THE MAGOTHY RIVER INDEX–2003
February 18, 2004
"State of the Magothy River"

The Magothy River Association (MRA) is dedicated to the preservation and improvement of the water quality, plants, and wildlife of the Magothy River and its watershed. Founded in 1946, it is an all-volunteer group representing about 46 communities along the Magothy River Watershed. We devote our efforts to projects that protect the welfare of the river and its inhabitants.

The Magothy River Association's Magothy River Index is an annual assessment of the health of the tidal river for communication to the residents of the watershed. Its format is based on similar reports by the Chesapeake Bay Foundation on the whole Bay, and by the Potomac River Association on Breton Bay in Saint Mary's County. We hope that this index is useful to residents of the watershed to learn more about the status of vital habitats and water quality in the previous year. We plan to issue this report each year in late winter, and hope to add more data to it each year as they become available. This document will be available soon on our web site, www.magothyriver.org. Suggestions on how to improve the report are welcome, and can be sent to principal author Peter Bergstrom at sav@magothyriver.org.

SUMMARY OF CHANGES IN 2003

The unusually high rainfall in 2003 appeared to hurt some aspects of the Magothy's aquatic health, and possibly help other aspects. It appeared that the sustained high rainfall had more impact than the tropical storm in September.

- High rainfall appeared to cause a worsening of bottom dissolved oxygen conditions at the deep Midriver site, compared to MRA's 2002 results from the same site.
- However, there are no oysters at the Midriver site, and the bottom dissolved oxygen conditions at MRA's three shallower oyster restoration sites were better in 2003 than in 2002. This is encouraging since poor dissolved oxygen conditions can kill aquatic life.
- Water clarity increased (improved) slightly at Magothy upper creek sites in 2003 compared to 2002, and stayed the same at one mainstem site. This is contrary to the usual tendency to have worse water clarity with higher rainfall. This usual pattern was seen at many other Chesapeake monitoring stations in 2003, however. Water clarity from 2000-2003 at the mainstem site was lower (worse) than what MRA volunteers measured there from 1997-1999, which is cause for concern, since it has SAV growing nearby, and its water clarity in 2000-2003 was below the Chesapeake Bay Program goal. Little or no SAV grows near the upper creek sites, although it did in the past (in the 1960's or earlier).
- Submerged Aquatic Vegetation (SAV) area increased in 2002, the latest year for which surveys are available, during a year with relatively low rainfall. In 2002 the Magothy's SAV area, 205 acres or 38% of the restoration goal, was higher than what was mapped in 1998, before an algae bloom caused a dieback of Magothy SAV in 2000. This is the highest SAV area mapped in the Magothy since 1979. This recovery is encouraging, and species diversity is also increasing, which tends to increase resilience. There was still SAV present in the Magothy in 2003 during the higher rainfall, but we won't know how many acres were mapped until later in 2004.

- Dissolved inorganic nitrogen levels in 2003 were at their highest (worst) levels since we started measuring them in 1993, probably due to the sustained high rainfall in 2003. Too much nitrogen can fuel algae blooms.
- The rain, winds and storm surge from Tropical Storm Isabel on September 18-19, 2003 appeared to have only minor and short-lived impacts on water quality, and the SAV beds that were checked before and after the storm showed only minor impacts. Isabel had much less rainfall than recent major tropical storms (Floyd in 1999 and Agnes in 1972), but a much higher storm surge. The storm surge may have protected SAV beds from wave impacts since it put them in deeper water.

2003 INDEX

The factors used in the Index are divided into two categories: **Vital Habitats** and **Water Quality**. The results are summarized in Table 1 and Figure 1. Habitats are good places for the fish and wildlife of the Magothy to live, such as fish, crabs, turtles, and birds. Water quality is another way to measure the quality of the Magothy as a habitat for aquatic life. Unfortunately, some factors for which we have data have no goal, and for some important measures (such as how many fish and wildlife we had in the Magothy) we have no data, so we cannot use them in the Index. Several important factors for which we cannot calculate an index value are discussed after the Water Quality section. We did not calculate an overall average index value, because so many important factors have no goal or no data available.

