OHIO DEPARTMENT OF HEALTH

246 North High Street
Columbus, Ohio 43215

614/466-3543
www.odh.ohio.gov

Ted Strickland/Governor

Alvin D. Jackson, M.D./Director of Health

December 21, 2010

Alex Schusler, Project Officer
Water Division, USEPA
77 West Jackson Blvd., WS-15J
Chicago, IL 60604

RE: Final Beach Grant Report – CU-00E52601-0

Dear Mr. Schusler,

Enclosed please find a copy of the final report for Ohio's Beach Monitoring Grant program. We wish to thank you for the opportunity to provide Lake Erie beach monitoring services for the residents of Ohio.

If you have any questions or would like to discuss the information in this report, please feel free to call 614-466-1390 and ask to speak with Mary Clifton, Program Administrator or myself.

Sincerely,

W. Gene Phillips, MPH, RS
Chief, Bureau of Environmental Health
Ohio Department of Health
246 N. High Street
Columbus, OH 43215

Cc: Holly Wirick, US EPA

YEAR 2010 BATHING BEACH MONITORING PROGRAM RESULTS

Ohio conducts a monitoring and notification program of selected public and semi-public beaches located along the Ohio/Lake Erie border. The goal of the program is to monitor the water quality of the state's bathing beach waters and to notify the public whenever bacteria levels present a potential health risk to bathers. The program involves the efforts and cooperation of multiple state and local health agencies and organizations. The Ohio Department of Health (ODH) coordinates the state effort and is responsible for monitoring several beach locations along the border.

There are 62 public and semi-public beaches that are monitored every season by ODH and our partners. The Ohio Department of Natural Resources (ODNR) published "Ohio's Lake Erie Public Access Guidebook" in 2010. This guidebook revealed that there are 164 points of public access to Lake Erie in Ohio and "nearly 53 miles of publicly accessible shore."[1] Work will begin next bathing season on determining if the 102 points of public access that are not being monitored currently should be added to the list of monitored beaches. Due to the limited funding available for this program, if the decision is made to add these additional points of access, monitoring at the current beaches may be reduced.

The normal beach season in Ohio runs approximately 13 weeks, from Memorial Day to Labor Day. For the 2010 swimming season, the ODH started collecting samples a week before Memorial Day in an attempt to provide a preseason set of samples. Sampling frequency throughout the locations changes with the number of visitors observed at the beach location. Many of the more frequently visited beaches, such as Edgewater, Villa Angela, Euclid, Headlands State Park, and Fairport Harbor are sampled 7 days a week. The ODH collected water samples from most beaches at a frequency of 4 days per week. Water sampling at two island beaches, Camp Perry and Catawba Island, on Lake Erie was reduced from four times per week to once per week due to historical results which indicated that the bacteria levels have rarely presented a potential health hazard. Another reason for the reduction in the sampling frequency at these beaches was due to a history of minimal use by the public. These two locations were sampled once per week unless the sample results indicated elevated E.coli levels that resulted in an advisory being posted. When this occurred, an additional sample was collected and analyzed on the next available business day. Table 1 indicates the sampling frequencies:

[1] Ohio's Lake Erie Public Access Guidebook, 2010, Ohio Department of Natural Resources

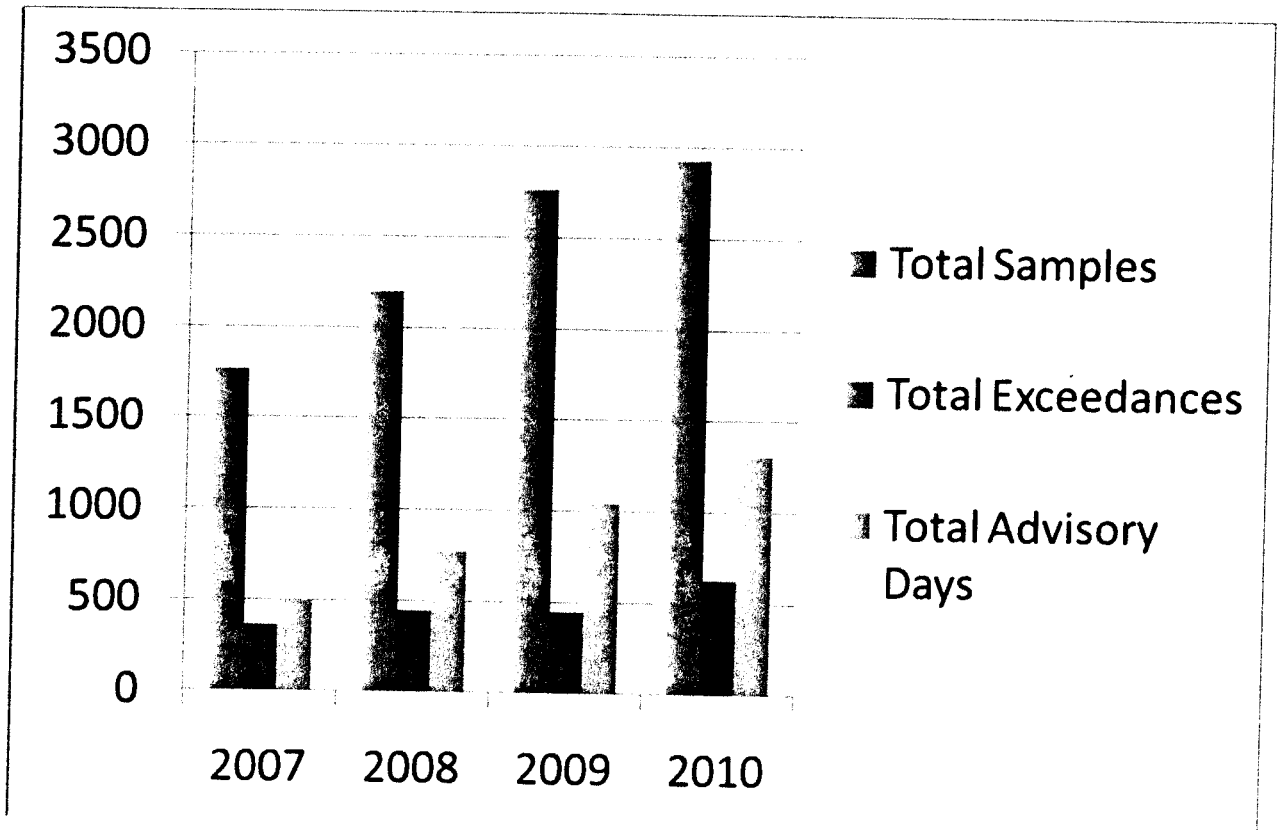
Table 1

7 samples per week	6 beaches
5-6 samples per week	1 beach
4 samples per week	36 beaches
1+ sample per week	3 beaches
Minimum of 1 sample per week	16 beaches

Even with the sampling frequency at 2 of the beaches being reduced from 4 times per week to once per week and the sampling frequency at Huntington Beach reduced to an average of 5.5 samples per week, a total of 2931 samples were collected during the 2010 season. This is an increase of 167 samples from 2009, which had 10 more days in the reporting cycle, and a total percentage increase of 39.85% in the number of samples taken for reporting since 2007.

Figure 1 represents the sampling efforts in Ohio's bathing beaches over the past 4 years.

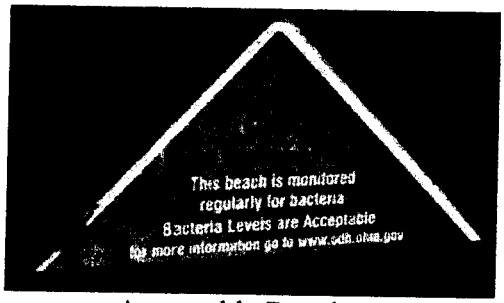
Figure 1



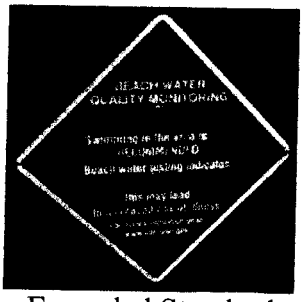
Data from the last 4 seasons indicate that the number of sample exceedances has risen as well as the number of days that Ohio's beaches are under an advisory. One reason for these increases is that Ohio samples every Tier 1 beach more than once a week. Ohio's percentage of exceedances was 21% in 2007, 19% in 2008, 16% in 2009 and 21% in 2010. Nationally, according to the NCRS publication, "Testing the Waters", the percentage was 7% in 2007, 2008 in 2009.

During 2010, water quality analysis in Ohio was based upon the single sample maximum established by the United States Environmental Protection Agency (USEPA) of 235 E. coli colony forming units (cfu) per 100mL. of water sampled. All water samples collected by ODH staff were analyzed at private microbiological laboratories for E. coli bacteria content. ODH, Erie County, and Lake County used the Collilert-18 method for sample analysis which has a maximum detection limit, without dilution, of 2419.6 cfu. Cuyahoga County and the Northeast Ohio Regional Sewer District used the Modified M-tech to analyze their samples. When sample results exceeded the standard of 235 cfu, advisory signs were posted to alert the bathing public of the water quality. Under normal circumstances, beaches are not closed solely due to high bacteria levels. However, the signage helps to educate the public and provides valuable data for making informed decisions about their aquatic recreational activity.

The following pictures are examples of the signage posted at a beach location to alert the public whether the sample results from the previous day were acceptable or if the results exceeded the bacterial standard.



Acceptable Results


Exceeded Standard

The ODH posted a request for proposals (RFP) to administer the beach monitoring and notification program at the local level in February 2010. In addition to posting the RFP on the internet, the local health jurisdictions that have beaches but have not participated in this program were contacted and encouraged to apply for the sub-grant. A total of five proposals were received. The proposals were reviewed and contracts were awarded. The total amount of money awarded to local health jurisdictions was $84,000.00, which represents 37.5% of the money awarded to ODH by the US EPA.

Contracts were awarded to the Lake County General Health District, Erie County General Health District, Cuyahoga County Board of Health, and the Northeast Ohio Regional Sewer District. The Lake County General Health District monitored 3 public beaches. The Erie County General Health District monitored 25 public beaches within its jurisdiction. The Northeast Ohio Regional Sewer District monitored 3 beaches in its area. The Cuyahoga County Board of Health monitored 16 beaches within its jurisdiction most of which are semi-public and private beaches.

Name of Contracted Entity	Amount of Award	Number of beaches monitored
Lake County General Health District	$15,500.00	3
Erie County General Health District	$31,500.00	25
Cuyahoga County Health District	$23,750.00	16
Northeast Ohio Regional Sewer District	$8,770.00	3
Cleveland Department of Public Health	$4,480.00*	Educational program only

The Cleveland Department of Public Health was awarded $4,480.00; however, due to their inability to fulfill their contractual obligations they were only paid $1,493.00 for the 2010 season.

Monitoring Data generated by the Ohio Department of Health and its service partners for the 2010 recreation season.

The single sample maximum level was used to evaluate sample results. Results were reported for evaluation against the standard, determination of whether an advisory was warranted, and notification to the public when necessary. The data was then transmitted to ODH and then to the US EPA for its e-beaches database.

The remaining 15 beaches were monitored by the ODH. Interns collected the samples for analysis at EPA approved laboratories. The results where then emailed to the ODH for review and advisory determination. These results and determinations were then communicated directly to the beach manager for action.

Table 2 is a summary of the sampling results and advisories for the monitored beaches in the State of Ohio.

Table 2

ID #	Name	Samples taken	Advisory days	Sample	Average Ecoli per sample taken	%Sample exceedance	% of the season on advisory	Average Daily Ecoli
OH400405	Conneaut Twp. Park	57	9	6	120.02	10.53%	8.65%	65.78
OH682568	Geneva State Park	57	5	2	83.42	3.51%	4.81%	45.72
OH882395	Lakeshore Park	57	36	18	408.51	31.58%	34.62%	223.89
OH610732	Walnut Beach	57	10	4	95.51	7.02%	9.62%	52.35
OH491555	Fairport Harbor	102	11	11	112.51	10.78%	10.58%	109.99
OH777353	Headlands State Pk. (East)	102	14	15	102.87	14.71%	13.46%	102.52
OH719776	Headlands State Pk. (West)	102	15	16	99.25	15.69%	14.42%	99.10
OH244759	Euclid State Park	102	46	45	442.32	44.12%	44.23%	433.82
OH736320	Villa Angela State Park	104	40	42	694.23	40.38%	38.46%	696.01
OH270037	Edgewater Beach	102	12	13	196.02	12.75%	11.54%	193.01

OH183537	Huntington Beach	81	16	10	115.48	12.35%	15.38%	89.94
OH810688	Arcadia Beach	14	29	4	144.86	28.57%	27.88%	19.50
OH983073	Bay Park Beach	14	20	3	443.43	21.43%	19.23%	59.69
OH135472	Clarkwood Beach	14	29	4	433.93	28.57%	27.88%	58.41
OH964162	Edgecliff Beach	13	20	3	107.62	23.08%	19.23%	13.45
OH507120	Moss Point Beach	14	22	3	492.00	21.43%	21.15%	66.23
OH159626	Noble Beach	14	42	6	644.07	42.86%	40.38%	86.70
OH645425	Parklawn Beach	14	13	2	431.71	14.29%	12.50%	58.12
OH934275	Royal Acres Beach	14	36	5	574.71	35.71%	34.62%	77.37
OH435857	Sims Beach	14	28	4	1161.86	28.57%	26.92%	156.40
OH775880	Utopia Beach	14	14	2	87.25	14.29%	13.46%	11.75
OH136995	Wagar Beach	13	27	4	525.23	30.77%	25.96%	65.65
OH862936	Columbia Park Beach	13	40	5	894.38	38.46%	38.46%	111.80
OH484007	Clifton Beach	25	29	7	259.92	28.00%	27.88%	62.48
OH678348	Shorehaven Beach	14	14	2	362.71	14.29%	13.46%	48.83
OH179611	Shoreby Club Beach	14	7	1	500.29	7.14%	6.73%	67.35
OH597908	Century Beach	55	27	14	220.62	25.45%	25.96%	116.67
OH273826	Lakeview Beach	55	47	22	297.56	40.00%	45.19%	157.37
OH133557	Kelleys Island St. Pk.	13	0	0	24.31	0.00%	0.00%	3.04
OH625113	Battery Park	51	2	2	69.20	3.92%	1.92%	33.27
OH510880	Bay View East	53	37	21	576.77	39.62%	35.58%	293.93
OH568760	Bay View West	54	15	9	132.71	16.67%	14.42%	68.91
OH011172	Cedar Point	54	10	7	160.84	12.96%	9.62%	83.51
OH934406	Chappel Creek	55	21	12	232.54	21.82%	20.19%	120.74
OH014323	Cranberry Creek	55	14	8	113.30	14.55%	13.46%	59.92
OH158931	Crystal Rock	54	40	21	471.51	38.89%	38.46%	244.82
OH881916	Darby Creek	43	25	11	329.41	25.58%	24.04%	136.20
OH517567	Edson Creek	55	73	35	911.30	63.64%	70.19%	481.94
OH242977	Fichtel Creek	55	4	4	115.06	7.27%	3.85%	59.74
OH497945	Hoffman Ditch	52	14	8	180.75	15.38%	13.46%	88.63
OH531706	Huron River East	54	12	6	139.90	11.11%	11.54%	72.64
OH102681	Huron River West	55	31	16	239.52	29.09%	29.81%	126.67
OH661129	Kiwanis Park	53	30	16	295.48	30.19%	28.85%	147.74
OH921073	Lion's Park	53	28	16	311.26	30.19%	26.92%	158.63
OH647956	Old Woman Creek East	53	9	2	62.52	3.77%	8.65%	31.86
OH787470	Old Woman Creek West	55	1	1	91.77	1.82%	0.96%	48.53
OH957157	Pickeral Creek	54	32	17	318.17	31.48%	30.77%	165.21
OH453378	Sawmill Creek	53	30	17	278.99	32.08%	28.85%	139.49
OH840983	Sherod Creek	55	41	23	440.25	41.82%	39.42%	232.83
OH287343	Showse Park	55	14	8	130.19	14.55%	13.46%	68.85
OH513071	Sugar Creek	54	28	16	320.71	29.63%	26.92%	166.52

OH084281	Vermilion East	55	32	20	354.05	36.36%	30.77%	187.24
OH944567	**Vermilion West**	**55**	**34**	**18**	**380.91**	**32.73%**	**32.69%**	**201.44**
OH422598	Whites Landing	52	17	10	217.76	19.23%	16.35%	108.88
OH351307	**Camp Perry**	**17**	**9**	**3**	**161.71**	**17.65%**	**8.65%**	**26.43**
OH396459	Catawba Island St. Pk.	16	2	1	119.81	6.25%	1.92%	18.43
OH685679	**East Harbor State Park**	**57**	**0**	**0**	**16.46**	**0.00%**	**0.00%**	**9.02**
OH216093	Lakeside	57	9	3	47.20	5.26%	8.65%	25.87
OH463595	**Port Clinton (Lakeview)**	**57**	**6**	**3**	**35.11**	**5.26%**	**5.77%**	**19.24**
OH907394	South Bass Island St. Pk.	12	7	1	61.13	8.33%	6.73%	7.05
OH182884	**Maumee Bay St. Pk. (Erie)**	**57**	**15**	**9**	**152.21**	**15.79%**	**14.42%**	**83.42**
OH318877	Maumee Bay St. Pk. (Inland)	57	9	6	114.72	10.53%	8.65%	62.88

Additional money was awarded for a comprehensive beach monitoring and notification system that will be installed at ODH over the next few months. That contract was awarded to Windsor Solutions, Inc. in the amount of $61,728.00.

