ANALYSIS OF SEDIMENTATION AND WATER QUALITY OF KIDD ISLAND BAY, LAKE COEUR D'ALENE, IDAHO

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Submitted to
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Spokane, Washington

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Kidd Island Bay is a heavily used recreation area with both vacation and summer homes on the surrounding shores. Over the past several years, the bay has become too shallow for use by boats curtailing the owners enjoyment of their property.

This project was begun with the objective of identifying sediment sources, determining the amount of sediment from each, and measuring the quality of the water in the bay. Because of the very low runoff, measurement of runoff and sediment was inconclusive. Therefore, the sediment-runoff relations had to be determined by using standard accepted methods of computation. The results of various measurements and computations are given in the sections that follow.

WATERSHED DESCRIPTION

The Kidd Creek watershed (identified as Kid Creek on the USGS maps) is approximately 4263 acres or 6.66 square miles and is about 6 miles southwest of Coeur d'Alene. The bay faces north-northeast and is sedimented in on the upper reaches. The land use in the total watershed is (in June 1985):

Forest	2683 acres
Grass	1408 acres
Wheat	88 acres
Fallow	52 acres
Corn	17 acres
Oats	15 acres
	4263 acres

Most of the cultivated land is located on Mica Flats and did not appear to contribute much to either the runoff or sediment.

RUNOFF AND SEDIMENTATION

Grab sampling stations were established at five locations marked on the enclosed map (Fig. 1). At each of these locations, discharge measurements and sediment samples were taken. Some water quality samples were also taken by the Coeur d'Alene office of the Idaho Division of the Environment. Results of those samples are available from that office. In addition to the staff gage stations, one location was equipped with a stage recorder to provide a continuous record of streamflow. Table 1 shows the daily average flow at the Kidd Creek Ranch bridge. Also attached is a listing of all other measurements and samples taken at other sites. It should be noted that none of the values are anywhere near what should be normal for this spring runoff.

Because of the low runoff, it was decided to use a standard Soil Conservation Service (SCS) runoff model called TR20 to obtain a range of runoff values from different types of storms and then use those values in a sediment yield calculation.

The watershed was divided into five parts as shown on the map (Fig. 1). A soils and land use map and photos were obtained from the SCS and the Agricultural Stabilization and Conservation Service (ASCS) in Coeur d'Alene. From these we determined the following for each watershed:

<u>Watershed 1</u>

Total Area = 3353 acres

Woods	-	2031 acres
Meadow	-	1150 acres
Wheat	-	88 acres
Fallow	-	52 acres
Corn	-	17 acres
Oats	-	15 acres

CN = 64 Tc = 1.08 hours

Watershed 2

Total Area = 399 acres

Meadow - 231 acres

Woods - 168 acres

CN = 71 Tc = 0.29 hours

Watershed 3

Total Area = 172 acres

Woods - 163 acres

Meadow - 9 acres

CN = 72 Tc = 0.16 hours

Watershed 4

Total Area = 241 acres

Woods - 229 acres

Meadow - 12 acres

CN = 70 Tc = 0.12 hours

Watershed 5

Total Area = 98 acres

Woods - 92 acres

Meadow - 6 acres

CN = 65 Tc = 0.10 hours

In the above descriptions, CN is the runoff curve number and Tc is the time of concentration, both determined using SCS techniques. The runoff curve number is an indicator of how much runoff will be generated by precipitation. A CN = 100 indicates that all precipitation will runoff and a CN = 0 indicates that there will be no runoff generated. The time of concentration refers to the time required for runoff to travel from the most distant part of the storm area to the watershed outlet. Both CN and Tc appear to be reasonable for the area.

The sediment yield equation requires the use of the storm runoff volume and peak discharge. These were determined using the TR20 model. The following assumptions were made in the calculations: the ground was very wet as it would be during or after spring snowmelt and a 24-hour storm was reasonable. The rainfall events used were design amounts as follows:

Recurrence Interval (years)	Amount in 24 Hours (inches)
2	1.35
5	1.60
10	1.85
25	2.20
50	2.50
100	2.80

The 10 and 25 year 24-hour storms are typically used for design of culverts and small conservation structures.

The sediment from each storm was then obtained using the Modified Universal Soil Loss Equation (MUSLE) developed in Texas and adapted for the Pacific Northwest. The equation used was

$$SY = 17.18\ (Q\ q_p)^{0.8}\ KLSCP$$

SY = sediment yield (tons/acre)

Q = storm volume (inches)

q_p = peak storm runoff (inches/hour)

K = soil erodibility factor

LS = slope length and steepness factor

C = crop management factor

P = conservation practice factor

The results of all the computations are shown below for each of the design storms.

24-Hour, 2-Year Storm
Precipitation = 1.35 inches

Watershed	Q inches	q_p in/hr	Sediment tons/acre	Tons
1	0.25	0.095	0.09	300
2	0.37	0.38	0.11	44
3	0.40	0.50	0.076	13
4	0.35	0.50	0.076	18
5	0.26	0.36	0.038	4
				379

24-Hour, 5-Year Storm
Precipitation = 1.60 inches

Watershed	Q inches	q_p in/hr	Sediment tons/acre	Tons
1	0.38	0.16	0.19	640
2	0.53	0.56	0.20	80
3	0.56	0.73	0.14	24
4	0.51	0.73	0.14	34
5	0.40	0.57	0.076	7
				785

24-Hour, 10-Year Storm
Precipitation = 1.85 inches

Watershed	Q inches	q_p in/hr	Sediment tons/acre	Tons
1	0.53	0.23	0.34	1140
2	0.71	0.76	0.32	130
3	0.74	0.97	0.21	36
4	0.68	0.98	0.22	53
5	0.54	0.80	0.13	13
				1372

24-Hour, 25-Year Storm
Precipitation = 2.20 inches

Watershed	Q inches	q_p in/hr	Sediment tons/acre	Tons
1	0.76	0.35	0.54	1810
2	0.97	1.05	0.54	210
3	1.01	1.32	0.35	60
4	0.93	1.35	0.36	87
5	0.77	1.15	0.23	22
				2189

