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ESTIMATED EXPLORATION COSTS FOR DOLLAR VALUATION OF AGGREGATE RESOURCES IN MENTAL HEALTH GRANT (TRUST) LANDS AND LEGISLATIVELY DESIGNATED REPLACEMENT POOL LANDS IN ALASKA

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Introduction

In August 1987, the Division of Geological and Geophysical Surveys (DGGS) was asked by the Division of Land and Water Management (DLWM) to initiate an assessment of sand-and-gravel resources in 1) lands originally granted to the State of Alaska by the federal government for the purpose of supporting mental-health programs in Alaska [Mental Health Grant (Trust) Lands] and in 2) state lands comprising a pool from which Mental Health Grant (Trust) Lands and resources could be replaced [Legislatively Designated Replacement Pool Lands]. In DGGS Public Data Files 87-28 and 88-2, five classes of aggregate potential were assigned to about 1.0 million acres of Mental Health Grant (Trust) Lands and to about 8.6 million acres of Legislatively Designated Replacement Pool Lands (Reger, 1987, 1988).

Subsequently, the Department of Natural Resources (DNR) Mental Health Lands Officer requested that DGGS provide the dollar value for each parcel identified in the two previous studies. When told that inadequate data exist to provide this information, he requested that DGGS estimate the costs of collecting necessary subsurface data. The purpose of this report is to summarize the results of that cost estimate.

Methodology

A standard procedure for evaluating the quantity, quality, and market value of a given sand-and-gravel deposit involves 1) consideration of existing information, 2) collection of new field data, 3) collection of new laboratory data, 4) feasibility analysis, and 5) report preparation (fig. 1). To date, only part of step 1, the initial office appraisal, has been accomplished for the mental health land replacement program: 1) aggregate potential was determined for the lands under consideration, and 2) high- and very high-quality targets (potential classes IV and V) are identified for further exploration (Reger, 1987, 1988). The final phase of the initial office appraisal is to estimate the cost of further data collection and sample analysis.

To establish a reasonable basis for estimating the costs of collecting necessary field and laboratory data, I initially contacted senior personnel in the Engineering Geology Section of the Alaska Department of Transportation and Public Facilities (DOTPF). In their estimates, they use figures of $10,000 to $12,000 per 40-acre parcel as the cost of subsurface exploration and sampling, subsequent laboratory analyses, and final report preparation. Relatively minor costs of reconnaissance geologic studies in existing gravel pits near parcels to be drilled (for the purpose of verifying subsurface

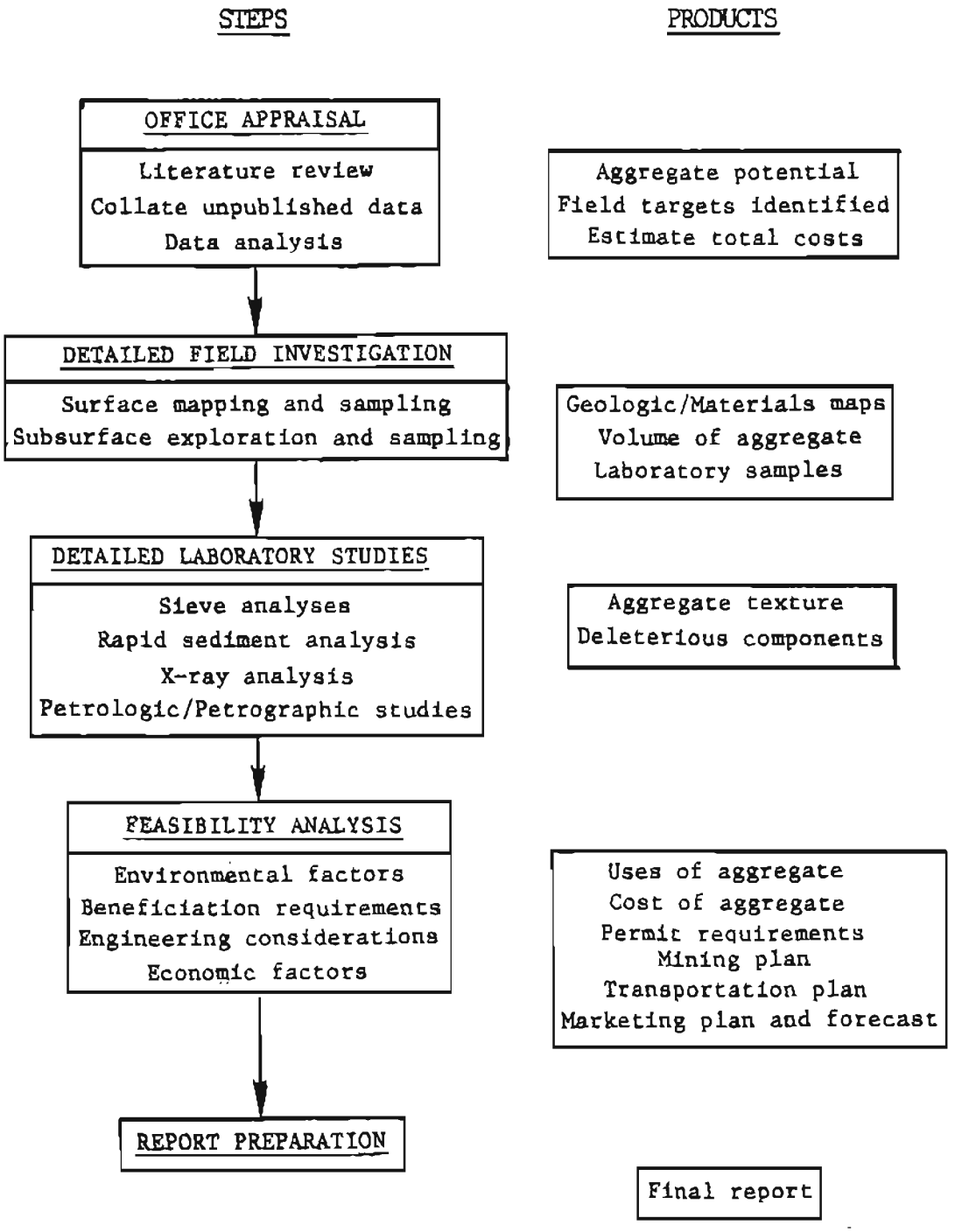

Figure 1. Standard procedures for evaluating sand-and-gravel deposits and products of each step in the process.

information) are included in these figures. Personnel costs are not included in these figures but must be added once the size of the area to be explored is determined. In calculating personnel costs, an assumption is made that a three-man field crew (one geologist, two drillers) will require 3 to 4 days to drill and sample one 40-acre site and a three-man laboratory team (two geologists, one assistant) will require 3 to 4 days to analyze the samples collected. The DOTPF exploration plan is designed to drill boreholes 200 feet apart in a grid pattern to depths of 30 feet, unless shallow groundwater is encountered; in that case, boreholes are extended to a depth of 40 feet, the operational limit of clamshell draglines. These assumptions and figures form the basis for the calculations made during this study.