NOWCASTING and predictive models

During the summer of 2010, the Cuyahoga County Board of Health, with the United States Geological Survey (USGS), continued the predictive modeling project at Huntington Beach, located on Lake Erie in Bay Village, Ohio. The project, known as Nowcasting System for Predicting Beach Advisories, evaluates multiple environmental factors such as rainfall, turbidity, wave height, and various other factors to determine the probability that the E. coli water quality standard will be exceeded. The Nowcast system provides the public with same-day, near real-time water quality data seven days per week.

The recreation season was divided into 2 "subseasons", for which the Nowcast model varied to some degree. Subseason 1 consisted of the time frame from May 24, 2010 through July 24, 2010. The model parameters were the same for each subseason: rainfall amounts, turbidity, and wave height. The only difference was that the rainfall used for the second subseason included the amounts from the previous 24 and 48 hours. During the first subseason, a water quality advisory was issued when the probability of exceeding the water quality standard was at or above a threshold of 23%. Subseason 2 consisted of the time frame from July 25, 2010 through September 6, 2010. A water quality advisory was issued when the probability of exceeding the water quality standard was at or above a threshold of 32%.

A recent review of the 2010 recreational season data by the USGS shows that the Nowcast model accurately predicted water quality conditions for 86% of the season. The remaining 14% of the data was inaccurate and consists of a combination of false positive and false negative results. A false positive result was a prediction of poor water quality when it was actually good, as determined by water sample analysis. A false negative result was a prediction of good water quality when it was actually poor, as determined by water sample analysis.

For 2010, a total of 81 water samples were collected and analyzed for *E. Coli* concentrations. Five of those samples had an associated false positive prediction. Seven samples had an associated false

negative prediction. Steps will therefore continue to be taken to further refine and improve the Huntington Beach model. The CCBH, in conjunction with the USGS, will continue to work to enhance the model in order to reduce the number of false positive and false negative results. [2]

The Northeast Ohio Regional Sewer District (NEORSD) continued the Nowcast predictive model developed in cooperation with the USGS for the beach at Edgewater State Park. The NEORSD sampling crews were equipped with laptop computers and a wireless card, to effectively and efficiently identify water quality issues using the model. The sampling crews entered several variables into the model and posted the appropriate beach signage based on the prediction from the model.

The predictive model used by the NEORSD was broken into three seasons based on the correlation of the data from the previous year. Season-1 lasted from May 3, 2010 through June 15, 2010. Season-2 covered the period of June16, 2010 through August 10, 2010. Season-3 lasted from August 11, 2010 through September 10, 2010. The predictive model developed by the USGS was executed daily throughout each of the seasons. A total of 121 predictions were made using the model, with an overall accuracy of 80%. Using the previous days *E. coli* results to predict water quality resulted in an accuracy of 79%. The models sensitivity or the ability to accurately predict a water quality exceedance, was 81% overall. Using the previous days *E. coli* results to accurately predict a water quality exceedance was only 25%.[3]

As in previous years, it was agreed that water samples would be collected and analyzed for E. coli in the normal fashion in addition to the sample protocol for the Nowcast system. It was also agreed that the Nowcast predictions would be used as the determinant factor for posting water quality advisories at Huntington Beach and Edgewater. A detailed explanation of the project as well as results of sampling and predictions was available to the public throughout the summer at the following website, www.ohionowcast.info.

Additional activities and accomplishments in 2010

In addition to monitoring water quality at beaches along Lake Erie, the NEORSD continued to collaborate with staff of the USGS to evaluate rapid analytical techniques, such as Quantitative Polymerase Chain Reaction (qPCR), in water quality analysis. The NEORSD analyzed a total of 110 samples for E. coli using qPCR. They found that the actual E. coli concentration derived from the qPCR analysis cannot be easily converted into colony forming units per 100 ml of sample (cfu/100ml) and be compared to the culture based method.[4] They performed many different data analyses which can be reviewed in the attached final report.

The Erie County General Health District continued working with the USGS to conduct Immunomagnetic Separation/ Adenosine Triphosphate (IMS/ATP) method and the qPCR method on three beaches. Additionally, the NEORSD also conducted analysis using the IMS/ATP method and the three beaches in its jurisdiction. These methods where being done as a pilot to help the USGS test the efficacy of the 2-4 hour procedure.

---

[2] Cuyahoga County Board of Health Bathing Beach Monitoring and Public Notification Project 2010 Recreation Season Final Report
[3] Northeast Ohio Regional Sewer District 2010 Bathing Beach Monitoring and Public Notification Final Report
[4] Northeast Ohio Regional Sewer District 2010 Bathing Beach Monitoring and Public Notification Final Report

In an effort to expand the number of beaches that use predictive modeling to look at health advisories, the Erie County General Health District and the University of Toledo have begun testing models in their areas and select beaches. The University of Toledo and the USGS have worked on a model for the beach at Maumee Bay State Park Lake beach that was in the testing phase for 2010. The Erie County General Health District continued collecting data for model development. They also had meetings with the USGS pertaining data entry into the Nowcast website for future development of the models.

Cuyahoga County Board of Health
Bathing Beach Monitoring and Public Notification Project

2010 Recreation Season

FINAL REPORT

Contractor: Cuyahoga County Board of Health

Address: 5550 Venture Drive
Parma, Ohio 44130

Federal Tax Identification Number: 34-6000817

Project Manager: Barry Grisez, R.S., Program Manager

Telephone: 216-201-2000

Fax: 216-676-1317

Email: bgrisez@ccbh.net

Table of Contents

Contents of Final Report

This report serves to inform the Ohio Department of Health of the outcome of the 2010 *Cuyahoga County Board of Health (CCBH) Bathing Beach Monitoring and Public Notification Project* as required by the Contract. Included in this report are bathing beach water quality sampling results for both Contract periods: May 24th, 2010 through June 30th, 2010, and July 1st, 2010 through September 30th, 2010. Also included in this report are the results of the implementation of the *Nowcasting System for Predicting Beach Advisories*, documentation to demonstrate the public notification component of the project, and the results of the beach user surveys that were administered.

Sampling Results

The table below shows bathing beach water quality data for all of the beaches that are associated with this project that are located along the Lake Erie shoreline. The data in the table consists of the beach name, the municipality in which the beach is located, the type of beach based upon its classification, the sampling date, and the *E. coli* bacteria content for each water sample that was collected. The table also indicates if a water quality advisory was issued due to an exceedance of the single sample standard of 235 *E. coli* colonies/100ml.

2010 Water Quality Data for Lake Erie Beaches

Beach	City	Tier	Sample Date	*E.coli* per 100mL	Advisory	Comments
Arcadia	Euclid	2	6/2/10	86	No	
Arcadia	Euclid	2	6/8/10	23	No	
Arcadia	Euclid	2	6/15/10	420	Yes	
Arcadia	Euclid	2	6/22/10	100	No	
Arcadia	Euclid	2	6/29/10	250	Yes	
Arcadia	Euclid	2	7/7/10	5	No	
Arcadia	Euclid	2	7/13/10	700	Yes	
Arcadia	Euclid	2	7/20/10	63	No	
Arcadia	Euclid	2	7/27/10	8	No	
Arcadia	Euclid	2	8/3/10	38	No	
Arcadia	Euclid	2	8/10/10	14	No	
Arcadia	Euclid	2	8/17/10	260	Yes	
Arcadia	Euclid	2	8/24/10	27	No	
Arcadia	Euclid	2	8/31/10	34	No	
Bay Park	Bay Village	3	6/1/10	2017	Yes	
Bay Park	Bay Village	3	6/7/10	3400	Yes	
Bay Park	Bay Village	3	6/14/10	36	No	
Bay Park	Bay Village	3	6/21/10	6	No	

Bay Park	Bay Village	3	6/28/10	160	No	
Bay Park	Bay Village	3	7/6/10	5	No	
Bay Park	Bay Village	3	7/12/10	6	No	
Bay Park	Bay Village	3	7/19/10	39	No	
Bay Park	Bay Village	3	7/26/10	56	No	
Bay Park	Bay Village	3	8/2/10	6	No	
Bay Park	Bay Village	3	8/9/10	3	No	
Bay Park	Bay Village	3	8/16/10	200	No	
Bay Park	Bay Village	3	8/23/10	270	Yes	
Bay Park	Bay Village	3	8/30/10	3	No	
Clarkwood	Euclid	3	6/2/10	133	No	
Clarkwood	Euclid	3	6/8/10	140	No	
Clarkwood	Euclid	3	6/15/10	4000	Yes	
Clarkwood	Euclid	3	6/22/10	150	No	
Clarkwood	Euclid	3	6/29/10	680	Yes	
Clarkwood	Euclid	3	7/7/10	76	No	
Clarkwood	Euclid	3	7/13/10	295	Yes	
Clarkwood	Euclid	3	7/20/10	65	No	
Clarkwood	Euclid	3	7/27/10	53	No	
Clarkwood	Euclid	3	8/3/10	1	No	
Clarkwood	Euclid	3	8/10/10	6	No	
Clarkwood	Euclid	3	8/17/10	352	Yes	
Clarkwood	Euclid	3	8/24/10	120	No	
Clarkwood	Euclid	3	8/31/10	4	No	
Clifton	Lakewood	2	6/1/10	375	Yes	
Clifton	Lakewood	2	6/3/10	147	No	
Clifton	Lakewood	2	6/7/10	2000	Yes	
Clifton	Lakewood	2	6/9/10	48	No	
Clifton	Lakewood	2	6/14/10	125	No	
Clifton	Lakewood	2	6/16/10	1020	Yes	
Clifton	Lakewood	2	6/21/10	85	No	
Clifton	Lakewood	2	6/23/10	44	No	
Clifton	Lakewood	2	6/28/10	1360	Yes	
Clifton	Lakewood	2	6/30/10	295	Yes	
Clifton	Lakewood	2	7/6/10	4	No	
Clifton	Lakewood	2	7/8/10	16	No	
Clifton	Lakewood	2	7/12/10	152	No	
Clifton	Lakewood	2	7/14/10	245	Yes	
Clifton	Lakewood	2	7/19/10	18	No	
Clifton	Lakewood	2	7/21/10	14	No	

Clifton	Lakewood	2	7/26/10	56	No	
Clifton	Lakewood	2	7/28/10	21	No	
Clifton	Lakewood	2	8/2/10	33	No	
Clifton	Lakewood	2	8/4/10	63	No	
Clifton	Lakewood	2	8/9/10	8	No	
Clifton	Lakewood	2	8/11/10	8	No	
Clifton	Lakewood	2	8/16/10	215	No	
Clifton	Lakewood	2	8/18/10	22	No	
Clifton	Lakewood	2	8/23/10	275	Yes	
Clifton	Lakewood	2	8/25/10	36	No	
Clifton	Lakewood	2	8/30/10	1	No	
Columbia Park	Bay Village	3	6/1/10	2300	Yes	
Columbia Park	Bay Village	3	6/7/10	2600	Yes	
Columbia Park	Bay Village	3	6/14/10	5300	Yes	
Columbia Park	Bay Village	3	6/21/10	2	No	
Columbia Park	Bay Village	3	6/28/10	190	No	
Columbia Park	Bay Village	3	7/6/10	290	Yes	
Columbia Park	Bay Village	3	7/12/10	34	No	
Columbia Park	Bay Village	3	7/19/10	350	Yes	
Columbia Park	Bay Village	3	7/26/10	160	No	
Columbia Park	Bay Village	3	8/2/10	7	No	
Columbia Park	Bay Village	3	8/9/10	26	No	
Columbia Park	Bay Village	3	8/16/10	185	No	
Columbia Park	Bay Village	3	8/23/10	215	No	
Columbia Park	Bay Village	3	8/30/10	2	No	
Edgecliff	Euclid	3	6/17/10	48	No	
Edgecliff	Euclid	3	6/22/10	28	No	
Edgecliff	Euclid	3	6/24/10	290	Yes	
Edgecliff	Euclid	3	6/29/10	245	Yes	
Edgecliff	Euclid	3	7/1/10	7	No	
Edgecliff	Euclid	3	7/7/10	2	No	
Edgecliff	Euclid	3	7/13/10	480	Yes	
Edgecliff	Euclid	3	7/20/10	70	No	
Edgecliff	Euclid	3	7/27/10	5	No	
Edgecliff	Euclid	3	8/3/10	29	No	
Edgecliff	Euclid	3	8/10/10	14	No	
Edgecliff	Euclid	3	8/17/10	153	No	
Edgecliff	Euclid	3	8/24/10	28	No	
Edgecliff	Euclid	3	8/31/10	7	No	
Huntington	Bay Village	1	5/24/2010	15	N/A	See Nowcast Data

Huntington	Bay Village	1	5/25/2010	15	N/A	See Nowcast Data
Huntington	Bay Village	1	5/26/2010	6	N/A	See Nowcast Data
Huntington	Bay Village	1	5/27/2010	7	N/A	See Nowcast Data
Huntington	Bay Village	1	5/28/2010	274	N/A	See Nowcast Data
Huntington	Bay Village	1	5/29/2010	50	N/A	See Nowcast Data
Huntington	Bay Village	1	5/30/2010	12	N/A	See Nowcast Data
Huntington	Bay Village	1	5/31/2010	9	N/A	See Nowcast Data
Huntington	Bay Village	1	6/1/2010	55	N/A	See Nowcast Data
Huntington	Bay Village	1	6/2/2010	23	N/A	See Nowcast Data
Huntington	Bay Village	1	6/3/2010	43	N/A	See Nowcast Data
Huntington	Bay Village	1	6/4/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	6/5/2010	122	N/A	See Nowcast Data
Huntington	Bay Village	1	6/6/2010	1415	N/A	See Nowcast Data
Huntington	Bay Village	1	6/7/2010	474	N/A	See Nowcast Data
Huntington	Bay Village	1	6/8/2010	128	N/A	See Nowcast Data
Huntington	Bay Village	1	6/9/2010	37	N/A	See Nowcast Data
Huntington	Bay Village	1	6/10/2010	25	N/A	See Nowcast Data
Huntington	Bay Village	1	6/11/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	6/12/2010	113	N/A	See Nowcast Data
Huntington	Bay Village	1	6/13/2010	20	N/A	See Nowcast Data
Huntington	Bay Village	1	6/14/2010	85	N/A	See Nowcast Data
Huntington	Bay Village	1	6/15/2010	839	N/A	See Nowcast Data
Huntington	Bay Village	1	6/16/2010	69	N/A	See Nowcast Data
Huntington	Bay Village	1	6/17/2010	64	N/A	See Nowcast Data
Huntington	Bay Village	1	6/18/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	6/19/2010	50	N/A	See Nowcast Data
Huntington	Bay Village	1	6/20/2010	8	N/A	See Nowcast Data
Huntington	Bay Village	1	6/21/2010	13	N/A	See Nowcast Data
Huntington	Bay Village	1	6/22/2010	27	N/A	See Nowcast Data
Huntington	Bay Village	1	6/23/2010	9	N/A	See Nowcast Data
Huntington	Bay Village	1	6/24/2010	593	N/A	See Nowcast Data
Huntington	Bay Village	1	6/25/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	6/26/2010	9	N/A	See Nowcast Data
Huntington	Bay Village	1	6/27/2010	10	N/A	See Nowcast Data
Huntington	Bay Village	1	6/28/2010	125	N/A	See Nowcast Data
Huntington	Bay Village	1	6/29/2010	233	N/A	See Nowcast Data
Huntington	Bay Village	1	6/30/2010	110	N/A	See Nowcast Data
Huntington	Bay Village	1	7/1/2010	25	N/A	See Nowcast Data
Huntington	Bay Village	1	7/2/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	7/3/2010	13	N/A	See Nowcast Data

Huntington	Bay Village	1	7/4/2010	7	N/A	See Nowcast Data
Huntington	Bay Village	1	7/5/2010	37	N/A	See Nowcast Data
Huntington	Bay Village	1	7/6/2010	29	N/A	See Nowcast Data
Huntington	Bay Village	1	7/7/2010	15	N/A	See Nowcast Data
Huntington	Bay Village	1	7/8/2010	22	N/A	See Nowcast Data
Huntington	Bay Village	1	7/9/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	7/10/2010	134	N/A	See Nowcast Data
Huntington	Bay Village	1	7/11/2010	20	N/A	See Nowcast Data
Huntington	Bay Village	1	7/12/2010	12	N/A	See Nowcast Data
Huntington	Bay Village	1	7/13/2010	48	N/A	See Nowcast Data
Huntington	Bay Village	1	7/14/2010	498	N/A	See Nowcast Data
Huntington	Bay Village	1	7/15/2010	25	N/A	See Nowcast Data
Huntington	Bay Village	1	7/16/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	7/17/2010	69	N/A	See Nowcast Data
Huntington	Bay Village	1	7/18/2010	85	N/A	See Nowcast Data
Huntington	Bay Village	1	7/19/2010	83	N/A	See Nowcast Data
Huntington	Bay Village	1	7/20/2010	130	N/A	See Nowcast Data
Huntington	Bay Village	1	7/21/2010	23	N/A	See Nowcast Data
Huntington	Bay Village	1	7/22/2010	34	N/A	See Nowcast Data
Huntington	Bay Village	1	7/23/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	7/24/2010	203	N/A	See Nowcast Data
Huntington	Bay Village	1	7/25/2010	118	N/A	See Nowcast Data
Huntington	Bay Village	1	7/26/2010	55	N/A	See Nowcast Data
Huntington	Bay Village	1	7/27/2010	8	N/A	See Nowcast Data
Huntington	Bay Village	1	7/28/2010	32	N/A	See Nowcast Data
Huntington	Bay Village	1	7/29/2010	372	N/A	See Nowcast Data
Huntington	Bay Village	1	7/30/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	7/31/2010	12	N/A	See Nowcast Data
Huntington	Bay Village	1	8/1/2010	68	N/A	See Nowcast Data
Huntington	Bay Village	1	8/2/2010	23	N/A	See Nowcast Data
Huntington	Bay Village	1	8/3/2010	19	N/A	See Nowcast Data
Huntington	Bay Village	1	8/4/2010	25	N/A	See Nowcast Data
Huntington	Bay Village	1	8/5/2010	587	N/A	See Nowcast Data
Huntington	Bay Village	1	8/6/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	8/7/2010	250	N/A	See Nowcast Data
Huntington	Bay Village	1	8/8/2010	42	N/A	See Nowcast Data
Huntington	Bay Village	1	8/9/2010	26	N/A	See Nowcast Data
Huntington	Bay Village	1	8/10/2010	21	N/A	See Nowcast Data
Huntington	Bay Village	1	8/11/2010	55	N/A	See Nowcast Data
Huntington	Bay Village	1	8/12/2010	610	N/A	See Nowcast Data

