



## Water Quality Testing July 2012



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## 1. Introduction

The St. Maarten Nature Foundation tested water quality at seven sites on the island. Tests were carried out in order to determine the quality of water for bathing (at swimming beaches) and for general water quality at various bodies of water throughout the island.

Water quality tests were carried out on seven monitoring sites in order to determine levels of water pollution. Tests were carried out in order to determine Nitrate, Phosphate, Nitrogen, Dissolved Oxygen, and pH levels. Tests were carried out on seven sites; Cole Bay Lagoon, Simpson Bay Lagoon, Mullet Pond, Kim Sha Beach, Great Bay Beach, Belair Pond, Fresh Pond, and the Great Salt Pond. The sites of Great Bay Beach and Kim Sha Beach were particularly chosen to test the swimming quality of the beaches.



Figure 1: Water quality testing locations

## 2 Methods

Samples were collected on the seven research sites using standard sampling vials. Once collected the samples were tested for the various levels within 24 hours using the Lamotte Water Pollution testing kit (figure 2). Once levels were measured the data was recorded and stored. pH levels and water temperature were tested *in situ* using the Oakton Acorn Series pre-calibrated pH meter.



Figure 2: Lamotte Water quality testing kit

## 3 Results

Follows are the results gathered from the water quality tests:

### 3.2 Nitrates (No)

Sewage is the main source of nitrates added by humans to marine and wetland areas. Sewage enters waterways in inadequately treated wastewater from sewage treatment plants, in the effluent (outflow) from illegal sanitary sewer connections, and from poorly functioning septic systems. Water containing high nitrate levels can cause, amongst others, a serious condition called methemoglobinemia, if it is consumed. This condition prevents an infant's blood from carrying oxygen; hence the nickname "blue baby" syndrome.

Based on research conducted on the 6th, 7th, and 8th of November it was determined that sites 1 (Cole Bay Lagoon), 2 (Kim-Sha Beach), 3 (Mullet Pond), and 4 (Great Bay) had medium levels of nitrates in samples tested. All levels recorded were at or around .2 ppm which indicates that nitrates are present. The highest level was recorded in the Great Salt Pond (site 7) at .7 ppm, which is a relatively high number and indicates the presence of elevated nitrate levels. Similarly the Fresh Pond (site 6) showed relatively high numbers of nitrates (.4 ppm) and Belair Pond (.2 ppm)

Site #	1	2	3	4	5	6	7
No	.2 ppm	.2 ppm	.2 ppm	.2 ppm	.2 ppm	.4 ppm	.7 ppm

### 3.2 Phosphates (Po)

Phosphorus is usually present in natural water as phosphates (orthophosphates, polyphosphates, and organically bound phosphates). Phosphorus is a plant nutrient needed for growth and a fundamental element in the metabolic reactions of plants and animals (hence its use in fertilizers). Sources of phosphorus include human and animal wastes (i.e., sewage), industrial wastes, soil erosion, and fertilizers. Excess phosphorus causes extensive algal growth called "blooms," which are a classic symptom of cultural eutrophication and lead to decreased oxygen levels in wetlands and enclosed marine environments.

Based on research conducted on the 6th, 7th, and 8th of November it was determined that sites 1 (Cole Bay Lagoon), 2 (Kim-Sha Beach), 3 (Mullet Pond), and 4 (Great Bay) had medium levels of phosphates in samples tested. All levels recorded were at or around .2 ppm which indicates the presence of phosphates in the water. The highest level was recorded in the Great Salt Pond (site 7) at .5 ppm, which is a relatively high number and indicates the presence of elevated phosphate levels. Similarly the Fresh Pond (site 6) showed relatively high numbers of nitrates (.3 ppm) and Belair Pond (.2 ppm). Although recorded levels were relatively high, they were not high enough to cause significant algal blooms in the near future, though these sights should be closely monitored and tested for possible algal blooms in the future.

Site #	1	2	3	4	5	6	7
Po	.2 ppm	.2 ppm	.2 ppm	.2 ppm	.2 ppm	.3 ppm	.5 ppm

### 3.3 Nitrogen (Nh3)

Ammonia, a by-product of nitrogen, is toxic to fish and aquatic organisms, even in very low concentrations. When levels reach 4 ppm fish can suffer gill damage. When levels reach 5 ppm, sensitive fish can begin to die. As levels near 7 ppm, even ammonia-tolerant fish can begin to die. Ammonia levels greater than approximately 2 ppm usually indicates polluted waters.

