MONITORING THE EFFECTS OF FLOWS FROM GLEN CANYON DAM ON SAND BAR DYNAMICS IN THE COLORADO RIVER CORRIDOR, GRAND CANYON NATIONAL PARK, ARIZONA

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ABSTRACT

Grand Canyon sand bars are a primary resource of Grand Canyon National Park and the effects of interim flows on sand bars is of particular concern to river managers. This study assessed whether interim flows minimized sand bar erosion by comparing biannual topographic and bathymetric surveys at 32 study sites along the Colorado River through Grand Canyon National Park.

The lower range of flow fluctuation during interim flows increased the amount of sand bar area exposed above the surface of the river. Subaerially exposed bar surfaces are subjected to erosive process that occur by river related mechanisms (tractive and seepage erosion), surface runoff, wind, and human impact. The data obtained in this study indicate that the upper, emergent areas of the study sand bars were significantly eroded. Sand was redistributed to lower elevations within the recirculation zones, within and below the flow fluctuation zone, and into the main channel. Sand bar erosion was typically caused by the development and shoreward migration of cutbanks. Tractive force erosion caused cutbanks to develop at the maximum elevation of river flow. The reduced downramp rates and restricted flow fluctuation criteria of interim flows appeared to have minimized seepage-driven erosion, therefore, tractive force erosion was the dominant erosional mechanism. Deposition occurred periodically within and below the discharge levels of interim flows, but the overall volume of sand within recirculation zones decreased. Other topographic change included disconnection of the high-discharge return channel component of reattachment bars from the river as they gradually filled in with sand, silt, and vegetation. Active return channels during interim flow discharges occur at lower elevation and are narrower and shallower due to bankward migration of bar platforms.

The beneficial aspects of flooding were examined when three floods from the Little Colorado River (LCR) occurred during the winter of 1993. The floods provided an unexpected test case of a bar-building event by elevating Colorado River flows to slightly greater than powerplant capacity. Downstream of the LCR, a significant amount of flood-related deposition occurred as evidenced by 1-2 m of bar elevation increase. This was the only gain in sand volume at the higher topographic areas (>566 m^3/s stage elevation) detected during the monitoring. Erosion rates following the flood event were initially high but within approximately nine months had decreased to pre-flood levels. As of 1995, high elevation flood-deposition remained in areas not reached by interim flow stage elevations. The LCR floods demonstrated that sediment accumulated on the river bottom can be redistributed to sand bars during a high flow release.

These results support the need for cyclic rebuilding of sand bars with annual Bar-Building/Habitat Maintenance flows, as recommended in each of the Restricted Fluctuating and Steady Flow Alternatives in the Glen Canyon Dam Environmental Impact Statement. Sediment redistributed and stored in sand bars is removed from downstream transport and becomes available for riparian habitat development and recreational camping area. However, maintenance of sand bars depends on determining the duration and discharge which will build bars and restructure habitats without causing a net depletion of sand. Continued monitoring and research is needed to determine the effects of these, and future dam management strategies.

ACKNOWLEDGMENTS

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INTRODUCTION

Project Overview

Glen Canyon Dam (GCD) operations completely control the flow of the Colorado River through Grand Canyon and as a result downstream sediment resources are impacted (Water Science and Technology Board, 1991). Operational effects of GCD include: 1) a reduction in sediment supply because the dam traps nearly all incoming sediment, 2) extremely reduced flows as compared to historic peak flows which in turn has reduced the capacity of the river to transport sediment, and 3) fluctuating flows that affect sand bar stability and limit the height of annual deposition and erosion to the range of powerplant releases. Sand bars form the foundation on which the fluvial ecosystem is structured, and therefore sediment resources below GCD are a management priority of Grand Canyon National Park.

Specific objectives for sediment management in the Grand Canyon National Park River Management Plan are: 1) to maintain the various morphologic components of temporary sand storage (e.g., sand bar deposits), and 2) to maintain a positive sand balance (U.S. National Park Service, 1989). Starting in August of 1991, a program of restricted maximum flow and reduced fluctuation from GCD, termed interim flows, has been in effect. This operating strategy was designed to limit the impacts of dam operations on downstream river resources until a Record of Decision is delivered by the Secretary of the Interior for the GCD-Environmental Impact Statement (GCD-EIS) (U.S. Bureau of Reclamation, 1994). Implementation of Interim flows for GCD during the EIS preparation period requires that sediment resource conditions be monitored.

Sand bar stability and sand storage varies with changes in discharge, size and dimensions of debris fans, and tributary sand input (Schmidt and Rubin, 1995). The effects of dam operations on the morphology of sand bar deposits is closely linked to how recirculation zones respond to alternative water release patterns (Beus et al., 1992). Depending on the operating regime for GCD the balance between sand supply and main channel transport can be positive or negative (Smillie, et al., 1992). Because much of the remaining sediment in the Colorado River below GCD is stored in recirculation zones as sand bars (Schmidt and Rubin, 1995) it is critical that this resource be monitored. The stability of sand bar deposits and changes in sand storage in recirculation zones are used in this study as an indicator of the impacts of interim flows. Short-term changes in sand bars are monitored so that impacts related to changes in water release patterns are documented and long-term sand storage trends can be detected.

This report presents the results from survey studies designed to monitor the effects of interim flows on Colorado River sand bar dynamics in Grand Canyon during Fiscal Year 1995. We expand on the results of Kaplinski et al. (1995) by reporting the results from two additional surveys conducted in November 1994 and April 1995. These surveys allow us to test the hypothesis that interim flows have minimized sand bar erosion and increased sediment storage. The study of this discharge strategy for GCD during the period of EIS review is important because the EIS-Preferred Alternative (EIS-PA) closely resembles

interim flows, but also includes yearly bar-building/habitat maintenance flows and endangered aquatic species research flows (U.S. Bureau of Reclamation, 1994). This sand bar study involved the comparison of topographic and bathymetric surveys at 32 sites located in each of the 11 geomorphic reaches of the Colorado River corridor that were defined by Schmidt and Graf (1990). To determine the effects of Interim flows on the sediment and recreational resources within Grand Canyon National Park, the following objectives were established:

Objectives

A. Monitor the subaerial and subaqueous topography at 32 representative sand bars along the Colorado River corridor downstream from Glen Canyon Dam.

B. Use the results from the above objectives to compare topographic change and assess sand bar dynamics to determine whether sand bar deposits have been stabilized by interim flows, and whether Grand Canyon National Park management objectives for the Colorado River in Grand Canyon are being met.

C. Assess the effects of of interim flows on sand bars that were aggraded during the flood flows and sediment input from the Little Colorado River tributary during the winter of 1993.

D. Assist in compilation of the above data for the GCES/NPS Geographic Information System (GIS).

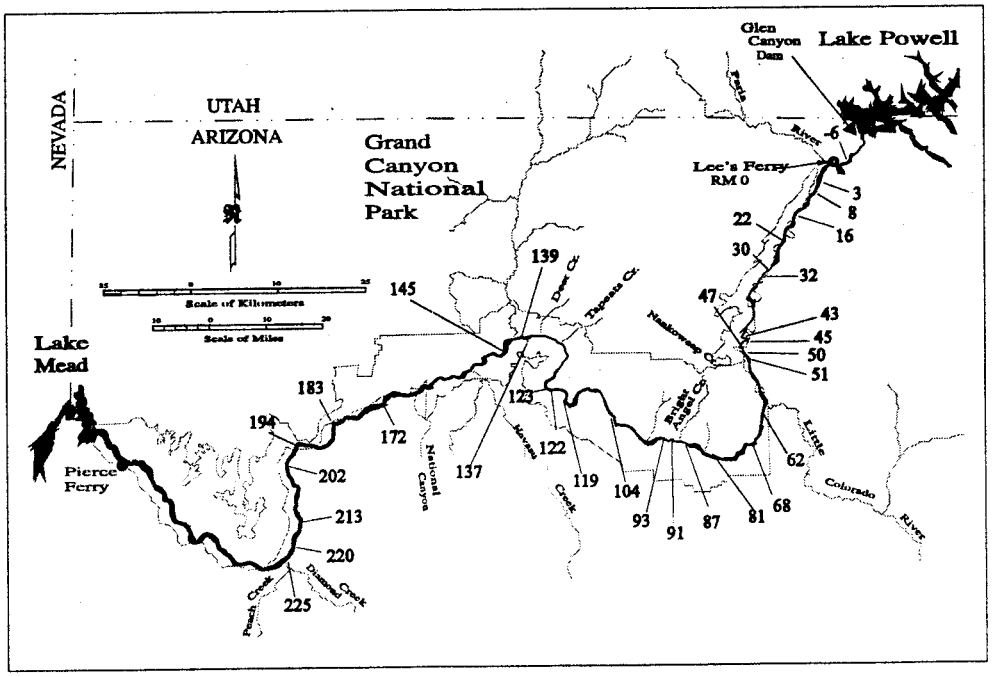

Figure 1. Location map showing study locations.

Table 1. Sand Bar Survey Sites

Site Ref.#	River Mile (RM)*	River Side	Site #	Site Name	Deposit Type	Reach/ Relative Width
-6	-6.5	Right	2	Hidden Sloughs	R	0W
3	2.6	Left	3	Cathedral Wash	R	1W
8	7.9	Left	4	Lower Jackass	S	1W
16	16.4	Left	5	Hot Na Na	S	2N
22	21.8	Right	6		R	2N
30	30	Right	7	Fence Fault	R	3N
31	31.6	Right	8	South Canyon	S	3N
43	43.1	Left	10	Anasazi Bridge	R/UP	4W
45	45.6	Left	11	Eminence Break	S	4W
47	47.1	Right	12	Lower Saddle	R	4W
50	50	Right	13	Dino	R/S	4W
51	51.2	Left	14		R	4W
62	62.4	Right	34	Crash Canyon	R	5W
68	68.2	Right	15	Upper Tanner	R/UP	5W
81	81.1	Left	16	Grapevine	R/S	6N
87	87.5	Left	17	Cremation	R/UP	6N
91	91.1	Right	18	Upper Trinity	S	6N
93	93.3	Left	19	Upper Granite	R/UP	6N
104	103.9	Right	20		R/UP	6N
119	119.1	Right	21		R	7N
122	122.2	Right	22		R	7N
123	122.7	Left	23	Upper Forster	R/UP	7N
137	136.7	Left	24	Middle Ponchos	R	8N
139	139	Right	25	Upper Fishtail	R/UP	8N
145	145	Left	26	Above Olo	R	9N
172	172.2	Left	27		R	10W
183	182.8	Right	28		R	10W
194	194.1	Left	29		R	10W
202	202	Right	30		S	10W
213	212.9	Left	31	Pumpkin Spring	R/UP	10W
220	219.9	Right	32	Middle Gorilla	R/UP	11N
225	225.3	Right	33		R	11N

* Distance downstream from Lees Ferry in Stevens (1983) river miles (RM). Deposit type from Schmidt and Graf (1990): R- reattachment deposit, S - separation deposit, UP - upper pool deposit. Reaches (0-11) and channel width (W-wide, N-narrow) from Schmidt and Graf (1990).

Previous Work

Historical and concurrent studies of sand bar dynamics, morphology, and sedimentology that pertain to this study can be separated into research conducted prior to initiation of the Bureau of Reclamation's Glen Canyon Environmental Studies (GCES) program in 1982 (National Resource Council, 1987), publications from GCES Phase I and II investigations, the latter of which was intended to be used for the GCD-EIS (Bureau of Reclamation, 1994), and on-going monitoring during the interim flow period.

Adverse downstream impacts from GCD were first recognized by Dolan et al. (1974) and early work that first quantified dam induced changes on sand deposits was based on analysis of aerial and ground photography since 1965 (Laursen and Silverston, 1976; Turner and Karpiscak, 1980) and topographic profile surveys of about 20 sand bars since 1973 (Howard, 1975; Howard and Dolan, 1981; Beus et al., 1985). These studies documented erosion of sand bars under the post-dam fluctuating flow regimes, with bar building and rapid erosion observed during the high flows of 1983-1986.

Public concern over dam operations culminated with the proposal by the Bureau of Reclamation in the early 1980's to revise and possibly increase the peaking power generation at GCD. This led the Department of the Interior, under pressure from the concerns of the public and other government agencies, to direct the Bureau of Reclamation to initiate the GCES Phase I program, the results of which are included in the GCES Final Report (U.S. Department of Interior, 1988). Several studies that were part of the Phase I program were the first to carefully describe the general hydraulic and sedimentologic characteristics of recirculation zones and associated bars. Schmidt and Graf (1990) developed a classification and description of alluvial sand deposits in Grand Canyon, a reach-length classification of the river corridor, and documented the history of bar aggradation and degradation at several study sites. Schmidt (1990) described the general association of sand bars with recirculating flow. Sand bar sedimentology and morphology were examined by Rubin et al. (1990). These studies greatly increased our understanding of the effects of fluctuating flows on sand bar stability and many of the concepts and processes discussed in this investigation were anticipated by them.

Increased public environmental concern initiated another phase of multidisciplinary research (GCES Phase II) in 1990 (Water Science and Technology Board, 1991) to provide information for the GCD-EIS. As part of this research, the Bureau of Reclamation conducted a series of discrete research flows from June 1990 through July 1991 to determine the impacts of specific flow regimes on sand bar stability (Beus and Avery, 1992). The test flows lasted a minimum of 11 days and included a variety of both steady and fluctuating releases. Fluctuating releases were either uniform (same daily pattern) or varied in response to changes in electrical load (normal releases). Each flow was preceded by 3 days of 142 m^3/s (5,000 ft^3/s). Important studies contained within Beus and Avery (1992) and other investigations conducted as part of the GCES Phase II program that are relevant to this report include bank stability changes related to groundwater fluctuations (Carpenter et al., 1991;

Budhu, 1992; Werrel et al., 1993), the importance of surface-gravity waves on sand bar stability (Bauer and Schmidt, 1993), modeling of recirculating flow (Nelson, 1991), daily photography detailing short-term topographic changes (Cluer, 1992), repeated surveying of topographic changes (Beus et al., 1992), and analysis of long-term trends in sediment storage (Clark et al., 1991; Schmidt, 1992; Webb et al., 1991).

The results from the GCES Phase II research flows, and in lieu of a Record of Decision for the GCD-EIS, led the Bureau of Reclamation to examine the effectiveness of the interim operating criteria. Ongoing monitoring studies related to this investigation during interim flows are repeated inventories of campsite size (Kearsley et al., 1994; Kearsley, 1995), sedimentologic investigations (Rubin et al., 1994), the importance of seepage erosion (Budhu and Gobin, 1994), daily eddy dynamics (Dexter et al., 1994), and long-term history of sediment storage change (Schmidt, 1994; Schmidt and Leschin, 1995).

Previous results from the monitoring effort detailed in this report were reported by Beus et al. (1992), Hazel et al. (1993), and Kaplinski et al. (1994; 1995). Based upon comparison surveys conducted on August, 1991, October, 1992, April, 1993, October, 1993, and April 1994, they concluded that interim flows significantly eroded Colorado River sand bars. Hazel et al. (1993) and Kaplinski et al. (1994; 1995) also demonstrated the importance of flooding to the system by documenting system-wide deposition as a result of tributary flooding in the LCR.

Modern Alluvial Deposits of the Colorado River

The characteristic channel unit of bedrock canyon rivers with abundant debris fans has been termed the fan-eddy complex (Schmidt and Rubin, 1995). This is a geomorphic assemblage of river constricting debris fan, backwater (pool) above the debris fan constriction, associated eddies with debris fans, and downstream gravel bars. At nearly all tributary junctions, debris fans locally constrict the main river channel (Figure 2; Hamblin and Rigby, 1969; Howard and Dolan, 1981). In the channel expansion above and below the narrowed channel, a recirculation zone (eddy) forms where flow separates from and then reattaches to the bank (Schmidt, 1990). In reaches dominated by debris fans, as much as 75% of the sand-sized sediment load of the Colorado River is deposited within these debris fan-eddy complexes (Schmidt and Rubin, 1995). Water velocities within eddies are much lower than velocities in the main channel and therefore are sites of potential sand deposition by a variety of bar forms (Schmidt et al., 1993). Deposition is typically localized near the separation point, reattachment point, and eddy center (Schmidt, 1990).

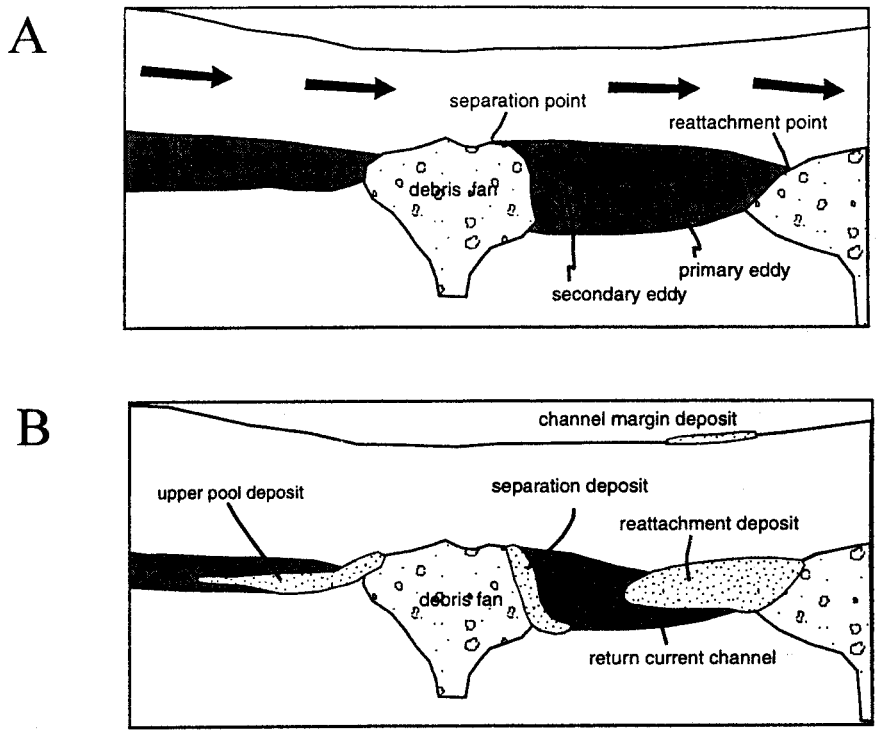

Figure 2. Schematic diagram showing flow patterns and configuration of bed deposits in a typical recirculation zone. A) flow patterns during higher volume flows. B) configuration of bed deposits during lower volume flows. Modified from Schmidt and Graf (1990).

Schmidt and Graf (1990) described and categorized several different types of alluvial sand deposits in Grand Canyon. These are:

Reattachment deposits form near the reattachment point of large primary eddies (Rubin et al., 1990). These bars are typically deposited along the downstream regions of the eddy by sediment swept across the eddy toward the shore, perpendicular to the main river current. This type of bar is characterized by a broad platform that extends upstream into the eddy. Return current channels form along the shoreward side of the reattachment bar platform where the eddy current is redirected along the shoreline. When a recirculation zone is present in the pool above the constriction an *upper pool deposit* is deposited that is similar to reattachment bar morphology or exists as a linear deposit along and parallel to the shoreline.

Separation deposits typically form immediately downstream of the debris fan constriction. They commonly mantle the downstream portion of the debris fan and are deposited in secondary eddies upstream of the larger primary eddy associated with the debris fan. This type of bar is typically steeper and of higher elevation than reattachment bars.

Channel margin deposits are those that parallel the shoreline in areas not specifically related to recirculation zones or separation points. This type of deposit was not examined in this study.

In addition to the above, *main-channel sediments* are transported and locally deposited along the channel bottom and in pools above constrictions.

The morphology and sedimentology of sand bars in recirculation zones is closely associated with changing flow patterns in the recirculating eddy (Rubin et al., 1990; Schmidt, 1990). During increasing discharge, recirculation zones expand as more bar area is inundated, and secondary eddies or low velocity zones develop upstream of the return current channel. This results in downstream migration of the reattachment point and upstream migration of the separation point onto the debris fan (Schmidt, 1990). Deposition rates also increase (Andrews, 1991). The reattachment deposit may fill much of the recirculation zone beneath the primary eddy. During periods of low discharge recirculation zones generally consist of a smaller, primary eddy and large areas where both the reattachment and separation bars are exposed (Schmidt and Graf, 1990).

Flow Regimes During Study

The discharge of the Colorado River in Grand Canyon has been regulated by GCD since its completion in 1963. GCD has substantially reduced the sediment load, sediment concentration, duration of high flows, and peak-flow rates compared to the unregulated streamflow of the pre-dam era. The annual flood from spring runoff is contained by Lake Powell. Only under extreme circumstances such as the extended periods during 1983-86 when spillway releases were necessary, has discharge exceeded maximum powerplant capacity of 940 m^3/s (33,200 ft^3/s). The other important flow exception during the post-dam era occurred in 1965 and 1980 for reservoir balancing and spillway tests, respectively, and when discrete research flows were conducted from June 1990 through July 1991 to provide data for the GCD-EIS. Prior to these test flows and until Interim flows were implemented, the previous range of discharge fluctuation was 85 m^3/s (3,000 ft^3/s) to 892 m^3/s (31,500 ft^3/s), with no limitations on maximum daily change and the rate of change in powerplant output discharge (ramp rate).

When interim flows began at the conclusion of the 1990-1991 test flow period the maximum discharge was limited to 566 m^3/s (20,000 ft^3/s), the minimum discharge to 142 m^3/s (5,000 ft^3/s), with up- and down-ramp rates of 57 $m^3/s/hr$ (2,000 $ft^3/s/hr$) and 42.5 $m^3/s/hr$ (1,500 $ft^3/s/hr$), respectively. In addition, normal dam operations that have continued during interim flows are low-, medium-, and high-volume months, with low flows during the late spring and late fall, moderate flows in May and September, and high flows during mid-summer and mid-winter (Figure 3). Interim flow criteria specify that daily change cannot exceed 142 m^3/s (5,000 ft^3/s) during low volume months, 170 m^3/s (6,000 ft^3/s) during medium volume months, and 227 m^3/s (8,000 ft^3/s) during high volume months. Flows are reduced on weekends as the demand for electricity decreases.

Tributary flooding from the Little Colorado River (LCR) caused significant deviations from regulated flows during the winter of 1993 (Figure 3). Three separate floods, January 12-16, January 19-23, and February, 23-26, 1993, raised flows that peaked at Phantom Ranch (RM88) to approximately 966 m^3/s (34,120 ft^3/s), 793 m^3/s (28,016 ft^3/s), and 824 m^3/s (29,100 ft^3/s), respectively. By raising mainstem flows to slightly above powerplant capacity and delivering a significant amount of sediment, the 1993 winter floods provided an unexpected test-case of a bar-building flow event (Hazel et al., 1993).

Unusually high surface runoff throughout the upper Colorado River basin caused abnormally high flow releases from June 1995 to the present (Figure 3). Flows from GCD between June and October, 1995 have averaged 523 m^3/s (18,520 ft^3/s), compared with averages of 350 m^3/s (12,390ft^3/s), 363 m^3/s (12,882ft^3/s), 375 m^3/s (13,286ft^3/s), and 412 m^3/s (14,599 ft^3/s) for the same period of time during 1991, 1992, 1993 and 1994, respectively. The effects of this major change in flow regime on the resources of the river corridor remains uncertain, but will be addressed by Fiscal Year 1996 transitional monitoring (Parnell et al., 1995).

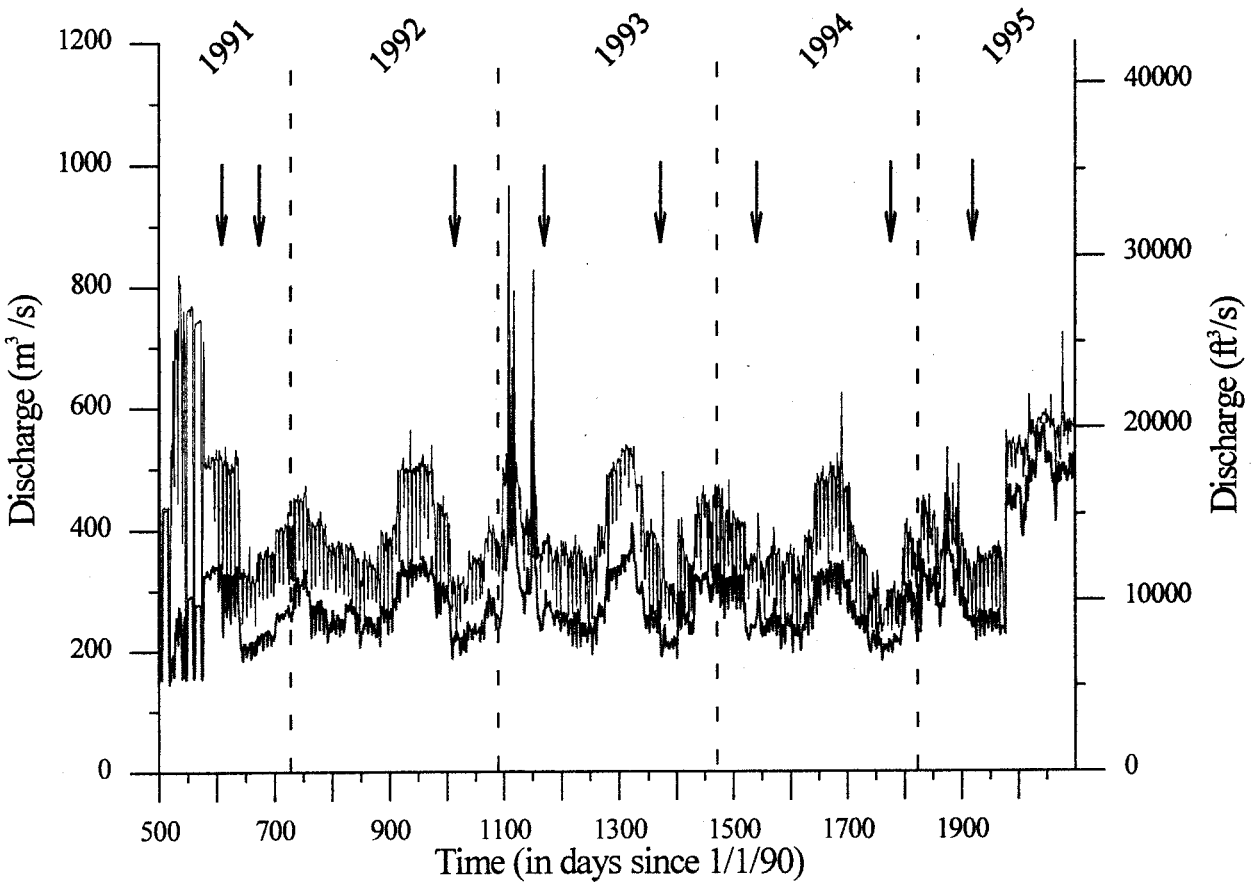

Figure 3. Daily minimum and maximum discharge hydrograph from Colorado River gage near Grand Canyon (RM 88) for the interval between September 1991 and June 1995. Arrows indicate time of sand bar survey conducted. Note seasonal variation in flows. Provisional USGS gage data.

METHODS

Study Sites

Thirty-two fluvial sand deposits (sand bars), approximately 15% of all large sand deposits between GCD and Diamond Creek, were selected for repeated surveys of bar topography during the GCES Phase II test flow series (Figure 1). These sand bars were selected by Beus et al. (1992) on the basis of: 1) distribution throughout the geomorphic reaches identified by Schmidt and Graf (1990); 2) sufficient size to guarantee persistence through the period of study; 3) geomorphic diversity within and between sites; 4) availability of historical topographic data; 5) variation in recreation use intensity and vegetation cover; and 6) access limitations downstream of Diamond Creek. Site selection, baseline surveys, and protocol development were accomplished during June and August, 1990.