Huntington	Bay Village	1	8/13/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	8/14/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	8/15/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	8/16/2010	393	N/A	See Nowcast Data
Huntington	Bay Village	1	8/17/2010	47	N/A	See Nowcast Data
Huntington	Bay Village	1	8/18/2010	49	N/A	See Nowcast Data
Huntington	Bay Village	1	8/19/2010	12	N/A	See Nowcast Data
Huntington	Bay Village	1	8/20/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	8/21/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	8/22/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	8/23/2010	88	N/A	See Nowcast Data
Huntington	Bay Village	1	8/24/2010	163	N/A	See Nowcast Data
Huntington	Bay Village	1	8/25/2010	22	N/A	See Nowcast Data
Huntington	Bay Village	1	8/26/2010	89	N/A	See Nowcast Data
Huntington	Bay Village	1	8/27/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	8/28/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	8/29/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	8/30/2010	136	N/A	See Nowcast Data
Huntington	Bay Village	1	8/31/2010	9	N/A	See Nowcast Data
Huntington	Bay Village	1	9/1/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	9/2/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	9/3/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	9/4/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	9/5/2010	NS	N/A	See Nowcast Data
Huntington	Bay Village	1	9/6/2010	NS	N/A	See Nowcast Data
Moss Point	Euclid	3	6/2/10	150	No	
Moss Point	Euclid	3	6/8/10	90	No	
Moss Point	Euclid	3	6/15/10	760	Yes	
Moss Point	Euclid	3	6/22/10	165	No	
Moss Point	Euclid	3	6/29/10	440	Yes	
Moss Point	Euclid	3	7/7/10	8	No	
Moss Point	Euclid	3	7/13/10	4800	Yes	
Moss Point	Euclid	3	7/20/10	130	No	
Moss Point	Euclid	3	7/27/10	56	No	
Moss Point	Euclid	3	8/3/10	13	No	
Moss Point	Euclid	3	8/10/10	6	No	
Moss Point	Euclid	3	8/17/10	120	No	
Moss Point	Euclid	3	8/24/10	135	No	
Moss Point	Euclid	3	8/31/10	15	No	
Noble	Euclid	3	6/2/10	335	Yes	

Noble	Euclid	3	6/8/10	120	No	
Noble	Euclid	3	6/15/10	540	Yes	
Noble	Euclid	3	6/22/10	2000	Yes	
Noble	Euclid	3	6/29/10	560	Yes	
Noble	Euclid	3	7/7/10	5	No	
Noble	Euclid	3	7/13/10	4700	Yes	
Noble	Euclid	3	7/20/10	48	No	
Noble	Euclid	3	7/27/10	24	No	
Noble	Euclid	3	8/3/10	55	No	
Noble	Euclid	3	8/10/10	68	No	
Noble	Euclid	3	8/17/10	440	Yes	
Noble	Euclid	3	8/24/10	79	No	
Noble	Euclid	3	8/31/10	43	No	
Parklawn	Rocky River	2	6/1/10	3200	Yes	
Parklawn	Rocky River	2	6/7/10	1800	Yes	
Parklawn	Rocky River	2	6/14/10	32	No	
Parklawn	Rocky River	2	6/21/10	110	No	
Parklawn	Rocky River	2	6/28/10	155	No	
Parklawn	Rocky River	2	7/6/10	1	No	
Parklawn	Rocky River	2	7/12/10	5	No	
Parklawn	Rocky River	2	7/19/10	195	No	
Parklawn	Rocky River	2	7/26/10	110	No	
Parklawn	Rocky River	2	8/2/10	7	No	
Parklawn	Rocky River	2	8/9/10	22	No	
Parklawn	Rocky River	2	8/16/10	190	No	
Parklawn	Rocky River	2	8/23/10	215	No	
Parklawn	Rocky River	2	8/30/10	2	No	
Royal Acres	Euclid	3	6/2/10	158	No	
Royal Acres	Euclid	3	6/8/10	130	No	
Royal Acres	Euclid	3	6/15/10	4600	Yes	
Royal Acres	Euclid	3	6/22/10	145	No	
Royal Acres	Euclid	3	6/29/10	1470	Yes	
Royal Acres	Euclid	3	7/7/10	62	No	
Royal Acres	Euclid	3	7/13/10	365	Yes	
Royal Acres	Euclid	3	7/20/10	68	No	
Royal Acres	Euclid	3	7/27/10	52	No	
Royal Acres	Euclid	3	8/3/10	11	No	
Royal Acres	Euclid	3	8/10/10	11	No	
Royal Acres	Euclid	3	8/17/10	680	Yes	
Royal Acres	Euclid	3	8/24/10	292	Yes	

Royal Acres	Euclid	3	8/31/10	2	No	
Shoreby Club	Bratenahl	2	6/2/10	100	No	
Shoreby Club	Bratenahl	2	6/8/10	24	No	
Shoreby Club	Bratenahl	2	6/15/10	6500	Yes	
Shoreby Club	Bratenahl	2	6/22/10	34	No	
Shoreby Club	Bratenahl	2	6/29/10	50	No	
Shoreby Club	Bratenahl	2	7/7/10	1	No	
Shoreby Club	Bratenahl	2	7/13/10	130	No	
Shoreby Club	Bratenahl	2	7/20/10	20	No	
Shoreby Club	Bratenahl	2	7/27/10	6	No	
Shoreby Club	Bratenahl	2	8/3/10	76	No	
Shoreby Club	Bratenahl	2	8/10/10	30	No	
Shoreby Club	Bratenahl	2	8/17/10	16	No	
Shoreby Club	Bratenahl	2	8/24/10	16	No	
Shoreby Club	Bratenahl	2	8/31/10	1	No	
Shorehaven	Euclid	3	6/2/10	210	No	
Shorehaven	Euclid	3	6/8/10	94	No	
Shorehaven	Euclid	3	6/15/10	1020	Yes	
Shorehaven	Euclid	3	6/22/10	71	No	
Shorehaven	Euclid	3	6/29/10	195	No	
Shorehaven	Euclid	3	7/7/10	23	No	
Shorehaven	Euclid	3	7/13/10	3000	Yes	
Shorehaven	Euclid	3	7/20/10	150	No	
Shorehaven	Euclid	3	7/27/10	59	No	
Shorehaven	Euclid	3	8/3/10	11	No	
Shorehaven	Euclid	3	8/10/10	20	No	
Shorehaven	Euclid	3	8/17/10	148	No	
Shorehaven	Euclid	3	8/24/10	69	No	
Shorehaven	Euclid	3	8/31/10	8	No	
Sims	Euclid	3	6/2/10	292	Yes	
Sims	Euclid	3	6/8/10	230	No	
Sims	Euclid	3	6/15/10	13000	Yes	
Sims	Euclid	3	6/22/10	40	No	
Sims	Euclid	3	6/29/10	660	Yes	
Sims	Euclid	3	7/7/10	7	No	
Sims	Euclid	3	7/13/10	1567	Yes	
Sims	Euclid	3	7/20/10	36	No	
Sims	Euclid	3	7/27/10	8	No	
Sims	Euclid	3	8/3/10	34	No	
Sims	Euclid	3	8/10/10	135	No	

Sims	Euclid	3	8/17/10	178	No	
Sims	Euclid	3	8/24/10	65	No	
Sims	Euclid	3	8/31/10	14	No	
Utopia	Euclid	2	6/2/10	56	No	
Utopia	Euclid	2	6/8/10	27	No	
Utopia	Euclid	2	6/15/10	420	Yes	
Utopia	Euclid	2	6/22/10	45	No	
Utopia	Euclid	2	6/29/10	230	No	
Utopia	Euclid	2	7/7/10	2	No	
Utopia	Euclid	2	7/13/10	245	Yes	
Utopia	Euclid	2	7/20/10	24	No	
Utopia	Euclid	2	7/27/10	<1	No	
Utopia	Euclid	2	8/3/10	11	No	
Utopia	Euclid	2	8/10/10	8	No	
Utopia	Euclid	2	8/17/10	106	No	
Utopia	Euclid	2	8/24/10	46	No	
Utopia	Euclid	2	8/31/10	1	No	
Wagar	Rocky River	2	6/1/10	2900	Yes	
Wagar	Rocky River	2	6/7/10	2300	Yes	
Wagar	Rocky River	2	6/14/10	42	No	
Wagar	Rocky River	2	6/21/10	20	No	
Wagar	Rocky River	2	6/28/10	170	No	
Wagar	Rocky River	2	7/6/10	5	No	
Wagar	Rocky River	2	7/12/10	45	No	
Wagar	Rocky River	2	7/19/10	580	Yes	
Wagar	Rocky River	2	7/26/10	215	No	
Wagar	Rocky River	2	8/2/10	11	No	
Wagar	Rocky River	2	8/9/10	30	No	
Wagar	Rocky River	2	8/16/10	365	Yes	
Wagar	Rocky River	2	8/23/10	185	No	
Wagar	Rocky River	2	8/30/10	5	No	

Regularly scheduled testing for the above beaches began the week of May 31st, 2010. Sampling at Huntington Beach, where the *Nowcast* system for predicting beach advisories is being used, began the week of May 24th, 2010; this beach is sampled 4-6 days a week throughout the recreation season due to funding restrictions, however Nowcast predictions were made 7 days a week. All remaining beaches were sampled once or twice a week.

Nowcasting System for Predicting Beach Advisories

The tables provided on the following pages contain the *Nowcast* results for Huntington Beach over the course of both contract periods. Data is provided on the predicted water quality each day, the probability that the water quality standard will be exceeded, advisory information, and the actual *E. coli* result. Data pertaining to turbidity, water temperature, wave height, and rainfall amounts is also provided. These tables were obtained directly from the *Nowcast* website, www.ohionowcast.info.

The recreation season was divided into 2 "subseasons", for which the Nowcast model varied to some degree. Subseason 1 consisted of the time frame from May 24th, 2010 through July 24rd, 2010. The model parameters were the same for each subseason: rainfall amounts, turbidity, and wave height. The only difference was that the rainfall used for the second subseason included the amounts from the previous 24 and 48 hours. During the first subseason, a water quality advisory was issued when the probability of exceeding the water quality standard was at or above a threshold of 23%. Subseason 2 consisted of the time frame from July 25th, 2010 through September 6th, 2010. A water quality advisory was issued when the probability of exceeding the water quality standard was at or above a threshold of 32%.

A recent review of the 2010 recreational season data by the USGS shows that the *Nowcast* model accurately predicted water quality conditions 86% of the season. The remaining 14% of the data was inaccurate and consists of a combination of false positive and false negative results. A false positive result was a prediction of poor water quality when it was actually good, as determined by water sample analysis. A false negative result was a prediction of good water quality when it was actually poor, as determined by water sample analysis.

For 2010, a total of 81 water samples were collected and analyzed for *E. Coli* concentrations. Five of those samples had an associated false positive prediction. Seven samples had an associated false negative prediction. Steps will therefore continue to be taken to further refine and improve the Huntington Beach model. The CCBH, in conjunction with the USGS, will continue to work to enhance the model in order to reduce the number of false positive and false negative results.

ID	Site	Date	Time	Turbidity (NTU)	Water temp. (°F)	Wave height (ft)	*E. coli* (CFU/ 100 mL)	Hopkins rain in past 24 hours (in)	Radar rain in past 24 hours (in)	Predicted water quality	Probability	Advisory	Notes
23	Huntington	5/24/2010	8:22:00 AM	5.7	62.4	0.1	15	0	0	Good	1.3	A swimming advisory is NOT in effect at this time	BE
24	Huntington	5/25/2010	8:22:00 AM	12.8	59.5	0.2	15	0		Good	1.8	A swimming advisory is NOT in effect at this time	BE
26	Huntington	5/26/2010	8:23:00 AM	3.5	61.8	0.1	6	0		Good	0.8	A swimming advisory is NOT in effect at this time	BE
29	Huntington	5/27/2010	8:20:00 AM	2.78	64.7	0	7	0		Good	0.6	A swimming advisory is NOT in effect at this time	BE
32	Huntington	5/28/2010	8:25:00 AM	17.7	69.6	1.5	274	0		Good	9.4	A swimming advisory is NOT in effect at this time	BE
35	Huntington	5/29/2010	8:19:00 AM	7.25	71	0.5	50	0	0	Good	1.3	A swimming advisory is NOT in effect at this time	BE
36	Huntington	5/30/2010	8:21:00 AM	3.63	72.8	0.4	12	0	0	Good	0.8	A swimming advisory is NOT in effect at this time	BE
38	Huntington	5/31/2010	8:14:00 AM	3.88	69.4	0.1	9	0	0	Good	0.5	A swimming advisory is NOT in effect at this time	BE
40	Huntington	6/1/2010	8:17:00 AM	4.35	70.8	0.5	55	1.16	3.17	Good	14.6	A swimming advisory is NOT in effect at this time	BE
44	Huntington	6/2/2010	8:20:00 AM	2.6	72.3	0	23	0	0	Good	0.4	A swimming advisory is NOT in effect at this time	BE
47	Huntington	6/3/2010	8:21:00 AM	2.85	70.3	0.2	43	0.08	0.19	Good	0.7	A swimming advisory is NOT in effect at this time	BE
50	Huntington	6/4/2010	8:28:00 AM	4.2	72.3	0.5	NS	0	0	Good	1.1	A swimming advisory is NOT in effect at this time	BE
52	Huntington	6/5/2010	8:21:00 AM	6.8	71.6	0.1	122	0	0.31	Good	1.2	A swimming advisory is NOT in effect at this time	BE
55	Huntington	6/6/2010	8:27:00 AM	31.23	69.6	4-Feb	1415	0.73	3.25	Poor	64.1	A swimming advisory IS in effect at this time	BE
57	Huntington	6/7/2010	8:24:00 AM	36.35	68.7	4-Feb	474	0.27	0.68	Poor	27.4	A swimming advisory IS in effect at this time	BE
60	Huntington	6/8/2010	8:18:00 AM	21.73	69.2	0.7	128	0	0	Good	4.2	A swimming advisory is NOT in effect at this time	BE
63	Huntington	6/9/2010	8:18:00 AM	9.55	67.6	0.1	37	0.03	0.03	Good	1.3	A swimming advisory is NOT in effect at this time	BE
66	Huntington	6/10/2010	8:37:00 AM	8.75	67.1	0.3	25	0.44	0.09	Good	1.7	A swimming advisory is NOT in effect at this time	BE
69	Huntington	6/11/2010	8:19:00 AM	6.08	67.6	0.3	NS	0	0	Good	1.3	A swimming advisory is NOT in effect at this time	BE
72	Huntington	6/12/2010	8:22:00 AM	9.65	68	0.2	113	0	0	Good	1.5	A swimming advisory is NOT in effect at this time	BE
74	Huntington	6/13/2010	8:19:00 AM	3	70.8	0.3	20	0.03	0.52	Good	1.5	A swimming advisory is NOT in effect at this time	BE
76	Huntington	6/14/2010	8:26:00 AM	2.85	71.9	0.1	85	0	0	Good	0.6	A swimming advisory is NOT in effect at this time	BE
78	Huntington	6/15/2010	8:21:00 AM	5.9	71.4	0.5	839	0.17	0	Good	1.9	A swimming advisory is NOT in effect at this time	BE
80	Huntington	6/16/2010	8:14:00 AM	43.88	67.4	0.4	69	0	0.03	Good	5.3	A swimming advisory is NOT in effect at this time	BE
82	Huntington	6/17/2010	8:49:00 AM	36.15	67.6	1.6	64	0	0	Good	16.3	A swimming advisory is NOT in effect at this time	BE
84	Huntington	6/18/2010	8:14:00 AM	13.33	68.1	0	NS	0	0	Good	1.7	A swimming advisory is NOT in effect at this time	BE
87	Huntington	6/19/2010	8:17:00 AM	5.78	69.6	0.2	50	0	0	Good	1.4	A swimming advisory is NOT in effect at this time	BE
89	Huntington	6/20/2010	8:12:00 AM	3.35	73	0.3	8	0	0.17	Good	1.4	A swimming advisory is NOT in effect at this time	BE
90	Huntington	6/21/2010	8:28:00 AM	3.25	73.9	0.3	13	0	0	Good	1.2	A swimming advisory is NOT in effect at this time	BE
92	Huntington	6/22/2010	8:25:00 AM	8.5	73.7	0.3	27	0.43	2.74	Good	17.4	A swimming advisory is NOT in effect at this time	BE
95	Huntington	6/23/2010	8:21:00 AM	1.83	74.6	0.2	9	0	0	Good	0.7	A swimming advisory is NOT in effect at this time	BE
99	Huntington	6/24/2010	8:13:00 AM	12.5	73.4	0.8	593	0.07	0.91	Good	10.3	A swimming advisory is NOT in effect at this time	BE
101	Huntington	6/25/2010	8:17:00 AM	4.03	75	0.3	NS	0	0.01	Good	1.5	A swimming advisory is NOT in effect at this time	BE
103	Huntington	6/26/2010	8:16:00 AM	3.6	75.5	0.2	9	0	0	Good	1.2	A swimming advisory is NOT in effect at this time	BE
105	Huntington	6/27/2010	8:17:00 AM	2.85	76.1	0.1	10	0	0.02	Good	1	A swimming advisory is NOT in effect at this time	BE
107	Huntington	6/28/2010	8:20:00 AM	5.1	75.5	0.4	125	0.86	1.71	Good	8.9	A swimming advisory is NOT in effect at this time	BE
110	Huntington	6/29/2010	8:28:00 AM	28.08	74.4	2	233	0.89		Poor	72.5	A swimming advisory IS in effect at this time	BE
113	Huntington	6/30/2010	8:20:00 AM	27.35	74.1	1.8	110	0	0	Good	21.5	A swimming advisory is NOT in effect at this time	BE

