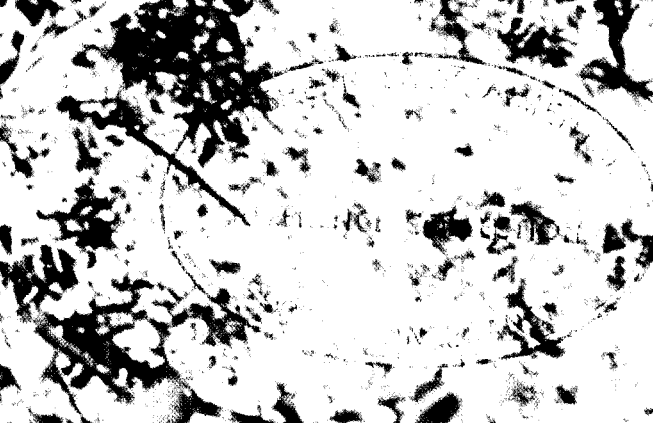




Public Works    Travaux publics  
Canada            Canada

Western Region    Région de l'ouest



MACKENZIE HIGHWAY, N.W.T.  
MILE 935.9 (S) TO MILE 902  
PRELIMINARY SUBMISSION - DETAIL DESIGN DATA  
JULY, 1974

## MEMORANDUM

## NOTE DE SERVICE

TO  
Mr. W. R. Binks  
Program Manager (Civil)  
Design & Construction  
OTTAWA, Ontario

FROM  
F. E. Kimball  
Project Manager NWT Roads  
Western Region

SECURITY - CLASSIFICATION DE SECURITE

OUR FILE - N/REFERENCE

9 305-52-300

YOUR FILE - V/REFERENCE

DATE


SUBJECT  
OBJET

PRELIMINARY DESIGN SUBMISSION - MILE 935.9 (S) TO MILE 902  
MACKENZIE HIGHWAY

Enclosed are 24 copies of the narrative portion of the above-noted Design Submission. Two sepia copies of the plans have been forwarded under separate cover.

Six copies of the narrative and a sepia of the plans have been forwarded to Mr. C. Amos of D.I.N.A. in Yellowknife. Single copies of the narrative and a single set of prints have been forwarded to D.O.E. in Edmonton and Winnipeg and E.M.R. in Calgary and Mr. J. Hamilton of D.I.N.A. in Edmonton.

Every attempt has been made to provide all information required in a Preliminary Design Submission. It would be appreciated if you could obtain an early response identifying any omissions or additional information requirements relative to this Preliminary Design Submission.

  
F. E. Kimball  
Project Manager NWT Roads  
Western Region

Encl.

MACKENZIE HIGHWAY

PRELIMINARY DESIGN DATA

MILE 935.9 (S) - MILE 902

Department of Public Works  
of Canada  
Western Region  
EDMONTON, Alberta

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INTRODUCTION

The general design criteria used by the Department of Public Works design teams in preparing the preliminary and final designs of the Mackenzie Highway are outlined in the General Design Data Report, Section "D", Mile 715 to Mile 936 published on June 29, 1974 by the Public Works of Canada, Western Region. Narratives on specific concerns for this Design Submission are contained in this Report, Preliminary Design Data, Mile 935.9(S) to Mile 902.

The reader should note that this Report forms part of the Preliminary Design Submission, the major portion of which is contained in separate plan form.

CHAPTER 1

OVERLAND DRAINAGE

The length of the Highway from Mile 935.9(S) to Mile 902 encounters several variations in terrain conditions and encumbent drainage characteristics. This has resulted in occasional variations of the requirement for drainage facilities in and along the Highway.

From Mile 935.9(S) to Mile 925 the right-of-way crosses a gently sloping till plain consisting of moderate plasticity clays. The Highway gradually ascends a gentle slope to Mile 931 as it follows a ridge line with the drainage direction being predominantly to the west. There are several well-defined local drainage courses which handle much of the overland flow in this area and few problems are anticipated. From Mile 931 to Mile 925 the quality of the local drainage systems deteriorate and the potential for upslope ponding has been recognized. Additional culverts have been added to the design for this area in order to disrupt the present natural drainage system as little as possible.

Between Mile 925 and Mile 917, the alignment crosses an extensive area of organic terrain and bogs, dissected by numerous drainage channels and by two streams at Mile 918.2 and Mile 917.0.

Although locally well-defined drainage systems exist, the generally poor relief of this section and the nature of the surface materials indicate a high potential for upslope ponding of overland flow. Culverts have been placed in all low areas in the profile and additional culverts have added to the design to retain the present drainage network as much as possible.