Because subsurface exploration of all 9.6 million acres under consideration would be prohibitively expensive ($2.4 billion to $3.0 billion), two criteria were established to limit land area. First, only lands with high and very high aggregate potential (classes IV and V) were chosen. Second, because clearing land and building access roads to undeveloped resources is very expensive, a distance of 1 mile between potential aggregate sources and established transportation routes (roads, railroads, navigatible coasts) was set as a maximum limit. After lands meeting these criteria were identified, the next step involved calculating parcel areas.

Acreages of all parcels [including Mental Health Grant (Trust) Lands for which acreages of parcels with DLWM identifier numbers were not available] were determined using a Lasico Model L30 Compensating Polar Planimeter. While looking through the centering circle in the magnifying tracing lens on this instrument, the operator continuously follows parcel boundaries once around the parcel, reads the dials, and (using a conversion factor) calculates the area of the parcel. This instrument can rapidly and accurately determine the areas of regular and irregular parcels.

Sources of possible error in area that are incorporated during the measurement process are of concern and were evaluated. In my opinion, the most serious source of area error is incorrect plotting of parcel boundaries on maps provided for this study, especially for plots of Mental Health Grant (Trust) Lands. In several cases, boundary lines, which undoubtedly actually follow section lines, were crudely plotted, resulting is displacements of over 100 feet (e.g., parcel F091 in Fairbanks D-2 Quadrangle). Cumulative errors from this source may be an order of magnitude (10 times) greater than errors from other sources. Area error is also introduced by distortion each time a map is xeroxed. The 'original' maps used to plot areas measured in this study are second or perhaps third generation xerox copies. Changes in size due to xerox distortion are compensated by determining new conversion factors (found by taking a planimeter reading around a mile-square section) for each generation of map. For the arm adjustments set up on the planimeter during this study and kept constant, a planimeter reading of 0.065

equals 640 acres. Error due to this source was determined to be less than 1 percent during three test measurements of parcel 5757, which occupies an entire section in the Tyonek B-1 Quadrangle. A third source of error is incorporated during the process of actually following boundary lines. Failure to keep the guide circle in the tracing lens centered directly over the line is not uncommon; however, minor deviations on one side of the line and then the other are compensating so that the error finally introduced is very small.

To evaluate measurement reproducibility, three measurements were made of four parcels of different sizes in four different quadrangles. Variation between all measurements in a given parcel was less than 1 percent and variation was logarithmically related inversely to the size of the area being measured (fig. 2). Planimeter readings of larger areas were more uniform (in terms of percent deviation) than readings of smaller areas. To avoid errors of measurement, small parcels (less than 20 acres) were measured cumulatively until uniform readings were obtained. Some very small, irregular parcels (e.g., parcel S227C in the Kenai C-3 Quadrangle) had to be measured up to 10 times before reasonable consistency was achieved.

Data Presentation

Table 1 summarizes measured land areas and ranges of estimated exploration costs for about 77,000 acres in 268 parcels or blocks of parcels [representing parts or all of 722 parcels of Mental Health Grant (Trust) Lands identified by DLWM] in 37 quadrangles. Questionable values are noted in the footnote. Locations of parcels and blocks of parcels are shown in Plates 1 through 37. A total of 54 remote parcels that did not meet the selection proximity criterion were not evaluated during this study, even though they have high or very high aggregate potential. Two parcels (F872 in the Fairbanks B-1 Quadrangle and parcel C063B in the Skagway B-4 Quadrangle) could not be located on the maps provided and so were not evaluated.

Table 2 summarizes measured land areas and ranges of estimated exploration costs for about 149,000 acres of selected Legislatively Designated Replacement Pool Lands. Plates 38 through 89 illustrate corresponding parcels, their sizes, and the range of estimated costs for a field exploration program in each parcel. A total of 16 separate legislatively designated areas (parks, preserves, refuges, forests, etc.) are represented in the 52 quadrangles.

Table 3 lists personnel costs that will be incurred during field, laboratory, and report-writing phases of the proposed aggregate evaluation, based on DOTPF figures. Because entry-level salaries and benefits were used in these calculations, personnel costs should be considered as minimum values.

