



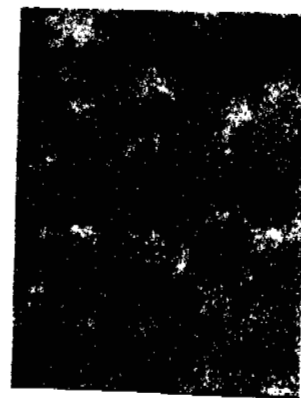
Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

SUPPORTING DOCUMENT A

CONTACTS

- A.1 Phone Network
- A.2 Phase 1 Contacts
- A.3 Phase 2 Contacts
- A.4 Project Correspondence



A.1 PHONE NETWORK

PHONE NETWORK FOR QUARRY STUDY

862-1806

INDIVIDUAL POSITION LOCATION TELEPHONE

** * PROJECT MANAGEMENT

LARRAINE PEDERSEN, DSS	CONTRACT ADMIN.	OTTAWA, ONT.	(819) 997-7397
ROBERT J. GOWAN, DIAND	SCIENTIFIC AUTHORITY	HULL, QUE.	(819) 994-7464
DALE LONGLITZ, DIAND	ACTING SCIENTIFIC AUTHORITY	HULL, QUEBEC	(819) 994-7484

** * BARGE INFORMATION

SEASPAN INTERNAT. LTD.	SUPERVISOR	NORTH VANCOUVER, B.C.	(604) 988-3111
JOHN DUDUMAN, TRANSPORT CANADA	SUPERVISOR	NORTH VANCOUVER, B.C.	(604) 984-3730
OZZIE ISFELD, TRANSPORT CANADA	SUPERVISOR	NORTH VANCOUVER, B.C.	(604) 984-3736
ARCTIC TRANSPORT. LTD.		INUVIK, NWT	(403) 979-4158
JUDY, POINTS NORTH TRANSPORT. INC.		INUVIK, NWT	(403) 979-3530
NORTHERN TRANSPORT. CO. LTD.		INUVIK, NWT	(403) 979-2442
CAMERON CLEMENT, NORTHERN TRANS.CO. LTD.		EDMONTON, ALTA.	(403) 423-9201
BELUGA TRANSPORT.		INUVIK, NWT	(403) 979-2176
LEN CARDINAL, CARDINAL TRANSPORT LTD.	OWNER	INUVIK, NWT	(403) 979-3333

PHONE NETWORK FOR QUARRY STUDY

862-1806

~~~~~  
INDIVIDUAL                      POSITION                      LOCATION                      TELEPHONE  
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** * EXISTING QUARRIES

GORDON CAMPBELL, NORTH STAR SERV. & CONS.	OWNER	INUVIK, NWT	(403) 979-2393
PETER TREMBLAY, MINISTRY OF TRANSPORT.	AIRPORT MANAGER	INUVIK, NWT	(403) 979-2467
RON WAINMAN, TOWN OF INUVIK WORKS DEPT.		INUVIK, NWT	(403) 979-2185
DAVID STORR, STORR & SONS CONSTR. LTD.	OWNER	AKLAVIK, NWT	(403) 978-2342

** * PARKS, WILDLIFE AND ENVIRONMENT

LAWRENCE TRICOUTEUX, DIAND	REGIONAL MANAGER, LAND RESOURCES	YELLOWKNIFE, NWT	(403) 920-8290
ED HORNBY, DIAND	RESEARCH AND SPECIAL PROJECTS OFFICER	YELLOWKNIFE, NWT	(403) 920-8168
MARG CROMBIE, DIAND	ENVIRONMENT. ADVISOR	WHITEHORSE, YT	(403) 667-3172
BOB FRIESEN, DIAND	LAND RESOURCES	WHITEHORSE, YT	(403) 668-5151
PAUL KRAFT, GNWT RENEWABLE RESOURCES	ASSISTANT REGIONAL SUPERINTEND.	INUVIK, NWT	(403) 979-7235
MAUREEN, GNWT ECONOMIC DEVELOPMENT		INUVIK, NWT	(403) 979-7238

** * LAND USE AND RESOURCES

RUDY COCKNEY, DIAND	DISTRICT MANAGER, LAND RESOURCES	INUVIK, NWT	(403) 979-3361
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PHONE NETWORK FOR QUARRY STUDY

862-1806

INDIVIDUAL POSITION LOCATION TELEPHONE

EVAN SAUGSTAD, DIAND DISTRICT MANAGER, DAWSON CITY, (403) 993-5468
LANDS & FORESTS YT

** * NATIVE CONCERNS

FRANK PIELAK, GNWT ECONOMIC DEVELOPMENT INUVIK, NWT (403) 979-7238

BOB SIMPSON, MAC. DELTA EXECUTIVE DIRECTOR INUVIK, NWT
REGIONAL COUNCIL

** * CLIMATIC RECORDS

JIM MCLEOD, DIAND SUPERVISOR, DEPT. INUVIK, NWT (403) 979-2460
OF ENVIRONMENT

WILLIAM PRUSAK ATMOSPHERIC ENVIRONMENT SERVICE EDMONTON, ALBERTA (403) 420-3143

TED HANSON, WEATHER OFFICE WEATHER OFFICER INUVIK, NWT (403) 978-2460

** * ROCK SPECIFICATIONS

GEORGE ELAHERTY, DPW ENGINEERING EDMONTON, ALTA. (403) 420-3235

STAN BUTCHER, DPW ENGINEERING VANCOUVER, BC (604) 666-6964

TED KOLBERG, DPW ENGINEERING OTTAWA, ONT. (613) 998-8171

ROBERT SMITH, DPW ENGINEERING EDMONTON, ALTA. (403) 420-3235

PHONE NETWORK FOR QUARRY STUDY
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862-1806
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INDIVIDUAL                      POSITION                      LOCATION                      TELEPHONE  
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** * PHOTOGRAPHS AND MAPS

GEOLOGICAL SURVEY OF CANADA	SECRETARY	VANCOUVER, B.C.	(604) 666-0271
NATIONAL AIR PHOTO LIBRARY		OTTAWA, ONT.	(613) 995-4560
AIR PHOTO LIBRARY		VICTORIA, B.C.	
SUSAN ROSS, PA SATELLITE STATION	SUPERVISOR	PRINCE ALBERT, SASK.	(306) 764-3602

** * PETROLEUM OPERATIONS

RICK MYERS, DOME		CALGARY, ALTA.	(403) 231-1951
BILL LIVINGSTONE, GULF		CALGARY, ALTA.	(403) 233-5481
KEVIN HEWIN, DOME	SECRETARY	CALGARY, ALTA.	(403) 231-1951

** * HELICOPTER RENTAL

JIM HODGES, SUNRISE HELICOPTER	OPERATOR	INUUVIK, NWT	(403) 979-2874
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** * EQUIPMENT PREPARATION

JOE TANYI, GA		CALGARY, ALTA.	(403) 259-3413
DOUG MAGNUSON, GA	LAB SUPERVISOR	CALGARY, ALTA.	(403) 259-3413

A.2 PHASE 1 CONTACTS

LIST OF GOLDER PERSONNEL

INITIALS

NAME

PFS

PETER F. STACEY

NRM

NORM R. MCCAMMON

DFW

DAVID F. WOOD

GER

GRAHAM E. RAWLINGS

RSR

RODNEY S. READ

WMG

WILLIAM M. GILMER

LISTING OF PHONE CONVERSATIONS

862-1806

DATE mm/dd/yy	GA	INDIVIDUAL	POSITION	LOCATION	PHONE	SUBJECT
09/09/86	NRM	LARRAINE PEDERSEN, DSS	CONTRACT ADMIN.	OTTAWA, ONT.	(819) 997-7397	CHANGES TO PROPOSED PRICE
09/15/86	PFS	R. GOWAN, DIAND	SCIENTIFIC AUTHORITY	OTTAWA, ONT.	(819) 994-7484	MEETING IN VANCOUVER
09/15/86	PFS	R. GOWAN, DIAND	SCIENTIFIC AUTHORITY	OTTAWA, ONT.	(819) 994-7464	DATA REVIEW
09/15/86	RSR	RUDY COCKNEY, DIAND	DISTRICT MANAGER, LAND RESOURCES	INUVIK, NWT	(403) 979-3361	LAND USE PERMITS
09/15/86	RSR	JIM MCLEOD, DIAND	SUPERVISOR, DEPT. OF ENVIRONMENT	INUVIK, NWT	(403) 979-2460	CLIMATIC HISTORY
09/15/86	RSR	WILLIAM PRUSAK	ATMOSPHERIC ENVIRONMENT SERVICE	EDMONTON, ALBERTA	(403) 420-3143	CLIMATIC HISTORY
09/15/86	RSR	LAWRENCE TRICOUTEUX, DIAND	REGIONAL MANAGER, LAND RESOURCES	YELLOWKNIFE, NWT	(403) 920-8290	ENVIRONMENTAL CONSTRAINTS
09/15/86	RSR	ED HORNBY, DIAND	RESEARCH AND SPECIAL PROJECTS OFFICER	YELLOWKNIFE, NWT	(403) 920-8168	ENVIRONMENTAL CONSTRAINTS
09/15/86	RSR	BOB FRIESEN, DIAND	LAND RESOURCES	WHITEHORSE, YT	(403) 668-5151	ENVIRONMENTAL CONSTRAINTS
09/15/86	RSR	EVAN SAUGSTAD, DIAND	DISTRICT MANAGER, LANDS & FORESTS	DAWSON CITY, YT	(403) 993-5468	LAND USE PERMITS
09/15/86	RSR	MARG CROMBIE, DIAND	ENVIRONMENT. ADVISOR	WHITEHORSE, YT	(403) 667-3172	ENVIRONMENTAL CONSTRAINTS
09/15/86	DFW	STAN BUTCHER, DPW	ENGINEERING	VANCOUVER, BC	(604) 666-6964	NOT AVAILABLE

LISTING OF PHONE CONVERSATIONS
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862-1806
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DATE mm/dd/yy	GA	INDIVIDUAL	POSITION	LOCATION	PHONE	SUBJECT
09/16/86	RSR	LAWRENCE TRICOUTEUX, DIAND	REGIONAL MANAGER, LAND RESOURCES	WHITEHORSE, YT	(403) 920-8290	CONTACTS
09/16/86	RSR	ED HORNBY, DIAND	RESEARCH AND SPECIAL PROJECTS OFFICER	WHITEHORSE, YT	(403) 920-8168	I B P SITES
09/16/86	RSR	MARG CROMBIE, DIAND	ENVIRONMENT. ADVISOR	WHITEHORSE, YT	(403) 667-3172	REFERENCES FOR ENVIRONMENT
09/16/86	RSR	DOUG MAGNUSON, GA	LAB SUPERVISOR	CALGARY, ALTA.	(403) 259-3413	SURVIVAL PACKS
09/16/86	RSR	SUSAN ROSS, PA SATELLITE STATION	SUPERVISOR	PRINCE ALBERT, SASK.	(306) 764-3602	LANDSAT 5 PHOTOS
09/16/86	RSR	SEASPAN INTERNAT. LTD.	SUPERVISOR	NORTH VANCOUVER, B.C.	(604) 988-3111	BARGE SIZES
09/16/86	RSR	JOHN DUDUMAN, TRANSPORT CANADA	SUPERVISOR	NORTH VANCOUVER, B.C.	(604) 984-3730	BARGE SIZES
09/16/86	RSR	OZZIE ISFELD, TRANSPORT CANADA	SUPERVISOR	NORTH VANCOUVER, B.C.	(604) 984-3736	BARGE SIZES AND RESTRICTIONS
09/16/86	RSR	NATIONAL AIR PHOTO LIBRARY		OTTAWA, ONT.	(613) 995-4560	AIR PHOTO INFORMATION
09/16/86	RSR	AIR PHOTO LIBRARY		VICTORIA, B.C.		AIR PHOTO INFORMATION
09/16/86	RSR	GEOLOGICAL SURVEY OF CANADA	SECRETARY	VANCOUVER, B.C.	(604) 666-0271	MAPS

LISTING OF PHONE CONVERSATIONS
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862-1806
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DATE mm/dd/yy	GA	INDIVIDUAL	POSITION	LOCATION	PHONE	SUBJECT
09/17/86	RSR	STAN BUTCHER, DPW	ENGINEERING	VANCOUVER, BC	(604) 666-6964	SPECS FOR ROCK GRADES
09/17/86	RSR	TED KOLBERG, DPW	ENGINEERING	OTTAWA, ONT.	(613) 998-8171	SPECS FOR ROCK GRADES
09/17/86	RSR	ROBERT SMITH, DPW	ENGINEERING	EDMONTON, ALTA.	(403) 420-3235	NOT AVAILABLE
09/17/86	DFW	ROBERT SMITH, DPW		EDMONTON, ALTA.	(403) 420-3235	ROCK SPECS (N/A)
09/18/86	DFW	R. GOWAN, DIAND		HULL, QUE.	(819) 994-7464	FINALIZE FIELD PROGRAM
09/18/86	PFS	BILL LIVINGSTONE, GULF		CALGARY, ALTA.	(403) 233-5481	GULF OPERATIONS
09/18/86	PFS	KEVIN HEWIN, DOME	SECRETARY	CALGARY, ALTA.	(403) 231-1951	DOME OPERATIONS
09/19/86	DFW	JIM HODGES, SUNRISE HELICOPTER	OPERATOR	INUVIK, NWT	(403) 979-2874	RESERVATIONS
09/22/86	DFW	GEORGE FLAHERTY, DPW	ENGINEERING	EDMONTON, ALTA.	(403) 420-3235	ROCK SPECS
09/22/86	DFW	JOE TANYI, GA		CALGARY, ALTA.	(403) 259-3413	AIRPLANE INSURANCE
09/29/86	DFW	TED HANSON, WEATHER OFFICE	WEATHER OFFICER	INUVIK, NWT	(403) 978-2460	WEATHER RECORDS FOR SITES
09/29/86	DFW	MAUREEN, GNWT ECONOMIC DEVELOPMENT		INUVIK, NWT	(403) 979-7238	CURRENT GNWT PARKS
09/29/86	DFW	PAUL KRAFT, GNWT RENEWABLE RESOURCES	ASSISTANT REGIONAL SUPERINTEND.	INUVIK, NWT	(403) 979-7235	WILDLIFE CONCERNS

LISTING OF PHONE CONVERSATIONS
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862-1806
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DATE mm/dd/yy	GA	INDIVIDUAL	POSITION	LOCATION	PHONE	SUBJECT
09/29/86	DFW	ARCTIC TRANSPORT. LTD.		INUVIK, NWT	(403) 979-4158	NO RESPONSE
09/29/86	DFW	JUDY, POINTS NORTH TRANSPORT. INC.		INUVIK, NWT	(403) 979-3530	BARGE SIZE INFORMATION
09/29/86	DFW	NORTHERN TRANSPORT. CO. LTD.		INUVIK, NWT	(403) 979-2442	NO RESPONSE
09/29/86	DFW	CAMERON CLEMENT, NORTHERN TRANS.CO. LTD.		EDMONTON, ALTA.	(403) 423-9201	NO RESPONSE
09/29/86	DFW	BELUGA TRANSPORT.		INUVIK, NWT	(403) 979-2176	NO RESPONSE
09/29/86	DFW	LEN CARDINAL, CARDINAL TRANSPORT LTD.	OWNER	INUVIK, NWT	(403) 979-3333	BARGE SIZES AND RESTRICTIONS
09/30/86	DFW	DAVID STORR, STORR & SONS CONSTR. LTD.	OWNER	AKLAVIK, NWT	(403) 978-2342	RIPRAP SOURCE AT MT. GIFFORD
10/01/86	NRM	BOB GOWAN, DIAND	SCIENTIFIC AUTHORITY			EXTENSION OF WORK
10/01/86	DFW	DAVID STORR, STORR & SONS CONST. LTD.	OWNER	AKLAVIK, NWT	(403) 978-2342	CONFIRMATION OF MEETING
10/01/86	DFW	N. MCCAMMON, GOLDER ASSOCIATES		VANCOUVER, B.C.	(604) 879-9266	PROGRESS REPORT
10/02/86	DFW	GORDON CAMPBELL, NORTH STAR SERV. & CONS.	OWNER	INUVIK, NWT	(403) 979-2393	EXISTING QUARRIES

LISTING OF PHONE CONVERSATIONS
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862-1806
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DATE mm/dd/yy	GA	INDIVIDUAL	POSITION	LOCATION	PHONE	SUBJECT
10/02/86	DFW	FRANK PIELAK, GNWT ECONOMIC DEVELOPMENT		INUVIK, NWT	(403) 979-7238	SET UP MEETING
10/02/86	DFW	PETER TREMBLAY, MINISTRY OF TRANSPORT.	AIRPORT MANAGER	INUVIK, NWT	(403) 979-2467	MOT QUARRIES
10/02/86	DFW	RON WAINMAN, TOWN OF INUVIK WORKS DEPT.		INUVIK, NWT	(403) 979-2185	TOWN QUARRY
10/02/86	DFW	BOB SIMPSON, MAC. DELTA REGIONAL COUNCIL	EXECUTIVE DIRECTOR	INUVIK, NWT		NATIVE LAND CLAIMS
10/02/86	DFW	BOB GOWAN, DIAND	SCIENTIFIC AUTHORITY	HULL, QUE.	(819) 994-7464	PROGRESS REPORT
10/06/86	DFW	LARRAINE PEDERSEN, DSS	CONTRACT ADMIN.			UPDATE OF FIELD WORK
10/07/86	PFS	RICK MYERS, DOME		CALGARY, ALTA.	(403) 231-1951	DOME OPERATIONS
10/14/86	DFW	DALE LONGLITZ, DIAND	ACTING SCIENTIFIC AUTHORITY	HULL, QUEBEC	(819) 994-7484	APPROVAL TO PROCEED TASK 11
10/17/86	DFW	R. GOWAN, DIAND	SCIENTIFIC AUTHORITY	HULL, QUE.	(819) 994-7464	LAB TESTING AND PHOTO ALBUM
12/31/86	DFW	ROBERT J. GOWAN, DIAND	SCIENTIFIC AUTHORITY	HULL, QUE.	(819) 994-7464	STATEMENT OF WORK
01/08/87	DFW	BOB GOWAN, DIAND	SCIENTIFIC AUTHORITY	HULL, QUE.		MEETING TO DISCUSS CONTRACT
01/13/87	DFW	BOB GOWAN, DIAND	SCIENTIFIC AUTHORITY	HULL, QUE.		AIRPHOTO REQUEST

LISTING OF PHONE CONVERSATIONS
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862-1806
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DATE	GA	INDIVIDUAL	POSITION	LOCATION	PHONE	SUBJECT
mm/dd/yy						
01/15/87	DFW	BOB GOWAN, DIAND	SCIENTIFIC AUTHORITY	HULL, QUE.		UPCOMING MEETING
02/23/87	PFS	BOB GOWAN, DIAND	SCIENTIFIC AUTHORITY	HULL, QUE.		REPORT DETAILS
02/24/87	DFW	LARRAINE PEDERSEN, DSS	CONTRACT ADMIN.	HULL, QUE.	(819) 997-7397	QUERIES IN BILLING
03/09/87	PFS	BOB GOWAN, DIAND	SCIENTIFIC AUTHORITY	HULL, QUE.		COMPLETION DATE
03/12/87	DFW	BOB GOWAN, DIAND	SCIENTIFIC AUTHORITY	HULL, QUE.		CHANGES TO CONTRACT

A.3 PHASE 2 CONTACTS

FIELD CONTACTS

COMPANY: POSITION/TITLE NAME: PHONE NUMBER:	INTEREST:
Canada, DIAND District Manager Rudy A. Cockney (403) 979-3361	Overall coordination of field aspects of program.
Canada, DIAND Kay McGuinness (403) 920-8168	Regional aspects of International Biological Project zoning.
GNWT, Economic Development and Tourism Tourism Development Officer Frank Pielak (403) 979-7237	Possible conflicting use of Campbell Hills area with recreational parkland. Possible conflict with Hunters and Trappers Associations of Inuvik and Aklavik.
GNWT, Renewable Resources Assistant Regional Superintendent Paul Kraft (403) 979-7235 Wildlife Biologist Gordon Stenhouse	Wildlife and environmental concerns for potential development. Awareness of Beaufort Environmental Assessment panel, the Inuvialuit claims, and ESC for COPE land.
Canada, Department of Environment Weather Briefing Officer Ted Hansen (403) 979-2460	Weather records for the Inuvik region.
Canada, Ministry of Transport Airport Manager Peter Tremblay (403) 979-2467	Use of the two quarries on MOT property at Inuvik airport.
Mackenzie Delta Regional Council Executive Director Bob Simpson (403) 979-	Dene/Metis land claims in area. Naturalist/Conservation/Recreational park at Campbell Hills.
Town of Inuvik Works Department Ron Wainman (403) 979-2185	Use of quarry rock in the Inuvik region.
GNWT, Public Works	Use of DPW quarry on Dempster Highway

Jim Greer
(403) 952-2173

Dome Petroleum
Gulf drilling contacts
Kevin Hewin/Rick Meyers
(403) 231-1951

Storr & Sons Construction Ltd.
President
Buck Storr
(403) 978-2342

Points North Transportation Inc.
Secretary
Judy
(403) 979-3530

Northern Transportation Company Ltd
Manager, Marketing & Traffic
Cameron Clement
(403) 423-9201

Cardinal Transport Ltd.
President
Len Cardinal
(403) 979-3338

North Star Service & Construction (Inuvik)
President
Gordie Campbell
(403) 979-2393

Use of rip rap from Campbell's quarry
for transportation to Beaufort in 1982-83.

Development of rip rap source from colluvial
material on west slope of Mt. Gifford.

Transportation of quarry rock on barges.

Transportation of quarry rock on barges.

Transportation of quarry rock on barges.

Development of rock quarries in Inuvik
region, potential for rip rap in Campbell
Hills rocks.

A.4 PROJECT CORRESPONDENCE

LIST OF GOLDER PERSONNEL

INITIALS

NAME

PFS
NRM
DFW
GER
RSR
WMG

PETER F. STACEY
NORM R. MCCAMMON
DAVID F. WOOD
GRAHAM E. RAWLINGS
RODNEY S. READ
WILLIAM M. GILMER

LISTING OF PROJECT CORRESPONDENCE

862-1806

DATE mm/dd/yy	SUBJECT	FROM	TO	NUMBER
09/02/86	REQUEST FOR PROPOSAL 38ST.A713	GOLDER ASSOCIATES	DSS HULL	NONE
09/10/86	LOANED REPORTS AND PHOTOS	R. GOWAN, DIAND	GOLDER ASSOCIATES	28-3-12
09/17/86	CLIMATIC RECORDS	DFW	W. PRUSAK, AES	TLX0019 OUT
09/17/86	CONFIRMATION OF FIELD WORK	DFW	LAURENCE TRICOUTEUX , DIAND	TLX0017 OUT
09/17/86	CONFIRMATION OF FIELD WORK	DFW	ED HORNBY, DIAND	TLX0041 OUT
09/17/86	CONFIRMATION OF FIELD WORK	DFW	MARG CROMBIE, DIAND	TLX0034 OUT
09/17/86	CONFIRMATION OF FIELD WORK	DFW	EVAN SAUGSTAD, DIAND	TLX0028 OUT
09/17/86	PACKING NOTE FOR SATELLITE PHOTOS	CCRS	R. READ, GA	208240
09/18/86	PROPOSAL 862-1806	DFW	R. GOWAN, DIAND	16 TELECOPY
09/19/86	CONFIRMATION OF FIELD WORK	DFW	RUDY COCKNEY, DIAND	TLX0019 OUT
09/25/86	GEOLOGICAL RECONNAISSANCE & MAPPING	DFW	R. GOWAN, DIAND	E /86 /1069
09/29/86	APPROVAL OF FIELD PROGRAM	PFS	L. PEDERSEN, DSS	TLX0018 OUT
10/08/86	PACKING NOTE FOR SATELLITE PHOTOS	CCRS	R. READ, GA	208336
10/10/86	TENTATIVE LAB TESTING SCHEDULE	RSR	WMG	INTERNAL

Page No.
03/24/87

LISTING OF PROJECT CORRESPONDENCE

862-1806

DATE mm/dd/yy	SUBJECT	FROM	TO	NUMBER
10/16/86	CONSTRAINTS FOR YUKON SITES	ED HORNBY, NAP, LANDS	DFW	0246
10/21/86	UPDATE ON BILLING AND PROGRESS	DFW	L. PEDERSEN, DSS	TLX0041 OUT
11/17/86	TRANSMITTAL LETTER FOR PHOTO ALBUM	DFW	R. GOWAN, DIAND	NONE
12/12/86	CV FOR G. RAWLINGS	DFW	L. PEDERSEN, DSS	NONE
12/31/86	TABLES OF RESULTS TO DATE	DFW	R. GOWAN, DIAND	032
01/09/87	AIR PHOTOS - LOW LEVEL	R. J. GOWAN	RSR	NONE
01/09/87	LOW LEVEL AIR PHOTOS	DFW	BOB GOWAN, DIAND	47
02/25/87	AMMENDMENTS TO CONTRACT	L. PEDERSEN	P. F. STACEY	NONE
03/03/87	ANNOTATIONS OF DRAFT REPORT	R. J. GOWAN, DIAND	P. F. STACEY	28-3-12
03/23/87	AIR PHOTOS FOR QUARRY PLANS	RSR	R. J. GOWAN, DIAND	GA 31

SUPPORTING DOCUMENT B

AVAILABLE DATA

- B.1 Maps**
- B.2 Previous Reports**
- B.3 Air Photographs**

B.1 MAPS

LISTING OF MAPS
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862-1806
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MAP TYPE    SCALE    DATE    TITLE    MAP #
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** SITE 0
* - GENERAL

TOPOGRAPHIC 1:50000 1973 YUKON TERRITORIES-NWT 117 A/8

** SITE 1
* - MT. FITTON

AERONAUTICAL 1:500000 1982 HERSCHEL 117S 1/2

GEOLOGY 1:250000 1981 BLOW RIVER & DAVIDSON MOUNTAINS, Y.T.- 1516A
D. OF MACKENZIE

GEOLOGY 1:250000 1981 HERSCHEL ISLAND AND DEMARCATION POINT, 1514A
Y.T.

SURFICIAL 1:500000 1971 NORTHERN YUKON TERRITORY AND NW 1319A
GEOLOGY DISTRICT OF MACKENZIE

TOPOGRAPHIC 1:250000 1973 BLOW RIVER, YUKON-NWT 117A

TOPOGRAPHIC 1:50000 1983 MOUNT CLOSE, YUKON TERRITORY 117 A/7

TOPOGRAPHIC 1:250000 1962 HERSCHEL ISLAND, YUKON TERRITORIES 117 D

** SITE 2
* - MT. DAVIES GILBERT

AERONAUTICAL 1:500000 1982 HERSCHEL 117S 1/2

GEOLOGY 1:250000 1981 BLOW RIVER & DAVIDSON MOUNTAINS, Y.T.- 1516A
D. OF MACKENZIE

GEOLOGY 1:250000 1981 HERSCHEL ISLAND AND DEMARCATION POINT, 1514A
Y.T.

SURFICIAL 1:500000 1971 NORTHERN YUKON TERRITORY AND NW 1319A
GEOLOGY DISTRICT OF MACKENZIE

TOPOGRAPHIC 1:50000 1966 MOUNT DAVIES GILBERT, YUKON-NWT 117 A/9W

LISTING OF MAPS
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862-1806
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MAP TYPE	SCALE	DATE	TITLE	MAP #
TOPOGRAPHIC	1:250000	1973	BLOW RIVER, YUKON-NWT	117A
TOPOGRAPHIC	1:250000	1962	HERSCHEL ISLAND, YUKON TERRITORIES	117 D
TOPOGRAPHIC	1:50000	1966	MT. DAVIES GILBERT, YUKON-NWT	117 A/9E

** SITE 3

* - MT. GIFFORD

AERONAUTICAL	1:500000	1982	INUVIK	107S 1/2
GEOLOGY	1:250000	1981	AKLAVIK, DISTRICT OF MACKENZIE	1517A
PHOTO MOSAIC	1:50000	1973	AKLAVIK RANGE, DISTRICT OF MACKENZIE, NWT	107 B/4
SURFICIAL GEOLOGY	1:500000	1971	NORTHERN YUKON TERRITORY AND NW DISTRICT OF MACKENZIE	1319A
TOPOGRAPHIC	1:50000	1967	AKLAVIK RANGE, DISTRICT OF MACKENZIE, NWT	107 B/4
TOPOGRAPHIC	1:50000	1966	AKLAVIK CHANNEL, DISTRICT OF MACKENZIE, NWT	107 B/3W

** SITE 3C

* - WEST DELTA ROCHE MOUTONEE

TOPOGRAPHIC	1:50000	1966	BEAVER HOUSE CREEK, DISTRICT OF MACKENZIE, NWT	107 B/5W
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** SITE 4

* - GULL CREEK QUARTZITE

AERONAUTICAL	1:500000	1982	INUVIK	107S 1/2
GEOLOGY	1:250000	1981	AKLAVIK, DISTRICT OF MACKENZIE	1517A

LISTING OF MAPS
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862-1806
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MAP TYPE	SCALE	DATE	TITLE	MAP #
PHOTO MOSAIC	1:50000	1973	CAMPBELL LAKE, DISTRICT OF MACKENZIE, NWT	107 B/2
SURFICIAL GEOLOGY	1:500000	1971	NORTHERN YUKON TERRITORY AND NW DISTRICT OF MACKENZIE	1319A
TOPOGRAPHIC	1:50000	1966	CAMPBELL LAKE, DISTRICT OF MACKENZIE, NWT	107 B/2W
TOPOGRAPHIC	1:250000	1974	AKLAVIK, NWT, DISTRICT OF MACKENZIE	107/B
TOPOGRAPHIC	1:250000	1962	MACKENZIE DELTA, D. OF MACKENZIE, N.W.T.	107 C

** SITE 5
* - GULL CREEK DOLOMITE

AERONAUTICAL	1:500000	1982	INUVIK	107S 1/2
GEOLOGY	1:250000	1981	AKLAVIK, DISTRICT OF MACKENZIE	1517A
PHOTO MOSAIC	1:50000	1973	CAMPBELL LAKE, DISTRICT OF MACKENZIE, NWT	107 B/2
SURFICIAL GEOLOGY	1:500000	1971	NORTHERN YUKON TERRITORY AND NW DISTRICT OF MACKENZIE	1319A
TOPOGRAPHIC	1:250000	1974	AKLAVIK, NWT, DISTRICT OF MACKENZIE	107/B
TOPOGRAPHIC	1:50000	1966	CAMPBELL LAKE, DISTRICT OF MACKENZIE, NWT	107 B/2W
TOPOGRAPHIC	1:250000	1962	MACKENZIE DELTA, D. OF MACKENZIE, N.W.T.	107 C

** SITE 6
* - DELTA OUTLIERS

AERONAUTICAL	1:500000	1982	INUVIK	107S 1/2
GEOLOGY	1:250000	1981	AKLAVIK, DISTRICT OF MACKENZIE	1517A

LISTING OF MAPS
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862-1806
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MAP TYPE	SCALE	DATE	TITLE	MAP #
PHOTO MOSAIC	1:50000	1973	CAMPBELL LAKE, DISTRICT OF MACKENZIE, NWT	107 B/2
PHOTO MOSAIC	1:50000	1973	AKLAVIK CHANNEL, DISTRICT OF MACKENZIE, NWT	107 B/3
SURFICIAL GEOLOGY	1:500000	1971	NORTHERN YUKON TERRITORY AND NW DISTRICT OF MACKENZIE	1319A
TOPOGRAPHIC	1:50000	1966	CAMPBELL LAKE, DISTRICT OF MACKENZIE, NWT	107 B/2W
TOPOGRAPHIC	1:250000	1974	AKLAVIK, NWT, DISTRICT OF MACKENZIE	107/B
TOPOGRAPHIC	1:50000	1966	AKLAVIK CHANNEL, DISTRICT OF MACKENZIE, NWT	107 B/3E
TOPOGRAPHIC	1:250000	1962	MACKENZIE DELTA, D. OF MACKENZIE, N.W.T.	107 C

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SITE X1

*

- EXISTING DPW QUARRY

AERONAUTICAL	1:500000	1982	INUVIK	107S 1/2
GEOLOGY	1:250000	1981	AKLAVIK, DISTRICT OF MACKENZIE	1517A
PHOTO MOSAIC	1:50000	1973	CAMPBELL LAKE, DISTRICT OF MACKENZIE, NWT	107 B/2
SURFICIAL GEOLOGY	1:500000	1971	NORTHERN YUKON TERRITORY AND NW DISTRICT OF MACKENZIE	1319A
TOPOGRAPHIC	1:50000	1966	CAMPBELL LAKE, DISTRICT OF MACKENZIE, NWT	107 B/2E
TOPOGRAPHIC	1:250000	1974	AKLAVIK, NWT, DISTRICT OF MACKENZIE	107/B
TOPOGRAPHIC	1:250000	1962	MACKENZIE DELTA, D. OF MACKENZIE, N.W.T.	107 C

LISTING OF MAPS
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862-1806
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MAP TYPE      SCALE      DATE      TITLE      MAP #  
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SITE X2

*

- EXISTING CAMPBELL QUARRY

AERONAUTICAL	1:500000	1982	INUVIK	107S 1/2
GEOLOGY	1:250000	1981	AKLAVIK, DISTRICT OF MACKENZIE	1517A
PHOTO MOSAIC	1:50000	1973	INUVIK, DISTRICT OF MACKENZIE, NWT	107 B/7
SURFICIAL GEOLOGY	1:500000	1971	NORTHERN YUKON TERRITORY AND NW DISTRICT OF MACKENZIE	1319A
TOPOGRAPHIC	1:250000	1974	AKLAVIK, NWT, DISTRICT OF MACKENZIE	107/B
TOPOGRAPHIC	1:250000	1962	MACKENZIE DELTA, D. OF MACKENZIE, N.W.T.	107 C

B.2 PREVIOUS REPORTS

LISTING OF PREVIOUS REPORTS
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862-1806
=====

DATE (yr/mo)	TITLE	WRITTEN BY	PREPARED FOR	REPORT NUMBER
1963/--	THE MACKENZIE DELTA AREA, NWT	J. ROSS MACKAY	DEPT. OF MINES & TECH. SURV.	MEMOIR 8
1975/--	UPPER CRETACEOUS STRATIGRAPHY, YUKON COASTAL PLAIN AND NW MACKENZIE DELTA, GSC BULLETIN 249	F.G. YOUNG	GSC	249
1975/02	PREPARATION OF SHORE PROTECTION MATERIALS FOR FUTURE OFFSHORE ISLANDS	IMPERIAL OIL LIMITED	DR. M.J. RUEL	20300
1976/06	LAND USE APPLICATION	D. LONGLITZ	W. SMITH	
1976/07	FIELD SURVEY OF POTENTIAL RIPRAP QUARRY SITES IN THE CAMPBELL LAKE AREA	IMPERIAL OIL LTD.		4
1976/09	EVALUATION OF POTENTIAL ROCK QUARRIES, ROCKY HILL - CAMPBELL LAKE AREA, NWT	EBA ENGINEERING CONS. LTD.	DIAND	2
1976/12	SOURCES OF MASSIVE RIPRAP IN THE MACKENZIE DELTA AREA	J.T. INGLIS	I.G. PETRIE	5
1977/01	GRANULAR MATERIALS INVENTORY, YUKON COASTAL PLAIN AND ADJACENT AREAS	RM HARDY AND ASSOCIATES	DIAND	3
1982/--	ENVIRONMENTAL GUIDELINES - PITS AND QUARRIES	INAC	PUBLIC	
1982/04	DESIGN AND CONSTRUCTION OF ROCK RIPRAP BANK PROTECTION	P.J. WOODS	WATER MANAGEMENT BRANCH	5352
1983/11	EVALUATION OF POTENTIAL SOURCES OF QUARRY ROCK FOR BEAUFORT MARINE STRUCTURES	EBA ENGINEERING CONS. LTD.	INAC	101-3929
1986/09	RIP RAP SPECIFICATIONS	DEPT. OF PUBLIC WORKS	INTERNAL	

B.3 AIR PHOTOGRAPHS

LISTING OF AIR PHOTOGRAPHS

862-1806

PHOTO TYPE	DATE	PHOTO #	HEIGHT (FT)	F.LTH. (IN)	SCALE
** SITE 0					
* - GENERAL					
LANDSAT5	JUN 1986	4 64 12	0	0.000	1:250000
LANDSAT5	SEP 1986	5 59 12	0	0.000	1:250000
LANDSAT5	JUL 1985	5 61 12	0	0.000	1:250000
LANDSAT5	AUG 1986	5 62 12	0	0.000	1:250000
** SITE 1					
* - MOUNT FITTON, Y.T.					
AIR	AUG 1974	A23838 88	30000	6.000	1:59400
AIR	AUG 1974	A23838 89	30000	6.000	1:59400
AIR	AUG 1974	A23838 90	30000	6.000	1:59400
AIR	AUG 1974	A23838 91	30000	6.000	1:59400
AIR	JUL 1976	A24501 201	30000	6.000	1:59400
AIR	JUL 1976	A24501 202	30000	6.000	1:59400
AIR	JUL 1976	A24501 203	30000	6.000	1:59400
AIR	JUL 1976	A24501 204	30000	6.000	1:59400
** SITE 2					
* - MOUNT DAVIES GILBERT, Y.T.					
AIR	JUL 1974	A23816 178	30000	6.000	1:58200
AIR	JUL 1974	A23816 179	30000	6.000	1:58200
AIR	JUL 1974	A23816 180	30000	6.000	1:58200
AIR	AUG 1974	A23838 13	30000	6.000	1:58200
AIR	AUG 1974	A23838 14	30000	6.000	1:58200
AIR	AUG 1974	A23838 15	30000	6.000	1:58200
** SITE 3					
* - MOUNT GIFFORD, NWT					
AIR	JUL 1978	A25004 100	10400	6.000	1:20300
AIR	JUL 1978	A25004 101	10400	6.000	1:20300
AIR	JUL 1978	A25004 102	10400	6.000	1:20300
AIR	JUL 1978	A25004 103	10400	6.000	1:20300
AIR	JUL 1978	A25004 104	10400	6.000	1:20300
AIR	JUL 1978	A25004 105	10400	6.000	1:20300
AIR	JUL 1978	A25004 106	10400	6.000	1:20300
AIR	JUL 1978	A25004 107	10400	6.000	1:20300
AIR	JUL 1978	A25004 108	10400	6.000	1:20300
AIR	JUL 1978	A25004 109	10400	6.000	1:20300
AIR	JUL 1978	A25004 110	10400	6.000	1:20300
AIR	JUL 1978	A25004 91	10400	6.000	1:20300
AIR	JUL 1978	A25004 92	10400	6.000	1:20300
AIR	JUL 1978	A25004 93	10400	6.000	1:20300

LISTING OF AIR PHOTOGRAPHS
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862-1806
=====