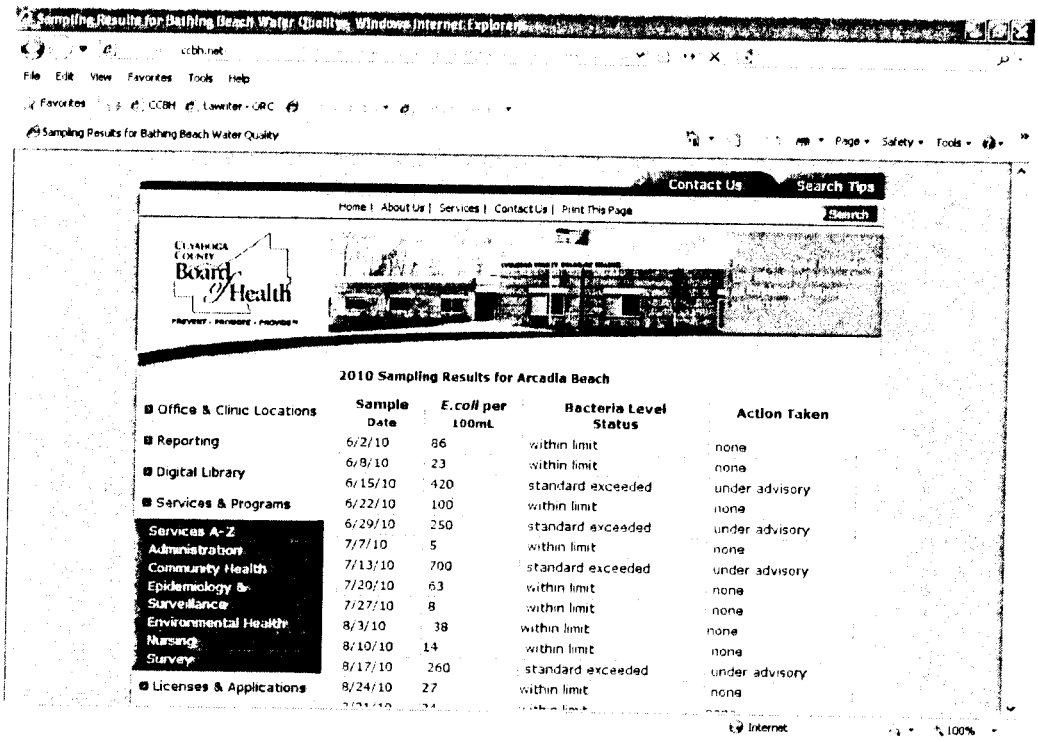
116	Huntington	7/1/2010	8:09:00 AM	11.45	73.5	0.2	25	0	0	Good	2.8	A swimming advisory is NOT in effect at this time	BE
119	Huntington	7/2/2010	7:39:00 AM	16.48	72.5	1.3	NS	0		Good	10	A swimming advisory is NOT in effect at this time	BE
122	Huntington	7/3/2010	7:45:00 AM	4.18	74.1	0.2	13	0	0	Good	1.7	A swimming advisory is NOT in effect at this time	BE
124	Huntington	7/4/2010	8:09:00 AM	2.9	75.7	0.1	7	0	0	Good	1.2	A swimming advisory is NOT in effect at this time	BE
126	Huntington	7/5/2010	8:19:00 AM	3.1	77.1	0.2	37	0	0	Good	1.5	A swimming advisory is NOT in effect at this time	BE
127	Huntington	7/6/2010	8:15:00 AM	2.58	78	0	29	0	0	Good	1	A swimming advisory is NOT in effect at this time	BE
130	Huntington	7/7/2010	8:22:00 AM	2.7	77	0.1	15	0	0	Good	1.3	A swimming advisory is NOT in effect at this time	BE
133	Huntington	7/8/2010	8:20:00 AM	2.95	79.1	0	22	0	0	Good	1.2	A swimming advisory is NOT in effect at this time	BE
136	Huntington	7/9/2010	8:42:00 AM	4.4	81.1	0.3	NS	0	0.71	Good	4.4	A swimming advisory is NOT in effect at this time	BE
139	Huntington	7/10/2010	8:01:00 AM	24.63	77.7	1.3	134	0.64		Poor	32	A swimming advisory IS in effect at this time	BE
141	Huntington	7/11/2010	8:20:00 AM	4.15	79.1	0.1	20	0	0	Good	1.8	A swimming advisory is NOT in effect at this time	BE
143	Huntington	7/12/2010	8:19:00 AM	2.78	78.9	0	12	0.03	0.09	Good	1.4	A swimming advisory is NOT in effect at this time	BE
146	Huntington	7/13/2010	8:23:00 AM	2.73	78.9	0.1	48	0.3	1.34	Good	5	A swimming advisory is NOT in effect at this time	BE
149	Huntington	7/14/2010	8:27:00 AM	12.1	78.2	1.8	498	0	0	Good	20.3	A swimming advisory is NOT in effect at this time	BE
152	Huntington	7/15/2010	8:23:00 AM	3.03	79.3	0.1	25	0	0	Good	1.7	A swimming advisory is NOT in effect at this time	BE
155	Huntington	7/16/2010	8:19:00 AM	12.33	79.3	2	NS	0	0	Poor	24.5	A swimming advisory IS in effect at this time	BE
157	Huntington	7/17/2010	8:20:00 AM	7.4	77.9	0.8	69	0	0	Good	6.9	A swimming advisory is NOT in effect at this time	BE
159	Huntington	7/18/2010	8:17:00 AM	12.28	78.8	0.7	85	0.07	1.85	Poor	24.9	A swimming advisory IS in effect at this time	BE
161	Huntington	7/19/2010	8:29:00 AM	9.3	78.2	0.5	83	0	0.07	Good	6.1	A swimming advisory is NOT in effect at this time	BE
164	Huntington	7/20/2010	8:26:00 AM	18.9	77.5	1	130	0.01	0.28	Good	15.9	A swimming advisory is NOT in effect at this time	BE
167	Huntington	7/21/2010	8:24:00 AM	4.15	78.9	0.4	23	0	0	Good	3.6	A swimming advisory is NOT in effect at this time	BE
170	Huntington	7/22/2010	8:20:00 AM	12.23	78.9	0.9	34	0	0	Good	10.6	A swimming advisory is NOT in effect at this time	BE
173	Huntington	7/23/2010	8:19:00 AM	7.48	79.5	0.4	NS	0.26	1.15	Good	11.8	A swimming advisory is NOT in effect at this time	BE
176	Huntington	7/24/2010	8:29:00 AM	7.95	78.6	0.5	203	0.96	5.15	Poor	67.8	A swimming advisory IS in effect at this time	BE
177	Huntington	7/25/2010	8:22:00 AM	5.33	79.7	0.8	118	0.6	0.17	Good	8.2	A swimming advisory is NOT in effect at this time	BE
179	Huntington	7/26/2010	8:30:00 AM	20.3	77.5	1.5	55	0.14	0.14	Good	14.9	A swimming advisory is NOT in effect at this time	BE
182	Huntington	7/27/2010	8:21:00 AM	3.45	78.9	0.1	8	0	0	Good	0.9	A swimming advisory is NOT in effect at this time	BE
185	Huntington	7/28/2010	8:22:00 AM	4.78	78.9	0.1	32	0	0	Good	1.1	A swimming advisory is NOT in effect at this time	BE
188	Huntington	7/29/2010	8:27:00 AM	42.75	78.2	6-Mar	372	0.56	2.29	Poor	66	A swimming advisory IS in effect at this time	BE
191	Huntington	7/30/2010	8:25:00 AM	13.6	77	0.9	NS	0	0	Good	8.8	A swimming advisory is NOT in effect at this time	BE
194	Huntington	7/31/2010	8:20:00 AM	3.6	78	0.1	12	0	0	Good	0.9	A swimming advisory is NOT in effect at this time	BE
196	Huntington	8/1/2010	8:31:00 AM	11.68	77.9	1	68	0	0	Good	6.4	A swimming advisory is NOT in effect at this time	BE
198	Huntington	8/2/2010	8:29:00 AM	7.05	78.6	0.3	23	0	0	Good	1.9	A swimming advisory is NOT in effect at this time	BE
201	Huntington	8/3/2010	8:21:00 AM	3.55	80.6	0.1	19	0	0	Good	0.9	A swimming advisory is NOT in effect at this time	BE
204	Huntington	8/4/2010	8:58:00 AM	2.4	79.1	0	25	0.05	0.02	Good	0.6	A swimming advisory is NOT in effect at this time	BE
207	Huntington	8/5/2010	8:38:00 AM	10.88	79.3	1	587	0.88	0.23	Good	6.6	A swimming advisory is NOT in effect at this time	BE
210	Huntington	8/6/2010	8:26:00 AM	24.65	78.6	2	NS	0.19	0.13	Good	24.8	A swimming advisory is NOT in effect at this time	BE
212	Huntington	8/7/2010	7:40:00 AM	20.53	77.3	1.1	250	0.59	0.19	Good	10.1	A swimming advisory is NOT in effect at this time	BE
215	Huntington	8/8/2010	8:40:00 AM	4.45	77	0.2	42	0	0	Good	1.3	A swimming advisory is NOT in effect at this time	BE
217	Huntington	8/9/2010	8:52:00 AM	2.8	77.5	0.1	26	0	0	Good	0.8	A swimming advisory is NOT in effect at this time	BE
219	Huntington	8/10/2010	8:32:00 AM	2.33	78.9	0.1	21	0	0	Good	0.7	A swimming advisory is NOT in effect at this time	SR
222	Huntington	8/11/2010	8:24:00 AM	2.8	80	0.2	55	0	0	Good	0.9	A swimming advisory is NOT in effect at this time	BE

225	Huntington	8/12/2010	8:35:00 AM	4.95	80	0.1	610	0.7	0.88	Good	1.6	A swimming advisory is NOT in effect at this time	BE
228	Huntington	8/13/2010	8:17:00 AM	16.1	80.2	1.5	NS	0	0	Good	14.3	A swimming advisory is NOT in effect at this time	BE
231	Huntington	8/14/2010	8:48:00 AM	16.55	78.2	0.25	NS	0	0	Good	5.2	A swimming advisory is NOT in effect at this time	SR
233	Huntington	8/15/2010	8:33:00 AM	4.8	77.5	0.17	NS	0.34		Good	5.7	A swimming advisory is NOT in effect at this time	SR
234	Huntington	8/16/2010	8:36:00 AM	36.9	77.9	2.17	393	0		Poor	40.1	A swimming advisory IS in effect at this time	SR
237	Huntington	8/17/2010	8:33:00 AM	11.8	77.5	0.5	47	0		Good	5.9	A swimming advisory is NOT in effect at this time	SR
240	Huntington	8/18/2010	8:29:00 AM	5.58	77.7	0.33	49	0	0	Good	1.7	A swimming advisory is NOT in effect at this time	SR
243	Huntington	8/19/2010	8:27:00 AM	3.35	77.9	0.1	12	0	0	Good	0.9	A swimming advisory is NOT in effect at this time	SR
246	Huntington	8/20/2010	8:27:00 AM	12.8	79.5	1	NS	0	0	Good	6.7	A swimming advisory is NOT in effect at this time	SR
249	Huntington	8/21/2010	8:55:00 AM	13.45	78.4	0.67	NS	0	0	Good	4.6	A swimming advisory is NOT in effect at this time	SR
251	Huntington	8/22/2010	8:39:00 AM	37.1	76.2	2	NS	0.84	3.33	Poor	47.9	A swimming advisory IS in effect at this time	SR
252	Huntington	8/23/2010	8:29:00 AM	61.88	75.9	1.5	88	0.04	0	Good	30.7	A swimming advisory is NOT in effect at this time	SR
255	Huntington	8/24/2010	8:26:00 AM	80.33	75	1.3	163	0.01	0	Good	20.2	A swimming advisory is NOT in effect at this time	SR
258	Huntington	8/25/2010	8:26:00 AM	11	75.7	0.33	22	0	0	Good	2.6	A swimming advisory is NOT in effect at this time	SR
261	Huntington	8/26/2010	8:28:00 AM	65.8	75.3	1.75	89	0	0	Good	26.9	A swimming advisory is NOT in effect at this time	SR
263	Huntington	8/27/2010	8:22:00 AM	16.53	74.6	0.8	NS	0	0	Good	6	A swimming advisory is NOT in effect at this time	SR
266	Huntington	8/28/2010	8:21:00 AM	3.7	75.7	0.1	NS	0	0	Good	0.9	A swimming advisory is NOT in effect at this time	SR
268	Huntington	8/29/2010	8:24:00 AM	2.8	75	0.1	NS	0	0	Good	0.8	A swimming advisory is NOT in effect at this time	SR
269	Huntington	8/30/2010	8:35:00 AM	3	75.5	0	136	0	0	Good	0.7	A swimming advisory is NOT in effect at this time	SR
271	Huntington	8/31/2010	8:35:00 AM	2.4	76.1	0.08	9	0	0	Good	0.7	A swimming advisory is NOT in effect at this time	SR
273	Huntington	9/1/2010	8:17:00 AM	3.2	76.6	0.2	NS	0	0	Good	1	A swimming advisory is NOT in effect at this time	SR
275	Huntington	9/2/2010	8:22:00 AM	2.23	76.6	0.2	NS	0	0	Good	0.8	A swimming advisory is NOT in effect at this time	SR
277	Huntington	9/3/2010	8:19:00 AM	2.83	77	0.1	NS	0	0	Good	0.8	A swimming advisory is NOT in effect at this time	SR
280	Huntington	9/4/2010	8:42:00 AM	54.95	73.4	2	NS	0.27	0.22	Poor	32.1	A swimming advisory IS in effect at this time	SR
282	Huntington	9/5/2010	8:38:00 AM	89	66.9	1.1	NS	0	0.08	Good	18.6	A swimming advisory is NOT in effect at this time	SR
284	Huntington	9/6/2010	8:32:00 AM	13.43	70.1	0.17	NS	0	0	Good	2.4	A swimming advisory is NOT in effect at this time	SR

Public Notification

The public notification component of this project consisted of providing timely water quality data on the Cuyahoga County Board of Health website, www.ccbh.net, in addition to emailing beach operators and other stakeholders their water quality data as soon as it is received from the contract lab, the Northeast Ohio Regional Sewer District. For Royal Acres Beach, the beach operator received a weekly telephone call due to lack of computer/email access.

An example of how water quality data appeared on the CCBH website is provided below:



Contact Us | Search Tips

Home | About Us | Services | Contact Us | Print This Page | Search

Cuyahoga County Board of Health

2010 Sampling Results for Arcadia Beach

- Office & Clinic Locations
- Reporting
- Digital Library
- Services & Programs
- Services A-Z
- Administration
- Community Health
- Epidemiology & Surveillance
- Environmental Health
- Nursing
- Survey
- Licenses & Applications

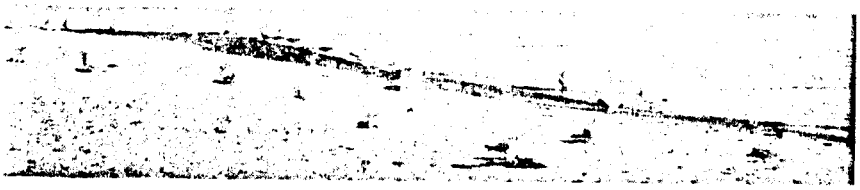
Sample Date	E.coli per 100mL	Bacteria Level Status	Action Taken
6/2/10	86	within limit	none
6/8/10	23	within limit	none
6/15/10	420	standard exceeded	under advisory
6/22/10	100	within limit	none
6/29/10	250	standard exceeded	under advisory
7/7/10	5	within limit	none
7/13/10	700	standard exceeded	under advisory
7/20/10	63	within limit	none
7/27/10	8	within limit	none
8/3/10	38	within limit	none
8/10/10	14	within limit	none
8/17/10	260	standard exceeded	under advisory
8/24/10	27	within limit	none

The CCBH also electronically submitted an Excel spreadsheet, developed by the Ohio Department of Health (ODH), to the ODH daily, as results were received, in order to satisfy contract requirements. This data was further used for public notification via the Beach Monitoring Section of the ODH website.

An educational fact sheet, specific to the *Nowcast* system, was kept on display at Huntington Beach in an outdoor brochure/literature holder in an easily accessible location to the public. This fact sheet was re-stocked as needed and an example of the fact sheet is provided on the following page. A general water quality brochure was also kept stocked at Huntington Beach. A copy of this brochure is included as an attachment to the electronic version of this Final Report due to formatting conflicts, and a hard copy of the brochure is included with the hard copy of this Final Report.