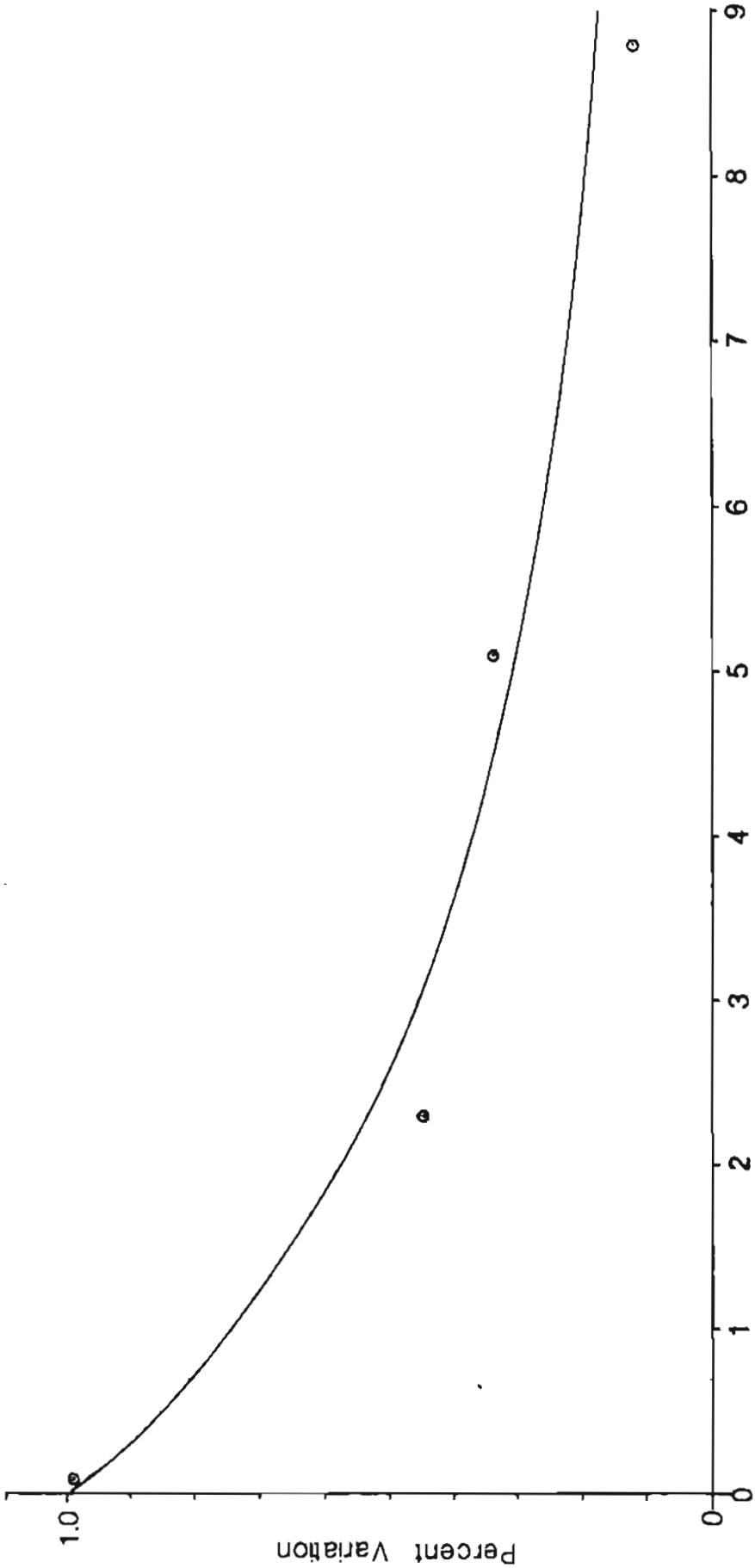

Figure 2. Relationship between variation of compensating-planimeter measurement and size of four parcels during three separate measurements.

QUADRANGLE	PARCEL NUMBERS*	TOTAL ACREAGE	RANGE OF ESTIMATED COSTS
Anchorage A-8	S641 - S642	58.2	$14,550 - 17,460
Anchorage B-6	S1254[a]	794.9[a]	198,725 - 238,470
	S1260	97.3	24,325 - 29,190
	S1261	48.6	12,150 - 14,580
	S1262[b]	601.0[b]	150,250 - 180,300
	S1263[c]	48.6[c]	12,150 - 14,580
Anchorage C-6	S1253	1,212.2	303,050 - 363,660
	S1255 - S1257	77.4	19,350 - 23,220
	S1263A	14.7	3,675 - 4,410
	S1265	14.7	3,675 - 4,410
	S1266	12.8	3,200 - 3,840
	S1267 - S1271	542.7	135,675 - 162,810
	S1272 - S1279	339.2	84,800 - 101,760
	S1280	9,745.3	2,436,325 - 2,923,590
	S1281	184.3	46,075 - 55,290
	S1282 - S1284	310.4	77,600 - 93,120
	S1285	19.2	4,800 - 5,760
	S1305	2,191.4	547,850 - 657,420
	S1306 - S1311	213.1	53,275 - 63,930
	S1332 - S1336	213.1	53,275 - 63,930
	S1337	7.0[d]	1,750 - 2,100[d]
Anchorage C-7	S1164	5.1[d]	1,275 - 1,530[d]

* Locations of parcels and parcel blocks are shown on Plates 1 through 37.

a. Includes 19.2 acres of parcel S1254 in Anchorage C-6 Quadrangle.

b. Includes 9.6 acres of parcel S1262 in Anchorage C-6 Quadrangle.

c. Includes 9.6 acres of parcel S1263 in Anchorage C-6 Quadrangle.

d. Small size and irregular shape of this parcel increase measurement error and make calculated area and costs of exploring aggregate resources suspect.

Table 1. Estimated field and laboratory costs by quadrangle and parcel or parcel block for dollar valuation of selected high- and very high-potential sand-and-gravel deposits in Mental Health Grant (Trust) Lands in Alaska.

QUADRANGLE	PARCEL NUMBERS*	TOTAL ACREAGE	RANGE OF ESTIMATED COSTS
Anchorage C-8	S830 - S835	271.4	$67,850-81,420
	S842 - S843	58.2	14,550-17,460
	S899 - S914	271.4[e]	67,850-81,420[e]
	S1019	5.1[d]	1,275-1,530[d]
	S1020	7.0[d]	1,750-2,100[d]
	S1022 - S1023	87.0[f]	21,750-26,100[f]
	S1024 - S1025	9.6[e]	2,400-2,880[e]
	S1026 - S1031	19.2[e]	4,800-5,760[e]
	S1032	9.6[e]	2,400-2,880[e]
	S1035 - S1036	9.6[e]	2,400-2,880[e]
	S1037 - S1040	28.8[e,g]	7,200-8,640[e,g]
	S1108	17.5[d,h]	4,375-5,250[d,h]
	S1128	562.6[i]	140,650-168,780[i]
	S1129	2.6[d]	650-780[d]
	S1130 - S1136	28.8[f]	7,200-8,640[f]
	S1137 - S1146	87.0	21,750-26,100
	S1167	474.9	118,725-142,470
	S1170	19.2	4,800-5,760
Anchorage D-4	S1345 - S1347[j]	58.2[j]	14,550-17,420[j]
	S1389 - S1391	28.8[f]	7,200-8,640[f]
	S1442 - S1444	39.0	9,750-11,700
	S1450 - S1454	213.1	53,275-63,930
	S1458 - S1459	87.0[d]	21,750-26,100[d]
	S1460	5.1[d]	1,275-1,530[d]

e. Small sizes and irregular shapes of several parcels in this block increase measurement error and make calculated area and costs of exploring aggregate resources suspect.

f. Small sizes and irregular shapes of scattered parcels increase measurement error and make calculated area and costs of exploring aggregate resources suspect.

g. Includes at least 19.2 acres of parcels S1037 - S1040 in Tyonek C-1 Quadrangle. However, base map provided was very poorly xeroxed and does not show all boundary lines. Therefore, values for acreage and exploration costs must be considered minimal.

h. Includes at least 9.6 acres of parcel S1108 in Tyonek C-1 Quadrangle. However, base map provided was very poorly xeroxed and does not show all boundary lines. Therefore, values for acreage and exploration costs must be considered minimal.

i. Includes 213.1 acres of parcel S1128 in Tyonek C-1 Quadrangle. However, base map provided was very poorly xeroxed and does not snow all boundary lines. Therefore, values for acreage and exploration costs must be considered minimal.

j. Includes 48.6 acres of parcels S1345 - S1347 in Anchorage D-5 Quadrangle.