~~~~~ PHOTO TYPE ~~~~~	~~~~~ DATE ~~~~~	~~~~~ PHOTO # ~~~~~	~~~~~ HEIGHT (FT) ~~~~~	~~~~~ F.LTH. (IN) ~~~~~	~~~~~ SCALE ~~~~~
AIR	JUL 1978	A25004 94	10400	6.000	1:20300
AIR	JUL 1978	A25004 95	10400	6.000	1:20300
AIR	JUL 1978	A25004 96	10400	6.000	1:20300
AIR	JUL 1978	A25004 97	10400	6.000	1:20300
AIR	JUL 1978	A25004 98	10400	6.000	1:20300
AIR	JUL 1978	A25004 99	10400	6.000	1:20300
AIR	AUG 1985	A26752 60	31000	6.000	1:61500
AIR	AUG 1985	A26752 61	31000	6.000	1:61500
AIR	AUG 1985	A26752 62	31000	6.000	1:61500
AIR	AUG 1985	A26752 63	31000	6.000	1:61500
** SITE 4/5					
* - GULL CREEK, NWT					
AIR		A22936 118	18200	0.000	LOW LVL
AIR		A26358 05	0	0.000	LOW LVL
AIR	JUL 1985	A26723 117	31000	6.000	1:61800
AIR	JUL 1985	A26723 118	31000	6.000	1:61800
AIR	JUL 1985	A26723 119	31000	6.000	1:61800
AIR	JUL 1985	A26723 142	31000	6.000	1:61800
AIR	JUL 1985	A26723 143	31000	6.000	1:61800
AIR	JUL 1985	A26723 144	31000	6.000	1:61800
** SITE 6					
* - DELTA OUTLIERS, NWT					
AIR		A22936 98	18200	0.000	LOW LVL
AIR	SEP/02/72	A23016 10	18500	6.012	1:36876
AIR	SEP/02/72	A23016 11	18500	6.012	1:36876
AIR	SEP/02/72	A23016 113	18500	6.012	1:36876
AIR	SEP/02/72	A23016 114	18500	6.012	1:36876
AIR	SEP/02/72	A23016 115	18500	6.012	1:36876
AIR	SEP/02/72	A23016 116	18500	6.012	1:36876
AIR	SEP/02/72	A23016 12	18500	6.012	1:36876
AIR	SEP/02/72	A23016 13	18500	6.012	1:36876
AIR	JUL 1985	A26723 33	31000	6.000	1:61950
AIR	JUL 1985	A26723 34	31000	6.000	1:61950
AIR	JUL 1985	A26723 35	31000	6.000	1:61950
AIR	JUL 1985	A26723 36	31000	6.000	1:61950
AIR	JUL 1985	A26723 57	31000	6.000	1:61950
AIR	JUL 1985	A26723 58	31000	6.000	1:61950
AIR	JUL 1985	A26723 59	31000	6.000	1:61950
AIR	JUL 1985	A26723 60	31000	6.000	1:61950
AIR	JUL 1985	A26723 61	31000	6.000	1:61950

