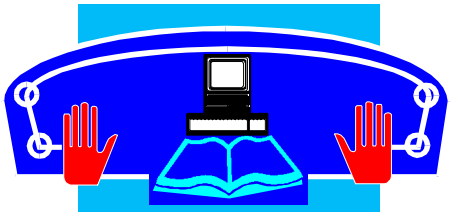

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Black Stone Park Implementation Plan
Author: Project Planing Associates Limited
Catalogue Number: 11-55-90

Black Stone Park

CONTENTS

Implementation 11-55-90 Plan

ILLUSTRATIONS

1. HISTORY OF THE PROJECT

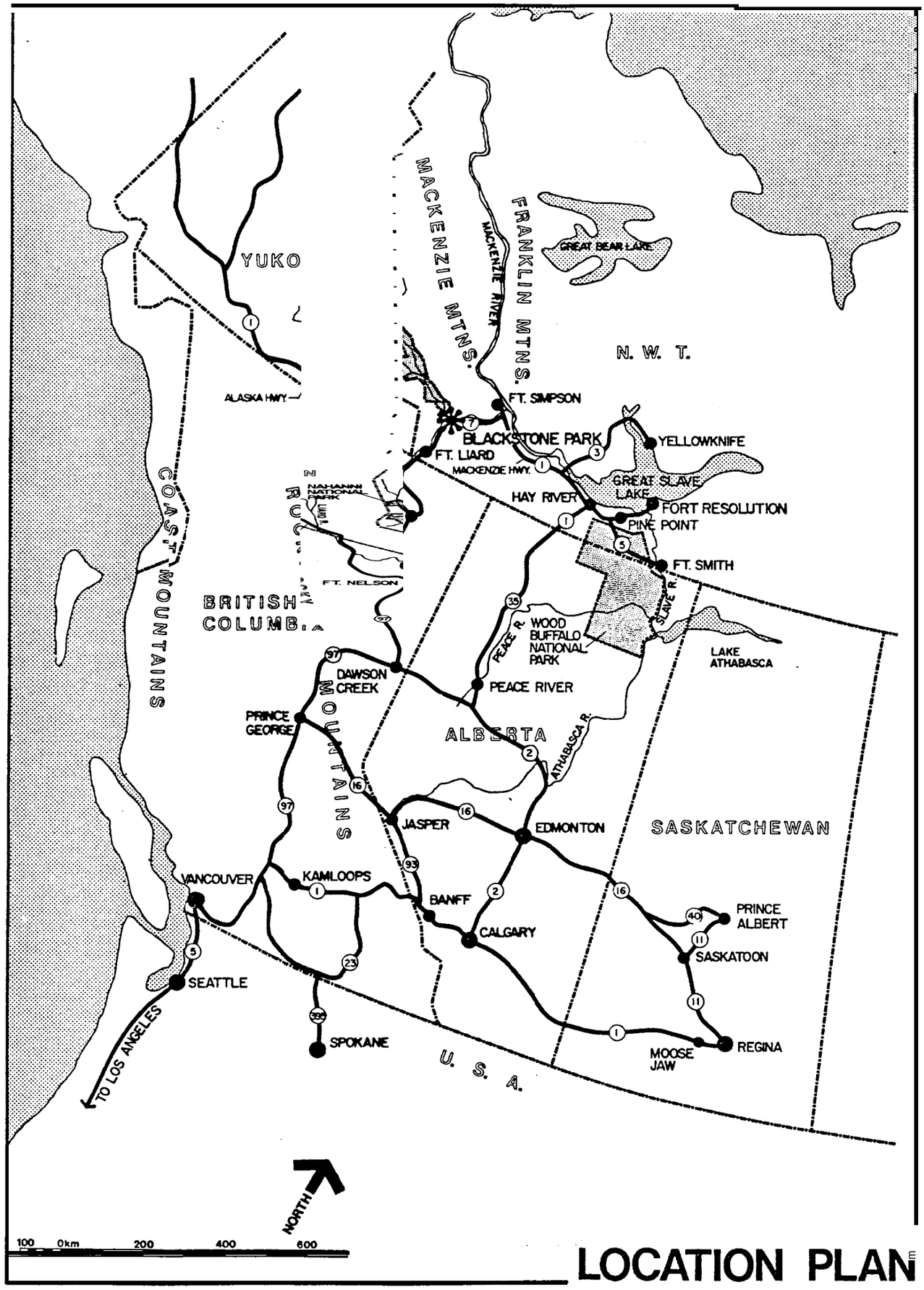
1.1 Rationale

Blackstone Park has been conceived by the Government of the Northwest Territories to accommodate the anticipated influx of tourists traveling the new Liard Highway subsequent to its opening summer 1983. Additionally, it will provide important economic opportunities to the peoples of neighbouring Nahanni Butte, Fort Simpson and Fort Liard. These opportunities should include both participation in the initial capital development of the Park along with on-going involvement in the operation and maintenance of Park facilities. Thus, development decisions and all aspects of the Park Master Plan should be assessed in light of these two basic parameters; anticipated tourist demand and the benefit to surrounding communities.

1.2 Previous Study

In October 1980, Project Planning Associates Ltd., Ferguson Naylor Simek Ltd., and Laventhol and Horwath Ltd. were commissioned by the G.N.W.T., through its Department of Economic Development and Tourism, to study the means and resultant effects of the development of a Park along the Liard Highway at the Blackstone River (figure 1.1).

