UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

THE ARCTIC LOWLAND REGION

POTENTIAL LANDFORM AND LIFEFORM NATURAL LANDMARKS

by

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Administrative report prepared for

the National Park Service

November 1974

CONTENTS

	Page
Introduction	1
The Arctic Lowland--a physiographic and geologic sketch	2
Theme analysis	9
Selection of potential National Natural Landmarks	13
Natural areas for Landmark consideration summary table	21
Potential Landform and Lifeform Landmark sites suggested for other site categories	30
Priority rating	35
Landforms	36
Theme 1. Plains, Plateaus, and Mesas	36
General statement	36
Site priority rating	43
Site description	46
Theme 2. Seashores and Islands	101
General statement	101
Site priority rating	105
Site description	106
Theme 3. River Systems	149
General statement	149
Site priority rating	154
Site description	156
Theme 4. Lakes and Lake shores	180
General statement	180
Site priority rating	184
Site description	186

Page

Landforms (Continued)

Theme 5. Permafrost Landforms - - - - - - - - - - - - - - - 211

General statement - 211

Site priority rating - - - - - - - - - - - - - - - - - - - 215

Site description - 218

Theme 6. Work of Glaciers - - - - - - - - - - - - - - - - - 236

General statement - 236

Site priority rating - - - - - - - - - - - - - - - - - - - 239

Site description - 240

Theme 7. Cuestas and Hogbacks - - - - - - - - - - - - - - - 258

General statement - 258

Site priority rating - - - - - - - - - - - - - - - - - - - 259

Site description - 260

Theme 8. Sculpture of the Earth - - - - - - - - - - - - - - 277

General statement - 277

Site priority rating - - - - - - - - - - - - - - - - - - - 279

Site description - 280

Theme 9. Movement of the Earth's Crust - - - - - - - - - - 293

General statement - 293

Site priority rating - - - - - - - - - - - - - - - - - - - 296

Site description - 298

Theme 10. Springs - 320

General statement - 320

Site priority rating - - - - - - - - - - - - - - - - - - - 322

Site description - 324

Page

Lifeforms - 335

Theme 4. The Great Development of Land Life and

Changes in Marine Life - - - - - - - - - - - - - - - - - - 337

General statement - 337

Site priority rating - - - - - - - - - - - - - - - - - - 340

Site description - 342

Theme 5. The Age of Reptiles - - - - - - - - - - - - - - - - 347

General statement - 347

Site priority rating - - - - - - - - - - - - - - - - - - 350

Site description - 352

Theme 7. Golden Age of Mammals - - - - - - - - - - - - - - - 370

General statement - 370

Site priority rating - - - - - - - - - - - - - - - - - - 371

Site description - 372

Theme 8. Age of Man - 377

General statement - 377

Site priority rating - - - - - - - - - - - - - - - - - - 379

Site description - 380

Bibliography - 390

Appendix A--Index to localities - - - - - - - - - - - - - - - - 402

Appendix B--Index by quadrangles - - - - - - - - - - - - - - - - 406

Illustrations

Page

Figure 1. Map of northern Alaska showing physiographic divisions - in pocket

2. Land status map for northern Alaska - - - - - - - in pocket

3. Potential Natural Landform and Lifeform Landmarks in the Arctic Lowland - - - - - - - - - - - - - - in pocket

4. Quadrangle index map of the Arctic Lowland region - 20

5. Tussock tundra on Arctic coastal plain - - - - - - - 41

6. Oriented lakes and permafrost polygons on Arctic coastal plain - - - - - - - - - - - - - - - - - - 41

7. Badland topography at Franklin Bluffs - - - - - - - 42

8. Gravel upland surface at the White Hills - - - - - - 42

9. Wave-cut cliffs in the Lisburne Peninsula area - - 106

10. Ice-rich unconsolidated sediment typical of most of the Arctic Lowland coast - - - - - - - - - - - 106

11. Section of offshore bar near Point Lay - - - - - - - 107

12. Goose nesting area on offshore bar near Icy Cape - 107

13. Meander scrolls along Ikpikpuk River - - - - - - - - 155

14. Aufeis field on Ivishak River - - - - - - - - - - - 155

15. Oriented lakes on arctic coastal plain - - - - - - - 185

16. Kurupa Lake site - - - - - - - - - - - - - - - - - - 185

17. Low-center polygons on western coastal plain - - - 216

18. High-center polygons near Barrow - - - - - - - - - - 216

19. Kadleroshilik mound southeast of Prudhoe Bay - - - 217

Page

Figure 20. Mature beaded drainage near Kokolik River - - - - 217

21. Limestone cliffs at Cape Thompson - - - - - - - - - 297

22. Shublik Springs site - - - - - - - - - - - - - - - - 323

23. Tar pit at Cape Simpson - - - - - - - - - - - - - - 323

24. Fire Creek gorge, Sadlerochit Formation - - - - - 341

25. Shublik Formation, Fire Creek - - - - - - - - - - - 341

26. Ichthyosaurs skeleton, Cutaway Creek - - - - - - - 351

Locality Maps

Landforms

	Page
Barrow Plains	46
Putuligayuk Plains	50
Clarence Fan Plains	52
Foggy Island Bay	56
Meade River Plains	58
Angun Plains	62
Epizetka Plains	64
Staines Plains	66
Kongakut Fan Plains	68
Franklin Bluffs	70
White Hills	74
Katakturuk Plateau	78
Igloo Mountain	82
Hatbox Mesa	86
Ignek Mesa	90
Poko Mountain	94
Ayiyak Mesa	96
Outpost Mountain	98
Icy Cape - Kasegaluk Lagoon	108
Cape Lisburne	112
Flaxman Island	116
Point Hope	120
Icy Reef - Beaufort Lagoon	124
Kasegaluk Lagoon	126

Colville Delta - 162

Ivishak - Saviukviayak - 166

Kukpowruk River - 170

Meade River - 172

Echooka River - 174

Awuna River - 178

Takrak Lakes - 186

Teshekpuk Lake - 190

Lake Peters - Lake Schrader - - - - - - - - - - - - - - - - - - 192

Pik Dunes - 194

Kurupa - Cascade Lakes - 196

Topagoruk Lakes - 200

Shainin Lake - 202

Esook Lake - 206

Judy Creek - 208

Kadleroshilik Mound - 218

Kadleroshilik River - 222

Barrow - Brant Point - 224

Okpilak Valley - 256

Archimedes Ridge - 260

Disappointment Ridge - 264

Lookout Ridge - 266

Amatusuk Hills - 268

Tuktu Escarpment - 270

Rooftop Ridge - 274

Castle Mountain - 280

Atigun Gorge - 284

Fortress Mountain - 280

Kiruktagiak Notch - 290

Cape Thompson - Crowbill Point - 298

Cape Dyer - Kiliahlik Point - 302

Umiat Mountain - Shivugak Bluff - - - - - - - - - - - - - - - - - - - 304

Ninuluk Bluff - 308

Schrader Bluff - 312

Ishukpak Bluff - 314

Nasaurak Mountain - 316

	Page
Katakturuk Fold	318
Shublik Springs	324
Sadlerochit Springs	328
Simpson Seeps	330
Lifeforms	
Fire Creek	342
Cutaway Creek	352
Ignek Creek	354
Black Island	358
Monotis Creek	362
Tuktu Bluff	362
Aucella Creek	362
Valley of the Willows	372
Skull Cliff	374
Tigara	380
Tukuto Lake	384
Natvakruak Lake	386

The Arctic Lowland is that part of Alaska between the north front of the Brooks Range and the Arctic Ocean (Fig. 1). This is a wedge shaped area about 200 miles wide at the widest point that narrows to less than 15 miles at the Canadian border. This is the "Barren Ground," a frozen tundra region that slopes gently to the Arctic Ocean. The entire region is within the zone of continuous permafrost, which means that the soil and rock are permanently frozen to a depth of several hundred feet; it is only the surface layer that thaws and supports life during the brief summer. This tundra region, although similar to parts of Siberia and northern Canada, is unique under the American flag and consequently is of special interest as the site of natural landmarks where people can study and observe the landforms as they develop in an Arctic environment.

Alaska along with the rest of United States lends itself to a division into major physiographic provinces. These are large areas where the agencies of erosion interact uniformly with the surficial materials, bedrock, and bedrock structures to produce a characteristic landscape. The first general subdivision of Alaska into physiographic provinces was made by Fenneman (1928). At that time much of Alaska was still unmapped and only the broad outline of the topographic features were known. A more up-to-date physiographic classification was prepared by Wahrhaftig (Physiographic divisions of Alaska) in 1965. The boundary between the Arctic Lowland and the Brooks Range used in this report (Fig. 1) is the one established by Wahrhaftig, with slight modification near the west coast. Two main sections are recognized in the Arctic Lowlands; the Arctic Coastal Plain on the north and the Arctic Foothills on the south.

Figure 1 in pocket.

Age	Western part Cape Thompson to Point Franklin	Central part Point Franklin to Colville River	Eastern part Colville River to Canadian Border
Quaternary	Alluvium Glacial deposits	Alluvium, glacial deposits, and loess Gubik Formation	Alluvium Glacial deposits Gubik Formation
Tertiary			Sagavanirktok Fm.
Upper Cretaceous	Colville Group Prince Creek Fm.	Colville Group Prince Creek Fm. Schrader Bluff Fm. Seabee Fm. Nanushuk Group Ninuluk Fm.	Colville Group Prince Creek Fm. Schrader Bluff Fm. Seabee Fm.
Lower Cretaceous	Corwin Formation Kukpowruk Fm. Torok Formation Fortress Mtn. Fm. Kisimilok Fm.	Nanushuk Group Chandler Fm. Grandstand Fm. Tuktu Fm. Torok Formation Fortress Mtn. Fm. Okpikruak Fm.	Nanushuk Group Chandler Fm. Tuktu Fm. Bathtub Graywacke Kongakut Formation
Jurassic	Televarik Fm. Ogotoruk Fm.	Kingak Shale	Kingak Shale
Triassic	Shublik Fm.	Shublik Fm.	Shublik Formation Ivishak Formation
Permian	Siksikpuk Fm.	Siksikpuk Fm. Nuka Fm.	Echooka Formation
Pennsylvanian to Mississippian	Lisburne Group	Lisburne Group	Lisburne Group

STRATIGRAPHIC CHART

The ancestral Brooks Range started to form about 150 million years ago during Late Jurassic time. The mountain-building movements were gentle at first, but the intensity increased over a period of about 45 million years culminating about 105 million years ago. Most of the folding and faulting probably took no more than 5 million years during a part of the Early Cretaceous for which no record has been preserved in northern Alaska. While the ancestral Brooks Range was gradually being uplifted the ancient landmass to the north was dropped beneath the sea. Mid- and Late Cretaceous rocks were deposited over this old mountain system forming structural traps that hold much of the petroleum being produced in northern Alaska. Deep structural basins formed adjacent to the ancestral Brooks Range at the same time and these were filled primarily with shale of Early Cretaceous age that now form the broad valleys in the southern part of the Arctic Lowland.

For 35 million years during Mid- and Late Cretaceous time the Arctic Lowland was alternately downwarped beneath the sea and uplifted above sea level. Rivers flowing out of the ancestral Brooks Range immediately started to fill the basins formed by the marine transgressions. As deltas formed near the mouth of the rivers they were covered with coal swamps that have left their record in the numerous coal beds found in parts of the Lowland. The rocks record five major transgressions and regressions of the sea across the area during this period of time. Volcanoes were active south of the Brooks Range and left their record as ash beds in the rocks of the region. During this part of the Cretaceous 10,000 to 15,000 feet of sediments accumulated in the Arctic Lowland. The removal of this vast amount of material from the Brooks Range reduced it to an area of low relief.

modified since. The effects of the Ice Age are readily apparent on the lowland, not only in the numerous glacial deposits but, also, in the abundant permafrost features. The permafrost is a relic of the Ice Age along with the abundant bones of the mammoth, mastodon, bison, and musk ox.

Theme Analysis

Any region contains an infinite number of landscape forms, but with man's passion to categorize and classify his physical environment this number is reduced to workable proportions. The National Park Service has developed a theme analysis system to classify the various types of

Subthemes: Raised coastal plain, alluvial fan plain, alluvial terrace plain

Theme 2. Seashores and Islands

Subthemes: Wave-cut cliffs, drowned coasts, estuaries and lagoons, spits and offshore bars, islands, raised beaches

Theme 3. River Systems

Subthemes: Braided channels, aufeis fields, oxbow lakes and meander scrolls, beaded streams, stream piracy

Theme 4. Lakes and Lake Shores

Subthemes: Oriented, thermokarst, glacial, drained or filled

Theme 5. Permafrost Landforms

Subthemes: Pingos, polygons, relict ice wedges, solifluction lobes, altiplanation terraces

Theme 6. Work of Glaciers

Subthemes: Morainal features, glacial lake deposits, periglacial stream channels

Theme 7. Cuestas and Hogbacks

Theme 8. Sculpture of the Land

Subthemes: Buttes, gorges, erosional remnants

Theme 9. Movement of the Earth's Crust

Subthemes: Folds, faults, unconformities, erosion surfaces

Theme 10. Springs

Fossils found in the rocks are an extremely important element of any geologic investigation. The lifeforms found in two similarly appearing rock units can tell us if they are actually the same, or that one may be many millions of years older or younger than the other. For it is through these lifeforms that we can trace the biologic evolutionary development of life on earth. Consequently, themes dealing with the history of lifeforms are essentially chronologic elements relating to this evolutionary development. Links in the chain of evolutionary development are based on faunal assemblages, or groups of fossils, rather than a single fossil form.

The National Park Service theme analysis for the History of Lifeforms takes into consideration the major changes in the development of life on

earth. The broad stages of biologic development used in this analysis are as follows:

Theme 1. The Morning of Life (Precambrian time)

Theme 2. The Age of Primitive Invertebrates (Cambrian, Ordovician, Early Silurian)

Theme 3. The Rise of Vertebrates and the First Forests (Late Silurian and Devonian)

Theme 4. The Great Development of Land Life and Changes in Marine Life (Mississippian, Pennsylvanian, Permian, and Triassic)

Theme 5. The Age of Reptiles (Permian, Triassic, Jurassic, and Cretaceous)

Theme 6. The Emerging Dominance of Animals (Paleocene and Eocene)

Theme 7. The Golden Age of Animals (Oligocene, Miocene, Pliocene, and Pleistocene)

Theme 8. The Age of Man (Pleistocene and Holocene)

The Arctic Lowland has an exceptional fine record of part of this evolutionary chain of life, but the record is by no means complete and some of the intervals are not of the caliber to warrant recommendation as National Natural Landmarks. In order to keep the Arctic Lowland themes in their proper time reference the National Park Service numbering system will be used. The themes that are relevant are as follows:

Group II. Lifeforms

Theme 4. The Great Development of Land Life and Changes in Marine Life

Theme 5. The Age of Reptiles

Theme 7. The Golden Age of Animals

Theme 8. The Age of Man

Figure 2 in pocket.

particularly those on the coastal plain, will have little of scenic interest for the average tourist. The spatial requirements for the sites varies considerably. For example, one small lake cannot be considered as adequate representation of the thousands of oriented lakes on the coastal plain.

With all these factors considered, the following sites are recommended for inclusion in the Registry of National Natural Landmarks (Fig. 3). Each site has a distinctive code symbol consisting of a Roman numeral followed by Arabic numerals 1 through 80. Lifeform sites are identified by the Roman numeral II and subsequent Arabic numerals.

A quadrangle index map for the Arctic Lowland (Fig. 4) is presented here in order to facilitate the locating of sites. This figure shows, also, the method of identification used for 1:63,360 maps in Alaska. Individual 1:63,360 maps are not named as they are in mainland United States, instead a letter and number code is used.

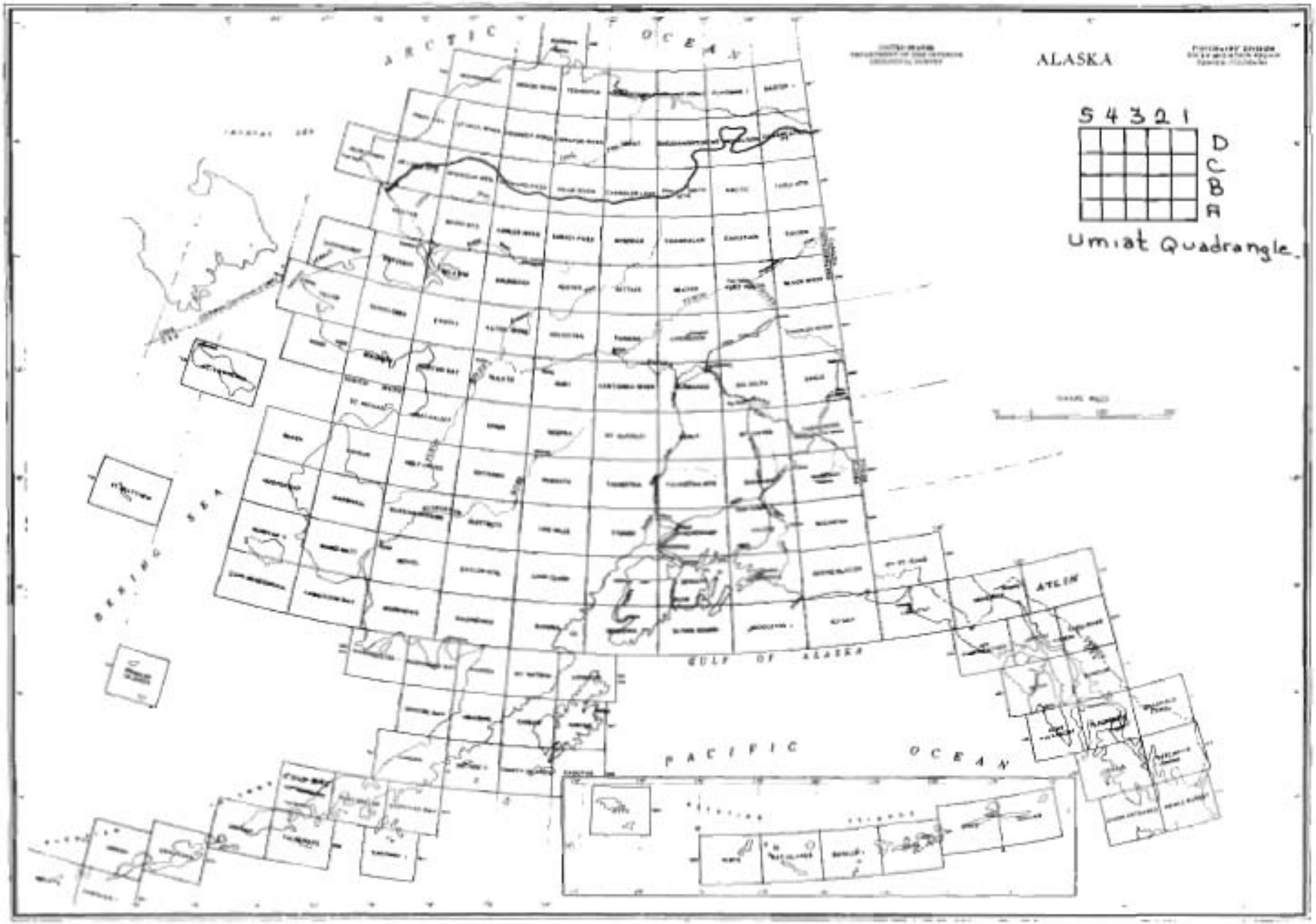


FIGURE 4. QUADRANGLE INDEX MAP OF THE ARCTIC LOWLANDS REGION.

ARCTIC LOWLANDS

NATURAL AREAS FOR LANDMARK CON

LANDFORMS

Theme: Plains-Plateaus-Mesas

Locality	Landform
Barrow Plains Barrow Quad.	Raised coastal plain, seas islands, permafrost
Putuligayuk Plains, Sagavanirktok Quad.	Plains, lakes and lakeshor permafrost
Clarence Fan Plain, Demarcation Point Quad.	Alluvial fan plain, river systems, permafrost
Foggy Island Bay, Beechey Point Quad.	Raised coastal plain, perm lakes and lakeshores, se seashores
Meade River Plains, Meade River Quad.	Raised coastal plain and b permafrost, lakes and la eolian
Angun Plains, Demarcation Point Quad.	Alluvial terrace plain, ri system
Epizetka Plains, Point Lay Quad.	Raised coastal plain, sea shores, permafrost
Staines Plains, Mt. Michelson Quad.	Alluvial terrace plain, ri systems
Kongakut Fan Plain, Demarcation Point Quad.	Alluvial fan plain, river
Franklin Bluffs, Sagavanirktok Quad.	Gravel pediment plateau

Locality	Landform
White Hills, Sagavanirktok Quad.	Gravel pediment and bedroc
Katakturuk Plateau, Mt. Michelson Quad.	Bedrock plateau, movement crust
Igloo Mountain, De Long Mountains Quad.	Mesa, movement of earth's
Hatbox Mesa, Chandler Lake Quad.	Mesa, movement of earth's age of reptiles
Ignek Mesa, Mt. Michelson Quad.	Mesa, movement of earth's age of reptiles
Poko Mountain, De Long Mountains Quad.	Mesa, movement of earth's
Ayiyak Mesa, Chandler Lake Quad.	Mesa
Outpost Mountain, Umiat Quad.	Mesa, movement of the eart crust, age of reptiles

Theme: Seashores and Islands

Icy Cape-Kasegaluk Lagoon, Wainwright Quad.	Spit, offshore bar, lagoon
Cape Lisburne, Pt. Hope quad.	Wave-cut cliffs, movement crust, changes in marine
Flaxman Island, Flaxman Island Quad.	Island, eolian
Point Hope, Pt. Hope Quad.	Spit, lagoon, permafrost, river system

Locality	Landform	Land status
Icy Reef-Beaufort Lagoon, Demarcation Point Quad.	Offshore bar, lagoon, river system, permafrost, eolian	Arctic National Wildlife Range
Kasegaluk Lagoon, Point Lay Quad.	Offshore bar and lagoon	Native village Deficiency area
Wainwright Inlet-Kuk River, Wainwright Quad.	Estuary, lagoon, offshore bar, river system, permafrost	Naval Petroleum Reserve No. 4, native village withdrawal
Walakpa Bay, Barrow Quad.	Estuary, permafrost, plains	Naval Petroleum Reserve No. 4, native village withdrawal
Point Barrow-Nuwuk Spit, Barrow Quad.	Spit, island, lagoon	Naval Petroleum Reserve No. 4, native village withdrawal
Demarcation Bay, Demarcation Point Quad.	Spit, lagoon, permafrost, raised coastal plain	Arctic National Wildlife Range
Plover Islands, Barrow Quad.	Islands	Naval Petroleum Reserve No. 4, native village withdrawal
Admiralty Bay, Teshekpuk Quad.	Estuary, islands	Naval Petroleum Reserve No. 4
Theme: River Systems		
Sagavanirktok River, Sagavanirktok Quad.	Braided channel	Utility corridor
Ikpikpuk River, Teshekpuk Quad.	Braided channel, oxbow lake, meander scrolls, eolian, lakes and lakeshores	Naval Petroleum Reserve No. 4
Colville Delta Harrison Bay Quad.	Deltas, seashores and islands, lakes and lakeshores, eolian	Naval Petroleum Reserve No. 4, native village withdrawal, State Selection pending

Locality	Landform	Land status
Ivishak-Saviukviayak, Sagavanirktok Quad.	Aufeis field, braided channel	Native Regional Deficiency area
Kukpowruk River, Point Lay Quad.	Entrenched meanders, movement of the earth's crust	Native Regional Deficiency area
Meade River, Meade River Quad.	Oxbow lakes, meander scrolls, eolian, permafrost, lakes and lakeshores, plains	Naval Petroleum Reserve No. 4, native village withdrawal
Echooka River, Sagavanirktok Quad.	Aufeis field, springs	Native Regional Deficiency area
Awuna River, Lookout Ridge Quad.	Entrenched meanders, movement of earth's crust	Naval Petroleum Reserve No. 4
Theme: Lakes and Lakeshores		
Takrak Lakes, Meade River and Wainwright Quads.	Oriented, thermokarst, permafrost, plains	Naval Petroleum Reserve No. 4
Teshekpuk Lake, Teshekpuk Quad.	Thermokarst, permafrost, plain	Naval Petroleum Reserve No. 4
Lake Peters-Lake Schrader, Mt. Michelson Quad.	Glacial, work of glaciers, movement of earth's crust	Arctic National Wildlife Range
Pik Dunes, Teshekpuk Quad.	Drained, eolian, plains, permafrost	Naval Petroleum Reserve No. 4
Kurupa-Cascade Lake, Killik River Quad.	Glacial, work of glaciers, movement of earth's crust	Gates of the Arctic National Park - proposed
Topagoruk Lakes, Teshekpuk Quad.	Oriented, thermokarst, plains, permafrost	Naval Petroleum Reserve No. 4
Shainin Lake, Chandler Lake Quad.	Work of glaciers, movement of earth's crust	Gates of the Arctic National Park - proposed, native village withdrawal

Locality	Landform	Land status
Fortress Mountain, Chandler Lake Quad.	Buttes, erosional remnants	Gates of the Arctic National Park - proposed
Atigun Gorge, Philip Smith Mtns. Quad.	Gorge, movement of the earth's crust, changes in marine life, age of reptiles	Utility corridor
Kiruktagiak Notch, Chandler Lake Quad.	Erosional remnants	Native Regional Deficiency area, Gates of the Arctic National Park
Theme: Movement of the Earth's Crust		
Cape Thompson-Crowbill Point Point Hope Quad.	Folds, faults, sea cliffs, sculpture of the land	Proposed Chukchi National Wildlife Refuge
Cape Dyer-Kiliahlik Point Point Hope Quad.	Erosion surface, folds, seashores and islands	Native village withdrawal
Umiat Mountain-Shivugak Bluff, Umiat Quad.	Folds, unconformity, river system, age of reptiles	Naval Petroleum Reserve No. 4, Native Regional Deficiency area
Ninuluk Bluff, Ikpikpuk River Quad.	Unconformity, folds, fault	Gates of the Arctic National Park - proposed
Schrader Bluff, Umiat Quad.	Fold, unconformity	Native Regional Deficiency area
Ishukpak Bluff, Umiat Quad.	Fold, fault, river system	Naval Petroleum Reserve No. 4
Nasaurak Mountain, Chandler Lake Quad.	Fold, fault	Native village withdrawal
Katakturuk Fold Mt. Michelson Quad.	Fold, fault, unconformity, development of life on earth	Arctic National Wildlife Range

Theme: Springs

Locality	Landform	Land status
Shublik Springs Mt. Michelson Quad.	Springs	Arctic National Wildlife Range
Sadlerochit Springs Mt. Michelson Quad.	Springs	Arctic National Wildlife Range
Simpson Seeps Teshekpuk Quad.	Oil seep, permafrost, plains, lakes and lakeshores	Naval Petroleum Reserve No. 4

LIFEFORMS

Theme: Changes in Marine Life

Fire Creek Mt. Michelson Quad.	Mississippian, Pennsylvanian, Permian, Triassic, Jurassic, movement of the earth's crust, sculpture of the land	Arctic National Wildlife Range

Theme: Age of Reptiles

Cutaway Creek Howard Pass Quad.	Triassic, movement of the earth's crust	Naval Petroleum Reserve No. 4
Ignek Creek Mt. Michelson Quad.	Triassic, movement of the earth's crust	Arctic National Wildlife Range
Black Island Mt. Michelson Quad.	Jurassic, river system	Arctic National Wildlife Range

LIST OF POTENTIAL LANDFORM AND LIFEFORM LANDMARK

SITES THAT ARE SUGGESTED FOR OTHER SITE CATEGORIES

This Study	Ecological Landmark Study		Ecological Reserves - ER Arctic National Wildlife Range - ANWR Chukchi National Wildlife Refuge - CNWR
	Aquatic theme	Terrestrial theme	
Barrow Plains	Barrow area	--	--
Meade River Plains	Central Meade River	Meade River Dunes	--
Clarence Fan Plain	--	Lower Kongakut and Firth Rivers	ANWR
Angun Plains	--	--	ANWR
Kongakut Fan Plain	Kongakut River	Lower Kongakut and Firth Rivers	ANWR
Franklin Bluffs	Franklin Bluffs	Franklin Bluffs	Franklin Bluffs - ER
White Hills	--	White Hills	--
Katakturuk Plateau	--	--	ANWR
Ignek Mesa	--	--	ANWR
Cape Lisburne	--	--	Cape Lisburne - CNWR
Flaxman Island	Flaxman Island	Flaxman Island	--
Point Hope	--	--	Point Hope - ER
Icy Reef-Beaufort Lagoon	--	--	Beaufort Lagoon - ER
Kasegaluk Lagoon	Kasegaluk Lagoon-Pt. Lay	Point Lay	--
Wainwright Inlet-Kuk River	Kuk-Utukok Rivers	--	Kuk River Fossil Amber - ER

This Study	Aquatic Theme	Terrestrial Theme	
Walakpa Bay	--	--	Walakpa Monument - ER
Point Barrow-Nuwuk Spit	Nuwuk Spit-Elson Lagoon	Northern tip of Arctic Coastal Plain	Point Barrow - ER
Demarcation Bay	--	Lower Kongakut and Firth Rivers	ANWR
Plover Islands	Plover Islands	--	Pt. Barrow-offshore islands - ER
Ikpikpuk River	Ikpikpuk River	Central Ikpikpuk	--
Colville Delta	Colville Delta	Colville Delta	Colville Delta - ER
Meade River	Central Meade River	Meade River Dunes	--
Echooka River	Echooka Springs	--	Echooka Springs and Balsam Poplar Stand - ER
Teshekpuk Lake	Teshekpuk Lake	Teshekpuk Lake	Teshekpuk Lake - ER
Lake Peters-Lake Schrader	--	--	Neruokpuk Lakes - ER
Pik Dunes	Pik Dunes	Pik Dunes	--
Kurupa-Cascade Lakes	--	--	Gates of the Arctic National Park
Kadleroshilik Mound	Kadleroshilik Mound	Kadleroshilik Mound	--
Kadleroshilik River	--	--	Prudhoe Bay Pingo Area - ER
Barrow-Brant Point	Barrow area	Barrow area	Point Barrow - ER
Toolik River Pingo Field	--	Kuparuk-Sagavanirktok interfluve	--
Oumalik River	Ikpikpuk River	Central Ikpikpuk River	--

This Study	Aquatic Theme	Terrestrial Theme	
Killik River Valley	--	--	Gates of the Arctic National Park Killik Tundra Fire - ER
Tago Valley	--	--	Tago Valley - ER
Sagavanirktok-Itkillik	--	--	Galbraith Lake - ER
Okpiklak Valley	--	Lower Hula Hula and Okpiklak Rivers	ANWR
Archimedes Ridge	Kuk-Utukok Rivers Drainage	Upper Utukok River Drainage	Utukok River - ER
Disappointment Ridge	Kuk-Utukok Rivers Drainage	Upper Utukok River Drainage	Utukok River - ER
Lookout Ridge	Kuk-Utukok Rivers Drainage	Upper Utukok River Drainage	Utukok River - ER
Castle Mountain	--	--	Gates of the Arctic National Park
Fortress Mountain	--	--	Gates of the Arctic National Park
Atigun Gorge	--	--	Atigun Gorge - ER
Kiruktagiak Notch	--	--	Gates of the Arctic National Park
Cape Thompson-Crowbill Point	Ogotoruk Creek	--	Cape Thompson - CNWR Cape Thompson-Ogotoruk Creek - ER
Umiat Mountain	Colville River Bluffs	Colville River Bluffs	Colville River and bluffs - ER
Ninuluk Bluff	Upper Colville River	Upper Colville River Valley	Colville River and bluffs - ER
Ishukpak Bluff	Colville River Bluffs	Colville River Bluffs	Colville River and bluffs - ER

This Study	Aquatic Theme	Terrestrial Theme	
Katakturuk Fold	--	--	ANWR
Shublik Springs	Shublik Springs	Shublik Springs	Shublik Springs - ER
Sadlerochit Springs	--	--	ANWR
Simpson Seeps	--	Cape Simpson area	--
Fire Creek	--	--	ANWR
Ignek Creek	--	--	ANWR
Monotis Creek	--	--	Gates of the Arctic National Park
Aucella Creek	--	--	Gates of the Arctic National Park
Valley of the Willows	Ikpikpuk River Drainage	Ikpikpuk River Drainage	Valley of the Willows - ER
Tigara	Kukpuk-Ipewik Rivers Drainage	--	Point Hope - ER

Priority Rating

The National Park Service has developed a priority rating system to be used as part of the site selection process. The value of this rating system is that sites with the highest rating will receive first onsite evaluation. This system, which follows with slight modification, will be used throughout this report.

Priority 1. High degree of national significance, recommended without reservation.

Priority 2. Definitely eligible and recommended, but not quite as good as priority 1.

Priority 3. A good site, but not quite nationally significant.

Priority 4. Not recommended.

Additionally, letters are used with the priority numbers to indicate the relative impending danger to the sites. They are as follows:

A. Site in serious impending danger.

B. Site in some jeopardy.

C. Site in no apparent danger.

D. Relative jeopardy unknown.

NATIONAL NATURAL LANDMARK SURVEY LANDFORMS

Theme 1. Plains, Plateaus, and Mesas

The theme, Plains, Plateaus, and Mesas, is the most significant theme, under the category Landforms of the Present, found in the Arctic Lowland. The coastal plain section of the Arctic Lowland is a nearly flat, featureless region that stretches from horizon to horizon. Many thousands of square miles of this plain border the Arctic Ocean and extend inland to the foothills. It gradually slopes upward from sea level to about 600 feet at the junction with the foothills, but the angle of slope is so low as to appear flat to the unaided eye. Even a sand dune a few feet high seems to be a notable promontory visible for miles.

The plains of northern Alaska, while seemingly flat and featureless to the casual observer, do have a variety of micro-relief features that are extremely important ecologically. Many of these microfeatures are geometrically oriented and result from the permafrost that underlies the region. Small variations in elevation can change the entire aspect of the tundra from wet to dry, which makes a great difference not only in the plant communities present but also in the bird and animal life that the area supports.

There are major changes in the character of the coastal plain in addition to the numerous microfeatures. Most of the plain west of the Colville River is dotted by tens of thousands of lakes and ponds. Many of these are elliptical to ovoid in shape with a distinct preferred orientation, others have a very irregular outline characteristic of thermokarst development. The lake country is primarily underlain by silt

and sand across which the streams sluggishly make their tortuous trip to the sea. The eastern part of the plain is underlain mainly by sand and gravel across which the rivers have developed intricately braided channels; this part of the plains, also, has fewer lakes and most are not oriented.

Geologically, the Arctic coastal plains are young. Their present configuration results from processes that were acting on the landforms during the Pleistocene and Holocene. The last major uplift of the Brooks Range and adjoining Arctic Lowland was during the Late Tertiary; however, the process is still continuing with the slow elevation of the coastal plain. The area north of the Brooks Range has been a lowland since Early Cretaceous time; at times emergent and again submerged, it received many thousands of feet of sediments eroded from the range. These strata now underlie the plains, but are almost completely covered by unconsolidated silt, sand, and gravel that were deposited during the Pleistocene and Holocene.

This theme, Plains, Plateaus, and Meses, can be divided into several subthemes. The divisions decided upon are: Raised Coastal Plain, Alluvial Fan Plain, Alluvial Terrace Plain, Plateau, and Mesa.

Raised Coastal Plain

The raised Coastal Plain is present along much of the Arctic Ocean and Chukchi Sea shoreline. It is best developed and widest in the area south of Point Barrow where it extends inland for about 80 miles. This is an area of oriented and thermokarst lakes with abundant and varied permafrost features. Numerous and well-developed ecological zones occur across this area all of which are of comparatively recent origin owing to the newness of these plains. Locally beaches with sand dunes are present 40 to 50 miles

inland and several hundred feet above the modern shoreline.

The plain is treeless except for a few stunted willow along some of the streams. However some of the surficial deposits contain remnants of poplar and spruce logs dated by radiocarbon 14 at greater than 34,000 years, which would indicate that trees probably were present in northern Alaska during a period when the climate was warmer than at present. Several tundra plant communities, which will be discussed in a companion report, are important features of the raised coastal plain.

The raised plain probably has little of scenic interest for the average tourist, but has much of scientific interest as attested by the hundreds of investigations carried on by personnel from the Arctic Research Laboratory at Barrow. Results of some of these investigations are included in the bibliography to this report. With the current development of northern Alaska, resulting in part from the quest for petroleum, these plains will be heavily scarred. Some should be set aside while still in their pristine condition.

Alluvial Fan Plain

The Alluvial Fan Plain is an unusual type of plain for northern Alaska, being very similar to the fans formed in the Basin and Range province of southwestern United States. They are formed where high volume and velocity rivers, carrying a large load of gravel, leave the Brooks Range onto the Arctic Lowland. Perfectly formed fans as much as 20 miles long and 25 miles wide, at the outer margin, develop with the apex at the point where the river exits the mountains. These are typically formed by only two rivers, Kongakut and Clarence, in the extreme eastern part of the Arctic Lowland.

These fans have a very uniform gradient of about 50 feet per mile,

and being primarily composed of gravel are well-drained as compared to most of the plains in northern Alaska. These well-drained areas support a different plant community than the wet coastal plain, but at the same time show a good succession of plant communities from the wet to dry areas. These fans are also on the main caribou migration route for the eastern herd that ranges between northeastern Alaska and Canada.

Alluvial Terrace Plain

The Alluvial Terrace Plain is an example of a mature to old age Alluvial Fan Plain that has been dissected by the rivers forming them. They are found mainly between the Canning and Kongakut Rivers. The two best examples are the Staines and Angun Plains, both of which exhibit geologic and ecologic features of interest.

Plateau

The Arctic Lowland does not contain any extensive plateau areas now, but does contain several small remnants of formerly large Tertiary plateaus. The White Hills and Franklin Bluffs are outstanding examples of remnants preserved on the coastal plain. They stand 700 to 1,000 feet above the surrounding lowlands. The Katakturuk Plateau is an example of this old Tertiary surface that is still attached to the north side of the Sadlerochit Mountains.

In all cases the plateau areas are capped by gravel that is probably the remnant of a Late Tertiary pediment surface. The gravel, which is locally cemented by iron oxide, is more resistant to erosion than the soft underlying shales of Tertiary and Cretaceous age. The fact that these plateau areas are gravel covered and consequently well-drained, plus the difference in elevation over the surrounding lowland, give rise to

completely different plant communities. The bluffs and hills associated with these areas are also important falcon aeries.

Mesa

There are numerous and outstanding examples of mesas in the foothill section of the Arctic Lowland. All were formed by the erosive action of running water acting on bedrock of Cretaceous age. When the ancestral Brooks Range and the adjacent area were uplifted at the beginning of the Tertiary streams started to cut into deposits of Cretaceous age that had laid down in the Arctic Lowland area. Some of the Early Cretaceous sandstone and conglomerate were very resistant to erosion, but the streams gradually cut through them into the softer underlying shale and siltstone. Once the protective cover had been cut the underlying soft rock eroded very rapidly, leaving remnants of the resistant sandstone and conglomerate as mesas.

The mesas extend as a line across northern Alaska at about the same position relative to the mountain front and nearly all expose about the same sequence of rocks. Igloo and Poko Mountains are outstanding examples in the western part of the Arctic Lowland, Hatbox and Ayiyak Mesas are in the central part, and Ignek Mesa in the eastern part of the lowland. Most stand 1,000 to 1,500 feet above the surrounding areas and are important habitat of the Dall sheep as well as falcon and hawk aeries.

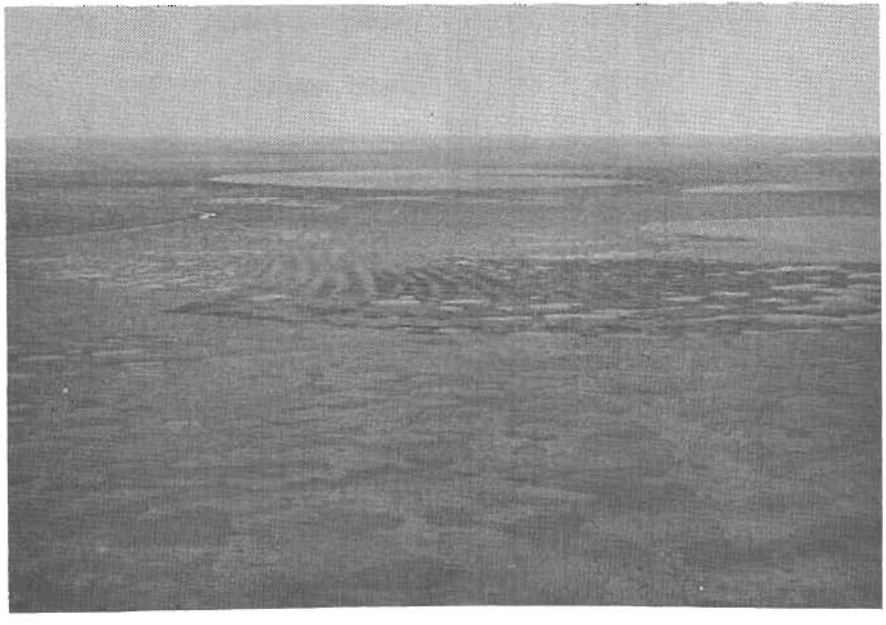
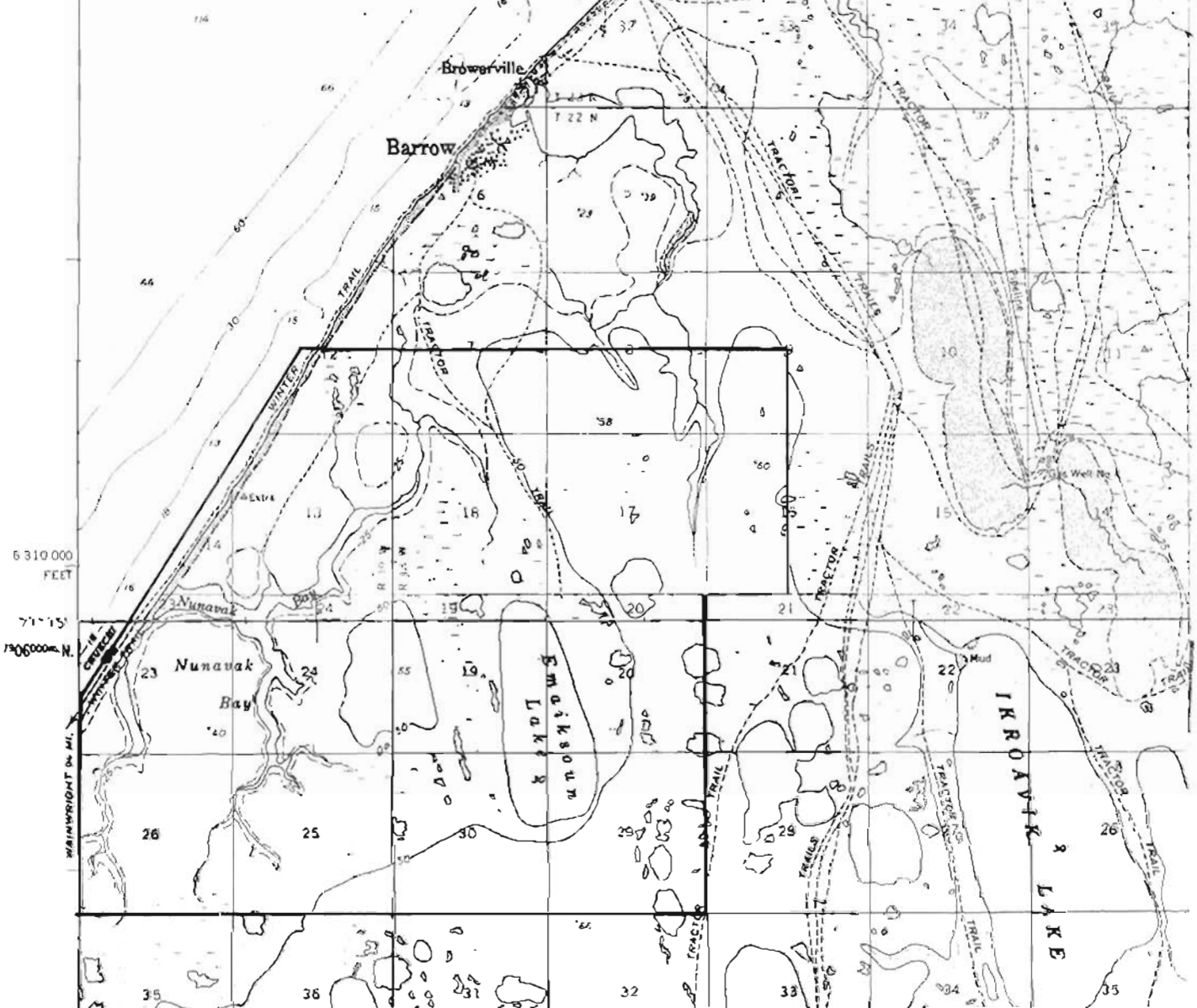


Figure 6.--Oriented lakes and permafrost polygons on Arctic coastal plain.

4. Sites not recommended

None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NATURAL LANDMARK SURVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 1 BARROW PLAINS 1A

Themes: Plains, plateaus, and mesas; Seashores and islands; Permafrost landforms.

Location: Arctic Coastal Plain Province, Barrow A-4 and B-4 quadrangles (1:63,360), T. 22 N., R. 18 E., sections 7, 8, 9, 16, 17, 18, 19. 20, 29, and 30; R. 19 W., sections 12, 13, 14, 23, 24, 25, and 26.

Ownership: Native village withdrawal; final selection not made as of 8/1/74.

Approximate acreage: 8,270 (3,346 hectares)

Geologic features: This site is an excellent example of the nearly flat coastal plain common to northern Alaska. The flat surface slopes a few feet per mile towards the northwest coast where it ends abruptly in bluffs 25 to 30 feet high on the Chukchi Sea coast. The material forming this plain is gravel, sand, silt, and clay of the Barrow unit of the Gubik Formation of Late Pleistocene age. This plain is probably no more than 10,000 to 20,000 years old, and unconformably overlies strata of Late Cretaceous age. Some excellent examples of permafrost polygons are present, both high- and low-center polygons are common. Large ice wedges are visible in the sea cliffs. Sediment transport by northeast littoral current has barred the mouth of two small streams forming Nunavak Bay. Emaiksoun Lake is a good example of the oriented lakes on the coastal plain.

Biotic features: The site is primarily an area of wet sedge meadow, but does contain good examples of dry upland meadow as well as aquatic plant communities around Emiaksoun Lake and the smaller ponds. The area is an important nesting area for shore birds and many migratory species.

Land use and vulnerability: The area has no organized land use at present, but its position about 1 mile south of the village of Barrow and adjacent to the Barrow gas field, on the east, makes it vulnerable to development. Several trails from the village cross the area, but it is still largely in its pristine condition.

Data source: Numerous sources. The Barrow area has for many years been the site of Naval Arctic Research Laboratory investigations as well as the International Biologic Project and Tundra Biome investigations, many scientific investigations already published and the area should be protected for future research.

Selected references:

Black, R. F., 1952, Growth of ice-wedge polygons in permafrost near Barrow, Alaska: Geol. Soc. America Bull., v. 63, no. 1212, p. 1235-1236.

_____, 1964, Gubik Formation of Quaternary age in northern Alaska: U.S. Geol. Survey Prof. Paper 302-C, p. C59-C91.

Duguid, J. O., 1971, Thin gravel deposits on wave-eroded cliffs near Barrow, Alaska: Arctic, Jour. Arctic Inst. N. Am., v. 24, no. 4, p. 304-306.

Hartwell, A. D., 1972, Coastal conditions of arctic northern Alaska, in Terrain and coastal conditions on arctic Alaska coastal plain: U.S. Army CRREL Special Report 165, p. 32-72.

Hume, J. D., and Schalk, Marshall, 1967, Shoreline processes near Barrow, Alaska, a comparison of the normal and near catastrophic: Arctic, Jour. Arctic Inst. N. Am., v. 20, no. 2, p. 86-103.

Other knowledgeable persons:

M. C. Brewer, Juneau, Alaska
A. H. Lachenbruch, Menlo Park, Calif.
Jerry Brown, Hanover, New Hampshire

Publicity sensitivity: None

NATURAL LANDMARK SURVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 2 PUTULIGAYUK PLAINS 1A

Themes: Plains, plateaus, and mesas; Permafrost landforms; Lakes and lake shores.

Location: Arctic Coastal Plains Province, Sagavanirktok D-4 quadrangle (1:63,360), T. 7 N., R. 12 E., sections 1, 2, 11, 12, 13, 14, 23, 24, 25, 26, 35, 36, R. 13 E., sections, all except 1, 12, 13, 24, 25 and 36.

Ownership: 19,200 acres lying in T. 7 N., R. 13 E. are withdrawn for a utility corridor under jurisdiction of Bureau of Land Management, Dept. of Interior. The remaining acreage is Alaska State selection, pending; 8/1/74

Approximate acreage: 26,880 acres (10,878 hectares)

Geologic features: An excellent example of the flat interior plain of northern Alaska. The 42 square mile area has only 80 feet of change in elevation. This change is so gradual it cannot be detected by the unaided eye. The plain formed of unconsolidated sand, silt, and gravel overlies Tertiary bedrock. Permafrost landforms abound in the area including pingos, high- and low-center polygons, beaded streams, and thermokarst lakes. Good examples of drained and partially filled lakes also present.

Biotic features: Wet sedge tundra plant communities primarily in western part of site with dry upland meadow type in eastern part. Aquatic plant communities near lakes and ponds. Important nesting area for migratory birds and caribou feeding grounds.

Land use and vulnerability: This site is highly vulnerable to destruction. The Trans-Alaska Pipeline is being built a couple of miles to the east and the remaining lands have oil and gas lease applications pending. Wells drilled to both east and west of the site, and probably will be drilled on the site in the near future.

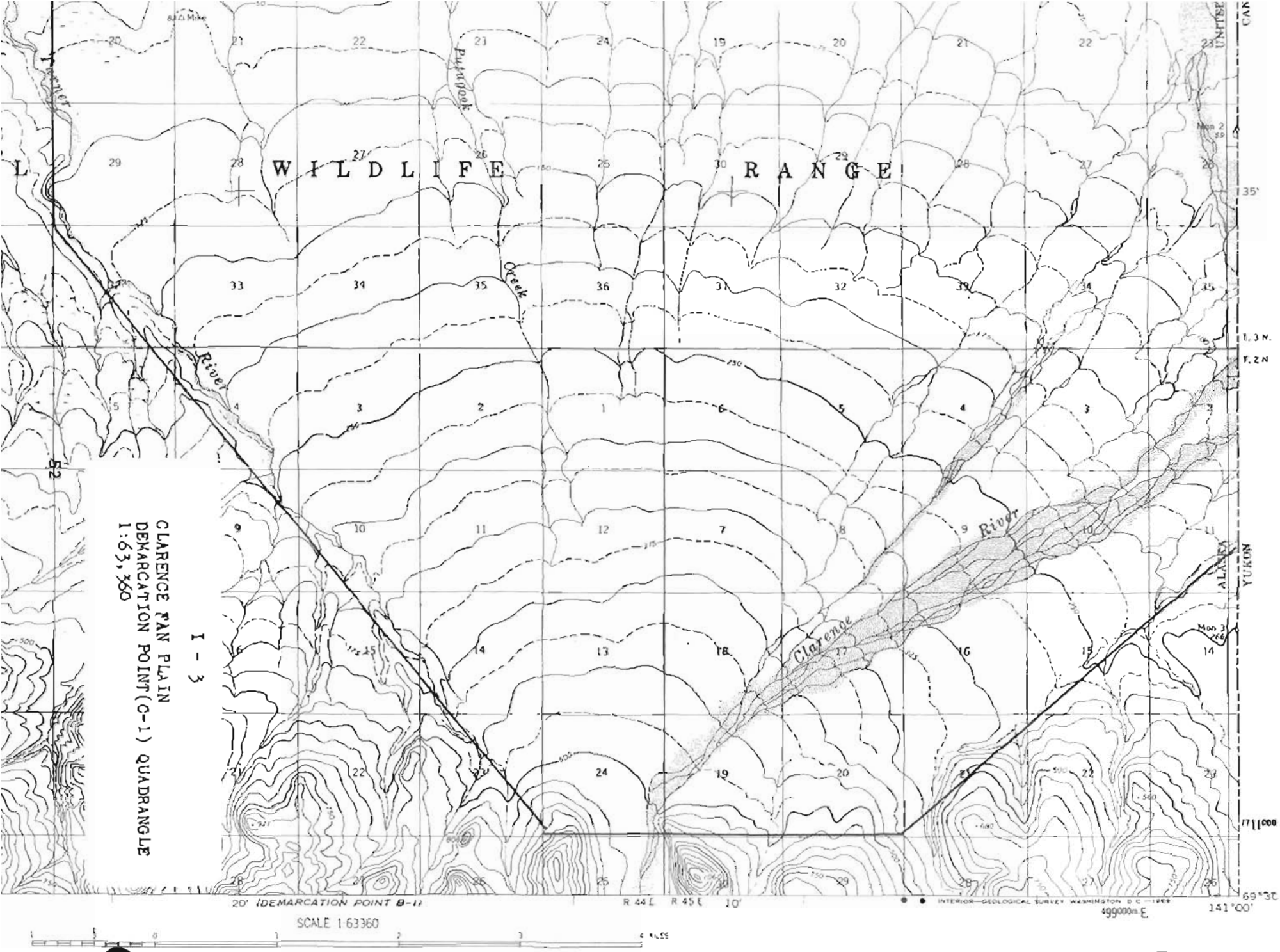
Data source: Author from personal knowledge and investigations of the site.

Selected references: None

Other knowledgeable persons:
John J. Koranda, Livermore, Calif.
Marvin D. Mangus, Anchorage, Alaska

Publicity sensitivity: None

Comments: Site definitely eligible for entry into Registry of Natural Landmarks.



CLARENCE FAN PLAIN
DEMARCATION POINT (C-1) QUADRANGLE
1:63,360

I - 3

Publicity sensitivity: None

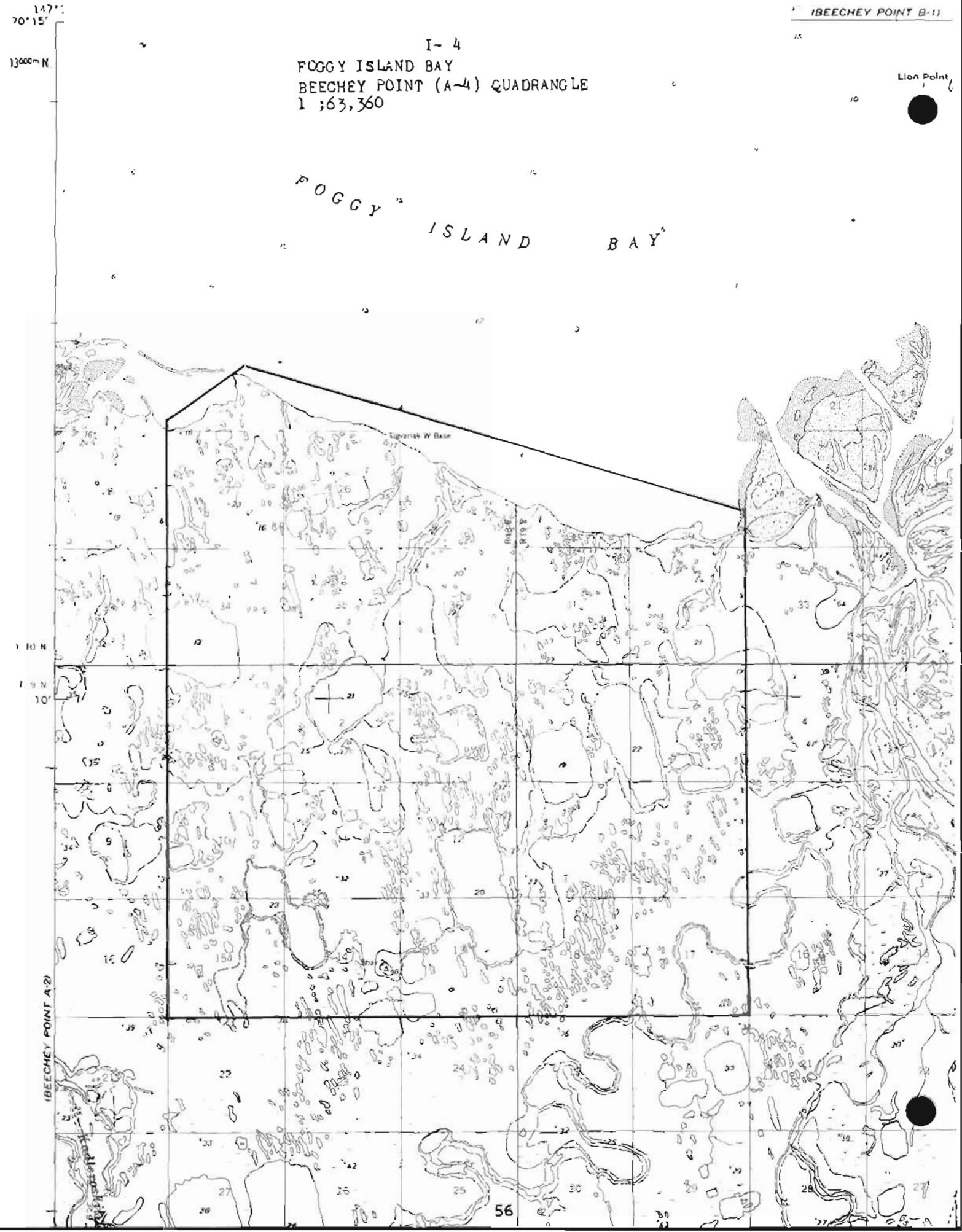
Comments: This site is of national significance and is eligible for entry into the Registry of Natural Landmarks.

I- 4

FOGGY ISLAND BAY

BEECHEY POINT (A-4) QUADRANGLE

1 ;63,360



sand dunes are present along the coast particularly near mouth of the Shaviovik River. During the Pleistocene unconsolidated material was dropped by the glaciers and carried by melt water streams onto this area where it covered the Tertiary and Upper Cretaceous bedrock. Much of the material reaching the coast was sand and silt which favors the development of permafrost features. Ice-free channels in this material permit the movement of ground water that aids in the development of the pingos.

Biotic features: An area of wet sedge tundra and aquatic vegetation.

Land use and vulnerability: The lands are all under lease to petroleum companies and several exploratory wells have been drilled in the area. The wells were dry; consequently, drilling activity may stop and they can possibly be preserved.

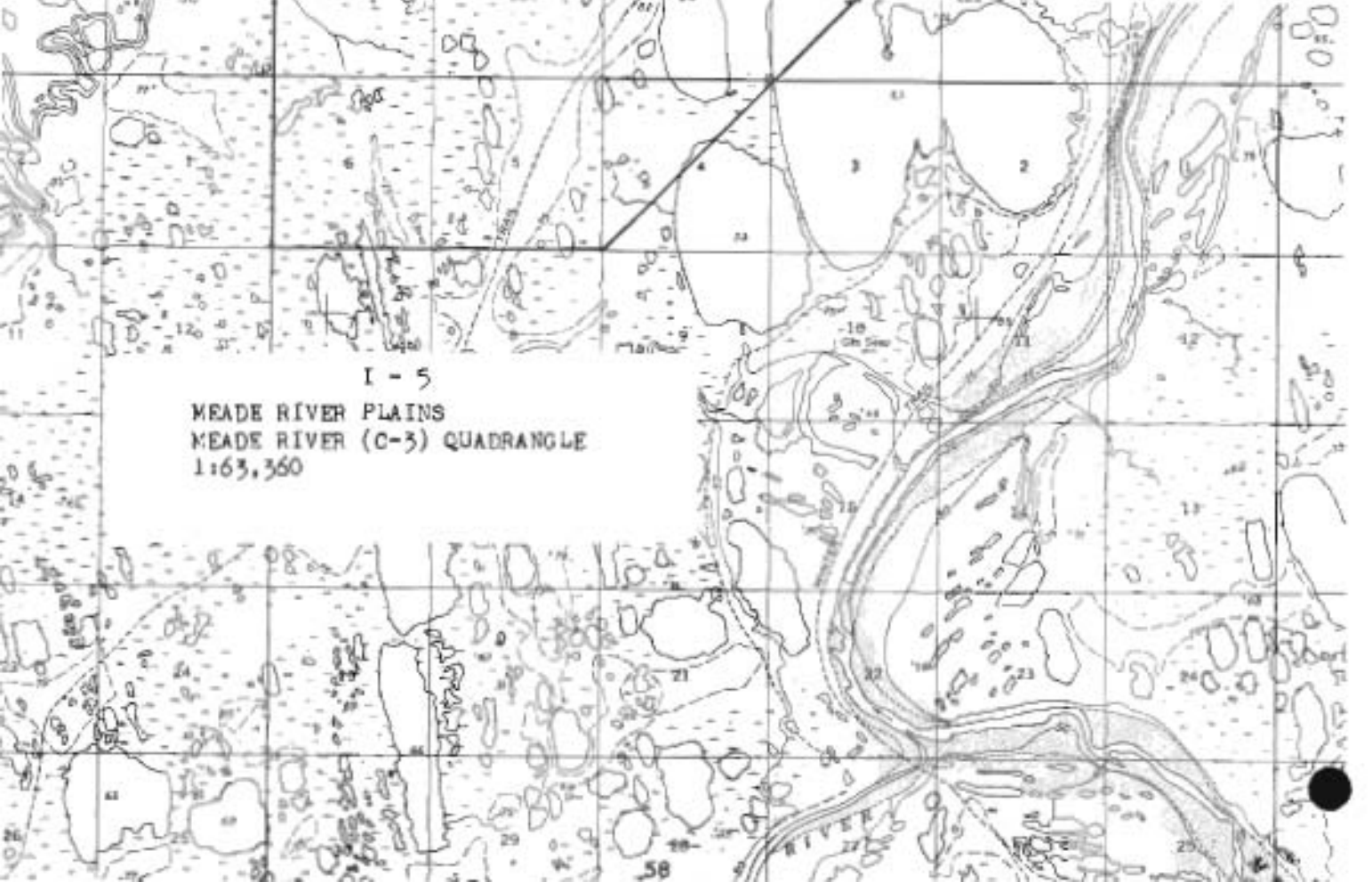
Data source:
M. D. Mangus, Anchorage, Alaska
Joint Federal-State Land Use Planning Commission for Alaska

Selected references: None

Other knowledgeable persons:
M. D. Mangus, Anchorage, Alaska

Publicity sensitivity: None

Comments: This is a fine site and worthy of Landmark status.


I - 5
MEADE RIVER PLAINS
MEADE RIVER (C-3) QUADRANGLE
1:63,360
RIVER

NATURAL LANDMARK SURVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 5 MEADE RIVER PLAINS 2B

Themes: Plains, plateaus, and mesas; Permafrost landforms; Lakes and lakeshores; River systems; Eolian landforms.

Location: Arctic Coastal Plain Province adjacent to the lower Meade River, Meade River C-3 quadrangle (1:63,360), T. 14 N., R. 22 W., sections 4, 5, and 6; T. 15 N., R. 22 W., sections 7-24 and 26-34.

Ownership: Naval Petroleum Reserve No. 4, U.S. Navy, Department of Defense. Native Village Withdrawals, selection not made as of 8/1/74.

Approximate acreage: 17,920 acres (7,252 hectares)

Geologic features: An excellent stretch of plains in the central part of the lake country of northwestern Alaska. The area contains only a few feet of relief and the monotony is broken only by the large northwest-trending oriented lakes. The Meade River meanders sluggishly past the eastern edge of the site with numerous sand dunes on its flood plain. Some of the lakes are compound and others are being filled by aquatic vegetation. This is entirely an area of sand and silt much of which was deposited a few tens of thousands of years ago when the site was at or near sea level. Inland beach ridges are common on this part of the coastal plain. Both high- and low-center polygons are to be found. The unconsolidated sand and silt are part of the Meade River unit of the Gubik Formation that unconformably overlies Late Cretaceous age bedrock.

Biotic features: Both wet sedge and dry tundra type plant communities, as well as aquatic vegetation found here. The sandy nature of the surficial deposits permit development of plant succession groups not generally found in other areas. Important nesting ground for birds.

Land use and vulnerability: There is no organized land use at present. The site is a few miles downriver from the Meade River coal mine which may be exploited in the near future.

Data source:

W. P. Brosgé, Menlo Park, Calif.
J. J. Koranda, Livermore, Calif.

Selected references:

Black, R. F., 1951, Eolian deposits of Alaska: Arctic, Jour. Arctic Inst. N. Am., v. 4, no. 2, p. 89-111.

_____, 1964, Gubik Formation of Quaternary age in northern Alaska: U.S. Geol. Survey Prof. Paper 302-C, p. C59-C91.

Smith, P. S., and Mertie, J. B., Jr., 1930, Geology and mineral resources of northwestern Alaska: U.S. Geol. Survey Bull. 815, p. 350.

Other knowledgeable persons:

W. P. Brosgé, Menlo Park, Calif.
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

NATURAL LANDMARK SURVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 6 ANGUN PLAINS 3C

Themes: Plains, plateaus, and mesas: River systems.

Location: Arctic Coastal Plain Province, eastern Arctic lowlands adjacent to Beaufort Sea, Demarcation Point D-3 quadrangle (1:63,360), T. 6 N., R. 38 E., sections 1-36.

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Dept. of the Interior.

Approximate acreage: 23,040 acres (9,324 hectares)

Geologic features: Northeasterly sloping gravel plain formed by outwash from Pleistocene glaciers in the Brooks Range. Somewhat similar to the alluvial fan plains found farther east along the mountain front. Beautiful paired terraces along the Angun and Sikrelurak Rivers show that these streams are cutting through these surficial deposits as they are being gradually uplifted. The glacial outwash deposits overlie the Gubik Formation, also of Quaternary age. Wood from a Poplar sp. log found at the contact between the two units on a nearby stream was dated by the Carbon-14 method as greater than 39,000 years old.

Biotic features: The comparatively dry and well-drained gravel of most of this area supports the dry upland meadow type tundra plant communities, some wet sedge meadow types in northwestern corner. Cutbank successions and shrub communities are found along the streams. This site is on the migration route of the eastern caribou herd.

Land use and vulnerability: None

Data source: Author from personal investigation.

Selected references:

Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1974, Preliminary geologic map, Demarcation Point quadrangle, Alaska: U.S. Geol. Survey MF Map.

Other knowledgeable persons:

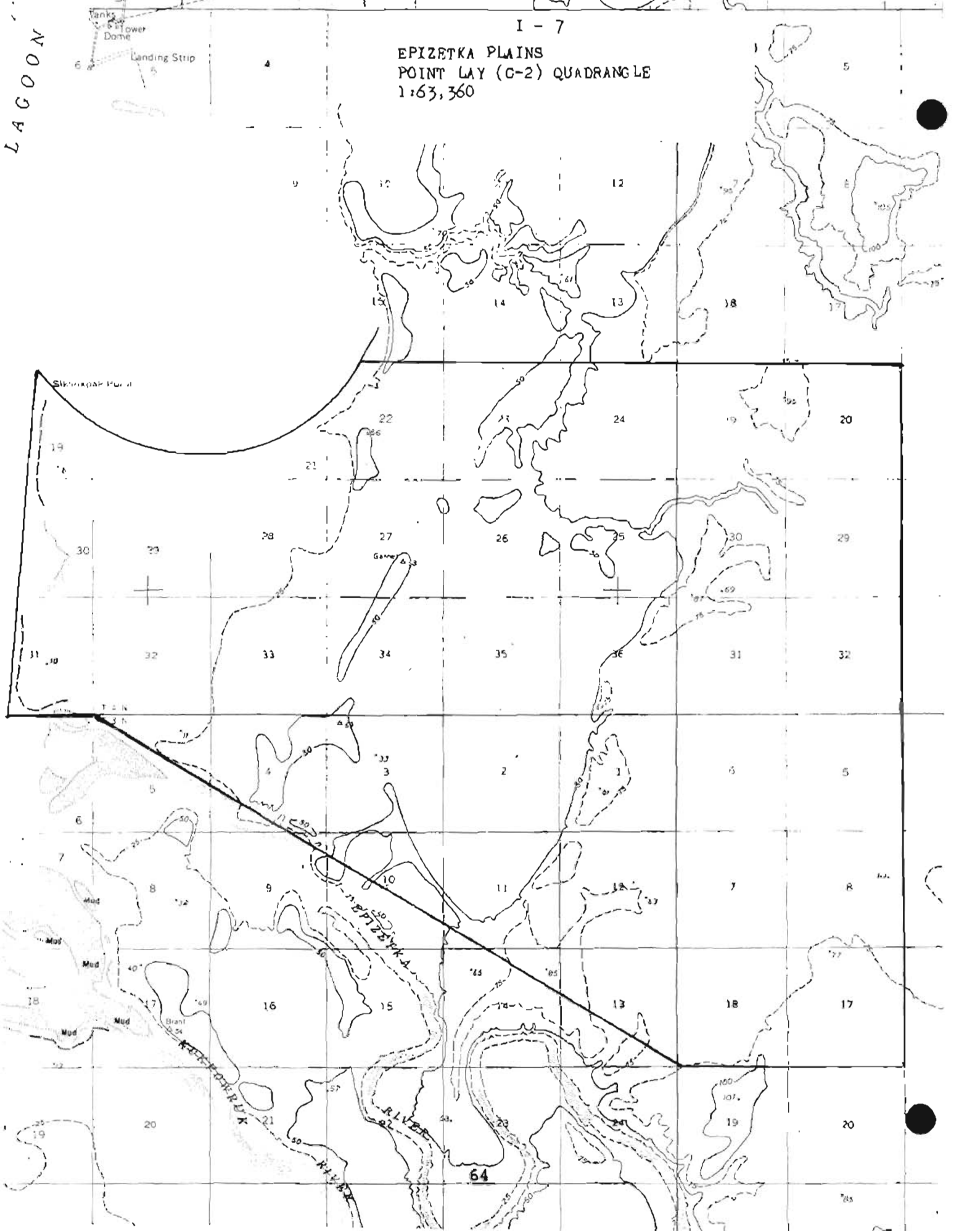
J. T. Dutro, Jr., Washington, D. C.
H. N. Reiser, Menlo Park, Calif.

Publicity sensitivity: None

Comments: This is a good example of the glacial gravel outwash plains found near the areas of maximum Pleistocene glaciation.

I - 7

EPIZETKA PLAINS
POINT LAY (C-2) QUADRANGLE
1:63,360



I - 7 EPIZETKA PLAINS 3C

Themes: Plains, plateaus, and mesas; Seashores and islands; Permafrost landforms.

Location: Arctic Coastal Plain Province, western Arctic lowland adjacent to Chukchi Sea and Kasegaluk Lagoon, Point Lay C-2 quadrangle (1:63,360), T. 3 N., R. 44 W., sections 5-8, 17 and 18; T. 3 N., R. 45 W., sections 1-5, 10-14; T. 4 N., R. 44 W., sections 19, 20 and 29-32; T. 4 N., R. 45 W., sections 19-36.

Ownership: State of Alaska selection (pending) and Native Village withdrawal. No final action on any part as of 8/1/74.

Approximate acreage: 20,000 acres (8,094 hectares)

Geologic features: An excellent example of a raised coastal plain showing successive periods of uplift in the series of old beach ridges found inland from the present coast. Two of this series are located within the site which borders Kasegaluk Lagoon behind an offshore bar. This is both a marine and river depositional coast. Low center polygons and beaded streams are abundant. This site very clearly shows how the coastal plain is being built and extended by the combination of marine and river deposition.

Biotic features: Mostly an area of wet sedge tundra, but does show a remarkable plant community succession from the shoreline to wet sedge to the dry meadow types on the old beach ridges. An important nesting area for shore birds and other water fowls. Sheltered marine ecosystems found in Kasegaluk Lagoon.

Land use and vulnerability: No organized use of the land at present. The site lies a few miles from the village of Point Lay and the White Alice station so occasional use is to be expected. All of the lands except those reserved for military use have oil and gas leases filed. No action will be taken on the leases until settlement of the Native Claims.

Data source: Author from personal investigations. Site also being considered as an ecological landmark.

Selected references:

Chapman, R. M., and Sable, E. G., 1960, Geology of the Utukok-Corwin region, northwestern Alaska: U.S. Geol. Survey Prof. Paper 303-C, p. C49-C167.

Hartwell, A. D., 1972, Coastal conditions of arctic northwestern Alaska, in Terrain and coastal conditions on arctic Alaska coastal plain: U.S. Army CRREL Special report 165, p. 32-72.

Other knowledgeable persons:

E. G. Sable, Denver, Colo.

R. M. Chapman, Menlo Park, Calif.

Publicity sensitivity: None

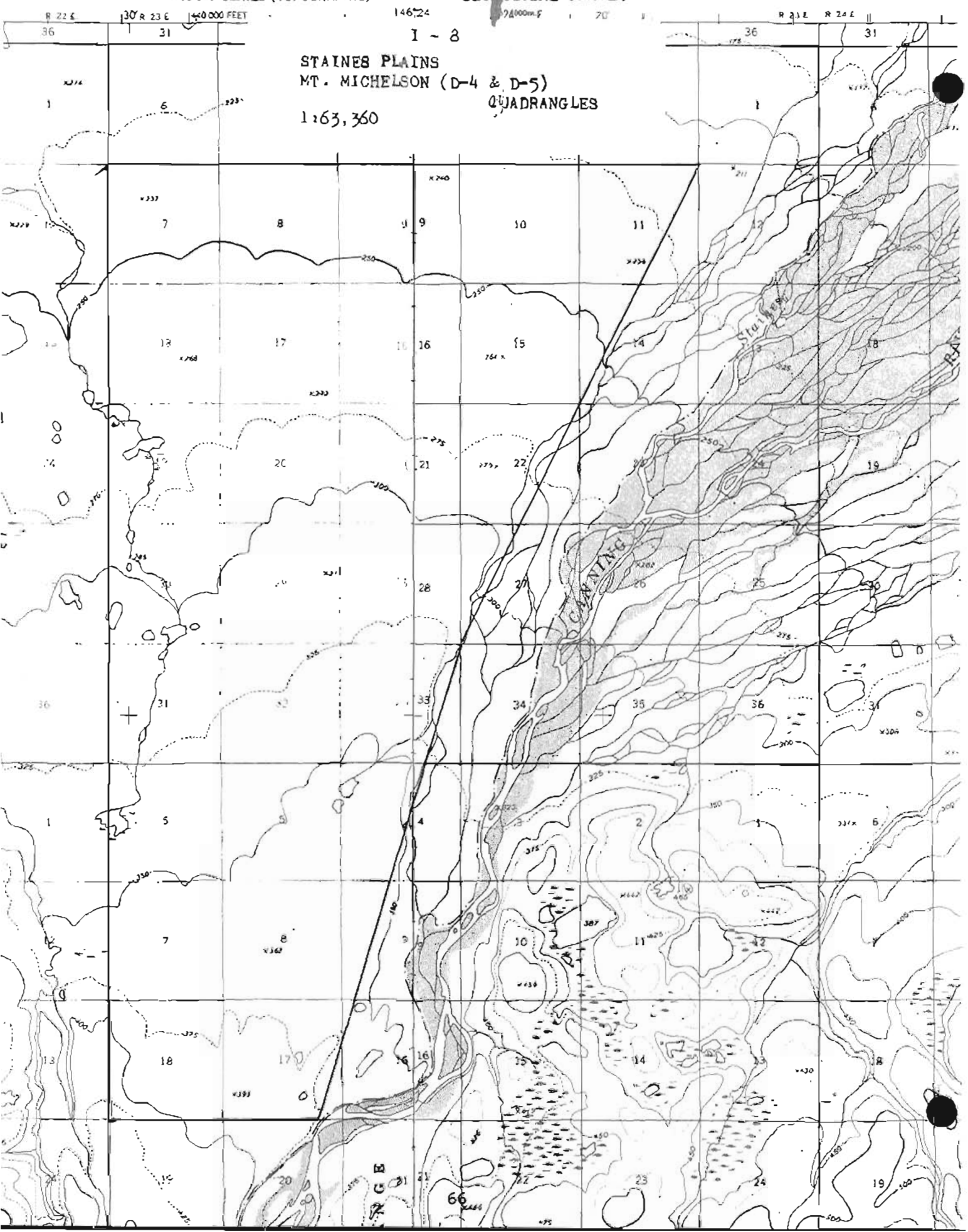
Comments: A good example of the western coastal plain showing how this plain is being constructed.

1:63 360 SERIES (TOPOGRAPHIC) GEOLOGICAL SURVEY

I - 8

STAINES PLAINS
MT. MICHELSON (D-4 & D-5)
QUADRANGLES

1:63,360



NATURAL LANDMARK SRUVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 8 STAINES PLAINS 4

Themes: Plains, plateaus, and mesas; River systems, Permafrost landforms

Location: Arctic Coastal Plain Province, central Arctic lowlands, along west side Canning River, Mt. Michelson D-4 and D-5 quadrangles (1:63,360), T. 6 N., R. 23 E., sections 4-9 and 17, 18; T. 7 N., R. 23 E., sections 7-11, 14-22, and 27-33.

Ownership: State of Alaska, and State of Alaska (pending), land under lease to several petroleum companies including Mobil Oil Corporation and Humble Oil Corporation.

Approximate acreage: 16,250 acres (6,576 hectares)

Geologic features: Northward sloping alluvial terrace plain formed mainly of gravel and sand outwash dropped by one of the late Pleistocene glaciers that came down the Canning River valley. The braided channel of the Canning lies along east side of the site. This is a good example of a braided stream characteristic of the Arctic Lowland. A mature beaded stream flows along west side of area and other permafrost features are common, namely polygonal ground.

Biotic features: Primarily an area of dry tundra meadow on the well-drained gravel and sand substratum. Abundant cutbank shrub communities.

Land use and vulnerability: Site lies just outside of the Arctic National Wildlife Range. All acreage under lease to petroleum companies and several wells drilled nearby. Site probably will be location of several more exploratory wells in near future.

Data source: Personal investigation of the area.

Selected reference:

Leffingwell, E. de K., 1919, The Canning River region, northern Alaska: U.S. Geol. Survey Prof. Paper 109, 251 p.