Nowcasting Beach Advisories

Fact Sheet for the general public



How safe it is to swim at Lake Erie bathing beaches?

To find out, local agencies monitor (sample) the beaches to determine bacteria levels. The bacterium, *E. coli*, is found in sewage and other animal wastes. Because the results for *E. coli* levels take at least 24 hours by traditional methods, we are using other quickly-obtained measurements to predict when *E. coli* levels may be high. This is called a "Nowcast".

How does the Nowcast work?

The Nowcast system is similar to a weather forecast, but instead of forecasting future weather conditions, the Nowcast system estimates current conditions. A computer model, which takes into account current weather and environmental conditions, is used to estimate bacteria levels. The computer model will predict the likelihood that *E. coli* bacteria levels may be GOOD (low) or POOR (high), and whether or not a Water Quality Advisory should be issued. This information is provided to the public for use in planning beach activities.

Where is the Nowcast system being used?

In Ohio, the Nowcast is being used at Huntington Beach in Bay Village and at Edgewater Beach in Cleveland during 2008. Research is being done to identify other beaches that may be suitable for the Nowcast.

What is the water quality standard for *E. coli*?

The Ohio bathing water standard for *E. coli* is 235 colony forming units (cfu) per 100 milliliters of beach water tested. If the computer model predicts that *E. coli* bacteria levels may be below 235, a **GOOD Water Quality Nowcast** will be made. If the computer model predicts that *E. coli* bacteria levels may be high, a **POOR Water Quality Nowcast** will be made and a Water Quality Advisory will be issued.

What is a Water Quality Advisory?

A Water Quality Advisory is a public notification, typically in the form of a sign posted at the beach, to advise the public that current water quality conditions are not acceptable for swimming due to high bacteria levels. A Water Quality Advisory remains in effect until another measurement is made that indicates that bacteria levels are within acceptable limits.

What illnesses may result from contact with the water?

There is a potential for illness to occur when bacteria levels are high. Gastrointestinal upset, including nausea, vomiting, abdominal cramps, and diarrhea may occur as a result of swallowing contaminated water. There is also a potential for developing upper respiratory infections, in addition to ear and eye infections. Skin infections may also occur if an open wound is not properly protected. Children, the elderly, and individuals with weakened immune systems are most at risk for becoming ill when bacteria levels are high.

How often is the Nowcast system used and where can information be obtained?

The Nowcast system is being used 7 days a week, from Memorial Day through Labor Day. Health officials will make each day's water quality Nowcast by 9:30a.m., based on conditions observed in the morning. Signs will be posted at the entrances to the beach area, reflecting each day's Nowcast. The Nowcast system is Internet-based, providing near real-time, same-day, water quality information to the public. Nowcasts do not consider predicted weather changes. Water quality can quickly change from Good to Poor in response to rain and wind storm conditions.

FOR MORE INFORMATION ON NOWCAST:

Visit the Nowcast website at www.ohionowcast.info

Contact the Cuyahoga County Board of Health: (216) 201-2000, www.ccbh.net

Contact the USGS, Ohio Water Science Center: (614) 430-7700, http://oh.water.usgs.gov

Northeast Ohio Regional Sewer District's Beach Water Quality Information Line: (216) 432-7301

Project Partners

Cuyahoga County Board of Health

CMHI

Ohio State Parks

Cleveland Metroparks

Northeast Ohio Regional Sewer District

USGS Science for a changing world

CDPH

Ohio Lake Erie Commission

Sampling was conducted on a weekly basis at Shorehaven Beach in Euclid during the 2010 recreation season. However, the operator has not yet indicated to CCBH that it will be considered a bathing beach. A copy of this letter is included at the end of this report. The CCBH will continue to follow up with the operator and the City of Euclid until a decision is made.

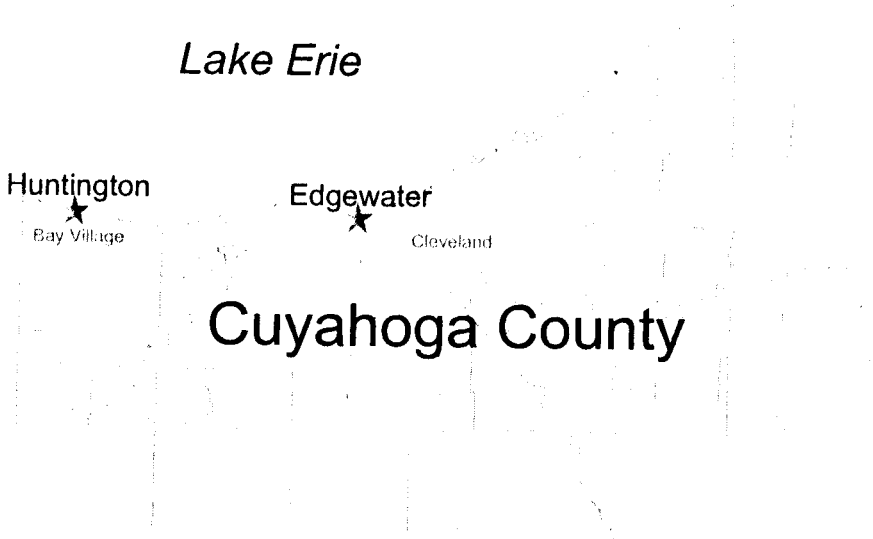
Beach User Surveys

Beach User Surveys were again administered during the 2010 recreation season. The beach survey data was automatically entered and stored into a Microsoft Access Database as the surveys were administered. The CCBH Epidemiology and Surveillance Service Area has reviewed the data and has generated a descriptive analysis of the data. Several hypotheses related to the public's concerns, awareness, and potential illness episodes were tested. Traditional descriptive statistics were used in conjunction with bi-variate techniques (e.g. Chi-Square Analyses) on the data. A total of 193 surveys were administered.

The *Summary Report of Findings and a Select Look at Data from 2005 – 2010* is included on the following pages.

The 2010 Beach User Survey for Cuyahoga County, Ohio:
Summary Report of Findings
and
a Select Look at Data from 2005-2010

Date of Report: September 25, 2010



This summary report represents the final analyses conducted for the 2010 Beach User Survey. It includes: a general overview of the findings; a list of seven suppositions and three hypotheses that were evaluated; eight tables that contain the descriptive statistics for the survey (Tables 1-8), two figures pertaining to the NOWCAST system (Figures 1-2); and four tables generated from the hypotheses testing (Tables 9-11ab). It also compares results of the current survey with the 2009 beach user survey and a comparison of select items over the past six years (Figures 3-8).

This report was produced by Epidemiology, Surveillance, and Informatics Services at the Cuyahoga County Board of Health.

Public Health
Northeast Ohio Public Health Partnership

Cuyahoga County Board of Health
PREVENT · PROMOTE · PROVIDE

Table of Contents

I. GENERAL OVERVIEW

A total of 193 people completed the survey during the months of July (n=166) and August (n=27). A majority (86%) of the respondents were from Huntington Beach. Most survey respondents were: white (95%); non-Hispanic (94%); female (74%); and between the ages of 16-50 years old (73%) [Table 1]. Approximately two out of three respondents was aware of water quality signs being posted at the beach. Among those that were aware of the signs, 87% indicated that they pay attention to the signs [Table 2]. Approximately three out of four respondents indicated that they were concerned or very concerned with the impact that industrial/chemical pollutions have on beach water quality. Approximately four out of five respondents indicated that they were concerned or very concerned with the impact that sanitary sewage from system overflows and aging infrastructure has on beach water quality [Table 3]. Approximately 14% of the respondents indicated that they have heard of the NOWCAST system [Table 8]. Among those that have heard of NOWCAST, 100% were comfortable with the predictions [Figure 2].

Seventy one percent of the respondents indicated that they sun bathe and 83% indicated that they had partial (i.e. wading) or full body contact with the water during normal weather conditions [Table 5]. Many respondents appeared to take safety precautions as: 95% of the respondents indicated that they/their children know how to swim; 60% indicated that they are certified in cardiopulmonary resuscitation; and 75% indicated that they use sun block/take appropriate precautions [Table 6]. Less than two percent (n=6) of the respondents reported becoming ill after swimming at the beach. Among the ill respondents, three indicated that they saw a physician for their illness; three indicated that the nature of the illness was an ear, nose, throat infection; and 67% of the ill respondents indicated that they swallowed water while swimming at the beach [Table 7].

The results of this year's survey suggest that the awareness and knowledge of water quality issues were comparable to past years [Figure 3 and 5] except for last year where it was much lower possibly due to a larger percentage of the younger respondents and a larger number of respondents from Edgewater Beach compared to previous years.

II. SUMMARY OF SURVEY CHANGES

Three questions were added to assess whether or not respondents were taking safety precautions when going to the beach. Specifically, the following questions were added: *Do you and/or your children know how to swim*; *Have you ever been certified in CPR*; and *Do you apply sunblock or take appropriate measures to protect yourself from sun exposure.*

III. METHODS

The survey was administered at two local beaches on the shores of Lake Erie, Ohio. These beaches included one beach located in the City of Cleveland (Edgewater) and Huntington Beach located in the City of Bay Village. Employees from the Cuyahoga County Board of Health (CCBH) used electronic tablets to capture survey responses. The respondents were selected by

convenience sampling. These responses were stored in a *Microsoft Office ACCESS 2003* database and exported in *SPSS v15.0 for Windows* for analyses.

Descriptive statistics (e.g. frequencies) as well as bivariate analyses were used during the analyses. Where appropriate, statistical significance associated with hypotheses testing was determined by *chi-square* or *Fisher Exact* tests at the $p < 0.05$ level.

IV. EVALUATION OF SUPPOSITIONS/HYPOTHESES

Prior to data analysis, the following suppositions and hypotheses were generated (evaluation of the results is italicized):

Suppositions

S1. **Individuals that know there are water quality signs posted on the beach should pay attention to the signs.** *Among the 123 respondents that reported being aware of the water quality signs, 87% indicated that they pay attention to the signs (Table 2).*

S2. **Individuals that pay attention to the signs should understand what the signs mean.** *Among the 107 respondents that reported paying attention to the signs, 97% indicated that they understand the signs (Table 2).*

S3. **Individuals that visit the bathing beach section of the CCBH website reported that the website does influence their decision to go to the beach.** *Among the seven respondents that reported visiting the Beach section of the CCBH web site, all seven indicated that it influenced their decision to go to the beach (Table 4).*

S4. **Individuals that reported becoming ill after swimming reported swallowing lake water while swimming at the beach.** *Among the six respondents that reported becoming ill after swimming at the beach, 67% of the respondents indicated that they swallowed water while swimming at the beach (Table 6).*

S5. **Individuals that had never heard of the NOWCAST system for predicting beach advisories were informed that it is an internet-based system; these individuals should use the internet to check current water quality conditions before they go to the beach.** *Among the 167 respondents that reported not being aware of the NOWCAST system, 67% indicated that they would use the internet to check current water conditions before going to the beach (Table 7).*

S6. **Individuals that have heard of the NOWCAST system for predicting beach advisories understand the concept of predicting water quality.** *Among the 26*

respondents that reported being aware of the NOWCAST system, 65% indicated that they understand the concept of predicting water quality (Figure 2).

S7. **Individuals that understand the NOWCAST system are comfortable with water quality predictions being made.** *Among the 17 respondents that reported understanding the NOWCAST system, all respondents indicated that they were comfortable with the water quality predictions being made (Figure 2).*

Hypotheses

H1. **Individuals that understand what the water quality signs mean should not swim in the lake if a water quality advisory has been issued.** *The results from the current survey provides weak statistical support ($p = 0.17$) for this hypothesis (among those that understand the sign content, 18.5% reported that they swam compared to 50.0% among those that do not understand the content) – see Table 9.*

H2. **Individuals that understand what the water quality signs mean should not swim in the lake after heavy rains.** *Among this year's respondents, there is no evidence to suggest that understanding the content of a swimming advisory sign decreased the likelihood that individuals swam after a heavy rain (among those that understood the sign content, 30.3% still reported that they waded or had full body contact with water after a heavy rain compared to 50.0% among those that do not understand the content) – see Table 10.*

H3. **Individuals that reported becoming ill after swimming at the beach reported that they swim with full body water contact.** *Among this year's respondents, there is no evidence that suggests that swimming which involves full body contact with water may be associated with illness. Among those that reported full body contact, 1.2% reported becoming ill after swimming at the beach compared to 4.5% that report wading or no contact, (see Table 11a). This relationship was also explored by excluding individuals who indicated that they did not have any contact with the water. Specifically, 1.2% reported becoming ill among those reporting full contact compared to 6.4% who reported partial (e.g. wading) contact with the water (see Table 11b).*

V. RESULTS

Table 1. Demographics

Variable	*N = 193* n (%)
Month/Year Surveyed	
July 2010	166 (86.0)
August 2010	27 (14.0)
Beach Location	
Edgewater Beach	28 (14.5)
Huntington Beach	165 (85.5)
Age(in years)	
Under 16	35 (18.1)
16-20	39 (20.2)
21-30	38 (19.7)
31-40	38 (19.7)
41-50	27 (14.0)
Over 50	16 (8.3)
Gender	
Female	142 (73.6)
Male	51 (26.4)
Race	
Asian or Pacific Islander	1 (0.5)
Black/African American	8 (4.1)
White	184 (95.3)
Ethnicity	
Hispanic/Latino	12 (6.2)
Non-Hispanic	181 (93.8)

Table 2. Beach Water Quality Awareness and Practices

Variable	*N = 193* n (%)
Know there are Water Quality Signs Posted	
Yes	123 (63.7)
No	70 (36.3)
Among those Aware of Signs (n=123): Pay Attention to Posted Sign	
Yes	107 (87.0)
No	16 (13.0)
Among those Aware of Signs (n=123): Understand Posted Signs	
Yes	119 (96.7)
No	4 (3.3)
Among those Aware of Signs (n=123): Swim in Lake even if Advisory Posted	
Yes	24 (19.5)
No	99 (80.5)
Among those that Pay Attention to the Posted Signs (n=107): Understand Posted Signs	
Yes	104 (97.2)
No	3 (2.8)

Table 3. Type of Water Quality Concerns and Level of Concern

	Level of Concern (N = 193)				
Type of Water Quality Concern	Not Concerned n (%)	Of Little Concern n (%)	Moderately Concerned n (%)	Concerned n (%)	Very Concerned n (%)
Storm Water Runoff	37 (19.2)	40 (20.7)	38 (19.7)	36 (18.7)	42 (21.7)
Industrial/Chemical Pollution	7 (3.6)	13 (6.7)	24 (12.4)	37 (19.2)	112 (58.1)
Animal Waste (Birds, etc...)	12 (6.2)	36 (18.7)	47 (24.4)	35 (18.1)	63 (32.6)
Sanitary Sewage from System Overflow	5 (2.6)	7 (3.6)	18 (9.4)	39 (20.2)	124 (64.2)
Other Bathers (e.g. fecal accidents)	24 (12.4)	34 (17.6)	42 (21.8)	32 (16.6)	61 (31.6)

Table 4. Information Sources

Variable	***N = 193*** n (%)
Ever visited CCBH website	
Yes	12 (6.2)
No	181 (93.8)
Among CCBH website visitors (n=12)	
Visit "Beach Section"	
Yes	7 (58.3)
No	5 (41.7)
If Yes, does it effect your decision (n=7)	
Yes	7 (100.0)
No	0 (0.0)

Table 5. Beach Activities

Variable	*N = 193* N (%)
Do you sun bathe	
Yes	137 (71.0)
No	56 (29.0)
Do you play in the sand	
Yes	96 (49.7)
No	97 (50.3)
Contact with Water During Normal Weather	
No Contact	33 (17.1)
Wading	78 (40.4)
Swimming with Full Body Contact	82 (42.5)
Contact with Water After Heavy Rains	
No Contact	128 (66.3)
Wading	31 (16.1)
Swimming with Full Body Contact	34 (17.6)
What time of day do you visit beach	
Morning (8am to noon)	10 (5.2)
Afternoon (noon to 3pm)	173 (89.6)
Mid-afternoon (3pm to 6pm)	7 (3.6)
Early Evening (After 6:00pm)	3 (1.6)
How much time do you spend in the water	
< 15 minutes	75 (38.9)
15-30 minutes	19 (9.8)
30-45 minutes	19 (9.8)
45-60 minutes	28 (14.6)
> 60 minutes	52 (26.9)
How many times do you visit beach each year	
Everyday	1 (0.5)
Once a Week	21 (10.9)
Few Times a Week	21 (10.9)
Once a Month	43 (22.3)
Few Times a Month	41 (21.2)
Once a Year	66 (34.2)

Table 6. Safety Precaution Information

Variable	*N = 193* n (%)
Do you and/or your children know how to swim	
Yes	183 (94.8)
No	10 (5.2)
Have you ever been certified in CPR	
Yes	116 (60.1)
No	77 (39.9)
Do you apply sunblock or take appropriate measures to protect yourself from sun exposure	
Yes	144 (74.6)
No	49 (25.4)

Table 7. Illness Information

Variable	*N = 193* n (%)
Did you ever become ill after swimming at beach	
Yes	6 (3.1)
No	187 (96.9)
If ill, did you see a physician (n=6)	
Yes	3 (50.0)
No	3 (50.0)
If ill, nature of illness (n=6)	
Gastrointestinal	1 (16.7)
Upper Respiratory	1 (16.7)
Ears, Nose, and Throat Infection	3 (50.0)
Skin Infection	1 (16.6)
Other	0 (0.0)
If ill, did you swallow water while swimming at beach (n=6)	
Yes	4 (66.7)
No	2 (33.3)
If ill and saw doctor, mentioned swimming at beach (n=3)	
Yes	2 (66.7)
No	1 (33.3)

Table 8. NOWCAST Information

Variable	*N = 193* n (%)
Did you ever hear of NOWCAST	
Yes	26 (13.5)
No	167 (86.5)
If never heard of NOWCAST, would you use internet to check water conditions (n = 167)	
Yes	111 (66.5)
No	56 (33.5)

Figure 1.