The danger ammonia poses for fish depends on the water's temperature and pH, along with the dissolved oxygen and carbon dioxide levels; the higher the pH and the warmer the temperature, the more toxic the ammonia. Also, ammonia is much more toxic to fish and aquatic life when water contains very little dissolved oxygen and carbon dioxide.

Based on research conducted on the 6th, 7th, and 8th of November it was determined that sites 1 (Cole Bay Lagoon), 2 (Kim-Sha Beach), 3 (Mullet Pond), and 4 (Great Bay) had low levels of Nitrogen in samples tested. All levels recorded were below 1 ppm which is a relatively good quality. The highest level was recorded in the Great Salt Pond (site 7) at .6 ppm, which is a high number and indicates the presence of elevated nitrogen levels which can pose a threat to aquatic organisms and which may cause fish die-offs. The Nature Foundation will continuously monitor Nitrogen Levels at this sight in order to give an approximation when fish die offs may be expected. The Fresh Pond (site 6) showed relatively low numbers of nitrates (1 ppm) and Belair Pond (2 ppm).

Site #	1	2	3	4	5	6	7
NH3	< 1 ppm	< 1 ppm	< 1 ppm	< 1 ppm	2 ppm	1 ppm	6 ppm

### 3.4 Dissolved Oxygen (O)

Dissolved oxygen analysis measures the amount of gaseous oxygen (O<sub>2</sub>) dissolved in an aqueous solution. Oxygen gets into water by diffusion from the surrounding air, by aeration (rapid movement), and as a waste product of photosynthesis.

Total dissolved gas concentrations in water should not exceed 15 ppm.

Concentrations above this level can be harmful to aquatic life. Fish in waters containing excessive dissolved gases may suffer from "gas bubble disease"; however, this is a very rare occurrence. The bubbles or emboli block the flow of blood through blood vessels causing death. External bubbles (emphysema) can also occur and be seen on fins, on skin and on other tissue. Aquatic invertebrates are also affected by gas bubble disease but at levels higher than those lethal to fish. Inversely gas levels should not go below 5 ppm, which can show a lack of oxygen and can cause fish die-offs and algal blooms.

Based on research conducted on the 6th, 7th, and 8th of November it was determined that sites 1 (Cole Bay Lagoon), 2 (Kim-Sha Beach), 3 (Mullet Pond), and 4 (Great Bay) had low levels of dissolved oxygen in samples tested. All levels recorded were at sufficient levels to maintain healthy life. The lowest level was recorded in the Great Salt Pond (site 7). This site should be closely monitored for a further drop in oxygen levels which may result in fish kills and breeding of airborne insects (i.e. Midges). It is interesting to note that previously recorded levels in April 2011 in the Fresh Pond (site 6) indicated a dissolved oxygen level of 5.3. Current levels have been recorded at 7.0, which is a significant improvement. This is probably related the installation of aeration pumps in the Fresh Pond by the Public Works (ROB) Department of the Ministry VROMI.

Site #	1	2	3	4	5	6	7
O	7.2 ppm	7.5 ppm	7.2 ppm	7.0ppm	7.2 ppm	7.0 ppm	5.2 ppm

### 3.5 Alkalinity (pH) and Temperature

A range of pH 6.5 to pH 8.2 is optimal for most organisms. Most organisms have adapted to life in water of a specific pH and may die if it changes even slightly. The toxicity level of ammonia to fish, for example, varies tremendously within a small range of pH values. Acidic water can cause heavy metals such as copper and aluminium to be released into the water. Copper from worn automobile brake pads is often present in runoff. Rapids growing algae remove carbon dioxide from the water during photosynthesis, which can result in a significant increase in pH levels.

Based on research conducted on the 6th, 7th, and 8th of November it was determined that all sites showed relatively stable pH levels. Sites 5 (Belair Pond) and 7 (Salt Pond) showed higher and lower values respectively, although still within the range of stable pH levels. Temperature levels were consistent with the mean for this time of year.