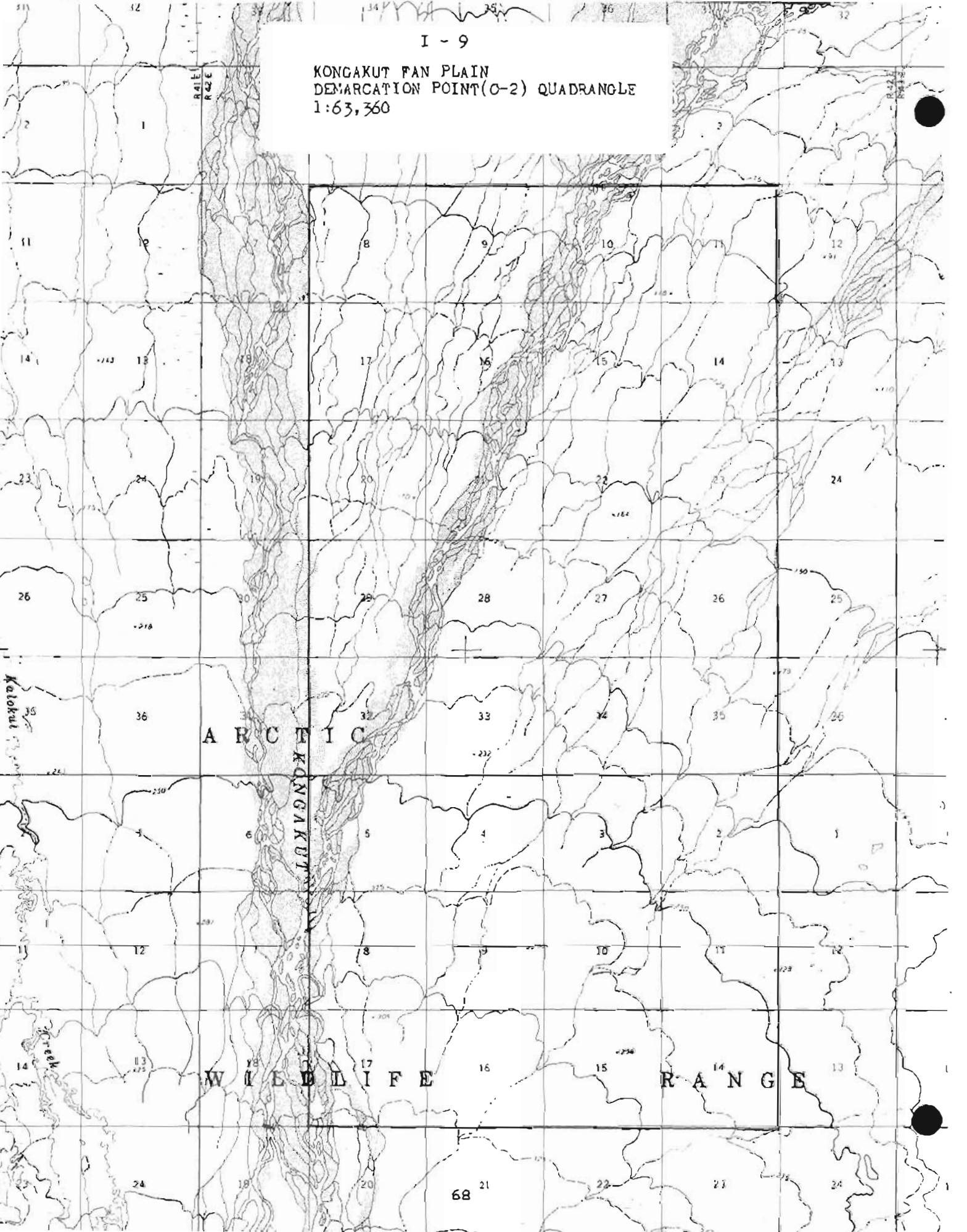
Other knowledgeable persons:
M. D. Mangus, Anchorage, Alaska
C. D. Mull, Denver, Colo.

Publicity sensitivity: None

Comments: A good example of an alluvial terrace plain, but probably not quite worthy of Landmark status.

I - 9

KONGAKUT FAN PLAIN
DEMARCATION POINT(C-2) QUADRANGLE
1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 9 KONGAKUT FAN PLAIN 4

Theme: Plains, plateaus, and mesas; River systems.

Location: Arctic Coastal Plain Province, eastern Arctic lowlands, Demarcation Point C-2 quadrangle (1:63,360), T. 3 N., R. 42 E., sections 2-5, 8-11, and 14-17; T. 4 N., R. 42 E., sections 8-11, 14-17, 20-23, 26-29, and 32-35.

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Department of the Interior.

Approximate acreage: 20,480 acres (8,288 hectares)

Geologic features: This site is a part of a very large alluvial fan plain constructed by the Kongakut River where it leaves the mountains and flows out onto the Arctic Lowland. Large masses of gravel, sand, and silt were dropped by Pleistocene glaciers in the Kongakut valley. The river has moved this out onto the coastal plain in the form of a fan that is about 100 square miles in area. The river now flows across this fan in numerous braided channels.

Biotic features: Riparian plant communities with abundant low shrubs and both dry and wet tundra exist. Part of the migration route of the eastern caribou herd.

Land use and vulnerability: Part of the Arctic National Wildlife Range. No immediate danger.

Selected references:

Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1974, Preliminary geologic map, Demarcation Point quadrangle, Alaska: U.S. Geol. Survey MF Map.

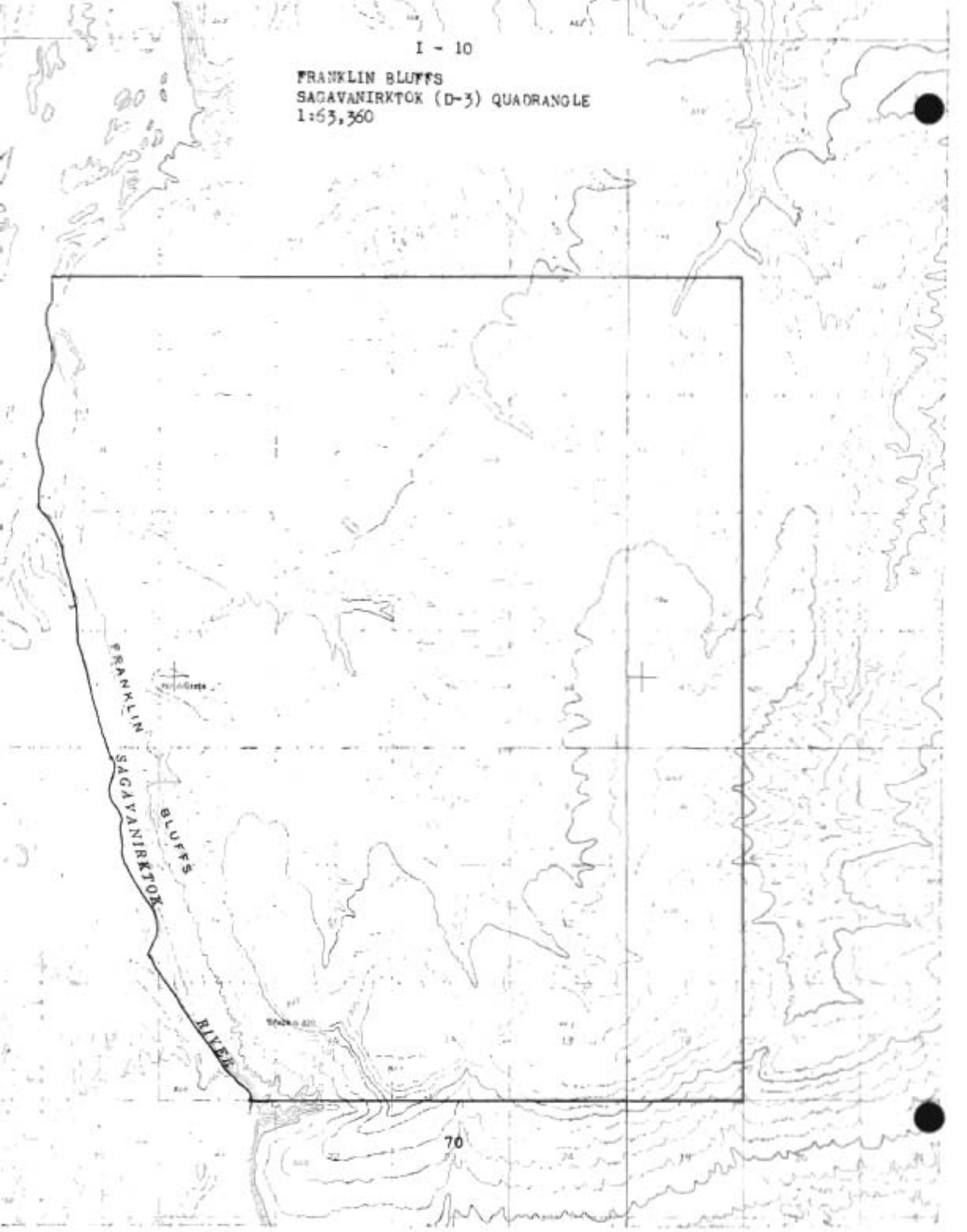
Other knowledgeable persons:

M. D. Mangus, Anchorage, Alaska
H. N. Reiser, Menlo Park, Calif.

Publicity sensitivity: None

Comments: This site is a part of an extremely large well-developed alluvial fan plain similar to the Clarence fan, but is not as spectacular as the Clarence fan.

FRANKLIN BLUFFS
SAGAVANIRKTOK (D-3) QUADRANGLE
1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 10 FRANKLIN BLUFFS 1B

Themes: Plains, plateaus, and mesas; River systems.

Location: Arctic Coastal Plain Province, east side of Sagavanirktok River, prominent landmark south of Prudhoe Bay, Sagavanirktok D-3 quadrangle (1:63,360), T. 5 N., R. 14 E., sections 1-5, 9-12, and 13-16; T. 5 N., R. 15 E., sections 6, 7, and 18; T. 6 N., R. 14 E., sections 13-17, 20-29, 32-36; T. 6 N., R. 15 E., sections 18, 19, 30, and 31.

Ownership: Utility corridor, Bureau of Land Management, Department of the Interior and State of Alaska selection (pending), no action taken as of 8/1/74.

Approximate acreage: 24,500 (9,915 hectares)

Geologic features: This site contains a fine example of an eroded remnant of the Late Tertiary plateau surface on the Arctic coastal plain. The plateau stands 500 to 600 feet above the surrounding lowland and represents a spectacular landmark visible for miles. The plateau surface is gravel covered, part of a gravel pediment that once covered most of northern Alaska from the Brooks Range to the Arctic Ocean. Where streams have cut through the gravel the soft Tertiary bedrock weathers into typical badlands topography. The bedrock is brilliantly colored red, pink, yellow, orange, and white that make imposing formations as the result of differential weathering. This is the type locality of the Franklin Bluffs Member of the Sagavanirktok Formation. Much of this member was deposited in a playa lake environment during the middle Tertiary. Excellent sedimentary features are preserved in the rocks including various types of cross bedding and varved sediments.

Biotic features: Many plant succession communities are represented as the bluffs are ascended, and the river bluffs are important falcon and hawk aeries. The area has been the site of numerous ecological investigations.

Scenic features: The varicolored cliffs developed in the soft Tertiary bedrock form a spectacular badlands topography. This is one of the most scenic spots on the coastal plains and one readily accessible from Prudhoe Bay.

Land use and vulnerability: This site is part of the utility corridor and the Trans-Alaska Pipeline and access road are being constructed nearby. This will undoubtedly alter the present natural state of this unique area which shall be preserved.

Data source:

M. D. Mangus, Anchorage, Alaska
C. D. Mull, Denver, Colo.
Personal investigation of the area and numerous other sources.

Selected references:

Gryc, George, Patton, W. W., Jr., and Payne, T. G., 1951, Present Cretaceous stratigraphic nomenclature of northern Alaska: Washington Acad. Sci. Jour., v. 41, no. 5, p. 159-167.

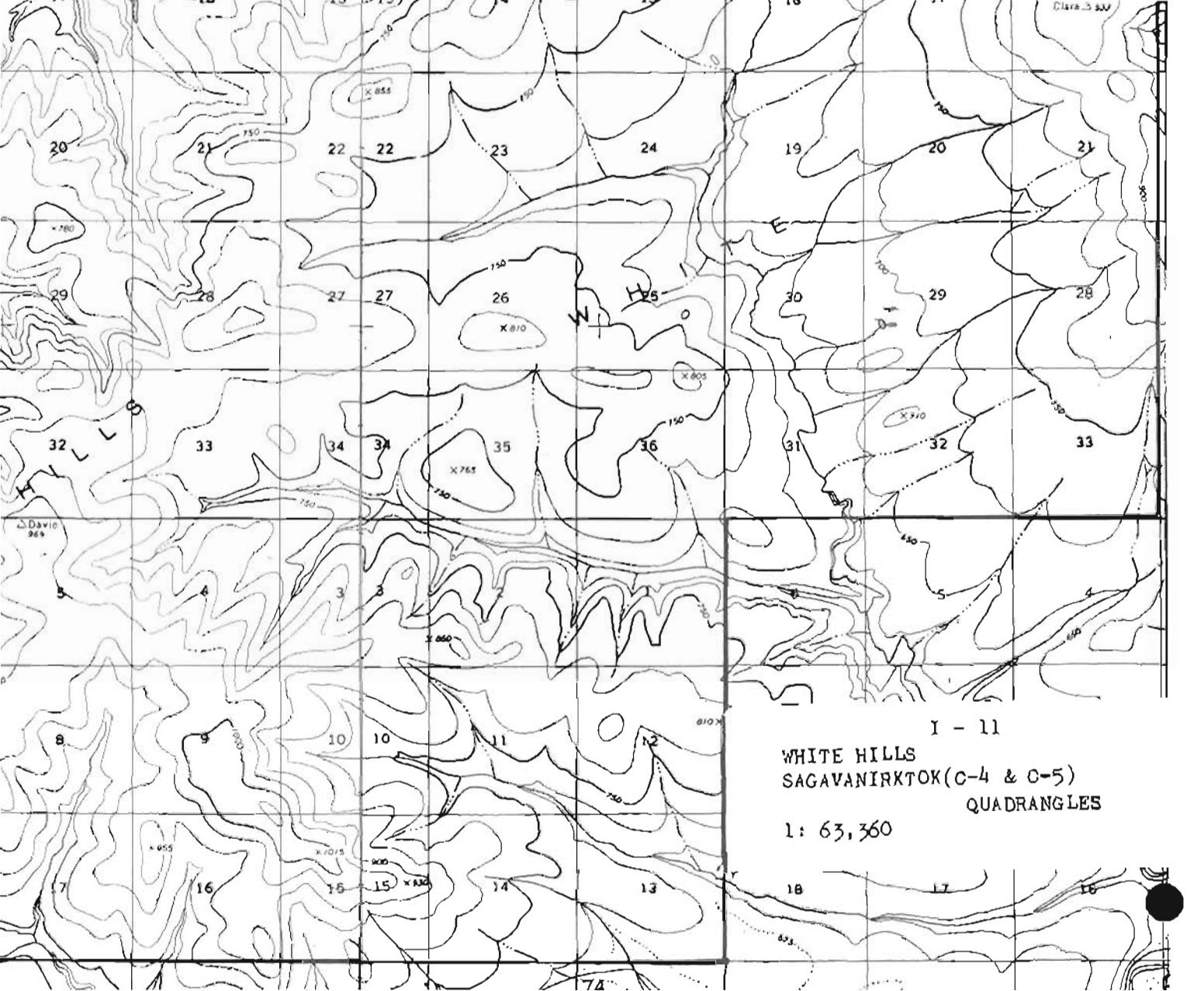
Detterman, R. L., Reiser, H. N., Brosgé, W. P., and Dutro, J. T., Jr., _____, Post-Cretaceous stratigraphy, northeastern Alaska: U.S. Geol. Survey Prof. Paper 886 (in preparation).

Koranda, J. J., 1960, The plant ecology of the Franklin Bluffs area, Alaska: Ph.D. Thesis, Univ. of Tennessee, 235 p.

Other knowledgeable persons:

M. D. Mangus, Anchorage, Alaska
J. J. Koranda, Livermore, Calif.

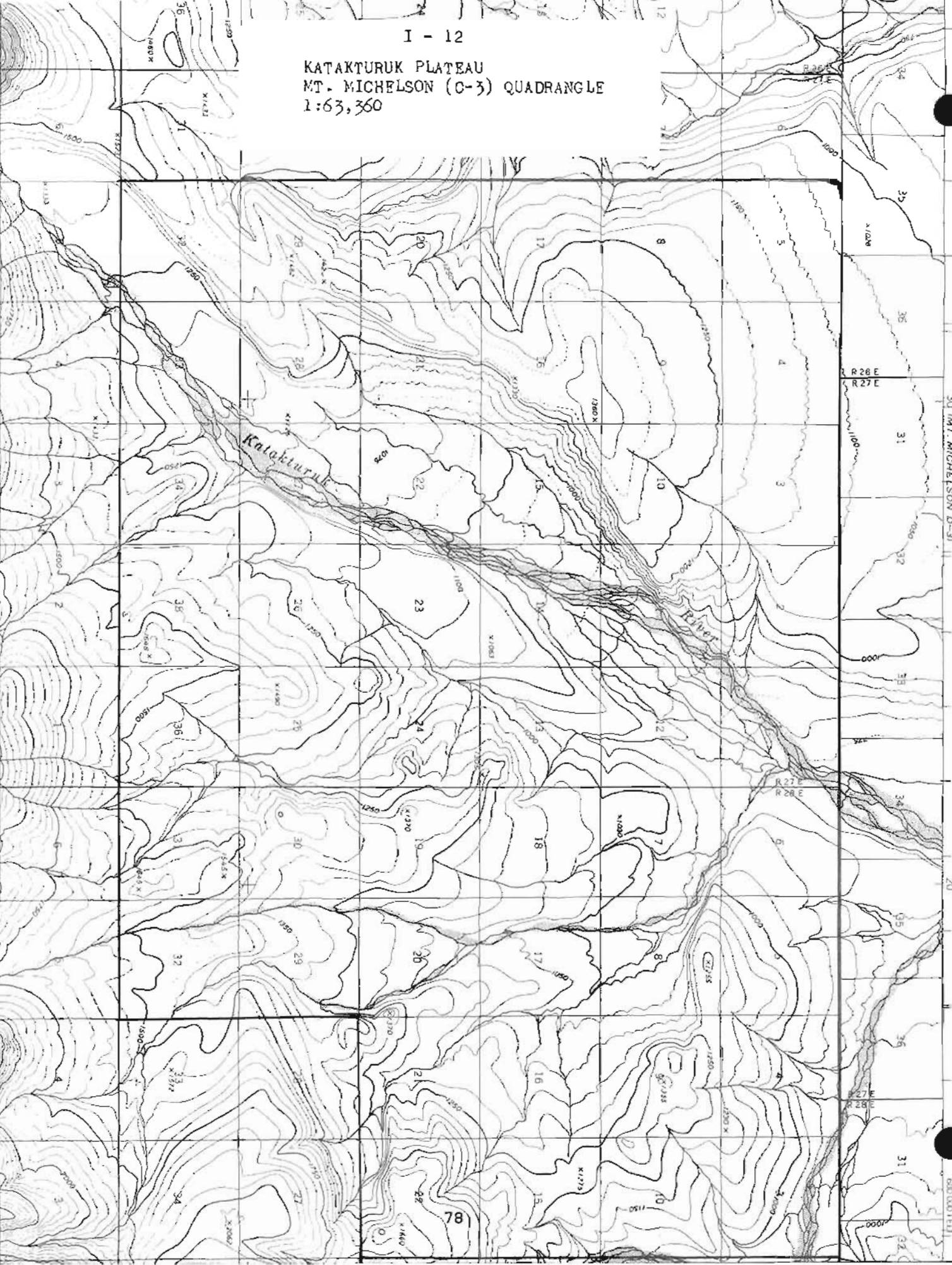
mended as an Ecological Landmark and has been selected as an Ecological Reserve area by the Joint Federal-State Land Use Planning Commission.


WHITE HILLS
Davis
I - 11
WHITE HILLS
SAGAVANIRKTOK(C-4 & C-5)
QUADRANGLES
1: 63,360

Comments: This site is of Landmark quality and should be included in the Registry of Natural Landmarks. Area also being considered as an ecological landmark.

I - 12

KATAKTURUK PLATEAU
MT. MICHELSON (C-3) QUADRANGLE
1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 12 KATAKTURUK PLATEAU 2C

Themes: Plains, plateaus, and mesas; Movement of the earth's crust.

Location: Arctic Foothills Province, north front of Sadlerochit Mountains, Mt. Michelson C-3 quadrangle (1:63,360), T. 4 N., R. 27 E., sections 1-5, 8-17, 20-29, and 32-36; T. 4 N., R. 28 E., sections 3-10, 15-22, and 29-32.

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Department of the Interior.

Approximate acreage: 32,000 acres (12,950 hectares)

Geologic features: This plateau area along the north flank of the Sadlerochit Mountains is formed by the continued uplift of the region. The Permian to Late Cretaceous bedrock is deeply dissected. The Katakturuk River has been able to maintain its gradient in spite of the uplift and has carved a deep canyon through the Mountains and across the plateau area to the north. The forces responsible for the uplift have produced many folds and faults that are well exposed on this site.

Biotic features: This site is much higher and closer to the mountains than any of the other plateau sites and as a result the plant communities are characteristically alpine. The area is also an important feeding area of the White Doll Sheep, caribou, and contains a few muskox. Falcon and hawk aeries are located on some of the bluffs.

Scenic features: This is one of the more scenic spots in the Arctic lowland. Rolling hills formed of brightly colored Upper Cretaceous rocks are flanked on the south by high rugged mountains of gray limestone. The sweep of the low coastal plain and ice-covered Arctic Ocean is plainly visible to the north.

Land use and vulnerability: Part of the Arctic National Wildlife Range so integrity and pristine condition probably will be preserved.

Data source:

C. D. Mull, Denver, Colo.
M. D. Mangus, Anchorage, Alaska
H. N. Reiser, Menlo Park, Calif.
Author from personal investigations of the site

Selected references:

Leffingwell, E. de K., 1919, The Canning River region, northern Alaska: U.S. Geol. Survey Prof. Paper 109, 251 p.

Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., Detterman, R. L., 1974, Preliminary geologic map, Mt. Michelson quadrangle, Alaska: U.S. Geol. Survey open-file report, 2 sheets.

Other knowledgeable persons:

W. P. Brosgé, Menlo Park, Calif.
J. T. Dutro, Jr., Washington, D.C.

Publicity sensitivity: Slight

NATURAL LANDMARK SURVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 13 IGLOO MOUNTAIN 1C

Themes: Plains, plateaus, and mesas; Movement of the earth's crust.

Location: Arctic Foothills Province, western Arctic section, De Long Mountains D-2 quadrangle (1:63,360); T. 7 S., R. 46 W., sections 31-34; T. 7 S., R. 47 W., section 36; T. 8 S., R. 46 W., sections 3-10; T. 8 S., R. 47 W., sections 1 and 12.

Ownership: Native Regional Deficiency area none of the acreage selected as of 8/1/74. Oil and gas leases applied for all of area.

Approximate acreage: 7,680 acres (3,107 hectares)

Geologic features: The Igloo Mountain site in the western Arctic Lowland is in an area of long east-west trending cuestas with intraspaced mesas. A region of spectacular vistas that is entirely different than most of the lowland region. As the ancestral Brooks Range was uplifted during the Early Cretaceous vast quantities of sediment were deposited in the sea flanking the mountains on the north. These sediments consisting of silt, clay, sand, and gravel were deeply buried and compacted into hard rock. When the region was uplifted the conglomerate formed from the gravel was very hard and formed a resistant cap rock that makes the top of the mesa. Erosion removed most of the strata down to the soft shales that form the base for the mesa. It now stands about 1,500 feet above the surrounding lowland. The rocks are warped into a gentle syncline that graphically portrays the forces that uplifted and shaped the landscape.

Biotic features: This site contains several plant community successions that are in general controlled by change in elevation. The upper surface of the mesa is primarily bare lichen-covered rock with some alpine plants in more protected spots.

Scenic features: The mesa and cuesta section of the Arctic Lowland offers spectacular views of high ridges and deep canyons. This is the most scenic part of the lowland.

Land use and vulnerability: There is no organized usage of the site at present. Oil and gas lease applications have been filed for entire area and development will probably proceed when the Native Land Claims are settled.

Data source:

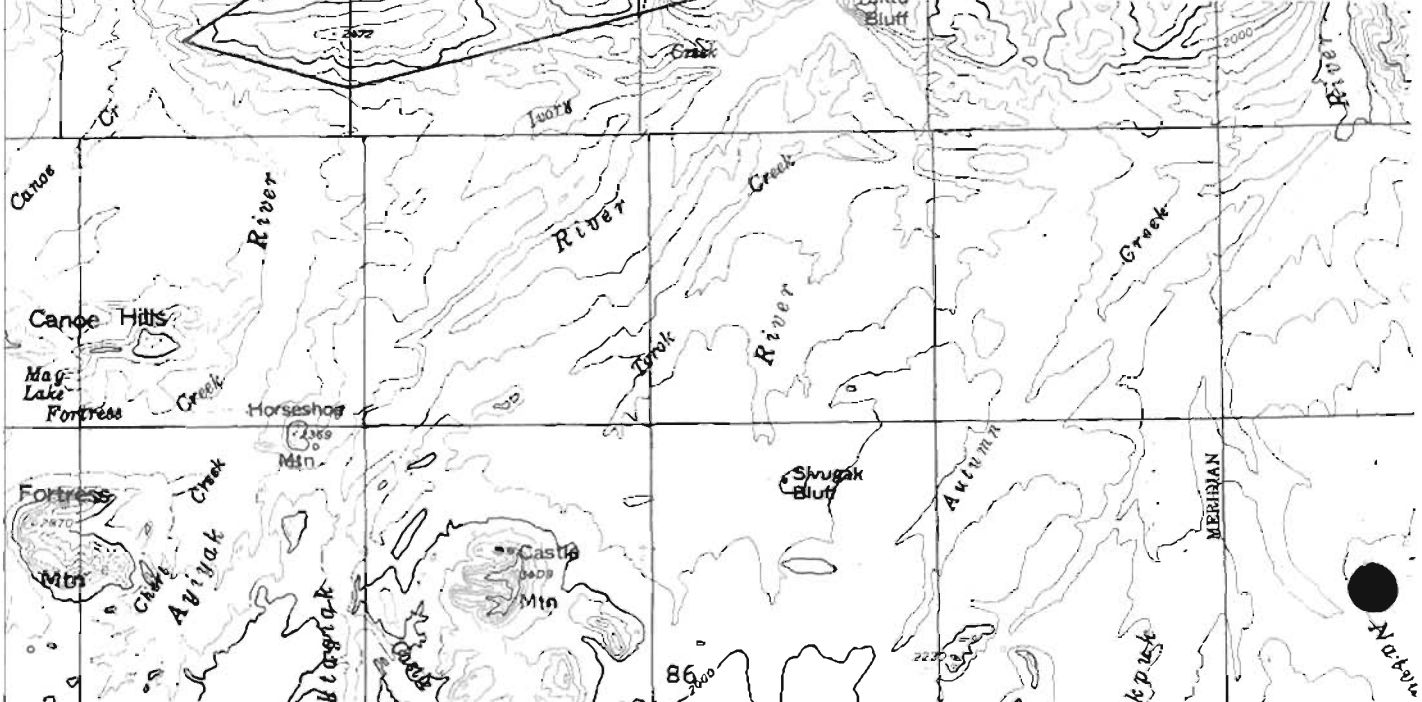
I. L. Tailleur, Menlo Park, Calif.
C. D. Mull, Denver, Colo.

Selected references:

Chapman, R. M., and Sable, E. G., 1960, Geology of the Utukok-Corwin region, northwestern Alaska: U.S. Geol. Survey Prof. Paper 303-C, p. C47-C167.

Other knowledgeable persons:

E. G. Sable, Denver, Colo.
R. M. Thompson, Denver, Colo.


Canoe
Cr
River
River
Creek
Creek
Canoe Hills
Mag-Lake
Fortress
Creek
Horseshoe
Mtn
Fortress
Mtn
Creek
Ayiyak
Creek
Ayiyak
Creek
Castle
Mtn
Tonk
River
Shugak
Bluff
Autumn
Creek
MERIDIAN
T 9 S
T 10 S
86

NATURAL LANDMARK SURVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 14 HATBOX MESA 1C

Themes: Plains, plateaus, and mesas; Movement of the earth's crust; Age of reptiles.

Location: Arctic Foothills Province, central foothills section, Chandler Lake quadrangle (1:250,000), T. 8 S., R. 2 W., sections 7-9 and 16-19; T. 8 S., R. 3 W., sections 7-24 and 27-30; T. 8 S., R. 4 W., sections 13, 14 and 21-27.

Ownership: Native Regional Deficiency area selections not made as of 8/1/74.

Approximate acreage: 19,325 acres (7,820 hectares).

Geologic features: Long, nearly flat lying ridges of conglomerate and sandstone cap the Rooftop Mesa that towers over the lowlands of shale. The south edge of the mesa forms the Tuktu Escarpment between the Chandler and Ayiyak Rivers. The resistant cap rock overlies siltstone, shale, and coal and is part of the Chandler and Tuktu Formations of Early Cretaceous age. The rocks were all derived from the ancestral Brooks Range to the south and were deposited by rivers that flowed across low swampy deltas to a shallow sea. The abundant swamp vegetation is now preserved as thick beds of coal and abundant plant fossils. Marine sea shells are common in the lower rocks before the deltas with swamps developed. These rocks were deeply buried, compacted and then uplifted into gentle folds. Streams flowing across the area kept pace with the uplift and now cut deep canyons through these rocks.

Biotic features: Dry upland tundra meadow is the most common plant community with areas of bare lichen-covered rock. Doll sheep and caribou are common visitors and many of the ledges contain hawk or falcon aeries.

Scenic features: Spectacular canyon and ridge country with imposing views of the north front of the Brooks Range.

Land use and vulnerability: No organized use of land at, but oil and gas leases applications filed and some development will take place when the Native Land Claims are settled.

Data source; Author from personal investigations in area.

Selected references:

Detterman, R. L., Bickel, R. S., and Gryc, George, 1963, Geology of the Chandler River region, Alaska: U.S. Geol. Survey Prof. Paper 303-E, p. E223-E324.

Gryc, George, Patton, W. W., Jr., and Payne, T. G., 1951, Present Cretaceous stratigraphic nomenclature of northern Alaska: Washington Acad. Sci. Jour., v. 41, no. 5, p. 159-167.

Other knowledgeable persons:

George Gryc, Menlo Park, Calif.
R. S. Bickel, Hacienda Heights, Calif.

Publicity sensitivity: None

NATURAL LANDMARK SURVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 15 IGNEK MESA 1C

Themes: Plains, plateaus, and mesas; Movement of the earth's crust; Development of life on earth; Age of reptiles.

Location: Arctic Foothills Province, eastern section east end of Ignek Valley, south of Sadlerochit Mountains, Mt. Michelson C-3 quadrangle (1:63,360), T. 2 N., R. 28 E., sections 5 and 6; T. 3 N., R. 28 E., sections 31 and 32.

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Department of the Interior.

Approximate acreage: 1,600 acres (647 hectares).

Geologic features: This site is small as mesas go, but it commands a spectacular view of the varicolored strata in Ignek Valley as well as the surrounding Shublik and Sadlerochit Mountains. This site also contains some of the richest fossil collecting areas in northern Alaska with a complete record for the Upper Triassic, Jurassic, and Lower Cretaceous. Nearly 100,000,000 years of the earth's history can be viewed in this one small site. The rocks were all deposited in the sea, but they show different source areas and changing conditions of deposition.

Biotic features: The upper surface contains only lichen-covered rock. Several types of plant communities are to be found along the sides in response to the changing types of bedrock. Doll sheep are commonly found on the mesa.

Scenic features: Spectacular view of the varicolored rocks exposed in Ignek Valley as well as imposing mountain scenery.

Land use and vulnerability: Part of the Arctic National Wildlife Range as is protected.

Data source:

H. N. Reiser, Menlo Park, Calif.
M. D. Mangus, Anchorage, Alaska
C. G. Mull, Denver, Colo.
Author from personal investigations in the area.

Selected references:

Leffingwell, E. de K., 1919, The Canning River region, northern Alaska: U.S. Geol. Survey Prof. Paper 109, 251 p.

Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1971, Preliminary geologic map, Mt. Michelson quadrangle, Alaska: U.S. Geol. Survey open-file report, 2 sheets.

Other knowledgeable persons:

George Gryc, Menlo Park, Calif.
W. P. Brosgé, Menlo Park, Calif.

Publicity sensitivity: Information on the abundant fossils should not be given widespread circulation. The use of the helicopter makes this site readily accessible and widespread indiscriminate collecting could soon deplete this locality.

NATURAL LANDMARK SURVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 16 POKO MOUNTAIN 2C

Themes: Plains, plateaus, and mesas and Movement of the earth's crust.

Location: Arctic Foothills Province, western section, De Long Mountains D-2 quadrangle (1:63,360), T. 7 S., R. 44 W., sections 2-6 and 8-10; T. 7 S., R. 45 W., section 1; T. 8 S., R. 44 W., sections 13-36; T. 8 S., R. 45 W., sections 13, 14, 23-26, and 36.

Ownership: Native Regions Deficiency area selections not made as of 8/1/74. Oil and gas lease applications filed on all of the area.

Approximate acreage: 23,360 acres (9,453 hectares)

Geologic features: Poko Mountain is a highly dissected mesa in the cuesta-mesa region of the western Arctic Lowland. Resistant bedrock of the Kukpowruk Formation forms the cap rock that overlies the surrounding lowlands formed of soft Torok Formation shale. The beds are gently folded into a syncline that is well exposed in the mountain. The top of the mesa stands about 1,500 to 1,700 feet above the lowland.

Biotic features: Several plant succession communities grow at increasing elevations along side of mesa. Mostly lichen-covered rock at summit. Poko Mountain is on the migration route of the western caribou herd.

Scenic features: Spectacular views of the valleys of Kokolik, Tingmerkpuk, and Kukpowruk Rivers and the ridge and canyon land of the western arctic lowland.

Land use and vulnerability: No organized land use at present, but most of the area included in oil and gas lease applications. Development probably will start with the settlement of the Alaska Native Claims.

Data source:
I. L. Tailleur, Menlo Park, Calif.
C. G. Mull, Denver, Colo.
E. G. Sable, Denver, Colo.

Selected references:
Chapman, R. M., and Sable, E. G., 1960, Geology of the Utukok-Corwin region, northwestern Alaska: U.S. Geol. Survey Prof. Paper 303-C, p. C49-C167.

Other knowledgeable persons:
M. D. Mangus, Anchorage, Alaska

Publicity sensitivity: None

Comments: The area is eligible for entry into Registry of Natural Landmarks.

I - 17
AYIYAK MESA
CHANDLER LAKE QUADRANGLE
1:250,000
153°00'
69°00'
R 4 W
510000m.E.
R 3 W.
30'
700 0000 FEET (ZONE 5)
R 1 W
152°
R 1 E
T. 5 S.
T. 6 S.
T. 7 S.
T. 8 S.
T. 9 S.
T. 10 S.
T. 11 S.
7650000m.N.
5 400 000 FEET (ZONE 5)
45'
30'
Ayiyak
Mesa
Hatbox
Mesa
Tuktu
Bluff
Gunsight
Pass
Canoe Hills
Mac
Lake
Fortress
Horseshoe
Mtn
Fortress
Mtn
Sivugak
Bluff
Castle
Mtn
Ayiyak
Creek
Kitnilivak
Speedway
Creek
Chandler
River
Wolverine
Creek
Nitnak
Creek
Canoe
Creek
River
Tuktu
Creek
Tuktu
River
Creek
Autumn
Sikrakpak
Natvakruak
Tigluktuk
Conjuring
Creek
Ayiyak
Valley
Ayiyak
River
Grandstand
Ridge
Cabin
Grandstand
Test Well
CHANDLER
RIVER
TRACT
NORTHERN
UMIAT
96

Approximate acreage: 4,900 acres (1,983 hectares)

Geologic features: This site is a small, low mesa formed of conglomerate and sandstone of the Prince Creek Formation of Late Cretaceous age. The Chandler and Ayiyak Rivers have cut through these resistant beds into the softer underlying shale and have left this erosional remnant standing a few hundred feet above the surrounding valleys.

Biotic features: Hawk and eagle aeries in cliffs along sides.

Land use and vulnerability: None at present

Data source: Author from personal investigations in area.

Selected references:

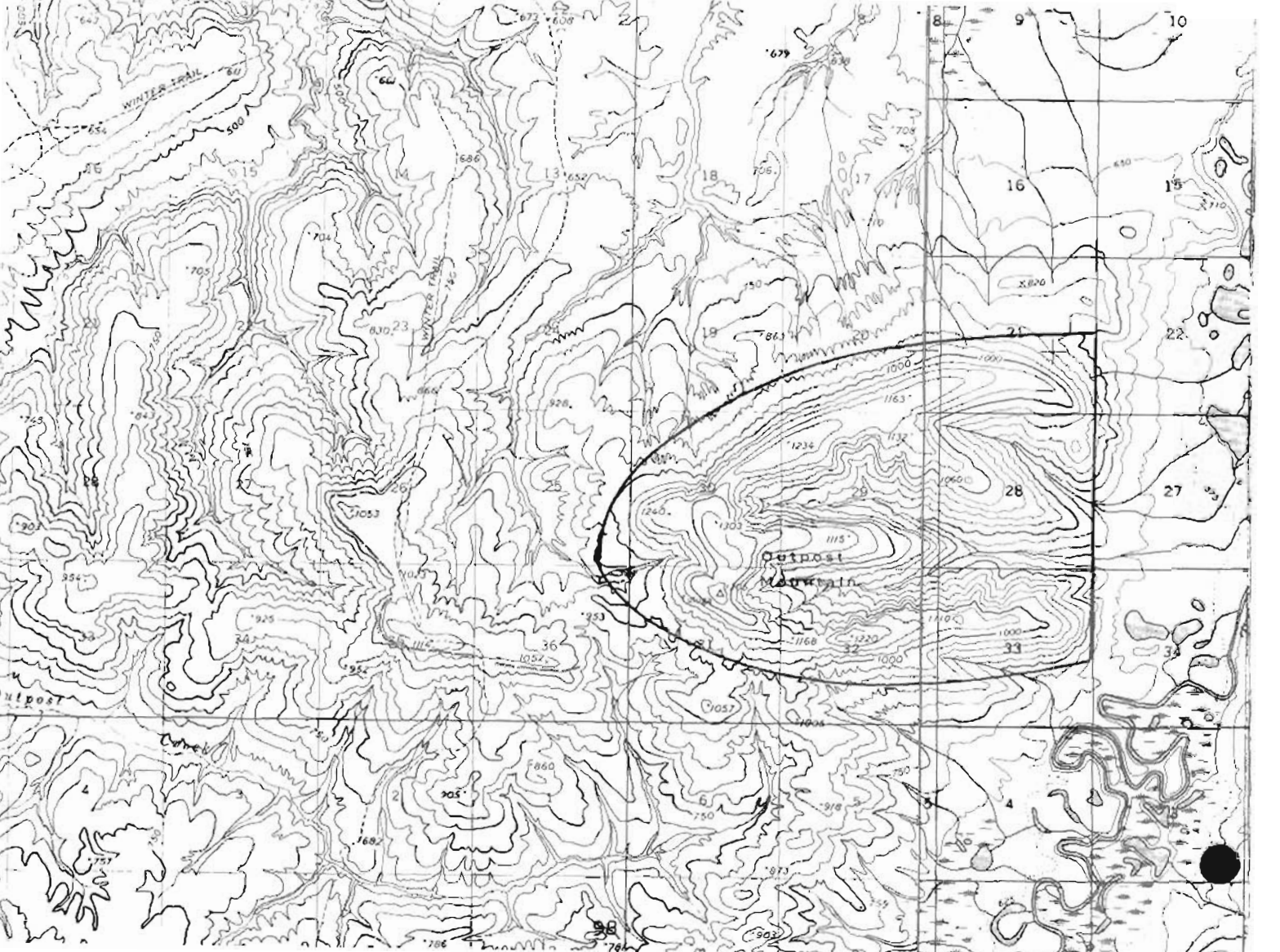
Detterman, R. L., Bickel, R. S., and Gryc, George, 1963, Geology of the Chandler River region, Alaska: U.S. Geol. Survey Prof. Paper 303-E, p. E223-E324.

Other knowledgeable persons:

W. W. Patton, Jr., Menlo Park, Calif.

Publicity sensitivity: None

Comments: This site may be nationally significant, but other better sites are available in the Arctic Lowland.


WINTER TRAIL
Outpost
Mountain

NATURAL LANDMARK SURVEY
LANDFORMS
PLAINS, PLATEAUS, AND MESAS

I - 18 OUTPOST MOUNTAIN 4

Themes: Plains, plateaus, and mesas; Movement of the earth;s crust; Development of life on earth; Age of reptiles.

Location: Arctic Foothills Province, central part, Colville River region, Umiat A-2 and A-3 quadrangle (1:63,360), T. 3 S., R. 3 E., sections 25 and 36; T. 3 S., R. 4 E., sections 19-21, 28-33.

Ownership: Native Regional Deficiency area selections not made as of 8/1/74.

Approximate acreage: 3,600 acres (1,457 hectares).

Geologic features: The Outpost Mountain site is a remnant of a large synclinal structure formed of resistant tuffaceous sandstone of the Schrader Bluff Formation of Late Cretaceous age. This is the northernmost mesa and sets on the edge of the flat coastal plain. The mountain is a prominent landmark about 30 miles southeast of Umiat. The white volcanic ash mixed with the sandstone forms spectacular white cliffs that stand 500 to 600 feet above the surrounding plains. The rocks forming the mesa were all deposited in the sea and contain abundant fossilized remains of the Late Cretaceous marine life present at the time of deposition. These rocks were gently warped as the area was uplifted in the Tertiary, and the streams that kept pace with the uplift now reflect the structure of the underlying strata.

Biotic features: Primarily an area of dry upland tundra meadow. Contains some unusual plants that have developed on the tuffaceous rocks. Falcon and hawk aeries on cliffs.

Land use and vulnerability: No organized use at present. Most of area under lease to oil companies and several exploratory wells drilled nearby.

Data source:
M. D. Mangus, Anchorage, Alaska
Author from personal field investigations

Selected references:
Detterman, R. L., Bickel, R. S., and Gryc, George, 1963, Geology of the Chandler River region, Alaska: U.S. Geol. Sruvey Prof. Paper 303-E, p. E223-E324.

Other knowledgeable persons:
R. M. Chapman, Menlo Park, Calif.
R. S. Bickel, Hacienda Heights, Calif.

Publicity sensitivity: None

Comments: The Outpost Mountain site is geologically interesting as the included rocks are different than any of the other mesas, but there are other better examples of mesas in the Arctic Lowland.

are the nesting ground for thousands of shore birds and the Secretary of the Interior is recommending the establishment of Coastal National Wildlife Refuges at Cape Lisburne and Cape Thompson.

Estuaries and Lagoons

Estuaries and lagoons along with offshore bars and spits are all characteristic of an emergent coastline. Much of the Arctic Lowland coast is recently emergent and the materials forming most of this coast are unconsolidated silt, sand, and gravel with the only cementing material being ice. These soft materials are easily eroded and transported by longshore littoral currents to form extensive offshore bars. Estuaries and lagoons are formed between the coast and the offshore bar. Kasegaluk Lagoon along the northwest coast is about 125 miles long and 1 to 4 miles wide. The offshore bar acts as a barrier between the sea ice and the coast so that the lagoon is ice-free for a longer period of time than is the open ocean. Fresh water from streams greatly dilutes the sea water in the lagoon and estuary forming a brackish water environment that supports different lifeforms than are found in the open sea.

Offshore Bars and Spits

The extensive system of offshore bars and spits are formed by the movement of sand and gravel along the coast by longshore currents. The Northern Alaska Littoral Current flows northeastward along the northwest coast of the Arctic Lowland and has built a nearly continuous bar a few hundred feet to 1/4-mile wide from south of Point Lay to Point Barrow. This bar contains some interesting plant communities as well as being the nesting ground for many geese and ducks. Other extensive offshore bars are found along the northeastern lowland coast, but they are mainly absent from the central part of the lowland.

Islands

Islands by their isolated condition, cut-off from the mainland, excite the imagination of most people. Here lifeforms are free to develop independently and there are often unusual or relic species found. However, islands lying offshore of the Arctic Lowland do not have the isolation usually afforded these areas. The sea is frozen most of the year and thus they are effectively tied to the mainland. Most of the islands are merely remnants of former offshore bars, but some contain interesting plants and birds.

Raised Beaches

Raised beaches found inland from the modern coast are a good indication that the coastline is emergent. Sometimes these beaches contain wood or other material that can be dated by the radiocarbon method which gives us an indication of the rate of uplift. Numerous raised beaches, some with sand dunes, are found in many parts of the Arctic Lowland. Most are on sites that are being considered for other categories of Natural Landmarks and not specifically on their merit as raised beaches.

SEASHORES AND ISLANDS

1. Highest priority

   Icy Cape - Kasegaluk Lagoon - subtheme - offshore bar - lagoon

   Cape Lisburne - subtheme - wave-cut cliffs

   Flaxman Island - subtheme - islands

   Point Hope - subtheme - offshore bar - spit

   Icy Reef - Beaufort Lagoon - subtheme - offshore bar - lagoon

2. Site definitely eligible

   Kasegaluk Lagoon - subtheme - lagoon

   Wainwright Inlet - Kuk River - subtheme - estuary

3. Sites of uncertain eligibility

   Walakpa Bay - subtheme - barred estuary

   Point Barrow - Nuwuk Spit - subtheme - spit

   Demarcation Bay - subtheme - spit

4. Sites not recommended

   Plover Islands - subtheme - islands

   Admiralty Bay - subtheme - estuary

Figure 9. Wave-cut cliffs in the Lisburne Peninsula area

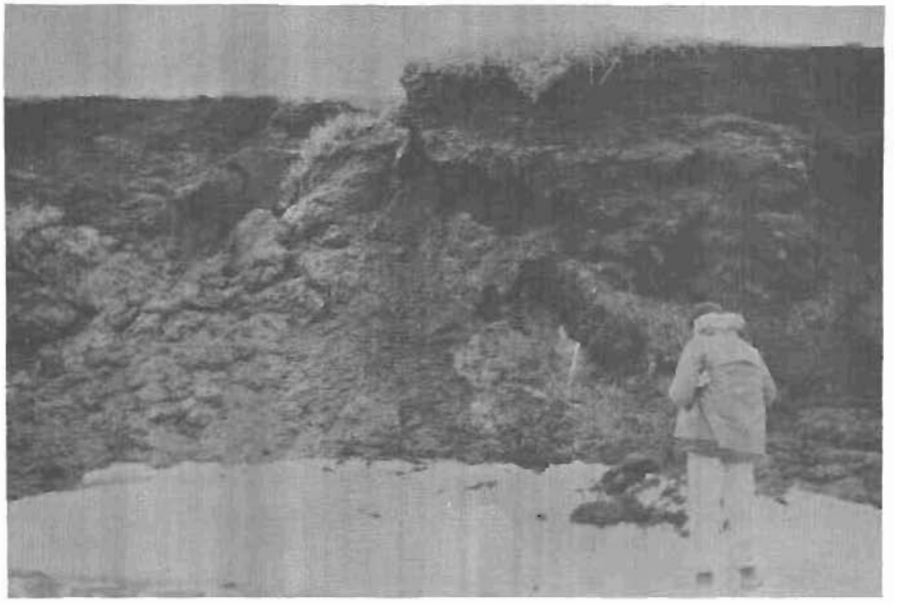


Figure 10. Ice-rich unconsolidated sediment typical of most of Arctic Lowland coast.

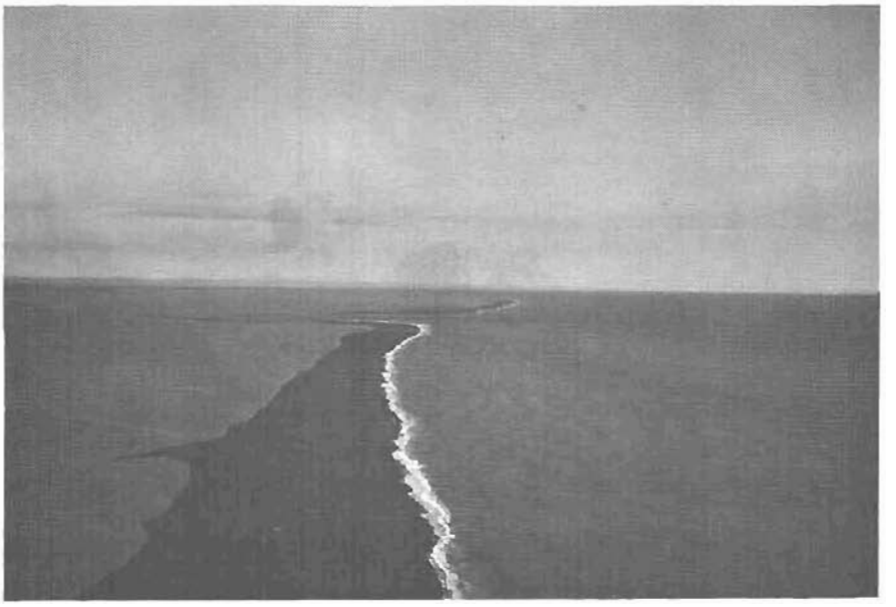
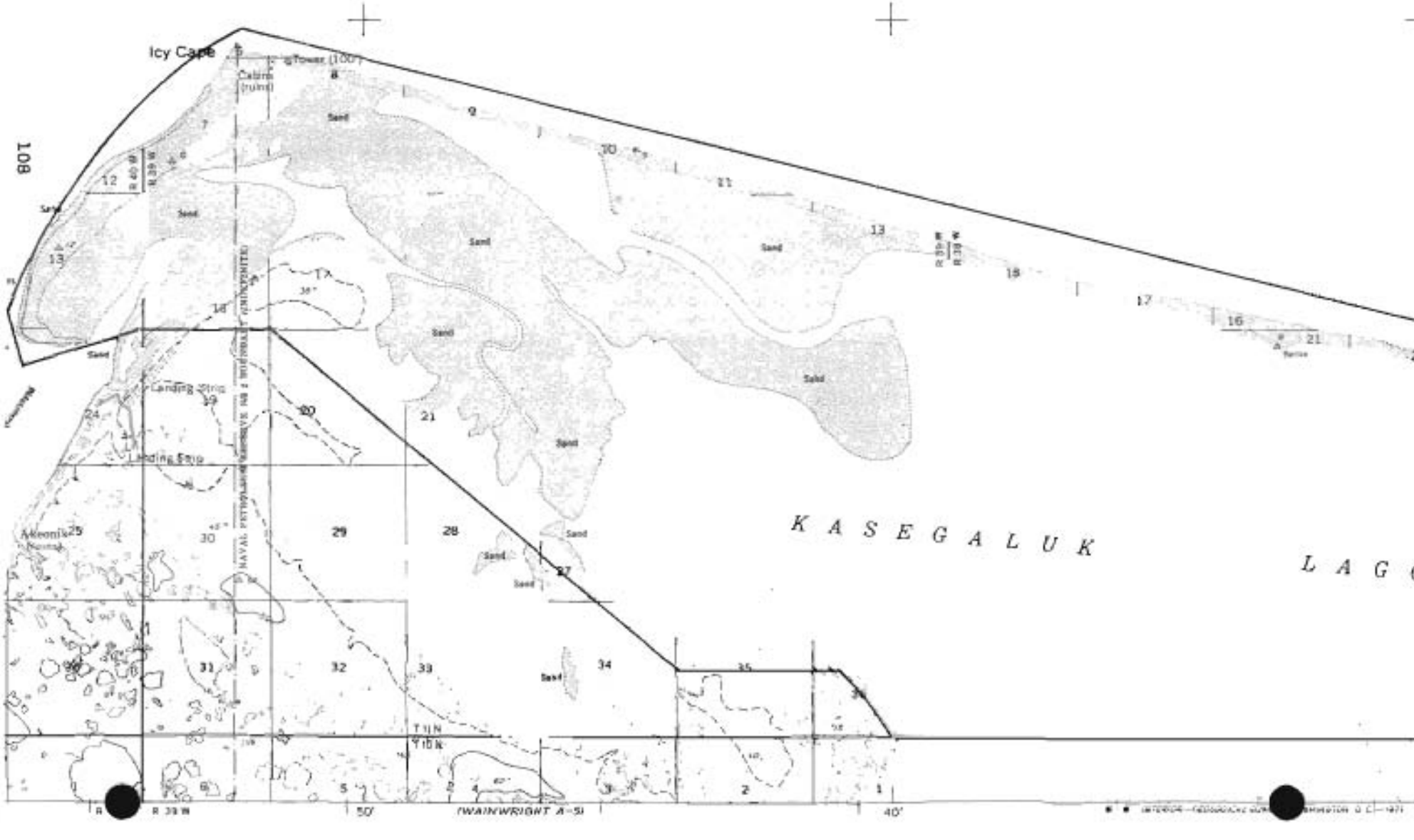


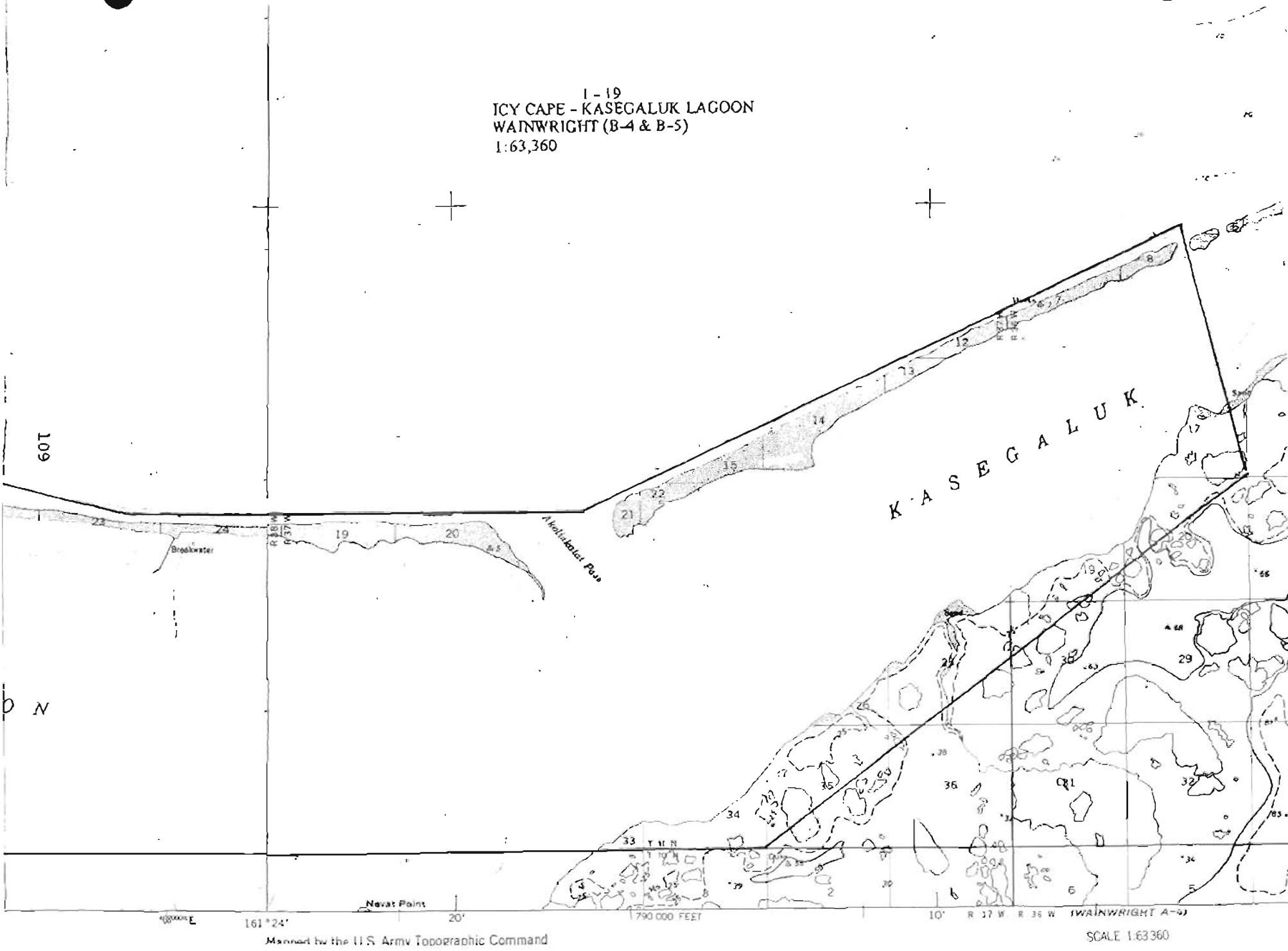
Figure 11. Section of offshore bar near Point Lay.

Figure 12. Goose nesting area on offshore bar near Icy Cape.

ICY CAPE - KASEGALUK LAGOON
WAINWRIGHT (B-4 & B- 5)
1: 63,360



I - 19
ICY CAPE - KASEGALUK LAGOON
WAINWRIGHT (B-4 & B-5)
1:63,360



Mapped by the U.S. Army Topographic Command

SCALE 1:63 360

NATURAL LANDMARK SURVEY
LANDFORMS
SEASHORES AND ISLANDS

I - 19 ICY CAPE - KASEGALUK LAGOON 1B

Themes: Seashores and islands (subtheme, offshore bar, spits, lagoon and estuary); Eolian landforms.

Location: Arctic Coastal Plain Province, northwestern coast, Wainwright B-4 and B-5 quadrangles (1:63,360), T. 11 N., R. 36 W., sections 7, 8, 17-20, and 30; T. 11 N., R. 37 W., sections 12-15, 19-36; T. 11 N., R. 38 W., sections 15-36; T. 11 N., R. 39 W., sections 5-18, 20-28, and 34-36: T. 11 N., R. 40 W., sections 12 and 13.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense and State of Alaska. State selection includes only T. 11 N., R. 40 W.

Approximate acreage: 34,000 acres (13,760 hectares).

Geologic features: This site is an outstanding example of an offshore bar with compound spits enclosing a lagoon and estuary system. This is a part of the long offshore bar deposited by the northeast-trending Northern Alaska Littoral Current. This segment is primarily sand and extensive dune systems are developed, both active and stabilized. The stabilized dunes are covered by sea grass and are an important nesting ground for ducks and geese. Marine and lagoonal depositional systems are well portrayed at Icy Cape.

Biotic features: An outstanding area for marine life both mammals and shell fish. They are more abundant and varied at Icy Cape than at any other section of the Arctic Lowland coast. The abundant shell fish also attract a greater variety of birds than are found elsewhere. Brackish water species are found inside the bar and marine outside. The stabilized dune areas contain a great variety of shore plants. The abundance of bird and animal life attracted early man and the site contains important archeological remains.

Scenic features: Excellent sea coast scenery.

Land use and vulnerability: No organized land use at present, but with increased pressure for oil exploration and development in the offshore area of the Chukchi Sea this section of offshore bar will undoubtedly be utilized. This is a fragile ecosystem that cannot withstand much abuse.

Data source:

Arthur Grantz, Menlo Park, Calif.
M. D. Mangus, Anchorage, Alaska
Author from personal investigation

Selected references:

Hartwell, A. D., 1972, Coastal conditions of arctic northern Alaska, in Terraine and coastal conditions on arctic Alaska coastal plain: U.S. Army CRREL Special Report 165, p. 32-72.

_____, 1973, Classification and relief characteristics of northern Alaska coastal zone: Arctic, Jour. Arctic Inst. N. Am., v. 26, no. 3, p. 244-252.

Other knowledgeable persons:

M. D. Mangus, Anchorage, Alaska
Arthur Grantz, Menlo Park, Calif.

Publicity sensitivity: None

Comments: The Icy Cape-Kasegaluk Lagoon site is definitely of national significance and should be given highest priority for entry in the Registry of Natural Landmarks. This is truly an outstanding site.

CAPE LISBURNE
POINT HOPE (D-2) QUADRANGLE
1:63,360

NATURAL LANDMARK SURVEY
LANDFORMS
SEASHORES AND ISLANDS

I - 20 CAPE LISBURNE 1B

Themes: Seashores and islands (subtheme, wave-cut cliffs); Movement of the earth's crust; Changes in marine life.

Location: Arctic Foothills Province, west coast bordering Chukchi Sea; Point Hope D-2 quadrangle (1:63,360); T. 6 S., R. 60 W., sections 32 and 33; T. 7 S., R. 60 W., sections 4, 5, 8, 9, 16, 17, 20, 21, 28, and 33; T. 8 S., R. 60 W., sections 4, 9, and 16.

Ownership: Bureau of Land Management, Department of the Interior under Section D-2 of Alaska Native Claims Settlement Act. Area being recommended as a Coastal National Wildlife Refuge.

Approximate acreage: 3,900 acres (1,578 hectares).

Geologic features: Cape Lisburne presents a spectacular view of a section of the earth's crust. The Brooks Range, here represented by the Lisburne Hills, are terminated by the sea in a series of wave-cut cliffs. The folding and faulting that these strata have undergone during the process of mountain building are well exposed in the cliffs. These are some of the oldest rocks exposed in the Arctic Lowland. They are nearly all gray limestone of Late Paleozoic (Mississippian) age and contain abundant fossilized forms of the sea life present when they were deposited about 300 to 324 million years ago.

Biotic features: Thousands of birds nest in the cliffs along this section of the Arctic Lowland. The site is being recommended by the Secretary of the Interior as a Coastal National Wildlife Refuge. A succession of plant communities from shore to alpine varieties are present.

Scenic features: Contains some of the most spectacular scenery in the Arctic Lowland.

Land use and vulnerability: A Distant Early Warning Radar Station is located about 1 mile east of site and personnel from site occasionally visit site, but there is no organized usage at present.

Data source:

M. D. Mangus, Anchorage, Alaska
A. K. Armstrong, Menlo Park, Calif.
I. L. Tailleur, Menlo Park, Calif.

Selected references:

Armstrong, A. K., 1970, Carbonate facies and the Lithostrotionid corals of the Mississippian Kogruk Formation, De Long Mountains, northwestern Alaska: U.S. Geol. Survey Prof. Paper 664, 38 p.

_____, 1972, Biostratigraphy of Mississippian Lithostrotionid corals, Lisburne Group, Arctic Alaska: U.S. Geol. Survey Prof. Paper 743-A, p. A1-A28.

_____, Mamet, B. L., and Dutro, J. T., Jr., 1971, Lisburne Group, Cape Lewis-Niak Creek, northwestern Alaska: U.S. Geol. Survey Prof. Paper 750-B, p. B23-B34.

Other knowledgeable persons:

J. T. Dutro, Jr., Washington, D.C.
I. L. Tailleur, Menlo Park, Calif.
E. G. Sable, Denver, Colo.

Publicity sensitivity: None

Comments: Cape Lisburne is highly eligible to be entered into the Registry of Natural Landmarks and is strongly recommended on the basis of the geologic, biotic, and scenic qualities.

I - 21

FLAXMAN ISLAND

FLAXMAN ISLAND (A-4) QUADRNAGLE
1:63,360

NATURAL LANDMARK SURVEY
LANDFORMS
SEASHORES AND ISLANDS

I - 21 FLAXMAN ISLAND 1A

Themes: Seashores and islands (subtheme, Islands); Eolian landforms.

Location: Arctic Coastal Plain Province, island in Beaufort Sea near mouth of Canning River, Flaxman Island A-4 quadrangle (1:63,360), T. 10 N., R. 23 E., sections 23-26; T. 10 N., R. 24 E., sections 19-21, 26-30, and 33-36.

Ownership: State of Alaska, under lease in part to Humble Oil Company.

Approximate acreage: 4,000 acres (1,680 hectares).

Geologic features: The Flaxman Island site is extremely interesting in that it is the type locality for the Flaxman Formation of Quaternary age. The formation is composed mainly of gravel and boulders that probably represent a glacial deposit. The interesting thing, however, is that the fragments are all exotic rock types that are not found in the Brooks Range. The best evidence suggests they came from somewhere in interior Canada. These rocks include pink granite, ultramafic intrusives, diabase, red quartzite, tan marble and a variety of other exotic rocks. Some of the boulders are 8 to 10 feet across. The Flaxman Formation composes the main part of the island. An offshore bar with compound spits extends westward about 4 miles from the main part of the island.

Biotic features: Several important shore plant communities and bird nesting areas. Also the site of polar bear dens. Flaxman Island is being considered also, as an Ecologic Natural Landmark.

Land use and vulnerability: Land under lease to oil companies and one well has been drilled along north shore. This site is in delicate ecologic balance and continued development will make it highly vulnerable to destruction.

Data source:

C. G. Mull, Denver, Colo.
J. J. Koranda, Livermore, Calif.

Selected references:

Leffingwell, E. de K., 1919, The Canning River region, northern Alaska: U.S. Geol. Survey Prof. Paper 109, 251 p.

Barnes, P. W., Reimnitz, Erk, Gustafson, C. W., and Larsen, B. P., 1973, U.S.G.S. marine geologic studies off northern Alaska, 1970 through 1972, date type and location, U.S. Geol. Survey open-file report.

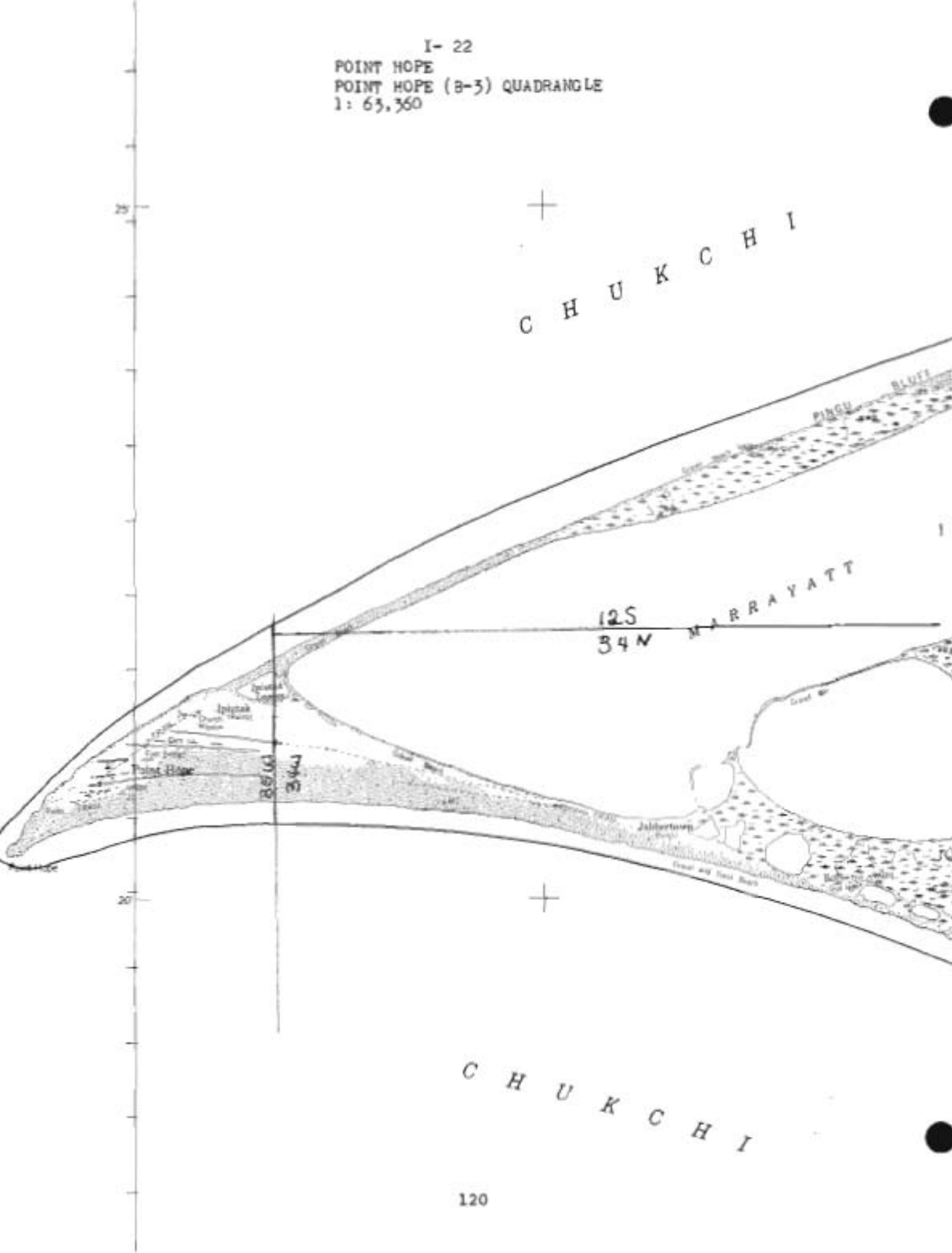
Other knowledgeable persons:

M. D. Mangus, Anchorage, Alaska

Publicity sensitivity: None

Comments: The Flaxman Island site is definitely qualified for entry into the Registry of Natural Landmarks on both geologic and biotic features. The cabin of E. de K. Leffingwell, an early explorer of the Arctic, is located on the island and has been made a state historic site.

I- 22
POINT HOPE
POINT HOPE (B-3) QUADRANGLE
1: 63,360

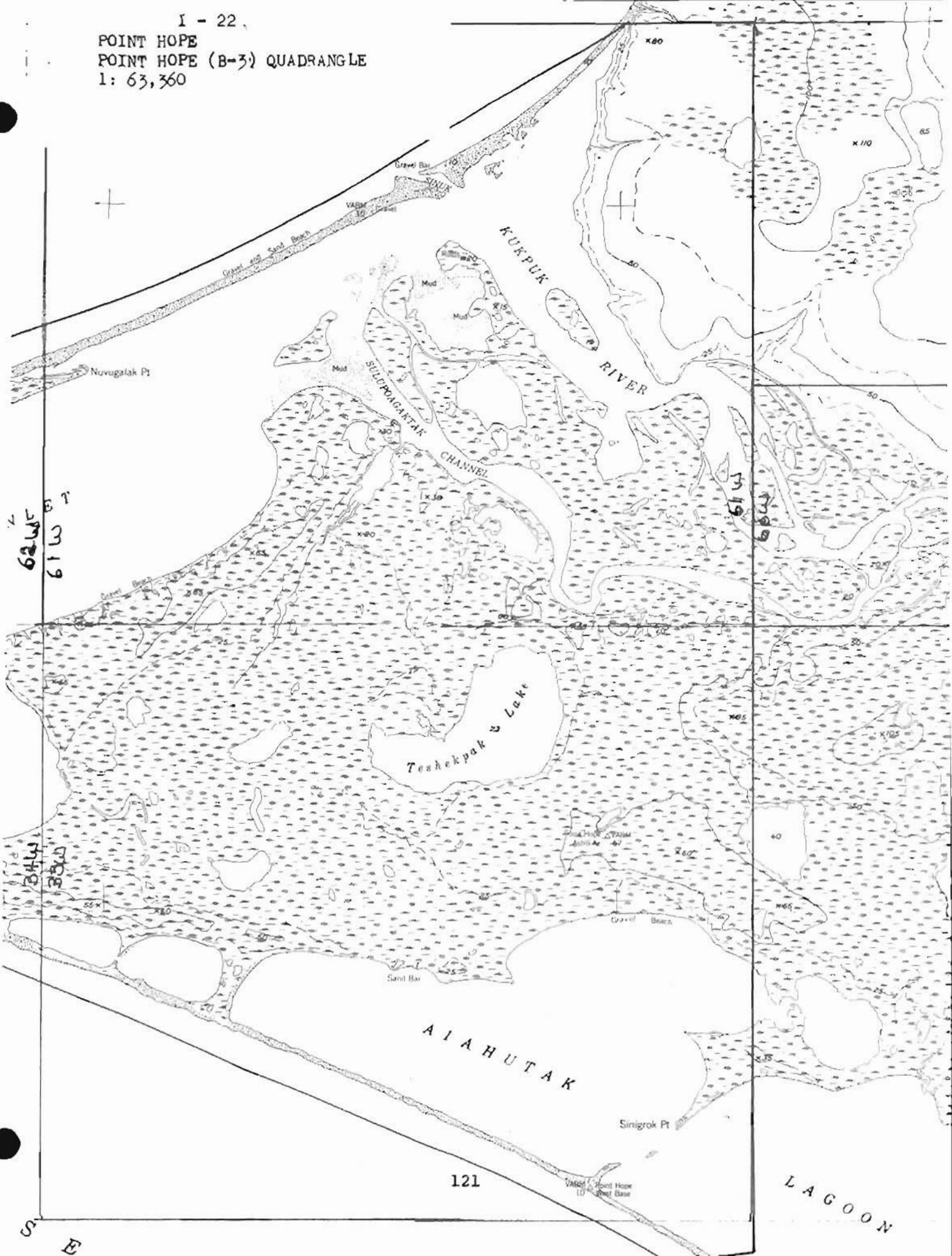


I - 22

POINT HOPE

POINT HOPE (B-3) QUADRANGLE

1: 63,360



NATURAL LANDMARK SURVEY
LANDFORMS
SEASHORES AND ISLANDS

I - 22 POINT HOPE 1A

Themes: Seashores and Islands (subtheme spit and lagoon); Permafrost landforms; River systems; Eolian landforms.

Location: Arctic Foothills Province, westernmost point in Arctic Lowlands, Pt. Hope B-3 quadrangle (1:63,360); Umiat Base, T. 12 S., R. 61 W., sections 10-36; T. 12 S., R. 62 W., sections 23-29, and 31-36; Kateel Base, T. 34 N., R. 33 W., sections 1-26, and 35-36; T. 34 N., R. 34 W., sections 1-15; T. 34 N., R. 35 W., sections 1 and 2, 10-12.

Ownership: Native Village withdrawal area. Part of acreage selected as of 8/1/74, but final selection not complete.

Approximate acreage: 48,500 acres (19,628 hectares)

Geologic features: The Point Hope site is the westernmost tip of land in the Arctic Lowland. It is a spit and offshore bar system that has been built 60 miles out into the Chukchi Sea by opposing littoral currents. North of the point the current flows northeast and south of the point to the southeast. At present the southeast current is strongest and is cutting the north side of spit and moving the sediments around to the southeast. Marrayatt Inlet and Aiahutak Lagoon are large barred lagoons behind the spit. Thousands of square miles of flat plains lie behind the lagoons. These represent elevated sea floor. Point Hope site has been occupied by man for thousands of years and may well represent the first site inhabited on the North American continent. Some of the early sites are being eroded by the sea along the west side of the spit. Abundant permafrost features are to be found on the flat plains and extensive dune systems are locally developed on the offshore bars.

Biotic features: Wet sedge tundra plant communities cover the plains with shore communities on the bars. The site is the nesting area for many ducks, geese, and swans. Sea mammals and shell fish are abundant in the waters, both offshore and in the lagoons.

Land use and vulnerability: The area used primarily for hunting by the village. Some grazing by reindeer from the village, but herds are not large. Oil and gas lease applications filed on some of the lands and activity will increase with the settlement of the Native Land Claims. Site is in considerable jeopardy.

Data source:

I. L. Tailleur, Menlo Park, Calif.
C. G. Mull, Denver, Colo.
M. D. Mangus, Anchorage, Alaska
Author from personal investigation

Selected references:

Humphrey, R. L., Jr., 1970, The prehistory of the Arctic Slope of Alaska, Pleistocene cultural relationships between Eurasia and North America: Ph.D. Thesis, University of New Mexico, 332 p.

McCulloch, D. S., 1967, Quaternary geology of the Alaskan shore of the Chukchi Sea, in Hopkins, D. M., ed., The Bering Land Bridge, Stanford University Press, Stanford, Calif., p. 91-120.

Tailleur, I. L., Jordan, C. F., Mangus, M. D., and Polski, W., Coastal scarp-edge retreat on the Tigara Peninsula, northwestern Alaska, 22 years of observations: Jour. of Sedimentary Petrology (in press).

Other knowledgeable persons:

I. L. Tailleur, Menlo Park, Calif.
C. G. Mull, Denver, Colo.

Publicity sensitivity:

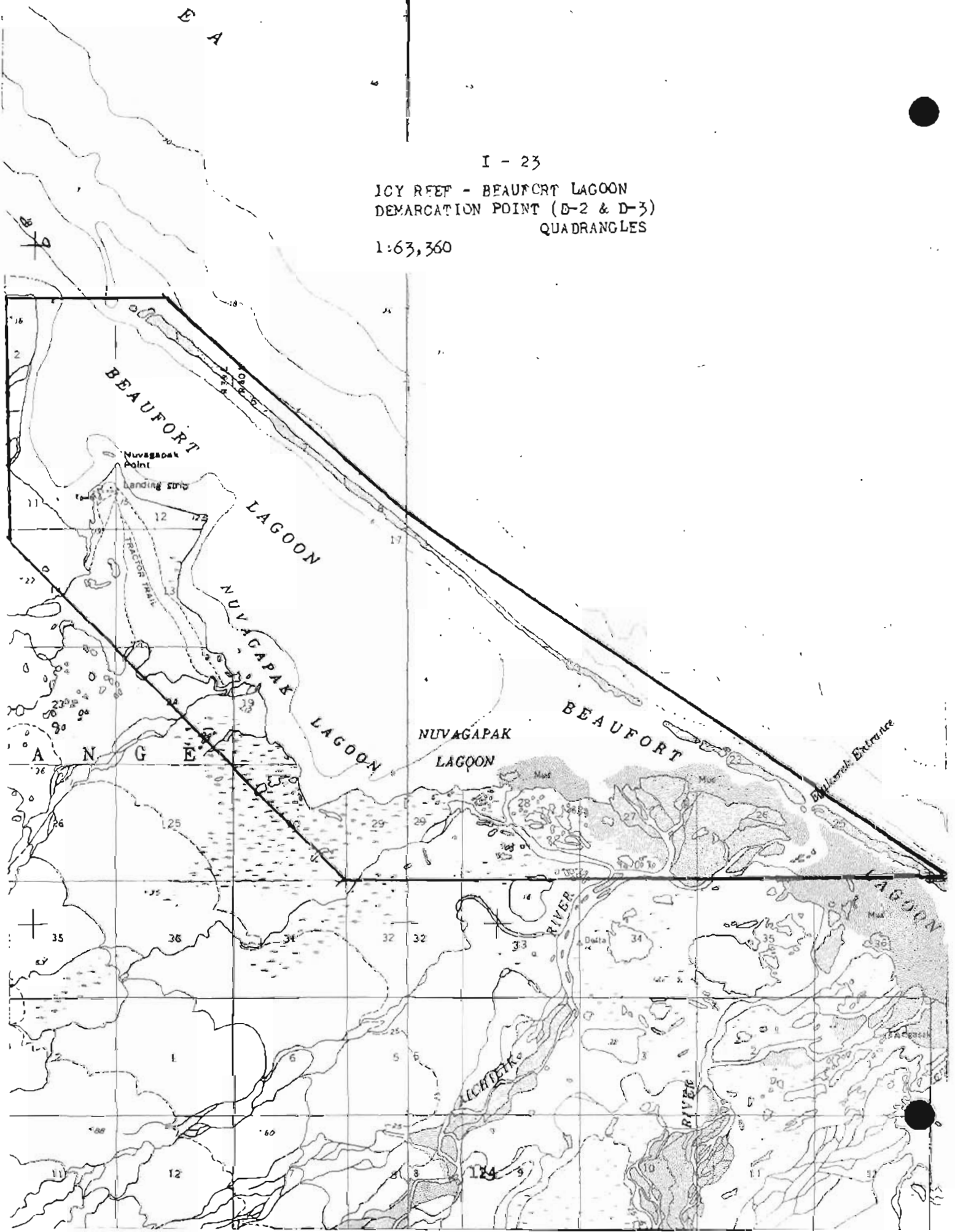
Data on archeological sites should not be widely distributed until they can be excavated properly.

Comments: The Point Hope site is definitely eligible for entry into the Registry of Natural Landmarks.