Table 1 (continued)

QUADRANGLE	PARCEL NUMBERS*	TOTAL ACREAGE	RANGE OF ESTIMATED COSTS
Anchorage D-8	S1178	135.7	$33,925 - 40,710
	S1179	165.1	41,275 - 49,530
Big Delta B-6	F853	116.5	29,125 - 34,950
	F854	116.5	29,125 - 34,950
	F870[k]	271.4[k]	67,850 - 81,420
	F871[l]	1,037.4[l]	259,375 - 311,220
	F879	48.6	12,150 - 14,580
	F880	39.0	9,750 - 11,700
	F881	48.6	12,150 - 14,580
	F886A[m]	1,639.0[m]	409,750 - 491,700
Big Delta D-5	F080A[n]	3,180.8[n]	795,200 - 954,240
Big Delta D-6	F070	397.4	99,350 - 119,220
	F070A	106.9	26,725 - 32,070
	F070B	698.2	174,550 - 209,460
	F078	67.8	16,850 - 20,340
	F725[o]	2,211.2[o]	522,800 - 663,330
	F760 - F763	135.7	33,925 - 40,710
	F764[p]	911.4[p]	227,850 - 273,420

k. Includes 39.0 acres of parcel F870 in Fairbanks B-1 Quadrangle.

l. Includes 67.9 acres of parcel F871 in Fairbanks B-1 Quadrangle.

m. Includes 882.4 acres of parcel F886A in Fairbanks B-1 Quadrangle.

n. Measured only area of high- and very high-potential floodplain and low-terrace deposits of Chena River and avoided low-potential upland deposits in parcel F080A.

o. Measured only area of high- and very high-potential floodplain and low-terrace deposits of Chena River and avoided low-potential upland deposits in parcel F725. Includes 2,307.8 acres of parcel F725 in Fairbanks D-1 Quadrangle.

p. Measured only area of high- and very high-potential floodplain and low-terrace deposits of Chena River and avoided low-potential upland deposits in parcel F764. Includes 48.6 acres of parcel F764 in Fairbanks D-1 Quadrangle.

Table 1 (continued)

QUADRANGLE	PARCEL NUMBERS*	TOTAL ACREAGE	RANGE OF ESTIMATED COSTS
Big Delta D-6	F765 - F766	67.8	$16,850 - 20,340
	F767 - F768	77.4	19,350 - 23,220
	F769	28.8	7,200 - 8,640
	F769A & F769B	48.6	12,150 - 14,580
	F770 - F771	9.6	2,400 - 2,880
	F772A	39.0	9,750 - 11,700
Fairbanks B-1	F869	48.6	12,150 - 14,580
Fairbanks B-5	F518	106.9	26,725 - 32,070
Fairbanks C-1	F817	165.1	41,275 - 49,530
	F832	3,801.0	950,250 - 1,140,300
Fairbanks D-1	F709 - F711	474.9	118,725 - 142,470
	F713 - F716	106.9	26,725 - 32,070
	F726	9.6	2,400 - 2,880
	F727A	2,802.6	700,650 - 840,780
	F731 - F735	1,202.6	300,650 - 360,780
	F779 - F816[q]	3,927.0[q]	981,750 - 1,178,100
Fairbanks D-2	F091	203.5	50,875 - 61,050
	F094 - F095	48.6	12,150 - 14,580
	F096 - F105[r]	97.3[r]	24,325 - 29,190[r]
	F106 - F108	28.8	7,200 - 8,640
	F109 - F113	174.7	43,675 - 52,410
	F114	67.8	16,850 - 20,340
	F115	19.2	4,800 - 5,760
	F116 - F117	97.3	24,325 - 29,190
	F139 - F140	48.6	12,150 - 14,580
	F141A	7.0[d]	1,750 - 2,100[d]
	F702 - F703	300.8	75,200 - 90,240
	F712	39.0	9,750 - 11,700
Fairbanks D-3	F146 - F149[s]	87.0[s]	21,750 - 26,100[s]

q. Includes 2,191.5 acres of parcels F779 - F816 in the Fairbanks D-2 Quadrangle.

r. Boundary locations and acreage of parcels F096 - F105 are highly suspect; therefore, estimated costs of exploration are highly questionable.

s. Boundary locations and acreage of parcels F146 - F149 are highly suspect; therefore, estimated costs of exploration are highly questionable.

Table 1 (continued)

QUADRANGLE	PARCEL NUMBERS*	TOTAL ACREAGE	RANGE OF ESTIMATED COSTS
Healy D-4	F602[t]	39.0[t]	$9,750 - 11,700[t]
	F636 - F637	77.4	19,350 - 23,220
Juneau B-5	C481[u]	1,018.2[u]	254,550 - 305,460
	C482 - C486	165.1	41,275 - 49,530
Juneau B-6	C459 - C460	4,043.5	1,010,875 - 1,213,050
	C461	154.9	38,725 - 46,470
	C463	67.8	16,850 - 20,340
	C464 & C464A	126.1	31,525 - 37,830
	C465	5.1[d]	1,275 - 1,530[d]
	C466 - C470	320.0	80,000 - 96,000
	C468A & C468B	232.7	58,175 - 69,810
	C468C	67.8	16,850 - 20,340
	C471 - C473	116.5	29,125 - 34,950
	C474 - C478	116.5	29,125 - 34,950
	C479	48.6	12,150 - 14,580
	C480	222.7	55,675 - 66,810
	C487 - C490	320.0	80,000 - 96,000
	C491	19.2	4,800 - 5,760
	C492	2.6[d]	650 - 780[d]
	C492A	28.8	7,200 - 8,640
	C493	39.0	9,750 - 11,700
	C493A	87.0	21,750 - 26,100
Kenai B-3	S232	39.0	9,750 - 11,700
	S234	28.8	7,200 - 8,640
	S234A	5.1[d]	1,275 - 1,530[d]
	S237A	87.0	21,750 - 26,100
	S238 - S240	58.2	14,550 - 17,460
	S241 - S243	320.0	80,000 - 96,000
	S245	28.8	7,200 - 8,640
	S257 - S258	28.8	7,200 - 8,640
	S259 & S259A	9.6[d]	2,400 - 2,880[d]
	S260 - S261	174.7	43,675 - 52,410
	S302	5.1[d,v]	1,275 - 1,530[d,v]

t. Boundary locations and acreage of this parcel are highly suspect; therefore, estimated costs of exploration are highly questionable.

u. Includes 814.5 acres of parcel C481 in Juneau B-6 Quadrangle.

v. The size and shape of this island in the Kenai River likely changed after the base map was revised in 1980. Therefore, calculated acreage and costs of exploration are suspect.