24-Hour, 50-Year Storm
Precipitation = 2.50 inches

Watershed	Q inches	q_p in/hr	Sediment tons/acre	Tons
1	0.97	0.46	0.97	3250
2	1.20	1.31	0.76	300
3	1.25	1.64	0.49	84
4	1.16	1.69	0.52	120
5	0.98	1.46	0.33	32
				3786

24-Hour, 100-Year Storm
Precipitation = 2.80 inches

Watershed	Q inches	q_p in/hr	Sediment tons/acre	Tons
1	1.19	0.57	1.35	4530
2	1.45	1.58	1.03	410
3	1.50	1.96	0.65	110
4	1.40	2.03	0.70	170
5	1.21	1.79	0.46	45
				5265

The largest watershed contributes the most sediment simply because it is the largest watershed. For small storms, Watershed 2 contributes more on a unit area basis while for large storms, the main watershed contributes the most on a unit area basis. These two are the main contributors of sediment.

Further, they cause problems in two different ways. The main watershed brings sediment into the bay in such a manner that it will spread out over the entire bay until forced to move to the west of the A-frames. At the same time, Watershed 2 builds up a delta just at the end of the large land span at the head of the bay impeding sediment movement down the bay. The net result is extra deposition at this location. Therefore this is one trouble spot that future engineering studies should address.

The runoff and sediment computation results can be used in several ways but the most useful is to estimate volumes deposited by an average storm such as the 5-year event which yields 640 tons from the main watershed. All of the sand and much of the silt material will stay in the bay. For these watersheds the sand and silt particles should typically compose 75 percent by weight of the sediment carried by a stream all of which will stay in the bay. This means that for each storm, the following amounts of sediment will be deposited in the bay from all watersheds:

Storm (yr)	Tons	Sediment in Bay (tons)	Volume of Sediment (yd^3)	Depth (ft)
2	379	284	421	0.01
5	785	589	873	0.03
10	1372	1029	1524	0.05
25	2189	1642	2432	0.08
50	3786	2840	4207	0.15
100	5265	3949	5850	0.20

Over a 25 year period, if all storms occured exactly as the probabilities show and each storm lasted exactly 24 hours, there would be 12 2-year storms, 5 5-year storms, etc. for a total sediment delivery in the bay of 16420 cubic yards or a depth of 0.57 feet. At the same time, since the larger storms typically last more than 24 hours, this figure could probably be raised to 0.8 to 1.0 feet. This is the depth to be expected from these storms given the assumption that went into the calculation.

There is also a large amount of sediment that comes from the spring snowmelt. This amount would typically be less than that from the rainstorm, but for a worse case design condition it could be said to be equal to the rainfall amount. Thus a design amount of sediment for both rainfall and snowmelt is about 1.6 to 2.0 feet spread uniformly over the 350,000 square yards of the bay from Transect 2 to Transect 6. This does not really happen because more is deposited at the upper end of the bay than at the mouth so the problem of reduced depths appears first above the constrictions at Spencer's Creek (Watershed 2) and the A-frame.

BAY BOTTOM SEDIMENT AND WATER QUALITY

Introduction

Sampling of the lake bottom material and water within Kidd Island Bay was conducted on August 22 and 23, 1985. A series of six transects were established across the bay. These transects ran in a generally east-west orientation (see Fig. 2). The first transect was established at the mouth of the bay, just south of Kidd Island. Subsequent transects were established across the bay from the Hunt's, across the bay from the Knox's, south of the island but north of the A-frames, south of the A-frames and across the bay from the Rouse's. Additional sampling areas were located in the boat dock area east of the A-frames and on each arm of the bay bordering the peninsula at the head of the bay.

Each transect had six sampling points. The A-frame dock area had two sampling points and four sampling points were located along each side of the peninsula. At each sampling point, core samples of bottom material and water quality samples of the water column were obtained. In areas where the water depth was greater than 10 feet, two water quality samples were taken at 5 feet and mid-depth and were composited to form one sample. In areas where the water depth was less than 10 feet, one sample was obtained from mid-depth.

A profile was obtained of the delta formed where the creek near Spencer's house (referred to as Spencer's Creek for this project and labeled Watershed 2 on Fig. 1) empties into the bay. Material in the delta was basically course unconsolidated material and was very difficult to core sample. It would appear that the fine material within the delta area has been scoured away and deposited elsewhere in the bay.

The core samples of bottom sediment material were analyzed for bulk density, nitrate content, particle size distribution and the presence of a distinctive ash layer. Bulk density is the weight of one cubic foot of bottom sediment. Loose, porous sediments will generally have lower bulk densities. Particles of finer textured sediments do not ordinarily rest as close together as those of coarse sediments and therefore, a unit volume of fine textured sediments may contain a significant amount of void spaces. Finer textured sediments also contain higher amounts of organic matter which also contributes to lower bulk densities.

The nitrate ion is formed by the complete oxidation of ammonium ions by soil and water microorganisms. Growing plants assimilate nitrate and convert it into protein. The presence of nitrate on sediment particles can therefore, promote aquatic plant growth as well as approaching levels that present a human health hazard. Both point sources and non-point sources may contribute nitrates to the aquatic system. In the former category are septic tanks and feedlot discharges, both possible sources found on the Kidd Creek watershed. In the latter category are farm fertilization operations, animal wastes, lawn fertilizer, atmospheric deposition, losses from natural sources due to erosion, and combustion of fossil fuels.

Particle size analysis is conducted to determine the proportion of the sediment sample comprised of sand, silt and clay. Sand is comprised of material greater than 0.002 inches, silt ranges between 0.0002 inches and 0.002 inches and the clay fraction is comprised of particles less than 0.0002 inches. The particle size distribution found within a series of sediment samples may provide information about sediment deposition patterns.