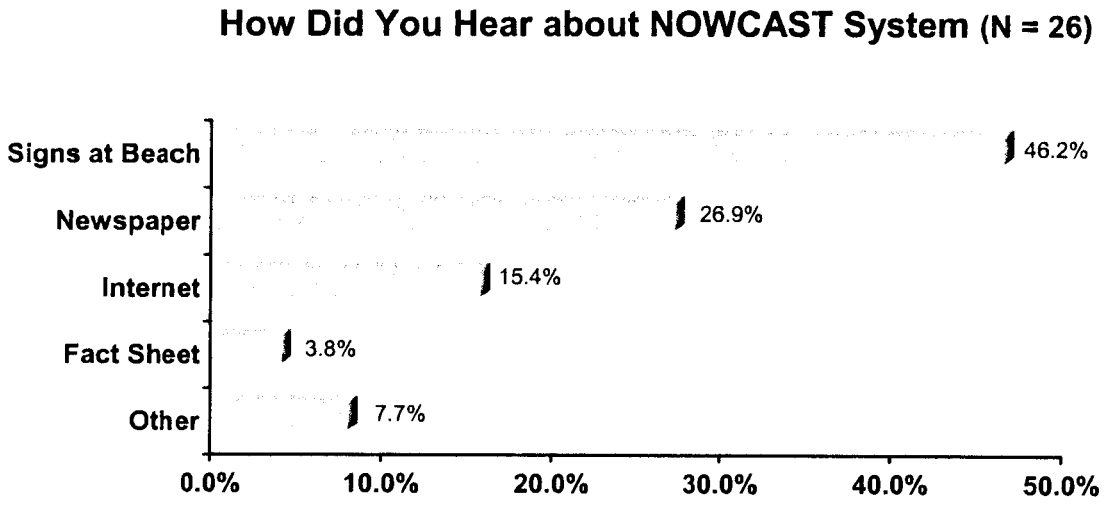


Figure 2.

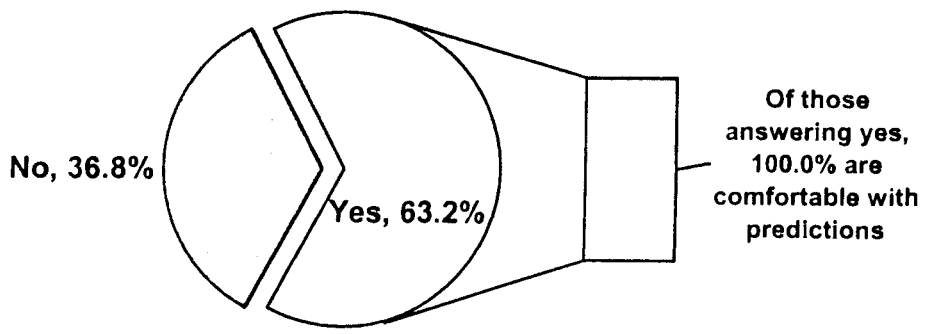


Table 9 – Hypothesis #1.

Association[1] Between Understanding Content of Water Quality Signs and Swimming When a Water Advisory is Posted[2]

	Swimming When a Water Advisory is Posted N = 123[†]	
Understand Content Of Water Quality Sign	Yes n (row %)	No n (row %)
Yes	22 (18.5)	97 (81.5)
No	2 (50.0)	2 (50.0)

[1] Fisher's exact test used, p-value > 0.17.

[†] Among respondents reporting that they are aware of water quality signs.

Table 10 – Hypothesis #2.

Association[1] Between Understanding Content of Water Quality Signs and Swimming After Heavy Rains[2]

	Swimming After Heavy Rains N = 123[†]	
Understand Content Of Water Quality Sign	Wading or Full Body Contact n (row %)	No Contact with Water n (row %)
Yes	36 (30.3)	83 (69.7)
No	2 (50.0)	2 (50.0)

[1] Fisher's exact test used, p-value > 0.58.

[†] Among respondents reporting that they are aware of water quality signs.

Table 11a – Hypothesis #3 (Original).

Association[1] Between Full Body Contact with Water and Reporting Becoming Ill After Swimming at the Beach

	Reported Becoming Ill after Swimming at the Beach N = 193	
Water Contact during Normal Weather	Yes n (row %)	No n (row %)
Full Body Contact	6 (3.8)	154 (96.2)
Wading or No Contact	0 (0.0)	33 (100.0)

[1] Fisher's exact test used, p-value > 0.59.

Table 11b – Hypothesis #3 (Expanded).

Association[1] Between Full Body versus Partial (Wading) Contact with Water and Reporting Becoming Ill After Swimming at the Beach

	Reported Becoming Ill after Swimming at the Beach N = 160[†]	
Water Contact during Normal Weather	Yes n (row %)	No n (row %)
Full Body Contact	5 (6.4)	73 (93.6)
Wading	1 (1.2)	81 (98.8)

[1] Fisher's exact test used, p-value > 0.10.

[†] Excludes 33 who reported no contact with water during normal weather including two who still reported becoming ill.

VI. COMPARISONS TO 2009 BEACH USERS SURVEY

Demographics
There were some differences in the demographic characteristics between the 2010 and 2009 surveys. Specifically, there were a higher percentage of females (73.6% compared to 65.3%) and Whites (95.3% vs. 86.2%). These differences may be due to the fact that there was a large increase in the percentage of respondents from Huntington Beach in 2010 (85.5%) compared to 2009 (48.1%).

Water Quality Awareness and Associated Behaviors
Awareness of water quality signs was higher this year (63.7%) compared to last year (51.1%). Additionally, among respondents aware of the signs there appeared to be marked increase in the understanding of the water quality signs. Specifically, 96.7% reported understanding the signs compared to 62.8% last year. However, among all respondents, 33.7% reported swimming after a heavy rain this year compared to 24.3% last year.

Water Quality Concerns
Concerns about the water quality due to sanitary sewage from system overflow and industrial/chemical pollution remained the largest areas of concern among respondents. Specifically, 84.4% reported being "concerned" or "very concerned" about sanitary sewage (compared to 79.5% in 2009) and 77.2% of respondents reported being "concerned" or "very concerned" about industrial/chemical pollution (compared to 76.9% in 2009).

Information Sources
There was a small increase in the percentage of respondents who reported visiting the Cuyahoga County Board of Health website (6.2% in 2010 vs. 5.2% in 2009) and specifically visiting the beach section of the site (58.3% in 2010 vs. 50.0% in 2009).

Beach Activities
There were little differences in beach activities reported this year compared to last year. Specifically, respondents reported similar full body contact with the water (42.5% in 2010 vs. 48.9% in 2009) and sun bathing (71.0% in 2010 vs. 68.9% in 2009).

Illness Information
The percentage of respondents who reported becoming ill after swimming at the beach was lower this year (3.1%) compared to last year (5.2%) and the percentage of ill respondents who reported seeking medical attention was slightly higher 50.0% in the current survey compared to 35.7% last year. Ears, nose, and throat illness accounted for 50.0% of the reported illness this year while gastrointestinal illness was the main type of illness (71.4%) last year.

NOWCAST Information
Respondent awareness of the NOWCAST system was almost double this year compared to last year (13.5% vs. 7.1% respectively). Signs at the beach as the information source for NOWCAST increased significantly this year (46.2%) compared to last year (10.0%).

VII. A Select Look At Data from 2005-2010

The following trends appear to exist:

- The decreasing trend of percentage of the beach survey respondents aware of the water quality signs seen the previous two years stopped (Figure 3).
- The percentage of the beach survey respondents who pay attention to the water quality signs has been fairly constant since 2006 (Figure 4).
- The percentage of the beach survey respondents who understand the water quality signs was significantly lower in 2005 and 2009 compared to 2006-2008 and 2010 (Figure 5).
- The percentage of the beach survey respondents who were aware of the NOWCAST system was lower the past two years compared to 2006-2008 (Figure 6).
- The percentage of the beach survey respondents who reported becoming ill after going to the beach has declined the past two years (Figure 7).
- The percentage of the beach survey respondents who reported visiting the Cuyahoga County Board of Health website remains low (Figure 8).

Figure 3.

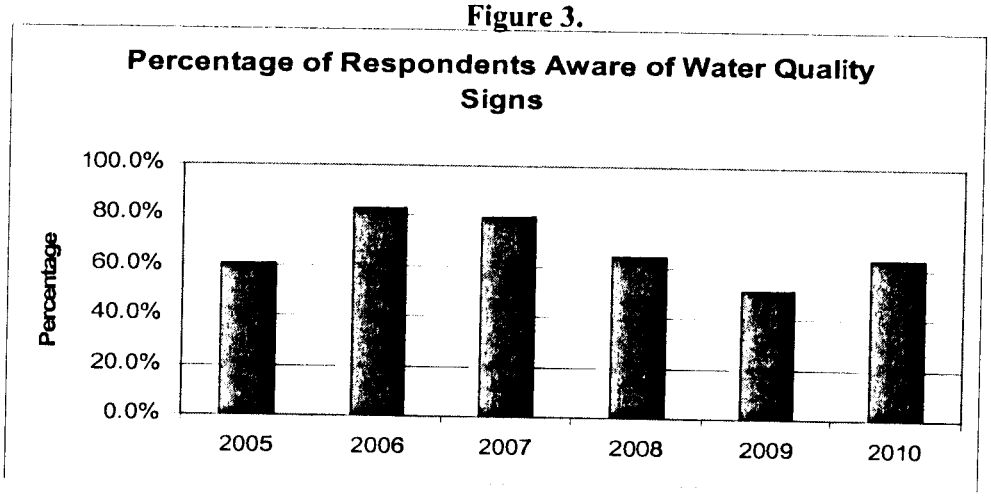


Figure 4.

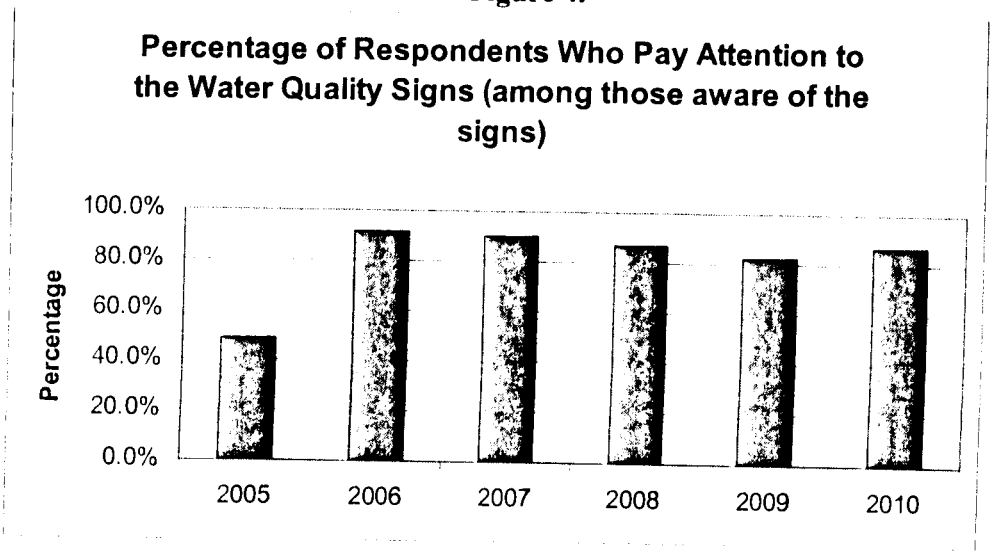


Figure 5.

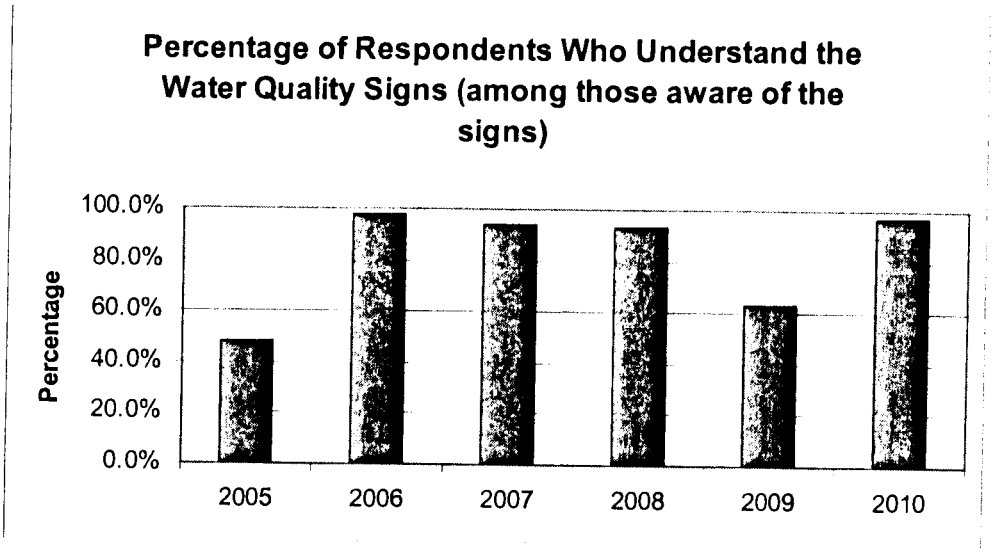


Figure 6.

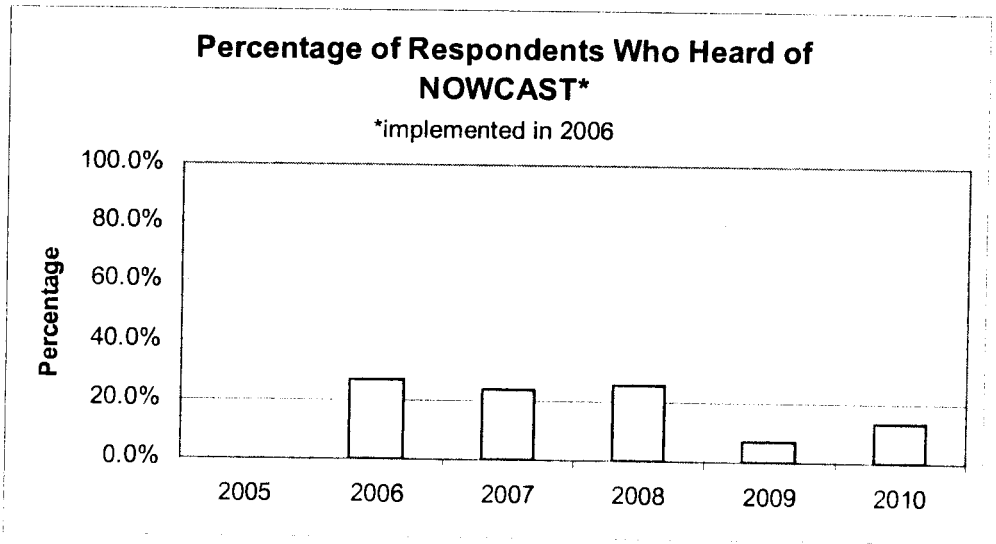


Figure 7.

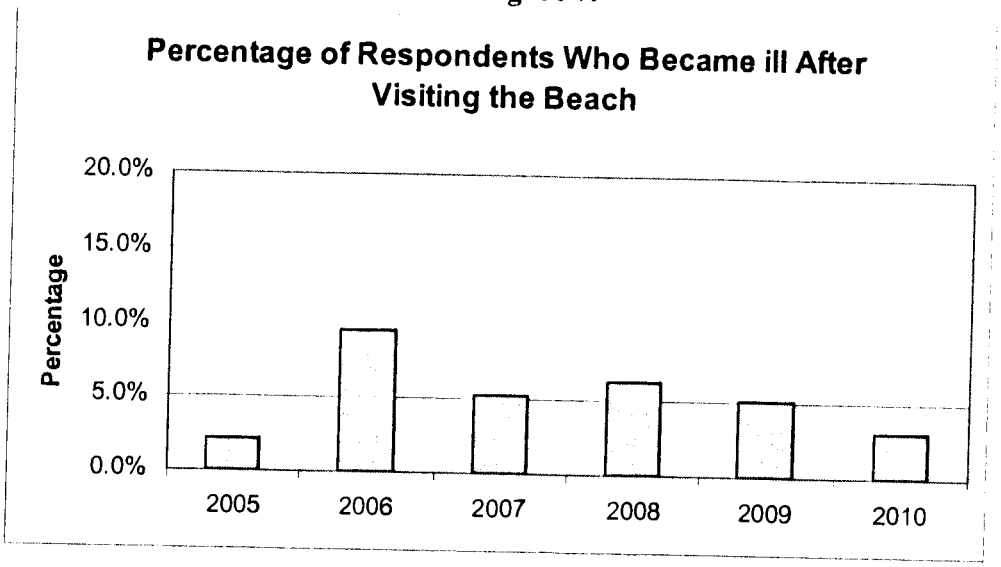
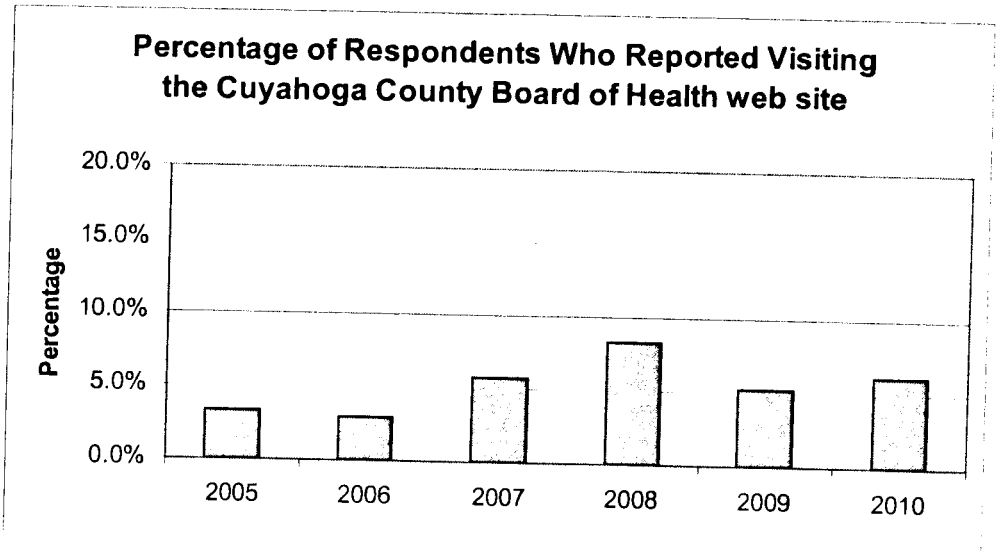


Figure 8.