We collected topographic and bathymetric measurements from these sites during six river survey expeditions: October 15-November 3, 1992, April 1-15, 1993, October 7-28, 1993, April 7-18, 1994, November 20-December 5, 1994, and April 25-May 10, 1995 (Figures 1 and 3; Table 1; Appendix A). However, not all sites were sampled during every research trip (Table 2). In addition to topographic surveying, sedimentologic data was acquired from trenching 1993 winter flood and pre-flood deposits.

Study sites (sand bars) were named on the basis of river mile (RM) and located within each of the geomorphic reaches defined by Schmidt and Graf (1990) (Table 1). Twelve sites are located between the Paria River (RM1) and LCR (RM60) confluences, a reach supplied with sand primarily from the Paria River. Twenty sites are situated between the LCR and Diamond Creek (RM226), and receive sediment from the Paria, LCR, and other tributaries. One site, RM-6, is located 6.5 miles upstream from Lees Ferry (RM0) in the tailwaters reach below GCD, which has no regular tributary contribution of sediments.

Data Collection

Field surveys were conducted biannually during the low-discharge spring and fall months on 15-20 day river trips. The trips typically consisted of two ground-based survey teams, a bathymetry team, and a sedimentology/stratigraphy team. Each ground-based team completed one survey per day using Leitz Set4c and Set3c total stations equipped with digital data collectors. Site size and topographic complexity determine the point density needed to form proper topographic models. Smaller sites (~2000 m^2) typically require 200-400 points and larger sites (~10,000 m^2) require 750-1000 points. Points are also collected offshore to depths of approximately 1 m to provide overlapping coverage with the bathymetry survey and extend the ground-based coverage across the entire HAZ region (see discussion of HAZ later in the Methods section). Survey protocol was developed during the GCES Phase II test flows (Beus et al., 1992) and documented according to standard survey practices for ground surveying. Benchmark and backsight relationships were verified at all sites in March 1991. Priority was placed on completing surveys within the zone of dam fluctuation, then

Table 2. HAZ Volumes From Interim Flow Sand Bar Surveys

		July 1991		October 1992		April 1993		October 1993		April 1994		November 1994		April 1995	
Site (Mile)	Deposit Type	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
-6R	R	2826.5	561.48	2792.7	538.7	2819.4	551	2772.4	565.534	2732.8	542.9	2819.9	578.4	2791.4	550.1
3L	R	2966.9	597.5	3471	581.4	3569.4	425.7	2564.2	496.7	2971.9	444.8	2698.7	401.7	3036.6	416.1
8L	S	1125.3	225.9	1173.6	180.273	1247.5	160.6	1129.4	171.2	1105.1	180.443	467	104	545.6	73.3
16L	S	1580.6	145.6	1959	144.3			1204	112.3	1272.7	113.5	991.8	101	1034.4	97.5
22R	R	2548.7	1029.5	2422.6	853.5	2691	840.9	3144.6	863.7	3085.6	844.7	2914.2	686.2	3192.7	836
30R	R	5856.3	1509.5			4549.7	1111.4	2977.3	731.1	3274.7	694.4	3390.4	576.4	2267.5	240
31R	S	1767.3	287.7	2281.1	278.8	1861.1	262.7	1509.7	230	1541.7	264	1506.7	193.9	1622.3	242.3
43L	R/UP	2867.5	794	2596.7	856.1	2463.5	823	2539.6	840.7	2776.1	839.5	2487.4	808.1	2363.8	808.3
45L	S	2505.5	950.4	2279.3	839.7			2331.5	789.3	2312.3	821.2	2290	772.9	2163.7	719.8
47R	R	5883.2	1764	4520.4	1268			4552.9	1208	4116	1197.3	4092.1	1155.6	3365	1031.9
50R	S/R	2892.8	1028.3	1706.3	683.5	1739.5	654.4	2177.2	605.1	2119.8	611.7	1526.7	573.8	2093.5	565.3
51L	R	5398.3	1043	5145.8	962.4	5083.2	945.7	3786.9	723.7	4419.9	715.7	4169.7	659.9	4021.2	756.1
62R	R	900	900	900	900	15807.6	5703.6	1995.6	327.7	1427.5	317.6	1566.6	276.6	4634.3	274.9
68R	S/R/UP	2916.3	806.7	2560.9	612.1	1824.9	564.6	4818.6	1521.9	4085.8	1503.1	3977.8	1532.6	2473	1189.3
81L	R/S/UP	328.8	2485.6	298.3	2133.1	306	2459.6	292.5	2274.5	287.2	2197.7	279.9	2150.7	293.3	2097.4
87L	UP	300.9	191.7	388.9	218.5	396.6	199.7	386.6	205.9	389.976	214.6	365.7	216.2	448.3	234.5
91R	S	103.2	137.8	86.5	102.3	69	146.8	57.414	113.2	67.6	112.1	80.6	120.2	78.5	119.4
93L	UP/R	1020.3	613.4	1280.5	607.2	1236.1	908.5	1227.3	829.4	1407	816.5	1254.5	804.7	1488	858.3
104R	UP/R	420.3	105.4	406.5	97			335.2	92.3	331.9	94.1	359.7	91.6	389.1	94.7
119R	R	3318.3	1506.5	1851	629.7	2468.4	1484.1	2223.9	967.7	2065.2	702.2	2122.9	610.9	2440.3	533
122R	R	4221.9	706.5	3731.6	703.6	3628.7	2037.5	3434.1	1686.1	3313	1594.4	3165.8	1537.7	3337.1	1483.3
123L	R/UP	1181.2	128.4	1151.8	70.7			993.3	167.1	699.7	125.1	1135.3	123.1	821	138.9
137L	R	3907.9	1081.2	3487.4	477.9	3185.2	889.2	3196	516.1	3303	457.7	3341.5	509.8	3085.3	489.1
139R	R/UP	2915.7	852.3	2663	588.9			1385.1	482	2225.3	476	1192.7	998	2071.4	680.4
145L	R	402.8	525.3	341.9	413.7	387.8	658.9	370.2	562.3	369.8	546.3	356.1	537.7	373.4	513.7
172L	R/UP	1654.9	793.5	1131.4	587.2	850	685	607.3	435.3	938.5	428.7	1006.6	432.6	1020.6	457.4
183R	R/UP	1375.5	702.3	1312.9	924	1405.8	1304.8	1255.9	1180	1440	1036.4	1067.7	1164.7	1258.1	1114.8
194L	R/UP	2856.2	1500.6	2944.9	1519.4	2755.7	2066.3	2985.2	2019.7	2857.9	1906.6	2796	1888.8	2737.8	1839.3
202R	S	2632.2	1077.4	2280.9	796.7	1943.9	1047.1	1734.1	561.3	1668.9	464.3	1788.7	333.2	2067.7	332.9
213L	R/UP	2067.9	703.7	2994	630.8	2511.9	1269.1	2067.9	734.1	2133.5	680.2	2139	644	2921.1	600.9
220R	S/UP	876.3	313.5	806.4	228.4	816.2	450.1	658.4	294.4	737.5	294.5	681.2	273.3	784.2	260.2
225R	R	3533.4	1161.5	4257	1182.8			2536.6	1438.1	3163.4	1424.9	2961.7	1464.2	4038.9	1467.8

* R-Reattachment Bar; S-Separation Bar; UP-Upper Pool (from Schmidt and Graf, 1990).

expanding coverage to the higher elevations. Survey coverage typically extended from the 142 m^3/s (5,000 ft^3/s) stage elevation to slightly above the 850 m^3/s (30,000 ft^3/s) stage elevation contour. Upon completion of each survey, field data were transferred to micro-computers and edited.

A variety of bathymetric survey techniques were used during the course of this study. Initially (1991), bathymetric surveys were conducted using a Lowrance X-16 depthfinder mounted on the raft. Sonar profiles were located by attaching one end of a metered cable to the transducer mount on the boat and locating a survey assistant with a cable/reel system on the sand bar at a surveyed point. Two points along the beach were marked and used to guide the boat along the proper azimuth. Distances from the cable operators location to the boat were recorded at two meters increments that corresponded to fiducial marks on the analog sonar recording. Coordinates of individual depth and distance were obtained by calculating the offsets along the azimuth of the profile based on the surveyed location of the cable reel operator. Elevations of the bathymetry points were calculated by subtracting the sonar depths from the surveyed water's surface elevation. The sonar equipment was calibrated daily to control changes in the travel time of the signal due to suspended sediment load. The extent of areal coverage generated from this technique was limited to the region directly in front of the sand bar face and to the 45 m length of the metered cable. On the October, 1992 survey trip we employed a different bathymetric survey system that allowed us to expand our coverage to include the entire river channel surrounding the sand bar. This system consisted of the Lowrance depthfinder mounted on the boat and a total station located at a known shore location. The location of the boat was determined by targeting a reflective prism mounted directly above the transducer. The analog sonar recording was marked each time a position was acquired, typically every 7-10 seconds. The sonar records were then digitized at every mark and the elevation of the bathymetry points were obtained by subtracting the digitized depths and distance between the target and the transducer from the elevation collected by the total station. Following the October, 1992 survey trip, the GCES survey division purchased the "Hydrographics Survey Package" (HSP) that consists of a shore-based total station, a boat-mounted transducer, a digital/analog receiving unit, and a computer that controls the digital data collection process. The shore station data is radio-telemetered to the boat computer where depth-position data is calculated and automatically stored. Starting in April 1993, and continuing to the present, the HSP has been used by bathymetry crews to survey two sites per day.

Data Processing and Analysis

Topographic Model Formation

The ground-based and bathymetric survey points were combined and used to form a Triangulated Irregular Network (TIN) model of the sand bar surface using Sokkia Mapping Software (Datacom Software Research Limited, 1992). Breaklines were coded during ground-based data collection along lines known to have a constant grade, such as cutbanks, water surface lines, slope breaks, etc. Breaklines are used in TIN model formation to force

individual prism sides along the proper grade breaks and stop the program from making incorrect interpolations across the surface (Datacom Software Research Limited, 1992). Topographic maps of the sites were prepared with a 0.2 m contour interval to insure proper model formation. The surface model, not the topographic map, is used to generate profiles at predetermined locations, and determine volumes and areas within what we term the "hydrologically active zone" (HAZ) (Table 2; *also see study www page at http://vishnu.glg.nau.edu/gces/sbar/sbar.html*).

The "Hydrologically Active Zone" (HAZ)

The HAZ is a boundary formed around a subset of the survey area that encompasses the elevation range of dam operations (142-850 m^3/s). The concept of the HAZ boundary was developed during the GCES Phase II test flows to provide a consistent, repeatable region, within which to quantify changes in sand bar volume and area (Beus et al., 1992). The HAZ is used in this study to examine changes in sediment storage, recreational use, and riparian habitat areas, resources which are recognized management priorities for Grand Canyon National Park. A limitation of this analysis is that it does not detect changes outside the range of the HAZ boundary. However, the improvements in bathymetric survey techniques described earlier allow us to compare changes in the sandbar surface throughout the eddy complex.

The HAZ boundary consists of two sections: a fixed upper and side section, and a mobile front section. Figure 4 shows an example HAZ zone constructed at RM122 for two different surveys. These segments are formed using the following general guidelines. The upper, or back HAZ boundary is placed at or slightly above (~0.5 m) the 850 m^3/s stage elevation. While the survey coverage typically extends beyond this stage elevation, placing the HAZ boundary at this level isolates the region directly affected by dam operations. The side sections of the fixed boundary at reattachment bars were placed along the center of the return channel and downstream of the 850 m^3/s reattachment point. In addition, the HAZ boundary typically excludes large boulders, armored areas, large groves of vegetation, and regions of poor survey accuracy. For example, the fixed section of the HAZ boundary in Figure 4 (solid black line) follows the approximate level of the 850 m^3/s stage elevation (93-93.4 m) along the rear of the bar, excludes a large boulder and tamarisk trees (the large indentation), and follows the return channel. The lower HAZ boundary is defined by the 142 m^3/s stage elevation contour in between the intersection with the fixed segment (Figure 4). We determined the total volume and area within the HAZ zone above the 142 m^3/s elevation contour, and partitioned volumes from a lower HAZ section (between the 142 m^3/s and the 410 m^3/s elevation contour), and an upper section (above the 410 m^3/s elevation contour) (Table 3, Figure 4).

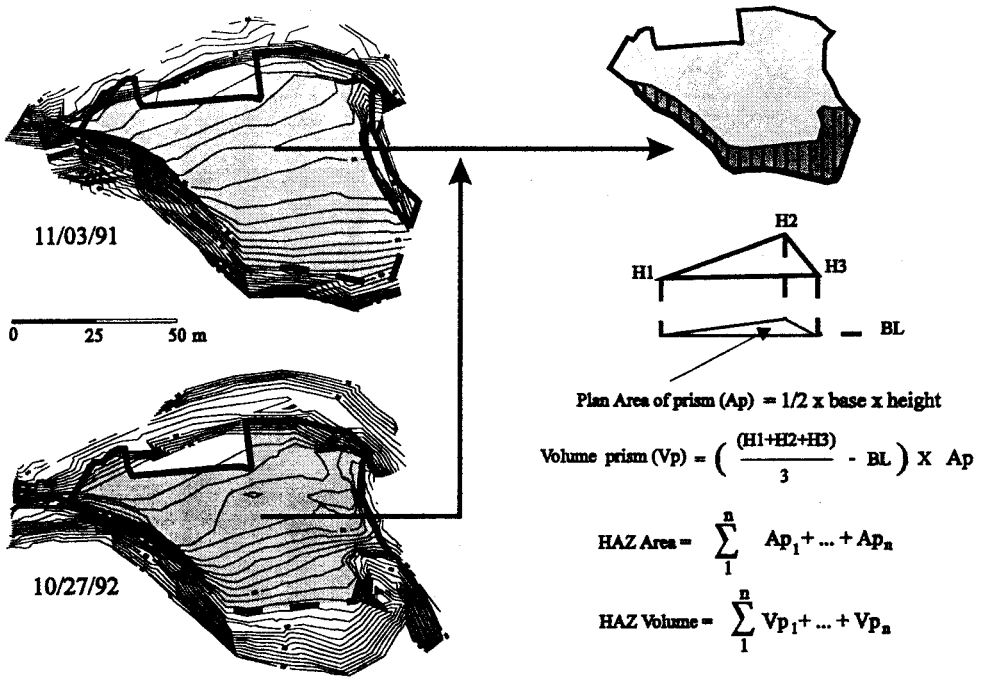

Figure 4. Topographic maps from RM122 showing HAZ boundary and area and volume calculations.

RESULTS AND DISCUSSION

A revised analysis of changes in HAZ volume clearly demonstrates that interim flows have significantly eroded Colorado River sand bars in Grand Canyon. Kaplinski et al.(1995) stated that sediment was eroded from the upper, exposed areas of sand bars and redistributed to the main channel and the lower elevation areas of sand bars. This observation was based on field observations and comparison of topographic profiles generated across the sand bars. Although Kaplinski et al. (1995) did state that the bars eroded with quantitative data, a quantitative analysis of this pattern was not possible because the HAZ was constructed to enclose the range of stage elevations from 142 m^3/s to 850m^3/s, which includes both the higher and lower areas of the study sand bars. To quantitatively address the observed pattern of sediment transfer from high to low elevation, volumes within the HAZ, were calculated from an upper and lower section at each sand bar. We used the stage elevation corresponding to the average daily release from GCD during the interim flow period [410 m^3/s (14,500 ft^3/s)] to divide the HAZ into an upper and lower section. The lower section ranges from the 142 m^3/s (5,000 ft^3/s) to the 410 m^3/s (14,500 ft^3/s) elevation contours, and the upper section ranges from the 410 m^3/s (14,500 ft^3/s) elevation contour to ground surface.

Comparison of volume changes within the partitioned HAZ section from the beginning of interim flows (7/91) to the latest survey run (4/95) show that, within the upper HAZ section, sites above the LCR decreased an average of 32.3%, while sites below the LCR lost an average of 13.9% (Figure 5). In comparison, changes within the lower HAZ section show that sites above the LCR averaged a 21.3% loss, while sites below the LCR gained an

average of 14.5%. The average percent change between each survey run is shown in Figure 6 for both the upper (Figure 6A) and lower (Figure 6B) sections. Negative values in Figure 6 are indicative of a system-wide or reach-wide loss in volume from within the upper or lower section of the HAZ boundary. This plot reveals that sand bars were eroded for the majority of survey comparisons in both the upper and lower sections but that there was a large positive percent change in sand volume below the LCR, the effects of which rapidly diminished in 1993 (Figure 6).

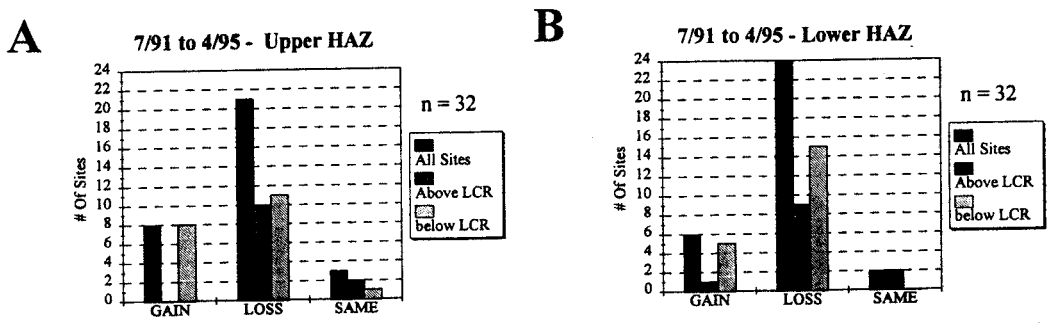

Figure 5. Histograms of site response to interim flow period for both the upper and lower HAZ sections.

The 1993 winter LCR floods inflicted a significant amount of change at the study sand bars downstream of the LCR confluence. These flood events inundated the higher elevations of sand bars, scoured vegetation, and deposited sediment in nearly all eddies downstream of the LCR confluence (Hazel et al., 1993; Kaplinski et al., 1995; Kearsley and Ayers, 1995). In the upper HAZ section, volumes from sites below the LCR increased significantly, while volumes from sites above the LCR, unaffected by the LCR floods, continued the pattern of interim flow high elevation erosion (Figure 6a). A Friedman test of the average percent change within the HAZ zone demonstrated that a significant amount of change occurred between survey runs in both the upper and lower HAZ sections [A) upper zone: $F=18.45$, $p < 0.008$; B) lower zone: $F=18.93$, $p < 0.008$, serial Bonferoni adjusted p values]. Multiple comparison of values from the upper HAZ section shows that volume changes surrounding LCR flooding, 10/92 to 4/93 and from 4/93 to 10/93, are significant (difference in rank sums $<= 37.24$, p(0.05)). These results demonstrate that high flow events, in excess of the maximum interim flow levels, are necessary to maintain sediment volume in the upper areas of sand bars. The significant difference between upper HAZ section values following the LCR flood event indicates that erosion rates increased following the tributary high flow deposition, then decrease with time, as reported by Beus et al. (1985), Schmidt and Graf (1990), Hazel et al. (1993), and Kaplinski et al. (1995). In contrast, values from the lower HAZ zone following the 1993 LCR event did not increase, and in fact show a trend of volume loss (Figure 6b). High flows, whether natural or controlled dam releases, are the only mechanism that we have observed that will increase the amount of sediment at the higher elevations of sand bars.

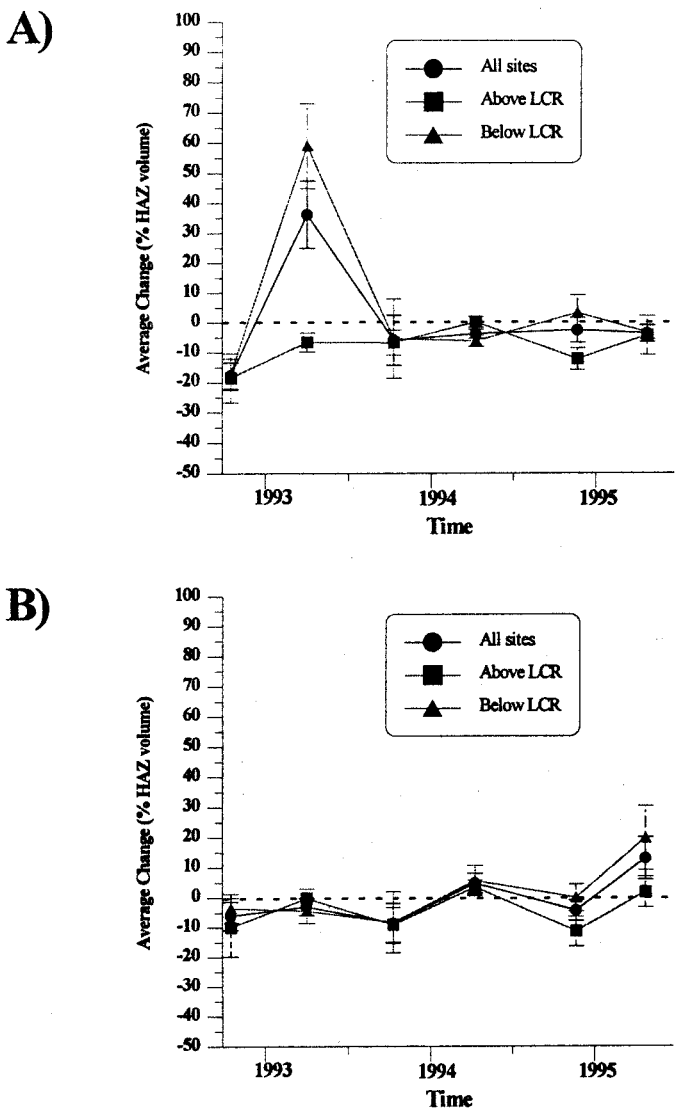

Figure 6. Averaged percent change for each survey run (standard error about the mean error bars) vs. time for A) upper HAZ section, and B) lower HAZ section.

The most significant change within the lower HAZ section occurred during the most recent interim flow monitoring. The volume change from 11/94 to 4/95 in Figure 6b was significantly larger than comparisons of change from 7/91 to 10/92, 4/93 to 10/93, and 4/94 to 11/94 (difference in rank sums <= 37.24, p(0.05)). This increase in the lower HAZ volume reflects the redistribution of sand along the lower bar elevations, either from eroded higher elevation sand or sediment transported by mainstem flows, or both. It is important to note that, while this survey shows a depositional response to GCD releases, the total increase is not substantial enough to offset the loss of sediment incurred during the previous four years of interim flows and the gross volume of sediment in the lower HAZ section shows a significant loss (Figure 5, Appendix A). Interestingly, the lower HAZ volume changes exhibit a fluctuating pattern of volume change (Figure 6b). This oscillation of change within

the lower zone suggests that sediment subject to daily inundation by the river is being reworked and transported into and out of the lower HAZ section. This trend also suggests that antecedent conditions may play an important role in determining whether a particular site loses, or gains sediment below the elevation reached by flow fluctuations. Conversely, this pattern could be a completely random phenomena and appears as a discernable pattern due to the fact that our sampling interval (approximately 6 months) is long, compared to the rate at which the process of erosion and deposition can occur at an individual sand bar, which is of the order of hours to days in some cases (Cluer, 1995).

SUMMARY

The following patterns of erosion and deposition of sand bars along the Colorado River have been recognized during the interim flow period. In Figure 7, a cross section from the 122 mile study site is used to illustrate the changes we have observed. The beginning of the interim flow period was characterized by system-wide erosion of both the upper and lower HAZ sections as the sand bars, following a year of test flows (see Beus and Avery, 1992), adjusted to the new, lower volume flow regime (Figure 7a). Surveys conducted in April 1993 indicated that the winter floods from the LCR deposited a significant amount of sediment at topographic levels not reached by interim flows. Near the LCR confluence, the flood deposits consisted mostly of sand delivered from the LCR drainage. However, further downstream (approximately 30 miles), comparison of cross-channel profiles suggest that the flood deposits were derived from the redistribution of the lower areas of sand bars and sediment stored in the main channel (Hazel et al., 1993; Kaplinski et al., 1995)(Figure 7b). Sand bars above the LCR confluence were not affected by the high flow events and continued to erode. Following the LCR high flow events, erosion rates increased significantly at bars affected by the flood, then decreased to "normal" rates within approximately nine months. After the LCR events, a consistent, system-wide pattern of erosion developed. The upper elevations of the study bars lost HAZ volume as sediment was distributed within and out of the lower HAZ zone. The sand storage capacity of eddys was lessened by interim flows because recirculation zones are smaller during low flows (Schmidt, 1990). Without restoration of sediment to the upper elevations of sand bars, the pattern of interim flow erosion will continue to adversely effect the riparian ecosystem. High flow events planned for Spring, 1996 have been designed to replace this eroded sediment and restore a seasonal high flow/bar building event to the system. We believe that the long-term effects of this high flow event will be beneficial to the ecosystem as a whole, and to the long-term maintenance of sediment along the river.

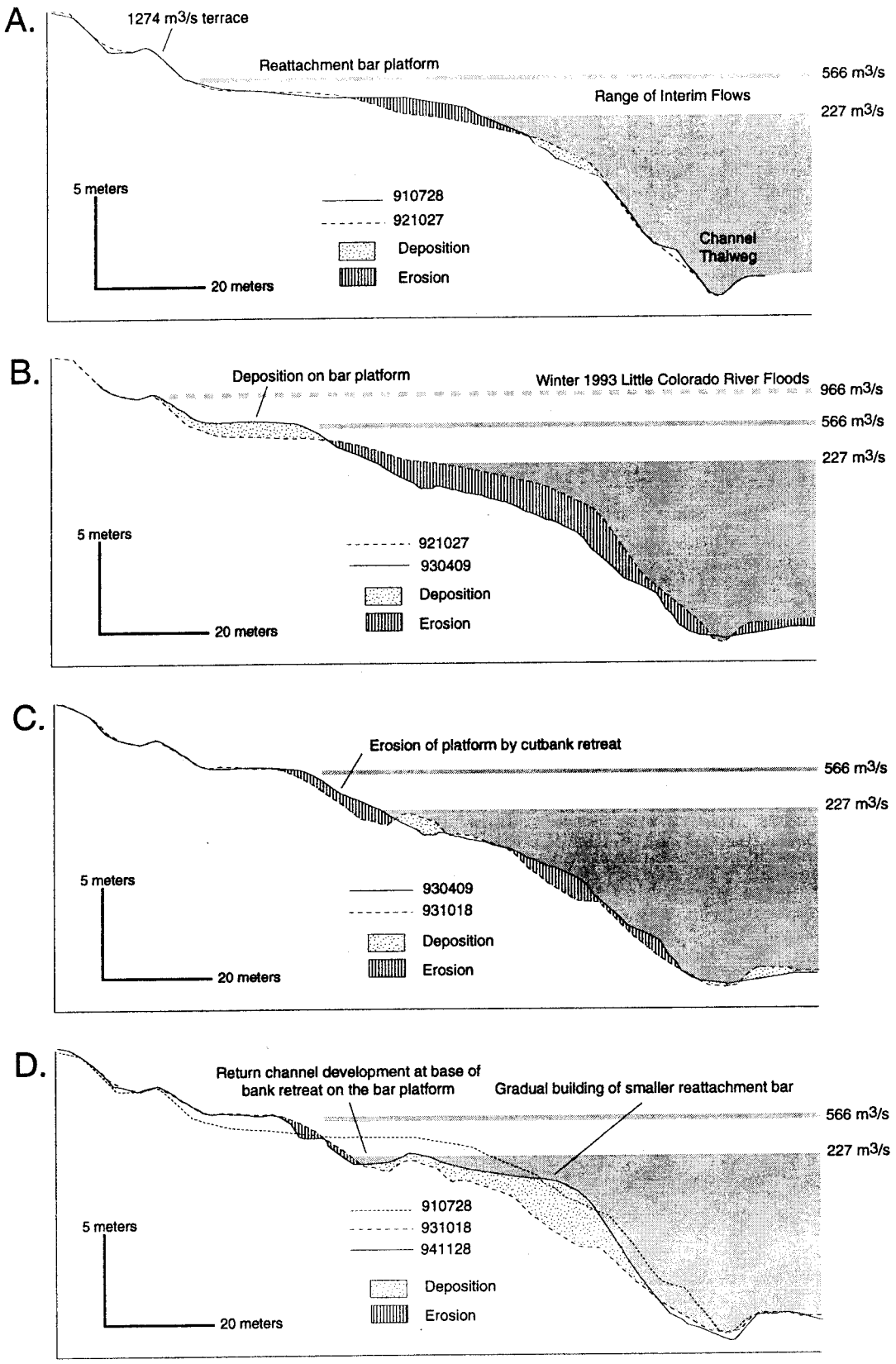

Figure 7. Topographic profile comparisons from the RM 122 site demonstrating general patterns of sand bar changes between survey runs during the interim flow period. A) 7/28/91 to 10/27/92, B) 10/27/92 to 4/09/93, C) 4/09/93 10/18/93, D) 7/28/91 and 10/18/93 to 11/28/94.