VITAL HABITATS

Tidal and non-tidal wetlands: These are important habitats for fish and wildlife, and they are greatly reduced in the Magothy watershed compared to what was here in the past. Wetlands once made up 7.5% of the watershed, which we used as our interim goal. They now cover 2% of the watershed, so currently **wetlands are 27% of this goal**.

Submerged Aquatic Vegetation (SAV): These underwater bay grasses provide crucial habitat for fish, crabs and numerous other aquatic creatures. The Chesapeake Bay Program goal for SAV restoration in the Magothy is 544 acres. In 2002, the last year with for which data are available, there were 209 acres of SAV mapped in the Magothy, or **38% of the CBP goal.**

The sago pondweed that increased in the Magothy during the drought in 2002 held on in many areas in 2003, which was good news. Increased species diversity of SAV makes it more likely that some species will persist as conditions change. The redhead grass planted by MRA volunteers at the Grachur Club (near the mouth of Cockey Creek) in 2002 and 2003 was doing fine before Isabel. After Isabel, the redhead grass at Grachur had died back a bit but was still present, and some of that dieback could have been normal for the time of year. More information on Magothy SAV can be found on the MRA web site at http://www.magothyriver.org/Plants.html and about our SAV planting projects at http://www.magothyriver.org/SAV_Restoration.html and http://www.magothyriver.org/Grasses_for_the_Masses.html

Forested stream buffers: These buffers improve water quality and provide wildlife habitats. In 1997 (the latest year with data), **23% of Magothy streams** had at least a 100 foot wide forested buffer, also called a riparian forested buffer. Ideally, this would be 100% (our goal), and we can increase this by planting trees along streams that lack them (see Conclusions section).

WATER QUALITY

Water Clarity: To allow the return of submerged aquatic vegetation (SAV) the Chesapeake Bay Program (CBP) has adopted the goal of improving water clarity (in rivers with higher salinity such as the Magothy) so that at least 22% of surface light reaches the bottom, at the restoration depth for SAV in that river (1 meter at Mean Low Water in the Magothy). MRA volunteers collected the water clarity data used for this index in shallow water (where SAV grows) at three stations in two groups, all sampled monthly on the same day:

1) "Upper creeks:" data from two creek stations (Old Man and Cattail creeks) were averaged to represent conditions in the smaller, upriver creeks.
2) "Mainstem:" data from the Ulmstead pier represents conditions near shore in the wider part of the river and the mouths of the larger creeks.

We found that the water clarity at the Upper creek sites in 2003 only achieved **66%** of the goal, while the Mainstem site achieved **83%** of the water clarity goal. This was a slight improvement over revised 2002 values for the Upper Creeks, and showed no change from 2002 at the mainstem site (Table 1 and Figure 1). This improvement might not be expected due to the increased rainfall in 2003 (see below), but higher rainfall does not always mean murkier water.

Dissolved Oxygen: Dissolved oxygen is important to the survival of the organisms we cherish in the Magothy River. Most aquatic animals require adequate dissolved oxygen to survive. State water quality standards require a minimum of 5.0 milligram per liter (mg/l) of dissolved oxygen, the level needed by many fish. Oysters can survive with less dissolved oxygen, as little as 2.0 mg/l. MRA volunteers collected the dissolved oxygen data used for this index near the bottom (where oysters live) at four stations in two groups, all sampled weekly on the same day:

1) "Midriver" is the same station (WT6.1) that is also sampled monthly by Maryland Department of Natural Resources, located between North & South Ferry Points, which has no oysters nearby. It is about 5.5 meters (18 feet) deep.
2) Three shallower "Oyster restoration sites" were all at oyster restoration sites and had similar water quality, so their results were averaged and reported as a single value.