LISTING OF AIR PHOTOGRAPHS  
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862-1806  
*****

~~~~~ PHOTO TYPE ~~~~~	~~~~~ DATE ~~~~~	~~~~~ PHOTO # ~~~~~	~~~~~ HEIGHT ~~~~~	~~~~~ F.LTH. ~~~~~	~~~~~ SCALE ~~~~~
			(FT)	(IN)	

**

SITE X1

*

- EXISTING DPW QUARRY, NWT

AIR		A22936 224	18200	0.000	LOW LVL
AIR		A22959 111	6200	0.000	LOW LVL
AIR		A26357 142	0	0.000	LOW LVL

**

SITE X2

*

- EXISTING CAMPBELL QUARRY, NWT

AIR		A26357 153	0	0.000	LOW LVL
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SUPPORTING DOCUMENT C

PREVIOUS DATA AND PRELIMINARY SITE ASSESSMENT

- C.1 Previous Data**
- C.2 Preliminary Site Assessment**

C.1 PREVIOUS DATA

SITE 3

MOUNT GIFFORD, N.W.T.

- A. Site No: R27
- B. Overall Rating: Good
- C. Location: Mount Gifford,
N.W.T.
- D. Latitude: 68° 09' N.
Longitude: 135° 26' W.
- E. Region: Aklavik
- F. Reconnaissance Level: Ground
- G. Geologic Data
Formation: Martin Creek
Geologic Age: Cretaceous
Lithology: Sandstone
Description: Clean, blocky, durable, 70 to 100 cm bedding.
- H. Site Data
Description: On eastern edge of mountain ridge, dipping northerly. Provides large blocks of durable talus. Ridge forming member commonly 20 to 30 m thick.
Base Elevation (m): 125
Optimum Location: Lower end of the ridge near north end of the mountain.
Local Access: Moderate climb to area of site. Morainal terrain is moderately wet and may be thermally sensitive.
Regional Access: West Channel to river mouth.
Likely Tidewater: Mouth of West Channel
Direct Distance (km): 5 km to West Channel access.
Quantity: 5 to 10 million cubic metres
- I. Potential Uses
Armour Stone (> 5 tonnes): Fair (some talus blocks are 5 to 10 tonne size)
Rip Rap (1 to 5 tonnes): Good
Blast Rock (< 1 tonne): Good
General Fill: Good
Concrete Aggregate: Good
- J. Previous References
Preliminary Report: Site No. P25
Hardy Associates (1976): Site No. 468
- K. General Comments: The area examined is less than a kilometer from the borrow pit used by Aklavik residents to obtain gravel.
- L. Development Feasibility: Locally available labour and accomdations might be enough to justify development.

TABLE 1 (continued)

SUMMARY OF QUARRY POTENTIAL AT THE SITES INVESTIGATED

SITE NO.	LOCATION	QUALITY OF MATERIAL FOR MARINE CONSTRUCTION	QUALITY OF AGGREGATE	DEVELOPMENT POTENTIAL	OVERALL RATING
C. SITES IN THE NORTHWEST TERRITORIES, WEST OF MACKENZIE DELTA					
P22	Coal Mine Lake	Good general fill	Unsuitable	Poor quality and no tidewater	Unsuitable
R24	Cache Creek	Good general fill	Poor	Too distant to tidewater.	Unsuitable
R25	S. of Shallow Bay	Fair rip rap	Fair - Good	Modest development possible.	Fair
R26	N.W. of Aklavik	General fill	Poor	Not recommended	Poor
R27	Mt. Gifford	Good rip rap	Good	Alternate to R25, seems ok.	Good
D. SITES EAST OF MACKENZIE DELTA (WITHIN PROPOSED INTERNATIONAL ECOLOGICAL SITE)					
R28	Gull Creek (Quartzite)	Good armour stone	Good	Barge access limited by shallow draught.	Good
R29	Gull Creek (Dolomite)	Fair armour stone	Good	Barge access limited by shallow draught.	Good
	Cape Parry	Good blast rock	Good	Good harbour at Wise Bay would avoid proposed IBP site.	Fair
	Cape Nelson	Good (?)	Good	Steep cliffs and poor harbour.	Fair
	Holman Island	Good (?)	Good	Very short shipping season.	Poor
	Minto Inlet	Good (?)	Good	Even shorter shipping season.	Poor

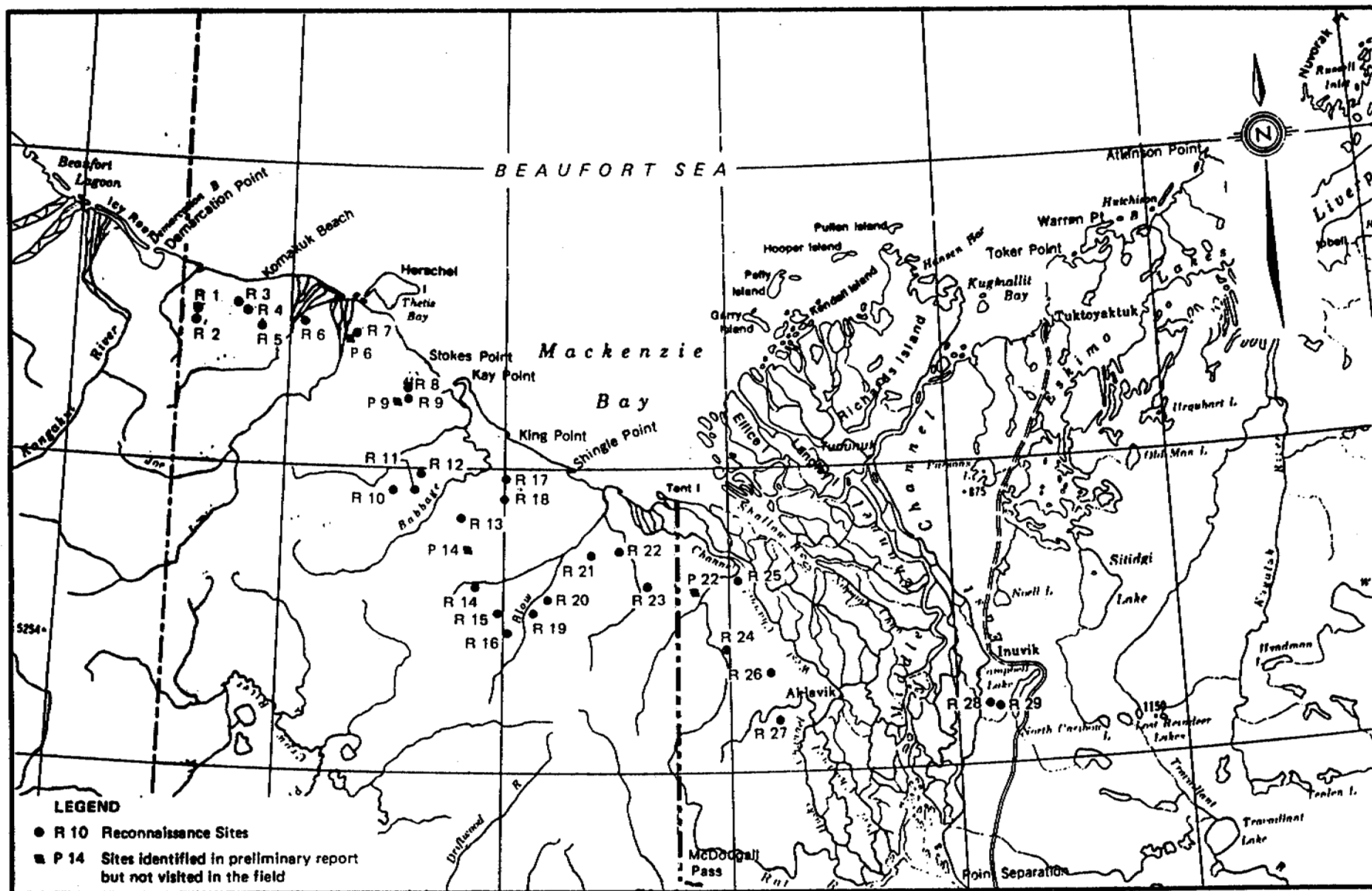


FIGURE 2 POTENTIAL QUARRY SITES INVESTIGATED

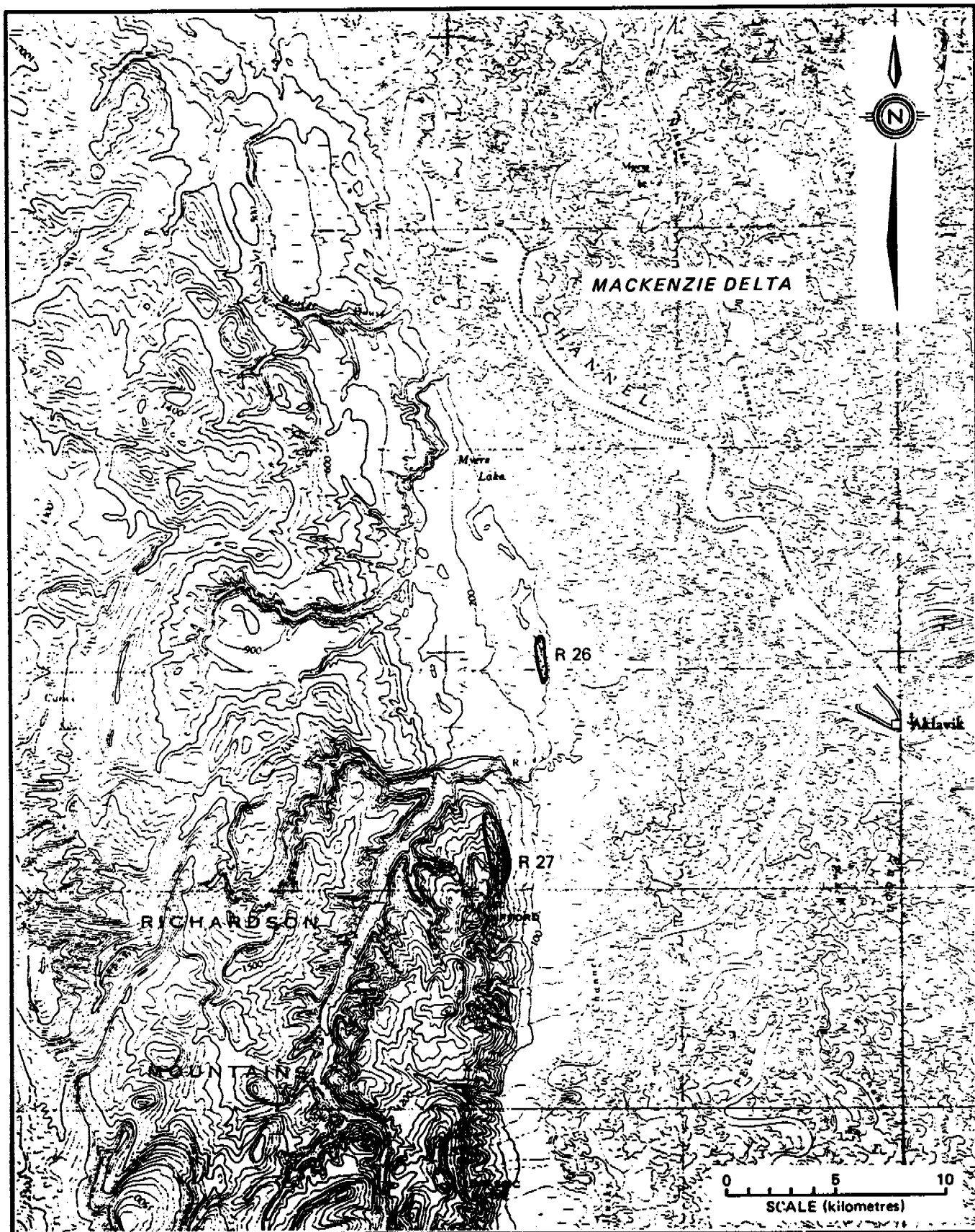


FIGURE A - 28 LOCATION OF SITE R 27

DEPOSIT 468

Setting: Glacially scoured bedrock ridges at the crest of large escarpment located 1 mile north of Mount Gifford.

Material: Quartz sandstone; rock and rubble.

Volume: 5,000,000 cubic yards total.

Assessment: Contains rock suitable for crushing. Further testing is required to determine its suitability for riprap or concrete aggregate. Access to site is difficult.



Airphoto No. : A22885-80

Deposit Outline - R.M. Hardy

Deposit Outline - Others

Approx. Scale : 1"=4800'

Test Pit

Exposures



DEPOSIT 468

SETTING

Deposit 468 consists of a number of glacially-scoured bedrock ridges at the northern end of a long 1500 foot high escarpment running parallel to the western edge of the Mackenzie Delta. The deposit is located 1 mile north of Mount Gifford and 12½ miles west of Aklavik, N.W.T.

Scarps, 10 to 100 feet high, often form the sides of the long bedrock ridges. Small talus fans are commonly present at the base of the scarps. Numerous faults are present in this area and the rocks have various strikes and dips. Most rocks are inclined at dips of 10 to 45 degrees. The outcrop shows a 2-dimensional jointing pattern that complements the bedding. The rock is a very light gray, fine-grained quartz sandstone containing minor rock fragments. The rock at Deposit 468 is known locally as the Lower Sandstone Division of the Early Cretaceous age.

The deposit is generally bare of vegetation, although a few swales have a continuous cover of tundra.

Deposit 468 is at the northern end of a large steep escarpment, and steep slopes to the northeast lead to a flatter bench and the Mackenzie Delta. The Willow River canyon is located to the northwest and its steep escarpment may provide nesting sites for raptors.

MATERIAL

Deposit 468 contains rock which may be suitable for concrete aggregate or riprap after processing. The talus is very variable with cubes ranging from 2 inches to the side to 6 feet to the side. Generally, the blocks average 1 inch in thickness and 1½ feet across. Additional investigation will be necessary to outline areas of different

rock quality. The size of some fragments and the friable nature of the rock on freshly fractured surfaces indicate that this rock may not be durable.

VOLUME

The total volume of 5,000,000 cubic yards assumes that the rock might be quarried to an average depth of 20 feet over most of the area.

DEVELOPMENT

Durability and crushing tests to determine the breakage characteristics of the rock would be necessary before Deposit 468 is developed as a source of aggregate or riprap. Development would require blasting and quarrying.

Access to this deposit will be difficult as steep slopes, susceptible to thermokarst and erosion, will have to be traversed. Frozen lakes and channels will provide smooth haul roads across the Mackenzie Delta during the winter.

SUMMARY OF PETROGRAPHIC DATA FOR ROCK SAMPLES

PETROGRAPHIC ANALYSIS

PARTICLE TYPE	PERCENT
Detrital quartz	99
Chert	1
Limonite	trace
Siliceous cement	trace

ROCK NAME: Quartz sandstone

GRAIN SIZE: 0.7 mm to less than 0.06 mm, most grains 0.15 to 0.25 mm

GRAIN SHAPE: Angular to subrounded

MATRIX AND CEMENT: Poorly cemented although some siliceous overgrowth and recrystallization is present.

POROSITY AND PACKING: Grain boundaries interlock, but moderately porous (22.5%). Few clusters of grains densely packed, but generally not.

COMMENTS: Cohesive, but slightly friable; color banding indicates bedding.

NOTE: PETROGRAPHIC ANALYSIS BY DOLMAGE CAMPBELL & ASSOCIATES (1975) LTD.

GOVERNMENT OF CANADA
DEPARTMENT OF INDIAN AFFAIRS
AND
NORTHERN DEVELOPMENT



R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERS & PROFESSIONAL SERVICES
• GEOTECHNICAL DIVISION

TEST PIT NO.
468-A(e)

SITE 4

GULL CREEK QUARTZITE, N.W.T.

- A. Site No: R28
- B. Overall Rating: Good
- C. Location: Gull Creek,
N.W.T.
- D. Latitude: 68° 10' N.
Longitude: 133° 47' W.
- E. Region: Inuvik
- F. Reconnaissance Level: Aerial Only
- G. Geologic Data
Formation: Undifferentiated
Geologic Age: Precambrian
Lithology: Quartzite
Description: Massive to blocky.
- H. Site Data
Description: Pronounced cliff of 75 m.
Base Elevation (m): 20
Optimum Location:
Local Access: Barge by river.
Regional Access: Middle Channel of Mackenzie River Delta.
Likely Tidewater: Mouth of the River.
Direct Distance (km): Less than a kilometer to water.
Quantity: 15 million cubic metres (plus)
- I. Potential Uses
Armour Stone (> 5 tonnes): Good
Rip Rap (1 to 5 tonnes): Good
Blast Rock (< 1 tonne): Good
General Fill: Good
Concrete Aggregate: Good
- J. Previous References
Preliminary Report: Site No. P27
EBA (1976): Report No. 1-1537
- K. General Comments: This area is within the proposed
Dolomite Lake - Campbell Hill IBP
site.
- L. Development Feasibility: A good prospect with available local
harbour and infrastructure.

SUMMARY OF QUARRY POTENTIAL AT THE SITES INVESTIGATED

SITE NO.	LOCATION	QUALITY OF MATERIAL FOR MARINE CONSTRUCTION	QUALITY OF AGGREGATE	DEVELOPMENT POTENTIAL	OVERALL RATING
C. SITES IN THE NORTHWEST TERRITORIES, WEST OF MACKENZIE DELTA					
P22	Coal Mine Lake	Good general fill	Unsuitable	Poor quality and no tidewater	Unsuitable
R24	Cache Creek	Good general fill	Poor	Too distant to tidewater.	Unsuitable
R25	S. of Shallow Bay	Fair rip rap	Fair - Good	Modest development possible.	Fair
R26	N.W. of Aklavik	General fill	Poor	Not recommended	Poor
R27	Mt. Gifford	Good rip rap	Good	Alternate to R25, seems ok.	Good
D. SITES EAST OF MACKENZIE DELTA (WITHIN PROPOSED INTERNATIONAL ECOLOGICAL SITE)					
R28	Gull Creek (Quartzite)	Good armour stone	Good	Barge access limited by shallow draught.	Good
R29	Gull Creek (Dolomite)	Fair armour stone	Good	Barge access limited by shallow draught.	Good
	Cape Parry	Good blast rock	Good	Good harbour at Wise Bay would avoid proposed IBP site.	Fair
	Cape Nelson	Good (?)	Good	Steep cliffs and poor harbour.	Fair
	Holman Island	Good (?)	Good	Very short shipping season.	Poor
	Minto Inlet	Good (?)	Good	Even shorter shipping season.	Poor

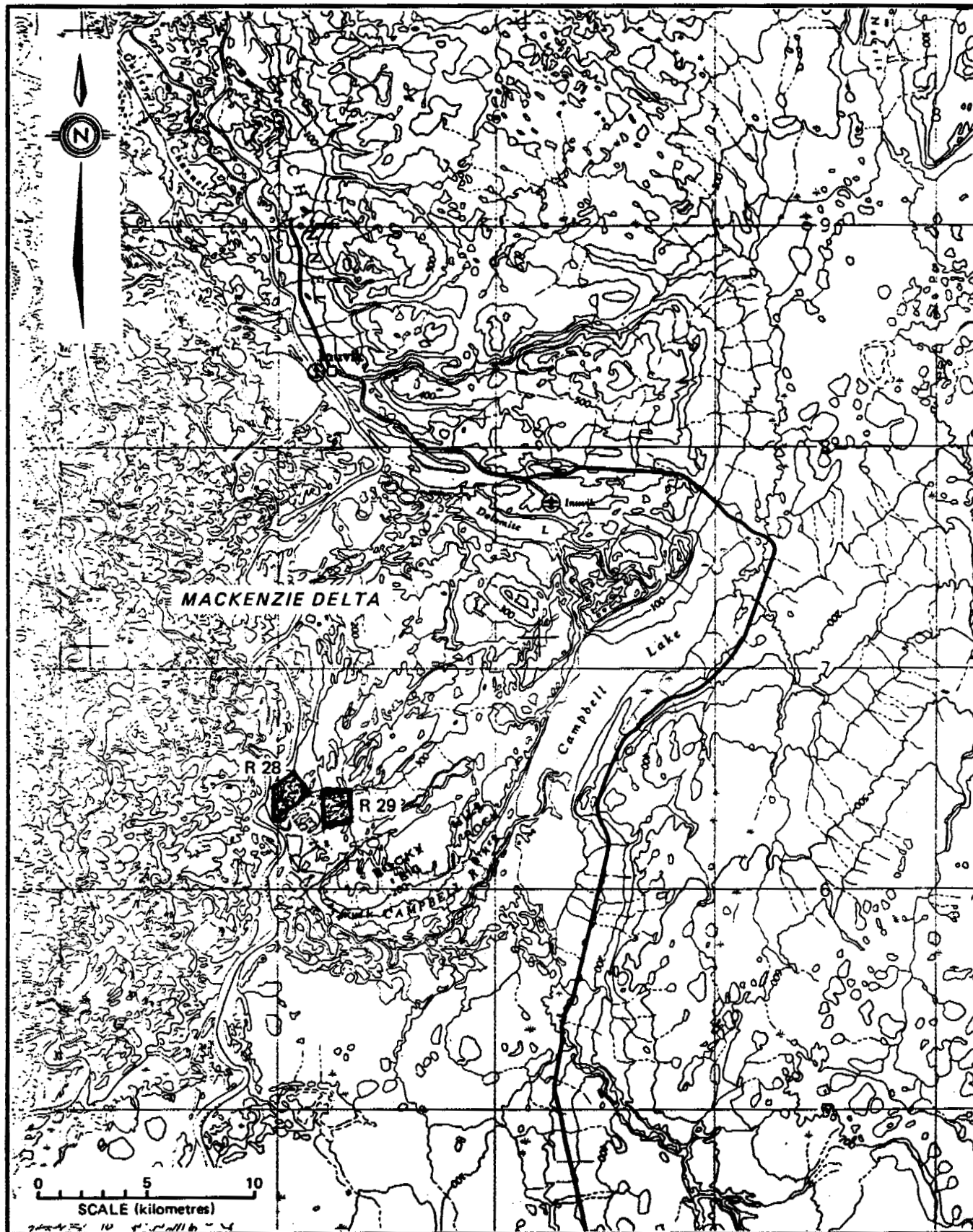


FIGURE A - 30 LOCATION OF SITE R 29

FIELD DESCRIPTIVE NOTE

SITE 10

GULL CREEK QUARTZITE

MINERAL: Pre-Cambrian quartzite (f_1) is found on the large ridge that lies north of the Gull Creek basin, and east of the east channel. The rock ranges from hard durable quartzite, to a poorly-cemented quartz sandstone.

Individual stations are described below and their locations are shown on Drawing 13.

STOP 10-1

LOCATION: South Face of Quartzite Knob

LOWER SLOPE: - occasional blocks of rock on surface with dimensions 3 feet to 6 feet
- rock varies from fine grained well-cemented quartzite with small rust specks to weakly cemented rust coloured sandstone. The latter is quite weak and ill-suited for use as construction material.

UPPER SLOPE: Quartzitic sandstone, fine grained, some pebble layers
- white with salt and pepper rust specks
- bedding irregular, 3 to 6 inches thick, strike E-W dip 10°N
- jointing N60E/90 and N20W/90 (irregular)
- weathering poorly as this is a weakly cemented rock

TOP OF RIDGE

- open park-like area
- Inuvik visible at N5°E
- outcrops scarce
- soil cover is silty sand with sandstone fragments, typical of that derived from weathering of a weak sandstone.

STOP 10-2

- | | |
|-----------------------|--|
| EAST EDGE OF
RIDGE | <ul style="list-style-type: none">- cross-bedded quartzitic sandstone- fine grained, light brown to white- mostly well cemented, some weakly cemented calcareous zones- bedding<ul style="list-style-type: none">- not distinct- 6 inches to 1 foot thick- Strike N50W Dip 10°S- jointing quite strong<ul style="list-style-type: none">- N60E/90- N10W/90- N70W/90- weathers to resistant blocks with dimensions ranging from one to three feet across |
|-----------------------|--|

STOP 10-3

NORTH FLANK OF - a northward sloping area with intermittent outcrops
RIDGE SOUTH OF of low ridges of quartzitic bedrock
V SHAPED LAKE

- ROCK
- quartzitic sandstone, fine grained
 - white with rusty brown salt and pepper specks
 - well cemented and resistant to weathering
 - local poorly cemented zones
 - bedding
 - 1 to 3 feet thick
 - indistinct, undulates, dips generally to NE and SE
 - jointing
 - fairly strong
- J1 N60E/90
J2 N10W/90
J3 N70W/90

Low outcrops frequently have joint systems that run parallel to the outcrop face. There is a progressive widening of the joints as the face is approached, and toppling of the bedrock blocks is also evident as the face is approached. The open joints are spaced several feet apart, and are 10 feet or more deep. A typical exposure would be 15 to 20 feet high and the zone of progressive opening and toppling would be 75 to 100 feet wide.

Blocks of bedrock formed by this action range from 1 to several feet across. The block faces are formed on joint and bedding planes and the lichen-covered surface indicates good resistance to freeze-thaw. Occasional poorly-cemented zones display frost spalling features.

Photo 25 shows the frost derived blocks of quartzite in this area.

STOP 10-4

LOCATION: Small test quarry on north slope of ridge

A test blast was evident on a small north-facing cliff approximately 3 feet high.

ROCK:

- quartzite, fine grained, white
- bedding 1 to 3 feet thick, indistinct
- strike E-W dip 10°N
- jointing N60E/90, N60W/90, N-S/90

The test blast was evidently overpowered as fresh faces were created on the blast face. The fragment size produced by the blast ranged from inches to only a foot or so across

STOP 10-5

West slope of quartzite ridge.

A large felsenmeer field exists along the west edge of the outcrop ridge.

The fragments are quite angular with dimensions of one to two feet. The rock is a well cemented quartzite. It's lichen-covered faces demonstrate good resistance to weathering.

STOP 10-6

f₂ outcrop east of the mouth of Gull Creek.

- ROCK:
- greywacky quartzite, medium grey colour
 - bedding 1 to 3 inches thick
 - attitude - undulating, strike N20E Dip 5°E
 - jointing - closely spaced, N10E/90, N80E/90

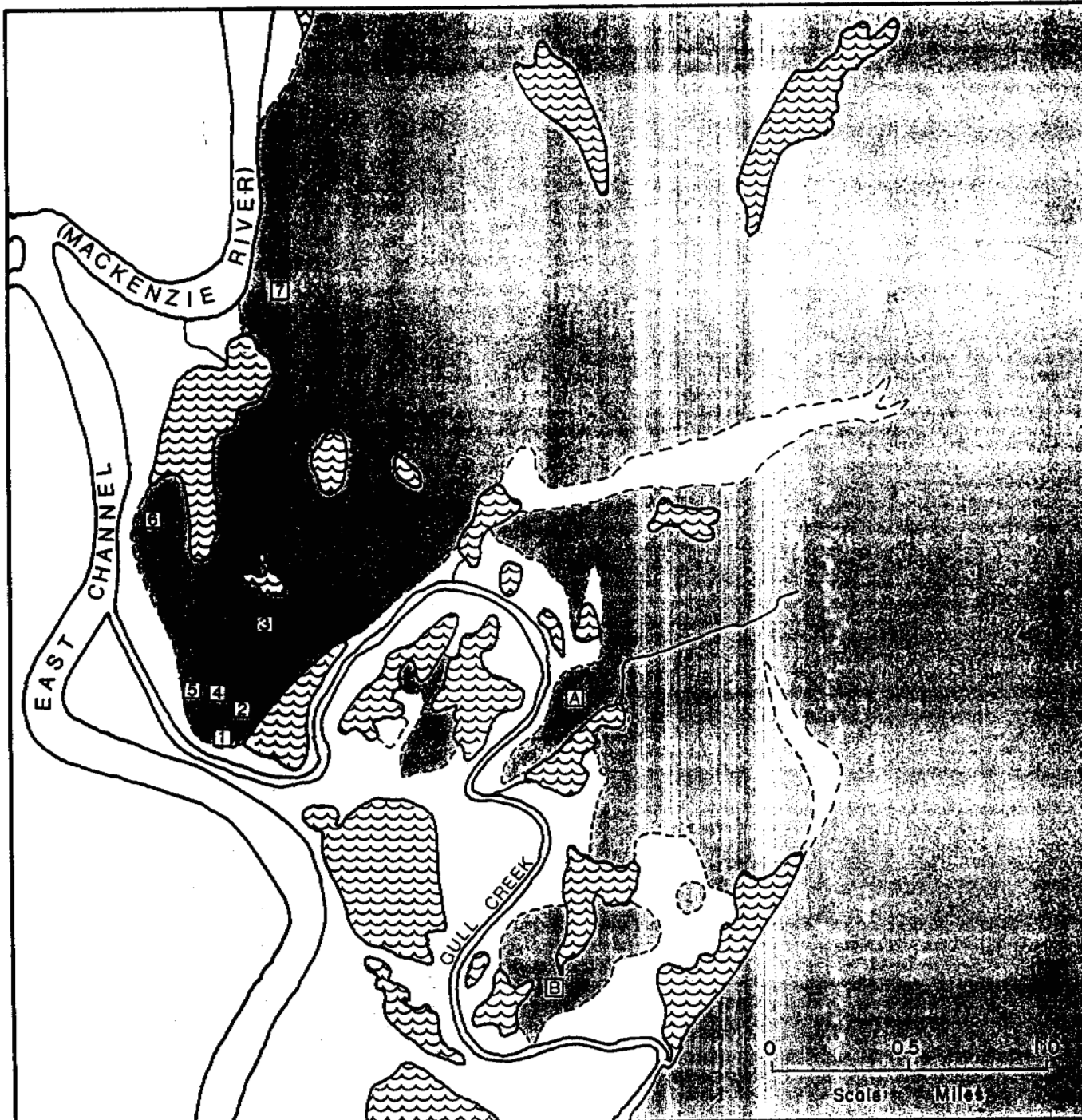
This rock weathers readily to flaggy, flat fragments and is not suitable as a construction material.

STOP 10-7

f₂ outcrop at edge of east channel 2 miles north of quartzite ridge.

- ROCK:
- slaty argillite, red, green and grey colour
 - bedding strikes N30E dips 30E
 - jointing - quite strong
 - J1 N40E/90
 - J2 N60W/90
 - J3 N-S/90

Weathering breaks the rock down into splintery fragments 1/4 inch to 1/8 inch across and 2 to 3 inches long. The axis of the splintery fragments is N60°E and reflects planes of weakness in this direction. This rock is entirely unsuitable for construction purposes.



LEGEND

-  ROCK OUTCROP (Approximate)
-  FIELD OBSERVATION LOCATION
-  FIELD STATION DESCRIPTION UNDER SITE 9
-  LAKES

FIELD OBSERVATION LOCATION MAP GULL CREEK AREA

EDA Engineering Consultants Ltd. 

JOB No: 1-1537

DATE: 28/10/76

Modified from Air Photo
No.: A-22936-118
(Energy, Mines and
Resources)

DRAWING No:

13

SITE 5

GULL CREEK, DOLOMITE, N.W.T.

- A. Site No: R29
- B. Overall Rating: Good
- C. Location: Gull Creek,
N.W.T.
- D. Latitude: 68° 10' N.
Longitude: 133° 47' W.
- E. Region: Inuvik
- F. Reconnaissance Level: Aerial Only
- G. Geologic Data
 Formation: Vunta
 Geologic Age: Cambrian - Silurian
 Lithology: Dolomite (Cherty)
 Description: Blocky
- H. Site Data
 Description: Moderate ridges and low scarp 15 to 25 m high.
 Base Elevation (m): 20
 Optimum Location: Near river
 Local Access: By river barge
 Regional Access: Middle Channel of Mackenzie River
 Likely Tidewater: Mouth of river
