevation Grassland	X	X		X	X	X	X
Low Elevation Grassland	X	X		X	X	X	X
Sagebrush Grassland	X						X
Big Sage Grassland							X
Bog	X						X
Cultivated Fields							X
Miscellaneous							X

Source: TERA Environmental Resource Analyst, Ltd. 2 /.



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SUMMARY OF SAMPLING WITHIN WILDLIFE HABITATS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 2.4-1

PART THREE

DATA SOURCES

<u>TOPICS</u>	<u>PUBLISHED REPORTS</u>	<u>AGENCY CONTACTS</u>	<u>CONSULTANT DRAFT HAT CREEK REPORTS</u>	<u>AERIAL PHOTO INTERPRETATION</u>	<u>FIELD CHECKS</u>	<u>PRIVATE INDIVIDUALS</u>	<u>GOV'T MAPS</u>
Setting	X		X	X	X		X
Recreational Assets	X	X			X		X
Recreational Facilities	X	X		X	X	X	X
Recreational Activities	X	X	X			X	
Capability - Constraints	X	X	X				X



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DATA SOURCES FOR REPORT TOPICS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE

2.5-1

PART THREE

SITE	FROM	TO	DESCRIPTION
1	2:00 a.m. Oct. 26/76	12 Midnight Oct. 26/76	Fall-Weekday
	12 Midnight Oct. 22/76	12 Midnight Oct. 23/76	Fall-Weekend
	7:00 a.m. March 9/77	7:00 p.m. March 9/77	Winter-Weekday
	11:00 p.m. Feb. 10/77	7:00 a.m. Feb. 11/77	
	8:40 a.m. Feb. 20/77	5:40 a.m. Feb. 21/77	Winter-Weekend
<hr/>			
2	12 Midnight Oct. 24/76	12 Midnight Oct. 25/76	Fall-Weekday
	2:00 a.m. Oct. 24/76	12 Midnight Oct. 24/76	Fall- Weekend
	8:00 a.m. Feb. 14/77	6:00 a.m. Feb. 15/77	Winter-Weekday
	8:00 a.m. March 6/77	6:00 a.m. March 7/77	Winter-Weekend
<hr/>			
3	12 Midnight Oct 28/76	12 Midnight Oct. 29/76	Fall-Weekday
	12 Midnight Oct. 29/76	12 Midnight Oct. 30/76	Fall-Weekend
	7:00 a.m. Feb. 18/77	6:00 a.m. Feb. 19/77	Winter-Weekday
	7:00 a.m. Feb. 19/77	6:00 a.m. Feb. 20/77	Winter-Weekend
<hr/>			
4	12 Midnight Oct. 31/76	12 Midnight Nov. 1/76	Fall-Weekend
	12 Midnight Oct. 30/76	12 Midnight Oct. 31/76	Fall-Weekend
	8:00 a.m. March 10/77	6:00 a.m. March 11/77	Winter-Weekday
	--	--	Winter- Weekend
<hr/>			
5	11:00 p.m. May 26/77	10:00 p.m. May 27/77	Spring-Weekday

Prepared by: Harford, Kennedy, Wakefield, Ltd. 1/



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NOISE MONITORING SCHEDULE

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 2.6-1
PART THREE

Mean Maximum/Minimum Temperatures (°C)

<u>Month</u>	<u>Ashcroft</u>	<u>Dog Creek</u>	<u>Hat Creek</u>	<u>Kamloops</u>	<u>Kelowna</u>	<u>Lytton</u>	<u>Penticton</u>
December	-1/-8	-2/-9	-3/13	1/-5	1/-4	1/-5	2/-3
January	-4/-13	-6/-12	-5/-17	-2/-9	-1/-7	-1/-6	0/-6
February	1/-8	-3/-10	1/-12	1/-7	2/-7	4/-4	3/-5
March	7/-3	3/-5	4/-14	9/-2	8/-2	11/1	10/-1
April	14/2	10/0	11/-3	17/3	14/1	18/4	16/2
May	22/7	17/4	17/2	22/8	20/6	23/8	21/6
June	23/10	18/8	20/4	25/11	23/9	25/12	25/9
July	28/12	23/10	24/6	29/13	27/12	29/14	29/12
August	27/12	21/8	23/6	28/12	26/11	29/M*	27/11
September	23/7	17/6	19/2	22/8	20/7	23/10	19/2
October	13/2	9/-4	11/-2	13/3	13/2	15/6	15/3
November	4/-3	0/-7	2/-9	5/-1	6/-1	7/0	7/-1
Annual	13/2	9/-1	11/-4	14/3	13/2	15/4	15/3
Period of Record (yrs)	9	6	7	61	40	13	32

* M= Missing

Source: Environmental Research & Technology, Inc. 1 /



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CLIMATOLOGICAL AVERAGES OF DAILY TEMPERATURE RANGES IN THE HAT CREEK REGION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.2-1

PART THREE

Mean Dew Point (°C) per Station

Season	Ashcroft	Dog Creek	Kamloops	Kelowna	Lytton	Penticton
Winter	-10.9	-10.0	-6.3	-4.3	-4.3	-4.3
Spring	0.6	-1.8	1.7	1.5	2.8	1.5
Summer	7.8	7.4	10.0	10.5	10.0	10.5
Fall	1.3	0.0	3.3	4.1	4.4	4.0
Annual	0.2	-1.1	2.2	2.9	3.2	2.9

Mean Relative Humidity (%) per Station

Winter	83.7	82.7	79.3	79.3	82.0	79.3
Spring	57.7	61.7	57.7	61.3	61.0	61.3
Summer	49.0	62.3	53.7	60.0	50.7	60.0
Fall	66.3	73.0	71.7	71.3	72.0	71.3
Annual	64.2	69.9	65.6	68.0	66.4	68.0

Period of Record (yrs)	6	6	10	10	6	10
------------------------	---	---	----	----	---	----

Source: Environmental Research & Technology, Inc. 1 /



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DEW POINT AND RELATIVE HUMIDITY IN
THE HAT CREEK REGION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.2-2

PART THREE

STATION NUMBER	STATION NAME	NO. OF VALID OBSERVATIONS (% OF TOTAL)	NUMBER OF OBSERVATIONS IN RANGE ($\mu\text{g}/\text{m}^3$)							GEOMETRIC MEAN ($\mu\text{g}/\text{m}^3$)	
			0-20	21-40	41-60	61-80	81-100	101-120	121-140		< 140
1	Highway 12	38 (73)	33	5							9.2
2	Valley Junction	36 (67)	19	6	7	3			1		21.0
3	B.C. Hydro Camp	23 (50)	14	7	2						17.2
4	Milner's Ranch	33 (79)	28	5							9.6
5	Valley Trailer	22 (96)	21	1							7.6
6	Cache Creek	35 (70)	5	14	8	4	3	1			37.3

Source: B.C. Hydro and Power Authority 6/



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SUMMARY OF 1977 (APRIL THROUGH DECEMBER) SUSPENDED
PARTICULATE CONCENTRATION DATA FOR HAT CREEK AREA

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.2-3

PART THREE

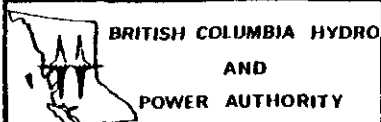
Contaminant	Averaging Time	Units	Ontario	Alberta	Canada Federal*		B.C. Level			USA Federal	Washington	Idaho	Montana
					1	2	A	B	C				
Sulphur dioxide	Ann. Arith	$\mu\text{g}/\text{m}^3$	55	30	30	60	25	50	80	80 primary	50	80 primary	50
	24 hr.	$\mu\text{g}/\text{m}^3$	275	150	150	300	160	260	360	365 primary	260	365 primary	260
	1 hr.	$\mu\text{g}/\text{m}^3$	690	450	450	900	450	900	900		1050		650
				525 (1/2 hr)						1300 secondary (3 hr. Av)	650**	1300 secondary (3 hr. Av)	
Suspended Particulate	Ann. geo.	$\mu\text{g}/\text{m}^3$	60	60	60	70	60	70	75	75 primary	60	75 primary	75
	24 hr.	$\mu\text{g}/\text{m}^3$	120	100		120	150	200	260	260 60 secondary 150	150	260 60 secondary 150	200
Nitrogen Oxides As NO ₂	Ann. Arith	$\mu\text{g}/\text{m}^3$		60	60	100				100***	100		
	24 hr.	$\mu\text{g}/\text{m}^3$	200	200		200							
	1 hr.	$\mu\text{g}/\text{m}^3$	400	400		400							
Carbon Monoxide	8 hr.	mg/m^3	15.7	6	6	15	5.5	11	14.3	10***	10	10	
	1 hr.	mg/m^3	36.2	15	15	35	14.3	28	35	40***	40	40	
Oxidants as O ₃	Ann. Arith	$\mu\text{g}/\text{m}^3$		30	20	30							
	24 hr. hr.	$\mu\text{g}/\text{m}^3$	165	100	100	160				160***	160	160	

* Canada Federal Level 1 - maximum desirable level and Level 2 - maximum acceptable level.

** 1 hr. average may occur twice per 7 days.

*** Primary and secondary standard.

Prepared by: Simons. /f



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AMBIENT AIR QUALITY STANDARDS OR CRITERIA FOR PRIMARY AIR CONTAMINANTS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.2-4

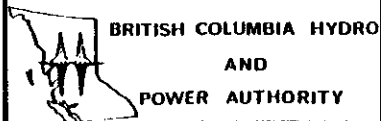
PART THREE

	Ontario	Alberta	Canada Federal	B,C, Level			Units	U.S.A. Federal	Washington	Idaho	Montana
				A	B	C					
Particulate	Max. 1/2 hr. ave. concentration at point of impingement 100 $\mu\text{g}/\text{m}^3$	229 mg/m^3 0.2 g/kg (50% excess air)	See Below	229 5	343 7	564 13	mg/m^3 * $\text{g}/10^6$ cal**	90 mg/m^3 0.18 $\text{g}/10^6$ cal*	225 mg/m^3	0.22 $\text{g}/10^6$ cal	0.22 $\text{g}/10^6$ cal
Sulphur Dioxide	Max. 1/2 hr. ave. concentration at point of impingement 830 $\mu\text{g}/\text{m}^3$ plus additional restrictions (see comment)	Mass emission rate controlled through permit system.	See Below	798 1.8	1596 2.7	2660 5.4	mg/m^3 * $\text{g}/10^6$ cal**	975 mg/m^3 2.2 $\text{g}/10^6$ cal*	2660 mg/m^3	812.5 mg/m^3	812.5 mg/m^3
Nitrogen Oxides as NO_2	Max. 1/2 hr. ave. concentration at point of impingement 500 $\mu\text{g}/\text{m}^3$	Mass emission rate controlled through permit system.	See Below	1146 2.4	1910 4.0	2292 4.8	mg/m^3 * $\text{g}/10^6$ cal**	600 mg/m^3 1.26 $\text{g}/10^6$ cal*			
Comment	Calculated ground level concentration 525 $\mu\text{g}/\text{m}^3$ (rural), 390 $\mu\text{g}/\text{m}^3$ if within 48.3 km of a town of 40,000 or 150 $\mu\text{g}/\text{m}^3$ if in an industrial area with other sources.		Guidelines are currently in final development stage and expected in 1977.						For sources greater than 2.5×10^4 cal/hr	Same as Idaho	

* Specified emission rate, others are calculated.

** Basis 5550 calories/gram of coal.

Prepared by: Simmons. 7/



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MAXIMUM ALLOWABLE EMISSIONS RATE CRITERIA

THE HAT CREEK PROJECT - Detailed Environmental Studies

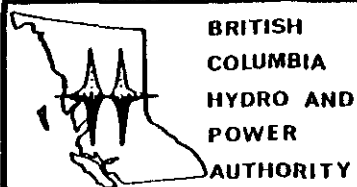
TABLE 3.2-5

PART THREE

ELEMENT	Province of B.C. Pollution Control Objectives 24-hr Average (Except as noted) $\mu\text{g}/\text{m}^3$ Level			Province of Ontario Ambient Air Quality Criteria 24-hr Average (except as noted) $\mu\text{g}/\text{m}^3$	United States Ambient Standards $\mu\text{g}/\text{m}^3$	U.S. EPA Sponsored Panel Safe 24-hr Ambient Air Quality Levels $\mu\text{g}/\text{m}^3$
	A	B	C			
Arsenic	1.0	1.0	1.0	25		5.9
Beryllium					0.01 (30 day average)	0.005
Cadmium	0.1	0.1	0.3	2.0		1.2
Chromium						4.6
Copper						10.0
Fluoride	gaseous 7 day average			Expressed as HF Apr. 15 to Oct. 15 0.86 for 24 hrs (gaseous) 1.72 for 24 hrs (gaseous plus particulate) Oct. 16 to Apr. 14 1.38 for 24 hrs (gaseous plus particulate)		47
Lead	1.0	1.0	1.7			47
Manganese	4.0	4.0	6.0	5.0		4.7
Mercury	1.0	1.0	1.0	2.0	1.0 (24 hour average)	11.4 0.8
Nickel				2.0		3.7
Selenium						5.4
Uranium					0.4 (1×10^{-13} $\mu\text{curies}/\text{ml}$)*	
Vanadium				2.0		6.8
Zinc	5.0	5.0	8.0			34

* Conversions based on the specific activity of naturally occurring uranium being 6.77×10^{-1} $\mu\text{curies}/\text{g}$.

Prepared by: Simmons. 7/



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AMBIENT AIR QUALITY STANDARDS AND GUIDELINES FOR TRACE ELEMENTS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.2-6

PART THREE

STATION:	DOMESTIC WELLS Excluding HMB	STEEL BRUSH WELL	DRILL HOLE #1	ARTESIAN # 2-EAST	DRILL HOLE #19	BUCKET ANGER HOLE #7 (COAL SEAM)	DRILL HOLE #27-48	DRILL HOLE #27-49	WELL 1, 2, 4+ TRENCH B	WELL 3	HAT CREEK	BONAPARTE RIVER	YIMPSUM RIVER	FIMNEY LAKE	COURSE/ FISH HOLE LAKE
CATIONS - TRACE ELEMENTS															
Aluminum (Al)	< 0.011	-	-	-	0.004 (0.010)**	-	-	< 0.014	< 0.011	< 0.010	< 0.010	< 0.011	< 0.010	< 0.010	< 0.010
Arasonic (As)	< 0.005	-	-	-	< 0.005 (0.012)**	-	-	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Cadmium (Cd)	< 0.005	-	< 0.001	-	< 0.001	< 0.005	< 0.001	< 0.001	< 0.010	< 0.010	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Chromium (Cr)	< 0.010	-	-	-	< 0.001	< 0.010	-	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Copper (Cu)	< 0.009	-	< 0.002	-	< 0.002	< 0.005	0.004	< 0.001	< 0.009	< 0.001	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Iron (Fe)	< 0.284	-	< 0.041	-	< 0.05	< 0.125	< 0.035	0.073	0.123	0.142	< 0.026	0.048	< 0.022	< 0.041	< 0.010
Lead (Pb)	< 0.010	-	< 0.001	-	< 0.01	< 0.010	0.002	< 0.001	-	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Mercury (Hg)	< 0.00020	-	-	-	< 0.0002	(0.00039)	-	-	(0.00012)	(0.00013)	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020
Molybdenum (Mo)	< 0.020	-	-	-	< 0.04	< 0.003	-	-	< 0.004	< 0.003	< 0.020	< 0.020	< 0.020	< 0.020	0.03
Nickel (Ni)	< 0.003	-	-	-	< 0.10	< 0.005	< 0.04	< 0.04	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Vanadium (V)	< 0.005	-	< 0.04	-	-	-	-	-	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Zinc (Zn)	0.074	-	0.008	-	1.97	0.008	< 0.015	< 0.001	< 0.016	0.030	< 0.007	< 0.027	0.017	< 0.006	< 0.030
CATIONS - SMALL EARTHS & METALS															
Calcium (Ca)	49	71.4	50.0	140	47.2	4.8	30.2	173.4	46	264	37	38	11	26	11
Lithium (Li)	0.004	-	-	-	0.02	< 0.000	-	< 0.004	-	0.020	0.002	< 0.001	< 0.001	< 0.001	0.070
Magnesium (Mg)	21	45.4	30.4	64	21.4	4.1	4.8	91.2	14	80	19	14	2.3	0.3	19
Potassium (K)	-	3.4	4.6	-	34.8	27	3.8	4.7	-	-	4.8	1.8	0.63	2.4	190
Sodium (Na)	15	0.4	41.6	28	330	300	182.1	32.2	20	364	20	12	3.3	15	1390
Strontium (Sr)	0.33	-	0.50	-	0.06	0.14	0.34	1.74	0.25	1.76	0.31	0.15	0.035	0.13	1.2
ANIONS - GENERAL															
Boron (B)	< 0.10	-	-	-	< 0.10	< 0.10	-	-	< 0.10	0.10	< 0.10	< 0.10	< 0.10	< 0.1	0.3
Chloride (Cl)	< 1.4	14.5	6.8	7.4	< 0.5	0.2	4.2	1.0	1.3	7.5	1.1	0.94	1.4	0.22	96
Fluoride (F)	0.35	-	-	-	0.047	0.33	-	-	0.120	0.120	0.14	0.17	0.11	0.22	< 0.37
Sulfate (SO ₄)	50	70	81.2	250	17.3	160	112.0	196.8	49	1320	54	18	7.6	5.0	2160
ANIONS - NUTRIENTS															
Total - Kjeldahl - Nitrogen (N)	0.16	-	-	-	22.2	3.7	-	-	-	-	0.19	0.27	0.06	0.03	3.2
Nitrate - Nitrogen (NO ₃ - N)	< 0.10	-	-	-	< 0.10	0.02	-	-	-	-	< 0.05	< 0.06	< 0.07	< 0.02	< 0.047
Nitrite - Nitrogen (NO ₂ - N)	< 0.0013	-	-	-	< 0.001	0.001	-	-	-	-	< 0.002	< 0.002	< 0.002	< 0.0019	< 0.0016
Total - Orthophosphate - Phosphorus (P)	0.037	-	-	-	< 0.01	0.037	-	-	0.027	0.040	0.063	0.030	0.020	0.025	1.3
ORGANIC, NUTRIENT & CALCULATED VALUES															
COD	< 37	-	-	-	-	-	-	-	-	-	21	19	21	22	124
BOD	16	-	-	-	-	22	-	-	30	88	0	10	3	18	144
Phenol	< 0.002	-	-	-	-	-	-	-	-	-	< 0.003	< 0.003	< 0.003	< 0.002	< 0.002
Total Hardness (CaCO ₃)	247	-	269	-	208	289	70	682	231	945	135	38	94.8	434	4324
Total Alkalinity (CaCO ₃)	264	350	327	430	842	791	421	672	233	533	376	147	35	123	1520
PHYSICAL DATA															
pH (units)	7.0	7.4	8.0	7.6	7.6	7.3	8.2	8.0	7.0	7.4	8.4	8.2	7.8	8.2	8.0
Specific Conductance (µmhos/cm - 25°C)	519	664	681	1100	1834	1700	942	1226	530	3010	489	294	93	232	4700
Turbidity (Pt-Co Units)	< 9	-	-	-	-	20	-	-	-	-	13	16	9	19	50
Viscosity (cP)	1.3	-	-	-	-	3.3	-	-	-	-	1.5	2.1	0.81	1.1	2.9
Temperature (°C)	-	-	-	-	-	10	-	-	-	-	6.6	6.6	8.0	5.8	6.4
PHYSICAL DATA - RESIDUES															
Total residue	357	-	-	-	-	1244	-	-	379	2858	348	222	7	170	5074
Filterable residue	353	-	-	-	-	1220	-	-	347	2714	347	207	74	174	5070
Non-filterable residue	4	-	-	-	-	24	-	-	32	144	0	16	3	3	4
Fixed total residue	305	-	-	-	-	1088	-	-	-	-	201	160	50	133	4708
Fixed filterable residue	308	-	-	-	-	1090	-	-	-	-	278	145	49	112	4703
Fixed non-filterable residue	4.3	-	-	-	-	6	-	-	-	-	4	13	1	4	3
BIOCHEMICAL, DISSOLVED GASES & RELATED MEASUREMENTS															
BOD	-	-	-	-	-	7	-	-	-	-	41	41	4.1	1	1
D.O.	-	-	-	-	-	8.0	-	-	-	-	11.1	11.2	11.1	9.0	9.0
% Saturation	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-	-

* All parameters expressed in mg/L, except as noted
 ** () Denotes Total Concentration

Source: Beak Consultants, Ltd. 1/



BRITISH COLUMBIA HYDRO
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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants

WATER QUALITY MONITORING RESULTS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-1

PART THREE

<u>Parameter</u>	<u>Units</u>	<u>Hat Creek</u>	<u>Bonaparte River</u>
Average Suspended Solids Concentration	mg/L	6	16
Maximum Suspended Solids Concentration	mg/L	300	65
Suspended Solids Yield			
Winter	tonnes/month	2	10-25
Freshet	tonnes/month	2400	2700
Mean Annual	t/km ² /a	5.6	1.3
Average Dissolved Solids Concentration	mg/L	342	207
Maximum Dissolved Solids Concentration	mg/L	413	275
Dissolved Solids Yield			
Winter	tonnes/month	260-400	1600-2200
Freshet	tonnes/month	3000	7200
Mean Annual	t/km ² /a	14.3	8.0

Source: Beak Consultants, Ltd. 1/

Rev. 1 Feb. 1979.



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SUSPENDED AND DISSOLVED SOLIDS
VARIATIONS FOR
HAT CREEK AND BONAPARTE RIVER

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-2

PART THREE

Parameter *	COAL A (Low HV)	COAL B (Medium HV)	COAL C (High HV)	OVERBURDEN BAH 76-1	OVERBURDEN BAH 76-13	WASTE ROCK	LOW GRADE COAL WASTE	FLY ASH	BOTTOM ASH
pH	7.1	7.0	7.4	7.6	7.65	7.85	7.85	9.4	8.8
Suspended Solids	2010	640	1000	72	412	7520	1650	35	80
Total Filterable Residue	2940	3500	3700	1900	2000	3400	5320	9450	4770
Alkalinity as CaCO ₃	1850	1750	1080	920	1120	1320	3120	2600	1110
Chloride -Cl	220	200	80	28	16	270	380	110	110
Fluoride -F	1.2	1.4	< 0.4	< 0.4	< 0.4	2.4	1.5	55.2	6.8
Nitrate-Nitrogen -N	24	21	2	15	18	19	19	5	3
Nitrite-Nitrogen -N	6	< 0.4	< 0.4	< 0.4	< 0.4	6	9	< 0.4	< 0.4
Total Kjeldahl Nitrogen -N	9	13	21	6	5	2	12	9	4
Biochemical Oxygen Demand (5-day)	1400	1250	1520	370	340	400	520	200	200
Chemical Oxygen Demand	1840	1840	2940	440	440	660	950	360	700
Ortho-Phosphate - Phosphorus -P	3.0	3.0	3.6	2.7	3.5	9.2	5.0	1.3	2.2
Sulphur -S	96	160	420	80	111	250	224	2000	1000
Aluminum -Al	10	20	12	26	13	24	25	10	7
Arsenic -As	0.6	0.4	0.8	1.3	0.5	1.0	0.8	4.3	3.1
Boron -B	1.0	1.0	1.0	1.0	1.0	2.0	1.0	6.3	0.7
Cadmium -Cd	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	0.02	0.06
Calcium as CaCO ₃	80	90	60	290	400	480	600	3240	1320
Chromium -Cr	1.0	< 1	< 1	1.0	1.5	< 1	< 1	< 1	< 1
Copper -Cu	7.0	5.0	6.5	2.2	3.4	4.0	6.0	0.2	0.2
Iron -Fe	40	30	32	14	31	76	76	1	1
Lead -Pb	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3
Lithium -Li	0.3	0.3	0.6	< 0.3	< 0.3	< 0.3	0.6	0.3	0.3
Magnesium as CaCO ₃	80	86	100	358	380	440	540	190	190
Mercury -Hg	0.004	0.006	0.008	0.010	0.010	0.006	0.006	< 0.002	< 0.001
Selenium -Se	0.6	0.6	0.6	0.2	0.2	0.2	0.9	< 0.02	< 0.01
Sodium -Na	980	975	920	178	225	542	1280	100	110
Strontium -Sr	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4
Vanadium -V	0.2	0.2	0.2	< 0.2	< 0.2	0.2	0.3	1.4	3.8
Zinc -Zn	8.4	7.2	15.0	6.8	10.8	8.8	15.0	40	80

*Except for pH, all units are mg/kg, indicating milligrams extracted per kilogram of dry solids.

Source: Acres Consulting Services, Ltd. 10/.

Parameter *, **	COAL A	COAL B	COAL C	OVERBURDEN BAH 76-1	OVERBURDEN BAH 76-1J	WASTE ROCK	LOW GRADE WASTE COAL
Volume of Extract	128	94	165	186	117	100	222
pH (units)	6.95	7.2	5.0	7.6	7.9	8.3	7.8
Suspended Solids (mg/l)	289	187	253	21	25	1210	81
Total Filterable Residue (mg/l)	2560	2735	1658	180	160	2078	1520
Specific Conductance (mho/cm)	1900	1925	1310	80	290	670	865
Alkalinity as CaCO ₃	606	338	297	102	90	180	872
Chloride	63	33	44	4	2	53	89
Fluoride	0.04	0.06	0.22	0.09	0.08	0.06	0.18
Nitrate-Nitrogen	6.0	3.5	0.3	7.4	7.0	3.7	5.3
Ortho-Phosphate - Phosphorus	0.26	0.13	0.11	0.28	0.23	0.40	0.33
Sulphur	12.5	13.3	46.9	1.3	7.8	10.0	22.2
Arsenic	0.03	0.01	0.04	0.1	0.04	0.1	0.1
Boron	0.26	0.19	0.11	0.04	0.02	0.05	0.27
Cadmium	< 0.002	< 0.02	< 0.0022	< 0.004	< 0.003	< 0.002	< 0.005
Calcium, as CaCO ₃	9.1	15.2	15.1	24.6	29.3	76.2	83.3
Chromium	0.21	0.05	0.06	0.09	0.06	0.20	0.44
Copper	2.05	2.19	2.09	0.65	1.64	2.10	5.44
Iron	2.8	0.6	1.1	0.6	1.2	1.9	12.7
Lead	0.02	< 0.02	< 0.022	< 0.04	< 0.03	< 0.02	< 0.05
Magnesium, as CaCO ₃	14.5	11.5	18.9	27.2	34.2	43.7	75.9
Mercury	0.002	0.003	0.002	0.004	0.002	0.003	0.004
Sodium	314	179	191	27	47	70	593
Vanadium	< 0.01	< 0.01	< 0.011	< 0.02	< 0.02	< 0.01	< 0.022
Zinc	0.18	0.08	0.01	0.06	0.04	0.28	0.28

ADDITIONAL DATA:

	COAL SAMPLES	OVERBURDEN SAMPLES	WASTE ROCK	LOW GRADE WASTE COAL
Weight of Sample :	150 g	100 g	100 g	100 g
Particle Size:	2 mm x 0.6 mm	2 mm x 0.6 mm	2 mm x 0.6 mm	2 mm x 0.6 mm
Packed Column Length:	20 cm	10 cm	11 cm	11 cm
Water Required for Saturation:	80 ml	25 ml	65 ml	30 ml
Average Temperature:	22°C	22°C	22°C	22°C

*Except where noted, results are expressed in units of mg/kg, indicating milligrams extracted per kilogram of dry solids.

** Results are extractions from Day 1 only.

Source: Acres Consulting Services, Ltd. 10/.



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RATE OF RELEASE TEST RESULTS

THE HAT CREEK PROJECT - Detailed Environmental Studies

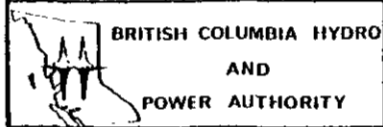
TABLE 3.3-4

PART THREE

Period Analyzed 1	RAIN			STREAMFLOW			Fast Runoff (mm) 8	Fast runoff as proportion of rainfall 9	Runoff coefficient based on 24 hr. period 10	Comments 11
	Total over period (mm) 2	Date of highest rate 3	Highest 24 hr. rate (mm) 4	Date of peak flow 5	Peak Flow (m ³ /s) 6	Lag (days) 7				
May 26-31, 1961	21	May 26	15	May 27	4.90	1	1.079	.0514	.0806	Rain during snowmelt
July 21-25, 1961	7.4	July 21	7.4	July 22	0.608	1	0.149	.0202	.0203	Distinct rain peak
May 23-30, 1962	26	May 25	10	May 26	12.06	1	7.40	.285	.300	Rain on snow, followed by hot weather
Sept. 10-14, 1962	22.5	Sept. 10	22.5	Sept. 11	0.440	1	0.109	.0048	.0054	Distinct, small rain peak
Oct. 11-17, 1962	28.5	Oct. 12	16.3	Oct. 13	0.710	1	0.159	.0056	.0061	Sharp rain peak
Oct. 20-30, 1963	13	Oct. 21	13	Oct. 22	0.400	1	0.184	.0141	.0076	Rectangular hydrograph probably rain at low el. and fast melting snow higher up
June 10-14, 1964	34.6	June 11	22.3	June 11	14.5	≈1/2	3.28	.0949	.1605	Rain during period of high snowmelt flow
June 16-22, 1964	32.9	June 18	17.6	June 18	12.1	1	2.64	.0803	.170	Rain at declining snowmelt flows
Sept. 6-11, 1964	31.4	Sept. 7	26.6	Sept. 8	1.24	1	0.358	.0114	.0115	Prominent rain peak on a wet basin
Aug. 22-30, 1965	45.8	Aug. 23	30	Aug. 24	1.38	1	0.699	.0153	.0114	Rain peak
July 5-9, 1966	27.9	July 5	26.9	July 6	3.70	1	1.00	.0358	.0340	Rain peak
July 23 - Aug. 3, 1966	47	July 24	39	July 25	3.62	1	2.13	.0454	.0229	Rain peak, possibly some snowmelt
July 1-12, 1969	54.6	July 5	14.5	July 6	6.60	1	3.95	.0724	.112	Rain peak during later snow runoff
Aug. 10-17, 1974	46.2	Aug. 12	23.2	Aug. 12	1.09	< 1	0.439	.0189	.0116	Rain peak

Note: A drainage area of 350 km² has been assumed.

Prepared by: Beak Consultants, Ltd. 1/



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HYDROGRAPH ANALYSIS FOR THE STREAMGAUGE "HAT CREEK NEAR UPPER HAT CREEK"

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-5

PART THREE

Location of Diversion	Irrigation Licence*		Supplemental Licence**		Storage Licence		Storage Location
	Number of Licences	Water Quantity (10 ⁶ m ³)	Land Area (ha)	Number of Licences	Water Quantity (10 ⁶ m ³)	Number of Licences	
Region I							
Hat Creek	2	165 (37)***		-	-		
Gallagher Creek	1	11		-	-	1	11
Robertson Creek	2	12		-	-		
Sub Total	5	188 (37)	205 (40)	-	-	1	11
Region II							
Hat Creek	4	21		-	-		
Lloyd (Houth) Creek	1	11		-	-		2
Medicine Creek	5	236 (224)		-	-	3	216
Finney Creek	2	24		-	-		12
Anderson Creek	-	-		1	12		
Ambusten Creek****	1	4		-	-		
Sub Total	13	296 (224)	346 (318)	1	12	3	230
Region III							
Hat Creek	6	89		-	-		
Anderson Creek	3	24		1	28		
Ambusten Creek****	1	12		-	-		
Cashmere Creek	1	2		1	2		
Martin Creek	1	7		-	-		
McCormick Creek	2	34		-	-		
McDonald Creek	4	40		1	10		
White Rock Creek	2	5		-	-	1	4
Schneider Br.	1	7		-	-		6
Parke Creek	-	-		1	4		2
Phil Creek****	2	28		1	6	1	5
Crater Creek	1	3		-	-		
Dorough Creek****	3	20		-	-		
Pocock Creek	2	11		-	-		
Sub Total	29	288	538	5	50	2	17
Region IV							
Hat Creek	6	184 (158)		1	48 (48)	2	36
Pocock Creek	6	49		-	-		
Yet Creek****	2	5		-	7		
Colley Creek	4	40		-	-		
Dorough Creek	1	Whole Flow		-	-		
Sub Total	17	278 (158)	510 (325)	1	55 (48)	2	36
Totals	66	1050 (419)	1698 (683)	7	117 (48)	8	294

* Supplemental licences not included.

** Used only when primary source is inadequate, but not available for other licences.

*** Bracketed numbers refer to quantities used outside of Hat Creek watershed.

**** Fully Recorded.



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IRRIGATION WATER LICENCE INFORMATION FOR HAT CREEK DRAINAGE Rev. 1 Feb. 1979.
(Source: Beak Consultants, Ltd. 1/)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-6

PART THREE

Location of Diversion	Irrigation Licence*		Land Area (ha)	Supplemental Licence**		Storage Licence		Storage Location
	Number of Licences	Water Quantity ($10^6 m^3$)		Number of Licences	Water Quantity ($10^6 m^3$)	Number of Licences	Water Quantity ($10^6 m^3$)	
Bonaparte Drainage (South of Township 23)								
Bonaparte River	38	684		1	49			
Settlement Brook	1	1		-	-			
Walter Brook	1	2		-	-			
Perry Brook	1	8		-	-			
Craig Spring	2	44		-	-			
Cache Creek	12	379		1	26	2	66	Sewlin Lake and Reservoir, West Fork Cache Creek
Cache Swamp	1	24		-	-			
Thompson River	1	148		-	-			
Total	57	1290	1266	2	75	2	66	
Cornwall & Cheetsum Drainages								
Cornwall Creek	5	59		1	45	3	64****	McLean, Fitzellian & Henry Lakes
Cheetsum Creek***	1	10		-	-			
Lone Tree Creek	1	18		-	-	1	18	UK Lake
Ashcroft Creek	1	15		-	-	1	15	UK Lake
102 Gulch Creek	1	10		-	-			
Mahashket & Tingley Springs	1	13		-	-			
Total	10	125	307	1	45	5	97	
Oregon Jack & Minaberriet Drainages								
Oregon Jack Creek	7	136		3	92	4	68	Pond
Minaberriet Creek	1	6		-	-			
Basque Swamp	1	Whole Flow		-	-			
Lulu Brook	1	5		-	-			
McKenna Brook	1	1		-	-			
Total	11	148	166	3	92	4	68	

* Supplemental licences not included.

** Used only when primary source is inadequate, but not available for other licences.

*** Fully recorded (note that the licence for Cheetsum Creek also uses some water Minaberriet Creek).

**** A licence for $37 \times 10^6 m^3$ has been included in this total as well as the total shown on Table 3.3-6.

Source: Beak Consultants, Ltd. 1/



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IRRIGATION WATER LICENCE INFORMATION FOR OTHER STUDY AREAS Rev. 1 Feb. 1979.

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-7

PART THREE

Region	Soils Group	Irrigation Method and Crop Type				Ditch/Pasture		Total	
		Sprinkler/Hay	Water*	Ditch/Hay	Water	Area	Water	Area	Water
		Area*	Volume	Area	Volume	Area	Volume	Area	Volume
I	Upland**	-	-	157	107	53	36	210	143
	Floodplain	16	7	-	-	-	-	16	7
II	Upland	18	11	35	23	59	40	112	74
	Total	34	18	35	23	59	40	128	81
	Floodplain	157	70	32	17	-	-	189	87
III	Upland	10	6	271	183	87	59	368	248
	Total	167	76	303	200	87	59	557	335
	Floodplain	-	-	-	-	-	-	-	-
IV	Upland	70	40	113	76	6	4	189	120
	Total	70	40	113	76	6	4	189	120
Total	Floodplain	173	77	32	17	-	-	205	94
Water-Shed	Upland	98	57	576	389	205	139	879	585
	Total	271	134	608	406	205	139	1084	679

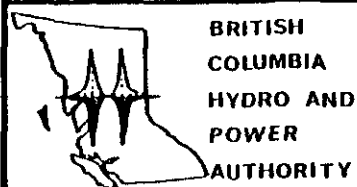
Region	Seasonal Distribution ($10^4 m^3$)						Total
	May	June	July	August	September		
Sub-Region I	21	27	44	34	17	143	
Sub-Region II	12	15	25	20	9	81	
Sub-Region III	46	63	105	82	39	335	
Sub-Region IV	17	23	37	29	14	120	
Total Watershed	96	128	211	165	79	679	

* All areas expressed in hectares while all water volumes are expressed in $10^4 m^3$.

** All soils were assumed to be upland soils as a sufficient characterization was not available.

Source: Beak Consultants, Ltd. 1/

Rev. 1 Feb. 1979.



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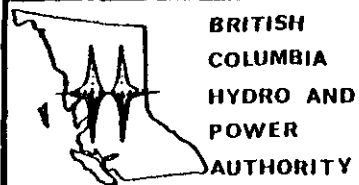
MODEL ESTIMATE OF PRESENT IRRIGATION WATER USE IN HAT CREEK VALLEY

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-8

PART THREE

Waterbody	Total Alkalinity *	Hardness *	Filtrable Residue **	Sulphates**	Specific Conductivity ***	pH
<u>Category I - Alkalinity Range >50 mg/l</u>						
Nahatlatch River	17.0 (7.2)***	15.5 (7.6)	29.0 (27.0)	5.0 (-)	43.1 (37.2)	7.4 (0.3)
Seton River	35.8 (4.5)	40.6 (5.9)	58.2 (6.9)	11.3 (2.5)	97.2 (23.2)	7.7 (0.2)
Stein River	30.2 (11.6)	26.7 (11.2)	45.8 (15.7)	6.9 (2.5)	71.0 (26.4)	7.5 (0.2)
Clearwater River	35.2 (3.1)	36.4 (3.8)	50.2 (4.9)	5.7 (0.8)	104.9 (104.1)	7.6 (0.4)
N. Thompson River	36.4 (9.1)	38.8 (11.0)	57.0 (13.6)	7.6 (2.0)	86.4 (31.8)	7.6 (0.3)
N. Thompson River at Kamloops	36.9 (8.9)	40.2 (9.2)	57.0 (13.4)	7.5 (2.2)	99.4 (27.3)	7.5 (3.4)
Thompson River at Savona	34.8 (4.4)	37.8 (4.7)	56.6 (9.1)	7.1 (1.3)	95.3 (21.7)	7.6 (0.3)
Thompson River at Walhachin	34.0 (3.7)	37.4 (4.5)	56.4 (8.7)	6.8 (1.5)	95.5 (17.1)	7.5 (0.6)
Thompson River at Spences Bridge	38.2 (5.6)	42.9 (6.4)	64.2 (10.0)	8.9 (2.8)	107.0 (31.7)	7.7 (0.2)
Brarrie River	48.0 (8.2)	44.9 (5.7)	71.0 (8.3)	5.7 (0.9)	132.4 (111.5)	7.6 (0.3)
Tranquille River at 21 mile	40.4 (4.2)	34.1 (3.7)	60.0 (10.0)	-	80.8 (8.9)	7.6 (0.2)
Seymour River	12.1 (3.4)	-	24.8 (4.6)	-	48.3 (41.8)	7.0 (0.3)
Eagle River	19.0 (6.6)	-	42.0 (-)	-	50.6 (18.7)	-
Adams River	22.5 (0.7)	-	39.3 (3.0)	-	55.0 (3.8)	-
Pennask Lake	-	-	27.0 (-)	-	-	-
Little Shuswap Lake	30.5 (-)	-	52.7 (-)	-	73.0 (-)	-
South Thompson River	37.0 (8.0)	-	55.5 (12.7)	-	94.7 (21.5)	7.5 (0.7)
Scotch Creek	37.1 (11.7)	-	61.0 (19.0)	-	-	-
Shuswap Lake	40.7 (-)	-	61.7 (-)	-	112.9 (-)	-
Mara Lake	42.7 (5.1)	-	64.2 (-)	-	118.1 (-)	-
Adams Lake	-	-	57.0 (-)	-	-	-
Dunn Lake	-	-	63.0 (-)	-	-	-



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WATER QUALITY PARAMETERS, REGIONAL WATER BODIES

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THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-9
SHEET 1 OF 5

PART THREE

Waterbody	Total Alkalinity*	Hardness*	Filtrable Residue**	Sulphates**	Specific Conductivity***	pH
Category II - Alkalinity Range 50 - 100 mg/l						
Cultus Lake	49.0	-	86.0	-	165	7.5
Nicola River near Spences Bridge	92.6 (26.2) ****	85.9 (26.7)	126.8 (35.1)	15.6 (5.8)	204.4 (64.7)	8.2 (0.4)
Brich Lake	-	-	144	-	-	-
North Barriere Lake	-	-	80.5	-	-	-
Bridge River	90.0 (22.9)	103.6 (29.0)	152.0 (2.0)	21.2 (5.8)	207.1 (75.7)	8.0 (0.3)
Yalakom River	86.5 (20.8)	92.7 (22.5)	110.4 (24.0)	15.6 (3.9)	197.0 (69.2)	8.0 (0.2)
Fraser River at Lillooet	63.5 (13.4)	68.0 (13.8)	95.8 (18.1)	9.2 (4.1)	154.4 (38.9)	7.9 (0.2)
Fraser River at Lytton	61.3 (8.6)	64.4 (8.9)	91.4 (13.9)	9.7 (5.3)	153.4 (48.2)	8.0 (0.3)
Nicola River below Douglas Lake	69.2 (17.4)	88.0 (32.9)	145 (39.6)	35.3 (16.1)	206.1 (74.3)	8.0 (0.3)
Nicola River at outlet of North Lake	92.3 (7.4)	98.9 (8.2)	145.7 (10.9)	19.7 (5.5)	222.4 (26.0)	8.1 (0.3)
Jameison Creek	94.1 (27.0)	105.8 (36.2)	139.7 (45.5)	22.7 (14.3)	210 (83.4)	8.0 (0.3)
Criss Creek	93.0 (55.8)	82.6 (49.3)	127.4 (58.6)	8.5 (-)	196.9 (99.8)	7.9 (0.3)
Coldwater River at Merritt	62.7 (19.7)	62.8 (20.3)	85.3 (25.0)	-	140.4 (44.4)	7.8 (0.3)
Nicola River below Coldwater	92.5 (17.2)	96.3 (19.4)	141.4 (26.1)	-	213 (44.5)	8.0 (0.2)
Nicola Lake at east end	87.2 (2.8)	94.1 (2.3)	140.7 (5.7)	-	212.3 (6.6)	7.9 (0.4)
Nicola Lake opposite Nicola River	87.9 (4.0)	94.8 (3.4)	140.2 (5.7)	20.8 (0.2)	223.7 (25.9)	7.8 (0.4)
Nicola Lake at deepest Point	88.1 (2.5)	95.0 (2.6)	144.7 (6.8)	21.4 (0.2)	213.7 (8.0)	7.7 (0.4)
Nicola Lake at outlet	88.1 (0.7)	94.6 (0.6)	143.3 (3.0)	21.1 (-)	222.2 (10.6)	8.1 (0.1)



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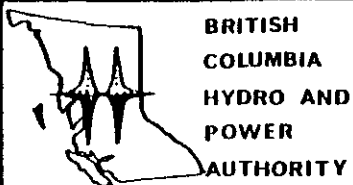
WATER QUALITY PARAMETERS, REGIONAL WATER BODIES
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THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-9
SHEET 2 OF 5

