Summary File Report
Third, Second, Submarine, Monroeville and Intermediate Beaches, Nome District, Alaska

Submitted to

U. S. Bureau of Mines
Alaska Field Operations Center
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by

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CONTENTS

SUMMARY FILE NARRATIVE

Property Name: Third, Submarine, Second, Monroeville and Intermediate Beaches, Nome, Alaska

Property Location: The properties are located T11S, R33W, T11S, R34W, and T12S, R33W, Kateel Meridian. The location of the properties is shown on Figure 1.a. 1:250,000 map of the Nome quadrangle, Alaska. The properties are located within 5 km of Nome and are accessible via motor vehicle.

Detailed ownership data: The properties are owned and operated by the Alaska Gold Company. The company is a subsidiary of U. V. Industries, Inc., 437 Madison Avenue, New York, New York 10022.

History and production: The early history of the Nome mining district was reviewed in Collier (1908). Gold was discovered on Anvil Creek, a tributary of Snake River on September 22, 1898 by Jafet Lindeberg, Jon Brynteson and Eric O. Lindblom. The great rush to the district began in 1399 and continued through 1900. By 1900 the deep gravels and beach placers had been discovered and a long period of economic stability commenced (Koschmann and Bergendahl, 1960). Koschmann and Bergendahl (1968) estimate that from 1897 to 1959 the district produced at least 3,606,000 troy ounces of gold however there is no production data for the period 1931-1946. Mulligan (1967) estimated that total placer production for the district had exceeded 4 million troy ounces. U. S. Bureau of Mines unpublished data shows reported production through 1974 of approximately 2 million troy ounces. Since 1974, the Alaska Gold Company has been the major producer in the district. The reported production of 117 days in 1975 was 7,796 troy ounces after processing 566,399 cubic meters (740,391 cubic yards) of gravel. Production was from one 9 cu. ft. dredge working the Third Beach. The 1976 production totalled 14,320 troy ounces of gold from 913,884 cubic meters (1,194,620 cubic yards) of gravel. The 1977 production came from one 9 cu. ft. dredge working the Third Beach at a rate of 6,885 cubic meters (9,000 cubic yards) per day and one 9 cu. ft. dredge working the Submarine Beach at a rate of 5,355 cubic meters (7,000 cubic yards) per day.

General Geology: The Nome Beaches are located on the southwest coast of the Seward Peninsula. The Peninsula includes approximately 65,000 square kilometers of complex geology and diverse topography. Geologic units include Precambrian schist, phyllite, slate and limestone, Paleozoic carbonates, Mesozoic volcanics and Cenozoic volcanic and clastic sedimentary rocks. The older rocks are intruded by Cretaceous granitic rocks ranging in composition form diorite to two-mica granite.

The rocks of the Seward Peninsula have undergone intense tectonic deformation thus they exhibit varying degrees of dynamic metamorphism.

The geologic column has been complicated by tectonic mixing on a large scale near major thrust faults (Sainsbury, 1975). The oldest rocks in the Nome area are metavolcanic and metasedimentary Precambrian rocks. The rocks were formerly referred to as the "York Slate" and the Nome Group. The metavolcanic sequence includes greenschist and associated schistose marble. The rocks contain chlorite, epidote, albite, quartz, calcite, amphibole, sphene and minor local garnet and glaucophase. The metasedimentary sequence includes graywacke, siltstone, slate, phyllite, phyllitic schist, schist, metasiltite, calcareous and micaceous schist and minor marble. The sequences are intruded by mafic sills and dikes. The rocks show multiple S-planes indicating polymetamorphism. The prominent drag folding is overturned to the east thus indicating eastward movement. The Precambrian rocks in the Nome area are intersected by fractures and fracture filling quartz veins. The veins and fracture zones exhibit sericitic-clay-quartz alteration. The veins contain sulfide minerals and scheelite. The Precambrian rocks are unconformably overlain by Paleozoic limestone and marbles. The limestones are light to dark gray and in part dolomitic. The rocks have been tentatively assigned to the Devonian based on fossils in similar lithologies in other areas of the Seward Peninsula.

Pleistocene and Holocene beach deposits overlie the Precambrian and Paleozoic rocks. The deposits include silt, sand and gravel. The beach deposits are the hosts for the placer gold deposits of the Nome District.

The localization of the placer gold deposits of the Seward Peninsula in general and the Nome beach deposits in particular is controlled by the following regional factors.

1. The presence of the Precambrian rocks.
2. The presence of granitic rocks or the indication of buried intrusives by the localization of intense fracturing, by the presence of intricate quartz vein systems and by the occurrence hydrothermal alteration.

Description of the Ore Bodies: Cobb (1973) described in detail the placer deposits of the Nome District. The beach and offshore placer deposits were formed by eustatic changes in sea level during the Pliocene and Pleistocene. Cobb (1978) has summarized the deposits as follows.

> Glacial erosion of lodes and stream placers in hills north of Nome coastal plain distributed gold in glacial drift on coastal plain and on sea bottom offshore of present beach. Gold was concentrated by wave action during pauses in eustatic changes in sea level during late Pliocene and Pleistocene. Gold also on old marine abrasion platforms (particularly along what was once thought to be an old channel of Anvil Cr.). 6 beaches at or above and 6 beaches below present sea level. Gold first discovered and mined at present beach in 1899. Since then gold has been mined from second, third, intermediate, and Monroeville beaches above sea level and from inner and outer submarine beaches below sea level; submarine beaches are landward from present shoreline. Offshore beaches may contain gold; have not been adequately explored. Fourth beach (at base of

hills) is too low grade to be mined, but has contributed gold to minable stream placers in coastal plain. Offshore are probable buried stream channels that may contain gold and thin auriferous relict gravels from which fine and light material has been winnowed by currents; mining would present technological problems because of thinness (about 1 ft.) of gravels. Beach deposits have been mined by rockers (present beach), much drift mining, and (since about 1909) dredges that also worked auriferous glacial drift, particularly near Anvil and Little Creeks. For economic reasons dredging ceased in 1962; resumed in 1975. Most creeks in coastal plain concentrated gold from glacial drift and (or) old beaches. Only metallic minerals found in beach and coastal plain deposits are scheelite (Saturday Cr.) and sulfides (including chalcopyrite and arsenopyrite probably locally derived from as yet undiscovered lodes."

Figure 2 is a diagrammatic sketch of the Nome Beach deposits showing their relationship to the Precambrian and Paleozoic rocks. The depths of the beach placers ranges from 13.68 meters (44.86 ft.) to 23.35 meters (76.60 feet). The deposits cover 518.01 hectares (1,280 acres) and contain 97,024,950 cubic meters (126,830,000 cubic yards) of gravel.

Probabilistic grade quantity matrix calculations: Reserve data was taken from unpublished company data dated May 1, 1975. Reserves are estimated at 1,193,000 troy ounces of gold (0.0123 troy ounces per cubic meter or 0.0094 troy ounces per cubic yard).