I - 23

ICY REEF - BEAUFORT LAGOON
DEMARCATION POINT (D-2 & D-3)
QUADRANGLES

1:63,360



I - 23 ICY REEF - BEAUFORT LAGOON 1B

Themes: Seashores and Islands (subtheme offshore bar and lagoon); Permafrost landforms; Eolian landforms

Location: Arctic Coastal Plain Province, eastern part, Demarcation Point D-2 and D-3 quadrangles (1:63,360), T. 6 N., R. 39 E., sections 1, 2, 11-14, and 24; T. 6 N., R. 40 E., sections 6-8, 16-23, 25-30.

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Department of the Interior.

Approximate acreage: 11,220 acres (4,540 hectares).

Geologic features: An excellent section of offshore bar constructed by the northern Alaska Littoral Current. The bar encloses the Beaufort and Nuvagapak Lagoons. Large intricate delta system built up at mouth of Aichilik River, which supplies much of the sediment used in the construction of the offshore bar. Some sand dune areas on delta and abundant permafrost polygons on the coastal sections of site. An exceptional good site to study coastal depositional features in the eastern Arctic.

Biotic features: Wet sedge tundra plant communities on shore. Large brackish water fish and invertebrate population in the lagoon with marine forms on the seaward side of bar. Lagoon connected to sea but primarily fresh water due to great input of rivers draining into it. Site suggested as an Ecological Reserve by Joint Federal-State Land Use Planning Commission.

Land use and vulnerability: No use made of site at present. United States Fish and Wildlife Service maintain a camp at Nuvagapak Point for study of area. The proposed gas pipeline along arctic coast to Canada would probably go through site and the construction would greatly alter the natural conditions that now exist there.

Data source: M. D. Mangus, Anchorage, Alaska

Selected references:

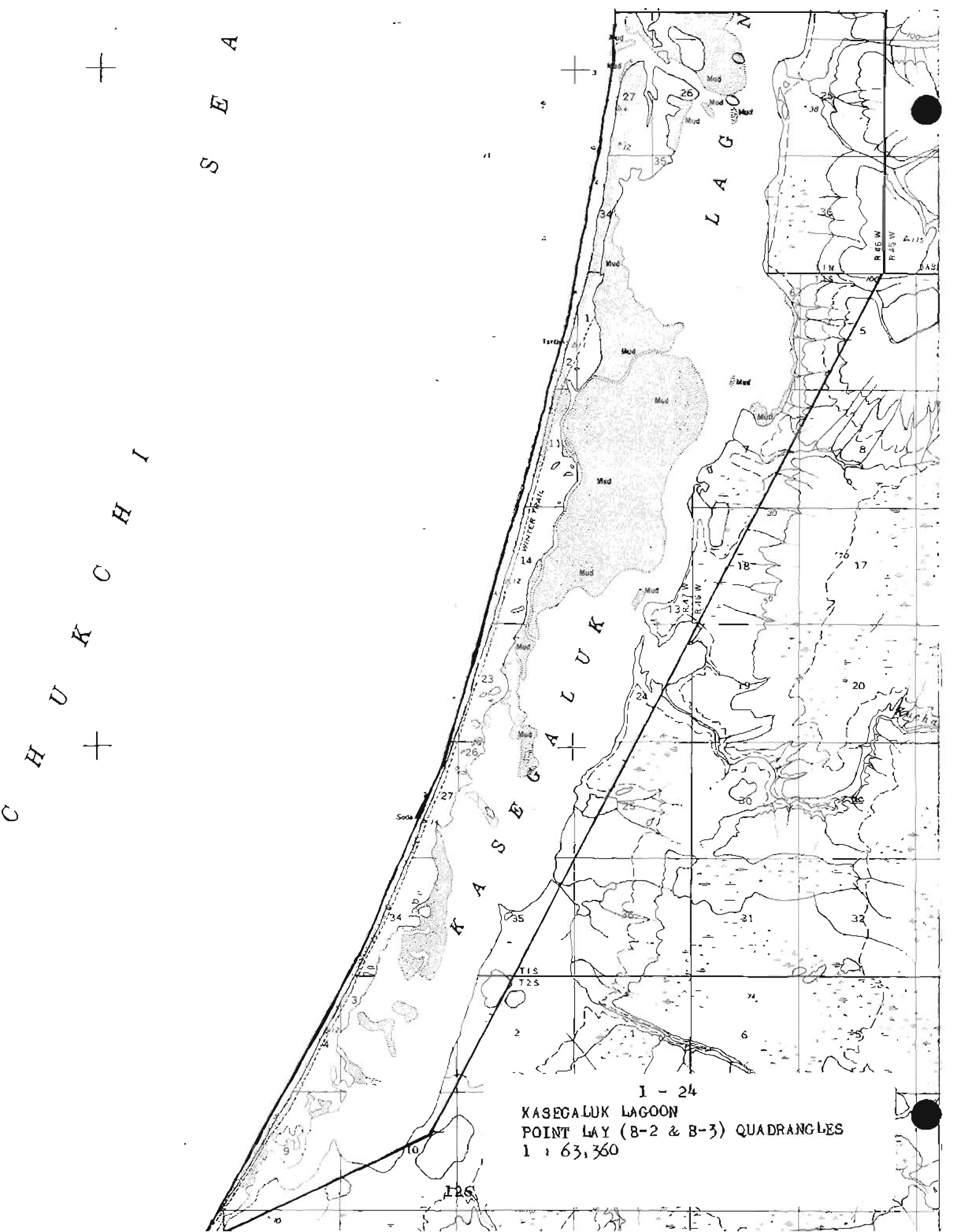
Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1974, Preliminary geologic map, Demarcation Point quadrangle, Alaska: U.S. Geol. Survey MF map.

Other knowledgeable persons:

H. N. Reiser, Menlo Park, Calif.
J. T. Dutro, Jr., Washington, D.C.

Publicity sensitivity: None

Comments: An excellent offshore bar and lagoonal system in the eastern Arctic Lowland. Definitely eligible for entry into Registry of Natural Landmarks.



1 - 24

KASEGALUK LAGOON
POINT LAY (B-2 & B-3) QUADRANGLES
1 : 63,360

I - 24 KASEGALUK LAGOON 2B

Themes: Seashores and islands (subtheme offshore bar and lagoon).

Location: Arctic Coastal Plain Province, west coast bordering Chukchi Sea, Point Lay B-2 and B-3 quadrangles (1:63,360), T. 1 N., R. 46 W., sections 22-27 and 34-36; T. 1 S., R. 46 W., sections 5-7, and 18; T. 1 S., R. 47 W., sections 1, 2, 11-14, 22-27, and 34-36; T. 2 S., R. 47 W., sections 2-4, 9, 10, and 17.

Ownership: Native Village Deficiency area, and State of Alaska selections (pending). Oil and gas lease applications filed on all acreage pending settlement of Native Claims.

Approximate acreage: 12,620 acres (5,107 hectares)

Geologic features: Kasegaluk Lagoon extends for over 100 miles along the northwest coast of the Arctic Lowland. This site marks the south end of the lagoon where the offshore bar is tied to the mainland. This bar constructed of sand and gravel carried along the coast by the northern Alaska Littoral Current. Excellent lagoonal depositional system. Gradual uplift of this coast is filling the lagoon and it will eventually form a new section of the coastal plain. Former beach levels now exposed on present coastal plain.

Biotic features: Good examples of both brackish and marine invertebrate and vertebrate faunas. Shore and wet sedge tundra plant communities.

Land use and vulnerability: No organized use at present, but oil and gas lease applications on file and exploration will probably start with settlement of Native Claims.

Data source: Author from personal investigations

Selected references:

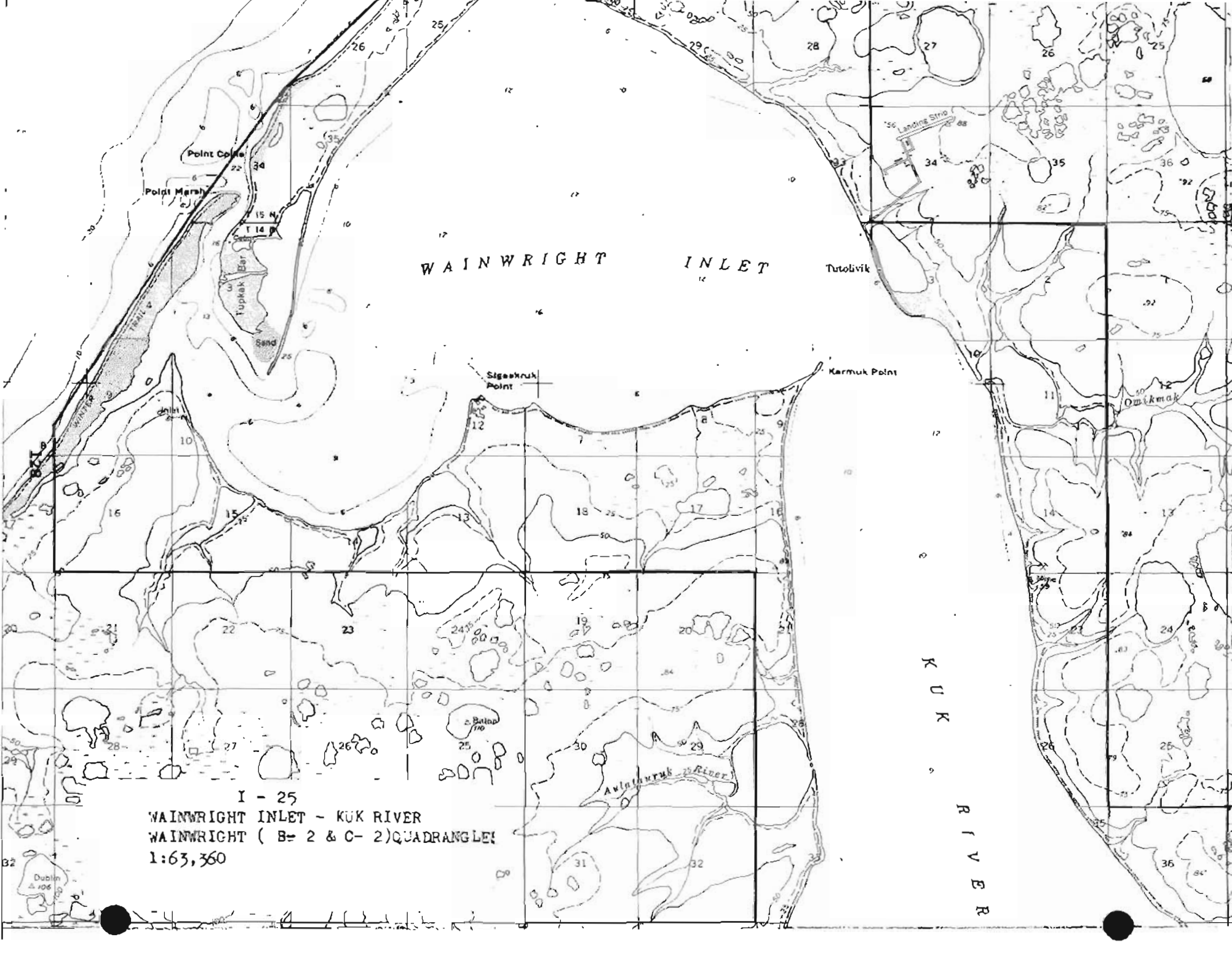
Chapman, R. M., and Sable, E. G., 1960, Geology of the Utukok-Corwin region, northwestern Alaska: U.S. Geol. Survey Prof. Paper 303-C, p. C49-C167.

Hartwell, A. D., 1973, Classification and relief characteristics of northern Alaska coastal zone: Arctic, Jour. Arctic Inst. N. Am., v. 26, no. 3, p. 244-252.

Other knowledgeable persons:
E. G. Sable, Denver, Colo.
J. J. Koranda, Livermore, Calif.

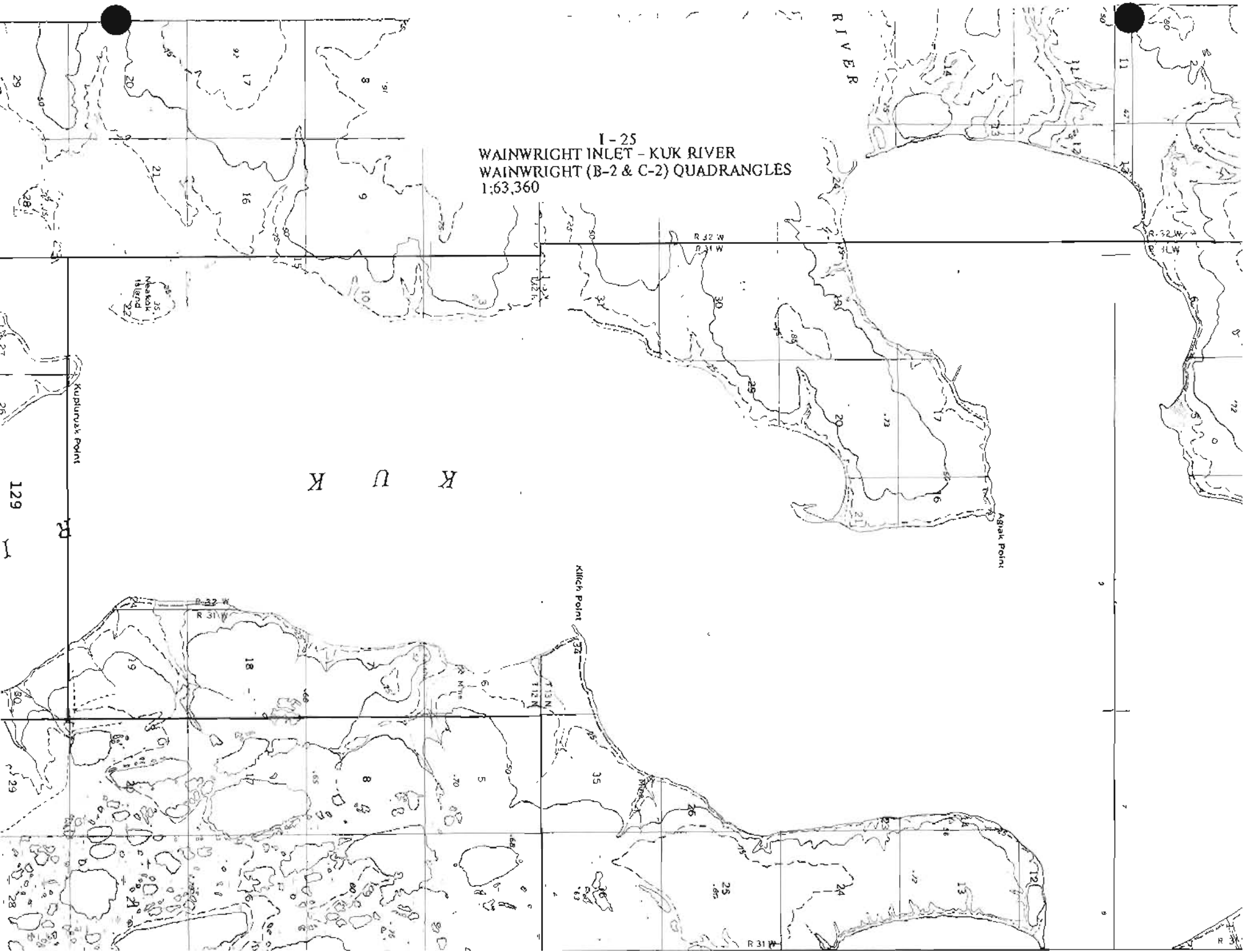
Publicity sensitivity: None

Comments: Site eligible for entry in Registry of Natural Landmarks. Also being considered as an Ecological Landmark site.



I - 25
WAINWRIGHT INLET - KUK RIVER
WAINWRIGHT (B- 2 & C- 2)QUADRANGLE
1:63,360

I - 25
WAINWRIGHT INLET - KUK RIVER
WAINWRIGHT (B-2 & C-2) QUADRANGLES
1:63,360



I - 25 WAINWRIGHT INLET - KUK RIVER 2B

Themes: Seashores and islands (subtheme estuary); River systems, Plains, plateaus, and mesas; Permafrost landforms.

Location: Arctic Coastal Plain Province, northwest coast, Wainwright B-2 and C-2 quadrangles (1:63,360), T. 12 N., R. 31 W., sections 6, 7, 18 and 19; T. 12 N., R. 32 W., sections 1-3, 10-15, 22-24; T. 13 N., R. 31 W., sections--all; T. 14 N., R. 31 W., sections 2-11, 14-18, 21-23, 26-28, 33-36; T. 14 N., R. 32 W., sections 1-4, 9-16; T. 15 N., R. 31 W., sections 28-33; T. 15 N., R. 32 W., sections 25, 26, 34-36.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense and Native Village withdrawal area.
The following areas have been selected:
Sections 16 and 21, T. 13 N., R. 31 W. -- Native
Sections 2 and 3, T. 14 N., R. 31 W. -- Military
Sections 9, 11, and 28, T. 14 N., R. 31 W. -- Native
Sections 9 and 16, T. 14 N., R. 32 W. -- Native
Sections 28 and 29, T. 15 N., R. 31 W. -- Military
Section 30, T. 15 N., R. 31 W. -- Native
Sections 25, 26, 34, 35, and 36, T. 15 N., R. 32 W. -- Native village

Approximate acreage: 61,900 acres (25,050 hectares)

Geologic features: Wainwright Inlet, the largest estuarine complex in the Arctic Lowland, was formed when an offshore bar dammed the mouth of the Kuk River. The bar has been breached, but the Inlet is largely a freshwater system. An excellent site for the study of estuarine depositional systems under Arctic conditions including a compound spit system on the outer bar. Deposition in the upper part of the estuary is closing off a series of basins that will eventually be part of the coastal plain area. Abundant well-preserved permafrost features, as well as preserved uplifted strand lines. Amber of Cretaceous age has been found along the Kuk River and parts of this site already being considered by the National Park Service as a Natural Landmark.

Biotic features: An important estuarine vertebrate and invertebrate locality. Several well-developed plant communities, and a major bird nesting area. Also, part of the caribou migration route.

Land use and vulnerability: The land near the mouth of the estuary receives considerable usage from the village of Wainwright and the Distant Early Warning Site. Lease applications have been filed to mine coal from the Upper Cretaceous strata exposed nearby. Oil exploration can also be expected to increase in the near future. Action should be taken quickly to preserve site in its present condition.

Data source:

M. D. Mangus, Anchorage, Alaska
Charles Evans, Anchorage, Alaska
Author from personal investigations

Selected references:

Hurd, R. D., Jr., Smith, R. F., and Usinger, R. L., 1958, Cretaceous and Tertiary insects in Arctic and Mexican amber: Proceedings of 10th International Congress of Entomology, No. 1, p. 851.

Langenheim, R. L., Jr., Smiley, C. J., and Gray, J., 1960, Cretaceous amber from the arctic coastal plain, Alaska: Geol. Soc. Am. Bull., v. 71, no. 9, p. 1345-1356.

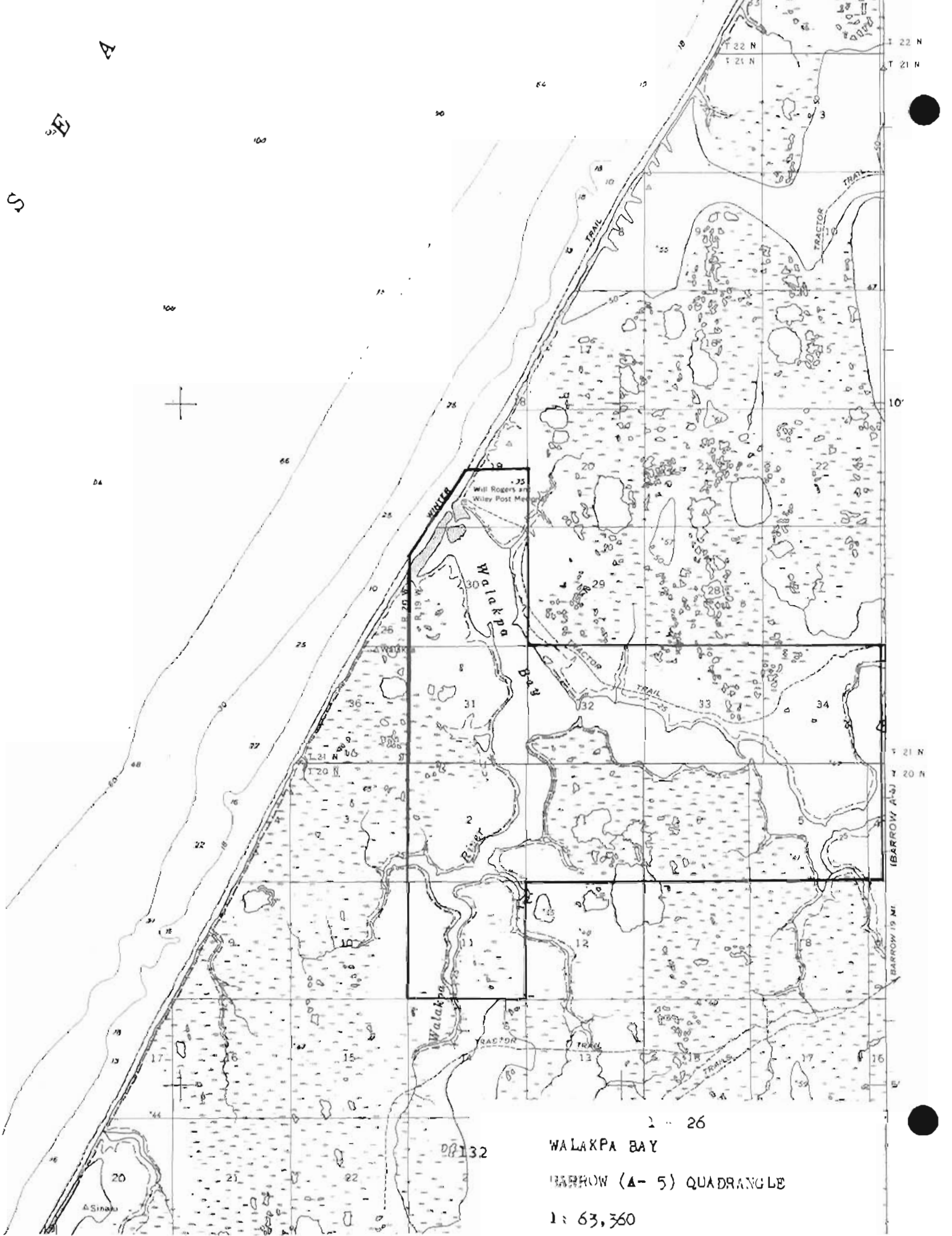
Smiley, C. J., 1971, Cretaceous floral sequences in the Alaskan Arctic: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 12, p. 2504-2505.

Other knowledgeable persons:

E. G. Sable, Denver, Colo.
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: Information on the amber localities should not be widely distributed as indiscriminate collecting would deplete the supply for scientific research.

Comments: Wainwright Inlet is an excellent locality for the study of estuarine systems, and is eligible for inclusion in the Registry of Natural Landmarks. Site is being considered for an Ecological Landmark and also being considered by the Park Service.



2 - 26

WALAKPA BAY

BARROW (A- 5) QUADRANGLE

1: 63,360

NATURAL LANDMARK SURVEY
LANDFORMS
SEASHORES AND ISLANDS

I - 26 WALAKPA BAY 3B

Themes: Seashores and islands (subtheme estuary); Permafrost landforms; Plains, plateaus, and mesas.

Location: Arctic Coastal Plain Province, northwest coast, 12 miles southwest of Barrow, site of Will Rogers-Wiley Post crash, August 1933, Barrow A-5 quadrangle (1:63,360), T. 20 N., R. 19 W., sections 4, 5, and 6; T. 20 N., R. 20 W., sections 1, 2, and 11; T. 21 N., R. 19 W., sections 19, and 30-34.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense and Native Village withdrawal area. Sections 31 and 32, T. 21 N., R. 19 W. have been selected by the village of Barrow.

Approximate acreage: 6,640 acres (2,687 hectares)

Geologic features: Walakpa Bay is an estuary formed by a bar across the mouth of the Walakpa River; this bar has been breached to make this an estuarine system. The estuary is cut into a section of the Barrow plains consisting of the Gubik Formation sand and silt of Quaternary age overlying Upper Cretaceous bedrock. A very sluggish estuary system that is being filled with sediment due to the very slight flushing action of the tide. This is an area of patterned ground in elongated oval-shaped basins that represent the site of former oriented lakes. The lakes were oriented at about 351°.

Biotic features: Numerous well-developed plant communities including shoreline, wet sedge, and dry tundra. Nesting area for shore birds. Has been suggested as an Ecological Reserve by the Joint Federal-State Land Use Planning Commission.

Land use and vulnerability: The proximity of this site to Barrow, about 12 miles, makes it vulnerable to increased use and deterioration.

Data source: Joint Federal-State Land Use Planning Commission.

Selected references:

Black, R. F., 1964, Gubik Formation of Quaternary age in northern Alaska: U.S. Geol. Survey Prof. Paper 302-C, p. C59-C91.

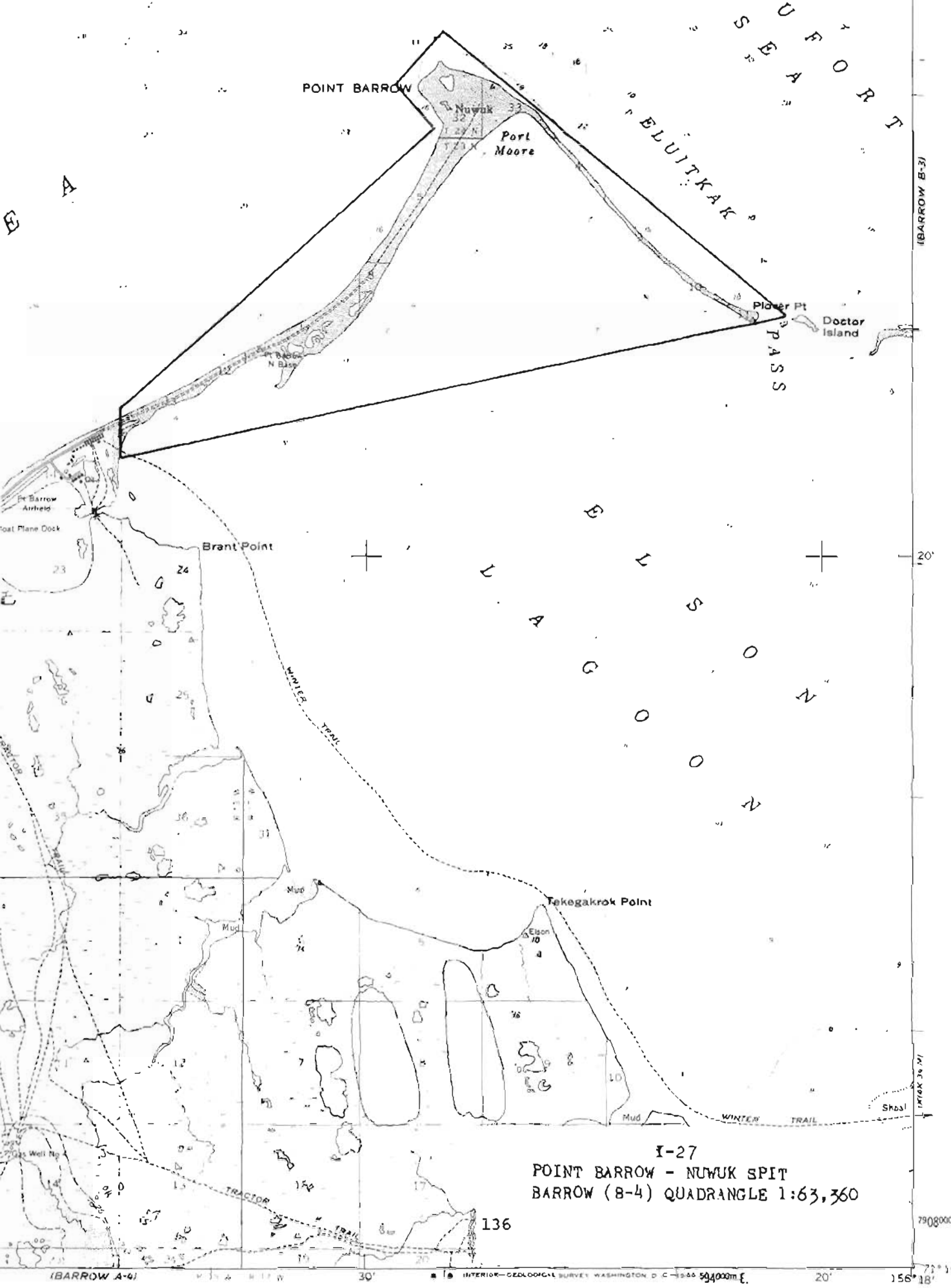
Potter, L. D., 1972, Plant ecology of the Walakpa Bay area, Alaska: Arctic, Jour. Arctic Inst. N. Am., v. 25, no. 2, p. 115-130.

Other knowledgeable persons:

J. J. Koranda, Livermore, Calif.
Jerry Brown, Hanover, New Hampshire

Publicity sensitivity: None

Comments: Walakpa Bay has significance nationally, but there are better sites in the Arctic Lowland. It still should be considered, however, as it is an important archeological site, and also, as the site where Will Rogers and Wiley Post were killed in a plane accident in August 1933.



I-27
POINT BARROW - NUWUK SPIT
BARROW (B-4) QUADRANGLE 1:63,360

NATURAL LANDMARK SURVEY
LANDFORMS
SEASHORES AND ISLANDS

I - 27 POINT BARROW - NUWUK SPIT 3A

Themes: Seashores and islands (subtheme spits)

Location: Arctic Coastal Plain Province, Pt. Barrow, northernmost point of land in United States, Barrow B-4 quadrangle (1:63,360), T. 23 N., R. 17 W., sections 3-11, 17 and 18; T. 23 N., R. 18 W., sections 12 and 13, T. 24 N., R. 17 W., sections 32 and 33.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense and Native Village withdrawal area. Selections not made as of 8/11/74.

Approximate acreage: 4,900 acres (1,983 hectares)

Geologic features: Point Barrow is the northernmost point of land in the United States lying at about 71°23'30" N. latitude. The point is a compound spit 4 miles long tied to the mainland with a subsidiary spit running southeast for 3 miles. The system of spits was formed by the intersection of northeast flowing Northern Alaska Littoral Current meeting the northwest flowing Pacific Gyral, which is the main current of the Arctic Ocean Basin. Logs dated by the radiocarbon method from a series of raised beaches indicate the point is at least 10,000 years old. The youngest series of raised beaches were formed about 1,000 years ago. The spit was breached by a storm in October 1963, but has since been reconstructed by the longshore currents. The spit has been occupied by man for at least 2,000 years.

Biotic features: A variety of marine vertebrate and invertebrates are found in the waters surrounding the spit. Some shore birds nest in the area and there are shoreline plant communities.

Land use and vulnerability: The spit has been used as a source of construction materials for Barrow and the Arctic Research Laboratory located at the base of the spit. Continued development in the Barrow area will probably cause further inroads into the natural condition of the area.

Data source: Arctic Research Laboratory, Barrow, Alaska

Selected references:

Hartwell, A. D., 1972, Coastal conditions of arctic northern Alaska, in Terrain and coastal conditions on arctic Alaska coastal plain: U.S. Army CRREL Special Report 165, p. 32-72.

Hume, J. D., 1965, Sea-level changes during the last 2,000 years at Point Barrow, Alaska: Science, v. 150, no. 3700, p. 1165-1166.

_____, 1967, Shoreline processes near Barrow, Alaska, a comparison of the normal and the catastrophic: Arctic, Jour. Arctic Inst. N. Am., v. 20, no. 2, p. 86-103.

Péwé, T. L., and Church, R. E., 1962, Age of the spit at Barrow, Alaska: Geol. Soc. Am. Bull., v. 73, no. 10, p. 1287-1291.

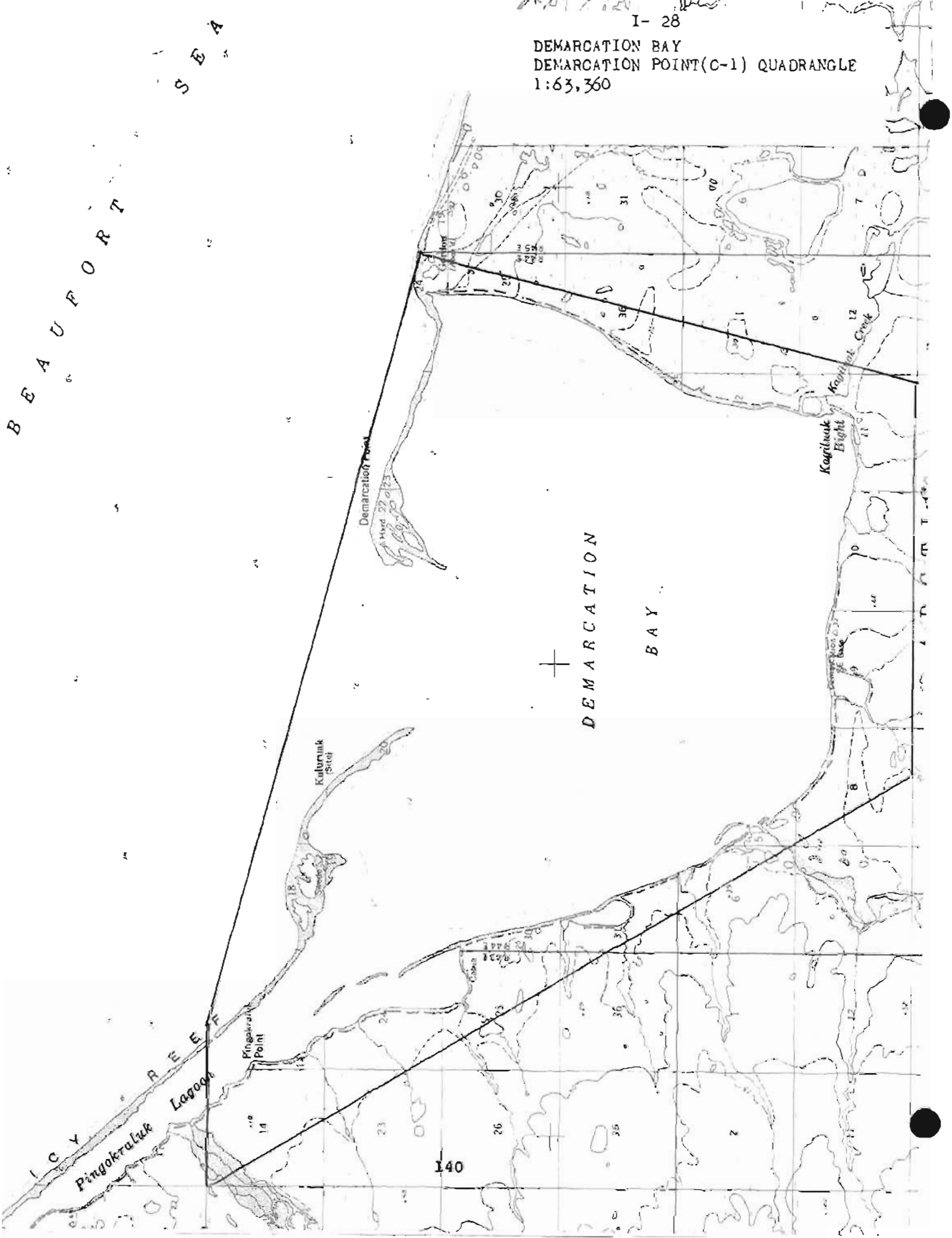
Rex, R. W., 1964, Arctic beaches, Barrow, Alaska, in Miller, R. L., ed., Papers in marine geology, p. 384-400.

Other knowledgeable persons: Many personnel associated with Arctic Research Laboratory, Barrow, Alaska.

Publicity sensitivity: None

Comments: This is geologically a good site, but it has been disturbed and probably will be again in the future.

DEMARCATION BAY
DEMARCATION POINT(C-1) QUADRANGLE
1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
SEASHORES AND ISLANDS

I - 28 DEMARCATION BAY 3B

Themes: Seashores and islands (subtheme spits and lagoon).

Location: Arctic Coastal Plain Province, north coast adjacent to Alaska-Canada border, Demarcation Point C-1 quadrangle (1:63,360), T. 3 N., R. 44 E., sections 1-6, 8-12; T. 4 N., R. 43 E., sections 13, 14, 23-25, and 36; T. 4 N., R. 44 E., sections 16-36.

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Department of the Interior.

Approximate acreage: 18,140 acres (7,341 hectares)

Geologic features: Demarcation Bay is an excellent site to study circulation and depositional systems in a nearby land locked arctic bay. Spits have been constructed from opposite points at the mouth of the bay so that they restrict the flow of water into the bay. There are no major streams entering the bay so that the main source of sediment is material being transported by the marine currents. Well-developed patterned ground is found on all the cliffs surrounding the bay. These are on the order of about 25 feet high and expose numerous ice-wedge polygons.

Biotic features: Wet sedge tundra interspaced with tussock tundra in the drier areas. Nesting gounds for many ducks and geese.

Land use and vulnerability: Site is part of the Arctic National Wildlife Range, but a gas pipeline along the northern coast from Prudhoe Bay to the Mackenzie Delta, in Canada, is being considered. If this pipeline is built this site would be highly vulnerable.

Data source: Author from personal investigation

Selected references:

Krinsley, D. B., Davies, W. E., Rochlin, J., and Newton, E. G., 1971, Existing environment of natural corridors from Prudhoe Bay, Alaska, to Edmonton, Canada: U.S. Geol. Survey open-file report, 104 p.

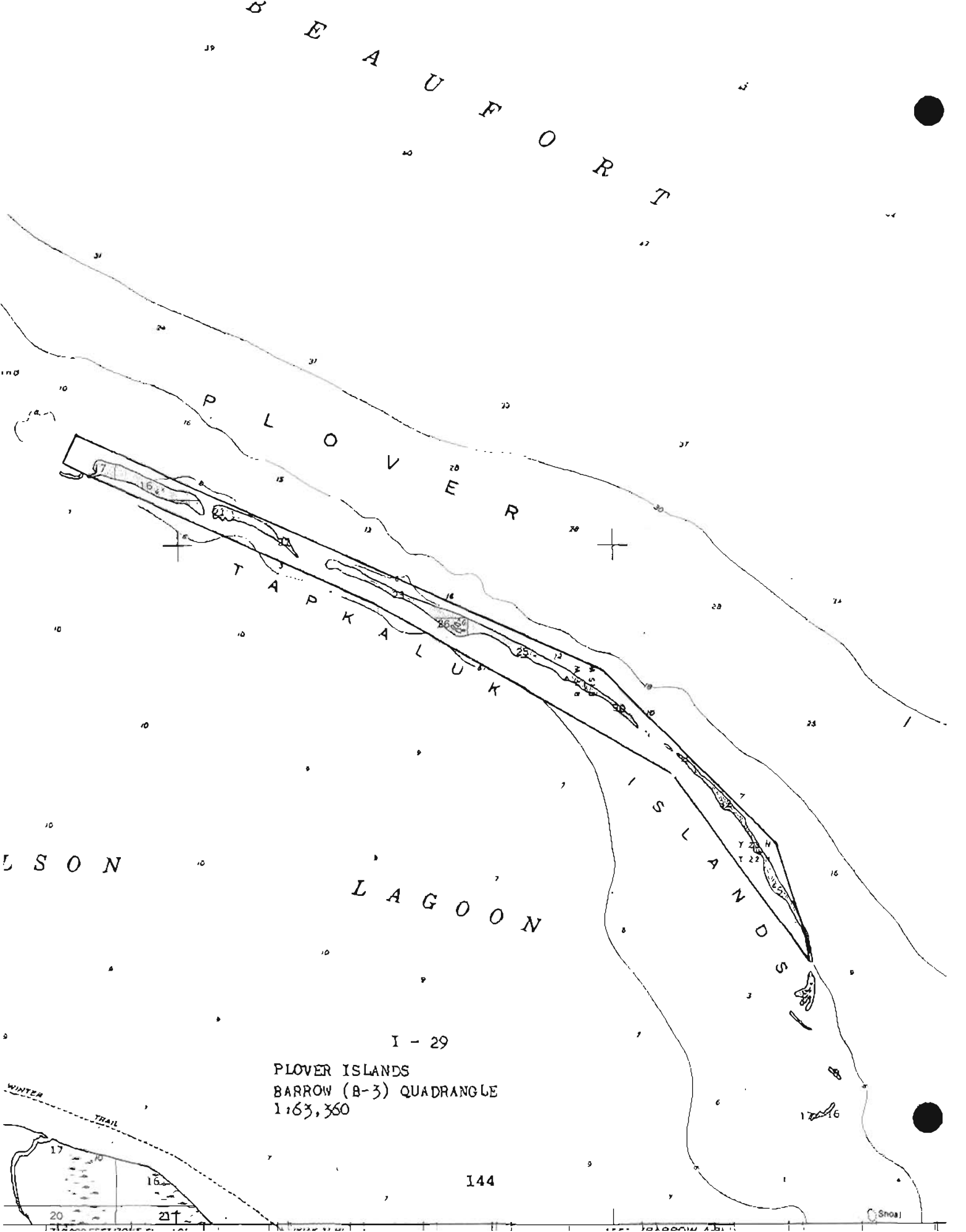
Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1974, Preliminary geologic map, Demarcation Point quadrangle, Alaska: U.S. Geol. Survey MF Map, 2 sheets.

Other knowledgeable persons:

M. D. Mangus, Anchorage, Alaska
C. G. Mull, Denver, Colo.

Publicity sensitivity: None

Comments: An excellent site to study the circulation and depositional patterns of a nearby landlocked arctic bay.



I - 29

PLOVER ISLANDS
BARROW (B-3) QUADRANGLE
1:63,360

NATURAL LANDMARK SURVEY
LANDFORMS
SEASHORES AND ISLANDS

I - 29 PLOVER (TAPKALUK) ISLANDS 4

Themes: Seashores and islands (subtheme islands).

Location: The Tapkaluk Island group of the Plover Island, lying 5 miles off the north coast just east of Pt. Barrow, Barrow B-3 quadrangle (1:63,360), T. 22 N., R. 15 W., section 5; T. 22 N., R. 16 W., sections 30, 31, and 32; T. 23 N., R. 16 W., sections 16, 17, and 21-26.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense and Native Village withdrawal. Lands not selected as of 8/1/74.

Approximate acreage: 1,420 acres (575 hectares).

Geologic features: The Plover (Tapkaluk) Islands are the segmented remnants of an old offshore bar lying about 5 miles off the coast just east of Point Barrow. This was originally a continuous narrow offshore bar that enclosed Elson Lagoon. The islands are composed entirely of unconsolidated sand and gravel.

Biotic features: Primarily a nesting area for shore birds.

Land use and vulnerability: No organized use of area at present and probably none in near future.

Data source: Author from personal investigation

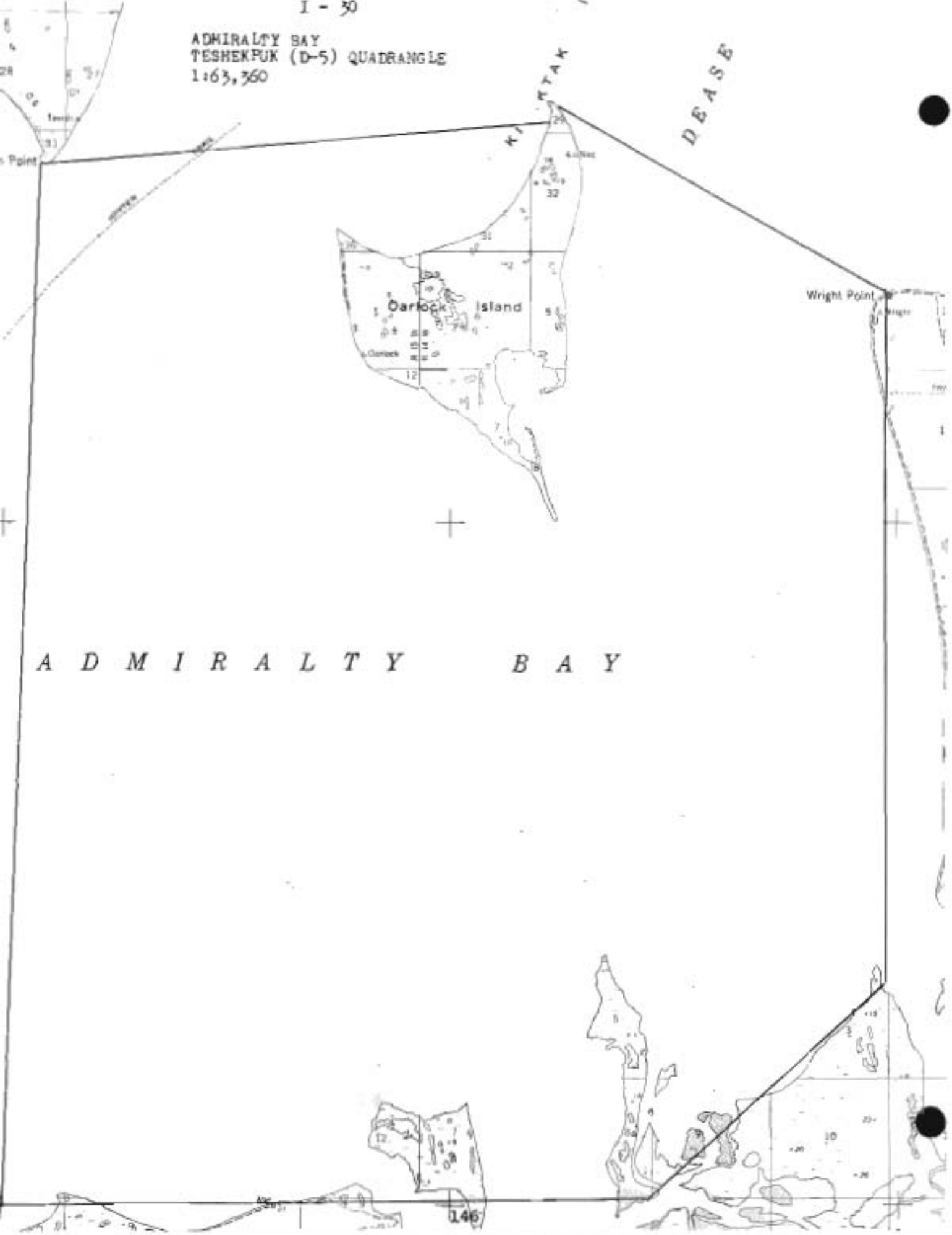
Selected references: None

Other knowledgeable persons:

J. J. Koranda, Livermore, Calif.

Comments: This site is not recommended as there are other better localities in the Arctic Lowland.

ADMIRALTY BAY
TESHEKPUK (D-5) QUADRANGLE
1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
SEASHORES AND ISLANDS

I - 30 ADMIRALTY BAY 4

Themes: Seashores and islands (subtheme estuary and islands).

Location: Arctic Coastal Plain Province, north coast east of Barrow, Teshekpuk D-5 quadrangle (1:63,360), T. 17 N., R. 14 W., sections 3-9; T. 17 N., R. 15 W., sections 1-4 and 9-12; T. 18 N., R. 14 W., sections 3-10, 15-22, and 27-34; T. 18 N., R. 15 W., sections 1-4, 9-16, 21-28, 33-36; T. 19 N., R. 18 W., sections 31-36.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 42,300 acres (9,038 hectares)

Geologic features: Admiralty Bay is a part of the largest estuarine system in the Arctic Lowland; it extends approximately 30 miles into the coastal plains southeast of Barrow. It contains a complex system of coalescing bays and islands most of which stand only a few feet above sea level. Patterned ground occurs throughout these low-lying areas.

Biotic features: Abundant brackish to fresh water vertebrate and invertebrates. Nesting area for ducks and geese.

Land use and vulnerability: None

Data source: Author from personal investigation

Selected references:

Black, R. F., 1964, Gubik Formation of Quaternary age in northern Alaska: U.S. Geol. Survey Prof. Paper 302-C, p. C59-C91.

Other knowledgeable persons:
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: Site not recommended as a Natural Landmark.

Theme 3.--River Systems

The theme River Systems, under the category Landforms of the Present, is of major importance in the Arctic Lowland. Rivers in the arctic are in many respects similar to those in desert areas in that they are subject to flash floods in which the volume of water may double within a matter of a few hours. This sudden dramatic runoff is aided by the nature of the arctic tundra. Only the upper few inches of the tundra mat thaws during the summer. This active layer is highly absorbent, but once it is saturated the runoff is total and any additional rain immediately finds its way into the streams. Anyone who camps along an arctic river has to consider, in picking a camp site, that the stream level may change 5-10 feet in a matter of a few hours. This sudden change in volume of water in conjunction with the abundance of unconsolidated sand and gravel produce classic examples of braided streams which are characteristic of the arctic environment.

The Colville River is the major stream in the Arctic Lowland; it drains most of the central and western foothill area. Few stream flow measurements have been made on the Arctic Slope, but the Colville is probably the second largest river in Alaska. Streams flowing across the lake country north and west of the Colville are mainly in areas underlain by sand and silt. Here the streams develop classic examples of meanders, meander scrolls, and oxbow lakes. East of the Colville the stream bed load is primarily gravel and the braided channel pattern is developed.

Many of the streams in the Arctic Lowland cease to flow during the long cold winters. The larger rivers contain considerable water under

the ice, but if excessively braided may freeze to the bottom locally. This condition produces a phenomenon of arctic rivers known as the aufeis field. Water flowing under the ice is stopped by an ice dam where the stream is frozen all the way to the bottom. The continued flow of water increases the hydrostatic pressure until the water breaks through to the surface and flows on top of the ice where it quickly freezes. This continues until an aufeis field 10 to 15 feet thick and many square miles in area is built up; once built these river glaciers will remain for a number of years before melting during an exceptionally warm summer. Even though they may melt a new one will form in the same area the following winter. Generally they form in areas where large springs flow the year around and add their water to the stream flow.

The theme River Systems is divided into several subthemes that are characteristic of, or well-developed in, the arctic environment of the Arctic Lowland. The subthemes decided on are Braided Channels, Aufeis Fields, Meander Scrolls and Oxbow Lakes, Entrenched Meanders, and Deltas. Beaded streams are another feature of arctic environment that will be discussed more completely under Permafrost Landforms.

Braided Channels

Braided streams develop where the bed load contains a wide variety of particle sizes and is excessive for the volume or velocity of water. Thus they tend to form in broad relatively flat areas downstream from localities where the stream has been confined by bedrock walls or other resistant stratum. This condition is best developed in the eastern and part of the central Arctic Lowland where numerous glacial moraines flank many of the streams. The moraines restrict

the stream to a few main channels while at the same time adding a wide range of particles to the stream. The larger particles in mid-channel are the first to be dropped as the velocity decreases. These become the locus for a central gravel bar which divides the channel and further restricts the flow, and the process is repeated until there are many interconnecting channels. Many of the braided stream areas are relatively small, but large classic textbook examples are found on the Sagavanirktok, Ivishak, Echooka, and Canning Rivers in the eastern Arctic Lowland.

Aufeis Fields

Perennial river glaciers form in the same general areas as the braided streams. Where the stream spreads out and the velocity drops are the precise localities that will freeze to the bottom during the winter. The deeper single channel upstream, particularly in areas that are spring fed, will continue to flow with the hydrostatic pressure forcing the water out on top of the ice. A domal ice structure is first developed which then ruptures and releases the water to the surface. The bluish-green ice formed in the aufeis field is very similar in appearance to a true glacier. Exceptionally fine examples are found on the Sagavanirktok, Ivishak, Echooka, and Canning Rivers.

Meander Scrolls and Oxbow Lakes

Meander scrolls are a series of depressions and rises on the convex sides of bends formed as the channel migrates laterally downvalley and towards the concave bank. The meander continues to grow until it is cut off during a spring flood. The cutoff portion starts to fill

almost immediately with sediment and vegetation and has the characteristic oxbow shape.

Classic examples of these features are found in the flat plain and lake country of northwestern Alaska. Here the low gradient rivers flow through an area composed primarily of sand and silt which is easily eroded. Most of the stream discharge is concentrated in a period of about 2 to 3 weeks in the spring when the snow melts. This rapid runoff easily erodes the sand forming almost a yearly succession of scrolls. Meanders are generally cut off during these same periods of flood when the water contains considerable silt. As the water level drops the circulation in the cutoff stops and the silt drops to the bottom where it forms an impervious seal that retains the water in the oxbow lake.

Entrenched Meanders

Meandering streams sometimes cut through the surficial materials into bedrock. If the stream retains a high discharge rate and the bedrock is uplifted slowly the meander is continued in the rock. Classic examples of this are found in the southwest along the Colorado, Green, and San Juan Rivers. Similar conditions have existed in the Arctic Lowland along the Kukpowruk, Utukok, and Awuna Rivers. They have locally cut 1,000 to 1,200 feet into bedrock.

Deltas

Deltas are formed where a stream enters a body of water and drops its load of transported sediment. These areas are of great interest to geologists mainly because of the wide variety of depositional features and the transition from fresh to brackish, and finally to

marine lifeforms. Ancient deltas are commonly the reservoir rocks for large oil fields. The Colville, Sagavanirktok, and Canning Rivers have developed extensive delta systems into the Arctic Ocean.

The following sites illustrating various parts of the theme River Systems are suggested for inclusion in the Registry of Natural Landmarks for the Arctic Lowland.

RIVER SYSTEMS

1. Highest priority

    Sagavanirktok River - subtheme - Braided Channel

    Ikpikpuk River - subtheme - Meander Scrolls and Oxbow Lakes

    Colville Delta - subtheme - Deltas

    Ivishak - Saviukviayak - subtheme - Aufeis Field

2. Sites definitely eligible

    Kukpowruk River - subtheme - Entrenched Meanders

    Meade River - subtheme - Meander Scrolls and Oxbow Lakes

3. Sites of uncertain eligibility

    Echooka River - subtheme - Aufeis Field

4. Sites not recommended

    Awuna River - subtheme - Entrenched Meanders

Figure 13. Meander scrolls along Ikpikpuk River.

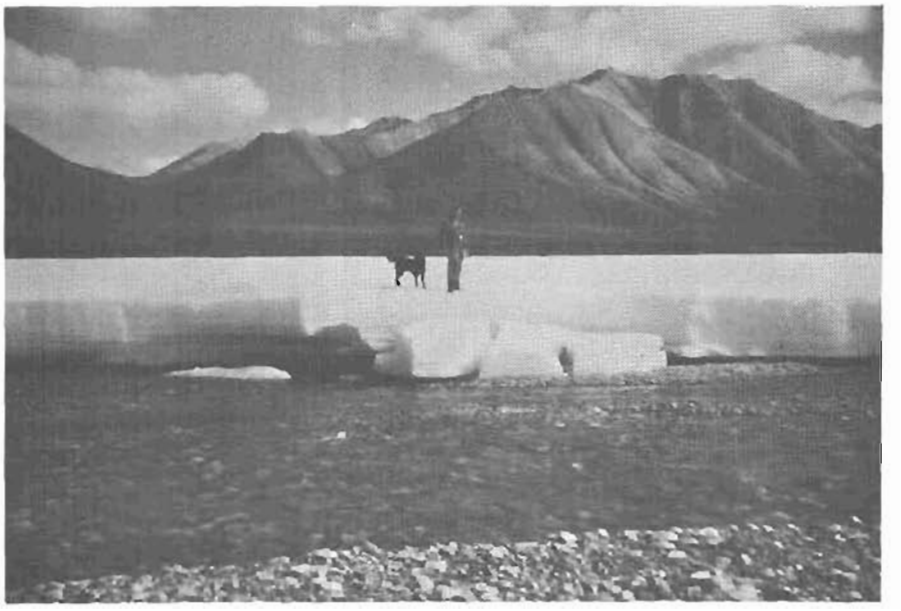
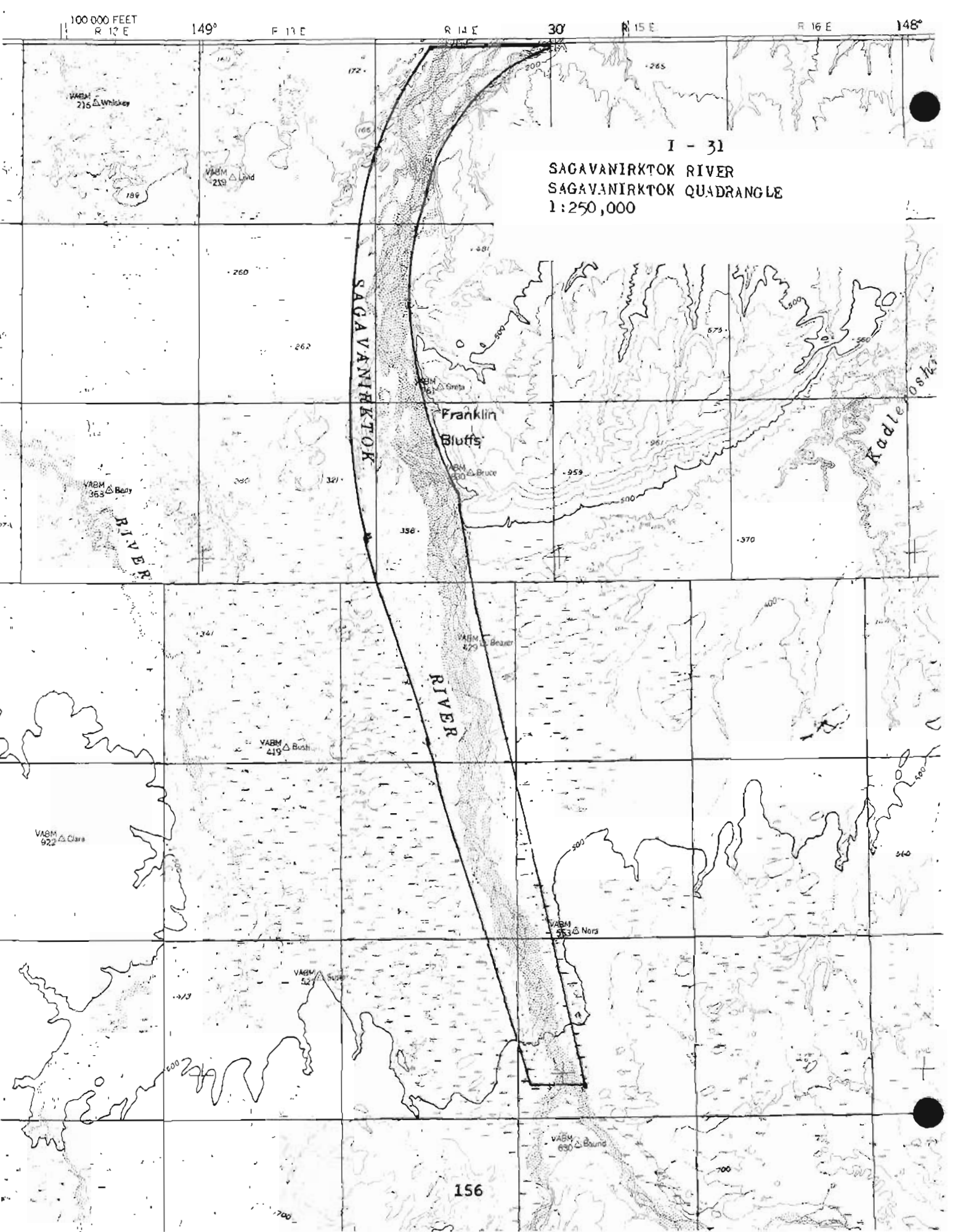


Figure 14. Aufeis field on Ivishak River.


100 000 FEET
R 12 E
149°
R 13 E
R 14 E
30'
R 15 E
R 16 E
148°
I - 31
SAGAVANIRKTOK RIVER
SAGAVANIRKTOK QUADRANGLE
1:250,000
SAGAVANIRKTOK
RIVER
Franklin
Bluffs
Kadleroshk
VABM 215 Whiskey
VABM 219 Lind
VABM 363 Beaty
VABM 361 Greta
VABM 330 Bruce
VABM 329 Beaver
VABM 419 Bush
VABM 922 Clara
VABM 563 Nora
VABM 630 Bound
156

NATURAL LANDMARK SURVEY
LANDFORMS
RIVER SYSTEMS

I - 31 SAGAVANIRKTOK RIVER 1A

Theme: River systems (subtheme braided channel).

Location: Arctic Coastal Plain Province, eastern part, south of Prudhoe Bay, Sagavanirktok quadrangle (1:250,000), T. 2 N., R. 14 E., sections 1, 12, 13, and 24; T. 2 N., R. 15 E., sections 5-8, 17-20, and 28-30; T. 3 N., R. 14 E., sections 1-3, 10-15, 23-26, and 35-36; T. 3 N., R. 15 E., sections 7, 18, 19, and 30-32; T. 4 N., R. 14 E., sections 2-5, 8-11, 21-28, and 34-36; T. 5 N., R. 13 E., sections 1, 12, 13, 24, 25, and 36; T. 5 N., R. 14 E., sections 5-9, 16-21, and 28-33; T. 6 N., R. 13 E., sections 1, 12, 13, 24, 25, and 36; T. 6 N., R. 14 E., sections 5-8, 18-20, and 29-32; T. 7 N., R. 13 E., sections 24, 25, and 36; T. 7 N., R. 14 E., sections 1-5, 7-10, 16-21, and 29-32.

Ownership: Utility corridor, Bureau of Land Management, Department of the Interior, and State of Alaska selection pending.

Approximate acreage: 51,840 acres (20,835 hectares).

Geologic features: The Sagavanirktok River in the arctic coastal plain province is a classic example of a braided stream. The intricately braided channels flow on a flood plain about 3 miles wide. There are generally 3 to 4 main channels and as many, or more, distributary channels some of which receive water only during peak flood periods. Most of the channels are 50 to 75 feet wide and carry about 11,000 cubic feet per second of water. There is very little elevation difference between channels and a modest rain storm can add enough water to make the channels as much as 1/4-mile wide.

The river flows across a broad alluvial plain cut into Late Cretaceous and Early Tertiary bedrock and cuts past the west end of Franklin Bluff. This part of the Sagavanirktok River is a classic example of stream piracy. The Sagavanirktok and Ivishak Rivers join at the south edge of the site. The Sagavanirktok originally flowed to the west as part of what is now the Toolik River.

Biotic features: Numerous cutbank plant succession communities along gravel bars on flood plain. Wet sedge meadow in areas back from the river followed by dry tundra meadow. Numerous willow and shrub succession groups.

Land use and vulnerability: This site is highly vulnerable to destruction and probably has already received irreparable damage during the road and pipeline construction. The Trans-Alaska Pipeline and access road are being built on the river flood plain (see figure 2).

Data source: C. G. Mull, Denver, Colo.
M. D. Mangus, Anchorage, Alaska
Author from personal investigations

Selected references:

Childers, J. M., 1972, Channel erosion surveys along proposed TAPS route, Alaska, July 1971: U.S. Geol. Survey open-file report, 79 p.

Childers, J. M., Sloan, C. E., Meckel, J. P., 1973, Hydrologic reconnaissance of streams and springs in eastern Brooks Range, Alaska, July, 1972: U.S. Geol. Survey open-file report, 25 p.

Koranda, J. J., 1960, The plant ecology of the Franklin Bluffs area, Alaska: Ph.D. Thesis, University of Tennessee, 235 p.

Ferrians, O. J., Jr., 1971a, Preliminary engineering geologic maps of the proposed trans-Alaska pipeline route, Beechey Point and Sagavanirktok quadrangles: U.S. Geol. Survey open-file report, 2 sheets.

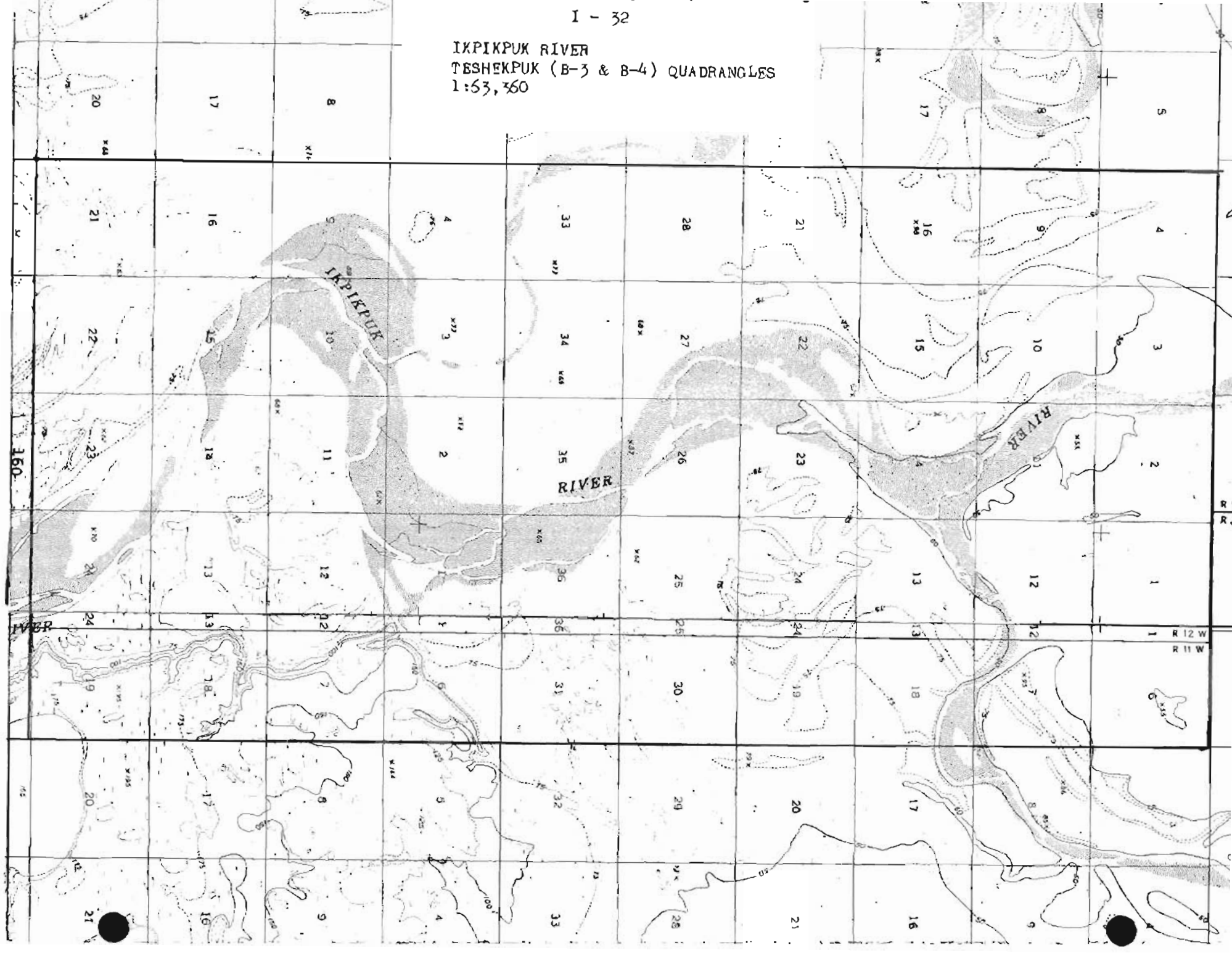
Other knowledgeable persons:

H. N. Reiser, Menlo Park, Calif.
Reuben Kachadoorian, Menlo Park, Calif.

Publicity sensitivity: None

Comments: An outstanding example of a braided stream and eligible for entry in Registry of Natural Landmarks.

IKPIKPUK RIVER
TESHEKPUK (B-3 & B-4) QUADRANGLES
1:63,360



I - 32 IKPIKPUK RIVER 1C

Themes: River systems (subtheme meander scrolls); Eolian landforms, Permafrost landforms; Lakes and lakeshores

Location: Arctic Coastal Plain Province, central part, Teshekpuk B-3 and B-4 quadrangles (1:63,360), T. 11 N., R. 11 W., sections 6, 7, 18 and 19; T. 11 N., R. 12 W., sections 1-4, 9-16, and 21-24; T. 12 N., R. 11 W., sections 6, 7, 18, 19, 30, and 31; T. 12 N., R. 12 W., sections 1-4, 9-16, 21-28, and 33-36.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 32,000 acres (12,950 hectares)

Geologic features: This stretch of the Ikpikpuk River is a classic example of a meandering old age stream. It flows sluggishly across a flood plain as much as a mile wide and has essentially reached base level. The gradient is no more than 1 to 2 feet per mile. This part of the coastal plain is composed of sand and silt of the Gubik Formation of Quaternary age. These materials are easily eroded by the spring break up flood which alters the course of the river nearly every year. Meander scrolls and oxbow lakes are readily developed in these materials. Many sand dunes develop on the active flood plain and relic dunes are present on old beach ridges along valley wall. Patterned ground develops in poorly drained areas away from the river, and the oxbow lakes coalesce into large sinuous lake basins.

Biotic features: This site affords a wide variety of plant communities from the dry well-drained sand dunes along the river to wet sedge and aquatic communities on the flood plain. Numerous small animals inhabit the dunes along the river.

Land use and vulnerability: None

Data source: M. D. Mangus, Anchorage, Alaska
W. P. Brosgé, Menlo Park, Calif.

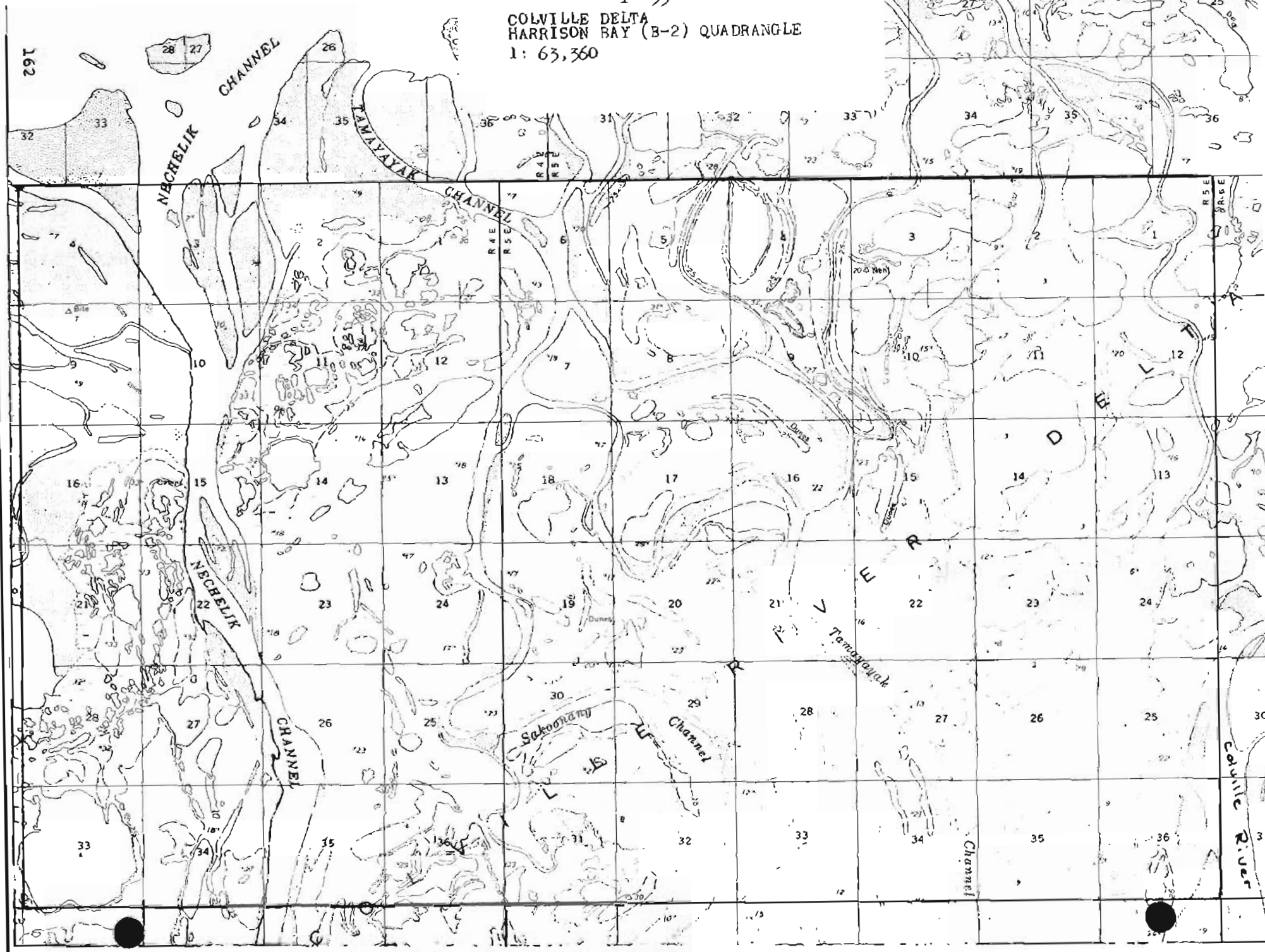
Selected references: None

Other knowledgeable persons:
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: This site is eligible for inclusion in the Registry of Natural Landmarks.

COLVILLE DELTA
HARRISON BAY (B-2) QUADRANGLE
1: 63,360



NATURAL LANDMARK SURVEY
LANDFORMS
RIVER SYSTEMS

I - 33 COLVILLE DELTA 1B

Themes: River systems (subtheme deltas); Seashores and islands; Eolian landforms; Lakes and lakeshores.

Location: Arctic Coastal Plain Province, central part, mouth of Colville River, Harrison Bay B-2 quadrangle (1:63,360), T. 12 N., R. 4 E., sections 1-4, 9-16, 21-28, and 33-36; T. 12 N., R. 5 E., sections--all.

Ownership: Native Village withdrawal area, Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense, and State of Alaska selection (pending). Final deposition of land not made as of 8/1/74.

Approximate acreage: 38,400 acres (15,540 hectares).

Geologic features: The Colville Delta site is part of the largest delta system in the Arctic Lowland. The interlaced system of distributary channels meander across the delta area which is about 20 miles wide. Classic examples of deltaic depositional systems are all well exposed here from true marine along the seaward edge to fluvial and eolian inland. Levees with back swamp form along most of the distributary channels. Contains the largest area of sand dunes in Arctic Lowland.

Biotic features: Major nesting area for water fowl and the sand dunes provide denning areas for fox and ground squirrels. A wide variety of plant succession groups from wet sedge tundra to grass and shrub communities. Site is also being considered as an Ecological Landmark and as an Ecological Reserve by the Joint Federal-State Land Use Planning Commission.

Land use and vulnerability: The site is vulnerable to destruction from oil well drilling. Several wells have been drilled and more are planned. Activity will increase with settlement of the Alaska Native Claims.

Data source: Numerous sources including the Joint Federal-State Land Use Planning Commission.

Selected references:

Barnes, P. W., Reimnitz, Erk, Gustafson, C. W., and Larson, B. P., 1973, Geological Survey marine geologic studies in Beaufort Sea, 1970 through 1972: U.S. Geol. Survey open-file report, 38 p.

Hartwell, A. D., 1972, Coastal conditions of arctic northern Alaska, in Terrain and coastal conditions on arctic Alaska coastal plain: U.S. Army CRREL Special Report 165, p. 32-72.

Walker, H. J., 1962a, The Colville River delta, in Grosline, D. S., ed., Proceedings of the 1st National Coastal and Water Research Conference, p. 472-474.

_____, 1962b, Morphology of a Colville delta lake, Alaska, a preliminary report, in Science in Alaska 1961: Proceedings, 12th.

_____, 1967b, Riverbank dunes in the Colville delta, Alaska: Louisiana State University, Coastal Studies Bull., no. 1, p. 7-14.

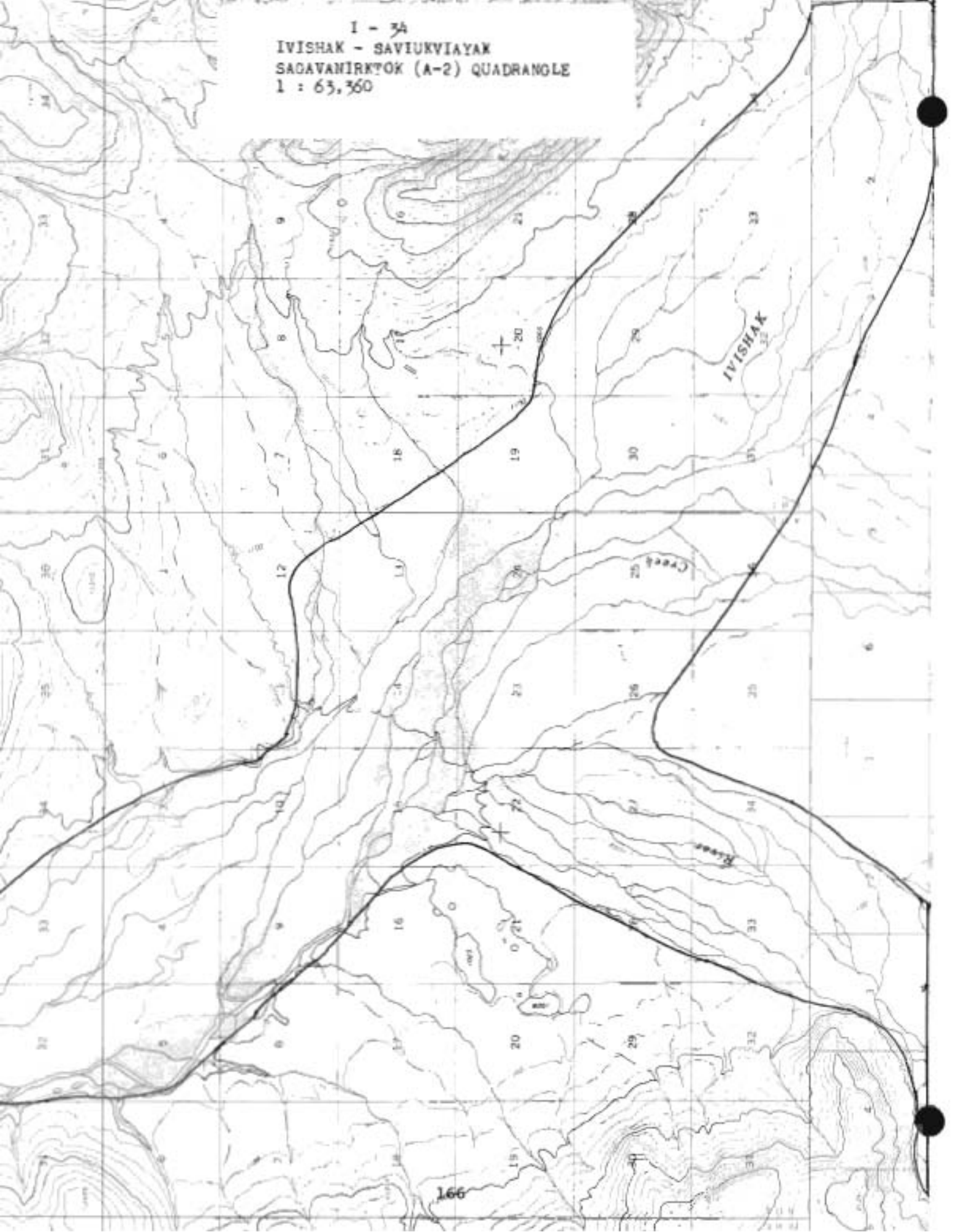
Other knowledgeable persons:

Charles Evans, Anchorage, Alaska
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: Site highly eligible for entry in Registry of Natural Landmarks. An outstanding area to study deltaic depositional systems in an arctic environment.