PART THREE

Waterbody	Total Alkalinity*	Hardness*	Filtrable Residue**	Sulphates**	Specific Conductivity***	pH
Category III - Alkalinity Range >100 mg/l						
Bonaparte River above Hat Creek	141 (28.0)***	128.5 (25.5)	183.0 (33.0)	5.9	268.0 (61.6)	8.1 (0.1)
Bonaparte River below Hat Creek	193.1 (39.2)	194.3 (45.5)	271.5 (52.7)	38.6 (15.2)	439.8 (93.1)	8.3 (0.3)
Hat Creek	242.2 (33.3)	-	336.7 (42.7)	-	521.0 (85.4)	8.5 (0.3)
Clinton Creek	272.4 (18.3)	-	340.5 (35.7)	-	539.4 (84.5)	8.3 (0.2)
Clinton Creek	323.1 (36.2)	338.6 (30.7)	398.2 (39.8)	40.6 (8.6)	599.5 (110.2)	8.5 (0.3)
Loon Lake at inlet	293.0 (-)	210.0 (-)	334.0 (-)	5.0 (-)	530.0 (-)	8.7 (-)
Loon Lake at White Moose	293.0 (-)	212.0 (-)	238.0 (-)	5.0 (-)	532.0 (-)	8.7 (-)
Loon Creek	434.0 (-)	345.0 (-)	500.0 (-)	5.4 (-)	735. (-)	8.5 (-)
Cache Creek	206.1 (60.0)	192.6 (64.3)	293.7 (70.2)	39.6 (9.9)	421.4 (131.9)	8.3 (0.6)
Pavilion Lake						
Deadman River near mouth	134.6 (57.9)	125.0 (54.1)	176.6 (59.0)	17.8 (-)	281.4 (118.3)	8.1 (0.4)
Deadman River above Criss Creek	149.1 (44.2)	134.9 (40.5)	192.3 (48.2)	17.4 (4.9)	308.6 (95.7)	8.2 (0.3)
Red Lake	-	-	-	-	362.0 (-)	-
Pukaist Creek near mouth	183.8 (47.4)	187.3 (43.0)	288.5 (65.3)	34.2 (53.0)	396.1 (71.6)	8.3 (0.3)
Witches Brook	172.3 (65.2)	167.0 (59.2)	227.2 (63.2)	9.8 (5.8)	364.9 (106.9)	8.2 (0.4)
Tunkwa Lake	-	-	200.0	-	-	-
Guichon Creek near mouth	188.1 (30.8)	187.4 (23.4)	246.3 (31.1)	17.8 (4.1)	375.9 (62.3)	8.2 (0.3)
Guichon Creek below Logan Lake	161.0 (33.1)	163.2 (22.8)	214.5 (26.5)	6.0 (1.2)	330.1 (50.0)	8.1 (0.3)
Guichon Creek above Logan Lake	181.0 (-)	163.0 (1.1)	230.0 (-)	5.8 (1.0)	333.0 (9.9)	8.2 (1.0)
Guichon Creek at Tunkwa Div.	110.8 (12.2)	99.1 (9.4)	160.9 (10.4)	5.0 (-)	219.7 (35.0)	8.0 (0.4)
Duffy Lake	430.5 (3.8)	575.8 (2.8)	768.0 (8.5)	191.0 (2.8)	1008.8 (36.0)	8.7 (0.1)
Jacko Lake	240.0 (5.2)	285.3 (2.4)	456.7 (3.8)	121.7 (4.7)	658.0 (8.5)	8.2 (0.4)
Peterson Creek	317 (19.0)	285.0 (3.0)	590.0 (8.0)	864.8 (45.6)	189.0 (-)	7.9 (0.2)
Lac le June	130 - 135.3	-	172.7-181.3	-	266.6-271.9	7.7-8.1
Stump Lake	-	-	1200	-	-	-
Tranquille River at mouth	102.4 (25.6)	87.9 (22.1)	138.4 (23.9)	7.1 (3.3)	205.5 (56.4)	8.3 (0.6)



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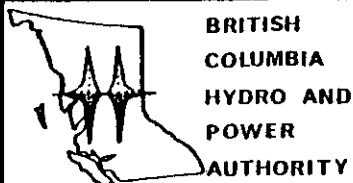
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THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-9
SHEET 3 OF 5

PART THREE

Waterbody	Total Alkalinity*	Hardness*	Filtrable Residue**	Sulphates**	Specific Conductivity***	pH
Tranquille River at mouth	112.0 (5.0) ^{†***}	98.9 (3.5)	143.0 (5.0)	-	218.2 (6.5)	8.6 (0.3)
Tranquille River at 9 mile	101.4 (4.6)	93.3 (5.0)	126.0 (6.0)	-	198.7 (8.9)	8.1 (0.1)
Paul Creek above Paul Lake	205.0 (-)	215.0 (-)	254 (-)	-	420 (-)	8.2 (-)
Paul Lake east end	161.0 (-)	170.0 (-)	222.0 (-)	25.8 (-)	335.0 (15.0)	8.5 (-)
Paul Lake west end	160.0 (-)	169.0 (-)	224.0 (-)	25.8 (-)	352.0 (-)	8.3 (-)
Paul Creek at outlet Paul Lake	178.2 (41.1)	190.4 (40.8)	243.6 (54.9)	31.8 (6.8)	393.3 (99.5)	8.1 (0.3)
Nicola River at Nivola Lake	101 (22.8)	105.5 (24.1)	146.8 (35.0)	0.5 (-)	240.1 (60.9)	8.3 (0.4)
Nicola River above Coldwater	114.5 (12.0)	124.3 (14.6)	174.9 (18.8)	26.2 (4.2)	283.1 (40.2)	8.0 (0.2)
Nicola River above Coldwater	134.0 (-)	120.4 (15.3)	175.4 (17.9)	-	269.8 (33.4)	8.0 (2.3)
Green Lake near Mt. Jack	873.0 (14.0)	498.5 (10.5)	976.0 (-)	-	1306.7 (9.4)	9.2 (0.1)
Green Lake opposite Nolan Creek	867.0 (8.0)	496.5 (12.5)	976.0 (-)	-	1353.3 (105.0)	-
Watch Lake	-	-	243	-	-	-
Taylor Lake	-	-	313	-	-	9.0
Edmund Lake	-	-	280	-	-	8.3
Exeter Lake	-	-	362	-	-	>8.4
108 Mile Lake	-	-	610	-	-	-
103 Mile Lake	-	-	655	-	-	-
Chris Lake	-	-	160	-	-	>8.5
Drewy Lake	-	-	385	-	400	>8.5
Hathaway Lake	-	-	480	-	600	>8.5
Deka Lake	-	-	320	-	390	>8.5
Longbon Lake	-	-	250	-	-	7.5
Sulphurous Lake	-	-	393	-	500	>8.5
Fawn Lake	-	-	310	-	-	-
Sheridan Lake	-	-	272	-	-	-
Buffalo Lake	-	-	390	-	450	-
Horse Lake	-	-	200	-	-	>8.5
Helena Lake	-	-	482	-	-	>8.5
Sucken Lake	-	-	475	-	-	7.5



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THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-9
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PART THREE

Waterbody	Total Alkalinity*	Hardness*	Filtrable Residue**	Sulphates**	Specific Conductivity***	pH
Soda Lake	-	-	1150	-	-	>8.4
Lac la Hache	-	-	-	-	-	-
Bridge Creek						
Bridge Creek at outlet Horse Lake	151.7 (16.4)****	136.0 (6.9)	179.0 (14.6)	50.0 (-)	313.6 (90.6)	8.0 (0.5)
Lac des Roches	-	-	153.0	-	-	-
Fishtrap Creek	101.4 (19.6)	108.7 (20.6)	140.0 (23.2)	11.6 (2.6)	218.2 (42.5)	8.0 (0.3)
Demers Creek	143.5 (6.1)	165.8 (10.1)	196.7 (9.0)	18.8 (-)	305.8 (52.2)	7.9 (0.4)
Lemieux Creek	112.0 (7.8)	118.2 (8.9)	142.0 (12.7)	3.0 (1.0)	234.3 (26.6)	8.0 (0.2)

* Expressed as mg/l as CaCO₃.

** Expressed as mg/l.

*** Expressed as µmho/cm.

**** Number in parentheses denotes one standard deviation.

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THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-9
SHEET 5 OF 5

PART THREE

aleutian sculpin	<i>Cottus aleuticus</i>
brassy minnow	<i>Hybognathus hankinsoni</i>
bridgelip sucker	<i>Catostomus columbianus</i>
brook trout	<i>Salvelinus fontinalis</i>
brown trout	<i>Salmo trutta</i>
burbot	<i>Lota lota</i>
carp	<i>Cyprinus carpio</i>
chiselmouth	<i>Acrocheilus alutaceus</i>
largescale sucker	<i>Catostomus macrocheilus</i>
Dolly Varden	<i>Salvelinus malma</i>
goldfish	<i>Carassius auratus</i>
kokanee	<i>Oncorhynchus nerka</i>
lake chub	<i>Couesius plumbeus</i>
lake trout	<i>Salvelinus namaycush</i>
leopard dace	<i>Rhinichthys falcatus</i>
longnose dace	<i>Rhinichthys cataractae</i>
mountain whitefish	<i>Prosopium williamsoni</i>
northern mountain sucker	<i>Catostomus platyrhynchus</i>
northern squawfish	<i>Ptychocheilus oregonensis</i>
peamouth chub	<i>Mylocheilus caurinus</i>
prickly sculpin	<i>Cottus asper</i>
pygmy whitefish	<i>Prosopium coulteri</i>
rainbow trout	<i>Salmo gairdneri</i>
redside shiner	<i>Richardsonius balteatus</i>
torrent sculpin	<i>Cottus rhotheus</i>

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RESIDENT FISH SPECIES IN THE HAT CREEK REGION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-10

PART THREE

Location	Pink		Sockeye		Chinook		Coho	
	Number	%*	Number	%*	Number	%*	Number	%*
Study Region	276,659	17	11,569	1	9,468	20	6,215	10
Study Region and Upstream	417,140	25	1,062,112	89	27,739	60	14,497	23
Downstream of Study Region	1,224,035	75	130,854	11	18,843	40	47,517	77
Total**	1,224,035		1,192,266		46,582		62,014	

* Percent of Fraser River escapement.

** Fraser River Escapement.



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REGIONAL SALMON SPAWNING ESCAPEMENT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-11

PART THREE

Location	Pink		Sockeye		Chinook		Coho	
	Number	%	Number	%	Number	%	Number	%
Barriere River	-	-	75	1	67	1	503	8.1
Bonaparte River	788	1	-	-	-	-	-	-
Bridge River	9,611	3.5	-	-	-	-	-	-
Brookfield Creek	-	-	-	-	-	-	75	1.2
Clearwater and Mahood Rivers	-	-	250	2.2	1,629	17.2	527	8.9
Deadman River	-	-	-	-	256	2.7	390	6.3
Lemieux Creek	-	-	-	-	18	1	904	14.5
Louis Creek	-	-	-	-	227	2.4	1,376	22.1
Mann Creek	-	-	-	-	-	-	80	1.2
Middle Fraser River	224	1	-	-	-	-	-	-
Nicola River (including Spius and Coldwater Creeks)	1,034	1	-	-	-	-	1,558	25.1
North Thompson River	-	-	164	1.4	1,090	11.5	682	11.0
South Thompson River	101	1	11,080	95.7	3,975	42.0	-	-
Thompson River	264,901	95.7	-	-	2,122	22.4	120	1.9
Yalakom River	-	-	-	-	84	1	-	-
Total	276,659		11,569		9,468		6,215	
Upstream of Study Region	140,481		1,050,543		18,271		8,282	
Downstream of Study Region	1,224,035		130,854		18,843		62,014	



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SALMON SPAWNING ESCAPEMENT TO STUDY REGION WATER BODIES

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TABLE 3.3-12

PART THREE

<u>User</u>	<u>Volume (m³/day)</u>	<u>Location</u>
<u>Mines</u>		
Afton	construction near completion	No. Loon Lake & One Loon L.
Bethlehem Copper	5679.7	Bethsaida Creek
	13.6	Peavine Creek
	16652.1	Jane Spring
	entire flow	Witches Brook
	2446.6	North Lodge
	2446.6	Mann Cr.
	2446.6	Nicholson Creek
	2446.6	Ford Creek
	2446.6	Michel Creek
	2446.6	Orm Creek
	210926.5	Bonaparte River
	299737.7	Scottie Creek
Lornex	1817.5	Thompson River
	13649.8	Pukaist Creek
	79560.0	Pukaist Creek
	113.6	Shuhost Creek
	113.6	Bethsaida Creek
	22202.8	Woods Creek
	5906.9	Nicola River
	169604.7	Stumbles Creek
	6.4	Stumbles Creek
<u>Pulp & Paper</u>		
Kamloops Mill	189649.4	Thompson River
<u>Municipalities</u>		
Ashcroft	4543.8	Thompson River
	1817.5	Thompson River
Cache Creek	4893.2	Bonaparte River
	3180.6	Bonaparte River
	2446.6	Lopez Creek



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MAJOR WATER USE INTAKES OF THE STUDY REGION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 5.3-15
SHEET 1 OF 2

PART THREE

<u>User</u>	<u>Volume (m³/day)</u>	<u>Location</u>
Clinton	90.9	Clinton Creek
	86.3	Clinton Creek
	10.9	Clinton Creek
	11101.4	Clinton Creek
Kamloops	90.9	South Thompson River
	2271.9	South Thompson River
	436654.9	South Thompson River
	396040.7	South Thompson River
	13631.2	South Thompson River
	44405.6	South Thompson River
	2271.9	South Thompson River
	2271.9	South Thompson River
	4543.8	North Thompson River
	1135.9	North Thompson River
	1850232.8	North Thompson River
	4543.8	North Thompson River
	2405302.6	North Thompson River
	22718.73	North Thompson River
	17268839.3	Jamieson Creek
	6167442.6	Jamieson Creek
	123348.9	Dairy Creek
	123348.9	Dairy Creek
	2466977.0	Noble Creek
	19735816.3	McQueen River
	13631.2	Thompson River
	111013.9	Thompson River
	2271.9	Thompson River
3885488.8	Thompson River	
2.3	Scotney Brook	
2446.6	Petersen Creek	
Savona	4543.8	Kamloops Lake
Spences Bridge	1817.5	Murray Creek
	4543.8	Thompson River

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MAJOR WATER USE INTAKES OF THE STUDY REGION
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-13
SHEET 2 OF 2
PART THREE

<u>USER</u>	<u>VOLUME (m³/day)</u>	<u>LOCATION</u>
-------------	-----------------------------------	-----------------

Mines

Afton	construction near completion	
Lornex	recirculating	
Craigmont	recirculating	
Bethlehem Copper	recirculating	

Municipalities - Thompson River System

Ashcroft	636.1	Thompson River
Cache Creek	681.6	Cache Creek
Clinton	363.5	Bonaparte River
Kamloops	9087.5	Thompson River
Savona	no discharge (septic tanks)	
Spences Bridge	no discharge (septic tanks)	

Pulp & Paper

Kamloops Mill	189649.4	Thompson River
---------------	----------	----------------

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MAJOR WATER DISCHARGES LOCATED
IN THE STUDY REGION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-14

PART THREE

Common Name

Scientific Name

Pink salmon	<u>Oncorhynchus gorbuscha</u>
Coho salmon	<u>Oncorhynchus kisutch</u>
Sockeye salmon	<u>Oncorhynchus nerka</u>
Chinook salmon	<u>Oncorhynchus tshawytscha</u>
Rainbow trout	<u>Salmo gairdneri</u>
Steelhead trout	<u>Salmo gairdneri</u>
Dolly varden	<u>Salvelinus malma</u>
Peamouth chub	<u>Mylocheilus caurinus</u>
Northern squawfish	<u>Ptychocheilus oregonensis</u>
Redside shiner	<u>Richardsonius balteatus</u>
Finescale sucker	<u>Catostomus catostomus</u>
Largescale sucker	<u>Catostomus macrocheilus</u>
Aleutian sculpin	<u>Cottus aleuticus</u>
Slimy sculpin	<u>Cottus cognatus</u>

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LIST OF FISH SPECIES IN THE THOMPSON RIVER IN THE VICINITY
OF THE PROPOSED INTAKE LOCATION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-15

PART THREE

STATION ^{**}																
	1	2	3	4	5	6	7	8	9 ^{**}	10	11	12	13	14	15A	15
Substrate (%):																
Boulder	10	-	-	-	-	5	-	Variable	-	10	Variable	Variable	Variable	5	-	-
Pebble	80	5	5	10	60	75	75	Sand to Small Pebble	-	80	Sand to Small Pebble	Sand to Large Pebble	Sand to Large Pebble	25	-	-
Gravel	10	90	90	80	20	20	20	-	-	5	Pebble	Pebble	Pebble	25	5	70
Sand/Silt	-	5	5	10	10	-	-	5	-	5	-	-	-	30	95	5 (Large)
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depth (m)	0.3-1.3	0.1-0.5	0.1-0.7	0.3-1.7	0.03-0.6	0.03-0.3	0.03-0.0	5.1-15.2	-	0.03-0.6	5.1-7.6	2.5-12.7	.102-.152	0.03-0.3	0.3-2.1	0.3-0.5
Width (m)	10.6	32.3	26.0	13.4	4.4	7.0	6.4	0.0	-	4.6	1.5	0.0	1.5-3.0	4.3	6.1	1.0
Pool: Rise/fall (s)	10:00	5:05	5:05	10:00	10:00	10:00	60:00	0:100	-	10:00	0:100	0:100	5:05	15:75	05:5	30:50
Current (m/s):																
September '76	-	0.3-1.3	0.00-1.1	0.1-1.1	0.09-0.4	0.03-1.3	0.03-0.3	-	-	0.03-0.9	Sluggish to Rapid	Rapid	Rapid	0.09-0.2	-	0.03-0.1
June '77	1.9	1.0	1.3	1.5	0.0	0.9	0.7	N/A	-	1.0	Rapid	-	-	0.5	0.3	0.5
August '77	1.5	1.5	1.5	1.2	0.3	0.4	0.4	-	-	0.4	-	-	-	0.3	0.3	-
Temperature (°C)																
September '76	16.0, 15.0	14.5, 12.0	14.5, 12.0	15.0, 14.0	12.0	11.0	12.0, 12.0	0.0	-	11.0	0.1	7.7	11.3	9.0	10.0	10.2
June '77	15.7	13.7	10.4	15.4	17.1	10.1	10.2	9.0	-	11.2	13.5	-	13.7	11.5	12.0	10.1
August '77	22.0	18.5	18.0	17.5	24.0	10.0	15.5	14.0	-	-	-	-	11.5	15.0	14.0	11.0

* Stations 16 & 17 are taken and are omitted from this table.

** No flow observed during field sampling programs.

Source: Beak Consultants, Ltd. 19/

Taxa	Bonaparte River	Hat Creek Type I	Hat Creek Type II	Hat Creek Tributaries	Goose Lake	Finney Lake
Coelenterata						
<u>Hydra</u> sp						X
Platyhelminthes						
Turbellaria						
Turbellaria sp unid		X	X	X		
Neorhabdocoela unid			X	X		
Rhabdocoela unid				X		
Nematoda						
Nematoda unid	X		X	X		X
Annelida						
Oligochaeta						
Oligochaeta unid	X	X				
Naididae	X	X	X	X		X
Lumbricidae		X	X	X		
Hirudinea						
Glossiphoniidae unid						X
Mollusca						
Gastropoda						
Bulimidae unid	X					
Planorbidae unid						X
Bivalvia						
Sphaeriidae						
<u>Pisidium</u> sp	X					
<u>Sphaerium</u> sp						X
Arthropoda						
Arachnida						
Acarina (Hydracarina)						
Sperchonidae						
<u>Sperchon</u> sp	X					



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MACROINVERTEBRATE TAXA COLLECTED DURING BENTHIC SAMPLING IN
SEPTEMBER 1976, JUNE 1977 AND AUGUST 1977

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-17
Sheet 1 of 5

PART THREE

Taxa	Bonaparte River	Hat Creek Type I	Hat Creek Type II	Hat Creek Tribu- taries	Goose Lake	Finney Lake
Arthropoda (Cont'd)						
Lebertiidae						
<u>Lebertia</u> sp		X	X	X		
Crustacea						
Cladocera						X
Copepoda						X
Amphipoda					X	X
Gammaridae						
<u>Crangonyx</u> sp				X		
Talitridae						
<u>Hyaella azteca</u>					X	
Insecta						
Ephemeroptera						
Heptageniidae						
Heptageniidae unid		X	X			
<u>Rithrogena</u> sp	X	X	X	X		
<u>Ironopsis</u> sp	X	X	X	X		
<u>Cinygmula</u> sp	X	X	X	X		
Baetidae						
<u>Baetis</u> sp	X	X	X	X		
<u>Ephemerella</u> (3) sp	X	X	X	X		
<u>Paraleptophlebia</u> sp	X	X	X	X		
<u>Caenis</u> sp	X	X				
<u>Ameletus</u> sp		X	X	X		
Odonata						
Anisoptera						
Gomphidae						
<u>Ophiogomphus</u> sp	X					
Zygoptera						
Agrionidae						
Agrionidae unid	X					
<u>Ischnura</u> sp						X



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MACROINVERTEBRATE TAXA COLLECTED DURING BENTHIC SAMPLING IN
SEPTEMBER 1976, JUNE 1977 AND AUGUST 1977

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-17
SHEET 2 OF 5

PART THREE

Taxa	Bonaparte River	Hat Creek Type I	Hat Creek Type II	Hat Creek Tributaries	Goose Lake	Finney Lake
Arthropoda (Cont'd)						
Plecoptera						
Plecoptera unid				X		
Perlidae						
<u>Claassenia</u> sp	X	X	X	X		
Chloroperlidae						
<u>Hastaperla</u> sp	X	X	X	X		
Pteronarcidae						
<u>Pteronarcys</u> sp	X					
<u>Pteronarcella</u> sp	X	X		X		
Perlodidae						
<u>Isoperla</u> sp	X			X		
<u>Isogenus</u> sp	X		X	X		
Nemouridae						
<u>Nemoura</u> sp		X	X	X		
Hemiptera					X	
Coleoptera						
Elmidae						
Elmidae sp unid				X		
<u>Lara</u> sp		X				
<u>Narpus</u> sp	X	X	X			
<u>Zaitzevia</u> sp	X	X			X	
Chrysopetalidae						
<u>Galerucella</u> sp				X	X	
Trichoptera						
Trichoptera unid				X	X	
Hydropsychidae						
<u>Hydropsyche</u> sp	X	X	X	X		
<u>Diplectrona</u> sp		X	X	X		
Brachycentridae						
<u>Brachycentrus</u> sp	X	X	X	X		
Hydroptilidae						
Hydroptilidae unid	X	X				



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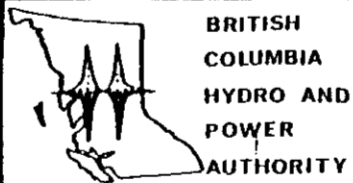
MACROINVERTEBRATE TAXA COLLECTED DURING BENTHIC SAMPLING IN
SEPTEMBER 1976, JUNE 1977 AND AUGUST 1977

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-17
SHEET 3 OF 5

PART THREE

Taxa	Bonaparte River	Hat Creek Type I	Hat Creek Type II	Hat Creek Tribu- taries	Goose Lake	Finney Lake
Arthropoda (Cont'd)						
Limnephilidae						
Limnephilidae unid	X	X	X	X		
Rhyacophilidae						
<u>Rhyacophila</u> sp	X	X	X	X		
Glossosomatidae						
<u>Agapetus</u> sp	X	X	X	X		
Psychomyiidae						
<u>Neureclipsis</u> sp		X	X	X		
Diptera						
Diptera unid			X			
Chironomidae						
Chironomidae unid		X		X		
Tanypodinae						
<u>Procladius</u> sp		X	X	X	X	X
Chironominae						
<u>Micropsectra</u> sp	X	X	X	X		
<u>Chironomus</u> sp			X		X	X
Orthoclaadiinae						
Orthoclaadiinae unid		X	X			
<u>Cricotopus</u> sp	X	X		X		
<u>Orthocladus</u> sp	X	X	X	X		
<u>Cardiocladius</u> sp	X	X	X	X		
<u>Thienemanniella</u> sp		X				
Tipulidae						
Tipulidae unid		X	X	X		
<u>Tipula</u> sp				X		
<u>Hexatoma</u> sp	X	X	X			
<u>Antocha</u> sp	X	X	X	X		
Tanyderidae						
<u>Protoplasa</u> sp	X					
Rhagionidae						
<u>Atherix</u> sp	X	X	X	X		



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MACROINVERTEBRATE TAXA COLLECTED DURING BENTHIC SAMPLING IN
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THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-17
SHEET 4 OF 5

PART THREE

Taxa	Bonaparte River	Hat Creek Type I	Hat Creek Type II	Hat Creek Tribu- taries	Goose Lake	Finney Lake
Arthropoda (Cont'd)						
Simuliidae						
<u>Simulium</u> sp	X	X	X	X		
Empididae						
Empididae unid	X	X	X	X		
Ceratopogonidae						
Ceratopogonidae unid	X	X	X			
<u>Leptoconops</u> sp		X				
Psychodidae						
<u>Pericoma</u> sp		X	X	X		
Syrphidae						
Syrphidae unid				X		
Culicidae						
<u>Chaoborus</u> sp					X	X

Source: Beak Consultants, Ltd. 19/



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SEPTEMBER 1976, JUNE 1977 AND AUGUST 1977

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-17
SHEET 5 OF 5

PART THREE

September 1976

Bonaparte River

Lower Hat Creek

Upper Hat Creek

Rhithrogena sp. (E)*
Baetis sp. (E)
Hydropsyche sp. (T)**
Cricotopus sp. (D)****

Baetis sp. (E)
Ephemerella sp. (E)
Hydropsyche sp. (T)
Diplectroma sp. (T)
Claassenia sp. (P)***
Micropsectra sp. (D)
Antocha sp. (D)

Rhithrogena sp. (E)
Cinygmula sp. (E)
Baetis sp. (E)
Ephemerella sp. (E)
Hydropsyche sp. (T)
Claassenia sp. (P)
Pericoma sp. (D)
Turbellaria

June 1977

Bonaparte River

Lower Hat Creek

Upper Hat Creek

Rhithrogena sp. (E)
Baetis sp. (E)
Ephemerella sp. (E)
Brachycentrus sp. (T)

Ironopsis sp. (E)
Cinygmula sp. (E)
Baetis sp. (E)
Ephemerella sp. (E)
Micropsectra sp. (D)
Orthocladius sp. (D)
Cardiocladius sp. (D)
Oligochaeta

Ironopsis sp. (E)
Cinygmula sp. (E)
Baetis sp. (E)
Hastaperla sp. (P)
Cardiocladius sp. (D)
Simulium sp. (D)
Turbellaria
Oligochaeta

August 1977

Bonaparte River

Lower Hat Creek

Upper Hat Creek

Rhithrogena sp. (E)
Baetis sp. (E)
Ephemerella sp. (E)
Caenis sp. (E)
Hydropsyche sp. (T)
Micropsectra sp. (D)

Baetis sp. (E)
Ephemerella sp. (E)
Hydropsyche sp. (T)
Claassenia sp. (P)
Nemoura sp. (P)
Antocha sp. (D)

Baetis sp. (E)
Ephemerella sp. (E)
Paraleptophlebia sp. (E)
Claassenia sp. (P)
Hastaperla sp. (P)
Nemoura sp. (P)
Cardiocladius sp. (D)

* E = Ephemeroptera

** T = Trichoptera

*** P = Plecoptera

**** D = Diptera

Source: Beak Consultants, Ltd. 19/



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SUMMARY OF DOMINANT INVERTEBRATE GENERA

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-18

PART THREE

<u>Dominant Orders</u>	<u>% of Stations where Dominant</u>		
	<u>September 1976</u>	<u>June 1977</u>	<u>August 1977</u>
Ephemeroptera	64.3	61.5	84.6
Trichoptera	14.2	7.7	0.0
Plecoptera	7.1	0.0	7.7
Diptera	7.1	30.8	7.7
Oligochaeta	7.1	0.0	0.0

Source: Beak Consultants, Ltd. 19/



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SUMMARY OF DOMINANT INVERTEBRATE ORDERS
INHABITING BONAPARTE RIVER AND HAT CREEK

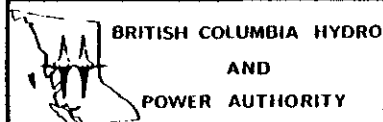
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-19

PART THREE

Station No.	Coelenterata	Turbellaria	Nematoda	Oligochaeta	Hirudinea	Gastropoda	Pelecyopoda or Bivalvia	Hydracarina	Cladocera	Copepoda	Amphipoda	Ephemeroptera	Odonata	Plecoptera	Coleoptera	Trichoptera	Chironomidae	Other Diptera	Hemiptera
Bonaparte River	1	0	0	2.15	0	0	0	0	0	0	0	136.71	2.15	30.14	7.53	48.44	292.79	37.67	0
	2	0	0	2.15	0	0	0	0	0	0	0	64.59	2.15	12.92	2.15	7.53	8.61	18.30	0
	3	0	0	2.15	3.23	0	0	2.15	0	0	0	116.25	0	18.30	5.38	82.88	34.45	93.65	0
	4	0	0	0	0	0	0	0	0	0	0	21.53	2.15	0	0	0	0	3.23	0
Hat Creek Type I	5	0	0	12.92	0	0	0	0	0	0	0	120.56	0	178.69	15.07	99.03	90.42	101.18	0
	6	0	0	3.23	0	0	0	0	0	0	0	431.32	0	34.45	3.23	121.64	12.92	129.17	0
	10	0	3.23	2.15	12.92	0	0	2.15	0	0	0	218.51	0	51.69	13.99	121.64	51.67	29.06	0
Hat Creek Type II	7	0	0	2.15	0	0	0	2.15	0	0	0	222.82	0	59.20	2.15	272.34	40.90	16.15	0
	14	0	5.38	3.23	26.91	0	0	0	0	0	0	282.02	0	10.76	8.61	7.53	30.14	7.53	0
	15	0	55.97	2.15	13.99	0	0	0	0	0	0	606.03	0	51.67	2.15	53.82	7.53	19.38	0
Hat Creek Tributaries	8	0	7.53	0	8.61	0	0	0	0	0	0	67.81	0	77.50	2.15	142.09	3.23	7.53	0
	11	0	24.76	3.23	34.45	0	0	0	0	0	0	493.00	0	153.93	64.59	105.49	57.05	48.44	0
	12	0	32.29	0	105.49	0	0	0	0	0	0	62.43	0	23.68	0	3.23	2.15	7.53	0
	13	0	16.15	0	7.53	0	0	2.15	0	0	0	186.22	0	34.45	0	13.99	0	172.23	0
Goose Lake	16	0	0	0	0	0	0	0	0	0	866.52	2.15	34.45	0	0	0	107.64	66.74	3.23
Finney Lake	17	3.23	0	3.23	26.91	26.91	16.15	7.53	7.53	373.52	13.99	40.90	0	10.76	0	0	245.43	39.83	0

Source: Beak Consultants, Ltd. 19/



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AVERAGE NUMBERS (per m²) OF MACROINVERTEBRATES COLLECTED
AT BENTHIC SAMPLING STATIONS (SEPTEMBER 1976)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-20

PART THREE

Station Location	Station No.	Coelenterata	Turbellaria	Nematoda	Oligochaeta	Miracidinea	Gastropoda	Pele Cyopoda or Bivalvia	Hydracarina	Cladocera	Copepoda	Amphipoda	Ephemeroptera	Odonata	Plecoptera	Coleoptera	Trichoptera	Chironomidae	Other Diptera	Hemiptera
Bonaparte River Stations	1	0	0	0	0	0	2.15	0	0	0	0	0	335.84	0	10.76	0	18.30	7.53	8.61	0
	2	0	0	0	0	0	0	2.15	0	0	0	0	37.67	0	0	0	0	2.15	7.53	0
	3	0	0	0	0	0	0	0	0	0	0	0	322.93	0	0	2.15	66.74	51.67	53.82	0
	4	0	0	3.23	2.15	2.15	0	2.15	2.15	0	0	0	121.64	8.61	12.92	7.53	139.94	40.90	30.14	0
Hat Creek Type I	5	0	0	0	50.59	0	0	0	0	0	0	0	719.05	2.15	62.43	23.68	88.27	2005.38	145.32	0
	6	0	2.15	2.15	132.40	0	0	0	0	0	0	0	319.70	0	62.43	2.15	169.00	1302.48	82.88	0
	10	0	3.23	2.15	10.76	0	0	0	0	0	0	0	493.00	0	86.11	8.61	59.20	186.22	30.14	0
Hat Creek Type II	7	0	7.53	3.23	10.76	0	0	0	0	0	0	0	395.05	0	62.43	0	202.37	204.52	94.73	0
	14	0	16.15	7.53	96.88	0	0	10.76	2.15	0	0	0	731.97	0	23.68	2.15	30.14	186.22	19.38	0
	15	0	724.43	0	32.29	0	0	0	0	0	0	0	13.99	0	269.11	2.15	51.67	638.32	2102.26	0
Hat Creek Tributaries	8	0	32.29	2.15	50.59	0	0	0	0	0	0	0	421.96	0	82.88	0	34.45	3.23	34.45	0
	11	0	277.72	10.76	263.72	0	0	0	0	0	0	0	115.18	0	100.11	51.67	127.02	1162.54	83.96	0
	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	13	0	83.96	0	26.91	0	0	0	0	0	0	2.15	1354.14	0	57.05	0	23.68	29.06	19.38	0
Goose Lake	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Finney Lake	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Source: Beak Consultants, Ltd. 19/



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AVERAGE NUMBERS (per m²) OF MACROINVERTEBRATES COLLECTED
AT BENTHIC SAMPLING STATIONS (JUNE 1977)

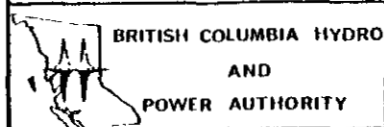
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-21

PART THREE

Station Location	Station No.	Coelenterata	Turbellaria	Nematoda	Oligochaeta	Hirudinea	Gastropoda	Pele Cyopoda or Bivalvia	Hydracarina	Cladocera	Copepoda	Amphipoda	Ephemeroptera	Odonata	Placoptera	Coleoptera	Trichoptera	Chironomidae	Other Diptera	Hemiptera	
Bonaparte River Stations	1	0	0	3.23	32.29	0	0	0	0	0	0	0	347.69	0	32.29	10.76	252.96	109.80	61.36	0	
	2	0	0	0	0	0	0	0	0	0	0	0	236.81	0	23.68	2.15	19.38	26.91	23.68	0	
	3	0	0	0	23.68	0	0	0	0	0	0	0	546.82	0	30.14	39.83	256.19	229.28	172.23	0	
	4	0	0	2.15	0	0	0	0	0	0	0	0	412.27	2.15	73.20	19.38	110.87	24.76	64.59	0	
Hat Creek Type I	5	0	0	0	34.45	0	0	0	0	0	0	0	493.00	2.15	177.61	96.88	118.41	362.76	72.12	0	
	6	0	0	0	13.99	0	0	0	0	0	0	0	801.94	0	62.43	8.61	174.38	80.73	272.34	0	
	10	0	8.61	0	5.38	0	0	0	0	0	0	0	664.15	0	159.31	16.15	153.93	185.15	35.52	0	
Hat Creek Type II	7	0	3.23	0	35.52	0	0	0	2.15	0	0	0	952.64	0	115.18	2.15	288.48	236.81	48.44	0	
	14	0	0	0	67.81	0	0	0	0	0	0	0	710.44	0	240.04	7.53	66.74	349.84	69.97	0	
	15	0	39.83	0	57.05	0	0	0	0	0	0	0	238.97	0	475.78	5.38	10.76	1568.35	80.73	0	
Hat Creek Tributaries	8	0	0	0	12.92	0	0	0	0	0	0	0	276.64	0	301.40	2.15	45.21	10.76	7.53	0	
	11	0	59.20	0	72.12	0	0	0	0	0	0	0	1824.54	0	936.49	59.20	21.53	470.40	32.29	0	
	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	13	0	7.53	0	30.14	0	0	0	0	0	0	24.76	821.31	0	578.04	0	59.20	34.45	0	0	
Goose Lake	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Finney Lake	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Source: Beak Consultants, Ltd. 19/



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AVERAGE NUMBERS (per m²) OF MACROINVERTEBRATES COLLECTED
AT BENTHIC SAMPLING STATIONS (AUGUST 1977)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-22

PART THREE

Station Location	Sampling Date	Coelenterata		Turbellaria		Nematoda		Oligochaeta		Hirudinea		Gastropoda		Pelecypoda or Bivalvia		Hydracarina		Cladocera		Copepoda	
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Bonaparte River	Sep 76	0		0		0-0.2		0-0.3		0		0		0-0.2		0		0		0	
(Surber Sampler)	Jun 77	0		0		0-0.3		0-0.2		0-0.2		0-0.2		0-0.2		0-0.2		0		0	
4 Stations	Aug 77	0		0		0-0.3		0-3.0		0		0		0		0		0		0	
Hat Creek Type I	Sep 76	0		0-0.3		0-0.3		0-1.2		0		0		0		0-0.2		0		0	
(Surber Sampler)	Jun 77	0		0-0.3		0-0.2		1.0-12.3		0		0		0		0		0		0	
3 Stations	Aug 77	0		0-0.8		0		0.5-3.2		0		0		0		0		0		0	
Hat Creek Type II	Sep 76	0		0-5.2		0.2-0.3		0-2.5		0		0		0		0-0.2		0		0	
(Surber Sampler)	Jun 77	0		0.7-67.3		0-0.7		1.0-9.0		0		0		0-1.0		0-0.2		0		0	
3 Stations	Aug 77	0		0-3.7		0		3.3-6.3		0		0		0		0-0.2		0		0	
Hat Creek Tributaries	Sep 76	0		0.7-3.0		0-0.3		0.7-9.8		0		0		0		0-0.2		0		0	
(Surber Sampler)	Jun 77	0		3.0-25.8		0-1.0		2.5-24.5		0		0		0		0		0		0	
4 Stations	Aug 77	0		0-5.5		0		1.2-6.7		0		0		0		0		0		0	
Goose Lake (Ponar Dredge)	Sep 76	0		0		0		0		0		0		0		0		0		0	
1 Station	Jun 77	-		-		-		-		-		-		-		-		-		-	
	Aug 77	-		-		-		-		-		-		-		-		-		-	
Finney Lake (Ponar Dredge)	Sep 76	-		0		-		-		-		-		-		-		-		-	
1 Station	Jun 77	-		-		-		-		-		-		-		-		-		-	
	Aug 77	-		-		-		-		-		-		-		-		-		-	



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RANGE IN THE STATION AVERAGE OF BENTHIC MACROINVERTEBRATES

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-23
Sheet 1 of 2
PART THREE

Station Location	Sampling Date	Amphi-poda		Ephemeroptera		Odonata		Plecoptera		Coleoptera		Trichoptera		Chironomidae		Other Dip-tera		Hemip-tera	
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Bonaparte River (Surber Sampler) 4 Stations																			
	Sep 76	0		2-12.7		0-0.2		0-2.8		0-2.8		0-7.7		0-27.2		0.3-8.7		0	
	Jun 77	0		3.5-31.2		0-0.8		0-1.2		0-1.2		0-13.0		0.2-4.8		0.7-5.0		0	
	Aug 77	0		22.0-50.8		0-0.2		2.2-6.8		2.2-6.8		1.8-23.8		2.3-21.3		2.2-16.0		0	
Hat Creek Type I (Surber Sampler) 3 Stations																			
	Sep 76	0		11.2-20.3		0		3.2-16.6		3.2-16.6		9.2-11.3		1.2-8.4		2.7-12.0		0	
	Jun 77	0		29.7-66.8		0-0.2		5.8-8.0		5.8-8.0		5.5-15.7		17.3-186.3		2.8-13.5		0	
	Aug 77	0		45.8-74.5		0-0.2		5.8-16.5		5.8-16.5		11.0-16.2		7.5-33.7		3.3-25.3		0	
Hat Creek Type II (Surber Sampler) 3 Stations																			
	Sep 76	0		20.7-56.3		0		1.0-5.5		1.0-5.5		0.7-25.3		0.7-3.8		0.7-1.8		0	
	Jun 77	0		1.3-68.0		0		2.2-25.0		2.2-25.0		2.8-18.8		17.3-59.3		1.8-195.3		0	
	Aug 77	0		22.2-88.5		0		10.7-44.2		10.7-44.2		1.0-26.8		22.0-145.7		4.5-7.5		0	
Hat Creek Tributaries (Surber Sampler) 4 Stations																			
	Sep 76	0		5.8-45.8		0		2.2-14.3		2.2-14.3		0.3-13.2		0-5.3		0.7-16.0		0	
	Jun 77	0-0.2		10.7-125.8		0		5.3-9.3		5.3-9.3		2.2-11.8		0.3-108.0		1.8-7.8		0	
	Aug 77	0-2.3		25.7-169.5		0		28.0-87.0		28.0-87.0		2.0-5.5		1.0-43.7		0-3.0		0	
Goose Lake (Ponar Dredge) 1 Station																			
	Sep 76	80.5		0.2		3.2		0		0		0		10.0		6.2		0.3	
	Jun 77	-		-		-		-		-		-		-		-		-	
	Aug 77	-		-		-		-		-		-		-		-		-	
Finney Lake (Ponar Dredge) 1 Station																			
	Sep 76	3.8		0		1.0		0		0		0		22.8		3.7		0	
	Jun 77	-		-		-		-		-		-		-		-		-	
	Aug 77	-		-		-		-		-		-		-		-		-	

Source: Beak Consultants, Ltd. 19/

Station:	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>14A</u>	<u>15</u>	<u>16</u>	<u>17</u>
Substrate	10% B	5% P	5% P	10% P	60% P	5% B	75% P			10% B				5% B	5% G	70% G		
Composition:*	80% P	90% G	90% G	80% G	30% G	75% P	20% G			80% P				35% P	95% SS	25% SS		
	10% G	5% SS	5% SS	10% SS	10% S	20% G	5% SS			5% G				25% G		5% D		
										5% SS				30% SS				
														5% D				

Percent
Composition:

September

Group 3	40.1	75.4	62.3	86.8	66.9	66.7	90.1	91.5		79.5	82.9	37.9	54.3	80.8		87.9	3.3	1.2
Group 2	59.5	23.0	36.7	13.2	31.0	33.3	9.9	5.7		17.7	13.6	17.5	44.0	12.2		10.4	96.7	89.0
Group 1	0.4	1.6	1.0	0.0	2.1	0.0	0.0	2.8		2.5	3.5	44.6	1.7	7.0		1.7	0.0	9.8

June

Group 3	95.3	76.0	78.7	77.7	28.9	26.6	67.3	81.5		73.6	17.9		89.9	69.9		8.8		
Group 2	4.7	24.0	21.3	21.8	69.4	66.9	31.6	10.8		25.2	70.0		8.4	21.5		90.4		
Group 1	0.0	0.0	0.0	0.5	1.7	6.5	1.1	7.7		1.2	12.1		1.7	8.6		0.8		

August

Group 3	75.7	84.7	67.7	87.1	65.4	74.1	80.6	95.3		80.9	81.8		93.8	67.8		29.5		
Group 2	20.5	15.3	30.9	12.9	32.0	25.0	17.3	2.7		18.7	16.2		4.3	27.8		68.2		
Group 1	3.8	0.0	1.9	0.0	2.6	0.9	2.1	2.0		0.4	2.0		1.9	4.4		2.3		

* B = Boulder
P = Pebble
G = Gravel
SS = Sand-Silt
S = Sand
O = Other

Source: Beak Consultants, Ltd. 19/



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SUMMARY OF BENTHIC INVERTEBRATE COLLECTION DATA AND STATION SUBSTRATE DATA
FOR SEPTEMBER 1976, JUNE 1977 AND AUGUST 1977

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-24

PART THREE

Species	Month	STATION											Total	
		1	2	3	4	5	6	7	10	14	14A	15		
Brook trout	September	0	0	1	0	0	0	0	0	0	0	0	0	1
	June	0	0	0	0	0	0	0	0	0	0	0	0	0
	August	0	0	0	0	0	0	0	0	0	0	0	0	0
Rainbow trout	September	5	2	0	0	29	19	19	38	62	30	28	232	
	June	4	1	3	0	13	28	30	33	32	13	40	197	
	August	1	0	2	0	8	25	26	60	33	17	9	181	
Mountain whitefish	September	0	2	2	0	0	0	0	0	1	1	0	6	
	June	0	0	1	0	0	0	3	1	0	1	0	6	
	August	1	0	0	0	3	0	0	0	0	0	0	4	
Bridgelip sucker	September	7	12	2	5	18	0	0	0	0	0	0	44	
	June	0	0	9	0	0	0	0	0	0	0	0	9	
	August	0	21	9	1	4	0	0	0	0	0	0	35	
Redside shiner	September	0	1	0	0	0	0	0	0	0	0	0	1	
	June	0	0	1	4	0	0	0	0	0	0	0	5	
	August	0	0	0	0	0	0	0	0	0	0	0	0	
Leopard dace	September	2	3	1	2	0	0	0	0	0	0	0	8	
	June	0	13	0	4	2	0	0	0	0	0	0	19	
	August	0	1	0	0	0	0	0	0	0	0	0	1	
Longnose dace	September	19	12	3	23	0	0	0	0	0	0	0	57	
	June	4	9	1	9	6	0	0	0	0	0	0	29	
	August	4	40	23	3	0	0	0	0	0	0	0	70	
TOTAL	September	33	32	9	30	47	19	19	38	63	31	28	349	
	June	8	23	15	17	21	28	33	34	32	14	40	265	
	August	6	62	34	4	15	25	26	60	33	17	9	291	

Source: Beak Consultants, Ltd. 19/



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SPECIES COMPOSITION AND RELATIVE ABUNDANCE OF FISH COLLECTION
MADE AT HAT CREEK AND BONAPARTE RIVER SAMPLING STATIONS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-25

PART THREE

Length Class (cm)											Type I	Type II	Type III
	1	2	3	5	6	7	10	14	14a	15	Sum (3, 6)	Sum (7, 10, 14, 15)	Sum (14a)
<u>September 28-30, 1976</u>													
0-2.0													
2.1-4.0					1	1			1	5	1	6	1
4.1-6.0	1	1		15	10	6	2	4	3	3	25	15	3
6.1-8.0	4	1		12	5		3	3	1	1	17	7	1
8.1-10.0				2	1		13	14			3	27	
10.1-12.0					1	7	3	10	4	3	1	23	4
12.1-14.0					1	3	10	13	8	5	1	31	8
14.1-16.0						2	3	7	5			12	5
16.1-18.0							2	7	1	3		12	1
18.1-20.0								2	1	3		5	1
20.1-22.0							2	1	5	2		5	5
22.1-24.0								1		3		4	
24.1-26.0									1				1
Sum	5	2		29	19	19	38	62	30	28	48	147	30
<u>June 14-16, 1977</u>													
0-2.0													
2.1-4.0		1											
4.1-6.0	4		3					1	3	5		6	3
6.1-8.0				4	7	8	2	4	1	1	11	15	
8.1-10.0				4	12	7	3	3	1	2	16	15	1
10.1-12.0				4	2	3	9	4	3	4	6	20	3
12.1-14.0				1	3	7	4	4	4	6	4	21	4
14.1-16.0					1	3	9	6	1	9	1	27	1
16.1-18.0					2	1		4	1	5	2	10	1
18.1-20.0						1	1	4		3		9	
20.1-22.0					1			3	1	4	1	8	
22.1-24.0								1		1		2	
24.1-26.0								1	1			2	
Sum	4	1	3	13	28	30	33	32	13	40	41	135	13
<u>August 3-5, 1977</u>													
0-2.0													
2.1-4.0				1	1	2					2	2	
4.1-6.0					2		1				2	1	
6.1-8.0						1	5	3	5	7		16	5
8.1-10.0				2	5	7	13	4	1	2	7	26	1
10.1-12.0				3	8	5	9	4			11	18	
12.1-14.0				1	4	5	11	8	3		5	24	3
14.1-16.0			1		2	2	6	5	4			13	4
16.1-18.0					2	1	5	1	3		2	7	3
18.1-20.0	2		1	1	2	1	6	5	1		3	12	1
20.1-22.0					1	2	3	1			1	6	
22.1-24.0								1				1	
24.1-26.0								1				1	
Sum	2		2	8	25	26	59	31	17	9	11	172	17

Source: Beak Consultants, Ltd. 19/

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LENGTH-FREQUENCY DISTRIBUTIONS FOR RAINBOW TROUT COLLECTED AT HAT CREEK
AND BONAPARTE RIVER STATIONS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-26

PART THREE

Length Class (cm)	September 1976			June 1977			August 1977		
	Cumulative Probability			Cumulative Probability			Cumulative Probability		
	Type I	Type II	I-II	Type I	Type II	I-II	Type I	Type II	i-ii
0-2.0									
2.1-4.0	.02	.04	.02				.06	.02	.04
4.1-6.0	.54	.14	.40		.04	.04	.12	.02	.10
6.1-8.0	.90	.19	.71	.27	.16	.11	.12	.15	.03
8.1-10.0	.96	.37	.59	.66	.27	.39	.33	.35	.02
10.1-12.0	.98	.53	.45	.80	.41	.39	.66	.50	.16
12.1-14.0	1.00	.74	.26	.90	.57	.33	.82	.69	.13
14.1-16.0	1.00	.82	.18	.93	.77	.16	.82	.79	.03
16.1-18.0	1.00	.90	.10	.98	.84	.14	.88	.84	.04
18.1-20.0	1.00	.94	.06	.98	.91	.07	.97	.94	.03
20.1-22.0	1.00	.97	.03	1.00	.97	.03	1.00	.98	.02
22.1-24.0	1.00	1.00	.00	1.00	.99	.01	1.00	.99	.01
24.1-26.0	1.00	1.00	.00	1.00	1.00	.00	1.00	1.00	.00

$$D = \text{Max } I-II = .71$$

$$\chi^2 = \frac{D^2 \cdot n_I \cdot n_{II}}{n_I + n_{II}} = \frac{(.71)^2 (48)(147)}{48 + 147}$$

$$= 18.24$$

Reject H_0 : Length-frequency distributions for Type I and Type II stations were generated by the same underlying distribution, at $\alpha = .001$,
In favor of H_1 : underlying distribution for trout at Type II stations consists of larger fish than at Type I stations.

$$D = \text{Max } I-II = .39$$

$$\chi^2 = \frac{D^2 \cdot n_I \cdot n_{II}}{n_I + n_{II}} = \frac{(.39)^2 (41)(135)}{176}$$

$$= 4.78$$

Reject H_0 : Length-frequency distributions for Type I and Type II stations were generated by the same underlying distribution, at $\alpha = .1$,
In favor of H_1 : underlying distribution for trout at Type II stations consists of larger fish than at Type I stations.

$$D = \text{Max } I-II = .16$$

$$\chi^2 = \frac{D^2 \cdot n_I \cdot n_{II}}{n_I + n_{II}} = \frac{(.16)^2 (33)(127)}{33 + 127}$$

$$= .67$$

Fail to Reject H_0 : Length-frequency distributions for Type I and Type II stations were generated by the same underlying distribution,
In favor of H_1 : underlying distribution for trout at Type II stations consists of larger fish than at Type I stations.

