Recreational use of water can deliver important benefits to health and well-being. Yet, there may also be adverse health effects associated with recreational use if the water is polluted or unsafe.

Water Quality and Health
World Health Organisation

Public participation is essential in grappling with the important issues related to water management. We must not believe that water management is the responsibility of others. The management of water is everybody’s responsibility. In the Caribbean context, farmers are good examples of resource managers. Their farming practices (such as slash and burn or overuse of pesticides), in the upper reaches of watersheds, unless properly managed (by these same farmers), can compromise the quality and quantity of water. They are however only one of the many groups who could be considered resource users, and by extension, resource managers. Tourist operators, industries, and individuals all have roles to play.

Protecting Our Watersheds and Coastal Areas: Community Tools for Managing Land and Water Resources in the Caribbean.
GEF-IWCAM
“WHAT”… Is Recreational Water?
Recreational Water is water used for activities like bathing, swimming, water-sports and even river walks. It includes the water found in pools, rivers, seas, ponds and waterfalls. Recreational waters refer to those natural waters used not only for the aforementioned primary contact activities e.g. swimming, but also for secondary contact activities, such as boating and fishing.

“WHAT”… Is Recreational Water Quality Monitoring?
The monitoring and assessment of water quality is based on physical, chemical and biological properties of water. Waters used for recreational purposes should be sufficiently free from microbiological, physical, and chemical hazards to ensure that there is negligible risk to the health and safety of the user. A hazard is an object or condition that may endanger human health or safety. For most bathing areas, contact with faecal pollution in the environment represents one of the typical hazards.

Additional existing or potential hazards can include:
- chemical hazards (e.g., industrial discharges, contamination from marinas/watercraft);
- biological hazards (e.g., organisms responsible for swimmer’s itch); and
- physical hazards (e.g., subsurface hazards, unsafe water conditions).

“WHAT”… Is a Recreational Water Environment?
A coastal, estuarine or freshwater area where any type of recreational usage of the water is made by a significant number of users.

“WHY”… Should Recreational Water Quality be Monitored?
Recreational water quality monitoring is an important activity to provide data for the assessment of the health risks to users. Water quality data are used to describe the condition of a water-body, to help understand why that condition exists, and to provide some clues as to how it may be improved. Water quality indicators or measurements of key physical, chemical, and biological variables (e.g. pH) are taken over time to provide a snapshot of the water quality at any point in time and the extent to which that is consistent with existing standards. Water quality standards define a measurable relationship between the quantity of the indicator in the water and the potential risk to human health associated with using the water for recreational purposes.

Attention should be paid to the potential sources of faecal contamination from point sources such as drain waste pipes and from the many “diffuse” point sources such as gutters, livestock pens and farm lands.

Agricultural Run-Off: Water flowing over agricultural land, whether from rain, irrigation or flooding, carries pollutants to the nearest water body. Agricultural pollutants that are carried to the water via run-off can include faecal matter, sediment, pesticides, fertilizers, bacteria, oils, grease and solvents. The result can be that elevated levels of suspended solids, nitrogen and phosphorus, synthetic organic chemicals and heavy metals are found in the receiving waters.

“WHY”… Is Recreational Water Quality Be Monitored?
Recreational water quality monitoring is an important activity to provide data for the assessment of the health risks to users. Water quality data are used to describe the condition of a water-body, to help understand why that condition exists, and to provide some clues as to how it may be improved. Water quality indicators or measurements of key physical, chemical, and biological variables (e.g. pH) are taken over time to provide a snapshot of the water quality at any point in time and the extent to which that is consistent with existing standards. Water quality standards define a measurable relationship between the quantity of the indicator in the water and the potential risk to human health associated with using the water for recreational purposes.

Attention should be paid to the potential sources of faecal contamination from point sources such as drain waste pipes and from the many “diffuse” point sources such as gutters, livestock pens and farm lands.

Bacteria are one of the most common single-celled microorganisms. Many types of bacteria are found in recreational waters. Some types of bacteria can be beneficial, while other types, including fecal coliform, salmonella, staphylococcus, and E. coli, can cause diseases. Fecal waste from warm-blooded animals (including humans) is a key source of bacteria found in water bodies. The threat of harmful bacteria in recreational waters can often be reduced to levels associated with relatively low health risks through chemical disinfection treatments, such as chlorination or ozonation of wastewater before it enters the recreational water environment.
Viruses are submicroscopic infectious agents that require host cells in which to live. Many of the viruses affecting water quality and human health originate in the gastrointestinal tracts of infected animals (including humans) and are then released to the environment in fecal wastes. Examples of some of the more common waterborne, disease-causing viruses include hepatitis A, rotaviruses, Norwalk-type viruses, adenoviruses, and enteroviruses. Viruses are more resistant than bacteria to conventional water treatment such as chlorination. Treatments such as ultraviolet light and ozonation are more effective than chlorination in treating viruses.

