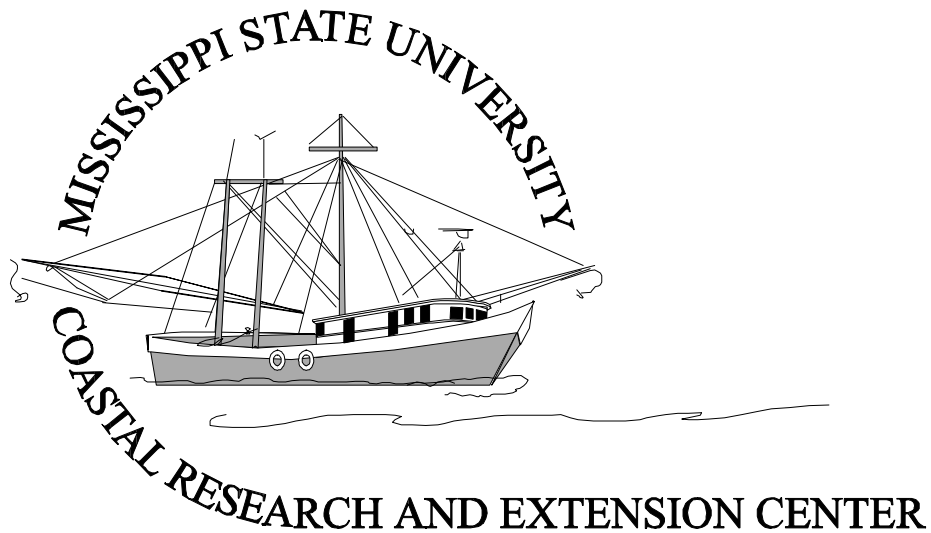


# Assessment of Iberville Drive Boat Launch Facility



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February 1999**

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## **Background and Project Description**

The economic boom currently being experienced in coastal Mississippi has increased the usage and placed unprecedented demands on existing public, beach access facilities especially along the front beach in Harrison County. Population growth and increased visitation rates from outside the coastal area have caused existing access facilities to be overtaxed and currently insufficient to meet this demand. In one instance, surrounding development caused a traditionally much used public boat ramp to be virtually inaccessible (Oak Street). The Kuhn Street boat ramp has very limited parking and problematic access to/from busy Highway 90. The only other boat launch facility with close access to the Mississippi Sound and barrier islands is located in the Biloxi Small Craft Harbor. This facility does have adequate parking, clear highway access, and is within an enclosed basin with close access to the west Biloxi channel. The Biloxi Harbor facility is currently the favored location for recreational boaters but cannot meet the demand, particularly on weekends and holiday periods. The three existing sites do have favorable aspects: 1) they are located within an enclosed basin and/or are sheltered by Deer Island and 2) they are located within close proximity to an existing navigational channel (the West Biloxi Channel). There are no other launching facilities along the front beach in Biloxi.

Other launching facilities within Harrison County are located at the Gulfport, Long Beach and Pass Christian small craft harbors. The limited number of boat launch facilities along front beach in Biloxi restricts the ability of small boat owners to access many fishing and recreational locations within the Sound. In an effort to reconcile this problem, a public boat launch facility has been proposed for construction on the front beach at Iberville Drive in middle Biloxi. The proposed facility consists of a recreational boat launch ramp capable of launching/retrieving four boats at a time; a dredged, 40-foot wide, 1,545-foot long approach channel; 1,545 linear feet of concrete rubble jetty; car and trailer parking and access road development.

The Mississippi State University/Coastal Research and Extension Center (CREC) was asked to provide guidance related to a potential new public boat launch development site at Iberville Drive. Site specific plans for the Iberville Drive facility were not available. Consequently, some of the comments in this analysis are based on an earlier proposed plan for a facility which was to be placed at the foot of McDonnell Avenue.

## **Description of Study Area**

The 26-mile, front beach along Harrison County is an artificial beach. It was originally constructed in 1951-1952 to provide protection and anchorage for the existing seawall. Sand used to create the beach was dredged from plentiful deposits located immediately offshore from the seawall. Constant erosion and the devastating effects of hurricanes required the beaches to be renourished in 1972-1973 and again in 1987-1988.