Mining and Beneficiation Methods: The Third Beach is currently being mined by a single 9 cu. ft. bucketline dredge with a capacity of 6,885 cubic meters (9,000 cubic yards) per day. The Submarine Beach is being mined with a 9 cu. ft. bucketline dredge at a rate of 5,355 cubic meters (7,000 cubic yards) per day.

Since itemized costs for the existing operations were not available, estimates were made for the existing and proposed operations. The unit costs of mining for the Third, Second, Submarine and Monroeville and Intermediate Beaches are $1.42, $2.09, $1.39 and $1.60 per cubic meter respectively. The corresponding capital costs are $14,111,553, $14,093,124, $13,721,780, and $15,118,666. The unit beneficiation costs are $0.19, $0.19, $0.25 and $0.19 per cubic meter respectively. The estimated capital cost of beneficiation for each of the operations is $2,000,000.

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APPENDIX A. - Probabilistic Grade Quantity Matrix Calculations

The yardage of dredgeable gravel and the grade of each of the beaches is given in Table I which is taken from the Alaska Gold Company Prospectus, dated May 1, 1975. Total reserves for the Nome beaches as of February 18, 1975 were 126,830,000 cubic yards containing an estimated 1,193,000 troy ounces.

APPENDIX B. - Surface Mining Calculations

B-1. Swell factor (all beaches same):

In place density: 2.00 g/cm^3

Loose density: 1.67 g/cm^3

$$\% \text{ Swell factor} = \frac{(2.00 - 1.67)(100)}{1.67} = 20\%$$

$$\text{Swell factor} = \frac{100}{100 + \% \text{ Swell}} = \frac{100}{200} = 0.83$$

B-2. Percent waste rock (all beaches same):

Assume overburden muck only waste material mined.

Muck only very small portion of total geologic column

2 ft. (average depth) x 1280 acres (table 1) x 43560 $ft^2/acre/27\ ft^3/yd^3$ = 4,130,133 yds

$$4{,}130{,}133\ yds^3 \times \frac{.765\ ft^3/yd^3}{m^3/yd^3} = 3{,}159{,}552\ yd^3$$

$$\% \text{ waste rock} = \frac{(\text{overburden } m^3)(100)}{(\text{overburden } m^3) + (\text{productive gravel } m^3)}$$

$$= \frac{}{97{,}024{,}950 + 3{,}159{,}552}$$

$$= 3.15\%$$

B-3. Preproduction stripping; none

B-4. Mine production:

B-4a. Thawing operations

Third Beach

Area	approximately (900 ft x 14,000 ft)
Acres	293
Square feet	12,763,080
Drill hole spacing	32 ft x 32 ft
Area	1024 ft^2

Average Depth 76.60 ft

Life 23.67 yrs

Dredge/Thaw Area per Year

12,763,080 ft^2/23.67 yrs = 539,209 ft^2/yrs

Number of Thaw Points per Year

539,209 ft^2/yr/1024 ft^2/pt - 527 pts

Length of Drilling per Year

527 pt/yr x 76.60 ft/pt = 40,368 pt/yr

Water Requirements (use 20 x 28 = 560 pts)

1.5 MI*/pt @ 25-30 psi =

1.5 MI/pt x 1.5 cfm/MI =

2.25 cfm/pt

560 pts x 2.25 cfm/pt =

1260 cfm

7.48 gal/ft^3 x 1260 cfm =

8924 gpm

Pump Requirements

2 each 12" x 10" centrifugal slurry, rubber lined closed impeller, 200 hp each

2 each syncronous motors (1800 rpm)

Pipe Requirements

Main Line

h_f = Head Loss

f = Friction Factor**

L = Length of Pipe

*MI = Miners Inch
**fig. 21 Mechanical Engineers Handbook

G = Volume in gpm

D = Diameter of Pipe in inches

$h_f = fLG^2/32.1D^5$

$= f(2.5)(5280)(8924)^2/32.1\ D^5$

$= 3.27 \times 10^{10} f/D^5$

R = Reynolds Number

u = 0.0179 poise

p = 1 g/cm^3

R = 31.6 Gp/uD

$= (31.6)(8924)(1)/0.0179D$

$= 1.58 \times 10^7/D$

Trial 1, D = 36"

R = 4.39×10^5, f = 0.015

$h_f = 3.27 \times 10^{10}(0.015)/(36)^5$

= 8.11 ft

Trial 2, D = 42"

R = 3.76×10^5 f = 0.015

$h_f = 3.27 \times 10^{10}(0.015)/(42)^5$

= 3.75 ft

Trial 3, D = 48"

R = 3.29×10^5 f = 0.015

$h_f = 3.27 \times 10^{10}(0.015)/(48)^5$

= 1.93 ft

Use 48" Pipe

Secondary Lines

Thaw Point Grid (20 x 28 = 560 pts)

7 each Secondary lines 864 ft long (27 x 32 ft)

8924 gpm/7 lines = 1275 gpm/line

$h_f = fLG^2/32.1\ D^5$

$= (864)(1275)^2\ f/32.1\ D^5$

$= 4.38 \times 10^7\ f/32.1\ D^5$

$R = 31.6\ Gp/uD$

$= 31.6(1275)(1)/(0.0179)D$

$= 2.25 \times 10^6/D$

Trial 1, 8"

$R = 2.81 \times 10^5 \quad f = 0.016$

$h_f = (4.38 \times 10^7)(0.016)/(8)^5$

$= 21.39$ ft

Trial 2, 12"

$R = 1.88 \times 10^5 \quad f = 0.017$

$h_f = (4.38 \times 10^7)(0.017)/(12)^5$

$= 2.99$ ft

Trial 3, 14"

$R = 1.61 \times 10^5 \quad f = 0.018$

$h_f = (4.38 \times 10^7)(0.018)/(14)^5$

$= 1.47$ ft

Use 14" Pipe

Connecting Pipes (see schematic)

(45.25 ft) x (4) + 5 ft = 186 ft

186 ft/5 pts = 37.20 ft/pts

37.20 ft/pt x 560 pts = 20,832 ft

Second Beach

Area (approx. 900 ft x 15,000 ft)

Acres	305
Square feet	13,285,800
Drill hole spacing	32 ft x 32 ft
Area	1024 ft^2
Average depth	44.86 ft
Life	14.43 yrs

Dredge/Thaw Area per Year

13,285,800 ft^2/14.43 yrs = 920,707 ft^2/yr

Number of Thaw Points per Year

920,707 ft^2/yr/1024/ ft^2/pt = 899

Length of Drilling per Year

899 pts/yr x 44.86 ft/pt = 40,329 ft/yr

Water Requirements (use 33 x 28 = 924)

1.5 MI/pt @ 25-30 psi

1.5 MI/pt x 1.5 cfm/MI

2.25 cfm/PT

924 pts x 2.25 cfm/PT = 2079 cfm

1.48 gal/ft^3 x 2079 cfm = 15,551 gpm

Pump Requirements

2 each 14" x 12" Centrifugal slurry, rubber-lined closed impeller, 350 hp each

2 each Synchronous motors (1800 rpm)

Pipe Requirements

Main Line

$h_f = fLG^2/32.1\ D^5$

$= f(2.5)(5280)(15,551)^2/32.1\ D^5$

$= 9.94 \times 10^9\ f/D^5$

$R = 31.6\ Gp/uD$

$= (31.6)(15,551)(1)/0.0179\ D$

$= 2.75 \times 10^7/D$

Trial 1, D = 42"

$R = 6.55 \times 10^5 \quad f = 0.014$

$h_f = 9.94 \times 10^9\ (0.014)/(42)^5$

$= 10.65$ ft.

