The Impact of New Highways upon Wilderness Areas

Opinions with respect to whether it is in the public interest to construct roads into wilderness areas of Alaska and the Canadian territories are varied. Ernest Gruening, governor of Alaska from 1939 to 1953, says, "Highways are indispensable to development and settlement."[1] George W. Rogers of the Institute of Social, Economic and Government Research deplores the fact that development has been "a simple linear process which either pretended there were no side effects or ignored everything but the desires of the exploiter."[2]

Much time has been devoted to impact studies of new or improved highways on urban and rural areas,[3] and much energy has been devoted to studies of the impact of new or improved highways on commercial, residential or recreational developments. Bucksar and Lotz have even studied the behaviour of squatters along highways and on the margins of settlements in the North.[4,5] However, the main thrust of these studies and of most research has been towards what happens to a settled countryside.

In Alaska and the Canadian Territories today the stage of development of the countryside at the time of highway construction compares in many ways to that of eastern North America in the early 1800s. Just as the National Pike was pushed west from Baltimore through wilderness areas after the Revolution, so the Richardson Highway was completed during the first quarter of the twentieth century through country in a comparable stage of development.

The Alaska Highway in 1942 gave access to the road system of south central Alaska by connection with the Richardson Highway at Delta Junction. At the same time this trunk highway from the United States and Western Canada provided a land connection to southeastern coastal Alaska via the White Pass and Yukon Railroad at Whitehorse and a water connection for passengers and freight with the river settlements of the Yukon through regularly scheduled steamboat service. Most of the principal British Columbia, Yukon, and Alaskan settlements were linked together by this one arterial highway. The Glenn Highway and Tok Cut-Off construction brought Anchorage into the system in 1943. Thus at the conclusion of World War II, Anchorage and the Cook Inlet-Kenai region as well as the Tanana Valley and Fairbanks were accessible to anyone in the United States or Canada who possessed a reasonably sound motor vehicle and the willingness to endure a few minor hardships. (Fig. 1.)

In Yukon Territory by 1951, highways had connected Dawson and Mayo with the outside world at Whitehorse. During the next twenty years the Yukon Territory opened the Robert Campbell Highway from Carmacks to Watson Lake via Ross River and brought to minimum standards for summer use the old Canol Pipeline Road and the Nehanni Ridge Road. Construction of the Dempster Highway began in 1959, when it was known as the Flat Creek-Eagle Plains Road.[6] Renamed the Dempster Highway in 1962, construction has now been completed to Mile 166.

Alaska during the same period completed roads to the Yukon River at both Eagle and a point near old Fort Hamlin northwest of Livengood, a connection from the Richardson Highway to McKinley Park, and a through highway paralleling the Alaska Railroad from Anchorage to Fairbanks.

Concern for the environment through which a highway passed was undreamed of in the early 1800s, and even 150 years later few actually worry about highway impact. Gruening's article,[1] written in 1953, does not recognize environmental degradation as a problem. Since 1953, however, concern for the environment has developed both in and out of the North, but there certainly is no agreement at the present time concerning the role highways should play in development, the nature and extent of damage to the wilderness, or even whether there is any permanent environmental damage when a new highway is built.

All authorities agree that changes in the visible landscape do begin with the construction of a highway through a wilderness area of the Arctic or Subarctic. A preponderance of opinion favours the view that the benefits to be derived from new highways do outweigh the undesirable side effects, and plans for future highway construction in Alaska, the Yukon, and Northwest Territories tend to indicate this to be the official view as well.[7]

The background of conflicting opinions, claims, and counter-claims which have been building to the present intensity for several years prompted this study. Much relevant information was obtained by interviews with knowledgeable individuals prior to actually visiting these areas and travelling the highways. Those interviewed included government officials, highway department employees, fish and game personnel, and researchers at the universities of Alaska and Alberta, as well as private individuals includ-