I - 34
IVISHAK - SAVIUKVIAYAK
SAGAVANIRKTOK (A-2) QUADRANGLE
1 : 63,360



NATURAL LANDMARK SURVEY
LANDFORMS
RIVER SYSTEMS

I - 34 IVISHAK - SAVIUKVIAYAK 1B

Themes: River systems (subtheme aufeis fields); Springs.

Location: Arctic Foothills Province, eastern part, north front of Brooks Range, Sagavanirktok A-2 quadrangle (1:63,360), T. 3 S., R. 17 E., sections 32-34; T. 4 S., R. 17 E., sections 3-5, 8-16, 21-28, 32-34, and 36; T. 4 S., R. 18 E., sections 18-20 and 28-34; T. 5 S., R. 17 E., sections 2-4; T. 5 S., R. 18 E., sections 1-4.

Ownership: Native Regional Deficiency area.

Approximate acreage: 15,680 acres (6,345 hectares).

Geologic features: The largest aufeis field in Arctic Lowland occupies the area at the junction of these rivers. In normal years this river glacier covers about 20 to 25 square miles with ice 5 to 20 feet thick. The ice field is fed by a series of springs that have a combined flow of about 80 cubic feet per second or about 36,000 gallons per minute. In the winter most of this is forced out onto the surface of the ice where it forms layer on layer of ice. Occasionally sand and gravel also are ejected with the water and are frozen into the mass of ice giving it a laminated appearance. Part of the aufeis melts each summer, but the main mass is perennial. Both rivers have a wide braided flood plain upstream from the aufeis which permits the stream to freeze to the bottom and force the spring water onto the surface.

Biotic features: This large mass of ice produces a cold microclimate in the vicinity with the resulting alpine environment plant communities.

Scenic features: The large aufeis field is very spectacular in the summer when the surrounding valley is green.

Land use and vulnerability: Most of the area has oil and gas lease applications filed and may be the site of future drilling. The main destructive force would be in diverting the spring water to some other purpose.

Data source:

M. D. Mangus, Anchorage, Alaska
C. G. Mull, Denver, Colo.
Author from personal investigation

Selected references:

Childers, J. M., Sloan, C. E., and Meckel, J. P., 1973, Hydrologic reconnaissance of streams and springs in eastern Brooks Range, Alaska, July 1972: U.S. Geol. Survey open-file report, 25 p.

Keller, A. S., Morris, R. H., and Detterman, R. L., 1961, Geology of the Shaviovik-Sagavanirktok River region, Alaska: U.S. Geol. Survey Prof. Paper 303-D, p. D169-D222.

Other knowledgeable persons:

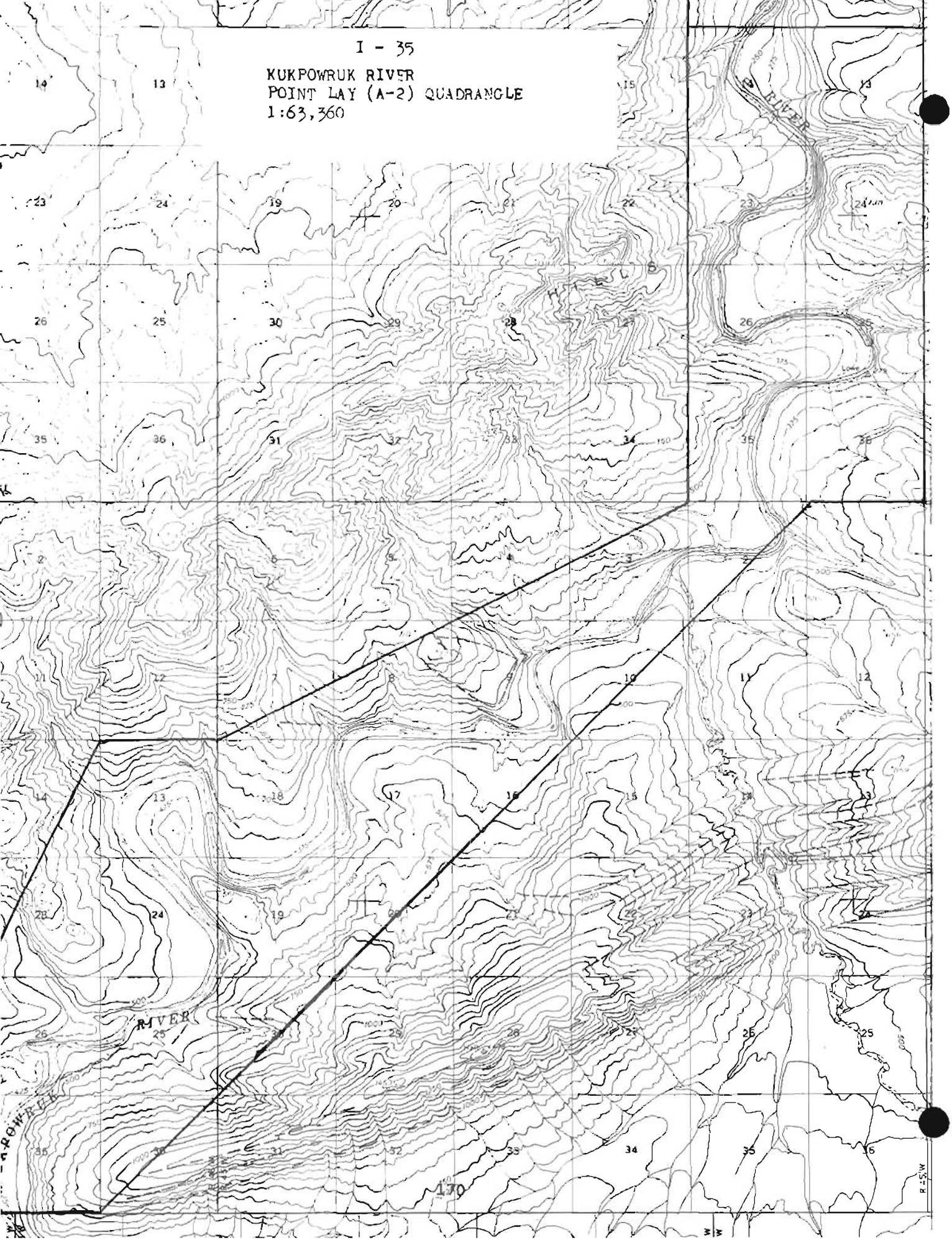
W. P. Brosgé, Menlo Park, Calif.
H. N. Reiser, Menlo Park, Calif.

Publicity sensitivity: None

Comments: An outstanding example of one of the arctic phenomena and eligible for entry in the Registry of Natural Landmarks.

I - 35

KUKPOWRUK RIVER
POINT LAY (A-2) QUADRANGLE
1:63,360



I - 35 KUKPOWRUK RIVER 2C

Themes: River systems (subtheme entrenched meanders); Movement of the earth's crust

Location: Arctic Foothills Province, western section, Point Lay A-2 quadrangle (1:63,360), T. 3 S., R. 45 W., sections 13-14, 23-26, and 35-36; T. 4 S., R. 45 W., sections 2-4, 7-10, 16-20, and 30; T. 4 S., R. 46 W., sections 13, 14, 23-26, and 35-36.

Ownership: Native Regional Deficiency area selections not made as of 8/1/74

Approximate acreage: 14,800 acres (5,990 hectares)

Geologic features: A magnificent section of canyon and ridge topography in the western Arctic Lowland that has been dissected by the Kukpowruk River. The river was able to maintain its grade during the slow uplift of this region and has cut through 1,000 feet of these Lower Cretaceous sandstone, conglomerate, and shale. Mesas and ridges were developed during this downcutting, all of which were further dissected by small tributary streams. The topography and scenery is similar to that found in the canyon country of the southwest United States. The structure and stratigraphy are well exposed in the canyon walls. The rocks are part of the Kukpowruk and Corwin Formations.

Biotic features: Shrub and willow communities along river followed by a series of plant succession groups that are restricted by changes in elevation.

Scenic features: Spectacular canyon and mesa country.

Land use and vulnerability: No organized usage at present. Oil and gas lease applications filed on most of the land and some activity can be expected with the settlement of the Alaska Native Claims.

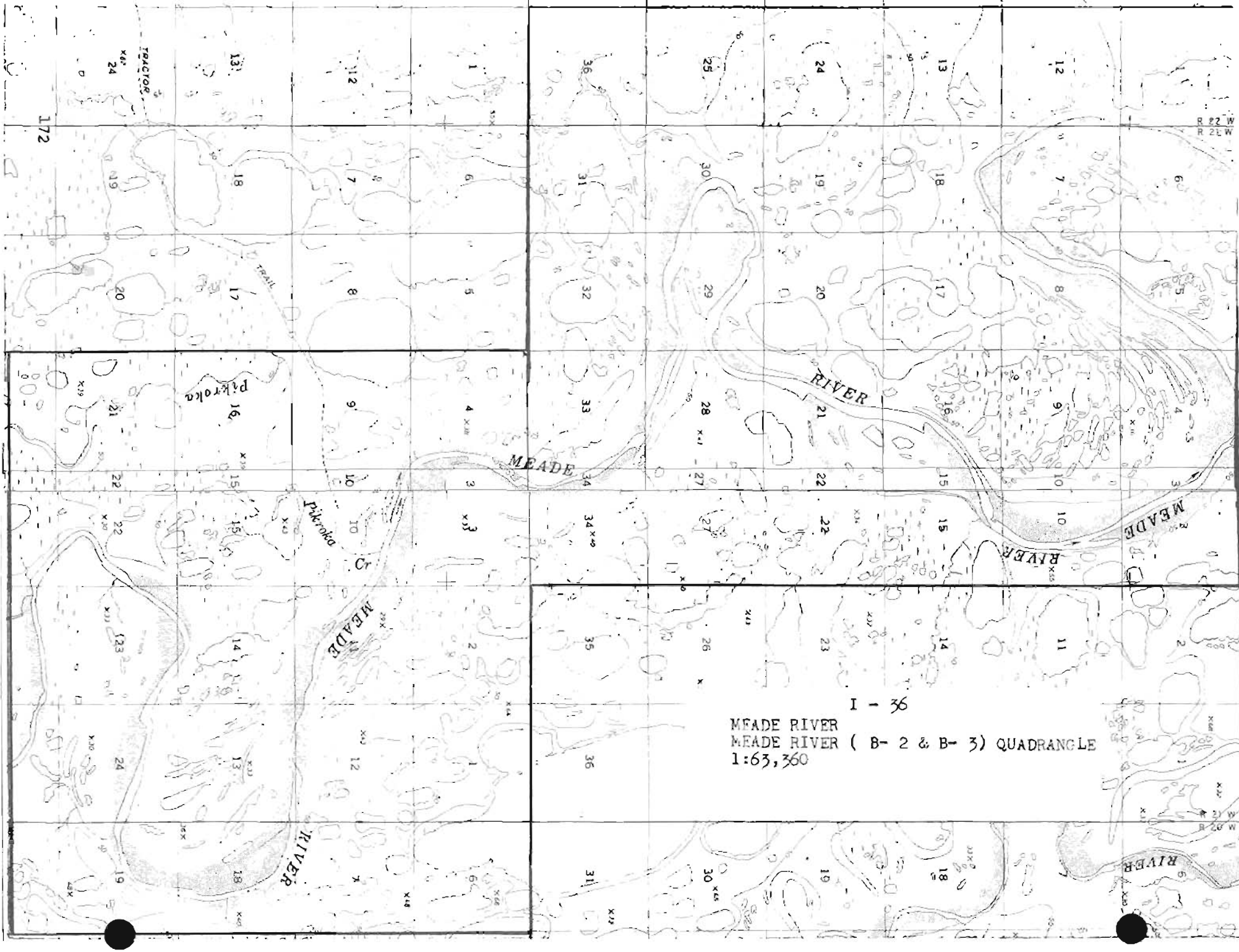
Data source:
C. G. Mull, Denver, Colo.
I. L. Tailleur, Menlo Park, Calif.

Selected references:
Chapman, R. M., and Sable, E. G., 1960, Geology of the Utukok-Corwin region, northwestern Alaska: U.S. Geol. Survey Prof. Paper 303-C, p. C49-C167.

Other knowledgeable persons:
M. D. Mangus, Anchorage, Alaska
E. G. Sable, Denver, Colo.

Publicity sensitivity: None

Comments: This site is eligible and can be recommended for entry into the Registry of Natural Landmarks.



I - 36

MEADE RIVER
MEADE RIVER (B- 2 & B- 3) QUADRANGLE
1:63,360

NATURAL LANDMARK SURVEY
LANDFORMS
RIVER SYSTEMS

I - 36 MEADE RIVER 2B

Themes: River systems (subtheme meander scrolls and oxbow lakes); Plains plateaus, and mesas; Permafrost landforms; Eolian landforms; Lakes and lakeshores.

Location: Arctic Coastal Plain Province, western part, Meade River B-2 and B-3 quadrangles (1:63,360), T. 11 N., R. 20 W., sections 6, 7, 18, 19, and 30; T. 11 N., R. 21 W., sections 1-4, 9-16, 21-28; T. 12 N., R. 21 W., sections 3-10, 15-22, and 27-34; T. 12 N., R. 22 W., sections 1, 12, 13, 24, 25, and 36.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense and Native Village withdrawal area. Sections 32 and 33, T. 12 N., R. 21 W. have been selected as of 8/1/74.

Approximate acreage: 33,600 acres (13,598 hectares)

Geologic features: Numerous meander scrolls and oxbow lakes formed by spring break up floods. River essentially at grade flows across the flat coastal plain reworking sand and silt of the Gubik Formation. Abundant permafrost features including non-sorted patterned ground and pingos. Large thermokarst lake basins and coalesced oxbow lakes indicate the river has been reworking its flood plains for thousands of years. Numerous sand dunes on flood plain.

Biotic features: Unique sand dune flora and shrub sequence on flood plain with wet sedge and tussock tundra away from river. Aquatic vegetation in the numerous lakes. Small mammals in sand dunes.

Land use and vulnerability: No usage at present, but site is a few miles from Meade River coal mine and may be subjected to considerable activity in near future.

Data source: Ecologic Landmark Survey team.

Selected references:

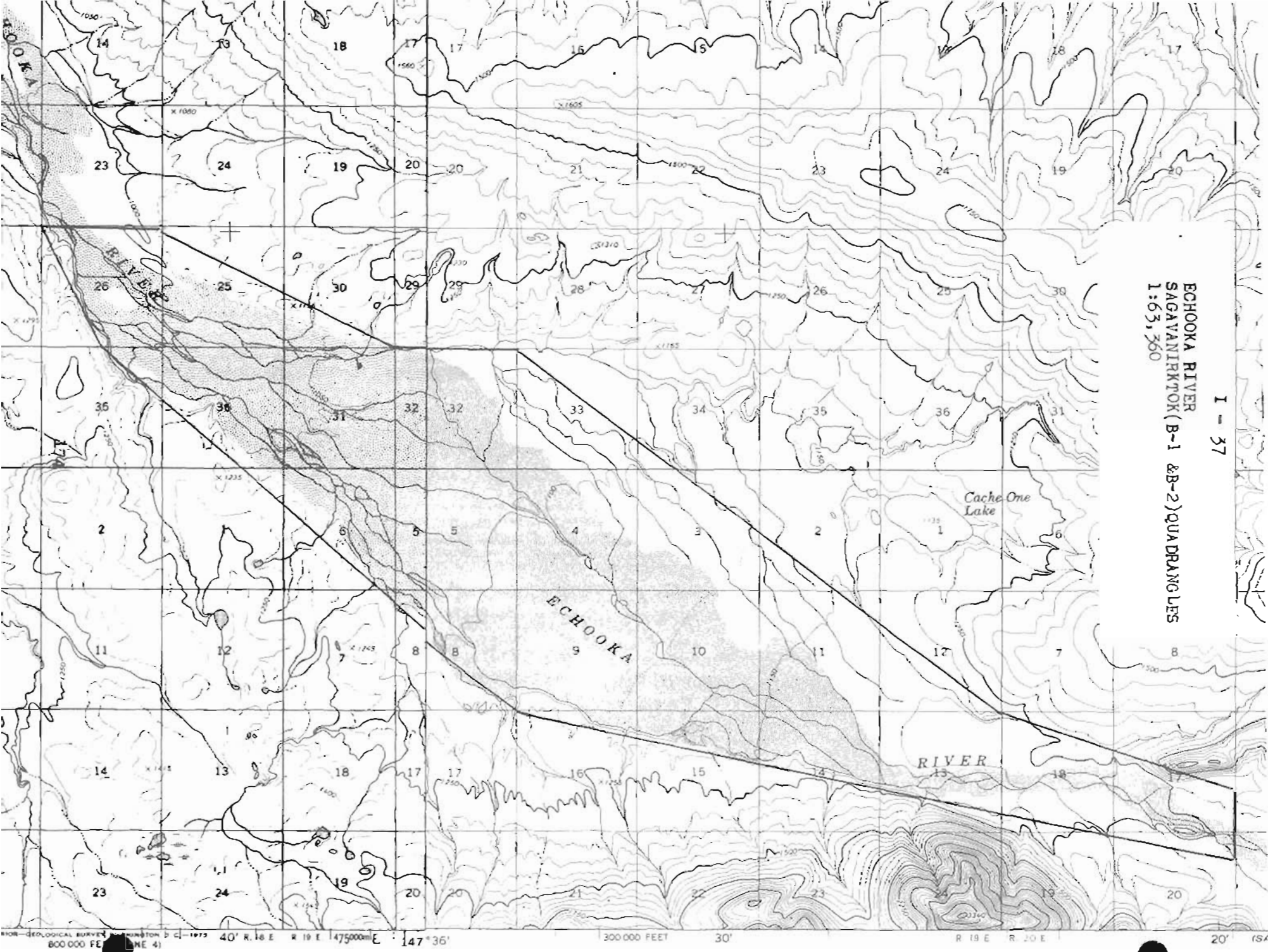
Black, R. F., 1964, Gubik Formation of Quaternary age in northern Alaska: U.S. Geol. Survey Prof. Paper 302-C, p. C59-C91.

Collins, F. R., 1958, Test wells, Meade and Kaolak areas, Alaska: U.S. Geol. Survey Prof. Paper 305-F, p. F341-F376.

Other knowledgeable persons:
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: Site recommended for Landmark status.


ECHOOKA RIVER
SAGAVANIRKTOK (B-1 & B-2) QUADRANGLES
1:63,360
I - 37
Cache One Lake
ECHOOKA
RIVER
40'
R. 18 E.
R. 19 E.
475000m E.
147°36'
300 000 FEET
30'
R. 19 E.
R. 20 E.
20'
800 000 FEET (LINE 4)

NATURAL LANDMARK SURVEY
LANDFORMS
RIVER SYSTEMS

I - 37 ECHOOKA RIVER 3C

Themes: River systems (subtheme aufeis field); Springs

Location: Arctic Foothills Province, eastern part, north front of Brooks Range, Sagavanirktok B-1 and B-2 quadrangles (1:63,360), T. 1 S., R. 18 E., sections 25, 26, 35, and 36; T. 1 S., R. 19 E., sections 31-34; T. 2 S., R. 18 E., section 1; T. 2 S., R. 19 E., sections 2-16; T. 2 S., R. 20 E., sections 17, 18, and 20.

Ownership: Native Regional Deficiency area. Selections not made as of 8/1/74.

Approximate acreage: 10,000 acres (40,047 hectares)

Geologic features: The Echooka River aufeis field is formed by springs flowing out of the Lisburne Limestone at the north front of the Brooks Range. An outwash gravel plain from glacial moraine lying just inside the front of the range has choked the stream valley forming a broad shallow stream that freezes to the bottom. The springs flow all year with an estimated discharge of about 32,000 gallons a minute. During the winter much of this water is forced to the surface and freezes forming an aufeis field of about 10 to 12 square miles.

Biotic features: The areas particularly areound the springs contain a wide variety of plants and shrubs. This is also the site of some of the largest trees in the Arctic Lowland. The balsam poplar grow to 30 feet and are 8-10 inches in diameter. The lush vegetation around the springs also attracts numerous birds and animals. This site also being considered as an Ecological Landmark and has been suggested as an Ecological Reserve by the Joint Federal-State Land Use Planning Commission.

Scenic features: Situated in a broad glacial valley at the front of the Brooks Range, the Echooka site has some of the most spectacular scenery in the Arctic Lowland.

Land use and vulnerability: No organized land use at present. Most of the acreage has oil and gas lease applications filed and some activity can be expected with the settlement of the Alaska Native Claims.

Data source: Author from personal investigations.
M. D. Mangus, Anchorage, Alaska
C. G. Mull, Denver, Colo.
W. P. Brosgé, Menlo Park, Calif.

Selected references:

Childers, J. M., Sloan, C. E., and Meckel, J. P., 1972, Hydrologic reconnaissance of streams and springs in eastern Brooks Range, Alaska: U.S. Geol. Survey open-file report, 25 p.

Keller, A. S., Morris, R. H., and Detterman, R. L., 1961, Geology of the Shaviovik-Sagavanirktok Rivers region, Alaska: U.S. Geol. Survey Prof. Paper 303-D, p. D169-D222.

Other knowledgeable persons:
H. N. Reiser, Menlo Park, Calif.
J. T. Dutro, Washington, D. C.

Publicity sensitivity: None

Comments: This site is probably of national significance and is recommended for Landmark Status.

I - 38

AWUNA RIVER
LOOKOUT RIDGE QUADRANGLE
1:250,000

NATURAL LANDMARK SURVEY
LANDFORMS
RIVER SYSTEMS

I - 38 AWUNA RIVER 4

Themes: River systems (subtheme entrenched meanders)

Location: Arctic Foothills Province, central part, Lookout Ridge quadrangle (1:250,000), T. 3 S., R. 23 W., sections 13, 23-26, and 36; T. 3 S., R. 22 W., sections 18-36; T. 4 S. R. 22 W., sections 1-5, and 12; T. 3 S., R. 21 W., sections 19-36; T. 4 S., R. 21 W., sections 1-16; T. 3 S., R. 20 W., sections 31-36; T. 4 S., R. 20 W., sections 1-26, and 36; T. 4 S., R. 19 W., sections 6-8, and 16-36; T. 5 S., R. 19 W., sections 1-6, and 11-12; T. 4 S., R. 18 W., sections 19-36; T. 5 S., R. 18 W., sections 1-6, and 8-12; T. 4 S., R. 17 W., sections 28-33.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 80,000 acres (32,376 hectares)

Geologic features: During the Tertiary and Quaternary the Awuna River was able to maintain its grade as the Arctic Lowland was slowly uplifted. The mature river meandered across a plain as the uplift started and this course was continued until canyons several hundred feet deep were cut into the Cretaceous bedrock of the Chandler Formation.

Biotic features: Primarily an area of dry upland and tussock meadows with shrub communities along stream.

Land use and vulnerability: No use at present, but a part of Naval Petroleum Reserve No. 4.

Data source:
C. G. Mull, Denver, Colo.
W. P. Brosgé, Menlo Park, Calif.

Selected references:
Tailleur, I. L., Kent, B. H., Jr., and Reiser, H. N., 1966, Outcrop geologic maps of the Nuka-Etivluk region, northern Alaska: U.S. Geol. Survey open-file report, 7 sheets.

Other knowledgeable persons:
M. D. Mangus, Anchorage, Alaska

Publicity sensitivity: None

Comments: This site is of interest but is not considered nationally significant and is not recommended for Landmark Status.

Theme 4.--Lakes and Lake Shores

The theme Lakes and Lake Shores is of prime significance, under the category Landforms of the Present, in the Arctic Lowland. One of the most striking features of this region is the abundance of lakes and ponds, particularly on the coastly plain west of the Colville River. Here lakes account for about 50 to 75 percent of the total area. Many are oval to oblong and show a remarkable preferred orientation.

A typical area in the lake country will show lakes in all stages of development from young to mature and many exhibit an overlapping sequence of cyclic development suggestive of repeated lake formation in a single basin. Drained lake basins are a common feature formed either by headward erosion of a stream or melting of an ice barrier between two adjoining lakes formed at different elevations. Mature lakes that are not drained usually become filled with aquatic vegetation and wind-blown silt.

The lake country of northwestern Alaska is a recently emergent area that has been above sea level for only a few tens of thousands of years. The surficial materials are sand and silt of the Gubik Formation. As this material is compacted the enclosed water is forced upward so there is an ice-rich zone about 10 to 30 feet thick at the surface. Polygonal patterned ground then developed on this ice-rich zone. The low-center type of polygon is primarily responsible for the formation of lakes. Water from melting snow and rain is trapped in the center of the polygon and starts melting the ice in the underlying silt and sand; this continues until a small basin is formed that eventually coalesces with adjoining polygons to develop a lake.

Mature lakes are 1 to 3 miles long and about 1/4 to 1½ miles wide. There are exceptions to this but in most cases it can be shown that the larger lake was formed by coalescence of adjoining lake basins. The lakes are rarely more than 9 to 10 feet deep as the zone of thawing is sharply limited by the decreasing ice content in the ice-rich zone. A depth of 6 feet appears to be a critical point in the development of these tundra lakes as that is themaximum thickness of ice that forms during the arctic winter. After a depth of 6 feet is attained there will be water under the ice. This water retains enough latent heat to melt the underlying permafrost and permits a much faster development of the lake basin.

This theme, Lakes and Lake Shores, can be divided into several subthemes to facilitate the discussion of sites. The divisions decided upon are Oriented Lakes, Thermokarst Lakes, Drained or Filled Lakes, and Glacial Lakes.

Oriented Lakes

Considerable data has been published in recent years on the origin and development of oriented lakes on the arctic coastal plain. Papers by Hussey and Michelson (1966) and Carson (1968) go into considerable detail that is summarized briefly here. Oriented lakes are a mature form of thermokarst lakes and are generally ovoid or oblong in shape. The shore commonly is fairly smooth. As the thermokarst pond develops it reaches a size where the wind can generate waves which attack the unconsolidated materials in the bank and the lake is enlarged primarily in the northeast-southwest direction of the prevailing wind. At this stage of development the lakes are generally square to rectangular

shaped. When the lakes reach about 1,500 feet in length the effect of longshore currents and beach drifting tends to concentrate their forces at the ends and the basin gradually becomes elongated in a more north-south direction. The typical mature oriented lake on the arctic coastal plain is aligned about 10 degrees west of north. Many show several well-developed strand lines. Peat obtained from some of these strand lines has been dated by the carbon-14 method at 2,000 to 4,000 years indicating a slow process of formation for oriented lakes.

Thermokarst Lakes

The feature here termed Thermokarst Lakes are the young immature stage of lake development. Nearly all of the lakes on the coastal plain start in this manner, commonly in an area of low-center polygons. Actually all lakes on coastly plain are thermokarst, but the above distinction is made for the purpose of this discussion.

Low-center polygons developed in ice-rich silt are generally 50 to 150 feet across with a rim 12 to 15 inches high. Water from melting snow and rain collect on the low center and gradually melt the underlying ice forming a pond. The pond enlarges into a lake by continued melting of both the center and edge of the polygon. Melting of the ice wedge at the margin of the polygon gives the lake its characteristic irregular shore line. This is particularly apparent when the thawing reaches the point of intersection of several polygons.

Drained or Filled Lakes

The final stage in lake development is for the lake to be drained or filled. A lake is drained by the headward erosion of a stream or by removal of the barrier between two adjoining lakes formed at different

elevations. Aquatic vegetation and silt commonly fill many of the lakes. Many of the lakes on the coastal plain show successive stages of development whereby new lakes develop in an old drained lake basin.

Glacial Lakes

Lakes formed by glacial action in the Arctic Lowland are confined to the southern part of the foothills and in the valleys at the front of the Brooks Range. Large spectacular lakes are present in many of the valleys where moraines have formed a dam across the natural drainage system. In most cases the moraine represents the last major advance of ice during the Pleistocene. Older advances of the glaciers onto the lowland left moraine many miles north of the range. As the ice melted kettle lakes were left on the moraine. Many of these still are present in the foothills area.

Lakes and Lake Shores

1. Highest priority

    Takrak Lakes - subtheme - oriented lakes

    Teshekpuk Lake - subtheme - coalesced oriented lake

    Lake Peters - Lake Schrader - subtheme - glacial lakes

    Pik Dunes - subtheme - drained and filled lakes

    Kurupa - Cascade Lakes - subtheme - glacial lakes

2. Sites definitely eligible

    Topagoruk Lakes - subtheme - oriented lakes

    Shainin Lake - subtheme - glacial lakes

3. Sites of uncertain eligibility

    None

4. Sites not recommended

    Esook Lake - subtheme - drained or filled lakes

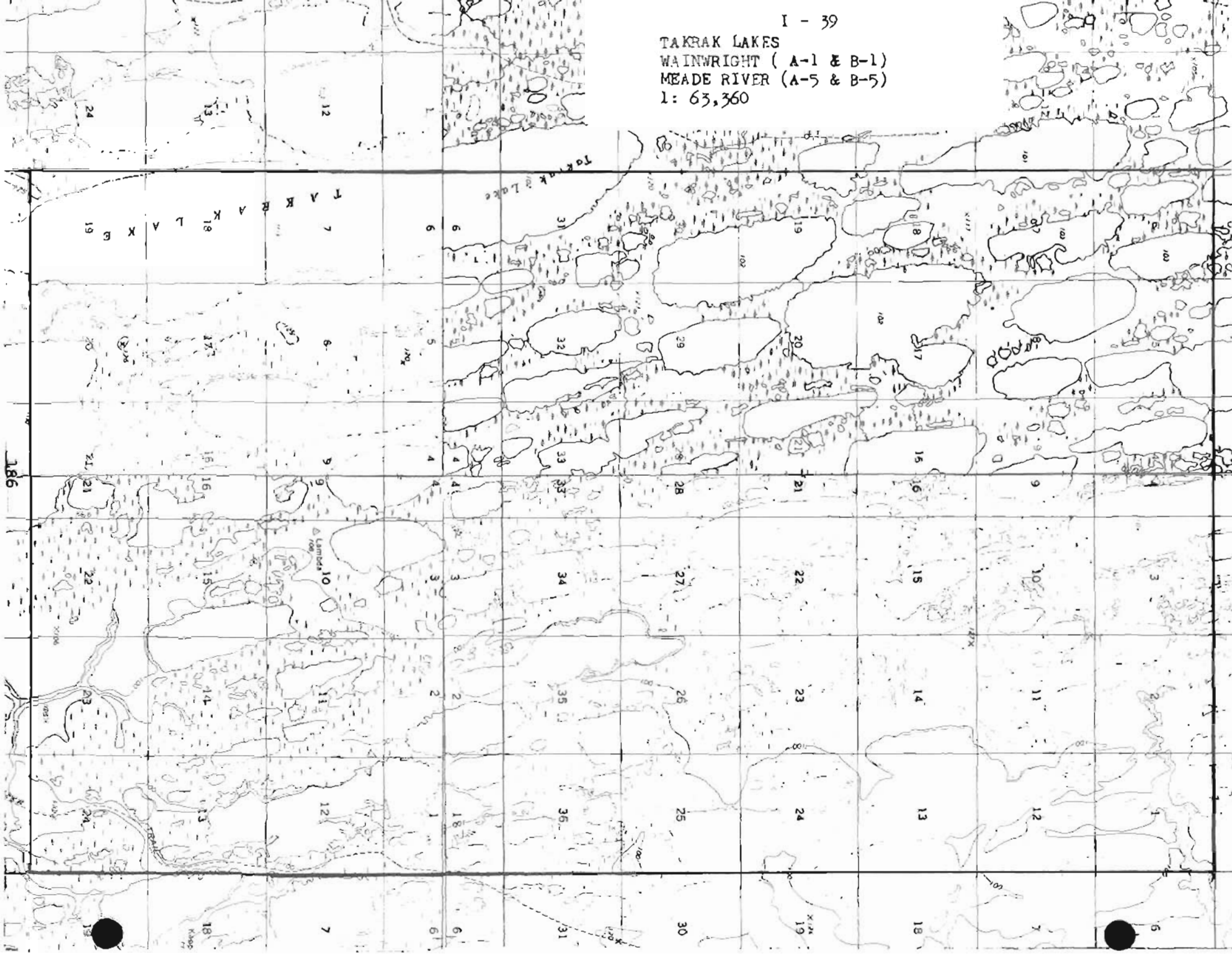
    Judy Creek - subtheme - oriented lakes

Figure 15. Oriented lakes on arctic coastal plain.

Figure 16. Kurupa Lake site.

I - 39

TAKRAK LAKES
WAINWRIGHT (A-1 & B-1)
MEADE RIVER (A-5 & B-5)
1: 63,360



NATURAL LANDMARK SURVEY
LANDFORMS
LAKES AND LAKE SHORES

I - 39 TAKRAK LAKES 1C

Themes: Lakes and Lake shores (subtheme oriented lakes), Permafrost landforms, Plains, plateaus, and mesas.

Location: Arctic Coastal Plain Province, western part, Wainwright A-1 and B-1, and Meade River A-5 and B-5 quadrangles (1:63,360), T. 10 N., R. 28 W., sections 1-24; T. 11 N., R. 28 W., sections 1-36.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 38,400 acres (15,540 hectares)

Geologic features: An outstanding area of oriented lakes that is part of a much larger area. There are about 75 lakes within this site and numerous small ponds. The site shows lakes in all stages of development from tundra pond to large coalesced lake basins. The mature lakes exhibit a remarkable consistency in direction of orientation being 12 to 13 degrees west of north. Most of the lakes are mature, but some young lakes are developing nearly at right angles to the direction of orientation. Some of less mature ones also show the square to rectangular outline that gradually enlarges and forms the oriented lake. Most of the immature forms on the site are second cycle lakes.

This is also an excellent section of plains. The only variation in elevation is due to lake basin development. The underlying ice-rich silt and sand is part of the Gubik Formation.

Biotic features: Wet sedge tundra with a few areas of dry tussock tundra. Abundant aquatic plant communities in some of the lakes. Major bird nesting area.

Land use and vulnerability: None at present and probably very slight in future.

Data source: M. D. Mangus, Anchorage, Alaska
Author from personal investigation

Selected references:

Anderson, G. S., and Hussey, K. M., 1963, Preliminary investigation of thermokarst development of the North Slope of Alaska: Proceedings, Iowa Acad. Sci., v. 70, p. 306-320.

Carson, C. E., 1968, Radiocarbon dating of lacustrine strands in arctic Alaska: Arctic, Jour. Arctic Inst. N. Am., v. 21, no. 1, p. 12-26.

_____, and Hussey, K. M., 1962, The oriented lakes of arctic Alaska: Jour. of Geology, v. 70, no. 4, p. 417-439.

Hussey, K. M., and Michelson, R. W., 1966, Tundra relief features near Point Barrow, Alaska: Arctic, Jour. Arctic Inst. N. Am., v. 19, no. 2, p. 162-184.

Livingstone, D. A., Bryan, Kirk, Leahy, R. G., 1958, Effects of an arctic environment on the origin and development of freshwater lakes: Limnology and Oceanography, v. 3, no. 2, p. 192-214.

Rosenfeld, G. A., Jr., and Hussey, K. M., 1958, A consideration of the problems of oriented lakes: Proceedings, Iowa Acad. Sci., v. 65, p. 279-287.

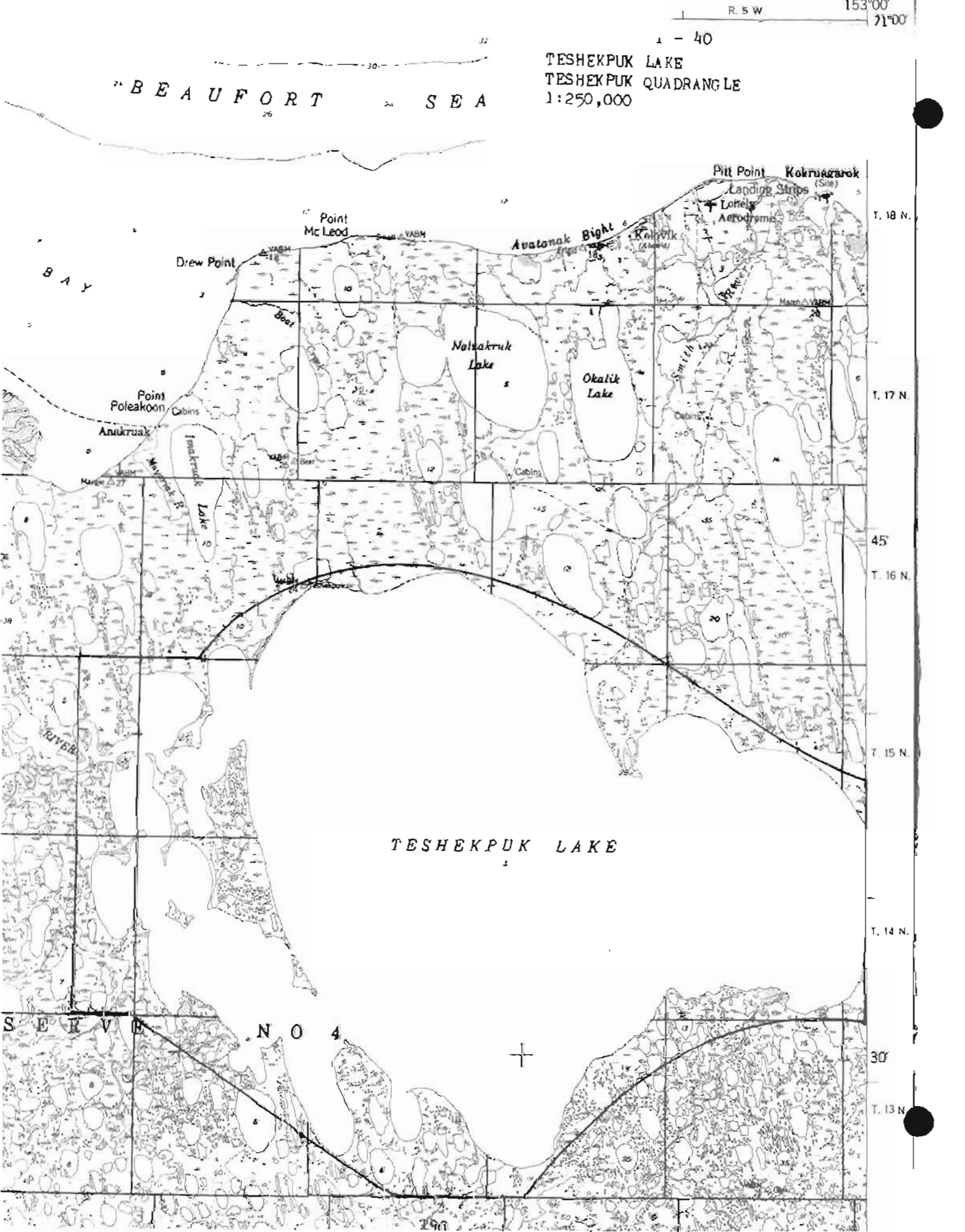
Other knowledgeable persons:

Jerry Brown, Hanover, New Hampshire
A. H. Lachenbruch, Menlo Park, Calif.

Publicity sensitivity: None

Comments: This is an outstanding example of oriented lakes of national significance and eligible for entry in Registry of Natural Landmarks.

TESHEKPUK LAKE
TESHEKPUK QUADRANGLE
1:250,000



I - 40 TESHEKPUK LAKE 1C

Themes: Lakes and Lake shores (subtheme compound oriented lake), Permafrost landforms, and Plain, plateaus, and mesas.

Location: Arctic Coastal Plain Province, central part, near Beaufort Sea coast, Teshekpuk quadrangle (1:250,000), T. 14 N., R. 4 W., sections 6, 7, 18, 19, 30, and 31; T. 15 N., R. 4 W., sections 6, 7, 18, 19, 30, 31; T. 13 N., R. 5 W., sections 4-7; T. 14 N., R. 5 W., sections--all; T. 15 N., R. 5 W., sections 6-9, 14-36; T. 13 N., R. 6 W., sections 1-22, and 28-32; T. 14 N., R. 6 W., sections--all; T. 15 N., R. 6 W., sections--all; T. 16 N., R. 6 W., sections 19, 20, and 27-36; T. 13 N., R. 7 W., sections 1-30, and 32-36; T. 14 N., R. 7 W., sections--all; T. 15 N., R. 7 W., sections--all; T. 16 N., R. 7 W., sections 14-36; T. 13 N., R. 8 W., sections 1-6, 8-15, and 23-24; T. 14 N., R. 8 W., sections--all; T. 15 N., R. 8 W., sections--all; T. 16 N., R. 8 W., sections 23-27 and 33-36; T. 14 N., R. 9 W., sections 1, 2, 11-14, 23-26, and 35, 36; T. 15 N., R. 9 W., sections 1, 2, 11-14, 23-26, and 35, 36.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 265,000 acres (107,245 hectares).

Geologic features: An outstanding example of a compound freshwater lake formed by the coalescence of numerous oriented lake basins. The lake surface is only 5 feet above sea level and is in delicate environmental balance with the surrounding area. The largest freshwater lake in the Arctic Lowland and a good illustration of how compound lakes develop by the melting of ice-rich silt between adjoining lake basins.

Biotic features: Major nesting area for water fowl and abundant aquatic plant communities. This site recommended as an Ecological Reserve by the Joint Federal-State Land Use Planning Commission and also an Ecological Landmark.

Land use and vulnerability: No land use at present, but possibility of oil drilling in near future.

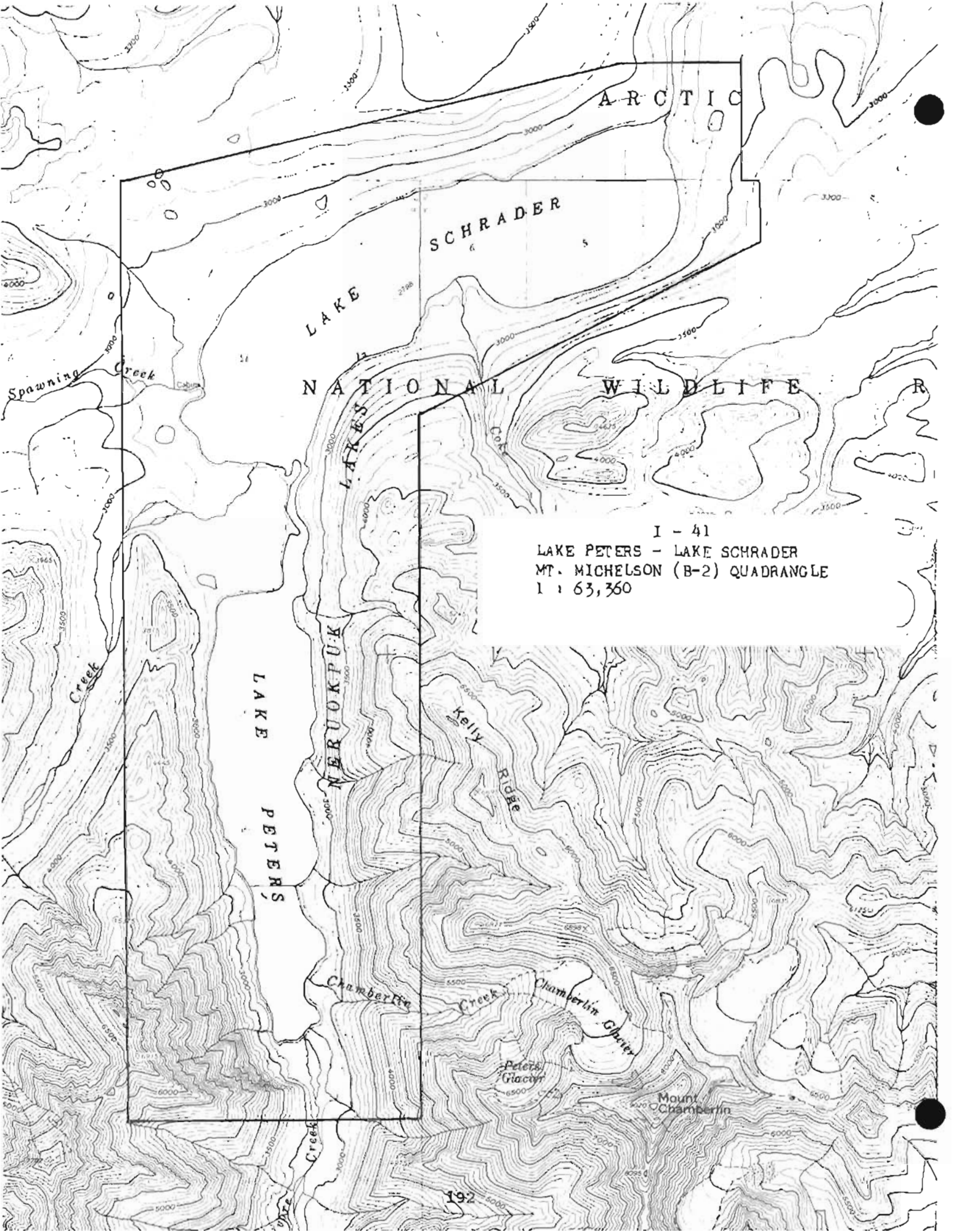
Data source: Joint Federal-State Land Use Planning Commission.

Selected references: None

Other knowledgeable persons:
Charles Evans, Anchorage, Alaska
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: This site is of national significance and eligible for entry in Registry of Natural Landmarks.



I - 41
LAKE PETERS - LAKE SCHRADER
MT. MICHELSON (B-2) QUADRANGLE
1 : 63,360

NATURAL LANDMARK SURVEY
LANDFORMS
LAKES AND LAKE SHORES

I - 41 LAKE PETERS-LAKE SCHRADER 1B

Themes: Lakes and Lake shores (subtheme glacial lakes), Work of glaciers, Movement of the earth's crust.

Location: Arctic Foothills Province and Brooks Range, eastern part, partially in Brooks Range, Mt. Michelson B-2 quadrangle (1:63,360), T. 1 N., R. 29 E., sections 32-36; T. 1 S., R. 29 E., sections 1-3, 10-15, 22-27, and 34-36; T. 1 S., R. 30 E., sections 4-8; T. 2 S., R. 29 E., sections 1-3, and 10-12.

Approximate acreage: 16,300 acres (6,596 hectares).

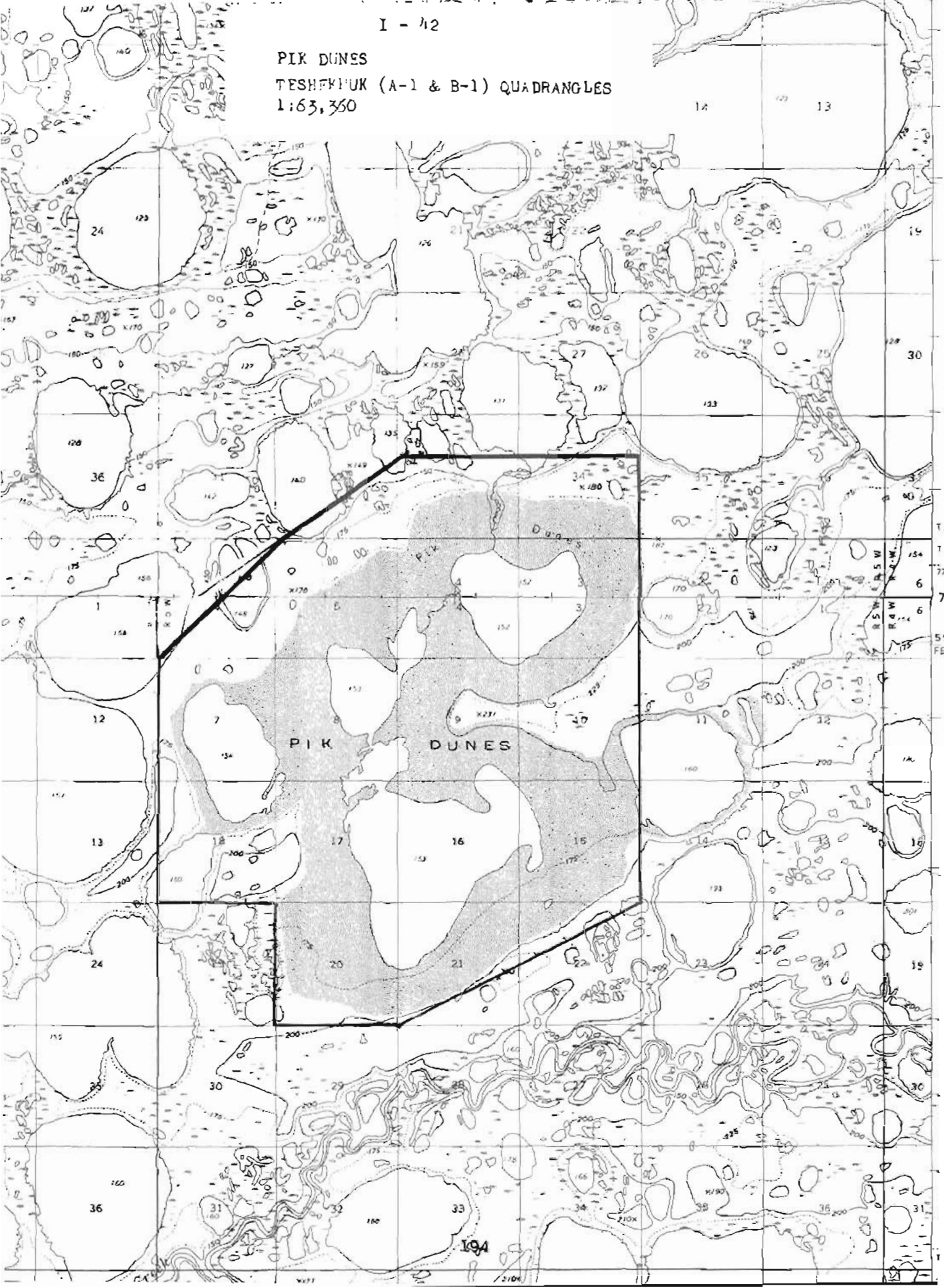
Comments: This site was previously suggested as a Natural Landmark by Dr. Frederick C. Dean of the University of Alaska, and a site evaluation report was made by Dr. Peter C. Lent of Alaska Cooperative Wildlife Research Unit, in 1968. Additional data will not be given on the site at this time. However, I do strongly suggest Park Service consideration be given to make it a Natural Landmark. We did use the Lake Peters camp as a base for geological investigations during 1969, 1970, and 1971. During this time most of the debris lying around the lakes, mentioned by Lent, was cleaned up. Consequently, the site is in better condition now than at the time he wrote the evaluation report.

I - 42

PIK DUNES

TESHEKPUK (A-1 & B-1) QUADRANGLES

1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
LAKES AND LAKE SHORES

I - 42 PIK DUNES 1C

Themes: Lakes and Lake shores (subtheme drained and filled lakes, Plains, plateaus, and mesas, Permafrost landforms.

Location: Arctic Coastal Plain Province, central part, near Teshekpuk Lake, Teshekpuk A-1, and B-1 quadrangles (1:63,360), T. 10 N., R. 5 W., sections 3-10, 15-18, and 20-22; T. 11 N., R. 4 W., sections 32-34.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 9,130 acres (3,695 hectares).

Geologic features: The Pik Dunes site is a remarkable sand dune and playa lake area that has formed in the basin of a large drained lake. This miniature desert, about 12 square miles, lies about 50 feet below the surrounding plain. The original lake developed in sand and was exceptionally deep. Headward erosion of a stream drained the lake and young lakes are now developing on the floor of the basin. The floor also contains an unusual sequence of dunes resulting from the fact they are in a hole about 50 feet below the surrounding plain. The entire area was originally part of a marine beach and depositional features are well exposed in the banks around the basin. This is all part of the Gubik Formation.

Biotic features: Unusual plant communities for arctic environment including sage and other arid type plants. Area is being recommended as an Ecological Landmark.

Land use and vulnerability: No land use at present and probably none in near future.

Data source: Author from personal investigation.

Selected references: None

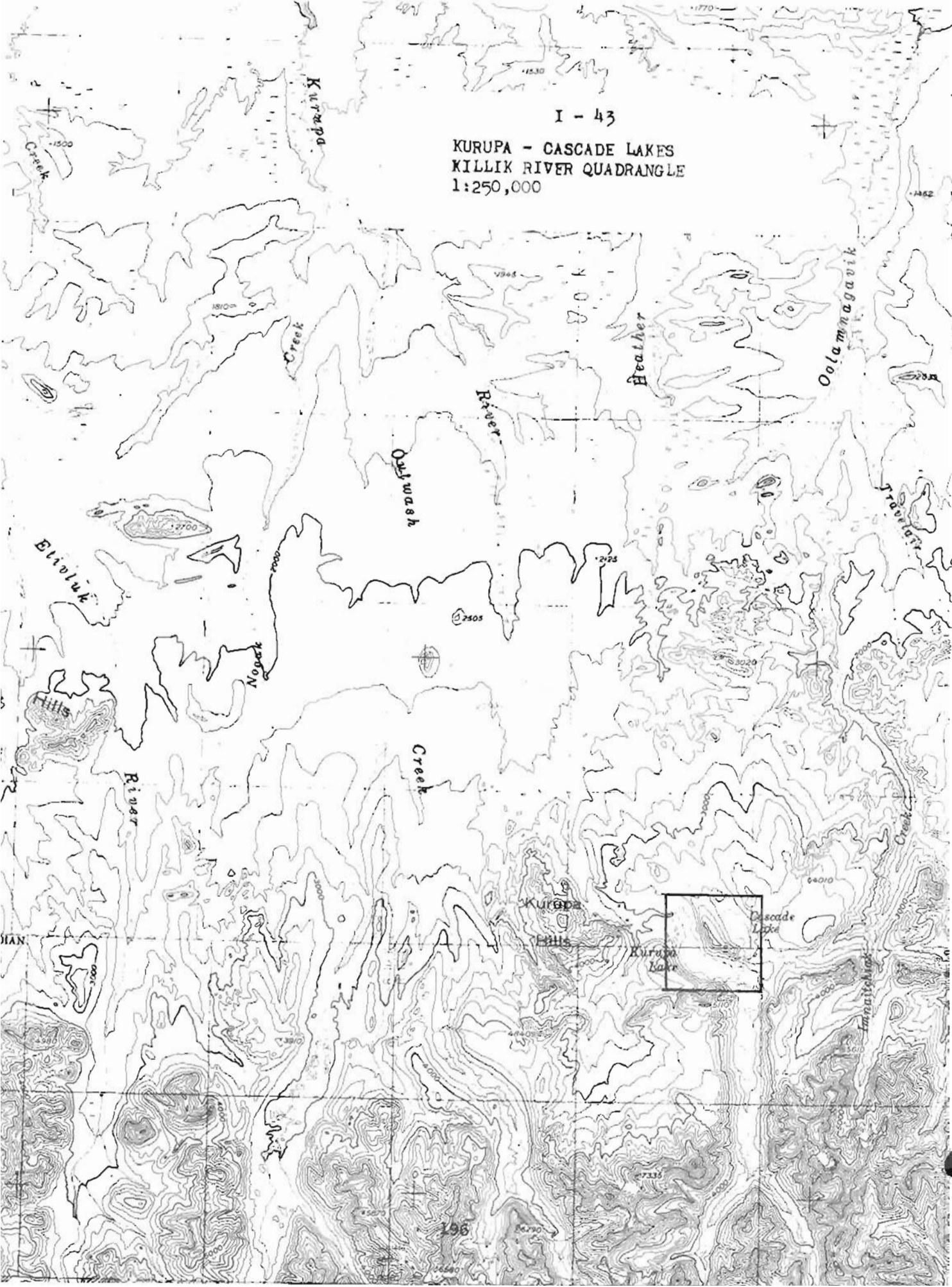
Other knowledgeable persons:
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: This is a unique site in the Arctic Lowland and is recommended for entry into Registry of Natural Landmarks.

I - 43

KURUPA - CASCADE LAKES
KILLIK RIVER QUADRANGLE
1:250,000



NATURAL LANDMARK SURVEY
LANDFORMS
LAKES AND LAKE SHORES

I - 43 KURUPA - CASCADE LAKES 1C

Themes: Lakes and Lake shores (subtheme glacial lakes), Work of glaciers, Movement of the earth's crust.

Location: Arctic Foothills Province, central part, north front of Brooks Range, Killik River quadrangle (1:250,000), T. 12 S., R. 12 W. (Umiat), sections 22-27; T. 34 N., R. 18 E. (Kateel), sections 1-3 and 10-12.

Ownership: Bureau of Land Management, Department of the Interior under Alaska Native Claims Settlement Act section 17, D-2. Proposed as part of Gates of the Arctic National Park. Dual selection, Native Regional Deficiency Area.

Approximate acreage: 5,760 acres (2,331 hectares).

Geologic features: Glacial moraine dropped by the last great advance of ice during the Pleistocene forms the dam that traps the waters of Kurupa and Cascade Lakes. Located at the north front of the Brooks Range, these lakes are in some of the most spectacular scenery in the Arctic Lowland. Mississippian limestone forms gray cliffs along south shore of Kurupa Lake and varicolored chert of Permian, Triassic, and Jurassic form the north side. Evidence of the great force necessary to build the mountains is well represented by the highly folded and faulted rock strata that can be seen in valley walls. The broad U-shaped valley south of the lake attests to the tremendous force of the glacier to carve and shape the landscape.

Biotic features: The lakes contain an abundance of large fresh water fish including lake trout, char, and grayling. Dall sheep are found on the crags around thelake, bear and wolf dens are also present. Alpine plants in great variety are found on the surrounding mountains.

Scenic features: This site contains the most spectacular scenery in the Arctic Lowland. Two long, narrow, deep blue lakes at the foot of massive rugged mountains.

Land use and vulnerability: Site a favorite spot for hunting parties. Sections 22-24 of T. 12 S., R. 12 W. have oil and gas lease applications filed with the Bureau of Land Management. This site is probably vulnerable to development unless it is protected in the near future.

Data source: M. D. Mangus, Anchorage, Alaska
Author from personal investigation

Selected references:

Chapman, R. M., Detterman, R. L., and Mangus, M. D., 1964, Geology of the Killik-Etivluk Rivers region, Alaska: U.S. Geol. Survey Prof. Paper 303-F, p. F325-F407.

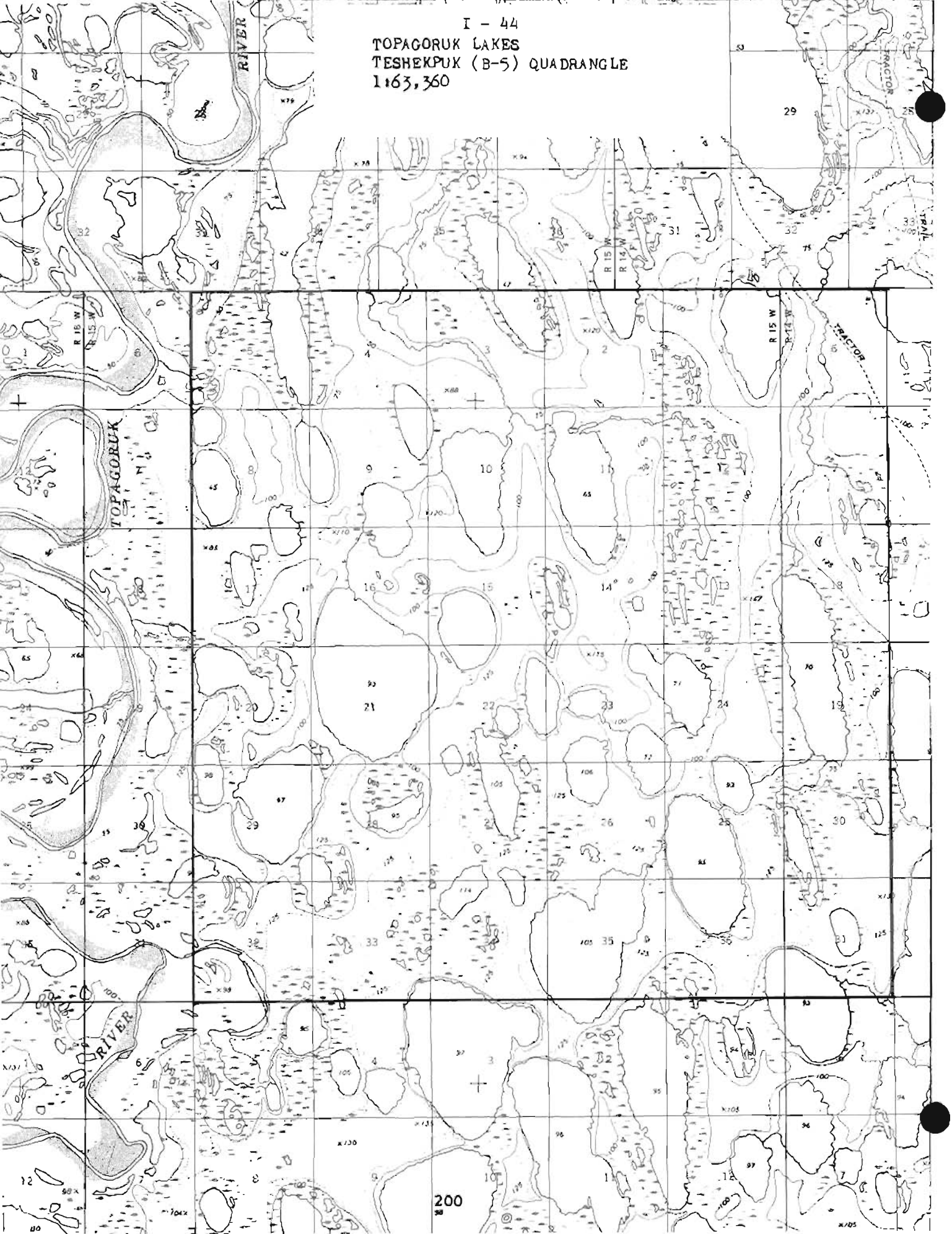
Other knowledgeable persons:

M. D. Mangus, Anchorage, Alaska
C. G. Mull, Denver, Colo.
R. M. Chapman, Menlo Park, Calif.

Publicity sensitivity: None

Comments: Strongly recommend this site to be included in the Gates of the Arctic National Park, If not included in part it should be included in Registry of Natural Landmarks. The author was one of the first persons to see these lakes, except for a few Eskimos, and it is one of the most spectacular spots in Alaska.

I - 44
TOPAGORUK LAKES
TESHEKPUK (B-5) QUADRANGLE
1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
LAKES AND LAKE SHORES

I - 44 TOPAGORUK LAKES 2C

Themes: Lakes and Lake shores (subthema oriented lakes), Permafrost landforms, Plains, plateaus, and mesas.

Location: Arctic Coastal Plain Province, western part, southeast of Barrow, Teshekpuk B-5 quadrangle (1:63,360), T. 12 N., R. 14 W., sections 6, 7, 18, 19, and 31; T. 12 N., R. 15 W., sections 1-5, 8-17, 20-29, and 32-36.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense

Approximate acreage: 23,040 (9,325 hectares).

Geologic features: Site contains about 40 lakes and numerous ponds. Lakes in various stages of development from initial tundra pond to typical northwest orientation. Some of the lakes are in the second and third cycle of development. Flat initial plain formed of silt and sand of the Gubik Formation. The only relief developed on this plain was caused by the lakes melting the permafrost. Lakes at the lowest elevation are generally second or third cycle whereby the lake is drained, permafrost reestablishes and then the process of lake developments starts again.

Biotic features: Abundant aquatic vegatation in numerous lakes and ponds. Wet sedge tundra away from lakes with areas of tussock tundra in dry areas.

Land use and vulnerability: Part of Naval Petroleum Reserve No. 4. One exploratory well drilled along west edge of site and possibly more will be drilled in future.

Data source: Author from personal investigations.

Selected references:

Collins, F. R., 1958, Test wells, Topagoruk area, Alaska: U.S. Geol. Survey Prof. Paper 305-D, p. D265-D316.

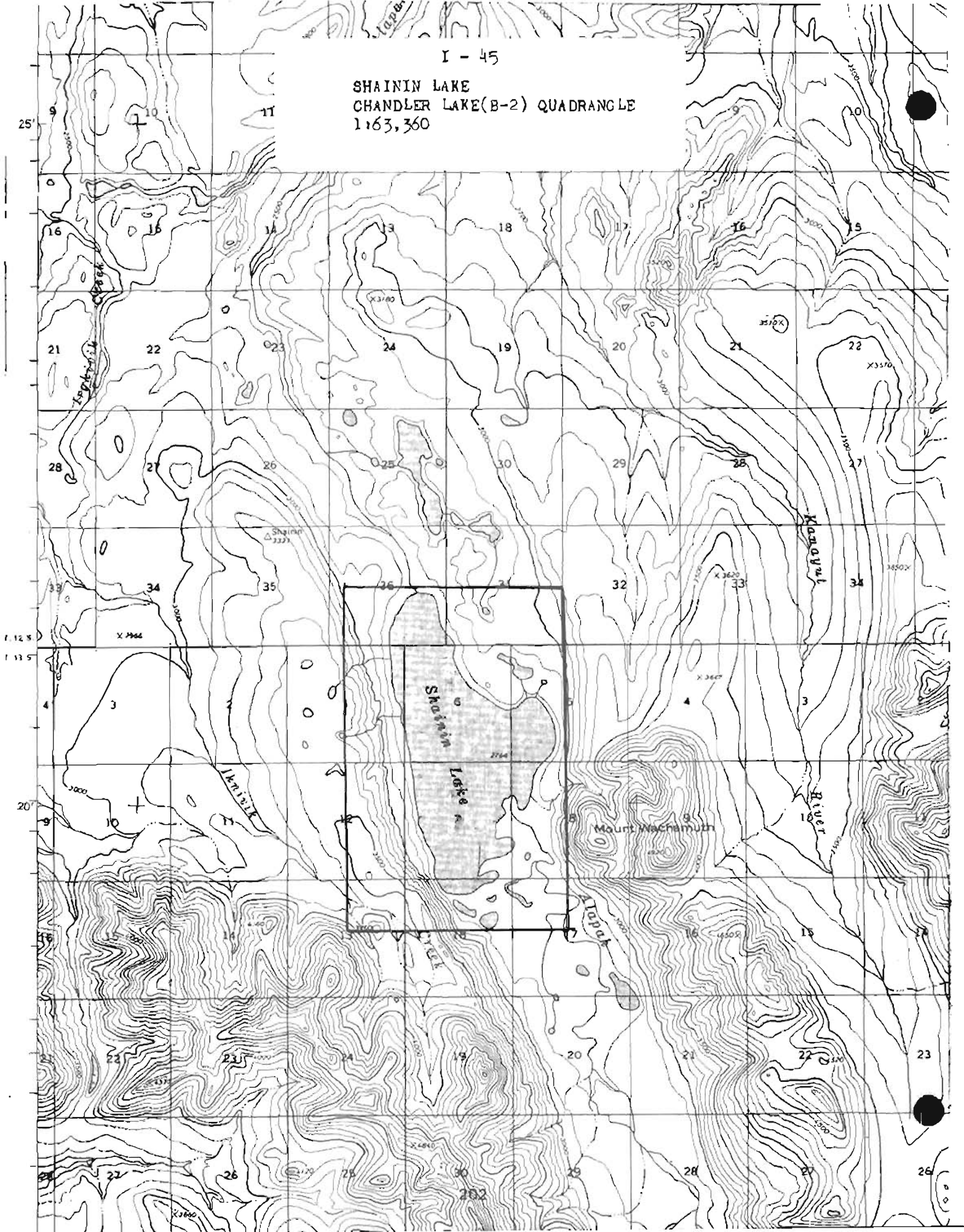
Other knowledgeable persons:
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: A good area of oriented lakes and plains recommended for entry into Registry of Natural Landmarks.

I - 45

SHAININ LAKE
CHANDLER LAKE(B-2) QUADRANGLE
1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
LAKES AND LAKE SHORES

I - 45 SHAININ LAKE 2C

Themes: Lakes and Lake shores (subtheme glacial lakes), Work of glaciers, Movement of the earth's crust.

Location: Arctic Foothills Province, central part, north front of Brooks Range, 10 miles east of Anaktuvuk River, Chandler Lake B-2 quadrangle (1:63,360), T. 12 S., R. 4 E., section 36; T. 12 S., R. 5 E., section 31; T. 13 S., R. 4 E., sections 1, 12, and 13; T. 13 S., R. 5 E., sections 5-8 and 17-18.

Ownership: Bureau of Land Management, Department of the Interior under section 17, D-2 Alaska Native Claim Settlement Act as part of proposed Gates of the Arctic National Park. Native village withdrawal area. Village has selected section 36, T. 12 S., R. 4 E., and sections 1, 12, and 13, T. 13 S., R. 4 E. Oil and gas lease applications filed on remaining area.

Approximate acreage: 3,800 acres (1,538 hectares).

Geologic features: Large spectacular glacial lake lying in broad U-shaped glacially carved valley at north front of the Brooks Range. Morainal dam formed by last major Pleistocene glacier. Rugged mountains of gray Mississippian limestone rise abruptly above lake. The mountain on east side of lake is the type locality of the Wachsmuth Limestone of the Lisburne Group. Contains abundant remains of Mississisppian marine life. Also type area for a glacial advance.

Biotic features: Alpine plant communities on mountains and dry upland meadow near lake. Dall sheep on mountains.

Land use and vulnerability: Used primarily as a hunting area which will deplete the game in area.

Data source:

J. T. Dutro, Jr., Washington, D.C.
Author from personal investigations

Selected references:

Bowsher, A. L., and Dutro, J. T., Jr., 1957, The Paleozoic section in the Shainin Lake area, central Brooks Range, Alaska: U.S. Geol. Survey Prof. Paper 303-A, p. A1-A45.

Detterman, R. L., Bowsher, A. L., and Dutro, J. T., Jr., 1958, Glaciation on the Arctic Slope of the Brooks Range, northern Alaska: Arctic, Jour. Arctic Inst. N. Am., v. 11, no. 1, p. 43-61.

Other knowledgeable persons:

W. P. Brosgé, Menlo Park, Calif.
H. N. Reiser, Menlo Park, Calif.

Publicity sensitivity: None

Comments: Spectacular mountain and lake scenery. Definitely eligible for entry into Registry of Natural Landmarks.

ESOOK LAKE
HARRISON BAY(D-5) QUADRANGLE
1:63,360

NATURAL LANDMARK SURVEY
LANDFORMS
LAKES AND LAKE SHORES

I - 46 ESOOK LAKE 4

Themes: Lakes and Lake shores (subtheme drained and filled lakes), Sea shores and islands, Permafrost landforms, Plains, plateaus, and mesas.

Location: Arctic Coastal Plain Province, central part west of Colville River delta, Harrison Bay D-5 quadrangle (1:63,360), T. 17 N., R. 2 W., sections 5-8, 17-20, and 29-32; T. 17 N., R. 3 W., sections 1-5, 8-17, 20-29, and 32-36; T. 18 N., R. 2 W., sections 25-32; T. 18 N., R. 3 W., sections 25-29 and 32-36.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy Department of Defense.

Approximate acreage: 29,930 acres (12,112 hectares).

Geologic features: Large oriented lake and old filled lake adjacent to the arctic coast. The filled lake is starting on the second cycle of lake development. One large oriented lake breached by marine erosion and is being filled. Lakes developed in ice-rich silt of the Gubik Formation. Abundant permafrost features.

Biotic features: Prime waterfowl nesting area. Abundant aquatic, marine, and wet sedge tundra plant communities. Most of the area only a few feet above sea level.

Land use and vulnerability: No use of land at present. Possibly some exploratory oil well drilling in future.

Data source: Author from personal investigations.

Selected references: None

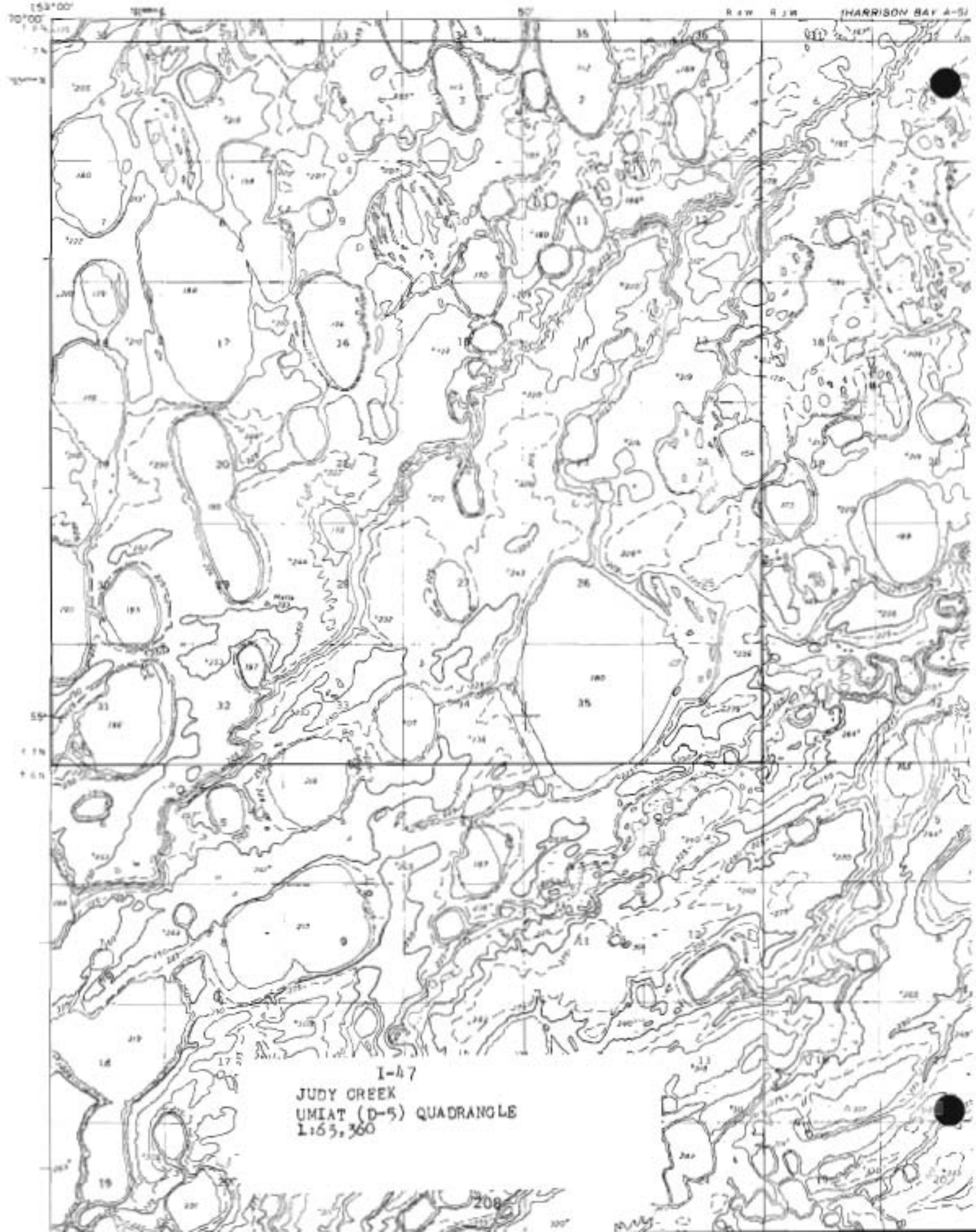
Other knowledgeable persons:

J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: Site not recommended for Landmark Status.

GEOLOGICAL SURVEY



NATURAL LANDMARK SURVEY
LANDFORMS
LAKES AND LAKE SHORES

I - 47 JUDY CREEK 4

Themes: Lakes and Lake shores (subtheme oriented lakes), Permafrost landforms, Seas and sea shores, Plains, plateaus, and mesas.

Location: Arctic Coastal Plain Province, central part, west of Colville River, Umiat D-5 quadrangle (1:63,360), T. 7 N., R. 4 W., sections--all.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 23,040 acres (9,324 hectares).

Geologic features: Oriented lakes superimposed on old strand line now about 40 miles inland from coast. Lakes in all stages of development; some in second and third cycle, compound and single. Abundant permafrost polygons and few pingos. Sand dunes and related strand line features.

Biotic features: Aquatic vegetation, wet sedge tundra, and dry tussock tundra plant communities.

Land use and vulnerability: No organized land use at present, but a part of Naval Petroleum Reserve No. 4.

Data source: W. P. Brosgé, Menlo Park, Calif.

Selected references:

Brosgé, W. P., and Whittington, C. L., 1966, Geology of the Umiat-Maybe Creek region, Alaska: U.S. Geol. Survey Prof. Paper 304-H, p. H501-H638.

Comments: A good area of oriented lakes on old strand line, probably not nationally significant and not recommended for Landmark Status.

Theme 5.--Permafrost Landforms

The theme Permafrost Landforms is of great significance to the category Landforms of the Present in the Arctic Lowland. This theme was not included in the general landform classification used by the National Park Service, but in a letter from Robert Linn dated January 9, 1973, permission was granted to include this major landform theme in the Arctic Lowland study.

Permafrost, or perennially frozen ground, forms whenever the average annual temperature remains below the freezing point. The entire Arctic Lowland region is within the zone of continuous thick permafrost. This zone is 1,300 to 1,700 feet thick along the arctic coast. Depth to the base of permafrost decreases to the south, but is still many hundreds of feet thick at the front of the Brooks Range.

The surface of the Arctic Coastal Plain Province is composed primarily of fine grained sediments, silt and sand, that have been emergent for only a few tens of thousands of years. These sediments contained much interstitial water that was turned to ice by the extreme cold. Thus the coastal plains contain the greatest variety of permafrost landforms. Some of the landforms discussed under other themes are, also, the product of permafrost. However, for the purpose of this study it was decided to discuss under the category Permafrost Landforms only those geomorphic features that did not logically fit any other theme. These include pingos, patterned ground or polygons, beaded drainage, thermokarst pits, and muck deposits.

Many scientific investigations of permafrost have been made in the last 25 years, and the controversy that developed over the construction

of the Trans-Alaska Pipeline has contributed greatly to the general public awareness of this phenomenon. However, the knowledge of how permafrost features develop and even the process of its formation have not been known for very many years. Leffingwell (1919) was one of the first to seriously study the causes and effects of permafrost. Most of his theories concerning its formation and development have proven to be correct. The age of its formation is much greater than Leffingwell suggested, but this was determined only through the refinement of dating by Carbon-14 which was not available to him.

This theme, Permafrost Landforms, can be divided into several subthemes for the purpose of this study. The subthemes decided upon are Polygons or Patterned Ground, Pingos, and Beaded Streams. Other permafrost-related landforms are not considered individually for landmark status. Some are included with the above categories or with other themes.

Polygons or Patterned Ground

Polygonal ground is readily apparent to even the casual visitor to the Arctic Lowland. The patterned ground formed by the polygons can be either sorted or unsorted and the polygons can be low-centered or high-centered. Nearly the entire coastal plain is covered as well as water saturated areas in the foothills.

Polygons develop wherever saturated fine grained, unconsolidated sediments occur. When this sediment freezes it produces a honeycomb-like network of vertical ice wedges that join to form the polygon. Contraction cracks form over the top of these ice wedges that collect melted snow and rain during the summer and which in turn freezes

adding to the mass of the ice wedge.

Low-center polygons develop first in the saturated sediments. The ice wedge forming the periphery of polygon is thrust upward during growth causing a bowl-shaped depression in the center. Depending on the amount of water available, the low-center polygon may develop into a thermokarst lake or be filled with sediment and vegetation resulting in a high-center polygon. The diameter of the low-center polygon is commonly 100 to 300 feet, which is an order of magnitude larger than the high-center type. Secondary and tertiary ice wedges forming within the low-center type eventually develop the smaller high-center polygon.