 Direct Distance (km): Less than 1 km to river
 Quantity: 5 million cubic metres
- I. Potential Uses
 Armour Stone (> 5 tonnes): Fair
 Rip Rap (1 to 5 tonnes): Good
 Blast Rock (< 1 tonne): Good
 General Fill: Good
 Concrete Aggregate: Good
- J. Previous References
 Preliminary Report: Site No. P27
 EBA (1976): Report No. 1-1537
- K. General Comments: This area is within the proposed Dolomite Lake - Campbell Hills IBP site.
- L. Development Feasibility: A good prospect with available local labour and good development infrastructure.

SUMMARY OF QUARRY POTENTIAL AT THE SITES INVESTIGATED

SITE NO.	LOCATION	QUALITY OF MATERIAL FOR MARINE CONSTRUCTION	QUALITY OF AGGREGATE	DEVELOPMENT POTENTIAL	OVERALL RATING
C. SITES IN THE NORTHWEST TERRITORIES, WEST OF MACKENZIE DELTA					
P22	Coal Mine Lake	Good general fill	Unsuitable	Poor quality and no tidewater	Unsuitable
R24	Cache Creek	Good general fill	Poor	Too distant to tidewater.	Unsuitable
R25	S. of Shallow Bay	Fair rip rap	Fair - Good	Modest development possible.	Fair
R26	N.W. of Aklavik	General fill	Poor	Not recommended	Poor
R27	Mt. Gifford	Good rip rap	Good	Alternate to R25, seems ok.	Good
D. SITES EAST OF MACKENZIE DELTA (WITHIN PROPOSED INTERNATIONAL ECOLOGICAL SITE)					
R28	Gull Creek (Quartzite)	Good armour stone	Good	Barge access limited by shallow draught.	Good
R29	Gull Creek (Dolomite)	Fair armour stone	Good	Barge access limited by shallow draught.	Good
	Cape Parry	Good blast rock	Good	Good harbour at Wise Bay would avoid proposed IBP site.	Fair
	Cape Nelson	Good (?)	Good	Steep cliffs and poor harbour.	Fair
	Holman Island	Good (?)	Good	Very short shipping season.	Poor
	Minto Inlet	Good (?)	Good	Even shorter shipping season.	Poor

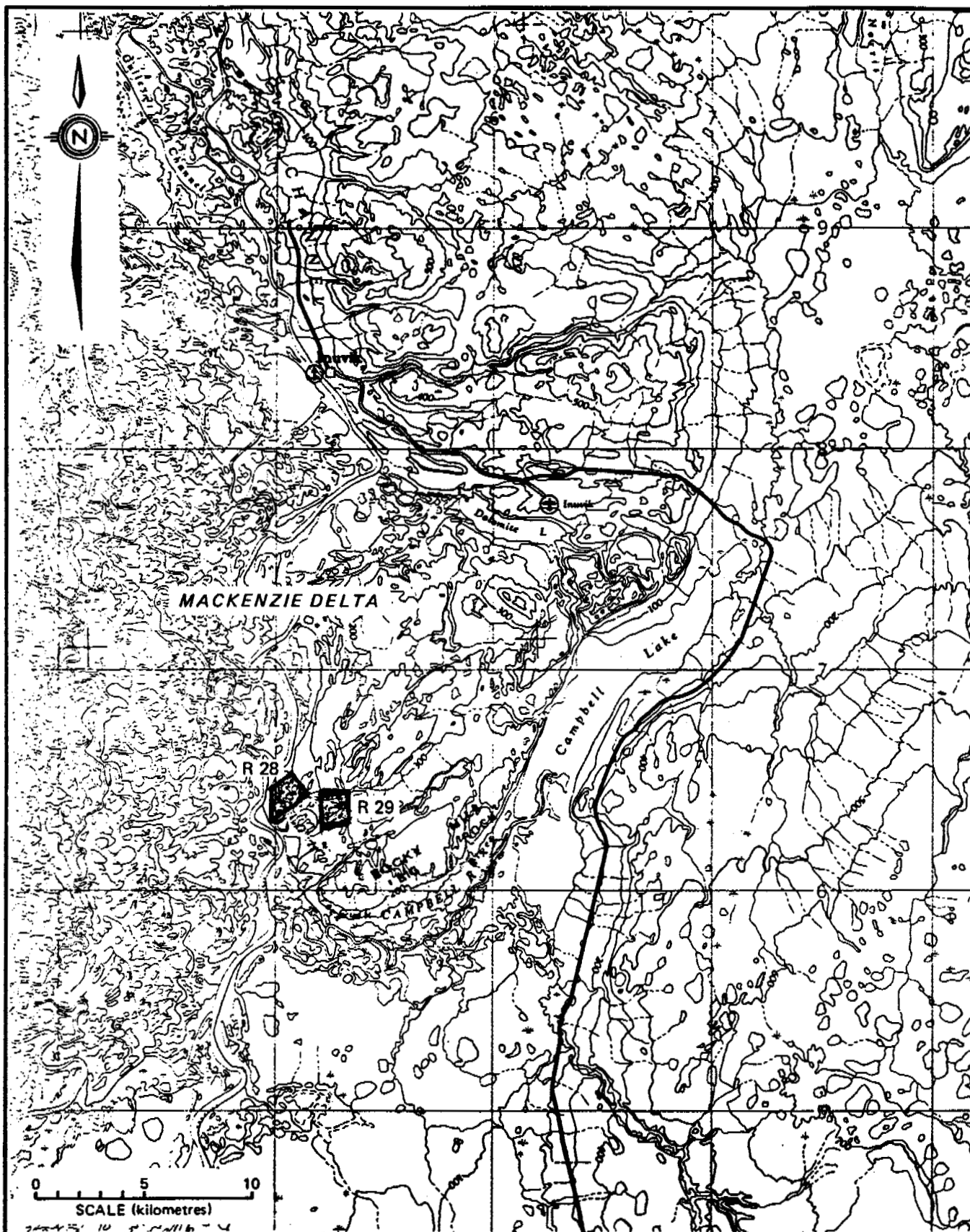


FIGURE A - 30 LOCATION OF SITE R 29

FIELD DESCRIPTIVE SITE

SITE 9

LOCATION: A. Gull Creek - Dolomite Ridge on North Side

Bedrock - Dolomite

- light grey to buff dolomite
- fine to medium crystalline
- locally banded and contains calcite blebs

Bedding - not distinct - 1 to 3 feet thick

- Strike N45E Dip 5°SE

Jointing - N60E/90°

- N50W - indistinct

Relief - Series of low ridges

- Local relief 15 to 20 feet

Note - small test quarry here - yielded some armour stone.

B. 1 Mile South

Bedrock - Dolomite

- medium grey, medium crystalline

Bedding - Not distinct

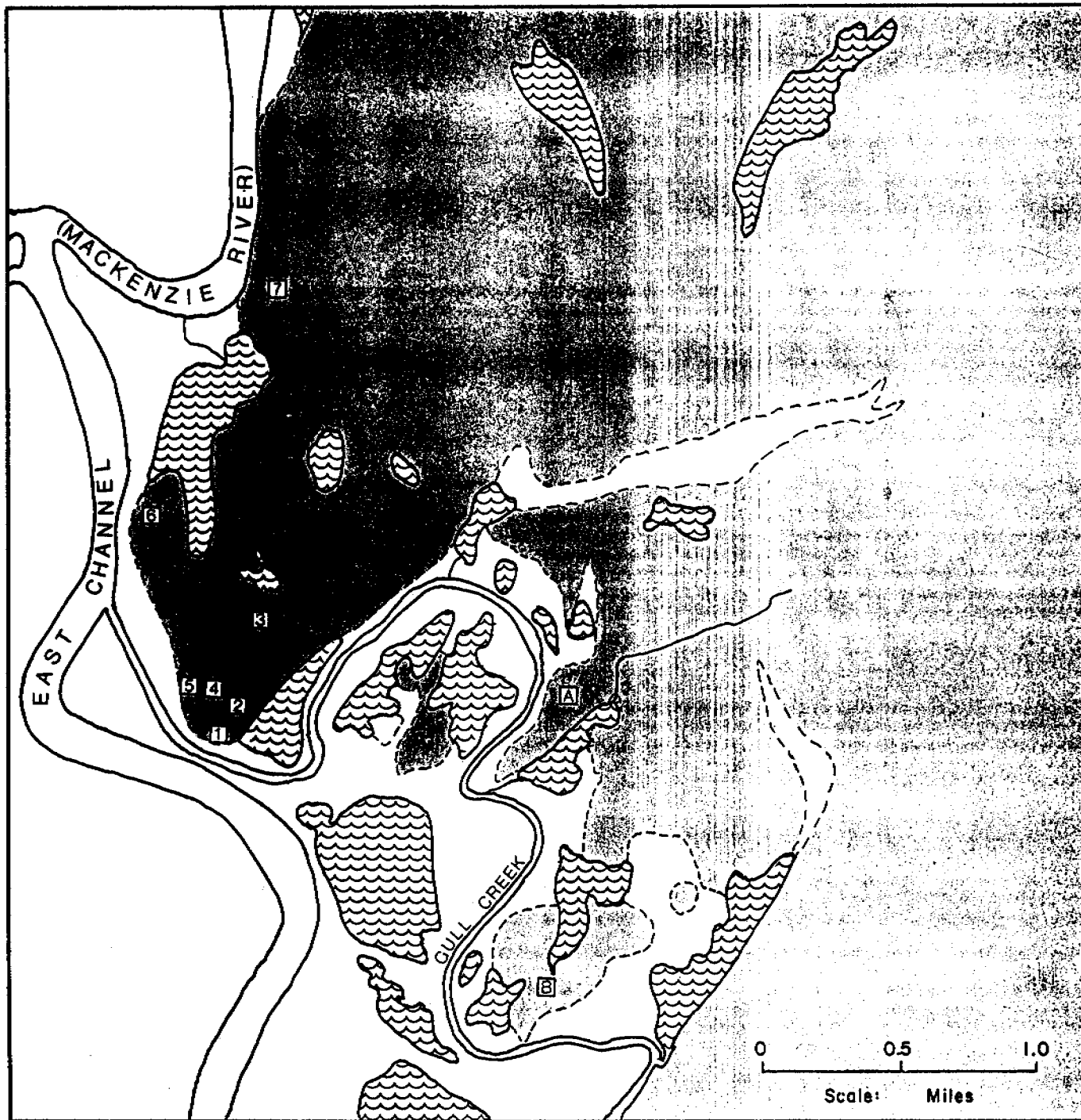
Relief - Low rounded hills

- glacial grooving
- roches moutonnées effect - irregular side to north

Exposed Surface - preserves glacial rounding and solution weathering

PHOTO 21 illustrates the glacially rounded ridges

PHOTO 22 illustrates surface solution pattern.



LEGEND

-  ROCK OUTCROP (Approximate)
-  FIELD OBSERVATION LOCATION
-  FIELD STATION DESCRIPTION UNDER SITE 9
-  LAKES

FIELD OBSERVATION LOCATION MAP GULL CREEK AREA

EDA Engineering Consultants Ltd. 

JOB No: I-1537

DATE: 28/10/76

Modified from Air Photo
No: A-22936-118
(Energy, Mines and
Resources)

DRAWING No:
13

SITE 6

DELTA OUTLIERS, N.W.T.

FIELD DESCRIPTIVE NOTE
SITE 11

LOCATION: Outlier - South of mouth of Campbell River
East of "East Channel"

Walked over outlier to Northwest corner of the outcrop area.

BEDROCK: Dolomite Limestone
- dark grey, fine grained

BEDDING: 6 inches to 3 feet thick - indistinct
Strike N80E, Dip 7°S

JOINTING: Main Sets J1 N60E/80W - locally closely spaced (6")
J2 N10W/90

RELIEF: Subdued - 15 to 20 feet locally

Ridges oriented N10 to N30W, roche moutonnée shape with
glacially smooth south flanks and blocky irregular
northern exposures.

Exposed surface preserves glacial rounding and develop some solution.
This indicates overall resistance to weathering.

PHOTOS 23 and 24 illustrate general topographic conditions in this area.

C.2 PRELIMINARY SITE ASSESSMENT

QUARRY LOCALITY ASSESSMENT - COMPARATIVE RATING

SITE NUMBER	LOCALITY	ARMOUR STONE *	RIP-RAP	BLAST ROCK	GENERAL FILL	CONCRETE AGGREGATE	ACCESS	WILDLIFE CONCERNS	POT'L QUANTITY	HYDROLOGY
1	Mt. Fitton	5/5	5	5	5	4	1	1	5	4
2	Mt. Davies Gilbert	3/3	5	5	5	4	2	2	3	4
3	Mt. Gifford	4/3	5	5	5	4	3	2	4	4
3C	West Delta Roche Moutonee	4/3	5	5	5	4	3	4	2	3
4	Gull Creek Quartzite	4/3	5	5	5	4	4	3	4	4
5	Gull Creek Dolomite	5/4	5	5	5	4	4	3	5	4
6	Delta Outlier	3/4	4	5	5	4	4	4	3	2

NOTE: Significance codes

1=Very poor

2=Poor

3=Fair

4=Good

5=Very good

Comparative rating of prospects

* Significance code for armour stone also includes potential quantity, see other table e.g. 5/2 Very good prospect but major concern over quantity of product.

*Preliminary assessment

NOTE: Significance codes

1=Critical concern

2=Major concern

3=Significant concern

4=Minor concern

5=No concern

Comparative rating of constraints

QUARRY SITE ASSESSMENT - COMPARATIVE RATING

PARAMETER	SITE NUMBER						
	1	2	3	3C	4	5	6
SITE CONDITIONS							
Access-regional	1	2	3	4	4	4	4
-local	2	1	3	3	4	4	4
Location	2	2	3	2	4	4	3
Extent of outcrop	3	3	3	2	4	4	3
Topography-landform	3	1	2	3	3	3	3
Relief-regional	2	3	3	3	4	4	4
-local	3	2	3	3	4	4	4
Slope	3	2	3	4	4	4	4
Aspect	3	4	2	3	3	3	3
Overburden extent	3	3	3	4	3	4	4
Overburden type	4	4	3	4	4	4	4
Drainage	4	4	4	3	4	4	2
Lithology	4	3	3	4	3	4	3
ENGINEERING CONSIDERATIONS							
Physical suitability	3	2	2	3	2	3	3
Potential quantity	4	4	3	2	4	3	2
Waste/reject	4	3	3	4	4	3	3
Slope stability	4	2	3	4	4	3	4
Groundwater	4	3	3	4	4	4	2
Excavatability	4	3	3	4	3	3	3
ENVIRONMENTAL CONSIDERATIONS							
Wildlife	1	1	2	3	2	2	3
Archaeology	4	4	4	3	3	3	3
Recreation	4	4	3	4	2	2	3
Screening potential	4	4	2	2	2	2	3
Trapper Camp	4	4	4	4	1	1	2
Land Claim	2	2	2	2	2	2	2

NOTE: Significance code

1=Critical

2=Major

3=Moderate

4=Minor

*Preliminary assessment

SUPPORTING DOCUMENT D

LABORATORY TEST RESULTS

- D.1 Uniaxial Compression**
- D.2 Point Load**
- D.3 Unit Weight/Specific Gravity**
- D.4 Los Angeles Abrasion**
- D.5 Sulphate Soundness**
- D.6 Slake Durability**
- D.7 Petrography**
- D.8 Listing of Laboratory Test Photographs**

TABLE D.1

OSS/QUARRIES/BEAUFORT

LABORATORY TEST RESULTS

862-1806

SITE #	UNIAXIAL COMPRESSION (MPa)	POINT LOAD (MPa)	UNIT WEIGHT (g/cm ³)	L.A. ABRASION (% LOSS)	SULPHATE SOUNDNESS (% LOSS)	SLAKE DURABILITY (% RETAINED)
1	52 85	104 288 (178)	2.63 2.69	27.7	0.94	97.8
2	89 111	89 312 (207)	2.58 2.56	27.1	2.98	98.9
3	52 106	65 283 (154)	2.42 2.45	33.4	4.15	97.9
3C	86 87	96 172 (144)	2.28 2.30	52.9	27.28	98.5
4	87	96 300 (218)	2.53 2.56	26.8	0.86	99.1
5	71 105	58 199 (124)	2.80 2.78	27.1	0.76	98.1
6	—	55 190 (112)	2.66	54.2	0.86	98.6

D.1 UNIAXIAL COMPRESSION

**Golder
Associates**

SUBJECT COMPRESSION STRENGTH RESULTS		
Job No. 802.1806	Made by DFW	Date 30 Dec 86
Ref.	Checked	Sheet of
	Reviewed	

SITE	UCS		PL → UCS (241550)		
	Low	HIGH	Low	MEAN	HIGH
1	52	85	104	176	268
2	89	111	89	207	312
3	52	106	65	159	283
4		87	96	218	300
5	71	105	58	124	199
6	Could not core		55	112	190
3c	86	87	96	144	172

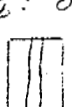
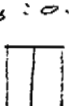
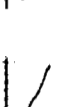
Rock material strength > 50 MPa classified as "strong"; > 100 MPa as "very strong"

No individual results would be classed as less than strong;

LABORATORY TEST RESULTS UNIAXIAL COMPRESSION TEST

Project DSS/QUARRIES/BAFOET Project Number 8621806

Date Oct. 28/86 Sheet 1 of 2 Technician P.O.

Borehole No.	Sample No.	Depth	ϕ (cm)	L (cm)	L/ ϕ	Wt. (g)	Gauge (MPa)	Factor	Breaking Stress (MPa)	Remarks
1	1		4.36	8.93	2.05	350	5.52	15.4	85.0	 ~70°
"	2		4.36	8.95	2.05	358.5	3.38		52.1	
2	1		4.36	7.85	1.80	302.4	7.31		111.2	 1/4 correction: 0.988
"	2		4.36	8.87	2.03	338.8	5.80		89.3	
3	1		4.36	9.85	2.26	355.2	3.38		52.1	
"	2		4.36	7.06	1.62	257.3	7.11		106.4	 1/4 : 0.972
3C	1		4.36	8.61	1.97	292.7	5.66		87.0	 1/4 : 0.998
"	2		4.36	8.56	1.96	293.3	5.59		85.9	 1/4 : 0.998
4	1		4.36	9.05		342.6	5.66		87.1	 ~75°

FACTOR:

Ram Area 230 cm^2

Sample Area $\frac{\pi}{4} \times 4.36^2 = 14.9 \text{ cm}^2$

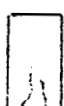
$F = \frac{230}{14.9} = 15.4$

Golder Associates

LABORATORY TEST RESULTS UNIAXIAL COMPRESSION TEST

Project D/S/Quarries/Bearfoot Project Number 862-1806

Date _____ Sheet 2 of 2 Technician _____

Borehole No.	Sample No.	Depth	ϕ (cm)	L (cm)	L/ ϕ	Wt. (g)	Gauge (MPa)	Factor	Breaking Stress (MPa)	Remarks
4	2		4.36	8.55		3262	—			bad sample for testing
58	1		4.36	9.05	2.07	377.3	6.83	15.4	105.2	
"	2		4.36	9.0	2.06	372.3	4.62	"	71.1	

FACTOR: Ram Area cm^2
 Sample Area $\frac{\pi L}{4} \times = \text{cm}^2$
 $F = \text{---} =$

D.2 POINT LOAD

POINT LOAD TEST

POINT LOAD TEST
Quarries/Beaufort

Project Number 862-1806

Date _____

Sheet

of

Technician

100
178
200

$$1 \text{ psi} = 0.0069 \text{ MPa}$$

$D/L = 1.0 - 1.4$
 $D = 50 \text{ mm}$

$D/L = 1.1 \pm 0.05$

$L/D > 1.4$

Project DSS/Quarrel/Benuefer Project Number 862-1206
Date _____ Sheet 2 of _____ Technician _____

51 (207)
312



$L/D > 1.4$

Project DSS/Quarries/Beaufort Project Number 862-1806
Date _____ Sheet 3 of _____ Technician _____

$$1 \text{ psi} = 0.0069 \text{ MPa}$$

$D/L = 1.0 - 1.4$
 $D = 50 \text{ mm}$

$D/L = 1.1 \pm 0.05$



$$L/D > 1.4$$

LABORATORY TEST RESULTS

POINT LOAD TEST

Project DSS/QUARLES/BEAUFORT

Project Number 602-1806

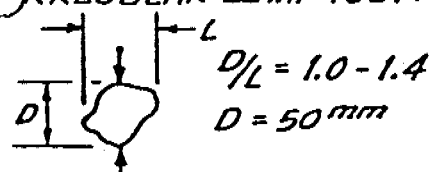
Date _____ Sheet 4 of _____

Technician _____

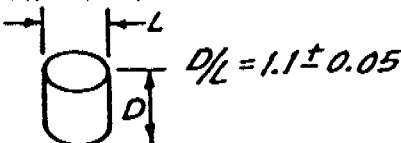
Borehole	Sample	Depth	Irregular Lump AXIAL TEST			DIAMETRAL T			G READING mPa	CALIB. FACTOR m ²	P mN	D ² m ²	$I_s = \frac{P}{D^2}$ mPa	I _s 50 mPa	24 x I _s 50 mPa
			D (cm)	L (cm)	D/L	D (cm)	L (cm)	D/L							
C			5.0	8.0					1990x-0069 13.7	9 x 10 ⁻⁴ 13.1	179.5	2.5	7.18	5	172
			5.5	6.0					1890x-4 13.0		170.3	30.3	5.58	6.5	134
			5.6	4.0					1400x-4 9.66		126.5	31.4	4.03	4.4	95
			4.5	5.0					1660x-4 11.5		150.7	20.3	7.42	7	178
			6.0	5.0					1290x-4 10.3		134.9	36.0	3.75	4	90
			5.2	6.5					1760x-4 12.1		158.5	27.0	5.87	6.3	141
													96		
													172		

1 psi = 0.0069 MPa

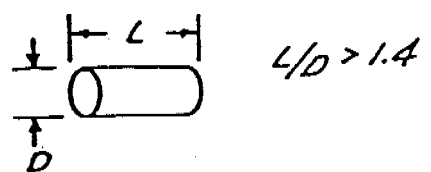
IRREGULAR LUMP TEST:



AXIAL TEST:



DIAMETRAL TEST:



LABORATORY TEST RESULTS

POINT LOAD TEST

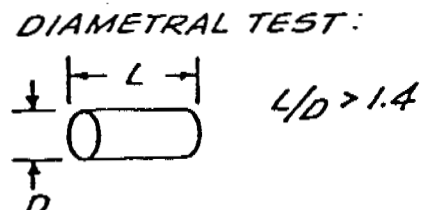
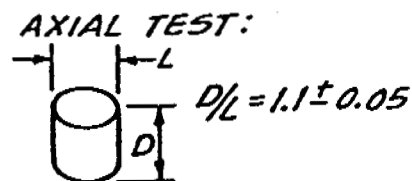
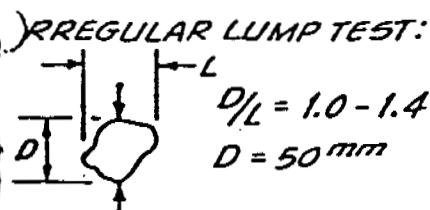
Project DS/QUARRIES/DEWEDGET Project Number 82-1806

Date _____ Sheet 5 of _____ Technician _____

SITING BENCH	Sample	Depth	Circular Lump AXIAL TEST			DIAMETRICAL T			G READING mPa	CALIB. FACTOR m ²	P mN	D ² m ²	I _s = $\frac{P}{D^2}$ mPa	I _{s50} mPa	24 x I _{s50} mPa
			D (cm)	L (cm)	D/L	D (cm)	L (cm)	D/L							
4			5.2	4.6					1580x10 ⁻⁴ 10.9	59 x10 ⁻⁴ x13.1	x10 ⁻⁴ 142.8	x10 ⁻⁴ 27.0	5.29	5.6	127.0
			5.0	6.0					2750x10 ⁻⁴ 19.0		248.9	25.0	9.96	✓	239.0
			4.8	6.0					3460x10 ⁻⁴ 17.0		322.7	23.0	7.68	7.3	232.0
			3.8	4.5					1960x10 ⁻⁴ 13.5		176.9	14.4	12.3	105	255.0
			4.5	6.0					3040x10 ⁻⁴ 21.0		275.1	20.3	13.6	125	326.2
			5.0	5.3					2740x10 ⁻⁴ 18.9		247.6	25.0	9.90	✓	238.0
			5.6	4.0					3080x10 ⁻⁴ 21.3		279.0	31.4	8.89	96	212.0
			4.9	7.0					2690x10 ⁻⁴ 18.6		243.7	19.6	12.4	12.2	297.0
			5.6	10.					1290x10 ⁻⁴ 8.90		116.6	31.4	3.71	4	29.0
4			4.7	6.5					1900x10 ⁻⁴ 13.1	1	171.6	22.1	7.76	7.5	186.0

96
213
300

1 psi = 0.0069 MPa



POINT LOAD TEST

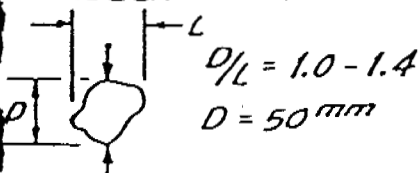
Project Number 832-1806

Date _____ Sheet 6 of _____ Technician _____

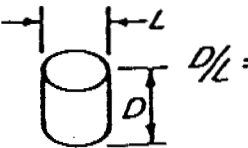
[illegible]

$$1 \text{ psi} = 0.0069 \text{ MPa}$$

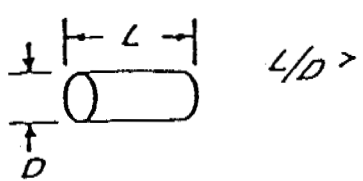
IRREGULAR LUMP TEST:



AXIAL TEST:


$$D_{//} = 1.1 \pm 0.05$$

DIAMETRICAL TEST:


$$L/D > 1.4$$

POINT LOAD TEST

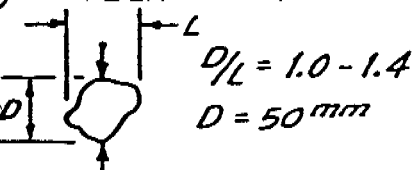
Project DSS / QUARRIES / BEAUFORT

Project Number 862-1806

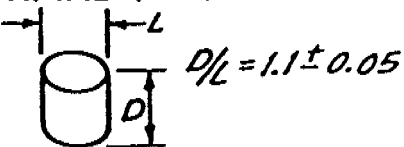
Date _____ Sheet 7 of _____ Technician _____

[illegible]
$$1 \text{ psi} = 0.0069 \text{ MPa}$$

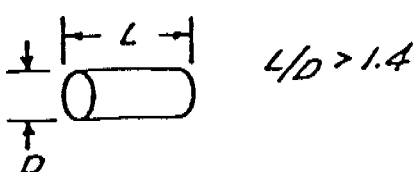
IRREGULAR LUMP TEST:



AXIAL TEST:



DIAMETRICAL TEST:



to the weakness planes. The spacing of diametral tests should be adjusted to ensure that the resulting pieces can later be used for axial testing, noting that the platen separation in the axial test is measured perpendicular to the weakness planes and not necessarily axial to the core. A similar procedure may be followed when testing irregular lumps. Results should be tabulated separately for specimens loaded along or perpendicular to the planes of weakness. Care should be taken to ensure that all test lumps are approximately equidimensional, particularly when the rock has a tendency to break into slabby or elongated pieces.

Calculations

4 (a) The Point-Load Strength Index I_p , defined as the ratio P/D^2 , may be obtained from the nomogram in Fig. 24.

(b) For standard classification the index $I_p(50)$ should be used, and may be obtained from I_p by correcting this value to a reference diameter of 50 mm using the correction chart given in Fig. 25.

(c) The median value may be found from a set of test results by systematically deleting highest and lowest values until only two remain. The average of these is the required median value.

(d) In diametral testing, where the core diameter D is effectively constant, the median failure load P may first be found, then the index applicable to this load calculated and the size correction applied. In axial and irregular lump testing, however, the index for each test must first be obtained and corrected for size. The median value of these corrected results is then computed.

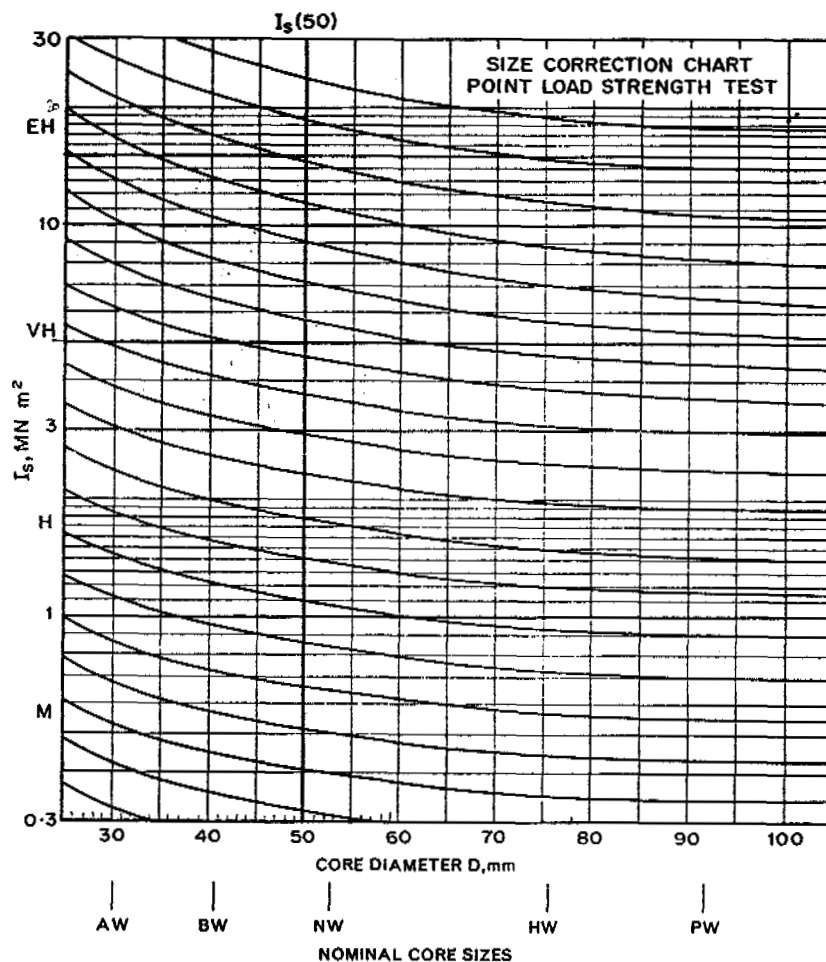


FIG. 25. Size correction chart for point-load strength testing (from Fig. 9).

D.3 UNIT WEIGHT/SPECIFIC GRAVITY

**Golder
Associates**

SUBJECT

Job No. 8621806
Ref. Dts/Quarries/
BEAUFORT

Made by M.O.
Checked
Reviewed

Date Jan. 13/87
Sheet of

**RESULTS OF SPECIFIC GRAVITY /
UNIT WEIGHT TESTS**

Site	G _s	Unit wt (g/cm ³)
1	2.66	2.60
2	2.62	2.58
3	2.67	2.48
3c	2.65	2.34
4	2.66	2.58
5	2.86	2.79
6	2.70	2.68

DETERMINATION NUMBER		1	2	3	4
BOTTLE NUMBER		1	3		
AIR REMOVAL METHOD					
WEIGHT OF BOTTLE, gm.		179.51	173.97		
INITIAL WEIGHT OF BOTTLE + SOIL, gm.		311.58	303.27		
INITIAL WEIGHT OF SOIL, gm.		132.07	129.30		
WEIGHT BOTTLE + SOIL + WATER, gm.	W_1	760.51	752.83		
TEMPERATURE, °C	T	24	24		
WEIGHT BOTTLE + WATER, gm.	W_2	677.63	671.98		

EVAPORATING DISH NUMBER		#27	#B3		
WEIGHT DISH + DRY SOIL, gm.		325.62	243.94		
WEIGHT OF DISH, gm.		193.27	114.44		
WEIGHT OF SOIL, gm.	W_s	132.35	129.5		
SPECIFIC GRAVITY OF WATER	G_T	0.9973	0.9973		
$G_T W_s$		131.99	129.15		
$W_1 - W_2$		82.80	80.85		
$W_s - (W_1 - W_2)$		49.47	48.65		
SPECIFIC GRAVITY OF SOIL	G_s	2.67	2.65		

$$G_s = 2.66$$

$$G_s = \frac{G_T W_s}{W_s - (W_1 - W_2)}$$

BOTTLE CALIBRATION		BOTTLE NUMBER			
DETERMINATION NUMBER		1	2	3	4
WEIGHT BOTTLE + WATER, gm.	W_2				
TEMPERATURE, °C	T				

REMARKS

SPECIFIC GRAVITY OF SOIL (PYCNOMETER METHOD)

TESTED BY	PROJECT NUMBER
CALCULATED BY	BOREHOLE NUMBER
CHECKED BY	SAMPLE NUMBER
DATE OF TESTING	DEPTH OF SAMPLE

DETERMINATION NUMBER		1	2	3	4
BOTTLE NUMBER		4	5	1	
AIR REMOVAL METHOD					
WEIGHT OF BOTTLE, gm.		172.68	173.85	179.5	
INITIAL WEIGHT OF BOTTLE + SOIL, gm.		317.41	319.41	307.70	
INITIAL WEIGHT OF SOIL, gm.		144.73	145.25	128.20	
WEIGHT BOTTLE + SOIL + WATER, gm.	W_1	760.23	762.02	756.66	
