

CWIP

White River Rapid Assessment

Coastal Water Quality Improvement Project

USAID Contract No. 532-C-00-98-00777-00

White River Rapid Assessment

July 31, 2000

Prepared for the

Government of Jamaica's
National Environment and Planning Agency

And the

United States Agency for International Development

Implemented by:

Associates in Rural Development, Inc.
P.O. Box 1397
Burlington, Vermont 05402

Table of Contents

Preface	5
1.0 Introduction	6
2.0 Approach and Limitations of Study	6
3.0 Study Team	6
4.0 Description of River Basin and Sample Sites	8
4.1 River Basin	8
4.2 Sample Sites	10
5.0 Results and Discussion of Data	16
5.1 Chemical	16
5.2 Bacteriological	18
5.3 Biological	19
6.0 Conclusion and Management Options	21
Appendix	23
Letter from Discovery Bay Marine Laboratory	

Preface

The Coastal Water Quality Improvement Project (CWIP) is a six-year bilateral initiative between the Government of Jamaica's National Environment and Planning Agency (NEPA)/Natural Resources Conservation Authority (NRCA) and the United States Agency for International Development (USAID). Five distinct, but interrelated, activities associated with coastal water quality improvement are being carried out to form a synergy of interventions contributing to the achievement of the USAID Strategic Objective 2 (SO2) – Improved quality of key natural resources in selected areas that are both environmentally and economically significant. CWIP is being implemented by Associates in Rural Development, Inc. (ARD) with assistance from Camp, Dresser & McKee, Inc. (CDM) and the Construction Resource and Development Centre (CRDC).

1.0 Introduction and Purpose of Assessment

A general study of the White River basin was done over the period April 3 – April 11, 2000 under the auspices of the Coastal Water Quality Improvement Project (CWIP) of the Natural Resources Conservation Authority (NRCA). The study was requested by residents and proprietors of businesses in the area who wanted to know the status of the water quality of the river as, over the years, concerns have been raised about possible pollution, also the suitability of the water for bathing, rafting, and other recreational uses. The study therefore sought to collect information that would determine the water quality status of the white river with reference to activities associated with river usage, and the impact of the activities of establishments situated along the river course. Findings of the study would be communicated to stakeholders.

A survey of the reach of the river was done on April 3, while sampling activities and a more detailed assessment was carried out on April 11th.

2.0 Approach and Limitations of Study

The study was conducted as a rapid assessment to provide a “snap shot” evaluation of conditions along the river course. A more detailed assessment would be necessary to amplify on the findings and to satisfy any other terms of reference (TOR).

Information collected related to:

- a) Chemical, biological, and bacteriological parameters as indicators of water quality. Parameters chosen included nutrients (nitrogen and phosphorus), relevant animal and plant life, and fecal coliform organisms.
- b) Uses of the River and lands adjoining the river;
- c) Presence of industrial activities, farming, and/or housing settlements proximal to the river course; and
- d) Physical configuration of the river course and drainage.

3.0 Study Team

The study team comprised the following individuals:

- a) A. M. Greenaway, Ph.D. – Senior Lecturer in the Department of Chemistry and Associate of the Centre for Marine Sciences at the University of the West Indies (UWI);
- b) Eric Hyslop, Ph.D. – Senior Lecturer in the Department of Life Sciences at the UWI;
- c) Kimberly John – Graduate Student in the Department of Life Sciences with an interest in aquatic biology and the use of aquatic life as indicators of pollution in freshwater systems in Jamaica;
- d) Dwight McKoy – Environmental Protection Officer at the Laboratory of the National Environment and Planning Agency/Natural Resources Conservation Authority (NEPA/NRCA);
- e) Denise Forrest – Environmental Management Systems Specialist (EMSS) with the Coastal Water Quality Improvement Project (CWIP); and

f) Louis Daley – Pollution Prevention Policy Specialist (PPPS) with CWIP.

4.0 Description of River Basin and Sample Sites

4.1 River Basin

The White River basin is located between the Rio Nuevo basin on the east and the Dry Harbour basin on the west. The river, which forms the border between the parishes of St. Ann and St. Mary, has its genesis in the Guys Hill area at an elevation of approximately 580 m. It flows approximately 26 km to the north where it enters the sea at White River Bay. At the time that this study was done, the tributaries flowing from Guys Hill were nearly dry. The study therefore commenced on the property of Forevergreen Farms where a leg of the river springs from the bottom of a deep valley at an elevation of approximately 280 m. The river flows about 11 km to the coast from this point.