Pingos

Pingos are ice-cored conical mounds that develop on parts of the arctic coastal plain. They are generally within a few miles of a major stream or spring and depend on a source of ground water for their development. Unfrozen channels of ground water are fairly common throughout the coastal plains. They are generally in areas where the subsoil contains lenses of gravel that is overlain by silt. The movement of ground water may be stopped by an ice wedge, frozen ground or other impermeable zone. The hydraulic head formed by continued flow of water causes a bulge to form on the ground surface. As the additional water freezes the ice-core enlarges until a conical mound is formed.

Pingos are prominent landmarks on the flat coastal plain. They range from 10 to several hundred feet high and 50 to several thousand feet in diameter. Typically they have a small crater-like depression in the top. This may contain a small pond with mud in it which accounts for the original idea that these features were mud volcanos.

Investigation has shown that the core is a solid mass of ice. The continued growth of a pingo causes a network of radiating cracks to develop at the top. As the cracks enlarge the ice core melts and the top collapses. Large pingos are fairly old features. Radiocarbon dates obtained from organic material enclosed in the pingo indicates some of the larger ones are 4,000 to 5,000 years old. Most of the pingos in Alaska are of the closed-system type. This means they developed in a depression or lake bed that is within itself a closed system.

Beaded Streams

Streams developing across an area of patterned ground are generally restricted to the trough at the margin of the polygon. Heat from the flowing surface water melts the ice wedge and consequently forms a deep narrow stream. The beads are caused by the melting of larger ice masses at the intersection point of several polygons. Typically a beaded stream has many sharply angular changes in direction with straight stretches between the angles. The beads occur at the angles which are intersection points of polygons and the straight part is formed by the side of the polygon.

Permafrost Landforms

1. Highest priority

   Kadleroshilik Mound - subtheme - pingos

   Kadleroshilik River - subtheme - pingos and patterned ground

   Barrow - Brant Point - subtheme - patterned ground

   Toolik River Pingo Field - subtheme - pingos

2. Sites definitely eligible

   Oumalik River - subtheme - patterned ground and thermokarst lakes

3. Sites of uncertain eligibility

   Shaviovik River Pingo Field - subtheme - pingos

4. Sites not recommended

   Kokolik River - subtheme - patterned ground and beaded streams

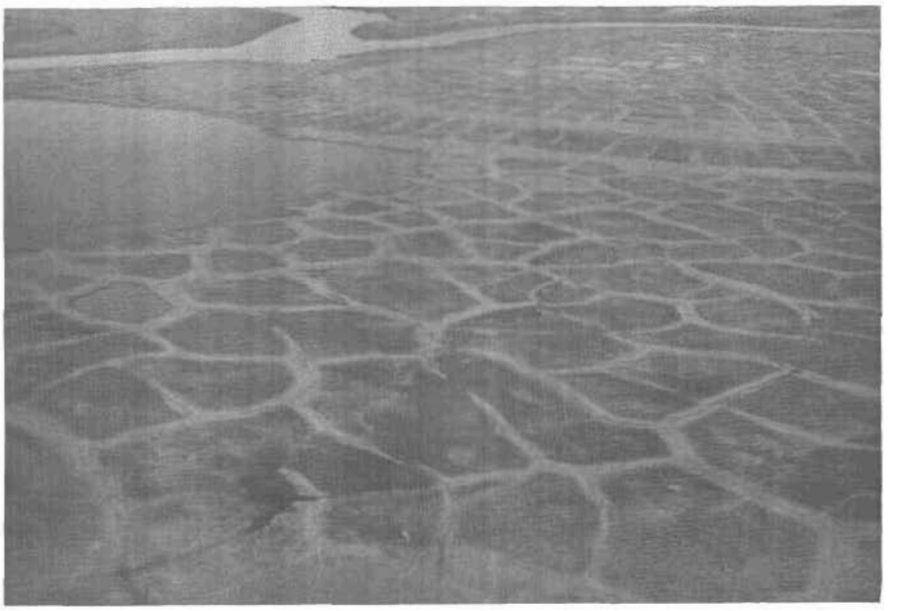


Figure 17. Low-center polygons on western coastal plain.

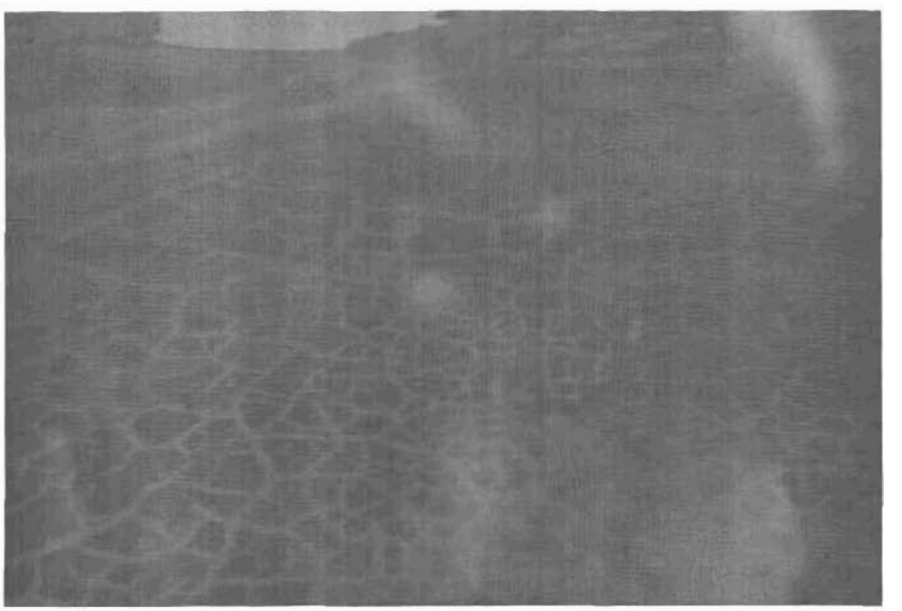


Figure 18. High-center polygons near Barrow.

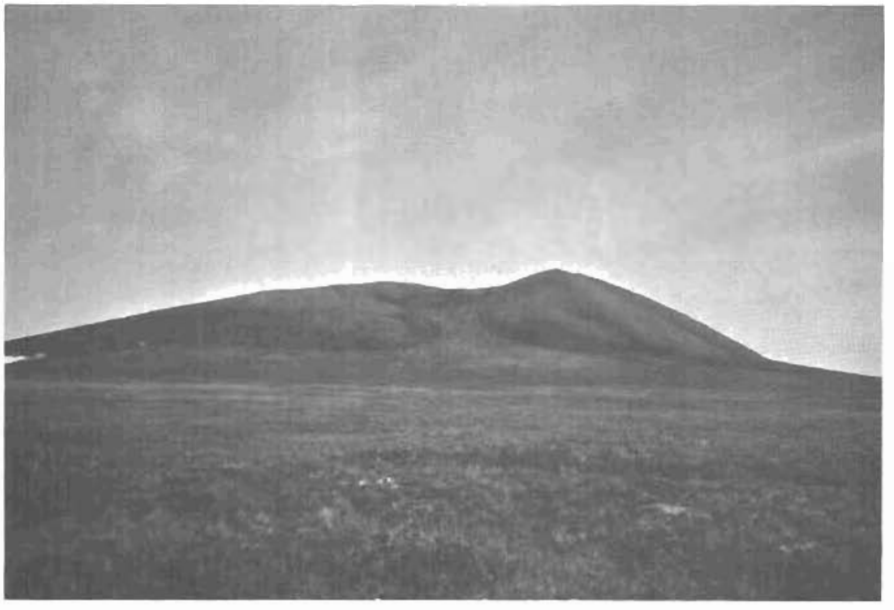


Figure 19. Kadleroshilik mound southeast of Prudhoe Bay.

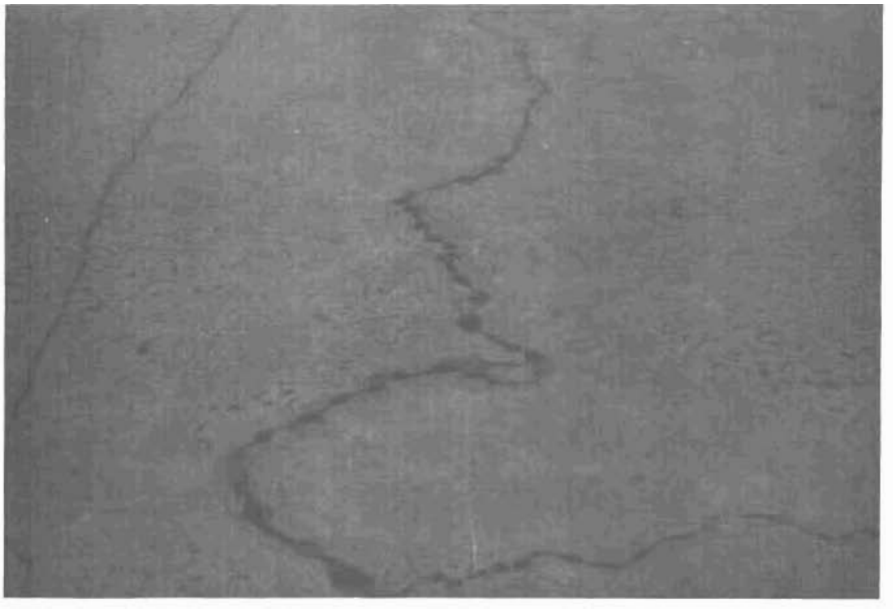
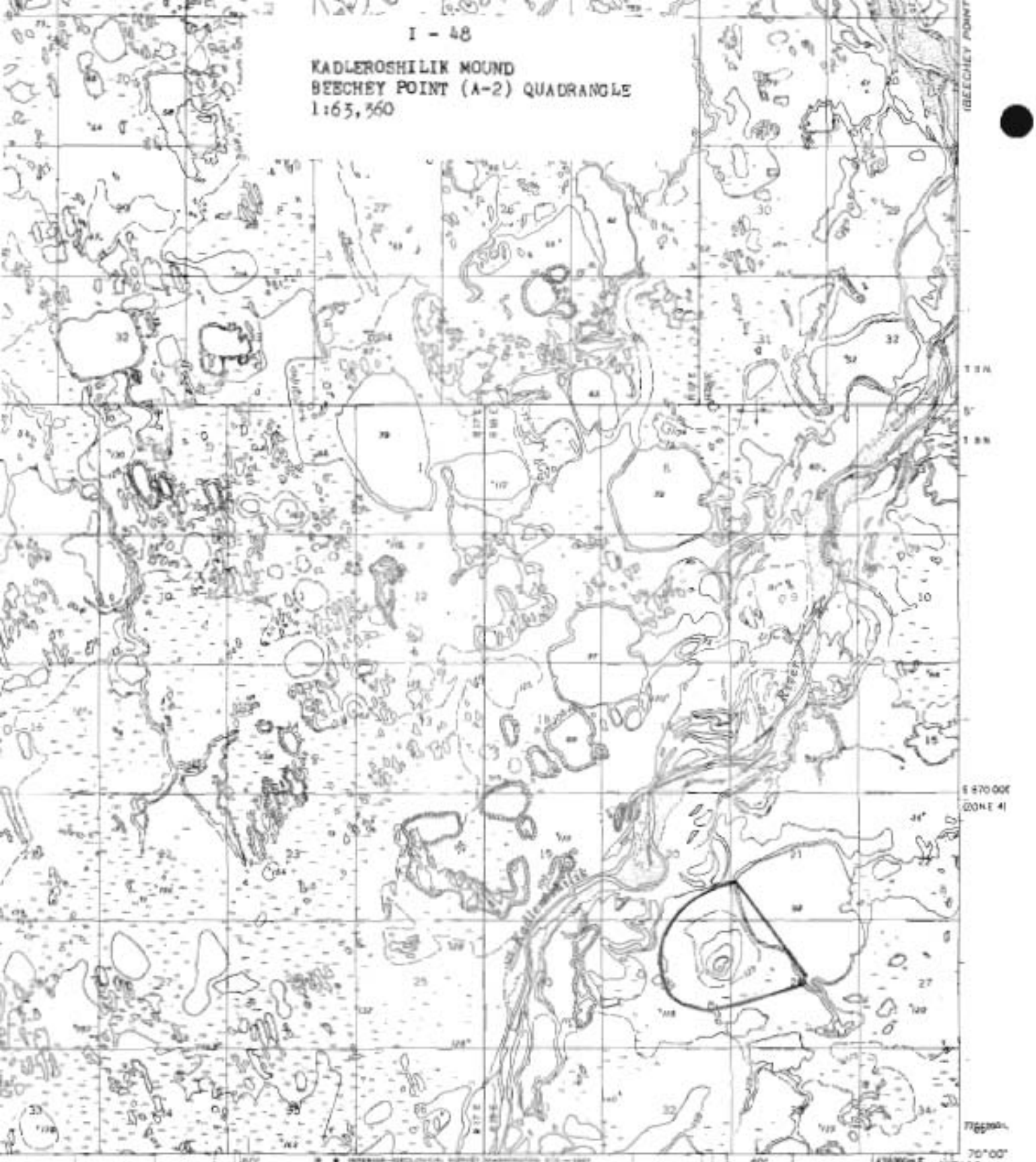


Figure 20. Mature beaded drainage near Kokolik River.

I - 48

KADLEROSHILIK MOUND
BEECHEY POINT (A-2) QUADRANGLE
1:63,360



R INTERVAL 50 FEET
REPRESENT 25-FOOT CONTOURS
IS MEAN SEA LEVEL
IN FEET—DATUM IS MEAN LOWER LOW WATER
TS THE APPROXIMATE LINE OF MEAN HIGH WATER
F TIDE IS APPROXIMATELY 0.5 OF A FOOT

ROAD CLASSIFICATION
Trails

QUADRANGLE LOCATION

BEECHEY POINT (A-2), ALASKA

NATURAL LANDMARK SURVEY
LANDFORMS
PERMAFROST LANDFORMS

I - 48 KADLEROSHILIK MOUND 1B

Themes: Permafrost Landforms (subtheme pingos), Lakes and lake shores, River systems.

Location: Arctic Coastal Plain Province, eastern part, 20 miles southeast of Prudhoe Bay, Beechey Point A-2 quadrangle (1:63,360), T. 8 N., R. 18 E., sections 20, 21, 28, and 29.

Ownership: State of Alaska selection (pending) under lease to Shell Oil Company and Texaco.

Approximate acreage: 440 acres (178 hectares).

Geologic features: Kadleroshilik Mound is the largest pingo in the Arctic Lowland and a prominent landmark on the coastal plain southeast of Prudhoe Bay. The summit at 291 feet is about 190 feet above the surrounding plain. The mound is nearly conical being slightly elongated to the north. The base is nearly 3,000 feet in diameter. The summit area is about 200 feet across with major cracks radiating from the center. The pingo developed on the flood plain of the Kadleroshilik River and alluvial stream gravel is present on the top of the mound. This gravel is similar in all respects to present stream gravel along the river and indicates it was merely uplifted by the ice-cored dome. The gravel, soil, and vegetation form a protective cover for the ice core of this mound. This is an outstanding example of the tremendous force of freezing water in a closed system.

Biotic features: A remarkable succession of plant communities influenced by changes in drainage and elevation on the mound. The base is in wet sedge tundra and the well-drained sides and top contain dry upland meadow type. Shrub communities commonly grow in the cracks developed on crest.

Scenic features: The presence of a nearly perfect cone 200 feet high on a flat plain is quite spectacular.

Land use and vulnerability: Land under lease to petroleum companies and one well drilled within 1/2 mile from site. Increased drilling activity will probably alter the ground water supply and cause collapse of the pingo.

Data source: M. D. Mangus, Anchorage, Alaska
Author from personal investigation

Selected references:

Ferrians, O. J., Jr., 1971, Preliminary engineering geologic maps of the proposed trans-Alaska pipeline route, Beechey Point and Sagavanirktok quadrangles: U.S. Geol. Survey open-file report, 2 sheets.

Ferrians, O. J., Jr. Kachadoorian, Reuben, and Greene, G. W., 1969, Permafrost and related engineering problems in Alaska: U.S. Geol. Survey Prof. Paper 678, 37 p.

Koranda, J. J., 1970, Pingos: Pacific Discovery, Calif. Acad. Sci., v. 23, no. 3, p. 18-24.

Leffingwell, W. de K., 1919, The Canning River region, northern Alaska: U.S. Geol. Survey Prof. Paper 109, 251 p.

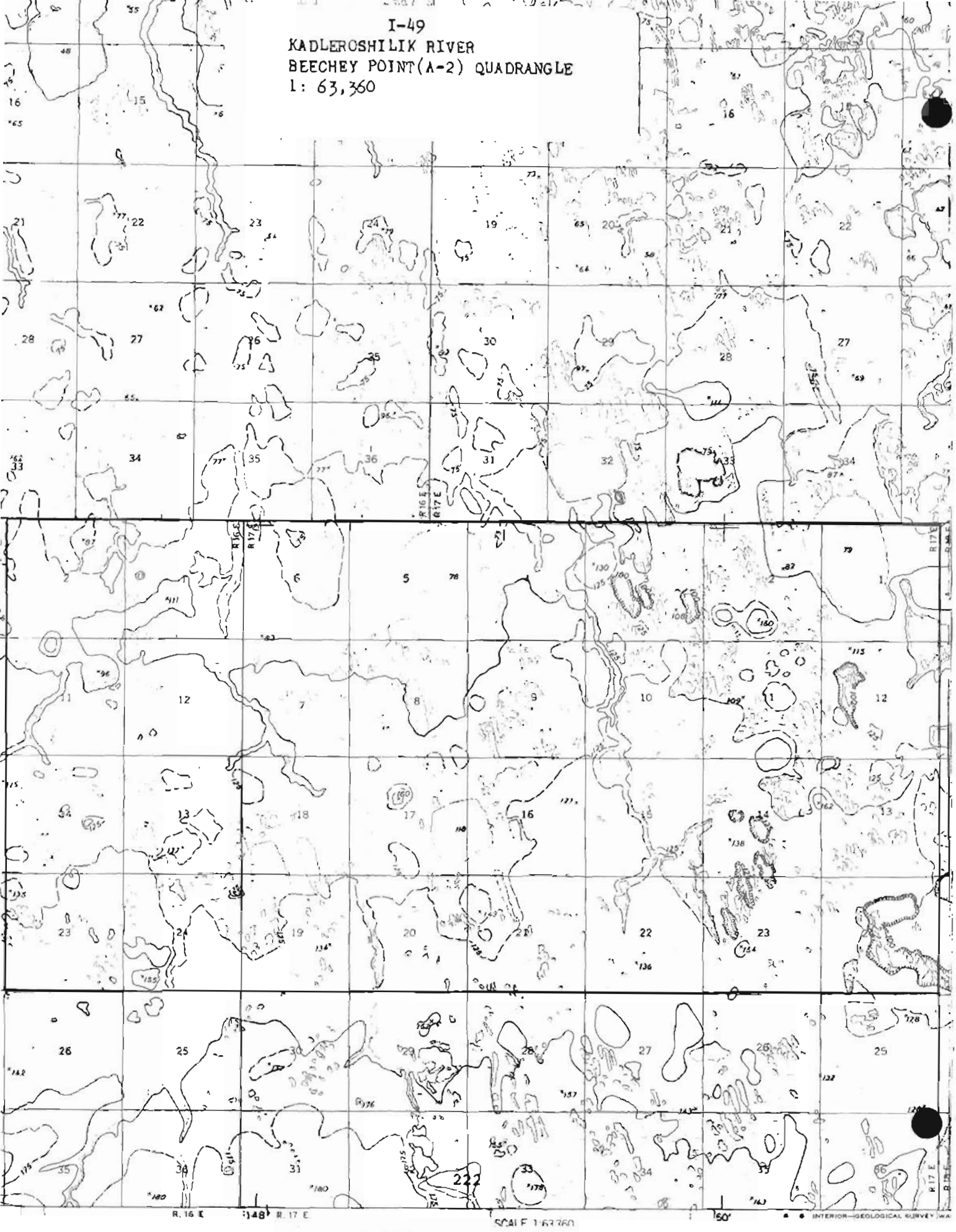
Yeend, Warren, 1973, Preliminary geologic map of a prospective transportation route from Prudhoe Bay, Alaska to the Canadian Border, Part 1, Beechey Point and Sagavanirktok quadrangles: U.S. Geol. Survey open-file report, 2 sheets.

Other knowledgeable persons:
O. J. Ferrians, Jr., Menlo Park, Calif.
Yeend, Warren, Menlo Park, Calif.

Publicity sensitivity: None

Comments: This is an outstanding example of a pingo and it is also being suggested as an Ecological Landmark. Definitely of national significance and recommended for Landmark Status.

I-49
KADLEROSHILIK RIVER
BEECHEY POINT(A-2) QUADRANGLE
1: 63,360



NATURAL LANDMARK SURVEY
LANDFORMS
PERMAFROST LANDFORMS

I - 49 KADLEROSHILIK RIVER 1A

Themes: Permafrost landforms (subtheme pingos and patterned ground), Plains, plateaus, and mesas, Lakes and lake shores.

Location: Arctic Coastal Plain Province, eastern part, 15 miles southeast of Prudhoe Bay, 8 miles south of Foggy Island Bay, Beechey Point A-2 quadrangle (1:63,360), T. 8 N., R. 16 E., sections 1, 2, 11-14, and 23, 24; T. 8 N., R. 17 E., sections 1-24.

Ownership: Utility corridor, Bureau of Land Management, Department of the Interior and State of Alaska selection (pending), land under lease to Atlantic Richfield, Texaco, and Shell Oil Comapny.

Approximate acreage: 20,480 acres (8,288 hectares).

Geologic features: Outstanding example of pingo development on the flat arctic coastal plain. More than 30 pingos in all stages of development from initial dome to complete collapse are located on this site. Numerous closed depressions probably will be site of future pingo development. Abundant patterned ground features including both high and low center polygons. Numerous thermokarst lakes and thaw pits.

Biotic features: Good examples of wet sedge tundra over most of area with dry upland meadow types on the sides of pingos. Area recommended as an Ecological Reserve by the Joint Federal-State Land Use Planning Commission.

Land use and vulnerability: Part of site included in proposed transportation corridor and remaining acreage under lease to oil companies. Area in delicate ecological balance and increased activity could completely alter the environment.

Data source: Joint Federal-State Land Use Planning Commission.

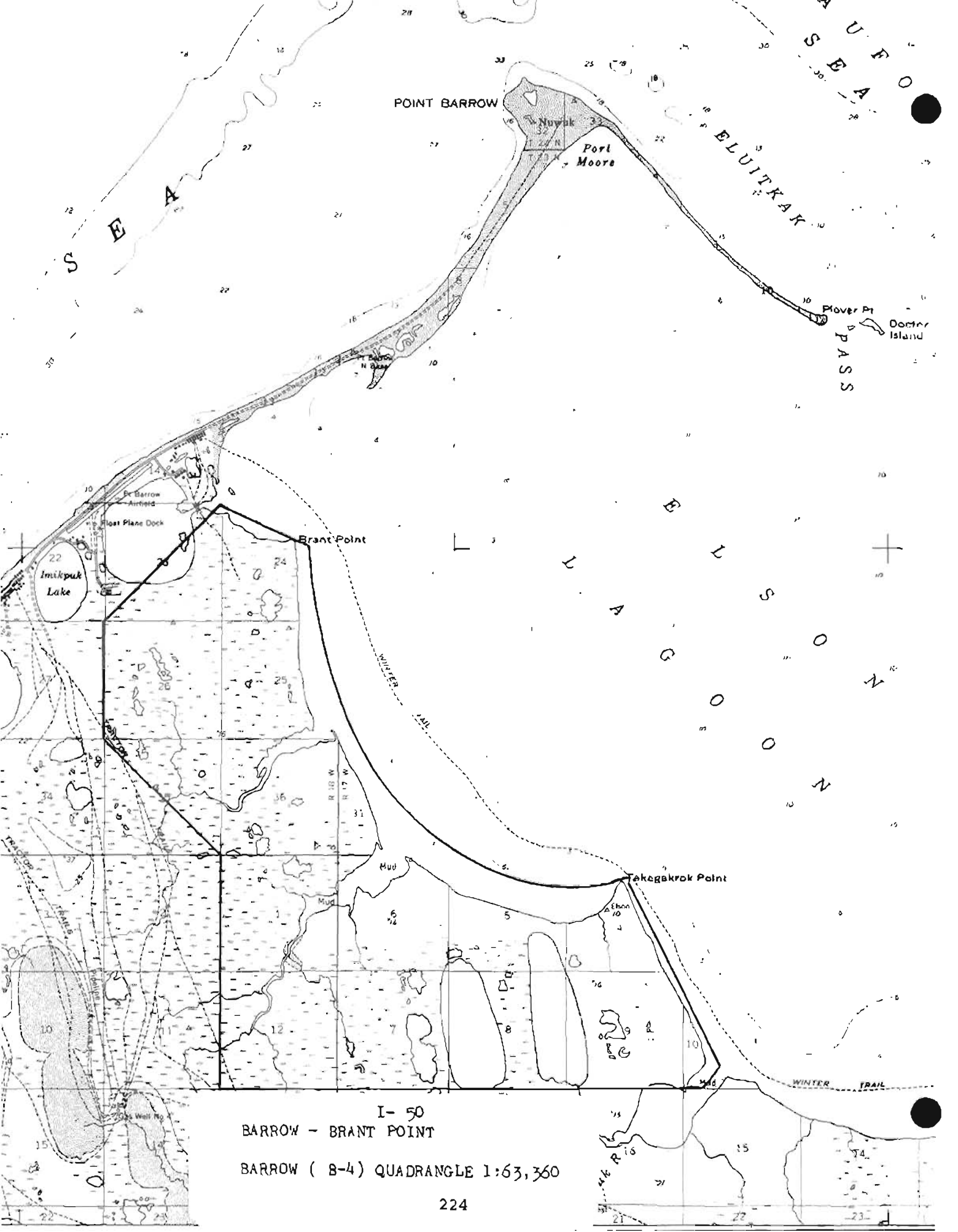
Selected references:

Yeend, Warren, 1973, Preliminary geologic map of a proposed transportation route from Prudhoe Bay, Alaska to the Canadian Border, Part 1, Beechey Point and Sagavanirktok quadrangles: U.S. Geol. Survey open-file report, 2 sheets.

Other knowledgeable persons:
O. J. Ferrians, Jr., Menlo Park, Calif.

Publicity sensitivity: None

Comments: An excellent example of a pingo plain that should be set aside while still relatively unspoiled. Definitely eligible for entry into Registry of Natural Landmarks.



I- 50

BARROW - BRANT POINT

BARROW (B-4) QUADRANGLE 1:63,360

NATURAL LANDMARK SURVEY
LANDFORMS
PERMAFROST LANDFORMS

I - 5 BARROW - BRANT POINT 1A

Themes: Permafrost landforms (subtheme patterned ground), Plains, plateaus, and mesas, Seashores and islands, Lakes and Lake shores.

Location: Arctic Coastal Plain Province, adjacent to Arctic Research Laboratory, Barrow, Barrow B-4 quadrangle (1:63,360), T. 22 N., R. 17 W., sections 4-10; T. 22 N., R. 18 W., sections 1 and 12; T. 23 N., R. 17 W., section 31; T. 23 N., R. 18 W., sections 23-26, 35, and 36.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense and Native Village withdrawal. Selections not made as of 8/1/74.

Approximate acreage: 7,280 acres (2,946 hectares).

Geologic features: An excellent section of the arctic coastal plain adjacent to Arctic Research Laboratory at Barrow. Contains nearly all types of permafrost landforms including high and low center polygons, thermokarst lakes, oriented lakes, ice wedges in organic muck deposits being eroded on sea coast, beaded stream development on tundra, and thaw pits. Site has been intensively studied for many years and should be made a landmark available for future study.

Biotic features: Site of many continuing vegetation and productivity studies from Arctic Research Laboratory and International Biological Program. Being considered for Ecological Landmark, and also an Ecological Reserve by Joint Federal-State Land Use Planning Commission.

Land use and vulnerability: Site adjacent to Arctic Research Laboratory and Barrow village. Wells drilled in Barrow gas field along west side. Site highly vulnerable by continued development in area.

Data source: Numerous people from Arctic Research Laboratory and Joint Federal-State Land Use Planning Commission.

Selected references:

Black, R. F., 1952, Growth of ice-wedge polygons in permafrost near Barrow, Alaska: Geol. Soc. Am. Bull., v. 63, no. 1212, p. 1235-1236.

Collins, F. R., 1961, Core tests and test wells Barrow area, Alaska: U.S. Geol. Survey Prof. Paper 305-K, p. K569-K643.

Hussey, K. M., and Michelson, R. W., 1966, Tundra relief features near Point Barrow, Alaska: Arctic Jour. Arctic Inst. N. Am., v. 19, no. 2, p. 162-184.

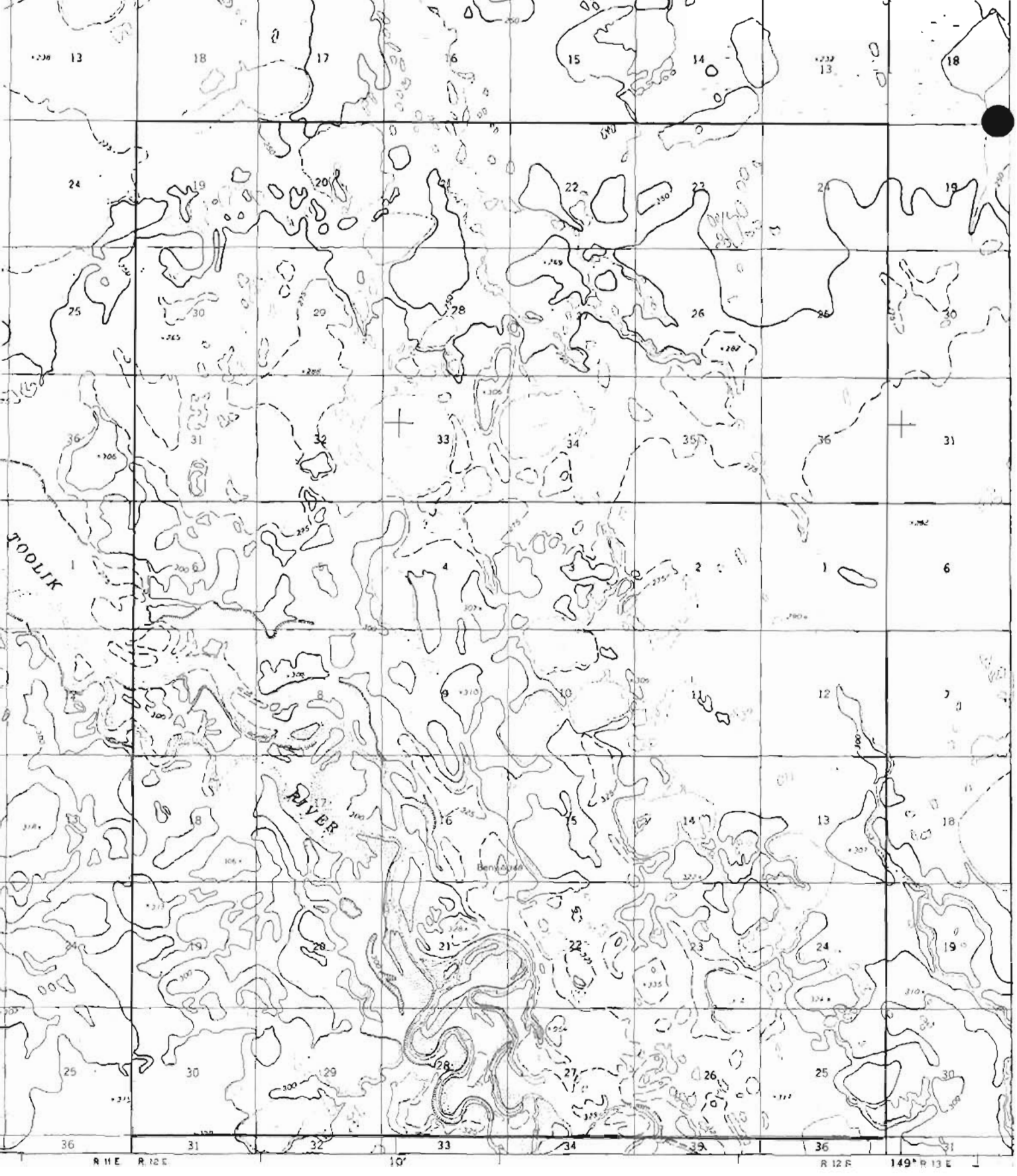
Lachenbruch, A. H., 1960, Contraction-crack polygons: U.S. Geol. Survey Prof. Paper 400B, p. B406-B409.

Other knowledgeable persons:

J. J. Koranda, Livermore, Calif.
Jerry Brown, Hanover, New Hampshire
Charles Evans, Anchorage, Alaska

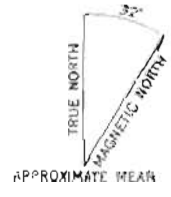
Publicity sensitivity: None

Comments: Site definitely eligible for Landmark Status.



I - 51

TOOLIK RIVER PINGO FIELD
SAGAVANIRKTOK (D-4) QUADRANGLE
1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
PERMAFROST LANDFORMS

I - 51 TOOLIK RIVER PINGO FIELD 1B

Themes: Permafrost landforms (subthemes, pingos, patterned ground), Plains, plateaus, and mesas, River systems.

Location: Arctic Coastal Plain Province, eastern part, southwest of Prudhoe Bay, Sagavanirktok D-4 quadrangle (1:63,360), T. 5 N., R. 12 E., sections 1-30; T. 6 N., R. 12 E., sections 19-36.

Ownership: State of Alaska selection (pending) under lease to numerous oil companies.

Approximate acreage: 30,720 acres (12,452 hectares).

Geologic features: An excellent section of the higher interior coastal plain that contains about 60 pingos in various stages of development. The highest about 100 feet above surrounding plain. Most are developed on the alluvial flood plain of the Toolik River and probably are formed by ground water percolating through unfrozen channels in the gravel. Polygonal ground with both high and low center polygons, beaded streams and numerous thermokarst lakes. Oxbow lakes and sand dunes along the Toolik River.

Biotic features: Site affords a wide variety of plant communities, aquatic vegetation, wet sedge tundra, tussock tundra, dry upland meadow, and shrub communities along river. Numerous water fowl nest in area.

Land use and vulnerability: Exploratory oil wells drilled near site and most of acreage now under lease with possibility of increased activity in the near future.

Data source: J. J. Koranda, Livermore, Calif.
Author from personal investigation.

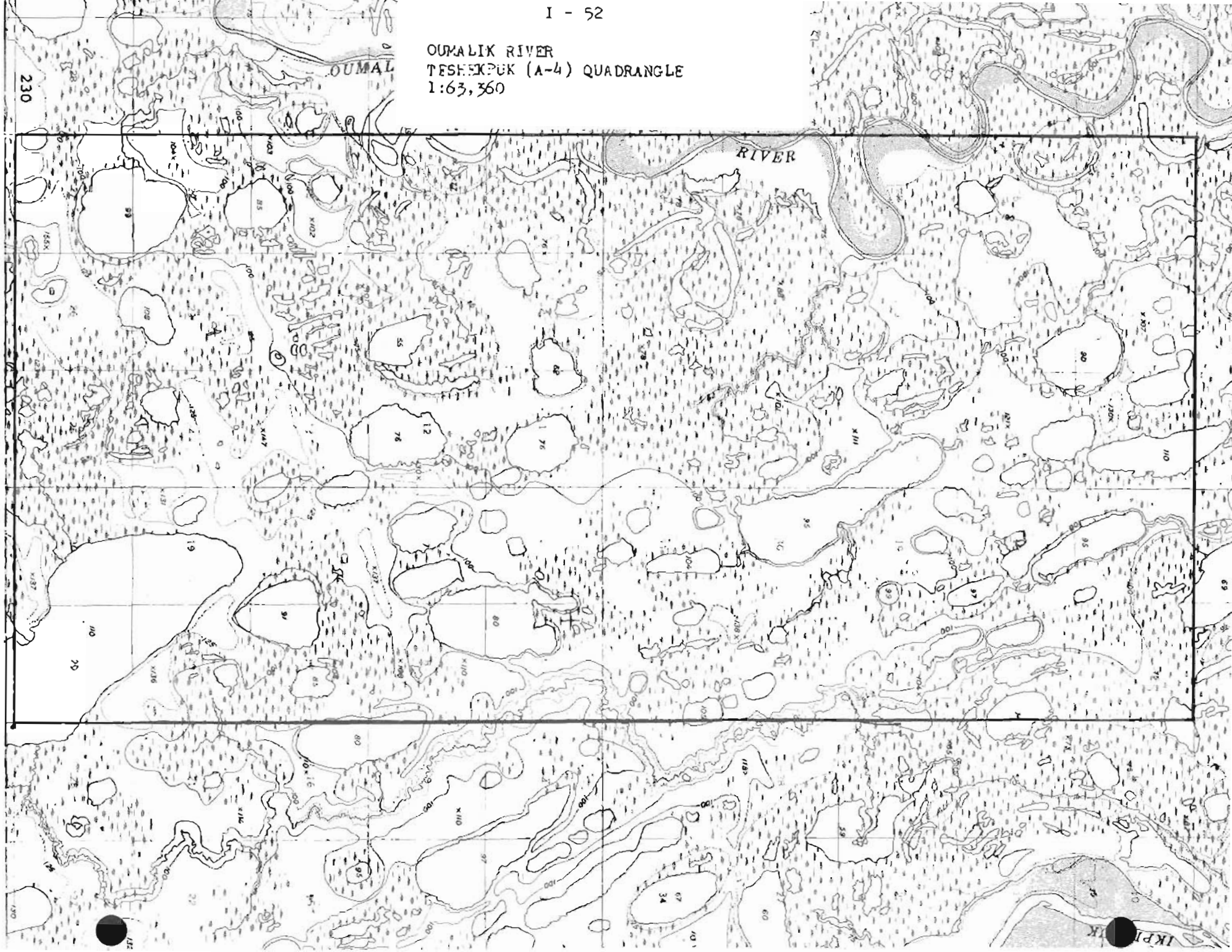
Selected references:
Koranda, J. J., 1970, Pingos: Pacific Discovery, Calif. Acad. Sci., v. 23, no. 3, p. 18-24.

Other knowledgeable persons:
M. D. Mangus, Anchorage, Alaska

Publicity sensitivity: None

Comments: Site definitely qualified for entry in Registry of Natural Landmarks.

OUMALIK RIVER
TESHEKPUK (A-4) QUADRANGLE
1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
PERMAFROST LANDFORMS

I - 52 OUMALIK RIVER 2B

Themes: Permafrost landforms (subtheme polygons, thermokarst lakes), Plains, plateaus, and mesas, River systems, Lakes and lake shores.

Location: Arctic Coastal Plain Province, western part, southeast of Pt. Barrow, Teshekpuk A-4 quadrangle (1:63,360), T. 9 N., R. 12 W., sections 5-8, 17-20, and 29-30; T. 9 N., R. 13 W., sections 1-3, 10-15, and 22-27; T. 10 N., R. 12 W., sections 7, 8, 17-20, and 29-32; T. 10 N., R. 13 W., sections 10-15, 22-27, and 36-

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 32,000 acres (12,950 hectares).

Geologic features: Extensive areas of both high and low center polygons showing how either thaw ponds or high-center polygons can develop from the low-center type. Several cycles of lake basin development, and the lakes in all stages from thaw pond to northeast aligned rectangular lake and finally to the northwest orientation. Oxbow lakes, meander scrolls, and dune areas along Oumalik River. Several good examples of beaded streams. These features are all in sand and silt of the Gubik Formation.

Biotic features: Water fowl nesting area and good aquatic and wet sedge tundra plant communities.

Land use and vulnerability: No organized use of land and probably none in immediate future.

Data source: Author from personal investigation.

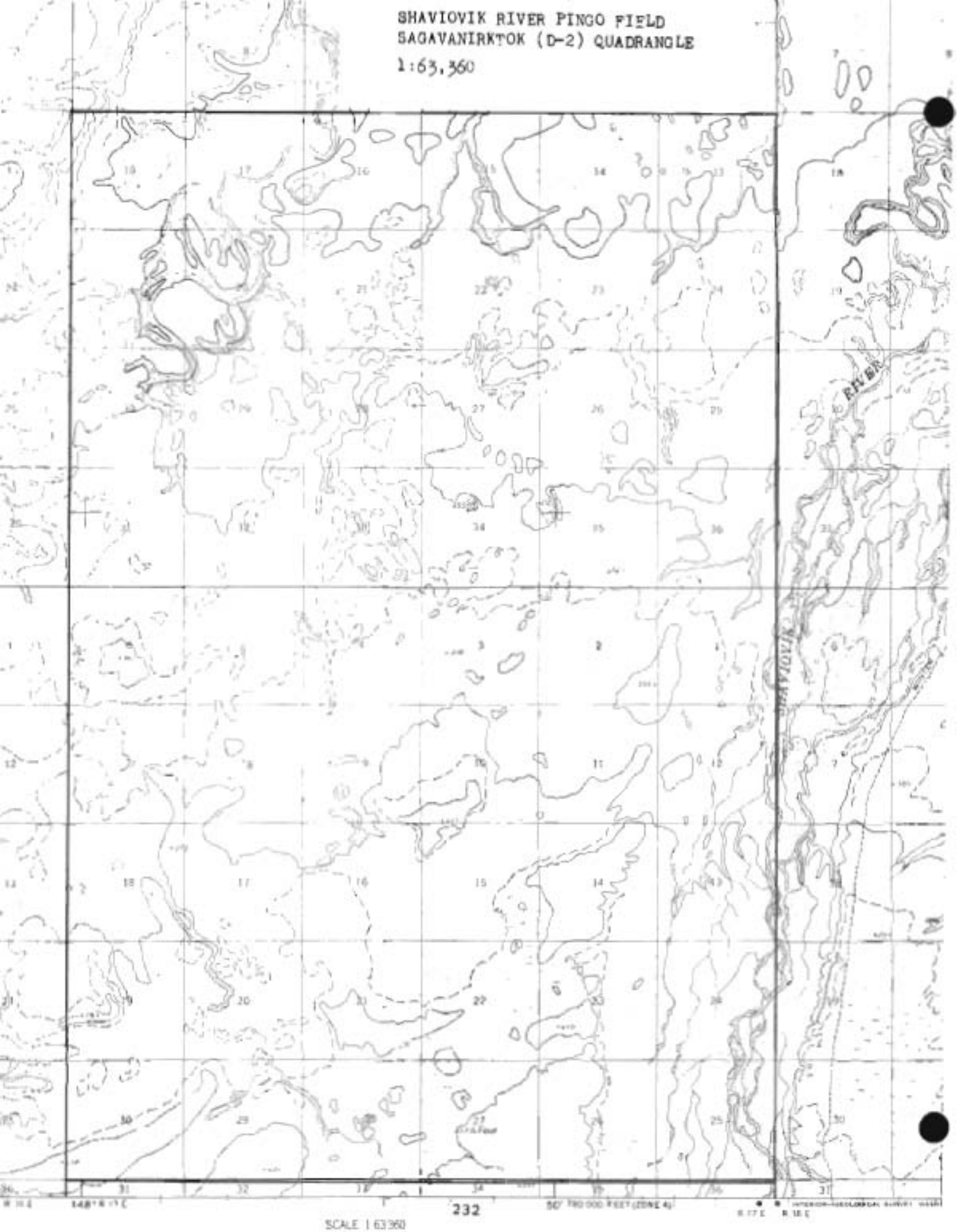
Selected reference: None

Other knowledgeable persons:
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: Excellent examples of most permafrost features. Eligible for Landmark Status.

SHAVIOVIK RIVER PINGO FIELD
SAGAVANIRKTOK (D-2) QUADRANGLE
1:63,360



SCALE 1:63360

NATURAL LANDMARK SURVEY
LANDFORMS
PERMAFROST LANDFORMS

I - 53 SHAVIOVIK RIVER PINGO FIELD 3B

Themes: Permafrost landforms (subtheme pingos), Plains, pleateaus, and mesas.

Location: Arctic Coastal Plain Province, eastern part, south edge Sagavanirktok D-2 quadrangle (1:63,360), T. 5 N., R. 17 E., sections 1-30; T. 6 N., R. 17 E., sections 13-36.

Ownership: Utility corridor, Bureau of Land Management, Department of the Interior and State of Alaska selection (pending).

Approximate acreage: 34,560 acres (13,986 hectares).

Geologic features: Some good examples of pingos and patterned ground. Several beaded streams in advance stage of development. The pingos are all of the closed system formed in depressions. Both low- and high-center polygons. Permafrost features developing in silt and sand overlying Tertiary bedrock.

Biotic features: Primarily an area of wet sedge and tussock tundra.

Land use and vulnerability: Part of land under lease to oil companies and part reserved as a possible pipeline route. Construction of a pipeline in these ice-rich sediments will do great damage to the site.

Data source: C. G. Mull, Denver, Colo.

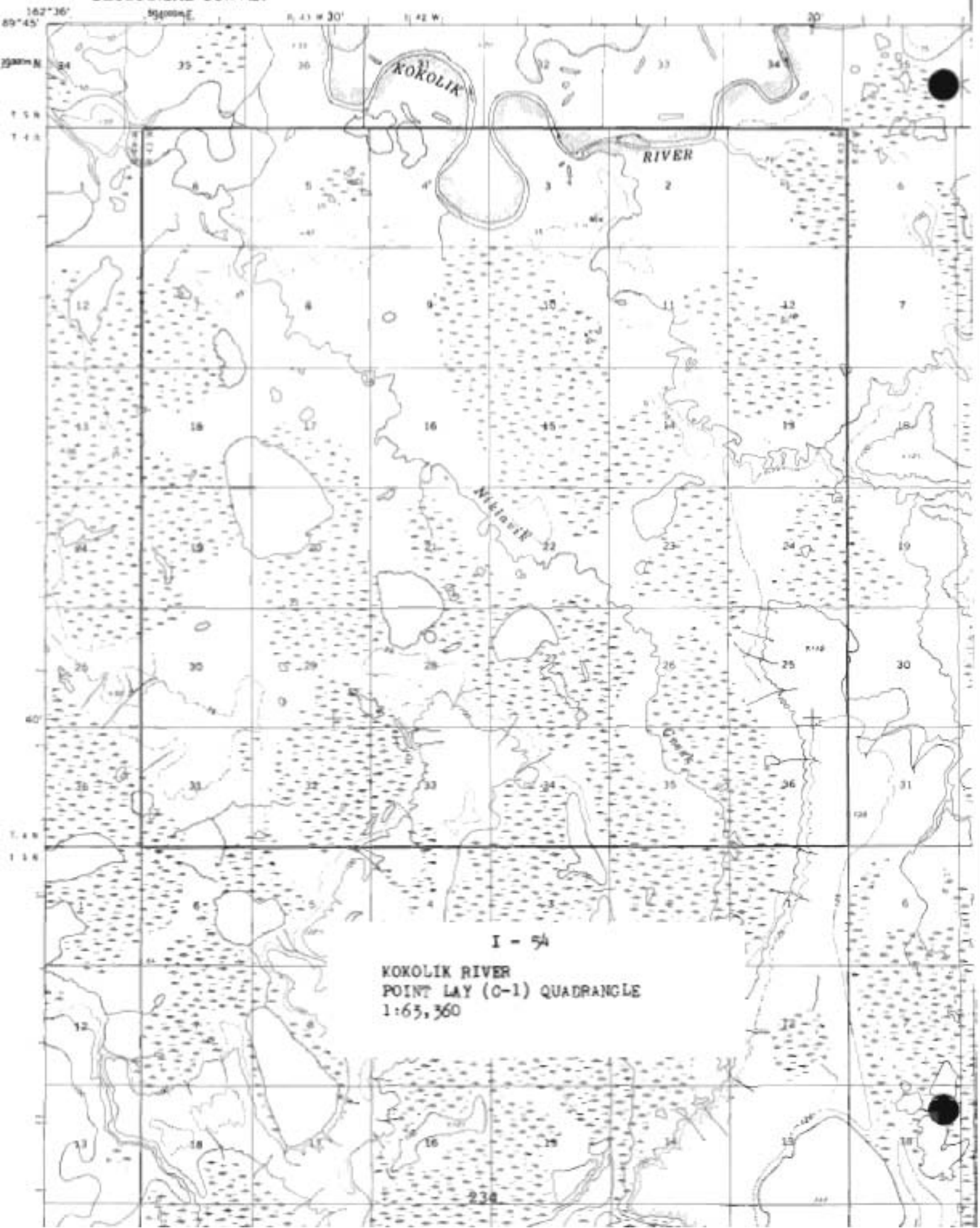
Selected references:

Yeend, Warren, 1973, Preliminary geologic map of a prospective transportation route from Prudhoe Bay, Alaska to the Canadian Border, Part 1, Beechey Point and Sagavanirktok quadrangles: U.S. Geol. Survey open-file report, 2 sheets.

Other knowledgeable persons:
M. D. Mangus, Anchorage, Alaska

Publicity sensitivity. None

Comments: This site is of uncertain eligibility.


KOKOLIK
RIVER
Nikiavik
Creek
I - 54
KOKOLIK RIVER
POINT LAY (C-1) QUADRANGLE
1:63,360

NATURAL LANDMARK SURVEY
LANDFORMS
PERMAFROST LANDFORMS

I - 54 KOKOLIK RIVER 4

Themes: Permafrost landforms (subtheme patterned ground and beaded streams), Plains, plateaus, and mesas.

Location: Arctic Coastal Plain Province, west coastal area, Point Lay C-1 quadrangle (1:63,360), T. 4 N., R. 43 W., sections 1-36.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense and Native Village withdrawal. Selections not made as of 8/1/74.

Approximate acreage: 23,040 acres (9,324 hectares).

Geologic features: A good example of a raised coastal plain with several sets of beach ridges. Low-center polygons now developed in wet areas between beach ridges and high-center polygons on dry beach ridges. Excellent examples of beaded streams. Primarily an area of silt and sand of the Gubik Formation unconformably overlying Upper Cretaceous bedrock.

Biotic features: Wet sedge tundra between beach ridges and dry upland tussocks on beach ridges. Nesting area for water fowl.

Land use and vulnerability: Near village of Pt. Lay with oil and gas lease applications filed. Will probably be explored and developed after settlement of Alaska Native Claims.

Data source: Author from personal investigations.

Selected references:

Chapman, R. M., and Sable, E. G., 1960, Geology of the Utukok-Corwin region, northwestern Alaska: U.S. Geol. Survey Prof. Paper 303-C, p. C49-C167.

Other knowledgeable persons:

E. G. Sable, Denver, Colo.
I. L. Tailleur, Menlo Park, Calif.

Publicity sensitivity: None

Comments: Good site but better ones are available. Consequently not recommended.

Theme 6. Work of Glaciers

The theme Work of Glaciers is an important category under Landforms of the Present, in the Arctic Lowland. Most of the obvious glacial features caused by the tremendous sculpturing power of moving ice, as well as the modern glaciers, are in the Brooks Range rather than the Arctic Lowland. Nearly all of the rock and debris plucked from the mountains was dumped onto the foothills by the Pleistocene glaciers. These deposits consisting mainly of marine and outwash are extremely important to developing the glacial chronology of northern Alaska. The knob and kettle topography of typical glacial deposits may not be as spectacular as the bold glacially sculptured mountains, but they are of much greater scientific value and as such should be considered for Landmark Status.

The Pleistocene is often referred to as the Ice Age, an interval almost 2,000,000 years long during which repeated periods of severe cold caused the formation of glaciers that covered large parts of the earth. Four major glaciations each thousands of years long and separated by warm interglacial periods have been recorded. Most of the deposits on the Arctic Lowland result from the last of these great glaciations, which in North America is called the Wisconsin Stage. During this time ice filled the mountain valleys and extended 20 to 40 miles onto the Arctic Lowland. This is called the Itkillik Glaciation. Four major periods of advance and retreat or readvance can be mapped for the Itkillik Glaciation in the foothills. Most were of the alpine valley glacier type, but locally the ice coalesced to form piedmont lobes.

We do not know exactly when the Wisconsin glaciers first covered parts of the Arctic Lowland, but we do have a minimum date of greater

than 39,000 years obtained by radiocarbon analysis of a poplar log buried by outwash of the first great advance. The initial advance probably started as much as 50,000 years ago and continued to about 5,000 years ago when a general warming trend melted most of the glaciers on the lowland. Several minor glacial advances have occurred since then, but none reached the mountain front. The four main advances of the Itkillik Glaciation have been named the Banded Mountain, Anayaknaurak, Antler Valley, and Anivik Lake Stades by Porter (1966).

Deposits of the various stades of the Itkillik Glaciation cover many square miles of the Arctic Lowland. Each stade had typical microrelief features that aid in correlation from one area to another. The last advance generally reached only to the mountain front and in many cases its moraine enclose the large lakes now found there. Some of these lakes are recommended for Landmark STatus under the general theme Lakes and Lake shores. Glacial features seen in the Arctic Lowland can be divided into several subthemes such as moraine, periglacial features, and glacial lake deposits.

Moraine

Glacial moraine is an accumulation of rock debris with an initial constructional topography that was deposited directly by glaciers. The maximum advance is marked by a set of lateral and terminal moraine. As the glacier retreats a series of recessional moraines may be deposited, and as is often the case the glacier may readvance forming a new set of lateral and terminal moraine. Material deposited directly under the ice is in the form of ground moraine.

Morainal topography is very irregular and commonly referred to as knob and kettle topography. The depressions generally fill with water

to form kettle lakes. Water from the melting ice reworks much of the morainal material into kames, kame terraces, and outwash plains. The water-laid deposits are generally stratified with a smooth topographic form as compared to the unsorted moraine.

Periglacial features

Periglacial features are those formed along the sides or outer margin of a glacier. In the Arctic Lowland these are mainly confined to the valley walls in the foothill section. Melt water from the ice formed large streams between the glacier and the valley wall. Locally these streams cut deep channels through bedrock. When the glacier retreated the channels were left perched hundreds of feet above the present valley floor. A variety of ice-contact features in the form of crumpled and disturbed strata are also present along the valley walls.

Glacial lake deposits

Many of the valleys adjacent to the front of the Brooks Range formerly contained large lakes that were confined behind moraine. As the moraine was breached the lakes were drained leaving excellent examples of lake deposits. These include varved sediments with much organic material. In places sand dunes have developed on the surface of these deposits.

WORK OF GLACIERS

1. Highest priority

    Killik River Valley

    Jago Valley

2. Sites definitely eligible

    Anaktuvuk River

    Sagavanirktok - Itkillik

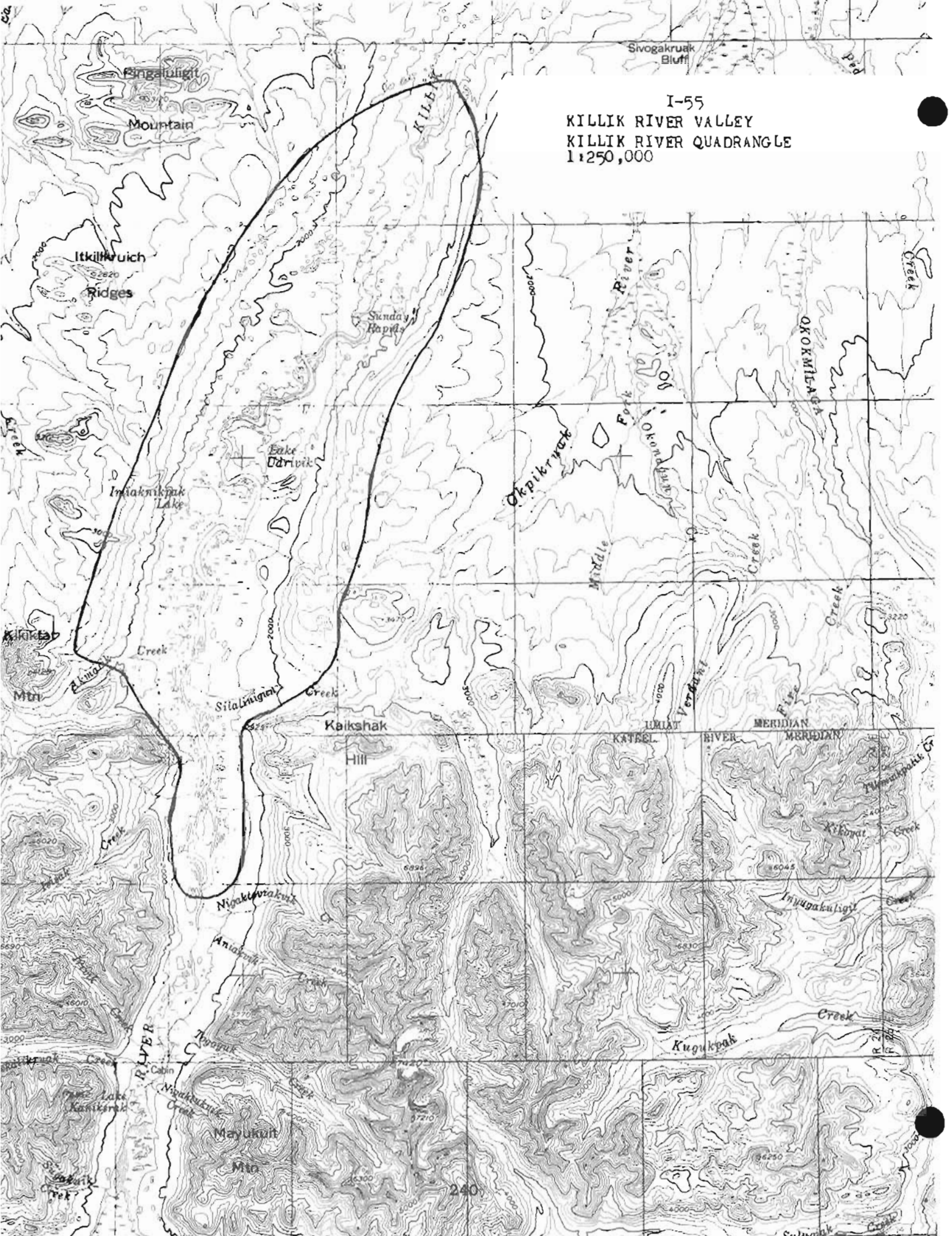
3. Sites of uncertain eligibility

    Okpilak Valley

4. Sites not recommended

    None

I-55
KILLIK RIVER VALLEY
KILLIK RIVER QUADRANGLE
1:250,000



NATURAL LANDMARK SURVEY
LANDFORMS
WORK OF GLACIERS

I - 55 KILLIK RIVER VALLEY 1C

Themes: Work of glaciers, River systems, Eolian landforms, Lakes and lake shores

Location: Arctic Foothills Province; central part at north front of Brooks Range; Killik River quadrangle (1:250,000); T. 9 S., R. 8 W., sections 8-11, 14-23, and 26-35; T. 9 S., R. 9 W., sections 23-27 and 34-36; T. 10 S., R. 8 W., sections 2-11, 15-22, and 28-33; T. 10 S., R. 9 W., sections 1-4, 8-17, and 19-36; T. 11 S., R. 8 W., sections 5-8, 17-19, 30-31; T. 11 S., R. 9 W., sections--all; T. 11 S., R. 10 W., sections 1, 12-14, 23-26, and 34-36; T. 12 S., R. 8 W., sections 6 and 7; T. 12 S., R. 9 W., sections 1-24, and 27-33; T. 12 S., R. 10 W., sections 1-3, 10-15, 24, and 25;

Kateel Meridian
T. 34 N., R. 21 E., sections 4-9, 16-21, and 28-30; T. 33 N., R. 21 E., sections 5 and 6.

Ownership: Part of proposed Gates of the Arctic National Park. National Park Service by authority of Alaska Native Claim Settlement Act, Section 17, D-2.

Approximate acreage: 105,000 acres (42,493 hectares).

Geologic features: An outstanding example of the deposits and topography left by valley glaciers. All of the stades of the Itkillik Glaciation are represented here by a remarkable series of lateral, terminal, recessional, and ground moraine. One set of terminal moraine crossed the valley just above Sunday Rapids forming a glacial lake over 20 miles long. When this moraine was breached the spectacular Sunday Rapids were formed. The river has now cut 60 to 80 feet through the lake bed deposits exposing varved sediments rich in organic material. Spectacular sand dunes and blowouts have formed on the surface of the old lake bed. Locally periglacial stream channels have cut 60 to 80 feet through chert and shale of the Shublik and Siksikpuk Formations along the east valley wall. Successive channels were cut as the glacier melted. The highest is about 600 feet above the valley floor. The present lakes along the river are remnants of the old glacial lake.

The spectacular canyon of hhe Killik is carved out of limestone, chert, conglomerate, sandstone, and shale of Mississippian to Early Cretaceous age.

Biotic features: Wide variety of plant life from aquatic vegetation to wet sedge meadow, dry upland meadow, and alpine. Shrub-willow communities along river and one grove of poplar. Many large game animals including bear, caribou moose, Dall sheep, and wolves plus an abundance of small animals and birds.

Scenic features: Spectacular mountain and valley scenery with broad slow moving Killik River. Sunday Rapids is a fine example of white water where the river has cut through the moraine and drops very rapidly through a boulder strewn series of rapids.

Land use and vulnerability: Site is all included within the proposed Gates of the Arctic National Park as part of the Alaska Native Claim Settlement Act. The area is qualified for park status and should be included. Oil and gas lease applications have been filed on most of the land if the park is rejected.

Data source: Numerous people including Joint Federal-State Land Use Planning Commission.
M. D. Mangus, Anchorage, Alaska
C. G. Mull, Denver, Colo.
Author from personal investigations

Selected references:

Chapman, R. M., Detterman, R. L., and Mangus, M. D., 1964, Geology of the Killik-Etivluk Rivers region, Alaska: U.S. Geol. Survey Prof. Paper 303-F, p. F325-F407.

Detterman, R. L., Bowsher, A. L., and Dutro, J. T., Jr., 1958, Glaciation on the Arctic Slope of the Brooks Range, northern Alaska: Arctic, Jour. Arctic Inst. N. Am., v. 11, no. 1, p. 43-61.

Smith, P. S., and Mertie, J. B., Jr., 1930, Geology and mineral resources of northwestern Alaska: U.S. Geol. Survey Bull. 815, p. 350.

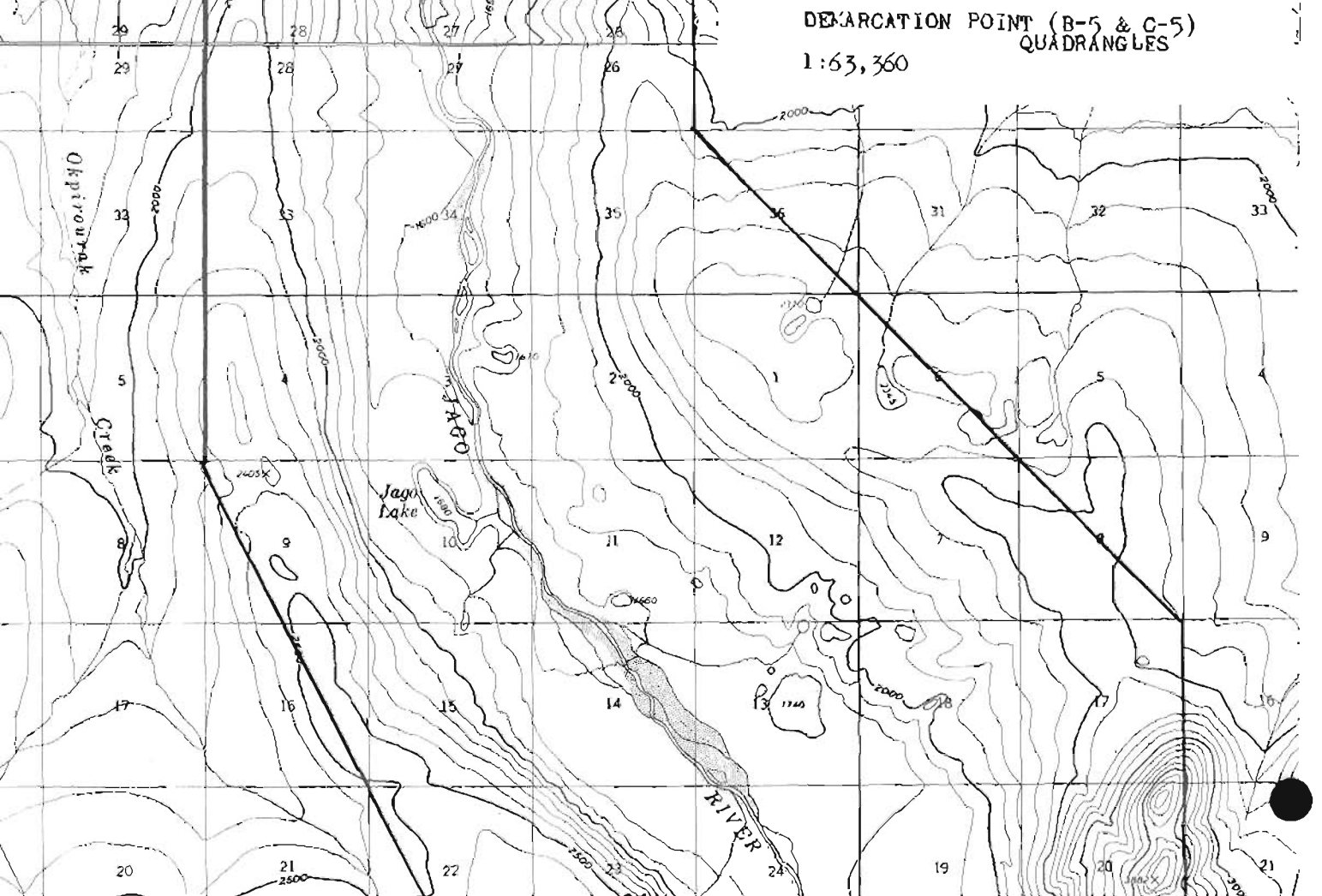
Other knowledgeable persons:

R. M. Chapman, Menlo Park, Calif.
C. M. Kirschner, San Francisco, Calif.

Publicity sensitivity: None

DEMARCATION POINT (B-5 & C-5) QUADRANGLES

1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
WORK OF GLACIERS

I - 56 JAGO VALLEY 1C

Themes: Work of glaciers

Location: Arctic Foothills Province, eastern part, north front of Brooks Range, Demarcation Point B-5 and C-5 quadrangles (1:63,360), T. 1 N., R. 34 E., sections 1-4, 9-16, and 22-24; T. 1 N., R. 35 E., sections 6-8 and 17-20; T. 2 N., R. 34 E., sections 2, 3, 9-11, 14-16, 21-23, 26-28, and 33-36.

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Department of the Interior.

Approximate acreage: 23,200 acres (9,389 hectares).

Geologic features: The Jago River valley is a classic example of a broad U-shaped glaciated valley on the Arctic Lowland. Glacier from Mt. Michelson constructed lateral moraine along the valley walls that are about 1,000 feet above the floor. These are all remnants of the Itkillik Glaciation of the Wisconsin Stage. Modern glaciers and moraine formed in last few thousand years lie just to the south of the site along the spectacular McCall Valley. Matched pairs of moraine on opposite sides of the valley. Minor glacial lake bed deposits along river.

Biotic features: Shrub-willow flood plain community succeeded by tussock tundra, dry upland meadow and alpine varieties. Habitat for most of game animals of the North Slope and on the migration route of the eastern caribou herd.

Scenic features: Spectacular mountain along south edge of site with Mt. Michelson, highest mountain in Brooks Range, a few miles to the southwest. Many glaciers nearby.

Land use and vulnerability: Part of Arctic National Wildlife Range and in protected status at present.

Data source: Joint Federal-State Land Use Planning Commission. Author from personal investigation.

Selected references:

Keeler, C. M., 1959, Notes on the geology of the McCall Valley Area: Arctic, Jour. of Arctic Inst. N. Am., v. 12, no. 2, p. 87-97.

Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1974, Preliminary geologic map, Demarcation Point quadrangle, Alaska: U.S. Geol. Survey open-file report, 2 sheets.

Other knowledgeable persons:

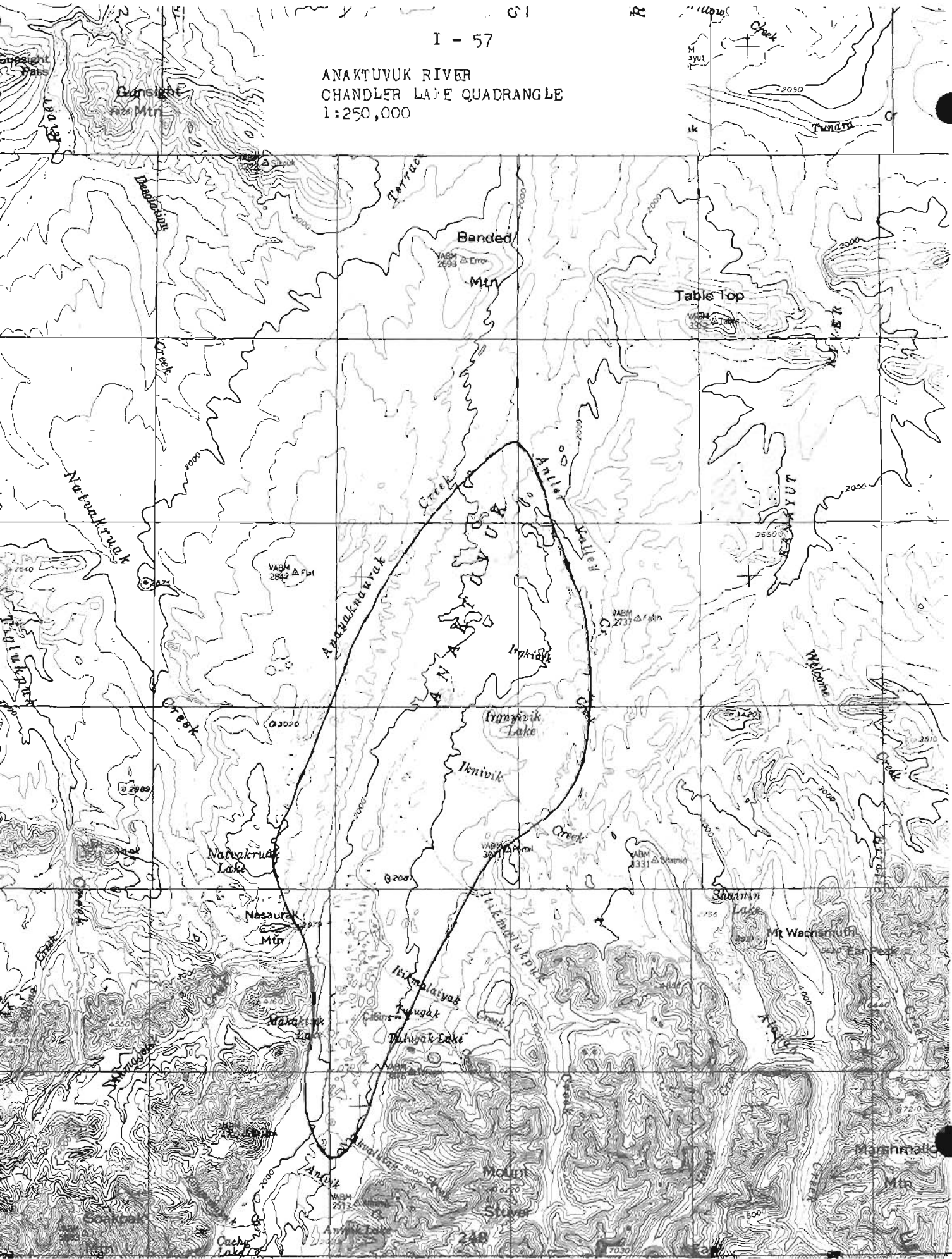
E. G. Sable, Denver, Colo.
M. D. Mangus, Anchorage, Alaska

Publicity sensitivity: None

Comments: This site is highly eligible for entry into Registry of Natural Landmarks. Also, part of the recommended Ecologic Reserve of the Joint Federal-State Land Use Planning Commission.

I - 57

ANAKTUVUK RIVER
CHANDLER LAKE QUADRANGLE
1:250,000



NATURAL LANDMARK SURVEY
LANDFORMS
WORK OF GLACIERS

I - 57 ANAKTUVUK RIVER 2C

Themes: Work of glaciers, River system

Location: Arctic Foothills Province, central part, north front of Brooks Range; Chandler Lake quadrangle (1:250,000); T. 10 S., R. 3 E., sections 24-27 and 34-36; T. 10 S., R. 4 E., sections 19, 30, and 31; T. 11 S., R. 3 E., sections 1-4, 8-17, and 19-36; T. 11 S., R. 4 E., sections 5-8, 17-21, and 28-33; T. 12 S., R. 2 E., sections 1, 12-14, 24-26, and 35-36; T. 12 S., R. 3 E., sections--all but 36; T. 12 S., R. 4 E., sections 5-8, 17-20, and 30; T. 13 S., R. 2 E., sections 1, 2, 11-13, 24, 25, and 36; T. 13 S., R. 3 E., sections 2-10, 15-21, and 28-32; T. 14 S., R. 2 E., sections 1, 12, and 13; T. 14 S., R. 3 E., sections 5-8, and 18.

Ownership: Native Village withdrawal area with sections 5, 6, 7, 8, and 18 of T. 14 S., R. 3 E. being selected to date 8/1/74. Native Regional Deficiency Area and also in area proposed for Gates of the Arctic National Park.

Approximate acreage: 76,160 acres (30,822 hectares)

Geologic features: This is the type area for the stades of the Itkillik Glaciation which is correlated with the classical Wisconsin of conterminous United States. Exceptionally well-exposed here. Part of the stades dated by radiocarbon. Matched pairs of lateral moraine, with good terminal and recessional moraine some of which dammed the river to form a glacial lake. The lake beds have sand dunes and blow-out features.

Biotic features: Habitat for all the animals and many of the birds found on the Arctic Slope. Wide variety of plant communities.

Scenic features: Spectacular mountain scenery at north front of the Brooks Range, broad glacial valley and sculptured peaks.

Land use and vulnerability: The Village of Anaktuvuk Pass is located in southern part of site. This is the main pass through the Brooks Range and has been used for many years; consequently, the area has had considerable usage. Oil and gas lease applications filed on most of the acreage so there probably will be heavy usage in future. Original winter haul road to Arctic Slope came through pass.

Data source: M. D. Mangus, Anchorage, Alaska
W. P. Brosgé, Menlo Park, Calif.

Selected references:

Detterman, R. L., Bowsher, A. L., and Dutro, J. T., Jr., 1958, Glaciation on the Arctic Slope of the Brooks Range, northern Alaska: Arctic, Jour. Arctic Inst. N. Am., v. 11, no. 1, p. 43-61.

Patton, W. W., Jr., and Tailleur, I. L., 1964, Geology of the Killik-Itkillik region, Alaska: U.S. Geol. Survey Prof. Paper 303-G, p. G409-G500.

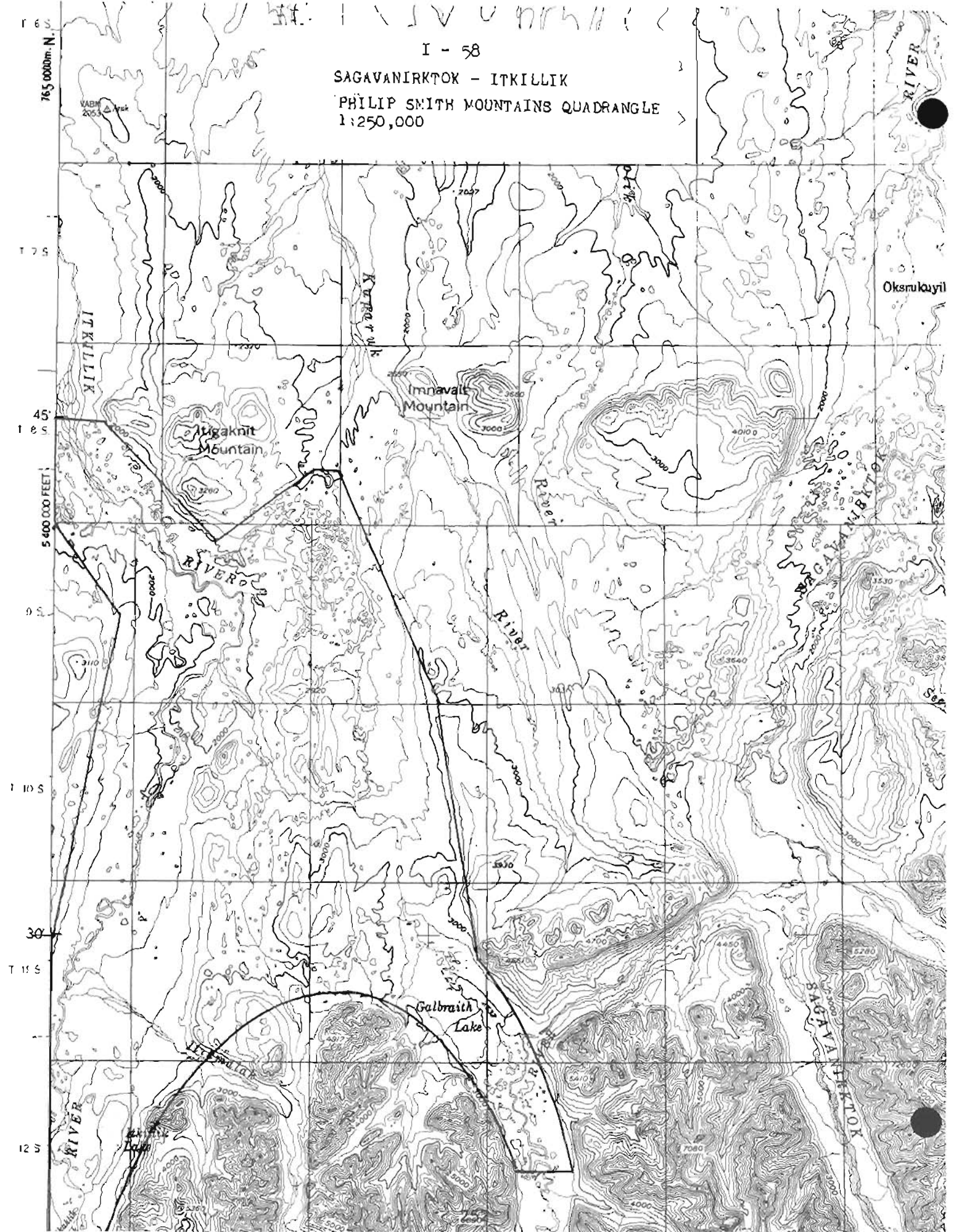
Porter, S. C., 1966, Pleistocene geology of Anaktuvuk Pass, central Brooks Range, Alaska: Arctic Inst. N. Am. Tech. Paper 18, p. 100.

Other knowledgeable persons:

George Gryc, Menlo Park, Calif.
H. N. Reiser, Menlo Park, Calif.

Publicity sensitivity: None

Comments: An excellent site that is recommended for entry into the Registry of Natural Landmarks.


I - 58
SAGAVANIRKTOK - ITKILLIK
PHILIP SMITH MOUNTAINS QUADRANGLE
1:250,000
765 000m. N.
5 400 000 FEET
ITKILLIK
RIVER
Itigaknit Mountain
Imnavait Mountain
Kuparuk
River
SAGAVANIRKTOK
Galbraith Lake
Oksrukuyil
RIVER

NATURAL LANDMARK SURVEY
LANDFORMS
WORK OF GLACIERS

I - 58 SAGAVANIRKTOK-ITKILLIK 2A

Themes: Work of glaciers, Lakes and lake shores, River systems.