The proposed project area is located on the artificial beach at Iberville Drive. The width of the beach at this location is approximately 240 feet. The beach sands are routinely groomed and graded resulting in a flat, straight and featureless morphology. The nearshore slope is very gentle, probably less than a three foot vertical drop over a horizontal distance of 1,300 feet. The length of the beach is interrupted with a series of shore-perpendicular storm drains that extend approximately 360 feet from Highway 90 into the Sound. These storm drains act as groins trapping sands from westward littoral drift resulting in a scallop-shaped shoreline. There is an existing, small parking bay between Highway 90 and the beach. To the west of the project site are commercial developments extending approximately 1.4 miles to the Broadwater Resort/President Casino complex. A continuous strand of sand beach approximately 195 feet wide exists on the south side of the commercial developments. To the east of the proposed project area is sand beach for approximately 2.4 miles to the I-110 interchange.

## **Physical Characteristics**

### **Wind and Waves**

The annual dominant wind direction is from the easterly directions while winds from the north and south are frequent. In the spring, prevailing winds are southeast having a strong eastern component. The summer months show equal frequencies of east, southeast and southerly wind directions. The dominant spring and summer wind patterns result from the expansion of the Bermuda High causing prevalent southeast and easterly winds. The passage of continental cold fronts in the fall and winter follows the decline of the Bermuda High. At this time, the predominant winds come from the northern quadrants. East and northeast winds prevail in the fall while in the winter months winds from the north, northeast, east and southeast occur equally. The annual resultant wind direction is from the east. In both the fall and winter seasons the resultant wind direction is east-northeasterly while in the spring, east-southeasterly winds result and in the summer, southeast.

There are no known, comprehensive wave studies or wave data bases available for the project area. Because the barrier islands provide protection to the mainland from storm generated waves in the Gulf of Mexico, wave height and direction along the front beach of Harrison County result from the prevailing wind direction and intensity. Limited fetch across the Mississippi Sound and the overall shallow water depths limit wave height. Waves breaking on the beach are commonly less than one foot, although, higher wave heights can occur. Waves can physically approach the front beach from the eastern, southern and western directions, however, the predominant wave approach is from the east and southeast. Waves approaching the beach from these directions set up westward flowing currents and result in westward drift of sediments. In addition to these macro climatic conditions, the sand beach/shore interface creates a diurnal land and sea breeze phenomenon. Differences in land and water temperatures create a landward breeze during daytime hours and a seaward flow during nighttime hours. This effect is most prevalent during the summer months corresponding with the peak of boating season.

## **Tides**

Tides in the proposed project area are microtidal i.e., the tidal range is less than 6 ft. (2 m). However, both astronomical and meteorological tides influence the area. Astronomical tides are diurnal, i.e. usually one high and one low water per day with an average tidal range of approximately 2 ft. (0.6 m). Tidal range fluctuates seasonally with a minimal range of 0 to 1.5 ft (0.5 m) during the winter months and a maximum range of 2 to 3 ft (0.6 to 0.9 m) during the summer months. Because of the minimal tide range of the area, meteorological conditions often exert a strong influence on local tide elevations. Strong southerly winds push water into the area exaggerating and often maintaining high water conditions. Strong northerly winds push water out of the area exaggerating and maintaining low water conditions often resulting in the exposure of large sandy shoal areas in the nearshore.

## **Sediments**

Sediment on the front beach was dredged from offshore borrow pits and deposited as part of an effort to protect the seawall and Highway 90. The sediment consists mostly of quartz sand and silt with little organic matter. To help determine if the sediments proposed to be dredged for construction of the boat launch facility can be used as renourishment sands on the downdrift beaches, eleven grab samples of sediment were collected along a transect at the project site. The transect trended perpendicular to shore, starting on the beach and continuing into the nearshore for 1,300 feet. Samples were taken every 200 feet or closer if deemed necessary. Standard sieve analysis was completed by Micro Methods, Inc. using one-phi mesh diameter intervals.