Trial 2, D = 48"

$R = 2.75 \times 10^7/D$

$= 5.73 \times 10^5 \quad f = 0.014$

$h_f = 9.94 \times 10^{10}(0.014)/(48)^5$

$= 5.46$ ft

Trial 3, D = 54"

$R = 2.75 \times 10^7/D$

$= 5.09 \times 10^5 \quad f = 0.014$

$h_f = 9.94 \times 10^{10}(0.014)/(54)^5$

$= 3.03$ ft

Trial 4, D = 60"

$R = 2.75 \times 10^7/D$

$= 4.58 \times 10^5 \quad f = 0.014$

$h_f = 9.94 \times 10^{10}(0.014)/(60)^5$

$= 1.79$ ft

Use 60" Pipe

Secondary Lines

Thaw Point Grid (33 x 28 = 924 pts)

11 each Secondary lines 864 ft long (27 x 32 ft)

15,551 gpm/11 lines = 1414 /line

$h_f = fLG^2/32.1\ D^5$

$= (864)(1414)^2 f/32.1\ D^5$

$= 5.38 \times 10 \times 10^7 f/D^5$

$R = 31.6\ Gp/uD$

$= 31.6(1414)(1)/(0.0179)D$

$= 2.50 \times 10^6/D$

Trial 1, 8"

$R = 3.12 \times 10^5$ $f = 0.016$

$h_f = (5.38 \times 10^7)(0.016)/(8)^5$

$= 26.27$ ft

Trial 2, 12"

$R = 2.08 \times 10^5$ $f = 0.018$

$h_f = (5.38 \times 10^7)(0.018)/(12)^5$

$= 3.89$ ft

Trial 3, 14"

$R = 1.79 \times 10^5$ $f = 0.018$

$h_f = (5.38 \times 10^7)(0.018)/(14)^5$

$= 1.80$ ft

Use 14" Pipe

Connecting Pipes (see schematic)

(45.25 ft) x (4) + 5" = 186 ft

186 ft/5 pts = 37.20 ft/pt

37.20 ft/pt x 924 pts = 34,373 ft

Submarine Beach

Area

Acres	258
Square Feet	11,238,480
Drill Hole Spacing	32 ft x 32 ft
Area	1024 ft^2
Average Depth	73.71 ft
Life	25.78 yrs

Dredge/Thaw Area per Year

11,238,480 ft^2/25.78 yrs = 435,938 ft^2/yr

Number of Thaw Points per Year

435,938 ft^2/yr/1024 ft^2/pt = 426 pt/yr

Length of Drilling per Year

426 pts/yr x 73.71 ft/pt = 31,401 ft/yr

Water Requirements (use 16 x 28 = 448 pts)

1.5 MI/pt @ 25-30 psi

1.5 MI x 1.5 cfm/PT = 2.25 cfm/pt

448 pts x 2.25 cfm/pt = 1008 cfm

7.48 gal/ft^3 x 1008 cfm = 7540 gpm

Pump Requirements

1 each 14" x 12" Centrifugal Slurry, Rubber lined closed impeller, 350 hy

1 each Synchronous motor (1800 rpm)

Pipe Requirements

Mainline

$h_f = fLG^2/32.1\ D^5$

$= f(1000)(7540)^2/32.1\ D^5$

$= 1.77 \times 10^9 f/D^5$

$R = 31.6\ Gp/uD$

$= (31.6) \times (7540)(1)/0.0179\ D$

$= 1.33 \times 10^7/D$

Trial 1, D = 36"

$R = 3.70 \times 10^5$ f = 0.016

$h_f = 1.77 \times 10^9 \times (0.016)/36^5$

= .47 ft

Trial 2, D = 24"

$R = 5.30 \times 10^5$ f = 0.015

$h_f = 1.77 \times 10^9 \times (0.015)/(24)^5$

= 3.34ft

Trial 3, D = 12"

$R = 1.11 \times 10^6$ f = 0.015

$h_f = 1.77 \times 10^9 \times (0.015)/(12)^5$

= 106.76 ft

Use 24" Pipe

Secondary Lines

Thaw Point Grid (use 16 x 28 = 448 pts)

6 each Secondary lines 864 ft long (27 x 32 ft)

7540 gpm/6 lines = 1257 gpm/line

$h_f = fLG^2/32.1\ D^5$

$= f(864)(1257)^2/32.1\ D^5$

$R = 31.6\ Gp/uD$

$= 31.6(1257)(1)/(0.0179)D$

$= 2.22 \times 10^5/D$

Trial 1, 8"

$R = 2.78 \times 10^4 \quad f = 0.026$

$h_f = (4.93 \times 10^7)(0.026)/(8)^5$

$= 39.12$ ft

Trial 2, 12"

$R = 1.85 \times 10^4 \quad f = 0.028$

$h_f = (4.93 \times 10^7)(0.028)/(12)^5$

$= 5.55$ ft

Trial 3, 14"

$R = 1.59 \times 10^4 \quad f = 0.030$

$h_f = (4.93 \times 10^7)(0.030)/(14)^5$

$= 2.75$ ft

Trial 4, 18"

$R = 1.23 \times 10^4 \quad f = 0.033$

$h_f = (4.93 \times 10^7)(0.033)/(18)^5$

$= 0.86$ ft

Use 14" Pipe

Connecting Pipes (see schematic)

(45.25 ft) x (4) + 5" = 186 ft

186 ft/5 pts = 37.20 ft/pt

37.20 ft/pt x 924 pts = 34,373 ft

Monroeville and Intermediate Beaches

Area	
Acres	381
Square feet	16,596,360
Drill hole spacing	32 ft x 32 ft
Area	1024 ft^2
Average depth	55.00 ft
Life	22.09 yrs

Dredge/Thaw Area per Year

16,596,380 ft^2/22.09 yrs = 751,306 ft^2/yr

Number Thaw Points per Year

751,306 ft^2/yr/1024 ft^2/pt = 734 pts/yr

Length of Drilling per Year

734 pts/yr x 55 ft/pt = 40,370 ft/yr

Water requirements (use 734 pts)