The study examined and quantified the anticipated tourist demand and the types of facilities required to meet this demand. It assessed the overall physical characteristics of the site. It presented a Development Concept with preliminary estimates of capital costs. And



LOCATION PLAN

The report studied the anticipated social, physical, and economic impacts that such a development would create.

Through a series of meetings held in Nahanni Butte, Fort Liard, Fort Simpson and Yellowknife, from March through June 1981, the G.N.W.T. achieved a concensus and agreement in principle with all involved parties to proceed with the project.

Figures 1.2 and 1.3 show the Development Concept as presented in March 1981 and September 1981 respectively. The latter drawing illustrates the concensus that was reached through the aforementioned meetings. The major change from its predecessor is an amendment to the proposed Park boundaries.

1.3 Current Study

In August 1981, the G.N.W.T. commissioned Project Planning Associates Limited (P.P.A.L.) to coordinate and undertake studies necessary to build, in the summer of 1982, 15 - 30 campsites and the required access road from the Liard Highway down to those sites.

To achieve this, P.P.A.L. was engaged specifically to:

.1 Retain geotechnical and hydrologic sub-consultants and coordinate their work;

.2 Retain a surveying crew and coordinate a topographic survey of portions of the site of particular concern;

.3 Produce a detailed site development plan;

.4 Flag the road alignment for construction 1982 on site;

.5 Prepare tender documents for clearing of the road alignment;

.6 Supervise clearing work on site;

.7 Prepare tender documents for roads and pads to be built in summer 1982.

.8 Supervise road and pad construction on site in summer 1982.

These tasks comprise the first contract year of a design and supervision programme which is currently estimated to span five years. Tables 1.1 and 1.2 present overviews of the physical site development and the planning required for this as currently envisioned.

The contract department for this work is the G.N.W.T.'s Department of Public Works, and P.P.A.L.'s sub-consultant are Hardy Associates (1978) Ltd. and Ferguson Naylor Simek Clark Ltd. Hardy Associates are responsible for detailed geotechnical and topographic studies and the results of this work to date are summarized in Section 2. of this report. Ferguson Naylor Simek Clark are responsible for all aspects of the municipal services required for the development of the Park. Section 3. of this report provides a more detailed description of these components.

1.4 Implementation Plan

'Pursuant to the minutes of a meeting held July 14, 1981 between the Department of Public Works and the Department of Economic Development, an Implementation Plan for Park facilities was established. Table 1.1, below, presents this current plan.

Table 1.1 - Implementation Plan

Summer 1982	approximately 15 unserviced campsites
	roadwork, as required, to access campsites and Liard River
	basic grading and site preparation for main G.N.W.T. development area.
Desirable 1982	15 additional campsites
	picnic tables, water, garbage disposal, barbeque pits, for all campsites
	clearing and pads for Summer 1983 construction
Summer 1983	shell for information/interpretive building (with self-explanatory displays)
	floating dock
	pit toilets
Desirable 1983	(Summer 1984 if 1983 funding does not permit.)
	- nature trails
	- picnic shelters
	- trailer pump-out station
	- sewage lagoon
	- day use area, Liard Highway

Summer 1984 (Summer 1985 if 1984 funding does not permit.)

staff residence

G.N.W.T. maintenance compound

outfitters centre

completion of the interpretive centre

Desirable 1984 (Summer 1986 if 1984 and 1985 funding does not permit.)

- remainder of roads and campsites as required
- wash house building (hot and cold running water, flush toilets, showers)
- cabins
- water supply
- electrical supply
- signage
- day use area at Liard River
- boat launch

It is subject to this plan that all design and construction work has been scheduled. Table 1.2, below, presents current timing for the design and construction of all components of the Park Master Plan.

Table 1.2 - Project Schedule, Design and Construction

CONTRACT YEAR	TASK	COMMENCEMENT	COMPLETION
1.	Geotechnical Analysis and Topographical Survey .	Aug. 14, 1981	Sept. 14, 19
	Detailed Site Development Plan	Sept. 14, 1981	Oct. 5, 1981
	Preparation of Tender Documents: Slashing	Sept. 21, 1981	Oct. 12, 198.
	Flagging on site	Oct. 5, 1981	Ott . 12, 198
	Tender Period and Award: Slashing	Ott . 5, 1981	Oct. 19, 198
	Construction Supervision: Slashing	Ott . 20, 1981	Nov. 30, 198
	Detailed Design: Roads and Pads (100% of facil- ities) WD's: Roads and Pads (Construction 1982, 75% of total)	Nov. 2, 1981	Feb. 2, 1982
	Site Supervision: Roads and Pads (75% of total construction)	July 1, 1982	Sept. 30, 19

CONTRACT YEAR	TASK	COMMENCEMENT	COMPLETION
2.	Design and WD's: Architectural Facilities (Construction 1983 - 18% of total)	Oct. 1, 1981	Feb. 28, 1983
	Design and WD's: Municipal Engineering Facilities (Construction 1983 - 50% of total)	Ott . 1, 1982	Feb. 28, 1983
	WD's: Roads and Pads (25% of total)	Dec. 1, 1982	Feb. 28, 1983
3.	Site Supervision: Roads and Pads Architecture Municipal Engineering	June 1, 1983	Oct. 15, 1983
	Design and WD's: Architectural Facilities (82% of total construction)	Oct. l, 1983	Feb. 29, 1984
	Design and WD's: Municipal Engineering Facilities (50% of total construction)	Oct. l, 1983	Feb. 29, 1984

CONTRACT YEAR	TASK	COMMENCEMENT	COMPLETION
4.	Site Supervision: Architecture Municipal Engineering	June 1, 1984	Sept. 30, 1984
5.	Site Supervision: Architecture Municipal Engineering	June 1, 1985	Sept. 30, 1985

1.5 Record of Costs

A separate record of costs is submitted with this report. That appendix presents both design and capital construction cost estimates based upon the current Master Plan and this Implementation Plan. Provision is also made to record actual versus estimated expenditures for each component of the project as it is completed.