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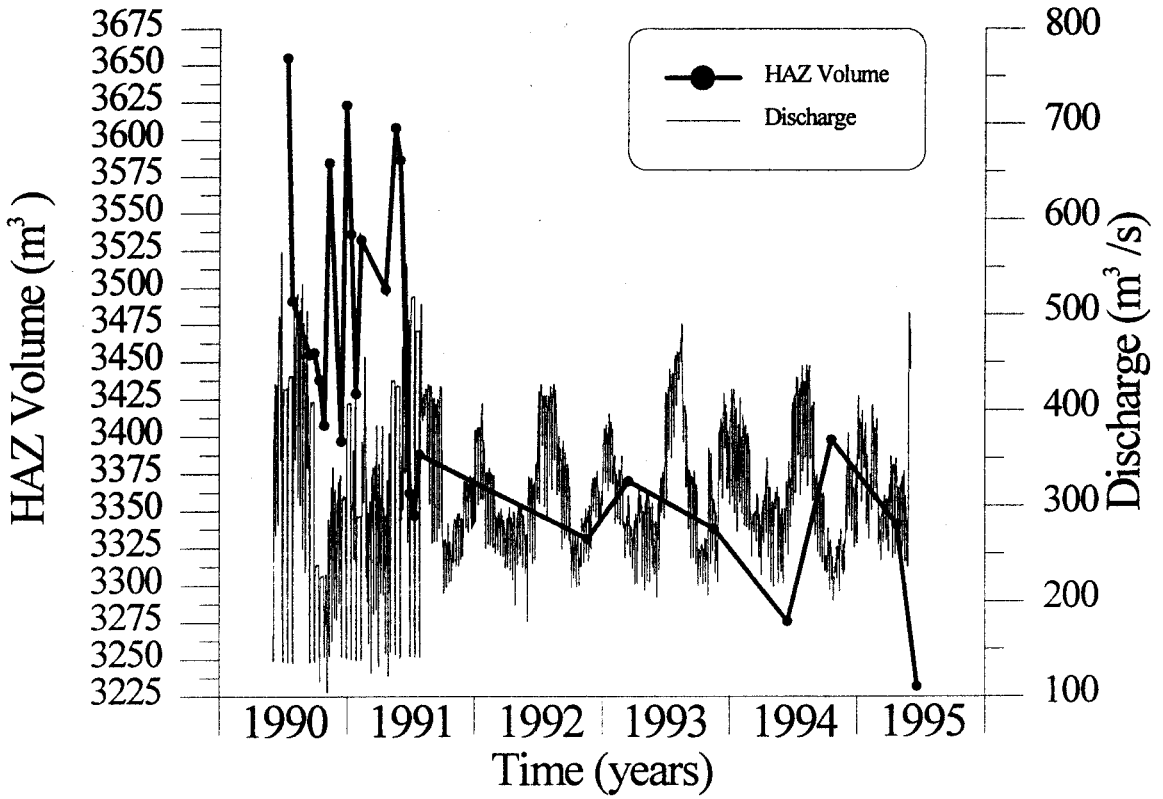
Appendix A

Survey Site HAZ Volume Tables

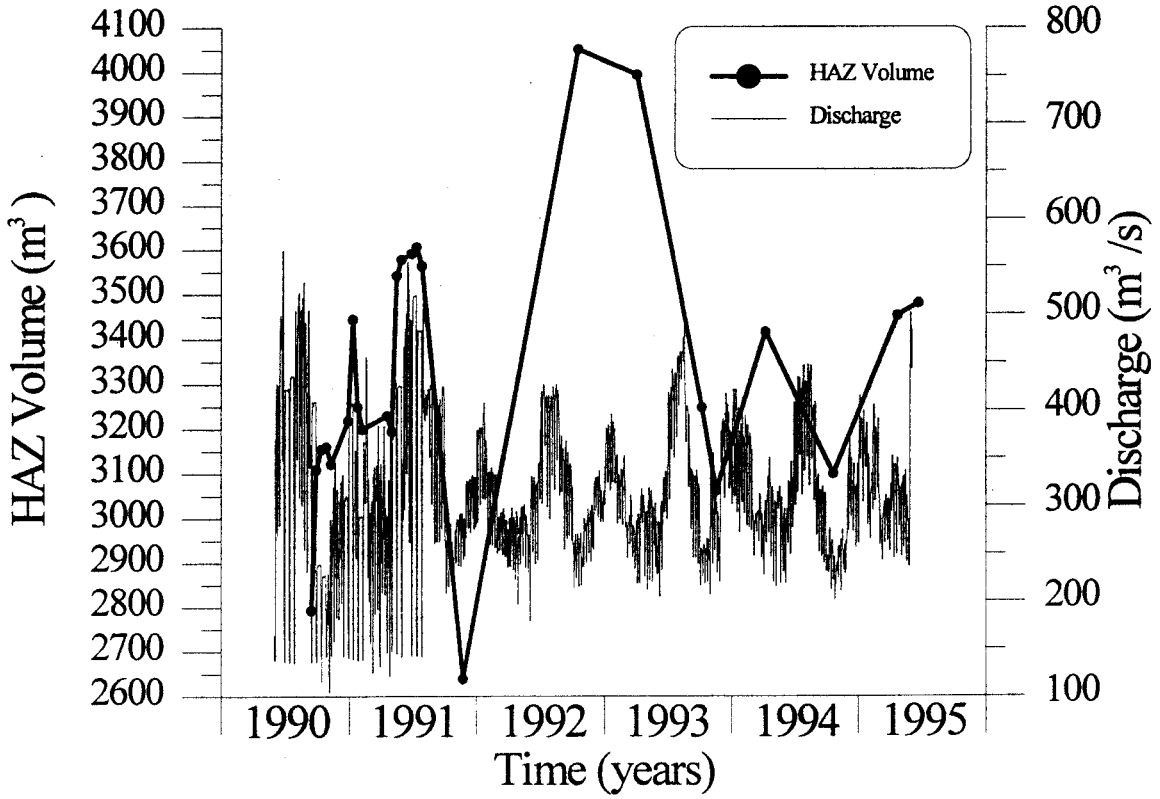
MILE: -6.5 KILOMETER: -10.5
BEACH #: 2 DEPOSIT TYPE: REATTACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C	900712	G	193	3441	3655				
D	900727	F	208	3417	3491	-24	-164	-0.70	-4.49
E		NORM							
F	900914	NORM	257	3383	3455	-34	-36	-1.00	-1.03
G	900928	E	271	3440	3456	57	1	1.68	0.03
H	901012	A	285	3407	3438	24	-17	0.71	-0.49
I	901026	8000 CFS	299	3419	3408	12	-30	0.35	-0.87
J	901109	NORM	313	3426	3584	7	176	0.20	5.16
K	901214	NORM	348	3399	3397	-27	-187	-0.79	-5.22
L	901228	11000 CFS	362	3425	3623	26	226	0.76	6.65
M	910111	C	376	3429	3536	4	-87	0.12	-2.40
N	910125	NORM	390	3412	3429	-17	-107	-0.50	-3.03
O	910208	B	404	3441	3532	29	103	0.85	3.00
P	910419	NORM	474	3446	3499	5	-33	0.15	-0.93
Q		NORM							
R	910517	D	502	3474	3608	28	109	0.81	3.12
S	910531	15000 CFS	516	3540	3586	66	-22	1.90	-0.61
T	910628	NORM	544	3543	3362	3	-224	0.08	-6.25
U	910712	G	558	3537	3347	-6	-15	-0.17	-0.45
V	910726	F	572	3523	3388	-14	41	-0.40	1.22
Y	921118	INT	1053	3645	3331	122	-57	3.46	-1.68
Z	930317	INT	1172	3516	3370	-129	39	-3.54	1.17
B02	931117	INT	1417	3470	3338	-46	-32	-1.31	-0.95
C02	940616	INT	1628	3585	3276	115	-62	3.31	-1.86
D02	941020	INT	1754	3570	3398	-15	122	-0.42	3.72
E02	950425	INT	1941	3464	3341	-106	-57	-2.97	-1.68
F02	950622	INT	1999	3446	3232	-18	-109	-0.52	-3.26



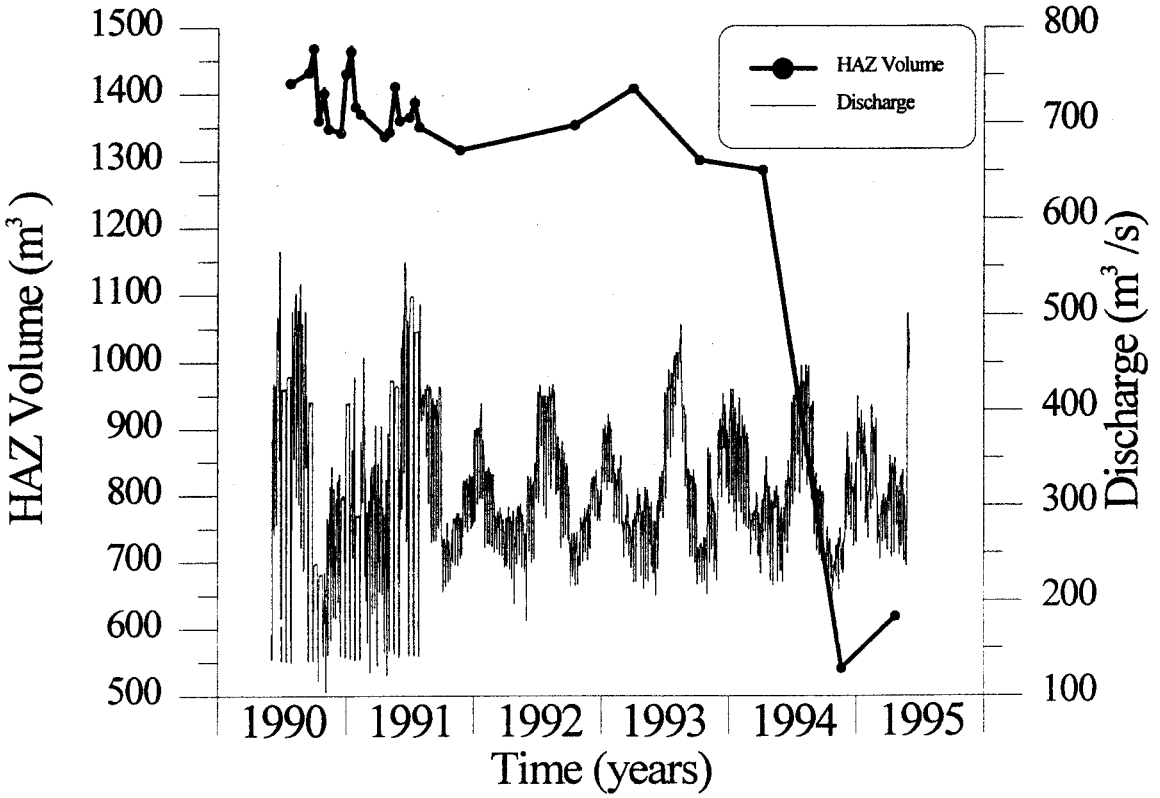
MILE: 2.6 KILOMETE 4.2
BEACH #: 3 DEPOSIT TYPE: REATTACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F	900914	NORM	257	2487	2793				
G	900928	E	271	2723	3109	236	316	9.49	11.31
H	901012	A	285	2670	3155	-53	46	-1.95	1.48
I	901026	8000 CFS	299	2722	3161	52	6	1.95	0.19
J	901109	NORM	313	2754	3122	32	-39	1.18	-1.23
K		NORM							
L	911228	11000 CFS	362	2897	3219	143	97	5.19	3.11
M	910111	C	376	2989	3444	92	225	3.18	6.99
N	910125	NORM	390	2861	3250	-128	-194	-4.28	-5.63
O	910208	B	404	2866	3200	5	-50	0.17	-1.54
P	910419	NORM	474	2769	3230	-97	30	-3.38	0.94
Q	910503	NORM	488	2826	3195	57	-35	2.06	-1.08
R	910517	D	502	2874	3542	48	347	1.70	10.86
S	910531	15000 CFS	516	2835	3578	-39	36	-1.36	1.02
T	910628	NORM	544	2726	3591	-109	13	-3.84	0.36
U	910712	G	558	2950	3606	224	15	8.22	0.42
V	910726	F	572	3016	3564	66	-42	2.24	-1.16
X	911123	INT	692	2467	2640	-549	-924	-18.20	-25.93
Y	921015	INT	1019	3601	4052	1134	1412	45.97	53.48
Z	930401	INT	1187	3448	3995	-153	-57	-4.25	-1.41
A03	931007	INT	1376	2774	3249	-674	-746	-19.55	-18.67
B03	931117	INT	1417	2401	3061	-373	-188	-13.45	-5.79
C03	940407	INT	1558	3130	3417	729	356	30.36	11.63
D04	941021	INT	1755	2864	3100	-266	-317	-8.50	-9.28
E04	950424	INT	1940	3145	3453	281	353	9.81	11.39
F04	950623	INT	1999	3091	3481	-54	28	-1.72	0.81



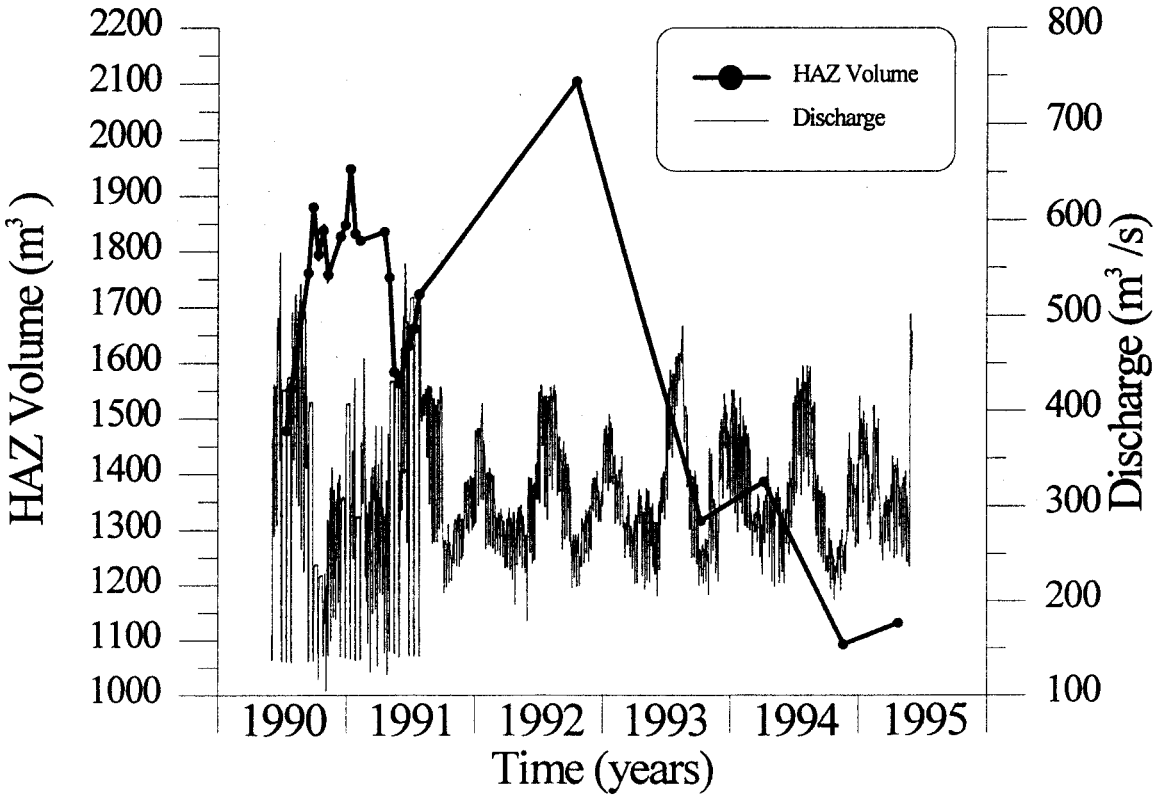
MILE: 8 KILOMETER: 12.9
BEACH #: 4 DEPOSIT TYPE: SEPARATION/REATTACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D	900725	F	206	1630	1416				
E		NORM							
F	900915	NORM	258	1559	1432	-71	16	-4.36	1.13
G	900929	E	272	1573	1468	14	36	0.90	2.51
H	901013	A	286	1558	1360	-15	-108	-0.95	-7.36
I	901027	8000 CFS	300	1605	1401	47	41	3.02	3.01
J	901110	NORM	314	1585	1348	-20	-53	-1.25	-3.78
K	901215	NORM	349	1587	1342	2	-6	0.13	-0.45
L	901229	11000 CFS	363	1574	1430	-13	88	-0.82	6.56
M	910112	C	377	1611	1464	37	34	2.35	2.38
N	910126	NORM	391	1591	1381	-20	-83	-1.24	-5.67
O	910209	B	405	1511	1370	-80	-11	-5.03	-0.80
P	910419	NORM	474	1502	1337	-9	-33	-0.60	-2.41
Q	910503	NORM	488	1506	1343	4	6	0.27	0.45
R	910518	D	503	1643	1411	137	68	9.10	5.06
S	910601	15000 CFS	517	1571	1360	-72	-51	-4.38	-3.61
T	910629	NORM	545	1534	1365	-37	5	-2.36	0.37
U	910713	G	559	1496	1387	-38	22	-2.48	1.61
V	910727	F	573	1482	1351	-14	-36	-0.94	-2.60
X	911122	INT	691	1524	1316	42	-35	2.83	-2.59
Y	921015	INT	1019	1729	1354	205	38	13.45	2.89
Z	930401	INT	1187	1788	1408	59	54	3.41	3.99
B04	931008	INT	1377	1440	1301	-348	-107	-19.46	-7.60
C04	940408	INT	1559	1403	1286	-37	-15	-2.57	-1.15
D04	941120	INT	1785	720	541	-683	-745	-48.68	-57.93
E04	940425	INT	1941	1137	619	417	78	57.92	14.42



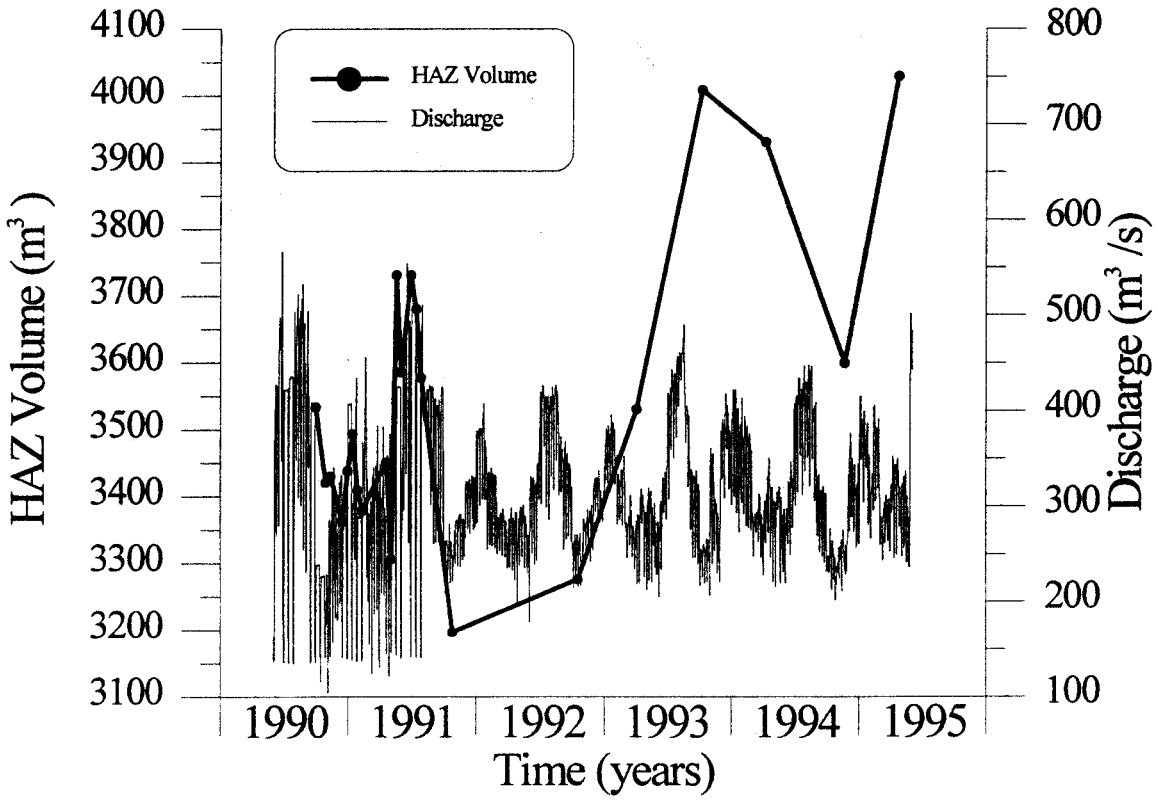
MILE: 16 KILOMETER: 26.4
BEACH #: 5 DEPOSIT TYPE: SEPARATION

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL AREA CH	ABS VOL CH	% AREA CH	% VOL CH
A		NORM							
B		NORM							
C	900714	G	195	1047	1478				
D	900728	F	209	1115	1555	68	77	6.49	5.21
E	910517	NORM							
F	900915	NORM	258	1207	1761	1207	1761	8.25	13.25
G	900929	E	272	1294	1880	87	119	7.21	6.76
H	901013	A	286	1288	1794	-6	-86	-0.46	-4.57
I	901027	8000 CFS	300	1298	1838	10	44	0.78	2.45
J	901110	NORM	314	1292	1758	-6	-80	-0.46	-4.35
K	901215	NORM	349	1328	1827	36	69	2.79	3.92
L	911229	11000 CFS	363	1338	1848	10	21	0.75	1.15
M	910112	C	377	1368	1948	30	100	2.24	5.41
N	910126	NORM	391	1343	1832	-25	-116	-1.83	-5.95
O	910209	B	405	1346	1820	3	-12	0.22	-0.66
P	910420	NORM	475	1379	1835	33	15	2.45	0.82
Q	910504	NORM	489	1362	1753	-17	-82	-1.23	-4.47
R	910518	D	503	1083	1584	-279	-169	-20.48	-9.64
S	910601	15000 CFS	517	1110	1564	27	-20	2.49	-1.26
T	910629	NORM	545	1207	1631	97	67	8.74	4.28
U	910713	G	559	1248	1663	41	32	3.40	1.96
V	910727	F	573	1280	1722	32	59	2.56	3.55
Y	921016	INT	1020	1549	2103	269	381	21.02	22.13
B05	931008	INT	1377	981	1316	-568	-787	-36.67	-37.42
C05	940408	INT	1559	1122	1386	141	70	14.37	5.32
D05	941120	INT	1786	864	1093	-258	-293	-22.99	-21.14
E05	940425	INT	1941	959	1132	95	39	11.00	3.57



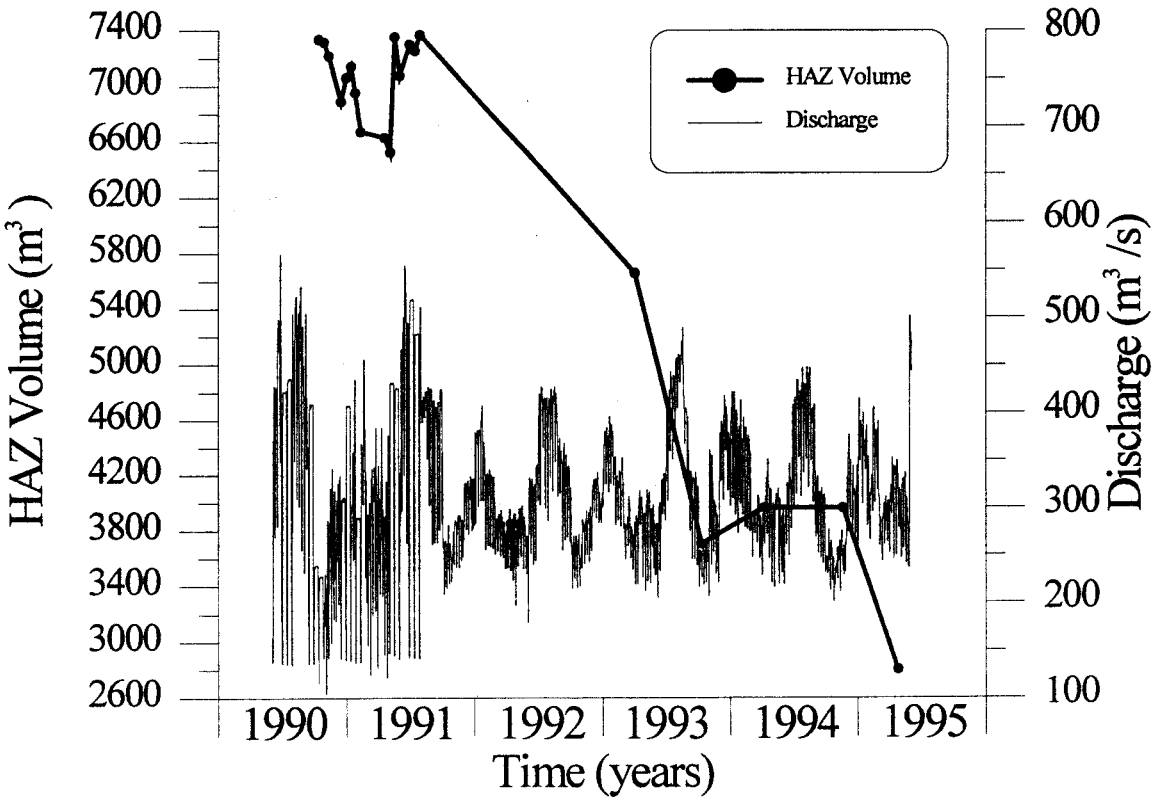
MILE: 22 KILOMETER: 35.1
BEACH #: 6 DEPOSIT TYPE: REATTACHEMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH	ABS VOL CH	% AREA CH.	% VOL CH
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F		NORM							
G	900930	E	273	1703	3534				
H		A							
I	901028	8000 CFS	301	1660	3421	-43	-113	-2.52	-3.20
J	901111	NORM	315	1694	3430	34	9	2.05	0.26
K	901216	NORM	350	1658	3363	-36	-67	-2.13	-1.95
L	901230	11000 CFS	364	1625	3438	-33	75	-1.99	2.23
M	910113	C	378	1685	3494	60	56	3.69	1.63
N	910127	NORM	392	1636	3409	-49	-85	-2.91	-2.43
O	910209	B	405	1624	3379	-12	-30	-0.73	-0.88
P	910420	NORM	475	1633	3451	9	72	0.55	2.13
Q	910504	NORM	489	1550	3306	-83	-145	-5.08	-4.20
R	910519	D	504	1908	3731	358	425	23.10	12.86
S	910601	15000 CFS	517	1787	3586	-121	-145	-6.34	-3.89
T	910629	NORM	545	1866	3731	79	145	4.42	4.04
U	910713	G	559	1777	3680	-89	-51	-4.77	-1.37
V	910727	F	573	1727	3578	-50	-102	-2.81	-2.77
X	911025	INT	663	1474	3197	-253	-381	-14.65	-10.65
Y	921016	INT	1020	1593	3276	119	79	8.07	2.47
Z	930402	INT	1188	1819	3531	226	255	14.19	7.78
B06	931008	INT	1377	2012	4008	193	477	10.61	13.51
C06	940409	INT	1560	1994	3930	-18	-78	-0.89	-1.95
D06	941121	INT	1786	1843	3600	-151	-330	-7.57	-8.40
E06	950426	INT	1942	2028	4029	185	429	10.04	11.92