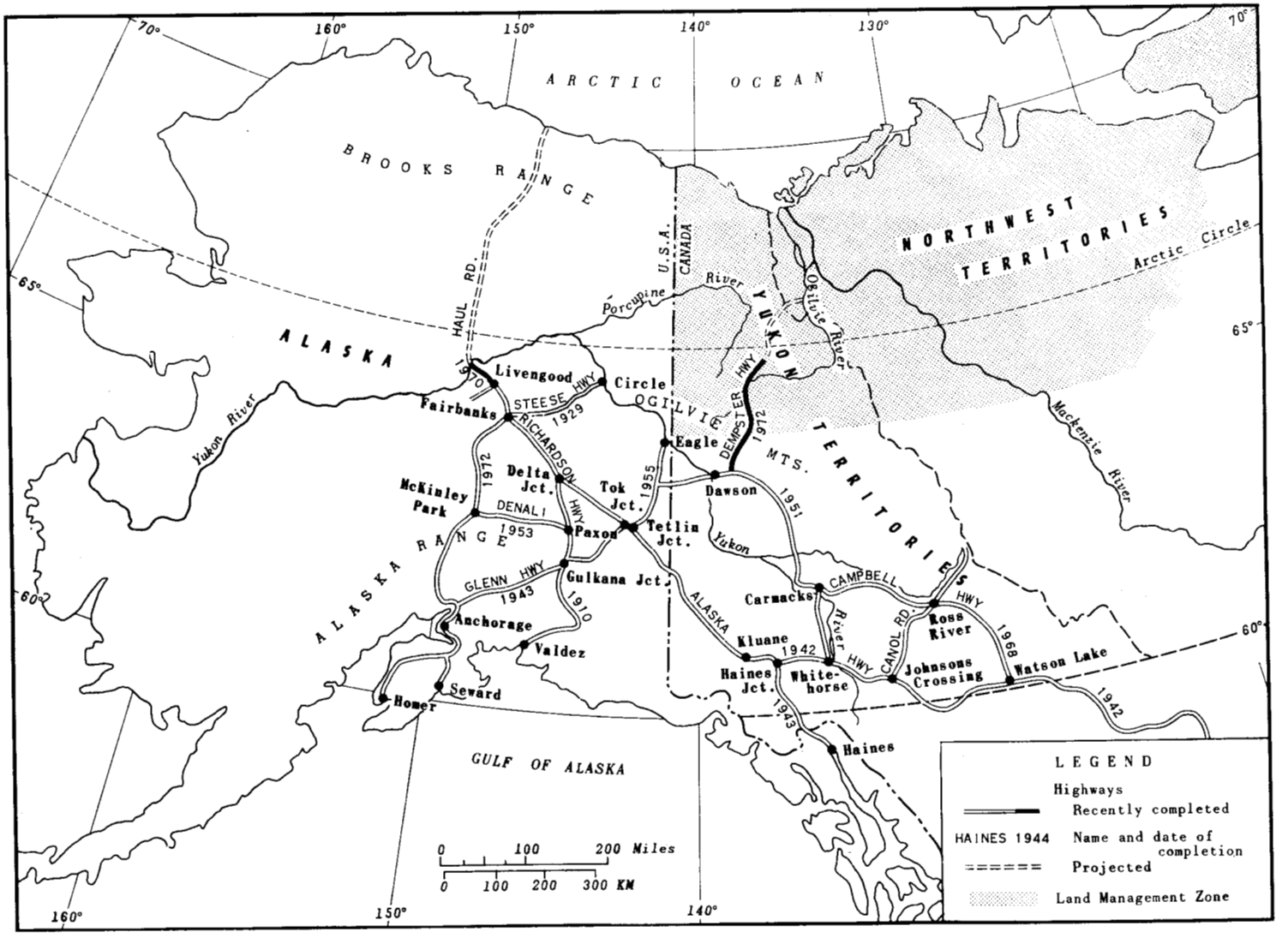

FIG. 1. Highways of Alaska & Yukon Territory.

ing hunting guides, resort operators, bankers, editors, and long-time residents of Alaska and the Yukon.

During the spring and summer of 1972 approximately 8,000 miles of Alaskan and Yukon Territorial highways were travelled in an effort to gain first-hand knowledge of present conditions along the corridors of highways which had been built through wilderness areas during the past thirty years (Fig. 1).

As was to be expected, dwellings, business establishments, and tourist accommodations were most concentrated in the vicinities of Whitehorse and Dawson in Yukon Territory, and in Anchorage, Fairbanks, and Delta Junction in Alaska. In those localities, highways, air facilities, and in some cases, railroads and water transportation converged. Radiating outward from these centres along the highways various structures have been built and modified with all types of materials and quality of workmanship. Many, although abandoned, still remain surrounded by the accumulated debris of twentieth century frontier life. This rubbish, left where it finally became unusable, economically unrepairable, or unsalable, is a characteristic feature of these highway corridors and the Alaskan-Yukon landscape. Commercial establishments in these crossroads communities are housed in all sorts of structures, including log cabins and house trailers.