Table 1 (continued)

QUADRANGLE	PARCEL NUMBERS*	TOTAL ACREAGE	RANGE OF ESTIMATED COSTS
Kenai B-3	S303	28.8[d,v]	$7,200 - 8,640[d,v]
	S304	7.0[t]	1,750 - 2,100[t]
	S305	7.0[d,v]	1,750 - 2,100[d,v]
	S305A	3.2[v]	800 - 960[v]
	S306	5.1[v]	1,275 - 1,530[v]
	S307	5.1[v]	1,275 - 1,530[v]
	S308	5.1[v]	1,275 - 1,530[v]
Kenai B-4	S201A	39.0	9,750 - 11,700
	S201B	39.0[d,v]	9,750 - 11,700[d,v]
Kenai C-2	S201	9.6[w]	2,400 - 2,880[w]
	S202A & S202B	9.6[d]	2,400 - 2,880[d]
Kenai C-3	S227C	3.2	800 - 960
	S228	48.6[f]	12,150 - 14,580[f]
	S250 - S253	39.0[d]	9,750 - 11,700[d]
	S254 - S256	48.6	12,150 - 14,580
	S267 - S269	135.7	33,925 - 40,710
	S279	135.7	33,925 - 40,710
	S282 - S291	184.3[d,v]	46,075 - 55,290[d,v]
	S292	7.0[w]	1,750 - 2,100[w]
	S294 - S295	14.7[d,v]	3,675 - 4,410[d,v]
	S296 - S300	193.9[d,v]	48,475 - 58,170[d,v]
	S301	14.7[d,v]	3,675 - 4,410[d,v]
	S308A	39.0	9,750 - 11,700
	S309 - S314	397.4	99,350 - 119,220
	S330	581.8	145,450 - 174,540
	S357 - S358	87.0	21,750 - 26,100
	S362 - S363	135.7	33,925 - 40,710

W. Small sizes and irregular shapes of the two parcels in this block increase measurement error and make calculated acreage and costs of exploring aggregate resources suspect.

Table 1 (continued)

QUADRANGLE	PARCEL NUMBERS*	TOTAL ACREAGE	RANGE OF ESTIMATED COSTS
Kenai C-4	S315 - S321	824.3	$206,075 - 247,290
	S322 - S329	4,073.0	1,018,250 - 1,221,900
	S330 - S331	4,053.1	1,013,275 - 1,215,930
	S332 - S335	154.9	38,725 - 46,470
	S336	28.8	7,200 - 8,640
	S337 - S346	14.7[e]	3,675 - 4,410[e]
	S347 - S354	39.0[e]	9,750 - 11,700[e]
	S354A - S354G	3.2[e]	800 - 960[e]
	S355	5.1[d]	1,275 - 1,530[d]
	S356	5.1[d]	1,275 - 1,530[d]
	S399 - S403	2,647.0	661,750 - 794,100
	S403A	14.7	3,675 - 4,410
	S404	28.8	7,200 - 8,640
	S405 & S405A	39.0	9,750 - 11,700
	S406	28.8	7,200 - 8,640
	S407	28.8	7,200 - 8,640
	S408 - S411	145.3	36,325 - 43,590
	S418 & S418A	892.2	223,050 - 267,660
	S435	19.2	4,800 - 5,760
	S444	126.1	31,525 - 37,830
	S448	174.7	43,675 - 52,410
	S456 - S459	14.7[e]	3,675 - 4,410[e]
	S460 - S461	77.4	19,350 - 23,220
	S462 - S465	28.8[d]	7,200 - 8,640[d]
	S467	24.3[d]	6,075 - 7,290[d]
Seldovia B-5	S1498C	5.1[d]	1,275 - 1,530[d]
	S1500	19.2[d]	4,800 - 5,760[d]
Seldovia C-4	S1486	2.6[d]	650 - 780[d]
	S1487 - S1488	5.1[w]	1,275 - 1,530[w]
	S1489	1.9[d]	475 - 570[d]
	S1490	3.8[d]	950 - 1,140[d]
Skagway A-1	C393	24.3[d]	6,075 - 7,290[d]
Skagway A-2	C306	2.6[d]	650 - 780[d]
	C307	5.1[d]	1,275 - 1,530[d]
	C327 - C333	48.6[x]	12,750 - 14,580[x]
	C335A, C347 - C350, C347A & C347B	14.7[x]	3,675 - 4,410[x]
	C338, C345A & C346A	43.5[x]	10,875 - 13,050[x]
	C352 & C352A	7.0[x]	1,750 - 2,100[x]
	C355	43.5[x]	10,875 - 13,050[x]
	C359 - C361, C361A & C361B	43.5[x]	10,875 - 13,050[x]
	C388	9.6[d]	2,400 - 2,880[d]

x. Locations of boundaries and irregular shapes of several parcels are highly suspect in this block, increasing measurement error and making calculated acreage and costs of exploring aggregate very questionable.