Channel of White River tributary nearby Wilderness Resorts



Genesis of White River on property belonging to Forevergreen Farms

Flows over the past 10 years are as follows:

- Mean: 2.9 m³/s
- Maximum: 4.2 m³/s
- Minimum: 2.1 m³/s

At the time of the study, flows measured at Exchange approximated 3.5 m³/s

Uses of the River

Uses of the river noted by the study team encompassed a wide range of activities. These included the following:

1. Recreation – tubing, rafting, swimming;
2. Drinking water – Labyrinth and Thatch Hill;
3. Hydropower;
4. Disposal of liquid and solid waste;
5. Washing of motor vehicles.

4.2 Sample Sites

Site No. 1

This site was the main tributary of the White River located on Forevergreen Farms. Samples were collected from the pond just downstream of the tributary north of Up Park Pen. The area was a narrow forested gorge, less than 0.6 m deep and 3-4 m wide, at an elevation of about 300 meters above sea level. The substrate consisted of karst boulders, cobble, and pebbles. There was no biological growth on rocks in the riverbed; however, there was vegetation on both riverbanks. Though not a pastureland, there were cow plats on the eastern bank of the river.

The water at this site was clear with a somewhat quiet flow. Samples were taken at 8:50 am under cloudy conditions approximately 1.0 m from the west bank of the river in fast flowing water.

Site No. 2

This site was located in a picnic area on Forevergreen farms on the lower reach of the main tributary approximately 1.5 m downstream of the first point. The western bank of the river was steep and forested, with the eastern bank sloping. The water was clear, but a splattering of filamentous algae was observed attached to submerged rocks near the surface. The river at the is point was fast flowing and approximately 10.0 m wide and 15.0 cm deep with substrate consisting of karst cobble, pebbles, and sand. Cow plats were visible in the area.

Samples were taken at 9:45 am below the swimming area approximately 10.0 m downstream of the beginning of the rapids. The weather was cloudy.

Site No. 3

This site was located in Labyrinth approximately 100.0 m below the National Water Commission's (NWC) potable water treatment plant, and 15.0 m downstream of an overhead bridge. The river at this point was about 15.0 m wide and 10.0 cm deep, fast flowing, with a substrate consisting of pebbles and coarse sand. Sampling time was 10:40 am under cloudy conditions.

Site No. 4

Samples were taken at the impoundment forming the intake to the Jamaica Public Service's (JPS) Hydro station. The water was cloudy and slightly greenish in color with litter floating on the surface. The substrate was somewhat muddy, and weeds were seen growing on the sides of the impoundment. The sample was taken at 11:35 am and the weather was cloudy.

Site No. 5

Samples were taken at Thatch Hill behind the hydropower impoundment, and from the bank on the St. Ann side of the river near to a picnic area approximately 100 m of where the hydropower station diversion starts, and 10 meters downstream of the NWC potable water takeoff. The river at this point was about 15-20 m wide and 2.5 meters deep with a muddy bottom underlain by stones. The area at the time marked the termination point for a water sport activity for tourists – tubing. Flows were slow and there was litter on the surface and on the bottom of the river. Sampling time was 11:50 am under cloudy conditions.

Site No. 6

Samples were taken at the starting point of the Calypso Rafting venture near the middle of the river. The river was 20 m wide at this point, generally shallow, but approximately 50 cm deep at the sampling point. River flow was turbulent and the water was a cloudy white with a white precipitate on the substrate that was largely pebbles and sand. Sampling time was 12:55 pm. It had rained immediately before the samples were taken.

Site No. 7

Sampling at this site was done midstream of the river, about 100 meters downstream of some houses situated along the eastern bank of the river on the St. Mary side. The river was some 10 m wide, having a depth of about 1 m near the eastern bank and dropping off to near 0 m on the western bank. Though the water was flowing rapidly, filamentous growths of algae were seen on the substrate which was largely pebbles and sand with a white muddy deposit. The samples were taken at 1:30 pm under cloudy conditions.

Site No. 8

Samples were collected from a raft about 30 m upstream of the confluence of the Salt River close to the middle of the white River. The area was about 20 m downstream of a discharge pipe coming from a commercial property adjacent to the eastern bank. The pipe was dripping at the time of sampling. The river was about 20 m wide and 1 meter deep at this point, with a dense growth of filamentous algae, duckweed, and *Elodea* covering the surface. The surface was 90% covered with this growth. Flows were quiet and the water was a cloudy white. Sampling time was 2:05 pm with the weather sunny.