Protozoa are single-celled organisms that live primarily in the aquatic environment. Some disease-causing protozoa exist in the environment as cysts that hatch, grow, and multiply after ingestion, causing illness. Two disease-causing, waterborne protozoa of major concern are *Giardia lamblia* and *Cryptosporidium*. Like viruses, protozoa are more resistant to conventional treatment such as chlorination. Ingesting water containing bacteria, viruses, or protozoa is the most common route of human exposure to these micro-organisms. A key factor in the successful treatment of these microbes is allowing adequate contact with the disinfecting agent. Certain physical and chemical conditions (e.g., high suspended solids) can reduce treatment effectiveness if not addressed.

For more information on bacteria, viruses, and protozoa, visit [http://www.epa.gov/microbes/](http://www.epa.gov/microbes/).

**“HOW”...**

**Do we go about setting up a Recreational Water Quality Monitoring Programme?**

**STEP ONE: GET HELP**

- If you’re an NGO, Community or School, get advice and support from the Environmental Health Department of your Ministry of Health or the appropriate organization in your country responsible for water monitoring. However, it is possible, especially if the technical support is available within your community, to conduct recreational water-quality testing.
- Ministries of Health, requiring advice or support, should liaise with the Caribbean Environmental Health Institute (CEHI), www.cehi.org.lc.

**NOTE:** There are a lot of information sources and toolkits, including this introductory manual, that will help to identify what you need or what resources are available to facilitate the next steps. However, try to build some alliances especially with the local authorities. Remember, Environmental Health is everybody’s business.

**STEP TWO: DESIGN A MONITORING PROGRAMME**

Monitoring programmes can be very simple or very complex. For an environmental NGO or community, your focus should be on whether the water in a particular recreational site is safe. For a Government agency with responsibility for all recreational sites used by locals and tourists the programme may have to be multifaceted. However, these are key activities in any monitoring programme:

1. Identify the objective(s) of the monitoring programme or study prior to data gathering: Objectives can have different emphases but ideally would address specific health and environmental issues. Some examples of objectives are “To investigate the reasons why water in a specific location does not meet the standards that have been set” or “To determine the effect of discharges on water quality compared with conditions prior to the discharges.” Within these general objectives, there can be more specific goals. Monitoring program objectives need to be clear, measurable and precise to properly design the program. For example, a program established to track changes over time may specifically state that a pre-determined degree of change should be detectable from the data. This specific objective will drive decisions on sampling frequency and duration of the program.

2. Put in place a quality assurance programme: Quality assurance, or QA for short, is the systematic monitoring and evaluation of the various aspects of a project to make sure that there are no discrepancies in the process used and that the results can both withstand scrutiny and be used as the basis of actions or decisions.

3. Involve all the stakeholders, especially the users of the site and see how best they could be part of the programme. Also, make sure the environmental health department and any other public, private or voluntary sector organisations are involved. Universities are useful since they may have technical expertise and equipment. At the same time identify and use volunteers with the relevant skills, interest and time. Initially, you can try to get support for training programmes.
for your volunteers, including the science classes of the Secondary Schools in your area.

4. **Catalogue or list, and update, the extent and nature of recreational activities** that take place at the recreational site and the types of hazards to human health that may be present or encountered. (See sampling Field Sheet below)

5. **Find out if people in the community are experiencing health problems** associated with water quality especially: rash, vomiting and diarrhea.

6. **Identify who is in charge of the various parts of the monitoring programme:** The communication chain or levels of authority, responsibility and actions should be identified and followed. In other words, who is in charge and who is responsible for what aspects of the programme should be known to everyone involved, as well as to the external organisations with which the programme interacts.

7. **Train all participants well:** All persons involved in the programme should be adequately trained. The GEF-IWCAM resource, "Protecting Our Watersheds and Coastal Areas: Community Tools for Managing Land and Water Resources in the Caribbean" is a useful information and training tool. It may be found at: www.iwcam.org

**STEP THREE: IDENTIFY AND INSPECT**

Some of the activities that you will typically need to undertake include determination of:

a. The presence and nature of natural or artificial hazards; what is there above or below the surface that could create problems for users of the facility or site.

b. The severity of the hazard as related to health outcomes or what are the bad things that can happen to those who use the site e.g. swallow water.

c. The availability and applicability of remedial actions; what can be easily and quickly done by the community or group to minimize or even avert the danger.

d. The frequency and intensity of use; how often and how many people use the site.

e. The level of development; is the site properly developed or is it under-developed without facilities in place.

f. The evidence of inadequately treated sewage, faecal matter, or chemical substances entering the water.

g. Knowledge of locations of all outfalls or drainage in the area that may contain sewage, including urban storm water and agricultural waste or runoff.

h. An inspection of the area for physical hazards e.g. water depth, waves, currents etc.

i. An assessment of the seasonal variability of hazards, the water temperature, the frequency of change or circulation of the water, changes in water depth, and the occurrence of algal blooms and other nuisances.