## **Grain Size Analysis**

Graphs of the grain size analysis for each sample are shown in Figure 1. There is little variation in the size distribution of sediments collected from within the nearshore (samples 1300, 1100, 900, 700, 600, 500, 300 and 100 feet). In these samples, the modal grain size (the most frequently occurring grain diameter) is 2.75 phi (0.15 mm). This grain size comprises over 60 percent of each sample. Grain sizes of 1.75 phi (0.3 mm) and 3.75 phi (0.08 mm) comprise between 10 and 30 percent and 5 and 9 percent respectively. Each of the other grain sizes comprises less than 3 percent of the sample. Based on these data, these sediments are classified as fine and medium sands.

The distribution of grain sizes in the swash line (foreshore) and two beach (berm) samples differ slightly from the samples collected in the nearshore. There are two modal grain sizes in the swash line sample, 0.75 and 1.75 phi (0.6 and 0.3 mm) with smaller percentages measured for the other grain sizes. This sediment is described more as medium and coarse sand. This is not surprising because higher energy levels exist in the foreshore and result in more efficient winnowing of fines from the sediment leaving the coarser sediment behind. The two beach samples differ slightly from each other. Beach #1 has a modal grain size of 1.75 phi (0.3 mm) with grain sizes on either side of the mode in excess of 10 percent. Beach #2 has two modal grain sizes 1.75 and 2.75 phi

(0.3 and 0.15 mm) comprising over 85 percent of the sample. Sample beach #1 would tend to be classified more as medium sand while sample Beach #2 fine/medium sand.

In general, the grain size distribution of the sediments collected along the transect are similar. As expected, the sediments in the nearshore are slightly finer than those on the beach. The fines of the beach sediment are winnowed out by wave action and transported aerially by winds leaving higher percentages of coarser sediment.

While this cursory analysis tends to support the potential use of sediments dredged from the proposed access channel as renourishment sands for the beach, these data are for surface samples only. Vertical cores within the proposed project area were not collected and analyzed for this report. Core sample taken by the Mississippi Department of Geology and Gulf Coast Research Laboratory in the Belle Fontaine area suggest that medium to fine sands might be found at sufficient depths to allow use of the dredged sediments for beach renourishment. It is important to understand how the sediment characteristics might change with depth.

### **Sediment Transport**

In general, there are three forces that affect the transport of sediment on beaches: waves, wind and currents. The dominant forces along the Harrison County beaches include waves and winds. While nearshore currents also contribute to sand transport within the beach system, currents are minimal within the project area.

Because the dominant wave direction is from the southeast (resulting from the prevailing winds) littoral drift processes cause alongshore sediment transport to be toward the west along the front beaches. Westward moving sediment is trapped on the east side of shore perpendicular structures e.g. harbor extensions and storm drain outfalls. Consequently, sediment accretes on the east side of structures, can no longer move toward the west and is, therefore, no longer available to replenish beaches on the downdrift side of structures. This results in erosion on the downdrift beaches of shore perpendicular structures.

Wind also results in loss of sediment from the beach system. Winds carry sediment from the beaches where they become trapped by the stepped seawall. As the steps of the seawall become progressively filled, the seawall resembles more of a ramp which then facilitates the movement of sediment off the beach. The wind blown sediment accumulates on the parking bays, medians and roadway of Highway 90. This can represent a substantial amount of sediment lost from the system if during highway sediment removal work, the sediment is not returned to the beach.

### **Sediment Budget**

Sediment losses from the Harrison County beaches result from longshore, offshore and airborne processes. The following estimates are from information obtained from the Harrison County Sand Beach Master Plan.

Offshore Sediment Transport. The majority of offshore sediment transport occurs during high energy events where wave energy tends to remove sediments from the berm and deposit them onto offshore bars or beyond. Offshore sediment transport resulting from this type of wave action is the most difficult to quantify. It is estimated that annual offshore losses resulting from this type of transport amount to less than 0.25 cubic yards per front foot of beach or approximately 27,000 cubic yards per year.

Airborne Sediment Transport. Airborne sediment transport results when winds are strong enough to carry sediment across the beach and ultimately over the seawall and out of the system. It is estimated that sediment losses resulting from this type of transport are on the order of 0.50 cubic yards per front foot of beach per year. This type of sediment transport is considered a loss to the system because sand removed from the parking bays and roadway is trucked to upland disposal sites and not returned to the beach. It is estimated that the airborne component of sediment transport is responsible for approximately one-half of the total sediment loss from the beach system.