TEMPERATURE, °C	T	26	26	23.5	
WEIGHT BOTTLE + WATER, gm.	W_2	670.45	676.70	677.69	

EVAPORATING DISH NUMBER		#23	#22	#20	
WEIGHT DISH + DRY SOIL, gm.		339.86	340.17	235.13	
WEIGHT OF DISH, gm.		194.88	194.37	107.09	
WEIGHT OF SOIL, gm.	W_s	144.98	145.80	128.04	
SPECIFIC GRAVITY OF WATER	G_T	0.9968	0.9968	0.9975	
$G_T W_s$		144.52	145.33	127.72	
$W_1 - W_2$		89.98	85.32	78.97	
$W_s - (W_1 - W_2)$		55.00	60.48	49.07	
SPECIFIC GRAVITY OF SOIL	G_s	2.63	2.40?	2.60	

$$G_s = \frac{G_T W_s}{W_s - (W_1 - W_2)}$$

$$G_s = 2.62$$

BOTTLE CALIBRATION

BOTTLE NUMBER _____

DETERMINATION NUMBER		1	2	3	4
WEIGHT BOTTLE + WATER, gm.	W_2				
TEMPERATURE, °C	T				

REMARKS

SPECIFIC GRAVITY OF SOIL (PYCNOMETER METHOD)

TESTED BY _____
 CALCULATED BY _____
 CHECKED BY _____
 DATE OF TESTING _____

PROJECT NUMBER 862-1806
 BOREHOLE NUMBER Site - 2
 SAMPLE NUMBER _____
 DEPTH OF SAMPLE _____

DETERMINATION NUMBER		1	2	3	4
BOTTLE NUMBER		1	3		
AIR REMOVAL METHOD					
WEIGHT OF BOTTLE, gm.		179.55	173.96		
INITIAL WEIGHT OF BOTTLE + SOIL, gm.		341.43	310.79		
INITIAL WEIGHT OF SOIL, gm.		161.88	136.83		
WEIGHT BOTTLE + SOIL + WATER, gm.	W ₁	778.55	757.51		
TEMPERATURE, °C	T	23.6	23.6		
WEIGHT BOTTLE + WATER, gm.	W ₂	672.18	672.02		

EVAPORATING DISH NUMBER		#24	#75		
WEIGHT DISH + DRY SOIL, gm.		271.30	244.43		
WEIGHT OF DISH, gm.		109.42	107.64		
WEIGHT OF SOIL, gm.	W _s	161.88	136.79		
SPECIFIC GRAVITY OF WATER	G _T	0.9974	0.9974		
G _T W _s		161.46	136.43		
W ₁ - W ₂		101.37	85.49		
W _s - (W ₁ - W ₂)		60.51	51.30		
SPECIFIC GRAVITY OF SOIL	G _s	2.67	2.66		

$$G_s = \frac{G_T W_s}{W_s - (W_1 - W_2)}$$

$$G_s = 2.67$$

BOTTLE CALIBRATION

BOTTLE NUMBER _____

DETERMINATION NUMBER		1	2	3	4
WEIGHT BOTTLE + WATER, gm.	W ₂				
TEMPERATURE, °C	T				

REMARKS

SPECIFIC GRAVITY OF SOIL (PYCNOMETER METHOD)

TESTED BY _____

PROJECT NUMBER 862-1806

CALCULATED BY _____

BOREHOLE NUMBER site-3

CHECKED BY _____

SAMPLE NUMBER _____

DATE OF TESTING _____

DEPTH OF SAMPLE _____

DETERMINATION NUMBER		1	2	3	4
BOTTLE NUMBER		1	3		
AIR REMOVAL METHOD					
WEIGHT OF BOTTLE, gm.		179.57	174.11		
INITIAL WEIGHT OF BOTTLE + SOIL, gm.		337.59	326.94		
INITIAL WEIGHT OF SOIL, gm.		158.02	152.83		
WEIGHT BOTTLE + SOIL + WATER, gm.	W_1	775.83	766.86		
TEMPERATURE, °C	T	26	26		
WEIGHT BOTTLE + WATER, gm.	W_2	677.37	671.72		

EVAPORATING DISH NUMBER		#B-4	#19		
WEIGHT DISH + DRY SOIL, gm.		269.85	265.65		
WEIGHT OF DISH, gm.		111.88	112.79		
WEIGHT OF SOIL, gm.	W_s	157.97	152.86		
SPECIFIC GRAVITY OF WATER	G_T	0.9968	0.9968		
$G_T W_s$		157.46	152.37		
$W_1 - W_2$		98.46	95.14		
$W_s - (W_1 - W_2)$		59.44	57.72		
SPECIFIC GRAVITY OF SOIL	G_s	2.65	2.64		

$$G_s = 2.65$$

$$G_s = \frac{G_T W_s}{W_s - (W_1 - W_2)}$$

BOTTLE CALIBRATION

BOTTLE NUMBER _____

DETERMINATION NUMBER		1	2	3	4
WEIGHT BOTTLE + WATER, gm.	W_2				
TEMPERATURE, °C	T				

REMARKS

SPECIFIC GRAVITY OF SOIL (PYCNOMETER METHOD)

TESTED BY _____
 CALCULATED BY _____
 CHECKED BY _____
 DATE OF TESTING _____

PROJECT NUMBER 862-1806
 BOREHOLE NUMBER site-35
 SAMPLE NUMBER _____
 DEPTH OF SAMPLE _____

DETERMINATION NUMBER		1	2	3	4
BOTTLE NUMBER		1	3		
AIR REMOVAL METHOD					
WEIGHT OF BOTTLE, gm.		179.50	174.00		
INITIAL WEIGHT OF BOTTLE + SOIL, gm.		351.47	341.05		
INITIAL WEIGHT OF SOIL, gm.		171.77	167.05		
WEIGHT BOTTLE + SOIL + WATER, gm.	W ₁	782.09	776.58		
TEMPERATURE, °C	T	22.5	22.5		
WEIGHT BOTTLE + WATER, gm.	W ₂	677.78	672.13		

EVAPORATING DISH NUMBER		#31	#307		
WEIGHT DISH + DRY SOIL, gm.		282.78	276.85		
WEIGHT OF DISH, gm.		110.77	109.77		
WEIGHT OF SOIL, gm.	W _s	172.01	167.08		
SPECIFIC GRAVITY OF WATER	G _T	0.9977	0.9977		
G _T W _s		171.61	166.70		
W ₁ - W ₂		104.31	104.45		
W _s - (W ₁ - W ₂)		67.70	62.63		
SPECIFIC GRAVITY OF SOIL	G _s	2.53	2.66		

$$G_s = \frac{G_T W_s}{W_s - (W_1 - W_2)}$$

G_s = 2.66

BOTTLE CALIBRATION					
			BOTTLE NUMBER _____		
DETERMINATION NUMBER		1	2	3	4
WEIGHT BOTTLE + WATER, gm.	W ₂				
TEMPERATURE, °C	T				

REMARKS

SPECIFIC GRAVITY OF SOIL (PYCNOMETER METHOD)	
TESTED BY _____	PROJECT NUMBER <u>8621806</u>
CALCULATED BY _____	BOREHOLE NUMBER <u>Site-4</u>
CHECKED BY _____	SAMPLE NUMBER _____
DATE OF TESTING _____	DEPTH OF SAMPLE _____

DETERMINATION NUMBER		1	2	3	4
BOTTLE NUMBER					
AIR REMOVAL METHOD					
WEIGHT OF BOTTLE, gm.		179.52	174.00		
INITIAL WEIGHT OF BOTTLE + SOIL, gm.		—			
INITIAL WEIGHT OF SOIL, gm.		—			
WEIGHT BOTTLE + SOIL + WATER, gm.	W ₁	782.82	777.52		
TEMPERATURE, °C	T	26.0	26.0		
WEIGHT BOTTLE + WATER, gm.	W ₂	677.36	671.72		

EVAPORATING DISH NUMBER		#24	9125		
WEIGHT DISH + DRY SOIL, gm.		357.45	356.11		
WEIGHT OF DISH, gm.		195.41	193.64		
WEIGHT OF SOIL, gm.	W _s	162.04	162.47		
SPECIFIC GRAVITY OF WATER	G _T	0.9968	0.9968		
G _T W _s		161.52	161.95		
W ₁ - W ₂		105.46	105.8		
W _s - (W ₁ - W ₂)		56.58	56.67		
SPECIFIC GRAVITY OF SOIL	G _s	2.85	2.86		

$$G_s = \frac{G_T W_s}{W_s - (W_1 - W_2)}$$

$$G_s = 2.86$$

BOTTLE CALIBRATION

BOTTLE NUMBER _____

DETERMINATION NUMBER		1	2	3	4
WEIGHT BOTTLE + WATER, gm.	W ₂				
TEMPERATURE, °C	T				

REMARKS

SPECIFIC GRAVITY OF SOIL (PYCNOMETER METHOD)

TESTED BY _____

PROJECT NUMBER 862180.6

CALCULATED BY _____

BOREHOLE NUMBER Site - 5

CHECKED BY _____

SAMPLE NUMBER _____

DATE OF TESTING _____

DEPTH OF SAMPLE _____

DETERMINATION NUMBER		1	2	3	4
BOTTLE NUMBER		1	3		
AIR REMOVAL METHOD					
WEIGHT OF BOTTLE, gm.		179.50	174.01		
INITIAL WEIGHT OF BOTTLE + SOIL, gm.		315.36	285.20		
INITIAL WEIGHT OF SOIL, gm.		135.86	111.19		
WEIGHT BOTTLE + SOIL + WATER, gm.	W_1	763.20	742.08		
TEMPERATURE, °C	T	24	24		
WEIGHT BOTTLE + WATER, gm.	W_2	677.62	671.97		

EVAPORATING DISH NUMBER		#5B	#50		
WEIGHT DISH + DRY SOIL, gm.		314.69	215.50		
WEIGHT OF DISH, gm.		178.95	104.43		
WEIGHT OF SOIL, gm.	W_s	135.74	111.07		
SPECIFIC GRAVITY OF WATER	G_T	0.9973	0.9973		
$G_T W_s$		135.37	110.77		
$W_1 - W_2$		85.58	70.11		
$W_s - (W_1 - W_2)$		50.16	40.96		
SPECIFIC GRAVITY OF SOIL	G_s	2.70	2.70		

$$G_s = \frac{G_T W_s}{W_s - (W_1 - W_2)}$$

$$G_s = 2.70$$

BOTTLE CALIBRATION

BOTTLE NUMBER _____

DETERMINATION NUMBER		1	2	3	4
WEIGHT BOTTLE + WATER, gm.	W_2				
TEMPERATURE, °C	T				

REMARKS

SPECIFIC GRAVITY OF SOIL (PYCNOMETER METHOD)

TESTED BY _____
 CALCULATED BY _____
 CHECKED BY _____
 DATE OF TESTING _____

PROJECT NUMBER _____ 26-21806
 BOREHOLE NUMBER _____ Site-6
 SAMPLE NUMBER _____
 DEPTH OF SAMPLE _____

NATURAL DENSITY TEST. SUBMERGED WAX METHOD

FIGURE

JOB N° 8621806 TITLE DSS/Quarries/Barro Colorado Date _____

Bore-Hole Site-1 Sample _____ Depth _____ by _____

Volume of Wax

Volume of Soil + Wax

Wt. soil + wax ② = 140.2 gr

Wt. soil + wax ② = 140.2 gr

Wt. soil ① = 133.6 gr

Wt. submerged ③ = 81.7 gr

Wt. wax = 6.6 gr

Vol. soil + wax = 59.1 cc

Vol. wax = 7.8 cc
($\frac{\text{Wt. wax}}{0.849}$)

Volume of Soil

Vol. soil + wax = 59.1 cc

Vol. wax = 7.8 cc

Vol. soil = 51.3 cc

W.C. Determination	
DISH N°	
Wt. wet soil + tare	
Wt. dry soil + tare	
Wt. tare	
Wt. water	
Wt. dry soil	
Water Content %	

$$\text{Natural Density } \gamma_{\text{nat}} = \frac{\text{Wt. soil } 133.6}{\text{Vol. soil } 51.3} = \boxed{2.60 \frac{\text{g}}{\text{cm}^3}}$$

$$\text{Dry Density } \gamma_d = \frac{\gamma_{\text{wet}}}{1 + \text{W.C.}} = \boxed{\frac{\text{g}}{\text{cm}^3}}$$

Golder Associates

NATURAL DENSITY TEST. SUBMERGED WAX METHOD

FIGURE

JOB N° 8621806 TITLE reservoir/bench Date _____

Bore Hole Site-2 Sample _____ Depth _____ by _____

Volume of Wax

Wt. soil + wax ② = 171.2 gr

Wt. soil ① = 164.8 gr

Wt. wax = 6.4 gr

Vol. wax = 7.5 cc
 $\left(\frac{\text{Wt. wax}}{0.849} \right)$

Volume of Soil + Wax

Wt. soil + wax ② = 171.2 gr

Wt. submerged ③ = 99.7 gr

Vol. soil + wax = 71.5 cc

Volume of Soil

Vol. soil + wax = 71.5 cc

Vol. wax = 7.5 cc

Vol. soil = 64.0 cc

W.C. Determination	
DISH N°	
Wt. wet soil + tare	
Wt. dry soil + tare	
Wt. tare	
Wt. water	
Wt. dry soil	
Water Content %	

$$\text{Natural Density } \gamma_{\text{nat.}} = \frac{\text{Wt. soil } 164.8}{\text{Vol. soil } 64.0} = \boxed{2.58 \text{ g/cm}^3}$$

$$\text{Dry Density } \gamma_d = \frac{\gamma_{\text{wet}}}{1 + \text{W.C.}} = \boxed{\text{g/cm}^3}$$

Golder Associates

NATURAL DENSITY TEST.

SUBMERGED
WAX METHOD

FIGURE

JOB N° 8621806 TITLE DE/Quarries/Barro Colorado Date _____

Bore Hole Site-3 Sample _____ Depth _____ by _____

Volume of Wax

Wt. soil + wax ② = 132.8 gr

Wt. soil ① = 126.3 gr

Wt. wax = 6.5 gr

Vol. wax = 7.7 cc
($\frac{\text{Wt. wax}}{0.849}$)

Volume of Soil + Wax

Wt. soil + wax ② = 132.8 gr

Wt. submerged ③ = 74.1 gr

Vol. soil + wax = 58.7 cc

Volume of Soil

Vol. soil + wax = 58.7 cc

Vol. wax = 7.7 cc

Vol. soil = 51.0 cc

W.C. Determination

DISH N°	
Wt. wet soil + tare	
Wt. dry soil + tare	
Wt. tare	
Wt. water	
Wt. dry soil	
Water Content %	

$$\text{Natural Density } \gamma_{\text{nat.}} = \frac{\text{Wt. soil } 126.3}{\text{Vol. soil } 51.0} = \boxed{2.48 \text{ g/cm}^3}$$

$$\text{Dry Density } \gamma_d = \frac{\gamma_{\text{wet}}}{1 + \text{W.C.}} = \boxed{\text{g/cm}^3}$$

Golder Associates

NATURAL DENSITY TEST.

SUBMERGED
WAX METHOD

FIGURE

JOB N° 8321806 TITLE DES/QUARRY/BENUE Date _____

Bore Hole site-3C Sample _____ Depth _____ by _____

Volume of Wax

Wt. soil + wax ② = 132.4 gr

Wt. soil ① = 128.4 gr

Wt. wax = 4.0 gr

Vol. wax = 4.7 cc
($\frac{\text{Wt. wax}}{0.849}$)

Volume of Soil + Wax

Wt. soil + wax ② = 132.4 gr

Wt. submerged ③ = 72.9 gr

Vol. soil + wax = 59.5 cc

Volume of Soil

Vol. soil + wax = 59.5 cc

Vol. wax = 4.7 cc

Vol. soil = 54.8 cc

W.C. Determination	
DISH N°	
Wt. wet soil + tare	
Wt. dry soil + tare	
Wt. tare	
Wt. water	
Wt. dry soil	
Water Content %	

$$\text{Natural Density } \gamma_{\text{nat}} = \frac{\text{Wt. soil } 128.4}{\text{Vol. soil } 54.8} = \boxed{2.34 \text{ g/cm}^3}$$

$$\text{Dry Density } \gamma_d = \frac{\gamma_{\text{wet}}}{1 + \text{W.C.}} = \boxed{\text{g/cm}^3}$$

Golder Associates

NATURAL DENSITY TEST.

SUBMERGED
WAX METHOD

FIGURE

JOB N° 8621806 TITLE del/awarres/benur Date _____

Bore Hole Site-4 Sample _____ Depth _____ by _____

Volume of Wax

Wt. soil + wax ② = 172.8 gr

Wt. soil ① = 165.4 gr

Wt. wax = 7.4 gr

Vol. wax = 8.7 cc
($\frac{\text{Wt. wax}}{0.849}$)

Volume of Soil + Wax

Wt. soil + wax ② = 172.8 gr

Wt. submerged ③ = 99.9 gr

Vol. soil + wax = 72.9 cc

Volume of Soil

Vol. soil + wax = 72.9 cc

Vol. wax = 8.7 cc

Vol. soil = 64.2 cc

W.C. Determination	
DISH N°	
Wt. wet soil + tare	
Wt. dry soil + tare	
Wt. tare	
Wt. water	
Wt. dry soil	
Water Content %	

$$\text{Natural Density } \gamma_{\text{nat}} = \frac{\text{Wt. soil } 165.4}{\text{Vol. soil } 64.2} = \boxed{2.58 \text{ g/cm}^3}$$

$$\text{Dry Density } \gamma_d = \frac{\gamma_{\text{wet}}}{1 + \text{W.C.}} = \boxed{\text{g/cm}^3}$$

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NATURAL DENSITY TEST - SUBMERGED WAX METHOD

FIGURE

JOB N° 862/806 TITLE DESIGNATION/COMPONENT Date _____
 Bore Hole Site-5 Sample _____ Depth _____ by _____

Volume of Wax

Wt. soil + wax ② = 237.0 gr

Wt. soil ① = 230.3 gr

Wt. wax = 6.7 gr

Vol. wax = $\frac{7.9}{0.849}$ cc

Volume of Soil

Vol. soil + wax = 90.3 cc

Vol. wax = 7.9 cc

Vol. soil = 82.4 cc

Volume of Soil + Wax

Wt. soil + wax ② = 237.0 gr

Wt. submerged ③ = 146.7 gr

Vol. soil + wax = 90.3 cc

W.C. Determination

DISH N°	
Wt. wet soil + tare	
Wt. dry soil + tare	
Wt. tare	
Wt. water	
Wt. dry soil	
Water Content %	

$$\text{Natural Density } \gamma_{\text{nat}} = \frac{\text{Wt. soil } 230.3}{\text{Vol. soil } 82.4} = \boxed{2.79 \text{ g/cm}^3}$$

$$\text{Dry Density } \gamma_d = \frac{\gamma_{\text{wet}}}{1 + \text{W.C.}} = \boxed{\text{g/cm}^3}$$

Golder Associates

NATURAL DENSITY TEST.

SUBMERGED
WAX METHOD

FIGURE

JOB N° 862/806 TITLE DS/QUARRIES/CAIRFOOT Date _____

Bore Hole site-6 Sample _____ Depth _____ by _____

Volume of Wax

Wt. soil + wax ② = 130.2 gr

Wt. soil ① = 124.3 gr

Wt. wax = 5.9 gr

Vol. wax
($\frac{\text{Wt. wax}}{0.849}$) = 6.9 cc

Volume of Soil + Wax

Wt. soil + wax ② = 130.2 gr

Wt. submerged ③ = 76.9 gr

Vol. soil + wax = 53.3 cc

Volume of Soil

Vol. soil + wax = 53.3 cc

Vol. wax = 6.9 cc

Vol. soil = 46.4 cc

W.C. Determination	
DISH N°	
Wt. wet soil + tare	
Wt. dry soil + tare	
Wt. tare	
Wt. water	
Wt. dry soil	
Water Content %	

$$\text{Natural Density } \gamma_{\text{nat}} = \frac{\text{Wt. soil } 124.3}{\text{Vol. soil } 46.4} = \boxed{2.68 \text{ g/cm}^3}$$

$$\text{Dry Density } \gamma_d = \frac{\gamma_{\text{wet}}}{1 + \text{W.C.}} = \boxed{\text{g/cm}^3}$$

Golder Associates

**Golder
Associates**

SUBJECT

Unit Weight

Job No. 8621806

Made by M.O

Date Dec. 186

Ref. ~~DS/BENEFIT~~
Quarries

Checked

Sheet

of

Reviewed

Site	SA	Area (cm ²)	Height (cm)	V (cm ³)	wt (g)	γ (g/cm ³)
1	1	14.9	8.93	133.1	350.0	2.63
1	2		8.95	133.4	358.5	2.69 ^{2.46}
2	1		7.85	117.0	302.4	2.58
2	2		8.87	132.2	338.8	2.56 ^{2.51}
3	1		9.85	146.8	355.2	2.42
3	2		7.06	105.2	257.3	2.45 ^{2.43}
3C	1		8.61	128.3	292.7	2.28
"	2		8.56	127.5	293.3	2.30 ^{2.2}
4	1		9.05	134.8	340.6	2.53
"	2		8.55	127.4	326.2	2.56 ^{2.48}
5	1		9.05	134.8	377.3	2.80
"	2		9.0	134.1	372.3	2.78 ^{2.7}
6	"		(max method)			2.66 ^{2.6}

D.4 LOS ANGELES ABRASION

PHYSICAL LABORATORY REPORT

REPORT OF: Los Angeles Abrasion Testing DATE : 20 November 1986
REPORT TO: Golder Associates Ltd. PROJECT NO. : 186-129
224 West 8th Avenue
Vancouver, B.C. V5Y 1N5 P.O. NO. : 84913
Attention: MR. Bill Gilmer

We have tested the samples identified below as requested and report our results as follows:

SAMPLE	TEST METHOD	GRADING	% LOSS
Site 1	ASTM C535	1	27.7
Site 2	ASTM C535	1	27.1
Site 3	ASTM C535	1	33.4
Site 3C	ASTM C535	2	52.9
Site 4	ASTM C535	1	26.8
Site 5	ASTM C535	1	54.2
Site 6	ASTM C535	1	27.1

Samples are available for pick-up.

Thank you for this opportunity to be of service.


B.H. LEVELTON & ASSOCIATES LTD.

Neil Cumming.

D.5 SULPHATE SOUNDNESS

SUBJECT
Job No. 8621806
Ref. D/S/Report/
Quotations

Made by
Checked
Reviewed

Site - 1

Date Dec 15/86
Sheet
or

SOUNDNESS OF AGGREGATES ASTM C 88-76							☒ SODIUM SULPHATE ☐ MAGNESIUM SULPHATE		5 cycles		
	PASS SIEVE		RETAINED SIEVE	WEIGHT (GMS)	PASS SIEVE	RETAINED SIEVE	ORIGINAL GRADING (%)	WEIGHT OF TEST FACTION		AFTER TEST % PASSING	WEIGHTED % LOSS
								BEFORE TEST (GMS)	AFTER TEST (GMS)		
COARSE AGGREGATE	2½		2	2818							
	2		1½	1973	2½	1½	7.0	4791	4769.1	0.46	0.03
	1½		1	1015.1							
	1		¾	511.6	1½	¾	63.6	1526.7	1516.0	0.70	0.45
	¾		½	670.7							
	½		⅜	330.7	¾	⅜	22.0	1001.4	790.2	1.12	0.35
	⅜		No 4	300.0	⅜	No 4	7.4	300.0	291.3	2.90	0.21
							100				0.94
FINE AGGREGATE	⅜		No 4								
	No 4		No 8								
	No 8		No 16								
	No 16		No 30								
	No 30		No 50								
	No 50		No 100								
	Minus No 100										

COARSE AGGREGATE	QUALITATIVE EXAMINATION										TOTAL NO. PARTICLE BEFORE TEST
	PASS SIEVE	RETAINED SIEVE	SPLITTING		CRUMBLING		CRACKING		FLAKING		
			NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	
	2½	1½	4	15.4							26
	1½	¾									63

REMARKS :

SOUNDNESS OF AGGREGATES ASTM C88-76							5 cycles			
☒ SODIUM SULPHATE ☐ MAGNESIUM SULPHATE										