CUYAHOGA COUNTY Board of Health
PREVENT · PROMOTE · PROTECT

TERRENCE M. ALLAN,
R.S., M.P.H.
Health Commissioner

5550 VENTURE DRIVE
PARMA, OHIO 44130
(216) 201-2000
www.ccbh.net

Public Health
Prevent. Promote. Protect.
Northeast Ohio Public Health Partnership

August 25, 2010

Mr. Joe Jernejcic
6 East 219th Street
Euclid, OH 44123

Dear Mr. Jernejcic:

The Cuyahoga County Board of Health (CCBH) has been actively involved with monitoring the water quality at Shorehaven Beach for the past several years. As you may recall, you had initiated the contact with our department, primarily to inquire about the water quality of Lake Erie in the vicinity of Shorehaven Beach. At that time, we were not aware of the existence of Shorehaven Beach and began monitoring (sampling) the beach water in order to determine potential public health risks that may be associated with the water at that location.

Numerous water samples have been collected over the years, paid for by the CCBH, in addition to federal grant money. On several sampling occasions, individuals have been observed swimming at Shorehaven Beach while our staff has been collecting samples. According to CCBH Bathing Beach Regulations, every person operating a public or community bathing beach shall obtain an annual Permit to Operate from the CCBH. It is the intent of the CCBH to assist beach operators in monitoring their bathing waters and to provide guidance in public notification requirements of water quality data.

Since Shorehaven Beach is indeed operating as a bathing beach, a permit must be obtained and renewed annually beginning with the 2011 recreation season. Water sampling and analysis will be conducted as part of an agreement between the CCBH and the beach operator. Based upon its usage, Shorehaven Beach would be classified as a Tier 3 bathing beach (low use). The total fee for a Tier 3 bathing beach is currently $101.00 ($35.00 permit fee + $66.00 for sampling). Sampling is conducted weekly during the recreation season, and operators of similar beaches paid for only 3 of 14 samples in 2010. The remainder of the program expenses were covered by federal grant funding obtained by the CCBH.

There are currently 7 other beaches within the Euclid area that are included in the CCBH bathing beach program. Shorehaven Beach is no different than these other beaches, and it is therefore subject to the program regulations. However, if it is to be decided that the area will no longer operate as a bathing beach, permitting will not be necessary. You will need to post a sign at the entrance stating that swimming is prohibited. We will also require written documentation to us to demonstrate that this decision has been made.

Please contact me with your decision on whether Shorehaven Beach will continue to operate as a bathing beach. I can be reached at (216) 201-2001 ext. 1232 or bgrisez@ccbh.net. Let me know of any questions or concerns about this matter. Please also let me know if you are not the correct point of contact for this matter. This letter was sent to your attention since you are the contact person we have on record. Thank you.

Sincerely,

Barry Grisez, R.S.
Program Manager
Cuyahoga County Board of Health

Appendix
(Quality Control)

Quality Control /Chain-of-Custody

In order to ensure that all environmental data collected is of sufficient quantity and quality to support the data's intended use, quality assurance procedures have been developed by the CCBH. The CCBH is involved with numerous water quality programs, including, but not limited to the following: a bathing beach monitoring and public notification program, a residential and semi-public sewage system operation and maintenance inspection program, a stream monitoring program to monitor water quality trends throughout the Cuyahoga County watersheds, and a storm water program. The CCBH's internal Quality Assurance Management Plan (QAMP) was previously submitted to the Ohio Department of Health as part of the Final Report for the 2003 Contract Period. That document has been modified as needed to reflect changes in protocol or regulations to ensure that consistent sampling protocol is being utilized. Numerous CCBH staff are also Qualified Data Collectors with the Ohio Environmental Protection Agency.

Water sampling and analysis protocol for this project was provided by the Northeast Ohio Regional Sewer District's Laboratory, located in Cuyahoga Heights, Ohio. This lab is the current contract lab for the CCBH and it therefore performed all water quality analyses associated with this project. The lab's Quality Assurance Manual is provided at the end of this Appendix.

Documents that describe CCBH's beach sampling protocol and the lab's sampling and analysis protocol are provided on the following pages. Also provided is a copy of the lab's manifest form, which is filled out by the sample collector at the time samples are delivered to the lab, an example of a CCBH Environmental Data Field Collection Form, which is filled out at the time the samples are collected, and an example of the field data collection form that is used for the Nowcast at Huntington Beach. The sample collector has sole custody of the samples from the time the samples are collected until they are delivered to each lab. The lab is responsible for the custody of the samples once they are received. The lab is further responsible for forwarding the sample results to the CCBH once they are obtained. The sample results are provided to the CCBH via email and the hard copies are mailed.

Beach Program

Bathing Beach Sampling Procedures

Sample collectors will follow the sampling protocol as specified in this document. Sample bottles will be prepared and provided by the NEORSD. The sample collectors will carry enough bottles to collect samples at all identified and monitored beaches. Collectors will also carry additional bottles to be used in the event that any sample bottle cannot be used of the collected sample becomes contaminated.

If, for any reason, the sample collector cannot collect assigned samples on any given day (except for dangerous or adverse weather conditions), or it becomes apparent that collected samples will not reach the laboratory within the required time limits, the collector should immediately notify the Program Manager who will take and document any needed corrective action. Such action may or may not include re-sampling of the affected beaches.

Bathing Beach Sample Handling and Custody

The laboratory data form (see end of this section) will serve as a Chain-of-Custody record for each sample collected and analyzed. In Keeping with laboratory requirements, all samples must be sealed, chilled, and transported from the sample point to the laboratory for analysis within six hours after sampling. Sample collectors will have exclusive custody of any sample from the time of collection until the sample is deposited with the laboratory. The laboratory will assume custody of each sample it receives and is responsible for forwarding all sample analysis results to the Program Manager within twenty-four hours of receiving the sample.

Bathing Beach Sampling Protocol

To assure consistency in collecting samples for analysis, the following procedures will be used:

1. Specific sites will be designated for collecting samples during the bathing season. Samples will be collected at these sites for the duration of the sampling period.
2. Sample bottles will be provided and prepared by NEORSD.
3. Collectors will sample where the water is approximately three feet deep, in an area of the beach generally used for swimming. Each sample will contain at least 100ml. of water. The sample bottle will be inverted. With a sweeping motion, the sample will be collected from about one (1) foot below the water surface. The sample will be sealed with care taken not to contaminate the lid, stopper, or neck of the sample bottle.
4. Every precaution will be taken to minimize sediment or debris in the sample. In cases where debris or sediment is present throughout the sample area, this information will be noted on the Field Data Form.

5. The sampler will complete the Field Data Form noting the time, date, and location of sample collected, number of bathers, number of birds, weather conditions, water temperature, clarity, wave height and any abnormal water conditions. The sampler will also indicate and describe any nearby know pollution sources, this information may also be included as part of a Sanitary Survey.
6. Sample bottles will be labeled, packed in ice or other cooling medium and transported to NEORSD such that delivery is accomplished within six hours of the time the first sample was collected.
7. NEORSD will analyze each submitted sample for E.coli bacteria content and transmit the result to CCBH and ODH within 24 hours of receiving the sample. This information will be entered into the database for future analysis.
8. Enterococci are also being analyzed for Huntington only (Nowcast data).

Northeast Ohio Regional
Sewer District
Protecting Your Health and Environment

Sampling Instructions - Beaches

Please collect the following bottles for each sample for the applicable tests (Do not collect bottles for tests that are not applicable for this sampling event):

E. Coli	One 250 mL Plastic Bottle	$Na_2S_2O_3$, EDTA, 4°C

Laboratory Contact Information
Analytical Services - Phone: 216-641-6000

Mark Citriglia
Manager Cell – 1-216-299-2767
Extension: 2514

Carol Turner
Extension: 2502
- ⊗ Chain of Custody
- ⊗ Sampling Kits
- ⊗ Data Reporting (Certificate of Analysis)

Denise Crison
Extension: 2509
- ⊗ Sampling kits, Sample Tags, Chain of Custody
- ⊗ Chemicals, Solutions, Laboratory Supplies

Cynthia Williams
Extension: 2517
- ⊗ Sampling kits, Sample Tags, Chain of Custody
- ⊗ Chemicals, Solutions, Laboratory Supplies

Cheryl Soltis-Muth
Extension: 2501
- ⊗ Metals and Mercury Analysis
- ⊗ Nutrient Analysis: Ammonia, Nitrite, Nitrate, TKN,
- ⊗ T-Phosphorous, O-Phosphorus, Alkalinity,
- ⊗ Sulfate, Hexavalent Chromium

Kristen Greenwood
Extension: 2518
- ⊗ Solids analyses (TSS, TDS, TS)
- ⊗ Cyanide, Sulfide, and Oil and Grease Analysis

Eva Hatvani
Extension: 2513
- ⊗ Microbiology
- ⊗ Beach Sampling

Company Name: Cuyahoga County Board of Health
Address: 5550 Venture Drive Parma, Ohio 44130
Phone: 216-201-2000
Fax: 216-676-1317 E-Mail: [illegible]
Reporting Turn Around Time (Please Check): [x] Standard 7 - 14 days [ ] Rush 24 - 48hrs

Program/Project: BATHING BEACHES 501
Location: EAST SIDE - COASTAL
Contact / Phone: [illegible]

CHAIN OF CUSTODY-ANALYTICAL SERVICES

Samplers: BARRY [illegible]

Sample Identification	Date Collected	Time Collected	Grab=G / Composite = C	Matrix = Potable Water (PW), Sewage (SE), Stormwater (SW), Recreation Water (RW), Solid (S), Special (SP)	Number of Bottles	Preservative Type: 1. HNO₃ 2. H_2SO_4 3. H_3PO_4 4. HCL 5. NaOH 6. Na_2SO_3 7. Cool 4 C 8. None 9. Others)	Ammonia Nitrogen (H_2SO_4)	Total Suspended Solids (TSS)	BOD	Fecal Coliform	E. Coli	Comments
1 ROYAL ACRES	8/24/10	8:55A	G	RW	1	None					✓	
2 [illegible]	↓	9:00A	↓	↓	1	↓					✓	
3 SIMS	↓	9:25A	↓	↓	1	↓					✓	
4 NOBLE	↓	9:40A	↓	↓	1	↓					✓	
5 [illegible] POINT	↓	9:55A	↓	↓	1	↓					✓	
6 [illegible]	↓	10:15A	↓	↓	1	↓					✓	
7 [illegible]	↓	10:3[illegible]A	↓	↓	1	↓					✓	
8 ACCADIA	↓	10:45A	↓	↓	1	↓					✓	
9 [illegible]	↓	[illegible]	↓	↓	1	↓					✓	
10 [illegible]	↓	[illegible]	↓	↓	1	↓					✓	
11												
12												
13												
14												
15												

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
[illegible]	8/24/10	12:15	[illegible]	8/24/10	1215
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

Report Options		
E-Mail:	☐	
Fax:	☐	216-676-1317
Telephone	☐	

Form 5039-00

Approved : 3/6/2009

Cuyahoga County Board of Health

2010 Bathing Beach Season – Environmental Data (East Side Beaches)

Sample Collection Date: 3/24/10

Sample Collected By: BARRY GRISEZ

Beach Name	Time	Rain Prev. 24 hrs. Yes No	Present Weather Rain Sun P. cloudy Overcast Hazy Foggy	Water Temp. (F)	Wave Height 0-2 ft. 1-3 2-4 3-6 Etc...	Water Clarity Clear Slightly Turbid High Turbidity Floating Debris	Algae/Muck None In Sampling Area Patches in water Along shoreline	Shore Conditions Clean Trash/Debris Dead Fish	# Bathers	# Birds	Sample Collected at 3 ft. depth? Yes No, what depth?
Royal Acres Beach	8:55A	Y	Overcast	75.5	1-3	High	None	Debris	0	0	Y
Clarkwood Beach	9:00A	Y	Overcast	75.5	1-3	High	None	Debris	0	0	Y
Noble Beach	9:40A	Y	Overcast	75.5	1-3	High	None	clean	0	0	Y
Moss Point Beach	9:55A	Y	Overcast	76.1	1-3	High	None	clean	0	0	Y
Shorehaven Beach	10:15A	Y	Overcast	76.1	1-3	High	None	clean	0	0	Y
Edgecliff Beach	10:30A	Y	Overcast	76.8	1-3	High	None	clean	0	0	Y
Arcadia Beach	10:45A	Y	Overcast	77.0	1-3	High	None	clean	0	8	Y
Utopia Beach	11:05A	Y	Sunny	77.3	1-3	High	None	clean	0	0	Y
Sims Beach	9:25A	Y	Overcast	75.3	1-3	High	None	litter	0	0	Y
Shoreby Club Beach	11:35A	Y	Sunny	76.4	0	~~Stright~~ clear	None	litter	0	70	Y
Meadow Lake Park								clean	2	0	Y
Briarhill Lake											
Sherwood Park Lake											
Sherbrook Lake											
Walton Hills Lake											

Comments on reverse side..... * Wind/waves out of the NE

* Significant erosion @ Edgewater, Arcadia & Utopia compared to last week

FIELD NOTES – HUNTINGTON BEACH ("SubSeason 1")

To be filled out at the time of sample collection:

Sampled by:_____ Date: ____/____/ 2010 Time: Central _____ West _____

Field Measurements and Observations:

Water Temperature: Central _____F West _____F **Air Temperature:** _____F

Sample Collected at 2.5 ft. Depth? (circle): Central (Yes) (No, what depth_____) West (Yes) (No, what depth_____)

Wave Height (measuring stick at Huntington Central):

Maximum Height _____ - Minimum Height ___2.5___ = _____(wave height in "feet")

Visual Estimate **(If unsafe conditions)** (circle): (1) 0-2 ft. (2) 1-3 ft. (3) 2-4 ft. (4) 3-6 ft.

Water Clarity (circle): (1) Clear (2) Slightly Turbid (3) High Turbidity/Sediment (4) Floating Debris

Algae (circle): (1) None (2) Some Visible (3) 1 Location <10 ft (4) 1 Location >10 ft (5) Both >10 ft

Debris (circle): (1) None (2) Some Visible (3) 1 Location <10 ft (4) 1 Location >10 ft (5) Both >10 ft

Fecal Material (circle): (1) None (2) Sparse (3) Some in 1 Area (4) Some in Both (5) All along Shore

Number of Swimmers (visual estimate): Central _____ West _____

Number of Birds (visual estimate): Central _____ West _____

Sky Conditions (circle): Clear P. Cloudy Overcast Hazy Foggy Rain

Turbidity Measurements (with turbidimeter): Calibration: Zero Standard _____ 40.0 NTU Standard _____

Central: 1st Reading _____ 2nd Reading _____ Average _____(NTU)

West: 1st Reading _____ 2nd Reading _____ Average _____(NTU)

Central Avg. _____ + West Avg. _____ = _____ divided by 2 = _____(NTU) OVERALL AVG.

Model Parameters: (SubSeason 1, May 24th, 2010 through July 24th, 2010)

Enter Month (MM)
Enter Date (DD)
Enter Radar Rain from USGS email (if no email, or error with email, enter Hopkins rainfall below)

Rainfall data from Hopkins (obtain online): 24 hr. rainfall (8:51a.m. yesterday to 7:51a.m. today) _____(inches)
Enter Turbidity (Overall average from above)
Enter Wave Height (Value determined using the stick method)

Model Output:

Predicted *E. coli*:_____ 90% Prediction Interval: Lower _____ Upper_____

Probability > 235 _____% **NOWCAST (circle): GOOD if <23%**
POOR if >, or = 23%

Precip (Radar) _____ Turbidity _____ Wave Stick _____ LTWS _____ Day of Year _____

Actual Lab E.coli Results:

Central: _____ *E. coli*/100ml West: _____ *E. coli*/100ml **AVERAGE:** _____ ***E. coli*/100ml**

Northeast Ohio Regional
Sewer District
Protecting Your Health and Environment

Analytical Services
4747 East 49th Street
Cuyahoga Hts., OH 44125

SOP 5001-4 Quality Assurance Manual
PA DEP Lab ID: 68-03670

Effective Date: January 8, 2008

This manual is applicable to the Quality Assurance System governing the Analytical Services Department of the Northeast Ohio Regional Sewer District Analytical Services Department.