Location: Arctic Foothills Province, eastern part, north front of Brooks Range, Philip Smith Mountains quadrangle (1:250,000), T. 8 S., R. 9 E., sections 14-16, 21-28, and 33-36; T. 8 S., R. 10 E., sections 25, 26, and 31-36; T. 8 S., R. 11 E., sections 30 and 31; T. 9 S., R. 9 E., sections 1-3, 11-14, 24, 25, and 36; T. 9 S., R. 10 E., sections--all; T. 9 S., R. 11 E., sections 5-9, 16-22, and 27-34; T. 10 S., R. 9 E., sections 1, 2, 11-14, 23-26, and 34-36; T. 10 S., R. 10 E., sections--all; T. 10 S., R. 11 E., sections 2-11, 14-23, and 26-35; T. 11 S., R. 9 E., sections 1-3, 10-15, 22-27, and 34-36; T. 11 S., R. 10 E., sections 1-24, and 26-34; T. 11 S., R. 11 E., sections 1-27 and 35-36; T. 11 S., R. 12 E., sections 19, 30-32; T. 12 S., R. 9 E., sections 1-3, 10-15, 22-27, and 34-36; T. 12 S., R. 10 E., sections 5-8, 18, and 19; T. 12 S., R. 11 E., sections 1; T. 12 S., R. 12 E., sections 5-9, 16-21, 28, 29, 32 and 33.

Ownership: T. 12 S., R. 9 and 10 E. proposed as part of Gates of the Arctic National Park. T. 8, 9, 10, and 11 S., R. 9 and 10 E. of Native Regional Deficiency Area. All remaining land is withdrawn as Utility Corridor, Bureau of Land Management, Department of the Interior.

Approximate acreage: 153,600 acres (62,162 hectares).

Geologic features: An exceptionally fine glacial sequence from the type area for the Itkillik Glaciation. A compound advance where glaciers from the two valleys coalesced to form a lobe. Galbraith and Itkillik Lakes are enclosed by moraine of the last stade of the Itkillik Glaciation. The moraine has formed barriers that changed the drainage patterns of several streams. Galbraith Lake drains through Atigun Gorge instead of to the north and the Itkillik has diverted to its present channel instead of through the Kuparuk River. Abundant knob and kettle topography.

Biotic features: Primarily dry upland meadow and alpine plant communities with shrub-willow along streams. Most of the larger animals of the North Slope found here as well as many birds. Galbraith Lake recommended as an Ecological Reserve by Joint Federal-State Land Use Planning Commission.

Scenic features: Outstanding mountain scenery adjacent to the range with numerous lakes.

Land use and vulnerability: The eastern part of this site is in the utility corridor and the access road for the pipeline has been completed. There will be a pipeline pumping station at Galbraith Lake. Possibly the eastern part should be excluded from consideration as a landmark site as it no longer can be considered as being in the unspoiled natural state.

Data source:

C. G. Mull, Denver, Colo
H. N. Reiser, Menlo Park, Calif.

Selected references:

Childers, J. M., 1972, Channel erosion surveys along proposed TAPS route, Alaska, July 1971: U.S. Geol. Survey open-file report, 79 p.

Ferrians, O. J., Jr., 1971b, Preliminary engineering geologic maps of the proposed trans-Alaska pipeline route, Philip Smith Mountains quadrangle: U.S. Geol. Survey open-file report, 2 sheets.

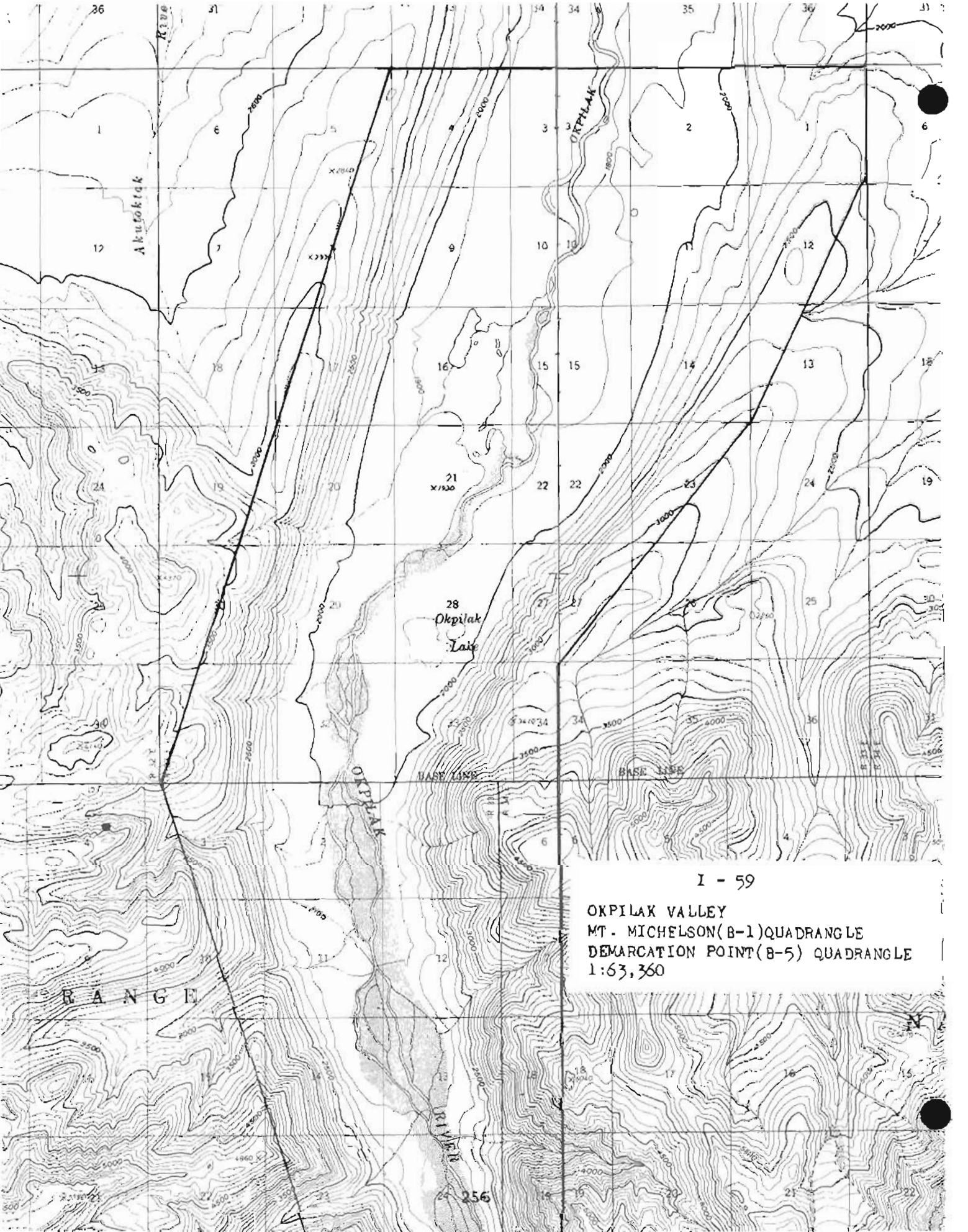
Keller, A. S., Morris, R. H., and Detterman, R. L., 1961, Geology of the Shaviovik-Sagavanirktok Rivers region, Alaska: U.S. Geol. Survey Prof. Paper 303-D, p. D169-D222.

Other knowledgeable persons:

W. P. Borsgé, Menlo Park, Calif.
M. D. Mangus, Anchorage, Alaska

Publicity sensitivity: None

Comments: This is an exceptionally good area to illustrate the works of Glaciers. The natural condition has been altered by road and pipeline construction but the site would give us a chance to monitor these changes. Site recommended for entry into Registry of Natural Landmarks.



I - 59

OKPILAK VALLEY
MT. MICHELSON(B-1)QUADRANGLE
DEMARCATION POINT(B-5) QUADRANGLE
1:63,360

I - 59 OKPILAK VALLEY 3

Themes: Work of glaciers, River system.

Location: Arctic Foothills Province, eastern part, north front of Brooks Range, Mt. Michelson B-1 quadrangle (1:63,360), T. 1 N., R. 33 E., sections 1-5, 9-17, 19-23, and 26-34; T. 1 S., R. 33 E., sections 1-3, 10-15, 23 and 24; T. 1 S., R. 34 E., sections 6, 7, 18, and 19.

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Department of the Interior.

Approximate acreage: 21,250 acres (8,600 hectares).

Geologic features: This site includes the broad glaciated valley formed by the repeated advances of the Itkillik Glaciation. Paired lateral moraine along valley wall indicate four major advances. River dammed by one set of moraine forming a glacial lake. Sand dunes and blow-out features now common to lake bed deposits.

Biotic features: Prim Dall sheep and caribou area. Shrub-willow and sand dune plant communities along river with dry upland meadow and alpine communities along valley walls. Site being considered as an Ecological Landmark.

Scenic features: Spectacular mountains and valleys with numerous glaciers just to south of site. Mt. Michelson nearby, highest peak in Brooks Range.

Land use and vulnerability: Part of the Arctic National Wildlife Range and protected.

Data source: C. G. Mull, Denver, Colo.
Author from personal investigations

Selected references:

Brown, Jerry, 1966, Soils of the Okpilak River region, Alaska: U.S. Army CRREL Research Report 188, 49 p.

Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1974, Preliminary geologic map, Demarcation Point quadrangle, Alaska: U.S. Geol. Survey open-file report, 2 sheets.

Sable, E. G., 1961, Recent recession and thinning of Okpilak Glacier, northeastern Alaska: Arctic, Jour. Arctic Inst. N. Am., v. 14, no. 3, p. 176-187.

Other knowledgeable persons: M. D. Mangus, Anchorage, Alaska
A. H. Lachenbruch, Menlo Park, Calif.

Publicity sensitivity: None

Comments: A classic example of a glaciated valley, but there are other better areas in Arctic Lowland. May be nationally significant.

Theme 7. Cuestas and Hogbacks

The theme Cuestas and Hogbacks is of importance to the natural history of the Arctic Lowlands. The development of these landform features can tell us considerable about the Late Tertiary and Quaternary geologic history of the region. By Late Tertiary time the mountains and hills uplifted at the beginning of the Tertiary had been reduced to a nearly level peneplain across which the rivers meandered towards the sea. A Late Tertiary uplift caused rejuvenation of the streams with subsequent erosion. The Cretaceous bedrock across which these streams flowed consisted of alternating hard sandstone and conglomerate with soft shale and siltstone. These strata had been folded into a series of long, open, gentle anticlines and synclines that greatly effected the position of the rejuvenated drainage. The main streams maintained their original course across the area but the headward erosion of the subsidiary streams excavated valleys through the softer rocks leaving gently tilted cuestas of sandstone and conglomerate.

Nearly all of the cuestas are found in the western part of the Arctic Lowland where the structures are long and gentle with the right combination of hard and soft layers. Locally where the beds are folded or faulted more steeply a hogback ridge is developed. These landforms are considered characteristic of semi-arid conditions and they develop in the semi-arid arctic environment just the same as in the southwest desert country.

CUESTAS AND HOGBACKS

CUESTAS

1. Highest priority

   Archimedes Ridge

   Disappointment Ridge

2. Sites definitely eligible

   Lookout Ridge

3. Sites of uncertain eligibility

   None

4. Sites not recommended

   Amatusuk Hills

   Tuktu Escarpment

HOGBACKS

1. Highest priority

   None

2. Sites definitely eligible

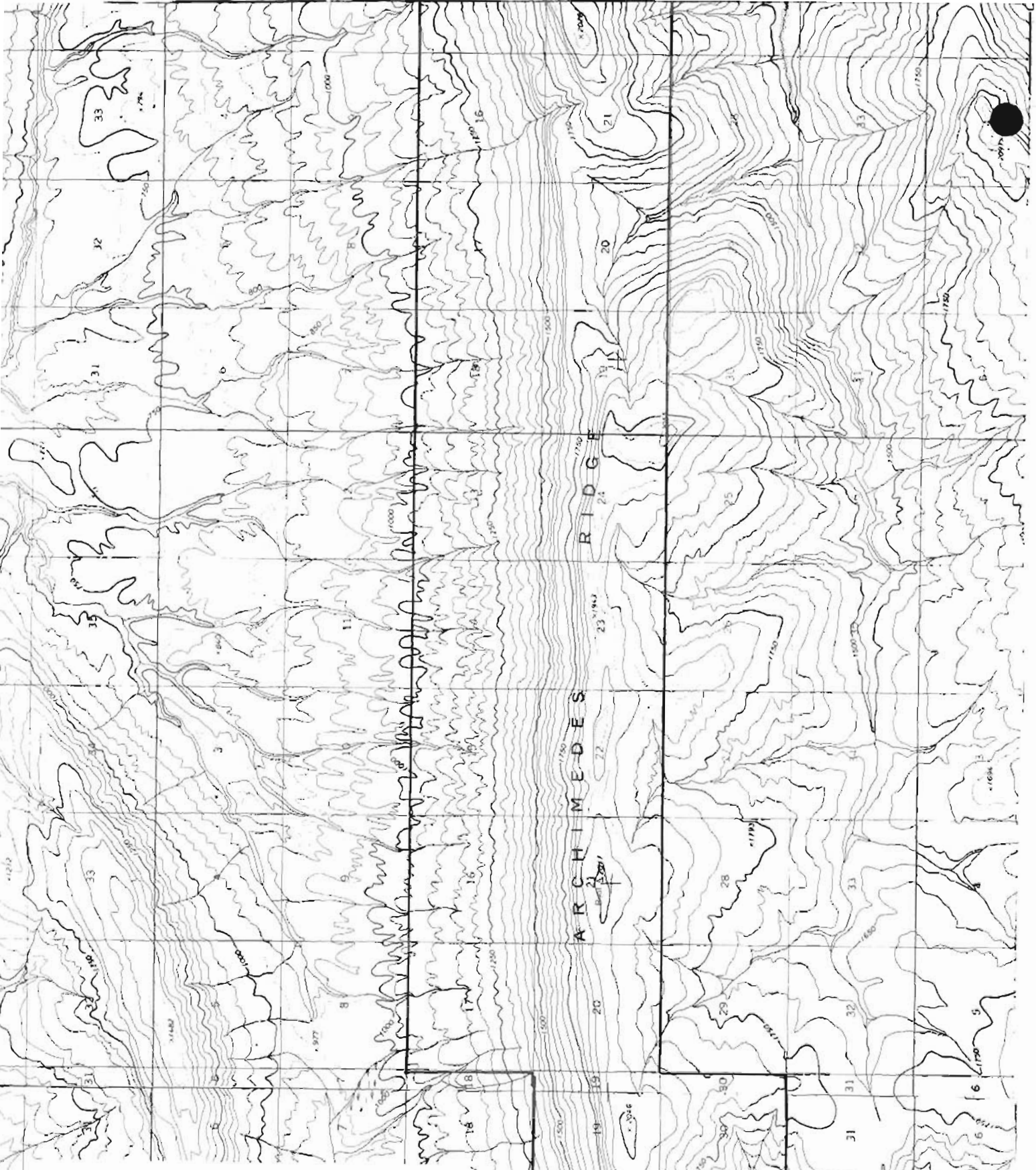
   Rooftop Ridge

3. Sites of uncertain eligibility

   None

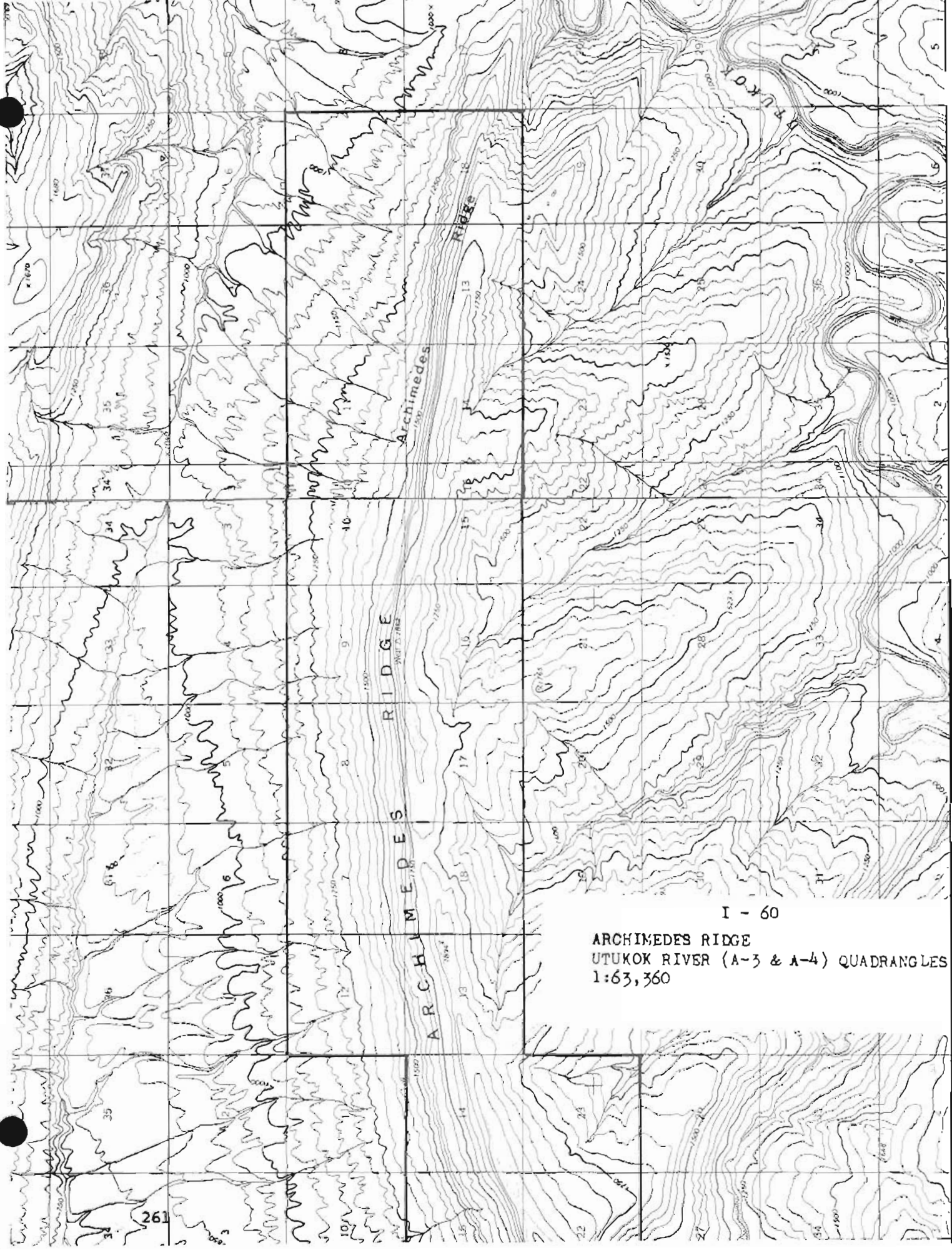
4. Sites not recommended

   None



I - 60

ARCHIMEDES RIDGE
UTUKOK RIVER(A-4 & A-5) QUADRANGLES
1:63,360



I - 60

ARCHIMEDES RIDGE
UTUKOK RIVER (A-3 & A-4) QUADRANGLES
1:63,360

NATURAL LANDMARK SURVEY
LANDFORMS
CUESTAS AND HOGBACKS

I - 60 ARCHIMEDES RIDGE 1C

Themes: Cuestas and hogbacks, Movement of the earth's crust, Sculpture of the land.

Location: Arctic Foothills Province, western part, Utukok River A-3, A-4, and A-5 quadrangles (1:63,360), T. 3 S., R. 36 W., sections 7 and 18; T. 3 S., R. 37 W., sections 7-18; T. 3 S., R. 38 W., sections 12-23; T. 3 S., R. 39 W., sections 13-24 and 30; T. 3 S., R. 40 W., sections 24 and 25.

Ownership: Naval Petroleum Reserve No. 4, U.S. Navy, Department of Defen

Approximate acreage: 25,600 acres (10,360 hectares).

Geologic features: Long, linear cuesta formed by the gentle warping of the Cretaceous beds into anticlines and synclines. The resistant beds forming the cuesta are sandstone and conglomerate of the Kukpowruk Formation that stand 1,000 feet above the lowlands of shale of the Torok Formation. The principal rivers, Utukok, Kokolik and Kukpowruk are all old meandering streams that crossed the original peneplain. As the peneplain was uplifted they maintained their grade and developed a trellis system of subsidiary drainages that cut through to the soft underlying shale of the Torok Formation leaving parallel cuesta ridges between the major streams. Locally the trellis drainage is starting to cut through the cuesta and will eventually form mesas.

Biotic features: Part of the area suggested as a Natural Landmark for ecologic themes by Dr. Frederick C. Dean primarily as a caribou calving area. Site study for this proposal made by Dr. Peter C. Lent, 9/23/68. In addition to caribou site contain other animal populations. Tussock tundra and dry upland meadow are main plant communities present in site.

Scenic features: Striking canyon land-type topography with long parallel ridges standing 800 to 1,000 feet above the rivers.

Land use and vulnerability: Part of Naval Petroleum Reserve No. 4, consequently subject to possible exploration and drilling.

Data source: C. G. Mull, Denver, Colo.
I. L. Tailleur, Menlo Park, Calif.

Selected references:

Chapman, R. M., and Sable, E. G., 1960, Geology of the Utukok-Corwin region, northwestern Alaska: U.S. Geol. Survey Prof. Paper 303-C, p. C49-C167.

Humphrey, R. L., 1966, The prehistory of the Utukok River region, Arctic Alaska: Current Anthropology, v. 7, p. 586-588.

Lent, P. C., 1966, The caribou of northwestern Alaska, in Wilimovksy, N. J., and Wolfe, J. N., eds., Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Comm., Washington, D.C., PNE 481, 1,250 p.

Other knowledgeable persons:

M. D. Mangus, Anchorage, Alaska
E. G. Sable, Denver, Colo.

Publicity sensitivity: None

Comments: An outstanding site for geologic and ecologic themes. Eligible for entry into Registry of Natural Landmarks. Also being recommended as part of an Ecological Reserve by the Joint Federal-State Land Use Planning Commission.

I - 61

DISAPPOINTMENT RIDGE
UTUKOK RIVER (A-3) QUADRANGLE

1:63,360

I - 61 DISAPPOINTMENT RIDGE 1C

Themes: Cuestas and hogbacks, Movement of the earth's crust

Location: Arctic Foothills Province, western part, Utukok River A-3 quadrangle (1:63,360), T. 5 S., R. 35 W., sections 6 and 7; T. 5 S., R. 36 W., sections 1-6, 11, and 12; T. 5 S., R. 37 W., sections 1-4.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 7,680 acres (3,108 hectares).

Geologic features: The Cretaceous sandstone, and conglomerate of the Disappointment Ridge cuesta are the north flank of Foggy syncline. The beds primarily of the Kukpowruk Formation stand 1,000 feet above the lowland composed of shale of the Torok Formation. The trellis drainage at the head of Disappointment Creek has cut through the more resistant beds into this shale section leaving the bold cliffs of the cuesta. Numerous bedding features visible in the cliffs.

Biotic features: Part of the caribou calving area of the upper Utukok-Colville Rivers area. Mainly an area of dry upland and tussock tundra.

Scenic features: Striking canyon land topography of the western Arctic Lowland. Meandering rivers 1,000 feet below the long parallel ridges.

Land use and vulnerability: Part of Naval Petroleum Reserve No. 4. Site is part of a syncline so probably will not be used as a drilling location.

Data source: C. G. Mull, Denver, Colo.
I. L. Tailleur, Menlo Park, Calif.

Selected references:

Chapman, R. M., and Sable, E. G., 1960, Geology of the Utukok-Corwin region, northwestern Alaska: U.S. Geol. Survey Prof. Paper 303-C, p. C49-C167.

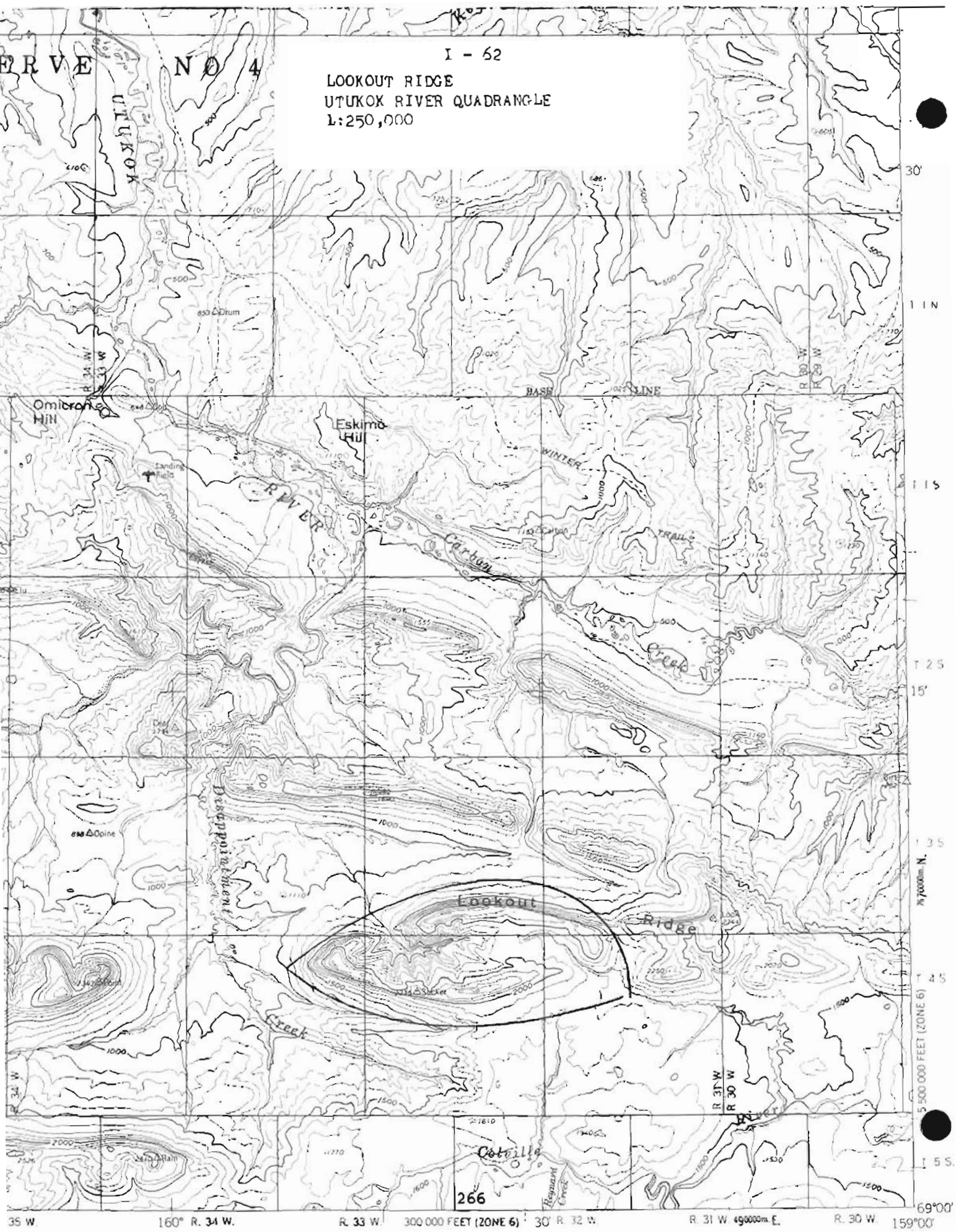
Other knowledgeable persons:
M. D. Mangus, Anchorage, Alaska
E. G. Sable, Denver, Colo.

Publicity sensitivity: None

Comments: Site eligible for Landmark Status and is recommended for entry into Registry of Natural Landmarks.

I - 62

LOOKOUT RIDGE
UTUKOK RIVER QUADRANGLE
1:250,000



NATURAL LANDMARK SURVEY
LANDFORMS
CUESTAS AND HOGBACKS

I - 62 LOOKOUT RIDGE 2C

Themes: Cuestas and hogbacks, Movement of the earth's crust, Sculpture of the land.

Location: Arctic Foothills Province, western part, Utukok River quadrangle (1:250,000), T. 3 S., R. 31 W., sections 29-32; T. 3 S., R. 32 W., sections 25-36; T. 3 S., R. 33 W., section 36; T. 4 S., R. 31 W., sections 4-9, and 16-18; T. 4 S., R. 32 W., sections 1-18; T. 4 S., R. 33 W., sections 1-3, and 10-14.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 24,320 acres (9,842 hectares).

Geologic features: Gently folded beds of the Corwin and Kukpowruk Formations exposed in the sides of this synclinal structure. Streams are breaching the structure to form a series of canyons. Marine depositional features well-exposed on canyon walls. Cuestas being sculptured into a series of mesas and buttes.

Biotic features: Within the caribou calving ground of the western herd plus most other animals of the Arctic Slope. Primarily dry upland meadow plant communities.

Scenic features: Good canyon land topography.

Land use and vulnerability: Part of Naval Petroleum Reserve No. 4. The synclinal structure probably will not be drilled, but nearby areas are likely drilling sites.

Data source: M. D. Mangus, Anchorage, Alaska
E. G. Sable, Denver, Colo.

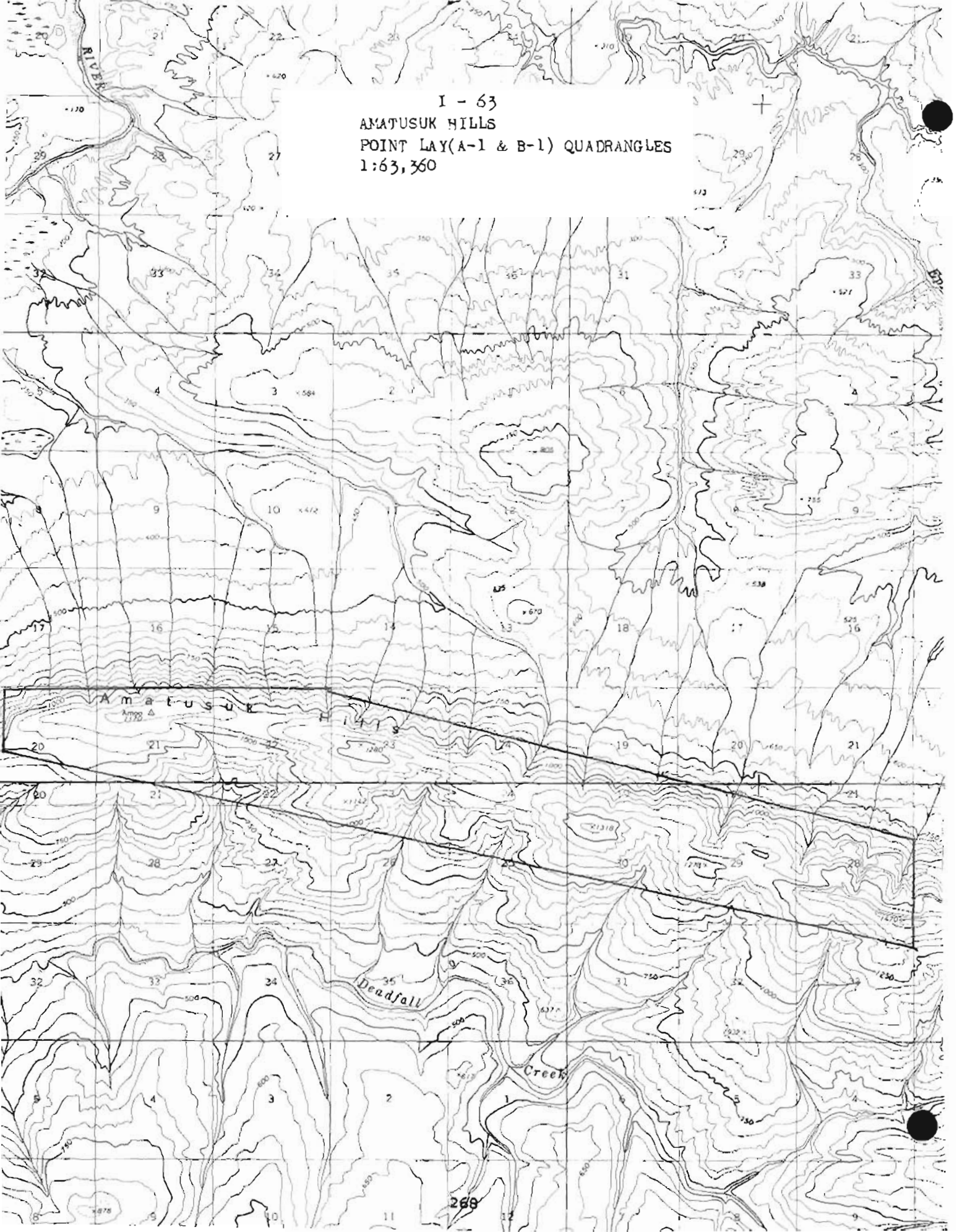
Selected references:

Chapman, R. M., and Sable, E. G., 1960, Geology of the Utukok-Corwin region, northwestern Alaska: U.S. Geol. Survey Prof. Paper 303-C, p. C49-C167.

Other knowledgeable persons:
I. L. Tailleur, Menlo Park, Calif.
A. H. Lachenbruch, Menlo Park, Calif.

Comments: An excellent site that is recommended for Landmark Status.

I - 63
AMATUSUK HILLS
POINT LAY(A-1 & B-1) QUADRANGLES
1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
CUESTAS AND HOGBACKS

I - 63 AMATUSUK HILLS 4

Themes: Cuestas and hogbacks.

Location: Arctic Foothills Province, western part, Point Lay A-1 and B-1 quadrangles (1:63,360), T. 2 S., R. 43 W., sections 19, 20, and 28-30; T. 2 S., R. 44 W., sections 20-27.

Ownership: Native regional deficiency area, Alaska Native Claims Settlement Act. Selections not made as of 8/1/74.

Approximate acreage: 4,680 acres (1,894 hectares).

Geologic features: The northernmost cuesta in the western Arctic Lowland formed from the late Early Cretaceous sandstone and conglomerate exposed along north flank of Archimedes Ridge anticline. Good examples of deltaic cross bedding and other near shore marine depositional features in the thin-bedded sandstone.

Biotic features: Dry upland meadow and shrub complex. Front of cuesta is nesting area for hawks and falcon.

Scenic features: At the edge of the canyon lands topography and affords good views of both the canyon land and the flat coastal plain to the north.

Land use and vulnerability: No organized use of land at present. Oil and gas lease applications filed on the lands and exploration probably will start with settlement of Alaska Native Claims.

Data source: Author from personal field investigations.

Selected references:

Chapman, R. M., and Sable, E. G., 1960, Geology of the Utukok-Corwin region, northwestern Alaska: U.S. Geol. Survey Prof. Paper 303-C, p. C49-C167.

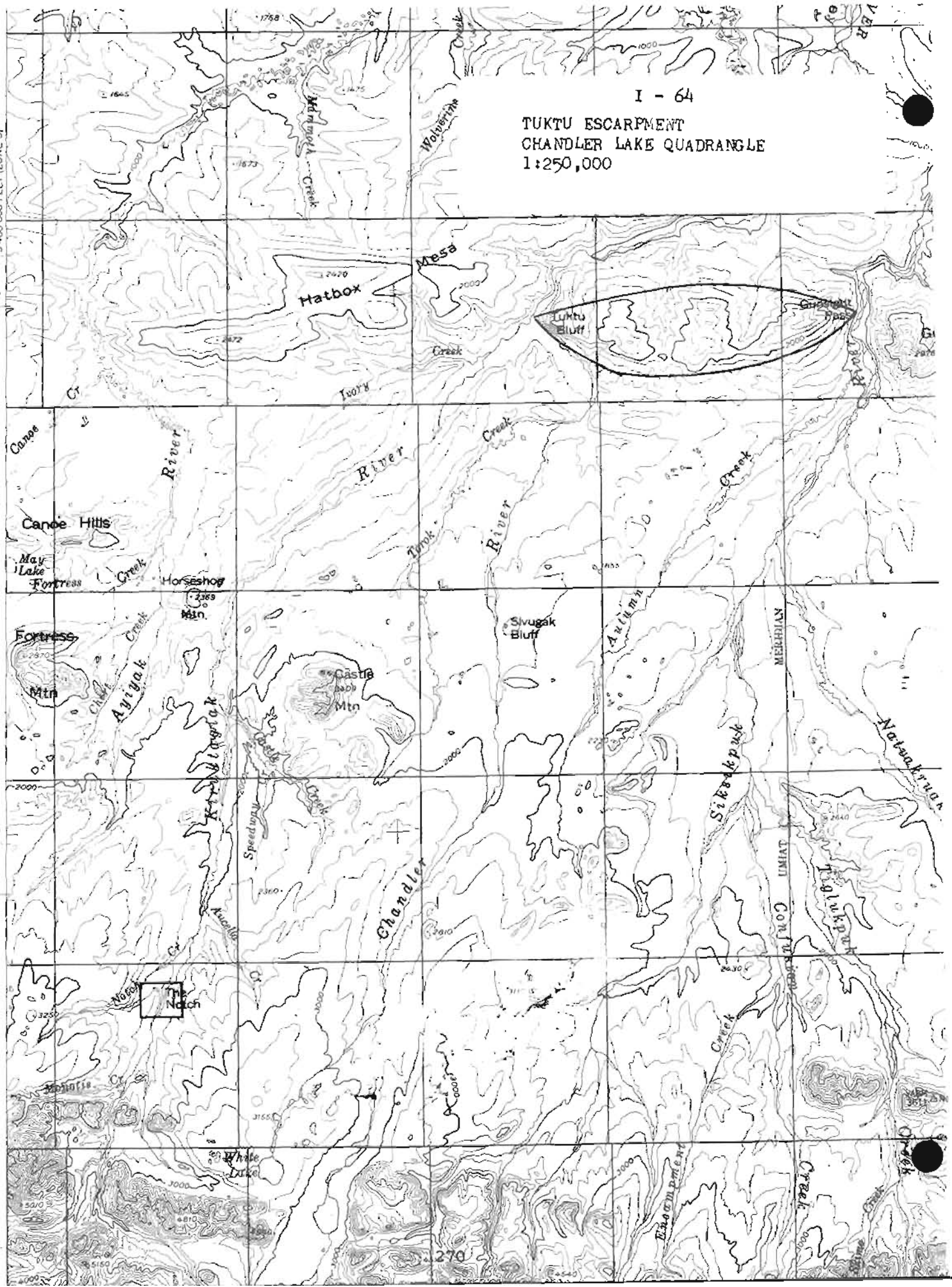
Salecki, P. S., 1950, A preliminary report on an archeological reconnaissance of the Kukpowruk and Kokolik Rivers in northwestern Alaska: American Antiquity, v. 16, no. 1, p. 66-69.

Other knowledgeable persons:

M. D. Mangus, Anchorage, Alaska
C. G. Mull, Denver, Colo.

Publicity sensitivity: None

Comments: A good site but better are available nearby. Not recommended for Landmark Status.


I - 64
TUKTU ESCARPMENT
CHANDLER LAKE QUADRANGLE
1:250,000
Hatbox
Mesa
Tuktu Bluff
Canoe Hills
May Lake
Fortress
Horseshoe Mtn.
Fortress Mtn
Castle Mtn
Sivugak Bluff
Chandler
The Notch
Whale Lake
Ivory
Wolverine
Tuktu
Autumn
Sivukpuk
Tiglukpuk
Natuakruak
Kiliuyak
Ayiyak
Speedway
Kaucha
Norfolk
Mahoney
Escarpment
Canoe
River
Creek
Cr
MERIDIAN
UMIAT
COUNTY
1758
1645
1675
1673
1672
2470
2000
1000
2370
2869
2570
2410
2640
2610
3250
3155
3000
5150
4000
270
T. 7 S.
T. 8 S.
T. 9 S.
T. 10 S.
T. 11 S.
T. 12 S.
T. 13 S.
45'
30'
5400000 FEET (ZONE 5)

NATURAL LANDMARK SURVEY
LANDFORMS
CUESTAS AND HOGBACKS

I - 64 TUKTU ESCARPMENT 4

Themes: Cuestas and hogbacks, Movement of the earth's crust; Development of life on earth, Age of reptiles.

Location: Arctic Foothills Province, central part, Chandler Lake quadrangle (1:250,000), T. 8 S., R. 1 E., sections 17-21, 29, and 30; T. 8 S., R. 1 W., sections 13-35; T. 8 S., R. 2 W., sections 13, 14, and 23-26.

Ownership: Native regional deficiency area, Alaska Native Claims Settlement Act. Selections not made as of 8/1/74.

Approximate acreage: 14,000 acres (5,665 hectares).

Geologic features: The Tuktu Escarpment is a prominent geologic and geomorphic feature that extends for about 175 miles westward across the Arctic Foothills Province. The escarpment is formed by the resistant sandstone and conglomerate beds of the Tuktu and Chandler Formations at the base of the Nanushuk Group. These resistant beds stand in bold relief above the shale lowlands of Torok Formation to the south. This site includes the type locality of the marine Tuktu Formation, which contains abundant fossil evidence of the Early Cretaceous marine shellfish fauna. Many Early Cretaceous fossil plants are contained in the coal seams of the nonmarine deltaic deposits in the overlying Chandler Formation.

Biotic features: The escarpment area locally contains Dall sheep and other large and small animals. Numerous hawk and falcon aeries.

Scenic features: Spectacular views of the Brooks Range across the shale lowlands.

Land use and vulnerability: No organized use of land at present. Oil and gas lease applications filed and there probably will be some exploration in near future.

Data source: Author from personal investigation.
M. D. Mangus, Anchorage, Alaska
W. W. Patton, Jr., Menlo Park, Calif.

Selected references:

Detterman, R. L., 1956, New and redefined nomenclature of the Nanushuk Group, in Gryc, George, and others, Mesozoic sequence in Colville River region, Alaska: Am. Assoc. Petroleum Geologists Bull., v. 40, no. 2, p. 233-244.

_____, Bickel, R. S., and Gryc, George, 1963, Geology of the Chandler River region, Alaska: U.S. Geol. Survey Prof. Paper 303-E, p. E223-E324.

Gryc, George, Patton, W. W., Jr., and Payne, T. G., 1951, Present Cretaceous stratigraphic nomenclature of northern Alaska: Washington Acad. Sci. Jour., v. 41, no. 5, p. 159-167.

Other knowledgeable persons:

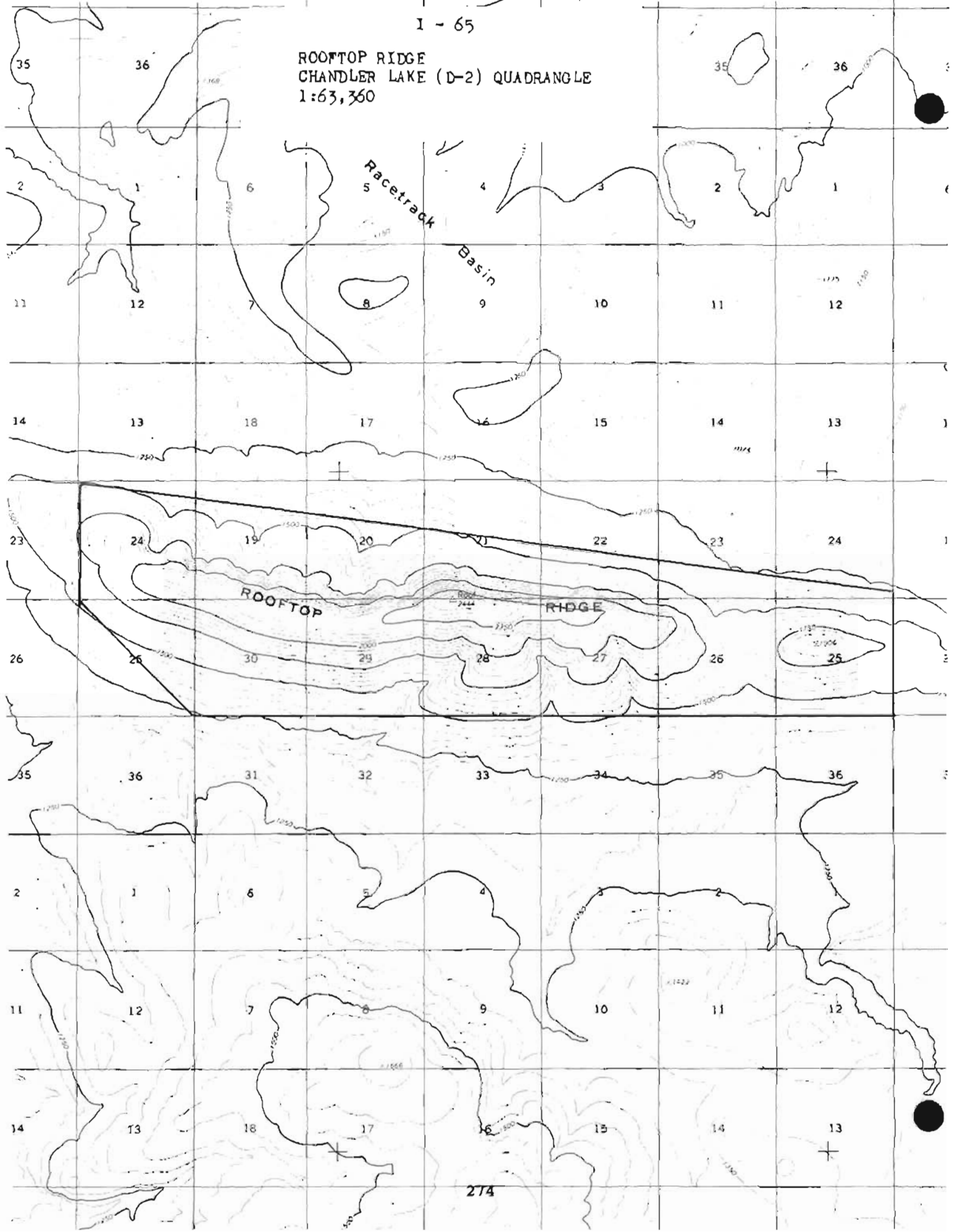
I. L. Tailleur, Menlo Park, Calif.
George Gryc, Menlo Park, Calif.

Publicity sensitivity: None

Comments: This site is not being recommended as a Landmark in this category. However, part of this same site will be recommended as a Lifeform Natural Landmark.

I - 65

ROOFTOP RIDGE
CHANDLER LAKE (D-2) QUADRANGLE
1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
CUESTAS AND HOGBACKS

I - 65 ROOFTOP RIDGE 2C

Themes: Cuestas and hogbacks, Movement of the earth's crust.

Location: Arctic Foothills Province, central part, Chandler Lake D-2 quadrangle (1:63,360), T. 6 S., R. 4 E., sections 24 and 25, T. 6 S., R. 5 E., sections 19-30.

Ownership: Native regional deficiency area, Alaska Native Claims Settlement Act. Selections not made as of 8/1/74.

Approximate acreage: 6,540 acres (2,646 hectares).

Geologic features: The steeply south-dipping Lower Cretaceous sandstone and conglomerate forming Rooftop Ridge were faulted into their present position during the Early Tertiary orogeny that formed the Brooks Range. This hogback ridge was faulted across the end of Race Track Basin, which contains Upper Cretaceous sandstone and tuff beds.

Biotic features: Falcon and Hawk aeries. Dry upland plant communities.

Land use and vulnerability: The winter haul road through Anaktuvuk Pass goes by west end of site. No other land use at present.

Data source: M. D. Mangus, Anchorage, Alaska
Author from personal investigation.

Selected references:

Detterman, R. L., Bickel, R. S., and Gryc, George, 1963, Geology of the Chandler River region, Alaska: U.S. Geol. Survey Prof. Paper 303-E, p. E223-E324.

Other knowledgeable persons:

R. M. Chapman, Menlo Park, Calif.
W. W. Patton, Jr., Menlo Park, Calif.

Publicity sensitivity: None

Comments: This site probably is of national significance and is recommended for entry into Registry of Natural Landmarks.

Theme 8. Sculpture of the Earth

The theme Sculpture of the Earth is of some importance to the landforms category for the Arctic Lowland. Sculpture of the Earth denotes landforms produced by erosion. This same thing can be said of nearly all landforms; they are produced by erosion in one form or another. The National Park Service established this theme to include forms that do not fit other categories and as such only a few sites are included for the Arctic Lowland. Many areas described under other themes also represent sculpturing of the landscape in one form or another.

This theme as used herein can be divided into those erosional remnants called buttes and into gorges.

Buttes

The advance dissection of a mesa results in isolated steep-sided hills rising high above a surrounding plain. The central part of the Arctic Foothills Province contains several spectacular examples of these erosional remnants. They are all that is left of the peneplane developed during the Tertiary and largely destroyed by the late Tertiary uplift and erosion. Buttes commonly form excellent exposures of the rock strata and many times represent the only remaining part of a sequence that has been removed by erosion.

Gorges

A gorge represents a deep slice into the earth's crust that generally was formed very rapidly in response to some unusual event. A common cause is the sudden release of a large volume of water such as the breaching of a morainal dam on a large lake. Rock strata and structure are well-exposed in gorges as most are young features. With

age, erosion will widen the gorge into a normal valley succession that will obliterate many of the geologic details.

Nearly all gorges in the Arctic Lowland are related to the Pleistocene glaciers. Melt water from the ice locally cut channels through bedrock, but the largest gorges were cut when large bodies of water were suddenly drained. Several large glacial lakes were enclosed by moraine of the Itkillik Glaciation. During the hypsithermal, about 5,000 years ago in the Arctic Lowland, the temperature was warmer than at present. The warm temperature melted the ice and raised the water level in the glacial lakes to the point where they were able to breach the morainal dam. Most of the gorges probably date from this time interval.

SCULPTURE OF THE EARTH

1. Highest priority

    Castle Mountain

    Atigun Gorge

2. Sites definitely eligible

    Fortress Mountain

3. Sites of uncertain eligibility

    Kiruktagiak Notch

4. Sites not recommended

    None

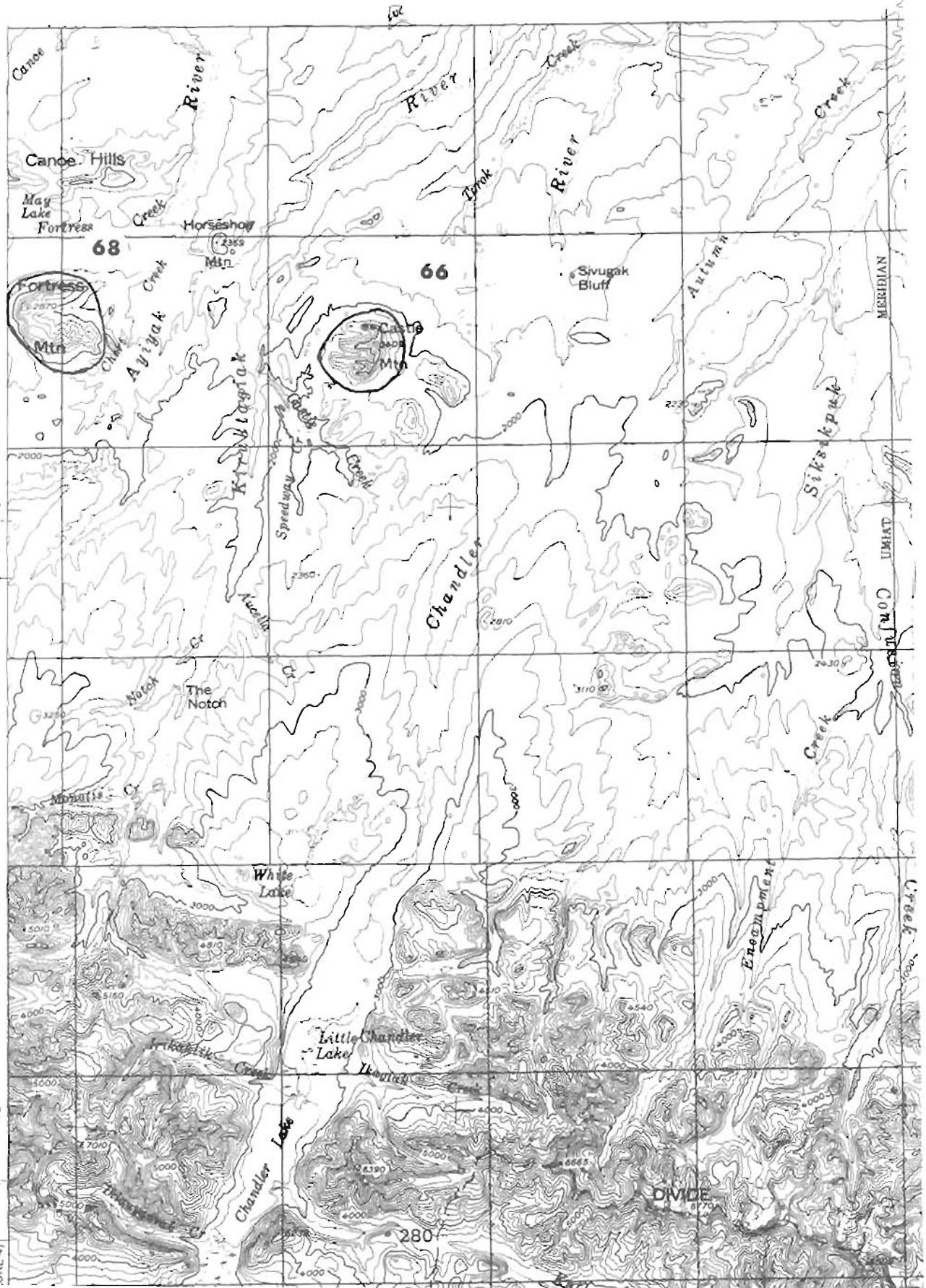
I- 68

FORTRESS MOUNTAIN
CHANDLER LAKE QUADRANGLE

1: 250,000

I - 66

CASTLE MOUNTAIN
CHANDLER LAKE QUADRANGLE
1:250,000



NATURAL LANDMARK SURVEY
LANDFORMS
SCULPTURE OF THE EARTH

I - 66 CASTLE MOUNTAIN 1C

Themes: Sculpture of the earth.

Location: Arctic Foothills Province, central part, Chandler Lake quadrangle (1:250,000), T. 10 S., R. 3 W., sections 15-17, 20-22, and 27-29.

Ownership: Bureau of Land Management, Department of the Interior by authority of Alaska Native Claims Settlement Act, section 17, D2, as part of proposed Gates of the Arctic National Park.

Approximate acreage: 2,600 acres (1,052 hectares).

Geologic features: Castle Mountain is an erosional remnant of Early Cretaceous conglomerate and graywacke that looms nearly 1,500 feet above the surrounding shale lowlands. Castle Mountain, along with nearby Fortress Mountain, is the type locality for the Fortress Mountain Formation of late Early Cretaceous age. The synclinal structure forming the mountain has preserved about 10,000 feet of the conglomerate, graywacke, siltstone, and shale that were rapidly deposited from the ancestral Brooks Range. Sedimentary structures are readily apparent in the steep sides of the butte. Fossil marine lifeforms found in these rocks indicate they were deposited mainly in fairly shallow water.

Biotic features: The Castle Mountain site is the habitat of a small group of Dall sheep, and also contains hawk and falcon aeries.

Scenic features: Bold crags and turrets formed by the massive rock units give this mountain the appearance of a castle. Spectacular views of the Brooks Range from the top of the mountain.

Land use and vulnerability: Recommended as part of the Gates of the Arctic National Park, but also being considered as part of the Native Regional Deficiency area. If selected as part of the native acreage there is a possibility of future oil and gas development.

Data source: I. L. Tailleur, Menlo Park, Calif.
M. D. Mangus, Anchorage, Alaska

Selected references:

Gryc, George, Patton, W. W., Jr., and Payne, T. G., 1951, Present Cretaceous stratigraphic nomenclature of northern Alaska: Washington Acad. Sci. Jour., v. 41, no. 5, p. 159-167.

Patton, W. W., Jr., 1956, New and redefined formations of Early Cretaceous, in Gryc, George, and others, Mesozoic sequence in Colville River region, Alaska: Am. Assoc. Petroleum Geologists Bull., v. 40, no. 2, p. 219-223.

_____, and Tailleur, I. L., 1964, Geology of the Killik-Itkillik region, Alaska: U.S. Geol. Survey Prof. Paper 303-G, p. G409-G500.

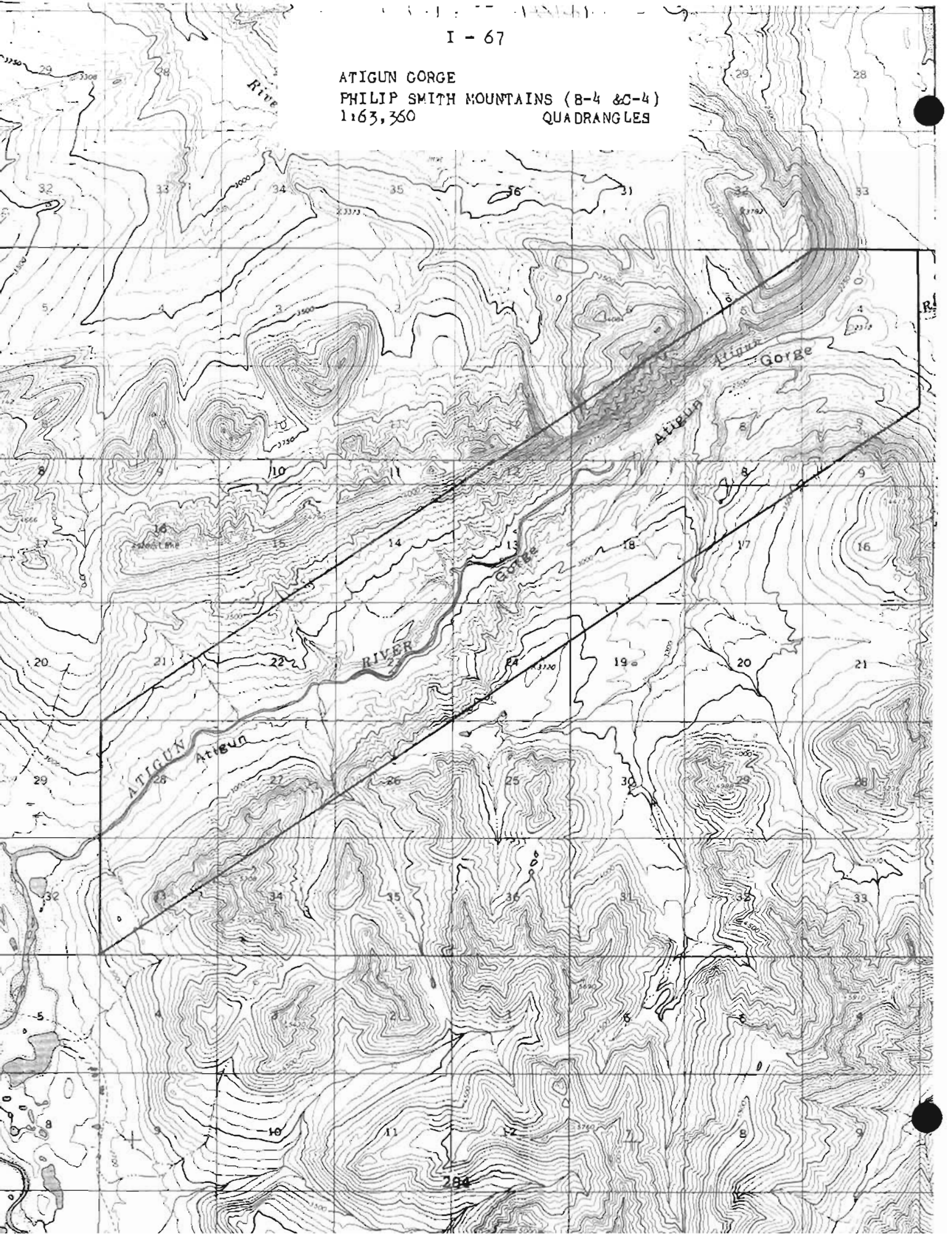
Other knowledgeable persons:

George Gryc, Menlo Park, Calif.
W. W. Patton, Jr., Menlo Park, Calif.

Publicity sensitivity: None

Comments: An outstanding example of an erosional remnant eligible for entry into Registry of Natural Landmarks.

ATIGUN GORGE
PHILIP SMITH MOUNTAINS (B-4 &C-4)
1:63,360 QUADRANGLES



NATURAL LANDMARK SURVEY
LANDFORMS
SCULPTURE OF THE EARTH

I - 67 ATIGUN GORGE 1A

Themes: Sculpture of the earth; Movement of the earth's crust; Development of life on earth; Changes in marine life, Age of reptiles.

Location: Arctic Foothills Province, eastern part, north front of Brooks Range, Philip Smith Mountains B-4 and C-4 quadrangles (1:63,360), T. 11 S., R. 12 E., sections 12-15, 21-24, 26-28, and 33-34; T. 11 S., R. 13 E., sections 4-9, and 17-19.

Ownership: Utility corridor, Bureau of Land Management, Department of the Interior.

Approximate acreage: 8,100 acres (3,278 hectares).

Geologic features: Atigun Gorge is an 8-mile slice through the mountains that exposes about 100,000,000 years of the earth's history. The many layers of limestone, chert, sandstone, shale, and conglomerate all deposited while this area was under the sea during the Late Paleozoic and Early Mesozoic contain abundant fossil shells of the sea life. The gorge also shows the tremendous force that was placed on these rocks when the mountains were finally uplifted from the sea. The beds were highly folded and faulted into many structures. Pleistocene glaciers and finally the draining of a glacial lake all helped form this gorge that is 1,500 to 2,000 feet deep.

Biotic features: Habitat for nearly all the large and small animals of the Arctic Lowland. Many plant communities present with particular emphasis on alpine varieties. Numerous archeological sites.

Scenic features: Spectacular chasm cut through mountains at the edge of the Arctic Lowland.

Land use and vulnerability: Site is highly vulnerable. Part of utility corridor for Trans-Alaska Pipeline. The pipeline and road were originally scheduled to go through the gorge, but were finally routed around this area. A pumping station for the pipeline will be located near the western end of gorge.

Data source: H. N. Reiser, Menlo Park, Calif.
I. L. Tailleur, Menlo Park, Calif.
Joint Federal-State Land Use Planning Commission

Selected references:

Childers, J. M., 1972, Channel erosion surveys along proposed TAPS route, Alaska, July 1971: U.S. Geol. Survey open-file report, 79 p.

Ferrians, O. J., Jr., 1971b, Preliminary engineering geologic maps of the proposed trans-Alaska pipeline: U.S. Geol. Survey open-file report, 2 sheets.

Other knowledgeable persons:

M. D. Mangus, Anchorage, Alaska
W. P. Brosgé, Menlo Park, Calif.

Publicity sensitivity: None

Comments: An excellent site highly qualified for entry into Registry of Natural Landmarks. Site also recommended as an Ecological Reserve by the Joint Federal-State Land Use Planning Commission.

I - 68

FORTRESS MOUNTAIN

Map on page 280

NATURAL LANDMARK SURVEY
LANDFORMS
SCULPTURE OF THE EARTH

I - 68 FORTRESS MOUNTAIN 2C

Themes: Sculpture of the earth.

Location: Arctic Foothills Province, central part, Chandler Lake quadrangle (1:250,000), T. 10 S., R. 4 W., sections 7, and 17-20; T. 10 S., R. 5 W., sections 11-14, and 24.

Ownership: Bureau of Land Management, Department of the Interior by authority of Alaska Native Claims Settlement Act, section 17, D-2, as part of Gates of the Arctic National Park.

Approximate acreage: 3,800 acres (1,538 hectares).

Geologic features: The Fortress Mountain site 6 miles west of Castle Mountain probably should be considered with that site. The geology and structural detail are similar and will not be discussed here. See page 281 for the discussion of Castle Mountain.

Land use and vulnerability: Being considered as part of Gates of the Arctic National Park, and also as a Native Regional Deficiency area. Oil and gas lease application filed on these lands and probably will be explored if selected by the natives.

Data source: I. L. Tailleur, Menlo Park, Calif.
C. G. Mull, Denver, Colo.

Selected references:

Patton, W. W., Jr., and Tailleur, I. L., 1964, Geology of the Killik-Itkillik region, Alaska: U.S. Geol. Survey Prof. Paper 303-G, p. G409-G500.

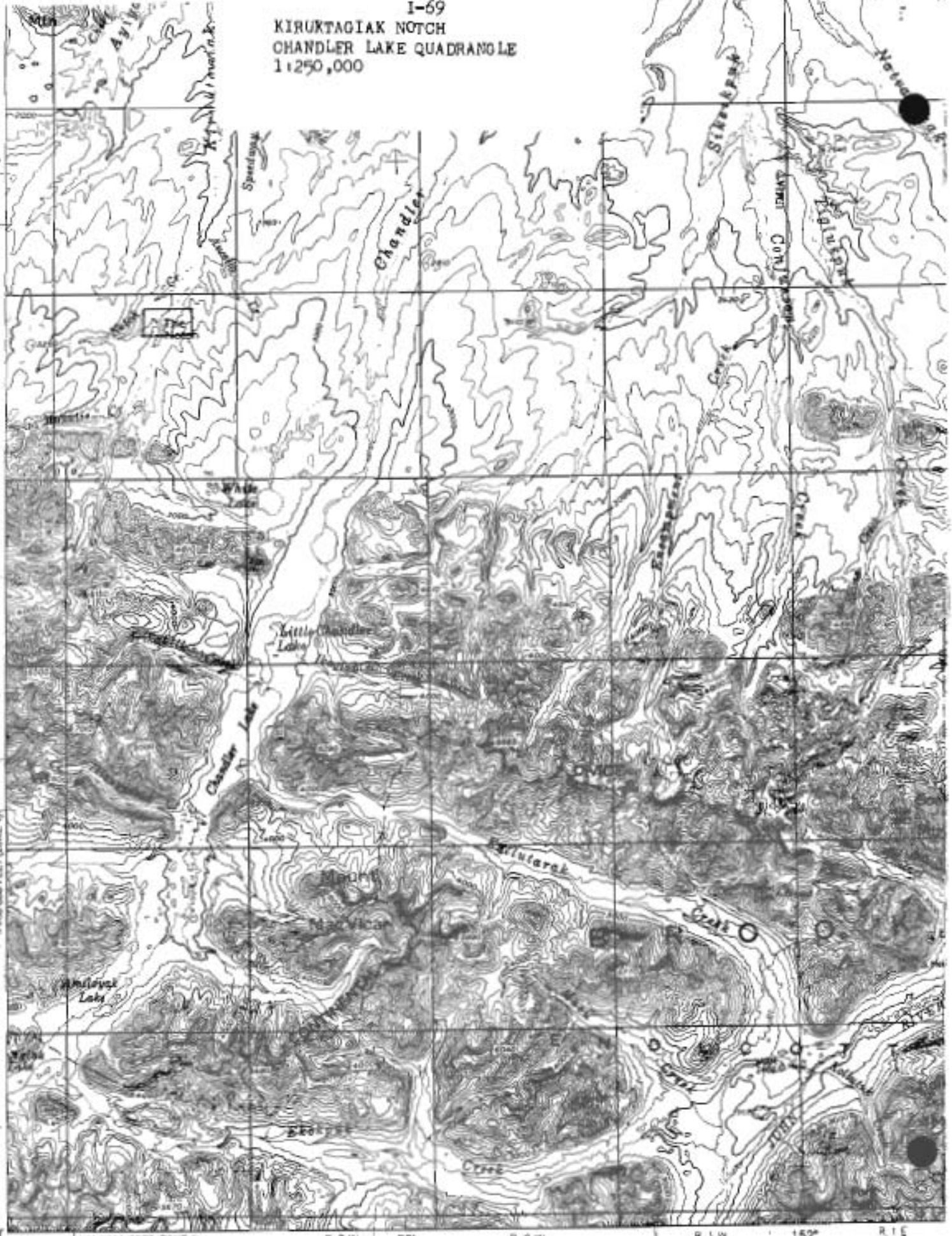
Other knowledgeable persons:

M. D. Mangus, Anchorage, Alaska
H. N. Reiser, Menlo Park, Calif.

Publicity sensitivity: None

Comments: This site probably should be considered with Castle Mountain all as part of one large area. Not as spectacular as Castle Mountain, but qualified as a Natural Landmark.

I-69
KIRUKTAGIAK NOTCH
CHANDLER LAKE QUADRANGLE
1:250,000



NATURAL LANDMARK SURVEY
LANDFORMS
SCULPTURE OF THE EARTH

I - 69 KIRUKTAGIAK NOTCH 3C

Themes: Sculpture of the earth; Movement of the earth's crust.

Location: Arctic Foothills Province, central part, Chandler Lake quadrangle (1:250,000), T. 12 S., R. 4 W., sections 3, 4, 9, and 10.

Ownership: Native regional deficiency area. Land not selected as of 8/1/74.

Approximate acreage: 720 acres (291 hectares).

Geologic features: Kiruktagiak Notch is a very interesting geologic feature formed when the Kiruktagiak River cut through vertical beds of the Lisburne Limestone of Mississippian age. These limestone beds had been intruded by Jurassic igneous rock and then a thin slice of these rocks were faulted into their present position when the ancestral Brooks Range was uplifted during the early Cretaceous.

Biotic features: Dall sheep and caribou commonly frequent this area. Shrub-willow and dry upland meadow plant communities.

Land use and vulnerability: No use of land at present.

Data source:

W. W. Patton, Jr., Menlo Park, Calif.
I. L. Tailleur, Menlo Park, Calif.

Selected references:

Patton, W. W., Jr., and Tailleur, I. L., 1964, Geology of the Killik-Itkillik region, Alaska: U.S. Geol. Survey Prof. Paper 303-G, p. G409-G500.

Other knowledgeable persons:

H. N. Reiser, Menlo Park, Calif.
M. D. Mangus, Anchorage, Alaska

Publicity sensitivity: None

Comments: This is an interesting geologic area, but probably not nationally significant.

Theme 9. Movements of the Earth's Crust

The theme Movements of the Earth's Crust is of great importance to the landform categories in the Arctic Lowland. Many of the geologic and geomorphic landform features are the direct result of movements within the crust of the earth. The effects of this movement can be seen in the rock strata, and this is one of the first things a geologist looks at in trying to decipher the history of any area. Often the rocks will show the effects of repeated movement that lasted for millions of years and resulted in the landforms we now see exposed.

Sea cliffs and the bare rock walls along a canyon or river are excellent places to inspect the folded and faulted strata that are present in most hills and mountains. The bold sea cliffs along the western coast of the Arctic Lowland contain some of the best examples of this movement. Others are present in the mountains and hills at the south edge of the lowland for it is here at the edge of the Brooks Range that the greatest movement took place.

This theme can be divided into several subthemes. The subdivisions decided upon are Folds, Faults, and Unconformities.

Folds

Folds are the most conspicuous geologic structure showing the movements of the earth's crust. Nearly everyone has observed massive rock strata folded into intricate structures on the side of a mountain. To many people this may look like a giant pretzel without any significant form, but to a geologist these structures take on form and can tell the story of how and when these beds were folded. The simplest types of folds are the gentle upwarp of beds called anticline, or downwarp, syncline.

Many of the more complex structures are merely combinations of these simple forms.

Folds have great economic importance in addition to their value for interpretation of the geologic history. The vast deposits of oil and gas accumulate and are trapped in the upwarped strata of an anticline or dome. Mineral deposits of certain types are also concentrated in folded strata.

Faults

Faults are ruptures that occur in rock strata as the results of severe folding. When the pressure continues after the rocks are tightly folded a fracture or rupture will develop that tends to relieve this pressure. The strata separate at this crack and move apart causing a fault or as it is commonly called, an earthquake. Repeated movement over millions of years may cause rocks on opposite sides of the fault to be separated by many miles.

There are numerous faults in the Arctic Lowland, some of which represent major dislocations in the crust of the earth. In general, the largest faults are along the front of the Brooks Range and the intensity decreases northward towards the coastal plain. Geologists have identified and named many different types of faults, but the two major forms are thrust and normal faults. In the thrust fault the beds on one side are pushed up over the beds on the other side of the fracture, and in the normal fault beds on one side drop down while the other side is uplifted.

Unconformity

An unconformity is often a subtle geologic feature that is not as easily seen as the fold or fault. They are depositional rather than

dislocational features and as such are some of the primary geologic structures. The rocks exposed in an area may represent strata that were deposited over many millions of years. Each layer of rock is deposited in an essentially horizontal position, but there is generally movement of the earth's crust over these long periods of time. In many cases the oldest strata are tilted and the more recent are deposited at an angle on top of them. This is termed an unconformity. Commonly the older strata are uplifted and eroded before the younger beds are deposited, so there may be a gap of many millions of years between beds on opposite sides of an unconformity. The geologist can usually determine this by examination of the lifeforms preserved as fossils in the strata. These primary geologic structures are extremely important to the geologic history of any area.

Movement of the Earth's Crust

1. Highest priority

    Cape Thompson - Crowbill Point - subtheme - folds, faults

    Cape Dyer - Kiliahlik Point - subtheme - folds, faults

    Umiat Mountain - Shivugak Bluff - subtheme - unconformity, folds

    Ninuluk Bluff - subtheme - unconformity, folds

2. Sites definitely eligible

    Schrader Bluff - subtheme - faults, folds

3. Sites of uncertain eligibility

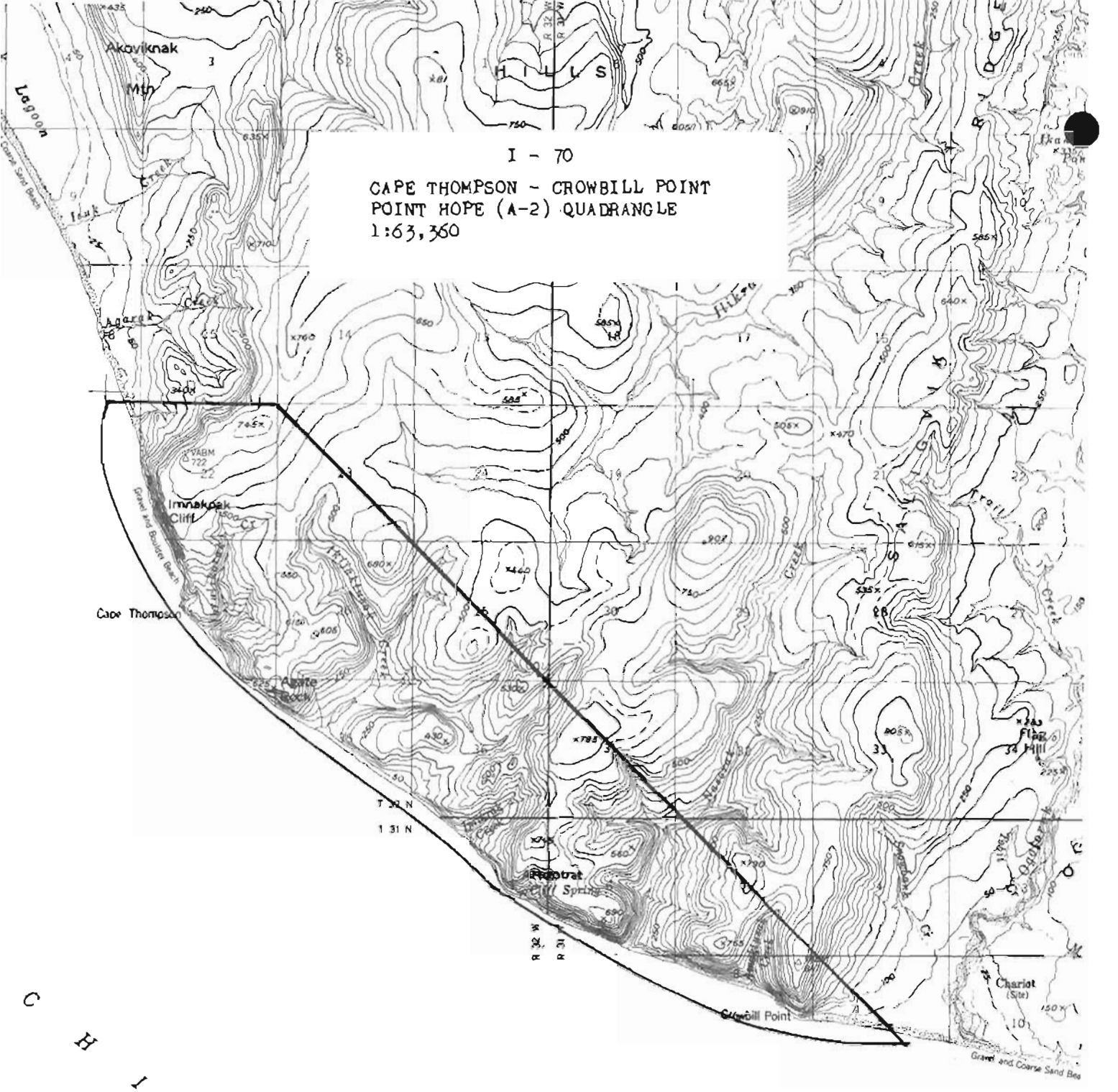
    Ishukpak Bluff - subtheme - folds, faults.

    Nasaurak Mountain - subtheme - faults

4. Sites not recommended

    Katakturak Fold - subtheme - folds

Figure 21. Limestone cliffs at Cape Thompson.


I - 70
CAPE THOMPSON - CROWBILL POINT
POINT HOPE (A-2) QUADRANGLE
1:63,360
Akoviknak Mtn
Lagoon
Cape Thompson
Imnakpak Cliff
Agate Rock
Crowbill Point
Chariot (Site)
Gravel and Coarse Sand Beach
T 32 N
T 31 N
R 32 W
R 31 W

C H I S E A

NATURAL LANDMARK SURVEY
LANDFORMS
MOVEMENT OF THE EARTH'S CRUST

I - 70 CAPE THOMPSON - CROWBILL POINT 1B

Themes: Movement of the earth's crust (subtheme folds and faults); Sculpture of the earth; Sea shores and islands; Development of life on earth; Change in marine life.

Location: Arctic Foothills Province, west coast, Point Hope A-2 quadrangle (1:63,360), T. 31 N., R. 31 W., sections 5-9; T. 32 N., R. 31 W., section 31; T. 31 N., R. 32 W., section 1; T. 32 N., R. 32 W., sections 21-23, 25-27, and 34-36; Kateel Meridian.

Ownership: Bureau of Land Management, Department of the Interior by authority of Alaska Native Claim Settlement Act, section 17, D-2. Proposed Coastal National Wildlife Refuge.

Approximate acreage: 6,000 acres (2,428 hectares).

Geologic features: This remarkable section of sea shore cliffs presents a truly outstanding example of the folds and faults in a section of the earth's crust. The highly contorted and faulted beds are well exposed and bear mute evidence to the tremendous forces responsible for shaping the face of the earth. Thousands of feet of strata are involved ranging in age from late Paleozoic through the Mesozoic. Locally beds of the Mississippian Lisburne Group limestone are thrust on top of Cretaceous beds. Much of the cliff sections are of light gray to white limestone that is weathered into spectacular cliffs.

Biotic features: Thousands of shore birds nest in the cliffs along this section of coast. Marine vertebrates and invertebrates are abundant in the Chukchi Sea adjacent to the site, and there are many different plant communities from the interior tussock tundra to shoreline.