Longshore Sediment Transport. Longshore sediment transport within the proposed project area is from east to west. Sediment transport rates are dependent on wave height and wave approach angle. It has been shown that for an uninterrupted beach, (i.e. a beach with no perturbations such as storm drains or harbor extensions), with waves approaching at a 15 degree angle, the sediment transport rate increases rapidly with breaking wave height. Table 1 shows this relationship. Estimates of the effective wave height is on the order of one-half to one foot and therefore, the net annual longshore sediment transport without the effects of shore perpendicular structures would range between 38,000 and 216,000 cubic yards. However, the existence of shore perpendicular structures greatly reduces these estimates. With the existence of perpendicular interruptions along the Harrison County beaches, it is estimated that annual losses due to longshore sediment transport, primarily around the groin at Henderson Point, amount to approximately 20,000 cubic yards. The effects of this type of sediment transport near the proposed project site can be seen at each storm drain. Sediment is accumulating on the eastern side of the drains and erosion is occurring on the western (downdrift) side resulting in the scalloped shape of the shoreline.

Table 1. Computations of Net Annual Longshore Sediment Transport, Q. Computations are based on  $Q = K H^{5/2} \sin 2\alpha$  and a wave angle of 15 degrees where K is a constant, H = breaking wave height and  $\alpha$  = angle of breaking wave (from Harrison County Sand Beach Master Plan 1986)

Wave Height H (ft)	Annual Rate of Net Longshore Sediment Transport, Q, (yd <sup>3</sup> /yr)
0.5	38,000
1.0	216,000
1.5	596,000

## **Site Development Considerations**

### **Dredging/Maintenance Dredging**

Based on the plans provided for the McDonnell Avenue site, approximately 11,500 cubic yards of material will have to be dredged to develop a launch basin and access channel. Surface sediment samples obtained by CREC and analyzed by Micro Methods, Inc. show the predominance of fine to medium sands which are subject to littoral transport. Core samples should be obtained in order to determine if the dredged material at the designed depth (5' minimum) is suitable for deposition on the existing sand beach at the site. This could have a dramatic effect on dredging costs which might range from \$5 to \$15 per cubic yard. Consideration should also be given to timing the development to coincide with sand beach replenishment operations. The plans also show a 1,545 foot long jetty to be placed parallel with the channel on the east side. This will reduce the frequency of required maintenance dredging. A similar channel constructed perpendicular to the shoreline at the Broadwater Marina requires maintenance dredging every three years at an average cost of \$100,000. During this time, the channel fills in reducing the desired maintenance depth by about four feet. However, it should be noted that the Broadwater channel is not protected by a jetty.

### **Jetties and Breakwaters**

As noted above, the plans call for a jetty to protect the channel from the predominant direction of littoral sediment drift. However, other breakwaters will likely be required to reduce sedimentation from other directions and more importantly, protect boats from waves and wakes while they are being launched and retrieved. Existing launch sites along the entire front beach from Biloxi Bay to Bay St. Louis protect boats by being located within harbor basins or taking advantage of existing shelter (e.g. Deer Island). This aspect of development is critical to the use of any unprotected area of the front beach shoreline. The wave energy in these areas, particularly during the times of strong afternoon sea breezes, is strong enough to make launching and retrieving boats problematic at best and could cause boat, trailer and vehicle damage at worst. The site as now configured is susceptible to southerly and westerly winds. Developers should plan on approximately 1,500 additional feet of breakwater at this site configured in a fashion to protect the site from wave energy while maintaining water exchange through the artificial basin. U. S. Coast Guard regulations stipulate that these structures will have to be marked with daytime/nighttime navigational aids.

### **Sand Bypass**

As noted earlier, the predominant direction of littoral sediment transport is from east to west along the front beach. As a result, any solid object built out into the water perpendicular to the beach will trap sediments on the east side and simultaneously cause erosion on the west or down-current side. This phenomenon is easily seen by examining storm drains on the east and west sides of harbor seawalls along the beachfront. Over time, this process can become severe enough to

require sand bypass operations to protect the beach and businesses on the down-current side of the structure. Sand bypass is usually accomplished by means of hydraulic dredging. Therefore, site considerations must take into account what is located immediately adjacent to the proposed development. In this case, there is substantial commercial development along the beachfront to the west in the area of potential erosion and undeveloped beach to the east in the area of accumulation.