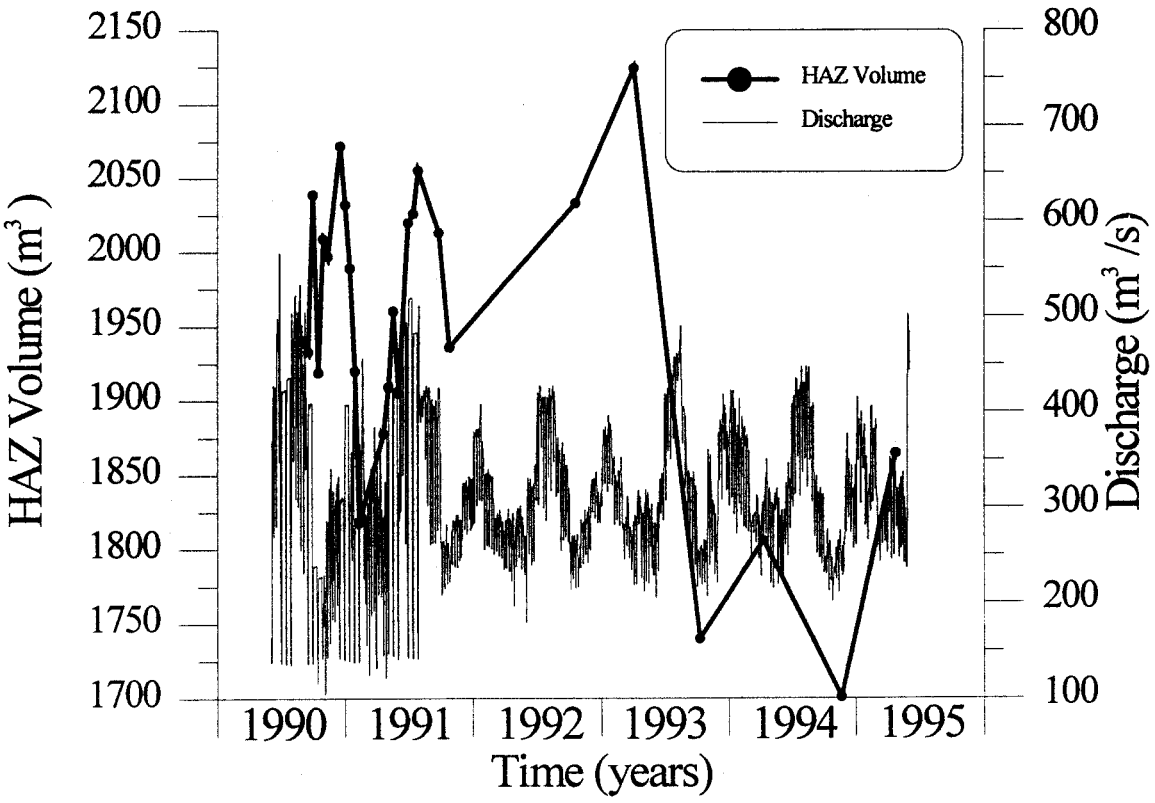
MILE: 30 KILOMETER: 48.3
BEACH #: 7 DEPOSIT TYPE: REATTACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL AREA CH	ABS VOL CH	% AREA CH	% VOL CH
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F		NORM							
G		E							
H	901014	A	287	3732	7336				
I	901028	8000 CFS	301	3672	7314	-60	-22	-1.61	-0.30
J	901111	NORM	315	3655	7216	-17	-98	-0.46	-1.34
K	901216	NORM	350	3705	6889	50	-327	1.37	-4.53
L	901230	11000 CFS	364	3686	7061	-19	172	-0.51	2.50
M	910113	C	378	3813	7140	127	79	3.45	1.12
N	910125	NORM	390	3812	6953	-1	-187	-0.03	-2.62
O	910210	B	406	3762	6673	-50	-280	-1.31	-4.03
P	910420	NORM	475	3741	6631	-21	-42	-0.56	-0.63
Q	910506	NORM	491	3752	6525	11	-106	0.29	-1.60
R	910519	D	504	3794	7352	42	827	1.12	12.67
S	910602	15000 CFS	518	3765	7076	-29	-276	-0.76	-3.75
T	910630	NORM	546	3444	7299	-321	223	-8.53	3.15
U	910714	G	560	3569	7254	125	-45	3.63	-0.62
V	910728	F	574	3656	7366	87	112	2.44	1.54
Z	930402	INT	1188	3377	5662	-279	-1704	-7.63	-23.13
B07	931009	INT	1378	2379	3708	-998	-1954	-29.55	-34.51
C07	940409	INT	1560	2922	3969	543	261	22.82	7.04
D07	941121	INT	1786	2747	3967	-175	-2	-5.99	-0.05
E07	950426	INT	1942	2278	2808	-469	-1159	-17.07	-29.22



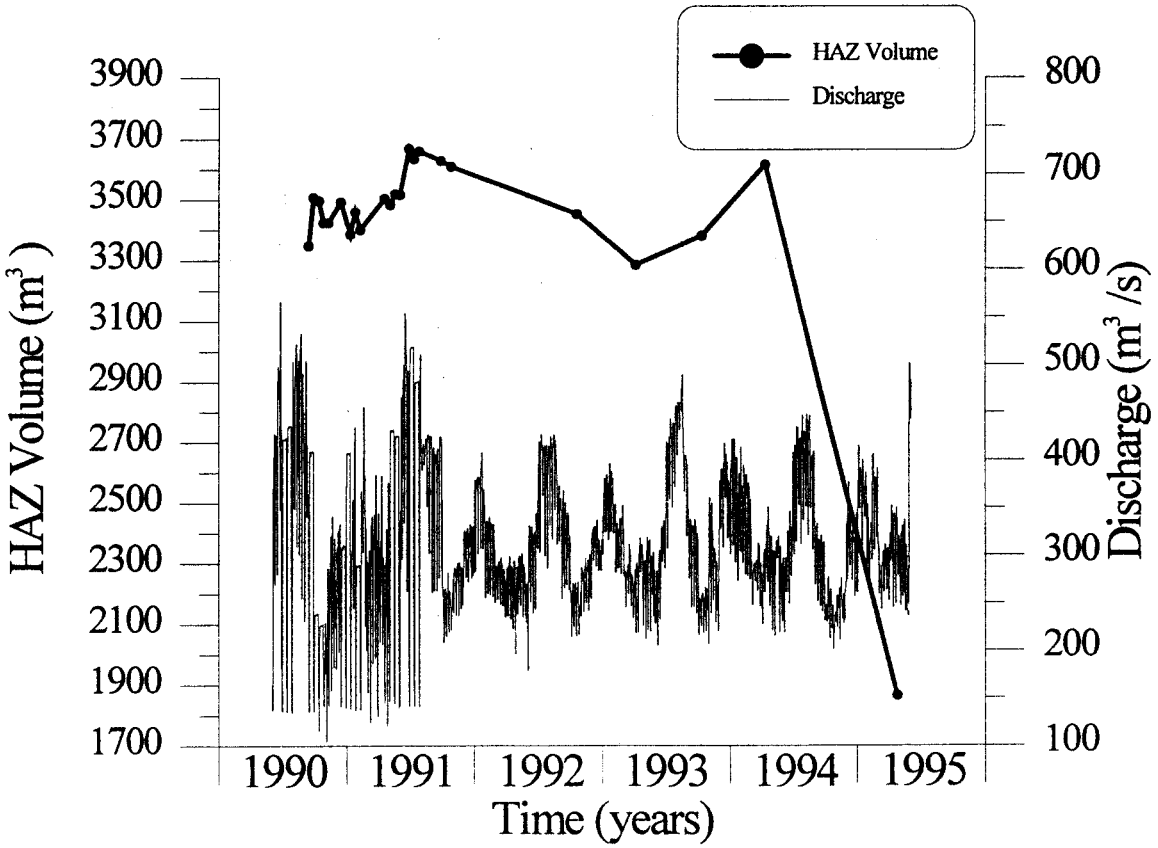
MILE: 32 KILOMETER: 50.2
BEACH #: 8 DEPOSIT TYPE: REATTACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	V=100%	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH	% VOL CH
A		NORM								
B		NORM								
C		G								
D		F								
E	900829	NORM	241	1924	1941	94.5				
F	900916	NORM	259	1972	1933	94.1	-8	-0.3892944	-0.41	-0.41
G	900930	E	273	1997	2039	99.2	106	5.15815085	5.48	5.48
H	901015	A	288	2032	1919	93.4	-14	-0.6812652	-0.72	-0.72
I	901029	8000 CFS	302	2053	2009	97.8	90	4.37956204	4.69	4.69
J	901112	NORM	316	2048	1997	97.2	-12	-0.5839416	-0.60	-0.60
K	901217	NORM	351	2066	2072	100.8	75	3.64963504	3.76	3.76
L	901231	11000 CFS	365	2054	2032	98.9	-40	-1.946472	-1.93	-1.93
M	910114	C	379	2111	1989	96.8	-43	-2.0924574	-2.12	-2.12
N	910128	NORM	393	2048	1920	93.4	-69	-3.3576642	-3.47	-3.47
O	910210	B	406	2035	1818	88.5	-102	-4.9635036	-5.31	-5.31
P	910421	NORM	476	2084	1878	91.4	60	2.91970803	3.30	3.30
Q	910505	NORM	490	2071	1909	92.9	31	1.50851582	1.65	1.65
R	910519	D	504	2173	1960	95.4	51	2.48175182	2.67	2.67
S	910602	15000 CFS	518	2185	1905	92.7	-55	-2.676399	-2.81	-2.81
T	910630	NORM	546	2289	2020	98.3	115	5.59610706	6.04	6.04
U	910714	G	560	2343	2026	98.6	6	0.2919708	0.30	0.30
V	910728	F	574	2407	2055	100.0	29	1.41119221	1.43	1.43
W	910925	INT	633	2400	2013	98.0	-42	-2.0437956	-2.04	-2.04
X	911026	INT	664	2298	1936	94.2	-77	-3.7469586	-3.83	-3.83
Y	921017	INT	1021	2884	2033	98.9	97	4.72019465	5.01	5.01
Z	930403	INT	1189	3333	2124	103.4	91	4.42822384	4.48	4.48
B08	931009	INT	1379	2130	1740	84.7	-384	-18.686131	-18.08	-18.08
C08	940410	INT	1561	2315	1806	87.9	66	3.21167883	3.79	3.79
D08	941121	INT	1786	2299	1701	50.2	-105	-37.6766	-5.81	-42.87
E08	950426	INT	1942	2550	1865	55.0	164	4.84061393	9.64	9.64



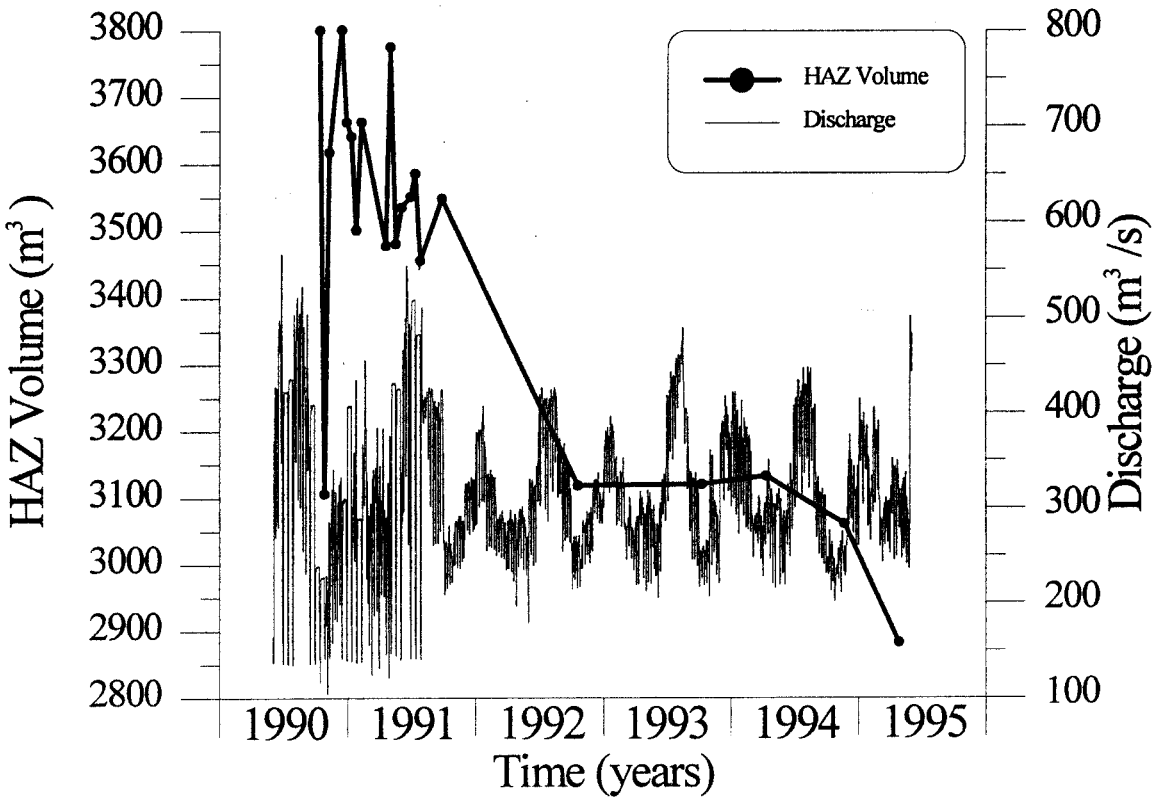
MILE: 43 KILOMETER: 69.3
BEACH #: 10 DEPOSIT TYPE: REATTACH /UPPER POOL

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F	900914	NORM	257	1736	3347				
G	900928	E	271	1849	3507	113	160	6.51	4.78
H	901012	A	285	1906	3496	170	149	9.79	4.45
I	901026	8000 CFS	299	1882	3424	-24	-72	-1.26	-2.06
J	901109	NORM	313	1858	3424	-24	0	-1.28	0.00
K	901214	NORM	348	1967	3492	109	68	5.87	1.99
L		11000 CFS							
M	910111	C	376	1934	3386	-33	-106	-1.68	-3.04
N	910125	NORM	390	1955	3460	21	74	1.09	2.19
O	910208	B	404	1872	3401	-83	-59	-4.25	-1.71
P	910419	NORM	474	2069	3504	197	103	10.52	3.03
Q	910505	NORM	490	2003	3484	-66	-20	-3.19	-0.57
R	910520	D	505	2036	3519	33	35	1.65	1.00
S	910602	15000 CFS	518	2069	3517	33	-2	1.62	-0.06
T	910628	NORM	544	2118	3668	49	151	2.37	4.29
U	910712	G	558	2100	3635	-18	-33	-0.85	-0.90
V	910726	F	572	2107	3661	7	26	0.33	0.72
W	910926	INT	634	1903	3629	-204	-32	-9.68	-0.87
X	911026	INT	664	1959	3610	56	-19	2.94	-0.52
Y	921019	INT	1023	1844	3453	-115	-157	-5.87	-4.35
Z	930403	INT	1189	1723	3285	-121	-168	-6.56	-4.87
B10	931010	INT	1380	1744	3380	21	95	1.22	2.89
C10	940410	INT	1561	1974	3616	230	236	13.19	6.98
E10	950426	INT	1942	2550	1865	576	-1751	29.18	-48.42



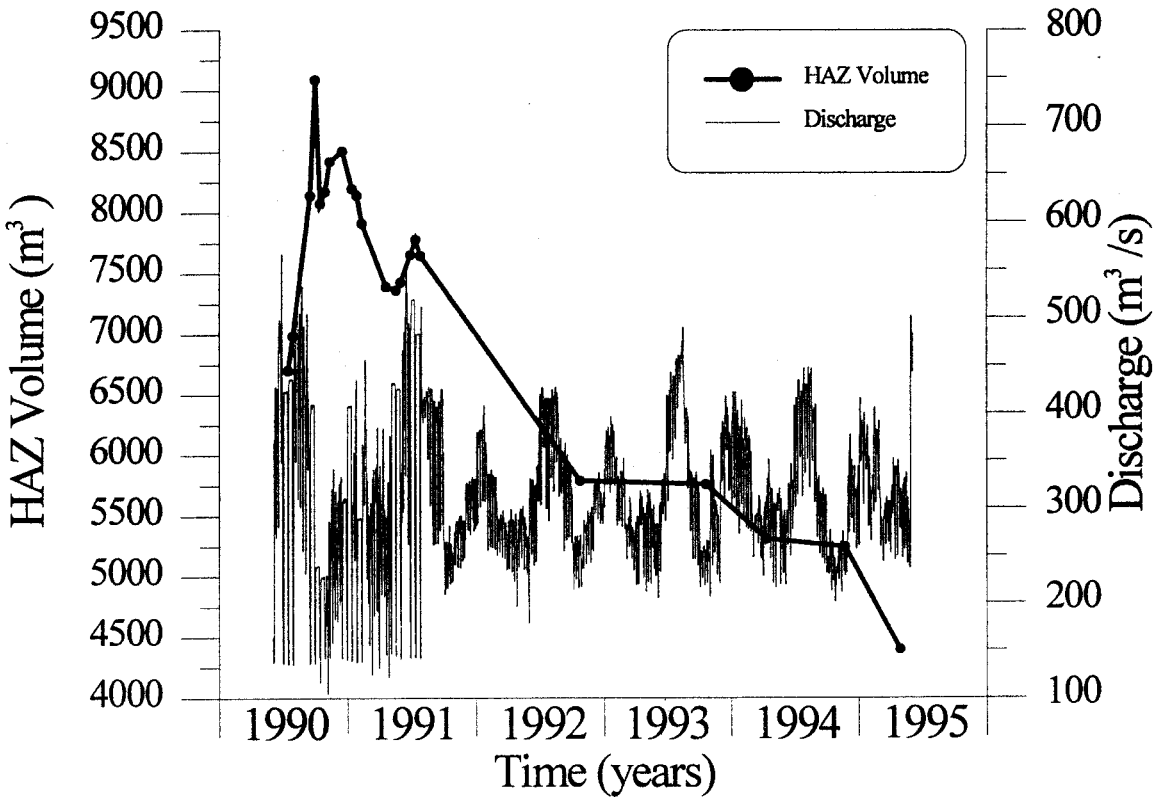
MILE: 45 KILOMETER: 71.6
BEACH #: 11 DEPOSIT TYPE: SEPARATION

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F		NORM							
G		E							
H	901012	A	285	2578	3801				
I	901026	8000 CFS	299	2417	3107	-161	-694	-6.25	-18.26
J	901109	NORM	313	2551	3618	134	511	5.54	16.45
K	901214	NORM	348	2611	3802	60	184	2.35	5.09
L	901228	11000 CFS	362	2722	3663	111	-139	4.25	-3.66
M	910111	C	376	2688	3642	-34	-21	-1.25	-0.57
N	910125	NORM	390	2577	3502	-111	-140	-4.13	-3.84
O	910208	B	404	2604	3663	27	161	1.05	4.60
P	910419	NORM	474	2623	3478	19	-185	0.73	-5.05
Q	910502	NORM	487	2633	3776	10	298	0.38	8.57
R	910517	D	502	2632	3481	-1	-295	-0.04	-7.81
S	910603	15000 CFS	519	2674	3536	42	55	1.60	1.58
T	910628	NORM	544	2646	3552	-28	16	-1.05	0.45
U	910712	G	558	2675	3586	29	34	1.10	0.96
V	910726	F	572	2585	3456	-90	-130	-3.36	-3.63
W	910926	INT	634	2656	3549	71	93	2.75	2.69
Y	921019	INT	1023	2479	3119	-177	-430	-6.66	-12.12
B11	931010	INT	1379	2498	3121	19	2	0.77	0.06
C11	940411	INT	1562	2550	3133	52	12	2.08	0.38
D11	941122	INT	1787	2485	3062	-65	-71	-2.55	-2.27
E11	940427	INT	1943	2450	2884	-35	-178	-1.41	-5.81



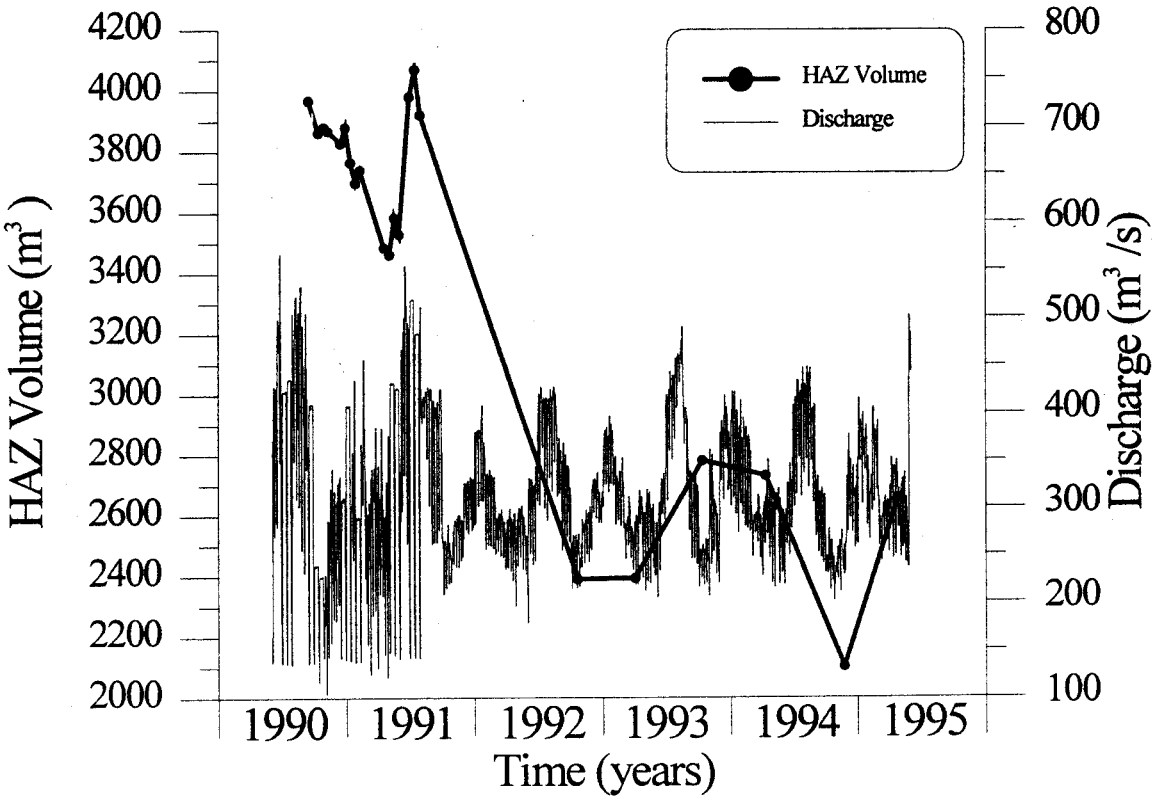
MILE: 47 KILOMETER: 75.8
BEACH #: 12 DEPOSIT TYPE: REATTACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH	% VOL CH.
A		NORM							
B		NORM							
C	907014	G	195	6575	6708				
D	900728	F	209	6914	6989	339	281	5.16	4.19
E		NORM							
F	900915	NORM	258	7555	8141	641	1152	9.27	16.48
G	900929	E	272	7829	9090	274	949	3.63	11.66
H	901013	A	286	7693	8077	138	-64	1.83	-0.79
I	901027	8000 CFS	300	7728	8173	35	96	0.45	1.19
J	901110	NORM	314	7615	8421	-113	248	-1.46	3.03
K	901215	NORM	349	7628	8507	13	86	0.17	1.02
L		11000 CFS							
M	910112	C	377	7298	8200	-330	-307	-4.33	-3.61
N	910126	NORM	391	7216	8144	-82	-56	-1.12	-0.68
O	910209	B	405	7083	7915	-133	-229	-1.84	-2.81
P	910420	NORM	475	6796	7393	-287	-522	-4.05	-6.60
Q	910503	NORM	488						
R	910518	D	503	6801	7366	5	-27	0.07	-0.37
S	900601	15000 CFS	517	6643	7428	-158	62	-2.32	0.84
T	910629	NORM	545	6951	7653	308	225	4.64	3.03
U	910713	G	559	7105	7781	154	128	2.22	1.67
V	910727	F	573	7180	7647	75	-134	1.06	-1.72
Y	921022	INT	1026	5923	5790	-1257	-1857	-17.51	-24.28
B12	931011	INT	1388	6078	5761	155	-29	2.62	-0.50
C12	940411	INT	1562	5273	5313	-805	-448	-13.24	-7.78
D12	941123	INT	1787	5028	5248	-245	-65	-4.65	-1.22
E12	950428	INT	1944	4154	4397	-874	-851	-17.38	-16.22



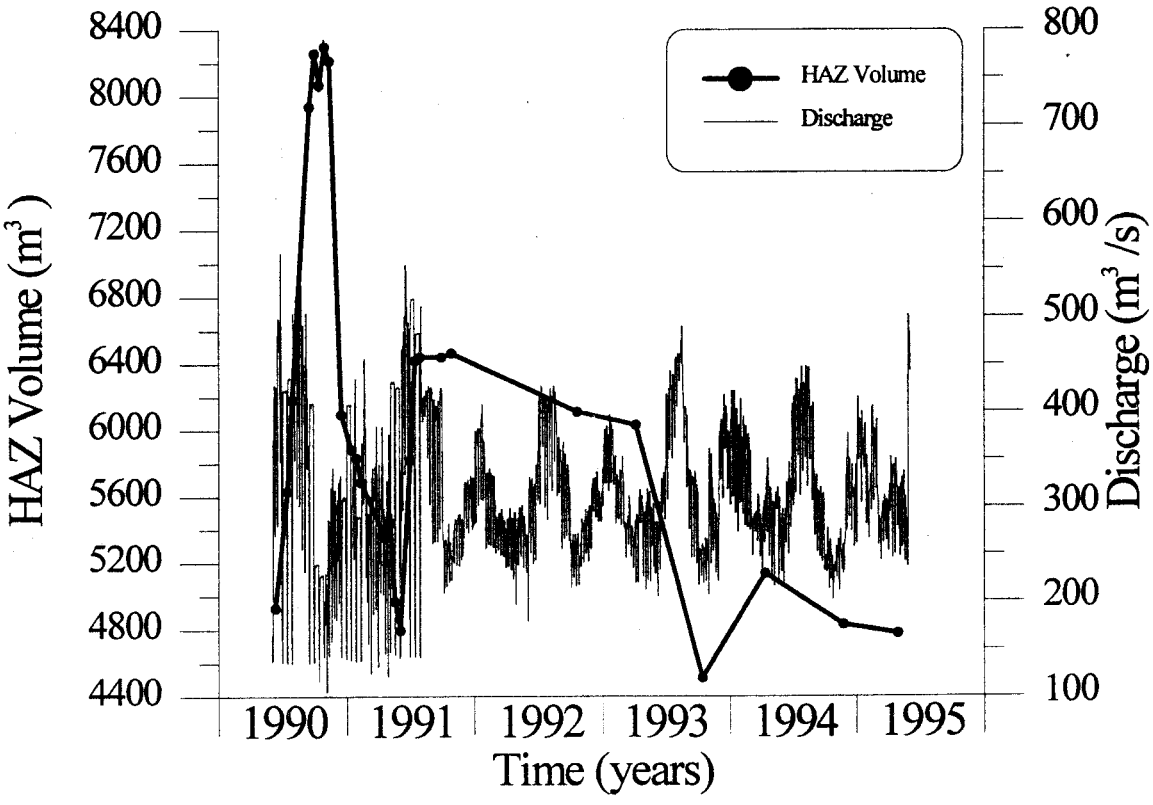
MILE: 50 KILOMETER: 80.5
BEACH #: 13 DEPOSIT TYPE: SEPARATION