It is intended that this appendix would be updated or revised regularly as new and more precise information is available. It has been conceived to serve as a comprehensive financial record for the duration of the project.

2. SUMMARY OF THE HARDY REPORT

2.1 Scope

Hardy Associates (1978) Limited were retained by P.P.A.L.in August, 1981 to undertake detailed geotechnical and topographic studies of the Blackstone Park site. Specifically, they were engaged to:

.1 Review and evaluate existing geotechnical and geological information;

.2 Investigate surficial geology and subsurface stratigraphic conditions at the site and provide data on subsoil engineering properties;

.3 Undertake a topographic survey of the access road and prime development areas and assist in the layout and flagging of final road alignments;

.4 Provide geotechnical recommendations with respect to foundations and road design;

.5 Investigate and make recommendations relative to the potential of flooding at the site;

.6 Recommend a sewage lagoon location for the development.

2.2 Report

The results of this study were presented in a report submitted by Hardy Associates to P.P.A.L.in November, 1981. This report deals in depth with the aspects listed above and includes field substantiation by. way of laboratory analysis of test pit material taken from approximately 15 locations on site.

It also records the topographic information obtained from the field surveys. This topographic information includes a contour plan, at 0.5 metre intervals of the prime development area and profile and cross sections of the road alignments.

2.3 Terrain Analysis

An important aspect of the study was terrain analysis. Through stereoscopic airphoto interpretation, verified by site observation and test pit analysis, relatively homogeneous terrain units are mapped. These terrain units, categorized in terms of landform, constituent materials, topography, drainage, permafrost, vegetation, etc., formed the basis for the geotechnical recommendations.

Figure 2.1 presents this terrain analysis; on that basis, the original P.P.A.L. Development Concept (September, 1981) was altered to avoid areas containing substantial permafrost.

2.4 Development Recommendations

The following pages comprise Section 6 of the Hardy Report. That section is entitled Development Recommendations and it deals specifically with potential foundation types, composition and structure of road beds, location of sewage lagoon, sources of granular and common fill materials and design data relative to flooding and ice jamming. The recommendations contained herein have been implemented in the current Master Plan and detailed Development Plan (Figures 3.1 and 4.3). Sections 3 and 4 of this report illustrate and describe those plans, as well as portray the influence that the geotechnical and topographic studies have had upon this design process.

6.0 DEVELOPMENT RECOMMENDATIONS

6.1 General

This section provides an assessment of site conditions, from the geotechnical engineering point of view. In the following paragraphs, development conditions are summarized and recommendations presented for a number of proposed Park facilities. Specific consideration is given to: foundations for various types of structure, access and prime development area loop roads, location of the sewage lagoon, and sources of common fill and granular borrow. Finally, a design development datum is proposed, relative to ice jamming and flooding.

6.2 Foundations

All permanent structures, with the likely exception of the sewage lagoon (described separately in Section 6.4), will be located in areas of glaciolacustrine plain or lake sediment-veneered moraine (map units 5a and 5b, respectively, on Plate 1). Expected near-surface stratigraphy within the prime development area consists of an interbedded sequence of sands and silts (Plates All, A13 to A17, Appendix "A"). Permafrost areas were avoided during final site selection for project facilities.

Foundation recommendations are provided below for two types of structure: pads for campsite, maintenance compound, etc., and more substantial facilities, such as the interpretive centre and outfitters camp.

6.2.1 Pads

Pads for camp sites, the maintenance compound and similar facilities, may be constructed of pit-run gravel, placed directly on the ground following clearing. A 30 cm thick pad is recommended, with a 10 cm thick surface course, of crushed gravel, where traffic is anticipated.

6.2.2 Permanent Facilities

All permanent structures should be located on a 30 cm thick pad, constructed of pit-run gravel, as described above. The recommended foundation system will depend on whether or not settlement is critical. Where some settlement is permissible (as is probably the case in this instance), a slab-on-grade foundation may be used. If settlement is critical, however, use of spread footings is recommended. Specific recommendations can be given, when more data on loading, settlement criteria etc. are available. We recommend, finally, that the edges of all foundations be insulated, to reduce heaving.

Our overall recommendation is that no permanent structures (including pads), be constructed in areas underlain by permafrost, so that problems with settlement, continuing maintenance requirements, etc., can be avoided. As noted above, such areas were avoided during final location of project facilities. Should construction on permafrost become necessary (and unavoidable) in the future, an increase in the thickness of the granular pad would be indicated; site-specific design and construction recommendations can be provided if requested.