Annulus

Age (Year Class)		1	2	3	4	5	6
I (1976)	\bar{X} r n	63 40-98 92					
II (1975)	\bar{X} r n	69 45-106 46	109 82-126 29				
III (1974)	\bar{X} r n	64 43-111 39	109 81-144 39	144 108-170 27			
IV (1973)	\bar{X} r n	61 39-79 20	103 88-131 20	140 115-173 20	169 139-198 15		
V (1972)	\bar{X} r n	63 54-79 14	108 88-127 14	144 114-172 14	172 143-206 14	193 177-212 9	
VI (1971)	\bar{X} r n	65 59-74 5	110 83-130 5	141 106-164 5	179 148-198 5	203 177-221 5	225 195-244 4
Overall weighted mean calculated length (mm)		64	108	143	172	197	225
Overall weighted mean increment (mm)		64	44	35	29	25	28

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MEAN BACK CALCULATED TOTAL LENGTHS AND RANGES FOR RAINBOW TROUT IN HAT CREEK

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-28

PART THREE

Age (Year Class)*	Month	Lower Hat Creek			Upper Hat Creek		Mean
		Station 5	Station 6	Station 7	Station 10	Station 14	
0+ (1977)	S**	-**	-**	-**	-**	-**	-**
	J	-	-	-	-	-	-
	A	36 (1)***	42 (3)	34 (2)	42 (1)	-	38 (7)
1+ (1976)	S	58 (10)	59 (9)	55 (3)	81 (9)	82 (6)	67 (37)
	J	88 (12)	85 (12)	77 (10)	82 (5)	86 (8)	84 (47)
	A	104 (14)	105 (10)	104 (13)	90 (10)	79 (8)	80 (45)
2+ (1975)	S	-	114 (2)	110 (5)	111 (4)	113 (6)	112 (17)
	J	134 (1)	133 (3)	126 (7)	117 (3)	117 (1)	125 (15)
	A	133 (1)	152 (3)	149 (3)	132 (4)	136 (3)	140 (14)
3+ (1974)	S	-	-	138 (5)	134 (6)	161 (1)	144 (12)
	J	-	174 (4)	167 (3)	138 (3)	150 (5)	157 (15)
	A	187 (1)	187 (2)	177 (1)	156 (2)	180 (4)	177 (11)
4+ (1973)	S	-	-	-	156 (2)	169 (3)	162 (5)
	J	-	-	-	151 (3)	177 (4)	187 (7)
	A	-	207 (1)	214 (2)	198 (2)	197 (3)	198 (8)
5+ (1972)	S	-	-	-	206 (2)	195 (3)	200 (5)
	J	-	-	-	201 (3)	202 (3)	201 (6)
	A	-	-	-	208 (1)	232 (2)	220 (3)
6+ (1971)	S	-	-	-	-	210 (1)	210 (1)
	J	-	-	-	229 (3)	244 (1)	232 (4)
	A	-	-	-	-	-	-

* Fish spawned in 1977 denoted as age 0+, in 1976 as age 1+, etc.

** 1977 year class not yet in existence in September 1976.

*** Numbers in parentheses denote sample sizes.

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MEAN OBSERVED TOTAL LENGTHS OF RAINBOW TROUT IN HAT CREEK

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-29

PART THREE

		<u>Station 5</u>	<u>Station 6</u>	<u>Station 7</u>	<u>Station 10</u>	<u>Station 14</u>
June						
Males	n*	0	4	4	6	3
	r**	-	140-170	140-187	145-255	177-244
Females	n	1	1	4	7	5
	r	134	127	123-162	121-208	141-211
August						
Males	n	1	2	5	7	5
	r	187	110-161	119-192	115-231	167-241
Females	n	0	4	5	4	4
	r	-	171-207	130-216	134-183	181-210

* Sample size

** Sample value length range (mm)

Source: Beak Consultants, Ltd. 19/



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NUMBERS AND LENGTH RANGES OF SEXUALLY MATURE RAINBOW TROUT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-30

PART THREE

Station	Month	0-100 mm Total Length*			>100 mm Total Length*		
		n	x	r	n	x	r
1	Sept.	5	0.96	0.87-1.01	0	-	-
	June	4	0.70	0.59-0.83	0	-	-
	Aug.	0	-	-	2	1.05	1.03-1.07
2	Sept.	2	0.78	0.74-0.83	0	-	-
	June	1	0.70	-	0	-	-
	Aug.	0	-	-	0	-	-
3	Sept.	0	-	-	0	-	-
	June	3	1.01	0.75-1.26	0	-	-
	Aug.	0	-	-	2	1.09	1.04-1.13
4	Sept.	0	-	-	0	-	-
	June	0	-	-	0	-	-
	Aug.	0	-	-	0	-	-
5	Sept.	29	0.81	0.60-0.97	0	-	-
	June	8	0.85	0.73-0.99	5	0.94	0.86-1.04
	Aug.	3	0.68	0.21-0.92	5	0.95	0.81-1.06
6	Sept.	17	0.91	0.27-1.14	2	0.70	0.66-0.73
	June	19	0.93	0.76-1.16	9	0.96	0.85-1.10
	Aug.	8	0.87	0.77-1.00	17	0.97	0.82-1.07
7	Sept.	7	1.15	1.07-1.40	12	0.81	0.73-0.93
	June	5	1.01	0.85-1.13	15	1.02	0.86-1.45
	Aug.	10	0.82	0.59-1.07	16	0.91	0.80-1.08
10	Sept.	18	0.80	0.63-0.90	20	0.83	0.72-0.95
	June	5	1.09	0.90-1.26	28	1.02	0.78-1.24
	Aug.	19	0.89	0.27-1.65	41	0.90	0.74-1.09
14	Sept.	21	0.80	0.35-1.16	41	0.97	0.68-1.22
	June	8	0.95	0.84-1.20	24	0.93	0.66-1.16
	Aug.	7	0.92	0.85-9.95	26	0.89	0.74-1.05
14A	Sept.	5	0.88	0.78-1.03	25	0.96	0.85-1.19
	June	4	0.83	0.35-1.08	9	0.93	0.85-1.03
	Aug.	6	0.97	0.81-1.07	11	0.95	0.86-1.07
15	Sept.	9	0.29	0.13-0.59	19	0.84	0.68-0.99
	June	8	1.23	0.98-1.81	32	0.94	0.82-1.40
	Aug.	9	1.08	0.91-1.36	0	-	-

* n = sample size, x = mean, r = range

Source: Beak Consultants, Ltd. 19/



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MEANS AND RANGES FOR CONDITION FACTORS OF
RAINBOW TROUT COLLECTED AT HAT CREEK AND
BONAPARTE RIVER STATIONS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 5.3-51

PART THREE

Sampling Period	Type I Habitat*		Type II Habitat*		Type III Habitat*		Overall*		
	Avg. #/m ²	n _I **	Avg. #/m ²	n _{II} **	Avg. #/m ²	n _{III} **	Avg. #/m ²	Avg. n	Sum. n
Sep '76	.022	1,072	.098	13,316	.138	16,836	.086	10,393	31,179
Jun '77	.014	682	.105	14,267	.050	6,100	.056	7,016	21,048
Aug '77	.027	1,315	.087	11,822	.061	7,442	.058	6,860	20,579
Average	.021	1,023	.097	13,135	.083	10,126	.067	8,090	24,269

* All values based on 100% gear efficiency.

** Calculated as (avg. #/m²) x total area, where total area = 48,720 m², 135,880 m², 122,000 m² for Types I, II and III habitat, respectively.

Source: Beak Consultants, Ltd. 19/



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POPULATION ESTIMATES FOR HAT CREEK RAINBOW TROUT GREATER THAN
100 mm IN TOTAL LENGTH

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-32

PART THREE

Station	Annual Mean Max/Min Temperatures (° C)	Mean Annual Dew Point (° C)	Mean Annual Relative Humidity (%)	Mean Annual Total Precipitation (mm)	Mean Annual Total Snowfall (cm)	Total Annual Number of Sunshine Hours
Ashcroft	13/2	0.4	64.2	239	81.8	-
Dog Creek	9/-1	-1.1	69.9	347	131.4	-
Kamloops	14/3	2.2	65.6	258	98.4	2,080
Kelowna	13/2	2.9	68.0	309	90.6	2,088
Lytton	15/4	3.2	66.4	367	111.9	1,990
Penticton	15/3	2.9	68.0	278	60.8	2,076
Williams Lake	N A*	N A*	N A*	403	236.4	2,168
Hat Creek	11/-4	N A*	N A*	317	132.9	N A*

* Denotes not available.

Source: Environmental Research and Technology, Inc. 1/



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REGIONAL CLIMATIC PARAMETERS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-1

PART THREE

<u>Map Symbol *</u>	<u>Parent Material</u>	<u>Soil Development</u>	<u>Surface Texture</u>	<u>Drainage</u>	<u>Agricultural Significance</u>
<u>Plant Island</u>					
33	Colluvial over glacial till	Orthic grey luvisol	Loam-silt loam	Excessive	Grazing
41	Glacial till	Orthic grey luvisol	Gravelly silt loam	Excessive	Grazing
58	Glacial till over lithic contact	Lithic dark grey chernozem	Silt loam - silty clay loam	-	Grazing
<u>Harry Lake Dump</u>					
37	Glacial till	Orthic grey luvisol - degraded eutric brunisol	Fine sandy loam - loam - silt loam	Well - imperfectly	Grazing
38	Glacial till	Orthic grey luvisol	Silt loam - gravelly loam (gl)	Moderately well	Grazing
51	Glacial till - glacial out- wash	Calcareous black chernozem	Loam - silt loam	Well	Grazing



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PREDOMINANT SOILS IN THE VICINITY OF THE PLANT & ASH DISPOSAL SITES

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-2

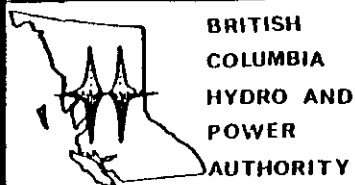
Sheet 1 of 3

PART THREE

Map Symbol*	Parent Material	Soil Development	Surface Texture	Drainage	Agricultural Significance
58	Glacial till over lithic contact	Lithic dark grey chernozem	Silt loam - silty clay loam	-	Grazing
59	Glacial till	Calcareous black chernozem	Loam - gravelly loam (gl)	Moderately well	Grazing
60	Glacial till	Gleyed orthic grey luvisol	Silt loam - gravelly clay loam	Poorly	Grazing

Medicine Creek Dump

16	Glacial till	Carbonated black chernozem	Loam - sandy loam	Imperfectly	Partially arable
35	Glacial till	Degraded eutric brunisol	Fine sandy loam - silt loam	Moderately well	Grazing
38	Glacial till	Orthic grey luvisol	Silt loam gravelly silt loam	Moderately well	Grazing
45	Glacial fluvial	Degraded eutric brunisol	Silt loam	Excessive	Grazing
51	Glacial till - glacial outwash	Calcareous black chernozem	Loam - silt loam	Well	Grazing



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PREDOMINANT SOILS IN THE VICINITY OF THE PLANT & ASH DISPOSAL SITES

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-2
Sheet 2 of 3
PART THREE

Map Symbol*	Parent Material	Soil Development	Surface Texture	Drainage	Agricultural Significance
52	Glacial till -	Orthic grey luvisol - gleyed grey luvisol	Silt loam - silty clay loam	Moderate - poorly	Grazing
53	Alluvial fan	Calcareous black chernozem	Silt loam - loam	Moderately - Imperfectly	Grazing
55	Alluvial fan and stream deposits	Carbonated black chernozem	Loam - silt loam	Poorly	Grazing
56	Glacial fluvial	Orthic dark brown - calcareous black chernozem	Loam - silt	Well	Grazing
57	Colluvial fan	Orthic dark brown - chernozem - degraded butric brunisol	Silt loam - gravelly silt loam	Well	Grazing

* See Map 4-4a,b 3/

Source: TERA Environmental Resource Analyst, Ltd. 3/



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PREDOMINANT SOILS IN THE VICINITY OF THE PLANT & ASH DISPOSAL SITES

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-2
Sheet 3 of 3
PART THREE

Map Symbol *	Parent Material	Soil Development	Surface Texture	Drainage	Agricultural Significance
4	Alluvial stream deposits	Orthic Regosol	Loam - silt loam	Moderately - poorly	Partially arable
6A	Glacial out-wash	Degraded eutric brunisol - orthic dark brown chernozem	Silt loam - silty clay loam	Well drained	Arable
10	Glacial till	Degraded eutric brunisol	Loam - silt loam	Moderately - Imperfectly	Pasture
17	Glacial till	Orthic dark brown chernozem - degraded eutric brunisol	Silt loam - silty clay loam	Excessive - poorly	Pasture
18	Glacial till	Degraded eutric brunisol	Loam - sandy loam	Moderately well	Arable
19	Glacial till	Degraded eutric brunisol - orthic dark brown	Silt loam	Excessive	Partial grazing, partial pasture
20A	Glacial lacustrine	Regosolic	Clay	Well	Nil
20B	Glacial lacustrine	Regosolic	Clay	Imperfectly	Nil
20C	Glacial lacustrine	Orthic eutric brunisol	Silty clay loam clay loam	Excessive	Grazing



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PREDOMINANT SOILS IN THE VICINITY OF THE MINE SITE

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-3

Sheet 1 of 2

PART THREE

Map Symbol *	Parent Material	Soil Development	Surface Texture	Drainage	Agricultural Significance
20D	Glacial lacustrine	Orthic eutric brunisol	Silt loam	Well	Grazing
34	Colluvial over lithic contact	Lithic eutric brunisol	Gravelly sandy loam - gravelly loam	-	Grazing

• See Map 4-4a,b 3/

Source: TERA Environmental Resource Analyst, Ltd. 3/



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PREDOMINANT SOILS IN THE VICINITY OF THE MINE SITE

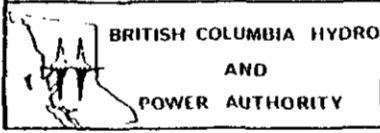
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-3
Sheet 2 of 2
PART THREE

Biogeoclimatic Zone	Elevation Range (m)	Soil Derivation	Vegetation Patterns	Dominant Climax Vegetation	Present Successional Vegetation	Predominant Land Use			Limiting Factors for Plant Growth	Unique Features
						Agricultural	Forestry	Wildlife		
Ponderosa Pine - Bunchgrass	275-915	Glacial till and alluvial	Open Savannah	Ponderosa pine, big sagebrush	N D*	Major zone cattle grazing w/irrigation	Poor productivity	Ungulates, upland game and wild ungulates	Rainfall	N D
Interior Douglas-fir	300-1525	Glacial till alluvial materials	N D*	Interior Douglas-fir	Ponderosa pine, Lodgepole pine, Engelmann spruce, Grand fir	Livestock summer forage, improved pasture alfalfa w/irrigation	Large and important industry	N D	N D	N D
Engelmann Spruce - Subalpine Fir	1225-2290	Glacial till granitic	Open parkland w/ Krummholz formations	Engelmann spruce, subalpine fir	Lodgepole pine	Livestock summer grazing amount & quality low	Second highest productivity	Heavy ungulates Summer range use	N D	Water storage area
Alpine Tundra	1830	Shallow glacial till	N D	Mountain evens, alpine pussy-toes, catchfly, beardtongue, sandwort	N D	None	None	Summer use	Severe climate	High recreation water use
Cariboo Aspen - Lodgepole Pine - Douglas-fir	Geographically defined	Glacial till outwash lacustrine	Mosaic of forest & grasslands	Douglas-fir, lodgepole pine, quaking aspen	N D	Restricted crop-type & productivity livestock grazing	Major use	N D	Severe winter w/limited snowfall	Lack many tree species
Coastal Western Hemlock	450-1050	N D	Rich shrub & herbaceous layer	Western hemlock, western red cedar, Pacific silver fir	Douglas-fir red alder	None	High forest productivity	N D	N D	Well developed moss layer
Mountain Hemlock	915	Glacial till and colluvium	Parkland forest with Krummholz	Mountain hemlock, Pacific silver fir, Yellow cedar	N D	None	Major use	Ungulate, minor use in summer months	Heavy snowfall	N D
Interior Western Hemlock	300-1350	N D	N D	Western hemlock, Interior Douglas-fir, Western larch, Western hemlock, western white pine, lodgepole pine, western red cedar, subalpine fir, Grand fir	N D	None	Highest forest productivity	N D	N D	High precipitation

* denotes no data presented in source document.

Source: TERA Environmental Resource Analyst, Ltd. 3/



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SUMMATION OF REGIONAL BIOGEOCLIMATIC ZONATION FEATURES Rev. 1 Feb. 1979.

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-4

PART THREE

Biogeoclimatic Zone	Vegetation Association	Areal Extent (km ²)
Engelmann Spruce - Subalpine Fir	Engelmann Spruce -	
	Grouseberry	197.9
	Grouseberry - Pinegrass	183.4
	Grouseberry - White Rhodendron	57.5
	Willow - Red Heather Barkland	10.9
	Grouseberry - Lupine	30.0
Interior Douglas-fir	Douglas-fir -	
	Pinegrass	478.6
	Bunchgrass	33.4
	Spirea - Bearberry	0.8
	Bunchgrass - Pinegrass	143.0
Ponderosa Pine - Bunchgrass	Ponderosa Pine -	
	Bunchgrass	13.9
Alpine Tundra	Mountain Avens -	
	Sedge	-
Intrazonal	Riparian	10.1
	Engelmann Spruce - Horsetail	6.2
	Willow - Sedge Bog	6.5

Source: TERA Environmental Resource Analyst, Ltd. 3/



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SUMMARY OF FOREST ASSOCIATIONS WITHIN LOCAL PROJECT AREA

THE HAT CREEK PROJECT - Detailed Environmental Studies

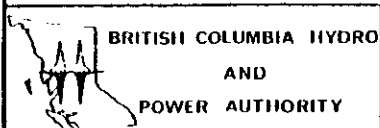
TABLE 3.4-5

PART THREE

Forest Association	Elevation Range	Soil Characteristics / Derivation	Successional Status	Dominant Vegetation Type		
				Overstory	Understory	Herbaceous Layer
Engelmann Spruce - Grouseberry	1520-1850	Medium-textured, well drained/ glacial till, colluvium	Seral	<u>Picea engelmannii</u> <u>Pinus contorta</u> <u>Pseudotsuga menziesii</u> var <u>glauca</u>	<u>Vaccinium scoparium</u> <u>Shepherdia canadensis</u> <u>Rosa gymnocarpa</u> <u>Vaccinium membranaceum</u>	<u>Linaea borealis</u> <u>Pyrola secunda</u> <u>Thalictrum occidentale</u> <u>Fragaria glauca</u> <u>Arnica latifolia</u> <u>Pedicularis bracteosa</u>
Engelmann Spruce Grouseberry - Pinegrass	1400-1675	Deep soils, medium textured /N A*	Seral	<u>P contorta</u> <u>P engelmannii</u>	<u>V scoparium</u> <u>Arctostaphylos uva-ursi</u> <u>S canadensis</u> <u>Juniperus communis</u> <u>Alnus incana</u> <u>Amelanchier alnifolia</u> <u>R gymnocarpa</u> <u>Spiraea betulifolia</u>	<u>Calamagrostis rubescens</u> <u>Lupinus lepidus</u> <u>L borealis</u> <u>P secunda</u> <u>F glauca</u>
Douglas-fir - Pinegrass	-	Medium to fine textured/N A*	Seral	<u>Pinus ponderosa</u> <u>P contorta</u> <u>P menziesii</u> var <u>glauca</u>	<u>R gymnocarpa</u> <u>A uva-ursi</u> <u>A alnifolia</u> <u>J communis</u>	<u>C rubescens</u> <u>Carex spp.</u> <u>Allium cernuum</u> <u>Achillea millefolium</u> <u>F glauca</u> <u>Astragalus miser</u> <u>Antennaria ruscus</u> <u>Taraxacum officinale</u>
Douglas-fir - Bunchgrass - Pinegrass	-	N A/ Colluvium material	-	<u>P menziesii</u> var <u>glauca</u> <u>P ponderosa</u>	<u>Juniperus scopulorum</u> <u>A uva-ursi</u> <u>Symphoricarpos albus</u> <u>A alnifolia</u>	<u>Agropyron spicatum</u> <u>C rubescens</u> <u>Balsamorhiza sagittata</u> <u>A millefolium</u> <u>F glauca</u> <u>Lithospermum ruderae</u> <u>A roseus</u> <u>A cernuum</u> <u>Geum triflorum</u> <u>T officinale</u>

* denotes data not available.

Source: TERA Environmental Resource Analyst, Ltd. 3/



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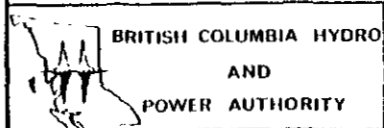
DESCRIPTIVE FEATURE SUMMARY OF MAJOR FOREST ASSOCIATIONS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-6
PART THREE

Grassland Association	Elevation Range (m)	Soil Characteristics	Unique Features	Dominant Vegetation Type	
				Shrub Layer	Herb Layer
Big Sagebrush - Bunchgrass	400-650	Glacial till, glaciofluvial deposits	<u>Agropyron spicatum</u> dominates in areas not overgrazed	<u>Artemisia tridentata</u> <u>Chrysothamnus nauseosus</u> <u>Artemisia frigida</u>	<u>Agropyron spicatum</u> <u>Poa sunbergii</u> <u>Stipa comata</u> <u>Sporobolus cryptandrus</u> <u>Bromus tectorum</u> <u>Erigeron lincais</u> <u>Antennaria diorpha</u> <u>Opuntia fragilis</u> <u>Draba verna</u> <u>Lithospermum ruderales</u> <u>Salsola kali</u>
Kentucky Bluegrass	1200-1800	Medium textured glacial till with high alkalinity	Increased soil moisture, herb layer, has high species diversity, Kentucky bluegrass forms complete turf over ground surface	<u>Rosa gymnocarpa</u>	<u>Poa pratensis</u> <u>Stipa occidentalis</u> <u>Stipa richardsonii</u> <u>Koeleria cristata</u> <u>Erigeron compositus</u> <u>Taraxacum officinale</u> <u>Achillea millefolium</u> <u>Fragaria glauca</u> <u>Anemone multifida</u> <u>Potentilla diversifolia</u> <u>Eriogonum heracleoides</u>
Sagebrush - Bluebunch Wheatgrass	-	Fine textured	Occurrence may be due to bentonite in soil	<u>A tridentata</u> <u>Juniperus scopulorum</u> <u>C nauseosus</u> <u>A frigida</u>	<u>A spicatum</u> <u>S richardsonii</u> <u>Lithospermum ruderales</u> <u>A millefolium</u> <u>Oxytropis sericea</u>

Source: TERA Environmental Resource Analyst, Ltd. 3/



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DESCRIPTIVE FEATURE SUMMARY OF MAJOR GRASSLAND ASSOCIATIONS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-7

PART THREE

<u>Plant Species*</u>	<u>Kentucky Bluegrass</u>	<u>Bunchgrass- Kentucky Bluegrass</u>	<u>Sagebrush - Bluebunch Wheatgrass</u>	<u>Big Sagebrush- Bunchgrass</u>
<u>Achillea millefolium</u>	In**	In	In	-
<u>Agropyron spicatum</u>	D***	D	D	D
<u>Anemone multifida</u>	Iv****	-	Iv	-
<u>Antennaria dimorpha</u>	-	-	-	In
<u>Antennaria roseus</u>	In	In	In	In
<u>Artemisia frigida</u>	-	In	In	-
<u>Artemisia tridentata</u>	-	-	In	In
<u>Bromus tectorum</u>	-	-	-	Iv
<u>Cerastium arvense</u>	Iv	-	-	-
<u>Chrysothamnus nauseous</u>	-	In	-	In
<u>Descurainia sophia</u>	-	-	-	Iv
<u>Draba verna</u>	-	-	-	Iv
<u>Erigeron compositus</u>	Iv	Iv	-	Iv
<u>Eriogonum heracleoides</u>	In	-	Iv	-
<u>Festuca scabrella</u>	D	D	-	-
<u>Fragaria glauca</u>	In	-	-	-
<u>Geum triflorum</u>	Iv	Iv	-	-
<u>Hordeum jubatum</u>	-	In	-	-
<u>Koeleria cristata</u>	In	In	-	-
<u>Lithospermum ruderale</u>	-	-	In	-
<u>Lomatium macrocarpum</u>	-	In	In	In
<u>Poa pratensis</u>	In	In	-	-
<u>Poa sandbergii</u>	-	D	-	In
<u>Salsola kali</u>	-	-	-	Iv
<u>Stipa comata</u>	-	-	-	D
<u>Stipa occidentalis</u>	In	In	-	-
<u>Stipa richardsonii</u>	In	-	-	-
<u>Sporobulus cryptandrus</u>	-	-	-	In
<u>Taraxacum officinale</u>	Iv	Iv	-	-

* No data were available for the Highland Grassland and Saline Depression Associations.

** Increaser

*** Decreaser

**** Invaders

Source: TERA Environmental Resource Analyst, Ltd. 3/



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SUCCESSIONAL STATUS SUMMARY
OF GRASSLAND SPECIES

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-8

PART THREE

Biophysical Unit*	Biophysical Subunit*	Land Form	Percent Material	Soils	Soil Modifier	Vegetation Association	Present Resource Use	Resource Capability		
								Agriculture	Forestry	Wildlife
<u>Plant</u> 2TBL/3	2TBL.17	Sloping land	Glacial till	Black chernozem	High alkalinity and/or salinity	Kentucky bluegrass	Grazing	Medium-high Class 2-3 grazing	None-poor	Medium-medium high - deer
2TG /3	2TG.7	Sloping land	Glacial till	Dark grey chernozem	-	Douglas-fir - pine-grass	Grazing	Class 2 grazing	Poor-medium	Medium - deer
2TGL/3	2TGL.7	Sloping land	Glacial till	Grey luvisols	-	Douglas-fir - pine-grass	Forestry/ grazing	Medium-high Class 3 grazing	Poor-medium	Medium-medium high - deer
3TGL/3	3TGL.7	Steepland	Glacial till	Grey luvisols	-	Douglas-fir - pine grass	Grazing	Class 2-5 grazing	Poor	Medium-medium high - deer
<u>Medicine Creek Disposal Area</u>										
2ABL/3	2ABL.17	Sloping land	Glacial fluvial	Black chernozem	High alkalinity and/or salinity	Kentucky bluegrass	Grazing	Class 2 grazing	No value	Medium - deer
2TBL/3	2TBL.17	Sloping land	Glacial till	Black chernozem	High alkalinity and/or salinity	Kentucky bluegrass	Grazing	Medium-high Class 2-3 grazing	None-poor	Medium-medium high - deer
2TE /3	2TE.7	Sloping land	Glacial till	Aeolian	-	Douglas-fir - pine-grass	Forestry/ grazing	Medium-medium high Class 2-4 grazing	None-poor	Medium medium high - deer
2TGL/3	2TGL.7	Sloping land	Glacial till	Grey luvisols	-	Douglas-fir - bunch-grass - pinegrass	Forestry/ grazing	Medium-high Class 3 grazing	Poor-medium	Medium-medium high - deer
3CE /3	3CE1.10	Steepland	Colluvium	Eutric brunisol	High alkalinity and/or salinity	Douglas-fir - bunch-grass - pinegrass	Forestry/ grazing	Class 4 grazing	Poor-medium	Medium-medium high - deer
3TGL/3	3TGL.7	Steepland	Glacial till	Grey luvisols	-	Douglas-fir - pine-grass	Grazing	Class 2-5 grazing	Poor	Medium-medium high - deer
<u>Mine</u> 1ADB/3	1ADB.17	Bottomland	Glacial - fluvial	Dark brown chernozem	-	Kentucky bluegrass	Grazing	Medium-high	No value	Medium - deer
1AE /3	1AE.10	Bottomland	Glacial - fluvial	Eutric brunisol	-	Douglas-fir - bunch-grass - pinegrass	Forestry/ grazing	Medium-high	Poor	Medium - deer
	1AE.19	Bottomland	Glacial - fluvial	Eutric brunisol	-	Sagebrush - blue-bunch wheatgrass	Forestry/ grazing	Medium-high	Poor	Medium - deer
1BRL/5	1BRL+3.13	Bottomland	Alluvium	Regosols	High alkalinity and/or salinity, flooding	Riparian	Grazing	Medium-high	No value	Medium - deer High - small animals



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SUMMARY DESCRIPTION OF PREDOMINANT BIOPHYSICAL UNITS IN VICINITY OF PROPOSED DEVELOPMENT

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Biophysical Unit*	Biophysical Subunit*	Land Form	Percent Material	Soils	Soil Modifier	Vegetation Association	Present Resource Use	Resource Capability		
								Agriculture	Forestry	Wildlife
1TE /3	1TEL17	Bottomland	Glacial till	Eutric brunisol	High alkalinity and/or salinity	Kentucky bluegrass	Grazing	Medium high	No value	Medium - deer
2CE /3	2CEL.7	Sloping land	Colluvium	Eutric brunisol	-	Douglas-fir - pine-grass	Forestry/ grazing	Class 4 grazing	Poor	Medium - deer
	2CEL.10	Sloping land	Colluvium	Eutric brunisol	High alkalinity and/or salinity	Douglas-fir - bunch-grass - pinegrass	Forestry/ grazing	Class 4 grazing	Poor	Medium - deer
2TBL/3	2TBL1.7	Sloping land	Glacial till	Black chernozem	High alkalinity and/or salinity	Douglas-fir - pine-grass	Grazing	Medium-high Class 2-3 grazing	Poor	Medium-high - deer
2TDB/3	2TDB1.19	Sloping land	Glacial till	Dark brown chernozem	High alkalinity and/or salinity	Sagebrush - blue-bunch wheatgrass	Grazing	Medium Class 2 grazing	No value	High - deer
	2TDB.19	Sloping land	Glacial till	Dark brown chernozem	-	-	Grazing	Medium Class 2 grazing	No value	High - deer
2TE /3	2TE.19	Sloping land	Glacial till	Eutric brunisol	-	Sagebrush - blue-bunch wheatgrass	Forestry/ grazing	Medium-high, Class 2-4 grazing	Poor	Medium-medium high - deer
3TE /3	3TEL17	Steepland	Glacial till with some colluvial material	Eutric brunisol	High alkalinity and/or salinity	Kentucky bluegrass	Forestry/ grazing	Class 3 grazing capability	Poor	Medium-medium high - deer
3CE /3	3CE.10	Steepland	Colluvium	Aeolian	-	Douglas-fir - bunch-grass - pinegrass	Forestry/ grazing	Class 4 grazing	Poor-medium	Medium-medium high - deer
3CG /3	3CG1+2.24	Steepland	Colluvium	Dark grey chernozem	High alkalinity and/or salinity, erosion or mass movement potential	Douglas-fir - spirea bearberry/Douglas-fir bunch-grass - pine-grass complex	Forestry/ grazing	Medium-high Class 3 capability	Poor-non-productive	Medium-medium high - deer

*See Map 4-7a-b, 3/.

Source: TERA Environmental Resource Analyst, Ltd. 3/



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Wildlife Habitat	Vegetation Associations	Percentage of Study Area	Area (km ²)
Subalpine Krummholz	Engelmann spruce - willow - red heather parkland	0.7	11.4
Engelmann spruce - lodgepole pine forest	Engelmann spruce - grouse-berry - white rhodendron Engelmann spruce - grouse-berry Engelmann spruce - subalpine fir - grouseberry Engelmann spruce - grouse-berry - pinegrass Engelmann spruce - horse-tail	24.1	391.1
Douglas-fir/pinegrass	Some seral stages within Engelmann spruce - subalpine fir - grouseberry Some seral stages within Engelmann spruce - grouse-berry - pinegrass Douglas-fir - spirea-bearberry Douglas-fir - pinegrass Douglas-fir - bunchgrass - pinegrass Douglas-fir - bunchgrass (a few mature, closed canopy stands)	38.7	627.1
Ponderosa pine - Douglas-fir/bunchgrass	Some seral stages within Douglas-fir - bunchgrass - pinegrass Most seral stages within Douglas-fir - bunchgrass Ponderosa pine - bunchgrass	8.3	134.9

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<u>Wildlife Habitat</u>	<u>Vegetation Associations</u>	<u>Percentage of Study Area</u>	<u>Area (km²)</u>
Aspen	Some forest types within Douglas-fir - pinegrass	1.7	27.2
	Some forest types within Douglas-fir - pinegrass - bunchgrass		
Riparian	Riparian	0.5	8.0
Open Range			
(a) Alpine	Mountain avens - sedge high elevation grassland	2.0	32.4
(b) Mid-elevation grassland	Kentucky bluegrass	3.4	54.5
(c) Low-elevation grassland	Bunchgrass - Kentucky bluegrass	2.9	46.4
(d) Sagebrush	Sagebrush - bluebunch wheatgrass	0.4	6.7
(e) Big Sage	Big sagebrush - bunchgrass	12.4	200.0
Brush	Not satisfactorily restocked	1.8	28.7
Bog	Willow - sedge bog	0.4	6.5
Cultivated Fields	Described in Chapter 6	2.1	33.7
Miscellaneous (Outcrops, lakes, rivers, urban areas, etc)		0.8	12.7
			1,621.0

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Species	British Columbia			Game Management Areas 4, 14 and 15	
	Estimated Population	Estimated Number Harvested Annually	Percent of Estimated Population Harvested Annually	Estimated Number Harvested Annually	Calculated Population
Deer	400,000	46,616	11.7	6,459	55,200
Moose	300,000	15,044	5.0	1,053	21,100
Goat	100,000	900	.9	104	NA*
Bighorn Sheep	6,500	210	3.2	7	220
Grizzly Bear	5,000- 10,000	219	4.4- 2.2	6	150- 300
Black Bear	Abundant	2,810	NA*	NA*	NA*
Cougar	5,000	265	5.3	15	300
Wolf	2,500- 5,000	995	4.0- 2.0	74	185- 370
Elk	25,000- 30,000	971	4.9- 2.4	0	NA

* Not applicable.

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POPULATION ESTIMATES OF BIG GAME SPECIES - RESIDENT AND ANNUALLY HARVESTED IN
BRITISH COLUMBIA AND GAME MANAGEMENT - AREAS 4, 14 AND 15

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Species	Trophic Status	Comments
* Masked shrew (<u>Sorex cinereus</u>)	insectivore	
* Dusky shrew (<u>Sorex obscurus</u>)	insectivore	
Northern water shrew (<u>sorex palustris</u>)	insectivore	Riparian habitat only
Western big-eared bat (<u>Plecotus townsendii</u>)	insectivore	
California myotis (<u>Myotis californicus</u>)	insectivore	
Long-eared myotis (<u>myotis evotis</u>)	insectivore	
Little brown myotis (<u>myotis lucifugus</u>)	insectivore	
Small-footed myotis (<u>Myotis leibin</u>)	insectivore	Dry-belt species
Fringed myotis (<u>Mvotis thvsanodes</u>)	insectivore	Dry-belt species
Long-legged myotis (<u>Myotis volans</u>)	insectivore	
Yuma myotis (<u>Mvotis vumanensis</u>)	insectivore	
Pallid bat (<u>Antrozous pallidus</u>)	insectivore	Dry-belt species
Big brown bat (<u>Eptesicus fuscus</u>)	insectivore	
Hoary bat (<u>Lasiurus cinereus</u>)	insectivore	
Silvery-haired bat (<u>Lasionvcteris noctivagans</u>)	insectivore	
Pika (<u>Ochotona princeps</u>)	herbivore	West of Fraser River
* Snowshoe hare (<u>Lepus americanus</u>)	herbivore	
Aplodontia (mountain beaver) (<u>Aplodontia rufa</u>)	herbivore	Recorded near Merritt
* Yellow-bellied marmot (<u>Marmota flaviventris</u>)	herbivore	



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Species	Trophic Status	Comments
Hoary marmot (<u>Marmota caligata</u>)	herbivore	Alpine - sub-alpine west of Fraser River
* Yellow pine chipmunk (<u>Eutamias amoenus</u>)	granivore	
* Red Squirrel (<u>Tamiasciurus hudsonicus</u>)	granivore	
Northern flying squirrel (<u>Glaucomys sabrinus</u>)	omnivore	
Northern pocket gopher (<u>Thomomys talpoides</u>)	herbivore	
Great basin pocket mouse (<u>Perognathus parvus</u>)	granivore	Dry-belt species
* Beaver (<u>Castor canadensis</u>)	herbivore	
* Deer mouse (<u>Peromyscus maniculatus</u>)	omnivore	
* Bushy-tailed woodrat (<u>Neotoma cinerea</u>)	herbivore	
Northern bog lemming (<u>Synaptomys borealis</u>)	herbivore	Alpine - subalpine
Heather vole (<u>Phenacomys intermedius</u>)	herbivore	Alpine - subalpine
Boreal redback vole (<u>Clethrionomys gapperi</u>)	herbivore	
* Long-tailed vole (<u>Microtis longicaudus</u>)	herbivore	
* Mountain vole (<u>Microtus montanus</u>)	herbivore	
Meadow vole (<u>microtus pennsylvanicus</u>)	herbivore	
Muskrat (<u>Ondatra zibethica</u>)	herbivore	
Norway rat (<u>Rattus norvegicus</u>)	omnivore	Human commensal
Roof rate (<u>Rattus rattus</u>)	omnivore	Human commensal
House mouse (<u>Mus musculus</u>)	omnivore	Human commensal



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Species	Trophic Status	Comments
Meadow jumping mouse (<u>Zapus hudsonius</u>)	granivore	
Western jumping mouse (<u>Zapus princeps</u>)	granivore	
Porcupine (<u>Erithizon dorsatum</u>)	herbivore	
* Coyote (<u>Canis lacrans</u>)	carnivore	Abundant
* Gray wolf (<u>Canis lupus</u>)	carnivore	Rarely seen in study area
Red fox (<u>Vulpes vulpes</u>)	carnivore	Uncommon
* Black bear (<u>Ursus americanus</u>)	omnivore	
Grizzly bear (<u>Ursus arctos</u>)	omnivore	West of Fraser
Pine marten (<u>Martes americana</u>)	carnivore	Not as common locally as fisher
Fisher (<u>Martes pennanti</u>)	carnivore	
* Short-tailed weasel (<u>Mustela erminea</u>)	carnivore	
Long-tailed weasel (<u>Mustela frenata</u>)	carnivore	
* Least weasel (<u>Mustela nivalis</u>)	carnivore	Rare
* Mink (<u>Mustela vison</u>)	carnivore	
River otter (<u>Lutra canadensis</u>)	carnivore (fish)	
Wolverine (<u>Gulo gulo</u>)	carnivore	Rare, alpine - subalpine
Badger (<u>Taxidea taxus</u>)	carnivore	Rare, dry-belt species
Striped skunk (<u>mephitus mephitus</u>)	omnivore	
Cougar (mountain lion) (<u>Felis concolor</u>)	carnivore	
Lynx (<u>Lynx canadensis</u>)	carnivore	



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Species	Trophic Status	Comments
Bobcat (<u>Lynx rufus</u>)	carnivore	
* Mule deer (<u>Odocoileus hemionus</u>)	herbivore	
* Moose (<u>Alces alces</u>)	herbivore	
Caribou (<u>Rangifer tarandus</u>)	herbivore	Historical records only, west of Fraser River, all mountainous terrain
Mountain goat (<u>Oreamnos americanus</u>)	herbivore	
* Bighorn sheep (<u>Ovis canadensis</u>)	herbivore	
Elk (<u>Cervus elephus</u>)	herbivore	Historical records, small herd released near Lytton

* Species seen by TERA personnel during field observations.