### **Vehicle Access and Parking**

Ease of vehicle access and on-site parking for vehicles and vehicles with trailers are critical components of boat launch facility development. Indeed, lack of these components is what creates underutilization at the otherwise suitable sites at Oak Street and Kuhn Street. A site-specific plan for the Iberville Drive site was not available, so facilities based on the McDonnel Avenue plan are addressed on the assumption that the Iberville Drive site will require the same amount and location of shoreside development associated with the boat ramp.

The McDonnel plan specifies 42 parking spaces for vehicles with trailers and an additional 15 spaces for vehicles without trailers. Access to and from the site off of Highway 90 is provided by turning lanes and a southward extension of both Veterans Blvd. and McDonnel Avenue in a modified loop pattern. Vehicles entering or leaving the site have the option of using the existing traffic light at the Highway 90 intersection with Veterans Blvd. Due to the amount of traffic on Highway 90 and the inherent difficulties of driving a vehicle/trailer combination, this signal is essential for vehicles desiring to leave the facility towards the north and west and enter from the east or north.

In transferring this design to the Iberville Drive site, the most obvious need is to install a traffic light at the intersection of the access road(s) and Highway 90. There would also need to be some modification of the roadway to provide for turning lanes depending on where the access road(s) is located. There appears to be sufficient room at the site to locate the proposed parking facilities.

### **Water Quality**

There is a potential for nonpoint source pollution to the waters at the site caused by vehicle crankcase drippings and bilge water discharge from boats. Adverse water quality impacts of this nature can be minimized by using permeable or semi-permeable material in parking areas and configuring jetties and breakwaters in a manner that facilitates water exchange through the basin. The closest oyster reef to the site is White House Reef which is located far enough away not to be impacted by boating activities but may be of some concern during dredging operations during the development phase of the facility.

## **User Conflicts**

The proposed Iberville Drive site is currently served by a parking bay designed to facilitate access to the public beach for swimming, fishing, floundering, picnics and other forms of beach-related activity. The public beach users will be displaced by the transformation of this area into a boating access facility. However, there are more alternative beach sites than launch ramps available. The businesses and residences located on the north side of Highway 90 will experience impacts related to increased traffic congestion and alterations of the viewshed currently provided by the undeveloped beachfront at this location. The littoral rights of these property owners also may have to be considered depending on the specific location of the facility. Positive benefits will accrue to fishermen because the rock jetty and breakwaters will serve as an artificial reef which attracts and holds marine life. It may be possible to incorporate a mechanism for accommodating shore-based fishermen into the design of the facility.

## **Cost Considerations**

Any boating access facility located along the unprotected front beach away from existing navigational channels is inherently going to be expensive due mainly to increased dredging and jetty/breakwater construction requirements. The largest expense is jetty and breakwater construction. For example, the current cost of a concrete rubble or rock jetty built by a commercial marine contractor ranges from \$500 to \$1,000 per linear foot (\$100 per ton of material). Because this site will have to be developed to withstand high energy storm events, the cost will most likely tend toward the higher end of this range. At a cost of \$800 per linear foot and the suggested requirement for 3,000 linear feet of jetties and breakwaters, this element of site development alone will cost \$2.4 million. Dredging will add approximately \$115,000 to the project costs. Other major costs will be parking lot and ramp construction and highway access modifications to provide turning lanes, access road(s) and a traffic light. These latter costs are particularly applicable to the Iberville Drive site and could be ameliorated by considering alternate locations near or at major north/south corridors with existing traffic controls.