1.5 MI/pt @ 25-30 psi

1.5 MI/pt x 1.5 cfm/MI = 2.25 cfm/pt

734 pts x 2.25 cfm/pt = 1652 cfm

7.48 gal/ft^3 x 1652 cfm = 12,357 gpm

Pump Requirements

2 each 14" x 12" centrifugal slurry, rubber lined closed impeller, 350 hp each

2 each synchronous motors (1800 rpm)

Pipe Requirements

Main Line

$h_f = fLG^2/32.1\ D^5$

$= f(2)(5280)(12,357)^2/32.1\ D^5$

$= 5.02 \times 10^{10} f/D^5$

$R = 31.6\ Gp/uD$

$= (31.6)(12,357)(1)/0.0179\ D$

$= 2.18 \times 10^7/D$

Trial 1, D = 42"

$R = 5.19 \times 10^5 \quad f = 0.015$

$h_f = 5.02 \times 10^{10}(0.015)/(42)^5$

$= 5.76$ ft

Trial 2, D = 48"

$R = 4.54 \times 10^5 \quad f = 0.014$

$h_f = 5.02 \times 10^{10}(0.014)/(48)^5$

$= 2.76$ ft

Trial 3, D = 54"

$R = 4.04 \times 10^5 \quad f = 0.015$

$h_f = 5.02 \times 10^{10}(0.015)/(54)^5$

$= 1.64$ ft

Use 48" Pipe

Secondary Lines

Thaw Point Grid (use 27 x 28 = 756 pts)

9 each Secondary lines 864 ft long (27 x 32 ft)

12,357 gpm/9 lines = 1373 gpm/line

$h_f = fLG^2/32.1\ D^5$

$= f(864)(2060)^2/32.1\ D^5$

$= (31.6)(2060)^2/32.1\ D^5$

$= 1.14 \times 10^8 f/D^5$

$R = 31.6\ Gp/uD$

$= (31.6)(2060)(1)/(0.179)D$

$= 3.64 \times 10^5/D$

Trial 1, D = 14"

$R = 2.6 \times 10^4 \quad f = 0.027$

$h_f = (1.14 \times 10^8)(0.027)/(14)^5$

$= 5.72$ ft

Trial 2, D = 18"

$R = 2.02 \times 10^4$ $f = 0.028$

$h_f = (1.14 \times 10^8)(0.028)/(18)^5$

$= 1.69$ ft

Use 18" Pipe

Connecting Pipes (see schematic)

(45.25 ft) x (4) + 5" = 186 ft

186 ft/5 pts = 37.20 ft/pt

37.20 ft/pt x 448 pts = 16,666 ft

Drilling/Install Thaw Points

1 hole/hr

4 man crew - two drilling, two installing and hooking up points

Third Beach

560 points x 1 hr = 560 machine-hours

Assume 160 hr/mo.

560/160 = 3.5 months

Submarine Beach

448 points x 1 hr. = 448 machine - hours

448 hrs x 4 men = 1792 man - hours

Assume 160 hr/mo

448/160 = 2.8 months

Second Beach

900 points x 1 hr = 900 machine - hours

900 hrs x 4 men = 3600 man - hours

Assume 160 hr/mo

900/160 = 5.6 months

Monroeville and Intermediate Beaches

734 points x 1 hr = 734 machine - hours

734 hrs x 4 men = 2936 man - hours

Assume 160 hr/mo

734/160 = 4.6 months

Total Drilling/Installation Time = 3.5 + 2.8 +5.6 +4.6

= 16.5 months

Assume Drilling/Installation: October-April = 7 months

Total Drilling Requirements = 16.5/7 = 2.4 machine/crew

Use: 3 each rotary dills w/down hole hammers

3 each 4 man crews

B-4b. Dredging Operations

Table II lists the dredging area and volume of dredging material of the Nome Beaches.

Third Beach (actual)

9 ft^3 dredge (135 buckets) = 9,000 yd^3/day (6,885 m^3/day)

9,000 yd^3/day x 170 days/yr = 1,530,000 yd^3/yr (1,170,450 m^3/yr)

36,210,000 yd^3/1,530,000 yd^3/yr = 23.67 yrs

Use: 1 each 9 cubic foot bucket line dredge

Submarine (actual)

9 ft^3 dredge (105 buckets) = 7,000 yd^3/day (5,355 m^3/day)

7,000 yd^3/day x 170 days/yr = 1,190,000 yd^3/yr (910,350 m^3/yr)

30,680,000 yd^3/1,190,000 yd^3/yr = 25.78 yrs

Use: 1 each 9 cubic foot bucket line dredge

Second (proposed)

9 ft^3 dredge (135 buckets) = 9,000 yd^3/day (6,885 m^3/day)

9,000 yd^3/day x 170 days/yr = 1,530,000 yd^3/yr (1,170,450 m^3/yr)

22,075,000 yd^3/1,530,000 yd^3/yr = 14.43 yrs

Use: 1 each 9 cubic foot bucket line dredge

Intermediate (proposed)

9 ft^3 dredge (135 buckets) = 9,000 yd^3/day (6885 m^3/day)

9,000 yd^3/day x 170 days/yr = 1,530,000 yd^3/yr (1,170,450 m^3/yr)

33,805,000 yd^3/1,530,000 yd^3/yr = 22.09 yrs

Use: 1 each 9 cubic foot bucket line dredge

B-5. Equipment Requirements

B-5a. Third Beach

Description	Quantity	Capital Cost	Monthly Operating Cost
Bucket line dredge (9 ft^3) (1000 hp)	1	$5,000,000	$ 5,000
Tractor dozer (D-8)	2	360,000	6,000
Piping			
Main 48" (ft)	13,200	1,056,000	---
Secondary 14" (ft)	6,048	241,920	---
Connecting (ft)	20,832	6,250	---
Thaw Points (76.60 ft x $1.62/ft x 527)	527	65,396	---
Pumps (12" x 10") (350 hp ea)	2	30,000	150
Power Distribution lines (ft) ($7.00/ft x 13,200 ft)	13,200	92,400	---
Power (kw-hr) (1400 hp @ $.18/kw-hr)	751,968	---	135,354
3/4 ton pickup truck	2	17,000	170
Skid mounted rotary drill and misc. (1)		100,000	100
TOTALS		$6,968,966	$146,774

(1) Machine tools not included in dredge machine shop.

B-5b. Second Beach

Description	Quantity	Capital Cost	Monthly Operating Cost
Bucket line dredge (9 ft^3) (1000 hp)	1	$5,000,000	$ 5,000
Tractor dozer (D-8)	2	360,000	6,000
Piping			
Main 60" (ft)	13,200	1,254,000	---
Secondary 14" (ft)	9,504	380,160	---
Connecting (ft)	34,373	10,312	---
Thaw Points (44.86 ft x $1.62/ft x 899)	899	65,333	---
Pumps (14" x 12") (350 hp ea)	2	40,000	200
Power Distribution lines (ft) ($7.00/ft x 13,200 ft)	13,200	92,400	---
Power (kw-hr) (1700 hp @ $.18/kw-hr)	913,104	---	164,359
3/4 ton pickup truck	2	17,000	170
Skid mounted rotary drill and misc. (1)		100,000	100
TOTALS		$7,319,205	$175,829

(1) Machine tools not included in dredge machine shop.