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL AREA CH.	ABS VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F	900915	NORM	258	2417	3968				
G		E							
H	901013	A	286	2391	3862	-26	-106	-1.08	-2.67
I	901029	8000 CFS	302	2377	3881	-14	19	-0.59	0.49
J	901110	NORM	314	2331	3867	-46	-14	-1.94	-0.36
K	901215	NORM	349	2351	3828	20	-39	0.86	-1.01
L	901229	11000 CFS	363	2359	3880	8	52	0.34	1.36
M	910113	C	378	2369	3765	10	-115	0.42	-2.96
N	910127	NORM	392	2350	3698	-19	-67	-0.80	-1.78
O	910209	B	405	2363	3739	13	41	0.55	1.11
P	910420	NORM	475	2340	3484	-23	-255	-0.97	-6.82
Q	910504	NORM	489	2341	3462	1	-22	0.04	-0.63
R	910518	D	503	2385	3584	44	122	1.88	3.52
S	910601	15000 CFS	517	2369	3529	-16	-55	-0.67	-1.53
T	910629	NORM	545	2500	3981	131	452	5.53	12.81
U	910713	G	559	2507	4069	7	88	0.28	2.21
V	910730	F	576	2452	3921	-55	-148	-2.19	-3.64
Y	921020	INT	1024	1952	2390	-500	-1531	-20.39	-39.05
Z	930404	INT	1189	2099	2394	147	4	7.53	0.17
B13	931011	INT	1381	2475	2782	376	388	17.91	16.21
C13	940411	INT	1562	2547	2732	72	-50	2.91	-1.80
D13	941123	INT	1788	1648	2101	-899	-631	-35.30	-23.10
E13	950428	INT	1944	2671	2659	1023	558	62.08	26.56



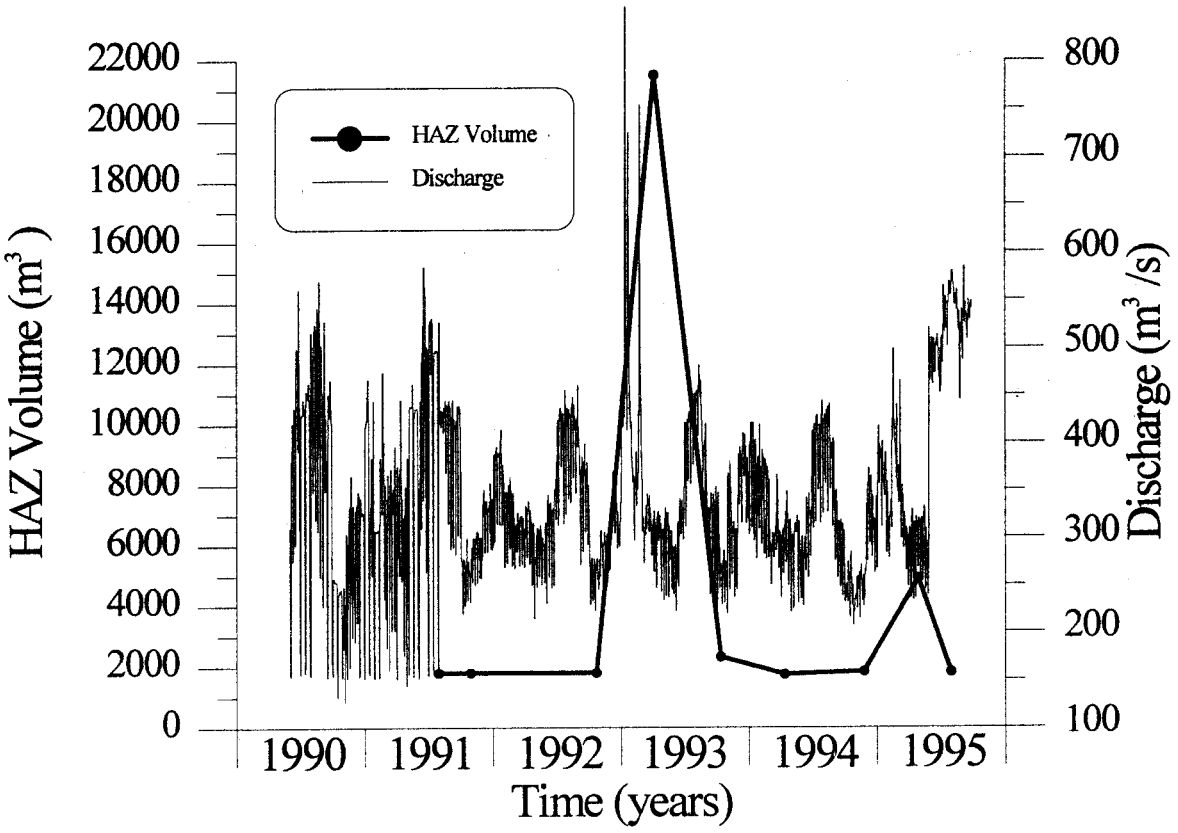
MILE: 51 KILOMETER: 82 9
BEACH #: 14 DEPOSIT TYPE: REATACHMNENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A	900611	NORM	162	5370	4930				
B		NORM							
C	900715	G	196	6058	5634	688	704	12.81	14.28
D	900729	F	210	6272	6184	214	550	3.53	9.76
E		NORM							
F	900916	NORM	259	7177	7938	905	1754	14.43	28.36
G	900930	E	273	7944	8257	767	319	10.69	4.02
H	901014	A	287	7781	8068	604	130	8.42	1.64
I	901028	8000 CFS	301	7869	8294	88	226	1.13	2.80
J	901111	NORM	315	7955	8211	86	-83	1.09	-1.00
K	901216	NORM	350	5955	6095	-2000	-2116	-25.14	-25.77
L		11000 CFS							
M	910113	C	378	6009	5883	54	-212	0.91	-3.48
N	910127	NORM	392	5693	5831	-316	-52	-5.26	-0.88
O	910210	B	406	5436	5687	-257	-144	-4.51	-2.47
P	910420	NORM	475	5085	5355	-351	-332	-6.46	-5.84
Q	910504	NORM	489	5126	5443	41	88	0.81	1.64
R	910518	D	503	4904	4968	-222	-475	-4.33	-8.73
S	910602	15000 CFS	518	4852	4795	-52	-173	-1.06	-3.48
T	910630	NORM	546	5645	5819	793	1024	16.34	21.36
U	910713	G	559	5869	6421	224	602	3.97	10.35
V	910728	F	574	5939	6441	70	20	1.19	0.31
W	910927	INT	635	5830	6442	-109	1	-1.84	0.02
X	911027	INT	665	5789	6463	-41	21	-0.70	0.33
Y	921021	INT	1025	5519	6109	-270	-354	-4.66	-5.48
Z	930404	INT	1190	5596	6029	77	-80	1.40	-1.31
B14	931012	INT	1382	4093	4511	-1503	-1518	-26.86	-25.18
C14	940412	INT	1563	4981	5136	888	625	21.70	13.86
D14	941124	INT	1789	4741	4830	-240	-306	-4.82	-5.96
E14	950429	INT	1945	4409	4777	-332	-53	-7.00	-1.10



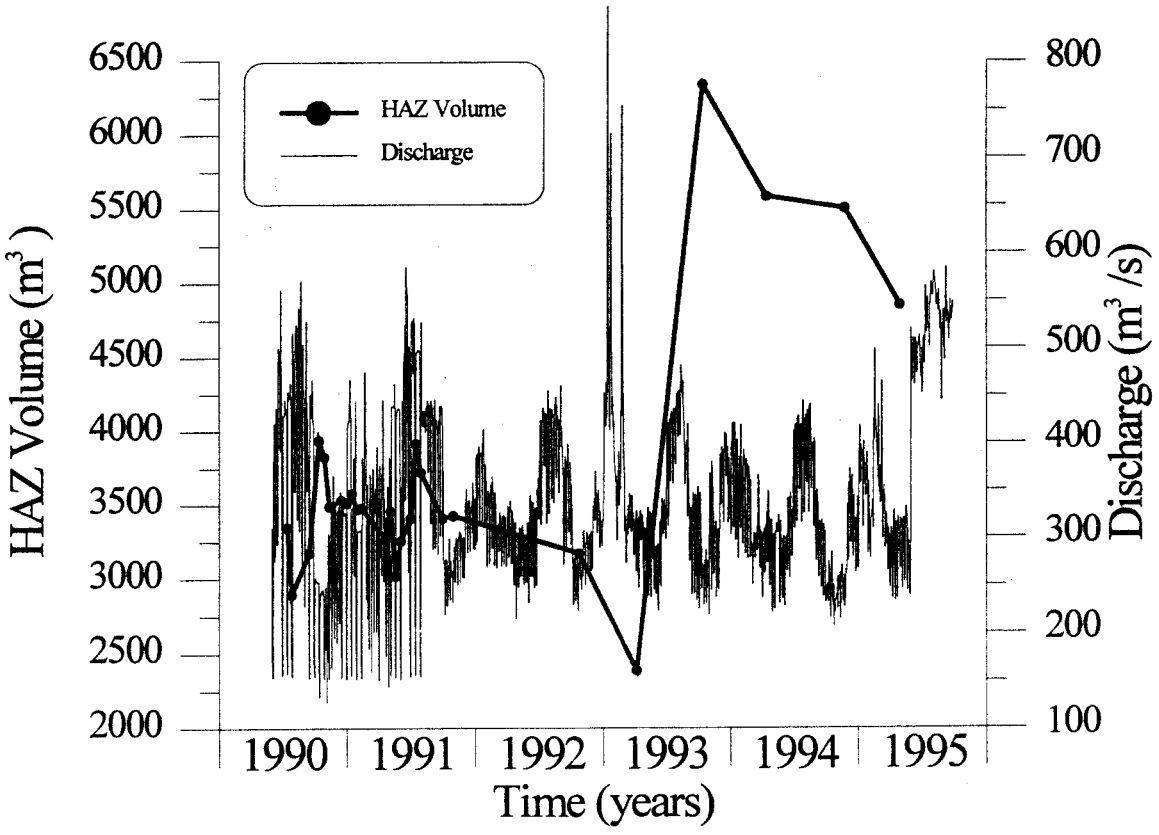
MILE: 62 KILOMETER: 100
BEACH #: 34 DEPOSIT TYPE: REATTACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F		NORM							
G		E							
H		A							
I		8000 CFS							
J		NORM							
K		NORM							
L		11000 CFS							
M		C							
N		NORM							
O		B							
P		NORM							
Q		NORM							
R		D							
S		15000 CFS							
T		NORM							
U		G							
V	910729	F	575	1130	1800				
W		INT							
X		INT	667	1130	1800	0	0	0.00	0.00
Y	921022	INT	1026	1130	1800	0	0	0.00	0.00
Z	930405	INT	1191	10258	21511	9128	19711	807.79	1095.06
B34	931013	INT	1382	2556	2323	-7702	-19188	-75.08	-89.20
C34	940413	INT	1564	1127	1745	-1429	-578	-55.91	-24.88
D34	941124	INT	1790	1135	1843	8	98	0.71	5.62
E34	950430	INT	1946	4913	4909	3778	3066	332.86	166.36
F34	950430	INT	2039	1121	1817	-3792	-3092	-77.18	-62.99



MILE: 68 KILOMETER: 109.6
BEACH #: 15 DEPOSIT TYPE: REATTACH /SEPAR.

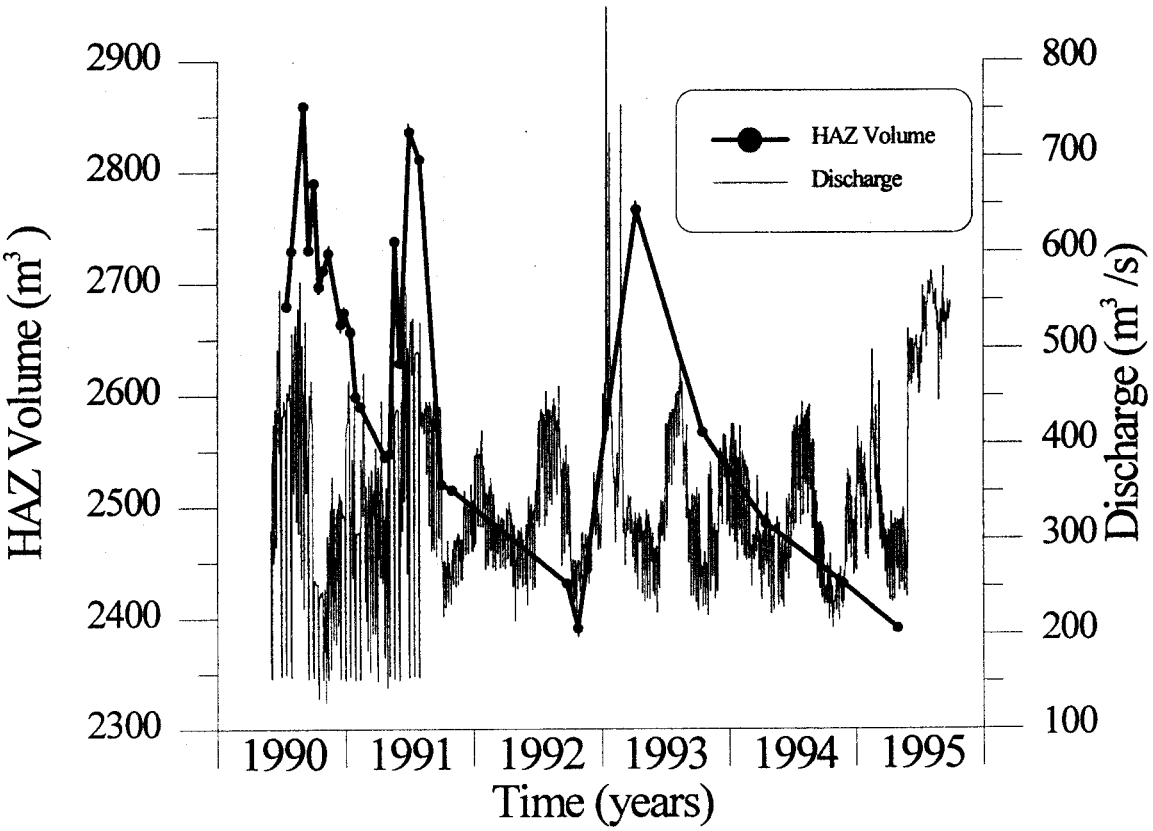
RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C	900715	G	196	2990	3348				
D	900729	F	210	2649	2894	-341	-454	-11.40	-13.56
E		NORM							
F	900916	NORM	259	2764	3174	115	280	4.34	9.68
G		E							
H	901014	A	287	3163	3940	399	766	14.44	24.13
I	901028	8000 CFS	301	3155	3827	-8	-113	-0.25	-2.87
J	901112	NORM	316	3116	3490	-39	-337	-1.24	-8.81
K	901216	NORM	350	2943	3536	-173	46	-5.55	1.32
L	901230	11000 CFS	364	2940	3511	-3	-25	-0.10	-0.71
M	910114	C	379	2971	3579	31	68	1.05	1.94
N	910128	NORM	393	2963	3469	-8	-110	-0.27	-3.07
O	910210	B	406	3063	3478	100	9	3.37	0.26
P	910421	NORM	476	2954	3269	-109	-209	-3.56	-6.01
Q	910505	NORM	490	3288	3459	334	190	11.31	5.81
R	910519	D	504	2808	3020	-480	-439	-14.60	-12.69
S	910602	15000 CFS	518	3019	3256	211	236	7.51	7.81
T	910701	NORM	547	2998	3409	-21	153	-0.70	4.70
U	910714	G	560	3162	3919	164	510	5.47	14.96
V	910729	F	575	3077	3723	-85	-196	-2.69	-5.00
W	910929	INT	637	2659	3410	-418	-313	-13.58	-8.41
X	911029	INT	667	2818	3426	159	16	5.98	0.47
Y	921022	INT	1026	2979	3171	161	-255	5.71	-7.44
Z	930406	INT	1192	2102	2389	-877	-782	-29.44	-24.66
B15	931013	INT	1382	4828	6341	2726	3952	129.69	165.42
C15	940414	INT	1565	4557	5589	-271	-752	-5.61	-11.86
D15	941124	INT	1790	3738	5510	-819	-79	-17.97	-1.41
E15	950430	INT	1946	4273	4858	535	-652	14.31	-11.83



MILE: 81 KILOMETER: 130.5

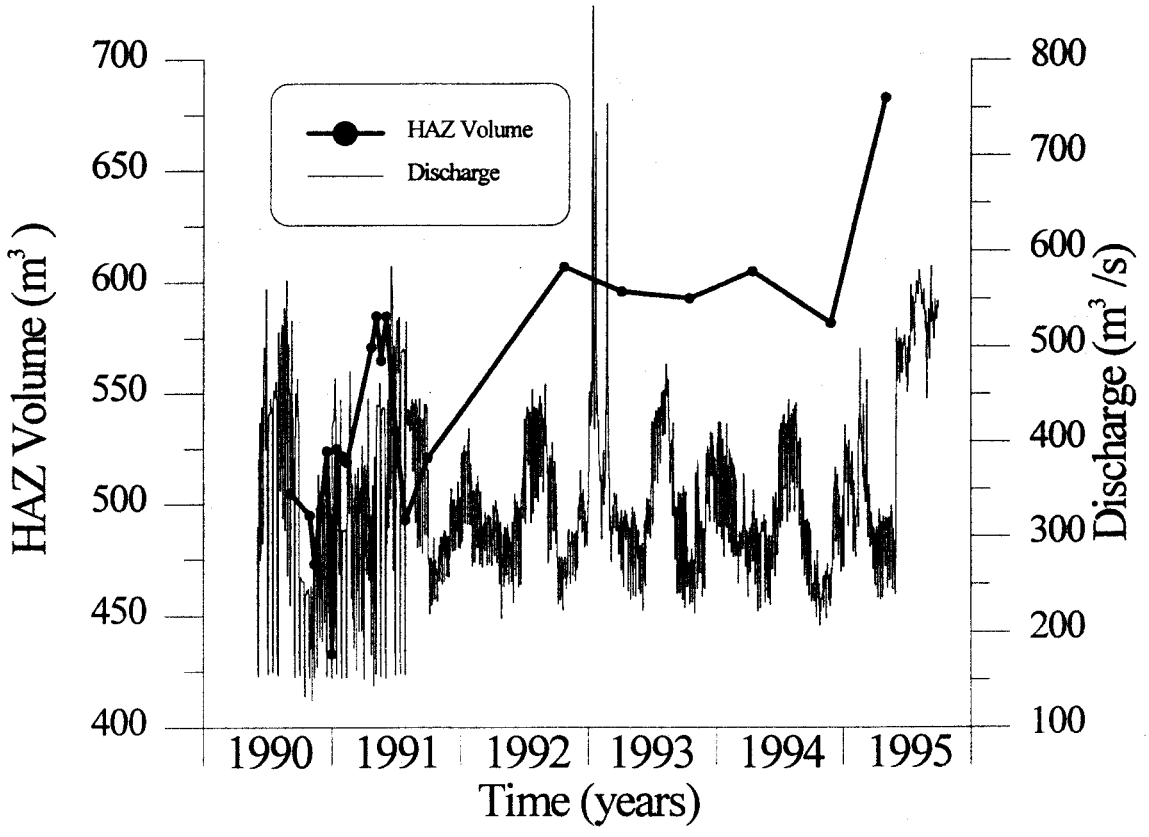
BEACH #: 16 DEPOSIT TYPE: SEPARATION 8K HAZ VOL COMPARIS

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH
A		NORM							
B		NORM							
C	900716	G	197	1308	2680				
D	900730	F	211	1300	2729	-8	49	-0.61	1.83
E	900902	NORM	245	1334	2859	34	130	2.62	4.76
F	900917	NORM	260	1296	2730	-38	-129	-2.85	-4.51
G	901001	E	274	1314	2790	18	60	1.39	2.20
H	901016	A	289	1255	2697	-41	-33	-3.16	-1.21
I	901029	8000 CFS	302	1223	2712	-32	15	-2.55	0.56
J	901112	NORM	316	1236	2727	13	15	1.06	0.55
K	901217	NORM	351	1218	2664	-18	-63	-1.46	-2.31
L	901227	11000 CFS	361	1189	2674	-29	10	-2.38	0.38
M	910114	C	379	1280	2657	91	-17	7.65	-0.64
N	910128	NORM	393	1211	2599	-69	-58	-5.39	-2.18
O	910211	B	407	1201	2590	-10	-9	-0.83	-0.35
P	910422	NORM	477	1198	2545	-3	-45	-0.25	-1.74
Q	910506	NORM	491	1201	2548	3	3	0.25	0.12
R	910520	D	505	1328	2738	127	190	10.57	7.46
S	910603	15000 CFS	519	1230	2629	-98	-109	-7.38	-3.98
T	910701	NORM	547	1350	2836	120	207	9.76	7.87
U		G							
V	910729	F	575	1334	2811	-16	-25	-1.19	-0.88
W	911001	INT	639	1184	2520	-150	-291	-11.24	-10.35
X	911031	INT	669	1154	2515	-30	-5	-2.53	-0.20
Y	920923	INT	996	1223	2431	69	-84	5.98	-3.34
&	921023	INT	1027	1170	2391	-53	-40	-4.33	-1.65
Z	930407	INT	1194	1249	2766	79	375	6.75	15.68
B16	931015	INT	1384	1197	2567	-52	-199	-4.16	-7.19
C16	940415	INT	1566	1180	2485	-17	-82	-1.42	-3.19
D16	941126	INT	1791	1147	2431	-33	-54	-2.80	-2.17
E16	950501	INT	1947	1203	2391	56	-40	4.88	-1.65



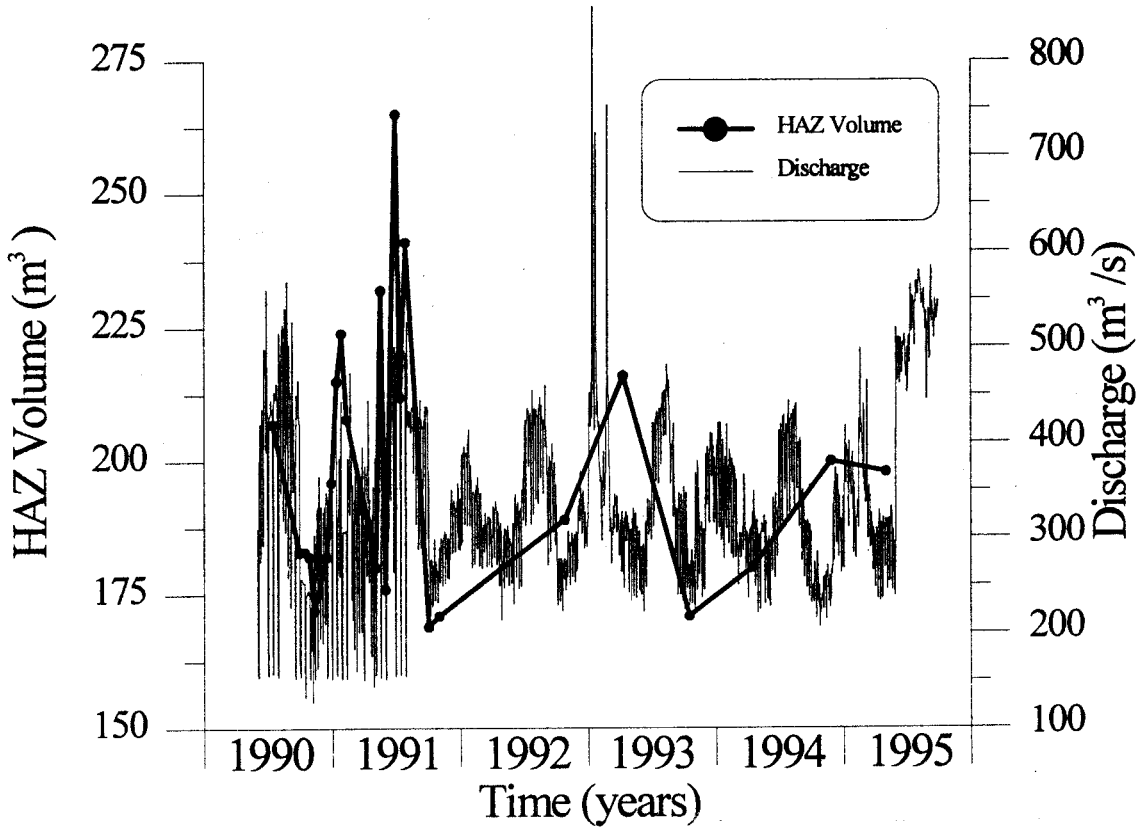
MILE: 87 KILOMETER: 140.3
BEACH #: 17 DEPOSIT TYPE: SEPARATION/REATTACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E	900903	NORM	246	307	505				
F		NORM							
G		E							
H		A							
I	901029	8000 CFS	302	305	495	-2	-10	-0.65	-1.98
J	901112	NORM	316	315	473	10	-22	3.28	-4.44
K	901217	NORM	351	334	524	19	51	6.03	10.78
L	901231	11000 CFS	365	310	433	-24	-91	-7.19	-17.37
M	910114	C	379	347	525	37	92	11.94	21.25
N	910128	NORM	393	340	522	-7	-3	-2.02	-0.57
O	910211	B	407	351	519	11	-3	3.24	-0.57
P	910422	NORM	477	387	571	36	52	10.26	10.02
Q	910506	NORM	491	404	585	17	14	4.39	2.45
R	910520	D	505	340	565	-64	-20	-15.84	-3.42
S	910603	15000 CFS	519	351	585	11	20	3.24	3.54
T	910701	NORM	547	321	533	-30	-52	-8.55	-8.89
U		G							
V	910729	F	575	317	493	-4	-40	-1.25	-7.50
W	911001	INT	639	323	521	6	28	1.89	5.68
Y	921023	INT	1027	395	607	72	86	22.29	16.51
Z	930407	INT	1193	571	596	176	-11	44.56	-1.81
B17	931015	INT	1384	414	593	-157	-3	-27.50	-0.50
C17	940415	INT	1566	414	605	0	12	0.00	2.02
D17	941117	INT	1791	391	582	-23	-23	-5.56	-3.80
E17	950501	INT	1947	480	683	89	101	22.76	17.35