	PASS SIEVE	RETAINED SIEVE	WEIGHT (GMS)	PASS SIEVE	RETAINED SIEVE	ORIGINAL GRADING (%)	WEIGHT OF TEST FRACTION		AFTER TEST % PASSING	WEIGHTED % LOSS
							BEFORE TEST (GMS)	AFTER TEST (GMS)		
COARSE AGGREGATE	2 1/2	2								
	2	1 1/2		2 1/2	1 1/2					
	1 1/2	1								
	1	3/4		1 1/2	3/4					
	3/4	1/2								
	1/2	3/8		3/4	3/8					
	3/8	No 4		3/8	No 4					
FINE AGGREGATE	3/8	No 4	100			20.7	100	98.0	2.00	0.41
	No 4	No 8	100			37.0	100	97.5	2.50	0.93
	No 8	No 16	100			16.7	100	96.9	3.10	0.52
	No 16	No 30	100			9.4	100	92.8	7.20	0.68
	No 30	No 50	100			6.3	100	93.0	7.00	0.44
	No 50	No 100				3.7				
	Minus No 100					6.1				
						100				2.98

COARSE AGGREGATE	PASS SIEVE	RETAINED SIEVE	QUALITATIVE EXAMINATION								TOTAL NO. PARTICLES BEFORE TEST
			SPLITTING		CRUMBLING		CRACKING		FLAKING		
			NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	
	2 1/2	1 1/2									
	1 1/2	3/4									

REMARKS :

Goldner Associates

SUBJECT		Job No. 8621806		Date Dec. 15/86	
Rel. Dss / Comments		Made by		Sheet	
Revised		Checked		or	
Revised		Reviewed			

Site - 3.

SOUNDNESS OF AGGREGATES ASTM C88-76			☒ SODIUM SULPHATE ☐ MAGNESIUM SULPHATE				5 cycles			
PASS SIEVE	RETAINED SIEVE	WEIGHT (GMS)	PASS SIEVE	RETAINED SIEVE	ORIGINAL GRADING (%)	WEIGHT OF TEST FRACTION		AFTER TEST % PASSING	WEIGHTED % LOSS	
						BEFORE TEST (GMS)	AFTER TEST (GMS)			
COARSE AGGREGATE	2½	2	2706.6							
	2	1½	2170.1	2½	1½	16.2	4876.7	4637.0	4.92	0.80
	1½	1	1013.4							
	1	¾	495.7	1½	¾	55.6	1509.1	1474.9	2.27	1.25
	¾	½	672.0							
	½	⅜	329.0	¾	⅜	21.1	1001.0	939.5	6.14	1.30
	⅜	No 4	302.1	⅜	No 4	7.1	302.1	268.7	11.06	0.79
					100				4.15	
FINE AGGREGATE	⅜	No 4								
	No 4	No 8								
	No 8	No 16								
	No 16	No 30								
	No 30	No 50								
	No 50	No 100								
MINUS No 100										

COARSE AGGREGATE	PASS SIEVE	RETAINED SIEVE	QUALITATIVE EXAMINATION								TOTAL NO. PARTICLES BEFORE TEST
			SPLITTING		CRUMBLING		CRACKING		FLAKING		
			NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	
	2½	1½	1	2.6							39
	1½	¾					2	3.3			60

REMARKS :

SOUNDNESS OF AGGREGATES ASTM C88-76							5 cycles			
☒ SODIUM SULPHATE ☐ MAGNESIUM SULPHATE										
	PASS SIEVE	RETAINED SIEVE	WEIGHT (GMS)	PASS SIEVE	RETAINED SIEVE	ORIGINAL GRADING (%)	WEIGHT OF TEST FACTION		AFTER TEST % PASSING	WEIGHTED % LOSS
							BEFORE TEST (GMS)	AFTER TEST (GMS)		
COARSE AGGREGATE	2½	2								
	2	1½		2½	1½					
	1½	1								
	1	¾		1½	¾					
	¾	½								
	½	⅜		¾	⅜					
	⅜	No. 4		⅜	No. 4					
FINE AGGREGATE	⅜	No. 4	100			32.3	100	70.7	29.3	9.46
	No. 4	No. 8	100			20.6	100	50.7	49.3	10.16
	No. 8	No. 16	100			5.2	100	35.4	64.6	3.36
	No. 16	No. 30	100			2.2	100	18.9	81.1	1.78
	No. 30	No. 50	100			2.8	100	10.0	90.0	2.52
	No. 50	No. 100				5.7				
	MINUS No. 100					31.2				
						100				27.28

COARSE AGGREGATE	PASS SIEVE	RETAINED SIEVE	QUALITATIVE EXAMINATION								TOTAL NO. PARTICLES BEFORE TEST
			SPLITTING		CRUMBLING		CRACKING		FLAKING		
			NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	
		2 1/2	1 1/2								
	1 1/2	3/4									

REMARKS :

SOUNDNESS OF AGGREGATES ASTM C88-76			☒ SODIUM SULPHATE ☐ MAGNESIUM SULPHATE				5 cycles			
PASS SIEVE	RETAINED SIEVE	WEIGHT (GMS)	PASS SIEVE	RETAINED SIEVE	ORIGINAL GRADING (%)	WEIGHT OF TEST FACTION		AFTER TEST % PASSING	WEIGHTED % LOSS	
						BEFORE TEST (GMS)	AFTER TEST (GMS)			
COARSE AGGREGATE	2½	2	2921.6							
	2	1½	1985.9	2½	1½	13.7	4907.5	4907.0	0.01	0
	1½	1	1010.4							
	1	¾	497.2	1½	¾	56.7	1507.6	1501.0	0.44	0.25
	¾	½	666.9							
	½	⅜	330.7	¾	⅜	22.7	997.6	981.7	1.59	0.36
	⅜	No 4	200.5	⅜	No 4	7.3	300.5	290.3	3.39	0.25
					99.9					0.86
FINE AGGREGATE	⅜	No 4								
	No 4	No 8								
	No 8	No 16								
	No 16	No 30								
	No 30	No 50								
	No 50	No 100								
MINUS No 100										

COARSE AGGREGATE	PASS SIEVE	RETAINED SIEVE	QUALITATIVE EXAMINATION								TOTAL NO PARTICLES BEFORE TEST
			SPLITTING		CRUMBLING		CRACKING		FLAKING		
			NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	
	2 1/2	1 1/2									36
	1 1/2	3/4									62

REMARKS :

**Golder
Associates**

SUBJECT **Site - 5**

SUBJECT	Job No. 862/806	Made by
	Rel. Dis./Contract/ <i>Beauregard</i>	Checked
Reviewed	Date Dec. 16/86	Sheet
	of	

SOUNDNESS OF AGGREGATES ASTM C68-76			☒ SODIUM SULPHATE ☐ MAGNESIUM SULPHATE				5 cycles			
PASS SIEVE	RETAINED SIEVE	WEIGHT (GMS)	PASS SIEVE	RETAINED SIEVE	ORIGINAL GRADING (%)	WEIGHT OF TEST FACTION		AFTER TEST % PASSING	WEIGHTED % LOSS	
						BEFORE TEST (GMS)	AFTER TEST (GMS)			
COARSE AGGREGATE	2½	2	2967.0							
	2	1½	1955.9	2½	1½	6.1	4922.9	4916.9	0.12	0.01
	1½	1	1014.6							
	1	¾	500.4	1½	¾	54.3	1515.0	1510.6	0.29	0.16
	¾	½	670.9							
	½	⅜	329.4	¾	⅜	30.2	1000.3	991.7	0.86	0.26
	⅜	No 4	301.2	⅜	No 4	9.4	301.2	280.5	3.55	0.33
					100					0.76
FINE AGGREGATE	⅜	No 4								
	No 4	No 8								
	No 8	No 16								
	No 16	No 30								
	No 30	No 50								
	No 50	No 100								
Minus No 100										

COARSE AGGREGATE	PASS SIEVE	RETAINED SIEVE	QUALITATIVE EXAMINATION								TOTAL NO PARTICLES BEFORE TEST
			SPLITTING		CRUMBLING		CRACKING		FLAKING		
			NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	
	2 1/2	1 1/2									26
	1 1/2	3/4									53

REMARKS :

SOUNDNESS OF AGGREGATES ASTM C88-76							5 cycles			
☒ SODIUM SULPHATE ☐ MAGNESIUM SULPHATE										
	PASS SIEVE	RETAINED SIEVE	WEIGHT (GMS)	PASS SIEVE	RETAINED SIEVE	ORIGINAL GRADING (%)	WEIGHT OF TEST FRACTION		AFTER TEST % PASSING	WEIGHTED % LOSS
							BEFORE TEST (GMS)	AFTER TEST (GMS)		
COARSE AGGREGATE	2 1/2	2	2660.5							
	2	1 1/2	1563.0	2 1/2	1 1/2	6.7	4223.5	4219.6	0.09	0.01
	1 1/2	1	1036.0							
	1	3/4	482.9	1 1/2	3/4	41.9	1518.9	1513.7	0.34	0.14
	3/4	1/2	669.2							
	1/2	3/8	332.2	3/4	3/8	35.9	1001.4	993.9	0.75	0.27
	3/8	No 4	300.0	3/8	No 4	15.6	300.0	291.5	2.83	0.44
						100				0.86
FINE AGGREGATE	3/8	No 4								
	No 4	No 8								
	No 8	No 16								
	No 16	No 30								
	No 30	No 50								
	No 50	No 100								
	Minus No 100									

COARSE AGGREGATE	PASS SIEVE	RETAINED SIEVE	QUALITATIVE EXAMINATION								TOTAL NO. PARTICLES BEFORE TEST
			SPLITTING		CRUMBLING		CRACKING		FLAKING		
			NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	NO.	PERCENT	
	2 1/2	1 1/2	1	3.7							27
	1 1/2	3/4									63

REMARKS :

**Golder
Associates**

SUBJECT

Job No. 962-1806

Ref. DSS/QUARRIES/
BEAUFORT

Made by

Checked

Reviewed

Date

Sheet

of

Site 1

Very hard, angular rock

(some equidimensional rock)

Site 2

Hard angular rock -

Site 3

Hard angular rock

(some platy and prismatic rock)

Site 3C

Hard subangular rock.

Site 4

Hard angular rock.

(some prismatic rock)

Site 5

Hard angular to subangular

Site 6

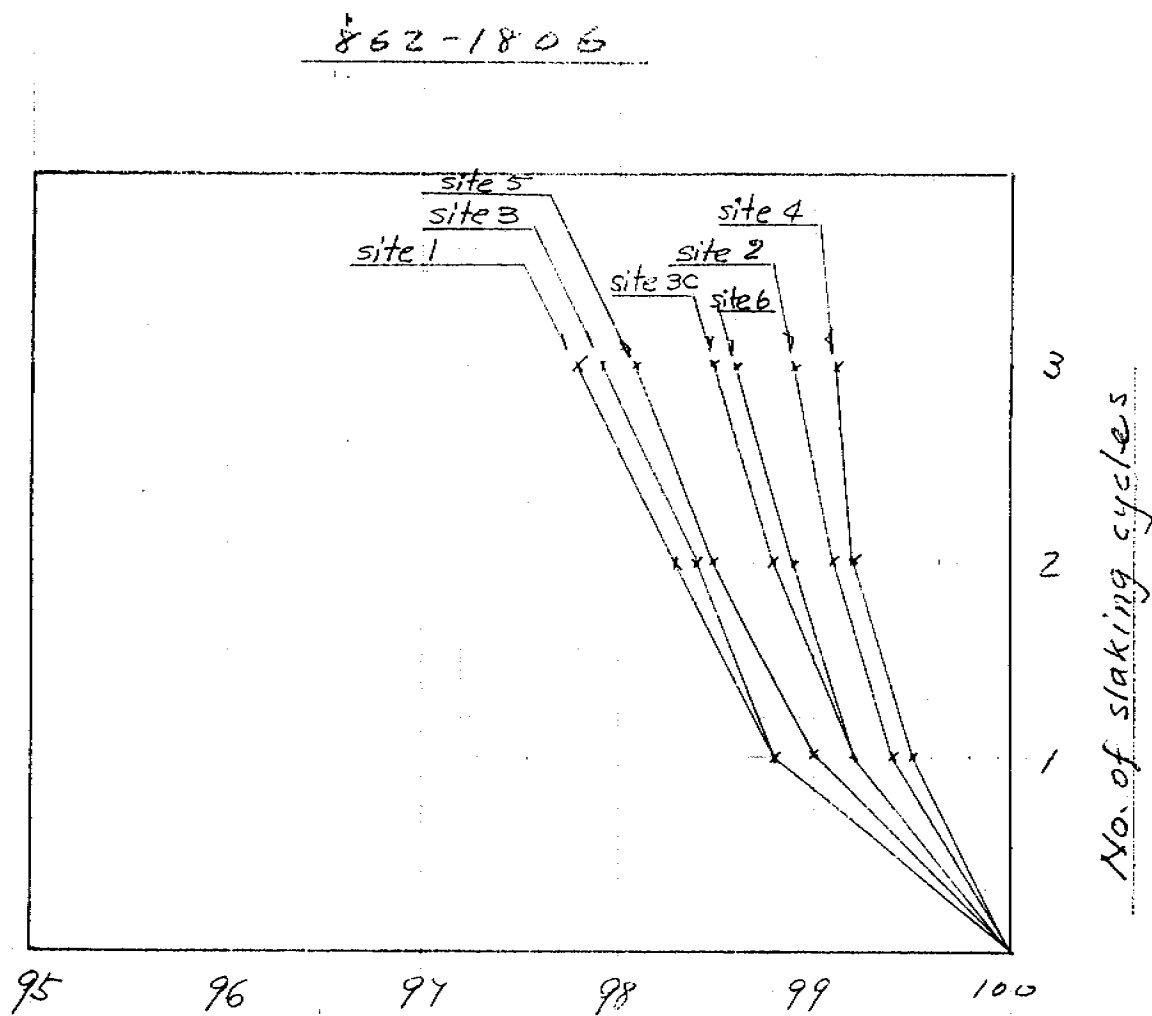
moderately hard (fractured rock), angular rock

(some platy rock)

D.6 SLAKE DURABILITY

Golder Associates

SUBJECT			Date
Job No.	862-1806	Made by	
Ref. Div./Company	Resource	Checked	
		Reviewed	
			Sheet of



95-100 % classified as "extremely high" even after 3 cycles.

D.7 PETROGRAPHY

PROJECT 862-1806: PETROGRAPHY OF SAMPLES

Peter B. Read

November 12, 1986

GEOTEX
CONSULTANTS Limited consulting geologists

PROJECT 862-1806: PETROGRAPHY OF SAMPLES

1. INTRODUCTION:

Golder Associates, 224 West Eighth Ave., Vancouver, B.C. supplied eight hand specimens and drill core samples from six sites. The rocks were examined as hand specimens under a binocular microscope and as thin sections under a petrographic microscope.

2. PETROGRAPHY OF SAMPLE SUITE:

The samples from sites 1 and 2 are granite and granophyric granite. Samples from sites 3(1), 3(2), 3(c) and 4 are all quartz sandstones with variable porosity and friability. The porosity and friability declines as the quartz cementation of the rock increases. The sample from Site 5 is a dolomite with minor calcite cement, and the sample from Site 6 is a very finely crystalline biomicritic limestone with macrofossils.

3. DESCRIPTIONS OF SAMPLES:

(a) Site 1:

Light grey to white, medium grain (1 to 3 mm) biotite (2%) hornblende (6%) porphyritic (white orthoclase up to 15 mm in length) granite.

Thin Section:

The following minerals are present in amounts determined from a mode based on 120 points:

A. Primary Minerals:

1. Biotite (2%):

Pleochroic medium red-brown to very pale brown flakes up to 2 mm in length. Numerous zircon inclusions are surrounded by destruction haloes. The biotite is locally chloritized.

2. Hornblende (6%):

Medium olive green to olive brown pleochroic prismatic grains which show two cleavages at 56° . The grains show biaxial interference figures with $2V_x=70^\circ$. The prisms are partly chloritized.

3. Quartz (25%):

Anhedral grains up to 1.2 mm in diameter showing slight undulatory extinction.

4. Plagioclase (27%):

The subhedral grains up to 1.5 mm in diameter are diffusely and reverse zoned with complex compositional changes. The cores of the grains show alteration to calcite, sericite and chlorite. Two flat-stage plagioclase composition determinations yield An_{40} and An_{44} .

5. Orthoclase and Perthitic Orthoclase (40%):

Carlsbad-twinned, subhedral phenocrysts up to 15 mm long. The phenocrysts are poikilitic with plagioclase grains as common inclusions. Some of the grains contain obvious perthitic intergrowths. All the grains have an obvious negative relief with respect to quartz.

B. Accessory Minerals:

1. Sphene (10 grains):

Diamond-shaped rhombs up to 0.4 mm long with extreme positive relief and extremely high birefringence. It is spatially associated with hornblende but lacks any surrounding destruction haloes.

2. Zircon (15 to 20 grains):

Equant grains up to 0.1 mm in diameter which have high positive relief and high birefringence. The grains are surrounded by destruction haloes where embedded in biotite.

3. Apatite (6 grains):

Euhedral hexagonal prisms up to 0.1 mm long.

C. Alteration:

1. Chlorite:

Flakes with anomalous clove brown and berlin blue interference tints which are scattered in the cores of plagioclase grains, and partly replacing biotite flakes and hornblende prisms.

2. Sericite:

Colourless, fine (0.1 mm long) flakes selectively in the cores of plagioclase grains.

3. Carbonate:

Colourless grains up to 0.1 mm in diameter with negative to high positive relief relative to the enclosing plagioclase.

(b) Site 2:

White, medium grain (1 mm) biotite (3%) granophyric granite in contact with a coarse grain (10 to 20 mm) quartz, white orthoclase pegmatite. Note that the sample is too small to identify which rock type is the younger.

Thin Section:

The following minerals are present in amounts determined from a mode based on 116 points:

A. Primary Minerals:

1. Orthoclase and Microcline(28%):

Unaltered, untwinned to locally cross-hatch twinned, anhedral grains up to 3 mm long composed of wormy intergrowths with potash feldspar as host and quartz as wormy intergrowths which are in optical continuity over areas which coincide with the outlines of the potash feldspar host. The potash feldspar is locally slightly perthitic.

2. Quartz (43%):

(a) As individual anhedral grains up to 0.3 mm in diameter.

(b) As optically oriented wormy inclusions in potash feldspar.

3. Plagioclase (26%):

Anhedral grains up to 1.5 mm long which are weakly altered to sericite and calcite. The grains show neutral to slightly negative relief with respect to quartz. Two flat-stage plagioclase composition determinations yield An₅ and An₇.

4. Biotite (3%):

Flakes up to 1 mm long which are totally altered to chlorite.

B. Alteration Minerals:

1. Chlorite:

Brownish-green flakes with low first order interference tints which totally replace biotite flakes.

2. Sericite:

Colourless, fine (0.05 mm long), flakes scattered in plagioclase grains.

3. Carbonate:

Colourless fine (up to 0.03 mm in diameter) grains which are scattered in plagioclase grains.

(c) Site 3(1):

White, coarse grain (0.5 mm) quartz sandstone with 10% white, angular to subrounded fragments of mainly clay minerals (kaolinite?). The hand specimen shows that the rock is porous and friable.

Thin Section:

The following minerals are present in amounts given by a visually estimated mode:

1. Monocrystalline Quartz (88%):

Angular quartz grains 0.6 mm in diameter which fit together with a few small voids left. Rare quartz grains show a ring of fine opaque inclusions outlining a rounded grain form outside of which is quartz in optical continuity that continues to the subangular outline that fits with the neighbouring

subangular grains. This observation suggests that the rock is a quartz sandstone incompletely cemented by quartz.

2. Polycrystalline Quartz and Chert (2%):

Angular to subrounded grains 0.5 mm in diameter.

3. Clay Minerals - kaolinite? (10%):

Angular to subrounded grains to 0.5 mm in diameter. The grains consist of a fine mat of flakes with a neutral relief with respect to quartz and first order grey to white interference tints. In hand specimen the grains are soft and white.

Remarks: The grains identified as kaolinite should have an X-ray diffractogram made as a check on their identification.

(d) Site 3(2):

Light buff, fine grain (0.2 mm) slightly porous, nonfriable quartz sandstone.

Thin Section:

The following minerals are present in amounts given by a visually estimated mode:

1. Monocrystalline Quartz (94%):

Angular quartz grains 0.1 to 0.2 mm in diameter with a few grains 0.5 mm in diameter. All grains have slight undulatory extinction.

2. Chert (1%):

Fine (0.2 mm diameter), polycrystalline subangular to subrounded grains.

3. "Limonite":

Interstitial opaque clots up to 0.1 mm in diameter which are responsible for the colour of the rock.

(e) Site 3(c):

Light buff, fine grain (0.1 to 0.2 mm) friable, slightly porous quartz sandstone.

Thin Section:

The following minerals are present in amounts given by a visually estimated mode:

1. Monocrystalline Quartz (99%):

Subangular 0.1 to 0.2 mm grains with slight undulatory extinction. The grains show no quartz cement in optical continuity, but nevertheless the subangular grains fit together with few intervening voids.

2. Chert (1%):

Subangular, 0.1 to 0.2 mm grains composed of finely crystalline quartz. These are probably the grey to black grains which speckle the hand specimen.

3. Zircon (3 grains):

Rounded, high positive relief and highly birefringent grains.

4. Hornblende (%%):

Olive green to olive brown pleochroic, subrounded grains 0.1 to 0.2 mm in diameter.

(f) Site 4:

Coarse grain (1 mm), white quartz sandstone with ochre yellow specks. Although the rock is porous it is nonfriable.

Thin Section:

The following minerals are present in amounts given by a visually estimated mode:

1. Monocrystalline Quartz (99%):

Rounded grains 0.5 to 0.7 mm in diameter which clearly show quartz cement in optical continuity with the original rounded quartz grains with a outline that is now preserved by a rim of fine opaque minerals. The quartz cementation is locally incomplete and voids remain.

2. Calcite (¼%):

Locally present as a cement between quartz-cemented quartz grains and younger than the quartz cement.

3. Polycrystalline Quartz and Chert (¼%):

Subrounded to rounded polycrystalline quartz grains 0.5 mm in diameter.