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Species	Occurrence*			Status**	Abundance***	Habitat
	Spring	Summer	Fall			
Common (<u>Gavia immer</u>)	X	X		S	2	Lakes, ponds
Red-necked grebe (<u>Podiceps grisegena</u>)		X		S	3	Lakes, ponds
Horned grebe (<u>Podiceps auritus</u>)	X			S	3	Lakes, ponds
Western grebe (<u>Aechmophorus occidentalis</u>)			X	S	3	Lake, ponds
Pied-billed grebe (<u>Podilymbus podiceps</u>)		X		S	3	Lakes, ponds
White pelican (<u>Pelecanus erythrorhynchos</u>)	X			T	4	Lakes
Great blue heron (<u>Ardea herodias</u>)	X	X		S	3	Riparian
Whistling Swan (<u>Olor columbianus</u>)	X			T,W	3	Wetlands
Trumpeter Swan (<u>Olor buccinator</u>)	X			T,W	3	Wetlands
Canada goose (<u>Branta canadensis</u>)	X			T,S	2	Wetlands, sa- line depressions
Mallard (<u>Anas platyrhynchos</u>)	X	X	X	S	1	Wetlands
Gadwall (<u>Anas strepera</u>)	X			S	3	Wetlands
Pintail (<u>Anas acuta</u>)	X	X	X	S	1	Wetlands
Green-winged teal (<u>Anas crecca</u>)	X	X	X	S	1	Wetlands
Blue-winged teal (<u>Anas discors</u>)	X	X	X	S	1	Wetlands
Cinnamon teal (<u>Anas cyanoptera</u>)	X	X	X	S	1	Wetlands
American wigeon (<u>Anas americana</u>)	X	X	X	S	1	Wetlands

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Species	Occurrence *			Status **	Abundance ***	Habitat
	Spring	Summer	Fall			
Northern shoveler (<u>Anas clypeata</u>)	X		X	S	2	Wetlands
Ring-necked duck (<u>Aythya collaris</u>)	X	X	X	S	2	Wetlands
Greater scaup (<u>Aythya marila</u>)	X		X	T	1	Wetlands
Lesser scaup (<u>Aythya affinis</u>)	X	X	X	S	1	Wetlands
Common goldeneye (<u>Bucephala clangula</u>)	X		X	T	2	Wetlands
Barrow's goldeneye (<u>Bucephala islandica</u>)	X	X	X	S	1	Wetlands
Bufflehead (<u>Bucephala albeola</u>)	X	X	X	S	1	Wetlands
White-winged scoter (<u>Melanitta deglandi</u>)			X	T,S	2	Wetlands
Ruddy duck (<u>Cxyura jamaicensis</u>)	X			S	2	Wetlands
Common merganser (<u>Mergus merganser</u>)		X		S	3	Lakes, ponds
Goshawk (<u>Accipiter gentilis</u>)				R	3	Varied
Sharp-shinned hawk (<u>Accipiter striatus</u>)	X		X	T,S	3	Varied
Cooper's hawk (<u>Accipiter cooperii</u>)			X	T,S	3	Varied
Red-tailed hawk (<u>Buteo jamaicensis</u>)	X		X	S	2	Varied
Swainson's hawk (<u>Buteo swainsoni</u>)		X		S	3	Open range
Golden eagle (<u>Aquila chrysaetos</u>)			X	S	3	Alpine
Marsh hawk (<u>Circus cyaneus</u>)	X		X	S	2	Open range
			X	S	3	Lakes



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Species	Occurrence*			Status**	Abundance***	Habitat
	Spring	Summer	Fall			
Osprey (<u>Pandion haliaetus</u>)			X	S	3	Lakes
Peregrine falcon (<u>Falco peregrinus</u>)	X			T,R	3	Open country
Prairie falcon (<u>Falco mexicanus</u>)						
Merlin (<u>Falco columbarius</u>)						
American kestrel (<u>Falco sparverius</u>)	X	X	X	S	1	Open range
Blue grouse (<u>Dendragapus obscurus</u>)	X	X	X	R	1	Forest edge
Spruce grouse (<u>Canachites canadensis</u>)			X	R	1	Spruce/pine forests
Ruffed grouse (<u>Bonasa umbellus</u>)	X	X		R	1	Douglas-fir forest, Riparian
Sharp-tailed grouse (<u>Pedioecetes phasianellus</u>)			X	R	2	Big sage
Chukar (<u>Alectoris chukar</u>)	X		X	R	2	Big sage
Sandhill crane (<u>Grus canadensis</u>)	X			T	3	Wetlands
American coot (<u>Fulica americana</u>)	X		X	S	2	Wetlands
Killdeer (<u>Charadrius vociferus</u>)	X	X		S	1	Saline depressions
Common snipe (<u>Capella gallinago</u>)	X			S	2	Wetlands
Long-billed curlew (<u>Nwnenius americanus</u>)	X			S	2	Wetlands
Spotted sandpiper (<u>Actitis macularia</u>)		X		S	1	Wetlands
Greater yellowlegs (<u>Tringa melanoleuca</u>)			X	S	2	Wetlands



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Species	Occurrence *			Status **	Abundance ***	Habitat
	Spring	Summer	Fall			
Wilson's phalarope (<u>Steganopus tricolor</u>)	X			S	3	Wetlands
Northern phalarope (<u>Lobipes lobatus</u>)	X			T	3	Wetlands
Mew gull (<u>Larus canus</u>)	X			T	3	Wetlands
Band-tailed pigeon (<u>Columba fasciata</u>)		X		T	4	Forests
Rock dove (<u>Columba livia</u>)		X		R	2	Urban
Mourning dove (<u>Zenaida macroura</u>)	X	X		S	2	Open range, spruce woodlands
Screech owl (<u>Otus asio</u>)	X			R	2	Forests
Great horned owl (<u>Bubo virginianus</u>)	X			R	2	Forests
Great Grey owl (<u>Strix nebulosa</u>)				W	3	Forests
Poorwill (<u>Phalaenoptilus nuttallii</u>)		X		S	3	Big sage
Common nighthawk (<u>Chordeiles minor</u>)		X		S	2	Varied
Black swift (<u>Cypseloides niger</u>)		X		S	2	Varied
Vaux's swift (<u>Chaetura vauxi</u>)		X		S	2	Varied
Rufous hummingbird (<u>Selasphorus rufus</u>)	X	X		S	2	Varied, riparian
Belted kingfisher (<u>Megascops alpestris</u>)	X	X		S	2	Riparian
Common flicker (<u>Colaptes auratus</u>)	X	X	X	S	1	Varied
Pileated woodpecker (<u>Dryocopus pileatus</u>)		X		R	3	Forests



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Species	Occurrence *			Status **	Abundance ***	Habitat
	Spring	Summer	Fall			
Yellow-bellied sapsucker (<u>Sphyrapicus varius</u>)	X	X		S	1	Deciduous trees
Hairy woodpecker (<u>Picoides villosus</u>)			X	R	3	Forests
Downy woodpecker (<u>Picoides pubescens</u>)				R	3	Forests
Black-backed three-toed woodpecker (<u>Picoides arcticus</u>)			X	R	3	Forests
Eastern kingbird (<u>Tyrannus tyrannus</u>)	X	X		S	1	Riparian ecotones
Western kingbird (<u>Tyrannus verticalis</u>)	X	X		S	1	Open range
Say's phoebe (<u>Sayornis saya</u>)	X			S	3	Varied
Willow flycatcher (<u>Empidonax traillii</u>)	X	X		S	2	Varied
Hammond's/Dusky flycatcher (<u>Empidonax sp</u>)		X		S	2	Varied
Western flycatcher (<u>Empidonax difficilis</u>)		X		S	1	Varied
Western wood peewee (<u>Contopus sordidulus</u>)		X		S	1	Forests, riparian
Olive-sided flycatcher (<u>Nuttallornis borealis</u>)		X		S	1	Forests
Horned lark (<u>Eremophila alpestris</u>)		X	X	S	1	Open range
Violet-green swallow (<u>Tachycineta thalassina</u>)	X	X		S	2	Varied
Tree swallow (<u>Iridoprocne bicolor</u>)	X	X		S	2	Varied
Rough-winged swallow (<u>Stelgidopteryx ruficollis</u>)	X	X		S	2	Varied
Barn swallow (<u>Hirundo rustica</u>)	X	X		S	3	Varied



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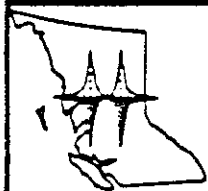
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HAT CREEK STUDY AREA

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-13
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PART THREE

Species	Occurrence *			Status **	Abundance ***	Habitat
	Spring	Summer	Fall			
Cliff swallow (<u>Petrochelidon pyrrhonota</u>)		X		S	3	Varied
Gray jay (<u>Perisoreus canadensis</u>)		X		R	2	Subalpine, spruce-pine forests
Stellar's jay (<u>Cyanocitta stelleri</u>)		X		R	2	Forests
Black-billed magpie (<u>Pica pica</u>)	X	X	X	R	2	Open range
Common raven (<u>Corvus corax</u>)	X	X	X	R	1	Varied
Common crow (<u>Corvus brachyrhynchos</u>)	X	X	X	S	1	Varied
Clark's nutcracker (<u>Nucifraga columbiana</u>)	X		X	R	1	Forests
Black-capped chickadee (<u>Parus atricapillus</u>)	X	X	X	R	1	Varied
Mountain chickadee (<u>Parus gambeli</u>)	X	X	X	R	1	Varied
White-breasted nuthatch (<u>Sitta carolinensis</u>)		X	X	R	3	Forests
Red-breasted nuthatch (<u>Sitta canadensis</u>)	X	X	X	R	1	Forests
Winter wren (<u>Troglodytes troglodytes</u>)		X		S	3	Forests
American robin (<u>Turdus migratorius</u>)	X	X	X	S	1	Varied
Hermit thrush (<u>Catharus guttatus</u>)		X		S	3	Forests
Swainson's thrush (<u>Catharus ustulata</u>)		X		S	1	Douglas-fir forests
Veery (<u>Catharus fuscescens</u>)		X		S	1	Riparian
Mountain bluebird (<u>Sialia currucoides</u>)	X	X	X	S	1	Ponderosa pine forests, varied



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AVIAN SPECIES IN THE
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TABLE 3.4-15
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PART THREE

Species	Occurrence *			Status **	Abundance ***	Habitat
	Spring	Summer	Fall			
Townsend's solitaire (<u>Mvadestes townsendi</u>)		X		S	2	Varied
Golden-crowned kinglet (<u>Regulus satrapa</u>)	X	X	X	S	3	Forests
Ruby-crowned kinglet (<u>Regulus calendula</u>)	X	X	X	S	2	Forests, prefers deciduous
Water pipit (<u>Anthus spinoletta</u>)	X	X		S	2	Open range, wetlands
Cedar waxwing (<u>Bombycilla cedrorum</u>)		X		S	3	Varied, wetlands
Common starling (<u>Sturnus vulgaris</u>)	X	X	X	S	3	Urban, cultivated fields
Red-eyes vireo (<u>Vireo olivaceus</u>)		X		S	3	Riparian
Warbling vireo (<u>Vireo gilvus</u>)		X		S	2	Riparian, varied
Orange-crowned warbler (<u>Vermivora celata</u>)	X	X		S	2	Riparian, aspen
Yellow warbler (<u>Dendroica petechia</u>)		X		S	1	Riparian
Yellow-rumped warbler (<u>Dendroica coronata</u>)	X	X	X	S	1	Varied
Townsend's warbler (<u>Dendroica townsendi</u>)		X		S	1	Forests
MacGillivray's warbler (<u>Oporornis tolmiei</u>)		X	X	S	2	Brush, riparian
Common yellowthroat (<u>Geothlypis trichas</u>)		X		S	3	Riparian
Wilson's warbler (<u>Wilsonia pusilla</u>)		X		S	3	Riparian
American redstart (<u>Setophaga ruticilla</u>)		X		S	3	Riparian
House sparrow (<u>Passer domesticus</u>)	X	X	X	R	1L	Urban
Western meadowlark (<u>Sturnella neglecta</u>)	X	X	X	S,R	1	Open range



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TABLE 3.4-15
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PART THREE

Species	Occurrence *			Status **	Abundance ***	Habitat
	Spring	Summer	Fall			
Red-winged blackbird (<u>Agelaius phoeniceus</u>)	X	X		S	1	Cultivated fields, wetlands
Northern oriole (<u>Icterus galbula</u>)		X		S	3	Riparian
Brewer's blackbird (<u>Euphagus cyanocephalus</u>)	X	X		S	1	Cultivated fields
Brown-headed cowbird (<u>Molothrus ater</u>)		X		S	2	Varied
Western tanager (<u>Piranga ludoviciana</u>)		X		S	3	Varied
Luzuli bunting (<u>Passerina ampena</u>)		X		S	3	Riparian
Evening grosbeak (<u>Hesperiphona vespertina</u>)		X	X	R	2	Varied, forests
Purple finch (<u>Carduelis purpureus</u>)	X	X	X	S	2	Forests
Pine Siskin (<u>Carduelis pinus</u>)	X	X	X	R,S	1	Coniferous forests
American goldfinch (<u>Carduelis tristis</u>)	X			S	3	Varied
Red crossbill (<u>Loxia curvirostra</u>)		X	X	R	2	Coniferous forests
Vesper sparrow (<u>Poocetes gramineus</u>)	X	X		S	1	Open range
Dark-eyed junco (<u>Junco hyemalis</u>)	X	X	X	S	1	Varied, forests
Chipping sparrow (<u>Spizalla passerina</u>)	X	X		S	1	Varied
White-crowned sparrow (<u>Zonotrichia leucophrys</u>)	X	X	X	S	2	Subalpine
Song sparrow (<u>Melospiza melodia</u>)	X	X	X	S	2	Riparian



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PART THREE

* Based on actual sightings or site records

** Status:

R resident, all seasons
T transient, spring and/or fall
S summer only, winters elsewhere
W winter only, breeds elsewhere

*** Abundance:

1 common, nearly always observed in appropriate season and habitat
2 regular, repeated sightings or records
3 uncommon, seen or recorded only a few times during field observations
4 rare, not to be expected to be found
L local, only occurs at a few scattered locations

Prepared by: TERA Environmental Resource Analyst, Ltd. 9/



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SUMMARY OF FIELD OBSERVATIONS, SEASONAL
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PART THREE

<u>Species</u>	<u>Status</u>	<u>Perspective</u>	<u>Reference</u>
Tailed frog (<u>Ascaphus truei</u>)	Rare	Canada	18
Gopher snake (<u>Pituophis melanoleucus catenifer</u>)	Rare	Canada	18, 19, 12
Cougar (<u>Felis concolor</u>)	Vulnerable	Canada	12
Grizzly bear (<u>Ursus arctos horribilis</u>)	Vulnerable	Canada	12
Wolf (<u>Canis lupus</u>)	Vulnerable	Canada	16
California bighorn sheep (<u>Ovis canadensis californiana</u>)	Vulnerable	Canada	20, 12, 16
Least weasel (<u>Mustela nivalis</u>)	Rare	British Columbia	21
Common Loon (<u>Gavia immer</u>)	Vulnerable	Canada	12
Prairie falcon (<u>Falco mexicanus</u>)	Endangered	Canada	14, 12
Peregrine falcon (<u>Falco peregrinus</u>)	Vulnerable Endangered	British Columbia Eastern Canada	16 13, 14, 15, 12
Osprey (<u>Pandion haliaetus</u>)	Endangered	Canada	12
Bald eagle (<u>Haliaeetus leucocephalus</u>)	Vulnerable	Canada British Columbia	15, 12
White pelican (<u>Pelicanus erythrorhynchos</u>)	Vulnerable Endangered	British Columbia	12
Poor-will (<u>Phalaenoptilus nuttallii</u>)	Rare	British Columbia	22
Long-billed curlew (<u>Numenius americanus</u>)	Rare	British Columbia	23
Trumpeter swan (<u>Olor buccinator</u>)	Rare (but increasing)	World	13, 16
Turkey vulture (<u>Cathartes aura</u>)	Rare	British Columbia	23

Source: TERA Environmental Resource Analyst, Ltd. 9 /



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RARE AND ENDANGERED SPECIES
WITHIN THE REGIONAL STUDY AREA

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TABLE 3.4-14

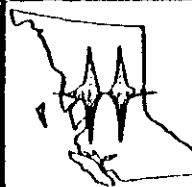
PART THREE

<u>Regional Study Area</u>					
<u>Forest Type</u>	<u>Crown (1,000 ha)</u>	<u>Alienated (1,000 ha)</u>	<u>Tree Farm Licence (1,000 ha)</u>	<u>Total</u>	
				<u>(1,000 ha)</u>	<u>(percent)</u>
Mature	781.0	46.1	13.2	840.3	49
Immature	690.6	69.5	13.4	773.5	44
Residual	48.1	12.7	-	60.8	4
NSR	42.9	8.2	1.5	52.6	3
NCC	2.4	0.6	1.5	4.5	1
Total	1,565.0	137.1	29.6	1,731.7	100

<u>Local Study Area</u>				
<u>Forest Type</u>	<u>Crown (1,000 ha)</u>	<u>Alienated (1,000 ha)</u>	<u>Total</u>	
			<u>(1,000 ha)</u>	<u>(percent)</u>
Mature	69.9	3.6	73.4	50
Immature	54.4	4.3	58.7	40
Residual	9.3	0.7	10.0	7
NSR	4.1	0.3	4.4	3
NCC	0.1	0.1	0.3	1
Total	137.9	9.0	146.9	100

Source: Reid, Collins and Associates, Ltd. 24/

Rev. 1 Feb. 1979.



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FOREST LAND TENURE AND PRESENT STATUS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-15

PART THREE

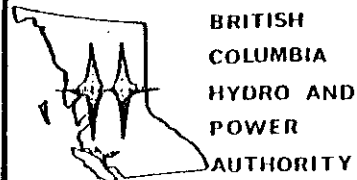
All Ownerships
18 cm⁺ dbh
Close Utilization - less decay only

Species	British Columbia		Regional Study Area			Local Study Area		
	1,000 m ³	% of BC Total Volume	1,000 m ³	As % of Regional Study Total Volume	As % of BC Total Volume	1,000 m ³	As % of Local Study Total Volume	As % of Regional Study Area Volume
Hemlock	1,835,926	22.7	218.6	0.2	T*	0	0	0
Spruce	1,750,852	21.7	20,924.8	15.4	0.3	1,447.8	13.8	1.1
Balsam	1,490,111	18.4	7,162.7**	5.3	0.1	237.9	2.2	0.2
Lodgepole Pine	1,121,090	13.9	52,195.8	38.5	0.6	2,586.1	24.7	1.9
Red Cedar	913,504	11.3	190.6	0.1	T	7.9	0.1	T
Douglas-Fir	530,402	6.6	49,349.7	36.4	0.6	5,746.5	54.9	4.2
Yellow Cedar	172,258	2.1	0	0	0	0	0	0
White Pine	29,902	0.4	869.6	0.6	T	105.4	1.0	T
Larch	19,029	0.2	8.2	T	T	0	0	0
Yellow Pine	8,062	0.1	3,284.1	2.4	T	323.6	3.1	0.2
Total Conifer	7,871,136	97.4	134,204.1	99.0	1.7	10,455.2	99.8	7.7
Aspen	131,468	1.6	1,187.0	0.9	T	7.1	0.1	T
Cottonwood	45,949	0.6	69.1	T	T	2.8	T	T
Birch	22,551	0.3	152.3	0.1	T	7.4	0.1	T
Alder	10,095	0.1	0	0	0	0	0	0
Maple	983	T	0	0	0	0	0	0
Total Broad Leaved	211,046	2.6	1,408.4	1.0	T	17.3	0.2	T
Total Species	8,082,182	100.0	135,612.5	100.0	1.7	10,472.5	100.0	7.7

* Trace, less than 0.1%.

** Includes 464,674 m³ of whitebark pine.

Source: Reid, Collins and Associates, Ltd, 24/



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STANDING MATURE VOLUME OF FOREST SPECIES IN PROVINCE AND REGIONAL AND LOCAL STUDY AREAS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-16

PART THREE

	British Columbia	Regional Study Area (RSA)		
	(10 ² km ²)	Estimated Totals ^{***} (10 ² km ²)	Column 2 ÷ Column 1 (percent)	Column 2 ÷ Total RSA Land Area (percent)
High Capability Land *				
CLI Class 1	7.0	2.1	30	0.6
CLI Class 2	39.8	3.5	9	1.0
CLI Class 3	100.0	11.0	11	3.0
CLI Class 4	213.2	27.7	13	7.5
Subtotal	360.0	44.3	12	12.1
Low Capability Land ** (Grazing Land)	(9,223)	160	-	43
Land of Limited or No Agricultural Capability	(9,223)	164	-	45
Total	9,583	368		100

* Improved Class Rating

** Defined as the following biogeoclimatic zones: Ponderosa Pine - Bunchgrass, Interior Douglas-fir, and Cariboo Aspen - Lodgepole Pine - Douglas fir.

*** Estimates are approximate and do not include the small amount of high capability land occurring in portion of Regional Study Area for which no CLI land capability maps are available.



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SUMMARY OF AGRICULTURAL LAND CAPABILITY OF REGIONAL STUDY AREA
(Prepared by Canadian Bio Resources Consultants, Ltd. 25/)

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TABLE 3.4-17

PART THREE

	Local Study Area (LSA)	
	km ²	% of LSA
Capability for Intensive Agriculture*		
CLI Ag Capability 1	36	1.8
CLI Ag Capability 2	18	0.9
CLI Ag Capability 3	69	3.5
CLI Ag Capability 4	79	4.0
CLI Ag Capability 5	<u>58</u>	<u>3.0</u>
Sub Total	260	13.2
Capability for Grazing:		
Grazing Capability 1	12	0.6
Grazing Capability 2	593	30.2
Grazing Capability 3	302	15.4
Grazing Capability 4	465	23.7
Grazing Capability 5	<u>331</u>	<u>16.9</u>
Sub Total	1,703	86.8
	<u><u> </u></u>	<u><u> </u></u>
Total	1,963	100.0

* Improved class rating

Prepared by: Canadian Bio Resources Consultants, Ltd. 26/



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SUMMARY OF AGRICULTURAL LAND CAPABILITY
OF LOCAL STUDY AREA

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TABLE 5.4-18

PART THREE

Capability Class as Identified By Preferred Crop	Areal Extent (km ²)	Percent of Site-Specific Study Area
Tomatoes	1.7	0.5
Corn Silage	3.7	0.8
Cabbage	2.4	0
Hay	25.7	5.7
Pasture	32.0	6.4
Total	65.5	13.2

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IRRIGABLE LANDS OF SITE-SPECIFIC STUDY AREA

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-19

PART THREE

Trees*

Populus tremuloides (quaking aspen)

Shrubs

Amelanchier alnifolia (serviceberry)
Cornus stolonifera (red-osier dogwood)
Rosa gymnocarpa (baldhip rose)

Salix cascadenis (willow)
S nivalis (willow)
Salix sp (willow)

Grasses and Sedges*

Agropyron caninum (awned wheatgrass)

Festuca ovina var rydbergii
(sheep fescue)

A spicatum (bluebunch wheatgrass)

Hordeum jubatum (squirrel-tail)

A Llba (wheatgrass)

Koeleria cristata (prairie
junegrass)

Agrostris scafra (winter bentgrass)

Phleum alpinum (alpine timothy)

Calamagrostis rubescens (pinegrass)

P pratense (common timothy)

Carex rostrata (beaked sedge)

Poa alpina (alpine bluegrass)

Danthonia intermedia (timber danthonia)

P pratensis (Kentucky bluegrass)

Elymus cinerens (giant wildrye)

Sporobolus cryptancrus
(sand dropseed)

Stipa comata (needle and thread)

Forbs*

Astragalus miser (weedy milkvetch)

Astragalus sp (milkvetch)

A purshii (wooly-pod milkvetch)

Medicago bysulina (blackmedic)

*Species included above were accorded relatively high or medium palatability or feed value, and relatively high or medium abundance.

Source: Canadian Bio Resources Consultants, Ltd. 25/ and the TERA Environmental Resource Analysts, Ltd. 3/



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IMPORTANT RANGE PLANTS OF LOCAL STUDY AREA

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TABLE 5.4-20

PART THREE

<u>Crop Type</u>	<u>Agricultural Significance</u>	<u>Productivity</u>
<u>Perennials</u>		
<u>Legumes</u>		
Alfalfa (<u>Medicago sativa</u>) - varieties Rambler, Vernal	High	7-16 Mg/ha (hay)
Alsike Clover (<u>Trifolium hybridum</u>) - varieties Aurora, Tetra	Medium	4-11 Mg/ha (grass hay mix)
White Clover (<u>Trifolium repens</u>) - variety White Dutch	Low	7-9 Mg/ha (hay-meadow grass mix)
<u>Grasses</u>		
Bromegrass (<u>Bromus arvensis</u> <u>Bromus inermis</u>) - varieties Carlton, Magna	Low	4-9 Mg/ha (hay-legume mix)
Crested Wheatgrass (<u>Agropyron cristatum</u>) - varieties Summit, Nordan	Medium	0.2-0.4 ha/AUM (pasture)
Orchardgrass (<u>Dactylis glomerata</u> L) - variety Sterling	High	7-11 Mg/ha (hay-legume mix)
Perennial Ryegrass (<u>lolium</u>) - varieties Norlea and Tetraploid types	Low	0.4 ha/AUM (wetland pasture)
Reed Canary Grass (<u>Phlaris arundinacea</u> L) - varieties Frontier, Castor	Medium	7-11 Mg/ha (hay)
Timothy (<u>Phleum pratensis</u> L) - varieties Climax, Champ	Medium	7 Mg/ha (hay)
<u>Annuals</u>		
Corn (<u>Zea mays</u> L) - hybrid variety	Medium	45 Mg/ha (silage)
Potatoes (<u>Solanum tuberosum</u>)	Low	27 Mg/ha

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FIELD CROP YIELDS IN LOCAL STUDY AREA

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TABLE 3.4-21

PART THREE

Grazing Permit Unit	AUM	Permit Area Within LSA		Calculated Carrying Capacity Hectares/AUM	Calculated Number of AUM Allotted to Permit Area of LSA
		Total (km ²)	(km ²)		
Barnes Lake	150	22	22	14.8	149
Bedard Lake - A/C	523	24	24	4.5	533
Bedard Lake - B	2,192	37	37	1.7	2,176
Bedard Lake - D/E	380	44	44	11.5	383
Blackhill Creek*	?	?	15	?	?
Blue Earth*	500	66	38	13.3	286
Cache Creek*	818	?)	152	?	?
Scottie Creek*	770	?)		?	?
Cairn-Blustery	450	30	30	6.6	455
Chipuln Creek	533	41	41	7.7	532
Cinquefoil*	540	36	34	6.7	507
Fountain Creek	148	20	20	7.1	282
Frantzen Creek	40	5	5	13.3	38
Gibbs Creek	111	8	8	6.9	116
Hat Creek Lowlands	150	1	1	0.4	250
Lower Colley	125	6	6	4.7	128
Langley Lake	293	20	20	5.7	351
Maiden Creek - A	1,250	181	181	14.5	1,248
Maiden Creek - B	255	77	77	30.1	256
McCormick Creek	360	22	22	6.2	355



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CURRENT CARRYING CAPACITY OF GRAZING PERMIT UNITS
IN LOCAL STUDY AREA

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-22
Sheet 1 of 2
PART THREE

Grazing Permit Unit	AUM	Permit Area		Calculated Carrying Capacity Hectares/AUM	Calculated Number of AUM Allotted to Permit Area of LSA
		Total (km ²)	Within LSA (km ²)		
McKenna Creek	130	18	18	14.1	128
McLean Lake - A	2,399	78	78	3.2	2,438
McLean Lake - B	476	7	7	1.5	467
McLean Lake - C	1,230	46	46	3.7	1,243
Nine Mile Creek	138	13	13	9.8	133
Parke Lake	188	11	11	5.7	193
Pavillion Mountain*	2,288	85	69	3.7	1,865
Rusty Creek	167	12	12	12.5	96
Sallus Creek	621	89	89	14.3	622
Tom Cole Mountain	825	34	34	4.2	810
Tremont Creek*	450	53	9	11.7	77
Twall*	2,910	280	27	9.6	281
Upper Rough Creek	509	37	7	7.2	97
Yet Creek*	40	22	14	54.1	26
Totals	21,959	1,425	1,211		

* Portion of unit lies outside Local Study Area.

Source: Canadian Bio Resources Consultants, Ltd. 25/.



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CURRENT CARRYING CAPACITY OF GRAZING PERMIT UNITS
IN LOCAL STUDY AREA

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-22

Sheet 2 of 2

PART THREE

Grazing Capability Class	Areal Extent		Potential Carrying Capacity		
	Local Study Area km ²	Hat Creek Watershed km ²	ha/AUM	AUM/yr	
				Local Study Area	Hat Creek Watershed
1	12	4	0.49-→0.49	2,449-→2,449	816-→816
2	593	232	0.98-0.49	60,510-121,020	23,673-47,347
3	302	85	1.96-0.98	15,408-30,816	4,337-8,673
4	465	124	3.85-1.96	12,078-23,724	3,221-6,327
5	331	128	0-3.85	0-8,597	0-3,325
Total	1,703	573		90,445-186,606	32,047-66,488

*Forage productivity was estimated for each grazing class in Runka, and translated into carrying capacity with the following assumptions: 1) 55 percent utilization of forage; 2) 300 kg forage supports 1 AUM; and 3) entire range area is accessible to cattle. The range of values reflects conditions characteristic of range areas where standing timber is mature, and conditions characteristic of areas recently clear cut (where forage production is maximized).

Prepared by: Canadian Bio Resources Consultants, Ltd. 26/



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POTENTIAL CARRYING CAPACITIES OF GRAZING CAPABILITY CLASSES

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TABLE 3.4-23

PART THREE

Vegetation Association	Areal Extent* (km ²)	Potential Carrying Capacity			
		Clear-Cut (ha/AUM)	Fully Stocked (ha/AUM)	Clear-Cut (AUM/Yr)	Fully Stocked (AUM/Yr)
Engelmann Spruce - Grouseberry - Pinegrass	172	2.0	8.3	8,600	2,070
Douglas-Fir - Bunchgrass	24	1.2-2.0	4.0	1,600**	600
Bunchgrass - Kentucky Bluegrass	24	0.8	0.8	3,000	3,000
Douglas-Fir - Bunchgrass - Pinegrass	69	1.2	4.0-6.3	5,750	1,725-1,095
Douglas-Fir - Pinegrass	177	2.0-2.9	4.8-6.3	7,480**	3,688-2,810
Kentucky Bluegrass	23	0.4	0.4	5,750	5,750
Sagebrush - Bunchgrass	5	0.8	0.8	625	625
Highland Grasslands & Alpine Tundra Zone	10	4.0	4.0	250	250
Engelmann Spruce - Subalpine Fir - Grouseberry; Engelmann Spruce - Grouseberry - White Rhododendron; & Engelmann Spruce - Grouseberry - Lupines	69	2.0	-0-	3,450	-0-
Total	573			36,505	16,955

*Excluding portion of Hat Creek watershed outside local study area.

**Based on average of values expressed in units of ha/AUM

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POTENTIAL CARRYING CAPACITIES OF RANGE
VEGETATION ASSOCIATIONS IN THE HAT CREEK WATERSHED

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-24

PART THREE

	Province (ha)	Thompson-Nicola Census Division (ha)	Percent of Province (%)
<u>Farmland</u>			
Improved	736,809	57,721	8
Unimproved	1,616,821	490,462	30
Total	2,353,630	548,183	23
<u>Cropland</u>			
Cereal Grains	149,027	1,147	0.8
Hay	251,431	28,372	11.3
Other Forage	33,334	2,396	7.2
Seed Crops	11,535	1	0.1
Potatoes	4,314	23	0.5
Vegetables	7,295	102	1.4
Tree Fruits	10,783	59	0.5
Small Fruits	3,734	6	0.2
Other	1,591	44	2.8
Total	473,044	32,150	

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AREAL EXTENT OF FARMLAND AND CROPLAND IN
THOMPSON-NICOLA CENSUS DIVISION

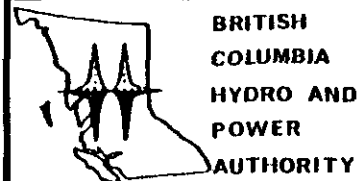
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-25

PART THREE

	<u>Province</u>	<u>Thompson-Nicola Census Division</u>	<u>Column 2 ÷ Column 1 (percent)</u>
Number of Farms by Size:			
Less than 28 ha	6,487	114	2
28 to 52 ha	1,248	66	5
53 to 162 ha	2,558	167	7
162 to 453 ha	1,792	151	8
Over 453 ha	948	128	14
Total Number of Farms	13,033	626	5
Farm Capital Value:			
Land & Buildings	\$2,504 million	\$168 million	7
Machinery & Equipment	307 million	19 million	6
Livestock	186 million	33 million	17
Total Capital Value	\$2,996 million	\$220 million	7
Livestock Numbers:			
Beef Cattle	587,606	135,119	23
Milk Cows	79,712	803	1
Pigs	53,014	1,873	4
Sheep	37,938	3,910	10
Hens & Chickens	9,628,929	51,325	5

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FARM SIZE, CAPITAL VALUE AND LIVESTOCK NUMBERS:
THOMPSON-NICOLA CENSUS DIVISION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-26

PART THREE

	Local Study Area (LSA)	
	km ²	% of LSA
Cultivated Cropland & Irrigated Pasture		
Private & Leased	42	2.1
Indian Reserve	3	0.2
Sub Total	45	2.3
Rangeland		
Private & Leased	593	30.2
Indian Reserve	76	3.9
Grazing Permits	1,211	61.7
Nonagricultural	38	1.9
Sub Total	1,918	97.7
Total	1,963	100
Low Use Grazing Land	415	21.1

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AREAL EXTENT OF LAND USE AND
LAND TENURE CATEGORIES: LOCAL STUDY AREA

THE MAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-27

PART THREE

<u>Cultural Period</u>	<u>Environmental Stratum</u>	
	<u>Forest</u>	<u>Grassland</u>
Old Cordilleran	0	0
Early Nesikep	3	16
Late Nesikep	1	3
Early and Late Nesikep	2	4
Undetermined	3	53
Total	9	76

Prepared by: Pokotylo and Beirna. 30/



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ESTIMATED ANTIQUITY OF PHASE I
CULTURAL HERITAGE RESOURCES SAMPLE SITES

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-28

PART THREE

Stratum	Total Number of Sites Located	Number of Quadrats in Stratum	Number of Quadrats Selected (Surveyed)	Area Surveyed km ²	Site Density Per Area	Site Density Per Quadrat Surveyed	Projected Number Of Sites
A	4	18	4(4)	0.64	6.25	1.0	18
B	8	18	4(4)	0.64	12.5	2.0	36
C	0	6	6(6)	0.96	-	-	-
D	1	8	2(2)	0.32	3.1	.5	4
E	6	46	10(10)	1.60	3.75	.6	275
H	2	72	8(8)	1.28	1.56	.25	18
I	49	72	25(24)	3.84	12.76	2.04	146.9
J	28	41	18(16)	2.56	10.9	1.75	71.75
K	6	3	3(3)	0.48	12.5	2.	6.

Source: Pokotylo and Beirne 30/



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PHASE II STRATA: SITES, SITE DENSITY
AND PROJECTION OF SITES

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-29

PART THREE

<u>Stratum</u>	<u>Mean Lithic Count (MLC)</u>	<u>MLC Standard Deviation</u>	<u>Mean Debitage Density (MDD)</u>	<u>MDD Standard Deviation</u>
A	263	498.1	1.0	.7
B	224	219.3	1.1	.5
C	-*	-	-*	-
D	-**	-	-**	-
E	146	167	.7	.4
H	42	7.1	.9	.1
I	1,834	6,640.8	3.6	3.4
J	5,602	8,926.9	1.9	2.7
K	2,796	5,331.7	5.0	2.6

* No sites located in this stratum.

** Site located had no lithic artifacts.

Source: Pokotylo and Beirne 30/



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PHASE II STRATA: MEAN LITHIC ARTIFACT COUNT
AND MEAN DEBITAGE DENSITY

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-30

PART THREE

<u>Cultural Period</u>	<u>Number of Sites</u>
Old Cordilleran	0
Early Nesikep	22
Late Nesikep	4
Early and Late Nesikep	6
Undetermined	69

Prepared by: Pokotylo and Beirne 30/



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ESTIMATED ANTIQUITY OF PHASE II
CULTURAL HERITAGE RESOURCES SAMPLE SITES

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.4-31

PART THREE

			Average Change Per Year		Average Change Per Year
	<u>1966</u>	<u>1971</u>	<u>%</u>	<u>1976</u>	<u>%</u>
			<u>1966-1971</u>		<u>1971-1976</u>
Ashcroft	1,154	1,916	10.6	2,030	1.2
Cache Creek	674	1,013	8.5	1,050	0.7
Clinton	983	905	-1.7	810	-2.2
Lillooet	1,379	1,514	1.9	2,220	8.0
Rural	1,200	1,370	3.3	1,390	1.1
LOCAL AREA	5,390	6,718	4.3	7,500	2.2
OTHER REGIONAL COMMUNITIES*	43,110	56,082	5.4	69,800	4.5
BRITISH COLUMBIA	1,873,674	2,184,621	3.1	2,466,608	2.5

*Includes Kamloops, Lytton, Logan Lake and various rural communities.

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Rev. 1 Feb. 1979.



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POPULATION GROWTH - HAT CREEK REGION
AND LOCAL AREAS (1966 TO 1976)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-1

PART THREE

	<u>Hat Creek Region</u>	<u>Ashcroft</u>	<u>Cache Creek</u>	<u>Clinton</u>	<u>Lillooet</u>
	<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>
<u>Population *</u>					
Non-Migrant	56.5	44.1	46.3	66.5	61.1
Migrant	43.5	55.9	53.7	33.5	38.9
TOTAL	100.0	100.0	100.0	100.0	100.0
<u>Migrants:</u>					
Within B.C.	57.6	68.5	70.9	83.0	68.5
Other Provinces	24.8	13.4	17.5	13.2	11.7
Outside Canada	8.8	8.2	5.3	1.9	13.5
Unspecified	8.8	9.9	6.3	1.9	6.3
TOTAL	100.0	100.0	100.0	100.0	100.0

* Population 5 years and over

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MIGRATION STATUS OF REGIONAL AND LOCAL POPULATION (1971)

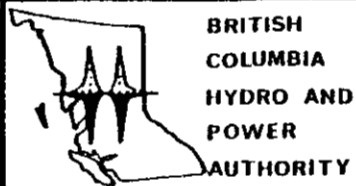
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-2

PART THREE

	<u>Local Area</u>	<u>Total Region</u>	<u>Total British Columbia</u>
	<u>%</u>	<u>%</u>	<u>%</u>
Employment Income	<u>89.8</u>	<u>89.8</u>	<u>85.0</u>
Wages & Salaries	80.4	82.0	78.0
Non-Farm Self-Employment	8.3	7.3	6.5
Farm Self-Employment	1.2	0.5	0.5
Government Transfers	5.7	5.1	6.9
Retirement Pensions	0.9	1.1	1.8
Investment Income	2.6	3.3	5.5
Other Income	<u>0.9</u>	<u>0.7</u>	<u>0.8</u>
TOTAL INCOME	100.0	100.0	100.0

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PERCENTAGE OF TOTAL INCOME BY SOURCE - LOCAL AREA AND HAT CREEK REGION (1970)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-3

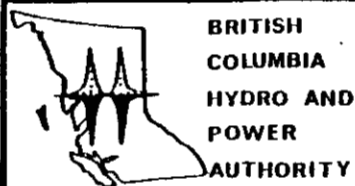
PART THREE

	Average Household Income	Regional Average	Dependency Rate	Household Income Distribution Indicators	
	<u>\$</u>	<u>%</u>	<u>%</u>	<u>Below \$5,000</u>	<u>Above \$5,000</u>
				<u>%</u>	<u>%</u>
Ashcroft	10,347	100	63	11.9	12.8
Cache Creek	9,560	92	60	14.6	9.1
Clinton	8,425	81	70	28.0	10.0
Lillooet	8,745	84	69	26.4	9.9
Rural	7,053	68	62	28.7	6.6
LOCAL AREA	<u>9,774</u>	<u>94</u>	<u>65</u>	<u>21.2</u>	<u>9.9</u>
Kamloops *	10,851	104	55	20.4	15.0
Other Regional Communities	10,339	99	64	20.4	12.8
HAT CREEK REGION	<u>10,391</u>	<u>100</u>	<u>60</u>	<u>20.5</u>	<u>13.6</u>
BRITISH COLUMBIA	<u>11,088</u>	<u>107</u>	<u>60</u>	<u>26.5</u>	<u>14.5</u>

* Kamloops includes Dufferin & Valleyview.

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SELECTED INCOME INDICATORS - LOCAL AREA AND HAT CREEK REGION (1970 TO 1971)

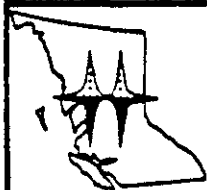
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-4

PART THREE

<u>Sector</u>	<u>Local Area</u>		<u>Total Region</u>	
	<u>Contribution</u>	<u>Average</u>	<u>Contribution</u>	<u>Average</u>
	<u>%</u>	<u>\$</u>	<u>%</u>	<u>\$</u>
Agriculture	3.5	5,424	1.5	3,760
Forestry	4.4	6,451	3.1	6,277
Mines	17.6	8,477	6.2	7,940
Manufacturing	8.8	5,416	11.3	6,248
Construction	8.9	7,319	12.6	7,378
Transport Utilities	12.9	6,764	13.7	7,146
Trade	9.0	5,202	14.2	4,853
Finance, Insurance & Real Estate	1.6	3,441	3.2	5,694
Community Services	21.7	4,641	22.1	4,678
Public Admini- stration	3.9	5,443	5.6	6,208
Unspecified	7.7	3,894	6.5	4,724
TOTAL ALL INDUSTRIES	100.0	5,638	100.0	5,680

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EMPLOYMENT INCOME BY INDUSTRY,
LOCAL AREA AND TOTAL HAT CREEK REGION
1970

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-5

PART THREE

	<u>September 1976</u>
	<u>\$</u>
Forestry	348.33
Mining	326.27
Manufacturing	298.32
Construction	389.22
Transportation	291.32
Trade	217.62
Finance, Insurance & Real Estate	219.40
Services	174.19
Industrial Composite	267.25

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AVERAGE WEEKLY EARNINGS, BRITISH COLUMBIA

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-6

PART THREE

	<u>Kamloops</u>		<u>Vancouver</u>	
	<u>Average Earnings</u>	<u>Index</u>	<u>Average Earnings</u>	<u>Index</u>
	<u>\$</u>		<u>\$</u>	
1970	118.44	88.8	133.90	90.0
1971	133.38	100.0	148.86	100.0
1972	154.40	115.8	161.10	108.2
1973	162.11	121.5	174.47	117.2
1974	180.67	135.4	194.41	130.6
1975	203.86	152.8	224.00	150.5
1976	233.48	175.0	251.93	169.2

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AVERAGE WEEKLY INDUSTRIAL EARNINGS - KAMLOOPS AND VANCOUVER
1970 TO 1976

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-7

PART THREE

<u>Income Class</u>	<u>Local Hat Creek Area</u>	<u>Total Hat Creek Region*</u>	<u>Total British Columbia</u>
<u>\$</u>	<u>%</u>	<u>%</u>	<u>%</u>
0 Income	3.7	2.7	2.4
Under 3,000	30.8	32.6	32.4
3,000 - 5,999	21.5	22.6	23.5
6,000 - 9,999	30.0	28.8	28.2
Over 10,000	14.0	13.3	13.5

* Thompson Nicola Regional District is used as a proxy for the Region.