With the erruption of Mt. St. Helens in May of 1980 and the resulting deposition of ash across northern Idaho, the presence of a distinctive ash layer would provide a good point of reference for determining sediment depostion since this event. The use of such a reference point would depend greatly in the ash layer remaining undisturbed after it had been deposited.

Water quality samples were analyzed for nitrate content as well as the presence of lead, zinc and mercury. Nitrate levels in the water can contribute to aquatic plant growth and the presence of the listed metals can produce human health hazards.

Results and Discussion

Bulk density analysis results are presented in Table 2 and Figure 3. A great deal of variability in bulk densities was encountered, ranging from a high of 114 lb/ft^3 near the outfall of the culvert draining Kidd Creek to a low of 9.3 lb/ft^3 found at the site of the old sawmill near Hunt's dock. Variability along individual transects is also apparent. A large portion of this variability is probably due to the uneven distribution of organic matter deposition throughout the bay. The more organic matter found in the sample, the lower the bulk density. The average bulk density calculated for each transect indicates a general decrease in bulk density as one moves from the head of the bay adjacent to the peninsula toward the mouth of the bay.

The water depth for each sampling point is also presented in Table 2 and mapped in Figure 4. The average depths for each transect within the previously dredged portion of the bay are: Transect 2 - 6.7 feet; and Transect 3 - 4.9 feet; Transect 4 - 4.7 feet; Transect 5 - 4.5 feet; and Transect 6 - 4.2 feet. This is a change in depth of 2.5 feet over a distance of approximately 2000 feet.

Particle size analysis and sediment nitrate content data are presented in Table 3. Moving from the head of the bay toward the mouth of the bay, the finest size fraction, the clay, begins to comprise in excess of 40 percent of the core samples. The nitrate content of the sediment samples ranges from

0.4 parts per million (PPM) on the east side of the peninsula to 3.7 PPM on the east side of the bay, south of the island but north of the A-frames. A study of lakes in Wisconsin, cited by Wetzel in his limnology text, reported a nitrate content of bottom sediments of 0.3 PPM in eutrophic (nutrient rich, plant supporting) lakes.

In approximately half of the core samples, a light, porcelain-like layer ranging in thickness from less than 0.25 inches to almost 4 inches was evident. Samples with such a layer were generally found at the sampling points located at the ends of the transects, nearer the shoreline. Microscopic examination of samples of this light colored material revealed the presence of significant amount of diatoms--microscopic algae of the phylum Chrysophyta--and greatly varying amounts of ash. It would appear that the deposited ash has been thoroughly mixed with other bottom material and that perhaps wave action has caused the concentration of ash to be the greatest along the shoreline areas of the bay. This disturbance of the ash layer eliminated its use as a good point of reference for estimating post-1980 sediment deposition.

Water quality data are presented in Table 4. Mercury and lead levels were below the detection limits of 0.04 PPM of the General Analytical Laboratory of the University of Idaho. The Environmental Protection Agency has established a limit of 0.05 PPM of lead for a domestic water supply. A limit of 0.002 PPM of mercury has been established by the EPA. Due to the range of detection of the equipment available in the General Analytical Laboratory, this report can make no concrete conclusions about the concentration of mercury within the bay.

Nitrate levels in the water samples ranged from less than 0.01 PPM to 0.09 PPM. The EPA has established a limit of 10 PPM for a domestic water supply. Limnological research has indicated levels of 0.5 PPM to 1.5 PPM of nitrate in circulating water generally leads to eutrophication problems.

Zinc levels ranged from 0.01 PPM to 0.11 PPM. The EPA has established an allowable limit of 5 PPM of zinc for a domestic water supply.

CONCLUSIONS

It appears that the bedload material being carried into the bay by Kidd Creek and Spencer's Creek is settling out quickly. The higher bulk densities at the outfall of the culvert and in the channel at the mouth of Spencer's Creek indicate that the heavier particles are being deposited in these areas while the fine sediments and organic material are being transported farther out into the bay.

The total amount of sediment being deposited in the bay was estimated using the MUSLE equation and 24 hour storms of differing return periods. Based on assumptions about the number of storms in a 25 year period, it was estimated that up to two feet of sediment could accumulate over the bay. The depth, bulk density and size analysis transects over the bay show that the mouth of Spencer Creek and perhaps the A-frame area are potential problem areas that should be looked at.

The heavy boat traffic experienced within the bay definitely affects the sediment transportation and distribution process. The presence of shallow water with large boat engines leads to a constant turning over of bottom material. These boats provide the energy necessary to dislodge particles of all three size classes under consideration and establish currents which can then transport the now suspended material down the bay and perhaps even into the lake. During the sampling period in August, it was observed that even at low rates of speed, power boats produced a large brown wake of sediment.

The reduction in depth as one moves toward the head of the bay is of particular interest in light of the fact that the original dredging established a uniform depth throughout that portion of the bay. Even with the power boats acting to mix and transport the deposited sediment, it appears that the dredged portion of the bay is filling in from the head on out toward the mouth. If the lake level and the depth of water immediately after dredging could be determined, then by knowing the lake level on August 22, 1985, the depth of accumulation could be computed.

The nitrate levels of the sediment samples may be a significant contributing factor to the eutrophication problem being encountered within the bay. Nutrients available for aquatic plant growth are used by the plant during the growing season and then returned to the aquatic system as organic matter when the plant dies. The area of highest sediment nitrate content is located in an area of heavy boat traffic near the A-frame docking area.

The results of the analysis of samples of the water column indicate no major problems with nitrate, lead, zinc or mercury within the bay. Nitrate levels are comparable with those found in other lakes in northern Idaho and is well below problem levels. The metals do not appear to be a problem although no concrete conclusions may be made about mercury levels due to the detection limits of the laboratory equipment.

COOPERATORS

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Ben and Barbara Hunt	- use of boat for coring and water quality sampling.
Mr. & Mrs. Tom Edmundson	- staff gage site.
Mr. & Mrs. Lee Kusske	- provided housing for the two students.
Mr. & Mrs. Ray Inderrieden	- provided housing for the two students.
Mr. Gordon Tate	- staff gage site.
Mr. Jay Hyatt	- staff gage site.
Mr. Clif Schoener	- recording gage site at bridge.
Mr. Norman Scheard	- staff gage site.