(g) Site 5:

Cream coloured, massive, crystalline (1.5 mm in diameter) dolomite with the dolomite having characteristic curved cleavage planes. Under cold dilute HCl the dolomite effervesces only where powdered, and local areas of unpowdered calcite effervesce.

Thin Section:

The following minerals are present in amounts given by a visually estimated mode: (Note that it is very difficult to estimate percentages of dolomite and calcite without staining for carbonates, but the estimates are probably in the correct order of magnitude.)

1. Dolomite (95%):

Subhedral rhombs to anhedral grains up to 1.5 mm in diameter which are dusted with fine opaque minerals. All grains are untwinned.

2. Calcite (5%):

Interstitial anhedral grains up to 0.4 mm in diameter which are sparsely twinned with the long axis of the intersecting (01 $\bar{1}$ 2) twin lamellae showing high positive relief which is characteristic of calcite. The grains lack the opaque dusting present in the dolomite grains. Apparently the calcite formed as a later cement interstitial to the dolomite rhombohedra.

(h) Site 6:

Very finely crystalline, medium grey, biomicritic limestone containing macrofossils (bivalves and crinoid ossicles) of which the former are filled with coarse white calcite and graphite.

Thin Section:

The limestone classification of Folk (1959) has been used in which the constituents of limestone are subdivided into: (I) terrigenous constituents which include all material derived from erosion of source lands outside the basin of deposition; (II) allochemical constituents which cover all materials formed by chemical or biochemical precipitation within the basin of deposition; and (III) orthochemical constituents which consist of all essentially normal precipitates formed within the basin of deposition or within the rock itself and showing little or no evidence of significant transportation. This subdivision is then combined with the grain size of the rock and the composition of the carbonate to produce the terminology used in this description. The rock effervesces readily under cold dilute HCl. The following minerals are present in amounts given by a visually estimated mode:

I. Allochemical Constituents:

1. Calcite (35%):

Anhedral grains up to 0.1 mm in diameter forming echinoid spines, bivalve shells, and microfossils. Coarse calcite plates to 1.5 mm in diameter form crinoid ossicles.

2. Oolites (%%):

Spherical forms made of radiating prismatic calcite up to 0.2 mm in diameter.

II. Orthochemical Constituents:

1. Calcite (60%):

Very fine grain less than 0.005 mm in diameter forming a micrite matrix which hosts the fossil debris.

2. Opaque Minerals (5%):

A fine dusting dispersed throughout the matrix but not the fossil debris.

REFERENCES

Folk, R.L. (1959):

1959: Practical petrographic classification of limestones; Journal of Geology, v. 43, p. 1-38.

D.8 LISTING OF LABORATORY TEST PHOTOGRAPHS

LISTING OF LAB PHOTOGRAPHS
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 103

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PHOTO NUMBER	DESCRIPTION	ALBUM SEQUENCE
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** SITE 1
 * - MT. FITTON, Y.T.

L-1	-01	ORIGINAL SAMPLES	1
L-1	-02	UNIAXIAL COMPRESSION (BEFORE)	2
L-1	-03	UNIAXIAL COMPRESSION (AFTER)	3
L-1	-04	CRUSHED SAMPLE	4
L-1	-05	LOS ANGELES ABRASION	5
L-1	-06	SODIUM SULPHATE (BEFORE)	6
L-1	-07	SODIUM SULPHATE (AFTER)	7
L-1	-08	SLAKE DURABILITY (BEFORE)	8
L-1	-09	SLAKE DURABILITY (AFTER)	9

** SITE 2

* - MT. DAVIES GILBERT, Y.T.

L-2	-01	ORIGINAL SAMPLES	10
L-2	-02	UNIAXIAL COMPRESSION (BEFORE)	11
L-2	-03	UNIAXIAL COMPRESSION (AFTER)	12
L-2	-04	CRUSHED SAMPLE	13
L-2	-05	LOS ANGELES ABRASION	14
L-2	-06	SODIUM SULPHATE (BEFORE)	15
L-2	-07	SODIUM SULPHATE (AFTER)	16
L-2	-08	SLAKE DURABILITY (BEFORE)	17
L-2	-09	SLAKE DURABILITY (AFTER)	18

**** SITE 3**
*** - MT. GIFFORD, NWT**

L-3	-01	ORIGINAL SAMPLES	19
L-3	-02	UNIAXIAL COMPRESSION (BEFORE)	20
L-3	-03	UNIAXIAL COMPRESSION (AFTER)	21
L-3	-04	CRUSHED SAMPLE	22
L-3	-05	LOS ANGELES ABRASION	23
L-3	-06	SODIUM SULPHATE (BEFORE)	24
L-3	-07	SODIUM SULPHATE (AFTER)	25
L-3	-08	SLAKE DURABILITY (BEFORE)	26
L-3	-09	SLAKE DURABILITY (AFTER)	27

LISTING OF LAB PHOTOGRAPHS

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PHOTO NUMBER	DESCRIPTION	ALBUM SEQUENCE
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**** SITE 3C**

* - WEST DELTA ROCHE MOUTONEE

L-3C-01	ORIGINAL SAMPLE	28
L-3C-02	UNIAXIAL COMPRESSION (BEFORE)	29
L-3C-03	UNIAXIAL COMPRESSION (AFTER)	30
L-3C-04	CRUSHED SAMPLE	31
L-3C-05	LOS ANGELES ABRASION	32
L-3C-06	SODIUM SULPHATE (BEFORE)	33
L-3C-07	SODIUM SULPHATE (AFTER)	34
L-3C-08	SLAKE DURABILITY (BEFORE)	35
L-3C-09	SLAKE DURABILITY (AFTER)	36

**** SITE 4**

* - GULL CREEK QUARTZITE, NWT

L-4	-01	ORIGINAL SAMPLES	37
L-4	-02	UNIAXIAL COMPRESSION (BEFORE)	38
L-4	-03	UNIAXIAL COMPRESSION (AFTER)	39
L-4	-04	CRUSHED SAMPLE	40
L-4	-05	LOS ANGELES ABRASION	41
L-4	-06	SODIUM SULPHATE (BEFORE)	42
L-4	-07	SODIUM SULPHATE (AFTER)	43
L-4	-08	SLAKE DURABILITY (BEFORE)	44
L-4	-09	SLAKE DURABILITY (AFTER)	45

**** SITE 5**

* - GULL CREEK DOLOMITE, NWT

L-5	-01	ORIGINAL SAMPLES	46
L-5	-02	UNIAXIAL COMPRESSION (BEFORE)	47
L-5	-03	UNIAXIAL COMPRESSION (AFTER)	48
L-5	-04	CRUSHED SAMPLE	49
L-5	-05	LOS ANGELES ABRASION	50
L-5	-06	SODIUM SULPHATE (BEFORE)	51
L-5	-07	SODIUM SULPHATE (AFTER)	52
L-5	-08	SLAKE DURABILITY (BEFORE)	53
L-5	-09	SLAKE DURABILITY (AFTER)	54

LISTING OF LAB PHOTOGRAPHS
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PHOTO      DESCRIPTION      ALBUM
NUMBER~~~~~SEQUENCE~~~~~
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** SITE 6

* - DELTA OUTLIERS, NWT

L-6	-01	ORIGINAL SAMPLE	55
L-6	-02	CRUSHED SAMPLE	56
L-6	-03	LOS ANGELES ABRASION	57
L-6	-04	SODIUM SULPHATE (AFTER)	58
L-6	-05	SLAKE DURABILITY (BEFORE)	59
L-6	-06	SLAKE DURABILITY (AFTER)	60

SUPPORTING DOCUMENT E
FIELD PHOTOGRAPH LISTING

FIELD PHOTOGRAPH INFORMATION
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PHOTO #	DATE	BY	FIELD #	ID#	SITE	CAPTION
0103	SEP/29/86	RSR	R1-2	7	1T	Inuvik and East Channel looking SE.
0102	SEP/29/86	RSR	R1-1	2	1T	Inuvik looking SW.
0104	SEP/29/86	RSR	R1-3	154	4T	Panorama of Campbell Hills looking SE. (1 of 2)
0105	SEP/29/86	RSR	R1-4	155	4	Panorama of Campbell Hills looking SE. (2 of 2)
0106	SEP/29/86	RSR	R1-5	156	4	Rocky Hill near East Channel looking SE.
0107	SEP/29/86	RSR	R1-6	158	4	Rocky Hill near East Channel looking ESE.
0108	SEP/29/86	RSR	R1-7	159	4	Rocky Hill near East Channel looking ESE.
0109	SEP/29/86	RSR	R1-8	161	4	Low lying area east of Rocky Hill looking NE.
0110	SEP/29/86	RSR	R1-9	168	5	Gull Creek quartzite ridges looking NE.
0111	SEP/29/86	RSR	R1-10	169	5	Gull Creek Dolomite cliffs and talus slopes looking N.
0112	SEP/29/86	RSR	R1-11	170	5	Gull Creek Dolomite cliffs and talus slopes looking N.
0113	SEP/29/86	RSR	R1-12	171	5	Gull Creek Dolomite cliffs and talus slopes looking N.
0114	SEP/29/86	RSR	R1-13	174	5	Gull Creek Dolomite cliffs looking N.
0115	SEP/29/86	RSR	R1-14	175	5	Gull Creek Dolomite cliffs and talus slopes looking N.
0116	SEP/29/86	RSR	R1-15	176	5	Gull Creek Dolomite cliffs and talus slopes looking N.
0117	SEP/29/86	RSR	R1-16	210	6	Subdued topography of Delta Outliers looking SE. (1 of 2)
0118	SEP/29/86	RSR	R1-17	211	6	Subdued topography of Delta Outliers looking SE. (2 of 2)

FIELD PHOTOGRAPH INFORMATION
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PHOTO #	DATE	BY	FIELD #	ID#	SITE	CAPTION
0119	SEP/29/86	RSR	R1-18	212	6	Low relief near small lake (limestone) looking SE.
0120	SEP/29/86	RSR	R1-19	214	6	Exposed limestone bluff at edge of lake looking NE.
0121	SEP/29/86	RSR	R1-20	215	6	Limestone outcrop at helicopter landing looking SW.
0122	SEP/29/86	RSR	R1-21	221	6	Limestone bluff at edge of lake looking NE.
0123	SEP/29/86	RSR	R1-22	226	6	Delta Outliers looking east from East Channel.
1000	OCT/02/86	DFW	D5-1	3	1T	Inuvik and delta looking SW.
1001	OCT/02/86	DFW	D5-2	4	1T	Inuvik and delta looking SW.
0200A	SEP/29/86	DFW	D1-1	5	1T	Inuvik looking S.
0200B	SEP/29/86	DFW	D1-2	6	1T	Inuvik looking SE.
0201	SEP/29/86	DFW	D1-3	157	4	Rocky Hill looking E. from Gull Creek.
0202	SEP/29/86	DFW	D1-4	160	4	Rocky Hill near East Channel looking NE.
0203	SEP/29/86	DFW	D1-5	162	4	Low lying area east of Rocky Hill looking ENE.
0204	SEP/29/86	DFW	D1-6	172	5	Dolomite cliffs and talus slopes at site 5 looking NNW.
0205	SEP/29/86	DFW	D1-6A	173	5	Dolomite cliffs and talus slopes at near site 5 looking N.
0206	SEP/29/86	DFW	D1-7	222	6	Low altitude view of outlier relief.
0207	SEP/29/86	DFW	D1-8	223	6	Limestone bluff at edge of lake looking NE.
0208	SEP/29/86	DFW	D1-9	213	6	Topography near SW lake in Outliers near mapping area 6A.
0209	SEP/29/86	DFW	D1-10	216	6	Panoramic view of limestone cliffs at site 6A looking NE. (1 of 4)

FIELD PHOTOGRAPH INFORMATION
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PHOTO #	DATE	BY	FIELD #	ID#	SITE	CAPTION
0210	SEP/29/86	DFW	D1-11	217	6	Panoramic view of limestone cliffs at site 6A looking NE. (2 of 4)
0211	SEP/29/86	DFW	D1-12	218	6	Panoramic view of limestone cliffs at site 6A looking NE. (3 of 4)
0212	SEP/29/86	DFW	D1-13	219	6	Panoramic view of limestone cliffs at site 6A looking NE. (4 of 4)
0213	SEP/29/86	DFW	D1-14	220	6	View of SW lake mapping area 6A looking SE.
0214	SEP/29/86	DFW	D1-15	224	6	Limestone bluff along edge of lake near mapping area 6B looking NE.
0215	SEP/29/86	DFW	D1-16	227	6	Delta Outliers looking east from East Channel.
0216	SEP/29/86	DFW	D1-17	230	6	Delta outlier relief looking east from East Channel.
0217	SEP/29/86	DFW	D1-19	231	6F	Gull Creek looking N from Campbell River.
0218	SEP/29/86	DFW	D1-20	208	5F	Dolomite hills to south of Rocky Hill looking NE.
0219	SEP/29/86	DFW	D1-21	209	5F	Dolomite hills to south of Rocky Hill looking NE.
0220	SEP/29/86	DFW	D1-22	177	5	View of Gull Creek Quartzite from Rocky Hill.
0221	SEP/29/86	DFW	D1-23	178	5	View of Gull Creek Dolomite from Rocky Hill.
0224	SEP/29/86	DFW	D1-26	197	5	Landing atop Gull Creek Dolomite cliffs.
0225	SEP/29/86	DFW	D1-27	198	5	View to west from top of dolomite cliffs.
0301	SEP/29/86	RSR	R2-1	199	5	D. Wood atop Gull Creek Dolomite cliffs near site 5.
0302	SEP/30/86	RSR	R2-2	8	1T	Mackenzie delta with Richardson Mtns. in background.

FIELD PHOTOGRAPH INFORMATION
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~~~~~ PHOTO # ~~~~~	~~~~~ DATE ~~~~~	~~~~~ BY ~~~~~	~~~~~ FIELD # ~~~~~	~~~~~ ID# ~~~~~	~~~~~ SITE ~~~~~	~~~~~ CAPTION ~~~~~
0303	SEP/30/86	RSR	R2-3	9	1T	Richardson Mtns. with Mackenzie delta in foreground.
0304	SEP/30/86	RSR	R2-4	12	1T	Polygonal permafrost patterns along stream channel.
0305	SEP/30/86	RSR	R2-5	14	1	Crest of Mt. Fitton with light snow cover, looking W.
0306	SEP/30/86	RSR	R2-6	15	1	Mosaic of Mt. Fitton and the Twins looking SW-W. (1 of 3)
0307	SEP/30/86	RSR	R2-7	16	1	Mosaic of Mt. Fitton and the Twins looking SW-W. (2 of 3)
0308	SEP/30/86	RSR	R2-8	17	1	Mosaic of Mt. Fitton and the Twins looking SW-W. (3 of 3)
0309	SEP/30/86	RSR	R2-9	18	1	Mt. Fitton looking S.
0310	SEP/30/86	RSR	R2-10	19	1	Mt. Fitton looking SE.
0311	SEP/30/86	RSR	R2-11	20	1	Mt. Fitton looking ESE.
0312	SEP/30/86	RSR	R2-12	21	1	Mt. Fitton looking E.
0313	SEP/30/86	RSR	R2-13	22	1	Mt. Fitton looking NE.
0314	SEP/30/86	RSR	R2-14	23	1	Mt. Fitton looking N.
0315	SEP/30/86	RSR	R2-15	24	1	Mt. Fitton looking NW.
0316	SEP/30/86	RSR	R2-16	25	1	Mosaic of Mt. Fitton and the Twins looking NW. (1 of 3)
0317	SEP/30/86	RSR	R2-17	26	1	Mosaic of Mt. Fitton and the Twins looking NW. (2 of 3)
0318	SEP/30/86	RSR	R2-18	27	1	Mosaic of Mt. Fitton and the Twins looking NW. (3 of 3)
0319	SEP/30/86	RSR	R2-19	28	1	Mt. Fitton looking WNW.
0320	SEP/30/86	RSR	R2-20	29	1	Crest of Mt. Fitton looking W.
0321	SEP/30/86	RSR	R2-21	30	1	Crest of Mt. Fitton looking WSW.

FIELD PHOTOGRAPH INFORMATION  
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~~~~~ PHOTO # ~~~~~	~~~~~ DATE ~~~~~	~~~~~ BY ~~~~~	~~~~~ FIELD # ~~~~~	~~~~~ ID# ~~~~~	~~~~~ SITE ~~~~~	~~~~~ CAPTION ~~~~~
0322	SEP/30/86	RSR	R2-22	34	1	Helicopter at landing location on NE side of Mt. Fitton.
0323	SEP/30/86	RSR	R2-23	36	1	Mosaic of Twins looking W. (1 of 2)
0324	SEP/30/86	RSR	R2-24	37	1	Mosaic of Twins looking W. (2 of 2)
0400	SEP/29/86	DFW	D2-1	200	5	Typical dolomite blocks in talus below cliffs with man for scale. (1 of 2)
0401	SEP/29/86	DFW	D2-2	201	5	Typical dolomite blocks in talus below cliffs with man for scale. (2 of 2)
0402	SEP/29/86	DFW	D2-3	202	5	Mosaic of mapping area 5 looking E-S. (1 of 5)
0403	SEP/29/86	DFW	D2-4	203	5	Mosaic of mapping area 5 looking E-S. (2 of 5)
0404	SEP/29/86	DFW	D2-5	204	5	Mosaic of mapping area 5 looking E-S. (3 of 5)
0405	SEP/29/86	DFW	D2-6	205	5	Mosaic of mapping area 5 looking E-S. (4 of 5)
0406	SEP/29/86	DFW	D2-7	206	5	Mosaic of mapping area 5 looking E-S. (5 of 5)
0407	SEP/29/86	DFW	D2-8	207	5	View to west of potential access to site 5.
0408	SEP/30/86	DFW	D2-10	10	1T	Mackenzie delta looking west.
0410	SEP/30/86	DFW	D2-11	11	1T	East slope of Richardson Mtns. with light snow cover.
0413	SEP/30/86	DFW	D2-13	13	1T	Grizzly bear in moderate snow cover near Mt. Davies Gilbert.
0415	SEP/30/86	DFW	D2-16	31	1	NE corner of Mt. Fitton.
0416	SEP/30/86	DFW	D2-17	32	1	The Twins looking W.
0417	SEP/30/86	DFW	D2-18	33	1	West side of Mt. Fitton.
0418	SEP/30/86	DFW	D2-19	35	1	Helicopter at landing location on NE side of Mt. Fitton.

FIELD PHOTOGRAPH INFORMATION
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~~~~~ PHOTO # ~~~~~	~~~~~ DATE ~~~~~	~~~~~ BY ~~~~~	~~~~~ FIELD # ~~~~~	~~~~~ ID# ~~~~~	~~~~~ SITE ~~~~~	~~~~~ CAPTION ~~~~~
0419	SEP/30/86	DFW	D2-20	38	1	Large granite blocks near summit of Mt. Fitton looking NE.
0420	SEP/30/86	DFW	D2-21	56	2T	River valley to north of Mt. Fitton near A. Hoidal camp.
0421	SEP/30/86	DFW	D2-22	77	2	Isolated hill to north of Mt. Davies Gilbert looking SW toward lake.
0422	SEP/30/86	DFW	D2-23	72	2	Mt. Davies Gilbert looking S.
0423	SEP/30/86	DFW	D2-24	73	2	Mt. Davies Gilbert looking SE.
0424	SEP/30/86	DFW	D2-25	74	2	North ridge of Mt. Davies Gilbert looking SE.
0425	SEP/30/86	DFW	D2-26	75	2	North ridge of Mt. Davies Gilbert looking E.
0501	SEP/30/86	RSR	R3-1	39	1	Typical granite block (outcrop) near summit of Mt. Fitton. (1 of 2)
0502	SEP/30/86	RSR	R3-2	40	1	Typical granite block (outcrop) near summit of Mt. Fitton. (2 of 2)
0503	SEP/30/86	RSR	R3-3	41	1	Closeup of granite showing pegmatitic structure.
0504	SEP/30/86	RSR	R3-4	42	1	Mosaic of granitic outcrops near summit of Mt. Fitton. (1 of 5)
0505	SEP/30/86	RSR	R3-5	43	1	Mosaic of granitic outcrops near summit of Mt. Fitton. (2 of 5)
0506	SEP/30/86	RSR	R3-6	44	1	Mosaic of granitic outcrops near summit of Mt. Fitton. (3 of 5)
0507	SEP/30/86	RSR	R3-7	45	1	Mosaic of granitic outcrops near summit of Mt. Fitton. (4 of 5)
0508	SEP/30/86	RSR	R3-8	46	1	Mosaic of granitic outcrops near summit of Mt. Fitton. (5 of 5)
0509	SEP/30/86	RSR	R3-9	47	1	Large granitic blocks with man for scale near summit of Mt. Fitton.

FIELD PHOTOGRAPH INFORMATION  
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PHOTO #	DATE	BY	FIELD #	ID#	SITE	CAPTION