B-5c. Submarine Beach

Description	Quantity	Capital Cost	Monthly Operating Cost
Bucket line dredge (9 ft^3) (1000 hp)	1	$ 5,000,000	$ 5,000
Tractor dozer (D-8)	2	360,000	6,000
Piping			
Main 24" (ft)	1,000	60,000	---
Secondary 14" (ft)	5,184	207,360	---
Connecting (ft)	34,373	10,312	---
Thaw Points (73.71 ft x $1.62/ft x 426)	426	50,869	---
Pumps (14" x 12") (350 hp ea)	1	20,000	100
Power Distribution lines (ft) ($7.00/ft x 5280 ft)	5,280	36,960	---
Power (kw-hr) (1350 hp @ $.18/kw-hr)	725,112	---	130,520
3/4 ton picup truck	2	17,000	170
Skid mounted rotary drill and misc. (1)		100,000	100
TOTALS		$5,862,501	$141,890

(1) Machine tools not included in dredge machine shop.

B-5d. Monroeville and Intermediate Beaches

Description	Quantity	Capital Cost	Monthly Operating Cost
Bucket line dredge (9 ft^3) (1000 hp)	1	$5,000,000	$ 5,000
Tractor dozer (D-8)	2	360,000	6,000
Piping			
Main 48" (ft)	10,560	844,800	---
Secondary 18" (ft)	7,776	388,800	---
Connecting (ft)	16,666	5,000	---
Thaw Points (55.00 ft x $1.62/ft x 734)	734	65,399	---
Pumps (14" x 12") (350 hp ea)	2	40,000	200
Power Distribution lines (ft) ($7.00/ft x 10,560 ft)	10,560	73,920	---
Power (kw-hr) (1700 hp @ $.18/kw-hr)	913,104	---	164,359
3/4 ton pickup truck	2	17,000	170
Skid mounted rotary drill and misc. (1)		100,000	100
TOTALS		$6,894,919	$175,829

(1) Machine tools not included in dredge machine shop. This extra drilling rig will be used as backup equipment.

B-6. Labor Requirements

B-6a. Third Beach

Description	Number	Wages	Monthly Labor Cost
Superintendent	1	$3,000/mo	$ 3,000
Foreman (Thaw Field)	1	2,800/mo	2,800
Dredge master	1	2,800/mo	2,800
Winchmen	3	17.00/hr	8,160
Machinist	1	15.00/hr	2,400
Mechanics	3	14.00/hr	6,720
Oilers	6	10.00/hr	9,600
Electricians	3	14.00/hr	6,720
Survey Technicians	3	10.00/hr	4,800
Deckhands	6	10.00/hr	9,600
Equipment operators	6	15.00/hr	14,400
Drillers[1]	3	15.00/hr	7,200
Labor (thaw field)	5	10.00/hr	8,000
TOTAL	42		$86,200

(1) Allocated labor from three 4-man crews of drillers and thaw point installers

B-6b. Second Beach

Description	Number	Wages	Monthly Labor Cost
Superintendent	1	$3,000/mo	$ 3,000
Foreman (Thaw field)	1	2,800/mo	2,800
Dredge master	1	2,800/mo	2,800
Winchmen	3	17.00/hr	8,160
Machinist	1	15.00/hr	2,400
Mechanics	3	14.00/hr	6,720
Oilers	6	10.00/hr	9,600
Electricians	3	14.00/hr	6,720
Survey Technicians	3	10.00/hr	4,800
Deckhands	6	10.00/hr	9,600
Equipment operators	6	15.00/hr	14,400
Drillers (1)	3	15.00/hr	7,200
Labor (Thaw field)	9	10.00/hr	14,400
TOTALS	46		$92,600

(1) Allocated labor from three 4-man crews of drillers and thaw point installers.

B-6c. Submarine Beach

Description	Number	Wages	Monthly Labor Cost
Superintendent	1	$3,000/mo	$ 3,000
Foreman (Thaw field)	1	2,800/mo	2,800
Dredge master	1	2,800/mo	2,800
Winchmen	3	17.00/hr	8,160
Machinist	1	15.00/hr	2,400
Mechanics	3	14.00/hr	6,720
Oilers	6	10.00/hr	9,600
Electricians	3	14.00/hr	6,720
Survey Technicians	3	10.00/hr	4,800
Deckhands	6	10.00/hr	9,600
Equipment operators	6	15.00/hr	14,400
Drillers (1)	3	15.00/hr	7,200
Labor (Thaw field)	4	10.00/hr	6,400
TOTALS	41		$84,600

(1) Allocated labor from three 4-man crews of drillers and thaw point installers.

B-6d. Monroeville and Intermediate Beaches

Superintendent	1	$3,000/mo	$ 3,000
Foreman (Thaw field)	1	2,800/mo	2,800
Dredge master	1	2,800/mo	2,800
Winchmen	3	17.00/hr	8,160
Machinist	1	15.00/hr	2,400
Mechanics	3	14.00/hr	6,720
Oilers	6	10.00/hr	9,600
Electricians	3	14.00/hr	6,720
Survey Technicians	3	10.00/hr	4,800
Deckhands	6	10.00/hr	9,600
Equipment operators	6	10.00/hr	14,400
Drillers (1)	3	15.00/hr	7,200
Labor (Thaw field)	7	10.00/hr	11,200
TOTALS	44		$89,400

(1) Allocated labor from three 4-man crews of drillers and thaw point installers.

B-7. Overhead Requirements

(40% of labor cost)

B-7a. Third Beach

0.40 x $86,200 = $34,480

B-7b. Second Beach

0.40 x $92,600 = $37,040

B-7c. Submarine Beach

0.40 x $84,600 = $33,840

B-7d. Monroeville and Intermediate Beaches

0.40 x $89,400 = $35,760

B-8. Contingency Requirements

10% of total monthly operating, labor, and overhead costs

B-Ea. Third Beach

0.10 x $267,454 = $26,745

B-8b. Second Beach

0.10 x $305,469 = $30,547

B-8c. Submarine Beach

0.10 x $260,330 = $26,033

B-8d. Monroeville and Intermediate Beaches

0.10 x $300,989 = $30,099

B-9. Total monthly operating costs and estimated unit production costs

B-9a. Third Beach $294,199

Estimated unit production cost (EUP)

$$EUP = \frac{\text{Total monthly operating cost}}{\text{Total monthly production}}$$

$$= \frac{\$\,294,199}{9000\ yd^3/day \times 30\ day/mo \times .765\ m^3/yd}$$

$$= \$1.42/m^3$$

B-9b. Second Beach $336,016

Estimated unit production cost (EUP)