In contrast to the highly individualized structures and random arrangements along the older highways and in crossroads communities which have grown up after highway construction are the company towns of the Yukon such as Clinton Creek and Faro. These settlements did not grow but were built according to a plan which included the provision of all services and facilities. These communities exhibit the orderly newness of mass-produced buildings constructed under contract and arranged geometrically in a cleared area. To the traveller who has driven many miles through the wilderness the appearance of a company town comes as a shock, but this impact is preferable to that of the unplanned agglomerations of substandard dwellings found elsewhere.

In contrast to these older highways and their somewhat settled corridors, stand the new roads under construction and still to be completed through virtually unsettled areas. Here it is possible to see the road through the wilderness environment without any complicating settlement features. Here also is an opportunity to obtain baseline data which can be compared with information to be obtained later as the pattern of settlement and development progresses.

One of these roads, the TAPS (Trans-Alaska Pipeline System) Haul Road, completed in 1970 for 55.5 miles from Highway 2 near Livengood, Alaska, to the Yukon River, had not yet been opened for public use in the summer of 1972. The recent controversy over the proposed construction of a highway paralleling the Trans-Alaska Pipeline and general concern for the Alaskan landscape have placed the oil companies and their contracting agent on the defensive with the public. Consequently, more than the usual planning and care have gone into the construction of this highway. In fact, this project might be considered an experiment designed to develop the techniques by which a first class heavy duty highway can be constructed through the subarctic forest with a minimum permanent impact on the environments where highway construction and landscape restoration are anything but easy. Permafrost is located close to the surface and cannot always be avoided. In some places relief is of the order of 1,500 feet. Many swamp areas are scattered through this predominantly spruce-birch forest of the Yukon-Tanana uplands. However, Hess Creek is the only stream of any size which had to be bridged.

The result of all the controversy, public debate and careful planning is a highway which is a joy to behold. Broad sweeping curves carrying the traveler along the contours of the low mountains open vistas of valley after valley until finally the broad loops of the Yukon River itself can be seen through gaps in the tributary valleys.

Much has been written about the retarded pace of revegetation in the Subarctic. No attempt to revegetate a highway corridor under these conditions ever was attempted on this scale before. No one knew whether highway cuts, push areas, fills, and permafrost exposures really could be stabilized and healed before erosion set in. However, the conditions imposed upon the Burgess Construction Company and TAPS left no choice. The landscape had to be restored, and the first necessity was to stabilize the sides of cuts, fills, permafrost exposures, and push areas.

Permafrost stabilization was achieved where ice lenses were exposed by leaving the road cuts with perpendicular sides. When an ice lens supporting the overburden of soil and vegetation melted away, the unsupported overburden gradually slumped to form a slope which healed rapidly and provided a base for revegetation. Non-permafrost areas were graded and prepared according to accepted practice. Gravel was obtained from

areas screened from the roadway by vegetation; sometimes borrow pits were established as much as half a mile from the highway right-of-way.

The final step was artificial seeding of exotic grasses, by hand in some localities and in other instances with a hydroseeder using a commercial mix of 75 percent oats and 25 percent perennial grasses mixed with 300 lbs. of 22-11-11 fertilizer per acre.

The first 33 miles of the highway corridor were seeded before 4 July 1970, and the remainder from Hess Creek to the Yukon River was completed by 17 July 1971. The areas which were in their third growing season showed the differential survival of different species which one would expect of a grass mixture planted under a variety of conditions of soil, moisture, slope, and exposure. However, even in the areas which were only in their second growing season, the natural revegetation cycle had already started. Willows and even a few white spruce seedlings were flourishing. A count of a typical area 36 inches by 36 inches in the section seeded in 1971 showed 46 healthy willow seedlings mixed with the grasses. A similar count made in the 1970 area of seeding showed 74 willow seedlings.