6.3 Roads

Some 1.4 km of access road and approximately 1.0 km of prime development loop road are proposed. Locations are shown on Figure 2, and in detail on Plate 4 (Appendix "D"). As presently-proposed, all roads traverse unfrozen ground; however, construction across permafrost may be unavoidable in the future. Design and construction recommendations are provided for both cases.

6.3.1 Roads Across Unfrozen Areas

For their entire length, the presently-proposed access and prime development area loop roads, traverse unfrozen ground. Based on the field testing results, fine sands and silts, with some clay, are the main near-surface deposits along the preferred alignments (Plates Al to A7 and A13 to Al7, Appendix "A"). Organic-rich silt is the near-surface

material along the existing seismic line (i.e. western section of the initially-proposed access road) close to the river.

It is our opinion that the access and loop roads in unfrozen areas may be constructed using common fill (silt and sand); preferred borrow sources are described in Section 6.5. An approximately 1 m thick embankment is proposed, with a 10 cm surface course consisting of crushed gravel (20 mm to 25 mm ø maximum). Side slopes should be graded at 3H : 1V and similar backslopes are recommended.

Should the road cross organic terrain (e.g. thawed permafrost areas), consideration may be given to placement of filter cloth beneath the embankment, to separate the fill material from the underlying peat and organic-rich mineral soil.

6.3.2 Roads across Permafrost Areas

As noted previously, our main recommendation is that permafrost areas be avoided, during road location and construction. Since short sections of frozen terrain may be unavoidable, we recommend that a thicker embankment section, constructed of gravel, be used in these sections. Consideration should again be given to use of filter fabric beneath the embankment, to separate the gravel from the underlying organic materials. Notwithstanding these recommendations, it is our

view that periodic maintenance will be required on a continuing basis for several years after construction of all roads across permafrost areas.

6.4 Sewage Lagoon

A sewage lagoon measuring approximately 100 m by 10 cm and 2 m deep is considered for the proposed development. Liquid wastes would probably be transported from the prime development area to the facility by truck.

From a geotechnical viewpoint, preferred sites for the lagoon are upland (recharge) areas, underlain by an impermeable surficial deposit. Within the Blackstone Park boundaries, ground moraine areas (terrain unit 7 on Plate 1) are, in our view, most suitable. Existing information, however, indicates that the till in these areas (which might otherwise provide a suitable impermeable subgrade) is overlain by a veneer of silts and sands of glaciolacustrine or meltwater-reworked morainic or ig in. Thus, we recommend consideration be given to installation of a synthetic liner, to minimize seepage losses.

Three potential lagoon sites, selected on the basis of the airphoto interpretation and field reconnaissance only, are indicated on Plate 1. Based on existing information, the site east of the highway at approximately km 106 is preferred. This is the site of an existing,

disused camp and, thus, already disturbed. Observations of road cuts in this area, and logs of Public Works Canda boreholes, indicate that till occurs at relatively shallow depth.

It is recommended that additional field testing be undertaken once selection of a lagoon site is. finalized. At that time, it will be possible to provide site-specific design and construction recommendations.

6.5 Borrow Sources

Sources of both common fill and granular borrow are required for the proposed development. Three potential sites for development of pits in each type of material are indicated on Plate 1 (Appendix "D").

6.5.1 Common Fill

Glaciolacustrine silts and sands will be used for common fill in road embankment construction, since sources of till are not readily available. Though not ideal (due to frost susceptibility), this material (silt and sand) has been used for construction of the Liard Highway, and has apparently performed satisfactorily. The preferred source of common fill is the existing Public Works Canada pit a short distance north of the Park (at km 100.5 approximately). Sites within the Park, where development of a new pit would be necessary, are shown

on Plate 1; the most suitable is probably one located adjacent to the preferred sewage lagoon location (see Section 6.4).

Grain size analysis curves for and Standard Proctor moisture-density relationships for the considered borrow material are shown on plates B1 to B3 and B5 to B6.

6.5.2 Granular Borrow

The glaciofluvial terrace north of the Blackstone River crossing constitutes an extensive source of good quality material for gravel pad and road construction. Possible pit locations are indicated on Plate 1. Our preferred location is one adjacent to the existing Public Works Canada pit, west of the Liard Highway. The gravel stratum is apparently considerably thicker east of the highway; however, utilization of this material would entail opening of a new borrow pit within the Park.

A grain size curve for a coarse aggregate sample from the existing Public Works Canada pit is shown on Plate B4.

6.6 Design Development Datum

In accordance with the established terms of reference, consideration was given during the literature review and field reconnaissance phases to available evidence for flooding and ice shove. These data provide a basis for delineating a design datum for the Blackstone Park development. Correspondence was also exchanged with B.C. Hydro, relative to recent flood levels at the site.

6.6.1 Field Evidence

During the field reconnaissance (Section 4.2), the Liard River bank along northwest boundary of the site was inspected for ice scouring damage of trees and flood debris. Evidence of ice scouring was noted on trees at the end of the seismic line near the bank crest, in conjunction with flood debris. It was also observed that some of the vegetation along the bank at lower elevations had been subjected to ice shoving. Small terraces composed of silt had been deposited by the Liard River at the base of the bank, and were being actively eroded by the river and intermittent drainageways which cross the site. Recently available evidence, notably discussions with local residents, indicates that maximum observed flood levels have been close to bankfull elevation.