**Figure 1. Grain Size Analysis - Iberville Beach**

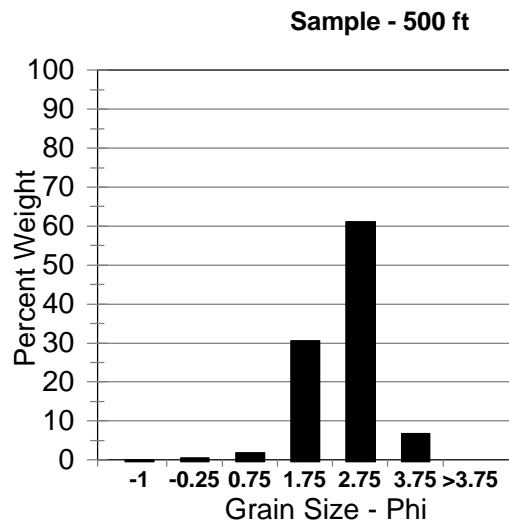
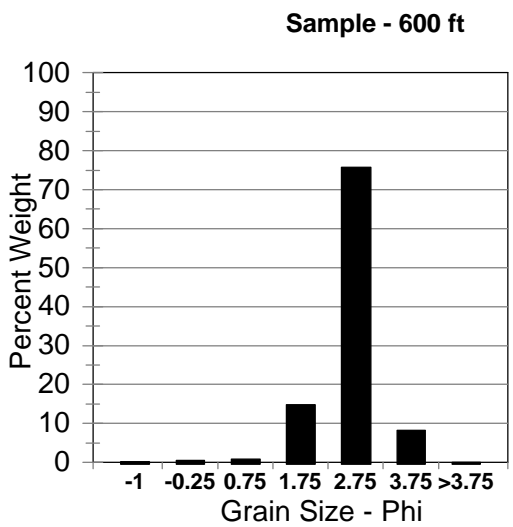
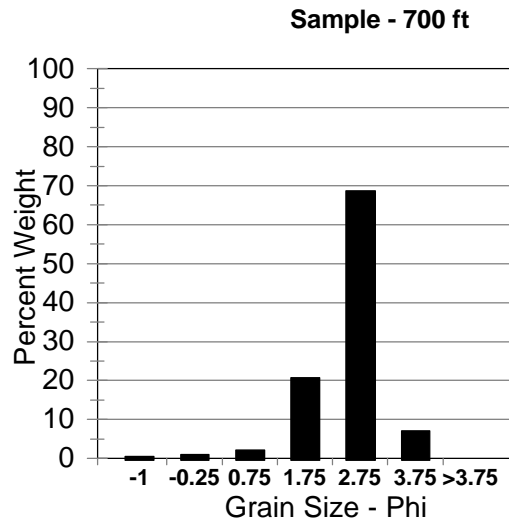
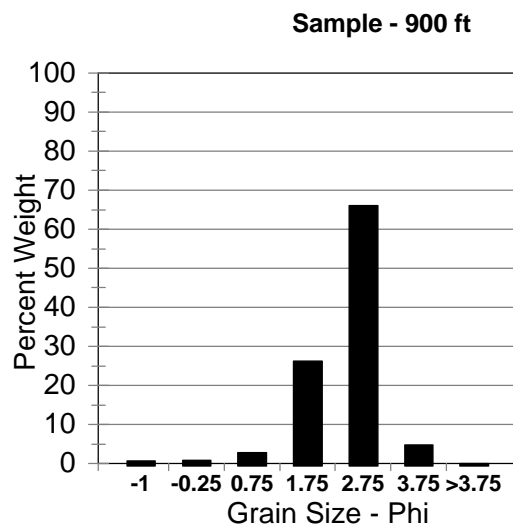
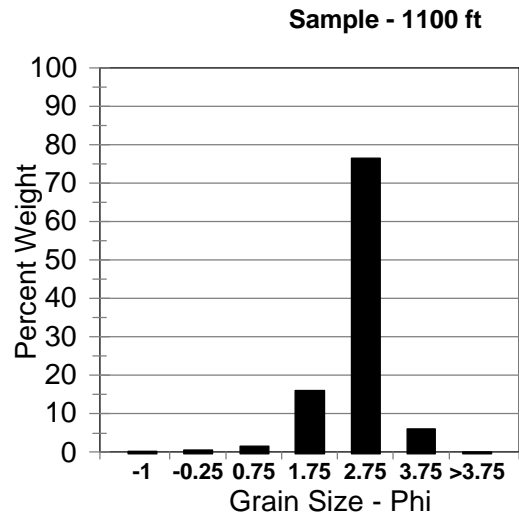
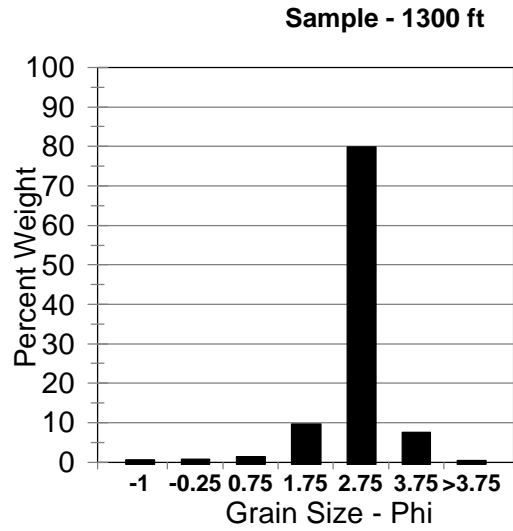
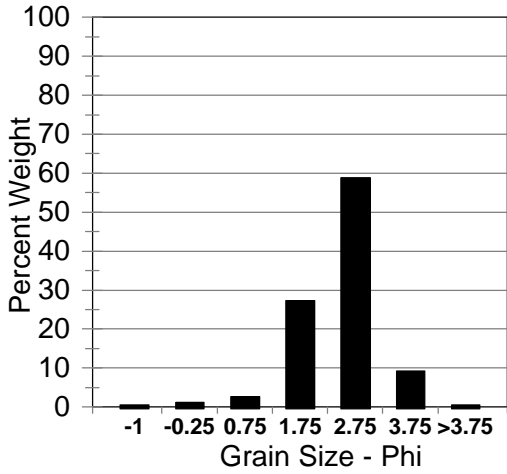
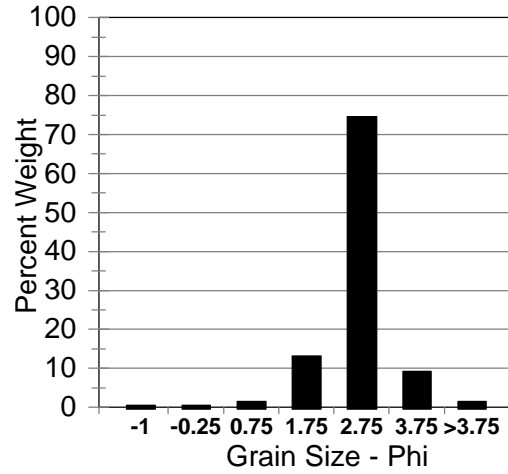