APPENDICES

TABLE 1 Daily Average Discharges at Kidd Creek Ranch

Date	average water level	average discharge (cfs)	Date	average water level	average discharge(cfs)
4-11	1.57	9.0	5-28	1.14	1.45
4-12	1.53	6.4	5-29	1.13	1.4
4-13	1.49	4.8	5-30	1.23	1.9
4-14	1.46	3.9	5-31	1.18	1.65
4.15	1.45	3.75	6-1	1.16	1.55
4-16	1.43	3.4	6-2	1.16	1.55
4-17	1.39	2.9	6-3	1.15	1.5
4-18	1.39	2.9	6-4	1.15	1.5
4-19	1.40	3.1	6-5	1.14	1.45
4-20	1.38	2.8	6-6	1.18	1.65
4-21	1.34	2.5	6-7	1.28	2.15
4-22	1.34	2.5	6-8	1.11	1.35
4-23	1.40	3.1	6-9	1.07	1.2
4-24	1.32	2.4	6-10	1.05	1.15
4-25	1.31	2.3	6-11	1.03	1.05
4-26	1.30	2.2	6-12	1.01	1.00
4-27	1.29	2.15	6-13	1.01	0.95
4-28	1.28	2.15	6-14	1.00	0.9
4-29	1.26	2.05	6-15	0.99	0.9
4-30	1.23	1.9	6-16	0.98	0.85
5-1	1.23	1.9	6-17	0.97	0.85
5-2	1.22	1.85	6-18	0.96	0.8
5-3	1.23	1.9	6-19	0.95	0.75
5-4	1.22	1.85	6-20	0.93	0.70
5-5	1.21	1.8			
5-6	1.20	1.75			
5-7	1.19	1.7			
5-8	1.19	1.7			
5-9	1.19	1.7			
5-10	1.18	1.65			
5-11	1.18	1.65			
5-12	1.17	1.6			
5-13	1.17	1.6			
5-14	1.17	1.6			
5-15	1.16	1.55			
5-16	1.15	1.5			
5-17	1.15	1.5			
5-18	1.14	1.45			
5-19	1.13	1.4			
5-20	1.12	1.4			
5-21	1.11	1.35			
5-22	1.10	1.35			
5-23	1.13	1.4			
5-24	1.13	1.4			
5-25	1.12	1.4			
5-26	1.13	1.4			
5-27	1.13	1.4			

TABLE 2 Bulk Density of Bottom Sediment Samples Obtained From Kidd Island Bay, Lake Coeur d'Alene, Idaho.

Transect	Sample Point	Water Depth (ft)	Bulk Density (lb/ft^3)	BULK DENSITY Transect Mean	BULK DENSITY Transect Standard Deviation
1	1	42			
	2	46	12.3		
	3	41	37.0		
	4	33	16.4		
	5	34	50.3		
	6	10	32.0	29.6	15.5
2	1	6	19.5		
	2	6	18.2		
	3	8	16.2		
	4	8	16.2		
	5	7	18.2		
	6	5	9.3	17.7[1]	1.4
3	1	4.9	40.6		
	2	5.3	16.6		
	3	5.0	25.0		
	4	5.5	24.6		
	5	4.9	24.0		
	6	4.0	24.1	25.8	7.9
4	1	3.6	41.4		
	2	5.3	45.8		
	3	4.7	18.6		
	4	4.8	42.6		
	5	5.0	60.7		
	6	4.7	44.3	42.2	13.6
5	1	3.5	37.8		
	2	4.9	41.8		
	3	4.8	38.6		
	4	4.8	51.2		
	5	5.0	44.0		
	6	4.1	47.8	43.5	5.2
6	1	4.3	54.8		
	2	4.3	60.3		
	3	4.3	51.8		
	4	4.6	46.4		
	5	4.0	41.6		
	6	3.8	47.9	50.4	6.6

TABLE 2 continued

Transect	Sample Point	Water Depth (ft)	Bulk Density (lb/ft^3)	BULK DENSITY Transect Mean	BULK DENSITY Transect Standard Deviation
Western Peninsula	1	5.0	113.9		
	2	3.5	74.3		
	3	8.2	66.7		
	4	4.5	87.7	85.6	20.7
Eastern Peninsula	1	3.9			
	2	4.6	74.8		
	3	7.6			
	4	7.6	51.4	63.1	16.5
A Frame	1	4.6	40.1		
	2	4.6	48.8	44.4	6.2

[1] Mean and Standard Deviation were calculated using the first five sample points only due to presence of sawdust at point 6.

TABLE 3 Bottom Sediment Sample Nitrate and Textural Analysis, Kidd Island Bay, Lake Coeur d'Alene, Idaho .

Sample Transect	Location Point	Nitrate (PPM)	Sand	Silt	Clay	Textural Class
			------Percent------			
1	2	0.9	22.4	36.8	40.8	Clay
1	4	1.2	21.6	36.8	41.6	Clay
2	1	0.7	19.6	36.8	43.6	Clay
2	5	0.5	21.6	32.8	45.6	Clay
3	4	0.5	20.4	34.0	45.6	Clay
3	6	0.6	19.6	38.8	41.6	Clay
4	2	0.5	17.6	31.6	50.8	Clay
4	5	3.7	13.6	29.6	56.8	Clay
5	2	1.5	17.6	45.6	36.8	Silt Clay Loam
5	4	1.0	17.6	36.0	46.4	Clay
6	2	0.5	22.8	55.0	22.2	Silt Loam
6	5	0.6	18.4	49.2	32.4	Silty Clay Loam
West Pen.	2	1.1	3.4	81.4	15.2	Silt Loam
West Pen.	4	0.5	31.8	19.8	48.4	Clay
East Pen.	4	0.4	18.8	46.8	34.4	Silty Clay Loam
A Frame	2	0.5	19.6	34.0	46.4	Clay

TABLE 4 Results Of Water Quality Analysis for Samples Obtained from Kidd Island Bay, Lake Coeur d'Alene, Idaho.