6.6.2 Previous Studies

B.C. Hydro are considering the construction of a hydro-electric darn on the Liard River which, depending on the location of the dam, could affect the maximum flood levels in the vicinity of the site. In connection with this project, flood elevations have been calculated and recorded for the Liard River at its confluence with the Blackstone River. These data, provided to us by Mr. B. Tutt, B.C. Hydro, are as follows:

Table II

Recent Flood Elevations, Liard-Blackstone Confluence

Year of Breakup	Maximum Level during Breakup (m above GSC Datum)	Comments
1974	172.1	Calculated
1978	174.5	Calculated
1980	173.3	Calculated
1981	177.3*	Observed

* This level was about 1 m below the vegetated trimline.

It should be noted that the above levels are those that occur during breakup of the winter ice cover, in late April or early May. No attempt has been made to assess the frequency of the levels (although

the proximity of the vegetation trimline indicates that the level reached in 1981 should be near the maximum) or to assess the levels reached during the June freshet peak.

6.6.3 Recommendations

Based on the field evidence for flooding and ice shove, and in light of data on' recent high flood levels provided by B.C. Hydro, we recommend that a set-back for development of 50 m from the bank crest should be adopted. It should be emphasised, however, that due to the variable flow and ice conditions for the Liard River, catastrophic floods, for example related to ice jamming in the area, could result in flooding further into the site than expected.

We understand a boat landing is proposed near the east mouth of the Blackstone River. It should be recognized, in this connection, that a relatively strong river current may occur in this area due to the discharge from the Blackstone River and that, the location will be subject to ice shoving in winter. Thus, it is recommended that the landing be placed further east along the bank and provision made to 'protect the installation from ice shoving.

Respectfully submitted,

HARDY ASSOCIATES (1978) LTD.

Per: I. Jones, M.Sc., P.Geol.

IJ: lbh

HARDY ASSOCIATES (1978) LTD.

CONSULTING ENGINEERING & PROFESSIONAL SERVICES

File No. K5846

November 16th, 1981

Project Planning Associates Limited,
111 Avenue Road,
Toronto, Ontario.

Attention: Mr. G. Whitelaw

Dear Sirs:

Re: Occurence of Permafrost in
Test Pits 12 and 14,
Blackstone Park, NWT

At your request, I have re-examined the Blackstone Park airphoto coverage and reviewed test pit logs, in an attempt to explain the above described apparent discrepancy (i.e., occurence of permafrost within an area described as unfrozen, based on airphoto interpretation).

Reference to the test pit logs indicates that at both sites, the near-surface materials consist of organic-rich silts and clays. Encountered thicknesses of organic-rich material in test pits 12 and 14 were $\geq$0.56 m and >1.22 m, respectively. As noted on page 18 of our recent report, permafrost exists where organic-rich material thicknesses are in excess of about 0.5 m. Our airphoto review suggests that the two test pits were located in small organic-infilled terrain depressions i.e., essentially inliers of terrain unit 1d, within the larger terrain unit 5a. For this reason, it is our view that the occurance of

permafrost is to be expected. In our opinion, however, the organic areas, and associated permafrost occurrences, are of limited extent. We believe that the areas of terrain unit 5a (glaciolacustrine plain) are generally unfrozen and, thus, suitable for development, as noted elsewhere in our report.

We trust the foregoing is satisfactory. Should you have any questions, please contact us at your convenience.

Yours truly,

HARDY ASSOCIATES (1978) LTD.

Per:
I. Jones, M.Sc., P.Geol.

IJ:bjh

HARDY ASSOCIATES (1978) LTD.

CONSULTING **ENGINEERING** & PROFESSIONAL SERVICES

File No. K5846

November 19, 1981

Project Planning Associates Limited
111 Avenue Road
Toronto, Ontario

Attention: **Mr. G. Whitelaw**

Dear Sirs:

RE: **Elevation** Differences Between Grades **for Roads** and Facility Pads, **Blackstone Park, N.W.T.**

Following our conversation of November 19, 1981, with respect to the Above topic, I have reviewed the recommendations contained in our recent report. My conclusions are as follows:

a) Fill and granular material thicknesses, recommended for roads and pads respectively, are in line with recent practice in this area. We are in full agreement with them.

b) In light of the above, we recommend that where differences in grade elevation are encountered, the road be ramped down to the facilities pad. A ramp grade of 6H:1V to 10H:1V may be adopted.

We trust that the above is satisfactory. Should you have any questions, please contact us at your convenience.

Yours truly,

HARDY ASSOCIATES **(1978) LTD.**

per: I. Jones

I. Jones, M.SC., P.Geol.

IJ: pm

3. PARK MASTER PLAN

3.1 User Groups

The market analysis undertaken by Laventhol and Horwath in the original P.P.A.L. report, subsequently confirmed in the most recent Master Plan design phase, identified four basic user groups. These are:

.1 **Tourists traveling the Liard Highway, en route to or from the Alaska and Mackenzie Highways, seeking overnight camping accommodation;**

.2 **Tourists traveling by auto or recreational vehicle to Nahanni National Park, wishing to spend first or last nights at Blackstone Park;**

.3 **Residents of neighboring communities in the N.W.T. or northern British Columbia wishing to spend long weekends with** family or friends (particularly during hunting and fishing season);

.4 Groups of tourists or community organizations (Boy Scouts) traveling the Liard Highway, requiring certain amenities and space to meet their group camping needs.

Within each of these categories persons seeking varying degrees of privacy and amenity can be expected.