Site No. 9

This sample set was taken about 30 m upstream of the mouth of the river, 100 m from the White River fishing beach, and 50 m downstream of a wastewater effluent discharge coming from a commercial property located adjacent to the eastern bank of the White River. There was a dense growth of filamentous algae, *Elodea*, and other rooted aquatic plants within the river and at the margins at this point. Flows were slow. Sample time was 3:15 pm under sunny skies.

Site No. 10

Samples were taken in the middle of a beach area east of the mouth of the river. Water depth at the sample point was about 75 cm. The water was cloudy and algae were seen growing on the

rocky substrate. Approximately 10 persons were on the beach. Samples were taken at 3:20 pm under sunny conditions.

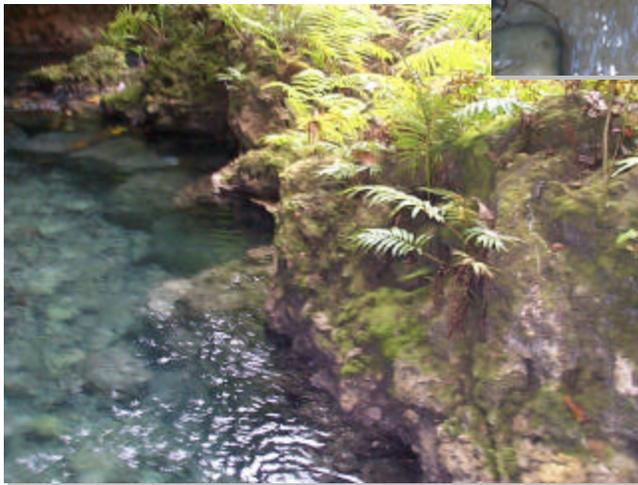


Preparing to sample on the property of Forevergreen Farms





Samples being collected



Appearance of river of river between sample points 1 and 8

Appearance of river between sample points 8 and 9



Discussions with persons familiar with the area suggest the presence of a pig farm somewhere proximal to the course of the river. None was seen, however, at the time that this investigation was done.

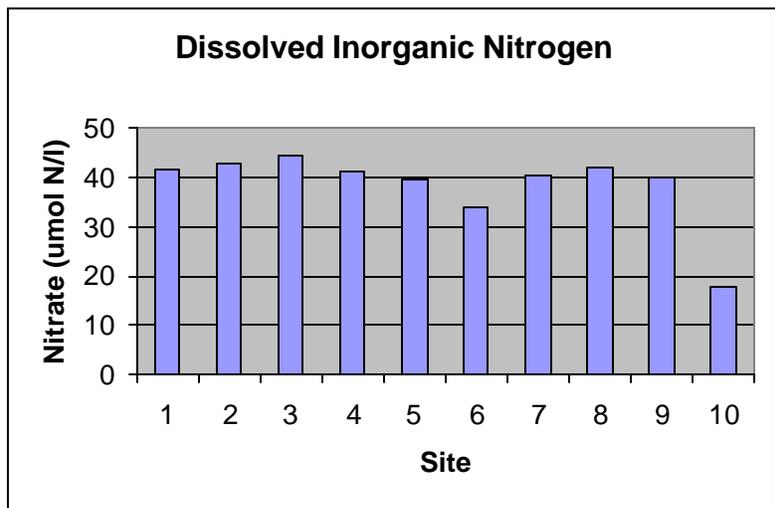
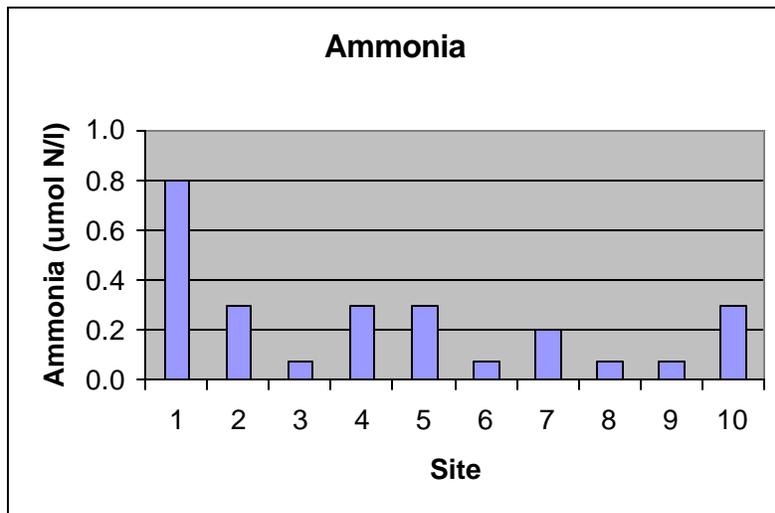
5.0 Results and Discussion of Data