Sample Location	Nitrate	Zinc	Mercury	Lead
	------ Part per Million-----			
Transect 1 Point 2	0.05	0.06	All less	
Transect 1 Point 4	0.01	0.05	than 0.04	
Transect 1 Point 6	0.09	0.03		
Transect 2 Point 2	0.01	0.03		
Transect 2 Point 4	0.01	0.02		
Transect 2 Point 5	0.01	0.11		
Transect 3 Point 2	0.01	0.05		
Transect 3 Point 4	0.01	0.03		
Transect 3 Point 6	0.01	0.02		
Transect 4 Point 1	0.01	0.03		
Transect 4 Point 3	0.01	0.01		
Transect 4 Point 5	0.01	0.01		
Transect 5 Point 1	0.05	0.09		
Transect 5 Point 3	0.03	0.01		
Transect 5 Point 6	0.02	0.01		
Transect 6 Point 2	0.02	0.02		
Transect 6 Point 4	0.02	0.01		
Transect 6 Point 6	0.02	0.03		
West Peninsula Point 2	0.02	0.03		
West Peninsula Point 3	0.02	0.02		
West Peninsula Point 4	0.02	0.02		

TABLE 5. WATER AND SEDIMENT DISCHARGE

SITE=EDMUNDS

DATE	TIME	GAGE (FT)	DISCH (CFS)	SEDCONC (PPM)	SEDIMENT (TONS)
3-28-85	13.10	0.19	2.15	47	0.27
4-4-85	12.14	0.27	3.32	17	0.15
4-4-85	14.40	0.27	2.72	7	0.05
4-4-85	16.24	0.27	3.14	42	0.35
4-5-85	15.25	0.24	2.29	21	0.13
4-6-85	11.12	0.18	2.01	56	0.30
4-6-85	13.23	0.17	1.94	50	0.26
4-6-85	15.28	0.17	1.95	65	0.34
4-9-85	16.13	0.12	1.53	103	0.42
4-10-85	10.00	0.12	1.39	979	3.67
4-10-85	16.29	0.10	.	.	.
4-11-85	10.00	0.10	1.22	.	.
4-11-85	14.02	0.09	.	.	.
4-12-85	10.05	0.08	1.11	4	0.01
4-17-85	14.40	.	0.44	.	.
4-18-85	17.20	0.01	0.49	23	0.03
4-19-85	9.43	0.01	0.52	2	0.00
4-19-85	13.34	0.01	.	.	.
4-23-85	9.42	0.03	.	.	.
4-23-85	13.50	0.00	.	.	.
4-24-85	9.20	.	.	.	.

SITE=HIWAY

DATE	TIME	GAGE (FT)	DISCH (CFS)	SEDCONC (PPM)	SEDIMENT (TONS)
3-25-85	15.00	0.20	1.85	82	0.41
3-28-85	13.45	0.16	0.69	353	0.66
4-4-85	12.36	0.16	0.64	102	0.18
4-4-85	15.00	0.16	0.46	181	0.22
4-5-85	15.57	0.16	0.60	217	0.35
4-6-85	11.25	0.14	0.48	96	0.12
4-6-85	13.41	0.13	0.56	221	0.33
4-6-85	15.40	0.13	0.41	191	0.21
4-9-85	16.34	0.06	0.38	311	0.32
4-10-85	9.21	0.07	0.26	.	.
4-10-85	16.41	0.05	.	.	.
4-11-85	10.25	0.04	0.18	76	0.04
4-11-85	14.12	0.02	.	.	.
4-12-85	10.27	0.02	0.13	54	0.02
4-17-85	15.09	.	0.06	72	0.01
4-18-85	17.49	.	0.09	101	0.02
4-19-85	10.09	0.00	0.18	26	0.01
4-23-85	10.00	0.05	.	2	.
4-24-85	9.25	.	.	.	.
4-22-85	17.15	.	.	35	.

SITE=HYATTS

DATE	TIME	GAGE (FT)	DISCH (CFS)	SEDCONC (PPM)	SEDIMENT (TONS)
4-5-85	17.07	4.17	7.85	125	2.65
4-6-85	10.55	4.11	6.20	.	.
4-6-85	12.53	4.10	5.79	24	0.38
4-6-85	14.54	4.10	5.60	24	0.36
4-9-85	15.20	4.03	3.85	23	0.24
4-10-85	10.08	4.02	3.50	5	0.05
4-10-85	16.26	4.02	.	.	.
4-11-85	9.45	4.00	2.93	9	0.07
4-11-85	13.59	3.98	.	.	.
4-12-85	9.48	3.97	2.40	128	0.83
4-17-85	14.11	3.82	1.01	.	.
4-18-85	17.06	3.82	0.94	.	.
4-19-85	9.17	3.84	1.17	.	.
4-19-85	13.31	3.85	.	.	.
4-22-85	17.00	3.80	.	7	.
4-23-85	9.38	3.92	.	.	.
4-23-85	13.34	3.87	.	.	.
4-24-85	9.14	3.79	.	.	.

SITE=KIDD CREEK RANCH

DATE	TIME	GAGE (FT)	DISCH (CFS)	SEDCONC (PPM)	SEDIMENT (TONS)
3-28-85	11.50	0.31	10.40	.	.
4-4-85	11.39	0.50	20.85	.	.
4-4-85	14.10	0.50	22.46	16	0.97
4-4-85	16.03	0.49	23.40	9	0.57
4-5-85	14.55	0.46	18.29	11	0.54
4-6-85	10.20	0.39	15.93	1	0.04
4-6-85	12.30	0.38	14.92	13	0.52
4-6-85	14.36	0.39	.	9	.
4-9-85	14.54	0.27	8.92	16	0.39
4-10-85	10.30	0.25	8.50	135	3.10
4-10-85	16.22	0.25	.	.	.
4-11-25	9.24	0.22	8.19	5	0.11
4-11-85	13.55	0.22	.	.	.
4-12-85	9.20	0.18	6.53	.	.
4-17-85	13.31	0.05	2.91	.	.
4-18-85	16.48	0.04	2.85	10	0.08
4-19-85	8.47	0.06	2.89	.	.
4-19-85	13.28	0.06	.	.	.
4-23-85	9.30	0.09	.	.	.
4-23-85	13.38	0.07	.	.	.
4-24-85	9.11	0.00	.	.	.