**STEP FOUR: IDENTIFY AND REPORT HOTSPOTS**

Hotspots are sites which are likely to be sources of chemical, organic or other pollutants which will enter drains and rivers, to be ultimately discharged to coastal waters. If there are hotspots affecting the water quality that communities or visitors use, report these to the Environmental Health Department which will take steps to mitigate and manage these high pollutant sources so that the water quality is improved and the environment is better protected. If no action is being taken, step up the monitoring and advise users to stop using the area if there are problems.

**STEP FIVE: TEST THE WATER**

Chemical contaminants can enter surface waters or be deposited on beaches from both natural and anthropogenic (impact of humans) sources. These may be either direct sources, such as industrial outfall or a natural spring, or diffuse sources, such as runoff from land. Generally, the sampling program includes specific tests that will indicate whether the water quality is above or below the accepted standard. Typical water quality parameters measured include: Secchi depth (a measure of water clarity), phosphorus concentrations (a measure of nutrient enrichment), dissolved oxygen and temperature. There is an agreement among Caribbean countries concerning pollution of the sea from Land-Based Sources (the LBS protocol) which identifies the following areas of concern:

- Domestic Sewage
- Agricultural Non-Point Sources
- Chemical Industries
- Extractive Industries and Mining
- Food Processing Operations
- Manufacture of Liquor and Soft Drinks
- Oil Refineries
- Pulp and Paper Factories
- Sugar Factories and Distilleries
- Intensive Animal Rearing Operations

The LBS Protocol (see http://www.cep.unep.org) also has lists of the chemical pollutants and tables with the standards that should be the basis for safe recreational water quality.

What To Do if you use a recreational water body that is not monitored regularly:

- Avoid swimming after heavy rain or several days of persistent rainfall.
- Look for storm drains (pipes that drain polluted water from streets) along the site. Don’t swim near them.
- Look for trash and other signs of pollution such as oil slicks in the water. These kinds of pollutants may indicate the presence of disease-causing microorganisms that may also have been washed into the water.
- If you think your water body is contaminated, contact...
For further information please contact:

Caribbean Environmental Health Institute
P.O. Box III, The Morne, Castries, Saint Lucia
Tel: (758)-452-2501/1412; Fax: (758)-453-2721
E-mail: cehi@candw.lc
www.iwcam.org

Your local health or environmental protection officials. It is important for them to know about suspected beach water contamination so they can protect citizens from exposure.

- Work with your local authorities to create a monitoring program.

DISEASE-CAUSING MICROORGANISMS IN SEWAGE

<table>
<thead>
<tr>
<th>Microorganisms</th>
<th>Some Illnesses and Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteria</td>
<td>Gastroenteritis (includes diarrhea and abdominal pain), salmonellosis (food poisoning), cholera.</td>
</tr>
<tr>
<td>Viruses</td>
<td>Fever, common colds, gastroenteritis, diarrhea, respiratory infections, hepatitis.</td>
</tr>
<tr>
<td>Protozoa</td>
<td>Gastroenteritis, cryptosporidiosis and giardiasis (including diarrhea and abdominal cramps), dysentery.</td>
</tr>
<tr>
<td>Worms</td>
<td>Digestive disturbances, vomiting, restlessness, coughing, chest pain, fever, diarrhea</td>
</tr>
</tbody>
</table>

Three Keys to a Healthy Environment and a Healthy Community:

1. MEASURE - taking samples & recording the measurements: this becomes “data”
2. MONITOR - collecting data over time in a systematic way, so that you can track changes in the environment over time.
3. TAKE ACTION - determining what actions could be taken that could lead to solving problems or making improvements in the environment.

NEXT STEPS:
This Introduction is meant to make you more aware of the importance of good water quality in waters used for recreational purposes, and to give you a sense of the importance of recreational water quality testing and its benefits to communities and countries. You might decide that it is worthwhile to set up a monitoring programme. Communities can do most of the work but will need to have resources including technical skills, equipment and training, as well as a programme for getting and maintaining the interest of stakeholders. For any programme to be successful it must be sustainable; testing must be continuous and conscientious. Remember, help is as close as your computer and a phone call to your local Environmental Health Department.

EASY INFORMATION SOURCES:

THE LBS PROTOCOL:

GEF-IWCAM:
“Protecting Our Watersheds and Coastal Areas: Community Tools for Managing Land and Water Resources in the Caribbean”
(www.iwcam.org | www.cehi.org.lc)