Figure 1. Cont.

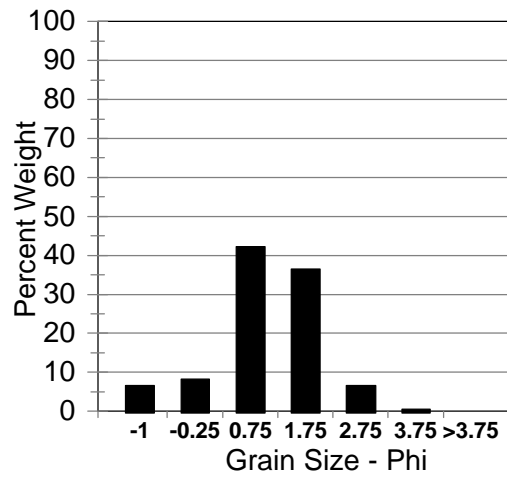
Sample - 300 ft



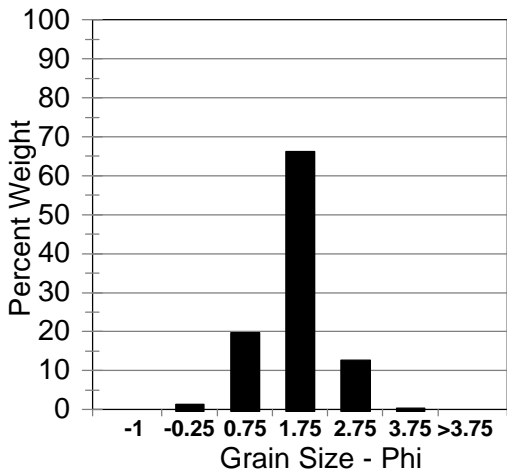
Sample - 100 ft



Sample - Swash Line



Sample - Beach #1



Sample - Beach #2