A large percentage of Park users are anticipated to be pulling trailers or traveling in recreational vehicles. These persons will generally require drive-to (and pull-through) sites which provide electrical hook-up and access to potable water.

A second cross-section of users will desire a greater degree of privacy than drive-to sites can offer. They would sacrifice minimal walking distances (maximum 100 metres) for desirable tent camping experiences.

Thirdly, those Park users destined for Nahanni National Park will prefer solitude and views that neither of the options described above can provide. It is our conclusion that these campers, a minority, would walk more substantial distances (± 500 metres) to arrive at more primitive camping sites.

The original market study undertaken in November, 1980 - March, 1981 by Laventhol and Horwath, concluded that by summer 1987, user demand would require 33 serviced sites and 5 primitive sites. We have continued to use these figures in the belief that they represent the best estimate available to date. Thus, the Master Plan, which illustrates the long-term development potential of the site, includes this first phase of construction up to 1987, as well as future sites and facilities to be built as required.

The first phase of development (see Figure 3.1) includes 33 serviced sites (24 of which are walk-to, semi-serviced tent camping sites adjacent to the access road) and 5 primitive camping sites at the

south end of the development along the river.

-The second phase, as indicated, could bring the total number of serviced sites up to 85, 25 of which would be semi-serviced. Additional primitive camping sites on Crescent Island at the confluence of the Blackstone and Liard Rivers, would bring that total to approximately 14 sites.

A third phase of expansion, in the distant future, would be accommodated north of the current prime development area, across the existing drainage course. That phase could include Parks Canada, a larger-scale group camping area if required and, additional serviced camping sites.

Based on these user groups and the types of camping experience which will be sought by them, the components of the Park Master Plan have been developed.

3.2 Component Facilities

The facilities which comprise the total proposed Park development (Figure 3.1) are:

.1 Day-use and Picnic area, at Liard Highway crossing of Upper Blackstone River;

.2 **Roadside Lookout and** Rest Stop along **Liard Highway, at ± kilometer 105;**

.3 A Park Centre, including registration, information, interpretation (indoor and outdoor) and outfitters functions;

.4 A Maintenance Centre, including garage, shop, storage and maintenance compound for Park staff;

.5 A bunkhouse for seasonal Park staff;

.6 A residence for the Park superintendent;

.7 Supervised parking for 20 vehicles, while owners are at Primitive Camping or in Nahanni National Park;

.8 Serviced Campsites, drive-to with electrical hook-ups (Phase I, 24 sites);

.9 Un-serviced Campsites, removed from road by footpath, for tent camping (Phase I, 9 sites);

.10 Primitive Campsites, distant from development area along Liard River, for tent camping (Phase I, 5 sites);

.11 Group Campsite, for congregate camping;

.12 Wash Houses, providing running water, hot showers and outdoor sinks for dishwashing;

.13 Primitive Cabins accommodating two to four persons per cabin, without running water or electricity;

.14 Floating Dock, for boats and floatplanes which are transporting campers into Nahanni National Park;

.15 Boat Launch Ramp, for launching of tourist and Park boats;

.16 Water supply and distribution, to main buildings and wash houses;

.17 Electrical supply and distribution, to main buildings, wash houses and serviced campsites;

.18 Solid waste collection and disposal system;

.19 Liquid waste collection and disposal system.

3.3 Prime Development Area

Items 3.2.3 through 3.2.15 listed above comprise the prime development area for the Park. These facilities are described in depth in Section 4 of this report. This present section will deal further with those components which lie outside the prime development area and constitute the balance of Park facilities.

3.4 Engineering Services

.1 Basis of Estimates

The requirements for water supply and distribution, waste disposal and electrical distribution are based on the following estimates of maximum occupancy of the Park on any one day. (Laventhol and Horwath, March, 1981)

	1983	1987
G.N.W.T. staff, official visitors and outfitters	15	15
Tourists	93	140
	108	155

.2 **Water Supply**

The location of facilities requiring water, i.e. wash houses, residence, Park centre, maintenance centre and bunkhouse, has primarily determined the decision to use drilled wells as water source in preference to Blackstone River water intake. Drilled wells will provide a consistent quality of water and will be more economical than piping water the distance from the Blackstone River to the prime development area. The extremely silty and turbulent water of the Liard River preclude consideration of that source.

The wells and a 20,000 litre storage tank would be located in the maintenance centre and water would be distributed via 30 mm and 50 mm diameter plastic pipe under pressure. The pipes would be buried in shallow trenches and would be drained at the close of the Park season.

Estimated water consumption is about, 22,000 litres per day in 1983, growing to 34,000 litres per day in 1987.

.3 Electricity

A 600 volt, 3 phase, 3 wire diesel generator will supply electricity to the prime development area. This generator would be located in the maintenance centre, along with a fuel storage tank with capacity of two weeks and would distribute power to the serviced

campsites, wash houses, Park centre, residence and bunkhouse.

Primarily for reasons of maintenance, we recommend distribution via overhead wires, on poles spaced approximately 70 metres apart. Main distribution would be at 600 volts, with small transformers stepping the power down at entry to a facility or to a loop.

.4 Liquid Waste

Figure 3.1, the Park Master Plan, shows the prime location recommended by the geotechnical consultants for liquid waste disposal. The relatively high percolation rates of the soil across the site determined a location which was distant from both the Liard and Blackstone Rivers. Based on this recommendation, we propose a septic disposal system. Such a system would use the high percolation rates of the soil to natural advantage and would consist of a concrete septic tank with a covered percolation pit constructed of logs.