We found that the dissolved oxygen at the Oyster sites was generally higher (better for oyster growth and survival) than dissolved oxygen at the Midriver site (Table 1 and Figure 1). This is encouraging and shows that we picked oyster restoration sites where there is usually enough dissolved oxygen for oyster survival (found in 97% of our samples). However, DO conditions got worse in 2003 compared to 2002 at the Midriver site, both for oyster needs (> 2 mg/l) and the state standard (> 5 mg/l). This could be due to the higher rainfall in 2003 compared to 2002. Rainfall totals in 2003 at BWI Airport (including snow as water) were above the long-term average in every month from February through September, except in April. The rain, winds and storm surge from Tropical Storm Isabel on September 18-19, 2003 caused extensive waterfront property damage, but the immediate effects on water quality appeared to be minor and short-lived.

Table 1. MAGOTHY RIVER INDEX 2003

Indicator	**What**	**Where**	2002 Index	**2003 Index**
VITAL HABITATS				
Submerged Aquatic Vegetation (SAV)	% of historical amount (for previous year; survey takes 1 yr to complete)	All tidal waters	36%*	**38%+**
Wetlands (tidal & non-tidal)	% of historical amount (estimated)	Whole watershed	27%	**27%**
Forested stream buffers	% of stream miles with 100 foot or wider buffers	All nontidal streams	23%	**23%**
WATER QUALITY				
Water Clarity	% of water clarity goal achieved (median of monthly data, April-October)	Upper creeks (2)	53%*	**66% +**
		Mainstem	83%*	**83%**
Bottom Dissolved Oxygen (DO)	% of June-November data that met level needed by oysters (> 2.0 mg/l)	Mid-river (WT6.1)	31%	**15% -**
		Oyster restoration sites (3)	94%	**97% +**
	% of June-November data that met level needed by fish, and state standard (> 5.0 mg/l)	Mid-river (WT6.1)	25%	**0% -**
		Oyster restoration sites (3)	59%	**78%+**

+ : got better 2002-2003
- : Got worse 2002-2003
*revised since 2002 Index (using revised goals for SAV area and water clarity)

The 2003 data are graphed in Figure 1 below. Dissolved oxygen (DO) conditions for oysters at the restoration sites have the highest index value (97%). In contrast, wetlands, forested stream buffers, and Mid-river DO data compared to both concentrations had the lowest index values (0-27%).

For most of the index values, we do not have comparable data from past years to see how they are changing over time. These data are available for the water clarity index and SAV area, however.

MRA volunteers have sampled water clarity at the same three stations since 1992, and Figure 2 shows that water clarity in 2003 was slightly higher (better) than in 2002 at the upper creeks and the same as 2002 in the mainstem. 1992, 1993, 1995, 1998, and 1999 had the best clarity at the Mainstem site, the only years in which the goal was met, while 1997 had the best clarity in the

Upper creeks. Two of the years when the goal was met, 1995 and 1999, were drought years, but 2001-2002 also had low rainfall, and the water clarity goal was not met. Water clarity tends to be better in most rivers in drought years. However, the water clarity goal was also met at the Mainstem site in 1993 and 1998, which had higher than normal rainfall. Thus, Magothy water clarity over this period did not appear to have any clear trend over time, or to respond in a predictable way to rainfall amount.

SAV area data from past years are also available for most years since 1978. Figure 3 shows that Magothy SAV area recovered in 2002 to higher than its level in 1998, before a series of extreme events caused an SAV dieback in 2000. Note that Magothy SAV area started increasing in 1993, when Mainstem water clarity was above (better than) the water clarity goal (Figure 2).

Figure 1. Graph of Magothy River Index values for 2003.