Scenic features: Spectacular seascape, one of the most impressive sections of coast line in the Arctic Lowlands.

Land use and vulnerability: This site is being proposed as a Coastal National Wildlife Refuge. If proposal accepted the site will be protected. The site was intensively studied by the Atomic Energy Commission as project Chariot, which would create a harbor by using an atomic bomb. This would have destroyed the entire area of this site, but project is now abandoned.

Data source: I. L. Tailleur, Menlo Park, Calif.
M. D. Mangus, Anchorage, Alaska
Author from personal investigations
Joint Federal-State Land Use Planning Commission

Selected references:

Campbell, R. H., 1967, Areal geology in the vicinity of the Chariot Site, Lisburne Peninsula, northwestern Alaska: U.S. Geol. Survey Prof. Paper 395, 71 p.

Currey, D. R., 1964, A preliminary study of valley asymmetry at Ogotoruk Creek are, northwestern Alaska: Arctic, Jour. Arctic Inst. N. Am., v. 17, no. 2, p. 84-98.

Kachadoorian, Reuben, 1966, Environment of the Cape Thompson region, Alaska, Geographic Setting, in Wilimovsky, N. J., and Wolfe, J. N., eds., Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Commission, PNE-481, p. 45-56.

Sainsbury, C. L., Kachadoorian, Reuben, Campbell, R. H., and Scholl, D. W., 1965, Marine platform of probable Sangamon age, and associated terrace deposits, Cape Thompson area, northwestern Alaska: Arctic, Jour. Arctic Inst. N. Am., v. 18, no. 4, p. 231-245.

Scholl, D. W., and Sainsbury, C. L., 1960, Marine geology and bathymetry of the nearshore shelf of the Chukchi Sea, Ogotoruk Creek area, northwestern Alaska: U.S. Geol. Survey open-file report, 68 p.

Other knowledgeable persons:

R. H. Campbell, Menlo Park, Calif.
Reuben Kachadoorian, Menlo Park, Calif.

Publicity sensitivity: None

Comments: This is truly an outstanding site highly eligible for entry into Registry of Natural Landmarks. It is also being considered as an Ecological Landmark, and as a Ecological Reserve by the Joint-Federal State Land Use Planning Commission.

I - 71
CAPE DYER - KILIAHLIK POINT
POINT HOPE(C-2 & C-3) QUADRANGLES
1:63,360
Cape Dyer
Kiliahlik Pt
Kiliahlik Creek
Ivanhlik Mountain
Ammonite Mountain
302

NATURAL LANDMARK SURVEY
LANDFORMS
MOVEMENT OF THE EARTH'S CRUST

I - 71 CAPE DYER - KILIAHLIK POINT 1C

Themes: Movement of the earth's crust (subtheme folds and faults); Sea shores and islands.

Location: Arctic Foothills Province, western part, Chukchi Sea coast, Point Hope C-2 and C-3 quadrangles (1:63,360), T. 9 S., R. 61 W., sections 21, 28, and 33; T. 10 S., R. 61 W., sections 4, 5, 8, 9, 16, 17, 20, 21, 28, 29, and 31-33; T. 11 S., R. 61 W., sections 4-9.

Ownership: Native Village withdrawal and native regional deficiency area. All of sections within T. 9 and 10 S. have been selected as of 8/1/74.

Approximate acreage: 8,600 acres (3,480 hectares).

Geologic features: An excellent section of rugged cliffs along the coast of the Lisburne Peninsula. Numerous folds and faults well exposed along shoreline. Sea stacks at 600 feet elevation and several miles inland attest to the continued uplift of this area. Deposits dated as Sangamon Interglacial associated with some of the elevated bedrock platforms. This bedrock platform locally warped. Major unconformity between the Mississippian slate and graywacke of the Ivlangik Formation and the Cretaceous Kapaloak Formation.

Biotic features: Marine vertebrates and invertebrates in Chukchi Sea, shore bird nesting area in cliffs, and shoreline plant communities.

Scenic features: Excellent section of shoreline including stacks and rugged cliffs.

Land use and vulnerability: Most of the acreage already selected by Native Village at Point Hope. Probably will be leased to petroleum companies.

Data source: I. L. Tailleur, Menlo Park, Calif.
C. G. Mull, Denver, Colo.

Selected references:

Armstrong, A. K., 1972, Biostratigraphy of Mississippian Lithostrotionid corals, Lisburne Group, Arctic Alaska: U.S. Geol. Survey Prof. Paper 743-A, p. A1-A28.

Tailleur, I. L., and Brosgé, W. P., 1970, Tectonic history of northern Alaska, in Adkison, W. L., and Brosgé, M. M., eds., Geological seminar on the North Slope of Alaska: Los Angeles Pacific Sec. Am. Assoc. Petroleum Geologists, p. E1-E19.

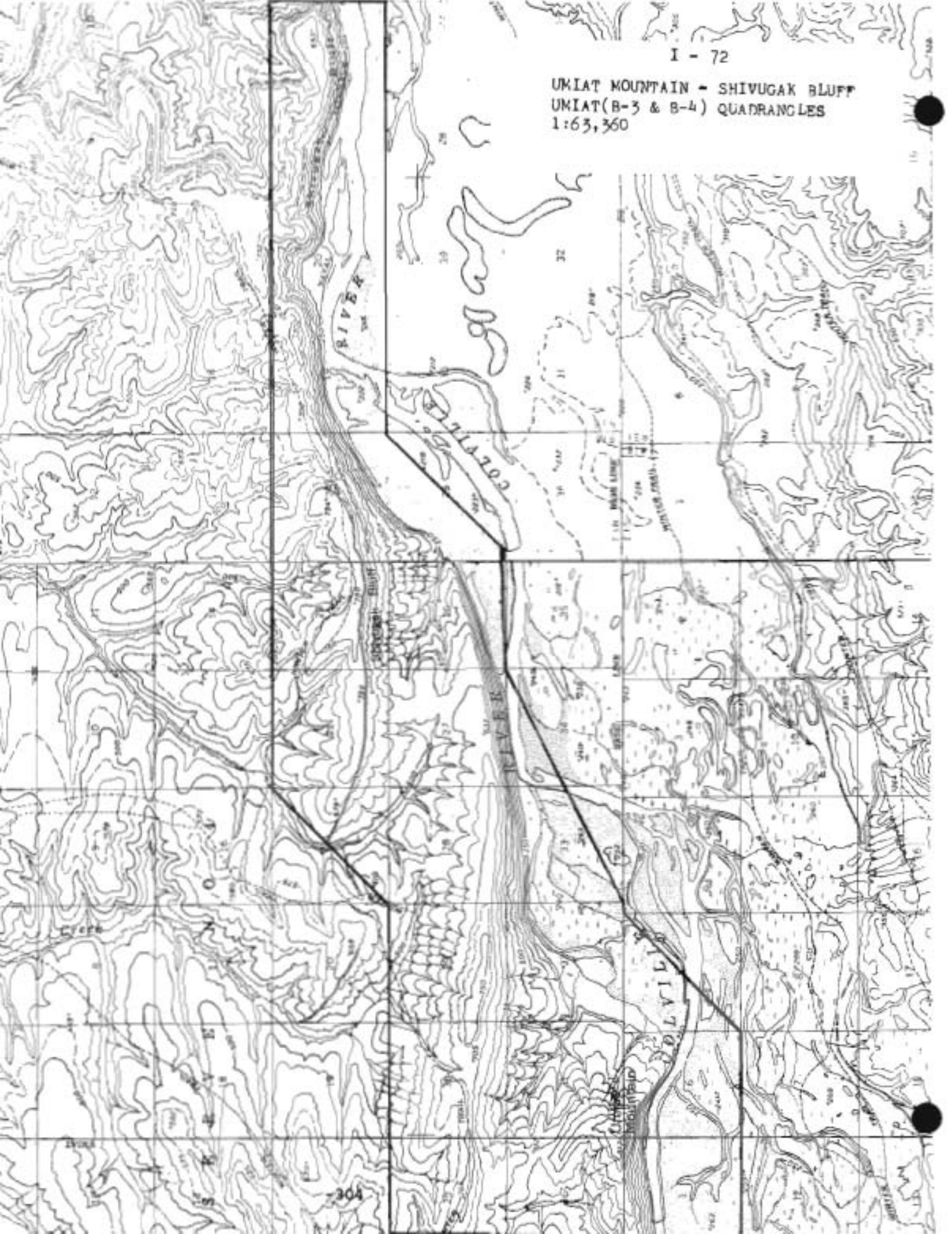
Other knowledgeable persons:
J. T. Dutro, Jr., Washington, D.C.
Arthur Grantz, Menlo Park, Calif.

Publicity sensitivity: None

Comments: Site eligible for Landmark Status and is recommended for entry into Registry.

I - 72

UMIAT MOUNTAIN - SHIVUGAK BLUFF
UMIAT(B-3 & B-4) QUADRANGLES
1:63,360



NATURAL LANDMARK SURVEY
LANDFORMS
MOVEMENT OF THE EARTH'S CRUST

I - 72 UMIAT MOUNTAIN - SHIVUGAK BLUFF 1C

Themes: Movement of the earth's crust (subtheme unconformity and folds); River systems; Sculpture of the earth; Development of life on earth; Age of reptiles.

Location: Arctic Foothills Province, central part, Umiat B-3 and B-4 quadrangles (1:63,360); T. 1 N., R. 1 W., sections 25 and 36; T. 1 S., R. 1 W., section 1; T. 1 N., R. 1 E., sections 21-34; T. 1 S., R. 1 E., section 5; T. 1 N., R. 2 E., sections 19-22.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense and Native regional deficiency area.

Approximate acreage: 12,640 acres (5,115 hectares).

Geologic features: Excellent exposures for many of the type localities of Upper Cretaceous Formations are in the bluffs along the north side of the Colville River. The massive sandstone beds of the Barrow Trail Member form long linear cuestas that can be followed for many miles. Black, fissile oil shale beds of the Seabee Formation underlie the sandstone and unconformably overlie the Ninuluk Formation. The oil shale contains abundant marine fossils and is probably the source for some of the petroleum in northern Alaska. The rocks in Shivugak Bluff are primarily nonmarine with beds of coal and plant fossils interbedded with tuffaceous sandstone, siltstone and bentonite. The beds of bentonite and tuff were produced by volcanic activity. Bluffs cut by the Colville River, the largest stream in the Arctic Lowland. Site contains an excellent section of braided channels and cut off meanders.

Biotic features: The bluffs along the Colville are prim hawk and gyrfalcon aeries, also contain abundant ground squirrels and marmots. Large willow groves on river bars with many moose. Shrub-alder on slopes, and upland tussock tundra plant communities on river bluffs.

Scenic features: Umiat Mountain and the bluffs along the Colville River can be seen for many miles in the surrounding flat plains. The badland topography is quite spectacular.

Land use and vulnerability: The land on north side of river is part of Naval Petroleum Reserve No. 4. Umiat, just upstream from Umiat Mountain was the center of drilling activity during the exploration of the Reserve from 1944-53. A number of oil wells drilled just west of site.

Data source: Numerous people associated with the exploration of Naval Petroleum Reserve No. 4, including W. P. Brosgé, George Gryc, I. L. Tailleur, W. W. Patton, Jr., H. N. Reiser, and the author--all from Menlo Park, Calif.

Selected references:

Brosgé, W. P., and Whittington, C. L., 1966, Geology of the Umiat-Maybe Creek region, Alaska: U.S. Geol. Survey Prof. Paper 303-H, p. H501-H638.

Collins, F. R., 1958, Test wells, Umiat area, Alaska: U.S. Geol. Survey Prof. Paper 305-B, p. B71-B205.

Gryc, George, Patton, W. W., Jr., and Payne, T. G., 1951, Present Cretaceous stratigraphic nomenclature of northern Alaska: Washington Acad. Sci. Jour., v. 41, no. 5, p. 159-167.

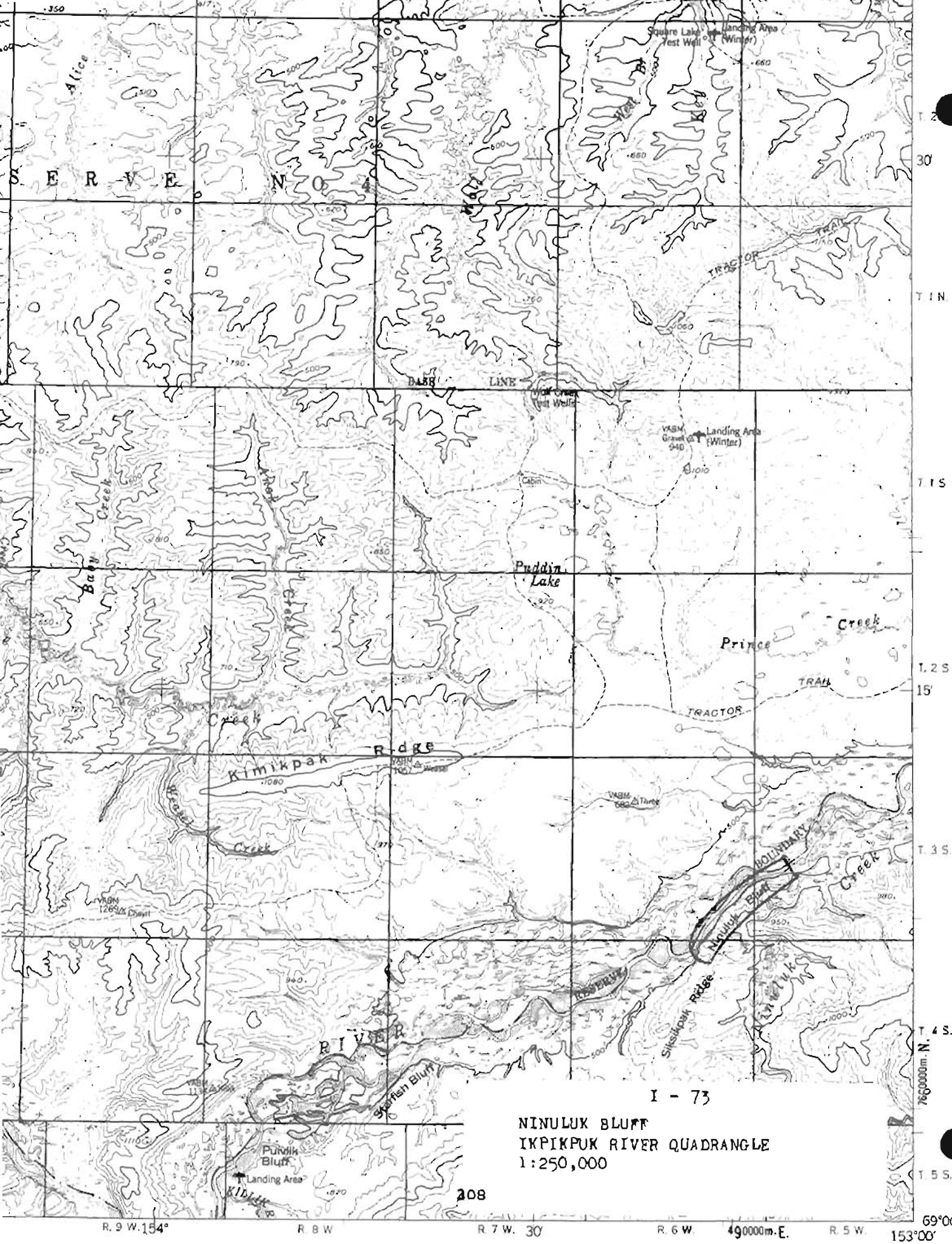
Spetzman, L. A., 1959, Vegetation of the Arctic Slope of Alaska: U.S. Geol. Survey Prof. Paper 302-B, p. B19-B58.

Other knowledgeable persons:

M. D. Mangus, Anchorage, Alaska
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: An excellent site both geologically and biotically. Highly qualified for Landmark Status. Site being recommended also as an Ecological Landmark and as an Ecological Reserve by the Joint Federal-State Land Use Planning Commission.



I - 73

NINULUK BLUFF
IKPIKPUK RIVER QUADRANGLE
1:250,000

NATURAL LANDMARK SURVEY
LANDFORMS
MOVEMENT OF THE EARTH'S CRUST

I - 73 NINULUK BLUFF 1B

Themes: Movement of the earth's crust (subtheme unconformity and folds); Development of life on earth; Age of reptiles.

Location: Arctic Foothills Province, central part, Colville River, Ikpikpuk River quadrangle (1:250,000), T. 3 S., R. 5 W., sections 19, 20, 29, and 30; T. 3 S., R. 6 W., sections 25, 26, 35, and 36; T. 4 S., R. 6 W., section 2.

Ownership: National Park Service, Gates of the Arctic National Park (proposal) and Native Regional Deficiency area. Selections not made as of 8/1/74.

Approximate acreage: 2,560 acres (1,036 hectares).

Geologic features: Excellent exposure of basal Upper Cretaceous Ninuluk Formation interbedded with the Niakogon Tongue of the Chandler Formation and unconformably overlain by the Seabee Formation. This is the type locality for both the Ninuluk and Niakogon. The marine Ninuluk contains abundant nearshore fossils and is interbedded with coal swamp deposits of the Niakogon. The swamp vegetation now preserved as numerous coal seams. Locally considerable amber in the carbonaceous shale beds. The Ninuluk-Niakogon sequence strongly folded before deposition of the Late Cretaceous organic shale of the Seabee Formation.

Biotic features: Falcon and hawk aeries on bluff. Willow-alder shrub complex along bluff and gravel bars. Tussock tundra on top of bluff.

Land use and vulnerability: Land may possible be included in Gates of the Arctic National Park, in which case they will be protected. If selected by Native Regional Corporation the land will probably be leased to oil and gas development.

Data source: Author from personal investigation.

Selected references:

Detterman, R. L., 1956, New and redefined nomenclature of Nanushuk Group, in Gryc, George, and others, Mesozoic sequence in Colville River region, northern Alaska: Am. Assoc. Petroleum Geologists Bull., v. 40, no. 2, p. 233-244.

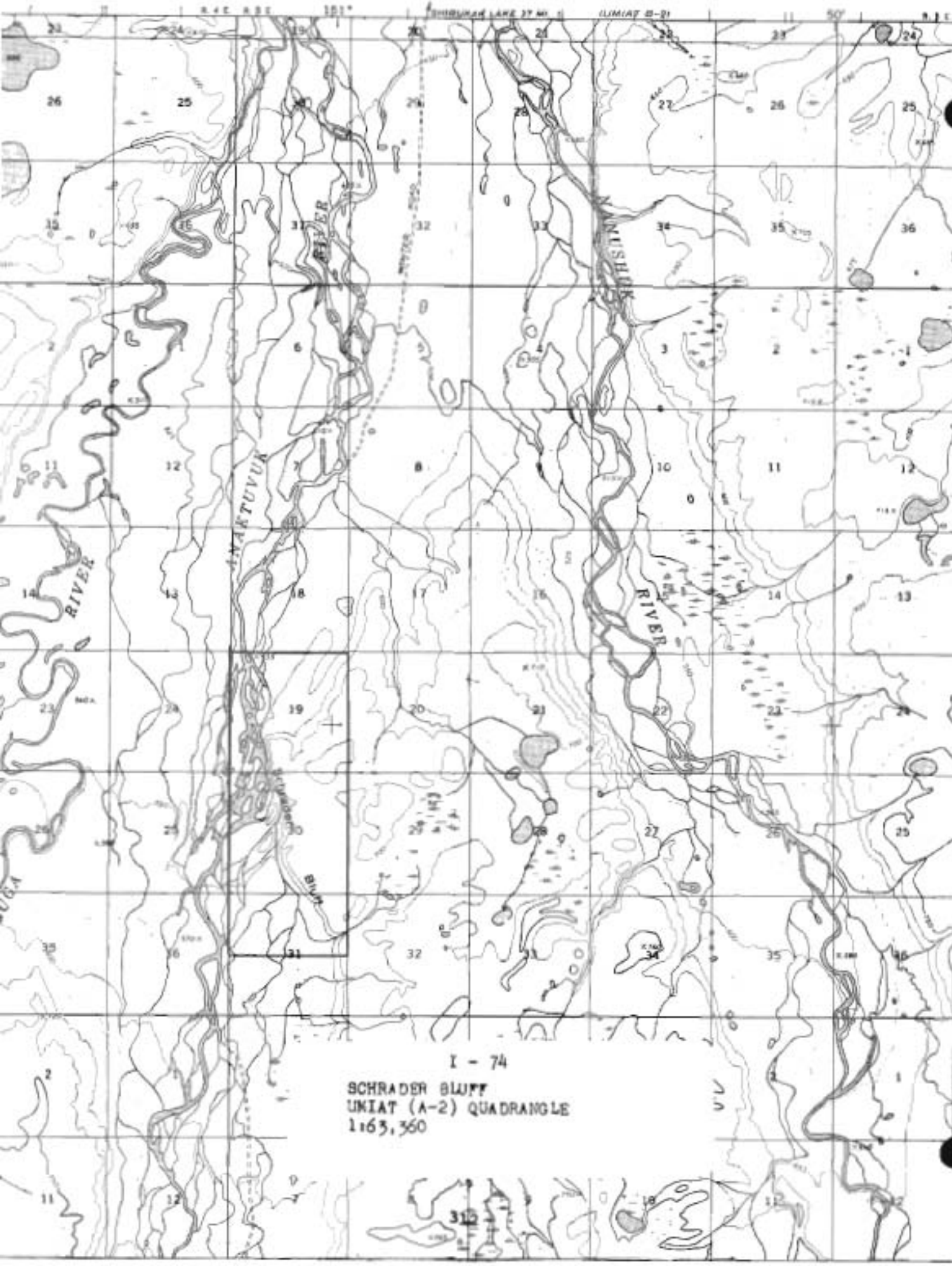
_____, Bickel, R. S., and Gryc, George, 1963, Geology of the Chandler River region, Alaska: U.S. Geol. Survey Prof. Paper 303-E, p. E223-E324.

Other knowledgeable persons:

R. M. Chapman, Menlo Park, Calif.
George Gryc, Menlo Park, Calif.

Publicity sensitivity: Widespread distribution of information on abundant fossils and amber at this site could result in depletion through overcollecting.

Comments: An excellent site showing both geologic processes and the Development of Life. Recommended for entry into Registry of Natural Landmarks.



I - 74

SCHRADER BLUFF
UKIAT (A-2) QUADRANGLE
1:63,360

NATURAL LANDMARK SURVEY
LANDFORMS
MOVEMENT OF THE EARTH'S CRUST

I - 74 SCHRADER BLUFF 2B

Themes: Movement of the earth's crust (subtheme faults and folds).

Location: Arctic Foothills Province, central part, Umiat A-2 quadrangle (1:63,360), T. 3 S., R. 5 E., sections 19, 30, and 31.

Ownership: Native regional deficiency area, Alaska Native Claims Settlement Act. Selections not made as of 8/1/74.

Approximate acreage: 1,600 acres (748 hectares).

Geologic features: Schrader Bluff is the type locality for the Schrader Bluff Formation and for the Tuluvak Tongue of the Prince Creek Formation. These are all Late Cretaceous rocks and include some of the youngest strata on the arctic coastal plain. The interbedded tuffs, bentonite, tuffaceous sandstone, siltstone, conglomerate, and coal are well exposed in one section. The Anaktuvuk River at this site is an excellent example of a braided stream, and an aufeis field generally forms near the upstream end of the bluff.

Biotic features: Large groves of felt leaf willow on gravel bars generally site of moose population.

Land use and vulnerability: The first winter haul road to the North Slope was built past the bluff on the gravel flood plain of the river. Probably will be oil and gas development in area often settlement of the Native Claims.

Data source: M. D. Mangus, Anchorage, Alaska
Author from personal investigation

Selected references:

Detterman, R. L., Bickel, R. S., and Gryc, George, 1963, Geology of the Chandler River region, Alaska: U.S. Geol. Survey Prof. Paper 303-E, p. E223-E324.

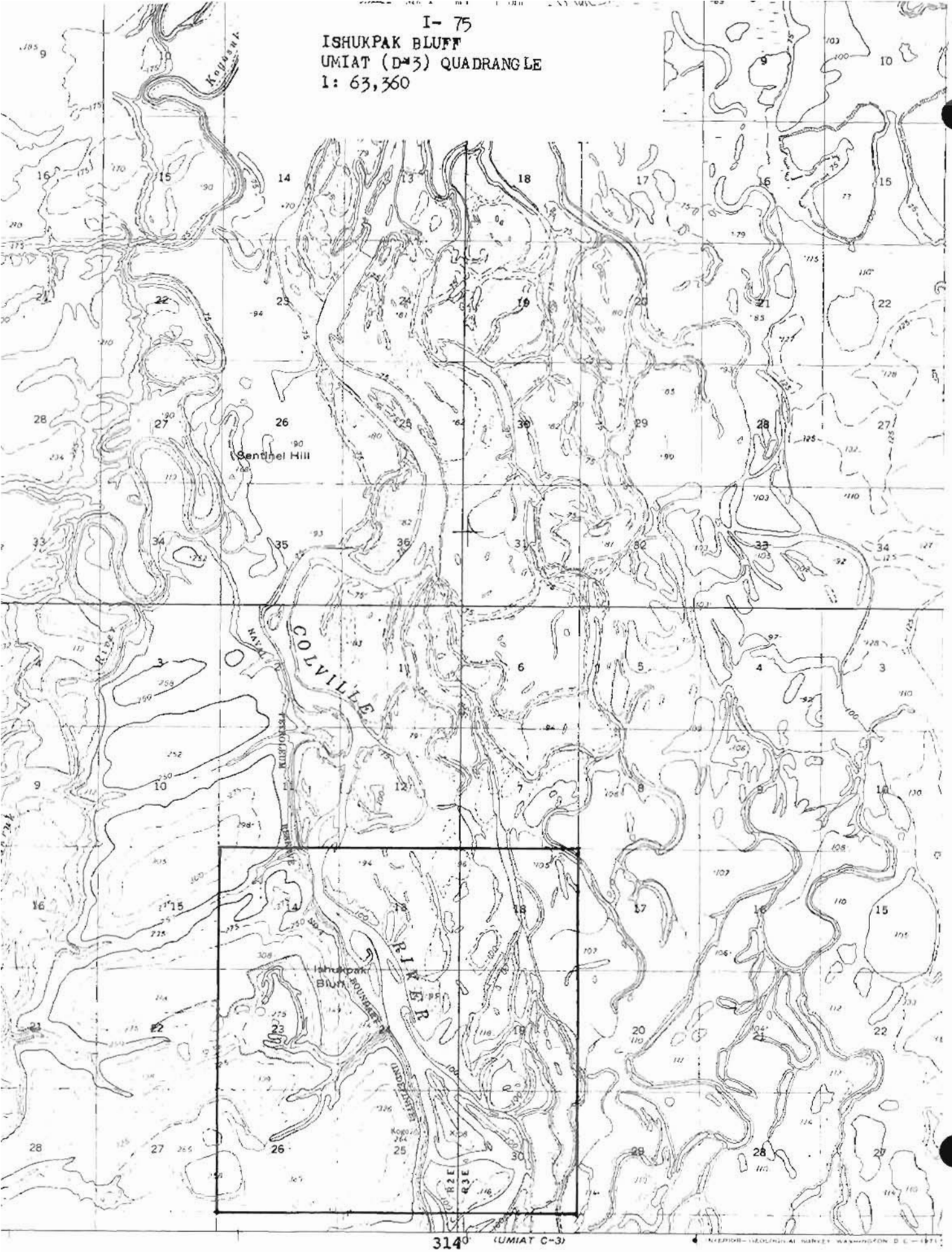
Whittington, C. L., 1956, Revised stratigraphic nomenclature of the Colville Group, in Gryc, George, and others, Mesozoic sequence in Colville River region, northern Alaska: Am. Assoc. Petroleum Geologists Bull., v. 40, no. 2, p. 244-253.

Other knowledgeable persons:
R. M. Chapman, Menlo Park, Calif.
George Gryc, Menlo Park, Calif.

Publicity sensitivity: None

Comments: Site eligible for entry into Registry of Natural Landmarks.

I- 75
ISHUKPAK BLUFF
UMIAT (D-3) QUADRANGLE
1: 63,360



314° (UMIAT C-3)

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NATURAL LANDMARK SURVEY
LANDFORMS
MOVEMENT OF THE EARTH'S CRUST

I - 75 ISHUKPAK BLUFF 3C

Themes: Movement of the earth's crust (subtheme folds and faults); River systems.

Location: Arctic Foothills Province, central part, west bank lower Colville River, Umiat D-3 quadrangle (1:63,360), T. 5 N., R. 2 E., sections 13, 14, and 23-26; T. 5 N., R. 3 E., sections 18, 19, and 30.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense and Alaska State selection (pending).

Approximate acreage: 5,760 acres (2,331 hectares).

Geologic features: The Ishukpak Bluff site contains very dramatic evidence of the Movement of the Earth's Crust. The Upper Cretaceous nonmarine starat consist of light-gray tuffaceous sandstone and siltstone with coal interbeds. The contrast between the black and white beds is very striking, which emphasizes the folding and faulting of strata. The Upper Cretaceous rocks are unconformably overlain by the Quaternary Gubik Formation. Abundant permafrost landforms in site.

Biotic features: Falcon and hawk aeries on river bluffs, willow thickets and moose habitat on river gravel bars, aquatic and wet sedge tundra on river flats with tussock tundra on river bluffs.

Land use and vulnerability: Area on west side of Colville River in Naval Petroleum Reserve No. 4, and east of the river part of State selection; both areas subject to extensive oil and gas exploration.

Data source:
W. P. Brosgé, Menlo Park, Calif.
Author from personal investigation

Selected references:
Black, R. F., 1964, Gubik Formation of Quaternary age in northern Alaska: U.S. Geol. Survey Prof. Paper 302-C, p. C59-C91.
Brosgé, W. P., and Whittington, C. L., 1966, Geology of the Umiat-Maybe Creek region, Alaska: U.S. Geol. Survey Prof. Paper 303-H, p. H501-H638.

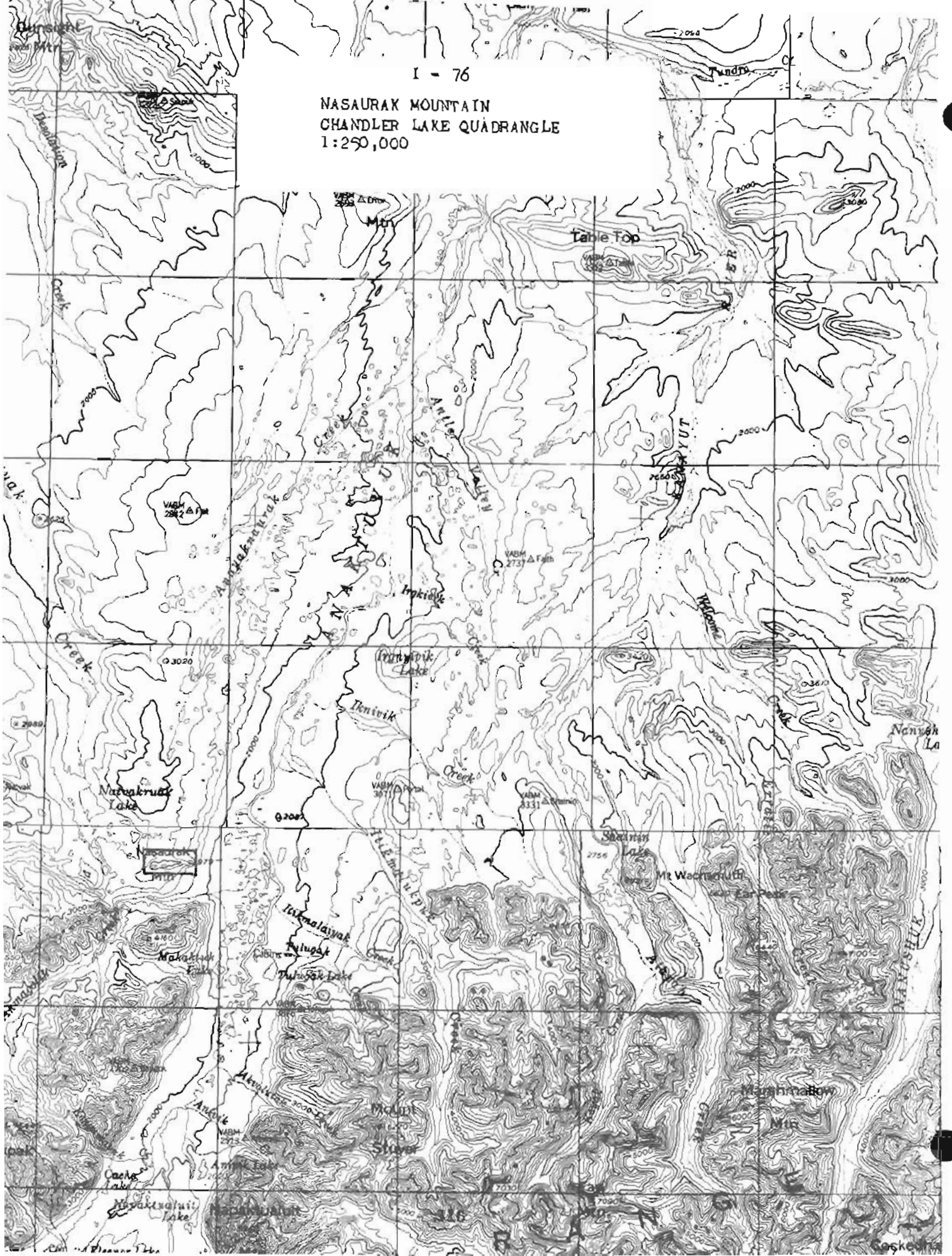
Other knowledgeable persons: J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: Site contains interesting geologic and biotic features, but probably is not nationally significant.

I - 76

NASAURAK MOUNTAIN
CHANDLER LAKE QUADRANGLE
1:250,000



NATURAL LANDMARK SURVEY
LANDFORMS
MOVEMENT OF THE EARTH'S CRUST

I - 76 NASAURAK MOUNTAIN 3C

Themes: Movement of the earth's crust

Location: Arctic Foothills Province, central part, Chandler Lake quadrangle (1:250,000), T. 13 S., R. 2 E., sections 2, 3, 10, and 11.

Ownership: Native village withdrawal area, Alaska Native Claims Settlement Act. Selection not made as of 8/1/74.

Approximate acreage: 1,200 acres (485 hectares).

Geologic features: Nasaurak Mountain is a faulted section of Lisburne Group limestone of Mississippian age. When the Brooks Range was being uplifted during the Early Tertiary part of the area was thrust faulted to the north. Nasaurak Mountain is an outlying remnant of the Brooks Range that was left lying in the Arctic Foothills Province. It is an erosional remnant of a thrust plate in a glaciated area.

Biotic features: Alpine and sub-alpine plant communities.

Land use and vulnerability: Site within hunting area of Anaktuvuk Pass village. Oil and gas lease applications filed waiting settlement of Native Claims.

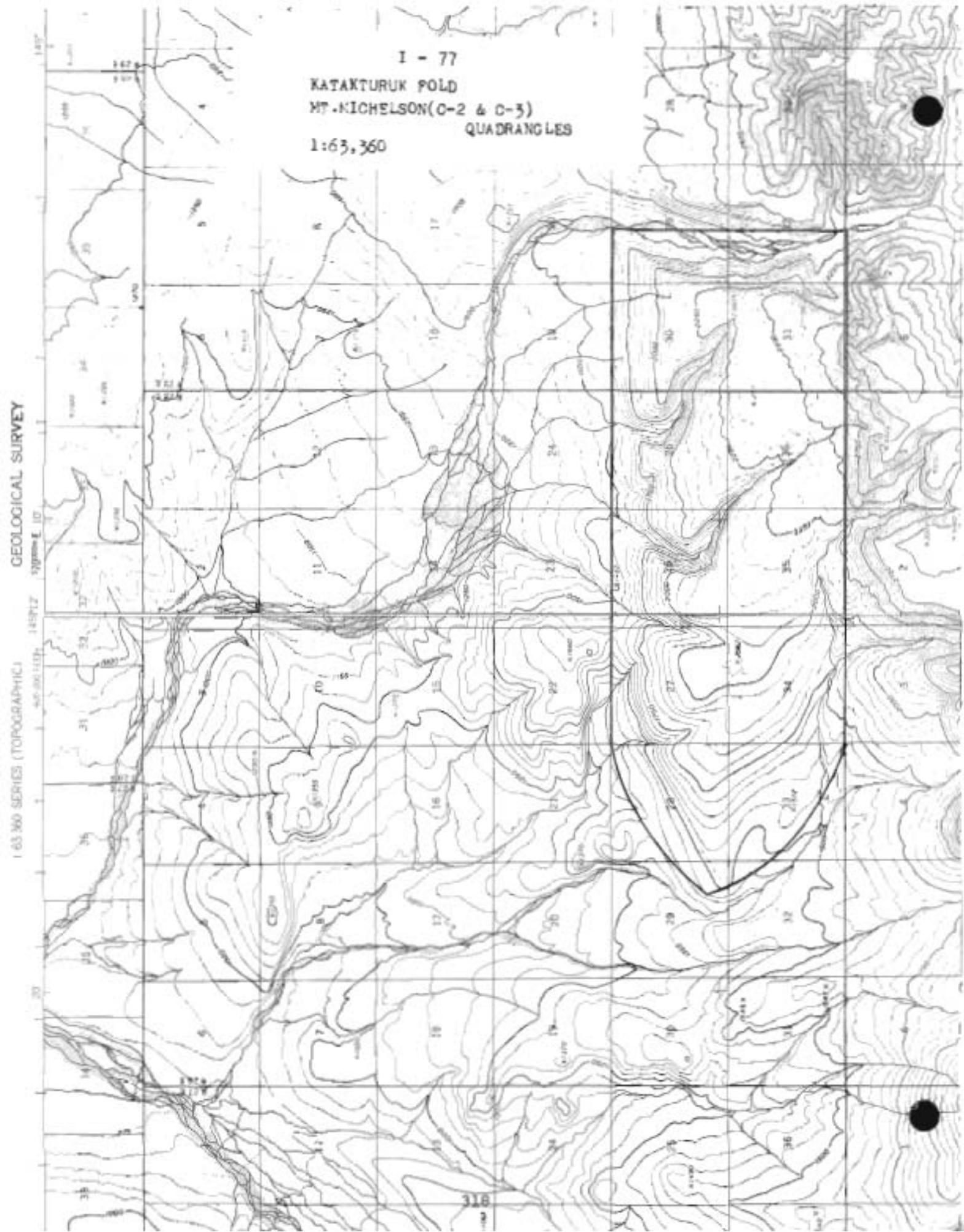
Data source: W. W. Patton, Jr., Menlo Park, Calif.
I. L. Tailleur, Menlo Park, Calif.

Selected reference:
Patton, W. W., Jr., and Tailleur, I. L., 1964, Geology of the Killik-Itkillik region, Alaska: U.S. Geol. Survey Prof. Paper 303-G, p. G409-G500.

Other knowledgeable persons:
M. D. Mangus, Anchorage, Alaska
S. C. Porter, Seattle, Wash.

Publicity sensitivity: None

Comments: Site probably not nationally significant.


I - 77
KATAKTURUK FOLD
MT. MICHELSON(C-2 & C-3)
QUADRANGLES
1:63,360
GEOLOGICAL SURVEY
1:63,360 SERIES (TOPOGRAPHIC)

NATURAL LANDMARK SURVEY
LANDFORMS
MOVEMENT OF THE EARTH'S CRUST

I - 77 KATAKTURUK FOLD 4

Themes: Movement of the earth's crust (subtheme folds and faults); Development of life on earth; Change in marine life.

Location: Arctic Foothills Province, eastern part, north flank of Sadlerochit Mountains, Mt. Michelson C-2 and C-3 quadrangles (1:63,360), T. 4 N., R. 28 E., sections 25-29 and 32-36; T. 4 N., R. 29 E., sections 29-32.

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Department of the Interior.

Approximate acreage: 6,820 acres (2,760 hectares).

Geologic features: This site is a folded thrust plate. Sadlerochit Formation rocks of Permian and Early Triassic age have been thrust faulted northward onto Cretaceous and Jurassic strata. A second thrust involving Devonian to Mississippian rocks is in turn faulted northward onto the Permian rocks. Excellent examples of fault planes and folding caused by faulting.

Biotic features: Dall sheep habitat, part of caribou migration route and numerous small mammals. Alpine tundra plant communities.

Scenic features: Spectacular limestone mountains and cliffs along north side of the Sadlerochit Mountains.

Land use and vulnerability: Part of Arctic National Wildlife Range and is protected.

Data source: M. D. Mangus, Anchorage, Alaska
C. G. Mull, Denver, Colo.
H. N. Reiser, Menlo Park, Calif.
Author from personal investigations

Selected references:

Leffingwell, E. de K., 1919, The Canning River region, northern Alaska: U.S. Geol. Survey Prof. Paper 109, 251 p.

Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1971, Preliminary geologic map, Mt. Michelson quadrangle, Alaska: U.S. Geol. Survey open-file report, 2 sheets.

Other knowledgeable persons: J. T. Dutro, Jr., Washington, D.C.
W. P. Brosgé, Menlo Park, Calif.

Publicity sensitivity: None

Comments: Site contains some excellent geologic structural features, but probably is not nationally significant. Site is not recommended for Landmark Status.

Theme 10. Springs

The theme Springs is of great interest, under the category Landforms of the Present, for the Arctic Lowland. The interest centers around the presence of free-flowing water in a frozen medium. The Arctic Lowland is in the region of the continuous permafrost with the soil and rock frozen to a depth of many hundreds of feet. A depth of 1,700 feet to the base of the permafrost has been recorded in the Prudhoe Bay oil field with the base being several hundred feet higher at the front of the Brooks Range.

The conditions permitting the free-flow of water in the frozen ground are not clearly understood. Springs are generally associated with cave systems in limestone, but no evidence for caves has ever been found in the Arctic Lowland. The known springs are all on or near the contact between limestone of the Lisburne Group and sandstone of the Sadlerochit Formation. The best geologic evidence indicates the springs are on fault zones rather than cave systems. Some solution within the fault breccia is possible, but it is extremely doubtful that large caves are developed in these zones.

The springs are commonly referred to as being warm. They do flow all year, but they are not warm springs. The temperature of the water remains at about 41° to 43° F. the entire year. In mid-winter with air temperature 30°-50° below zero the presence of flowing water at +48° may seem like a warm springs. Fog commonly forms over the water in winter giving the appearance of steam which can be misleading. The water is of the calcium bicarbonate type low in total dissolved solids. The temperature and composition indicate a local recharge during the summer months.

Large aufeis fields on rivers just downstream from springs are the most obvious manifestation of the large quantity of water discharged. Equally spectacular effects are produced in the vegetation surrounding the springs. The moderating effect of the water produces a microclimatic zone in which a wide variety of plants grow; some are found nowhere else on the Arctic Slope.

Oil Seeps

Oil Seeps are included, for convenience, with the general theme of Springs. They are related somewhat, the main difference being a discharge of oil rather than water. In most cases the oil is discharged into flowing water or into the sea and is soon dissipated. One large area near Cape Simpson contains hundreds of seepages that have built large tar pits many acres in extent. These tar pits are similar to Rancho La Brea at Los Angeles, only much larger. Personal observation has shown that caribou and other animals become trapped in the tar. These tar pits have been known for hundreds of years as the early man sites near Barrow indicated the use of the tar for fuel.

Springs

1. Highest priority

    Shublik Springs

    Simpson Seeps

2. Sites definitely eligible

    Sadlerochit Springs

3. Sites of uncertain eligibility

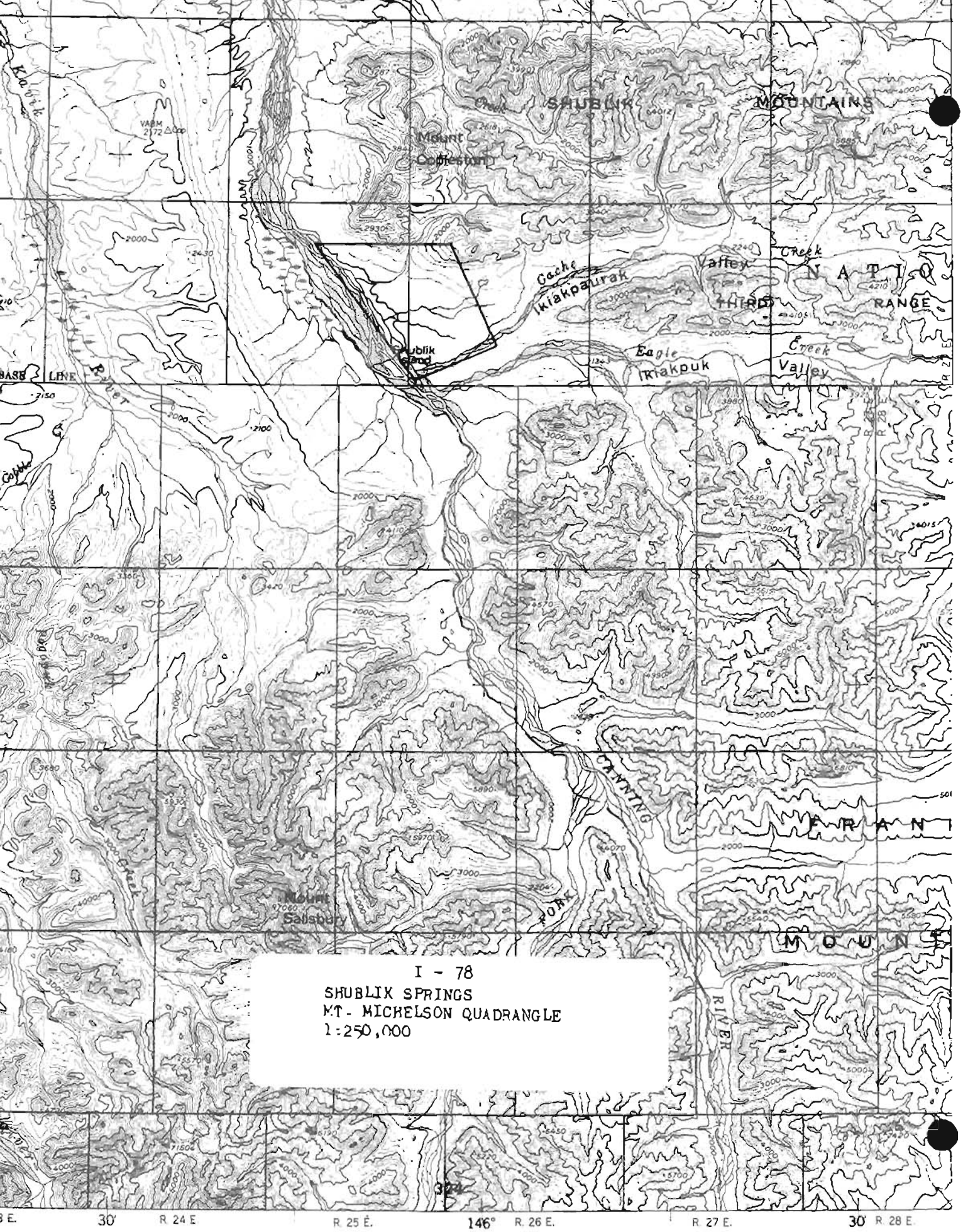
    None

4. Sites not recommended

    None

Figure 22. Shublik Springs site

Figure 23. Tar pit at Cape Simpson



I - 78
SHUBLIK SPRINGS
MT. MICHELSON QUADRANGLE
1:250,000

NATURAL LANDMARK SURVEY
LANDFORMS
SPRINGS

I - 78 SHUBLIK SPRINGS 1C

Themes: Springs; Development of life on earth; Age of reptiles.

Location: Arctic Foothills Province, eastern part, west end Shublik Mountains, Mt. Michelson quadrangle (1:250,000), T. 1 N., R. 24 E., sections 10-15, 23-25, and 36; T. 1 N., R. 25 E., sections 7, 8, 17-21, and 28-32.

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Department of the Interior.

Approximate acreage: 9,600 acres (3,885 hectares).

Geologic features: Shublik Springs is the largest continuously flowing spring on the Arctic Slope. The orifice is in talus of the Sadlerochit Formation at the west end of the Shublik Mountains about 1/2-mile east of the Canning River. The flow of about 24,000,000 gallons is primarily from one orifice although there are several small subsidiary springs nearby. A fault has been mapped in the bedrock about 1/4-mile east of the springs, but it is not known definitely that the water is in the fault zone or in the contact zone between the Sadlerochit Formation sandstone and the Lisburne Group limestone. Shublik Island and the east bank of the Canning River are included in the site. Shublik Island is the type locality of the Shublik Formation of Middle and Late Triassic age. Thousands of Monotis sp. and Halobia sp. pelecypods, typical of the Triassic, are found in these rocks.

Biotic features: An outstanding site for biotic features, also. Much vegetation surrounds the continuously flowing springs and the microclimatic ameliorating effect of the water permits many plant species to grow that ordinarily are not found on the Arctic Slope. A large grove of balsam poplar, the largest trees on the slope, grow nearby. The lush vegetation attracts numerous animals including moose and Dall sheep. The site is being considered, also, as an Ecological Natural Landmark and the Joint Federal-State Land Use Planning Commission has recommended it as an Ecological Reserve.

Scenic features: Spectacular mountain scenery nearby.

Land use and vulnerability: The site is in the Arctic National Wildlife Range and is protected. However, a proposed gas pipeline from Prudhoe Bay may be built along the west side of the Canning River near the site. This could have a serious effect on the local ecology.

Data source: Site suggested by many people including:

M. D. Mangus, Anchorage, Alaska
H. N. Reiser, Menlo Park, Calif.
Author from personal investigations,
Joint Federal-State Land Use Planning Commission

Selected references:

Childers, J. M., Sloan, C. E., and Meckel, J. P., 1972, Hydrologic reconnaissance of streams and springs in eastern Brooks Range, Alaska: U.S. Geol. Survey open-file report, 25 p.

Leffingwell, E. de K., 1919, The Canning River region, northern Alaska: U.S. Geol. Survey Prof. Paper 109, 251 p.

Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1971, Preliminary geologic map, Mt. Michelson quadrangle, Alaska: U.S. Geol. Survey open-file report, 2 sheets.

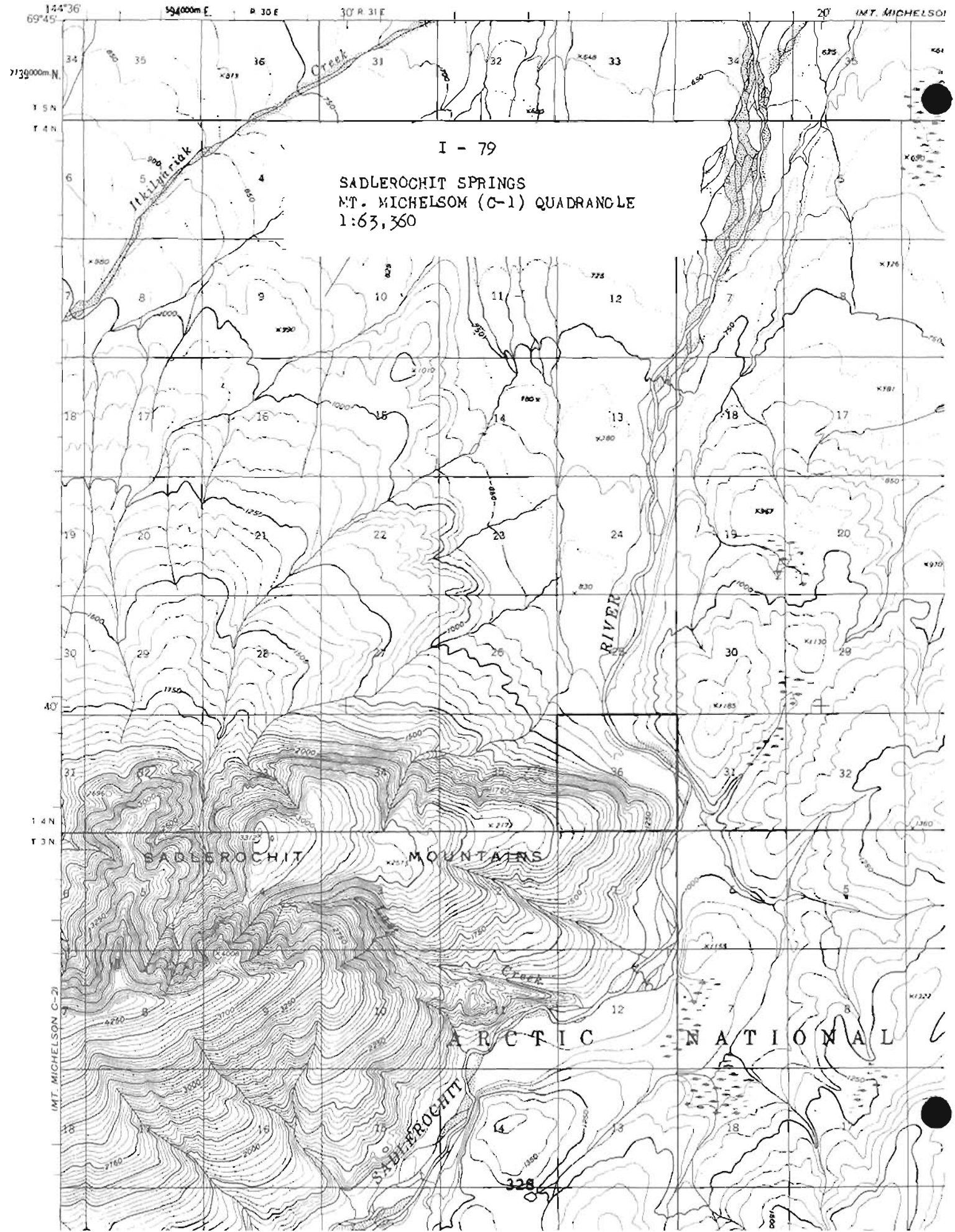
Yeend, Warren, 1973, Preliminary geologic map of a prospective transportation route from Prudhoe Bay, Alaska, to Canadian Border, part 2, Mt. Michelson quadrangle, Alaska: U.S. Geol. Survey MF map MF494, 2 sheets.

Other knowledgeable persons:

George Gryc, Menlo Park, Calif.
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: An outstanding site for both geology and ecology. Definitely of national significance and eligible for entry into Registry of Natural Landmarks.


I - 79
SADLEROCHIT SPRINGS
MT. MICHELSOM (C-1) QUADRANGLE
1:63,360
Tiklimiridik
Creek
RIVER
SADLEROCHIT
MOUNTAINS
Creek
ARCTIC
NATIONAL
SADLEROCHIT
(MT. MICHELSON C-2)
(MT. MICHELSO
144°36'
69°45'
534000m E.
R 30 E
30' R 31 E
20'
7139000m N.
T 5 N
T 4 N
40'
T 4 N
T 3 N
328

NATURAL LANDMARK SURVEY
LANDFORMS
SPRINGS

I - 79 SADLEROCHIT SPRINGS 2C

Themes: Springs.

Location: Arctic Foothills Province, eastern part, north flank Sadlerochit Mountains, Mt. Michelson C-1 quadrangle (1:63,360), T. 4 N., R. 31 E., section 36.

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Department of the Interior.

Approximate acreage: 640 acres (250 hectares).

Geologic features: Sadlerochit Springs is in talus of the Sadlerochit Formation at the east end of the Sadlerochit Mountains. The aquifer is apparently sandstone of the formation along a fault at the north front of the range. The nearest limestone is about 3 miles away. The limestone may be part of the storage area with the water moving down dip and into the sandstone along the fault. The flow from this spring has not been checked, but is less than Shublik Springs and the other springs farther west.

Biotic features: Lush vegetation near springs includes plants not generally found in the Arctic Lowland. Water attracts numerous animals including caribou and a small herd of musk ox.

Scenic features: Spectacular mountain backdrop to the coastal plains.

Land use and vulnerability: Part of Arctic National Wildlife Range. No apparent danger to integrity.

Data source: M. D. Mangus, Anchorage, Alaska
C. G. Mull, Denver, Colo.
H. N. Reiser, Menlo Park, Calif.

Selected references:

Leffingwell, E. de K., 1919, The Canning River region, northern Alaska: U.S. Geol. Survey Prof. Paper 109, 251 p.

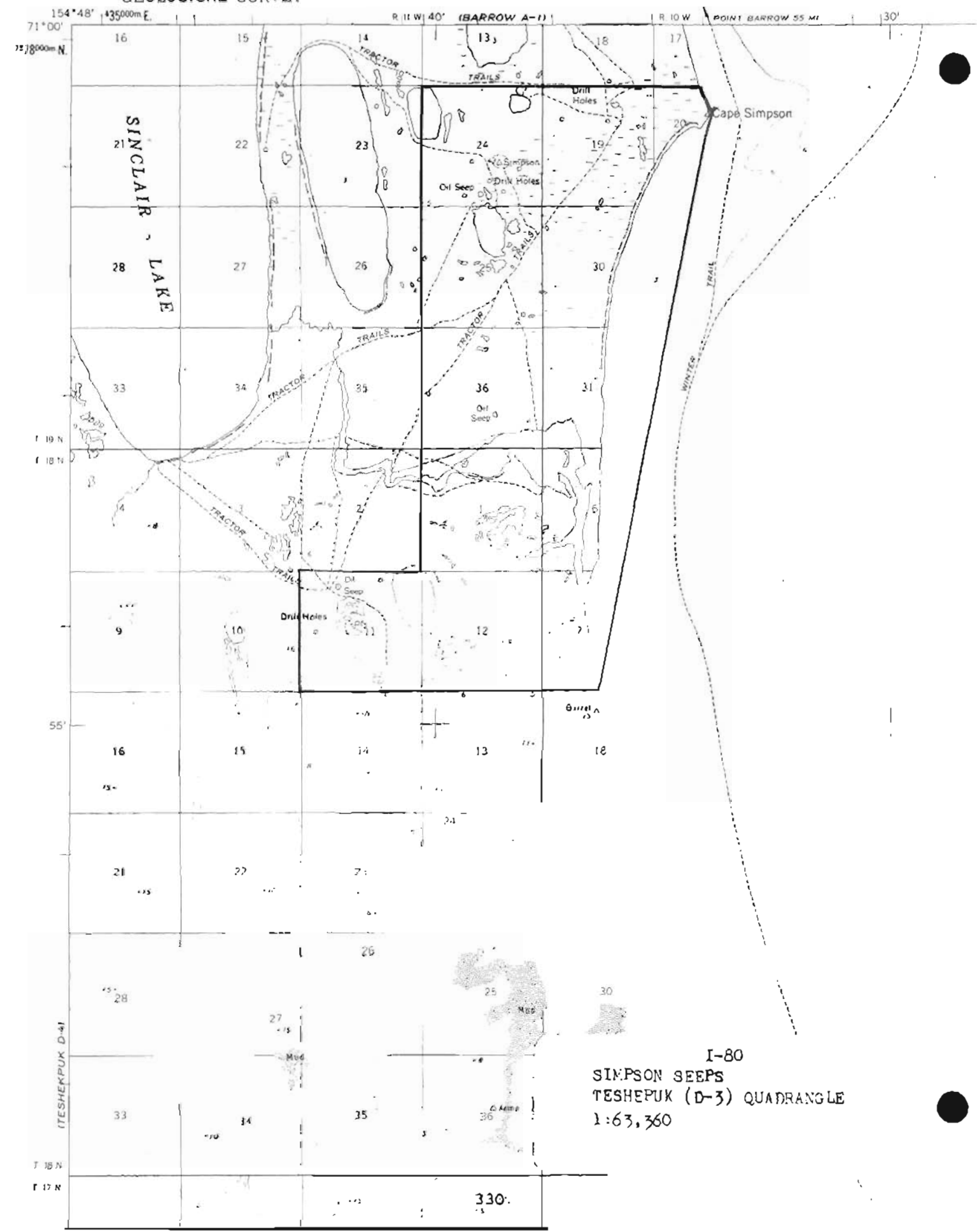
Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1971, Preliminary geologic map, Mt. Michelson quadrangle, Alaska: U.S. Geol. Survey open-file report, 2 sheets.

Other knowledgeable persons:
W. P. Brosgé, Menlo Park, Calif.
J. T. Dutro, Jr., Wasiington, D.C.

Publicity sensitivity: None

Comments: A good site but does not compare to Shublik Springs. Probably nationally significant and recommended for Landmark Status.

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



I-80
SIMPSON SEEPS
TESHEPUK (D-3) QUADRANGLE
1:63,360

NATURAL LANDMARK SURVEY
LANDFORMS
SPRINGS

I - 80 SIMPSON SEEPS 1B

Themes: Springs; Sea shores and islands; Permafrost landforms; Lakes and lake shores.

Location: Arctic Coastal Plain Province, western part, Teshekpuk D-3 quadrangle (1:63,360), T. 18 N., R. 10 W., sections 6 and 7; T. 18 N., R. 11 W., sections 1, 11, and 12; T. 19 N., R. 10 W., sections 19, 20, and 29-31; T. 19 N., R. 11 W., sections 24, 25, and 36.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 6,900 acres (2,792 hectares).

Geologic features: An outstanding site. Many oil seeps some of which have built tar domes 30 to 40 feet high and cover 10 to 20 acres. Oil seeps out of the ground along the permafrost cracks in many places and elsewhere has formed lakes of oil. Gubik Formation sand and silt overlie the Upper Cretaceous rocks unconformably. The oil comes out of the Cretaceous strata. Excellent examples of permafrost features including high-center polygons, and numerous ice wedges exposed in the sea cliffs, several oriented lakes in compound lake basins on a section of elevated coastal plain. The tar pits are known to have trapped caribou and probably contain a rich Pleistocene fauna similar to Rancho La Brea.

Biotic features: The oil saturated surface layers contain many unusual plant types and many lichen including orange, pink, yellow, and red types. Site also being considered as an Ecological Natural Landmark.

Scenic features: A very unusual area and the brightly colored lichen make it quite spectacular.

Land use and vulnerability: Part of Naval Petroleum Reserve No. 4, and several wells drilled on site. Much debris remaining from the drilling. Probably will be center of future drilling under some effort made to preserve the area.

Data source: Author from personal investigation.
M. D. Mangus, Anchorage, Alaska

Selected references:

Black, R. F., 1964, Gubik Formation of Quaternary age in northern Alaska: U.S. Geol. Survey Prof. Paper 302-C, p. C59-C91.

Hanna, G. D., 1963, Oil seepages on the Arctic coastal plain, Alaska: Occasional Papers of the Calif. Acad. Sci., No. 38, 18 p.

Hok, J. R., 1969, A reconnaissance of tractor trails and related phenomena on the North Slope of Alaska: U.S. Department of the Interior, Bureau of Land Management, 66 p.

Robinson, T. M., 1959, Test wells, Simpson area, Alaska: U.S. Geol. Survey Prof. Paper 305-J, p. J523-J568.

Other knowledgeable persons:
W. W. Patton, Jr., Menlo Park, Calif.
Arthur Grantz, Menlo Park, Calif.
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: An outstanding nationally significant site. Recommended for entry into Registry of Natural Landmarks.

Natural Landmark Survey

Lifeforms Category

The record of biologic evolutionary development of life on earth is contained in the fossils preserved in the rocks. Links in the chain of evolutionary development are based on faunal assemblages, or groups of fossils, rather than a single fossil. Consequently, it is important to preserve, as part of our great natural heritage, areas that contain important segments of this pageant of life.

The development of a theme analysis for lifeforms is based primarily on chronologic elements relating to the evolutionary pattern. Broad stages in biologic development were used by the National Park Service as the basis of its theme analysis system used in this Landmark Survey. These broad stages of development are represented in the following themes.

Theme 1. The Morning of Life (Pre-Cambrian)

Theme 2. The Age of Primitive Invertebrates (Cambrian, Ordovician, Early Silurian)

Theme 3. The Rise of Vertebrates and the First Forests (Late Silurian and Devonian)

Theme 4. The Great Development of Land Life and Changes in Marine Life (Mississippian, Pennsylvanian, Permian, Triassic)

Theme 5. The Age of Reptiles (Permian, Triassic, Jurassic, Cretaceous)

Theme 6. The Emerging Dominance of Animals (Paleocene and Eocene)

Theme 7. The Golden Age of Animals (Oligocene, Miocene, Pliocene, Pleistocene)

Theme 8. The Age of Man (Pleistocene and Holocene)

Rarely will any region show a complete sequence in the Development of Life. This is due to the nature of geologic structures and the deposition of rock strata through long periods of geologic time. Rocks may be deposited in an area for many millions of years only to be uplifted and become the source area for rocks deposited in another region.

The Arctic Lowland contains a fine record of part of this evolutionary development of life, but many links were forged in this chain of life before the record starts in this region. The Arctic Lowland is primarily an area of Mesozoic strata. Late Paleozoic strata are present locally in the foothills adjacent to the Brooks Range and on the Lisburne Peninsula and Tertiary rocks occur on the coastal plain in the northeastern part.

In order to keep the Lifeform Themes in their proper time reference for the Arctic Lowland the National Park Service numbering system will be used. All of geologic time from Mississippian to Holocene are represented by strata in the Arctic Lowlands, but some of the intervals are not of the caliber to be recommended as Landmark Sites. Only those themes represented by nationally significant sites will be discussed.

NATIONAL NATURAL LANDMARK SURVEY

LIFEFORMS

Theme 4. The great Development of Land Life

and Changes in Marine Life

Much of geologic time and great strides in the development of life had already taken place before the record starts in the Arctic Lowland. This theme, the great Development of Land Life and Changes in Marine Life, is then critical to an understanding of the geologic history of the region.

This theme represents about 150 million years of the earth's history that spans the close of the Paleozoic and the beginning of the Mesozoic Eras. This was a time of great change in the evolutionary development of Lifeforms. Many forms died out or were replaced by newly developing forms. It was also a time of great unrest in the earth's crust. Mountain systems were uplifted and others dropped beneath the sea. The Arctic Lowland was spared much of this crustal unrest. The area was beneath the sea and contains an exceptional fine record of the Changes in Marine Life. Minor unconformities and breaks in the succession of events attest to the crustal unrest in other parts of the world.

During the first half of the 150 million years represented by this theme, the Carboniferous (Mississippian and Pennsylvanian), great swamps with soft-wooded trees covered large areas of the earth. These swamp deposits are now coal seams. Amphibians developed as the initial form of land animal during this time. Reptiles first evolved during the latter part of the Pennsylvanian, and were to become the dominant land animal by the end of the time represented by this theme.

The seas that covered the Arctic Lowland contained an abundant and varied invertebrate fauna. Brachiopods were the dominant lifeform during most of this time, but the great upheaval that occurred at the end of the Paleozoic also signalled the end of their reign and the rapid expansion of the pelecypods and ammonites. By the end of the Triassic pelecypods had almost completely replaced the brachiopods as the dominant marine shellfish. Coiled free-swimming ammonites rapidly developed into one of the major lifeforms of the period. Because of the great changes recorded and the tremendous impact of these events on subsequent lifeforms, it might be desirable to examine the environment provided for lifeform development in the Arctic Lowlands.

Starting about 345 million years ago at the beginning of the Mississippian the seas covered all of the Arctic Lowland. This was a shallow carbonate reef-forming sea similar to the area around modern Bermuda. A low land mass lay to the north that supplied a small amount of detritus to this basin. Thousands of feet of thin-bedded to massive limestone and dolomite were built up in this basin primarily as coral reefs. Brachiopods flourished in these waters and became greatly diversified.

During the Early Permian about 280 to 240 million years ago the sea withdrew southward and parts of the Arctic Lowland were subjected to erosion. A major marine transgression started about 240 million years ago and once again the region was covered by the sea. Sediments from the northern landmass were deposited as sandstone and siltstone. The great coral reefs and many of the brachiopods had disappeared. Only locally where conditions were favorable did any great number of lifeforms flourish. This part of the Permian was a time of great stress for

lifeforms. Large land areas in the northern hemisphere were deserts while much of the southern hemisphere was covered by glaciers. Many of the marine lifeforms that had been so abundant completely disappeared or were replaced by other forms.

For about 10 to 15 million years during the Early Triassic the seas that covered the Arctic Lowland contained only a few lifeforms. These were very different from the earlier forms. Coiled ammonites appeared on the surface and pelecypods were the new bottom dwellers that had replaced the brachiopods. Starting about 215 million years ago and lasting for about 20 million years during the remainder of the Triassic the seas covering the Arctic Lowland experienced a population explosion that has never been equalled. The shallow quiet sea experienced a great upwelling of nutrients that permitted almost limitless growth of lifeforms. The dark phosphatic limestone, shale, and chert are almost a solid mass of fossils.

Rocks containing the fossil lifeforms representing this theme are exposed primarily in the southern foothills and along the mountain front as part of the Lisburne Group, and the Sadlerochit, Siksikpuk, and Shublik Formations. About 3,000 to 5,000 feet of these rocks remain, and they are present in the subsurface along the north coast where they are the oil producing horizons in the Prudhoe Bay oil field.

Group II, Theme 4. Changes in Marine Life

1. Highest Priority

   Fire Creek

2. Sites definitely eligible

   None

3. Sites of uncertain eligibility

   None

4. Sites not recommended

   None

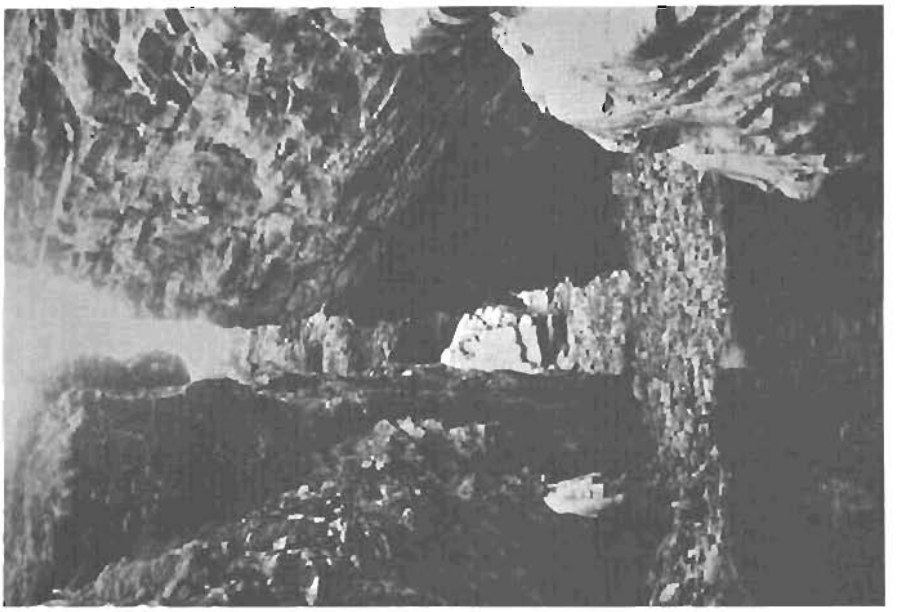
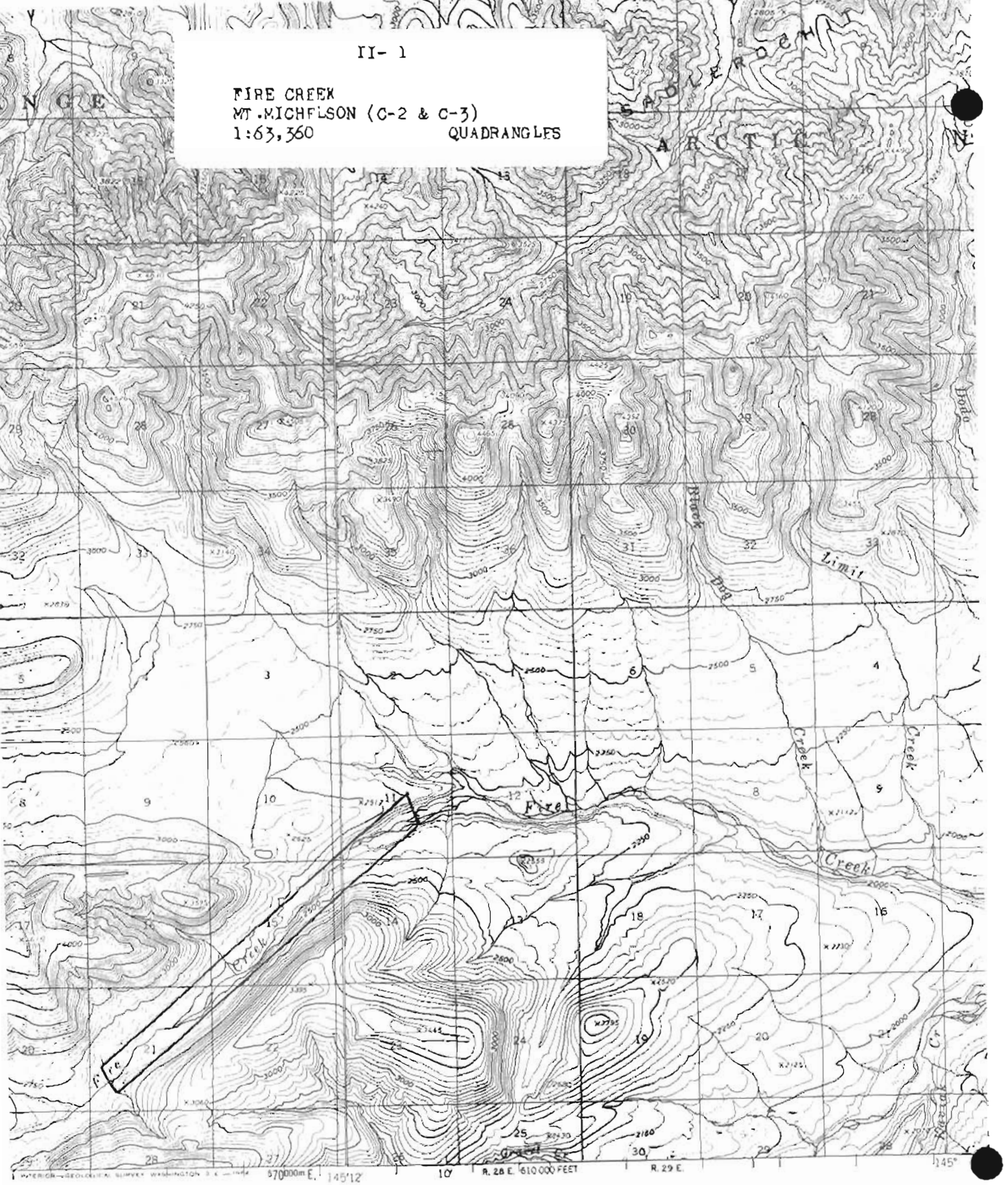


Figure 24. Fire Creek gorge, Sadlerochit Formation

Figure 25. Shublik Formation, Fire Creek

II- 1

FIRE CREEK
MT. MICHELSON (C-2 & C-3)
1:63,360 QUADRANGLES



Mapped by the Army Map Service
Edited and published by the Geological Survey
Control by USC&GS and USCE
Topography by photogrammetric methods from aerial photographs taken 1955, field annotated 1955. Map not field checked
Universal Transverse Mercator projection. 1927 North American datum

ROAD CLASSIFICATION
No roads or trails in this area

TRUE NORTH
MAGNETIC NORTH

NATURAL LANDMARK SURVEY
LIFEFORMS
CHANGES IN MARINE LIFE

II - 1 FIRE CREEK 1C

Themes: Changes in Marine Life: Movement of the earth's crust: Sculpture of the Earth.

Location: Arctic Foothills Province, eastern part, south of Sadlerochit Mountains, Mt. Michelson C-2 and C-3 quadrangles (1:63,360), T. 2 N., R. 28 E., sections 11, 14-16, 21, and 22.

Ownership: Arctic National Wildlife Range, Bureau of Sports Fisheries and Wildlife, Department of the Interior.

Approximate acreage: 520 acres (210 hectares).

Geologic features: Fire Creek is one of the most outstanding sites in the Arctic Lowland. The creek has cut a narrow gorge through the rock that completely exposes some of the most fossiliferous strata found anywhere. A complete record of the Development of Life from middle Mississippian to middle Jurassic, an interval of about 175 million years, are contained in these rocks. These strata are all marine; consequently, the lifeforms do not include land animals. The forces that shaped and molded earth are well expressed by the folded strata and the power of running water is well expressed by the narrow 40- to 60-foot deep gorge.

Biotic features: Riparian willow-alder plant community in gorge with alpine tundra at top. Falcon and hawk aeries on bluffs.

Scenic features: Spectacular gorge at the east end of Shublik Mountains. Gorge locally only a few feet across and contains numerous small waterfalls.

Land use and vulnerability: Part of the Arctic National Wildlife Range, but wide distribution of information on abundant fossils could result in vandalism and uncontrolled collecting that would soon ruin the value of this unique site.

Data source: I. L. Tailleur, Menlo Park, Calif.
H. N. Reiser, Menlo Park, Calif.
Author from personal investigations.

Selected references:

Detterman, R. L., 1970a, Sedimentary history of Sadlerochit and Shublik Formations in northeastern Alaska, in Adkison, W. L., and Brosgé, M. M., eds., Proceedings of the geologic seminar on the North Slope of Alaska: Los Angeles, Pacific Sec. Am. Assoc. Petroleum Geologists, p. O1-O13.

_____, Reiser, H. N., Brosgé, W. P., and Dutro, J. T., Jr., Post-Carboniferous stratigraphy, northeastern Alaska: U.S. Geol. Survey Prof. Paper 886. (In press)

Leffingwell, E. de K., 1919, The Canning River region, northern Alaska: U.S. Geol. Survey Prof. Paper 109, 251 p.

Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1971, Preliminary geologic map, Mt. Michelson quadrangle, Alaska: U.S. Geol. Survey open-file report, 2 sheets.

Tourtelot, H. A., and Tailleur, I. L., 1971, The Shublik Formation and adjacent strata in northeastern Alaska: U.S. Geol. Survey open-file report, 62 p.

Other knowledgeable persons:
M. D. Mangus, Anchorage, Alaska
C. G. Mull, Denver, Colo.

Publicity sensitivity: Information concerning the abundant fossils at this site should not be given wide distribution as indiscriminate collecting could soon ruin the value of this site.

Comments: One of the most outstanding sites in the Arctic Lowland. Highly qualified and of great national significance. Site highly recommended for entry into Registry of Natural Landmarks.

Theme 5. The Age of Reptiles

The Age of Reptiles is the name commonly given to the Mesozoic Era as it was during this time, from about 65 to 225 million years ago, that these vertebrates became the dominant animals on earth. The great dinosaurs are perhaps the best known and most exciting of all the fossil lifeforms that developed in the evolutionary chain of life. They arose from small insignificant animals during the Late Paleozoic to rule the land, sea, and air for 160 million years of the Mesozoic, only to be replaced by small, warm-blooded, mammals at the beginning of the Tertiary. The Mesozoic, or Age of Reptiles, is divided into three periods--Triassic, Jurassic, and Cretaceous.

The Triassic of the Arctic Lowland was described in part in theme 4, Changes in Marine Life, as this was the time, 195 to 225 million years ago, that great changes occurred in the marine invertebrate fauna. The brachiopods died out and were replaced by pelecypods and ammonites. The entire Arctic Lowland was covered by a sea that lay to the south of a low land area. Deposition of limestone, siltstone, chert, and shale was very slow, but at the same time a great upwelling of nutrients produced lifeforms in an abundance that has never been equalled. The prolific marine invertebrate fauna was accompanied by the large marine Ichthyosaurs, several of which have been found in the Arctic Lowlands.

