ENVIRONMENTAL STUDIES OF THE SHELL DREDGING PROGRAM

Following is a summary of environmental information related to shell dredging based on surveys conducted by DNR. Reports that contain the detailed environmental information were previously filed with the permitting agencies in 2005. This summary was provided during permit review at that time. It is provided now due to the re-submitted application for shell dredging at Man-O-War Shoal. This summary only serves as a compilation of certain information, not the entire source – for details, please consult Attachment #1 submitted with the application.

Water Quality Issues

Turbidity

Turbidity is increased by shell dredging, which creates a silt plume. The plume was monitored in 1998, 1999 and 2000 by MGS (Areas D and F near Pooles Island) and was determined to be variable in size and shape depending on the tidal conditions. The majority of the sediment rapidly settled in the first 400 m to 500 m from the dredge. Ambient water quality conditions were restored between 2,500 m to 4,500 m from the dredge. The plume was accentuated by strong ebb and flood tides associated with the lunar cycle. The MGS studies were reviewed by MDE-TARSA (Technical and Regulatory Services Administration). The Water Quality Certification for the permit was not revoked or modified.

Impacts on summer flounder and bluefish (the two species of concern in the upper Bay under Essential Fish Habitat (EFH) criteria) are expected to be minimal to none. Shell dredging occurs on the northern edge of their range. Since both species prefer more saline water and spawn offshore, they are unlikely to be in the area during dredging. These fish are highly mobile and can swim to undisturbed water which is nearby. Also, the dredging areas are near the turbidity maximum zone of the Bay so any fish in this area could encounter high natural turbidities (10-30mg/l based on the MGS study in 1998). Any fish, such as white perch or sturgeon, would also be able to swim from the plume if it were an issue to them. Note that fish surveys by DNR in 1986 and 1987 showed no negative impact on fish due to the plume and in fact more fish were at times found in the plume.

Dissolved Oxygen

Dissolved oxygen has been mentioned as an issue numerous times in the past. The deep cuts made by shell dredging have been hypothesized to create pockets of low DO in the cuts in the summer when temperatures are highest and the water column is potentially stratified.

Three days of data from DNR's 1987 fish trawl study showed no clear pattern when dredged areas were compared to undredged areas. See the data table below. Dredged areas at times had higher DO compared to undredged areas. Low DO occurred over the entire range of areas: in and out of the plume, in a dredged area and out of a dredged area, in deep water and in shallow water. Low DO could not be specifically linked to cuts as a causative agent. However, the data set was small so firm conclusions were tentative. Therefore more studies were conducted in 1999.

Bottom DO in Shell Dredging Areas, 1987
Surface DO's were 6.6 to 10.5 ppm

	Bottom DO (@ 15' to 25' in Cuts)		
Area	7/20	7/22	7/23
Non-Dredged (no cuts)	3.3	2.0	2.6
Moderately Dredged	7.0	5.9	4.0
Heavily Dredged	8.7	1.7	1.8
In Plume	-	2.1	1.2
Out of Plume	-	-	.6

Data was collected in the summer of 1999 to evaluate impacts of deep cuts on DO. The study looked at cuts that ranged from 9' to 36' in depth, within dredging areas A, D and F in the Upper Bay (see Map on the last page). The sites were monitored from June through September when it was assumed the water column would be stratified due to temperature and DO problems would be the worst.

In fact, there was no clear temperature stratification or patterns of low DO in dredged areas compared to undredged areas, regardless of cut depth. More specifically, there was no statistical correlation between DO and depth within the study areas. Occasional low DO levels were observed but were short lived, ephemeral phenomena due to tidal exchange. MDE's hypoxic standard is 5 ppm. There were DO levels below this standard, but these low DO occurrences were restricted to sites adjacent to the submarine valley of the shipping channel both within and outside of cuts. Low DO is already present in the shipping channel and may "spill" over to the adjacent shallower waters, suggesting that low DO in this region of the Bay is related to overall poor water quality and the shipping channel, not dredge cuts specifically.

Though there were low DO events, the facts above address them, plus the statistical analysis showed that there was no correlation between DO and depth or dredge cuts. The DO study report (previously submitted as Attachment E in 2005) was filed with the permit agencies after its completion, for review. The DO study indicated that overall bay water quality in the main channel was the primary concern, not shell dredge cuts.

Habitat Alteration

Shell dredging changes the bottom topography of the area, resulting in a series of hills and valleys. The change is permanent. Areas that were originally shell hills become a mixture of valleys and hills after dredging. The valleys are dredge cuts made into the original hill and the un-dredged portions of the original hill yield post-dredging hills, or ridges. Dredged areas become a series of hills and valleys. The edges of dredge cuts are steep sloped and provide useful fish habitat. Dredge cuts are up to 500' wide and range in depth from 3' to about 30’ deep below the original bottom, but they are mostly about 15' to 25' deep below the bottom. The bottoms of the dredge cuts are soft bottom mixture of mud and small shell grit.