In contrast to the TAPS Haul Road, the Dempster Highway has a more typical history. The first 79 miles were completed by 1962 to facilitate the initial petroleum exploration in the northern Yukon.[6] In 1965, the Northern Road Program scheduled the Dempster for completion to Fort McPherson by 1975 and projected the extension to Arctic Red River, Inuvik, and Tuktoyaktuk in the 1976-1985 time frame.[7] The section from Mile 79 to the Ogilvie River (Mile 123) was contracted in 1969; at the same time the surveys for Miles 123 through 166 were begun. This section was completed in 1972, and construction of an additional 12 miles started in July of that year. This last 12 miles is the first section of the highway to come completely under the provisions of the Territorial Lands Act of 1970 and the Territorial Land Use Regulations passed on 2 November 1971.[8]

The Territorial Land Use Regulations are designed to regulate exploration and development activities on federal lands of the Yukon and Northwest Territories, to insure maximum protection for the environment but in no way to exclude or prohibit exploration, development or exploitation of natural resources. The regulations refer specifically to water crossings and clearing of lines, trails and rights-of-way. They also deal with fuel storage areas and the required after construction cleanup. Land Management Zones have been established to facilitate administration.

Miles 79 through 123 had been bid and the contract let before the Land Use Regulations became effective. Hereafter they will apply to all construction work north of the 65th Parallel (approximately Mile 86.5). Consequently the remaining construction in Yukon Territory will be monitored for compliance with these regulations from Whitehorse where Yukon Land Management Zone #3 is administered (Fig. 1). Jurisdiction changes at the Yukon-Northwest Territorial boundary to Northwest Territorial Land Management Zone #2, and responsibility for enforcement of the regulations will shift to Yellowknife.

Unlike the TAPS Haul Road, which was completed by one contractor under a crash program in less than 12 months, the Dempster Highway has been constructed over a 10-year period by several contractors using different standards. In the beginning economy in layout and construction were the paramount considerations. Gravel was taken from stream beds; borrow pits were not concealed; brush was left in push areas; and no revegetation was attempted. Consequently the first 123 miles of this highway will provide an excellent basis for comparing the residual impact on the environment resulting from construction under the old standards with the impact from highways built later under the new standards. The section from Mile 123 (Ogilvie River) to Mile 166 is transitional since the new construction practices and restrictions imposed by the Territorial Lands Act were gradually applied. From Mile 166 northward all the new regulations will be in full effect.

In addition to the controls imposed with respect to construction practices, other sections of this same regulation give the Minister of Indian Affairs and Northern Development power to carry out land development plans through his authority to withdraw land and issue limited land use permits. He also may enforce the regulations through his power to cancel a permit when a provision of the act has been violated. Currently all the land along the Dempster Highway has been withheld from settlement until a development plan can be worked out. However, there are at present few restrictions which apply to the use of the highway or the newly accessible wilderness areas by either local residents or visitors. In fact, Paragraph 3 of the Act states that "These Regulations do not apply to (a) anything done by a resident of the Yukon Territory

or the Northwest Territories in the course of hunting, fishing or trapping; or (b) lands, the surface rights of which have been disposed of by the Minister."

Although the investigation of these Canadian and Alaskan highways was in the nature of a reconnaissance and any conclusions must certainly be validated by further study, it would appear that the construction of a new highway through a wilderness area starts an irreversible series of more or less predictable events. First come the surveyors and the contractors who plan and build the highway. Then there are the hunters and fishermen who want to get in and get theirs before they and others "spoil" the country. On the heels of the sportsmen come guides, outfitters, small enterprises which provide gasoline, tire repairs, groceries, and possibly food and lodging. These small businesses may expand and improve the quality of their services, or others with more capital and experience may provide competition which forces the first comers out of business. In rare instances at some favoured location such as at Delta Junction, Alaska, where transportation routes converge, or where there is some large mineral deposit as at Clinton Creek on the Forty Mile River, a settlement with schools and services may develop.

Since it must be assumed that new highways such as the TAPS Haul Road and the Dempster Highway will continue to penetrate the remaining wilderness areas of Canada and Alaska[7], what can be done to soften the impact on the environment? Do we know how to make highway construction compatible with permanent preservation of the wilderness? Do we know how to preserve the fish and game? And finally how can settlement and commercial development prosper without destroying the wilderness values on which they depend and so many seek to preserve?