The sea continued to roll over the Arctic Lowland during the entire Jurassic, 135 to 195 million years ago. During most of this time several thousand feet of shale and siltstone were being deposited slowly in fairly shallow water. Locally evidence of unrest in the

earth's crust is indicated by unconformities within the rock sequence accompanied by deposition of sandstone and graywacke. The marine invertebrate fauna, particularly pelecypods and ammonites, flourished and developed into many new forms. The giant sea lily Pentacrinus form extensive mats that covered large areas mainly in the northeastern part of the lowland. Land animals were absent, as they were during the Triassic, for the entire Arctic Lowland.

The Cretaceous Period, 65 to 135 million years ago, was a time of great unrest in the Arctic Lowland. A depositional system that had persisted for nearly 200 million years was ended with the uplift of the ancestral Brooks Range and the change from a northern to a southern source area for the rocks. During an interval of no more than a couple million years, about 110 to 112 million years ago, the position of the land and sea were completely reversed and this condition with minor variations has continued to the present.

The Cretaceous started as a continuation of the Jurassic with several thousand feet of dark marine siltstone and shale deposited on top of the Jurassic rocks. Evidence of the earlier crustal unrest increased with the formation of deep basins with restricted circulation and the local deposition of sandstone and graywacke. As the Early Cretaceous was drawing to a close the Brooks Range was uplifted with the formation of a rapidly subsiding basin in what is now the Arctic Lowland. This basin has received 25,000 to 30,000 feet of coarse clastic detritus from the newly formed mountains to the south. The rapidly accumulating sediments soon filled the basin and rivers built deltas covered with coal swamps across the area. Time and again these

new land areas were inundated by the sea so that the marine and continental strata succeed each other throughout the remainder of Cretaceous time. Volcanic activity accompanied the uplift of the Brooks Range and numerous beds of bentonite and tuff are interstratified with the Late Cretaceous rocks.

Theme 5. Age of Reptiles

1. Highest priority

    Cutaway Creek

    Ignek Creek

2. Sites definitely eligible

    Black Island

    Monotis Creek

    Tuktu Bluff

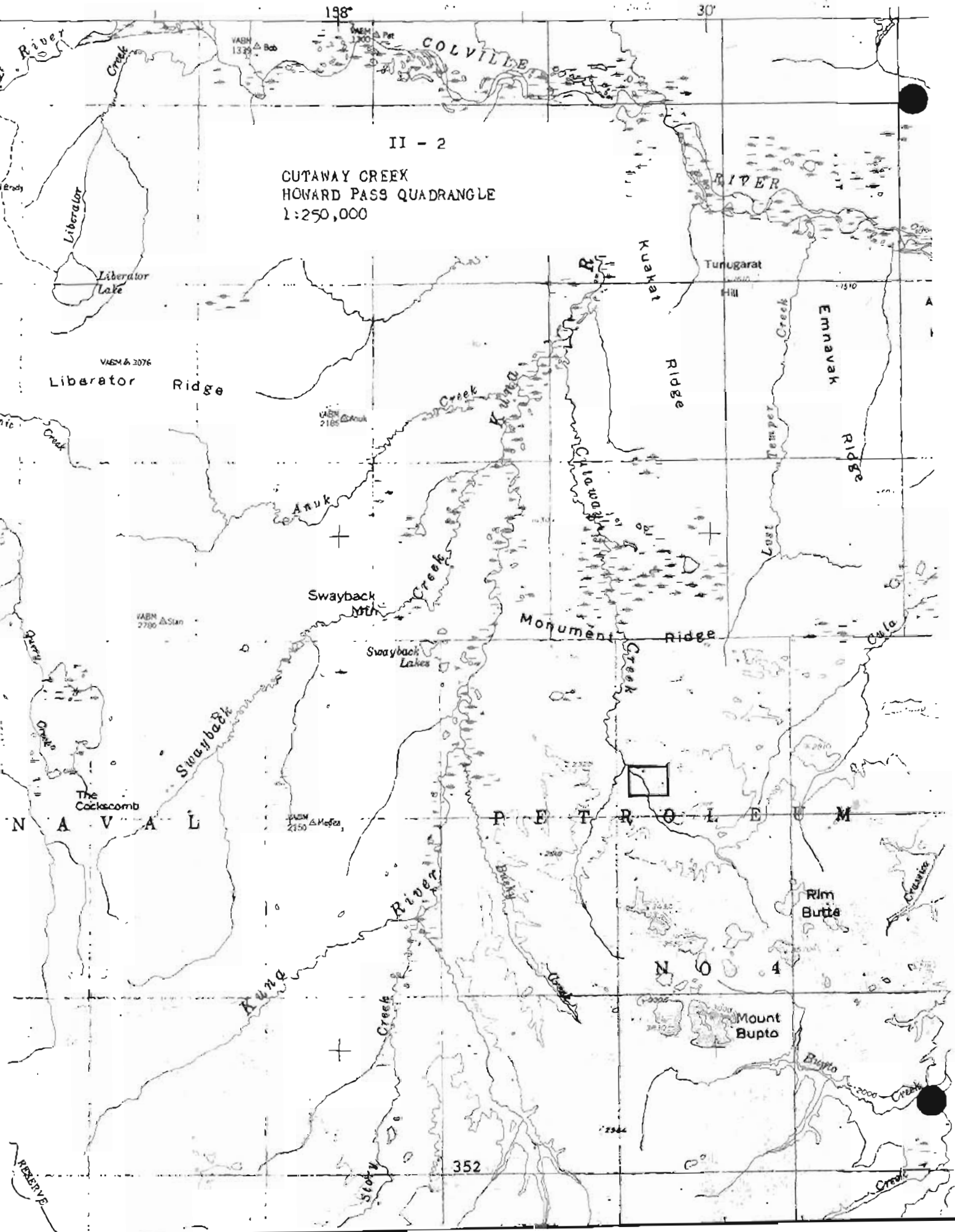
3. Sites of uncertain eligibility

    None

4. Sites not recommended

    Aucella Creek

Figure 26. Ichthyosaurs skeleton, Cutaway Creek


198°
30'
II - 2
CUTAWAY CREEK
HOWARD PASS QUADRANGLE
1:250,000
COLVILLE
RIVER
Liberator
Liberator Lake
Liberator Ridge
Kuakat Ridge
Tunugarat Hill
Emnavak Ridge
Temper Creek
Lost
Kuna Creek
Anuk Creek
Colville
Swayback Mtn
Swayback Creek
Swayback Lakes
Monument Ridge
Monument Creek
The Cockscomb
NAVAL PETROLEUM
NO 4
Kuna River
Rim Butte
Mount Bupto
Bupto Creek
Story Creek
352
RESERVE

NATURAL LANDMARK SURVEY
LIFEFORMS
AGE OF REPTILES

II - 2 CUTAWAY CREEK 1B

Themes: Age of Reptiles; Movement of the earth's crust.

Location: Arctic Foothills Province, central part, Howard Pass quadrangle (1:250,000), T. 9 S., R. 24 W., sections 29-32.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 960 acres (388 hectares).

Geologic features: An exceptionally good vertebrate locality in limestone, chert, and shale of the Triassic Shublik Formation. One articulated skeleton of a marine ichthyosaurs, possibly Mixosaurus, and numerous scattered bone fragments have been located. Pelecypods and a potassium-argon age date indicates this dinosaur is about 200 million years old. The enclosing strata are highly folded and locally faulted indicative of the tremendous forces involved in the movement of the earth's crust when this part of the Arctic Lowland was elevated above the sea during the Cretaceous.

Biotic features: Willow-alder riparine and dry upland tussock tundra plant communities. Local areas of lichen-covered rock surfaces.

Land use and vulnerability: Part of Naval Petroleum Reserve No. 4. There has been no drilling activity near this site.

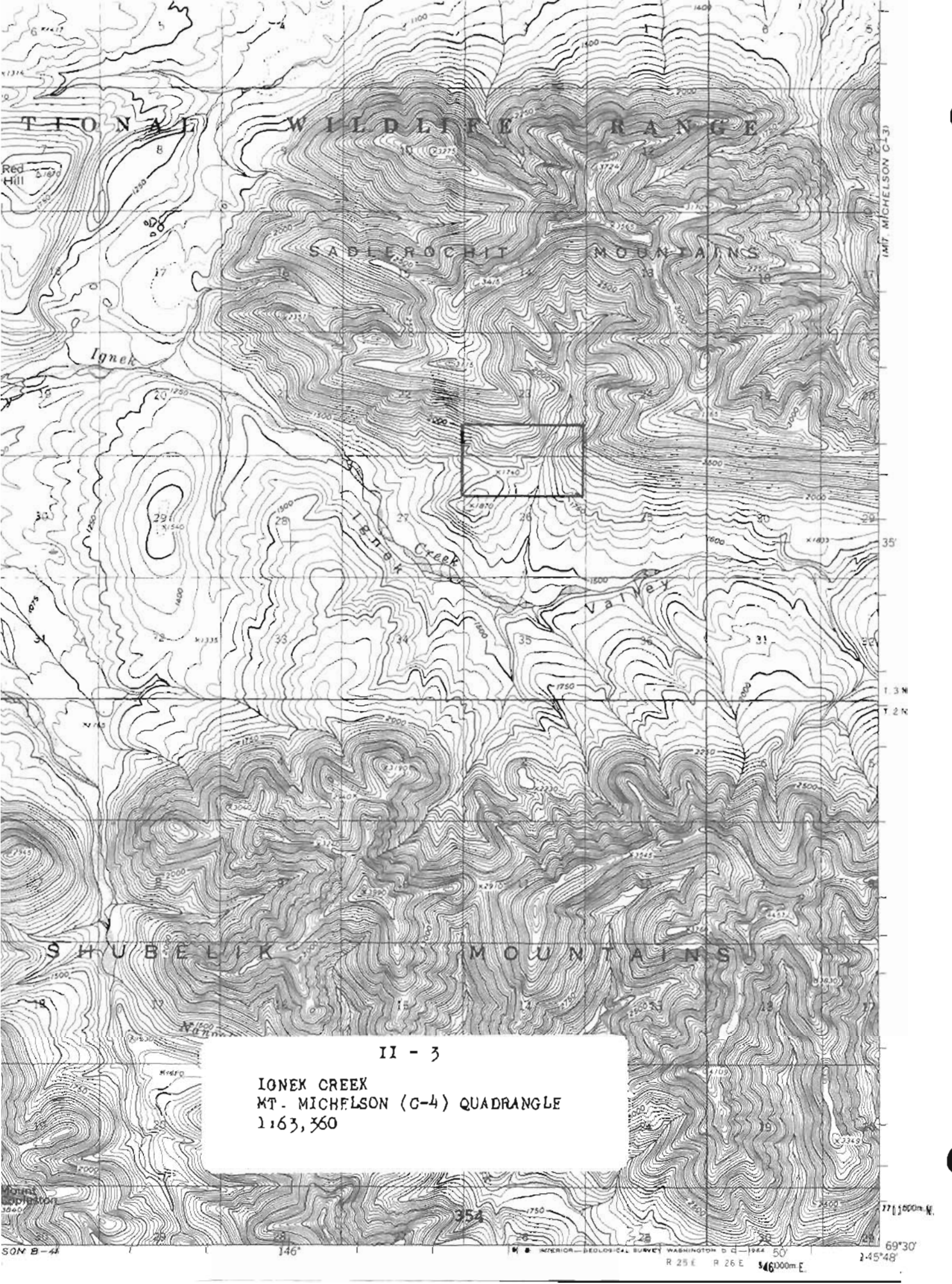
Data source: I. L. Tailleur, Menlo Park, Calif.
C. G. Mull, Denver, Colo.

Selected reference:
Tailleur, I. L., Mull, C. G., and Tourtelot, H. A., 1973, A skeleton in Triassic rocks in the Brooks Range Foothills: Arctic, Jour. Arctic Inst. N. Am., v. 26, no. 1, p. 79-81.

Other knowledgeable persons:
H. A. Tourtelot, Denver, Colo.

Publicity sensitivity: Information should not be widely distributed as site could be easily vandalized.

Comments: The best vertebrate locality in the Arctic Lowland. Eligible for entry into Registry of Natural Landmarks.



II - 3

IGNEK CREEK
MT. MICHELSON (C-4) QUADRANGLE
1:63,360

NATURAL LANDMARK SURVEY
LIFEFORMS
AGE OF REPTILES

II - 3 IGNEK CREEK 1C

Themes: Age of Reptiles; Changes in Marine life; Movement of the earth's crust.

Location: Arctic Foothills Province, eastern part, Ignek valley between Sadlerochit and Shublik Mountains, Mt. Michelson C-4 quadrangle (1:63,360), T. 3 N., R. 25 E., sections 23 and 26

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Department of the Interior.

Approximate acreage: 400 acres (162 hectares).

Geologic features: Vertebrate fossil site in limestone of the Triassic Shublik Formation. A marine ichthyosaur probably Shastasaurs represented by vertebra, costa, jaw and rib frabments. Bones weathering out of the limestone. Pelecypods associated with the vertebrate indicate a Late Triassic age. Fossiliferous strata nearby of Mississippian to Jurassic age.

Biotic features: Ignek valley is a main caribou migration route and there are Dall sheep in the adjoining Sadlerochit Mountains. Tussock tundra plant community.

Scenic features: Spectacular mountain scenery and the site overlooks the bright hued beds of Ignek Valley.

Land use and vulnerability: Part of the Arctic National Wildlife Range.

Data source: Site discovered by author during field investigations.

Selected references:

Detterman, R. L., 1970a, Sedimentary history of the Sadlerochit and Shublik Formations in northeastern Alaska, in Adkison, W. L., and Brosgé, M. M., eds., Proceedings of the geologic seminar on the North Slope of Alaska: Los Angeles, Pacific Sec. Am. Assoc. Petroleum Geologists, p. O1-O13.

Leffingwell, E. de K., 1919, Geology of the Canning River region, northern Alaska: U.S. Geol. Survey Prof. Paper 109, 251 p.

Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1971, Preliminary geologic map, Mt. Michelson quadrangle, Alaska: U.S. Geol. Survey open-file report, 2 sheets.

Other knowledgeable persons:

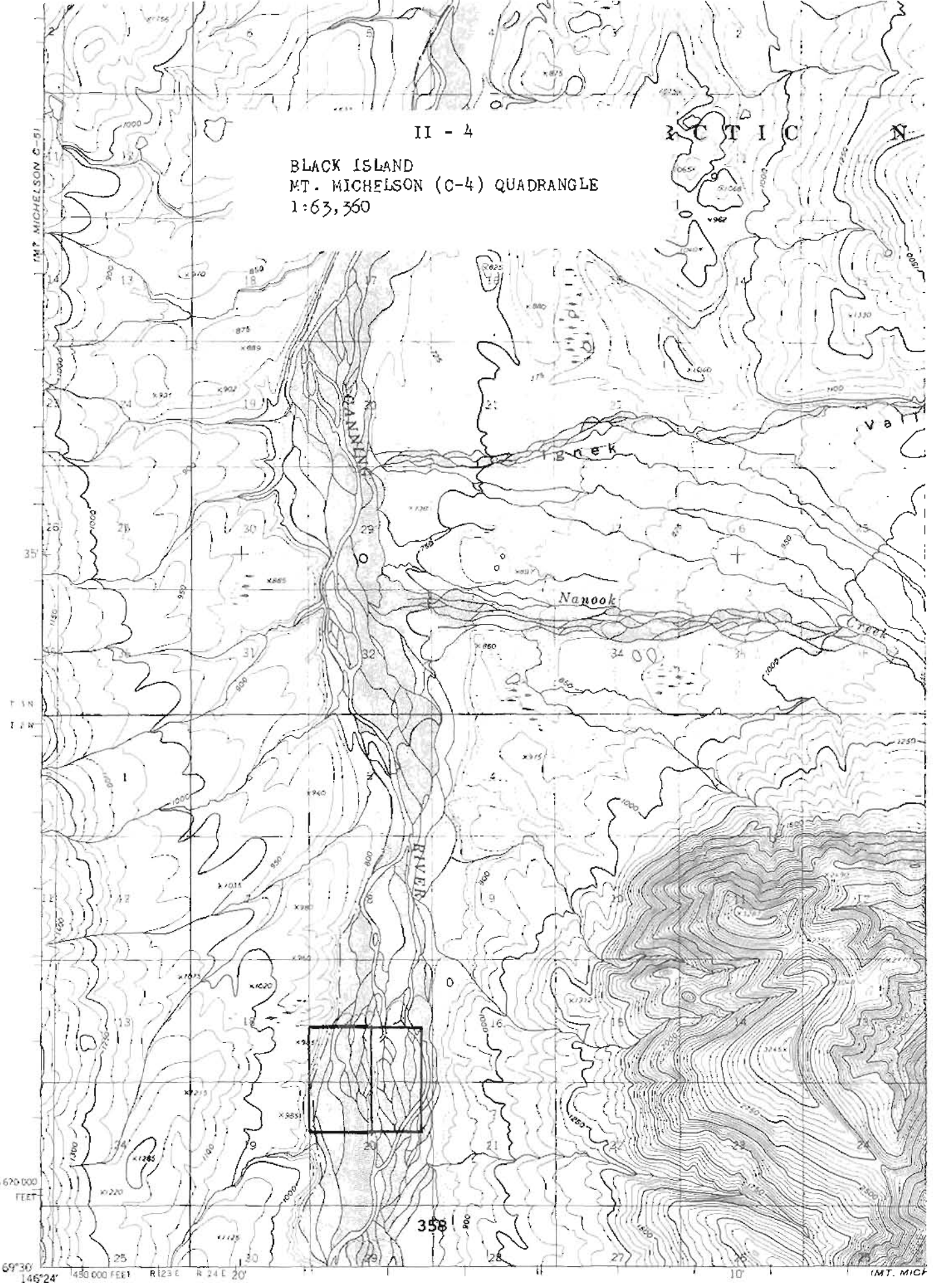
M. D. Mangus, Anchorage, Alaska

Publicity sensitivity: Site could be easily vandalized so information should not be widely distributed.

Comments: Site should be preserved for future scientific investigation. Eligible for entry into Registry of Natural Landmarks.

II - 4

BLACK ISLAND
MT. MICHELSON (C-4) QUADRANGLE
1:63,360



NATURAL LANDMARK SURVEY
LIFEFORMS
AGE OF REPTILES

II - 4 BLACK ISLAND 2B

Themes: Age of Reptiles; River systems.

Location: Arctic Foothills Province, eastern part, island in Canning River, Mt. Michelson C-4 quadrangle (1:63,360), T. 2 N., R. 24 E., sections 17 and 20.

Ownership: Arctic National Wildlife Range, Bureau of Sport Fisheries and Wildlife, Department of the Interior and Utility corridor, Bureau of Land Management, Department of the Interior.

Approximate acreage: 520 acres (210 hectares).

Geologic features: Black Island is the world famous site for the Early Jurassic crinoid Pentacrinus subangularis. Many specimens from this locality, discovered by E. de K. Leffingwell, are in museums throughout the world. The island is a small shale and siltstone outcropping of Kingak Shale on the braided Canning River flood plain. An aufeis field built by Shublik Springs generally surrounds the island.

Biotic features: The island is a barren mass of rock devoid of life.

Scenic features: Spectacular mountain scenery and ice fields.

Land use and vulnerability: Site is mainly in the Arctic National Wildlife Range, but proposed gas pipeline is under consideration for the west bank of the Canning River here. If pipeline is constructed the site probably will be destroyed.

Data source:

M. D. Mangus, Anchorage, Alaska
Author from personal investigations.

Selected references:

Imlay, R. W., and Detterman, R. L., 1973, Jurassic paleobiogeography of Alaska: U.S. Geol. Survey Prof. Paper 801, 34 p.

Leffingwell, E. de K., 1919, The Canning River region, northern Alaska: 1919, U.S. Geol. Survey Prof. Paper 109, 251 p.

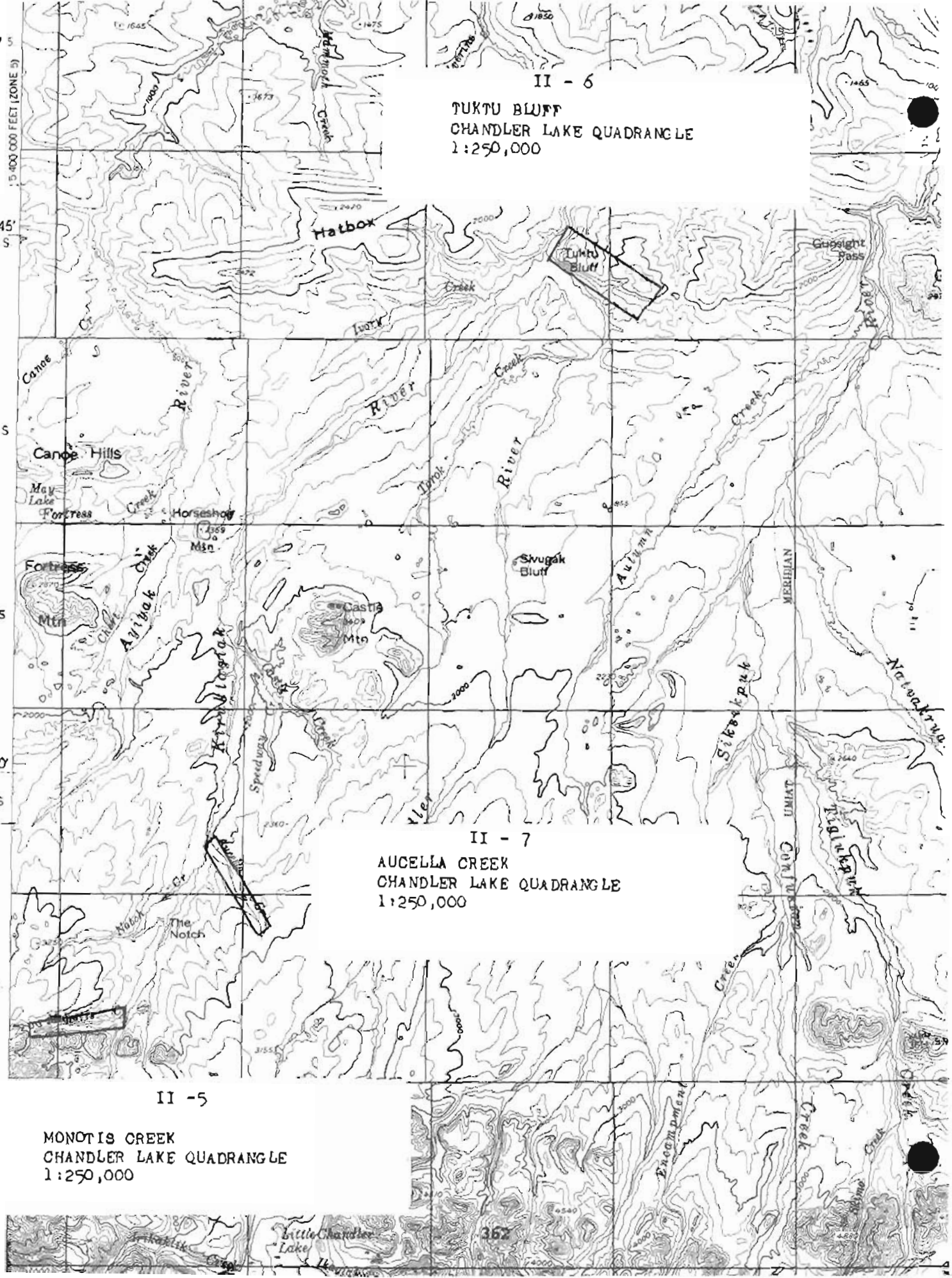
Reiser, H. N., Brosgé, W. P., Dutro, J. T., Jr., and Detterman, R. L., 1971, Preliminary geologic map, Mt. Michelson quadrangle, Alaska: U.S. Geol. Survey open-file report, 2 sheets.

Other knowledgeable persons:

George Gryc, Menlo Park, Calif.
C. G. Mull, Denver, Colo.

Publicity sensitivity: Information should not be released. Site has already been vandalized considerably and best material removed.

Comments: A world famous fossil locality but already considerably damaged by overcollecting. Probably should still be made a Natural Landmark to help protect remaining material.


II - 6
TUKTU BLUFF
CHANDLER LAKE QUADRANGLE
1:250,000
II - 7
AUCELLA CREEK
CHANDLER LAKE QUADRANGLE
1:250,000
II -5
MONOTIS CREEK
CHANDLER LAKE QUADRANGLE
1:250,000
Hatbox
Tuktu Bluff
Guesight Pass
Canoe Hills
May Lake
Fortress
Horseshoe Mtn
Fortress Mtn
Castle Mtn
Sivugak Bluff
Autumn
Meridian
Umiat
Coal
Nalvaktuq
Sikosukpuk
Kiruliagiak
Speedway
Aulbak
Chut
Canoe
River
Iyork
Iprok
Creek
The Notch
Notch
Encampment
Green
Little Chandler Lake
362

NATURAL LANDMARK SURVEY
LIFEFORMS
AGE OF REPTILES

II - 6 TUKTU BLUFF 2C

Themes: Age of Reptiles; Cuestas and hogbacks; Movement of the earth's crust.

Location: Arctic Foothills Province, central part, Chandler Lake quadrangle (1:250,000), T. 8 S., R. 1 W., sections 19, and 29-31; T. 8 S., R. 2 W., sections 13, 14, and 23-25.

Ownership: Native regional deficiency area, Alaska Native Claims Settlement Act. Selections not made as of 8/1/74.

Approximate acreage: 2,880 acres (1,165 hectares).

Geologic features: This site is the type locality for the Tuktu Formation, of Early Cretaceous age, at the base of the Nanashuk Group. Massive sandstone and siltstone exposed in an escarpment 1,000 feet high. Beds deposited by the first major marine transgression of the cyclic transgressive-regressive phase of the late Lower Cretaceous and Upper Cretaceous of the Arctic Lowland. Major cuesta at top of escarpment formed by the basal nonmarine beds of the overlying Chandler Formation. Abundant pelecypods and ammonites in Tuktu strata and coal swamp deposits in the Chandler Formation. Nonmarine strata show numerous deltaic cross-bedding features.

Biotic features: Willow-alder shrub communities on lower slope followed by upland tussock tundra on top. Falcon and hawk aeries on ledges. Dall sheep commonly seen on escarpment.

Scenic features: Spectacular views of Brooks Range and shale lowlands to the south.

Land use and vulnerability: No organized use of land at present, but may be leased after settlement of Alaska Native Claims.

Data source: Author from personal investigations.

Selected references:

Detterman, R. L., 1956, New and redefined nomenclature of Nanushuk Group, in Gryc, George, and others, Mesozoic sequence in Colville River region, northern Alaska: Am. Assoc. Petroleum Geologists Bull., v. 40, no. 2, p. 233-244.

_____, Bickel, R. S., and Gryc, George, 1963, Geology of the Chandler River region, Alaska: U.S. Geol. Survey Prof. Paper 303-E, p. E223-E324.

Other knowledgeable persons:

W. W. Patton, Jr., Menlo Park, Calif.
M. D. Mangus, Anchorage, Alaska

Publicity sensitivity: Slight

Comments: An important site for both lifeforms and landforms. Recommended for inclusion in Registry of Natural Landmarks.

See map on page 362.

NATURAL LANDMARK SURVEY
LIFEFORMS
AGE OF REPTILES

II - 7 AUCELLA CREEK 4

Themes: Age of Reptiles; Movement of the earth's crust.

Location: Arctic Foothills Province, central part, Chandler Lake quadrangle (1:250,000), T. 11 S., R. 3 W., section 31; T. 11 S., R. 4 W., sections 25, 26, and 36; T. 12 S., R. 3 W., sections 6 and 7; T. 12 S., R. 4 W., section 1.

Ownership: Native Regional Deficiency area and Gates of the Arctic National Park (proposed), National Park Service, Department of the Interior. Selection not made as of 8/1/74.

Approximate acreage: 1,000 acres (404 hectares).

Geologic features: This site is an important locality for the study of the Okpikruak Formation of Early Cretaceous age. The Okpikruak is the last sequence of beds deposited before the uplift of the Brooks Range and the shift in direction of deposition. Evidence for the change is contained in these rocks.

Biotic features: Willow-alder shrub and upland tundra plant communities.

Land use and vulnerability: Dual selection of land for Gates of the Arctic National Park and Native Regional Deficiency. Oil and gas leases applied for. Possibility of future development for oil and gas.

Data source: I. L. Tailleur, Menlo Park, Calif.

Selected references:

Gryc, George, Patton, W. W., Jr., and Payne, T. G., 1951, Present Cretaceous nomenclature of northern Alaska: Wash. Acad. Sci. Jour., v. 41, no. 5, p. 159-167.

Patton, W. W., Jr., and Tailleur, I. L., 1964, Geology of the Killik-Itkillik region, Alaska: U.S. Geol. Survey Prof. Paper 303-G, p. G409-G500.

Other knowledgeable persons:
W. W. Patton, Jr., Menlo Park, Calif.

Publicity sensitivity: Slight.

Comments: This is an important site, but probably not of national significance. Site not recommended.

Theme 7. Golden Age of Mammals

That part of the geologic time designated the Golden Age of Mammals includes the Oligocene, Miocene, Pliocene, and Pleistocene from about 38,000,000 to 10,000 years ago. This was the time of rapid development of mammals with modern aspect and a period of dying out of the archaic types. Great herds of camels, horses, rhinoceroses, animals not now found wild in North America, roamed across Alaska during this period. Other great animals like the mammoth and mastodon succumbed to the rigors of the Ice Age during the Pleistocene.

Exposures of Tertiary rocks, Sagavanirktok Formation, are confined to a few areas in the eastern part of the Arctic Lowland. The 3,000 to 5,000 feet of continental sandstone, conglomerate, siltstone, and shale are generally devoid of fossils except for a few plants and pelecypods. These indicate that most of the Tertiary is probably present, but the lifeforms do not compare with other areas in Alaska and mainland United States. Consequently, no sites are being recommended for Natural Landmarks.

During the Pleistocene and into the Recent great herds of animals roamed across the Arctic Lowland. Some of them like the caribou are still present in herds numbering 20,000 to 30,000, but others like the mammoth, mastodon, great bison, and the great musk ox are extinct. The remains of the extinct species are commonly found in the frozen muck deposits on the coastal plain. Other parts of the recently elevated coastal plain contain marine deposits of the Gubik Formation with great deposits of shellfish remains. The Gubik Formation is primarily unconsolidated, cross-bedded sand and silt that represents a shallow, near-shore environment.

Theme 7. Golden Age of Mammals

1. Highest priority

   None

2. Sites definitely eligible

   Valley of the Willows

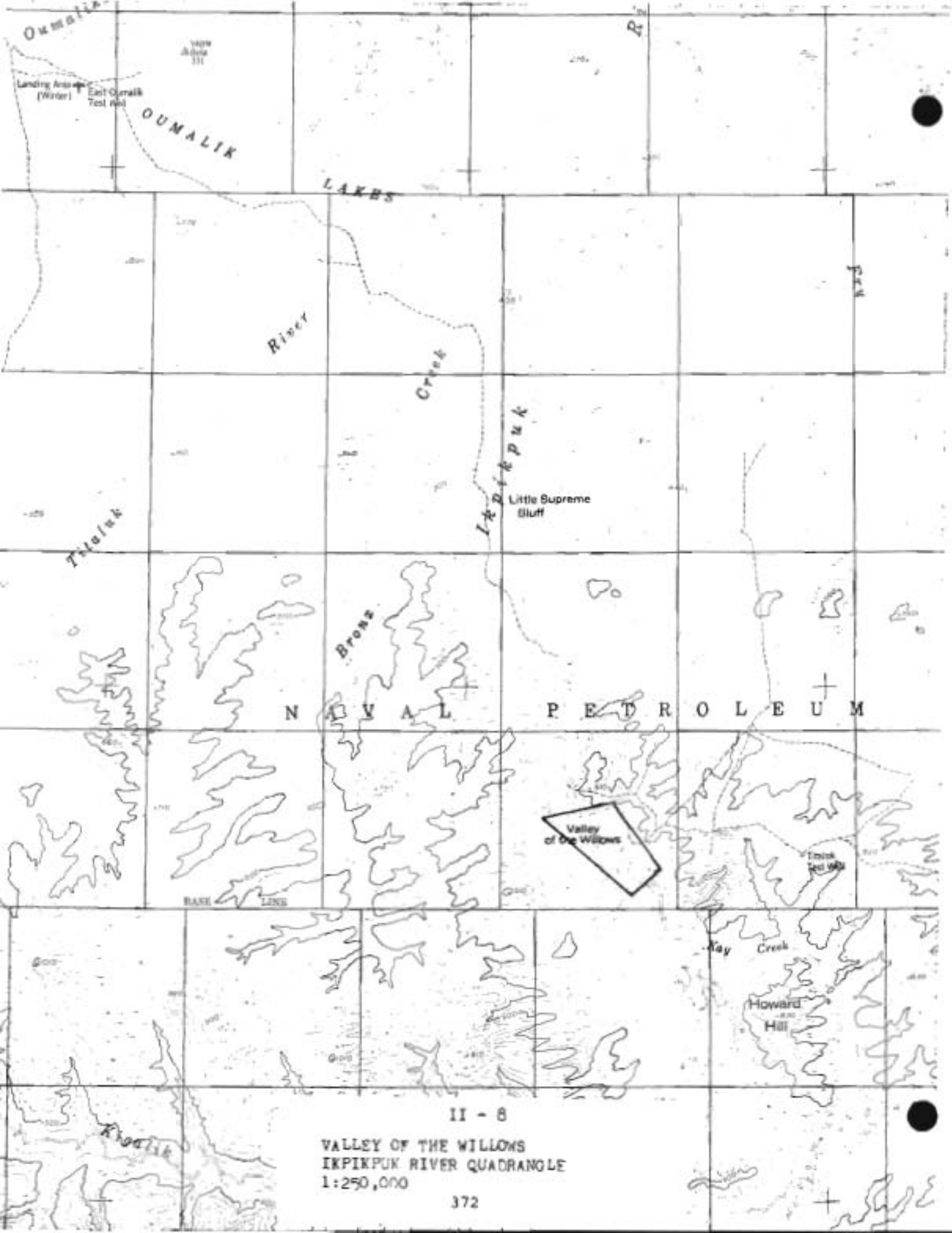
   Skull Cliff

3. Sites of uncertain eligibility

   None

4. Sites not recommended

   None



II - 8

VALLEY OF THE WILLOWS
IKPIKPUK RIVER QUADRANGLE
1:250,000

NATURAL LANDMARK SURVEY
LIFEFORMS
GOLDEN AGE OF MAMMALS

II - 8 VALLEY OF THE WILLOWS 2C

Themes: Golden Age of Mammals; River systems.

Location: Arctic Foothills Province, central part, Ikpikpuk River quadrangle (1:250,000), T. 1 N., R. 12 W., sections 14-17, 20-28, and 34-36.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 2,880 acres (1,165 hectares).

Geologic features: The Valley of the Willows is a part of the upper Ikpikpuk River Valley. The river maintains a meandering course through the Late Cretaceous bedrock hills at this site and has left three distinct levels of terraces. The terraces at 20, 50, and 70 feet are mantled by alluvium and silt. The 70-foot level may be in the Gubik Formation. The remains of many mammoth and mastodons, primarily tusks and teeth, have been found in the deposits of these terraces.

Biotic features: Exceptional riparian willow groves along stream, and upland tussock tundra on hills. Good ptarmigan habitat. Site being recommended as an Ecological Natural Landmark and has been suggested as an Ecological Reserve by the Joint Federal-State Land Use Planning Commission.

Land use and vulnerability: Part of Naval Petroleum Reserve No. 4, and a well has been drilled a few miles to the east. Possibility of future drilling in the area.

Data source: W. P. Brosgé, Menlo Park, Calif.

Selected references:

Brosgé, W. P., and Whittington, C. L., 1966, Geology of the Umiat-Maybe Creek region, Alaska: U.S. Geol. Survey Prof. Paper 303-H, p. H501-H638.

Other knowledgeable persons:
J. J. Koranda, Livermore, Calif.

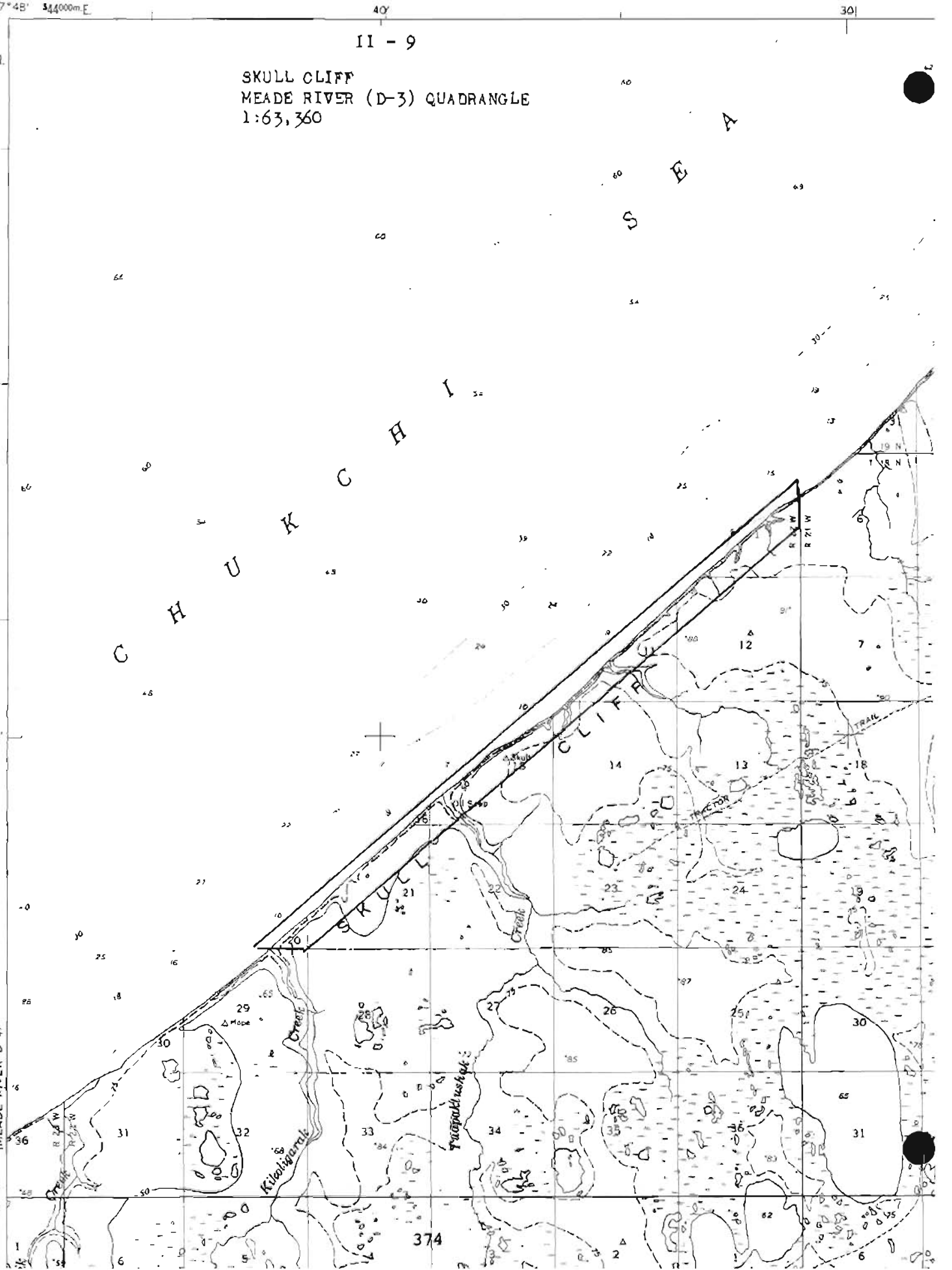
Publicity sensitivity: Slight

Comments: An interesting site containing remains of extinct mammals. Recommended for entry into Registry of Natural Landmarks.

GEOLOGICAL SURVEY

II - 9

SKULL CLIFF
MEADE RIVER (D-3) QUADRANGLE
1:63,360



NATURAL LANDMARK SURVEY
LIFEFORMS
GOLDEN AGE OF MAMMALS

II - 9 SKULL CLIFF 2B

Themes: Golden Age of Mammals, Sea shores and islands; Permafrost landforms; Plains, plateaus and mesas.

Location: Arctic Coastal Plain Province, western part, northwest coast about 25 miles southwest of Barrow, Meade River D-3 quadrangle (1:63,360), T. 18 N., R. 22 W., sections 1, 11, 12, 14, 15, and 20-22.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 900 acres (364 hectares).

Geologic features: Skull Cliff is an exceptionally good site for the investigation of the Pleistocene Gubik Formation; it is the type locality for the Skull Cliff Member of that formation and also contains excellent exposures of the Barrow Member. Cliffs 50 to 70 feet high have been cut into the coastal plain by the Chukchi Sea. The Gubik Formation is mainly unconsolidated silt and sand containing lenses of gravel. Some of the beds contain great quantities of pelecypod and gastropod shells. The unconformity between the Gubik Formation and the Upper Cretaceous Prince Creek Formation is exposed near the base of the cliff. Well-developed high-center permafrost polygons are present on top of the cliffs.

Biotic features: Abundant modern marine shellfish species along shore. nesting area for shore birds.

Land use and vulnerability: No organized use of land at present, but a part of Naval Petroleum Reserve No. 4.

Data source: Author from personal investigation.

Selected reference:

Black, R. F., 1964, Gubik Formation of Quaternary Age in northern Alaska: U.S. Geol. Survey Prof. Paper 302-C, p. C59-C91.

Other knowledgeable persons:
Arthur Grantz, Menlo Park, Calif.
J. J. Koranda, Livermore, Calif.

Publicity sensitivity: None

Comments: An exceptional site eligible for entry into Registry of Natural Landmarks.

Theme 8. Age of Man

The Age of Man includes only the most recent part of geologic time, the Pleistocene and Holocene, more commonly referred to as the Quaternary. Man is one of the mammals that shared the rapid development during the Golden Age of Mammals, and by the beginning of the Pleistocene was ready to take a position as one of the dominant lifeforms on earth.

The Pleistocene Epoch is commonly known as the Ice Age, a time of great stress for lifeforms and many of the endangered species succumbed to the rigors of the time. Man the supreme predatory animal was probably in part responsible for the extinction of many species. Evidence mainly from Africa, Asia, and Europe indicates that Man has been a successful hunter for at least 2,000,000 years. It is now generally accepted that he has been in the Americas only a few tens of thousands of years and that he arrived by way of the Bering land bridge. Sea level was lowered considerably on several occasions during the Pleistocene when great glaciers covered much of the northern hemisphere. On one of these occasions, when the Bering Sea was partially dry, Man crossed from Asia into North America. Point Hope, at the southwest tip of the Lisburne Peninsula, is one of the closest points between the two continents and may have been one of the points of entry. Pleistocene glaciers covered less of northern Alaska than areas further south in the state. This is primarily due to the decreased precipitation in northern Alaska, and for this reason the Arctic Lowland was probably one of the prime migration routes for Man into the Americas. Consequently, it seems appropriate to discuss several of the better known sites as Lifeform Natural Landmarks.

Geological events of the Pleistocene and Holocene are responsible for many of the geomorphic landforms present in the Arctic Lowland.

Glaciers carved and sculptured the mountains and foothills and dropped their loads of debris on the lowland. At the same time the severe cold that produced the glaciers was also the source of the permafrost that is still retained in the soil and rock. The Gubik Formation and the numerous glacial and alluvial deposits are the main product of erosion and deposition during the Quaternary. These unconsolidated materials consisting of gravel, sand, silt, and clay unconformably mantle all of the older rock units.

NATURAL LANDMARK SURVEY
LIFEFORMS
AGE OF MAN

II - 10 TIGARA 1A

Themes: Age of Man; Sea shores and islands.

Location: Arctic Foothills Province; westernmost point: Point Hope B-3 quadrangle (1:63,360); T. 34 N., R. 35 W. (Kateel), sections 1, 2, and 10-12.

Ownership: Native Village Withdrawal, land already selected by Point Hope village.

Approximate acreage: 640 acres (251 hectares).

Geologic features: The Early Man site of Tigara is located on the tip of the Point Hope spit near the modern village of Point Hope. Erosion of the spit by the Chukchi Sea is rapidly cutting away the site and moving the sediments around to the south side. The erosion of the beach is apparently cyclic with the greatest amounts occurring about every 11 years.

Archeological features: Limited investigations of the numerous sites at Tigara indicate continuous occupation for about 2,000 years. As one of the westernmost points in Alaska it probably was one of the migration routes into the Americas.

Land use and vulnerability: This site is extremely vulnerable to destruction, not only from man but from the sea. The site is rapidly being eroded by the sea and the exposed artifacts are being collected and sold by the native store in the Point Hope village.

Data source: I. L. Tailleur, Menlo Park, Calif.
C. G. Mull, Denver, Colo.
Author from personal investigations.

Selected references:

Humphrey, R. L., 1970, The prehistory of the Arctic Slope of Alaska, Pleistocene cultural relationship between Eurasia and North America: Ph. D. thesis.

McCulloch, D. S., 1967, Quaternary geology of the Alaskan shore of the Chukchi Sea, in Hopkins, D. M., ed., The Bering Land Bridge: Stanford University Press, Stanford, Calif., p. 91-120.

Moore, G. W., 1966, Arctic beach sedimentation, in Wilimovsky, N. J., and Wolfe, J. N., eds., Environment of the Cape Thompson region, Alaska: U.S. Atomic Energy Commission, PNE-481, 1,250 p.

Solecki, R. S., 1950, Archeology and ecology of the Arctic Slope, Alaska: Smithsonian Institution Report for 1950, Publication 4042, p. 469-495.

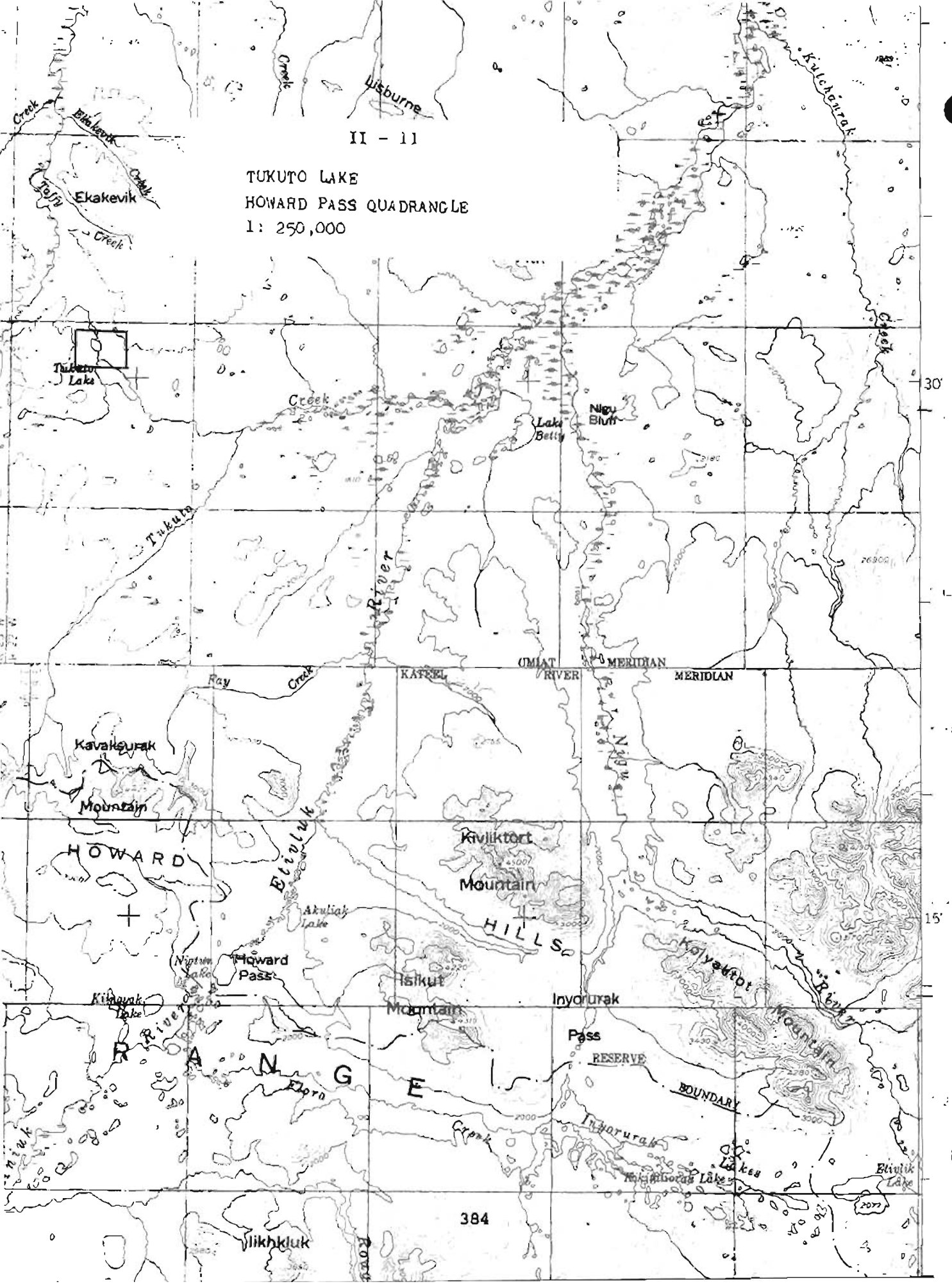
Tailleur, I. L., Jordan, C. F., Mangus, M. D., and Polski, W., Coastal scarp edge retreat on the Tigara Peninsula: Jour. Sed. Petrology. (In press)

Other knowledgeable persons:

M. D. Mangus, Anchorage, Alaska
Arthur Grantz, Menlo Park, Calif.

Publicity sensitivity: Data on this major archeological site probably should be withheld until it is excavated.

Comments: One of the outstanding sites to trace man's entry into the Americas is rapidly being destroyed by the sea and vandalized by modern man. The National Park Service should take immediate steps to excavate and preserve this material. Site suggested as an Ecological Reserve by the Joint Federal-State Land Use Planning Commission.


II - 11
TUKUTO LAKE
HOWARD PASS QUADRANGLE
1: 250,000
Ekakevik
Tukuto Lake
Tukuto
Creek
Lisburne
Kuichaurak
Niguu Bluff
Lake Betty
Niguu
River
UMIAT MERIDIAN
KATEEL RIVER
MERIDIAN
Ray Creek
Kavaksurak Mountain
HOWARD
Eliviluk
Kivliktort Mountain
HILLS
Akuliak Lake
Niguu Lake
Howard Pass
Kilinuvak Lake
Rivers
Isikut Mountain
Inyorurak Pass
RESERVE
BOUNDARY
Kolyaktort Mountain
Binty
RANGE
Elora Creek
Inyorurak Lakes
Eliviluk Lake
Ilikhkluk
30'
15'
384

NATURAL LANDMARK SURVEY
LIFEFORMS
AGE OF MAN

II - 11 TUKUTO LAKE 2C

Theme: Age of Man

Location: Arctic Foothills Province, central part; Howard Pass quadrangle (1:250,000); T. 11 S., R. 22 W., sections 3, 4, 9, and 10.

Ownership: Naval Petroleum Reserve No. 4, U. S. Navy, Department of Defense.

Approximate acreage: 1,000 acres (405 hectares).

Geologic features: Tukuto Lake lies in the glaciated area north of the Brooks Range. Moraine of the Itkillik Glaciation mantles this area and would indicate an age of less than 5,000 years for this site.

Archeological features: Abundant remains suggesting an Early Man village site at north end of lake. Howard Pass 20 miles to south was an important route Noatak River Valley and central Alaska. Numerous flint chipping sites found along most streams in the area. Fluted Folsom points found in general area suggest great antiquity.

Land use and vulnerability: No organized use of land at present, but it is a part of Naval Petroleum Reserve No. 4. Probably little likelihood of drilling in near future.

Data source: C. G. Mull, Denver, Colo.

Selected references:

Chapman, R. M., Detterman, R. L., and Mangus, M. D., 1964, Geology of the Killik-Etivluk Rivers region, Alaska: U.S. Geol. Survey Prof. Paper 303-I, p. F325-F407.

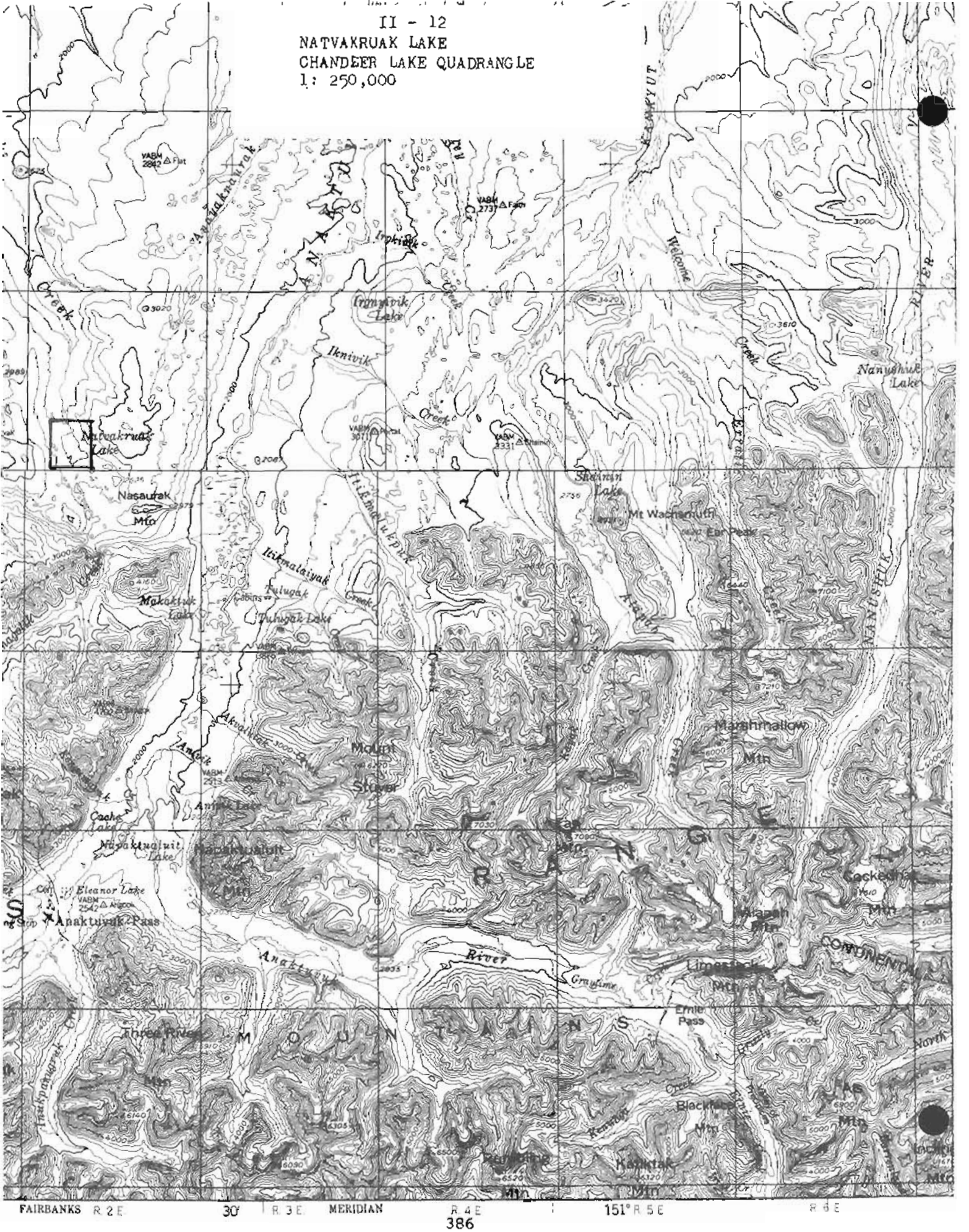
Solecki, R. S., 1950a, New data on the inland Eskimo of northern Alaska: Jour. Wash. Acad. Sci., v. 40, no. 5, p. 137-157.

Other knowledgeable persons:
I. L. Tailleur, Menlo Park, Calif.

Publicity sensitivity: Publication of data on this site should be withheld until it has been excavated.

Comments: An important Early Man site eligible for Landmark Status.

II - 12
NATVAKRUAK LAKE
CHANDEER LAKE QUADRANGLE
1: 250,000



Publicity sensitivity: Data should be withheld until complete excavation of site is possible.

Comments: An outstanding site recommended for entry into Registry of Natural Landmarks.

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Anderson, G. S., 1963, Patterned ground development and distribution in the foothills section, northern Alaska: M.A. thesis, Iowa State University.

_____, and Hussey, K. M., 1963, Preliminary investigation of thermokarst development on the North Slope, Alaska: Proceedings, Iowa Acad. Sci., v. 70, p. 306-320.

Armstrong, A. K., 1970, Carbonate facies and Lithostrotionid corals of the Mississippian Kogruk Formation, De Long Mountains, northwestern Alaska: U.S. Geol. Survey Prof. Paper 664, 38 p.

_____, 1972, Biostratigraphy of Mississippian Lithostrotionid corals, Lisburne Group, Arctic Alaska: U.S. Geol. Survey Prof. Paper 743A, p. A1-28.

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Appendix A--Index to localities

Landforms

	Page
Admiralty Bay, Teshekpuk Quadrangle	146
Amatusuk Hills, Point Lay Quadrangle	268
Anaktuvuk River, Chandler Lake Quadrangle	248
Angun Plains, Demaracation Point Quadrangle	62
Archimedes Ridge, Utukok River Quadrangle	260
Atigun Gorge, Philip Smith Mountains Quadrangle	284
Awuna River, Lookout Ridge Quadrangle	178
Ayiyak Mesa, Chandler Lake Quadrangle	96
Barrow - Brant Point, Barrow Quadrangle	224
Barrow Plains, Barrow Quadrangle	46
Cape Dyer - Kiliahlik Point, Point Hope Quadrangle	302
Cape Lisburne, Point Hope Quadrangle	112
Cape Thompson - Crowbill Point, Point Hope Quadrangle	298
Castle Mountain, Chandler Lake Quadrangle	280
Clarence Fan Plain, Demarcation Point Quadrangle	52
Colville Delta, Harrison Bay Quadrangle	162
Demarcation Bay, Demarcation Point Quadrangle	140
Disappointment Ridge, Utukok River Quadrangle	264
Echooka River, Sagavanirktok Quadrangle	174
Epizetka Plains, Point Lay Quadrangle	64
Esook Lake, Harrison Bay Quadrangle	206
Flaxman Island, Flaxman Island Quadrangle	116
Foggy Island Bay, Beechey Point Quadrangle	56
Fortress Mountain, Chandler Lake Quadrangle	280

	Page
Franklin Bluff, Sagavanirktok Quadrangle	70
Hatbox Mesa, Chandler Lake Quadrangle	86
Icy Cape - Kasagaluk Lagoon, Wainwright Quadrangle	108
Icy Reef - Beaufort Lagoon, Demaraction Point Quadrangle	124
Igloo Mountain, De Long Mountains Quadrangle	82
Ignek Mesa, Mt. Michelson Quadrangle	90
Ikpikpuk River, Teshekpuk Quadrangle	160
Ishupak Bluff, Umiat Quadrangle	314
Ivishak - Saviukviayak, Sagavanirktok Quadrangle	166
Jago Valley, Demaraction Point Quadrangle	244
Judy Creek, Umiat Quadrangle	208
Kadleroshilik Mound, Beechey Point Quadrangle	218
Kadleroshilik River, Beechey Point Quadrangle	222
Kasagaluk Lagoon, Point Lay Quadrangle	126
Katakturuk Fold, Mt. Michelson Quadrangle	318
Katakturuk Plateau, Mt. Michelson Quadrangle	78
Killik River Valley, Killik River Quadrangle	240
Kiruktagiak Notch, Chandler Lake Quadrangle	290
Kokolik River, Point Lay Quadrangle	234
Kongakut Fan Plain, Demarcation Point Quadrangle	68
Kukpowruk River, Point Lay Quadrangle	170
Kurupa - Cascade Lakes, Killik River Quadrangle	196
Lake Peters - Lake Schrader, Mt. Michelson Quadrangle	192
Lookout Ridge, Utukok River Quadrangle	266
Meade River, Meade River Quadrangle	172
Meade River Plains, Meade River Quadrangle	58

Page

Nasaurak Mountain, Chandler Lake Quadrangle - - - - - - - - - - 316

Ninuluk Bluff, Ikpikpuk River Quadrangle - - - - - - - - - - - 308

Okpilak Valley, Demarcation Point Quadrangle - - - - - - - - - 256

Oumalik River, Teshekpuk Quadrangle - - - - - - - - - - - - - - 230

Outpost Mountain, Umiat Quadrangle - - - - - - - - - - - - - - 98

Pik Dunes, Teshekpuk Quadrangle - - - - - - - - - - - - - - - - 194

Plover Islands, Barrow Quadrangle - - - - - - - - - - - - - - - 144

Point Barrow - Nuwuk Spit, Barrow Quadrangle - - - - - - - - - 136

Point Hope, Point Hope Quadrangle - - - - - - - - - - - - - - - 120

Poko Mountain, De Long Mountains Quadrangle - - - - - - - - - - 94

Putuligayuk Plains, Sagavanirktok Quadrangle - - - - - - - - - 50

Rooftop Ridge, Chandler Lake Quadrangle - - - - - - - - - - - - 274

Sadlerochit Springs, Mt. Michelson Quadrangle - - - - - - - - - 328

Sagavanirktok - Itkillik, Philip Smith Mountains Quadrangle - 252

Sagavanirktok River, Sagavanirktok Quadrangle - - - - - - - - - 156

Schrader Bluff, Umiat Quadrangle - - - - - - - - - - - - - - - 312

Shainin Lake, Chandler Lake Quadrangle - - - - - - - - - - - - 202

Shaviovik River Pingo Field, Sagavanirktok Quadrangle - - - - 232

Shublik Springs, Mt. Michelson Quadrangle - - - - - - - - - - - 324

Simpson Seeps, Teshekpuk Quadrangle - - - - - - - - - - - - - - 330

Staines Plains, Mt. Michelson Quadrangle - - - - - - - - - - - 66

Takrak Lakes, Wainwright and Meade River Quadrangles - - - - 186

Teshekpuk Lake, Teshekpuk Quadrangle - - - - - - - - - - - - - 190

Toolik River Pingo Field, Sagavanirktok Quadrangle - - - - - 228

Topagoruk Lakes, Teshekpuk Quadrangle - - - - - - - - - - - - - 200

Tuktu Escarpment, Chandler Lake Quadrangle - - - - - - - - - - 270

Page

Umiat Mountain - Shivugak Bluff, Umiat Quadrangle - - - - - - 304

Wainwright Inlet - Kuk River, Wainwright Quadrangle - - - - - 128

Walakpa Bay, Barrow Quadrangle - - - - - - - - - - - - - - - 132

White Hills, Sagavanirktok Quadrangle - - - - - - - - - - - - 74

Lifeforms

Aucella Creek, Chandler Lake Quadrangle - - - - - - - - - - - 362

Black Island, Mt. Michelson Quadrangle - - - - - - - - - - - 358

Cutaway Creek, Howard Pass Quadrangle - - - - - - - - - - - - 352

Fire Creek, Mt. Michelson Quadrangle - - - - - - - - - - - - 342

Ignek Creek, Mt. Michelson Quadrangle - - - - - - - - - - - - 354

Monotis Creek, Chandler Lake Quadrangle - - - - - - - - - - - 362

Natvakruak Lake, Chandler Lake Quadrangle - - - - - - - - - - 386

Skull Cliff, Meade River Quadrangle - - - - - - - - - - - - - 374

Tigara, Point Hope Quadrangle - - - - - - - - - - - - - - - - 380

Tuktu Bluff, Chandler Lake Quadrangle - - - - - - - - - - - - 362

Tukuto Lake, Howard Pass Quadrangle - - - - - - - - - - - - - 384

Valley of the Willows, Ikpikpuk River Quadrangle - - - - - - 372

Appendix B--Index by quadrangles

Landforms

	Page
Barrow Quadrangle	
Barrow - Brant Point	224
Barrow Plains	46
Plover Islands	144
Pt. Barrow - Nuwuk Spit	136
Walakpa Bay	132
Barter Island Quadrangle	
None	
Beechey Point Quadrangle	
Foggy Island Bay	56
Kadleroshilik Mound	218
Kadleroshilik River	222
Chandler Lake Quadrangle	
Anaktuvuk River	248
Ayiyak Mesa	96
Castle Mountain	280
Fortress Mountain	280
Hatbox Mesa	86
Kiruktagiak Notch	290
Nasaurak Mountain	316
Rooftop Ridge	274
Shainin Lake	202
Tuktu Escarpment	270

Page

De Long Mountains Quadrangle

Igloo Mountain - 82

Poko Mountain - 94

Demarcation Point Quadrangle

Angun Plains - 62

Clarence Fan Plain - 52

Demarcation Bay - 140

Icy Reef - Beaufort Lagoon - - - - - - - - - - - - - - - - - 124

Jago Valley - 244

Kongakut Fan Plain - 68

Okpilak Valley - 256

Flaxman Island Quadrangle

Flaxman Island - 116

Harrison Bay Quadrangle

Colville Delta - 162

Esook Lake - 206

Howard Pass Quadrangle

None

Ikpikpuk River Quadrangle

Ninuluk Bluff - 308

Killik River Quadrangle

Killik River Valley - 240

Kurupa - Cascade Lakes - - - - - - - - - - - - - - - - - - - 196

Lookout Ridge Quadrangle

Awuna River - 178

Page

Meade River Quadrangle

Meade River - 172

Meade River Plains - 58

Takrak Lakes - 186

Misheguk Mountains Quadrangle

None

Mt. Michelson Quadrangle

Ignek Mesa - 90

Katakturuk Fold - 318

Katakturuk Plateau - 78

Lake Peters and Lake Schrader - - - - - - - - - - - - - - - 192

Sadlerochit Springs - 328

Shublik Springs - 324

Staines Plains - 66

Philip Smith Mountains Quadrangle

Atigun Gorge - 284

Sagavanirktok - Itkillik - - - - - - - - - - - - - - - - - - 252

Point Hope Quadrangle

Cape Dyer - Kiliahlik Point - - - - - - - - - - - - - - - - 302

Cape Lisburne - 112

Cape Thompson - Crowbill Point - - - - - - - - - - - - - - 298

Point Hope - 120

Point Lay Quadrangle

Amatusuk Hills - 268

Epizetka Plains - 64

Page

Point Lay Quadrangle (continued)

Kokolik River - 234

Kasagaluk Lagoon - 126

Kukpowruk River - 170

Sagavanirktok Quadrangle

Echooka River - 174

Franklin Bluffs - 70

Ivishak - Saviukviayak - - - - - - - - - - - - - - - - - - 166

Putuligayuk Plains - 50

Sagavanirktok River - - - - - - - - - - - - - - - - - - - 156

Shaviovik River Pingo Field - - - - - - - - - - - - - - - 232

Toolik River Pingo Field - - - - - - - - - - - - - - - - 228

White Hills - 74

Teshekpuk Quadrangle

Admiralty Bay - 146

Ikpikpuk River - 160

Oumalik River - 230

Pik Dunes - 194

Simpson Seeps - 330

Teshekpuk Lake - 190

Topagoruk Lakes - 200

Umiat Quadrangle

Ishupak Bluff - 314

Judy Creek - 208

Outpost Mountain - 98

Schrader Bluff - 312

Page

Umiat Quadrangle (continued)

Umiat Mountain - Shivugak Bluff - - - - - - - - - - - - - 304

Utukok River Quadrangle

Archimedes Ridge - 260

Disappointment Ridge - - - - - - - - - - - - - - - - - - - 264

Lookout Ridge - 266

Wainwright Quadrangle

Icy Cape - Kasagaluk Lagoon - - - - - - - - - - - - - - - 108

Takrak Lakes - 186

Wainwright Inlet - Kuk River - - - - - - - - - - - - - - - 128

Lifeforms

Chandler Lake Quadrangle

Aucella Creek - 362

Monotis Creek - 362

Tuktu Bluff - 362

Natvakruak Lake - 386

Howard Pass Quadrangle

Cutaway Creek - 352

Tukuto Lake - 384

Ikpikpuk River Quadrangle

Valley of the Willows - - - - - - - - - - - - - - - - - - 372

Meade River Quadrangle

Skull Cliff - 374

Mt. Michelson Quadrangle

Black Island - 358

Fire Creek - 342

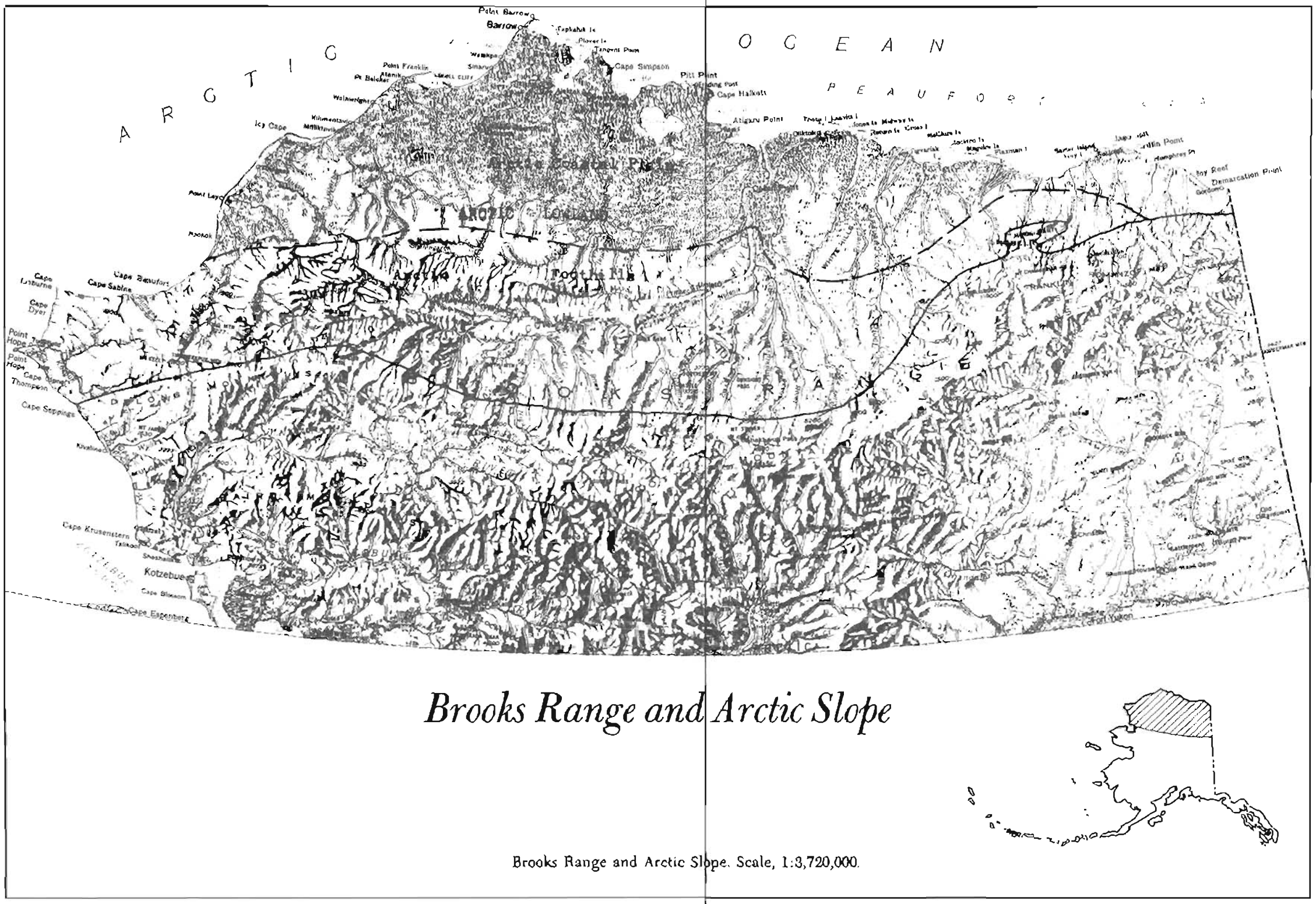
Page

Mt. Michelson Quadrangle (continued)

Ignek Creek - 354

Point Hope Quadrangle

Tigara - 380



Brooks Range and Arctic Slope

Brooks Range and Arctic Slope. Scale, 1:3,720,000.

Figure 1. Map of Northern Alaska showing physiographic divisions

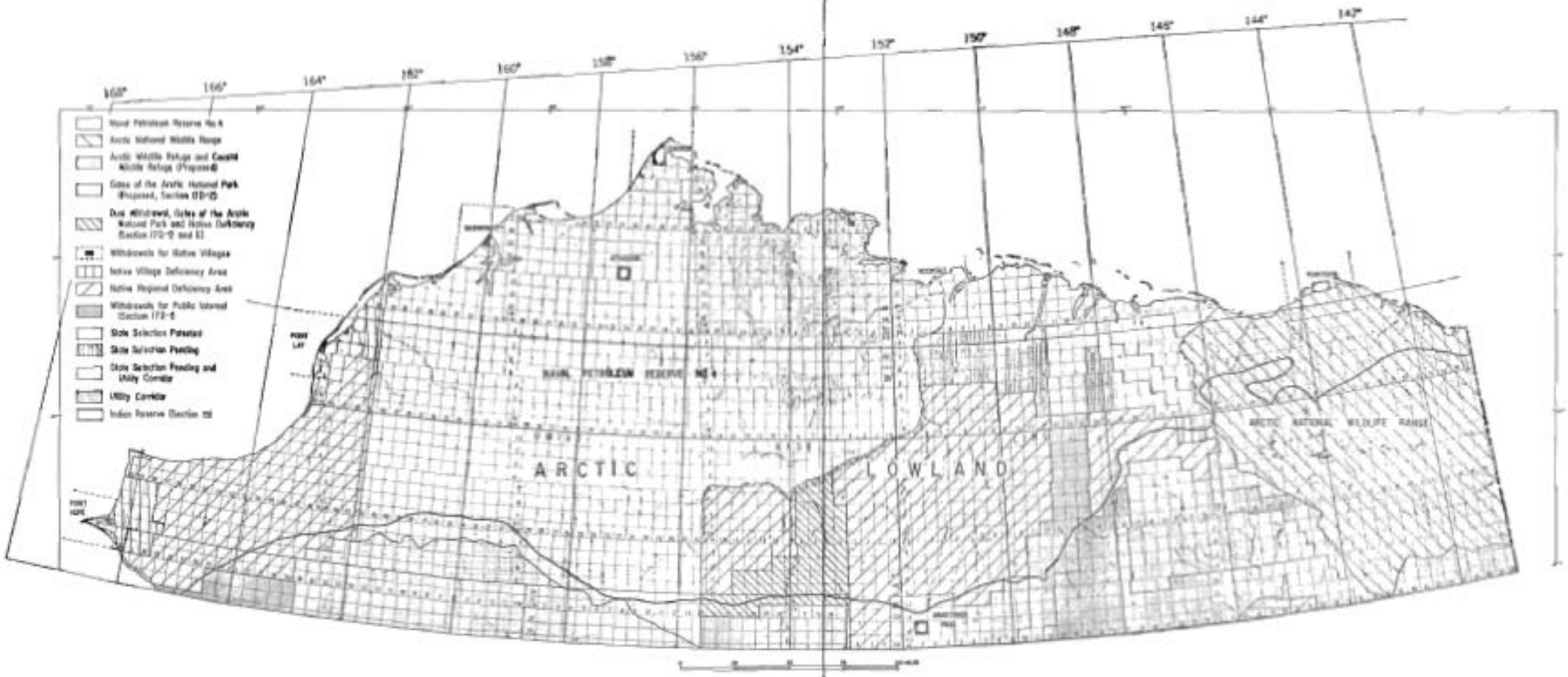


Figure 2 LAND STATUS MAP FOR NORTHERN ALASKA

COMPILED FROM BUREAU OF LAND MANAGEMENT MAP
EDITION OF MARCH, 1974

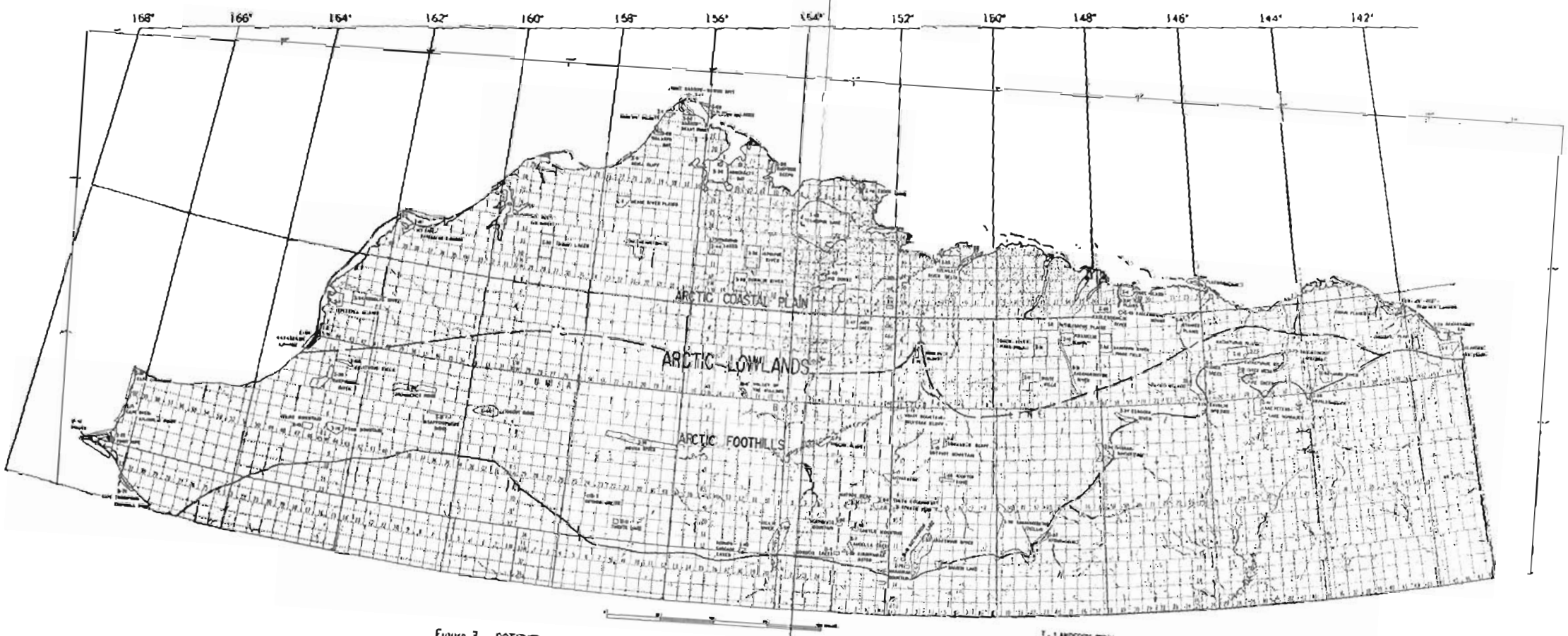


Figure 3 POTENTIAL NATURAL LANDFORM AND LIFEFORM LANDMARKS IN THE ARCTIC LOWLAND

I - LANDFORM SITES
II - LIFEFORM SITES