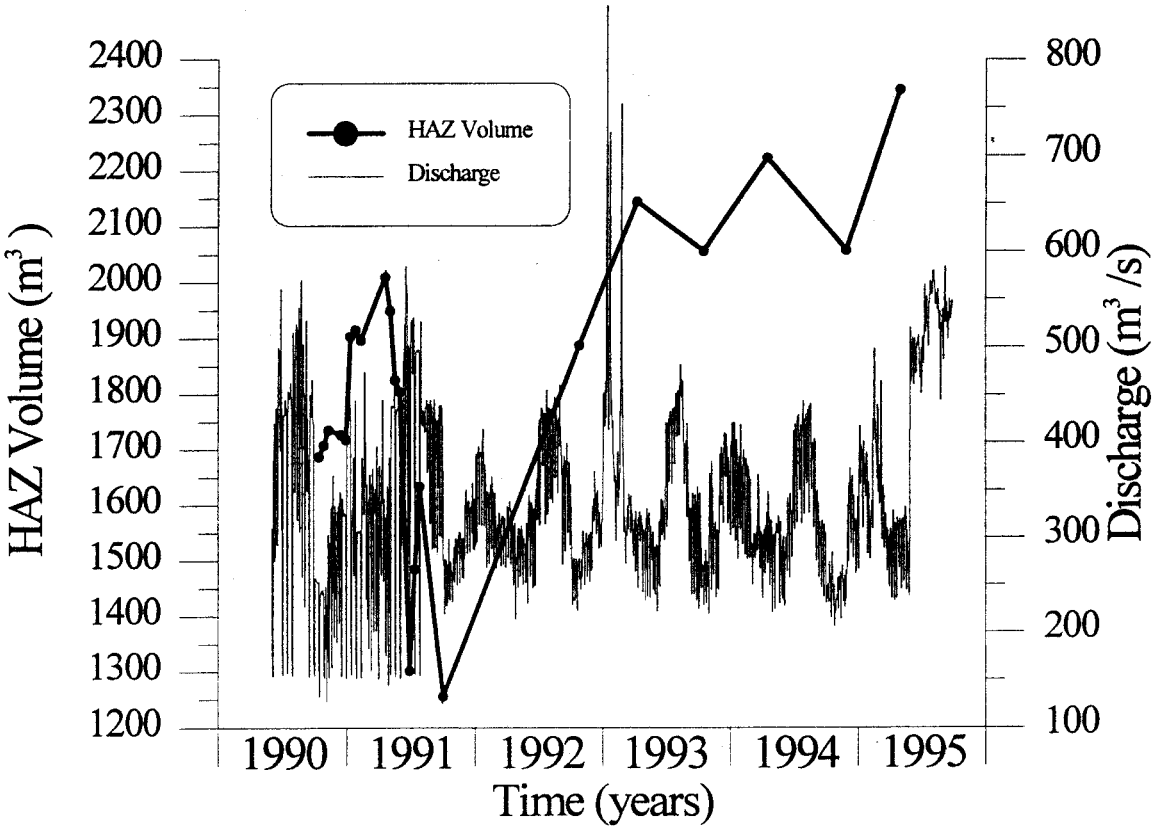
MILE: 91 KILOMETER: 146.6
BEACH #: 18 DEPOSIT TYPE: SEPARATION

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C	900714	G	195	215	207				
D		F							
E		NORM							
F		NORM							
G	900928	E	271	177	183	-38	-24	-17.67	-11.59
H	901012	A	285	176	183	-1	0	-0.56	0.00
I	901026	8000 CFS	299	178	182	2	-1	1.14	-0.55
J	901109	NORM	313	159	172	-19	-10	-10.67	-5.49
K	901214	NORM	348	174	182	15	10	9.43	5.81
L	911228	11000 CFS	362	177	196	3	14	1.72	7.69
M	910112	C	377	223	215	46	19	25.99	9.69
N	910126	NORM	391	238	224	15	9	6.73	4.19
O	910209	B	405	235	208	-3	-16	-1.26	-7.14
P	910420	NORM	475	182	186	-53	-22	-22.55	-10.58
Q	910504	NORM	489	189	180	7	-6	3.85	-3.23
R	910518	D	503	225	232	36	52	19.05	28.89
S	910601	15000 CFS	517	142	176	-83	-56	-36.89	-24.14
T	910702	NORM	545	217	265	75	89	52.82	50.57
U	910712	G	558	198	212	-19	-53	-8.76	-20.00
V	910727	F	573	223	241	25	29	12.63	12.03
W	911002	INT	640	139	169	-84	-72	-37.67	-42.60
X	910001	INT	670	135	171	-4	2	-2.88	1.17
Y	921024	INT	1028	208	189	73	18	54.07	9.52
Z	930408	INT	1195	155	216	-53	27	-25.48	12.50
B18	931016	INT	1385	126	171	-29	-45	-18.71	-26.32
C18	940416	INT	1567	161	180	35	9	27.78	5.00
D18	941127	INT	1792	177	200	16	20	9.94	10.00
E18	950502	INT	1948	187	198	10	-2	5.65	-1.01



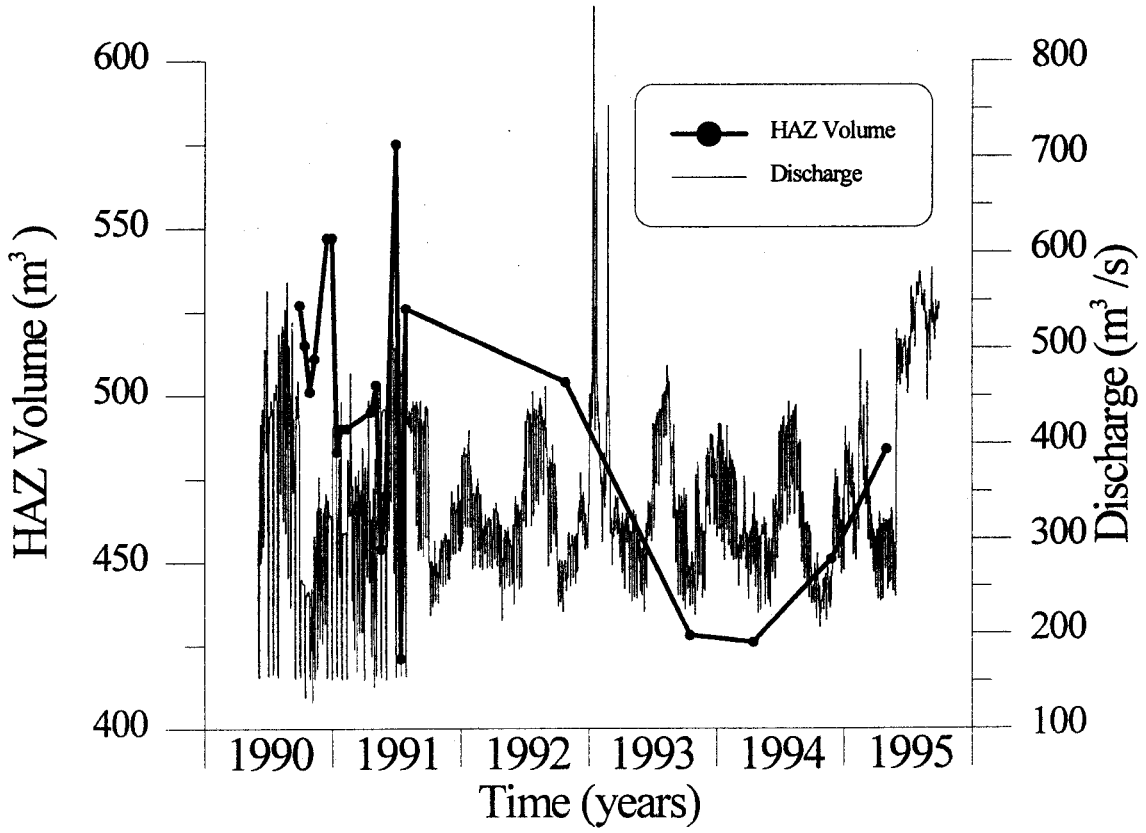
MILE: 93 KILOMETE 149.6
BEACH #: 19 DEPOSIT TYPE: UPPER POOL

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL AREA CH	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F		NORM							
G		E							
H	901013	A	286	1394	1688				
I	901027	8000 CFS	300	1390	1708	-4	20	-0.29	1.18
J	901110	NORM	314	1397	1735	7	27	0.50	1.58
K	901215	NORM	349	1433	1727	36	-8	2.58	-0.46
L	901229	11000 CFS	363	1417	1719	-16	-8	-1.12	-0.46
M	910112	C	376	1631	1904	214	185	15.10	10.76
N	910126	NORM	391	1598	1915	-33	11	-2.02	0.58
O	910209	B	405	1601	1897	3	-18	0.19	-0.94
P	910420	NORM	475	1574	2010	-27	113	-1.69	5.96
Q	910504	NORM	489	1637	1949	63	-61	4.00	-3.03
R	910518	D	503	1380	1826	-257	-123	-15.70	-6.31
S	910601	15000 CFS	517	1418	1805	38	-21	2.75	-1.15
T	910629	NORM	545	1001	1302	-417	-503	-29.41	-27.87
U	910713	G	559	1231	1485	230	183	22.98	14.06
V	910727	F	573	1401	1634	170	149	13.81	10.03
W	911002	INT	640	1021	1256	-380	-378	-27.12	-23.13
Y	921024	INT	1028	1690	1888	669	632	65.52	50.32
Z	930408	INT	1195	1717	2145	27	257	1.60	13.61
B19	931016	INT	1385	1590	2057	-127	-88	-7.40	-4.10
C19	940416	INT	1567	1878	2224	288	167	18.11	8.12
D19	941127	INT	1792	1628	2059	-250	-165	-13.31	-7.42
E19	940502	INT	1948	1924	2346	296	287	18.18	13.94



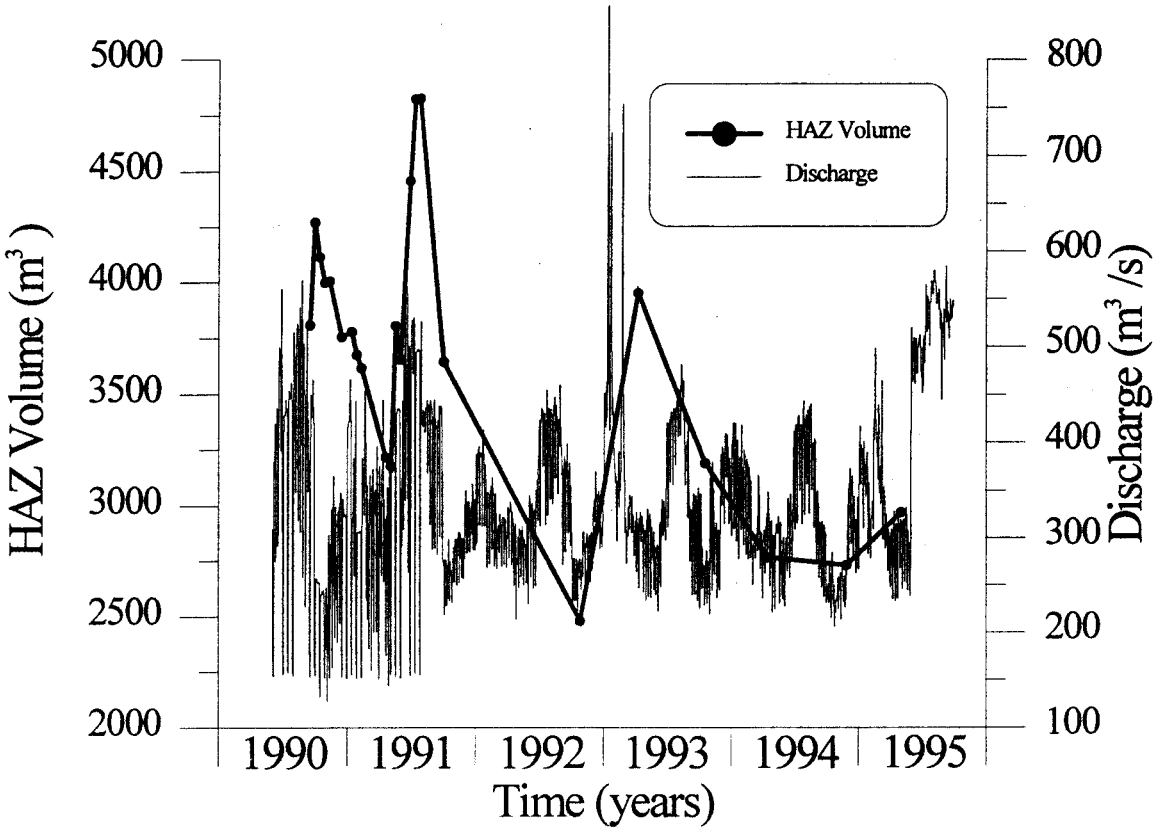
MILE: 104 KILOMETER: 167.2
BEACH #: 20 DEPOSIT TYPE: UPPER POOL

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F		NORM							
G	900929	E	272	324	527				
H	901013	A	286	330	515	6	-12	1.85	-2.28
I	901027	8000 CFS	300	330	501	0	-14	0.00	-2.72
J	901110	NORM	314	326	511	-4	10	-1.21	2.00
K	901215	NORM	349	333	547	7	36	2.15	7.05
L	901229	11000 CFS	363	358	547	25	0	7.51	0.00
M	910113	C	378	308	483	-50	-64	-13.97	-11.70
N	910126	NORM	391	335	490	27	7	8.77	1.45
O	910209	B	405	333	490	-2	0	-0.60	0.00
P	910420	NORM	475	319	495	-14	5	-4.20	1.02
Q	910504	NORM	489	315	503	-4	8	-1.25	1.62
R	910518	D	503	288	454	-27	-49	-8.57	-9.74
S	910601	15000 CFS	517	315	470	27	16	9.38	3.52
T	910629	NORM	545	364	575	49	105	15.56	22.34
U	910713	G	559	278	421	-86	-154	-23.63	-26.78
V	910727	F	573	364	526	86	105	30.94	19.96
Y	921025	INT	1029	360	504	-4	-22	-1.10	-4.37
B20	931017	INT	1386	289	428	-71	-76	-19.72	-17.76
C20	940417	INT	1568	311	426	22	-2	7.61	-0.47
D20	941127	INT	1792	312	451	1	25	0.32	5.54
E20	950503	INT	1949	345	484	33	33	10.58	6.82



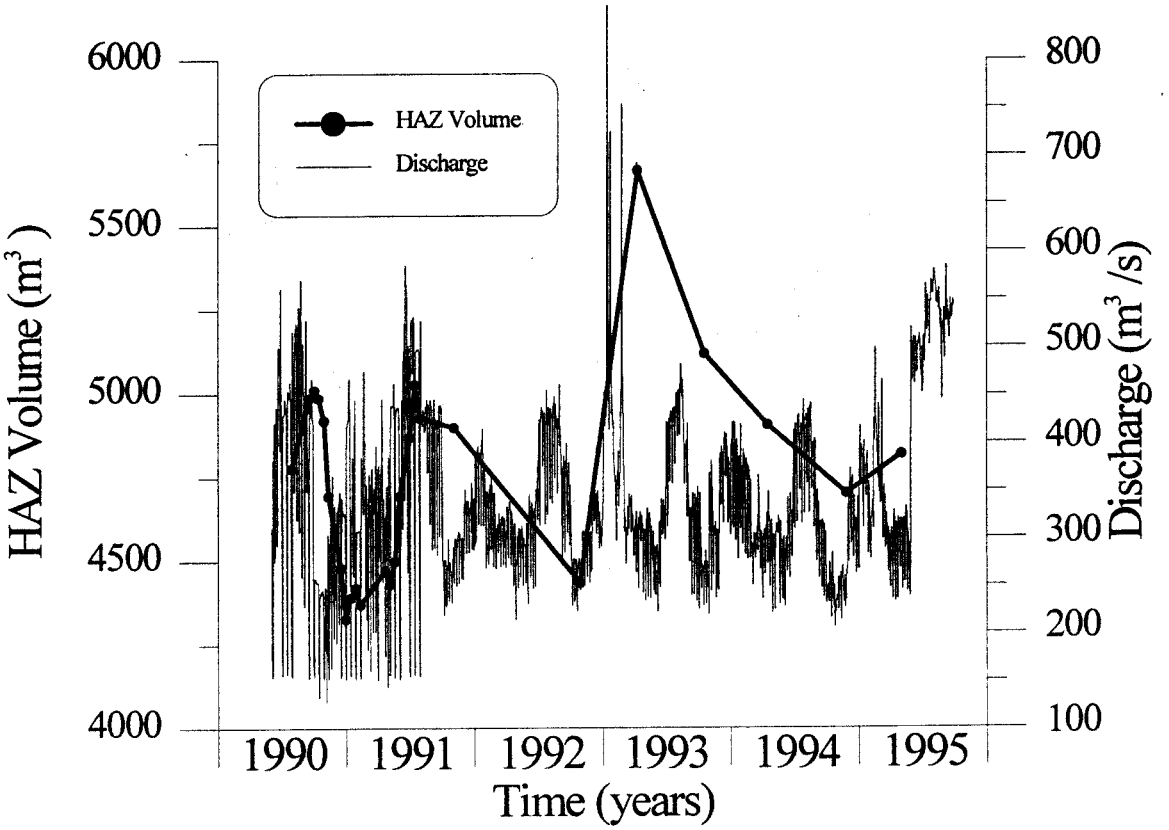
MILE: 119 KILOMETER: 191.5
BEACH #: 21 DEPOSIT TYPE: REATTACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D	900729	F							
E		NORM							
F	900916	NORM	259	2586	3809				
G	900930	E	273	2725	4273	139	464	5.38	12.18
H	901014	A	287	2556	4116	-169	-157	-6.20	-3.67
I	901028	8000 CFS	301	2454	4000	-102	-116	-3.99	-2.82
J	901111	NORM	315	2352	4005	-102	5	-4.16	0.13
K	901216	NORM	350	2260	3757	-92	-248	-3.91	-6.19
L		11000 CFS							
M	910113	C	378	2326	3780	66	23	2.92	0.61
N	910127	NORM	392	2252	3677	-74	-103	-3.18	-2.72
O	910210	B	406	2205	3619	-47	-58	-2.09	-1.58
P	910421	NORM	476	2093	3219	-112	-400	-5.08	-11.05
Q	910505	NORM	490	2036	3180	-57	-39	-2.72	-1.21
R	910519	D	504	2465	3807	429	627	21.07	19.72
S	910602	15000 CFS	518	2312	3655	-153	-152	-6.21	-3.99
T	910630	NORM	546	2709	4459	397	804	17.17	22.00
U	910714	G	560	2814	4822	105	363	3.88	8.14
V	910728	F	574	2792	4825	-22	3	-0.78	0.06
W	911004	INT	642	2290	3645	-502	-1180	-17.98	-24.46
Y	921026	INT	1030	1724	2481	-566	-1164	-24.72	-31.93
Z	930410	INT	1196	2360	3952	636	1471	36.89	59.29
B21	931018	INT	1387	2011	3192	-349	-760	-14.79	-19.23
C21	940417	INT	1568	2252	2767	241	-425	11.98	-13.31
D21	941128	INT	1793	1884	2732	-368	-35	-16.34	-1.26
E21	950503	INT	1949	2420	2973	536	241	28.45	8.82



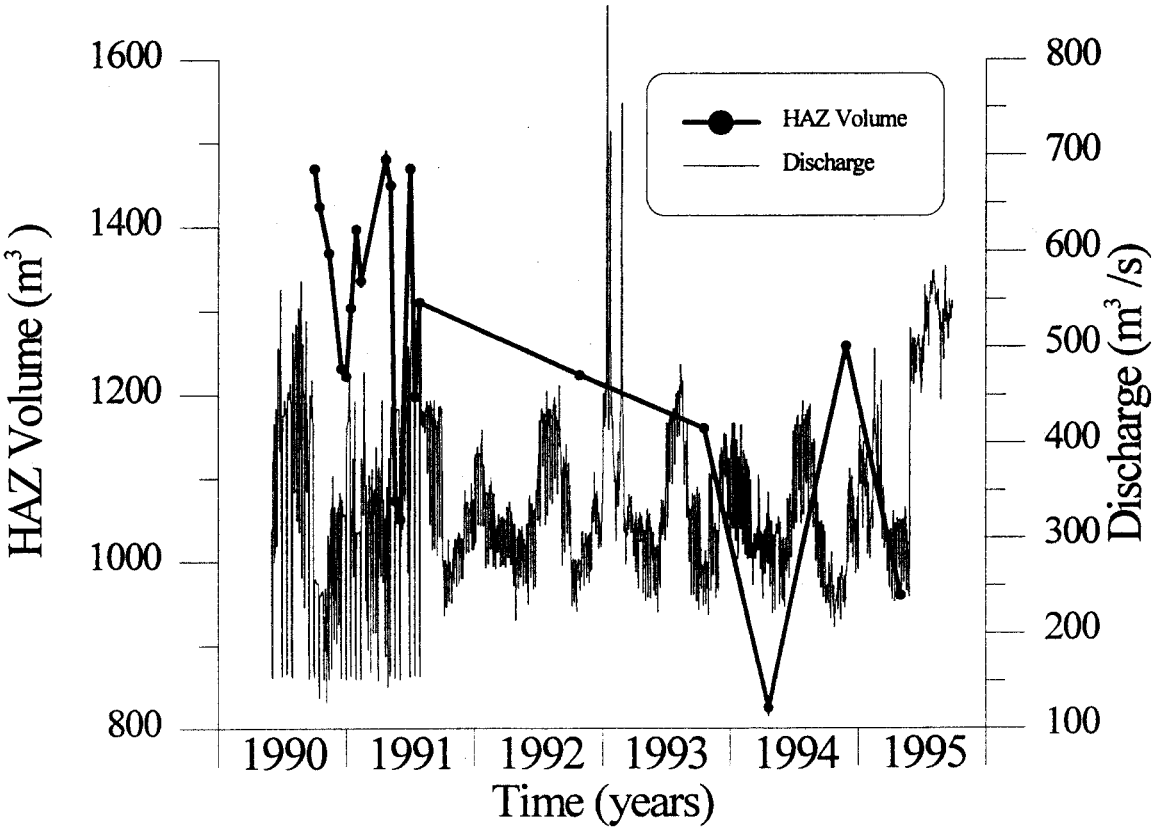
MILE: 122 KILOMETER: 196.5
BEACH #: 22 DEPOSIT TYPE: REATTACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D	900729	F	210	3642	4778				
E		NORM							
F	900917	NORM	260	3785	4988	143	210	3.93	4.40
G	901001	E	274	3779	5011	-6	23	-0.16	0.46
H	901014	A	287	3428	4987	-351	-24	-9.29	-0.48
I	901029	8000 CFS	302	3293	4921	-135	-66	-3.94	-1.32
J	901111	NORM	315	3215	4694	-78	-227	-2.37	-4.61
K	901216	NORM	350	3183	4480	-32	-214	-1.00	-4.56
L	901230	11000 CFS	364	3126	4327	-57	-153	-1.79	-3.42
M	910113	C	378	3332	4391	206	64	6.59	1.48
N	910127	NORM	392	3518	4420	186	29	5.58	0.66
O	910210	B	406	3491	4370	-27	-50	-0.77	-1.13
P	910421	NORM	476	3522	4472	31	102	0.89	2.33
Q	910505	NORM	490	3524	4431	2	-41	0.06	-0.92
R	910519	D	504	3645	4500	121	69	3.43	1.56
S	910602	15000 CFS	518	3895	4695	250	195	6.86	4.33
T	910630	NORM	546	3585	4870	-310	175	-7.96	3.73
U	910714	G	560	3498	5028	-87	158	-2.43	3.24
V	910728	F	574	3622	4928	124	-100	3.54	-1.99
X	911103	INT	672	3568	4900	-54	-28	-1.49	-0.57
Y	921027	INT	1031	3134	4435	-434	-465	-12.16	-9.49
Z	930409	INT	1196	2991	5666	-143	1231	-4.56	27.76
B22	931018	INT	1387	2860	5120	-131	-546	-4.38	-9.64
C22	940417	INT	1568	3004	4908	144	-212	5.03	-4.14
D22	941128	INT	1793	2760	4704	-244	-204	-8.12	-4.16
E22	950504	INT	1950	2766	4821	6	117	0.22	2.49



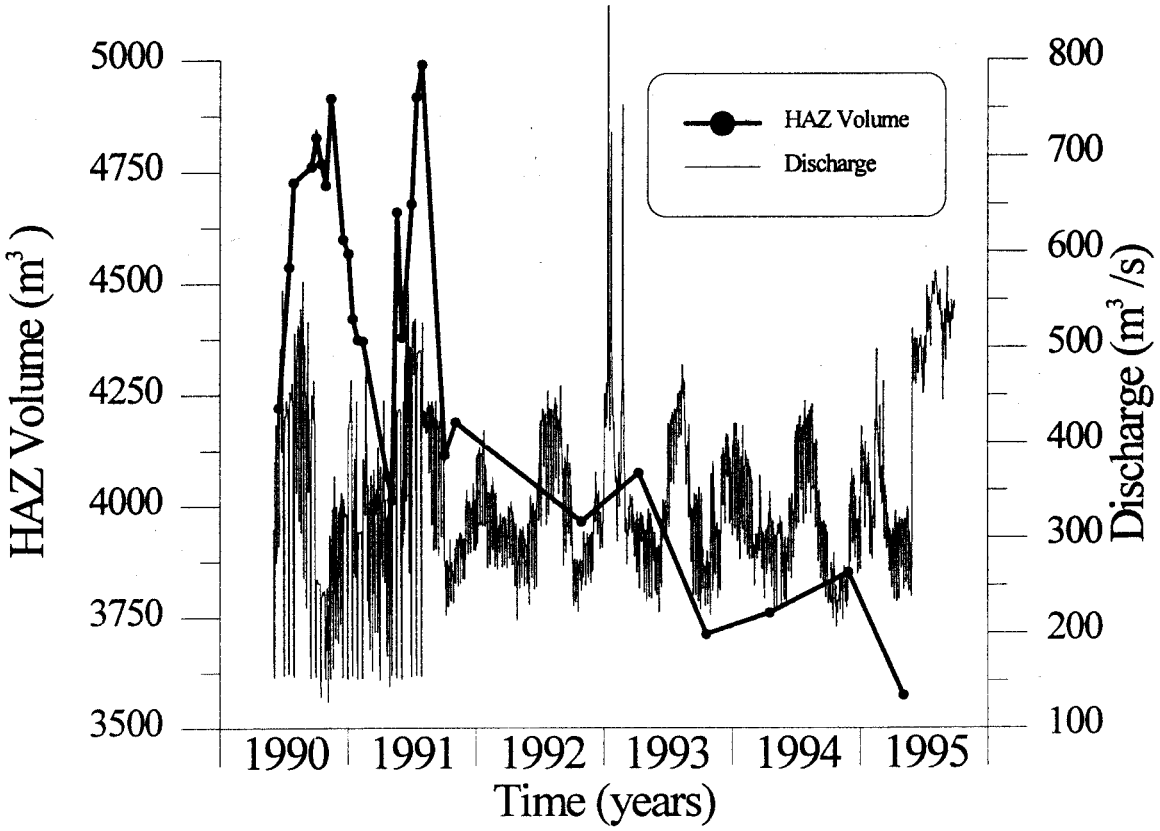
MILE: 123 KILOMETER: 197.6
BEACH #: 23 DEPOSIT TYPE: REATTACHMENT/UPPER POOL

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F	900917	NORM	260						
G	901001	E	274	1453	1469				
H	901015	A	288	1423	1424	-30	-45	-2.06	-3.06
I		8000 CFS							
J	901112	NORM	316	1383	1369	-40	-55	-2.81	-3.86
K	901217	NORM	351	1300	1231	-83	-138	-6.00	-10.08
L	901231	11000 CFS	365	1322	1222	22	-9	1.69	-0.73
M	910114	C	379	1481	1304	159	82	12.03	6.71
N	910128	NORM	393	1477	1397	-4	93	-0.27	7.13
O	910211	B	407	1450	1336	-27	-61	-1.83	-4.37
P	910422	NORM	477	1495	1480	45	144	3.10	10.78
Q	910506	NORM	491	1475	1449	-20	-31	-1.34	-2.09
R	910520	D	505	1097	1073	-378	-376	-25.63	-25.95
S	910603	15000 CFS	519	1084	1051	-13	-22	-1.19	-2.05
T	910701	NORM	547	1501	1469	417	418	38.47	39.77
U	910715	G	561	1181	1198	-320	-271	-21.32	-18.45
V	910728	F	574	1280	1310	99	112	8.38	9.35
Y	921027	INT	1031	1317	1223	37	-87	2.89	-6.64
B23	931018	INT	1387	1118	1160	-199	-63	-15.11	-5.15
C23	940419	INT	1570	954	825	-164	-335	-14.67	-28.88
D23	941128	INT	1793	1402	1258	448	433	46.96	52.48
E23	950504	INT	1950	1056	960	-346	-298	-24.68	-23.69