SITE=REED

DATE	TIME	GAGE (FT)	DISCH (CFS)	SEDCONC (PPM)	SEDIMENT (TONS)
4-6-85	15.17	.	.	20	.

SITE=SPENCER

DATE	TIME	GAGE (FT)	DISCH (CFS)	SEDCONC (PPM)	SEDIMENT (TONS)
3-25-85	13.00	0.36	.	388	.
3-28-85	10.20	0.20	0.760	64	0.13
4-4-85	10.45	0.26	0.900	50	0.12
4-4-85	13.45	0.25	1.100	49	0.15
4-4-85	15.34	0.26	0.950	1	0.00
4-5-85	14.15	0.25	0.960	164	0.42
4-6-85	9.54	0.20	0.740	28	0.06
4-6-85	12.13	0.20	0.730	11	0.02
4-6-85	14.15	0.20	0.770	19	0.04
4-9-85	14.22	0.17	0.450	23	0.03
4-10-85	10.54	0.15	0.430	27	0.03
4-10-85	17.16	0.16	.	.	.
4-11-85	9.04	0.15	0.300	63	0.05
4-11-85	13.47	0.14	.	.	.
4-12-85	9.02	0.13	0.230	79	0.05
4-17-85	12.42	0.08	0.090	.	.
4-18-85	16.27	0.08	0.096	17	0.00
4-19-85	8.26	0.09	0.110	9	0.00
4-19-85	13.24	0.09	.	.	.
4-22-85	16.43	0.07	0.086	77	0.02
4-23-85	9.25	0.11	.	.	.
4-23-85	13.33	0.09	.	.	.
4-24-85	9.04	0.07	.	.	.

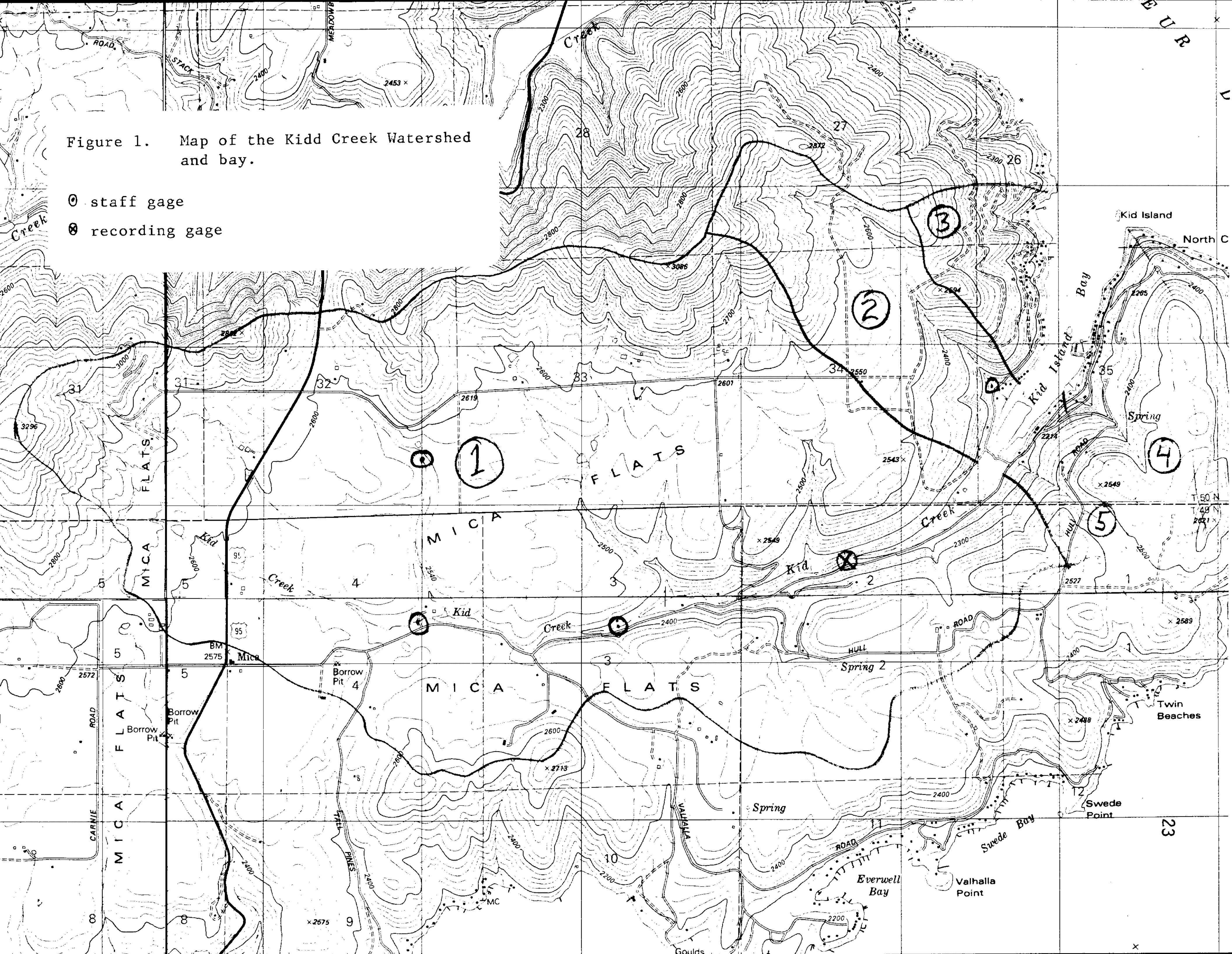

Figure 1. Map of the Kidd Creek Watershed and bay.