$$EUP = \frac{\text{Total monthly operating cost}}{\text{Total monthly production}}$$

$$= \frac{\$336,016}{7000\ yd^3/day \times 30\ day/mo \times .765\ m^3/yd^3}$$

$$= \$2.09/m^3$$

B-9c. Submarine Beach $286,363

Estimated unit production cost (EUP)

$$EUP = \frac{\text{Total monthly operating cost}}{\text{Total monthly production}}$$

$$= \frac{\$286,363}{9000\ yd^3/day \times 30\ day/mo \times .765\ m^3/yd^3}$$

$$= \$1.39/m^3$$

B-9d. Monroeville and Intermediate Beaches $331,088

Estimated unit production cost (EUP)

$$EUP = \frac{\text{Total monthly operating cost}}{\text{Total monthly production}}$$

$$EUP = \frac{\$331,088}{9000\ yd^3/day \times 30\ day/mo \times .765\ m^3/yd^3}$$

$$= \$1.60/m^3$$

B-10. Estimated mine capital costs

B-10a. Third Beach

1. Acquisition cost: (10% of gross value @ $150/tr oz)	$ 4,164,000
2. Exploration cost: (3 holes/5 acres x 293 acres x 76.6 ft/hole x $10.00/ft)	134,663
3. Development cost: (one season operating cost)	1,667,128
4. Equipment cost:	6,968,966
5. Working capital cost: (cost of four months of operations)	1,176,796
TOTAL	$14,111,553

B-10b. Second Beach

1. Acquisition cost: (10% of gross value @ $150/tr oz)	$ 3,444,000
2. Exploration cost: (3 holes/5 acres x 305 acres x 44.68 ft/hole x $10.00/ft)	81,764
3. Development cost: (one season operating cost)	1,904,091
4. Equipment cost:	7,319,205
5. Working capital cost: (cost of four months of operation)	1,344,064
TOTAL	$14,093,124

B-10c. Submarine Beach

1. Acquisition cost: (10% of gross value @ $150/tr oz)	$ 4,977,000
2. Exploration cost: (3 holes/5 acres x 258 x 73.71 ft/hole x $10.00/ft)	114,103
3. Development cost: (one season operating cost)	1,622,724
4. Equipment	5,862,501
5. Working capital cost: (cost of four months of operation)	1,145,452
TOTAL	$13,721,780

B-10d. Monroeville and Intermediate Beaches

1. Acquisition cost: (10% of gross value @ 150/tr oz)	$ 4,897,500
2. Exploration cost: (3 holes/5 acres x 381 acres x 55.00 ft/hole x $10.00/hole)	125,730
3. Development cost: (one season operating cost)	1,876,165
4. Equipment cost:	6,894,919
5. Working capital cost: (cost of four months of operations)	1,324,352
TOTAL	$15,118,666

APPENDIX C. - Beneficiation Calculations

C.1. Mill Design Capacity

C.1a. Third Beach

Mill design capacity: 6885 m^3/day (9000 yd^3/day)
Estimated recovery of beneficiation product: 95%
Estimated percentage of gold in concentrate: 85%
Estimated amount of beneficiation product shipped:

$$\frac{6885\ m^3}{day} \times \frac{0.31162\ g}{m^3} \times 0.95 \times \frac{1}{0.85} \times \frac{0.001\ kg}{g} = 2.398\ kg/day$$

C.1b. Second Beach

Mill design capacity: 6885 m^3/day (9000 yd^3/day)
Estimated recovery of beneficiation product: 95%
Estimated percentage of gold in concentrate: 85%
Estimated amount of beneficiation product shipped:

$$\frac{6885\ m^3}{day} \times \frac{0.42296\ g}{m^3} \times 0.95 \times \frac{1}{0.85} \times \frac{0.001\ kg}{g} = 3.255\ kg/day$$

C.1c. Submarine Beach

Mill design capacity: 5355 m^3/day (7000 yd^3/day)
Estimated recovery of beneficiation product: 95%
Estimated percentage of gold in concentrate: 85%
Estimated amount of beneficiation product shipped:

$$\frac{5355\ m^3}{day} \times \frac{0.43975\ g}{m^3} \times 0.95 \times \frac{1}{0.85} \times \frac{0.001\ kg}{g} = 2.632\ kg/day$$

C.1d. Monroeville and Intermediated Beaches

Mill design capacity: 6885 m^3/day (9000 yd^3/day)
Estimated recovery of beneficiation product: 95%
Estimated percentage of gold in concentrate: 85%
Estimated amount of beneficiation product shipped:

$$\frac{6885\ m^3}{day} \times \frac{0.39279}{m^3} \times 0.95 \times \frac{1}{0.85} \times \frac{0.001\ kg}{g} = 3.023\ kg/day$$

C.2. Equipment Requirements and Capital Costs

C.2a. Third Beach

Description	Quantity	Capital Cost (1)	Monthly Operating Cost
Bucket line dredge	1	$2,000,000	$ 2,000
Power (kw-hr)	107,424	---	19,336
TOTAL		$2,000,000	

C.2b. Second Beach

(same as Third Beach)

C.2c. Submarine Beach

(same as Third Beach)

C.2d. Monroeville and Intermediate Beaches

(same as Third Beach)

C.3. Labor Requirements

C.3a. Third Beach

Description			
Panners	3	$12.00/hr.	$ 5,760
Labor	3	10.00/hr.	4,800
Total	6		$10,560

C.3b. Second Beach

(Same as Third Beach)

C.3c. Submarine Beach

(Same as Third Beach)

C.3d. Monroeville and Intermediate Beaches

(Same as Third Beach)

(1) Five sevenths of the capital and operating costs of the dredge is allocated to the mining operation.

C.4. Overhead requirements

40% of labor

C.4a. Third Beach

0.40 x $10,560 = $4,224

C.4b. Second Beach

(Same as Third Beach)

C.4c. Submarine Beach

(Same as Third Beach)

C.4d. Monroeville and Intermediate Beaches

(Same as Third Beach)

C.5. Contingency Requirements

10% of total monthly operating, labor and overhead costs

C.5a. Third Beach

0.10 x $36,120 = $3,612

C.5b. Second Beach

(Same as Third Beach)

C.5c. Submarine Beach

(Same as Third Beach)

C.6. Total Monthly Operating Costs

C.6a.	Third Beach	$39,732
C.6b.	Second Beach	39,732
C.6c.	Submarine Beach	39,732
C.6d.	Monroeville and Intermediate Beaches	$39,732

C.7. Estimated Unit Production Cost (EUP)

$$EUP = \frac{\text{Total monthly operating cost}}{\text{Total monthly production}}$$

C.7a. Third Beach

$$EUP = \frac{\$39,732/\text{mo}}{6885\ m^3/\text{day} \times 30\ \text{days/mo}}$$

$$= \$0.19/m^3$$

C.7b. Second Beach

(Same as Third Beach)