Each building to be serviced, the wash houses, Park centre, maintenance centre, residence and bunkhouse would have a holding tank within and a sewage truck would pump them out daily and deliver the sewage to the disposal site.

.5 Solid Waste

By 1987, the estimated maximum generation of solid waste (155 park occupants) will be about

305 kilograms per day. This waste will contain a large percentage of foodstuffs which could attract wild animals. Specially designed receptacles will be required to prevent access by animals; there must be daily collection and disposal. A small, two-ton truck with high side boards will be suitable for collection.

The disposal site, located adjacent to the liquid waste disposal site (Figure 3.1), would consist of a trench approximately 100 metres long, dug once a year by backhoe, into which waste is dumped and manually covered with approximately 0.5 metres of earth.

This site and the adjacent septic system, would be enclosed by chain link fence to prevent excessive foraging by animals.

.6 Day-use and Picnic Area

As shown in Figure 3.1, we propose a day-use area, for persons traveling the Liard Highway, which is located on the banks of the Lower Blackstone River.

Additional sites may be developed in future in other quadrants; for the present we recommend two nodes, east and west of the Highway, which include:

- picnic tables (5)
- fireplaces (5)
- signs indicating facilities offered at Blackstone Park

- parking: at least 5 spaces
- litter bins (2)
- pit toilets (2)
- walking trails connecting with the overall Blackstone Park system of trails
- approximate area required for a 5 table site: 6,000 m^2

.7 **Roadside Lookout and Rest Stop**

At a location near kilometres 105 on the Liard Highway, Figure 3.1, a natural vantage point of the Nahanni Butte and Range exists. We propose construction of a rest stop and lookout at that point (note: for trucks, it is well away from the Blackstone bridges and gradients either side).

The lookout would provide parking for 5 cars **along with clearing and selective cutting to give a good view of the Butte, the** Nahanni **Range and possibly the** Liard River.

Detailed design will assess the need for a raised platform; if a raised platform is required, it will be constructed of logs and planks to conform with the Blackstone Park motif (Section 4.2) .

4. PRIME DEVELOPMENT AREA

4.1 Opportunities and Constraints

The Hardy study undertaken in August and September, 1981 provided, for the first time, in-depth and site specific information. That information has been reviewed and augmented by numerous field trips and considerable time on site. With each trip, new information has been obtained and previous assumptions refined. As a result, by mid-October, a more complete understanding of the nuances of the site prevailed and, with relative accuracy, its opportunities and constraints could be mapped.

.1 Soil Types

The foremost site constraint has proven to be soil conditions. Figure 2.1 shows the terrain analysis carried out by Hardy Associates and Figure 4.2 incorporates this aspect with the other site factors which have influenced the development.

Large areas of fine grained silt, overlain by organic material forming a bed of insulation, were found to exist at the southern and northern extremities of the originally proposed development area. These areas were confirmed to be underlain by permafrost and, as such, considered to be problematic for initial construction and on-going maintenance. The existence of these permafrost areas became strong parameters and, at the advice of our geotechnical

consultants, it was determined that road alignments or permanent structures should not be located within these areas.

Other soil types within the prime development area were found to be generally acceptable for construction purposes. As indicated in Figure 2.1, they are all relatively fine-grained, hence are frost susceptible. Isolated pockets of permafrost were found to occur in zones which are largely ice free. Foundation and construction recommendations dealing with these concerns have been presented by the geotechnical consultants and are included in Section 2 of this report.

.2 Vegetation

The foremost site opportunity has proven to be vegetation. Figure 4.1 presents an enlarged airphoto of the site and delineates the types of vegetation which occur within the prime development area.

The lower portion of the site adjacent to the Liard River is covered by low alder and diamond willow. The permafrost zones are wet, owing to poor ground water percolation and are covered by black spruce. Stands of mature deciduous i.e. birch and poplar, are found in isolated spots throughout the development area and in larger stands where site drainage is particularly good, i.e. sides of drainage courses, the crest and side

of the River bank and sides of the upper terrace of the Liard.

In addition, as shown in Figures 4.1 and 4.2, dense stands of mature white spruce ranging from 10 metres to 25 metres in height are situated in five or six locations within the prime development area. These stands are likely remnants from a mature forest existing on the site prior to the large forest fire of 1941 which decimated the area.

These varying types of vegetation have formed the basis around which design ideas have evolved. The principal concept has been to minimize the cutting and clearing of the mature white spruce stands and to locate the semi-private, un-serviced campsites within these groves. Access roads, loop roads and all drive-to campsites would be located in the less desirable alder and willow areas. These areas should be thinned in any case to aid regrowth of more desirable deciduous and coniferous trees. Other areas which are extremely rich with varied vegetation (i.e. along the major drainage courses) would be left untouched for interpretive walks or primitive camping.

.3 Topography

The topography within the prime development area is relatively uniform. As a result, it has been a less dominant design factor.

At a distance of approximately 500 metres from the crest of the Liard River bank, a second terrace of the Liard River exists. At this point the grade alters from an even 2 % to approximately 10 %, exceeding the 5 % gradient which we have considered to be maximum for practical development. This second terrace forms the eastern limit of the prime development area.