⊙ staff gage

⊗ recording gage

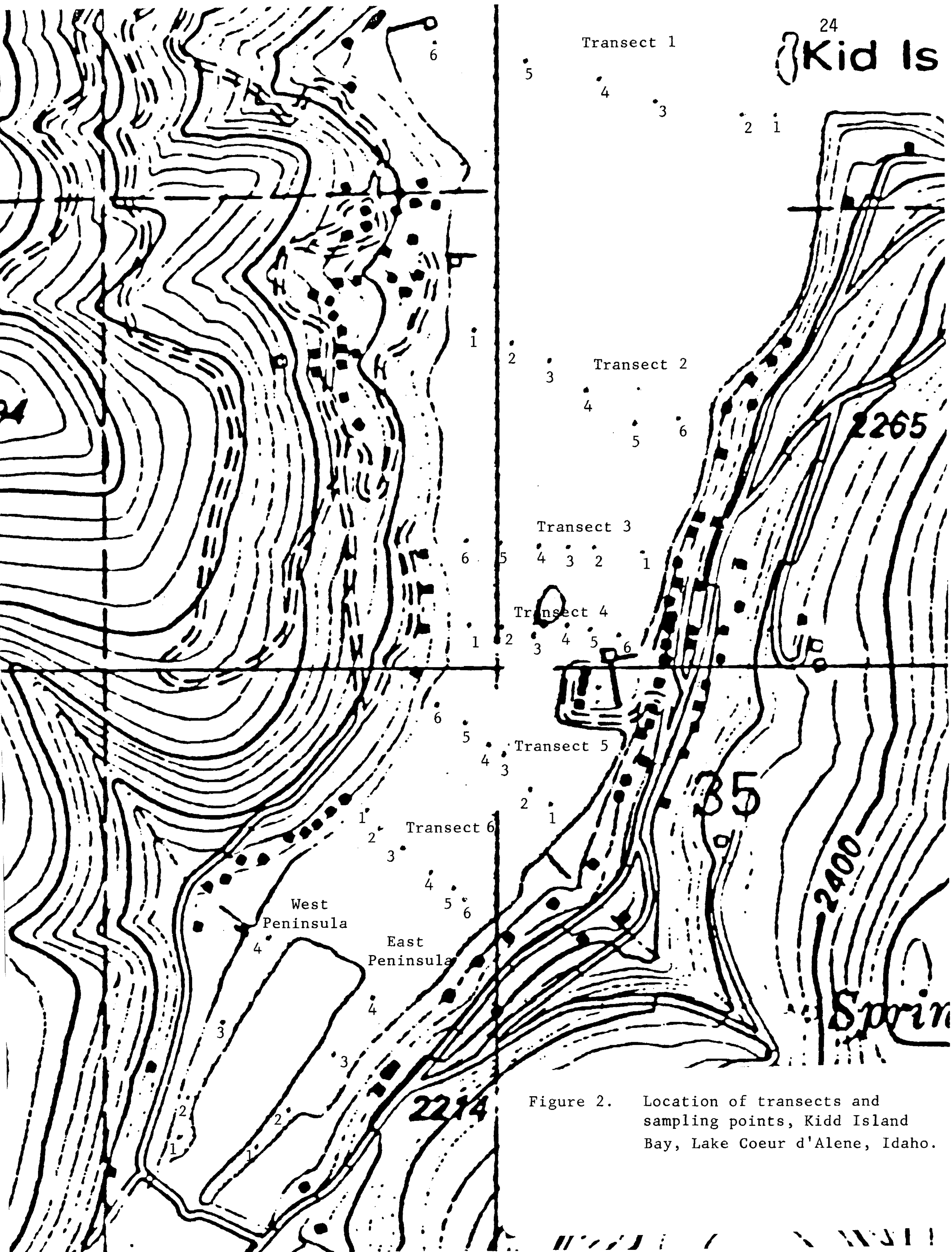

Figure 2. Location of transects and sampling points, Kidd Island Bay, Lake Coeur d'Alene, Idaho.