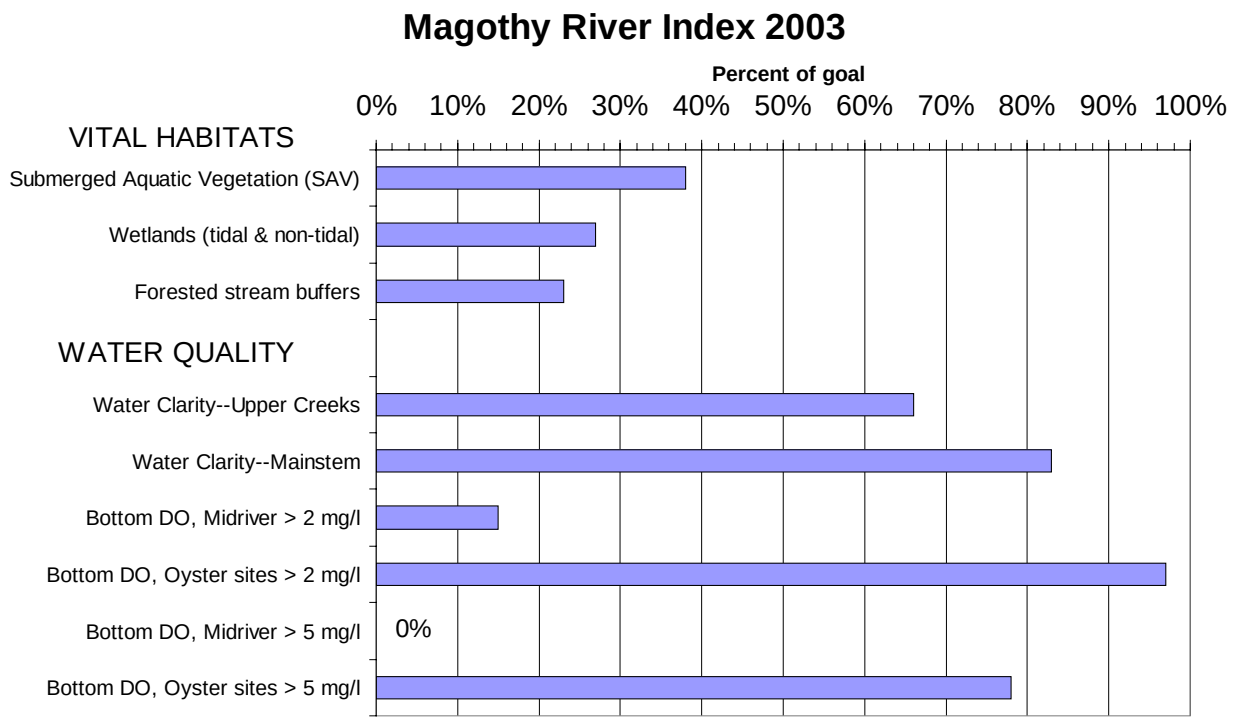


Figure 2. Growing season medians of water clarity by year and site, 1992-2003, compared to 22% water clarity goal.