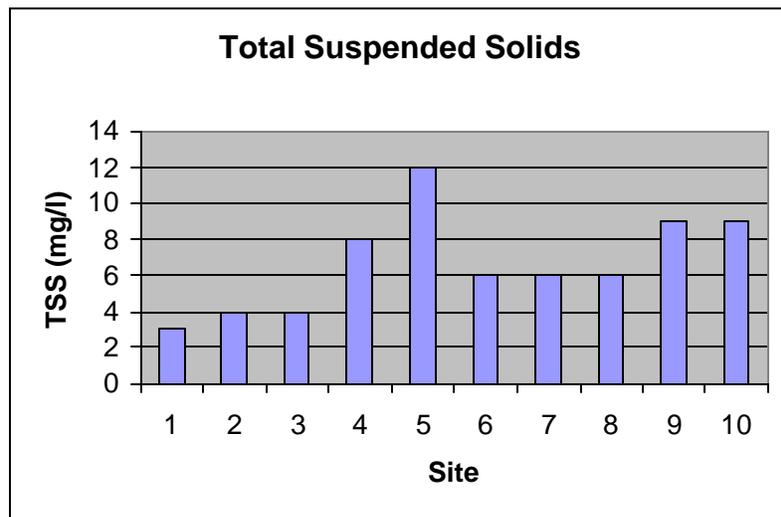
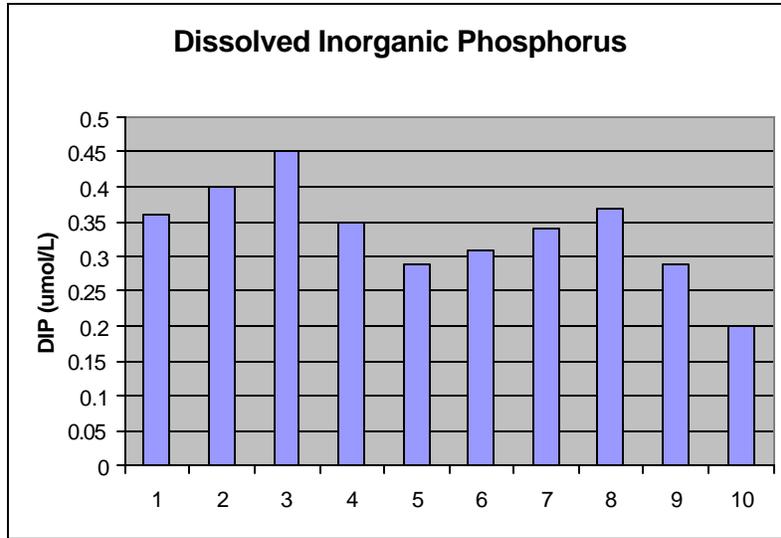
Analytical results for this survey is presented in the appendix found at the end of this report. A synopsis of the findings is presented below.

5.1 Chemical

The data showed little variability in the concentrations of the constituents examined as a function of distance down the river, suggesting that the activities along the river were having minimal effects on the chemistry of the river. Concentrations for nitrates were a bit elevated, with similarities to concentrations in fresh water springs found in the hills behind Discovery Bay and the Turtle River in Ocho Rios.

There was a marginal drop in the nitrate and phosphate concentrations between sites 4 and 6. The beginning of algal growth on rocks along the riverbed was noted below site 6. There was also a drop in conductance at site 6 coincident with the presence of a coating of a white substance on the riverbed suggesting the precipitation of calcium carbonate.