Site #	1	2	3	4	5	6	7
pH	8.2	8.0	8.2	8.0	9.4	8.6	6
Temp	23 C	28 C	26 C	23 C	23 C	25.6 C	27.5 C

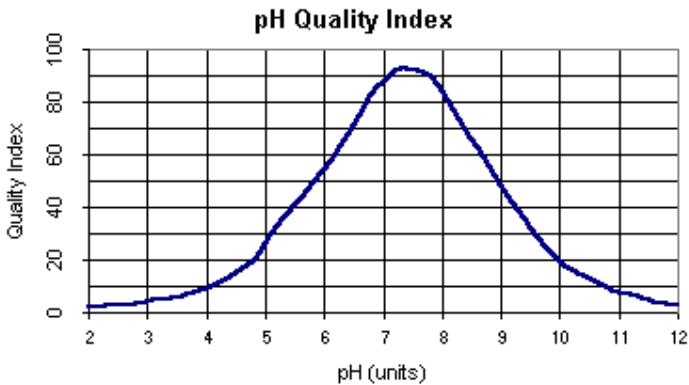


Figure 7: Water quality testing locations

#### 4 Summary and Conclusion

The Nature Foundation carried out water quality tests on the 22<sup>nd</sup>, 23<sup>rd</sup>, and 24<sup>th</sup> of July 2012 at seven sites surrounding St. Maarten. These tests, which are conducted bi-annually, are carried out in order to determine the levels of pollutants and other factors affecting wetlands and beaches on St. Maarten. Tests were carried out in order to determine Nitrates (which shows that the water is polluted), Phosphates (which shows the presence of Sewage), Nitrogen, Dissolved Oxygen, and the acidity of the water. Tests were carried out on seven sites; Cole Bay Lagoon, Simpson Bay Lagoon, Mullet Pond, Kim Sha Beach, Great Bay Beach, Belair Pond, Fresh Pond, and the Great Salt Pond. The sites of Great Bay Beach and Kim Sha Beach were particularly chosen to test the swimming quality of the beaches.

It was determined that the sites Cole Bay Lagoon, Kim-Sha Beach, Mullet Pond, and Great Bay had medium levels of both phosphates and nitrates in samples tested. Elevated levels of nitrates and phosphates show that there is a presence of various types of pollutants and sewage which can cause toxic algal blooms and mortality events (large scale dying of fish, turtle and crabs) in wetlands and coastal areas. The highest level was recorded in the Great Salt Pond and indicates the presence numerous pollutants and sewage in the tested water. This may cause fish die offs and algal blooms. Taking this into consideration levels will continuously be monitored by the Nature Foundation.

It was further established that the sites Cole Bay Lagoon, Kim-Sha Beach, Mullet Pond, and Great Bay had low levels of Nitrogen in samples tested. Elevated levels of Nitrogen, caused by pollutants, can cause massive fish die-offs in wetlands and coastal areas. The highest level was recorded in the Great Salt Pond at .6 ppm, which is a relatively high number and indicates the presence of elevated nitrogen levels which can pose a threat to aquatic organisms and which may cause fish die-offs between now and the end of the year. The Nature Foundation will continuously monitor Nitrogen Levels at this site in order to give an approximation when fish die offs may be expected.

Almost all levels of oxygen recorded were at sufficient levels to maintain healthy life. The lowest level was recorded in the Great Salt Pond. This site should be closely monitored for a further drop in oxygen levels which may result in fish kills and breeding

of airborne insects (i.e. Midges). It is interesting to note that previously recorded levels in April 2011 of Oxygen in the Fresh Pond indicated a low level present. Current levels have been recorded at healthy levels, which is a significant improvement. This is probably related to the installation of aeration pumps in the Fresh Pond by the Public Works (ROB) Department of the Ministry VROMI.

Despite the fact that many sites showed Low to Medium readings, the Nature Foundation will follow up on a monthly basis during the summer months to carefully monitor for changes in the respective levels. Similarly the levels recorded in the Great Salt Pond show that there exists the possibility of fish die-offs and increased midge activity between now and end of 2012.

**Summary of water quality testing results**

Site #	1	2	3	4	5	6	7
No	.2 ppm	.2 ppm	.2 ppm	.2 ppm	.2 ppm	.4 ppm	.7 ppm
Po	.2 ppm	.2 ppm	.2 ppm	.2 ppm	.2 ppm	.3 ppm	.5 ppm
NH3	< 1 ppm	< 1 ppm	< 1 ppm	< 1 ppm	2 ppm	1 ppm	6 ppm
O	7.2 ppm	7.5 ppm	7.2 ppm	7.0ppm	7.2 ppm	7.0 ppm	5.2 ppm
pH	8.2	8.0	8.2	8.0	9.4	8.6	6
Temp	23 C	28 C	26 C	23 C	23 C	25.6 C	27.5 C