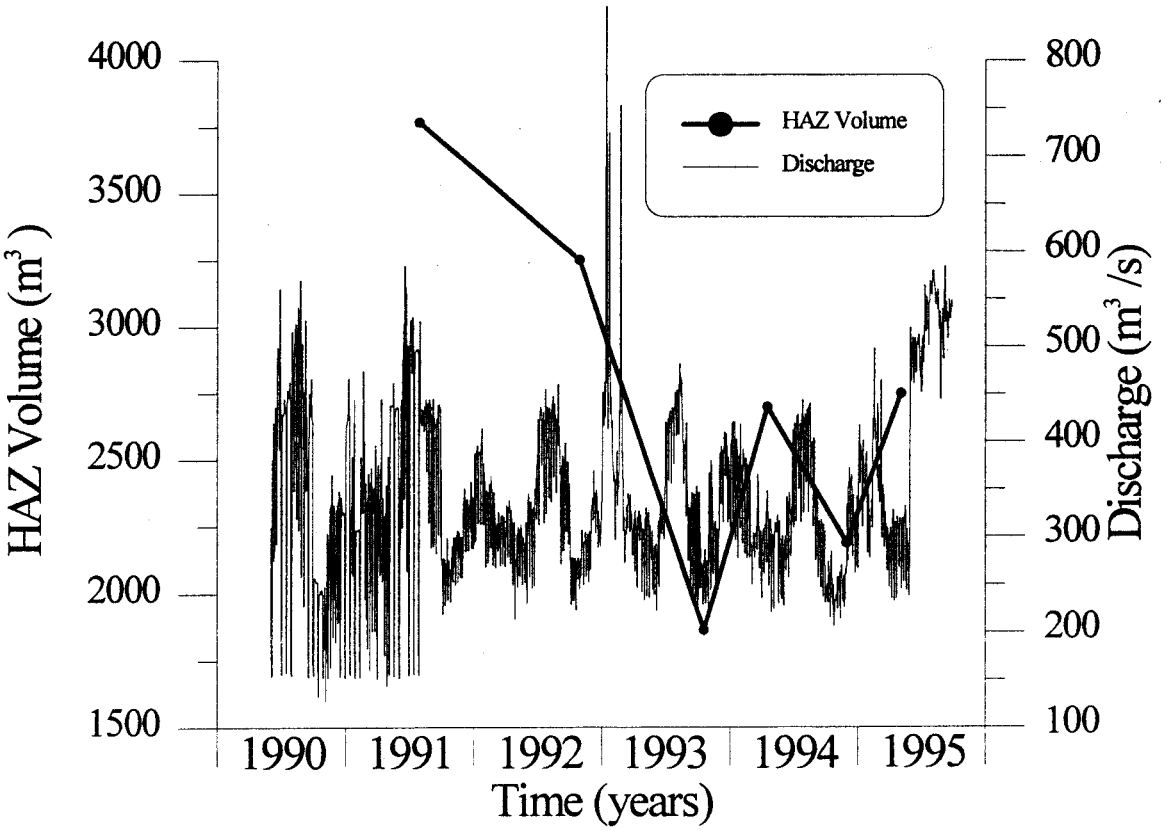
MILE: 137 KILOMETER: 220.4
BEACH #: 24 DEPOSIT TYPE: REATACHMNENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS VOL CH.	% AREA CH.	% VOL CH.
A	900617	NORM	168	3025	4222				
B		NORM							
C	900716	G	197	2953	4537	-72	315	-2.38	7.46
D	900729	F	210	2957	4727	4	190	0.14	4.19
E		NORM							
F	900918	NORM	261	2976	4762	19	35	0.64	0.74
G	901002	E	275	2943	4827	-33	65	-1.11	1.36
H	901016	A	289	2923	4769	-20	-58	-0.68	-1.20
I	901029	8000 CFS	302	2905	4721	-18	-48	-0.62	-1.01
J	901113	NORM	317	2933	4914	28	193	0.96	4.09
K	901217	NORM	351	3012	4599	79	-315	2.69	-6.41
L	910101	11000 CFS	366	2989	4568	-23	-31	-0.76	-0.67
M	910114	C	379	3009	4422	20	-146	0.67	-3.20
N	910128	NORM	393	3016	4374	7	-48	0.23	-1.09
O	910211	B	407	3018	4371	2	-3	0.07	-0.07
P	910422	NORM	477	2943	4067	-75	-304	-2.49	-6.95
Q	910506	NORM	491	2953	4014	10	-53	0.34	-1.30
R	910520	D	505	2854	4661	-99	647	-3.35	16.12
S	910603	15000 CFS	519	2946	4379	92	-282	3.22	-6.05
T	910701	NORM	547	2831	4679	-115	300	-3.90	6.85
U	910715	G	561	2864	4917	33	238	1.17	5.09
V	910729	F	575	2924	4989	60	72	2.09	1.46
W	911005	INT	642	3018	4116	94	-873	3.21	-17.50
X	911104	INT	673	2965	4189	-53	73	-1.76	1.77
Y	921028	INT	1032	2995	3965	30	-224	1.01	-5.35
Z	930411	INT	1197	2880	4074	-115	109	-3.84	2.75
B24	931019	INT	1388	2976	3712	96	-362	3.33	-8.89
C24	940418	INT	1569	3074	3761	98	49	3.29	1.32
D24	941129	INT	1794	2991	3851	-83	90	-2.70	2.39
E24	950505	INT	1951	2967	3574	-24	-277	-0.80	-7.19



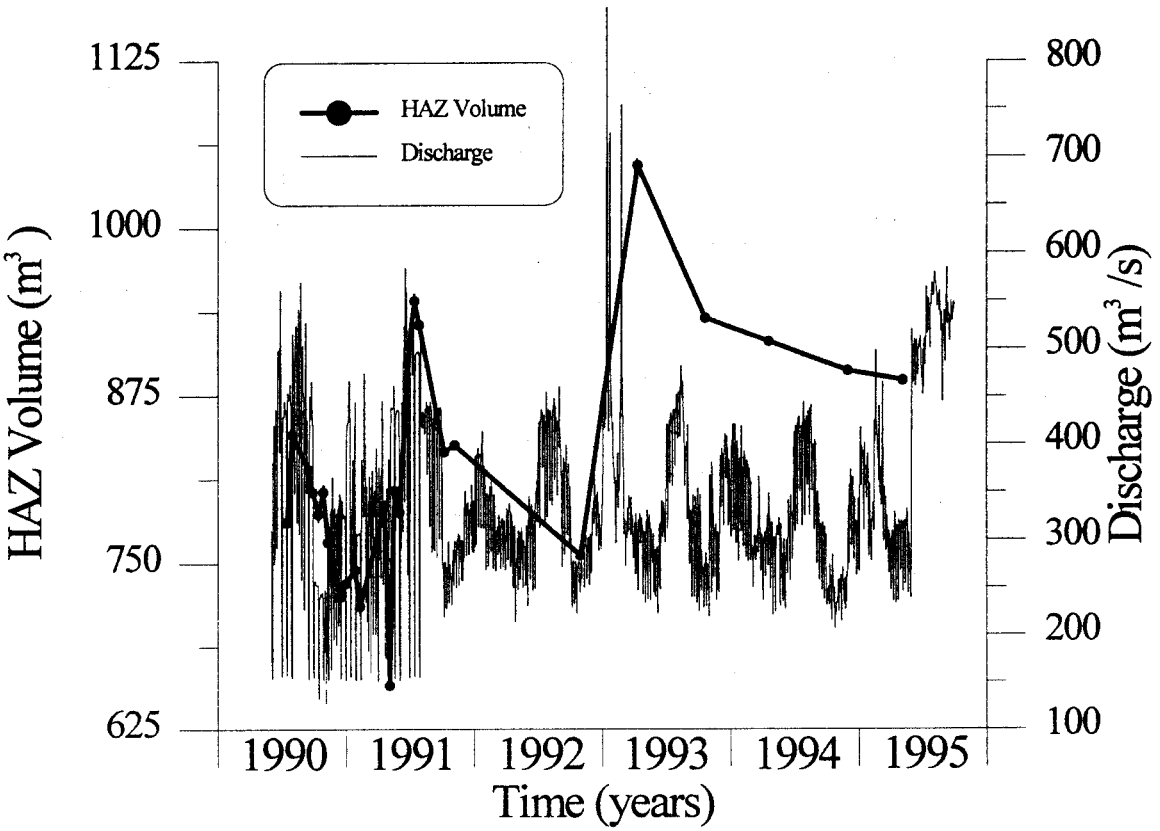
MILE: 139 KILOMETER: 222.4
BEACH #: 25 DEPOSIT TYPE: REATACHMENT/UPPER POOL

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F		NORM							
G		E							
H		A							
I		8000 CFS							
J		NORM							
K		NORM							
L		11000 CFS							
M		C							
N		NORM							
O		B							
P		NORM							
Q		NORM							
R		D							
S		15000 CFS							
T		NORM							
U		G							
V	910729	F	575	1896	3768				
Y	921028	INT	1032	1989	3252	93	-516	4.91	-13.69
B25	931019	INT	1388	1113	1867	-876	-1385	-44.04	-42.59
C25	940418	INT	1570	2079	2701	966	834	86.79	44.67
D25	941130	INT	1795	1642	2191	-437	-510	-21.02	-18.88
E25	950505	INT	1951	1595	2752	-47	561	-2.86	25.60



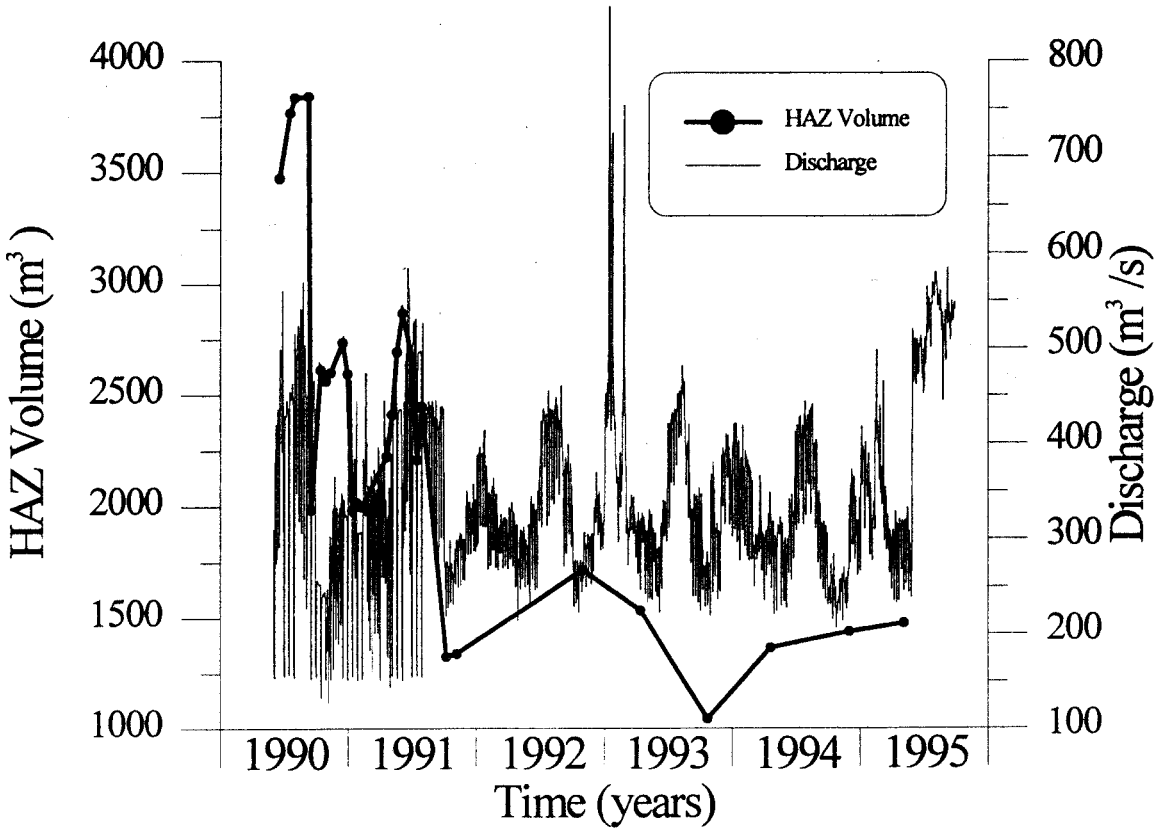
MILE: 145 KILOMETER: 223
BEACH #: 26 DEPOSIT TYPE: REATTACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C	900716	G	197	531	781				
D	900730	F	212	536	846	5	65	0.94	8.32
E		NORM							
F	900915	NORM	258	540	820	4	-26	0.75	-3.07
G	900928	E	271	544	803	4	-17	0.74	-2.07
H	901013	A	286	520	787	-24	-16	-4.41	-1.99
I	901027	8000 CFS	300	515	803	-5	16	-0.96	2.03
J	901110	NORM	314	482	766	-33	-37	-6.41	-4.61
K	901215	NORM	349	491	725	9	-41	1.87	-5.35
L	901229	11000 CFS	363	482	735	-9	10	-1.83	1.38
M		C							
N	910125	NORM	390	528	745	46	10	9.54	1.36
O	910208	B	404	505	718	-23	-27	-4.36	-3.62
P	910420	NORM	475	535	793	30	75	5.94	10.45
Q	910504	NORM	489	481	658	-54	-135	-10.09	-17.02
R	910518	D	503	545	804	64	146	13.31	22.19
S	910601	15000 CFS	517	549	788	4	-16	0.73	-1.99
T	910629	NORM	545	566	913	17	125	3.10	15.86
U	910713	G	559	576	946	10	33	1.77	3.61
V	910727	F	573	581	928	5	-18	0.87	-1.94
W	911006	INT	644	540	833	-41	-95	-7.06	-11.40
X	911105	INT	674	510	838	-30	5	-5.56	0.60
Y	921029	INT	1033	497	756	-13	-82	-2.55	-10.85
Z	930411	INT	1197	570	1047	73	291	14.69	27.79
B26	931020	INT	1389	549	933	-21	-114	-3.68	-12.22
C26	940419	INT	1570	544	916	-5	-17	-0.91	-1.86
D26	941130	INT	1795	500	894	-44	-22	-8.09	-2.46
E26	950506	INT	1952	577	887	77	-7	15.40	-0.79



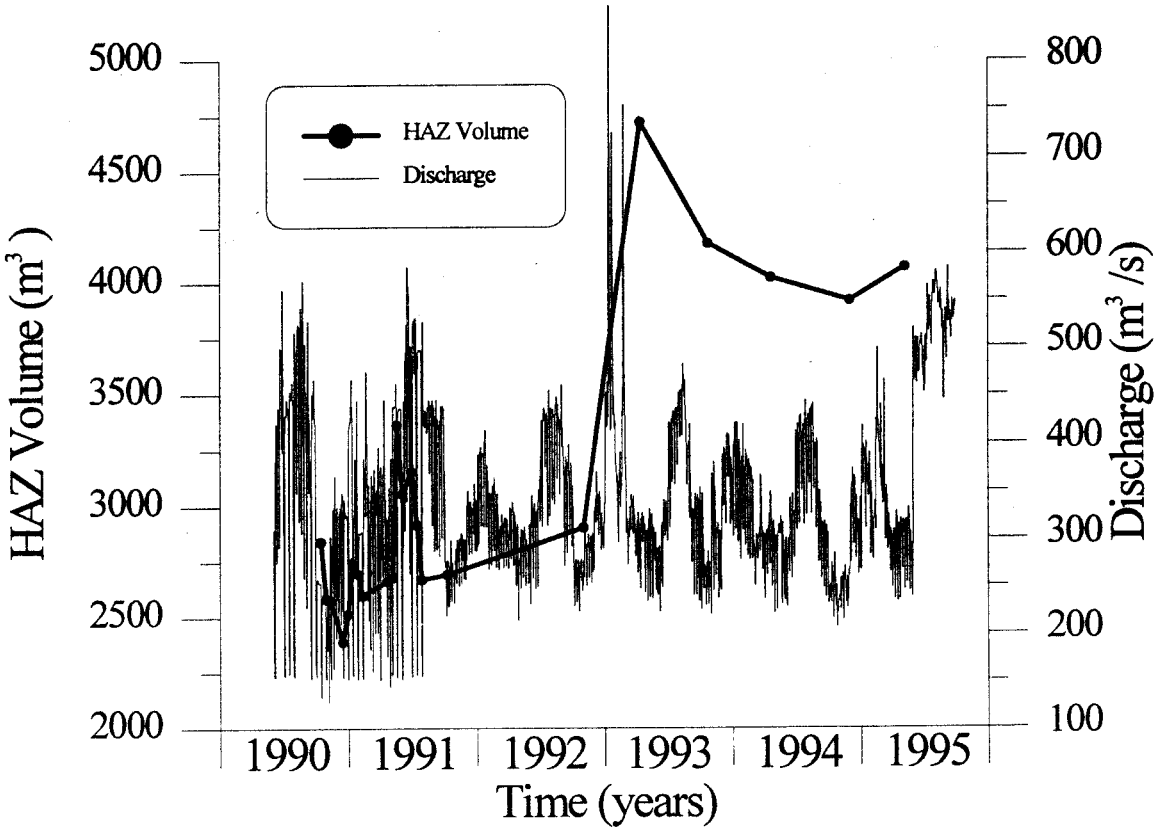
MILE: 172 KILOMETER: 276.9
BEACH #: 27 DEPOSIT TYPE: REATTACH./UPPER POOL

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A	900618	NORM	169	2769	3476				
B		NORM							
C	900717	G	198	2804	3766	35	290	1.26	8.34
D	900731	F	212	2747	3833	-57	67	-2.03	1.78
E	900908	NORM	251	2747	3839	0	6	0.00	0.16
F	900916	NORM	259	1757	1985	-990	-1854	-36.04	-48.29
G	900930	E							
H	901014	A	287	2162	2614	405	629	23.05	31.69
I	901028	8000 CFS	301	2177	2563	15	-51	0.69	-1.95
J	901111	NORM	315	2197	2602	20	39	0.92	1.52
K	901216	NORM	350	2276	2737	79	135	3.60	5.19
L	901230	11000 CFS	364	2234	2597	-42	-140	-1.85	-5.12
M	910112	C	377	1517	1985	-717	-612	-32.09	-23.57
N	910126	NORM	391	1600	2017	83	32	5.47	1.61
O	910209	B	405	1594	1998	-6	-19	-0.38	-0.94
P	910420	NORM	475	1925	2225	331	227	20.77	11.36
Q	910504	NORM	489	2024	2412	99	187	5.14	8.40
R	910518	D	503	2006	2696	-18	284	-0.89	11.77
S	910602	15000 CFS	518	2147	2869	141	173	7.03	6.42
T	910629	NORM	545	2146	2674	-1	-195	-0.05	-6.80
U	910714	G	560	1864	2212	-282	-462	-13.14	-17.28
V	910728	F	574	2254	2448	390	236	20.92	10.67
W	911007	INT	645	1068	1327	-1186	-1121	-52.62	-45.79
X	911106	INT	675	1119	1340	51	13	4.78	0.98
Y	921030	INT	1034	1416	1719	297	379	26.54	28.28
Z	930412	INT	1198	1105	1535	-311	-184	-21.96	-10.70
B27	941023	INT	1392	878	1043	-227	-492	-20.54	-32.05
C27	940421	INT	1572	1591	1367	713	324	81.21	31.06
D27	941201	INT	1796	1649	1439	58	72	3.65	5.27
E27	950507	INT	1953	1700	1478	51	39	3.09	2.71



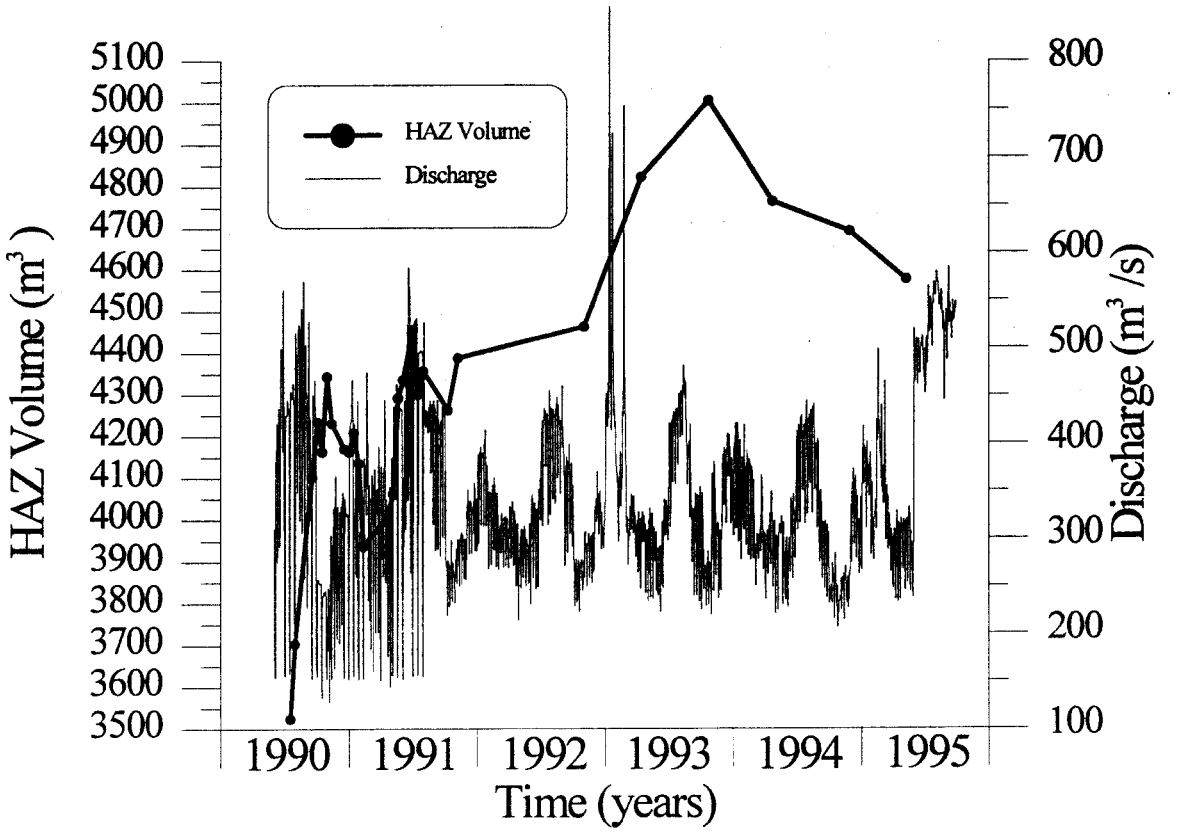
MILE: 183 KILOMETER: 295.3
BEACH #: 28 DEPOSIT TYPE: REATTACH/UPPER POOL

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F		NORM							
G		E							
H	901014	A	287	2041	2844				
I	901028	8000 CFS	301	1831	2583	-210	-261	-10.29	-9.18
J	901111	NORM	315	1790	2575	-41	-8	-2.24	-0.31
K	901216	NORM	350	1865	2390	75	-185	4.19	-7.18
L	901230	11000 CFS	364	1921	2515	56	125	3.00	5.23
M	910112	C	377	2073	2744	152	229	7.91	9.11
N	910128	NORM	393	2044	2697	-29	-47	-1.40	-1.71
O	910210	B	406	2027	2599	-17	-98	-0.83	-3.63
P	910421	NORM	476	2112	2663	85	64	4.19	2.46
Q	910506	NORM	491	2123	2680	11	17	0.52	0.64
R	910519	D	504	2242	3364	119	684	5.61	25.52
S	910602	15000 CFS	518	2215	3056	-27	-308	-1.20	-9.16
T	910630	NORM	546	2144	3156	-71	100	-3.21	3.27
U	910714	G	560	2087	2919	-57	-237	-2.66	-7.51
V	910728	F	574	2078	2670	-9	-249	-0.43	-8.53
W	911008	INT	646	2152	2694	74	24	3.56	0.90
Y	921031	INT	1035	2237	2906	85	212	3.95	7.87
Z	930412	INT	1198	2710	4723	473	1817	21.14	62.53
B28	931023	INT	1392	2436	4179	-274	-544	-10.11	-11.52
C28	940422	INT	1572	2476	4023	40	-156	1.64	-3.73
D28	941201	INT	1796	2232	3921	-244	-102	-9.85	-2.54
E28	950508	INT	1954	2372	4073	140	152	6.27	3.88