From Mile 917 to Mile 906, the Highway enters an area of hummocky terrain, which features generally good relief, numerous well-defined drainage channels and only a few areas of organic terrain. In several sections the drainage pattern is deranged and care in the placement of larger culverts will be taken in order not to disturb the natural regime of the area. The Highway descends from Mile 906 to Mile 902 crossing a drumlinized till plain. The possibility of upslope ponding would appear to be remote for most of this area. However, in those areas where distinct drainage channels are lacking, additional culverts have been included in the design.

In this Preliminary Design Submission the initial size for all culverts over sixty inches in diameter are those recommended by Fenco, the hydrology consultant for Section "D". Fenco's two publications, Hydrology Study, Mackenzie Highway, Fort Good

Hope to Dempster Highway, March, 1974 and Birdge and Culvert  
Hydraulics, Mackenzie Highway, Fort Good Hope to Dempster  
Highway, March, 1974, contain analytical data to substantiate  
these recommended culvert sizes.

It is D.P.W.'s intent to carry out the complete design of  
the large culverts on Section "D" in-house in the Final Design  
Submission.



CHAPTER 2

SOURCES OF BORROW

The section of the Mackenzie Highway covered by this Preliminary Design Submission is an area of wet medium plastic clays with varying ice contents. The designed gradeline used was one of overlay construction. The borrow areas chosen were on the basis of quantity take-offs from the designed gradeline, on suitability of material as determined from the geotechnical information and on practical haul distances.

The following haul limits were proposed for each borrow area.

Mile 935.9(S) - Mile 933.2

Since no suitable borrow material was available in this section it is intended to extend the existing shale borrow pit used for the Dempster and Mackenzie Highway. This pit is located approximately 2.8 miles north of Mile 935.9.

Mile 933.2 - Mile 925.4

Five areas in this section were investigated as potential borrow areas. Two of these areas were rejected by the designer as potential borrow areas

because of the excessive depths of overburden and one area was rejected because the massive ice in the area could limit development.

The two areas chosen, Mile 927.8 and Mile 927.5, contain hard shale and siltstone overlain by six to eight feet of overburden. These two areas will provide good material for construction of the subgrade through this section.

Mile 925.4 to Mile 921.3

Shale overlain by approximately four feet of overburden was located in three locations in this section. The borrow area chosen on the basis of haul economics was at Mile 923.2.

Mile 921.3 to Mile 917.7

The borrow area at Mile 919.8 was the only area tested in this section. The shale and siltstone overlain by eight feet of moderate ice content clay, will provide good construction material for the Highway subgrade.

Mile 917.7 to 912.9

Out of the seven areas tested in this section the borrow area chosen at Mile 915.6 provided the largest quantity of shale with the least overburden.

Mile 912.9 to Mile 907.5

Three areas were tested in this section. Two were rejected because of the excessive depth of overburden. The borrow area chosen at Mile 910.2 provides shale and siltstone, overlain by approximately seven feet of nonusable overburden. It would be possible to place the borrow pit closer to the Highway alignment, however, depth and ice content of the overburden decrease with distance from centreline.

Mile 907.5 to 902.0

Shale overlain by ten feet of nonusable overburden was located in the borrow area tested at Mile 904.5. Five other areas were also tested in this section but contained shale-rich clay till with moderate ice content.

CHAPTER 3

SPECIAL DITCH TREATMENT

No special treatment was required in this Design Submission.

CHAPTER 4

SUMMARY OF ENVIRONMENTAL DATA

MILES 935.9(S) TO 902

Prepared by: Schultz International Limited  
Environmental Consultants

Data derived from field work during 1973 and air photo analysis are presented on the Environmental Data sheets. The portion of the Highway alignment under discussion is the northernmost section which joins with the Dempster Highway at Mile 935.9(S). Within this section of the alignment, no initial conflicts of alignment versus environment exist. However, areas of concern are identified and discussed.

Following are brief discussions of Miles 935.9(S) to 902 of the proposed alignment under each of the assessment categories found on the Environmental Data sheets. These categories are:

TERRAIN	LANDSCAPE ARCHITECTURE
VEGETATION	RECREATION
WILDLIFE	CONSTRUCTION
FISH	ENVIRONMENTAL ASSESSMENT
ARCHAEOLOGY	

TERRAIN

The proposed alignment passes over four general areas of terrain. The changes in terrain are outlined below.

Beginning at an elevation of approximately 256 feet at the junction of the Dempster Highway (Mile 935.9(S), the route

traverses a till plain that gradually rises to an elevation of 610 feet at approximately Mile 925. The till plain slopes gently to the west. Some organic terrain, hummocky till, and a group of lakes at Mile 930 are encountered on the till plain. No major construction problems are anticipated in this section.

Within four miles, the alignment drops about 95 feet to an extensive flat area of organic terrain and bogs. During this drop, the route passes the C.N. tower and crosses a creek at Mile 921.5. The flat organic terrain has numerous drainage channels and two small streams at Miles 918.2 and 917.2. Adequate drainage and organic terrain are the major construction problems in this section.