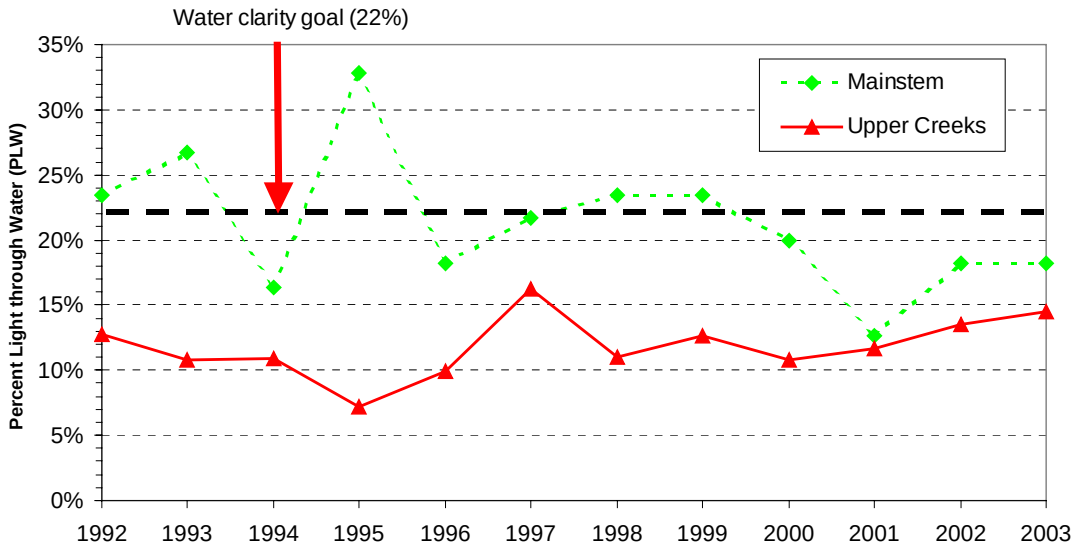
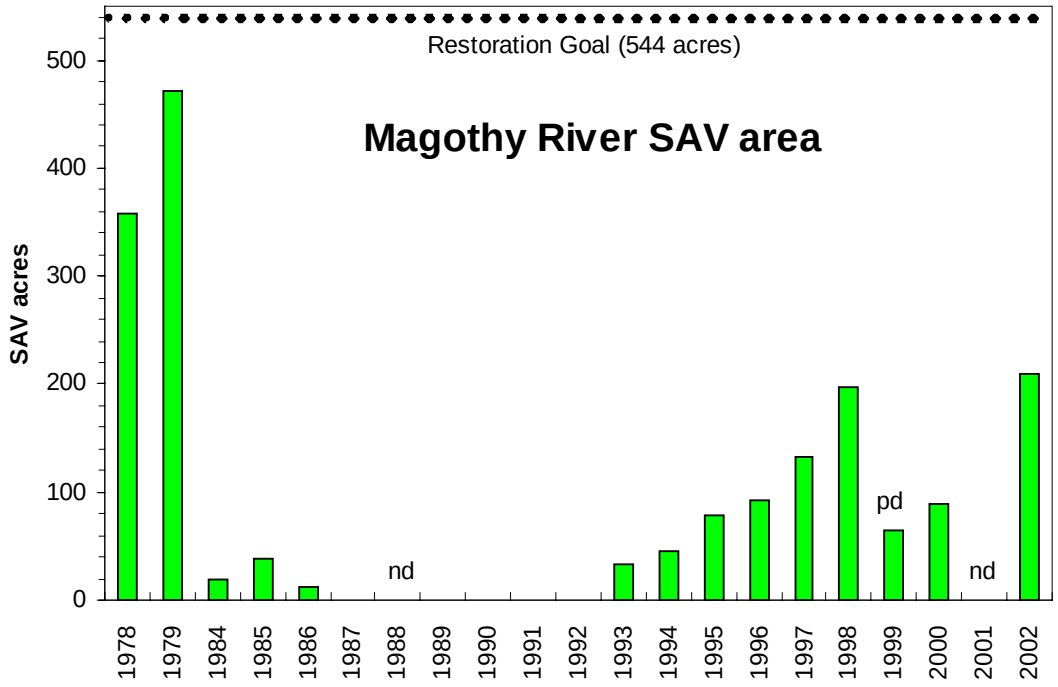


Figure 3. Submerged Aquatic Vegetation (SAV) area in the Magothy River, 1978-2002. Key: 'nd' means no data, 'pd' means partial data.
(1978-2001 data are from http://www.vims.edu/bio/sav/segtots.html converted to acres, and http://noaa.chesapeakebay.net/sav/sav%20release%20pak%20092503.pdf for 2002)