0510	SEP/30/86	RSR	R3-10	48	1	Large granitic blocks with man for scale near summit of Mt. Fitton.
0511	SEP/30/86	RSR	R3-11	49	1	Pegmatitic granite at summit of Mt. Fitton.
0512	SEP/30/86	RSR	R3-12	50	1	Typical felsenmeer on southern slope near summit of Mt. Fitton.
0513	SEP/30/86	RSR	R3-13	51	1	Typical blocky granite outcrops at summit of Mt. Fitton looking NW.
0514	SEP/30/86	RSR	R3-14	52	2T	Hoidal Cupola looking NW.
0515	SEP/30/86	RSR	R3-15	53	2T	Hoidal Cupola looking ESE.
0516	SEP/30/86	RSR	R3-16	54	2T	Hoidal Cupola looking N.
0517	SEP/30/86	RSR	R3-17	55	2T	Grizzly bear near Mt. Fitton.
0518	SEP/30/86	RSR	R3-18	57	2	Isolated hill at north end of Mt. Davies Gilbert looking NE.
0519	SEP/30/86	RSR	R3-19	58	2	Mt. Davies Gilbert ridge looking E.
0520	SEP/30/86	RSR	R3-20	59	2	Mt. Davies Gilbert looking N toward sea.
0521	SEP/30/86	RSR	R3-21	60	2	Mt. Davies Gilbert ridge and isolated hill to north looking NW.
0522	SEP/30/86	RSR	R3-22	61	2	Typical felsenmeer on west slope of Mt. Davies Gilbert with potential access to sea to N.
0523	SEP/30/86	RSR	R3-23	62	2	Typical felsenmeer and drifted snow on west slope of Mt. Davies Gilbert.
0524	SEP/30/86	RSR	R3-24	63	2	Northern view of typical felsenmeer on west slope of Mt. Davies Gilbert with man for scale.
0600	SEP/30/86	DFW	D3-1	65	2	Low level view of isolated hill to north of Mt. Davies Gilbert ridge.
0601	OCT/01/86	DFW	D3-2	81	3T	Aklavik looking W with Richardson Mtns. in background.



FIELD PHOTOGRAPH INFORMATION  
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PHOTO #	DATE	BY	FIELD #	ID#	SITE	CAPTION
0602	OCT/01/86	DFW	D3-3	84	3T	Aklavik looking S.
0603	OCT/01/86	DFW	D3-4	87	3T	Riprap shore protection along Husky Channel at Aklavik.
0604	OCT/01/86	DFW	D3-5	89	3T	Riprap shore protection along Husky Channel at Aklavik.
0605	OCT/01/86	DFW	D3-6	91	3T	Aklavik airport.
0606	OCT/01/86	DFW	D3-7	80	3T	Aklavik hamlet information sign.
0607	OCT/01/86	DFW	D3-8	95	3	Mt. Gifford looking W.
0608	OCT/01/86	DFW	D3-9	101	3	East slope of Mt. Gifford looking W.
0609	OCT/01/86	DFW	D3-10	102	3	East slope of Mt. Gifford looking N.
0610	OCT/01/86	DFW	D3-11	103	3	East slope of Mt. Gifford and existing riprap source looking N.
0611	OCT/01/86	DFW	D3-12	104	3	East slope of Mt. Gifford and existing riprap source looking NW.
0612	OCT/01/86	DFW	D3-13	105	3	Mapping area 3B with man for scale and potential access to SE in background.
0613	OCT/01/86	DFW	D3-14	106	3	Mosaic of Mt. Gifford (area 3A) with felsenmeer in foreground looking S-SE. (1 of 2)
0614	OCT/01/86	DFW	D3-15	107	3	Mosaic of Mt. Gifford (area 3A) with felsenmeer in foreground looking S-SE. (2 of 2)
0615	OCT/01/86	DFW	D3-16	109	3	Mosaic of access route to West Channel looking SE. (2 of 2)
0616	OCT/01/86	DFW	D3-17	108	3	Mosaic of access route to West Channel looking SE. (1 of 2)
0617	OCT/01/86	DFW	D3-18	132	3F	Martin Creek Sandstone.
0618	OCT/01/86	DFW	D3-19	137	3C	Site 3C near Grizzly Creek looking N.
0619	OCT/01/86	DFW	D3-20	138	3C	Site 3C near Grizzly Creek looking N.

FIELD PHOTOGRAPH INFORMATION  
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PHOTO	DATE	BY	FIELD	ID#	SITE	CAPTION	
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0620	OCT/01/86	DFW	D3-21	151	3C	Glacial striations in roche moutonee' looking N with man for scale.	
0622	OCT/01/86	DFW	D3-23	152	3C	Potential access to West Channel from east side of roche moutonee'.	
0623	OCT/01/86	DFW	D3-24	153	4T	Blocks on west slope of roche moutonee' with man for scale.	
0624	OCT/01/86	DFW	D3-25	79	2F	Typical view of the Mackenzie delta looking E.	
0701	SEP/30/86	RSR	R4-1	64	2	West slope of Mt. Davies Gilbert ridge with typical felsenmeer.	
0702	SEP/30/86	RSR	R4-2	66	2	Typical blocks near summit of Mt. Davies Gilbert looking E.	
0703	SEP/30/86	RSR	R4-3	67	2	Felsenmeer along summit ridge of Mt. Davies Gilbert looking SE.	
0704	SEP/30/86	RSR	R4-4	68	2	Typical blocks along summit ridge of Mt. Davies Gilbert looking E.	
0705	SEP/30/86	RSR	R4-5	69	2	Typical blocks along summit ridge of Mt. Davies Gilbert looking E.	
0706	SEP/30/86	RSR	R4-6	70	2	Ridge summit of Mt. Davies Gilbert looking N with sea in background.	
0707	SEP/30/86	RSR	R4-7	71	2	Snow covered blocks on east slope of Mt. Davies Gilbert.	
0708	SEP/30/86	RSR	R4-8	76	2	Typical large blocks at summit of Mt. Davies Gilbert.	
0709	SEP/30/86	RSR	R4-10	78	2F	Herd of migrating caribou near Mt. Davies Gilbert.	
0711	OCT/01/86	RSR	R4-11	82	3T	Hamlet of Aklavik, NWT looking W.	
0712	OCT/01/86	RSR	R4-12	83	3T	Confluence of Husky Channel and West Channel near Aklavik.	
0713	OCT/01/86	RSR	R4-13	85	3T	Aklavik looking SE.	

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0714	OCT/01/86	RSR	R4-14	86	3T	Riprap shore protection hauled by D. Storr of Aklavik looking NE.
0715	OCT/01/86	RSR	R4-15	88	3T	Riprap shore protection along Husky Channel at Aklavik.
0716	OCT/01/86	RSR	R4-16	90	3T	Docking facilities in West Channel near Aklavik airport.
0717	OCT/01/86	RSR	R4-17	92	3	Mosaic of Mt. Gifford looking S-W. (1 of 3)
0718	OCT/01/86	RSR	R4-18	93	3	Mosaic of Mt. Gifford looking S-W. (2 of 3)
0719	OCT/01/86	RSR	R4-19	94	3	Mosaic of Mt. Gifford looking S-W. (3 of 3)
0720	OCT/01/86	RSR	R4-20	96	3	Mt. Gifford looking SE.
0721	OCT/01/86	RSR	R4-21	97	3	Mt. Gifford looking ESE.
0722	OCT/01/86	RSR	R4-22	98	3	Mt. Gifford looking E.
0723	OCT/01/86	RSR	R4-23	99	3	Summit of Mt. Gifford looking E.
0724	OCT/01/86	RSR	R4-24	100	3	Summit of Mt. Gifford looking N.
0800	OCT/02/86	DFW	D4-1	225	6	Limestone bluff along edge of lake near mapping area 6B looking NE.
0801	OCT/02/86	DFW	D4-2	228	6	Detail of bedded limestone at site 6B.
0802	OCT/02/86	DFW	D4-3	229	6	Detail of bedded limestone at site 6B.
0803	OCT/02/86	DFW	D4-4	242	Q3	Town quarry with G. Campbell crushing operation. (4 of 7)
0804	OCT/02/86	DFW	D4-5	243	Q3	Town quarry with G. Campbell crushing operation. (5 of 7)
0805	OCT/02/86	DFW	D4-6	244	Q3	Town quarry with G. Campbell crushing operation. (6 of 7)
0806	OCT/02/86	DFW	D4-7	245	Q3	Town quarry with G. Campbell crushing operation. (7 of 7)

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PHOTO #	DATE	BY	FIELD #	ID#	SITE	CAPTION
0807	OCT/02/86	DFW	D4-8	253	Q4	Aerial circuit of DPW quarry. (2 of 7)
0808	OCT/02/86	DFW	D4-9	254	Q4	Aerial circuit of DPW quarry. (3 of 7)
0809	OCT/02/86	DFW	D4-10	256	Q4	Aerial circuit of DPW quarry. (5 of 7)
0810	OCT/02/86	DFW	D4-11	258	Q4	Aerial circuit of DPW quarry. (7 of 7)
0811	OCT/02/86	DFW	D4-12	259	Q5	Shale pit north of DPW quarry.
0812	OCT/02/86	DFW	D4-13	264	CH	Dolomite cliffs east of Campbell Lake.
0813	OCT/02/86	DFW	D4-14	265	CH	Dolomite cliffs east of Campbell Lake.
0814	OCT/02/86	DFW	D4-15	268	CH	Dolomite cliffs east of Campbell Lake.
0815	OCT/02/86	DFW	D4-16	269	CH	Dolomite cliffs east of Campbell Lake.
0816	OCT/02/86	DFW	D4-17	270	CH	Dolomite cliffs east of Campbell Lake.
0817	OCT/02/86	DFW	D4-18	271	6H	General view of Campbell Hills area.
0818	OCT/02/86	DFW	D4-19	196	5	Gull Creek Dolomite cliffs looking WNW.
0819	OCT/02/86	DFW	D4-20	163	4	Outcrop of quartzitic sandstone at site 4 (Rocky Hill) looking NW.
0820	OCT/02/86	DFW	D4-21	164	4	Outcrop of quartzitic sandstone at site 4 (Rocky Hill) looking NW.
0821	OCT/02/86	DFW	D4-22	166	4	Large blocks of quartzitic sandstone at site 4 with man for scale.
0822	OCT/02/86	DFW	D4-23	167	4	Large open fractures developed in quartzitic sandstone at site 4 with man for scale.
0823	OCT/02/86	DFW	D4-24	276	CH	General view of Campbell Hills area.
0824	OCT/02/86	DFW	D4-25	277	CH	General view of Campbell Hills area.
0825	OCT/02/86	DFW	D4-26	278	CH	General view of Campbell Hills area.
0901	OCT/01/86	RSR	R5-1	110	3	Mosaic of existing riprap source on East slope of Mt. Gifford looking W. (1 of 2)

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0902	OCT/01/86	RSR	R5-2	111	3	Mosaic of existing riprap source on East slope of Mt. Gifford looking W. (2 of 2)
0903	OCT/01/86	RSR	R5-3	112	3	Mapping area 3A looking WSW.
0904	OCT/01/86	RSR	R5-4	113	3	Typical quartzitic sandstone blocks at site 3A.
0905	OCT/01/86	RSR	R5-5	114	3	Typical bedding/crossbedding in sandstone at site 3A.
0906	OCT/01/86	RSR	R5-6	115	3	Typical bedding/crossbedding in sandstone at site 3A.
0907	OCT/01/86	RSR	R5-7	116	3	Typical outcrop with man for scale at site 3A.
0908	OCT/01/86	RSR	R5-8	117	3	Typical blocky structure and felsenmeer with man for scale at site 3B.
0909	OCT/01/86	RSR	R5-9	118	3	Shale interbeds at site 3B with hammer for scale.
0910	OCT/01/86	RSR	R5-10	119	3	Blocky sandstone at site 3B with hammer for scale.
0911	OCT/01/86	RSR	R5-11	120	3	Typical block size of felsenmeer at site 3B.
0912	OCT/01/86	RSR	R5-12	121	3	Felsenmeer at site 3B with man for scale.
0913	OCT/01/86	RSR	R5-13	122	3	Typical blocky talus at existing riprap source on east slope.
0914	OCT/01/86	RSR	R5-14	123	3	Existing riprap source on east slope of Mt. Gifford.
0915	OCT/01/86	RSR	R5-15	124	3	Bluffs above existing riprap source on east slope of Mt. Gifford.
0916	OCT/01/86	RSR	R5-16	125	3	Bluffs above existing riprap source on east slope of Mt. Gifford.

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0917	OCT/01/86	RSR	R5-17	126	3F	Rat River Sandstone exposure NW of Mt. Gifford.
0918	OCT/01/86	RSR	R5-18	127	3F	Martin Creek Sandstone exposures in inaccessible creek valley NW of Mt. Gifford.
0919	OCT/01/86	RSR	R5-19	128	3F	Martin Creek Sandstone exposures in inaccessible creek valley NW of Mt. Gifford.
0920	OCT/01/86	RSR	R5-20	129	3F	Martin Creek Sandstone exposures in inaccessible creek valley NW of Mt. Gifford.
0921	OCT/01/86	RSR	R5-21	130	3F	Martin Creek Sandstone cliffs NW of Mt. Gifford.
0922	OCT/01/86	RSR	R5-22	131	3F	Martin Creek Sandstone cliffs in inaccessible creek valley NW of Mt. Gifford.
0923	OCT/01/86	RSR	R5-23	133	3F	Martin Creek Sandstone.
0924	OCT/01/86	RSR	R5-24	134	3F	Martin Creek Sandstone.
1002	OCT/03/86	DFW	D5-4	260	Q4	Mosaic of DPW quarry S-N looking west. (1 of 4)
1003	OCT/03/86	DFW	D5-5	261	Q4	Mosaic of DPW quarry S-N looking west. (2 of 4)
1004	OCT/03/86	DFW	D5-6	262	Q4	Mosaic of DPW quarry S-N looking west. (3 of 4)
1005	OCT/03/86	DFW	D5-7	263	Q4	Mosaic of DPW quarry S-N looking west. (4 of 4)
1006	OCT/03/86	DFW	D5-8	246	Q3	Mosaic of town quarry from north side. (1 of 6)
1007	OCT/03/86	DFW	D5-9	247	Q3	Mosaic of town quarry from north side. (2 of 6)
1008	OCT/03/86	DFW	D5-10	248	Q3	Mosaic of town quarry from north side. (3 of 6)

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1009	OCT/03/86	DFW	D5-11	249	Q3	Mosaic of town quarry from north side. (4 of 6)
1010	OCT/03/86	DFW	D5-12	250	Q3	Mosaic of town quarry from north side. (5 of 6)
1011	OCT/03/86	DFW	D5-13	251	Q3	Mosaic of town quarry from north side. (6 of 6)
1012	OCT/03/86	DFW	D5-14	279	CH	General view of topography from plane.
1013	OCT/03/86	DFW	D5-15	280	CH	General view of topography from plane.
1014	OCT/03/86	DFW	D5-16	281	CH	General view of topography from plane.
1101	OCT/01/86	RSR	R6-1	135	3F	Willow River Sandstone.
1102	OCT/01/86	RSR	R6-2	136	3F	Willow River Sandstone.
1103	OCT/01/86	RSR	R6-3	139	3C	Felsenmeer on east slope of roche moutonee' (site 3C) looking W.
1104	OCT/01/86	RSR	R6-4	140	3C	Felsenmeer on east slope of roche moutonee' (site 3C) looking SW.
1105	OCT/01/86	RSR	R6-5	141	3C	West slope of roche moutonee' (site 3C) looking SSE.
1106	OCT/01/86	RSR	R6-6	142	3C	West slope of roche moutonee' (site 3C) looking E.
1107	OCT/01/86	RSR	R6-7	143	3C	South end of roche moutonee' (site 3C) looking E.
1108	OCT/01/86	RSR	R6-8	144	3C	Blocky structure of site 3C looking NE.
1109	OCT/01/86	RSR	R6-9	145	3C	Blocky east slope of site 3C looking NE.
1110	OCT/01/86	RSR	R6-10	146	3C	Blocky south end of site 3C looking N.
1111	OCT/01/86	RSR	R6-11	147	3C	Blocky east slope of site 3C looking NNW.
1112	OCT/01/86	RSR	R6-12	148	3C	Blocky east slope of site 3C looking W.

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1113	OCT/01/86	RSR	R6-13	150	3C	Polygonal patterns in permafrost east of site 3C.
1114	OCT/01/86	RSR	R6-14	149	3C	Blocky east slope of site 3C looking W.
1115	OCT/01/86	RSR	R6-15	1	1T	Docking facilities at Inuvik on East Channel looking NW.
1116	OCT/02/86	RSR	R6-16	232	Q1	MOT quarry near Inuvik airport. (1 of 5)
1117	OCT/02/86	RSR	R6-17	233	Q1	MOT quarry near Inuvik airport. (2 of 5)
1118	OCT/02/86	RSR	R6-18	234	Q1	MOT quarry near Inuvik airport. (3 of 5)
1119	OCT/02/86	RSR	R6-19	235	Q1	MOT quarry near Inuvik airport. (4 of 5)
1120	OCT/02/86	RSR	R6-20	236	Q1	MOT quarry near Inuvik airport. (5 of 5)
1121	OCT/02/86	RSR	R6-21	237	Q2	Campbell crusher at small MOT quarry. (1 of 2)
1122	OCT/02/86	RSR	R6-22	238	Q2	Campbell crusher at small MOT quarry. (2 of 2)
1123	OCT/02/86	RSR	R6-23	239	Q3	Town quarry with G. Campbell crushing operation. (1 of 7)
1124	OCT/02/86	RSR	R6-24	240	Q3	Town quarry with G. Campbell crushing operation. (2 of 7)
1201	OCT/02/86	RSR	R7-0	241	Q3	Town quarry with G. Campbell crushing operation. (3 of 7)
1202	OCT/02/86	RSR	R7-1	252	Q4	Aerial circuit of DPW quarry. (1 of 7)
1203	OCT/02/86	RSR	R7-2	255	Q4	Aerial circuit of DPW quarry. (4 of 7)
1204	OCT/02/86	RSR	R7-3	257	Q4	Aerial circuit of DPW quarry. (6 of 7)
1205	OCT/02/86	RSR	R7-4	266	CH	Dolomite cliffs east of Campbell Lake.

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1206	OCT/02/86	RSR	R7-5	267	CH	Dolomite cliffs east of Campbell Lake.
1207	OCT/02/86	RSR	R7-6	165	4	Outcrop of quartzitic sandstone at site 4 (Rocky Hill) looking NW.
1208	OCT/02/86	RSR	R7-7	272	CH	General view of Campbell Hills area.
1209	OCT/02/86	RSR	R7-8	182	5	Typical access to site 5 looking E.
1210	OCT/02/86	RSR	R7-9	183	5	Gull Creek Dolomite at site 5 mapping area looking ESE.
1211	OCT/02/86	RSR	R7-10	184	5	Talus slope at site 5 mapping area.
1212	OCT/02/86	RSR	R7-11	185	5	Gull Creek Dolomite cliffs and mapping access looking NE.
1213	OCT/02/86	RSR	R7-12	186	5	Gull Creek Dolomite cliffs looking NNE.
1214	OCT/02/86	RSR	R7-13	187	5	Talus below dolomite cliffs looking NNE.
1215	OCT/02/86	RSR	R7-14	188	5	Dolomite cliffs and talus looking NNW.
1216	OCT/02/86	RSR	R7-15	189	5	Lake and topography north of dolomite cliffs looking WSW>
1217	OCT/02/86	RSR	R7-16	190	5	Dolomite cliffs near small lake north of main cliffs looking S.
1218	OCT/02/86	RSR	R7-17	191	5	Dolomite cliffs north of main cliffs looking SE>
1219	OCT/02/86	RSR	R7-18	192	5	Access from site 5 looking SSE.
1220	OCT/02/86	RSR	R7-19	193	5	Gull Creek Dolomite cliffs looking ESE.
1221	OCT/02/86	RSR	R7-20	194	5	Topography of Gull Creek Dolomite at top of cliffs looking ENE.
1222	OCT/02/86	RSR	R7-21	195	5	Gull Creek Dolomite cliffs and talus looking E.
1223	OCT/02/86	RSR	R7-22	273	CH	General view of Campbell Hills area.

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1224  OCT/02/86  RSR  R7-23  274  CH  General view of Campbell Hills area.
1225  OCT/02/86  RSR  R7-24  275  CH  General view of Campbell Hills area.
0124  SEP/29/86  RSR  R1-23  179  5   Gull Creek Dolomite looking ENE.
0222  SEP/29/86  DFW  D1-24  180  5   Talus slope below dolomite cliffs near
      site 5.
0223  SEP/29/86  DFW  D1-25  181  5   Gull Creek dolomite cliffs near site
      5.
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