Leaving the flat organic terrain, the route crosses a creek at Mile 915.7 and rises rapidly to cross an area of distinctly hummocky terrain with numerous drainage channels. Extensive areas of organic terrain lie to the east and west with the route travelling over the high ground between the boggy areas. The route climbs to the highest point (in the section from Miles 935.9(S) to 902) of 878 feet at approximately Mile 908.

The proposed Highway falls over 200 feet within three miles as it approaches Foot Lake. A small stream draining into Foot Lake is crossed at Mile 905.8. The last portion of the Highway

crosses drumlinized terrain north of Wounded Bear Lake and ends at Mile 902 with an elevation of 714 feet. No major construction difficulties are foreseen in this last section of the route.

#### VEGETATION

The forest cover in the terrain traversed between Miles 935.9(S) and 902 of the proposed alignment consists mainly of Black Spruce Associations. Generally trees are small, the largest ones being found on the higher, better drained hummocks and knolls. Here white spruce and paper birch are also commonly found. Poorest tree growth is found in drainage channels and in the extensive organic terrain between Miles 921 and 915. Dense stands of trees are found on the banks of the stream at Mile 921.5 and on a knoll at Mile 922.2.

Impact of the Highway on the forest cover will be minimal. Removal of trees for the right-of-way, access roads, and borrow areas will have a minor impact.

#### WILDLIFE

Wolf and fox are common within the area of Miles 935.9(S) to 902. Based on winter track surveys, wolves are found throughout the route while foxes are present from about Mile 912 north. One wolf den was found on a gravel ridge on the east shore of Foot Lake. The major impact of the Highway will be possible destruction of den sites if gravel knolls and ridges are excavated. In addition, foxes and wolves may be trapped and hunted more

easily with improved access to the area.

Beaver and waterfowl are found on most of the lakes in the area. Identified areas of good beaver and waterfowl concentrations are the groups of lakes in the vicinity of Miles 931 to 926, and in the Foot Lake - Wounded Bear Lake area. The major impact of the Highway will be increased hunting and trapping pressure. Some species of waterfowl may be disturbed by the construction of the Highway. Winter road construction would negate this possible impact.

Actual sightings in the summer and track concentrations in the winter indicate that moose are common in the Foot Lake - Wounded Bear Lake area. Moose will face greater hunting pressure once the Highway is built.

No bear den sites were located, although black bear are probably present in the area. No raptor nest sites were identified in the area.

The major impact upon wildlife will be the increased trapping and hunting pressure resultant from improved access to the area. Highway construction impacts should be minimal.

#### FISH

There are five streams crossed by the Highway within the area from Miles 935.9(S) to 902. All five are tributaries of the



Rengleng River. They are located at Miles 921.5, 918.2, 917.2, 915.7, and 905.8.

No fish were caught or observed in any of the streams although the streams at Miles 921.5 and 915.7 appear to be good fish habitat. The other three streams are not fish habitat. Culverts designed for fish passage are recommended only at Miles 921.5 and 915.7.

The route passes near several major lakes which may support a sport fishery. Wounded Bear Lake contains Pike, Humpback Whitefish, and Broad Whitefish. Foot Lake and Bone Lake, being part of the same river system (Rengleng River) as Wounded Bear Lake, probably contain the same species of fish and could also support a sport fishery. Fish stocks in the lakes should be further examined to determine what catch level can be sustained.

#### ARCHAEOLOGY

Within the portion of the alignment under discussion, six archaeological sites were found. Four of the sites are historic sites (recent campsites). Three of these (HILD 14, 15, and 16) are located on the north shore of Wounded Bear Lake. HILD 19 is located on the north shore of Foot Lake. These historic sites have a low salvage priority.

Two prehistoric sites (HILD 17 and 18) are situated on the east shore of Foot Lake on a gravel ridge. HILD 17 yielded over 100 small chert flakes. Both sites have a medium-high excavation priority and the area should not be disturbed by construction activities.

The Foot Lake - Wounded Bear Lake area is a sensitive archaeological area. All areas of construction activity, especially stream crossings, borrow sites, and excavations near lakes or streams, should be given some archaeological surveillance during highway construction.

#### LANDSCAPE ARCHITECTURE

Opportunities exist for the enhancement of the visual potential along the Highway. Selective and variable clearing are the main means of relieving the monotony of the route. Variable clearing of the right-of-way will reduce the tunnel effect of a constant width clearing. Selective clearing is recommended to open up views of visual highlights. Areas where selective clearing can be used to advantage are at stream crossings, at approximately Mile 930 for a view of the lakes and extensive bog area southwest of the route, at the approach to Foot Lake and Wounded Bear Lake, and at about Mile 902 for views of the distinct drumlinized terrain.