Table 1 (continued)

QUADRANGLE	PARCEL NUMBERS*	TOTAL ACREAGE	RANGE OF ESTIMATED COSTS
Skagway B-2	C145[y]	572.2[y]	$143,050 - 171,660
	C146[z]	10.2[z]	2,550 - 3,060
	C200	24.3[t]	6,075 - 7,290[t]
	C222	24.3[t]	6,075 - 7,290[t]
	C223	28.8	7,200 - 8,640
	C227	48.6[d]	12,150 - 14,580[d]
	C235	2.6[d]	650 - 780[d]
	C236 & C236A	5.1[d]	1,275 - 1,530[d]
	C243 - C247	359.0	89,750 - 107,700
	C248 & C262	53.1	13,275 - 15,930
	C251 - C252	53.1[d]	13,275 - 15,930[d]
	C255	7.0[d]	1,750 - 2,100[d]
	C260 - C261	87.0	21,750 - 26,100
	C263 - C267	213.1[aa]	53,275 - 63,930
Skagway B-3	C070[aa]	931.2[aa]	232,800 - 279,360
	C089	24.3[e]	6,075 - 7,290[e]
	C090, C090A & C091	24.3[e]	6,075 - 7,290[e]
	C099	5.1[d]	1,275 - 1,530[d]
	C104 - C105	67.8[ab]	16,850 - 20,340
	C119[ab]	48.6[ab]	12,150 - 14,580
	C126 - C128 & C128A	28.8	7,200-8,640
	C132	39.0[w]	9,750-11,700[w]
	C133 - C134	9.6[d]	2,400-2,880[d]
	C135	14.7[d]	3,675-4,410[d]
	C136	28.8[e]	7,200-8,640[e]
	C137 - C139	19.2[e]	4,800-5,760[e]
	C147 - C149	92.2	23,050-27,660
	C150 - C156	213.1	53,275-63,930
	C157 - C159	135.7	33,925-40,710
	C161	53.1	13,275-15,930
	C163 - C164	97.3	24,325-29,190
	C165 - C167	97.3[w]	24,325-29,190[w]
	C168 & C168A	28.8	7,200-8,640
	C170 & C171A	48.6	12,150-14,580
	C171	19.2	4,800-5,760

y. Includes 523.6 acres of parcel C145 in Skagway B-3 Quadrangle.

z. Includes 33.9 acres of parcel C146 in Skagway B-3 Quadrangle.

aa. Measured only area of high- and very high-potential floodplain and low-terrace deposits of Chilkat River and avoided low-potential upland deposits in parcel C070.

ab. Includes 12.1 acres of parcel C119 in Skagway B-4 Quadrangle.

Table 1 (continued)

QUADRANGLE	PARCEL NUMBERS*	TOTAL ACREAGE	RANGE OF ESTIMATED COSTS
Skagway B-3	C172 - C176	387.8	$96,950-116,340
	C175A	19.2	4,800-5,760
	C178	48.6	12,150-14,580
	C189, C189A, C189B & C190	53.1	13,275-15,930
	C192 - C193	106.9	26,725-32,070
	C193A	9.6	2,400-2,880
	C194 - C195	39.0	9,750-11,700
	C197 - C199	87.0	21,750-26,100
	C201 - C204	145.3	36,325-43,590
	C206	19.2	4,800-5,760
	C213	28.8	7,200-8,640
	C215 - C216	58.2	14,550-17,460
	C218	39.0	9,750-11,700
Skagway B-4	C013	14.7[d]	3,675-4,410[d]
	C018	7.0[d]	1,750-2,100[d]
	C023	24.3	6,075-7,290
	C031	14.7[d]	3,675-4,410[d]
	C035 - C050[ac]	233.0[e,ac]	58,250-69,900[e]
	C051 - C062[ad]	116.5[ad]	29,125-34,950
Talkeetna A-1	S1194	39.0	9,750-11,700
	S1194A	77.4	19,350-23,220
Talkeetna B-1	S1192	12.8	3,200-3,840
	S1193	24.3	6,075-7,290
	S1195 - S1202 & S1204 - S1209	465.3	116,325-139,590
	S1210 - S1227	542.7	135,675-162,810
	S1229 - S1252	688.6	172,150-206,580
Tyonek B-1	S757	640.0	160,000-192,000
	S825	58.2	14,550-17,460

ac. Measured only areas of high- and very high-potential floodplain and low-terrace deposits of Klenini River and avoided low-potential upland deposits in parcels C035 - C050.

ad. Measured only areas of high- and very high-potential floodplain and low-terrace deposits of Klenini River and avoided low-potential upland deposits in parcels C051 - C062.

Table 1 (continued)

QUADRANGLE	PARCEL NUMBERS*	TOTAL ACREAGE	RANGE OF ESTIMATED COSTS
Tyonek C-1	S1041 - S1048	5.1[e]	$1,275-1,530[e]
	S1049	7.0[d]	1,750-2,100[d]
	S1103 - S1107 & S1109 - S1127	48.6[ae]	12,150-14,580
Tyonek D-1	S1181	19.2	4,800-5,760
	S1182	77.4	19,350-23,220
	S1183 -S1184	165.1	41,275-49,530
	S1185	97.3	24,325-29,190
	S1186	43.5	10,875-13,050
	S1187	77.4	19,350-23,220
	S1188	48.6	12,150-14,580
	S1189 - S1190	67.8	16,850-20,340
Total		76,906.1	$19,196,425-23,071,790

ae. Boundary locations and acreages of parcels S1103 - S1107 and S1109 - S1127 are highly suspect; therefore, estimated costs of aggregate exploration are highly questionable.

Table 1 (continued)

QUADRANGLE	LEGISLATIVELY DESIGNATED AREA REPRESENTED	TOTAL ACREAGE*	RANGE OF ESTIMATED COST*
Anchorage A-7	Chugach State Park	1,594.0	$398,500 - $478,214
Anchorage B-6	Palmer Hay Flats State Game Refuge	1,053.7	263,425 - 316,104
Anchorage B-7	Chugach State Park; Palmer Hay Flats State Game Refuge	3,287.8	821,950 - 986,340
Anchorage C-5	Matanuska Valley Moose Range	443.5	110,875 - 133,050
Anchorage C-6	Matanuska Valley Moose Range; Palmer Hay Flats State Game Refuge	12,130.5	3,032,625 - 3,639,150
Anchorage C-7	Palmer Hay Flats State Game Refuge	412.1	103,025 - 123,630
Anchorage D-4	Matanuska Valley Moose Range	118.3	29,575 - 35,490
Big Delta B-5	Tanana Valley State Forest	2,439.7	609,925 - 731,910
Big Delta B-6	Tanana Valley State Forest	5,129.6	1,282,400 - 1,538,880
Big Delta C-6	Tanana Valley State Forest	669.4	167,350 - 200,820
Big Delta D-5	Chena River State Recreation Area	6,803.8	1,700,950 - 2,041,140
Big Delta D-6	Chena River State Recreation Area	8,231.7	2,057,925 - 2,469,510
Circle A-5	Chena River State Recreation Area	1,142.4	285,600 - 342,720
Cold Bay B-3	Izembek (Lagoon) State Game Refuge	3,475.9	868,975 - 1,042,770
Cordova B-3	Copper River Delta Critical Habitat Area	5,090.6	1,272,650 - 1,527,180
Cordova B-4	Copper River Delta Critical Habitat Area	5,278.1	1,319,525 - 1,583,430
Cordova C-3	Copper River Delta Critical Habitat Area	2,432.0	608,000 - 729,600
Cordova C-5	Copper River Delta Critical Habitat Area	2,412.2	603,050 - 723,660
Fairbanks B-1	Tanana Valley State Forest	827.5	206,875 - 248,250
Fairbanks C-1	Tanana Valley State Forest	1,063.7	265,925 - 319,110
Fairbanks D-1	Tanana Valley State Forest	1,240.9	310,225 - 372,270
Fairbanks D-2	Creamer's Field Migratory Waterfowl Refuge	197.1	49,275 - 59,130
Fairbanks D-4	Tanana Valley State Forest	492.8	123,200 - 147,840
Kenai A-4	Clam Gulch Critical Habitat Area	325.1	81,275 - 97,530
Kenai A-5	Clam Gulch Critical Habitat Area	374.4	93,600 - 112,320
Kenai B-1	Kenai River Special Management Area	492.2	123,050 - 147,660