Highway construction by its very nature makes a mark on the landscape which is much more apparent from the air than on the ground. Healing of the construction scars takes place at varying rates, but can be accelerated by careful construction practices, selection of a route which avoids the worst permafrost areas and which takes gravel and other materials from concealed sites near, but not on, the right-of-way.[9] Artificial seeding of all exposed surfaces with a blend of annual and perennial exotic grasses along the right-of-way will accelerate the return of natural vegetation by fixing the soil and providing a hospitable environment for the natural reseeding and growth of native vegetation.

The first hunting and fishing seasons following the opening of a highway into a wilderness area will see a manifold increase in individuals intent upon enjoying the sport before the game disappears. Most private individuals believe that all the trophy specimens are gobbled up within two or three years. Game management personnel do not believe the changes are all bad but that proper management and enforcement practices will preserve healthy herds of prime animals and adequate stocks of fish. "No-hunting" zones of some depth on both sides of the highway appear to be effective in keeping the illegal practices of shooting from the highway at a minimum.

Settlement, commercial development and services are required by highway users whether they be hunters, tourists or commercial truckers. Attendant phenomena which threaten the environment are fires, sanitation, noise and over hunting, trapping, and fishing. When development is concentrated at reasonable intervals these hazards can more easily be controlled. At present all land along the Haul Road and the Dempster Highway is withdrawn from settlement in order to avoid land speculation and settlement which will not conform to plans which are under development.

In summation, we must recognize that highways will be built through wilderness areas, and that they can be built in such a way that the changes in the wilderness environment will be acceptable. The greatest environmental problems are created by those who will use the highways for purposes of access and exploitation of a heretofore inaccessible wilderness. It is essential that there be a comprehensive land use plan which would allocate appropriate areas for all activities and allocate the locations for all installations, services and recreational areas in such a way that incompatible activities would not be in too close proximity. Thus by anticipation of conflict and the use of land allocations or zoning it would appear that optimum land utilization can be achieved and the wilderness character of the area preserved.

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are too numerous to name in this short report.

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Physical Oceanographic Observations in Baffin Bay and Davis Strait*

INTRODUCTION

During February 1972, scientific personnel operating from the *Louis S. St. Laurent* obtained the first winter oceanographic temperature and salinity data from Baffin Bay[1]. Six oceanographic stations were occupied: one in central Baffin Bay; a second in eastern Baffin Bay southeast of the first; and a cross-section of 4 stations in southern Davis Strait (Fig. 1).

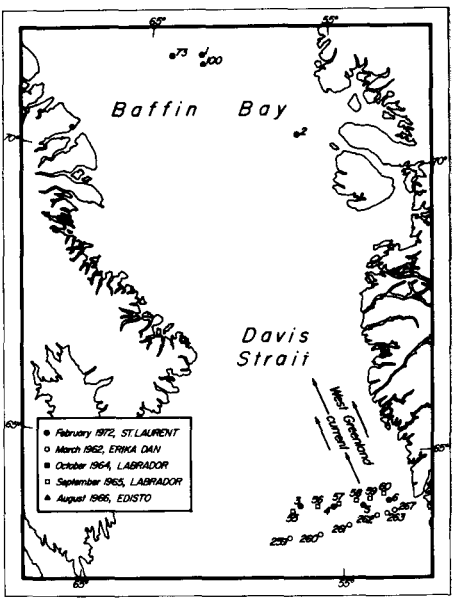

FIG. 1. Geographical locations of oceanographic stations occupied in Baffin Bay and Davis Strait during February 1972 and locations of the stations used in the text for purposes of comparison.

The temperature and salinity data were obtained using discrete samples from Knudsen bottles, equipped with deep-sea reversing thermometers, and an *in situ* recording salinity/temperature/depth unit (STD). Temperatures and salinities determined from the discrete water samples were used to calibrate the STD and correct it for drift, while the STD was used to detect fine structure in the vertical distributions of temperature and salinity. Salinities are felt to be accurate to ± 0.05‰, the advertised accuracy of the STD unit, except in the 0-200 m. deep layer at station 1; presence of ice within the Knudsen bottles during decanting of salinity samples, coupled with malfunctioning of the STD, created errors leading to a salinity accuracy of only about ± 0.3‰ in that case. Irregularities in the vertical distribution of salinity between 0 and 200 m. depths at station 1 (Fig. 2) may therefore not be real.

The temperatures presented below (Figs. 2 and 3) were those obtained from the reversing thermometers. They are considered accurate to ± 0.02°C.

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