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PERCENTAGE DISTRIBUTION OF EMPLOYMENT INCOME FOR INDIVIDUALS 15 YEARS AND OVER
1970

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-8

PART THREE

	<u>Local Study Area</u>			<u>Total Hat Creek Region</u>		
	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
1966	n/a*	n/a*	2,100	n/a*	n/a*	17,800
1971	2,083	912	2,995	18,608	8,737	27,345
1976	2,340	1,110	3,450	22,345	11,255	33,600

* Not available.

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TOTAL LABOUR FORCE - HAT CREEK REGION (1966 TO 1976)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-9

PART THREE

<u>Sector</u>	<u>Local Hat Creek Area</u>		<u>Total Hat Creek Region</u>	<u>Total British Columbia</u>
	<u>Number</u>	<u>%</u>	<u>%</u>	<u>%</u>
Agriculture	150	5.1	2.6	2.5
Forestry	100	3.4	2.9	3.0
Fishing	0	0	0	0.5
Mining and Quarrying	335	11.5	4.7	1.6
Manufacturing	265	9.1	11.5	16.1
Construction	205	7.0	11.1	7.0
Transportation, Commu- cation & Utilities	305	10.5	12.0	9.5
Trade	285	9.8	13.7	16.2
Finance, Insurance & Real Estate	95	3.3	3.4	4.6
Community, Business & Personal Services	730	25.2	24.1	24.8
Public Administration	105	3.6	5.4	6.3
Unspecified	335	11.5	8.6	7.9
TOTAL	2,910	100.0%	100.0%	100.0%

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PERCENTAGE LABOUR FORCE BY INDUSTRY
HAT CREEK STUDY REGION (1971)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-10

PART THREE

	<u>Age Distribution</u>				<u>Participation Rates</u>		
	<u>15-24</u>	<u>25-44</u>	<u>45-65</u>	<u>65+</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
	<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>
Local Area:							
Ashcroft	20.5	46.3	29.4	4.0	92.1	43.0	70.0
Cache Creek	29.5	50.5	16.8	3.2	92.4	54.8	74.2
Clinton	21.0	46.0	29.0	4.0	82.0	50.0	67.2
Lillooet	22.0	44.7	28.8	4.5	86.7	42.3	65.4
Rural	28.2	42.6	27.2	2.0	80.9	39.0	62.6
LOCAL AREA	23.8	45.8	26.8	3.6	87.2	44.7	67.6
Kamloops	27.4	43.5	27.2	1.9	81.6	47.6	64.9
Other Rural & Urban Communities	25.3	49.5	23.3	1.9	77.0	33.1	56.7
HAT CREEK REGION	26.2	46.0	25.7	2.1	80.2	41.6	61.8
BRITISH COLUMBIA	25.3	41.9	30.0	2.8	77.5	40.4	59.0

Source: Strong Hall & Associates, Ltd. 1/



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HAT CREEK REGION LABOUR FORCE (1971)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-11

PART THREE

<u>Trade</u>	<u>Union</u>	<u>Nonunion</u>	<u>Total</u>
Labourers	550	500	1,050
Equipment Operators	500	200	700
Iron Workers	15	5	20
Carpenters	400	400	800
Electrical Workers	450	50	500
Plumbers and Pipefitters	125	25	150
Cement Masons	10	5	15
Welders	100	50	150
Boilermakers	15	0	15
Bricklayers	30	20	50
Painters	20	50	70
Heavy Duty Mechanics	75	0	75
Office and Technical Workers	75	0	75
Machinists and Millwrights	25	0	25
Others*	40	15	55
	TOTAL	2,430	1,320
			3,750

* Includes: Teamsters, culinary workers, sheet metal workers, heat and frost workers

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ESTIMATED SUPPLY OF CONSTRUCTION LABOUR
BY TRADE - HAT CREEK REGION (1977)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-12

PART THREE

<u>Industry</u>	<u>Local Area*</u>			<u>Total Region**</u>		
	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
Teaching	2	3	5	9	45	54
Medicine & Health	0	7	7	23	125	148
Clerical	6	49	55	91	682	773
Sales	4	14	18	131	235	366
Service	19	68	87	195	470	665
Agriculture & Forestry	57	4	61	345	30	375
Mining	10	0	10	78	1	79
Processing	34	4	38	456	58	514
Construction	37	0	37	992	10	1002
Transportation	25	2	27	252	16	268
Other	29	9	38	354	91	445
TOTAL	223	160	383	2926	1763	4689

* About 3% of recipients are unemployed for sickness or medical reasons and are not seeking employment

** About 5% of recipients are unemployed for sickness or medical reasons and are not seeking employment

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HAT CREEK REGION RESIDENTS RECEIVING U.I.C.
BENEFITS BY OCCUPATION, APRIL 28, 1977

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-13

PART THREE

- B Built-up Areas
Land occupied by the built-up portions of cities, towns and villages, as well as isolated units away from settlements, such as manufacturing plants and rail yards. Open fields and parks within built-up areas are included.
- E Mines, Quarries and Gravel Pits
Land used now or in the past for the extraction of earth materials.
- K Open Grassland
Based on cover rather than use; this land is not necessarily used for grazing (e.g., remote meadows). Open grassland includes grasses, sedges, herbaceous plants and scattered shrubs to four feet in height. Abandoned farms and intermittently wet hay land (sloughs) are included.
- L Rock and Other Unvegetated Surfaces
Badlands, eroded river banks, rock barrens, etc.
- M Swamp, Marsh and Bog
Open wetlands, except for those with evidence or knowledge of haying or grazing in the drier years.
- O Outdoor Recreation
Land used for private or public outdoor recreational purposes. Summer cottages and associated beach areas; parks and golf courses are included.
- P Improved Pasture and Forage Crops
Land used primarily for the production of improved pasture, hay and other forage crops. Cultivation and planting have occurred in a recent year.
- T Productive Woodland
Land bearing a productive forest-type, including both mature and immature cover.
- TK
or
UK Open Woodland and Forest Range
These are classified as pasture and range if they are on, or contiguous with, occupied farmland or if there is evidence or knowledge of grazing activity.
- U Non-productive Woodland
Forest land which has been logged, burnt or diseased and has either not been satisfactorily restocked or has been restocked by a non-commercial type; or land bearing a non-productive type on a non-productive site.
- X Water Surfaces
Excluding temporarily flooded hay meadows, etc.

Source: B.C. Lands Service 5_/

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LAND USE CATEGORIES
CANADA LAND INVENTORY
BRITISH COLUMBIA

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-14

PART THREE

	Enrollment	Capacity	Teachers	Pupil/Teacher Ratio
Ashcroft Elementary	354	360	14	23.6
Coppervale Elementary	37	120	2	18.5
Cache Creek Elementary	313	337	15	19.6
Clinton Elementary	217	255	9	22.8
Ashcroft Secondary	573	595	30	19.1
David Stoddart Junior Secondary	104	225	8	13.0
TOTAL	1,598		78	Average: 19.7

Source: Strong Hall & Associates, Ltd. 1/



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NUMBER OF ELEMENTARY AND SECONDARY STUDENTS AND TEACHERS
IN SERVICE STUDY AREA, SEPTEMBER 30, 1976

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-15

PART THREE

<u>Facility Type</u>	<u>Ashcroft/ Cache Creek*</u>	<u>Clinton</u>	<u>Merritt</u>
Food			
- Grocery	5	2	5
- Bakery	1	0	1
- Meat	1	0	1
Clothing			
- Mens & Boys	3	1	5
- Ladies & Girls	3	1	3
- Shoes	0	0	2
Hardware & Building Supplies	5	2	5
Pharmacies	2	1	2
Sporting Goods	1	0	2
Banks	3	1	3
Heavy Appliances & Furniture	1	0	2
Liquor	2	1	1
Barbers	0	1	3
Beauty Salons	2	0	3
Laundry & Dry Cleaning	3	2	5
Hotels/Motels	11	5	12
Automotive			
- Service Stations	15	6	8
- Auto Supplies	1	0	6
- Auto Dealers	2	0	3
Restaurants	11	3	10
Beer Parlours	2	1	4
Cocktail Lounges	3	0	0
Finance, Insurance, Real Estate	5	1	6
Accountants	4	2	0
Miscellaneous Specialities	9	0	22

*Ashcroft and Cache Creek have been grouped together since the commercial sectors of these towns serve the populations of both communities.

Prepared by: Strong Hall & Associates, Ltd. 1/



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COMMERCIAL FACILITIES OF SELECTED LOCAL
COMMUNITIES COMPARED TO MERRITT
(APRIL, 1977)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-16

PART THREE

<u>Location</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
Highway No. 1 China Bar Tunnel	6,400	7,500	7,900	8,600	7,300	8,500	8,500
Highway No. 1 South of Ashcroft	5,700	6,500	-	-	8,200	8,300	6,300
Highway No. 1 At Cache Creek	8,500	9,400	10,700	10,500	11,700	12,600	9,800
Highway No. 97 South of Carquile	4,100	6,800	5,900	-	6,600	6,700	6,700
Highway No. 12 East of Pavilion	440	280	260	470	370	430	-
Highway No. 12 West of Highway No. 97	-	460	470	690	880	750	760

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HISTORICAL TRAFFIC GROWTH HAT CREEK
STUDY REGION (1970-1976)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-17

PART THREE

Fiscal Factor	Municipality	Selected Years			
		1970	1972	1974	1976
Population	Ashcroft	1,900	1,950	2,000	2,005
	Cache Creek	1,000	1,150*	1,200*	1,040**
	Clinton	1,150	890***	920	806**
Revenues	Ashcroft	\$178,569	\$266,144	\$459,879	\$600,714
	Cache Creek	\$131,874	\$204,955	\$265,722	\$422,054
	Clinton	\$117,700	\$113,900	\$161,000	\$184,200
Expenditure	Ashcroft	\$189,718	\$266,925	\$452,123	\$603,014
	Cache Creek	\$130,574	\$231,022	\$320,287	\$179,784
	Clinton	\$118,400	\$112,000	\$158,600	\$216,900

* Municipal Estimate

** 1976 Census Population

*** 1971 Census Population was 905

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Rev. 1 Feb. 1979.



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HISTORICAL MUNICIPAL REVENUES & EXPENDITURES - HAT CREEK REGION (1970 - 1976)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-18

PART THREE

	<u>Total</u>	<u>Ranchers</u>	<u>Miners</u>	<u>Tourist Trade Employees</u>
Excellent	28.6%	64.3%	33.3%	29.6%
Good	41.6%	28.6%	41.7%	29.6%
Average	21.8%	7.1%	20.8%	22.2%
Below Average	3.6%	0.0%	0.0%	7.4%
Poor	<u>4.5%</u>	<u>0.0%</u>	<u>4.2%</u>	<u>11.1%</u>
TOTAL	100.0%	100.0%	100.0%	100.0%

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RESIDENT PERCEPTION OF THE REGION AS A PLACE TO LIVE

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-19

PART THREE

	<u>Total (%)</u>	<u>Hat Creek Valley Residents (%)</u>	<u>Mining Residents (%)</u>
Less than 6 months	5.2	0.0	16.0
6-12 months	4.2	5.3	4.0
1-2 years	5.9	0.0	4.0
3-5 years	17.6	21.1	16.0
6-10 years	19.5	26.3	20.0
11-15 years	15.6	5.3	24.0
16-20 years	9.4	0.0	12.0
20+ years	<u>22.5</u>	<u>42.1</u>	<u>4.0</u>
TOTAL*	100.0	100.0	100.0

*May not total 100 percent due to rounding.

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LENGTH OF RESIDENCY IN THE STUDY AREA

THE HAT CREEK PROJECT - Detailed Environmental Studies

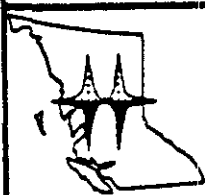
TABLE 3.5-20

PART THREE

Band	Reserve	Year Reserve Recognized	Indian Reserve No.	Area (ha)	Band Total (ha)
Bonaparte	Bonaparte	1878	3	193	
	Grasslands	1891	7	208	
	Loon Lake	1878	4	24	
	Lower Hat Creek	1878	2	32	
	Upper Hat Creek	1878	1	833	
	Mau Vais Rocher	1881	5	40	1330*
Ashcroft	Ashcroft	1894	4	135	
	Cheetsum's Farm	1881	1	298	
	McLean's Lake	1881	3	198	
	105 Mile Post	1881	2	1387	2018
Oregon Jack Creek	Oregon Jack Creek	1878	2	14	
	Oregon Jack Creek	1878	3	49	
	Oregon Jack Creek	1881	5	412	
	Hay Meadow	1878	1	12	
	South Nepa	1886	7	32	
	Upper Nepa	1886	6	304	823
Pavilion	Leon Creek	1881	2	473	
	Leon Creek	1915	2A	177	
	Marble Canyon	1915	3	263	
	Pavilion	1881	1	883	
	Pavilion	1923	1A	16	
	Pavilion	1915	3A	256	
	Pavilion	1916	4	45	2113

* Note: Further three Reserves, totalling 36 ha, in the Hihium Lake area, held jointly with other Bands.

Source: Strong Hall & Associates, Ltd. and Bob Ward Management Services 10/



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RESERVES HELD BY BANDS IN PRIMARY STUDY AREA
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-21

PART THREE

	<u>1965</u>	<u>1970</u>	<u>1975</u>	<u>Average Growth 1965-1975</u>
Bonaparte	285	331	342	1.9%
Ashcroft	71	76	78	1.0%
Oregon Jack Creek	17	16	16	-
Pavilion	<u>150</u>	<u>182</u>	<u>185</u>	<u>2.1%</u>
Total Primary Area	513	605	621	1.9%
Secondary Area	2,264	2,426	2,548	1.2%
British Columbia	44,081*	47,888	52,280	1.7%

*Data for 1966

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TOTAL STATUS INDIAN POPULATION BY AREA (SELECTED YEARS 1965-1975)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-22

PART THREE

	<u>1965</u>	<u>1970</u>	<u>1975</u>
	<u>%</u>	<u>%</u>	<u>%</u>
Bonaparte	71.2	52.0	52.0
Ashcroft	64.8	40.8	52.5
Oregon Jack Creek	76.5	50.0	81.3
Pavilion	66.7	73.1	65.9
Average Primary Area	<u>70.5</u>	<u>56.8</u>	<u>57.0</u>
Secondary Area	72.4	62.0	63.7
British Columbia	73.8*	67.5	63.2

* Data for 1966.

Prepared by: Strong Hall & Associates, Ltd. and Bob Ward
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PERCENTAGE OF TOTAL BAND MEMBERS ON-RESERVE
(SELECTED YEARS 1965-1975)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-23

PART THREE

	<u>%</u> <u>Male</u>	<u>%</u> <u>Female</u>	<u>%</u> <u>Total</u>
Bonaparte	62	40	52
Ashcroft/Oregon Jack	100	100	100
Pavilion	40	0	25
Average	67	40	56
Cache Creek	92	55	74
Ashcroft	92	43	70
Local Rural	81	39	63

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MALE AND FEMALE PARTICIPATION RATES
PRIMARY AREA BANDS AND LOCAL COMMUNITIES
1971

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-24
PART THREE

<u>Band</u>	<u>Agri- culture</u>	<u>Mines</u>	<u>Manu- facturing</u>	<u>Service</u>	<u>Admini- stration</u>	<u>Unspeci- fied</u>	<u>Total</u>
Bonaparte	10	0	10	10	0	10	40
Ashcroft/ Oregon Jack	5	10	5	5	5	0	30
Pavilion	0	0	0	0	0	0	0
TOTAL	15	10	15	15	5	10	70

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EXPERIENCED LABOUR FORCE BY INDUSTRY (NUMBER OF RESERVE RESIDENTS)
1971

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-25

PART THREE

<u>Band</u>	<u>Working Age Population</u>	<u>Labour Force</u>		<u>Employed At Time of Census</u>	<u>Full Time</u>
		Male	Female		
Bonaparte	100	40	20	60	30
Ashcroft/ Oregon Jack	35	30	10	30	25
Pavilion	55	10	-	5	0
TOTAL	190	80	30	95	55

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EMPLOYMENT STATUS
NUMBER OF RESERVE RESIDENTS
1971

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-26

PART THREE

	<u>Total Income \$</u>	<u>Total Employment Income \$</u>	<u>Employment Income as a % Total Income</u>	<u>Income Per Capita \$</u>	<u>Income Per Family \$</u>
Bonaparte	241,000	205,000	85	1,120	4,020
Ashcroft/ Oregon Jack	189,000	181,000	95	2,910	10,820
Pavilion	55,000	18,000	31	645	7,370

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INCOME CHARACTERISTICS OF PRIMARY BANDS (1970)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-27

PART THREE

	<u>No. of People With No Income</u>	<u>No. of People With Income</u>	<u>Income Average For Persons with Income</u>
Bonaparte	45	80	3,016
Ashcroft/ Oregon Jack	10	35	5,398
Pavilion	15	30	1,830

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AVERAGE INCOME OF INDIVIDUALS
15 YEARS AND OLDER
PRIMARY BANDS - 1970

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-28

PART THREE

	Total Persons With Income		Less Than \$3,000		\$3,000 to \$6,000		\$6,000 to \$10,000		More Than \$10,000	
	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>
Bonaparte	55	20	35	20	15	0	10	5	0	0
Ashcroft/ Oregon Jack	25	15	15	10	0	0	10	0	5	0
Pavilion	<u>20</u>	<u>10</u>	<u>20</u>	<u>5</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL	100	45	70	40	15	0	20	5	5	0

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TOTAL INCOME DISTRIBUTION OF INDIVIDUALS
15 YEARS AND OLDER BY SEX
PRIMARY BANDS - 1970

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-29

PART THREE

	Total Income (\$ 1970)	%
Employment Income	404,000	71
Other Cash Income	81,000	14
Income from Subsistence Activities*		
Fishing**	85,000	15
Hunting***	-	-
Trapping	-	-
Natural Vegetation Gathering	<u>NA****</u>	<u>NA****</u>
TOTAL	\$570,000	100.0

* 1976 Subsistence income has been deflated using the Consumer Price Index for meat, fish and poultry, Vancouver.

** Fishing values are the average estimates for the four primary area Bands estimated in Section 9.4, rounded to the nearest thousand dollars.

*** Hunting values are the average estimates for the four primary area Bands estimated in Section 9.1, rounded to the nearest thousand dollars.

**** Not available.

Prepared by: Strong Hall & Associates, Ltd. and Bob Ward Management Services 10/



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TOTAL INCOME ESTIMATED FOR BANDS
IN THE PRIMARY STUDY AREA
1970

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-30

PART THREE

<u>Highest Schooling Achieved</u>	<u>Primary Area* Indians</u>	<u>Cache Creek</u>	<u>Ashcroft</u>	<u>B.C. Indians</u>	<u>B.C. Total</u>
Elementary (To Grade 9)	56	27.7	24.9	63.0	26.2
Secondary (9-13)	42	63.8	66.5	28.0	44.1
Post Secondary	-	-	-	7.2	17.8
Some University	2	7.6	4.2	1.4	6.9
University	-	2.5	4.6	0.4	4.9

- On-Reserve residents only

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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants
LEVELS OF EDUCATION, PERCENTAGE OF POPULATIONS
AGE 15 AND OVER
1971
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-31

PART THREE

<u>Level of Schooling</u>	<u>Bonaparte</u> <u>%</u>	<u>Ashcroft/ Oregon Jack</u> <u>%</u>	<u>Pavilion</u> <u>%</u>	<u>Total</u> <u>%</u>
Less than Grade 5	20	40	10	25
5 - 8	40	10	30	35
9 - 10	20	10	30	20
11 - 13	20	25	30	20
Some University	0	10	0	0
University	$\frac{0}{100}$	$\frac{0}{100}$	$\frac{0}{100}$	$\frac{0}{100}$

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LEVELS OF EDUCATION,
PERCENTAGE OF POPULATION AGE 15 AND OVER ON-
RESERVE, PRIMARY AREA BANDS (1971)

THE HAT CREEK PROJECT - Detailed Environmental Studies

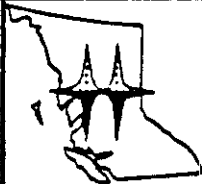
TABLE 3.5-32

PART THREE

(THOUSANDS OF FISH)

	<u>Sockeye</u>	<u>Pink</u>	<u>Other Salmon</u>	<u>Steelhead</u>	<u>Total No. of Fish</u>
1972	140	-	48	2	190
1973	159	53	46	2	260
1974	233	-	68	2	303
1975	250	41	57	2	350
1976	<u>240</u>	<u>-</u>	<u>75</u>	<u>2</u>	<u>317</u>
Average	205	19	59	2	285

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REPORTED CATCH OF THE INDIAN FOOD FISHERY
TOTAL FRASER RIVER SYSTEM
1972-1976

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-33

PART THREE

1972 - 1976

	MIDDLE FRASER		THOMPSON	
	No. of Fishermen	No. of Fish	No. of Fishermen	No. of Fish
1972	590	62,000	435	6,000
1973	965	77,000	125	6,000
1974	1,061	106,000	153	11,000
1975	1,191	117,000	151	7,000
1976	1,132	109,000	10	500

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REPORTED SOCKEYE CATCH AND NUMBER OF FISHERMEN
INDIAN FOOD FISHERY IN THE MIDDLE FRASER
AND THOMPSON RIVERS (1972-1976)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-34

PART THREE

	<u>A</u>	<u>B</u>
Number of Fishermen	5,800	1,880
Total Catch (fish)	806,000	190,300
Catch per Fisherman (fish)	147	101
Average Weight	2.7 kg	2.7 kg
Total Weight per Fisherman	400 kg	276 kg
Average Price Per kg*	\$ 0.64	\$ 0.64
Gross Value per Fisherman	\$ 1,215	\$ 840
Direct Cost Per Fisherman**	\$ 40	\$ 40
Net Value per Fisherman	\$ 1,175	\$ 800
Net Total Value	\$6.8 million	\$1.5 million
Population (1972 estimate)	\$ 16,900	\$ 16,900
Net Value per Capita	\$ 400	\$ 90

* Woodward's, Kamloops, 1977 average price of Sockeye, deflated to 1972 using the Consumer Price Index.

** Assumed at a level of \$40 per year.

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INCOME VALUE OF SUBSISTENCE FOOD FISHERY
TO INDIAN PEOPLE IN THE FRASER RIVER BASIN
1972

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-35

PART THREE

Area	D-1	D-2	D-3	D-4	Total
Private Accommodation Units	90	890	2504	6	3490
Parks Branch Facilities:					
Campsites	60	60	289	75	484
Picnic tables	25	46	63	30	164



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ESTIMATED ACCOMMODATION UNITS IN AREA D - 1977

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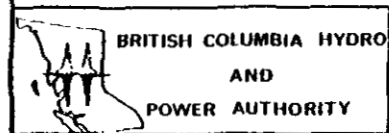
TABLE 3.5-36

PART THREE

VISUAL QUALITY:	Original Numerical Ranking of Visual Units									Normalized Ranking of Visual Units									Sum of Normalized Scores and Level of Visual Quality	
	Unity			Variety			Vividness			Unity			Variety			Vividness			Visual Quality Numerical Rank*	Level of Visual Quality
ASSESSOR:	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
VISUAL UNIT:																				
Marble Canyon	42	43	44	37	35	35	40	42	41	7	6	7	7	5	5	7	6	7	57	Outstanding
Upper Hat Creek Valley	37	46	41	33	37	40	30	38	32	5	7	6	6	5	7	4	5	3	48	Outstanding
Medicine Creek Valley	28	45	31	23	43	27	22	39	28	3	6	1	2	7	2	2	5	2	30	High
Cattle Valley	37	32	34	31	39	27	33	33	26	5	2	3	5	6	2	5	3	1	32	High
Highway #12	34	30	36	26	26	31	28	28	33	4	1	3	3	4	4	3	1	4	27	Average
Cache Creek	27	29	32	22	30	29	21	30	32	2	1	2	2	2	3	1	2	3	18	Fair to Poor
Thompson River	30	34	41	28	35	39	28	40	37	3	2	6	4	4	7	3	6	5	40	High
Highway #1	23	38	30	20	29	24	20	36	26	1	4	1	1	2	1	1	4	1	16	Fair to Poor
Oregon Jack	39	39	44	34	44	37	38	39	37	6	4	7	6	7	6	6	5	5	52	Outstanding
Langley	40	45	44	36	40	37	37	44	37	6	6	7	7	7	6	6	7	5	57	Outstanding

* Represents the sum of normalized scores for unity, variety, and vividness.

Prepared by: Toby, Russell, Buckwell & Partners 25/



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NUMERICAL RANKING OF VISUAL UNITS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.5-37
PART THREE

SITE	STATISTICAL INDEX (24 HOURS)	FALL		WINTER		SPRING
		WEEKDAY	WEEKEND	WEEKDAY	WEEKEND	WEEKDAY
1	L ₁₀	37	35	41	40	
	L ₅₀	29	25	34	29	
	L ₉₀	25	24	27	24	
2	L ₁₀	42	39	40	38	
	L ₅₀	33	33	28	32	
	L ₉₀	31	32	27	29	
3	L ₁₀	25	32	24	26	
	L ₅₀	21	28	19	19	
	L ₉₀	19	26	18	18	
4	L ₁₀	26	35	28	--	
	L ₅₀	22	30	20	--	
	L ₉₀	21	28	18	--	
5	L ₁₀					51
	L ₅₀					42
	L ₉₀					37

Prepared by: Harford, Kennedy, Wakefield, Ltd. 1/



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Values of L₁₀, L₅₀ and L₉₀

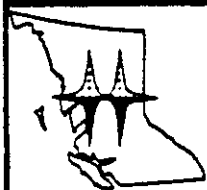
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.6-1

PART THREE

SITE	STATISTICAL INDEX (24 HOURS)	FALL		WINTER		SPRING
		WEEKDAY	WEEKEND	WEEKDAY	WEEKEND	WEEKDAY
1	L_d	48	45	46	46	
	L_n	42	38	42	38	
	$L_{eq}(24)$	47	43	45	44	
	L_{dn}	50	46	49	47	
2	L_d	50	43	48	43	
	L_n	42	39	42	35	
	$L_{eq}(24)$	48	42	47	41	
	L_{dn}	51	46	50	44	
3	L_d	30	37	31	28	
	L_n	26	25	24	29	
	$L_{eq}(24)$	29	35	29	28	
	L_{dn}	33	36	32	35	
4	L_d	34	42	27	--	
	L_n	24	27	25	--	
	$L_{eq}(24)$	32	40	26	--	
	L_{dn}	34	41	32	--	
5	L_d					50
	L_n					49
	$L_{eq}(24)$					50
	L_{dn}					56

Prepared by: Harford, Kennedy, Wakefield, Ltd. 1/



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Values of L_d , L_n , $L_{eq}(24)$ and L_{dn}

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.6-2

PART THREE

SITE	MONITORING PERIOD	CARS	TRUCKS	TOTAL	% TRUCKS
1	Fall Weekday	137	86	223	39
	Fall Weekend	174	54	228	24
	Winter Weekday	176	24	200	12
	Winter Weekend	180	25	205	12
2	Fall Weekday	203	114	317	36
	Fall Weekend	145	61	206	30
	Winter Weekday	121	35	156	22
	Winter Weekend	113	8	121	7
3	Fall Weekday	23	10	33	30
	Fall Weekend	17	2	19	11
	Winter Weekday	4	0	4	0
	Winter Weekend	6	1	7	14
4	Fall Weekday	5	0	5	0
	Fall Weekend	1	0	1	0
	Winter Weekday	0	0	0	0
	Winter Weekend	0	0	0	0

Prepared by: Harford, Kennedy, Wakefield, Ltd. 1/



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TRAFFIC LOG FOR
ENTIRE DAY (24 HRS.)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.6-5

PART THREE

Site	Date	Time	Temperature °C	Relative Humidity (%)	Wind Speed (km/h)	Wind Direction (°True)
1	Oct. 23	8:15			0	
		10:28			0	
		13:45	4	65		
		15:50			0	
		16:05	7	51		
	Oct. 26	20:25	2	69	0	
		23:55	1	67	0	
		9:22	0	73	0	
		12:46	8	64	0	
		20:16			0	
2	Oct. 24	8:00	0		0	
		13:55	5	73	2-3	52
		17:40	5	79	2-3	112
	Oct. 25	19:20	5	73	0	
		8:12	2.5	84	0	
		12:35	8	70	2-3	217
		13:07			8-16	212
		13:27			16	212
		14:40			2-3	
		15:23			16	42
		20:15	-1		0	
		22:45	-3		0	
		3	Oct. 29	0:01	2	69
7:56	-1				8	152
11:30					11-16	287
11:50					11-16	292
12:00					11-16	
14:16					10	
14:46					8	292



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METEOROLOGICAL CONDITIONS DURING
FALL MONITORING PERIODS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.6-4
Sheet 1 of 2

PART THREE

Site	Date	Time	Temperature °C	Relative Humidity (%)	Wind Speed (km/h)	Wind Direction (°True)	
3	Oct. 29	16:14			8	292	
		20:18	0	74	5-8	152	
	Oct. 30	0:30	0	82	0		
		11:20	6	43	16	267	
		11:58			19	187	
		12:46			29	142	
		16:24			24	142	
		17:40	5.5	49	8	190	
		19:07			0		
		19:47			16	367	
		20:50			18	182	
		22:00			8		
		23:03	5	59	0		
		4	Oct. 31	0:30	0.5	75	0
8:40					0		
9:20	7			63	< 8		
10:20					8-11	102	
11:58					11-16	172	
15:00	9			54	8-11	167	
15:53					16-19	107	
16:20					0		
20:12	6.5			33	< 8		
Nov. 1	0:20			-2		0	
	8:40			-2		0	
	12:09					0	
	14:35			6.5	38	0	
	18:25				0		
	19:00	0	65				
	23:30	-2		0			

Source: Harford, Kennedy, Wakefield, Ltd. 1/



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METEOROLOGICAL CONDITIONS DURING
FALL MONITORING PERIODS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.6-4
Sheet 2 of 2

PART THREE

NOISE MONITORING SITE	NEAREST B.C. HYDRO WEATHER STATION	DATE	TIME	TEMPERATURE °C	RELATIVE HUMIDITY %	WIND SPEED (km/h)	WIND DIRECTION ° true			
1	3	Feb. 20	8:00	-2	96	14	60			
			9:00	-2	94	13	65			
			10:00	0	90	11	65			
			11:00	2	82	11	65			
			12:00	3	72	8	75			
			13:00	6	61	3	90			
			14:00	8	55	5	45			
			15:00	10	51	5	35			
			16:00	10	47	6	45			
			17:00	9	47	6	55			
			18:00	8	53	5	60			
			19:00	7	61	6	50			
			20:00	5	70	5	50			
			21:00	3	79	2	50			
			22:00	3	83	5	45			
			23:00	3	85	3	75			
			24:00	1	93	3	60			
			Feb. 21			1:00	1	72	6	60
						2:00	2	51	5	275
						3:00	0	62	3	275*
						4:00	-3	73	2	320**
						5:00	-3	81	8	55
						6:00	-3	81	8	60
			Feb. 10			23:00	2	92	3	50**
24:00	1	93				2	195			
Feb. 11			1:00	1	95	2	185			
			2:00	0	94	2	185**			
			3:00	1	94	3	285			
			4:00	-2	94	2	275			
			5:00	-3	93	2	275			
			6:00	-3	93	2	275**			
			7:00	-3	93	3	30			
March 9			7:00	-7	89	3	45			
			8:00	-7	81	3	45			
			9:00	-5	61	3	25**			
			10:00	-1	45	5	235*			
			11:00	2	40	11	235			
			12:00	4	37	10	235			
			13:00	5	34	10	240			
			14:00	6	31	11	255			
			15:00	6	34	11	245			
			16:00	5	41	11	245			
			17:00	5	45	10	245			
18:00	4	47	3	255						
19:00	2	55	0	255						



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METEOROLOGICAL CONDITIONS DURING
WINTER MONITORING PERIODS
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.6-5
Sheet 1 of 4
PART THREE

NOISE MONITORING SITE	NEAREST B.C. HYDRO WEATHER STATION	DATE	TIME	TEMPERATURE °C	RELATIVE HUMIDITY %	WIND SPEED (km/h)	WIND DIRECTION °true	
2	2	Feb. 14	8:00	-7	89	2	190*	
			9:00	-6	88	3	170	
			10:00	-1	74	2	190*	
			11:00	3	63	2	150*	
			12:00	4	45	8	90	
			13:00	3	46	10	90	
			14:00	4	45	8	90	
			15:00	4	45	6	90	
			16:00	3	47	3	100*	
			17:00	2	54	2	75*	
			18:00	0	64	2	45	
			19:00	-1	73	2	100	
			20:00	-2	81	2	95	
			21:00	-2	84	2	95	
			22:00	-3	86	2	100	
			23:00	-3	87	5	245	
			24:00	-3	87	3	270*	
			Feb. 15	1:00	-4	91	2	220*
			2:00	-5	92	2	220*	
			3:00	-6	92	2	210*	
			4:00	-5	91	3	60	
			5:00	-4	90	2	210	
			6:00	-2	91	3	240	
			Mar. 6	8:00	-4	90	2	155
9:00	-3	86	2	155*				
10:00	0	72	2	195				
11:00	3	53	3	195				
12:00	5	40	11	195				
13:00	5	38	10	210				
14:00	5	40	10	180				
15:00	5	37	14	210				
16:00	5	37	11	210				
17:00	5	35	11	200				
18:00	4	35	5	225				
19:00	2	41	6	300				
20:00	1	61	5	310**				
21:00	-1	62	3	140*				
22:00	-2	71	2	170*				
23:00	-1	72	3	185*				
24:00	-1	71	2	330*				
Mar. 7	1:00	1	69	8	310			
2:00	2	69	5	320				
3:00	1	75	2	315*				
4:00	-1	81	2	310*				
5:00	-1	85	0	310				
6:00	-2	89	2	300*				



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METEOROLOGICAL CONDITIONS DURING
WINTER MONITORING PERIODS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.6-5
Sheet 2 of 4
PART THREE

NOISE MONITORING SITE	NEAREST B.C. HYDRO WEATHER STATION	DATE	TIME	TEMPERATURE °C	RELATIVE HUMIDITY %	WIND SPEED (km/h)	WIND DIRECTION ° true		
3	5	Feb. 18	7:00	-4	71	6	190*		
			8:00	-5	71	5	180		
			9:00	-3	71	3	170*		
			10:00	-2	64	2	105		
			11:00	1	56	3	100**		
			12:00	2	54	8	355		
			13:00	2	61	10	355		
			14:00	2	65	10	355		
			15:00	3	66	6	360		
			16:00	3	65	6	355		
			17:00	2	67	5	355		
			18:00	-1	79	3	360		
			19:00	-2	85	3	340*		
			20:00	-2	84	10	280*		
			21:00	-3	84	6	210		
			22:00	-3	84	8	200		
			23:00	-3	84	3	220		
			24:00	-4	85	3	205*		
			Feb. 19	1:00	-4	85	5	210	
					2:00	-5	85	6	200
					3:00	-5	86	5	195
					4:00	-5	86	5	195
					5:00	-5	85	5	190
					6:00	-5	86	6	190
Feb. 19	8:00	-5	86	3	180				
		9:00	-3	87	3	195			
		10:00	-2	82	3	185*			
		11:00	0	77	2	230*			
		12:00	0	76	3	100*			
		13:00	1	76	3	45			
		14:00	2	72	3	40			
		15:00	3	62	3	30*			
		16:00	4	54	3	25**			
		17:00	3	54	2	345*			
		18:00	2	63	2	330			
		19:00	0	76	3	350*			
20:00	0	80	3	290*					
21:00	-1	79	3	205					
22:00	-1	79	3	190					
23:00	-1	80	3	190					
24:00	-1	80	6	190					
Feb. 20	1:00	-1	81	3	190				
		2:00	-2	82	3	195			
		3:00	-2	82	10	195			
		4:00	-2	82	6	225*			
		5:00	-2	82	3	205			
		6:00	-2	82	6	220*			

NOISE MONITORING SITE	NEAREST B.C. HYDRO WEATHER STATION	DATE	TIME	TEMPERATURE °C	RELATIVE HUMIDITY %	WIND SPEED (km/h)	WIND DIRECTION ° true			
4	2	Mar. 10	8:00	-7	91	2	40			
			9:00	-5	79	3	35**			
			10:00	-1	55	3	360*			
			11:00	2	34	5	315			
			12:00	4	14	10	235			
			13:00	5	5	10	240			
			14:00	6	5	8	240			
			15:00	6	6	10	240			
			16:00	5	11	6	230			
			17:00	5	18	5	255**			
			18:00	4	30	5	15**			
			19:00	2	42	3	360**			
			20:00	1	51	2	35			
			21:00	1	56	3	25			
			22:00	1	56	3	45			
			23:00	1	57	3	35			
			24:00	1	57	3	45**			
			Mar. 11			1:00	1	58	2	355**
						2:00	1	59	3	45
						3:00	-1	62	5	50
						4:00	-1	67	5	45
						5:00	-1	67	6	50
						6:00	-1	65	5	45

• Variable

** Changing

Source: Harford, Kennedy, Wakefield, Ltd. 1/



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METEOROLOGICAL CONDITIONS DURING
WINTER MONITORING PERIODS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.6-5
Sheet 4 of 4

PART THREE

REGION	LOCATION/SOIL GROUP	AREA (ha)	WATER VOLUME (10 ⁴ m ³)
Sub-Region I	Lowlands *	790	602
	Highlands *	1440	1098
	TOTAL	2230	1700
SUB-REGION II	Floodplain Soils	64	29
	Upland Soils	1652	1095
	TOTAL	1716	1125
SUB-REGION III	Floodplain Soils	183	84
	Upland Soils	1129	748
	TOTAL	1312	832
SUB-REGION IV	Floodplain Soils	25	11
	Upland Soils	750	497
	TOTAL	775	508
TOTAL WATERSHED		6033	4165

REGION	SEASONAL DISTRIBUTION (10 ⁴ m ³)					TOTAL
	MAY	JUNE	JULY	AUGUST	SEPTEMBER	
SUB-REGION I	238	323	527	408	204	1700
SUB-REGION II	164	213	347	271	129	1124
SUB-REGION III	119	158	258	202	95	832
SUB-REGION IV	73	97	158	123	57	508
TOTAL WATERSHED	594	791	1290	1004	485	4164

* Based on C.I.I agricultural capability information
Source: Beak Consultants Ltd., 2/

Rev. 1 Feb. 1979.



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POTENTIAL IRRIGATION WATER USE IN THE HAT CREEK VALLEY

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 4.3-1

PART THREE

REGION	SOIL GROUP	ALL SEASON		SPRING PASTURE(6 wks.)		TOTAL	
		AREA*	WATER VOLUME**	AREA	WATER VOLUME	AREA	WATER VOLUME
SUB-REGION I	Upland Soils**	260	198	105	19	365	217
SUB REGION II	Floodplain Soils	16	7	-	-	16	7
	Upland Soils	394	261	57	9	451	270
	TOTAL	410	268	57	9	467	277
SUB-REGION III	Floodplain Soils	189	87	-	-	189	87
	Upland Soils	368	248	261	42	629	290
	TOTAL	557	335	261	42	818	377
SUB-REGION IV	Floodplain Soils	-	-	12	1	12	1
	Upland Soils	189	120	83	13	272	133
	TOTAL	189	120	95	14	284	134
TOTAL WATERSHED	Floodplain Soils	205	94	12	1	217	95
	Upland Soils	1211	827	506	83	1717	910
	TOTAL	1416	921	518	84	1934	1005

REGION	SEASONAL DISTRIBUTION ($10^4 m^3$)					
	MAY	JUNE	JULY	AUGUST	SEPTEMBER	TOTAL
SUB-REGION I	39	46	61	48	23	217
SUB-REGION II	45	54	83	65	30	277
SUB-REGION III	72	79	105	82	39	377
SUB-REGION IV	26	28	37	29	14	134
TOTAL WATERSHED	182	207	286	224	106	1005

* Areas are expressed in hectares while water volumes are expressed in ($10^4 m^3$)

** All soils are assumed to be upland soils as a sufficient characterization was not available.



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PROBABLE IRRIGATION WATER USE IN THE HAT CREEK VALLEY

(Source: Beak Consultants Ltd., 2 /) Rev. 1 Feb. 1979.

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 4.3-2

PART THREE

<u>Species</u>	<u>Present</u>	<u>Potential</u>	<u>%</u>
Chinook	128,151	257,652	100
Sockeye	2,291,607	3,647,065	60
Coho	73,048	148,883	105
Pink	470,767	805,628	70
Total	2,963,573	4,857,228	65

Source: Environment Canada 6 /



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POTENTIAL ANNUAL SALMON PRODUCTION, THOMPSON RIVER

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE

4.3-3

PART THREE

Preferred Crop	Irrigable Land		Projected Irrigated Acreage (without project)	
	Upper Hat Creek	Site-Specific Study Area*	Upper Hat Creek	Site-Specific Study Area*
	(km ²)	(km ²)	(km ²)	(km ²)
Tomatoes	0	1.7	0	1.6
Corn Silage	3.7	3.7	3.4	3.4
Cabbage	0	2.4	0	2.5
Hay	18.9	25.7	7.4	12.9
Pasture	15.6	32.0	5.4**	11.2
Total	38.2	65.5	16.2	31.7

*Excludes a small portion of the site specific study area which occurs in the lower Hat Creek Valley.

**1.2 km² all-season irrigated pasture; 4.2 km² spring pasture.

Source: Canadian Bio Resources Consultants, Ltd., 5, 6/



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AREAL EXTENT OF POTENTIAL AND PROJECTED
IRRIGATED CROPLAND: SITE AREA

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 4.4-1
PART THREE

	CROPLAND		GRAZING LAND*	
	Winter Feed (7 Months) ha x Mg/ha = Mg		Spring** (2 Months) ha ÷ ha/AUM = AUM	Summer*** (3 Months) ha ÷ ha/AUM = AUM
	grass - alfalfa: (655) x (5.6) = 3724		A: (2700) ÷ (0.62) = 4355	D: (2700) ÷ (5) = 540
Projected productivity without project	wetland hay: (142) x (6.8) = 966		B, C: (4800) ÷ (1.23) = 3903	E, F, G, H: (45,000) ÷ (6) = 7500
			spring pasture: (520) ÷ (0.6) = 867	J: (7,000) ÷ (10) = 700
			all-season pasture: (170) ÷ (0.5) = 340	all season pasture: (170) ÷ (0.5) = 340
Total		<u>5527 Mg</u>	<u>9465 AUM</u>	<u>9081 AUM</u>
Animals		3476****	4733	3027

*Grazing land vegetation associations: A = Kentucky Bluegrass; B = Bunchgrass - Kentucky Bluegrass; C = Sagebrush - Bunchgrass; D = Douglas-fir - Bunchgrass; E = Highland Grasslands and Alpine Tundra; F = Douglas-fir - Bunchgrass - Pinegrass; G = Douglas-fir - Pinegrass; H = Engelmann Spruce - Grouseberry - Pinegrass; J = Engelmann Spruce - Lupines - Grouseberry, Engelmann Spruce - Grouseberry - White Rhododendron, Engelmann Spruce - Salix app. - Heather, Engelmann Spruce - Horsetail.

**Assumed that present range carrying capacity will improve over a 20 year interval to a level 60-70 percent of potential (Table 3.4-24).

***Assumed that present summer range productivity and timber removal (clear cutting) rate remain the same.

****Assumed that one AU, including allowance for required number of bulls, requires 1.59 Mg forage over a 6 month interval; and that cattle graze on hay land stubble for one month in fall.

Source: Canadian Bio Resources Consultants, Ltd. 6 /



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SEASONAL CATTLE PRODUCTIVITY PROJECTED
FOR THE WITHOUT - PROJECT CASE

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 4.4-2

PART THREE

	Local Study Area	Kamloops	Other Regional Communities	Total Region*
1976	3,450	26,300	4,550	34,300
1978	3,505	28,150	4,760	36,410
1980	3,740	30,200	5,000	39,195
1982	4,195	32,300	5,255	41,715
1984	4,195	34,650	5,515	44,325
1986	4,385	37,100	5,800	47,245
1988	4,535	39,750	6,090	50,330
1990	4,685	42,600	6,400	53,635

* Total population rounded to the nearest 100.