A major drainage course which has known many configurations over the years forms a bowl-like depression at the northern end of the site. A deep incision runs from this depression down to the Liard River. We consider it prudent to avoid this depression and drainage course with camping sites or road alignments. Figure 4.3, the Development Plan, suggests that this drainage course could, in future, be crossed to lead to additional camping loops, group camping (larger scale than at present) and the potential Parks Canada development.

4.2 Park Architecture

Concern with off-season vandalism and with escalating maintenance costs has led the G.N.W.T. 's Department of Public Works to consider new directions with Park architecture. As the use of Blackstone Park, and resultant supervision of its facilities, will be primarily during late spring, summer and early fall; the suggestion has been put forth that the approach to architecture should similarly be seasonal. As

cited by D. P. W., strong precedent for this exists in the form of traveling carnival and exhibition structures.

Based on this notion, we would propose permanent shell structures of log construction, with fabric and screening forming an inner enclosure which is seasonably removed and safely stored. The log shell structure would consist of a roof, floor platform and the minimal supports required for stability.

We would propose that as indicated in Figure 4.3, very simple forms be utilized and that careful study be given toward roof shape, texture and colour, as this will be an important building elevation. Coloured fabrics could be used extensively to impart a vibrance which is generally difficult to achieve in log architecture.

This approach, and a basic form generated by it, should comprise a family of Park elements. These would range in size from the smaller cabins and wash houses to the supervisor's residence, bunkhouse, Park centre and maintenance centre. All of these facilities could be a similar combination of log shell structure with fabric enclosure. The use of screening in lieu of windows will permit larger openings without the maintenance problems of glass cracking due to log settlement or breakage by vandals.

Fixtures or equipment which may be difficult to remove seasonally, such as waterclosets, sinks, etc.,

could be contained to one room per building, which would be secured at the close of Park season from abuse by vandals.

This hybrid log and fabric system possesses the advantages of temporary buildings (at an admittedly greater cost); but minimizes the enormous daily **care which large tent structures do require. It also presents a sense of solidity and permanence which we consider to be important** in **this application.**

We enthusiastically welcome D.P.W.'s suggestion for this architectural approach and are convinced that, with proper study and execution, it could alleviate many traditional problems while creating a new expression which is economical and exciting.

5. RECOMMENDATIONS FOR IMPLEMENTATION

5.1 Site Drainage

Currently, site drainage is adequate in most areas upon which development will occur. However, a natural levee has been formed at the crest of the Liard River bank and this reduces surface sheet drainage substantially in some areas. The increased water content in the soil in those areas contributes to the proliferation of alder and willow and could be the cause of isolated permafrost pockets. We recommend that further study be given to enhancing drainage in these areas, possibly by cutting channels through the levee.

The second consideration in this regard is the effect upon overall site drainage which the creation of loop roads and camp pads, particularly those running perpendicular to current drainage, will produce. culverts will be placed at necessary intervals to avoid damming run-off; but there is concern that with fine grained soil such as this, silting-up of culverts and ditches may be a continual maintenance problem. The significance of this problem has yet to be quantified. If it is severe, consideration may be given to the provision of a counter-swale above the prime development area which would divert run-off coming down the slope prior to its reaching the roads and camp pads.

5.2 Erosion Control

Another aspect which should be monitored in the first years of Park operation is erosion of the Liard River

bank. This will be principally of concern in the vicinity of the proposed floating dock and boat launch ramp. At that point along the shoreline, a road down to the river's edge is proposed and, while it is at a location which is considered by the hydrological consultant to be reasonably safe, the potential extent of ice and damage at the river bank is not known for certain. Other such situations along the Liard River (i.e. at Edwin Lindberg's, the landing further downstream and the ferry crossings at Liard and Mackenzie rivers) suggest that a diagonal approach down to the river, with earth berming not greater than lv : 3h will stand up to erosion. This must be closely watched to determine if further retaining measures will be required to support the banks at that location.

5.3 Resident Site Superintendent

Due to the sensitive nature of a development in which preservation of natural site features is of paramount importance, coupled with the G.N.W.T.'s mandate to employ local forces not necessarily experienced in Park construction practices, we strongly recommend that a resident superintendent be present on site during any major construction. Innumerable field decisions will occur with work of this nature and it will not always be possible to wait for the next site visit.

5.4 Tree Inventorv

During summer construction in the first year, prior to detailed design of architectural facilities, we

would recommend that a limited tree inventory be undertaken. This will locate, more specifically, the mature trees in the vicinity of proposed architecture and will facilitate integration of buildings with the surrounding vegetation. The area to be inventoried would be approximately 0.5 hectare.

5.5 Trails and Walking Paths

It is our recommendation that for the first three years of Park operation, very few trails or walking paths be constructed. An established pattern, based on where the users wish to walk, will become evident. Trails may then be built in these proven areas of use.

Exceptions to this method may be environmentally sensitive areas, which should be restricted from the outset and, interpretive trails, which will likely need to be planned by a naturalist.

5.6 Park Maintenance

It is a well corroborated theory that vandalism is a function of maintenance and cleanliness. We presume this will be the case for Blackstone Park as well. Thus, from an economic point of view, not to mention that of tourist image, we would strongly recommend an extensive daily Park maintenance programme. This would include daily garbage pick-up at each campsite and a litter check of all sites, trails and public areas. It will provide local job opportunities and we are convinced that it will prove to be cost effective maintenance.