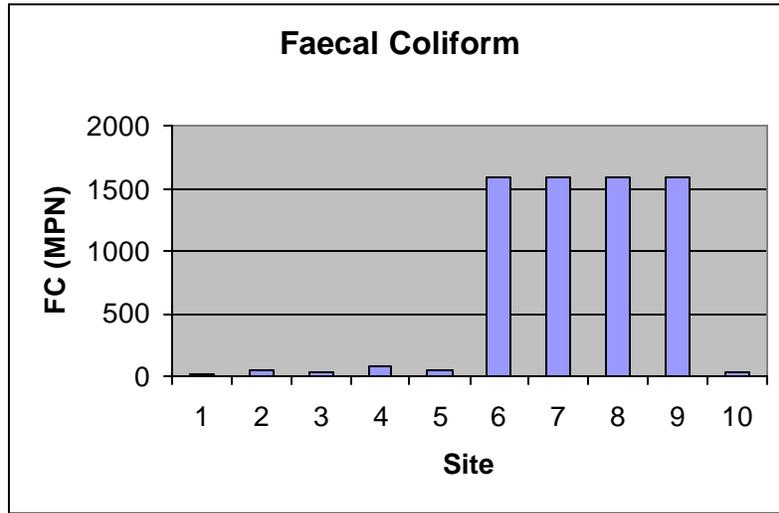
Discussion

Nutrients (nitrogen contained in the available forms of oxides of nitrogen, and phosphorus contained in the available forms of oxides of phosphorus), stimulate plant growth, and cause a proliferation of this growth under eutrophic conditions. These conditions can lead to a general deterioration in water quality with depletion in dissolved oxygen and the creation of anoxic conditions under certain conditions. The nutrient status (forms and concentrations) within the aquatic environment over a period influence the types and numbers of plant and animal species found in the aquatic environment.

Nutrients are derived from the decomposition of organic matter such as sewage, kitchen waste, decaying flesh, and inorganic fertilizers used on farms. Presently there are no concrete or definitive nutrient standards for recreational waters.

5.2 Bacteriological

Examination for the presence of fecal coliform organisms showed moderate concentrations between sites 1 to 5, and very high concentrations between sites 6 to 9. Concentrations returned to moderate at site number 10, which were exposed to the dilution effects of the sea.

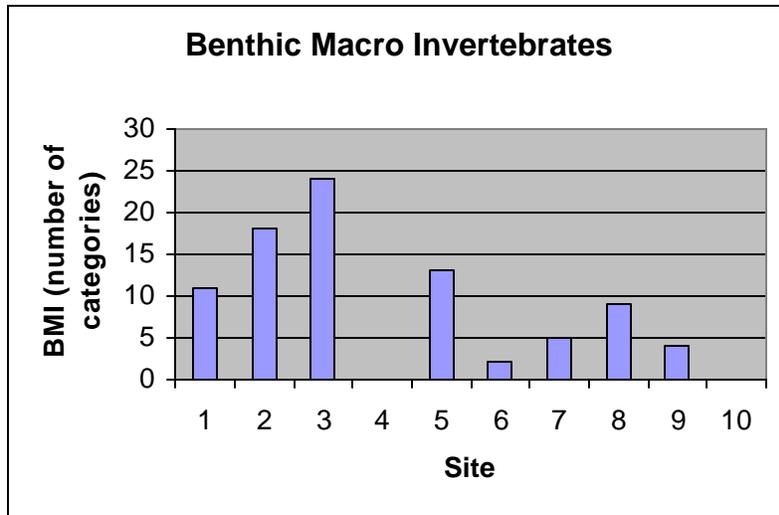


Discussion

Fecal coliforms are bacteria associated with the alimentary canal of warm blooded animals and as such indicates the possible presence of fecal contamination. The NEPA/NRCA guideline for the occurrence of these organisms in recreational waters is no more than 200 MPN/100 ml of water.