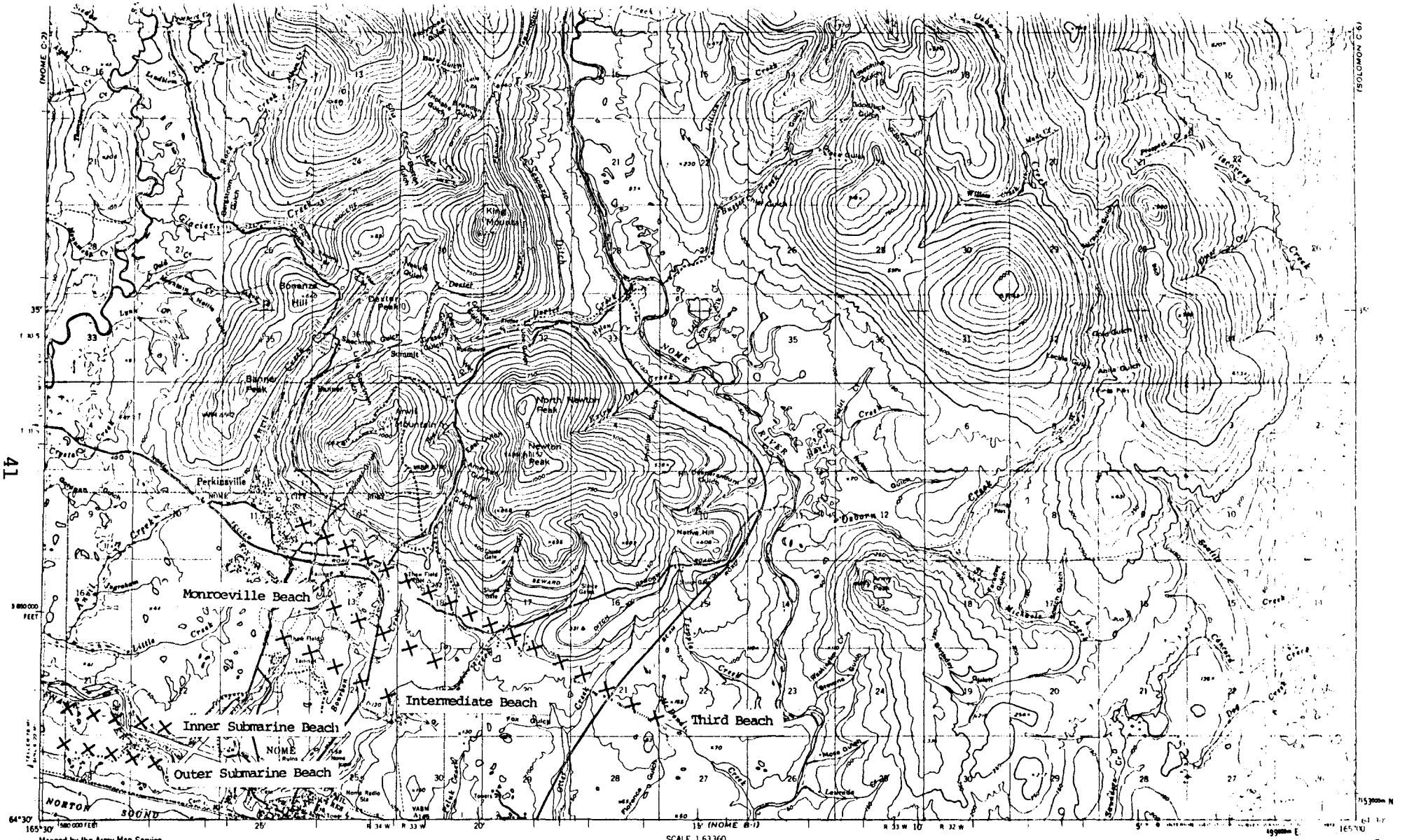
C.7c. Submarine Beach

$$EUP = \frac{\$39,732/\text{mo}}{5344\ m^3/\text{day} \times 30\ \text{days/mo}}$$

$$= .25/m^3$$

C.7d. Monroeville and Intermediate Beaches

(Same as Third Beach)



Mapped by the Army Map Service
Published for civil use by the Geological Survey

Control by USC&GS and USCE

Topography by photogrammetric methods from aerial photographs taken 1950. Map not field checked

Selected hydrographic data compiled from USC & GS Survey 7844 (1950). This information is not intended for navigational purposes

Universal Transverse Mercator projection, 1927 North American datum
10,000 foot grid based on Alaska coordinate system, zone 8
1000 meter Universal Transverse Mercator grid ticks, zone 3, shown in blue

Red tint indicates areas in which only landmark buildings are shown

Land lines represent unsurveyed and unmarked locations predetermined by the Bureau of Land Management
Folios K-13 and K-14, Kateel River Meridian

APPROXIMATE MEAN DECLINATION, 1950

SCALE 1:63360

CONTOUR INTERVAL 50 FEET
DASHED LINES REPRESENT 25 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
DEPTH CURVES IN FEET – DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 3 FEET