MAGOTHY ENVIRONMENTAL FACTORS NOT USED IN THE INDEX

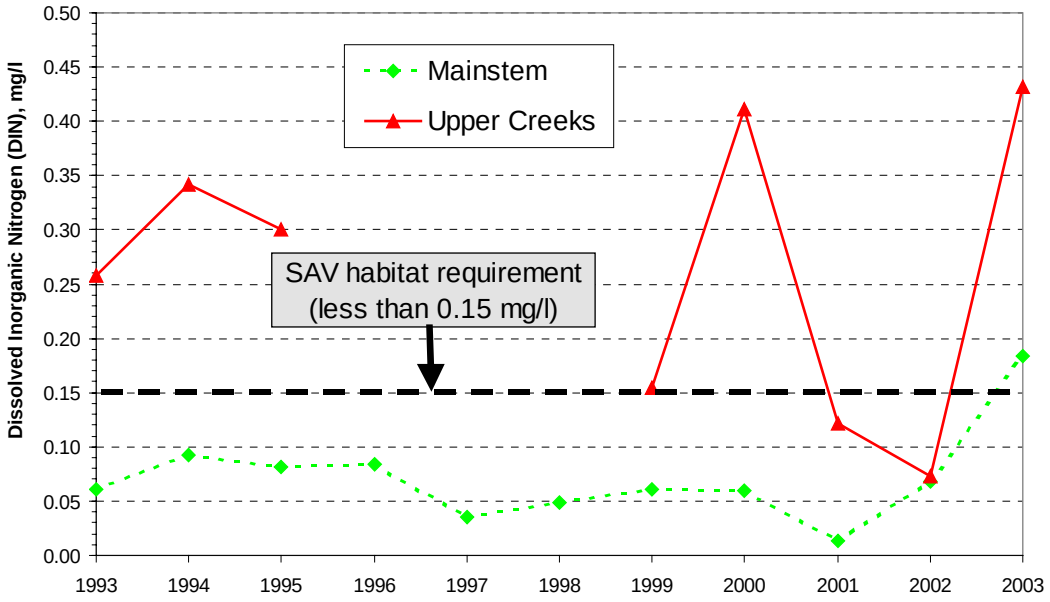
These environmental factors were not included in the index because the available data have no goal and thus could not be expressed as a percentage, or because data are missing.

Data available, but no goal:

Dissolved inorganic nitrogen and phosphorus, chlorophyll, and suspended solids concentrations: These water quality parameters are measured both by MRA volunteers at the three stations they monitor, and by Maryland DNR at the one station they monitor in the Magothy, using the same methods and lab. They are not as directly related to SAV survival as water clarity, but they give important clues to what affects water clarity and dissolved oxygen. They all have habitat requirements for SAV growth, but only chlorophyll has a Chesapeake Bay Program water quality goal, and its levels are usually lower (better) than the goal in the Magothy.

The most notable change in these concentrations in 2003 was that annual growing season medians of dissolved inorganic nitrogen (DIN) in 2003 were much higher than in 2002 or any previous years back to 1993 when we started measuring it (Figure 4). Unlike the values used in the Index above, for nitrogen, less is better. DIN was not measured in the Upper Creeks from 1996-1998. DIN medians were worse (higher) than the SAV habitat requirement at the Upper Creek sites every year except in 2001-2002 during the drought. DIN medians were better (lower) than the SAV habitat requirement at the Mainstem site in every year except 2003. DIN is generally more affected by changes in rainfall than any of the other water quality parameters, partly because one of its components, nitrate, can be abundant in ground water.

Figure 4. Growing season medians of Dissolved Inorganic Nitrogen in the Magothy River by year and site, 1993-2003, compared to SAV habitat requirement. (based on MRA data)



Fish Consumption Advisories: The Maryland Department of the Environment (MDE) issues these based on toxic contaminant levels found in fish caught in each river, using models of your risks from eating various amounts of fish. The Magothy is listed for two fish species: Channel Catfish and White Perch. The recommended limits for the general population are 2 meals per month for channel catfish and 1 meal per month for white perch; see the web site for limits for women of childbearing age and for children. Some nearby rivers had lower limits (showing higher contaminant levels). Obviously we would rather not see any fish advisories for our river, but it is very hard and expensive to clean up past chemical contamination. See: http://www.mde.state.md.us/assets/document/fish/advisory_summary.pdf

Non-tidal Tributary Health: in March 2002, Magothy River Association (MRA) volunteers sampled 11 points on Magothy non-tidal tributary streams for benthic invertebrate animals (insects living on the bottom of streams). Ten of the 11 sites had Poor quality based on these samples. The one site rated **Fair** was on Magothy Branch (the non-tidal Magothy) above Lake Waterford, just upstream of Jumpers Hole Road. MRA volunteers did similar sampling at 9 sites on other Magothy non-tidal streams in 2003, and all 9 sites rated Poor. Statewide, half of the small streams sampled by DNR were rated Poor, about a third were rated Fair, and the rest (11%) were rated Good. The Fair and Good sites were in watersheds with less developed land than the Magothy watershed, which has about 25% developed land. Some MD coastal plain watersheds have only 5% developed land or less. For more information see: http://www.dnr.state.md.us/streams/mbss/mbss_volun.html