The habitat alteration caused by shell dredging raises concerns for dissolved oxygen (summarized above), fish, and benthic communities.

The topography created by shell dredging has minimal impact on bluefish (EFH concern) primarily due to geographic separation. Most of the population occurs south of the shell dredging sites. Those fish that might occur in the area can use the habitat created. Any bluefish near the dredge site would primarily be juveniles and they would be able to utilize the edges that exist after dredging which are available for foraging. The edges form a 1:2 to 1:3 vertical to horizontal slope and are typically exposed oyster shell which provides benthic habitat for a diverse group of organisms that serve as food.

The topography created by shell dredging has minimal impact on summer flounder (EFH concern) primarily due to geographic separation. Though they occur in the upper bay, the population is most abundant in the lower bay. For any fish that might be present, juveniles frequent shallower habitat and SAV habitat, which are away from shell dredging sites. Adults frequent deeper waters which are nearby, but not the same as, shell dredging sites.

Regarding other species, DNR surveyed fish usage in dredged and nondredged areas in the mid- 1980’s and the data indicated no negative impacts to fish (information previously submitted as Attachment D in 2005). A topographic survey conducted in the dredged areas showed fish associated with dredged areas and specific fish surveys showed fish associated with cuts and heavily dredged bottom. This data were reviewed by the permit agencies.

Additional surveys were conducted in March 2006 by the Maryland Geological Survey (MGS) to update the topographic information on shell dredging. Digital data of bottom bathymetry and topography confirm past results: bottom topography has been altered, the alteration is in the form of alternating ridges and valleys (the result of having undredged and dredged bottom), and the permitted areas are not featureless flat bottom. Results from the March 2006 surveys were on file with MGS and were been reviewed by the permit agencies.

Fish/Fishing Success/Degraded Fishing Experience

There are no data within DNR and no data has been provided to DNR (other than a few public comments) that fishing success or the experience of fishing is diminished. It is observed that during many DNR surveys of shell dredging, fishing boats are found targeting the cuts and the dredge, presumably due to stirred up food that attracts fish.

There are data on fish usage of the dredged areas and this data does not show a negative impact. Beginning in 1986, DNR investigated the environmental impacts of shell dredging in the upper Bay. A four part study was organized in cooperation with the U.S. Army Corps of Engineers addressing water quality, bottom topography, benthic organisms, and striped bass. The results are summarized below.

The water quality study showed no detrimental impact to fish. Turbidity, total suspended solids, volatile solids and BOD were increased significantly due to dredging but they were below the levels where damage to adult fish would occur in the natural environment.

The bottom topography study showed no detrimental impact on the fish resource. Fish were found directly associated with the dredge cuts as well as with areas of natural bottom.

The summer trawl surveys showed no evidence to justify denial of the permit. Two years of summer surveys showed dredged areas and undredged areas were similar in their attractiveness to fish. One of the surveys showed a clear preference by fish for dredged areas compared to undredged areas. The following data table summarizes fish survey results from the 1987 Trawl Survey conducted in Area A near Tolchester, Area C (a prior dredging area west of A) and the overall vicinity comparing various types of dredged bottom. The number of winter flounder, hogchoker and white perch caught per 100 minutes with a trawl net are shown.

Area	Winter Flounder	Hogchokers	White Perch	Anchovy
Non-dredged Area	7.8	25.5	1.9	58.8
Moderately Dredged Area	1.8	12.9	200.0	42.6
Heavily Dredged Area	7.0	90.1	592.9	114.0
In Plume	0	0	0	30.6

The gillnet surveys showed no detrimental impacts. Winter gillnet surveys showed that most species of fish preferred the undredged areas one year, but then preferred the dredged areas the next year.

The gillnet surveys indicated that the edges created by dredging attract significant numbers of fish. Net set along the edges of the dredge cuts caught approximately equal numbers of fish as nets set in undredged areas. This was true for striped bass, white perch, striped bass hybrids, and gizzard shad.

On the Federal level, the shortnose sturgeon is a concern under the Endangered Species Act. In 1999, from July to September, DNR conducted field observations as directed by and coordinated with NMFS due to a specific condition placed upon the permit that required observers 2 days per week. The results showed no sturgeon were entrained by shell dredging in Areas D and F.

Benthic Invertebrates

In 1988, the University of Maryland studied Area A to evaluate bottom type and benthic population status. New cuts and old cuts were compared to a nearby undredged control site. The edges of cuts are exposed shell and the cut bottoms are predominantly silty, based on multiple benthic grabs and core samples analyzed for sand/silt/clay content. Though the initial impact of dredging was severe on the benthic populations dredged sites recovered quickly. The population data showed that the undredged areas, exposed sides of cuts and cut bottoms were similar in their population structure and abundance. No measurable adverse impact due to dredging was observed. Organisms typical of the areas included worms, amphipods, isopods, other crustaceans, and small clams. Within a year or less post-dredging of a new cut, the benthic population was re-established.

MAP of Past Shell Dredging: Areas A, D and F.