Prepared by: Strong Hall & Associates, Ltd. 1/



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PROJECTED LABOUR FORCE IN THE HAT
CREEK REGION WITHOUT THE HAT CREEK PROJECT
1976-1990

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 4.5-1

PART THREE

LOCAL AREA DISTRIBUTION						HAT CREEK REGION				
Ash-croft	Cache Creek	Clinton	Lillooet	Unincorporated	TOTAL	Local Area	Kamloops	Other Regional Communities	Total **	
1976	2,030	1,050	810	2,220	1,390	7,500	7,500	58,300	11,500	77,300
1978	2,100	1,095	810	2,220	1,390	7,615	7,615	61,900	11,900	81,400
1980	2,455	1,205	810	2,220	1,390	8,080	8,080	65,500	12,300	85,900
1982	2,455	1,205	1,155	2,785	1,390	8,990	8,990	69,200	12,800	91,000
1984	2,455	1,205	1,155	2,785	1,390	8,990	8,990	73,400	13,300	95,700
1986	2,685	1,355	1,155	2,785	1,390	9,370	9,370	77,600	13,800	100,800
1988	2,860	1,475	1,155	2,785	1,390	9,665	9,665	82,300	14,300	106,300
1990	3,035	1,595	1,155	2,785	1,390	9,960	9,960	86,900	14,800	111,700

* Estimated by Strong Hall & Associates Ltd.
(Does not include Indian Reserves)

** Total population rounded to the nearest 100.

Prepared by: Strong Hall & Associates, Ltd. 1/



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POPULATION PROJECTIONS WITHOUT THE HAT CREEK PROJECT
1976-1990

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 4.5-2

PART THREE

	<u>Local Area</u> (\$ Million)	<u>Total Region</u> (\$ Million)
1976	42.0	453.8
1978	43.2	505.1
1980	47.0	563.8
1982	53.8	631.4
1984	53.8	701.9
1986	56.9	781.6
1988	59.4	872.0
1990	61.8	969.4

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PROJECTED TOTAL INCOME WITHOUT THE
PROJECT, HAT CREEK REGION
1976-1990

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 4.5-3

PART THREE

Project	Location	In Service Year	Construction Labour Force Peak	Direct Operating Labour Force
1. Rock Crushing Plant	Ashcroft/MacAbee	1977	50	40
2. Columbia Lime	Clinton	1981	100	125
3. Bethlehem Lake Zone	Highland Valley	1979	1,050	180*
4. Lornex Expansion	Highland Valley	1979	1,600	400
5. Lillooet Prison	Lillooet	1982	150	200
6. Valley Copper Phase II	Highland Valley	1985	2,050	550
7. Copper Processing Plant	Highland Valley	1987	1,000-1,500	425
8. Highmont Mine	Highland Valley	1990	1,050	425
9. Kelly Lake/Nicola Transmission Line	Kelly Lake to Nicola	1988	285	-

* In addition, 20 indirect jobs in equipment repair and maintenance and steel ball manufacturing have been assumed.

Prepared by: Strong Hall & Associates, Ltd. 1/



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ECONOMIC DEVELOPMENT PROJECTS, 1976-90

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 4.5-4

PART THREE

	Ashcroft*	Cache Creek*	Clinton*	Lillooet*
1976				
1977	35	20		
1978				
1979	175	60		
1980				
1981			170	
1982				285
1983				
1984				
1985	115	75		
1986				
1987	90	60		
1988				
1989				
1990	90	60		

- Detailed methodology for determining the community location of incremental employment recipients is developed in the Socio-economic Report.

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TOTAL EMPLOYMENT INCREMENTS IN THE LOCAL
STUDY AREA WITHOUT THE HAT CREEK PROJECT
1976-1990

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 4.5-5

PART THREE

Unit Type	Estimated Household Size	Municipality			
		Ashcroft	Cache Creek	Clinton	Lillooet
Single Family and Duplex	3.6	160-165	95 - 100	60-65	95-100
Mobile Homes	3.6	70- 75	40 - 45	15-20	25- 30
Multi-Family	2.1	55- 60	35 - 40	10-15	20- 25

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RANGE OF REQUIRED DWELLING UNITS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 4.5-6

PART THREE

<u>Location</u>	<u>1981</u>	<u>1986</u>	<u>1991</u>
Highway No. 1 China Bar Tunnel*	11,000	7,500	8,900
Highway No. 1 South of Ashcroft	9,900	6,700*	8,000
Highway No. 1 At Cache Creek*	14,900	10,100	12,000
Highway No. 97 South of Carquile	8,500	10,000	11,500
Highway No. 12 East of Pavilion	500	550	600
Highway No. 12 West of Highway No. 97	800	850	900

* Interpolated and extrapolated from Ministry of Highways trend data and 1986 projections.

Source: Strong Hall & Associates, Ltd. 1/.



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PROJECTED TRAFFIC GROWTH AT SELECTED POINTS
HAT CREEK STUDY REGION
(JULY-AUGUST AVERAGE DAILY VEHICLES)

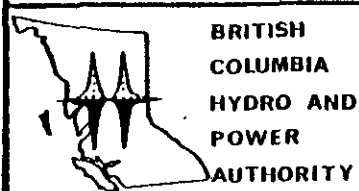
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 4.5-7

PART THREE

Fiscal Factor	Municipality	Selected Years						
		1978	1980	1982	1984	1986	1988	1990
Estimated Population	Ashcroft	2100	2455	2455	2455	2685	2860	3035
	Cache Creek	1095	1205	1205	1205	1355	1475	1595
	Clinton	810	810	1155	1155	1155	1155	1155
Non-Property Tax Revenues (\$ +000)	Ashcroft	229.5	284.5	263.5	263.5	299.5	317.5	337.5
	Cache Creek	116.0	133.5	126.5	126.5	150.5	161.0	175.0
	Clinton	91.0	91.0	127.0	122.0	122.0	122.0	122.0
Revenue Required from Project (\$ +000)	Ashcroft	174.5	185.0	206.0	206.0	253.5	271.0	287.5
	Cache Creek	114.0	114.0	121.0	121.0	120.0	134.5	136.5
	Clinton	26.0	26.0	48.5	53.5	53.5	53.5	53.5
Total Expenditures (\$ 000)	Ashcroft	404.0	469.5	469.5	469.5	553.0	588.5	625.0
	Cache Creek	230.0	247.5	247.5	247.5	271.0	295.5	311.5
	Clinton	117.0	117.0	175.5	175.5	175.5	175.5	175.5
Projected Taxable Assessments	Ashcroft	4935.0	5769.0	5769.0	5769.0	6310.0	6721.0	7132.0
	Cache Creek	4347.0	4760.0	4760.0	4760.0	5298.0	5723.0	6125.0
	Clinton	1822.5	1822.5	2599.0	2599.0	2599.0	2599.0	2599.0
Projected Tax (Mill Rate)	Ashcroft	35.4	32.1	35.7	35.7	40.2	40.3	40.3
	Cache Creek	26.2	24.0	25.4	25.4	22.7	23.5	22.3
	Clinton	14.3	14.3	18.7	20.6	20.6	20.6	20.6

Prepared by: Strong Hall & Associates, Ltd. 1/



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PROJECTED MUNICIPAL FISCAL FACTORS

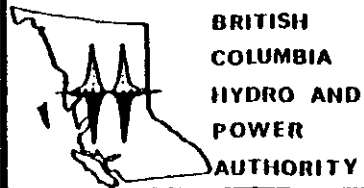
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 4.5-8

PART THREE

Measurement Site	Distance From Trench "A" (m)	Baseline "Leq" Values (DAY)	"Leq" (0.5 IIR) Values With Trench A Excavation	Location
1	975.4	32	33	125 m east of drill hole 76-138
2	762.0	32	38	Drill hole 76-144
3	823.0	30	49	Drill hole 76-168

Source: Harford, Kennedy, Wakefield Ltd. 1/.



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EXISTING AND MEASURED "Leq" VALUES AT SELECTED MONITORING SITES NEAR TRENCH "A"

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
2.5-1

PART FOUR

Impact of Land Alienation

Water Use Category	Project Activity	Area (ha)	Water Quantity (10 ⁴ m ³ /a)
Base Project Scheme:			
Presently Irrigated Land	Mine	12.5	8.3
	Plant	16.2	10.7
	Offsites	<u>16.6</u>	<u>13.8</u>
	Sub-total	45.3	32.8
Projected Irrigated Corn	Mine	113.0	74.6
	Plant	-	-
	Offsites	<u>61.5</u>	<u>40.6</u>
	Sub-total	174.5	115.2
Projected Irrigated Spring Pasture	Mine	47.7	7.6
	Plant	-	-
	Offsites	5.7	0.9
	Sub-total	<u>53.4</u>	<u>8.5</u>
Total Projected Use	Mine	173.2	90.5
	Plant	16.2	10.7
	Offsites	<u>83.8</u>	<u>55.3</u>
	Total	273.2	156.5

Alternate Schemes:

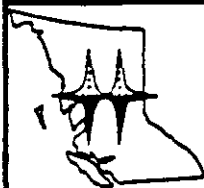
Presently Irrigated Land	Offsite	105.0	78.0
--------------------------	---------	-------	------

Other Impacts

Water Use Category	Project Activity	Water Quantity (10 ⁴ m ³ /a)
Loss of Present Storage	Finney Lake Dewatering	12
Conveyance Disruption	Finney Creek Diversion	12*
	Hat Creek Diversion	<u>23</u>
Total		47

* excludes 12 x 10⁴ m³/a of use lost due to Finney Lake dewatering

Source: Beak Consultants Ltd. 3/.



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IRRIGATION WATER USE IMPACTS
DUE TO PROJECT CONSTRUCTION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.2-1

PART FOUR

ASHCROFT

<u>Year</u>	<u>Without Project</u>		<u>With Project</u>	
	<u>Population</u>	<u>Usage*</u>	<u>Population</u>	<u>Usage</u>
1976	2030	1847	-	-
1980	2455	2234	3071	2795
1986	2685	2443	4665	4245
1990	3035	2762	5242	4770

CACHE CREEK

<u>Year</u>	<u>Without Project</u>		<u>With Project</u>	
	<u>Population</u>	<u>Usage</u>	<u>Population</u>	<u>Usage</u>
1976	1050	956	-	-
1980	1205	1097	1509	1373
1986	1355	1233	2330	2120
1990	1595	1451	2683	2442

*Water usage figures are m³/d

Based on assumed construction start in 1978

Prepared by: Beak Consultants Ltd. 3/.



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POPULATION AND SURFACE WATER USAGE
PROJECTIONS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.2-2

PART FOUR

Habitat Maintenance Level

Flushing Flow

Optimum

Outstanding

Excellent

Good

Fair or Degrading

Poor or Minimum

Severe Degradation

October-March

0.42 (60-100%)

0.28 (40%)

0.21 (30%)

0.14 (20%)

0.07 (10%)

0.07 (10%)

<0.07 (<10%)

Flow Regime (m³/s) *

Freshet

1.39 (200%) **

April-September

0.42 (60-100%)

0.42 (60%)

0.35 (50%)

0.28 (40%)

0.21 (30%)

0.07 (10%)

<0.07 (<10%)

Recommended Hat Creek Minimum Flow

Base Flow Period October-March 0.21 m³/s

Base Flow Period April-September 0.28 m³/s

Flushing Flows (for two week duration during May-June) 1.42 m³/s

*Based upon Upper Hat Creek Station annual discharge of 0.71 m³/s

**% values relate to flow regime expressed as a percentage of mean annual discharge

Prepared by: Beak Consultants Ltd. 10/.



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APPLICATION OF THE MONTANA METHOD FOR EVALUATING
INSTREAM FLOW REQUIREMENTS IN HAT CREEK

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.2-3

PART FOUR

Parameter*	Projected Mine Dewatering Quality**	Coal A****	Coal B****	Coal C****	Low-Grade Waste****
pH	7.5	6.95	7.2	5.0	7.8
Filterable Residue	1400	2560	2735	1658	1520
BOD ₅	3.5	--	--	--	148*****
Alkalinity (as CaCO ₃)	870	710	540	270	393
Chloride	4	74	52	40	40
Fluoride	0.2	0.05	0.1	0.2	0.08
Nitrate (as N)	< 0.06***	7.0	5.3	0.3	2.4
Kjeldahl Nitrogen (as N)	14.0***	--	--	--	--
Ortho-Phosphate (as P)	< 0.03	0.3	0.2	0.1	0.15
Sulphate	140	43.95	63.9	127.8	30.0
Arsenic	< 0.009	0.03	0.02	0.04	0.06
Boron	< 0.05	0.3	0.3	0.1	0.12
Cadmium	< 0.005	< 0.002	< 0.002	< 0.002	0.002
Calcium (as CaCO ₃)	120	10.7	24.2	13.7	37.5
Chromium	< 0.010	0.25	0.075	0.05	0.2
Copper	< 0.006	2.4	3.5	1.9	2.45
Iron	< 0.08	3.3	0.9	1.0	5.7
Lead	< 0.015	< 0.02	< 0.02	< 0.02	0.02
Magnesium (as CaCO ₃)	128	17.0	18.3	35.4	34.02
Mercury	< 0.0003	0.002	0.005	0.002	0.004
Sodium	315	368.2	286	174	267
Vanadium	< 0.05	< 0.01	< 0.01	< 0.01	0.01
Zinc	1.0	0.213	0.125	0.125	0.125

* All parameters expressed in mg/l except pH which is in units.

** Based on data for Well RH76-19 and Bucket Auger Hole #7 as given in Table 3.4-1, Part Three.

*** Does not include any contribution from blasting residuals.

**** At low pore volume displacement (see Table 3.4-4, Part Three).

***** Estimated by BEAK utilizing BOD of Total Extractable Tests and multiplying by ratio of Filterable Residue extracted in 24 hours to Total Extractable Filterable Residue.

Source: Beak Consultants Ltd. 3/.



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CONSTRUCTION PHASE WATER QUALITY ESTIMATES

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.2-4

PART FOUR

Facility Component (ha)

Soil Unit*	Plant Site	Makeup Water Reservoir	Medicine Ash Disposal	Harry Lake Ash Disposal	Associated Facilities	Total	Sensitivity
15	-	-	0.8	-	-	0.8	Moderate
16	-	-	12.5	-	-	12.5	Moderate
18	-	-	-	-	0.8	0.8	Moderate
28	-	-	11.3	-	-	11.3	Moderate
31	1.6	-	-	-	-	1.6	Moderate**
34	-	-	-	-	0.2	0.2	Moderate**
35	8.1	-	-	-	0.8	8.9	Moderate
37	-	-	-	26.3	1.2	27.5	Moderate
38	-	2.0	146.7	-	1.6	150.3	Moderate
41	5.7	5.2	-	-	-	10.9	Moderate
42	-	8.9	4.9	-	-	13.8	Moderate
45	-	-	11.8	-	-	11.8	Low
47	-	-	20.2	-	-	20.2	Low
50	-	7.7	2.4	-	-	10.1	Low
51	8.0	1.6	89.0	99.3	9.2	207.1	Moderate
52	-	-	120.2	-	-	120.2	Moderate
54	6.5	40.4	9.3	-	4.6	60.8	Moderate
55	-	-	35.2	-	-	35.2	High
56	-	-	85.0	-	-	85.0	Moderate
57	-	-	8.6	-	-	8.6	High
58	66.1	0.3	-	6.5	2.2	75.1	Moderate
59	-	-	-	24.3	-	24.3	Moderate**
60	3.2	-	-	19.8	0.5	24.5	Moderate
Lake	0.9	-	-	-	-	0.9	-
Unclassified	-	-	60.7	2.4	-	63.1	-

* See Map 4-4a,b 1/

** Denotes units with a moderate overall sensitivity rating but highly sensitive to a specific soil parameter.

Source: TERA Environmental Resource Analyst, Ltd. 1/.



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AREAL SUMMARY OF SOILS DISTURBED DURING PLANT CONSTRUCTION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.3-1

PART FOUR

Facility Component (ha)

Vegetation Association	Construction Camp	Plant Site	Makeup Water Reservoir	Medicine Creek Ash Disposal	Harry Lake Ash Disposal	Total	Sensitivity
Engelmann Spruce Grouseberry Pinegrass	-	-	57.9	31.0	6.5	95.4	Low
Douglas-Fir-Pinegrass	1.1	71.0	6.6	328.0	31.8	438.5	Low
Douglas-Fir-Bunchgrass	1.3	-	-	-	-	1.3	Moderate
Douglas-Fir-Bunchgrass-Pinegrass	-	-	-	-	8.5	8.5	Moderate
Willow-Sedge Bog	-	-	-	8.1	-	8.1	High
Kentucky Bluegrass	0.8	22.4	7.6	306.7	133.8	471.3	Low

Source: TERA Environmental Resource Analyst, Ltd. 1/.



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AREAL SUMMARY OF VEGETATION ASSOCIATIONS DISTURBED BY PLANT CONSTRUCTION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.3-2

PART FOUR

Facility	Total Facility Area (ha)	Engelmann Spruce Lodgepole Pine	Douglas-fir/Pinegrass	Ponderosa Pine-Douglas-fir/Bunchgrass	Aspen	Mid Elev Grassland
CP1*	13.2*				13.2*	
CP2*	0.02*				0.02*	
CP3	0.06					0.06
CP4*	0.02*		0.02*			
CP5*	0.06*				0.06*	
CP6	3.1		1.1	1.2		0.8
P1	92.0		9.2		59.8	23.0
P2	1.1					1.1
P3	0.3					0.3
P4	67.3	57.2	3.4			6.7
P5	4.8		4.1		0.5	0.2
Subtotal	168.7	57.2	17.8	1.2	60.3	32.2
% Local Study Area Affected	0.1	0.2	<0.1	<0.1	2.2	0.6

* Facility overlaps with P1, areas not included in subtotal.

Source: TERA Environmental Resource Analyst, Ltd. 2/.



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HABITATS LOST BY CONSTRUCTION
OF PROPOSED HAT CREEK THERMAL GENERATING PLANT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.3-3

PART FOUR

Facility	Total Facility Area (ha)	Engelmann Spruce Lodgepole Pine	Douglas-fir/Pinegrass	Aspen	Mid Elev Grassland	Bog	Waterbodies
Base Scheme Ash Pond plus Conveyance System	673.6	218.0	149.0	60.8	232.6	13.2	
Wet Alternative Ash Pond for Fly Ash; Dry Dump for Bottom Ash	854.2	218.0	176.5	63.7	381.5	13.2	1.3
Difference from Base Scheme	+180.6	-	+27.5	+2.9	+148.9	-	+1.3
Dry Ash Scheme #I	303.6		72.9	2.9	226.5		1.3
Difference from Base Scheme	-370.0	-218.0	-76.1	-57.9	-6.1	-13.2	+1.3
Dry Ash Scheme #II	260.5		45.8	2.9	210.5		1.3
Difference from Base Scheme	-413.1	-218.0	-103.2	-57.9	-22.1	-13.2	+1.3

Source: TERA Environmental Resource Analyst, Ltd. 2/.



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COMPARISON OF HABITAT
AREAS LOST BY ASH DISPOSAL SCHEMES

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.3-4

PART FOUR

Land Alienated by Project
(Site Specific Study Area)

Farm Unit	Projected Probable Irrigated Land			Projected Probable Grazing Land					
	Plant (ha)	Mine (ha)	Entire Project (ha)	Deeded and Leased			Grazing Permit		
				Plant (ha)	Mine (ha)	Entire Project (ha)	Plant (ha)	Mine (ha)	Entire Project (ha)
4	0	0	0	0	177	207	0	0	0
5	0	91	178	156	681	1,019	0	0	0
6	0	14	16	0	862	961	0	0	0
7	0	13	26	0	245	269	0	0	0
8	7	0	13	361	3	397	279	4	310
9	0	0	3	0	0	14	36	14	63
11	0	0	< 1	0	0	< 1	0	0	0
13	0	0	5	0	0	0	0	0	0
Unclassified	0	26	32	0	200	210	0	0	0
Total	7	144	273	517	2168	3077	315	18	373

Source: Canadian Bio Resources Consultants Ltd. 3/.



BRITISH
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EBASCO SERVICES OF CANADA LIMITED; Environmental Consultants

LAND AREA PREEMPTED FROM PROJECTED
PROBABLE AGRICULTURAL USES

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.3-5

PART FOUR

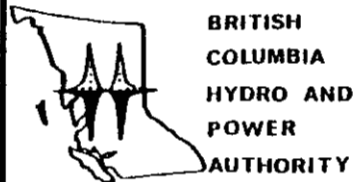
Farm Unit	Deeded Land			Leased Land			Permit Land		
	Current Acreage (ha)	Project Requirements (ha)	Project (percent)	Current Acreage (ha)	Project Requirements (ha)	Project (percent)	Current Acreage (ha)	Project Requirements (ha)	Project (percent)
1	368	-	-	694	-	-	5,274	-	-
2	246	-	-	355	-	-	4,831	-	-
3	62	-	-	643	-	-	*	-	-
4	651	11	1.7	3,811	196	5.1	4,049	-	-
5	4,973	76	1.5	9,267	1,121	12.1	12,658	-	-
6	2,037	318	15.6	4,955	659	13.3	25,915	1	<0.1
7	199	20	10.1	772	276	35.8	4,121	-	-
8	1,165	8	0.7	4,695	402	8.6	14,180	310	2.2
9	820	5	0.6	2,672	13	0.5	15,236**	63	0.4
10	-	-	-	732	-	-	2,751	-	-
11	2,300	-	-	-	-	-	***	-	-
12	-	-	-	3,196	-	-	***	-	-
13	340	5	1.5	340	-	-	-	-	-
Unclassified	19,039	222	1.2	7,068	21	0.3	32,085	-	-
Total	32,200	665		39,200	2,688		121,100	373	

* Also utilizes portion of Farm Unit 5 permit land

** Also utilizes portion of Farm Unit 6 permit land

*** Also utilizes portion of Farm Unit 9 land

Source: Canadian Bio Resources Consultants Ltd. 3/.



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EBASCO SERVICES OF CANADA LIMITED; Environmental Consultants

EFFECT OF TOTAL PROJECT LAND REQUIREMENTS
ON FARM UNITS OF THE LOCAL STUDY AREA

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.3-6

PART FOUR

Facility Component

Soil Unit*	Mine Pit No. 1	Medicine Creek Waste Disposal	North Valley Waste Disposal	Houth Meadow Waste Disposal	Topsoil Stock-pile B	Topsoil Stock-pile C	Low Grade Coal Stockpile	Other Facilities	Total	Sensitivity
4	39.3	-	15.4	-	-	-	-	5.6	60.3	Moderate
6A	49.0	-	9.3	64.7	-	-	-	28.6	151.6	Moderate
6B	40.5	-	-	-	-	-	-	-	40.5	High
7	-	-	4.9	-	-	-	-	2.0	6.9	Moderate
10	-	-	-	76.5	-	-	-	1.6	78.1	High
16	8.9	-	-	-	-	-	-	-	8.9	Moderate
17	131.9	-	-	-	61.8	-	-	-	193.7	High
18	59.5	-	0.1	-	-	-	-	16.4	76.0	Moderate
19	100.8	-	-	-	-	-	-	48.5	149.3	High
20A	8.1	-	-	-	-	-	-	-	8.1	High
20B	8.1	-	-	-	-	-	-	-	8.1	High
20C	16.6	-	-	-	-	-	-	-	16.6	High
20D	68.1	-	-	17.8	-	-	-	1.2	87.1	High
20E	23.1	-	-	-	-	-	-	-	23.1	High
21	57.4	-	-	-	-	-	-	-	57.4	High
31	-	-	-	32.0	-	-	-	-	32.0	Moderate**
34	-	60.7	-	25.0	-	19.0	-	4.6	109.3	Moderate**
35	-	59.1	-	-	-	-	71.3	3.3	133.7	Moderate
36	-	23.5	-	-	-	-	-	0.4	23.9	Moderate
37	-	4.0	-	-	-	-	-	11.1	15.1	Moderate
38	-	2.0	-	-	-	-	-	0.4	2.4	Moderate
42	-	43.7	-	-	-	-	-	0.8	44.5	Moderate
47	-	1.6	-	-	-	-	-	0.4	2.0	Low
50	-	58.7	-	-	-	-	-	1.6	60.3	Low
51	38.8	38.8	-	2.0	-	73.1	50.6	9.7	213.0	Moderate
52	-	-	-	-	-	-	-	0.8	0.8	Moderate
53	-	28.3	-	-	-	-	-	-	28.3	Moderate
54	-	-	-	-	-	-	-	0.8	0.8	Moderate
55	-	5.7	-	-	-	-	-	-	5.7	High



BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

EBASCO SERVICES OF CANADA LIMITED; Environmental Consultants

AREAL SUMMARY OF SOILS DISTURBED DURING MINE CONSTRUCTION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE 3.3-7
Sheet 1 of 2

PART FOUR

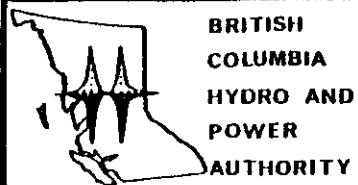
Facility Component

Soil Unit*	Mine Pit No. 1	Medicine Creek Waste Disposal	North Valley Waste Disposal	Houth Meadow Waste Disposal	Topsoil Stock-pile B	Topsoil Stock-pile C	Low Grade Coal Stockpile	Other Facilities	Total	Sensitivity
56	-	-	-	-	-	-	-	0.8	0.8	Moderate
57	-	137.2	-	129.9	-	-	-	1.6	268.7	High
58	-	-	-	-	-	-	-	1.2	1.2	Moderate
59	-	23.9	-	-	-	-	-	-	23.9	Moderate**
60	-	-	-	-	-	7.3	1.6	1.2	10.1	Moderate
62	92.7	-	-	-	-	-	-	-	92.7	Moderate
63	-	-	-	83.0	-	-	-	0.4	83.4	High
64	-	-	-	51.0	-	-	-	2.4	53.4	High
ROCK OUTCROP UNCL.	-	-	-	91.9	-	-	-	4.0	95.9	Low
	24.2	-	-	41.3	-	-	-	5.9	71.4	-

• See Map 4-4a,b 1/

** Denotes units with moderate overall sensitivity rating but highly sensitive to a specific soil parameter.

Source: TERA Environmental Resource Analyst, Ltd. 1/.



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AREAL SUMMARY OF SOILS DISTURBED DURING MINE CONSTRUCTION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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Sheet 2 of 2
PART FOUR

Vegetation Association	Construction Camp	Mine Pit No. 1	Medicine Creek Waste Dump	North Valley Waste Dump	South Meadow Waste Dump	Lagoons	Topsoil Stockpile A*	Topsoil Stockpile B*	Topsoil Stockpile C*	Coal Blending Area	Low Grade Coal Stockpile	Temporary Topsoil Stockpile	Coal Conveyors	Maintenance Buildings	Drainage Ditches	Total	Sensitivity
Englemann Spruce - Crouseberry - Pinegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	1.0	Low
Douglas-fir - Pinegrass	-	120.5	114.5	2.1	365.0	0.4	-	-	10.1	-	66.7	-	5.5	-	16.0	700.8	Low
Douglas-fir - Pinegrass	-	137.6	-	16.0	5.7	-	-	-	-	4.8	-	-	12.2	-	0.2	176.5	Moderate
Douglas-fir - Bunchgrass - Pinegrass	6.8	92.7	232.0	-	4.5	1.3	22.8	-	32.6	22.4	7.4	2.8	-	-	6.0	431.3	Moderate
Riparian	-	6.0	-	2.4	-	-	-	-	-	1.5	-	-	-	-	-	9.9	High
Willow - Sedge Bog	-	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	2.2	High
Kentucky Bluegrass	-	3.7	138.1	16.4	126.0	1.2	-	-	55.2	-	49.4	-	12.4	2.6	6.0	411.0	Low
Bunchgrass - Kentucky Bluegrass	-	7.8	2.6	-	-	-	-	-	1.6	0.7	-	-	0.39	-	0.1	13.19	Low
Sagebrush - Bluebunch Wheatgrass	-	388.7	-	3.7	-	-	-	32.3	-	-	-	-	-	-	0.5	425.2	High
Bunchgrass - Kentucky Bluegrass/Saline Depression Complex	-	7.8	-	-	-	-	-	29.5	-	-	-	-	-	-	1.8	39.1	N C**
Kentucky Bluegrass/Riparian Complex	-	-	-	7.4	-	-	-	-	-	-	-	-	-	-	-	7.4	N C
Douglas-fir - Spirea - Bearberry/Douglas-fir - Bunchgrass - Pinegrass Complex	-	-	-	-	111.5	0.4	-	-	-	-	-	-	-	-	3.4	115.3	N C
Douglas-fir - Spirea - Bearberry/Douglas-fir - Bunchgrass Complex	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	0.5	N C

*Topsoil stockpile "A" is found near the proposed mine entrance; "B" near the existing landing strip; and "C" in the area south of Medicine Creek.
 **N C - denotes Not Classified.

Source: TERA Environmental Resource Analyst, Ltd. 1/.

 BRITISH COLUMBIA HYDRO AND POWER AUTHORITY	EBASCO SERVICES OF CANADA LIMITED; Environmental Consultants	TABLE 3.3-8 PART FOUR
	AREAL SUMMARY OF VEGETATION ASSOCIATIONS DISTURBED BY MINE CONSTRUCTION	
	THE HAT CREEK PROJECT - Detailed Environmental Studies	

Facility	Total Facility Area (ha)	Douglas-fir-Pinegrass	Ponderosa Pine Douglas-fir Bunchgrass	Aspen	Riparian	Mid Elevation Grassland	Low Elevation Grassland Saline Depression	Sagebrush	Bog	Waterbodies	Exposed Rock
Open Pit #1	652.0 & 115.0	130.4	168.8		19.2		53.6	383.5	7.7	3.8	-
Medicine Creek Waste Dump	487.2	219.2	121.8	14.6	-	131.6	-	-	-	-	-
Houth Meadow Waste Dump	615.1	387.5	73.8	24.6	-	116.9	-	-	-	-	12.3
3 North Valley Waste Dump	48.0	2.9	17.8		3.8	20.6	-	2.9	-	-	-
Lagoon 1	1.2					1.2	-	-	-	-	-
Lagoon 2	0.4		0.4				-	-	-	-	-
Lagoon 3	0.4	0.4					-	-	-	-	-
Lagoon 4	0.8	0.8					-	-	-	-	-
Lagoon 5	0.5		0.5				-	-	-	-	-
Lagoon 6	0.5				0.5		-	-	-	-	-
Topsoil Stockpile, Mine Entrance	22.8	20.1	2.7				-	-	-	-	-
Topsoil Stockpile, Landing Strip	61.8						35.8	26.0	-	-	-
Topsoil Stockpile, South Medicine Creek	99.4	28.8		12.9			57.7	-	-	-	-
Coal Blending Area	29.5	18.3	5.0		1.2		-	5.0	-	-	-
Low Grade Coal Stocking Area	123.5	66.7	7.4			49.4	-	-	-	-	-
Temporary Topsoil Stockpile	59.1		19.1				-	40.0	-	-	-
Conveyors	30.5	5.5	12.2				-	-	-	-	-
Shop & Maintenance Buildings	2.6			1.3		1.3	-	-	-	-	-
Drainage Ditches	35.0	18.0	8.4	0.1		5.1	1.9	1.2	-	-	0.3
Mine Construction Camp Housing and Parking	5.1		5.1				-	-	-	-	-
Mine Construction Sanitary Effluent Treatment Plant	0.02		0.02				-	-	-	-	-
Mine Construction Camp Effluent Treatment Basin	0.07		0.07				-	-	-	-	-
Mine Construction Camp Substation	0.02		0.02				-	-	-	-	-
Mine Construction Camp Water Storage Reservoir	0.06		0.06				-	-	-	-	-
Mine Construction Camp Water Supply Pipeline	3.3	0.2	2.9				0.2	-	-	-	-
Subtotal	2,393.87	898.8	446.07	53.5	24.7	338.9	149.2	458.6	7.7	3.8	12.6
Percent (%) of Local Study Area Affected	1.5	1.4	3.3	2.0	2.4	6.2	3.1	68.5	1.2	0.5	1.8

Source: TERA Environmental Resource Analyst, Ltd. 2/.



BRITISH COLUMBIA HYDRO
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HABITATS LOST BY MINE DEVELOPMENT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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PART FOUR

Facility Component

Soil Unit*	Access Road	Airstrip	Airstrip Access Road	Other Offsite Facilities	Total	Sensitivity
3	-	-	-	6.9	6.9	Moderate
4	-	-	-	11.5	11.5	Moderate
6A	3.2	-	-	4.8	8.0	Moderate
7	-	-	-	0.4	0.4	Moderate
14	-	-	-	8.5	8.5	High
16	-	4.8	0.8	0.1	5.7	Moderate
17	-	-	-	6.5	6.5	High
18	-	-	-	9.5	9.5	Moderate
19	2.4	-	-	12.5	14.9	High
20A	5.7	-	-	-	5.7	High
22	-	-	-	0.4	0.4	High
24	-	-	0.8	-	0.8	Moderate
25	3.6	13.8	2.1	3.1	22.6	High
27	-	16.2	0.8	-	17.0	Moderate
29	0.4	-	-	0.8	1.2	High
30	0.4	-	-	-	0.4	High
31	2.4	-	-	3.3	5.7	Moderate**
32	-	2.0	-	-	2.0	Moderate
34	2.8	-	-	4.1	6.9	Moderate**
36	6.2	-	-	4.2	10.4	Moderate
37	5.7	-	-	1.6	7.3	Moderate
38	16.2	-	-	10.7	26.9	Moderate
39	5.3	-	-	-	5.3	Moderate
40	1.2	-	-	-	1.2	Moderate
41	-	-	-	0.4	0.4	Moderate
42	2.8	-	-	-	2.8	Moderate
45	9.1	-	-	-	9.1	Low



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AREAL SUMMARY OF SOILS DISTURBED DURING OFFSITE FACILITIES CONSTRUCTION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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Sheet 1 of 2

PART FOUR

Facility Component

Soil Unit*	Access Road	Airstrip	Airstrip Access Road	Other Offsite Facilities	Total	Sensitivity
46	4.5	-	-	-	4.5	Low
47	15.0	-	-	3.6	18.6	Low
48	1.2	-	-	-	1.2	Low
49	-	-	-	1.2	1.2	Moderate
50	2.4	-	-	2.5	4.9	Low
51	7.3	-	-	2.4	9.7	Moderate
52	1.6	-	-	-	1.6	Moderate
54	2.4	-	-	6.5	8.9	Moderate
56	5.7	-	-	-	5.7	Moderate
57	-	-	-	5.7	5.7	High
58	-	-	-	0.4	0.4	Moderate
59	0.8	-	-	-	0.8	Moderate**
60	-	-	-	0.4	0.4	Moderate
61	2.8	-	-	-	2.8	Moderate
AY	-	-	-	4.5	4.5	Low
BE	-	-	-	0.8	0.8	Moderate
BN	-	-	-	1.6	1.6	Moderate
CR	-	-	-	0.4	0.4	Low
CT	-	-	-	8.2	8.2	High
JS	-	-	-	5.2	5.2	Moderate
TL	8.5	-	-	7.2	15.7	Moderate
TN	0.4	-	-	0.8	1.2	Low**
RO	-	-	-	1.6	1.6	Low
B	-	-	-	4.9	4.9	N/C***
SW	-	-	-	0.4	0.4	N/C***
UNCL.	-	8.5	-	6.5	15.0	N/C***

* See Map 4-4a, 1/

** Denotes units with a low or moderate overall sensitivity rating but highly sensitive to a specific soil parameter.

*** Denotes not classified.

Source: TERA Environmental Resource Analyst, Ltd. 1/.



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AREAL SUMMARY OF SOILS DISTURBED DURING OFFSITE FACILITIES CONSTRUCTION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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Sheet 2 of 2
PART FOUR

Vegetation Association	Facility Component (ha)									Total	Sensitivity
	Headworks Reservoir	Hat Creek Diversion Canal	Pit Rim Reservoir	Finney Creek Diversion	Makeup Water Pipeline	69 kV Transmission Lines	Airstrip	Main Access Road	Other Access Roads		
Engelmann Spruce - Grouseberry - Pinegrass	-	-	-	-	4.3	-	-	4.9	-	9.2	Low
Douglas-fir - Pinegrass	-	-	-	-	16.9	2.2	-	39.3	4.6	63.0	Low
Douglas-fir - Pinegrass	-	2.4	-	-	-	0.2	-	0.6	-	3.2	Moderate
Douglas-fir - Bunchgrass - Pinegrass	-	23.8	-	-	-	9.0	-	33.7	-	66.5	Moderate
Ponderosa Pine - Bunchgrass	-	-	-	-	0.5	-	-	-	-	0.5	Moderate
Riparian	1.8	0.3	10.4	-	-	-	-	-	-	12.5	High
Kentucky Bluegrass	-	-	-	-	-	1.9	-	25.9	0.9	28.7	Low
Bunchgrass - Kentucky Bluegrass	-	8.8	1.5	-	-	-	-	-	-	10.3	Low
Saline Depression	-	-	-	-	-	-	3.2	-	-	3.2	Moderate
Big Sage - Bunchgrass	-	-	-	-	14.5	36.0	46.6	12.0	11.0	120.1	Low
Cultivated Fields	-	-	0.2	-	8.0	2.0	-	1.0	-	11.2	High
Bunchgrass - Kentucky Bluegrass/ Saline Depression Complex	5.5	-	-	6.9	-	-	-	-	-	12.4	NC
Kentucky Bluegrass/ Riparian Complex	-	1.1	-	-	-	0.9	-	2.5	-	4.5	NC

"NC" - denotes not classified.

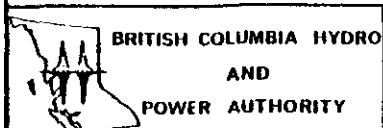
Source: TERA Environmental Resource Analyst, Ltd. 1/.

	Total Facility Area (ha)	Engelmann Spruce - Lodgepole Pine	Douglas-fir - Pinegrass	Ponderosa Pine - Douglas-fir - Bunchgrass	Aspen	Riparian	Mid Elev Grassland	low Elev Grassland/ Saline Depression	Sagebrush	Big Sage	Brush	Cultivated Field
Headworks Reservoir and Dam	7.3					1.8		5.5				
Hat Creek Diversion Canal	30.1		2.7	10.8				16.6				
Hat Creek Diversion Canal Conduit	6.3		1.1	5.1		0.1			1.1			
Pit Rim Reservoir and Dam	11.5					10.4						
Pit Rim Reservoir Pipeline	0.6							0.3				0.3
Diversion Canal Pipeline	7.7	0.2	2.6				4.9					
Finney Creek Diversion Canal	6.9		0.3					6.6				
Makeup Pipeline: Thompson River	39.0	2.3	14.5		0.8		1.2			16.7	0.8	2.7
Booster Pump Station No. I	2.0									2.0		
Booster Pump Station No. II	1.6		1.6									
Water Intake Station	nil											
Summit Surge Tank	0.02		0.02									
One-way Surge Tank	0.02		0.02									
Drainage Pipeline	1.6									0.2		1.4
Transmission Line to Construction Substation	2.4		0.9	1.3		0.2						
Transmission Line Between Construction Substations	10.8		2.2	5.2	0.3		3.1					
Transmission Line Between Booster Pumping Station II and Substation A	12.2									11.0		1.2
Transmission Line Between Booster Pumping Station I and Substation A	21.2									21.2		
Transmission Line Tie-in	2.7					0.2				1.8		0.7
Rattlesnake Substation	3.2									3.2		
Airstrip, Site A	45.3									45.3		
Airstrip Access Road, Site A	4.5									4.5		
Offloading Area	3.0									3.0		
Offloading Railroad Spur	-											
Offloading Access Road	-											
Main Access Road	120.0	4.4	49.2	16.8	2.9	1.2	26.3			12.0	4.8	2.4
Power Plant Site Access Road	4.5		3.6				0.9					
Water Intake Station Access Road	0.8									0.8		
Booster Pumping Station I Access Road	1.6									1.6		
Booster Pumping Station II Access Road	9.6		1.0							8.6		
Subtotal	356.5	6.9	79.8	39.2	4.0	13.9	36.4	29.0	1.1	131.9	5.6	8.7
% Local Study Area Affected	0.2	0.1	0.1	0.3	0.1	1.3	0.7	0.6	0.3	0.7	0.2	0.3

Source: TERA Environmental Resource Analyst, Ltd. 2/.

 BRITISH COLUMBIA HYDRO AND POWER AUTHORITY	EBASCO SERVICES OF CANADA LIMITED; Environmental Consultants		TABLE 3.3-12 PART FOUR
	HABITATS LOST BY CONSTRUCTION OF PROPOSED HAT CREEK OFFSITE FACILITIES		
	THE HAT CREEK PROJECT - Detailed Environmental Studies		

Biophysical Subunit*	Total Area Affected (ha)			Occurrence In Vicinity of Proposed Facilities	Primary Usage	Secondary Usage	Sensitivity of Physical and Biological Features	Integrated Resource Capability
	Plant	Mine	Offsite					
IAB.21	-	-	7.14	Thompson River Valley	Agriculture	-	Moderate**	High
IADB.27	-	3.47	0.90	North end-Hat Creek Valley	Agriculture	-	Moderate	High
IAE.8	-	15.86	1.87	North end-Hat Creek Valley	Agriculture	Forestry	Moderate	High***
IAE.10	-	64.41	1.94	North end-Hat Creek Valley	Agriculture	Forestry	Moderate**	High***
IAE.19	-	101.86	0.42	North end-Hat Creek Valley	Agriculture	-	High	High
IBGS1+3.21	-	-	59.09	Middle reaches Upper Hat Creek Valley	Agriculture	-	Moderate	High
IBGS1+3.28	-	-	6.95	Middle reaches Upper Hat Creek Valley	Agriculture	-	Moderate	High
IBRL1+3.10	-	-	1.47	Ambuaten Creek	Agriculture	-	Moderate	High
IBRL1+3.13	-	25.25	3.79	Hat Creek-North end of Valley	Agriculture	Wildlife	Moderate	High***
IBRL1+3.21	-	-	8.23	Middle and lower reaches Upper Hat Creek	Agriculture	-	Moderate	High
IBRL1+3.29	-	46.62	-	Lower reaches Upper Hat Creek	Agriculture	Wildlife	Moderate	High
IEB.21	-	-	11.13	Thompson River Valley	Agriculture	-	Moderate**	High
IEB1.31	-	-	0.92	Thompson River Valley	Agriculture	-	Moderate**	High
ITE1.17	-	30.28	-	North end-Upper Hat Creek Valley	Agriculture	-	Moderate**	High
2AB1.31	-	-	2.46	Thompson River Valley	Agriculture	-	Moderate**	High
2ABL1.17	210.29	2.57	-	Medicine Creek Valley	Grazing	-	Moderate**	Low
2CB.31	-	-	18.60	Thompson River Valley	Agriculture	-	Moderate	High
2CB1.31	-	-	5.55	Thompson River Valley	Agriculture	-	Moderate**	High
2CE1.7	-	266.0	-	North end-Upper Hat Creek Valley	Forestry	Grazing	Moderate**	Moderate
2CE.21	-	-	1.47	Confluence-Medicine & Hat Creel	Agriculture	-	High	High
2EB1.31	-	-	15.22	Thompson River Valley	Agriculture	-	Moderate**	High
2TB.31	-	-	1.48	Thompson River Valley	Agriculture	-	Moderate	High
2TB1.31	-	-	32.19	Thompson River Valley	Agriculture	-	Moderate**	High
2TDB1.8	-	92.36	0.68	North end-Upper Hat Creek	Agriculture	Forestry	High	Moderate***
2TDB1.19	-	253.69	8.29	North end-Upper Hat Creek	Agriculture	Wildlife	High	Moderate
2TDB1.23	-	33.17	12.95	Hat Creek-North of Anderson Creek	Agriculture	Wildlife	High	High
2TE1.10	0.96	25.64	13.34	Medicine Creek-within Hat Creek Valley	Agriculture	Forestry	Moderate**	Moderate
2TE.18	-	6.56	-	Southeast of Finney Lake	Agriculture	-	Moderate**	Moderate
2TE1.19	-	112.73	-	Steep bluffs-lower reaches Upper Hat Creek	Agriculture	Wildlife	High	High
2TG.7	56.87	-	1.45	Vicinity of Harry Lake	Forestry	Grazing	Moderate**	Low
2TG.17	-	-	5.86	Vicinity of Harry Lake	Grazing	-	Moderate**	Low
3AE2.24	-	18.19	-	North end-Upper Hat Creek Valley	Forestry	Grazing	High	Low
3CB1.31	-	-	3.49	Thompson River Valley	Agriculture	-	High	High
3CB2.31	-	-	6.13	Thompson River Valley	Grazing	Wildlife	High	Low
3CE1.10	-	111.18	-	Steep slope-lower Medicine Creek	Forestry	Grazing-Wildlife	High	Low
3CC1+2.24	-	71.52	-	Steep slopes above Houth Meadows	Forestry	Grazing	High	Low
3EB1.21	-	-	1.03	Thompson River Valley	Agriculture	-	High	High
3EB1.31	-	-	10.34	Thompson River Valley	Agriculture	-	High	High
3TB1.31	-	-	13.65	Thompson River Valley	Grazing	Wildlife	High	Low
3TBL1.17	-	149.37	-	Lower Medicine Creek Valley	Grazing	-	High**	Low



BRITISH COLUMBIA HYDRO
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EBASCO SERVICES OF CANADA LIMITED; Environmental Consultants

SUMMARY OF SENSITIVE BIOPHYSICAL UNITS AFFECTED BY PROJECT DEVELOPMENT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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Sheet 1 of 2

PART FOUR


Biophysical Subunit*	Total Area Affected (ha)			Occurrence In Vicinity of Proposed Facilities	Primary Usage	Secondary Usage	Sensitivity of Physical and Biological Features	Resource Capability
	Plant	Mine	Offsite					
3TDB.17	-	75.32	-	Lower reaches-Medicine Creek Valley	Grazing	Wildlife	High	Low
3TDB.23	-	-	32.22	Upper Hat Creek between McDonald and Anderson Creeks	Agriculture	Wildlife	High	High
3TE1.7	-	-	3.97	Northeast end-Upper Hat Creek Valley	Forestry	Grazing	Moderate**	Low
3TE.10	-	31.51	13.84	North end-Hat Creek Valley	Grazing	-	High	Moderate
3TE1.10	-	171.18	-	Southeast-Confluence Medicine & Hat Creeks	Grazing	-	High	Low
3TE1.17	-	103.57	-	Houth Meadows	Agriculture	-	High	High
Wetlands	9.06	4.84	-	Scattered throughout Hat Creek and Medicine Creek Valleys	Wildlife	Grazing	High	Low

*See Map 5-5, Physical Habitat and Range Vegetation Report 1/

**Subunits possessing an overriding physical or biological characteristic.

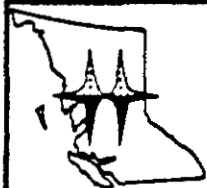
***Subunits possessing an overriding resource capability.