* Shown on Plates 38 through 89 for individual parcels.

Table 2. Summary of estimated field and laboratory costs by quadrangle for dollar valuation of selected high- and very high-potential sand-and-gravel deposits in Legislatively Designated Replacement Pool Lands in Alaska.

QUADRANGLE	LEGISLATIVELY DESIGNATED AREA REPRESENTED	TOTAL ACREAGE	RANGE OF ESTIMATED COST
Kenai B-3	Kenai River Special Management Area	1,368.3	$342,075 - $410,490
Kenai B-4	Clam Gulch Critical Habitat Area	98.6	24,650 - 29,580
Kenai C-2	Kenai River Special Management Area	442.9	110,725 - 132,870
Kenai C-3	Kenai River Special Management Area	698.8	174,700 - 209,640
Kenai C-4	Kenai River Special Management Area	69.1	17,275 - 20,730
Mt. Hayes C-1	Tanana Valley State Forest	2,382.7	595,675 - 714,810
Mt. Hayes C-2	Tanana Valley State Forest; Delta Junction Bison Range	1,250.6	312,650 - 375,180
Mt. Hayes D-2	Tanana Valley State Forest; Delta Junction Bison Range	12,485.1	3,121,275 - 3,745,530
Mt. Hayes D-3	Delta Junction Bison Range	8,034.5	2,008,625 - 2,410,350
Seldovia C-4	Kachemak Bay Critical Habitat Area	157.4	39,350 - 47,220
Seldovia C-5	Kachemak Bay Critical Habitat Area; Anchor River and Fritz Creek Critical Habitat Area	1,004.1	251,025 - 301,230
Seldovia D-4	Anchor River and Fritz Creek Critical Habitat Area	462.7	115,675 - 138,810
Seldovia D-5	Kachemak Bay Critical Habitat Area; Clam Gulch Critical Habitat Area; Anchor River and Fritz Creek Critical Habitat Area	275.8	68,950 - 82,740
Seward B-8	Kenai River Special Management Area	88.3	22,075 - 26,490
Seward D-7	Chugach State Park	885.7	221,425 - 265,710
Skagway A-2	Haines State Forest Resource Management Area	314.9	78,725 - 94,470
Skagway B-2	Haines State Forest Resource Management Area; Alaska Chilkat Bald Eagle Preserve	5,779.8	1,444,950 - 1,733,940
Skagway B-3	Chilkat River State Habitat Area; Haines State Forest Resource Management Area; Alaska Chilkat Bald Eagle Preserve	12,809.6	3,202,400 - 3,842,880
Skagway B-4	Haines State Forest Resource Management Area	4,204.2	1,050,600 - 1,261,260
Talkeetna C-1	Denali State Park	8,684.2	2,171,050 - 2,605,260
Talkeetna D-1	Denali State Park	1,565.4	391,350 - 469,620
Talkeetna Mountains C-6	Denali State Park	2,993.3	748,325 - 897,990
Talkeetna Mountains D-6	Denali State Park	3,308.1	827,025 - 992,430
Tanacross A-5	Tanana Valley State Forest	8,132.5	2,033,125 - 2,439,750
Tanacross B-6	Tanana Valley State Forest	2,008.9	502,225 - 602,670
Tanacross C-6	Tanana Valley State Forest	1,653.7	413,425 - 496,110
Total		148,987,6	$37,246,450 - 44,696,280

Table 2 (continued)

	Legislatively Designated Lands		Total	
tal Personnel sts ($ x 10^3)	Man-years*	Total Personnel Costs ($ x 10^3)	Man-years*	Total Personnel Costs ($ x 10^3)
35.5-1,042.3	30.6-40.8	1,511.6-2,015.5	46.5-61.9	2,297.1-3,057.8
30.2-1,234.4	30.6-40.8	1,790.1-2,386.8	46.5-61.9	2,720.3-3,621.2
30.2-1,234.4	30.6-40.8	1,790.1-2,386.8	46.5-61.9	2,720.3-3,621.2
45.9-3,511.1	91.8-122.4	5,091.8-6,789.1	139.5-185.7	7,737.7-10,300.2
32.1-905.2	30.6-40.8	1,312.7-1,750.3	46.5-61.9	1,994.8-2,655.5
94.7-789.1	30.6-40.8	1,144.4-1,525.9	46.5-61.9	1,739.1-2,315.0
94.5-656.2	30.6-48.8	951.7-1,268.9	46.5-61.9	1,446.2-1,925.1
71.3-2,350.5	91.8-122.4	3,408.8-4,545.1	139.5-185.7	5,180.1-6,895.6
7.2-5,861.6	183.6-244.8	8,500.6-11,334.2	279.0-371.4	12,917.8-17,195.8

is a minimum figure.

1 40-acre parcel and 3 to 4 days are required for laboratory analyses of collected

cessible, high- to very high-potential aggregate resources in Mental Health Grant Pool Lands in Alaska.

Discussion

This analysis indicates that the total approximate cost of a field-laboratory program to collect subsurface data necessary to derive reliable figures on the monetary value of the sand-and-gravel deposits in about 226,000 acres will range from $65,360,675 to $85,163,870 (table 4). This is equivalent to an exploration cost of about $307 to $377 per acre. Personnel costs for 279 to 374 man-years of work on this program represent about 20 percent of the total cost. These values assume that state-owned drill rigs are available and that state geologists and drillers perform the work, thus avoiding even higher private-sector expenses, including higher mobilization and demobilization charges and, of course, profit.