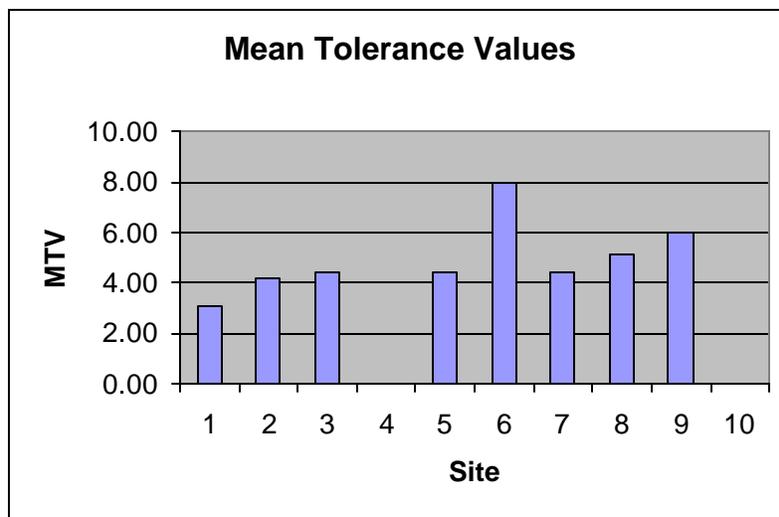
5.3 Biological

Data describing the types and distribution of benthic macro invertebrates (BMIs) categorizes the river as being healthy when considered as a whole. A different picture is presented, however, when the data is examined on a site by site basis. Here sites 1 to 4 show relatively unpolluted waters, while some deterioration is evidenced at site 6. The beginning of algal growth on rocks along the substrate was evidenced. Sites downstream of site 6 show some degree of recovery, with a suggestion that there may be a second input of organic pollution between sites 8 and 9 as evidenced by a decrease in BMI taxa and increased growth of filamentous algae. Interpretation of the data for sites 6 to 9 was complicated by a deposit of calcium carbonate, which could have contributed to the reduction of BMI between sites 6 to 9.



Discussion

An application of a modified scheme of mean tolerance values derived by Hiselhoff suggests that most of the sites sampled have good to very good water quality, with site 1 being rated as excellent. Sites 8 and 9 showed fair and fairly poor ratings with site 6 showing very poor water quality. This information showed broad agreement with the findings of the BMI analysis.



Plants and animal species living in the river provide an excellent indicator of water quality as the various species are influenced by conditions occurring in the river.

6.0 Conclusion and Management Options

Samples were taken during a relatively dry period when conditions in the river are expected to be at their “worse”. The upper reach of the river, however, show relatively good water quality (sites 1 – 5). There was some deterioration, however, in the reach below site 5. Deterioration at site six and could be due to the drainage of organic material (sewage) from soak away pits serving houses in the Exchange community, the community located upstream of site 6, also non-point discharges from farming practices upstream of site 6. Point discharges above sites 8 and 9 could be lending to the nutrient loading of the river.

A more detailed study is needed to isolate pollution sources and to determine the magnitude of pollution loading, as well as the impact on the reach of the river. A closer evaluation of the Exchange area should also be done to determine the activities in this area and their relationship to the watercourse. With this done, intervention strategies could be developed to mitigate against pollution episodes.

In the meantime, the following considerations should be evaluated:

1. Careful attention should be given to usage of the river. Users should adhere to guidelines and regulations established by national and local planning authorities, NEPA, and the health authorities.
2. Every effort should be made to connect to the sewage system where possible, and where not possible alternate methods of waste disposal that will mitigate against the introduction of pollutants in the waterway should be investigated.
3. Residents should seek out information that will inform them broadly on issues related to environmental management.
4. Existing and applicable laws should be enforced.

Discovery Bay Marine Laboratory University of the West Indies Chemical Analytical Facility

A.M. Greanaway, Ph.D.
P.O. Box 35, Discovery Bay
Jamaica, West Indies
Telephone: (876) 973-2241
Fax: (876) 973-3091
Email tgreen@uwimona.edu.jm

May 5, 2000

Mr. L. Daley
CWIP
5 Oxford Park Avenue
Kingston 5

Dear Mr. Daley:

Please find attached the results for analyses conducted on the samples collected from the White River, Ocho Rios on April 11, 2000 and an invoice for our services.

The analytical methods used were the same as for other work we have done for the CWIP program.

Site descriptions and observations made while sampling are as follows:

- Site 1: On Ever Green property close to the water pumping station. Samples were collected from the pond just downstream of the spring of the White River tributary north of Up Park Pen. Samples taken approximately 1m from the western bank in fast flowing water between a large rock and a small waterfall at the downstream end of the pond. The pond at the sampling site was approximately 1.5m deep and the water was clear with a few floating leaves. The substrate was stony. There was considerable vegetation on both river banks. There were many cow plats on the tracks and the "parking" area. Sampling time 8:50 a.m. The weather was cloudy.
- Site 2: On Ever Green property at a picnic site on the lower reaches of the above tributary. Sampled below the swimming area about 10m downstream of the beginning of the rapids. River is about 10.0 m wide and 15.0 cm deep. The water was clear and the substrate stony. There was litter and cow plats in the picnic area. There was a steep hill on the St. Ann side of the river. Sampling time 9:45 a.m. The weather was cloudy.
- Site 3: Sampled below the bridge at the White River NWC water treatment station at Labarinth. The water was clear and fast flowing. The substrate was stony. The river was about 15m wide and 10cm deep. Sampling time 10:40 a.m. The weather was cloudy.