Source: TERA Environmental Resource Analyst, Ltd. 1/.

 BRITISH COLUMBIA HYDRO AND POWER AUTHORITY	EBASCO SERVICES OF CANADA LIMITED; Environmental Consultants	TABLE 3.3-13 Sheet 2 of 2 PART FOUR
	SUMMARY OF SENSITIVE BIOPHYSICAL UNITS AFFECTED BY PROJECT DEVELOPMENT	
	THE HAT CREEK PROJECT - Detailed Environmental Studies	

Year	Thermal Plant	Construction Phase		Total Construction	Thermal Plant	Operating Phase	
		Mine	Offsites			Mine	Total Operating
1	75	-	160	235	1	-	1
2	232	123	285	640	1	-	1
3	545	260	131	936	1	136	137
4	1,299	258	509	2,066	3	141	144
5	2,102	712	100	2,914	54	179	253
6	2,200	740	10	2,950	156	203	359
7	1,662	618	10	2,290	169	276	445
8	990	618	10	1,618	237	347	584
9	295	618	10	923	247	394	641
10	-	618	10	628	247	580	827
11	-	331	-	331	247	591	838
12	-	331	-	331	247	607	854
13	-	331	-	331	247	616	863
23	-	244	-	244	247	696	943
33	-	75	-	75	247	850	1,097
43	-	-	-	-	247	905	1,152

Source: Strong Hall & Associates Ltd. 1/.



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DIRECT EMPLOYMENT BY YEAR, TOTAL HAT CREEK
PROJECT CONSTRUCTION & OPERATING PHASES
AVERAGE MAN-YEARS

THE HAT CREEK PROJECT - Detailed Environmental Studies

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PART FOUR

	<u>THERMAL PLANT CONSTRUCTION</u>	<u>MINE CONSTRUCTION</u>
	<u>Average Man-Years</u>	<u>Average Man-Years</u>
General Labourers	755	1,295
Operating Engineers	615	3,440
Teamsters		435
Culinary Workers	440	315
Office & Technical Employees	890	
Carpenters	450	890
Plumbers and Pipefitters	885	435
Electrical Workers	1,180	435
Iron Workers	1,025	
Heat and Frost Workers	290	
Machinists/Millwrights	175	1,725
Boilermakers	915	
Sheet Metal Workers	295	
Other Labourers	<u>305</u>	
Total Labourers	8,235	8,970
Engineer and Supervisory	<u>1,180</u>	<u>895</u>
Total Direct Employment	<u>9,400</u>	<u>9,865</u>

Source: Strong Hall & Associates, Ltd. 1/.



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DIRECT EMPLOYMENT BY TRADE CLASSIFICATION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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PART FOUR

Effective Regional Supply
Spring, 1977

General Labourers	450
Operating Engineers	500
Teamsters	30
Culinary Workers	30
Office and Technical Employees	75
Carpenters	245
Plumbers and Pipefitters	200
Electrical Workers (wiremen)	175
Iron Workers	50
Machinists/Millwrights	25
Boilermakers	15
Sheet Metal Workers	20
Others **	<u>60</u>
Total Regional Supply	<u>1,875</u>

* Effective refers to those union members who traditionally work in heavy industrial construction throughout the province.

** Others include Heat and Frost Workers, Bricklayers, Cement Masons and Finishers, and Painters.

Prepared by: Strong Hall & Associates Ltd. 1/.



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ESTIMATED EFFECTIVE REGIONAL SUPPLY OF
UNIONIZED CONSTRUCTION WORKERS

THE HAT CREEK PROJECT - Detailed Environmental Studies


TABLE
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PART FOUR

Year	Construction Phase			Operating Phase		
	Local Area Residents	Total Region Residents	Total Employment	Local Area Residents	Total Region Residents	Total Employment
1	60	175	235			1
2	115	430	640			1
3	115	550	936	25	40	137
4	115	895	2,066	25	40	144
5	115	1,405	2,914	30	50	233
6	115	1,370	2,950	55	95	359
7	115	1,040	2,290	65	115	445
8	115	830	1,618	75	155	584
9	115	545	923	80	165	641
10	60	385	628	90	200	827
11	60	200	331	100	220	838
12	60	200	331	105	240	854
13	60	200	331	115	250	863
23	45	170	257	130	275	943
33	20	50	75	150	330	1,097
43	-	-	-	155	350	1,152

Source: Strong Hall & Associates Ltd. 1/.

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	BRITISH COLUMBIA HYDRO AND POWER AUTHORITY	EBASCO SERVICES OF CANADA LIMITED; Environmental Consultants	TABLE 3.4-4 PART FOUR
	REGIONAL PARTICIPATION ON THE HAT CREEK PROJECT BY LABOUR		
	THE HAT CREEK PROJECT - Detailed Environmental Studies		

<u>Year</u>	<u>Induced Employment Local Area</u>	<u>Indirect and Induced Employment Kamloops</u>	<u>Total</u>
1	20	5	25
2	55	15	70
3	160	80	240
4	265	115	380
5	420	175	595
6	480	205	685
7	490	220	710
8	465	205	670
9	465	205	640
10	470	225	695
11	460	225	685
12	465	225	690
13	470	225	695
23	490	235	725
33	490	225	715
43	485	225	710

Prepared by: Strong Hall and Associates Ltd. 1/.

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INDIRECT AND INDUCED EMPLOYMENT IN THE
REGION, ASSOCIATED WITH THE HAT CREEK PROJECT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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PART FOUR

<u>Year</u>	<u>Local Area Residents</u>	<u>Total Region Residents</u>	<u>Total Employment</u>
1	5	-	25
2	15	25	70
3	50	100	240
4	80	150	380
5	125	230	595
6	145	270	685
7	145	275	710
8	140	265	670
9	140	265	640
10	140	275	695
11	140	275	685
12	140	275	690
13	140	275	695
23	145	285	725
33	145	290	715
43	145	280	710

Prepared by: Strong Hall & Associates Ltd. 1/.

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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants

LOCAL PARTICIPATION IN INDIRECT
AND INDUCED EMPLOYMENT POSITIONS
CREATED IN THE LOCAL STUDY AREA

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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PART FOUR

<u>Year</u>	<u>In-Migrants to Communities and Rural Areas</u>	<u>Construction Camp Residents</u>	<u>Total In-Migrants</u>
1	70	165	235
2	285	470	755
3	1,085	675	1,760
4	1,755	1,660	3,415
5	2,940	2,290	5,230
6	3,445	2,315	5,760
7	3,700	1,655	5,355
8	3,435	1,065	4,500
9	3,470	485	3,955
10	3,835	300	4,135
11	3,785	30	3,815
12	3,840	30	3,870
13	3,870	30	3,900
23	4,010	-	4,010
33	3,885	-	3,885
43	3,860	-	3,860

Prepared by: Strong Hall & Associates Ltd. 1/.

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DOMICILE OF IN-MIGRANT POPULATION
ASSOCIATED WITH THE HAT CREEK PROJECT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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PART FOUR

<u>Year</u>	<u>Without the Project</u>	<u>With the Project*</u>	<u>Project Associated Increment**</u>
1976	7500	7500	-
1977	7615	7615	-
1978	7615	7850	235
1979	8080	8835	755
1980	8080	9840	1760
1981	8990	12405	3415
1982	8990	14220	5230
1983	8990	14750	5760
1984	8990	14345	5355
1985	9370	13870	4500
1986	9370	13325	3955
1987	9665	13800	4135
1988	9665	13480	3815
1989	9665	13535	3870
1990	9960	13860	3900
2000	-	-	4010
2010	-	-	3885
2020	-	-	3860

* Based on assumed construction start in 1978.

** Includes construction camp population

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POPULATION GROWTH IN THE LOCAL STUDY AREA
WITH AND WITHOUT THE PROJECT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.4-8

PART FOUR

Year	CLINTON		ASHCROFT			CACHE CREEK		
	Without Project	With Project	Without Project	With Project Scenario #1	With Project Scenario #2	Without Project	With Project Scenario #1	With Project Scenario #2
1*	810	820	2,100	2,140	2,115	1,095	1,110	1,135
2	810	855	2,455	2,615	2,520	1,205	1,270	1,365
3	810	975	2,455	3,060	2,715	1,205	1,465	1,810
4	1,155	1,420	2,455	3,435	2,875	1,205	1,625	2,185
5	1,155	1,595	2,455	4,100	3,160	1,205	1,910	2,850
6	1,155	1,670	2,455	4,385	3,285	1,205	2,035	3,135
7	1,155	1,710	2,455	4,645	3,395	1,205	2,145	3,395
8	1,155	1,670	2,685	4,610	3,510	1,355	2,180	3,280
9	1,155	1,675	2,685	4,630	3,520	1,355	2,185	3,300
10	1,155	1,730	2,860	5,010	3,780	1,475	2,395	3,625
11	1,155	1,725	2,860	4,980	3,765	1,475	2,380	3,595
12	1,155	1,730	2,860	5,015	3,780	1,475	2,395	3,630
13	1,155	1,735	3,035	5,200	3,965	1,595	2,525	3,760

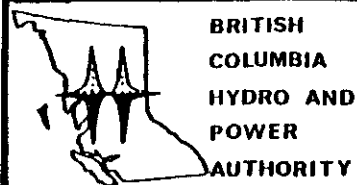
Scenario #1 - Split of Ashcroft/Cache Creek Incremental population - 70% Ashcroft, 30% Cache Creek

Scenario #2 - Split of Ashcroft/Cache Creek Incremental population - 30% Ashcroft, 70% Cache Creek

* Year 1 assumed to be 1978.

Prepared by: Strong Hall & Associates Ltd. I/.

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PROJECTED POPULATION OF COMMUNITIES WITH THE HAT CREEK PROJECT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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PART FOUR

(CONSTRUCTION PHASE)
(\$ million 1976)

<u>Regional Residents</u>	<u>Regional In-Migrants</u>	<u>REGIONAL</u>		<u>Local Area Residents</u>	<u>LOCAL AREA</u>		<u>Total Direct Net Local Area Income Gain</u>
		<u>In-Migrant Camp Resident Spending *</u>	<u>Total Direct Net Regional Income Gain</u>		<u>Local Area In-Migrants</u>	<u>In-Migrant Camp Resident Spending</u>	
\$ 132.6	\$ 96.0	\$ 10.4	\$ 239.0	\$ 13.0	\$ 154.0	\$ 22.4	\$ 189.4

* Assumed to average 10 percent of annual wage and salary receipts

Source: Strong Hall & Associates Ltd. 1/.



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TOTAL DIRECT NET INCOME GAINS GENERATED BY THE HAT CREEK PROJECT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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PART FOUR

(CONSTRUCTION PHASE)

(\$ million 1976)

<u>REGIONAL</u>				<u>LOCAL AREA</u>			
<u>Direct</u> <u>Income</u>	<u>Indirect</u> <u>Income</u>	<u>Induced</u> <u>Income</u>	<u>Total Net</u> <u>Regional</u> <u>Income Gain</u>	<u>Direct</u> <u>Income</u>	<u>Indirect</u> <u>Income</u>	<u>Induced</u> <u>Income</u>	<u>Total Net</u> <u>Local Area</u> <u>Income Gain</u>
\$ 239.0	\$ 4.8	\$ 122.1	\$ 365.9	\$ 189.4	-	\$ 46.9	\$ 236.3

Prepared by: Strong Hall & Associates Ltd. 1/.



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TOTAL NET INCOME GAINS
FROM THE HAT CREEK PROJECT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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PART FOUR

Year	SCENARIO 1				SCENARIO 2			
	Without Project		With Project		Without Project		With Project	
	Projected Population	Annual Incremental Households	Projected Population	Annual Incremental Households	Projected Population	Annual Incremental Households	Projected Population	Annual Incremental Households
1*	2,100	-	2,140	-	2,100	-	2,115	-
2	2,455	105	2,615	140	2,455	105	2,520	120
3	2,455	-	3,060	130	2,455	-	2,715	55
4	2,455	-	3,435	110	2,455	-	2,875	45
5	2,455	-	4,100	195	2,455	-	3,160	85
6	2,455	-	4,385	85	2,455	-	3,285	35
7	2,455	-	4,645	75	2,455	-	3,395	35
8	2,685	70	4,610	-	2,455	70	3,510	35
9	2,685	-	4,630	-	2,685	-	3,515	-
10	2,860	50	5,010	110	2,860	50	3,780	80
11	2,860	-	4,980	-	2,860	-	3,765	-
12	2,860	-	5,015	-	2,860	-	3,780	-
13	3,035	50	5,200	55	3,035	50	3,965	55
	TOTAL	275		900		275		545

* Year 1 assumed to be 1978.

Prepared by: Strong Hall & Associates Ltd. 1/.

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PROJECTED INCREASE IN HOUSING UNITS FOR ASHCROFT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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PART FOUR

Year	CACHE CREEK								CLINTON			
	SCENARIO 1				SCENARIO 2				Without Project		With Project	
	Without Project		With Project		Without Project		With Project		Without Project		With Project	
	Projected Population	Annual Incremental Households	Projected Population	Annual Incremental Households	Projected Population	Annual Incremental Households	Projected Population	Annual Incremental Households	Projected Population	Annual Incremental Households	Projected Population	Annual Incremental Households
1 *	1,095	-	1,110	-	1,095	-	1,135	-	810	-	820	-
2	1,205	35	1,270	50	1,205	35	1,365	70	810	-	855	10
3	1,205	-	1,465	55	1,205	-	1,810	130	810	-	975	35
4	1,205	-	1,625	45	1,205	-	2,185	110	1,155	100	1,420	130
5	1,205	-	1,910	85	1,205	-	2,850	195	1,155	-	1,595	50
6	1,205	-	2,035	35	1,205	-	3,135	85	1,155	-	1,670	25
7	1,205	-	2,145	35	1,205	-	3,395	75	1,155	-	1,710	10
8	1,355	45	2,180	10	1,355	45	3,280	-	1,155	-	1,670	-
9	1,355	-	2,185	-	1,355	-	3,300	-	1,155	-	1,675	-
10	1,475	35	2,395	65	1,475	35	3,625	70	1,155	-	1,730	10
11	1,475	-	2,380	-	1,475	-	3,595	-	1,155	-	1,725	-
12	1,475	-	2,395	-	1,475	-	3,630	-	1,155	-	1,730	-
13	1,595	35	2,525	35	1,595	35	3,760	40	1,155	-	1,735	-
	<u>TOTAL</u>	<u>150</u>		<u>415</u>		<u>150</u>		<u>775</u>		<u>100</u>		<u>100</u>

* Year 1 assumed to be 1978
Source: Strong Hall & Associates Ltd. 1/.

Housing Type	VILLAGE OF ASHCROFT			VILLAGE OF CACHE CREEK			VILLAGE OF CLINTON	
	Percentage Distribution	Number of Units Scenario 1	Number of Units Scenario 2	Percentage Distribution	Number of Units Scenario 1	Number of Units Scenario 2	Percentage Distribution	No. of Units
Single and two family	57%	515	310	57%	235	440	70%	190
Townhouses, Rowhouses	5	45	25	5	20	40	-	-
Apartments	15	135	85	15	65	115	5	15
Mobile Homes	23	205	125	23	95	180	25	65
TOTAL:	100%	900	545	100%	415	775	100%	270

Source: Strong Hall & Associates Ltd. 1/.



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PROJECTED DISTRIBUTION OF NEW HOUSEHOLDS TO 1990

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.4-14

PART FOUR

NUMBER OF PASSENGER VEHICLES *

Year	Regular Weekdays (8:00 AM & 4:00 PM) (12:00 PM)		Monday & Thursday 8:00 AM Wednesday 4:00 PM		Friday 4:00 PM		Sunday Night			
	#12**	H.A.**	#12	H.A.	#12	H.A.	#12	H.A.		
1	25	-	-	-	65	-	70	-	10	-
2	60	-	-	-	165	-	190	-	25	-
3	30	85	5	10	65	195	75	225	10	45
4	40	125	5	10	105	320	145	430	35	130
5	65	195	5	15	165	500	210	635	40	160
6	75	225	10	25	175	520	220	665	45	175
7	80	240	10	30	150	450	185	550	35	140
8	80	245	15	40	130	390	150	450	30	125
9	75	225	15	45	100	295	105	320	20	75
10	75	225	20	60	90	275	95	285	20	80
11	75	220	20	65	75	230	75	230	20	75
12	75	225	20	65	75	230	75	230	20	75
13	75	225	20	65	75	230	75	230	20	80
23	75	225	25	75	75	230	75	225	20	80
33	70	205	30	90	70	205	70	205	25	95
43	65	195	30	95	65	195	65	195	25	100

* Assumes an average of 3.0 persons per vehicle.

** Assumes 80 percent of commuting will be on Hydro access road and 20 percent on Highway No. 12.

Source: Strong Hall & Associates Ltd. 1/.

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NUMBER OF HAT CREEK RELATED PASSENGER AUTOMOBILES
TRAVELLING HIGHWAY 12 AND PROPOSED PROJECT ACCESS ROAD AT SELECTED TIMES

THE HAT CREEK PROJECT - Detailed Environmental Studies

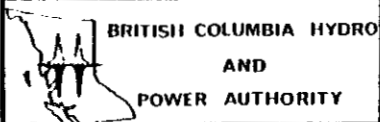
TABLE
3.4-15

PART FOUR

	SCENARIO 1 YEAR							SCENARIO 2 YEAR						
	1*	3	5	7	9	11	13	1*	3	5	7	9	11	13
Estimated Population	1,110	1,465	1,910	2,145	2,185	2,380	2,525	1,135	1,810	2,850	3,395	3,300	3,595	3,760
Projected Expenditures (\$)	250,000	319,500	390,000	429,500	438,000	476,500	545,500	265,500	421,500	652,000	725,000	719,500	757,500	792,000
Projected Non-Property Tax Revenues (\$)	117,000	172,000	221,000	243,500	240,500	268,000	278,000	119,000	223,500	359,000	396,500	358,500	396,000	411,000
Projected Revenue Requirements From Property Tax (\$)	133,000	147,500	169,000	186,000	198,000	208,500	267,500	146,500	198,000	293,000	328,500	361,000	361,500	381,000
Projected Taxable Assessments (\$)	4,406,500	5,684,000	7,162,500	7,915,000	8,248,500	8,592,000	9,027,000	4,500,500	6,833,000	9,918,000	11,203,500	11,000,000	11,684,000	12,072,000
Projected Tax (Mill) Rate	30.2	26.0	23.6	23.5	24.0	24.3	29.6	32.6	29.0	29.5	29.3	32.8	30.9	31.7

* Year 1 assumed to be 1978.

Prepared by: Strong Hall and Associates Ltd. 1/.



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CALCULATION OF TAX RATE WITH THE PROJECT FOR CACHE CREEK Rev. 1 Feb. 1979.

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.4-17

PART FOUR

Year *	1	3	5	7	9	11	13
Estimated Population	820	975	1,595	1,710	1,675	1,725	1,735
Projected Expenditures (\$)	120,000	142,000	254,000	272,500	268,500	274,000	275,000
Projected Non-Property Tax Revenues (\$)	91,500	108,500	184,500	187,000	185,000	187,500	192,000
Projected Revenue Requirements From Property Tax (\$)	28,500	33,500	69,500	85,500	83,500	84,500	83,000
Projected Taxable Assessments (\$)	1,845,000	2,194,000	3,588,000	3,847,500	3,769,000	881,000	904,000
Projected Tax (Mill) Rate	15.4	15.3	19.4	22.2	22.2	21.8	21.3

* Year 1 assumed to be 1978.
 Prepared by: Strong Hall & Associates Ltd. 1/.

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CALCULATION OF TAX RATE WITH THE PROJECT FOR CLINTON

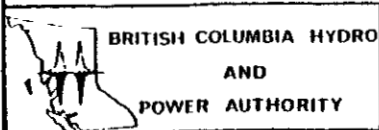
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
 3.4-18

PART FOUR

		1	2	3	4	5	6	7	8	9	10	11	12	13
PHASE	STUDY PHASE	INITIAL SOCIAL IMPACT PHASE	MAJOR SOCIAL IMPACT AND ADJUSTMENT PHASE	SOCIAL TRANSITION PHASE	SETTLING PHASE									
SOCIAL IMPACTS	<ul style="list-style-type: none"> minor changes to social and physical environment of Hat Creek Valley anticipation of resident and community awareness of project speculation and changing land ownership 	<ul style="list-style-type: none"> initial impacts of construction activities on quality of life in the valley initial project population demands on commercial and social services in communities atmosphere of growth and excitement construction in communities - housing, schools, recreation facilities project activities obvious to residents of study area possibly some opposition to project employment opportunities sought social patterns begin to be disrupted 	<ul style="list-style-type: none"> impact of construction activities and large workforce in valley on ranchers major impact of construction workforce on communities single men influence social patterns more spending power major demand for all services - education and housing especially some lag in supply social patterns and atmosphere of communities changed social problems relating to influx of project population would be evident - residents complain more choice of services and goods in study area traffic congestion, deterioration of roads residents concerned about changing quality of their environment stress on municipal organizations 	<ul style="list-style-type: none"> valley residents deal with impacts of operation of mine and generating station, and clearing of camps; natural setting of valley altered impact on communities of phasing out of construction workforce and activities traffic congestion lessens demand for services stabilizes - some lessen, some change housing demand stabilizing new social patterns develop new community leaders evolve 	<ul style="list-style-type: none"> operational aspects of plant in valley stabilize - coal and waste pits grow larger balance of supply and demand for services in communities employment situation stabilizes social patterns established families dominant social structure again new community images emerge 									

Prepared by: Strong Hall & Associates Ltd. 1/.



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DEVELOPMENT OF THE SOCIAL ENVIRONMENT: IMPACTS OF THE PROJECT Rev. 1 Feb. 1979.

THE HAT CREEK PROJECT - Detailed Environmental Studies

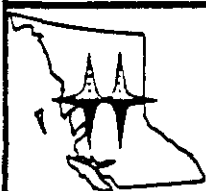
TABLE
3.4-19

PART FOUR

<u>Activity Affected</u>	<u>Amount</u>	<u>Quality</u>	<u>Impact Significance</u>
Hunting	840	Undetermined	-
Fishing	1490	Undetermined	High
Backroad Travel	150	Fair	Moderate
Other	50	Undetermined	-
Sightseeing*	NA	Good	-

*Sightseeing is expected to increase because of the project.

Prepared by: ESCLEC and bhi 17/.



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ESTIMATED ANNUAL RECREATION ACTIVITY DAYS
DISPLACED DURING CONSTRUCTION PHASE FOR
AREAS A AND B, 1978-1987

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.4-20

PART FOUR

Type of Correction*	Description	Amount of Correction To Be Added to Project YDNL or L _{dn} in dB
Seasonal Correction Correction for Outdoor Residual Noise	Summer (or year-round operation).	0
	Winter only (or windows always closed).	-5
	Quiet suburban or rural community (remote from large cities and from industrial activity and trucking).	+10
	Normal suburban community (not located near industrial activity).	+5
	Urban residential community (not immediately adjacent to heavily travelled roads and industrial areas).	0
	Noisy urban residential community (near relatively busy roads or industrial areas).	-5
	Very noisy urban residential community.	-10
Correction for Previous Exposure and Community Attitudes	No prior experience with the intruding noise.	+5
	Community has had some previous exposure to intruding noise but little effort is being made to control the noise. This correction may also be applied in a situation where the community has not been exposed to the noise previously, but the people are aware that bona fide efforts are being made to control the noise.	0
	Community has had considerable previous exposure to the intruding noise and the noise maker's relations with the community are good.	-5
	Community aware that operation causing noise is very necessary and it will not continue indefinitely. This correction can be applied for an operation of limited duration and under emergency circumstances.	-10
Pure Tone or Impulse	No pure tone or impulsive character.	0
	Pure Tone or impulsive character present.	+5

* To be added to YDNL of intruding project noise to obtain normalized YDNL.

Prepared by: Harford, Kennedy, Wakefield Ltd. 1/.

Rev. 1 Feb. 1979.



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NOISE SOURCE
COMMUNITY SENSITIVITY CORRECTIONS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.5-1

PART FOUR

DAY-NIGHT AVERAGE SOUND LEVEL IN DECIBELS				
LAND USE	50	60	70	80
Transient Lodging				
Office Buildings, Personal, Business and Professional				
Commercial-Retail, Movie Theatres, Restaurants				
Commercial-Wholesale, Some Retail, Ind., Mfg., Utilities				
Livestock Farming, Animal Breeding				
Agriculture (Except Livestock), Mining, Fishing				
Public Right-of-way				

COMPATIBLE



MARGINALLY COMPATIBLE



Prepared by: Harford, Kennedy, Wakefield, Ltd. 1/.

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LAND USE COMPATIBILITY WITH DAY-NIGHT
AVERAGE SOUND LEVEL (YDNL OR L_{dn}) FOR
BUILDINGS AS COMMONLY CONSTRUCTED.

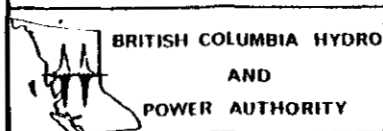
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.5-2

PART FOUR

JURISDICTION OF NOISE LEVEL CRITERION	NOISE LEVEL CRITERION	COMMENTS	REFERENCE
1. Severe Health Effects in Humans	$L_{eq}(24)70$	To protect against hearing loss and various stress-related diseases over a working lifetime.	<u>2/</u>
2. Residential Land-Use Incompatibility	YDNL 55	To protect against negative effects on public health and welfare: interference with activities, e.g., speech communication and sleep.	<u>2/</u>
3. Annoyance and Public Reaction Thresholds	YDNL of intruding Noise 10dB below existing YDNL, or normalized YDNL of intruding Noise 5 dB below Existing YDNL.	No public reaction if meet either criterion. If don't, public reaction increases with normalized YDNL.	<u>2/</u>
4. Grazing Land-Use Incompatibility	YDNL 65	To provide suitable environment for stock raising.	<u>4/</u>
5. Agricultural Land-Use Incompatibility	$L_{eq}(24)70$	As in 1.	<u>2/</u>
6. Unpopulated Areas (Recreation)	Natural Sound Levels (YDNL 30 to 40)	No single criterion available, but any identifiable noise intrusion considered environmental degradation.	<u>2/</u>
7. Very Infrequent Intermittent Noises (Nighttime) 5 to 30 sec. duration	With-Project YDNL plus 20 dBA to maximum of 75 dBA	Outdoor, a weighted level; Threshold of significant sleep disturbance.	<u>3/</u>
8. Public Address and Signal Systems (Frequent use)	Essential Inaudibility above background noise of continuous project activities	Outdoors at nearest residence, present or future.	-
9. Impulsive noise (Blasting and Circuit Breakers)	140 dB peak linear	Outdoors at project property line or nearest unprotected receptor on site.	<u>5/</u>

Prepared by: Harford, Kennedy, Wakefield, Ltd. 1/.



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SUMMARY OF NOISE LEVEL CRITERIA

Rev. 1 Feb. 1979.

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.5-3

PART FOUR

RESIDENTIAL AREA	PROJECT NOISE SOURCE(S)	SENSITIVITY CORRECTIONS FOR				TOTAL CORRECTION
		SEASONAL NOISE DURATION	OUTDOOR NOISE LEVEL W/OUT PROJ.	PREVIOUS EXPOSURE + COMMUNITY ATTITUDES	PURE TONE OR IMPULSE	
Bonaparte Reserve 1	Mine and Plant Construction and Mine Operation	0	+5	+5	0	+10
	Plant Operation	0	+5	+5	+5	+15
Upper Hat Creek Valley Ranch Houses	Mine & Plant Construction & Mine Operation	0	+10	+5	0	+15
	Plant Operation	0	+10	+5	+5	+20
Thompson - Bonaparte Confluence	River Bottom Preparation	0	0	-5 +5 = 0	0	0
	Water Intake Construction	0	0	-5 +5 = 0	+5	+5
	Pumping Station Construction	0	0	-5 +5 = 0	0	0
	Pumping Station Operation	0	0	+5	+5	+10
North Ashcroft Subdivision	Water Pipeline Construction	0	+5	-5 +5 = 0	0	+5
	Offloading Facility Operation (Trucking)	0	0 to +5	0	0	0 to +5
Along Highway 1 Western Semlin Valley	Airstrip Construction and Operation	0	-5	+5	0	0

Prepared by: Harford, Kennedy, Wakefield, Ltd. 1/.



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COMMUNITY NOISE SENSITIVITY CORRECTIONS (dB(A)) FOR VARIOUS RESIDENTIAL AREAS


THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
3.5-4

PART FOUR

RANCH HOUSE	OCCUPANT	DISTANCE FROM HIGHWAY 12 JUNCTION m	EXISTING YDNL	PROJECT YDNL	COMBINED YDNL	NORMALIZED PROJECT YDNL (+15 dB)	EXPECTED RESIDENT REACTION
1	Ed Lehman	3,650	35 - 40	46	46 - 47	61	Sporadic complaints to widespread complaints
2	M. Saulte	4,900	35 - 40	41	42 - 43.5	56	No reaction to sporadic complaints
3	Ike Lehman	4,900	35 - 40	41	42 - 43.5	56	No reaction to sporadic complaints
4	A. Parke	8,540	35 - 40	32	37 - 40.5	47	No reaction
5	D. Ridlar (Baldwin)	9,760	35 - 40	30	36 - 40	45	No reaction


Prepared by: Harford, Kennedy, Wakefield, Ltd. 1/.

	BRITISH COLUMBIA HYDRO AND POWER AUTHORITY	EBASCO SERVICES OF CANADA LIMITED; Environmental Consultants	TABLE 3.5-5 PART FOUR
		NOISE LEVELS AT HAT CREEK VALLEY RANCH HOUSES IN FIRST YEAR OF PROJECT (1978-1979) AND EXPECTED REACTIONS OF RESIDENTS	
		THE HAT CREEK PROJECT - Detailed Environmental Studies	

Contaminant	Averaging Period	Food Processing, Agriculturally Orientated & Misc. Industries of British Columbia* ($\mu\text{g}/\text{m}^3$)	Mining, Mine-Milling, Smelting & Assoc. Industries** ($\mu\text{g}/\text{m}^3$)	Epidemiological Studies*** ($\mu\text{g}/\text{m}^3$)	PCB Brief**** ($\mu\text{g}/\text{m}^3$)	Assumed in This Report ($\mu\text{g}/\text{m}^3$)
Sulphur Dioxide	1 hour	450	799	-	-	-
	3 hours	-	-	-	655	655
	24 hours	160	266	300-400	266	260
	1 year	25	53	90-100	53	25
Total Suspended Particulates	24 hours	150	150	150-300	150	150
	1 year*****	60	60	60-100	60	60
Carbon Monoxide	1 hour	14,300	-	40,000-60,000	40,000-60,000	14,300
	8 hours	5,500	-	15,000-20,000	15,000-20,000	5,500
Fluoride (Gaseous)	7 days	-	1.0	-	-	1.0
	1 year	-	0.5	-	-	0.5
Lead (Particulate)	24 hours	4.0	4.0	-	-	4.0
	1 year*****	2.0	2.0	-	-	2.0
Zinc (Particulate)	24 hours	5.0	5.0	-	-	5.0
	1 year*****	3.0	3.0	-	-	3.0
Cadmium (Particulate)	24 hours	-	0.1	-	-	0.1
	1 year*****	-	0.05	-	-	0.05
Mercury	1 month	-	1.0	-	-	1.0
Arsenic	24 hours	-	1.0	-	-	1.0
	1 year*****	-	0.2	-	-	0.2

Sources:

- *Level A Guidelines From Table 3 of "Pollution Control Objective for Food-Processing, Agriculturally Oriented, and Other Miscellaneous Industries of British Columbia", 1975^{2/}.
- **Level A Values From Appendix I of "Pollution Control Objectives for The Mining, Mine-Milling, and Smelting Industries of British Columbia", 1973^{3/}.
- ***Western Research and Development Ltd and Greenfield, Attawap, and Tyler, Inc. 1/.
- ****Brief submitted by B.C. Hydro to the Pollution Control Branch Public Inquiry to Review "Pollution Control Objectives for the Mining, Mine-Milling and Smelting Industries of British Columbia", January, 1978 4/.
- *****Annual Geometric Mean.

 BRITISH COLUMBIA HYDRO AND POWER AUTHORITY	EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants	TABLE 4.1-1 PART FOUR
	COMPARISON OF AMBIENT AIR QUALITY GUIDELINES Rev. 1 Feb. 1979.	
	THE HAT CREEK PROJECT - Detailed Environmental Studies	

Contaminant	Symbol	Emission Rate (kg per day)		
		Particulate	Gaseous	Total
Sulphur Dioxide	SO ₂		324,768	324,768
Nitrogen Oxide	NO		82,489*	82,489*
Nitrogen Dioxide	NO ₂		124,759*	124,759*
Total Particulates	TSP	40,000**		40,000**
Carbon Monoxide	CO		18,043***	18,043***
Total Hydrocarbons	HC		5,413****	5,413****
Arsenic	As	7.13****	11.9****	19.0****
Beryllium	Be	0.55****	0.11****	0.66****
Cadmium	Cd	0.195****		0.195****
Chromium	Cr	2.29****		2.29****
Copper	Cu	0.094****		0.094****
Fluorine	F	25.7*****	265*****	290.7*****
Lead	Pb	2.59*****	4.95*****	7.54*****
Manganese	Mn	4.4*****		4.4*****
Mercury	Hg	2.28*****	3.67*****	5.95*****
Nickel	Ni	3.14*****		3.14*****
Selenium	Se	0.0337*****	0.132	0.1657
Uranium	U		no emission	
Vanadium	V	0.12		0.12
Zinc	Zn	3.0		3.0
Sulphate	SO ₄		no emission	
Nitrate	NO ₃		no emission	
Polycyclic Organic Matter	POM		no emission	
Nitrosamines	NNA		no emission	

* Emission calculated on the basis of 600 ppm NO_x in the stack with equal parts of NO and NO₂.

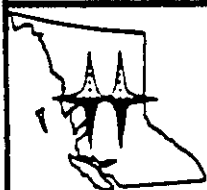
** Emission calculated on the basis of a maximum of 0.1 grains per standard cubic foot with the use of electrostatic precipitators.

*** Emission calculated on the basis of 0.45 kg CO per ton of coal.

**** Emission calculated on the basis of 0.14 kg HC per ton of coal.

***** Calculated from test burn sample analysis and coal consumption of 42,630 metric tons per day (see Appendix F to the Air Quality & Climatic Effects Report 6/).

Prepared by: Environmental Research & Technology, Inc. 7 / .



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ESTIMATED BASE-LOAD EMISSION PARAMETERS FOR
THE PROPOSED HAT CREEK GENERATING PLANT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.1-2

PART FOUR

<u>Contaminant</u>	<u>Averaging Time (Arithmetic Means)</u>	<u>Maximum Average Concentration ($\mu\text{g}/\text{m}^3$)</u>
Sulphur Dioxide	3-hours	366
	24-hours	208
	1-year	4.5
Total Suspended Particulates	24-hours	26*
	1-year	1.2*
Carbon Monoxide	1-hour	88.2
	8-hours	31.4
Fluoride (Gaseous)	24-hours	0.4
	1-year	0.008
Lead (Particulate)	24-hours	0.004
	1-year	0.00008
Zinc (Particulate)	24-hours	0.004
	1-year	0.00009
Cadmium (Particulate)	24-hours	0.0003
	1-year	0.000006
Mercury	24-hours	0.008
	1-year	0.0002
Arsenic	24-hours	0.03
	1-year	0.0006

* Concentrations above assumed background levels of 10-20 $\mu\text{g}/\text{m}^3$.

Source: Environmental Research & Technology, Inc. 7 /.

Rev. 1 Feb. 1979.



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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants
PREDICTED MAXIMUM AVERAGE GROUND-LEVEL
CONCENTRATIONS DUE TO THE HAT CREEK GENERATING
STATION WITH FGD AND A 366 m STACK
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.1-3

PART FOUR

<u>Percent of Full Load</u>	<u>Stack Gas Exit Temperature (°C)</u>	<u>Flue Gas Flow Rate (m³/min)</u>	<u>SO₂ Emissions Rate (kg/hr)</u>	<u>Adjustment Factor*</u>
80	139	212,090	10,953	0.81
70	134	186,240	9,624	0.71
60	129	163,570	8,293	0.62
50	127	129,110	7,173	0.53
40	121	108,480	5,720	0.42

- Adjustment factor may be multiplied by emission rates in Table IV-A-2 to estimate partial load emissions for other contaminants.

Prepared by: Environmental Research & Technology, Inc. 7/. Rev. 1 Feb. 1979.



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STACK GAS PARAMETERS AND SULPHUR DIOXIDE EMISSIONS
FOR SELECTED PARTIAL-LOAD CONDITIONS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.1-4


PART FOUR

<u>Contaminant</u>	<u>Averaging Time (Arithmetic Means)</u>	<u>Maximum Average Concentration ($\mu\text{g}/\text{m}^3$)</u>
Sulphur Dioxide	3-hours	647
	24-hours	260
	1-year	7.0
Total Suspended Particulates	24-hours	32*
	1-year	0.9*
Carbon Monoxide	1-hour	91.3
	8-hours	17.9
Fluoride (Gaseous)	24-hours	0.33
	1-year	0.006
Lead (Particulate)	24-hours	0.003
	1-year	0.00007
Zinc (Particulate)	24-hours	0.004
	1-year	0.00007
Cadmium (Particulate)	24-hours	0.0002
	1-year	0.000004
Mercury	24-hours	0.0075
	1-year	0.00015
Arsenic	24-hours	0.024
	1-year	0.0005

* Concentrations above assumed background levels of 10-20 $\mu\text{g}/\text{m}^3$.

Source: Environmental Research & Technology, Inc. 7 /.

Rev. 1 Feb. 1979.

	BRITISH	EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants	TABLE 4.1-5 PART FOUR
	COLUMBIA	PREDICTED MAXIMUM AVERAGE GROUND-LEVEL	
	HYDRO AND POWER AUTHORITY	CONCENTRATIONS DUE TO THE HAT CREEK GENERATING STATION WITH A MCS & A 366 m STACK	
		THE HAT CREEK PROJECT - Detailed Environmental Studies	

<u>Contaminant</u>	<u>Averaging Time (Arithmetic Means)</u>	<u>Maximum Average Concentration ($\mu\text{g}/\text{m}^3$)</u>
Sulphur Dioxide	3-hours	622
	24-hours	260
	1-year	9.3
Total Suspended Particulates	24-hours	32*
	1-year	1.1*
Carbon Monoxide	1-hour	96.1
	8-hours	18.6
Fluoride (Gaseous)	24-hours	0.42
	1-year	0.0075
Lead (Particulate)	24-hours	0.0042
	1-year	0.000085
Zinc (Particulate)	24-hours	0.005
	1-year	0.00009
Cadmium (Particulate)	24-hours	0.00025
	1-year	0.000005
Mercury	24-hours	0.01
	1-year	0.00017
Arsenic	24-hours	0.03
	1-year	0.0005

* Concentrations above assumed background levels of 10-20 $\mu\text{g}/\text{m}^3$.

Source: Environmental Research & Technology, Inc. 7/.

Rev. 1 Feb. 1979.



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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants
PREDICTED MAXIMUM AVERAGE GROUND-LEVEL
CONCENTRATIONS DUE TO THE HAT CREEK GENERATING
STATION WITH A MCS & A 244 m STACK
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.1-6
PART FOUR

Contaminant	Units	1 hr	8 hr	24 hr	Annual
Sulphur Dioxide	$\mu\text{g}/\text{m}^3$	n.r.*	n.r.	300-400	90-100
Total Suspended Particulates	$\mu\text{g}/\text{m}^3$	n.r.	n.r.	150-300	60-100
Nitrogen Oxides as NO ₂	$\mu\text{g}/\text{m}^3$	n.r.	n.r.	n.r.	100-200
Carbon Monoxide	$\mu\text{g}/\text{m}^3$	40-60	15-20	n.r.	n.r.
Oxidants as O ₃	$\mu\text{g}/\text{m}^3$	150-300	n.r.	n.r.	n.r.

*No recommendation.

Source: Simmons 12/



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HEALTH RELATED RECOMMENDATIONS FOR AMBIENT AIR QUALITY GUIDELINES

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.1-7

PART FOUR

Trace Element	Mean Maximum Concentrations Measured in Hat Creek Receptors (ppm)			Projected Annual Soil Enrichment							
	Soil	Grass	Shrub	Stack Emissions** (mg/kg)				Cooling Tower Emissions*** (mg/kg)			
				A	B	C	D	4700	2240	560	112
Arsenic (As)	76.8 (42.1)	7.0 (0.0)	5.6 (1.9)	1.4×10^{-4}	9.0×10^{-5}	2.7×10^{-5}	2.9×10^{-6}	3.0×10^{-2}	1.0×10^{-2}	4.0×10^{-3}	7.0×10^{-4}
Cadmium (Cd)	10.3 (5.5)	0.54 (0.3)	1.34 (0.7)	2.3×10^{-6}	1.3×10^{-6}	4.3×10^{-7}	4.3×10^{-8}	3.0×10^{-3}	1.0×10^{-3}	4.0×10^{-3}	7.0×10^{-5}
Chromium (Cr)	247.07 (68.98)	5.5 (1.1)	4.4 (1.29)	3.5×10^{-5}	2.7×10^{-5}	8.6×10^{-6}	8.6×10^{-7}	1.0×10^{-3}	5.0×10^{-4}	1.0×10^{-4}	2.0×10^{-5}
Copper (Cu)	47.13 (11.03)	10.18 (3.4)	35.43 (17.76)	4.0×10^{-5}	2.3×10^{-3}	8.6×10^{-6}	8.6×10^{-7}	6.0×10^{-3}	3.0×10^{-3}	7.0×10^{-4}	1.0×10^{-4}
Fluorine (F)	528.4 (377.6)	1448.25 (1110.1)	254.73 (81.66)	1.8×10^{-3}	1.4×10^{-3}	4.0×10^{-4}	4.0×10^{-5}	6.0×10^{-2}	3.0×10^{-2}	7.0×10^{-3}	1.0×10^{-3}
Lead (Pb)	7.3 (0.76)	7.8 (3.3)	5.33 (1.01)	3.1×10^{-5}	1.9×10^{-5}	4.3×10^{-6}	4.3×10^{-7}	3.0×10^{-2}	1.0×10^{-2}	4.0×10^{-3}	7.0×10^{-4}
Mercury (Hg)	0.18 (0.1)	1.32 (1.7)	0.31 (0.1)	4.6×10^{-5}	3.1×10^{-5}	8.6×10^{-6}	8.6×10^{-7}	6.0×10^{-4}	3.0×10^{-4}	7.0×10^{-5}	1.0×10^{-5}
Vanadium (V)	297.60 (51.56)	0.75 (0.20)	0.38 (0.2)	9.0×10^{-5}	4.6×10^{-5}	2.3×10^{-5}	2.9×10^{-6}	4.0×10^{-3}	2.0×10^{-3}	5.0×10^{-4}	9.0×10^{-5}
Zinc (Zn)	147.13 (31.06)	33.5 (7.4)	221.8 (33.94)	9.0×10^{-5}	4.6×10^{-5}	1.7×10^{-5}	1.4×10^{-6}	2.0×10^{-2}	9.0×10^{-3}	2.0×10^{-3}	5.0×10^{-4}

*Includes all sites within a particular sampling period. Numbers in parentheses are standard deviation. Grass sample was composed predominantly of *Agropyron spicatum*. *Carex sp.* was substituted in one sample. Shrub sample was composed of *Salix sp.*

**Values presented for A, B, C, D represent isopleth codes as presented in Figure F7-1. 6/. These values are for a 366 m stack height with no AQCS.