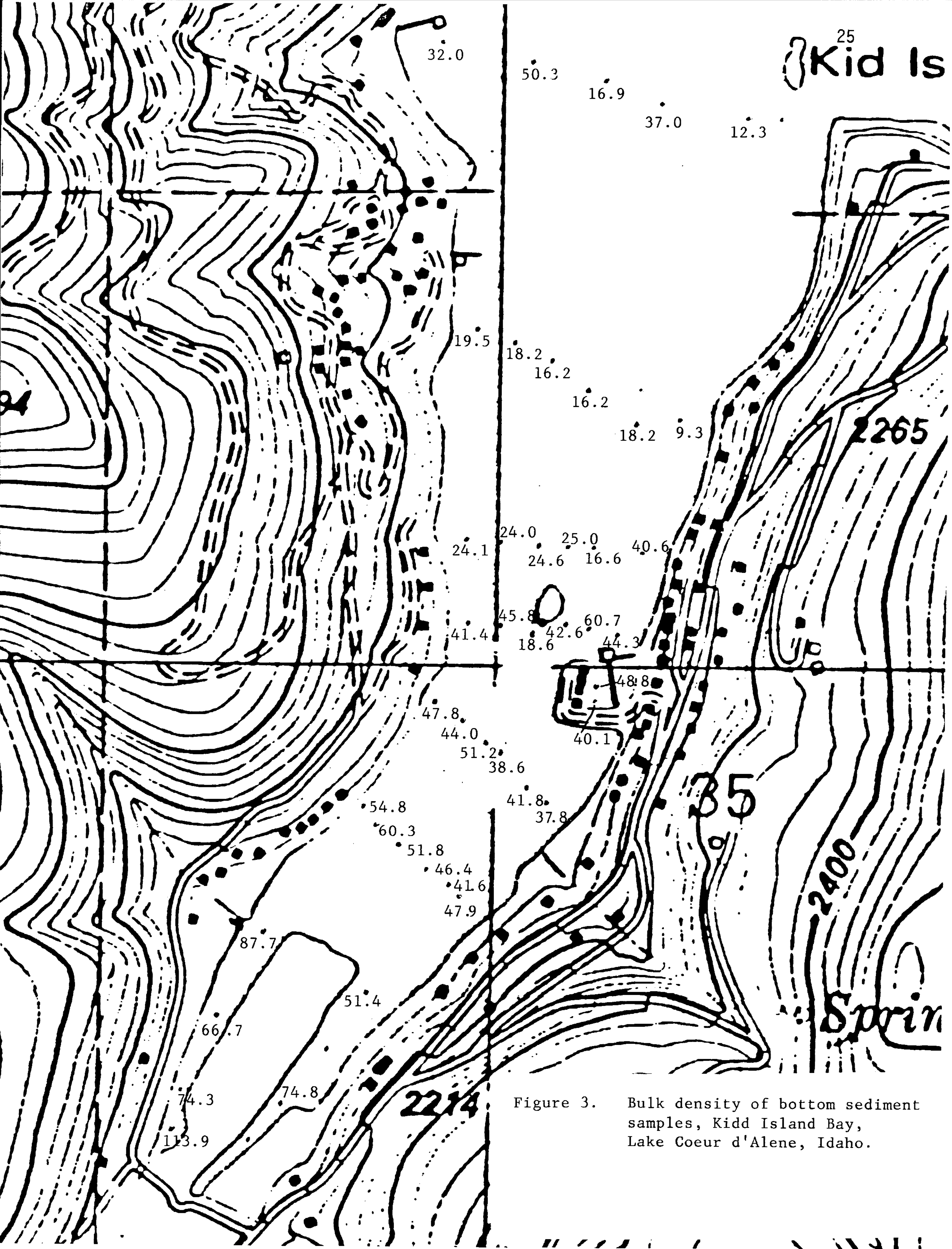

Figure 3. Bulk density of bottom sediment samples, Kidd Island Bay, Lake Coeur d'Alene, Idaho.

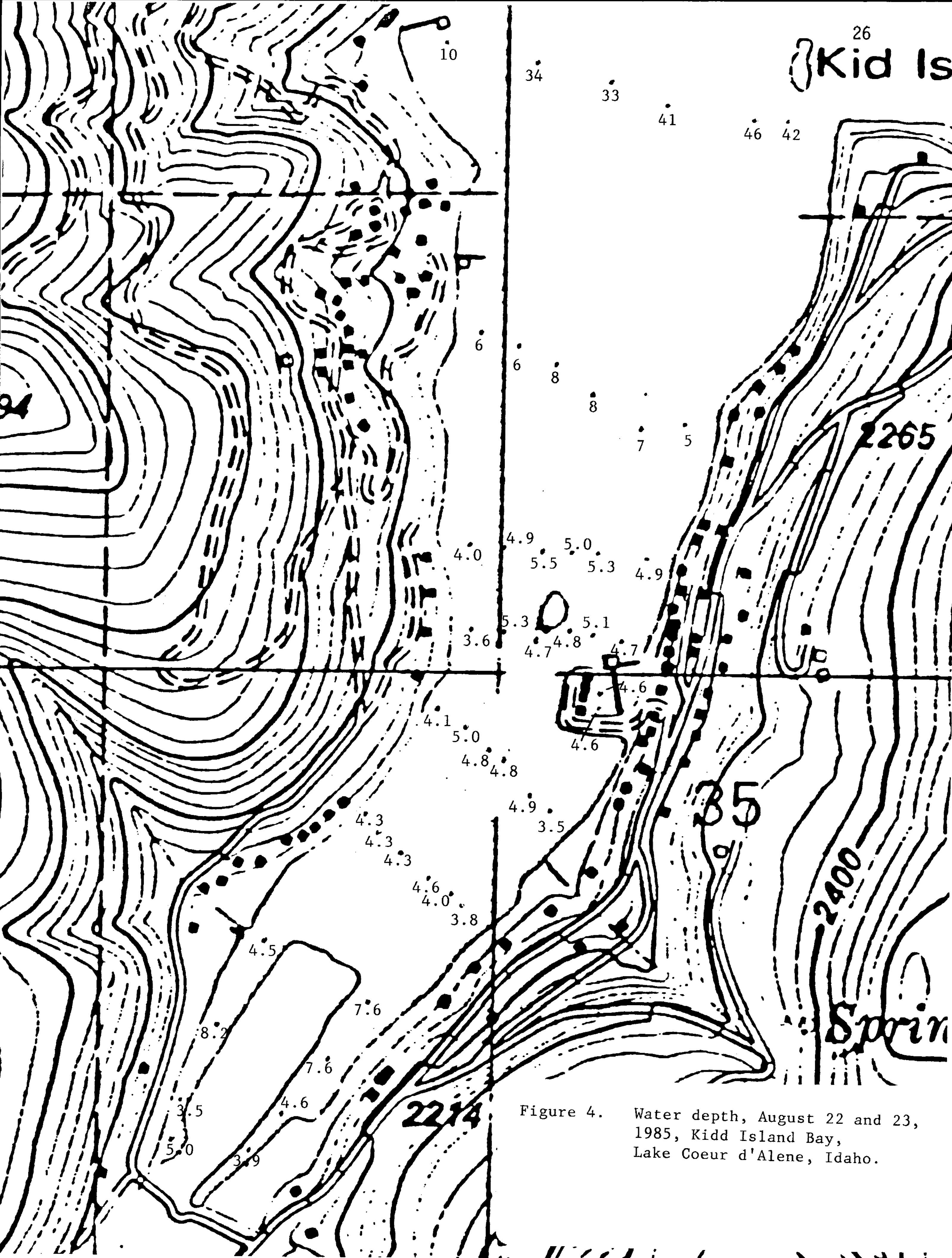

Figure 4. Water depth, August 22 and 23, 1985, Kidd Island Bay, Lake Coeur d'Alene, Idaho.