Site 4: Samples were collected from the intake to the hydro station pipe. There was litter floating on the reservoir and a considerable amount of weed growing on its sides. The water was slightly cloudy. Sampling time 11:35 a.m. The weather was cloudy.

Site 5: Sampled from the bank on St. Ann side of the river near to a picnic area (with barbecue), approximately 100 m upstream of where the hydropower station diversion starts and 10m downstream of the NWC water take off. The water was floating slowly with a lot of plant litter on the surface. The river was about 2m deep at the sampling site and about 20m wide. The substrate was muddy and rocky. Sampling time 11:50 a.m. The weather was cloudy.

Site 6: Sampled near the middle of the river at the starting point for the Calypso Rafting. River was about

Site No. 3

This site was located in Labyrinth approximately 100.0 m below the National Water Commission's (NWC) potable water treatment plant, and 15.0 m downstream of an overhead bridge. The river at this point was about 15.0 m wide and 10.0 cm deep, fast flowing, with a substrate consisting of pebbles and coarse sand. Sampling time was 10:40 am under cloudy conditions.

Site No. 4

Samples were taken at the impoundment forming the intake to the Jamaica Public Service's (JPS) Hydro station. The water was cloudy and slightly greenish in color with litter floating on the surface. The substrate was somewhat muddy, and weeds were seen growing on the sides of the impoundment. The sample was taken at 11:35 am and the weather was cloudy.

Site No. 5

Samples were taken at Thatch Hill behind the hydropower impoundment, and from the bank on the St. Ann side of the river near to a picnic area approximately 100 m of where the hydropower station diversion starts, and 10 meters downstream of the NWC potable water takeoff. The river at this point was about 15-20 m wide and 2.5 meters deep with a muddy bottom underlain by stones. The area at the time marked the termination point for a water sport activity for tourists – tubing. Flows were slow and there was litter on the surface and on the bottom of the river. Sampling time was 11:50 am under cloudy conditions.

Site No. 6

Samples were taken at the starting point of the Calypso Rafting venture near the middle of the river. The river was 20 m wide at this point, generally shallow, but approximately 50 cm deep at the sampling point. River flow was turbulent and the water was a cloudy white with a white precipitate on the substrate that was largely pebbles and sand. Sampling time was 12:55 pm. It had rained immediately before the samples were taken.

Site No. 7

Sampling at this site was done midstream of the river, about 100 meters downstream of some houses situated along the eastern bank of the river on the St. Mary side. The river was some 10 m wide, having a depth of about 1 m near the eastern bank and dropping off to near 0 m on the western bank. Though the water was flowing rapidly, filamentous growths of algae were seen on the substrate which was largely pebbles and sand with a white muddy deposit. The samples were taken at 1:30 pm under cloudy conditions.

Site No. 8

Samples were collected from a raft about 30 m upstream of the confluence of the Salt River close to the middle of the white River. The area was about 20 m downstream of a discharge pipe coming from a commercial property adjacent to the eastern bank. The pipe was dripping at the time of sampling. The river was about 20 m wide and 1 meter deep at this point, with a dense growth of filamentous algae, duckweed, and *Elodea* covering the surface. The surface was 90% covered with this growth. Flows were quiet and the water was a cloudy white. Sampling time was 2:05 pm with the weather sunny.

Site No. 9

This sample set was taken about 30 m upstream of the mouth of the river, 100 m from the White River fishing beach, and 50 m downstream of a wastewater effluent discharge coming from a commercial property located adjacent to the eastern bank of the White River. There was a dense growth of filamentous algae, *Elodea*, and other rooted aquatic plants within the river and at the margins at this point. Flows were slow. Sample time was 3:15 pm under sunny skies.

Site No. 10

Samples were taken in the middle of a beach area east of the mouth of the river. Water depth at the sample point was about 75 cm. The water was cloudy and algae were seen growing on the rocky substrate. Approximately 10 persons were on the beach. Samples were taken at 3:20 pm under sunny conditions.

CWIP

Coastal Water Quality Improvement Project