### RECREATION

Minimal opportunities for recreation exist throughout much of the section of the alignment under discussion. Not until the route reaches the Foot Lake - Wounded Bear Lake area do good recreational opportunities materialize. Both lakes may support a sport fishery and limited waterfowl hunting. Moose are also found in the area and could be hunted by boat on the series of interconnected lakes in the area. A rest stop or campground could be feasible on the shore of Wounded Bear Lake. This would be within easy driving distance from Inuvik. Harvesting of the fish and wildlife resources in the area must be regulated to prevent depletion of stocks.

### CONSTRUCTION

Construction difficulties should be minor in this section of the alignment. The provision of adequate drainage in the extensive organic area between Miles 921 and 915 may be a problem. Few cuts are proposed for the route, the most extensive being at the peak of land at approximately Mile 908.

Four 60-inch culverts are proposed at Miles 916.7, 916.1, 914.6, and 905.3. Normal design culverts are adequate on these streams. Five additional streams which will have culverts installed at the crossing site were evaluated for fisheries potential. Fish

passage design culverts are recommended only for the streams at Miles 921.5 and 915.7.

#### ENVIRONMENTAL ASSESSMENT

Throughout the majority of the section of the alignment under discussion, the impact of the Highway will be low. The Highway will have a moderate impact in the area of lakes containing beaver and waterfowl around Mile 930. The impact will result from the improved access to the area and resultant increased hunting and trapping pressure.

The only area of high impact is from Miles 906 to 902 in the Foot Lake - Wounded Bear Lake area. In this area are found moose, waterfowl, fur-bearers, and fish. All will face increased pressure once the road is built. In addition, the area is a sensitive archaeological area that requires further study.

CHAPTER 5

BORROW AREA DEVELOPMENT

Borrow pits are a necessity in highway construction, however, poorly planned, haphazard borrow areas will detract from the general appearance of the landscape. Even if borrow pits are hidden from the motorist's view, they will remain visible to those flying overhead. This may be a significant point since the Mackenzie Valley provides a rather narrow, well-used flight corridor.

It should be practical to design borrow areas which will provide necessary construction material, yet still blend into the landscape. Some borrow areas may be used for other purposes after highway construction. They may serve as parking areas for rest stops, as emergency pulloffs and recreation areas, as interpretive features depicting natural vegetation succession, and as wildlife viewing areas since various species of wildlife will undoubtedly invade these clearings. Such potential uses must be taken into account as the borrow pits are excavated.

At present, the general concensus appears to be that borrow areas should be hidden from the highway alignment. It must be borne in mind that natural landscape variety and features of interest are not uniformly distributed along the Mackenzie Highway route. Thus, it may be advantageous, in some instances,

to develop borrow areas which are open to the alignment. These would provide open space and, with proper contouring and revegetation measures, would improve rather than detract from the visual properties of the landscape.

Methods of excavating borrow material may require that the original pit shape be rectangular. The original boundaries may then be expanded by excavating material, to a lesser depth, in tongues from the rectangle and by accessory dozing and contour grading. Principles of selective clearing applied along the right-of-way can apply equally to borrow areas. Clearing may be used to modulate the vegetation edge, to accentuate certain vegetation types by isolating them, and to accentuate landscape features such as lakes, bogs, and ridges by providing visual access to them.

Conceptual designs for borrow areas are convenient in that they can be easily identified and may be applied to level or otherwise uniform terrain. In most areas, including those designated as borrow sites along the Mackenzie Highway alignment, it would be difficult, if not impossible, to construct a borrow pit which would totally conform to a predetermined shape. The final shape, size, and contours of a borrow area must be determined by the amount of material to be taken, location and shape of suitable deposits, local topography and drainage, and potential future use of the borrow area. Borrow areas will

take one of two very general shapes: linear where the material lies in ridges, or amoeboid where the material is found in irregular deposits below flat or undulating terrain. Final decisions must be made, on site, by agreement between the environmental consultant and the construction engineer to insure an amenable balance between environmental and aesthetic factors and engineering suitability.

CHAPTER 6

PROPOSED ALIGNMENT REVISIONS

Alignment Revisions are intended at:

Mile 933 - Sta. 114+00 to Sta. 176+10.5

Mile 915 - Sta. 1093+36.7 to Sta. 1116+88.5

Mile 903 - Sta. 1685+00 to Sta. 1714+54.9

Mile 902 - Sta. 1791+57.5 to Sta. 1817+89.8

By eliminating the deflections at Mile 933 and Mile 902 and by using one curve rather than two curves at Mile 915 and 904 the horizontal alignment will be improved at these locations.



CHAPTER 7

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MILE 935.9(S) - MILE 902

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