Costs for this exploration program can be cut substantially if test-hole spacing is increased and fewer samples are analyzed. However, this cost-saving measure will considerably reduce the reliability of the resulting data, especially in complex sediments.

The field exploration program is not the last expensive step in the resource analysis if the intent is to sell the aggregate (e.g., to generate revenues in support of mental health programs). A feasibility analysis of environmental, engineering, and economic factors will be required to determine ultimate uses of the sand-and-gravel products, to determine their market prices, and to develop an economically viable mining and marketing plan. Such an evaluation, which is usually done by an engineer and appraiser, will probably cost several tens or hundreds of thousands of dollars more for the 226,000 acres under consideration (fig. 3). Determination of more accurate figures is beyond the scope of this report.

Acknowledgements

I thank Hal Livingston, DOTPF Regional Geologist for interior and northern Alaska, who shared with me his considerable expertise on methods and costs of evaluating sand-and-gravel sites in Alaska. Cheri Daniels (DGGS) and Monty Weaver (DOTPF) kindly provided personnel costs for geologists and drillers, respectively. Tony Braden, DNR Mental Health Lands Officer, provided the topographic maps upon which the land parcels were plotted.

Mental Health Grant (Trust) Lands (76,906.1 acres):	
Field and Laboratory Studies	$19,196,425 to $23,071,790
Personnel	$4,417,200 to $5,861,600
Subtotal	$23,613,625 to $28,933,390
Legislatively Designated Replacement Pool Lands (148,987.6 acres)	
Field and Laboratory Studies	$37,246,450 to $44,696,280
Personnel	$8,500,600 to $11,334,200
Subtotal	$45,747,050 to $56,230,480
Total:	$65,360,675 to $85,163,870

Table 4. Summary of costs related to dollar valuation of accessible high- and very high-potential sand-and-gravel deposits in Mental Health Grant (Trust) Lands and Legislatively Designated Replacement Pool Lands in Alaska.

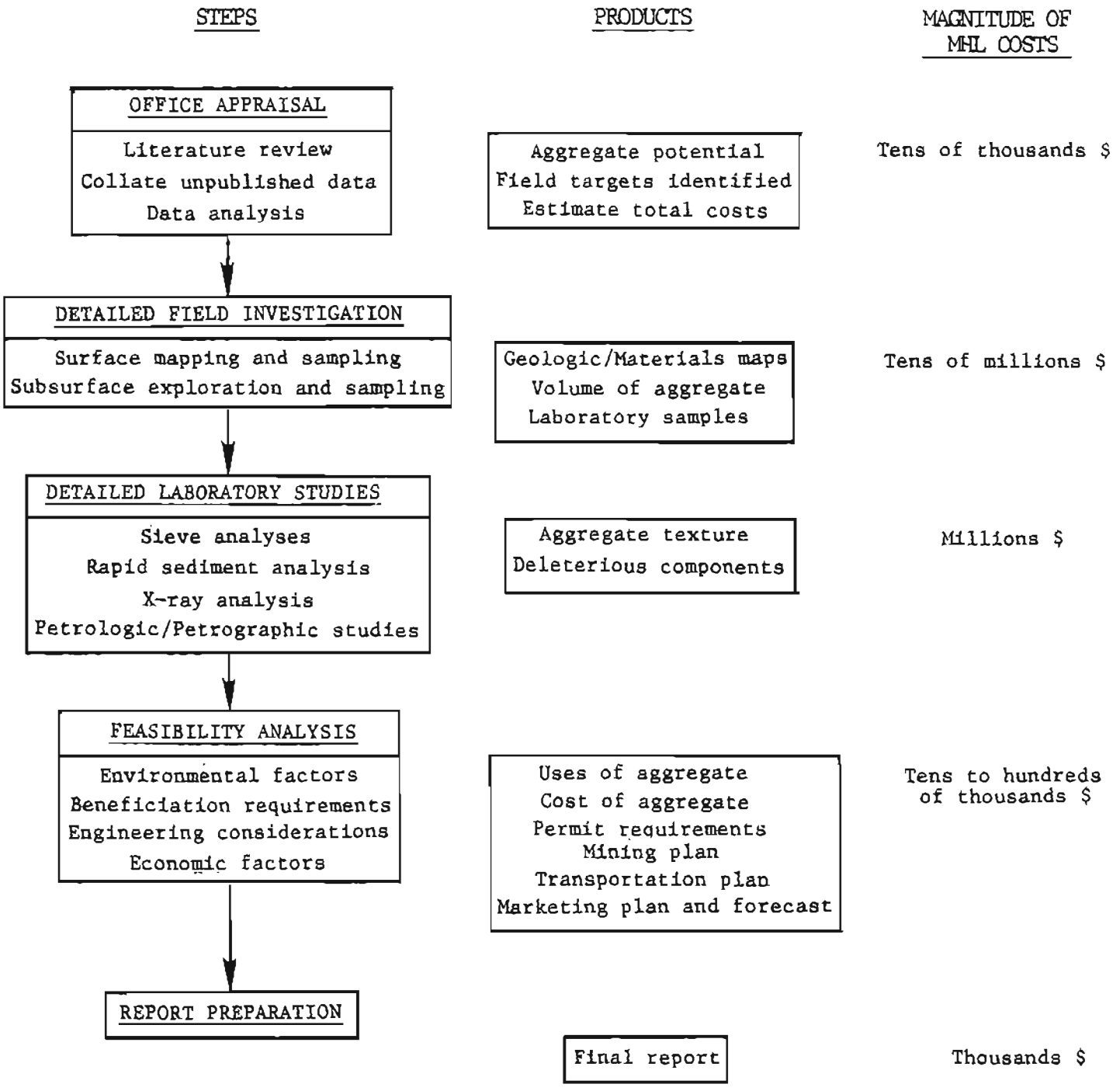

Figure 3. Comparison of standard procedures for evaluating sand-and-gravel deposits and magnitude of costs of these procedures for mental health land replacement program in Alaska.

References Cited

Reger, R.D., 1987, Survey of the sand-and-gravel potential of Mental Health Grant Lands in Alaska: Alaska Division of Geological and Geophysical Surveys Public Data File 87-28, scale 1:63,360, 85 sheets, 154 p.

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