***Values presented correspond to salt deposition zones presented in Figure F7-2. 6/.

Source: Environmental Research and Technology, Inc. 6/.

Exposure Period
(hr)

Threshold Concentration
($\mu\text{g}/\text{m}^3$)

	<u>(U.S. EPA, 1973)⁵²</u>	<u>(Linzon, 1973)⁵³</u>	<u>(Jones, et al, 1974)⁵⁴</u>	<u>(Jacobsen, 1977)⁴⁶</u>
1	1300 - 7860	1834	1300 - 2620	2000
2	655 - 5240	1048	-	1050
3	400 - 3750*	785*	786 - 1572	850
4	262 - 2620	681	-	750
8	131 - 1310	472	-	500

* Interpolated value



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ESTIMATED THRESHOLD SO₂ CONCENTRATIONS FOR VISIBLE INJURY TO
SENSITIVE PLANT SPECIES Rev. 1 Feb. 1979.

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Plant Species	SO ₂ Concentration (µg/m ³)	Exposure Time	Sensitivity Rating or Response	Reference
<u>Salix</u> sp. (Willow)	1074	1 hr.	10% injury	<u>55/</u>
	-	-	Sensitive	<u>56/</u>
<u>Populus tremuloides</u> (Quaking Aspen)	520	3 hr.	No injury	<u>57/</u>
	910	3 hr.	20% injury	<u>57/</u>
	681	4 hr.	10% injury	<u>55/</u>
	1100	1 hr.	10% of leaves injured	<u>52/</u>
	1022	2 hr.	10% of leaves injured	<u>52/</u>
	681	4 hr.	10% of leaves injured	<u>52/</u>
	341	8 hr.	10% of leaves injured	<u>52/</u>
<u>Pinus ponderosa</u> (Ponderosa Pine)	1300	5-10 hr. (per six-month period)	Needle injury	<u>58/</u>
<u>Pseudotsuga menziesii</u> (Douglas fir)	760	44 hr.	Slight marking on 2 yr. old seedlings	<u>59/</u>
	2044	8 hr.	Slight marking on 2 yr. old seedlings	<u>59/</u>
	7520	1 hr.	Traces of injury	<u>49/</u>

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Plant Species	SO ₂ Concentration (µg/m ³)	Exposure Time	Sensitivity Rating or Response	Reference
<u>Poa pratensis</u> (Bluegrass)	520	2 hr.	Mild to severe injury	<u>60</u> /
<u>Lolium perenne</u> (Perennial Ryegrass)	260	annual max.	Significant injury and growth suppression	<u>61</u> /
	191	26 weeks	(Decreased number of	
	343	9 weeks	(tillers, leaves, leaf (area and dry weight	
<u>Artemisia frigida</u> (Fringed Sagewort)	2600	4 hr.	Visible injury under low light, cool temperatures	<u>62</u> /
<u>Agropyron smithii</u> (Western Wheatgrass)	2600	4 hr.	Visible injury under low light, cool temperatures	<u>63</u> /
<u>Koeleria cristata</u> (Junegrass)	2600	4 hr.	Visible injury under high light, warm temperatures	<u>63</u> /
<u>Stipa comata</u> (Needle and Thread Grass)	2600	4 hr.	Visible injury under high light, warm temperatures	<u>63</u> /
<u>Bromus inermis</u> (Brome grass)	2600	4 hr.	65% injury	<u>64</u> /

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RESPONSE TO SO₂ OF HERBACEOUS SPECIES INDIGENOUS TO THE HAT CREEK AREA

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Plant Species	SO ₂ Concentration (µg/m ³)	Exposure Time	Sensitivity Rating or Response	Reference
<u>Medicago sativa</u> (Alfalfa)	1300	1 hr.	21% decrease in CO ₂ uptake	<u>65/</u>
	1300	4 hr.	19% foliar injury	<u>64/</u>
	524-785	2 hr.	5% reduction in CO ₂ uptake	<u>66/</u>
<u>Medicago sativa</u> (Alfalfa)	< 524	1 hr.	< 2% injury	<u>67/</u>
	655	4 hr.	No foliar injury	<u>64/</u>
	1300	4 hr.	5-19% foliar injury	<u>64/</u>
	2096	2 hr.	Acute injury - necrosis	<u>66/</u>
	1300-2520	1 hr.	Visible injury	<u>54/</u>
	786-1572	3 hr.	Visible injury	<u>54/</u>
<u>Avena sativa</u> (Oats)	260	3 hr.	Visible injury	<u>68/</u>
	520	1.5 hr.	Visible injury	<u>68/</u>
	2600	3 hr.	0.5% injury	<u>69/</u>
<u>Zea mays</u> (Corn)	156	12 days	Significant injury	<u>70/</u>
	780	4 hr./day for 12 days	Moderate injury	<u>71/</u>
	200	9-20 days	Beneficial effect in area of sulphur fertility	<u>72/</u>
<u>Lycopersicon esculentum</u> (Tomato)	1300	4 hr.	Visible injury	<u>64/</u>
	2096	4 hr.	Foliar injury	<u>73/</u>
	5240	5 hr.	Interveinal patches of necrotic tissue	<u>74/</u>
	1676	1 hr.	Foliar injury	<u>55/</u>
	1468	2 hr.	Foliar injury	<u>55/</u>
	1126	4 hr.	Foliar injury	<u>55/</u>



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Plant Species	SO ₂ Concentration (µg/m ³)	Exposure Time	Sensitivity Rating or Response	Reference
<u>Lycopersicon esulentum</u> (Tomato)	995 1300	8 hr. 4 hr.	Foliar injury Visible injury	<u>55/</u> <u>75/</u>

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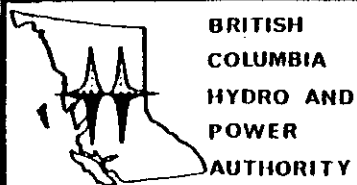
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Plant Species	NO ₂ Concentration (µg/m ³)	Exposure Time	Sensitivity Rating or Response	Reference
<u>Poa pratensis</u> (Kentucky Bluegrass)	-	-	Resistant	<u>78/</u>
	37600	4 hr.	1-2% leaf area marked	<u>76/</u>
	94000	4 hr.	1-6% leaf area marked	<u>76/</u>
<u>Bromus inermis</u> (Brome grass)	15040	1 hr.	Trace of injury	<u>79/</u>
	60160	1 hr.	Extensive injury	<u>79/</u>
<u>Avena sativa</u> (Oats)	56400	1 hr.	Little or no injury	<u>80/</u>
<u>Medicago sativa</u> (Alfalfa)	2820	2 hr.	10% reduction in CO ₂ uptake	<u>66/</u>
	-	-	Sensitive	<u>77/</u>
	56400	1 hr.	Some visible injury	<u>80/</u>
	11280	4-8 hr.	Moderate severe necrosis	<u>81/</u>
	1880-11280	2 hr.	50-60% reduction in photosynthetic activity, no foliar injury	<u>82/</u>
	470	2 hr.	No decrease in CO ₂ assimilation	<u>67/</u>
<u>Lycopersicon esculentum</u> (Tomato)	-	-	Intermediate	<u>75/</u>
	3760	4 hr.	Threshold dosage	<u>79/</u>
	15040	1 hr.	Trace of injury	<u>79/</u>
	56640	1 hr.	Extensive injury	<u>79/</u>
	18880	1.5 hr.	No visible injury	<u>83/</u>
	28320	1.5 hr.	90% leaf injury	<u>83/</u>
	283-490	10-22 days	Decrease in dry weight and leaf area	<u>84/</u>



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Plant Species	NO ₂ Concentration (µg/m ³)	Exposure Time	Sensitivity Rating or Response	Reference
<u>Lycopersicon esculentum</u> (Tomato)	755-944 472	21-45 days Entire growth period	Long stems - small leaves Decreased crop yield by 22%	<u>85/</u> <u>85/</u>



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Plant Species	O ₃ Concentration	Exposure Time	Sensitivity Rating or Response	Reference
<u>Medicago sativa</u> (Alfalfa)	< 25 pphm	2 hr.	Visible injury	<u>89/</u>
	-	-	Sensitive	<u>86/</u>
	10-12 pphm	2 hr.	Foliar injury	<u>88/</u>
	15 pphm	4 hr.	Foliar injury	<u>90/</u>
	10-30 pphm	8 hr.	Foliar injury	<u>91/</u>
	5 pphm	4 hr.	No injury	<u>64/</u>
	10 pphm	4 hr.	No injury	<u>90/</u>
	5 pphm	8 hr.	No injury	<u>92/</u>
<u>Avina sativa</u> (Oats)	< 25 pphm	2 hr.	Visible injury	<u>89/</u>
	40 pphm	0.5 hr.	1% leaf injury	<u>93/</u>
	45 pphm	0.5 hr.	1% leaf injury	<u>93/</u>
	50 pphm	1 hr.	1% leaf injury	<u>93/</u>
	60 pphm	1 hr.	2% leaf injury	<u>93/</u>
<u>Pinus ponderosa</u> (Ponderosa pine)	0.2-0.5 pphm	7 hr./day for 21 days	Chlorotic needle mottle	<u>94/</u>
	0.5 pphm	9 hr./day for 18 days	Visible needle injury	<u>87/</u>
<u>Populus tremuloides</u> (Quaking aspen)	25 pphm	4 hr.	Upper leaf bronzing on 50% of leaves	<u>95/</u>
<u>Lycopersicon esculentum</u> (Tomato)	60 pphm	1 hr.	1% leaf injury	<u>93/</u>
	3.5 pphm	93 days	33% reduction in fresh weight	<u>96/</u>
	10 pphm	4 hr.	2-75% foliar injury	<u>64/</u>



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Plant Species	O ₃ Concentration	Exposure Time	Sensitivity Rating or Response	Reference
<u>Lycopersicon esculentum</u> (Tomato)	5 pphm 10 pphm	4 hr. 8 hr.	No visible injury Necrotic leaf marking	<u>64/</u> <u>91/</u>



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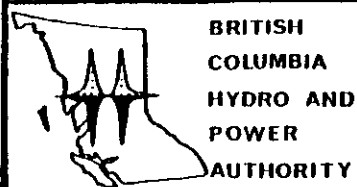
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Plant Species	Fluoride Concentration ($\mu\text{g}/\text{m}^3$)	Exposure Period	Sensitivity Rating or Response	Reference
<u>Medicago sativa</u> (Alfalfa)	10	2 hr.	Threshold level	<u>66/</u>
	4	3-9 day	Chlorosis or necrosis	<u>101/</u>
	5.2	9 day	Leaf tip and marginal necrosis	<u>101/</u>
	39.5	27 hr.	Slight injury	<u>101/</u>
	5.5	40 hr.	No injury	<u>101/</u>
<u>Pinus ponderosa</u> (Ponderosa pine)	0.4-0.6	Continuous for several months	Severe injury	<u>100/</u>
	0.5	10 days	Injury severe at time of emergence	<u>102/</u>
	7.5	(2) 8 hr./week	Incipient injury	<u>102/</u>
	2.5	(7) 8 hr./2 weeks	Incipient injury	<u>102/</u>
	0.75	(20) 8 hr./4 weeks	Incipient injury	<u>102/</u>
<u>Lycopersicon esculentum</u> (Tomato)	6.4	Continuous	Decrease in number of fruits w/ no foliar injury	<u>103/</u>
	5.0	513 hr.	No injury	<u>104/</u>
	100.0	26 hr.	Slight tip burn	<u>104/</u>
	650.0	4.25 hr.	Necrosis	<u>104/</u>
	1.6	8 days	67% increase in respiration	<u>105/</u>
	12.4	24 hr.	Reduced growth of leaves	<u>105/</u>
<u>Zea mays</u> (Corn)	0.4-0.6	Continuous for several months	Severe injury	<u>106/</u>
	10	9 days	Mottled chlorosis	<u>107/</u>



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Plant Species	Fluoride Concentration ($\mu\text{g}/\text{m}^3$)	Exposure Period	Sensitivity Rating or Response	Reference
<u>Zea mays</u> (Corn)	1.0	7 days	No chlorosis	<u>108/</u>
	2.0	7 days	Trace amounts of chlorosis	<u>108/</u>
	5.7	7 days	Moderate to pronounced Chlorosis	<u>108/</u>
	5	513 hr.	Mottling of mature foliage	<u>104/</u>
	100	26 hr.	Slight tip burn	<u>104/</u>
	650	4.25 hr.	Necrosis	<u>104/</u>



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Plant Species	SO ₂ Concentration (µg/m ³)	NO ₂ Concentration (µg/m ³)	Exposure Time	Sensitivity Rating or Response	Reference
<u>Avene satira</u> (Oats)	655	94	4 hr.	3% injury	<u>75/</u>
	262	188	4 hr.	27% injury	<u>75/</u>
	655	282	4 hr.	No injury	<u>75/</u>
	524	376	4 hr.	10% injury	<u>75/</u>
	1965	1410	1 hr.	Threshold	<u>75/</u>
<u>Medicago sativa</u> (Alfalfa)	655	0	1 hr.	2-3% reduction in photosynthesis	<u>67/</u>
	655	470	1 hr.	9% reduction in photosynthesis	<u>67/</u>
	917	0	1 hr.	8% reduction in photosynthesis	<u>67/</u>
	917	564	1 hr.	16% reduction in photosynthesis	<u>67/</u>
	393	282	1 hr.	7% reduction in photosynthesis	<u>67/</u>
<u>Lycopersicon esculentum</u> (Tomato)	655	94	4 hr.	1% leaf injury	<u>75/</u>
	262	188	4 hr.	1% injury	<u>75/</u>
	655	282	4 hr.	No injury	<u>75/</u>
	262	282	4 hr.	17% leaf injury	<u>75/</u>



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RESPONSE TO COMBINATIONS OF SO₂ AND NO₂ OF VEGETATION
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Plant Species	SO ₂ Concentration	O ₃ Concentration	Exposure Time	Sensitivity Rating or Response	Reference
<u>Medicago sativa</u> (Alfalfa)	262	0	4 hr.	No injury	<u>64/</u>
	-	196	4 hr.	No injury	<u>64/</u>
	262	196	4 hr.	24-50% foliar injury	<u>64/</u>
	655	-	4 hr.	No injury	<u>64/</u>
	655	196	4 hr.	21-22% foliar injury	<u>64/</u>



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Vegetative Cover Affected by Stack Emissions (km²)

Association	366 M Stack FGD	366 M Stack MCS	244 M Stack MCS	Sensitivity
Engelmann Spruce - Willow - Red Heather Parkland	0.03	22.66	27.11	High
Engelmann Spruce - Grouseberry - Lupines	0.98	29.27	29.87	Moderate
Engelmann Spruce - Grouseberry	7.43	100.86	124.05	Low
Engelmann Spruce - Grouseberry - Pinegrass	7.31	46.56	68.67	Low
Engelmann Spruce - Horsetail	-	0.35	0.35	Moderate
Douglas-fir - Pinegrass	2.2	18.51	37.64	Low
Douglas-fir - Bunchgrass	-	-	1.69	Moderate
Douglas-fir - Pinegrass - Bunchgrass	2.37	7.04	15.25	Moderate
Ponderosa Pine - Bunchgrass	-	-	0.38	Moderate
Kentucky Bluegrass	1.65	1.16	1.43	Low
Bunchgrass - Kentucky Bluegrass	-	1.26	2.22	Low
Willow - Sedge Bog	1.33	4.34	5.00	High
Riparian	-	0.04	0.67	High
Highland Grassland	-	0.02	0.04	Moderate
Big Sagebrush - Bunchgrass	-	0.04	0.14	Low
Sagebrush - Bluebunch Wheatgrass	-	0.01	0.01	High
Bunchgrass - Kentucky Bluegrass/ Saline Depression Complex	-	1.68	1.68	NC
Mountain Avens - Sedge/ Highland Grassland Complex	-	1.14	1.25	NC
Douglas-fir - Spirea - Bearberry/ Douglas-fir - Pinegrass - Bunchgrass Complex	-	-	3.56	NC



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SUMMARY OF VEGETATION ASSOCIATION AREAS AFFECTED BY PREDICTED AIR EMISSIONS
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Association	Area Affected by AQCS (km ²)			Sensitivity
	366 M Stack FGD	366 M Stack MCS	244 M Stack MCS	
Douglas-fir - Pinegrass/ Douglas-fir - Pinegrass - Bunchgrass Complex	.08	3.17	3.04	NC
Douglas-fir - Spirea - Bearberry/ Douglas-fir - Bunchgrass Complex	-	0.36	0.36	NC
TOTAL	23.38	238.47	324.41	-

NC - Denotes not classified.

Source: TERA Environmental Resource Analyst, Ltd. 138/



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Trace Element	Trace Element Concentration ($\mu\text{g}/\text{m}^3$)*			
	A	B	C	D
Arsenic (As)	3.0×10^{-4}	2.0×10^{-4}	6.0×10^{-5}	6.0×10^{-6}
Cadmium (Cd)	5.0×10^{-6}	3.0×10^{-6}	1.0×10^{-6}	1.0×10^{-7}
Chromium (Cr)	8.0×10^{-5}	6.0×10^{-5}	2.0×10^{-5}	2×10^{-6}
Copper (Cu)	9.0×10^{-5}	5.0×10^{-5}	2.0×10^{-5}	2.0×10^{-6}
Fluorine (F)	4.0×10^{-3}	3.0×10^{-3}	9.0×10^{-4}	9.0×10^{-5}
Lead (Pb)	7.0×10^{-5}	4.0×10^{-5}	1.0×10^{-5}	1.0×10^{-6}
Mercury (Hg)	1.0×10^{-4}	7.0×10^{-5}	2.0×10^{-5}	2.0×10^{-6}
Vanadium (V)	2.0×10^{-4}	1.0×10^{-4}	5.0×10^{-5}	5.0×10^{-6}
Zinc (Zn)	2.0×10^{-4}	1.0×10^{-4}	4.0×10^{-5}	4.0×10^{-6}

*Values presented are for isopleth codes as presented in Figure F7-1. 6/.

Source: Environmental Research and Technology, Inc. 6/.



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ANNUAL AMBIENT TRACE ELEMENT LEVELS FROM STACK EMISSIONS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.1-18

PART FOUR

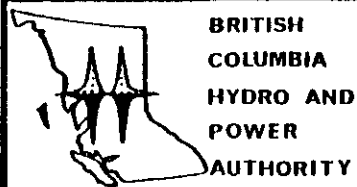
Irrigated Area

Upper Hat Creek Valley

Potential Percent Foliar Injury to Alfalfa

Presently Irrigated (ha)	Projected Irrigated (ha)	366m Stack - MCS		244m Stack - MCS	
		Worst Case	Average Case	Worst Case	Average Case
64	96	-	-	24	10
116	174	-	-	31	12
149	224	-	-	10	5
156	234	38	15	43	18
6	9	68	28	70	32

Source: Canadian Bio Resources Consultants Ltd. 141/



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PRESENT AND PROJECTED AGRICULTURAL LAND OF UPPER HAT CREEK VALLEY
SUBJECT TO SO₂/NO₂ DAMAGE

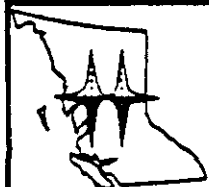
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.1-19

PART FOUR

<u>Parameter</u> (mg/l)	<u>Fly Ash</u> <u>Range</u>	<u>Bottom Ash</u> <u>Range</u>
pH (units)	8.5 - 9.5	8.0 - 9.0
Filterable Residue (105°C)	4900 - 9900	3400 - 5900
BOD ₅	< 30 - 190	< 30 - 190
Alkalinity (as CaCO ₃)	1030 - 1130	830 - 1030
Chloride	140 - 155	140 - 155
Fluoride	3.3 - 5.8	2.0 - 2.3
Nitrate (as N)	2.2 - 3.3	1.8 - 2.2
Ortho-phosphate (as P)	0.15 - 0.24	0.18 - 0.33
Sulphate	220 - 300	1180 - 1220
Arsenic	< 0.6 - 2.6	< 0.5 - 2.1
Boron	< 3.1 - 4.1	< 1.8 - 1.9
Cadmium	< 0.08	< 0.08
Calcium (as CaCO ₃)	990 - 1090	740 - 790
Chromium	< 0.1 - 0.22	< 0.089 - 0.11
Copper	< 0.2 - 0.3	< 0.1 - 0.3
Iron	< 1.6 - 1.7	< 1.6 - 1.7
Lead	< 0.04	< 0.04
Magnesium (as CaCO ₃)	190 - 200	190 - 200
Mercury	< 0.0012 - 0.0023	< 0.001 - 0.0016
Sodium	260 - 270	260 - 270
Vanadium	< 0.13 - 0.15	< 0.21 - 0.27
Zinc	0.6 - 1.8	0.9 - 3.3

Prepared by: Beak Consultants Ltd. 159/



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PROJECTED ASH LEACHATE QUALITY

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.1-20

PART FOUR

	<u>Unit 1</u> <u>Jan. 1984</u>	<u>Units 1-2</u> <u>Jan. 1985</u>	<u>Units 1-3</u> <u>Jan. 1986</u>	<u>Units 1-4</u> <u>Jan. 1987</u>
Supervisory, Professional and Confidential	22	22	25	25
Office and Technical Employees	14	14	16	16
Operating	69	74	115	120
Mechanical Maintenance	15	19	27	30
Electrical Maintenance	6	8	10	11
Instrument Maintenance	6	7	8	9
General Tradesmen	16	16	26	26
Stores	3	4	5	5
Security Guards	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>
Total Direct Employment	<u>156</u>	<u>164</u>	<u>232</u>	<u>247</u>

Prepared by: Strong Hall & Associates Ltd. 10 /



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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants

DIRECT EMPLOYMENT BY SKILL GROUP,
THERMAL PLANT OPERATING PHASE

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
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PART FOUR

Characteristic	ASHCROFT				CACHE CREEK				CLINTON		
	"Without Project" Population (n=3035)	Incoming Population	"With Project" Scenario One-Scenario Two (n=5200)	Population (n=3965)	"Without Project" Population (n=1595)	Incoming Population	"With Project" Scenario One-Scenario Two (n=2525)	Population (n=3760)	"Without Project" Population (n=1155)	Incoming Population (n=580)	"With Project" Population (n=1735)
Age Distribution*											
0-14	34.1%	38.0%	35.7%	35.0%	36.1%	38.0%	36.8%	37.2%	35.9%	38.0%	36.5%
15-19	7.6	8.0	7.8	7.7	8.4	8.0	8.3	8.2	8.8	8.0	8.5
20-24	9.4	12.0	10.5	10.0	9.4	12.0	10.4	10.9	7.2	12.0	8.8
25-34	17.2	20.0	18.4	17.9	20.8	20.0	20.5	20.4	14.4	20.0	16.3
35-44	12.5	12.0	12.3	12.4	11.8	12.0	11.9	11.9	11.6	12.0	11.8
45-54	9.6	6.0	8.1	8.8	8.2	6.0	7.4	6.9	8.3	6.0	7.6
55-64	6.4	3.0	5.0	5.6	4.0	3.0	3.6	3.4	7.2	3.0	5.8
65+	4.1	1.0	2.8	3.5	2.0	1.0	1.6	1.4	5.0	1.0	3.7
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Male-Female Distribution											
Male	53.6%	55.0%	54.2%	53.9%	50.9%	55.0%	52.4%	53.2%	53.0%	55.0%	53.6%
Female	46.4	45.0	45.8	46.1	49.1	45.0	47.6	46.8	47.0	45.0	46.6
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Marital Status											
Single	23.0%	23.0%	22.7%	23.0%	26.6%	23.0%	25.3%	24.0%	23.5%	23.0%	23.3%
Married	70.0	73.0	71.3	70.7	66.0	73.0	68.6	70.1	72.8	73.0	72.9
Other	7.0	4.0	5.8	6.3	7.4	4.0	6.1	5.5	3.7	4.0	3.8
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Children Per Family											
0	27.8%	25.0%	26.6%	27.1%	27.7%	25.0%	26.7%	26.1%	29.3%	25.0%	27.8%
1	17.8	22.0	19.5	18.8	19.2	22.0	20.2	20.8	17.1	22.0	18.7
2	25.6	26.0	25.8	26.7	21.3	26.0	23.1	24.0	12.2	26.0	16.8
3	15.5	16.0	14.7	14.4	19.2	16.0	18.0	17.3	24.4	16.0	21.6
4	8.9	7.0	8.1	8.5	8.5	7.0	7.8	7.5	12.2	7.0	10.5
4+	5.8	4.0	5.1	5.4	6.3	4.0	5.5	5.0	12.2	4.0	9.5
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%


* Figures may not equal 100% due to rounding.

Prepared by: Strong Hall & Associates Ltd. 10/

OPERATING PHASE
 (\$ million 1976)

<u>REGIONAL</u>			<u>LOCAL AREA</u>		
<u>Regional Residents</u>	<u>Regional In Migrants</u>	<u>Total Direct Net Regional Income Gain</u>	<u>Local Area Residents</u>	<u>In Migrants</u>	<u>Total Direct Net Local Area Income Gain</u>
\$ 101.9	\$ 581.5	\$ 683.4	\$ 42.9	\$ 643.2	\$ 686.1

Prepared by: Strong Hall & Associates Ltd. 10/.

 BRITISH COLUMBIA HYDRO AND POWER AUTHORITY	EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants	TABLE 4.1-25 PART FOUR
	DIRECT NET INCOME GAINS GENERATED BY HAT CREEK PROJECT	
	THE HAT CREEK PROJECT - Detailed Environmental Studies	

OPERATING PHASE
 (\$ million 1976)

<u>REGIONAL</u>				<u>LOCAL AREA</u>			
<u>Direct Income</u>	<u>Indirect Income</u>	<u>Induced Income</u>	<u>Total Net Regional Income Gain</u>	<u>Direct Income</u>	<u>Indirect Income</u>	<u>Induced Income</u>	<u>Total Net Local Area Income Gain</u>
\$ 683.4	\$ 23.6	\$ 353.5	\$ 1060.5	\$ 686.1	-	\$ 148.8	\$ 834.9

Prepared by: Strong Hall & Associates Ltd. 10/.



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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants

TOTAL NET INCOME GAINS
 FROM THE HAT CREEK PROJECT

THE HAT CREEK PROJECT - Detailed Environmental Studies


TABLE
 4.1-24

PART FOUR

<u>ACTIVITY AFFECTED</u>	<u>DISPLACED (d/a)</u>	<u>QUALITY</u>	<u>IMPACT SIGNIFICANCE</u>
Hunting	100	Undetermined	Low
Fishing	-	Undetermined	-
Backroad Travel	250	Fair	Low
Other	100	-	-

Operation Phase is defined as post 1987.

Prepared by: ESCLEC and bhi 161/.

	BRITISH COLUMBIA HYDRO AND POWER AUTHORITY	EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants	TABLE 4.1-25 PART FOUR
		ESTIMATED ANNUAL RECREATION ACTIVITY DAYS DISPLACED IN AREA "A" DURING OPERATION PHASE	
		THE HAT CREEK PROJECT - Detailed Environmental Studies	

Origin*	1980	1982	1984	1986	1988	1990
Hat Creek Camps	22,060	81,000	63,040	19,800	1,320	1,400
Ashcroft/ Cache Creek	21,820	64,240	87,000	87,580	101,600	109,260
Clinton	2,600	7,560	10,230	10,240	12,000	12,950
Other Areas	1,300	3,740	5,120	5,040	6,030	6,410
Total	47,780	156,540	165,390	122,660	120,950	130,020

- Based on population forecasts presented in Strong Hall and Associates Ltd. ^{10/}, and on assumed construction start in 1978

Prepared by: ESCLEC and bhi ^{161/}.



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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants

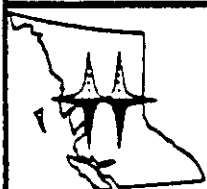
TOTAL ESTIMATED ACTIVITY DAYS
WITH THE HAT CREEK PROJECT

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.1-26
PART FOUR

<u>Community</u>	<u>1976</u>	<u>1980</u>	<u>1986</u>	<u>1990</u>	<u>1976-90 % increase</u>
Ashcroft	2030	2455	2685	3035	50
Cache Creek	1050	1205	1355	1595	52
Clinton	810	810	1155	1155	43
Lillooet	2220	2220	2785	2785	25
Unincorporated	1390	1390	1390	1390	0
Total	7500	8080	9370	9960	33

Source: Strong Hall & Associates Ltd. 10/



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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants

FORECAST POPULATION GROWTH WITHOUT THE
PROJECT IN COMMUNITIES NEAR
HAT CREEK. 1976-1990

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.1-27

PART FOUR

Activity Source	1976	1980	1982	1984	1986	1988	1990
Local Population (non-project)	104,356	125,200	135,630	146,060	156,500	166,950	177,400
Project Population*	-	47,780	156,540	165,390	122,660	120,950	130,020
Total	104,356	172,980	292,170	311,450	279,160	287,900	307,420

* Based on assumed construction start in 1978.

Prepared by: ESCLEC and bhi 162/.



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EBASCO SERVICES OF CANADA LIMITED; Environmental Consultants

FORECAST LOCAL NON-PROJECT AND PROJECT-INDUCED
RECREATIONAL ACTIVITY DAYS 1976 - 1990

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.1-28

PART FOUR

Ranch House	Current (1978) Occupant	Distance From Highway 12 Junction m	Without Project YDNL*	Project YDNL*	Combined With-Project YDNL*	Normalized Project YDNL* (+15 dB)	Expected Resident Reaction
1	M. Saulte	4,900	35 - 40	63	63	78	Vigorous Action
2	Ike Lehman	4,900	35 - 40	63	63	78	Vigorous Action
3	A. Parke	8,540	35 - 40	49	49	64	Widespread Complaints
4	D. Ridlar (Baldwin)	9,760	35 - 40	45	45 - 46	60	Widespread Complaints
5	A. Pocock	13,400	35 - 40	36	39 - 42	56**	Sporadic Complaints
6	G. Parke	14,000	35 - 40	35	38 - 41	55**	No Reaction

* Yearly average day/night noise level.

** The higher community sensitivity correction of +20 dB has been applied at locations where plant noise (containing pure tones) is expected to be the dominant project noise.

Prepared by: Harford, Kennedy, Wakefield, Ltd. 163/



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NOISE LEVELS AT HAT CREEK VALLEY RANCH HOUSES DURING
MINE STAGE 6 AND EXPECTED REACTIONS OF THE RESIDENTS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.1-29

PART FOUR

<u>Source/Type of Activity</u>	<u>Emission Factor</u>	<u>Source Operating Units</u>	<u>Emissions (kg/a)</u>
Surficial removal (scrapers)	7.26 kilograms per scraper hour	26,250 scraper-hours/year	191,000
Overburden removal (truck/shovel)	7.26 kilograms per shovel hour	27,000 shovel-hours/year	196,000
Coal removal (truck/shovel)	0.01 gm/kg coal removed	9.98 x 10 ⁹ kg/ a in-situ coal	99,800
Blasting	0.005 gm/kg coal blasted	9.98 x 10 ⁹ kg/ a in-situ coal	49,900
Coal haul road	0.31 kilograms per vehicle kilometre	4.96 x 10 ⁵ vehicle-km/ a	154,000
Overburden haul road	0.31 kilograms per vehicle kilometre	1.23 x 10 ⁶ vehicle-km/ a	381,000
Truck hopper dump	0.01 gm/kg coal dumped	9.98 x 10 ⁹ kg/ a in-situ coal	99,800
Conveyors	-	-	-
Coal stockpiles	0.122 gm/kg coal stored	9.07 x 10 ⁸ kg coal stored	111,000
Haul road repair	7.26 kilograms per grader hour	9000 grader-hours/year	65,300
Wind erosion	kilograms per square metre per year	1.68 x 10 ⁷ m ²	941,000
		TOTAL	2,288,800

Prepared by: Environmental Research & Technology, Inc. 2/. Rev. 1 Feb. 1979



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ESTIMATES OF PARTICULATE EMISSIONS FOR THE HAT CREEK PROJECT COAL MINE
(BASED ON A MAXIMUM LEVEL OF ACTIVITY FOR THE YEAR 2017-2018)

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.2-1

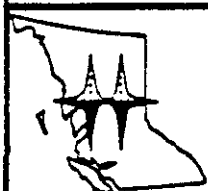
PART FOUR

Sample:	<u>Overburden 76-1</u>	<u>Overburden 76-13</u>	<u>Waste Rock</u>
<u>Parameters*</u>			
pH	7.6	7.9	8.3
Filterable Residue	180	160	2078
BOD ₅ **	35	27	244
Alkalinity (as CaCO ₃)	55	77	180
Chloride	2	1.5	53
Fluoride	0.05	0.07	0.06
Nitrate (as N)	4.0	6.0	3.7
O-phos. (as P)	0.15	0.2	0.4
Sulphur	0.7	6.7	10.0
Arsenic	0.03	0.03	0.1
Boron	0.02	0.02	0.05
Cadmium	0.002	0.002	< 0.002
Calcium (as CaCO ₃)	13.2	25	76.2
Chromium	0.05	0.05	0.2
Copper	0.35	1.4	2.1
Iron	0.3	1.05	1.85
Lead	0.02	0.02	0.02
Magnesium (as CaCO ₃)	14.6	29.2	43.7
Mercury	0.002	0.002	0.003
Sodium	15.0	40.0	70
Vanadium	0.01	0.01	0.01
Zinc	0.031	0.031	0.275

* All parameters expressed in mg/l except pH which is in units.

** Estimated by utilizing BOD₅ from Total Extractable Tests and multiplying by ratio of filterable residue extracted in 24 hours to Total Extractable Filterable Residue.

Prepared by: Beak Consultants Ltd. 6 /



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PROJECTED OVERBURDEN AND WASTEROCK
LEACHATE CHARACTERISTICS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.2-2
PART FOUR

<u>Parameters*</u>	<u>Projected</u>	<u>Existing</u>
pH (units)	8.2	8.4
Temperature (°C)	40	24
Suspended Solids	≤ 22	6
Filterable Residue	642	342
Total Hardness (as CaCO ₃)	197	224
Alkalinity (as CaCO ₃)	305	226
Chloride	6.2	1.1
Fluoride	0.15	0.16
Total Nitrogen -N	3.61	0.19
Phosphorus -P	< 0.096	0.043
Sulphate	60	54
Arsenic	< 0.013	< 0.005
Boron	< 0.10	< 0.10
Cadmium	< 0.005	< 0.005
Calcium (as CaCO ₃)	118	143
Chromium	< 0.018	< 0.010
Copper	< 0.015	< 0.005
Iron	< 0.092	< 0.026
Lead	< 0.013	< 0.010
Magnesium (as CaCO ₃)	75	77
Mercury	< 0.0005	< 0.0004
Sodium	72	20
Vanadium	< 0.013	< 0.005
Zinc	< 0.111	< 0.007

* All parameters expressed in mg/l except as noted

Prepared by: Beak Consultants Ltd. 6 /



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COMPARISON OF PROJECTED WATER QUALITY AND
EXISTING WATER QUALITY IN HAT CREEK

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.2-5

PART FOUR

Project Activity

Impact

Base Scheme:

- | | |
|---------------------|--|
| Mine Dust Control | - Evaporation of $10 \times 10^4 \text{ m}^3$ irrigation season; intended source of water unspecified. |
| Pit Rim Reservoir | - Evaporation of approximately $3 \times 10^4 \text{ m}^3$ from reservoir surface during irrigation season. |
| Headworks Reservoir | - Evaporation of approximately $3 \times 10^4 \text{ m}^3$ from reservoir surface during irrigation season. |
| Mine Pit Seepage | - Evaporation of up to $21 \times 10^4 \text{ m}^3$ of seepage during irrigation season.

- Potentially unsuitable water quality. |
| Pit Rim Dewatering | - Collection of up to $21 \times 10^4 \text{ m}^3$ of ground and surface water in vicinity of mine; diversion to Hat Creek canal during irrigation season. |
| Coal Stockpiles | - Potentially unsuitable leachate quality. |

Alternate Activity:

- | | |
|--|--|
| Medicine Creek Diversion to MacLaren Creek | - Diversion of unknown quantity of water from Hat Creek drainage to Cornwall Creek drainage. |
| Medicine Creek Water Supply | - Storage and use of unknown quantity of Medicine Creek water. |
| Hat Creek Water Supply Reservoir | - Storage and use of Hat Creek flow. |

Source: Beak Consultants Ltd. 6 /

Rev. 1 Feb. 1979.



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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants

IMPACT ON IRRIGATION WATER USE
DUE TO PROJECT OPERATION

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.2-4

PART FOUR

	<u>STAGE</u>						
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>
Mine Operating	93	168	276	303	376	424	404
Mine Maintenance	37	101	194	214	272	310	294
Mine Labour	12	40	67	81	104	112	109
Mine Staff	<u>61</u>	<u>81</u>	<u>98</u>	<u>98</u>	<u>98</u>	<u>98</u>	<u>98</u>
Total Direct Employment	<u>203</u>	<u>390</u>	<u>635</u>	<u>696</u>	<u>850</u>	<u>944</u>	<u>905</u>

Prepared by: Strong, Hall & Associates Ltd. 11/



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EBASCO SERVICES OF CANADA LIMITED: Environmental Consultants

DIRECT EMPLOYMENT BY SKILL GROUP,
MINE OPERATING PHASE

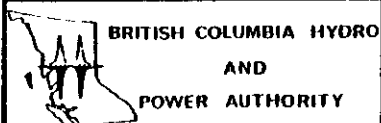
THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.2-5

PART FOUR

	Nesler Creek		Upper Hat Creek Valley		Medicine Creek Valley		Cattle Valley		Highway # 12		Coke Creek		Thompson River		Highway # 1		Oregon Junk		Langley		Corvallis Lockout		Treadwell Mills		Total Score for a Project Element	Average Impact per Element Unit						
	Fern	Cher.	Fern	Cher.	Fern	Cher.	Fern	Cher.	Fern	Cher.	Fern	Cher.	Fern	Cher.	Fern	Cher.	Fern	Cher.	Fern	Cher.	Fern	Cher.	Fern	Cher.								
Plant & Intake Facilities	Thermal Generation Plant and Cooling Towers	15	15	15	14	21	19	21	21	21	21	10	13	10	10	17	10					14	18	10	12	26	21	21	21	916	130.6	
	Stack	13	16	17	15	15	16	26	15	21	25	21	15	12	25	19	26	14	22	16	12		12	16	23	20	21	21	21			
	Ash Dump	19	15	10	16	19	17	16	16	21	20	10	19	10	15	10	15	20	10	10	10		17	17	10	14	16	20	11	20	993	124.2
Water S-conveyer	Water S-conveyer	15	14	15	15	14	14	16	18	17	13	13	15	15	14								17	14	10	15	16	19	20	18	454	151.1
	Open Pit Mine																						14	14	14	14	14	14	14	14		
	Bleeding Facilities and Flamplines	19	13	16	16	17	10	16	17	19	17	13	16										14	14	14	14	14	14	14	14	439	227.8
Medicine Creek Pump	Medicine Creek Pump	14	10	15	17	11	10	15	10	12	10	14	10										10	1	1	1	10	15	14	10	791	120.2
	Medicine Creek Pump	15	17	17	17	15	10	11	17	12	10	11	14										10	1	1	1	10	15	14	10		
	Hat Creek Diversion	19	13	16	13	16	14	21	15	20	16	21	14										16	14	14	14	14	14	14	14	953	138.3
Hat Creek Diversion	Hat Creek Diversion	15	15	17	14	16	19	17	10	21	21	21	14										17	15	17	14	16	19	17	10	303	207.7
	Conveyer	20	17	19	19	21	19	20	17	19	19	14											19	9	10	10	19	19	14	14	219	213
	Access Road	14	17	17	15	15	17	16	15	17	15	17	14										14	14	14	14	14	14	14	14	900	213.3
Landscape	500 m. Transmission Corridor	29	19	17	19	17	19	19	14	16	14	15	14										17	16	15	11	19	19	15	13	1054	234.7
	Water Pipeline Corridor	19	17	15	11	19	11	16	18	17	15	14											16	16	16	16	16	16	16	16	516	96
	Attract																						16	16	16	16	16	16	16	16	303	303
Construction Facilities	Water Tanks																						10	16	19	10					219	135
	Storage and Pumping Facilities																						10	15	17	13					303	303
	Plant Construction																															
Mine Construction Pmp	Mine Construction Pmp	20	15	10	17	16	11	19	10	16	11	10	10										20	9	10	0	10	10	10	10	755	110.3
	Mine Construction Pmp	12	10	11	14	11	19	21	13														14	10	12	13						

Prepared by: Toby, Russell, Buckwell & Partners. 11/



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NUMERICAL RANKING OF VISUAL IMPACT CAUSED BY PROJECT ELEMENTS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.3-1

PART FOUR

Project Element	Average Ranking	Number of Visual Units Affected	Level of Visual Impact
Ash Dump	151.4	1	Extreme
Open Pit Mine	142.8	4	High
Medicine Creek Dump	138.3	4	High
500 kv Transmission Corridor	131.7	8	High
Generation Plant and Cooling Tower	130.6	7	High
Blending Facilities and Stockpile	127.8	5	High
Stack	124.2	8	High
Conveyor	123.0	5	High
Houth Meadows Dump	120.2	6	High
Mine Construction Camp	118.3	5	Moderate
Water Intake	115.0	3	Moderate
Access Road	113.5	8	Moderate
Plant Construction Camp	112.0	4	Moderate
Hat Creek Diversion	107.7	3	Moderate
Storage and Pumping Facilities	103.0	3	Low
Airport	103.0	1	Low
Water Pipeline Corridor	96.0	6	Low

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AVERAGE RANKING OF VISUAL IMPACTS

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
4.3-2

PART FOUR

<u>Project Activity</u>	<u>Cause of Benefit</u>	<u>Water Quantity (10⁴m³/a)</u>
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Base Scheme:

Pit Rim Reservoir	Direct Irrigation storage becomes available	22
Pit Lake	Direct Irrigation storage becomes available	1014
Dust Control	Project use stops	10
Pit Rim Dewatering	Diversion stops	21
Make Up Reservoir	Direct Irrigation storage becomes available	830
Supply Pipeline	Capacity (25,000 USGPM)	650*

Alternate Activity:

Medicine Creek Water Supply	Project use stops and storage becomes available	?
Hat Creek Water Supply Reservoir	Project use stops and storage becomes available	213

* If operation is continued to supply irrigation water.

Source: Beak Consultants Ltd. 1/

Rev. 1 Feb. 1979.



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BENEFICIAL IMPACTS ON IRRIGATION WATER
USE DUE TO PROJECT DECOMMISSIONING

THE HAT CREEK PROJECT - Detailed Environmental Studies

TABLE
5.2-1

PART FOUR

<u>Resources</u>					
Receptors	Meteorology Air Quality	Water Resources	Land Resources	Socio-Economics	Noise
Ambient Air Quality	Primary and secondary contaminants Acid Rain Long Range Transport Salt Deposition				
Groundwater: wells		Water Quality			
Surface Water: Hat Creek, Bonaparte River, selected watersheds		Flow Water Quality			
Fisheries & Benthos Hat Creek		Habitat & Fish Populations			
Thompson River salmonids		Impingement			
Vegetation			Air Contaminant Sensitivity Trace Elements Salt deposition		
Soils			Trace Elements		
Wildlife			Bio-accumulation Air contaminants		
Hat Creek Valley Residents					Construction and mine equipment
Community Residents				Health Services Infra-structure Fiscal Land Use	