***No data available**:*

Oysters: Although the MRA has conducted extensive native oyster restoration efforts for a number of years, there is no easy way to locate or count the total number of oysters in a river. Even if we knew our current oyster population size, we don't know the historical abundance of oysters in the Magothy. For more on MRA oyster projects see: http://www.magothyriver.org/Current_Projects.html

Fish, Crabs and Turtles: These are also hard to count, but for different reasons: they move around and are hard to catch. Maryland DNR did summer fish surveys in the Magothy in the past (1989-1991) using a seine net in the shallows and trawls at various depths, and documented a total of 37 finfish species. There are no known surveys of Magothy crabs or turtles. Turtles seen in our tidal waters include snapping turtles and diamondback terrapins. Terrapins need natural shorelines to nest, and these are becoming rare on the Magothy.

Birds: One of our more visible waterbirds is the Osprey, which spends the warmer months here, and spends the winter in South America. Local resident George Kerchner counted osprey nests on the Magothy in 1996 when he found 25 active nests. Ospreys have increased so much that their nest sites may be limited in the Magothy. If you are a waterfront property owner and are interested in erecting a nest platform, contact sav@magothyriver.org for more information. The MRA web site has information about common birds seen around the Magothy at http://www.magothyriver.org/Critters.html

There are no confirmed bald eagle nests in the watershed, but eagles are sometimes seen flying over the river, sometimes in pairs. They prefer to nest in undisturbed wooded waterfront tracts, of which there are few on the Magothy. They nest on the Severn and South rivers most years.

Recent efforts to map mute swans and their nests by MD DNR and other agencies noted a few mute swan nests on the Magothy, but not as many as on the Severn and South rivers. The nests are being mapped as part of an effort to control this exotic and invasive species in Maryland, which competes with native waterfowl and damages SAV beds. For more details see: http://www.dnr.state.md.us/wildlife/inv2002egg.html

CONCLUSIONS: What you can do to help the Magothy

1. Increase oyster beds to increase filtration capacity and fish habitat. You can do oyster gardening and help with oyster nurseries (oysterinfo@magothyriver.org), and do diving to support oyster restoration (diver@magothyriver.org)
2. Increase Submerged Aquatic Vegetation (SAV) through "Grasses for Masses" to improve water quality and increase fish and shellfish habitat (Contact magothyriversavers@yahoo.com), and help with surveys of current SAV locations (Contact sav@magothyriver.org)
3. Reduce your lawn area and your use of lawn fertilizer, and use native plants. See: http://www.nwf.org/backyardwildlifehabitat/previoustips3.cfm
4. Reduce your use of vehicles and other internal combustion engines. These add nitrogen to the air, and much of this reaches the water. Car pool, combine trips, buy more fuel-efficient vehicles and four-cycle boat motors, and use electric yard tools instead of gas tools.
5. Encourage best management practices including nutrient management at horse farms and other farms in the watershed
6. Plant trees along streams and shorelines that lack them or have a narrow forested buffer, to increase the number of stream and shoreline miles that have forested buffers.
7. If you have a septic system, keep it pumped out and in good repair
8. Minimize and when possible reduce the amount of pavement and other impervious surfaces in your yard, since they increase runoff to the river. This can be done by using gravel or porous pavers for driveways and parking lots.
9. Install rain barrels, rain gardens, and other structures to retain and improve the quality of runoff before it leaves your yard. See: http://www.arlingtonecho.org/rainbarrel.htm
10. Join the Magothy River Association. See: http://www.magothyriver.org/Who_We_Are.html

or contact President Paul Spadaro at 410-647-8772, or president@magothyriver.org