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QUADRANGLE LOCATION

ROAD CLASSIFICATION
Medium duty — — — Light duty
Unimproved dirt

Figure 1b - Location map

NOME (C-1), ALASKA
N6430—W16500/15x10

1950

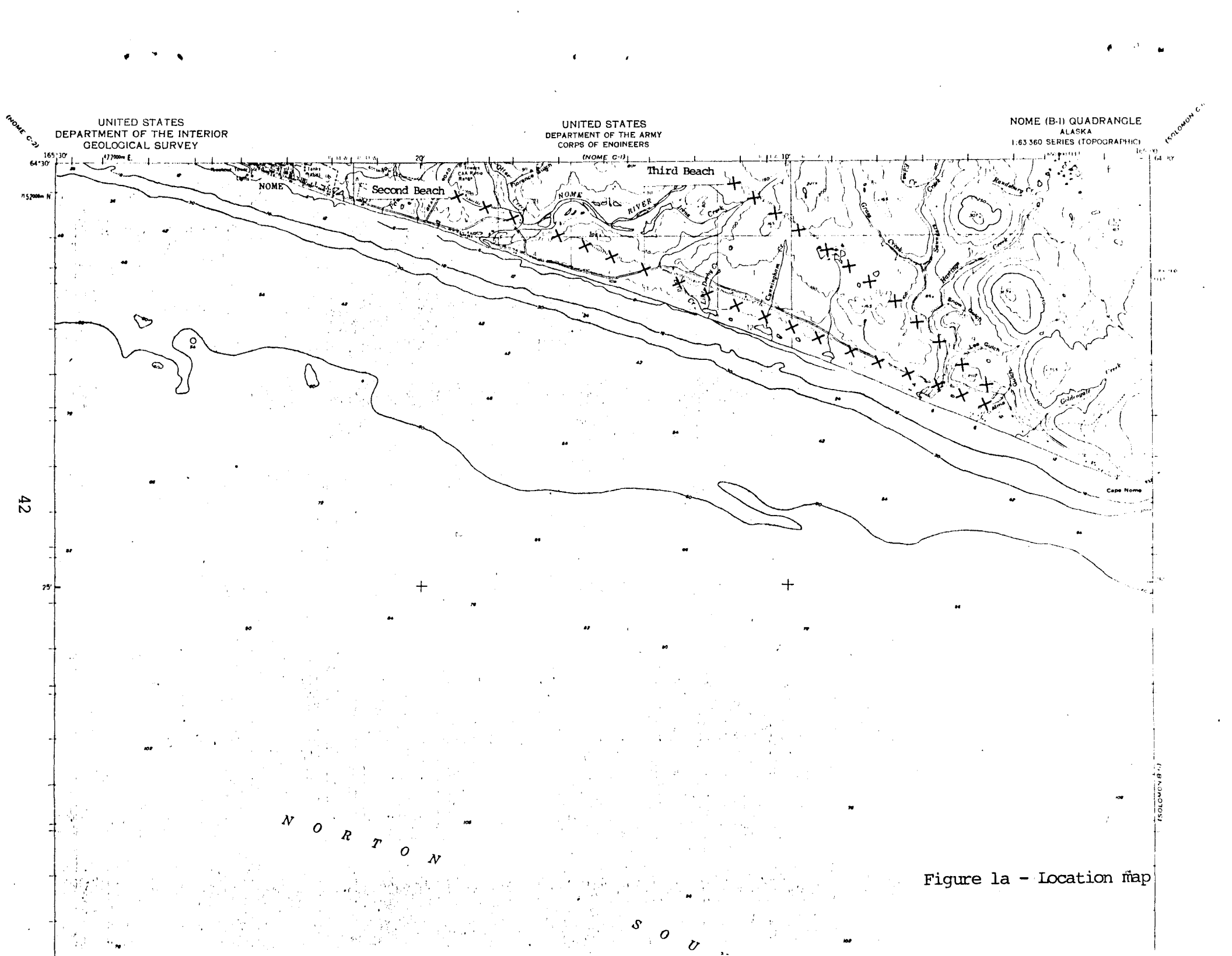

Figure 1a - Location map

Figure 2 - Block diagram of Nome Beaches

EXPLANATION

Recent alluvium

Glacial drift

Auriferous beach deposits

Paleozoic or older bedrock

1. Norton Sound
2. Outer Submarine Beach
3. Second Beach
4. Inner Submarine Beach
5. Snake River
6. Intermediate Beach
7. Monroeville Beach
8. Third Beach
9. Fourth Beach

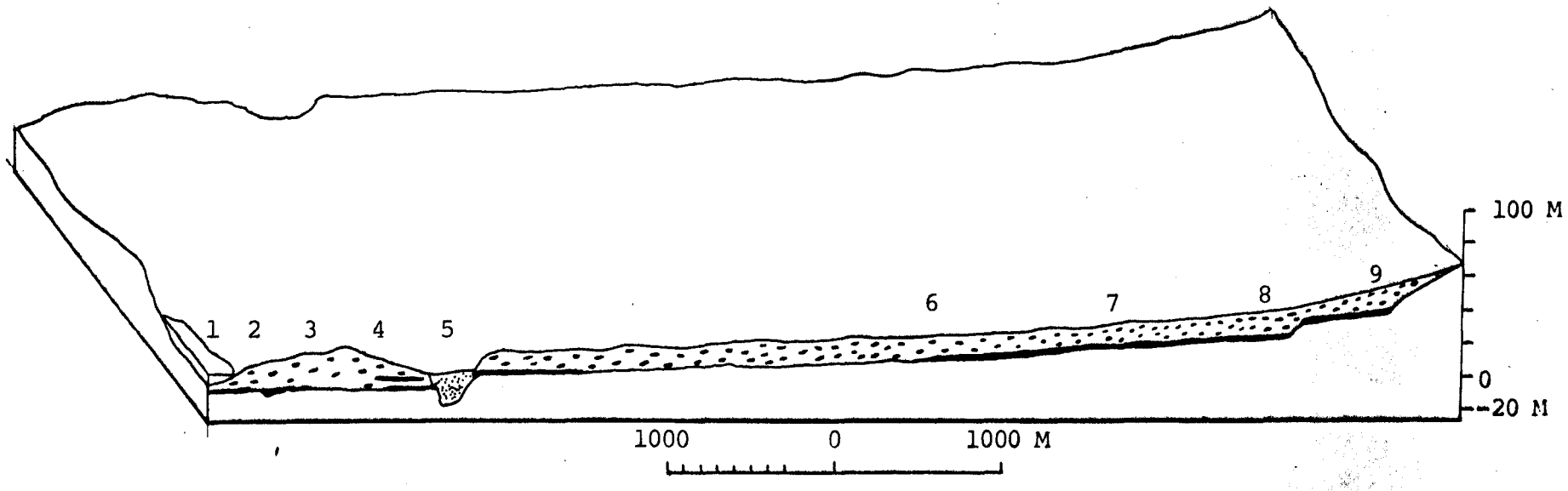

TABLE I Measured Ore Reserves of the Nome Beaches

	Area (acres)	Dredgeable Gravel (cubic yards)	Dredgeable Gravel (cubic meters)	Estimated Gold (tr.oz)	Estimated Gold (tr.oz/ cubic meter)	Estimated Gold (g/cubic meter)
Third Beach	293	36,210,000	27,700,650	277,600	0.01002	0.31162
Submarine Beach	258	30,660,000	23,470,200	331,800	0.01414	0.43975
Second Beach	305	22,075,000	16,887,375	229,600	0.01360	0.42296
Monroeville/ Intermediate Beaches	381	33,805,000	25,860,825	326,500	0.01263	0.39279
Other areas	43	4,060,000	3,105,900	27,500	0.00885	0.27536
TOTALS	1,280	126,830,000	97,024,950	1,193,000		

Table II Dredging area and volume of dredging material of the Nome Beaches

	Area (acres)	Area (square yards)	Area (hectares)	Area (square meters)	Volume (cubic yards)	Volume (cubic meters)	Average Depth (yards)	Average Depth (feet)	Average Depth (meters)
Third Beach	293	1,418,120	118.58	1,185,800	36,210,000	27,700,650	25.53	76.60	23.35
Submarine Beach	258	1,248,720	104.41	1,044,100	30,680,000	23,470,200	24.57	73.71	22.47
Second Beach	305	1,476,200	123.43	1,234,300	22,075,000	16,887,375	14.95	44.86	13.68
Monroeville/ Intermediate Beaches	381	1,844,040	154.19	1,541,900	33,805,000	25,860,825	18.33	55.00	16.77
Other	43	208,120	17.40	174,000	4,060,000	3,105,900	19.51	58.52	17.84