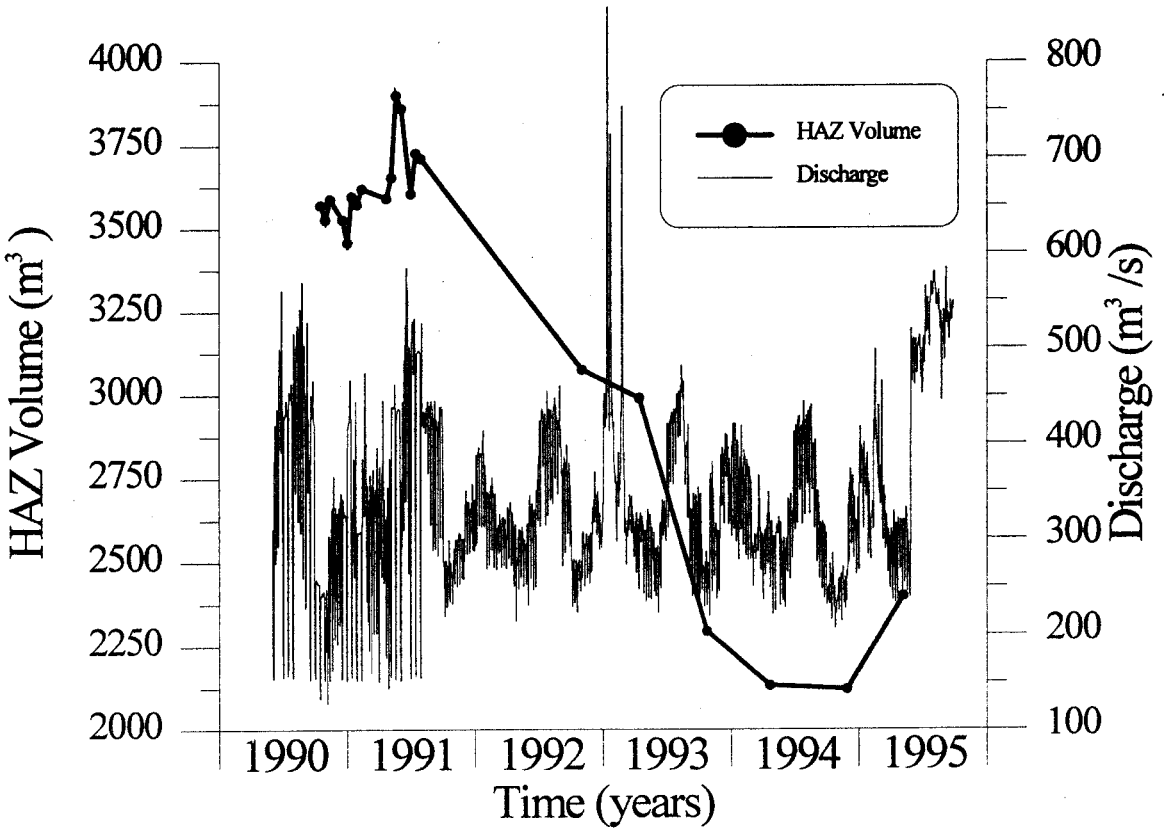
MILE: 194 KILOMETER: 312
BEACH #: 29 DEPOSIT TYPE: REATTACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G	198	3025	3524				
D		F	212	3049	3704	24	180	0.79	5.11
E		NORM							
F		NORM	260	3245	4102	196	398	6.43	10.75
G		E	275	3384	4235	139	133	4.28	3.24
H	901015	A	288	3392	4163	8	-72	0.24	-1.70
I	901029	8000 CFS	302	3379	4343	-13	180	-0.38	4.32
J	901112	NORM	316	3303	4231	-76	-112	-2.25	-2.58
K	901217	NORM	351	3154	4171	-149	-60	-4.51	-1.42
L	901231	11000 CFS	365	3075	4163	-79	-8	-2.50	-0.19
M	910113	C	378	3245	4209	170	46	5.53	1.10
N	910128	NORM	392	3228	4136	-17	-73	-0.52	-1.73
O	910210	B	406	3156	3938	-72	-198	-2.23	-4.79
P	910421	NORM	476	3122	4007	-34	69	-1.08	1.75
Q	910506	NORM	491	3120	4061	-2	54	-0.06	1.35
R	910520	D	505	3221	4291	101	230	3.24	5.66
S	910603	15000 CFS	519	3353	4336	132	45	4.10	1.05
T	910630	NORM	546	3344	4456	-9	120	-0.27	2.77
U	910715	G	561	3210	4301	-134	-155	-4.01	-3.48
V	910729	F	575	3284	4357	74	56	2.31	1.29
W	911008	INT	646	3296	4263	12	-94	0.37	-2.21
X	911107	INT	676	3234	4388	-62	125	-1.88	2.85
Y	921101	INT	1036	3377	4464	143	76	4.42	1.70
Z	930413	INT	1199	3288	4823	-89	359	-2.64	7.44
B29	931023	INT	1392	3451	5005	163	182	4.96	3.64
C29	940422	INT	1573	3363	4785	-88	-240	-2.55	-5.04
D29	941202	INT	1793	3159	4694	-204	-71	-6.07	-1.51
E29	950509	INT	1955	3279	4577	120	-117	3.80	-2.56



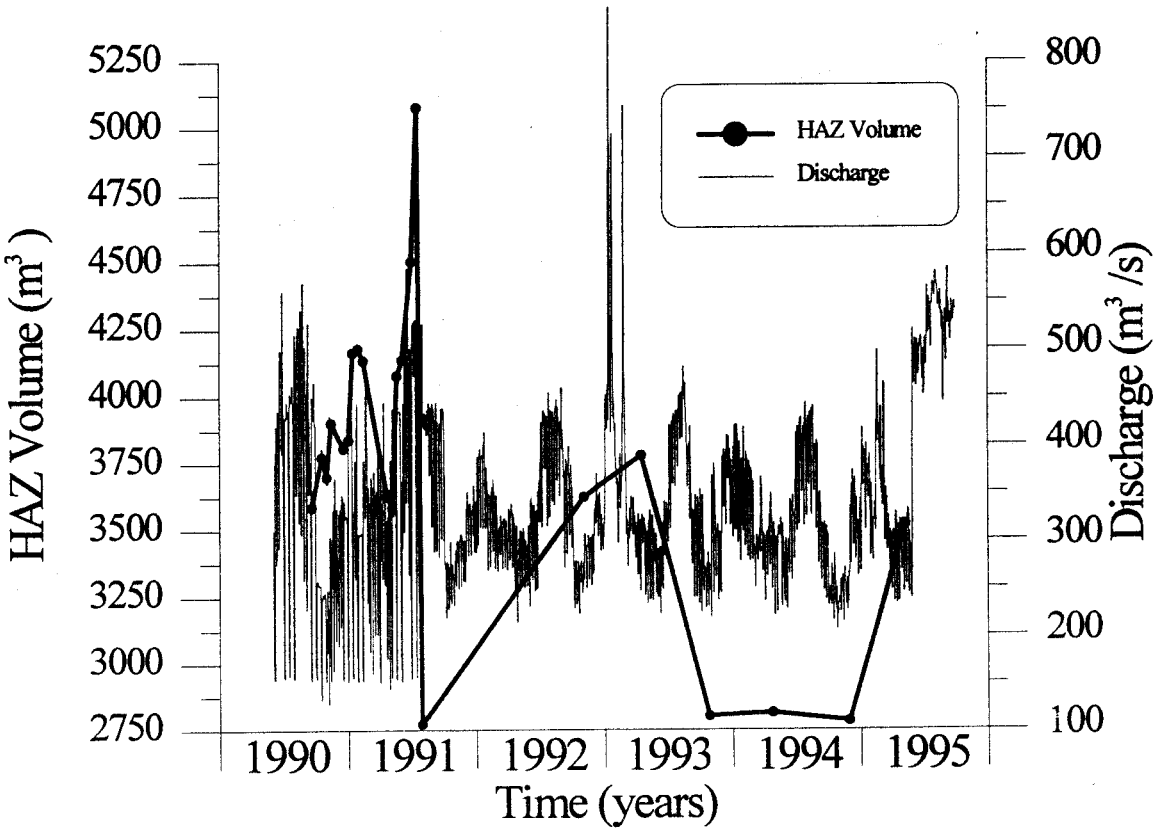
MILE: 203 KILOMETER: 325
BEACH #: 30 DEPOSIT TYPE: SEPARATION

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F		NORM							
G		E							
H	901016	A	289	2089	3570				
I	901030	8000 CFS	303	2060	3528	-29	-42	-1.39	-1.18
J	901113	NORM	317	2131	3588	71	60	3.45	1.70
K	901218	NORM	352	2142	3527	11	-61	0.52	-1.70
L	910101	11000 CFS	366	2158	3458	16	-69	0.75	-1.96
M	910114	C	379	2213	3596	55	138	2.55	3.99
N	910128	NORM	393	2246	3573	33	-23	1.49	-0.64
O	910211	B	407	2263	3619	17	46	0.76	1.29
P	910422	NORM	477	2328	3591	65	-28	2.87	-0.77
Q	910506	NORM	491	2328	3653	0	62	0.00	1.73
R	910520	D	505	2445	3899	117	246	5.03	6.73
S	910603	15000 CFS	519	2410	3861	-35	-38	-1.43	-0.97
T	910701	NORM	547	2132	3605	-278	-256	-11.54	-6.63
U	910715	G	561	2224	3726	92	121	4.32	3.36
V	910729	F	575	2230	3710	6	-16	0.27	-0.43
Y	921101	INT	1036	1981	3075	-249	-635	-11.17	-20.65
Z	930413	INT	1199	1768	2991	-213	-84	-10.75	-2.81
B30	931024	INT	1393	1611	2295	-157	-696	-8.88	-30.33
C30	940423	INT	1574	1617	2133	6	-162	0.37	-7.59
D30	941202	INT	1794	1783	2122	166	-11	10.27	-0.52
E30	950509	INT	1955	2009	2400	226	278	12.68	11.58



MILE: 213 KILOMETER: 342.7
BEACH #: 31 DEPOSIT TYPE: REATTACHEMENT/UPPER POOL

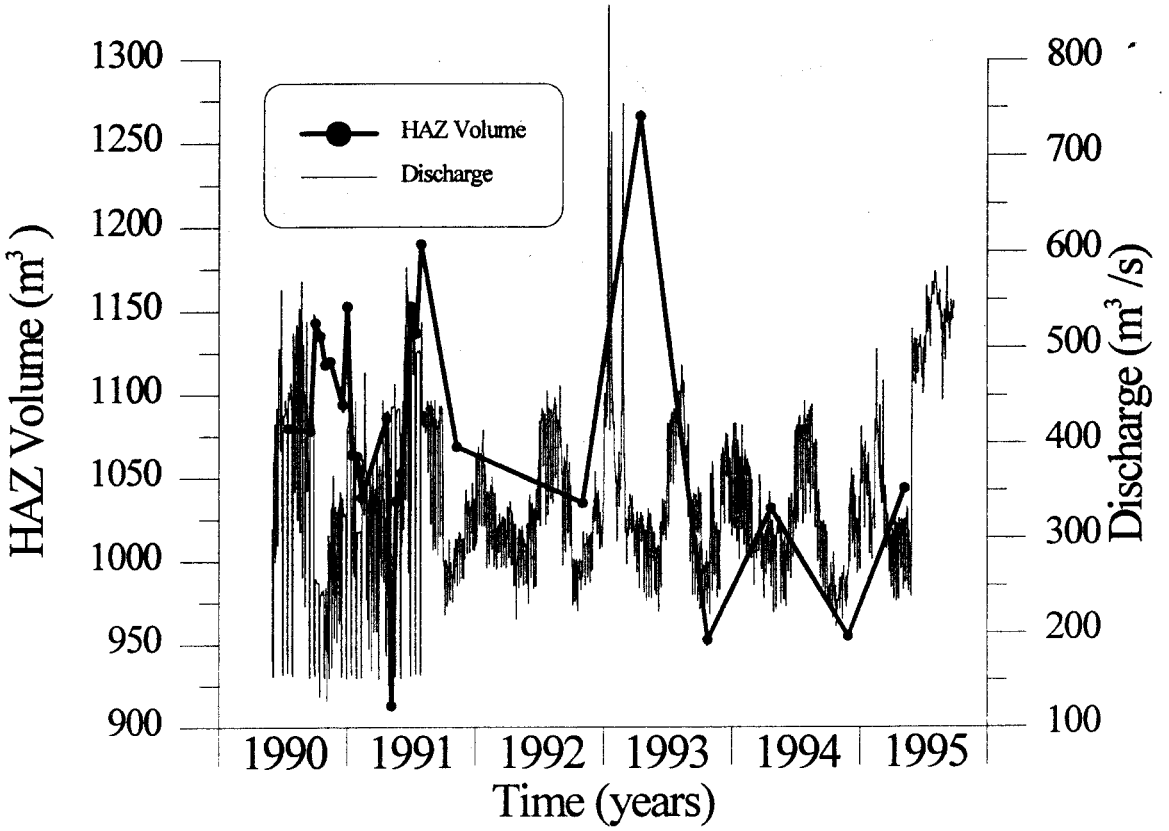
RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F	900918	NORM	261	1600	3587				
G		E							
H	901017	A	290	1859	3775	259	188	16.19	5.24
I	901031	8000 CFS	304	1736	3701	-123	-74	-6.62	-1.96
J	901113	NORM	317	1789	3903	53	202	3.05	5.46
K	901218	NORM	352	1820	3810	31	-93	1.73	-2.38
L	910101	11000 CFS	366	1823	3840	3	30	0.16	0.79
M	910114	C	379	1887	4166	64	326	3.51	8.49
N	910128	NORM	393	1904	4179	17	13	0.90	0.31
O	910211	B	409	1911	4137	7	-42	0.37	-1.01
P	910422	NORM	477	1588	3627	-323	-510	-16.90	-12.33
Q	910507	NORM	492	1622	3585	34	-42	2.14	-1.16
R	910521	D	506	1774	4080	152	495	9.37	13.81
S	910604	15000 CFS	520	1805	4138	31	58	1.75	1.42
T	910701	NORM	547	1842	4504	37	366	2.05	8.84
U	910716	G	562	1987	5077	145	573	7.87	12.72
V	910729	F	575	1334	2772	-653	-2305	-32.86	-45.40
Y	921102	INT	1037	1693	3625	359	853	26.91	30.77
Z	930414	INT	1200	1520	3781	-173	156	-10.22	4.30
B31	931025	INT	1394	1398	2802	-122	-979	-8.03	-25.89
C31	940423	INT	1575	1514	2814	116	12	8.30	0.43
D31	941204	INT	1794	1395	2783	-119	-31	-7.86	-1.10
E31	950509	INT	1955	1727	3522	332	739	23.80	26.55



MILE: 220 KILOMETER: 353.8

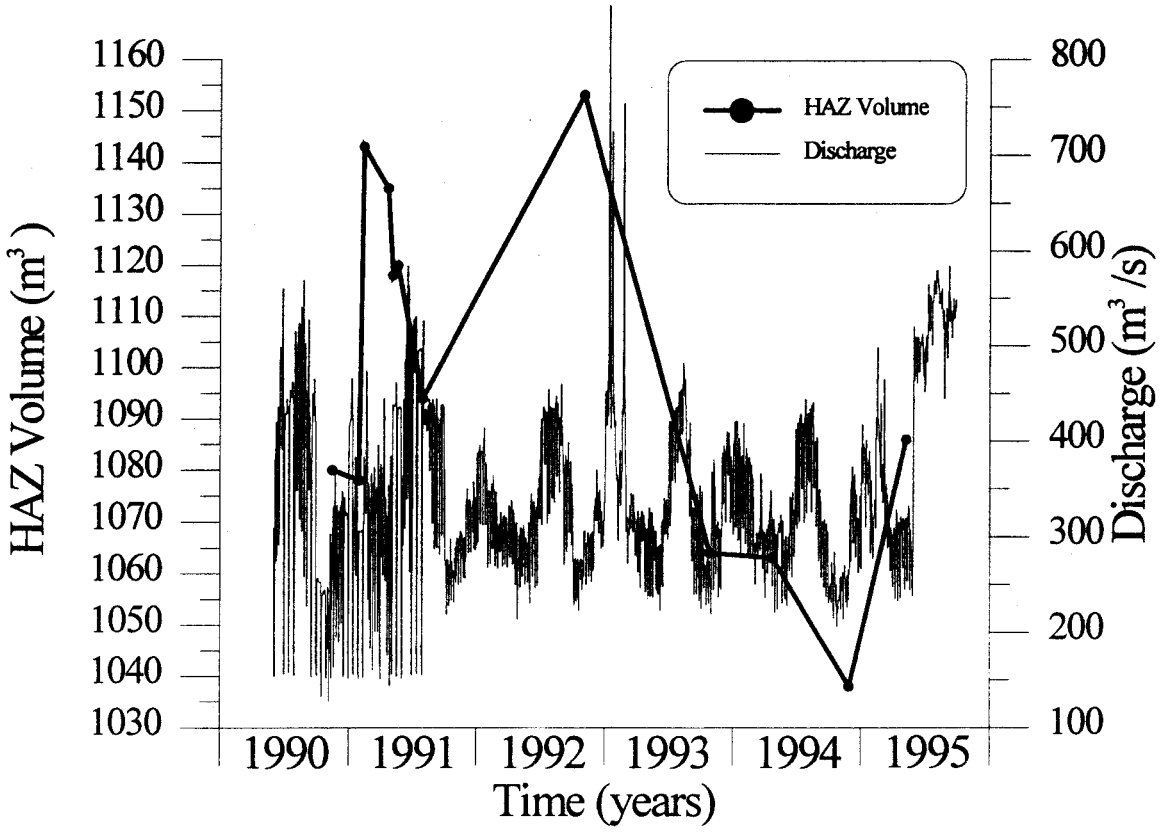
BEACH #: 32 DEPOSIT TYPE: SEPARATION/UPPER POOL

RUN ID	SURVEY DATE	FLOW EVALUAT	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C	900718	G	199	726	1080				
D		F							
E		NORM							
F	900918	NORM	261	696	1078	-30	-2	-4.13	-0.19
G	901003	E	276	715	1143	19	65	2.73	6.03
H	901017	A	290	711	1135	-4	-8	-0.56	-0.70
I	901031	8000 CFS	304	726	1118	15	-17	2.11	-1.50
J	901114	NORM	318	715	1120	-11	2	-1.52	0.18
K	901219	NORM	353	741	1094	26	-26	3.64	-2.32
L	910102	11000 CFS	367	776	1153	35	59	4.72	5.39
M	910115	C	380	721	1064	-55	-89	-7.09	-7.72
N	910129	NORM	394	737	1063	16	-1	2.22	-0.09
O	910212	B	408	749	1038	12	-25	1.63	-2.35
P	910423	NORM	478	732	1086	-17	48	-2.27	4.62
Q	910507	NORM	492	666	913	-66	-173	-9.02	-15.93
R	910521	D	506	714	1036	48	123	7.21	13.47
S	910604	15000 CFS	520	735	1053	21	17	2.94	1.64
T	910702	NORM	548	721	1153	-14	100	-1.90	9.50
U	910716	G	562	706	1137	-15	-16	-2.08	-1.39
V	910730	F	576	718	1190	12	53	1.70	4.45
X	911109	INT	678	719	1069	1	-121	0.14	-11.32
Y	921102	INT	1037	719	1035	0	-34	0.00	-3.29
Z	930414	INT	1200	742	1266	23	231	3.20	18.25
B32	931025	INT	1394	665	953	-77	-313	-10.38	-32.84
C32	940424	INT	1575	712	1032	47	79	7.07	7.66
D32	941204	INT	1794	666	955	-46	-77	-6.46	-8.06
E32	950510	INT	1956	756	1044	90	89	13.51	8.52



MILE: 225 KILOMETER: 360
BEACH #: 33 DEPOSIT TYPE: REATACHMENT

RUN ID	SURVEY DATE	FLOW EVALUATE	JULIAN DAYS	HAZ AREA	HAZ VOLUME	% VOL. AREA CH.	ABS. VOL CH.	% AREA CH.	% VOL CH.
A		NORM							
B		NORM							
C		G							
D		F							
E		NORM							
F		NORM							
G		E							
H		A							
I		8000 CFS							
J	901114	NORM	318	2802	4465				
K		NORM							
L		11000 CFS							
M		C							
N	910129	NORM	394	3132	4824				
O	910212	B	408	3183	4830				
P	910423	NORM	478	3240	5122				
Q	910507	NORM	492	2899	4623				
R	910521	D	506	2972	4997				
S		15000 CFS							
T		NORM							
U		G							
V	910729	F	576	2822	4695				
Y	921028	INT	1037	3286	5440	464	745	16.44	15.87
B33	931019	INT	1395	1860	3975	-1426	-1465	-43.40	-26.93
C33	940418	INT	1575	2646	4588	786	613	42.26	15.42
D33	941204	INT	1794	2713	4426	67	-162	2.53	-3.53
E33	950510	INT	1956	3657	5506	944	1080	34.80	24.40



Final Management Report:

Cooperative Agreement # CA8000-8-0002

Summary Of Expenses

	Budget	Encumbered	Expended	Unobligated
Salary	$49,951.00	$0.00	$51,562.15	<$1,611.15>
ERE	$10,878.00	$0.00	$8,958.50	$1,919.50
Operations	$5,350.00	$0.00	$6,941.28	<$1,591.28>
Travel	$1,700	$0.00	$1,656.98	$43.02
Capital	$4,000	$0.00	$0.00	$4,000
Indirect Costs	$14,375.00	$639.86	$13,735.14	$0.00
Totals	$86,254.00	$639.86	$82,854.05	$2,760.09

FISCAL YEAR= MY FUND= 35V4 AREA= GLG ORGANIZATION= 35V4
FUNCTION= 2567 ORG NAME: INTERIM FLOW SAND BAR STABILIT

TOTALS: 86,254.00 -21.03 83,096.37 3,178.66

	OBJECT	CURRENT BUDGET AMOUNT	ENCUMBERED AMOUNT	EXPENDED AMOUNT	UNOBLIGATED AMOUNT
01-	7110	49,951.00	0.00	0.00	49,951.00
02-	7111	0.00	0.00	39,180.04	-39,180.04
03-	7112	0.00	0.00	3,449.71	-3,449.71
04-	7113	0.00	0.00	0.00	0.00
05-	7114	0.00	0.00	3,700.00	-3,700.00
06-	7116	0.00	0.00	0.00	0.00
07-	7120	0.00	0.00	0.00	0.00

FUNCTION: ** EXPENSE BUDGET INQ ** 02/02/96 ADM22P4 0 EXPC

FISCAL YEAR= MY FUND= 35V4 AREA= GLG ORGANIZATION= 35V4
FUNCTION= 2567 ORG NAME: INTERIM FLOW SAND BAR STABILIT

TOTALS: 86,254.00 -21.03 83,096.37 3,178.66

	OBJECT	CURRENT BUDGET AMOUNT	ENCUMBERED AMOUNT	EXPENDED AMOUNT	UNOBLIGATED AMOUNT
01-	7121	0.00	0.00	0.00	0.00
02-	7122	0.00	0.00	0.00	0.00
03-	7124	0.00	0.00	4,839.10	-4,839.10
04-	7125	0.00	0.00	0.00	0.00
05-	7126	0.00	0.00	0.00	0.00
06-	7127	0.00	0.00	0.00	0.00
07-	7128	0.00	0.00	393.30	-393.30

FUNCTION: ** EXPENSE BUDGET INQ ** 02/02/96 ADM22P4 0 EXPC

FISCAL YEAR= MY FUND= 35V4 AREA= GLG ORGANIZATION= 35V4
FUNCTION= 2567 ORG NAME: INTERIM FLOW SAND BAR STABILIT

TOTALS: 86,254.00 -21.03 83,096.37 3,178.66

	OBJECT	CURRENT BUDGET AMOUNT	ENCUMBERED AMOUNT	EXPENDED AMOUNT	UNOBLIGATED AMOUNT
01-	7130	0.00	0.00	0.00	0.00
02-	7131	0.00	0.00	0.00	0.00
03-	7132	0.00	0.00	0.00	0.00
04-	7133	0.00	0.00	0.00	0.00
05-	7139	0.00	0.00	0.00	0.00
06-	7140	0.00	0.00	0.00	0.00
07-	7156	0.00	0.00	2,793.78	-2,793.78

FUNCTION: ** EXPENSE BUDGET INQ ** 02/02/96 ADM22P4 0 EXPC

FISCAL YEAR= MY FUND= 35V4 AREA= GLG ORGANIZATION= 35V4
FUNCTION= 2567 ORG NAME: INTERIM FLOW SAND BAR STABILIT

TOTALS: 86,254.00 -21.03 83,096.37 3,178.66

	OBJECT	CURRENT BUDGET AMOUNT	ENCUMBERED AMOUNT	EXPENDED AMOUNT	UNOBLIGATED AMOUNT
01-	7200	10,878.00	0.00	0.00	10,878.00
02-	7210	0.00	0.00	3,868.66	-3,868.66
03-	7220	0.00	0.00	1,483.44	-1,483.44
04-	7221	0.00	0.00	0.00	0.00
05-	7222	0.00	0.00	0.00	0.00
06-	7223	0.00	0.00	0.00	0.00
07-	7230	0.00	0.00	328.27	-328.27

FISCAL YEAR= MY FUND= 35V4 AREA= GLG ORGANIZATION= 35V4
FUNCTION= 2567 ORG NAME: INTERIM FLOW SAND BAR STABILIT

TOTALS: 86,254.00 -21.03 83,096.37 3,178.66

	OBJECT	CURRENT BUDGET AMOUNT	ENCUMBERED AMOUNT	EXPENDED AMOUNT	UNOBLIGATED AMOUNT
01-	7240	0.00	0.00	0.00	0.00
02-	7241	0.00	0.00	0.00	0.00
03-	7242	0.00	0.00	222.15	-222.15
04-	7243	0.00	0.00	12.69	-12.69
05-	7244	0.00	0.00	114.66	-114.66
06-	7280	0.00	0.00	240.00	-240.00
07-	7290	0.00	0.00	0.00	0.00

FUNCTION: ** EXPENSE BUDGET INQ ** 02/02/96 ADM22P4 0 EXPC

FISCAL YEAR= MY FUND= 35V4 AREA= GLG ORGANIZATION= 35V4
FUNCTION= 2567 ORG NAME: INTERIM FLOW SAND BAR STABILIT

		CURRENT BUDGET AMOUNT	ENCUMBERED AMOUNT	EXPENDED AMOUNT	UNOBLIGATED AMOUNT
TOTALS:		86,254.00	-21.03	83,096.37	3,178.66
01-	7300	2,000.00	0.00	0.00	2,000.00
02-	7310	0.00	0.00	55.30	-55.30
03-	7320	250.00	0.00	1,459.13	-1,209.13
04-	7322	0.00	0.00	1,214.79	-1,214.79
05-	7324	0.00	0.00	0.00	0.00
06-	7330	0.00	0.00	370.00	-370.00
07-	7331	0.00	0.00	0.00	0.00

FISCAL YEAR= MY FUND= 35V4 AREA= GLG ORGANIZATION= 35V4
FUNCTION= 2567 ORG NAME: INTERIM FLOW SAND BAR STABILIT

TOTALS:		86,254.00	-21.03	83,096.37	3,178.66

	OBJECT	CURRENT BUDGET AMOUNT	ENCUMBERED AMOUNT	EXPENDED AMOUNT	UNOBLIGATED AMOUNT
01-	7340	0.00	0.00	2.21	-2.21
02-	7350	0.00	0.00	73.06	-73.06
03-	7351	0.00	0.00	444.24	-444.24
04-	7355	0.00	0.00	30.40	-30.40
05-	7360	3,100.00	0.00	2,566.80	533.20
06-	7390	0.00	0.00	225.10	-225.10
07-	7394	0.00	0.00	0.00	0.00

FUNCTION: ** EXPENSE BUDGET INQ ** 02/02/96 ADM22P4 0 EXPC

FISCAL YEAR= MY FUND= 35V4 AREA= GLG ORGANIZATION= 35V4
FUNCTION= 2567 ORG NAME: INTERIM FLOW SAND BAR STABILIT

TOTALS:	86,254.00	-21.03	83,096.37	3,178.66

	OBJECT	CURRENT BUDGET AMOUNT	ENCUMBERED AMOUNT	EXPENDED AMOUNT	UNOBLIGATED AMOUNT
01-	7396	0.00	0.00	469.00	-469.00
02-	7420	0.00	0.00	36.67	-36.67
03-	7540	0.00	0.00	0.00	0.00
04-	7610	1,000.00	0.00	361.18	638.82
05-	7620	700.00	0.00	1,295.80	-595.80
06-	7830	4,000.00	0.00	0.00	4,000.00
07-	7910	0.00	0.00	0.00	0.00

FUNCTION: ** EXPENSE BUDGET INQ ** 02/02/96 ADM22P4 0 EXPC

FISCAL YEAR= MY FUND= 35V4 AREA= GLG ORGANIZATION= 35V4
FUNCTION= 2567 ORG NAME: INTERIM FLOW SAND BAR STABILIT

TOTALS: 86,254.00 -21.03 83,096.37 3,178.66

	OBJECT	CURRENT BUDGET AMOUNT	ENCUMBERED AMOUNT	EXPENDED AMOUNT	UNOBLIGATED AMOUNT
01-	7999	14,375.00	-21.03	13,866.89	529.14
02-					
03-					
04-					
05-					
06-					
07-					

02-*L008 END OF PARENT/SCAN