Approvals:

Superintendent of
Environmental Services: Frank Foley Date:01/08/08

Manager of Analytical Services: Mark Citriglia Date: 12/26/07

Quality Assurance Specialist: Carol Turner Date: 12/26/07

Supervising Chemist: Eva Hatvani Date: 01/08/08

Supervising Chemist: Cheryl Soltis-Muth Date: 12/26/07

Supervising Chemist: Kristen Greenwood Date:12/26/07

Northeast Ohio Regional Sewer District

Protecting Your Health and Environment

Analytical Services
4747 East 49th Street
Cuyahoga Hts., OH 44125

Quality Assurance Manual
Table of Contents

1.0 Quality Assurance Policy

1.1 The Analytical Services Department performs analytical testing for the various departments within the Northeast Ohio Regional Sewer District (NEORSD). The Analytical Services Department also performs work for external sources on a limited basis. The analytical information generated is used for daily operation of the wastewater treatment facilities, and provides compliance monitoring for the treatment facilities as required by the Ohio Environmental Protection Agency and the District's National Pollution Discharge Elimination System (NPDES) permits. Additionally the laboratory monitors materials introduced into the collection system and monitors water quality throughout the service area from samples submitted from the Water Quality and Industrial Surveillance Department.

1.2 The management staff of Analytical Services is committed to operating the laboratory in a safe, professional and proficient manner. To attain these goals, management is committed to and has adopted policies and procedures in accordance with the National Environmental Laboratory Accreditation Conference (NELAC).

1.3 The goal of management is to generate information of the highest quality that is legally defensible and presents the laboratory and its employees as ethical and competent. The management staff is responsible for ensuring that policies and objectives are communicated to, understood and implemented by all laboratory personnel.

1.4 The Quality System is documented and defined in the Quality Assurance Manual. The Quality Assurance Manual, Standard Operating Procedures and supplemental instructions for the performance of duties are available to the laboratory personnel. Every employee of the NEORSD Analytical Services department is responsible to read, understand and follow the policies defined in the Quality Assurance Manual.

2.0 Organization and Management Structure

2.1 Qualifications for laboratory personnel are kept on file by the District's Employee Resources Department and can be reviewed on-site upon request. Copies of all pertinent employee information and qualifications are kept on file in the employees personnel file at Analytical Services. The originals documents are property of the Employee Department as per the District's Records Management Policy.

2.2 Education requirements are included in all of the Districts job descriptions. Job descriptions are managed by the District's Employee Resources department. A signed copy of the employee's job description is available within the employee's personnel file.

2.3 The ***Superintendent of Environmental Services*** is the final authority for laboratory operations. The ***Superintendent*** has assigned daily management of the laboratory to the ***Manager of Analytical Services.***

2.4 The ***Manager of Analytical Services*** reports directly to the ***Superintendent of Environmental Services***. The manager is responsible for addressing the technical issues of the laboratory and assuring that the technical operations of the laboratory are conducted within the guidelines of the Quality Assurance System. ***The Manager of Analytical Services*** is responsible for implementing actions necessary to bring operations into compliance with the Quality Assurance System.

2.5 The ***Quality Assurance Specialist*** reports directly to the ***Manager of Analytical Services***. The ***Quality Assurance Specialist*** is responsible for monitoring laboratory compliance with those requirements set forth in this Quality Assurance Manual. The ***Quality Assurance Specialist*** has the authority to issue requests for corrective action on items or activities found to be out of compliance with the Quality Assurance System. The ***Quality Assurance Specialist*** has the final authority on issues dealing with the quality of the data. The ***Quality Assurance Specialist*** has the authority to suspend analyses or require re-analyses.

2.6 The ***Supervising Chemist*** is considered the technical director of the areas under his/her direct supervision. Responsibilities include assisting and training of laboratory personnel with the various approved EPA methods utilized within the laboratory, management of the day to day analytical activities of chemists, biologists and wastewater analysts. Evaluation, review and approval of data, and quality control statistics for the analyses performed in the laboratory. The Supervising Chemists report directly to the Manager of Analytical Services. A detailed job description for this position is on file with the Employee Resources Department.

2.7 The ***Logistic Chemist*** assists the Manager of Analytical Services and the QA/QC Specialist with coordination of administrative and operational functions including chemical inventory, disposition of laboratory equipment and supplies, data reporting, Chain of Custody procedures, project management, and scheduling. The Logistics Chemist reports directly to the QA/QC Specialist. A detailed job description for this position is on file with the Employee Resources Department.

2.8 The ***Advanced Instrumentation Chemist*** (AI Chemist) performs qualitative, and quantitative chemical analyses utilizing advanced instrumentation such as ICP, GFAA, Automated Analyzers, TOC and other instrumentation. The AI Chemist is responsible for troubleshooting and training on the advanced instrumentation. The AI Chemist reports directly to a Supervising Chemist. A detailed job description for this position is on file with the Employee Resources Department.

2.9 The ***Chemist*** is responsible for the analysis of water samples such as municipal and industrial wastewater and sludge samples for various chemical analyses, including wet chemistry, physical properties and instrumental analyses. The Chemists follow defined laboratory standard operating procedures and utilize good analytical techniques. Chemists report directly to the Supervising Chemist. A detailed job description for this position is on file with the Employee Resources Department.

2.10 The ***Biologist*** analyzes water samples such as municipal and industrial wastewater and sludge samples for various bacteriological and microbiological components, bioassay, and physical and chemical including wet chemistry, physical properties and instrumental analyses. Follow standard methods and good analytical techniques. The Biologist follows defined laboratory standard operating procedures and utilize good analytical techniques. The Biologists report directly to the Supervising Chemist. A detailed job description for this position is on file with the Employee Resources Department.

2.11 The ***Wastewater Analyst (III)*** analyzes water samples such as municipal and industrial wastewater and sludge samples for various chemical analyses, including wet chemistry, physical properties and instrumental analyses. Analysts follow defined laboratory standard operating procedures and utilize good analytical techniques. A detailed job description for this position is on file with the Employee Resources Department.

2.12 The ***Wastewater Analyst (II)*** analyzes water samples such as municipal and industrial wastewater and sludge samples for various chemical analyses, including wet chemistry and physical properties. Analysts follow defined laboratory standard operating procedures and utilize good analytical techniques. Wastewater Analyst will also collect samples and transport samples utilizing chain of custody procedures defined by the laboratory. A detailed job description for this position is on file with the Employee Resources Department.

2.13 The ***Wastewater Analyst (I)*** analyzes water samples such as municipal and industrial wastewater and sludge samples for various chemical analyses, including wet chemistry, and physical properties. Analysts follow defined laboratory standard operating procedures and utilize good analytical techniques. Wastewater Analyst will also collect samples and transport samples utilizing chain of custody procedures defined by the laboratory. A detailed job description for this position is on file with the Employee Resources Department.

2.14 The ***Sample Control Specialist*** administers, coordinates, documents, and participates in the chain of custody program controlling wastewater, sludge, industrial, and surface water samples submitted to Analytical Services. The Sample Control Specialist reports directly to the QA/QC Specialist. A detailed job description for this position is on file with the Employee Resources Department.

2.15 The ***Analytical Laboratory Assistant*** cleans, organizes and maintains laboratory glassware, sampling equipment, vehicles, refrigerator and general areas within the laboratory facilities. The lab assistant distributes and disposes of supplies and samples as directed. The Analytical Laboratory Assistant reports directly to the Logistic Chemist. A detailed job description for this position is on file with the Employee Resources Department

2.16 The ***Analytical Services Assistant*** assists the management staff of Analytical Services with the coordination of administrative tasks, operational functions, data reporting, document management and storage for compliance reports. A detailed

job description for this position is on file with the Employee Resources Department.

2.17 An organizational chart is included as Appendix A.

3.0 Documents Control

3.1 Maintenance and management of the document control system is the responsibility of the Quality Assurance Specialist. Documents related to analysis, calibration, calculations and reports are maintained to allow for historical reconstruction of data.

3.2 A complete list of all supporting Quality System operating procedures are included as Appendix A.

3.3 A complete list of analytical methods performed and supporting operating procedures are included as Appendix B.

3.4 The following documents are considered controlled documents and are to be maintained by the document control system.

- 3.4.1 Quality Assurance Manual
- 3.4.2 Standard Operating Procedures
- 3.4.3 Analytical Data Sheets, Forms and Notebooks
- 3.4.4 Instrument Printouts and Run Logs
- 3.4.5 Batch records
- 3.4.6 Calibration curves and records
- 3.4.7 Method detection limits records
- 3.4.8 Training Records
- 3.4.9 Instrument Maintenance logs

3.5 Document Control System

3.5.1 Controlled documents are maintained by the document control system. Controlled documents exist as procedures or forms. Logs are maintained of both types of documents to prevent duplication, for reference and organization. Controlled documents must be issued and revised by use of the document control system.

3.5.2 Controlled documents must be approved by the Quality Assurance Specialist and must have a unique identifying number and reflect revision and or effective date. The effective date also serves as the revision date.

3.5.3 All controlled copies distributed to laboratory employees will be signed by the Manager of Analytical Services and the Quality Assurance Office. These documents will also be stamped or have a watermark on the copy that states **"Controlled Copy"**.

3.5.4 **"Controlled Copies"** are not distributed to third party customers or auditors. All third parties will receive an unsigned copy for review. All "Controlled Copies" can be reviewed or audited on site.

3.5.5 The document control system is designed so only the current revision of each document is available for use. The document control system is a computerized system. The Quality Assurance Specialist maintains the control of documents on the computer network via password protection. Documents are available on the laboratory information management system as read only documents. Approved copies of controlled operating procedures are distributed throughout the laboratory. These documents are managed by the Quality Assurance Specialist. All analysts receive approved controlled copies of pertinent operating procedures that are stored in the Analytical Services Handbook. These operating procedures are managed by the Quality Assurance Specialist.

3.5.5.1 Documents can be printed from the LIMS system for review. These documents are only valid for review. Only documents stamped controlled can be used for analytical methods.

3.5.6 When a new revision is issued the original signed hard copy is marked obsolete. The obsolete document is retained in the historic record to provide for reconstruction of laboratory activities. A new controlled copy of the analytical procedures will be placed in the area and the original copy will be destroyed. When a new revision of pertinent operating procedures has been issued, the Quality Assurance Specialist will collect any old version and distribute the new controlled version of the operating procedure. The Quality Assurance Specialist will maintain the documentation needed for tracking of controlled copies of any operating procedures. Operating procedure that must be distributed to all Analytical Services Personnel will be performed during general meetings.

3.5.7 Support activities are documented on forms and maintained as controlled documents. Support activities include Quality Assurance assignments such as reagent standardization, equipment maintenance and thermometer and balance calibrations.

3.5.8 Records will reflect the dates, times, observations and identify the individual making the entries and observations. All controlled documents and records are retained for five years unless alternative arrangements are made.

4.0 Critical Staff Positions

4.1 The Manager of Analytical Services has authorized the establishment of the Quality Assurance System for the purpose of developing, monitoring and continually improving the quality control and documentation systems used within the laboratory. The Manager of Analytical Services will be informed of any non-compliance of the requirements of the Quality Assurance System. Enforcement of

the requirements of the Quality Assurance System ultimately is the responsibility of the Manager of Analytical Services.

4.2 The Supervising Chemist of Analytical Services exercises actual day-to-day supervision of laboratory operations and reporting of results. These include:

4.2.1 Monitoring standards of performance in quality control and quality assurance.

4.2.2 Monitoring the validity of the analyses performed and data generated in the laboratory to assure reliable data.

4.2.3 Provide support to laboratory in the review and response to corrective actions.

4.2.4 Provide technical support for development and improvement of methodologies.

4.2.5 Provide the focal point for technical training of employees.

4.3 Quality Assurance Specialist manages the Quality Assurance System as follows:

4.3.1 Reviewing Standard Operating Procedures for analytical and Quality Assurance procedures, assuring conformance with document control procedures.

4.3.2 Planning and conducting, if necessary, the training of analysts in good laboratory practices and test method requirements.

4.3.3 The analysis of trends in the laboratory precision and accuracy that are demonstrated by the results of analysis of quality control samples.

4.3.4 Serving as a focal point for the reporting and disposition of non-conformances.

4.3.5 Coordinating responses to Corrective Action Requests.

4.3.6 Suggesting actions to be taken in order to correct a problem with an analytical procedure.

4.3.7 Informing the Manger of Analytical Services of out-of-control situations This includes the authority to require the laboratory to discontinue a procedure until corrective action brings the analysis back into control.

4.3.8 Maintaining the laboratory quality files and preparing routine quality control reports for review by the Manager and Superintendent.

4.4 Laboratory personnel are responsible to follow the Quality Assurance Manual and the related Standard Operating Procedures (SOP) as written. All laboratory personnel must adhere to issued quality control practices and procedures as stipulated by management and dictated by good laboratory practices. It is the responsibility of all laboratory personnel to advise management of observations that may result in the laboratory performance not attaining the objectives of the Quality Assurance System.

5.0 Traceability of Analytical Measurements

5.1 Analytical testing performed within the Analytical Services Department is performed on a batch basis. Each batch will be identified with a unique number for traceability. SOP-5010-1 Sample Batch Determination defines the procedures for creating preparation and analytical batches.

5.2 Samples are grouped based on matrix and time. Influent, effluent and pretreatment samples are all classified as a wastewater matrix. Sludge, grits and soils are classified as solid matrix. Each batch of samples is monitored by specified quality control activities.

5.3 Analytical measurements are recorded on controlled forms, or entered directly into the Laboratory Information Management System (LIMS) that collects all measurements and quality control activities associated with the batch. The date and time the analysis was performed, measurements obtained and calculations used to obtain the result are recorded.

5.4 Calibration curves are part of the document control system. Calibration dates are recorded thus analytical data can be traced to specific calibration curves.

5.5 Following data review the batch records become part of the record retention and filed for future retrieval. All records are stored on site for two years and then moved to off-site storage as defined in the District's record retention policy.

5.6 All recording and data corrections will be documented according to generally recognized good laboratory practices. These practices include recording in ink, dating, initialing entries, and all correction will be made with a single-line through the old data and dated and initialed. The correction must not obscure the original entry.

5.7 Changes to electronic data are captured by the audit trail system included with the LIMS software package.

6.0 Methods Performed

6.1 Analytical procedures are performed according to issued Standard Operating Procedures derived from *Standard Methods for the Examination of Water and Wastewater, 19th edition, 20th edition, Methods for Chemical Analysis of Water and Wastes EPA 600/4-79-020* and cited ASTM or AWWA methods. A complete list of methods can be found in Appendix B.

6.2 All methods that are modified methods are formatted in italics and bold. Modified methods are not used for NPDES reporting.

6.3 Details regarding detection limits, precision and accuracy are included in the cited operating procedures.

7.0 Capabilities Review for Addition to Methods Performed

7.1 Tests may be added to methods performed after a review of resources and capabilities.

7.2 The Manager of Analytical Services is to review equipment, space and personnel resources to determine the capabilities of the laboratory to add methods.

7.3 The Quality Assurance Specialist is to review the method for proper quality control activities to be instituted for routine method performance evaluation.

7.4 The Quality Assurance Specialist and the Supervising Chemist are to review method validation requirements such as calibration requirements, method detection limit determination, training needed, accuracy and precision of the method for desired use of the data.

7.5 Following a determination that resources are satisfactory for successful performance, a test may be added. Standard Operating Procedures and method detection limit studies are to be added to the appropriate documentation.

8.0 Traceability of Calibration and Method Validation

8.1 Method Linearity Studies

8.1.1 Linearity studies are performed, where appropriate, to define the working range of the method and demonstrate that the response is linearly proportional to the analyte concentration.

8.1.2 Standards traceable to the National Institute of Standards are used for linearity studies. Vendor certification is retained for reference.

8.1.3 The correlation coefficient of the calibration curve must be 0.995 or better unless specified in individual Standard Operating Procedure. The linearity studies will also define the working range of the method.

8.1.4 The reporting level of a method must be included in the calibration curve, or must be verified each day of use with a control sample at the reporting level with 70%-130% recovery.

8.2 Method Specificity

8.2.1 Methods used at Northeast Ohio Regional Sewer District Laboratory are approved for monitoring and reporting to the Ohio Environmental Protection Agency.

8.2.2 Specificity is not monitored directly. Method bias is monitored by performing duplicate and spike analysis. Individual Standard Operating Procedures define the frequency and limits for variability and recoveries.

8.3 Method Accuracy

8.3.1 Method accuracy is monitored by the analysis of standards with each batch of samples. Individual Standard Operating Procedures define the acceptable performance.

8.3.2 The laboratory participates in proficiency test programs where sample are analyzed without prior knowledge of certified concentrations. Results are evaluated after the completion of the studies and any problem identified are addressed with corrective actions.

8.3.3 Controls charts are generated for long term tracking of analytical trends. Method specific quality control limits supersede system generated quality

control limits unless specified in the specific Standard Operating Procedure.

8.4 Method Precision

8.4.1 Method precision may be evaluated by the use of control samples of known concentration.

8.4.2 Sample matrix effects may create a positive bias or a negative bias. Method precision on specific samples is measured by the use of duplicates, spikes and spike duplicates. The accuracy is measured by the recovery and reproducibility of the recoveries.

8.4.3 Control charts are generated for long term tracking of analytical trends. Method specific quality control limits supersede system generated quality control limits unless specified in the specific Standard Operating Procedure.

8.5 Reagents and Standards

8.5.1 The type and purity of chemicals, reagents and solvents shall be dictated by the analytical method. Chemicals, reagents, and reference standards are purchased based upon the method specifications for each analysis regarding the purity of the material to be used in the analytical procedure. If a method does not specify the purity, then reagent grade (or better) chemicals, reagents and reference standards are purchased.

8.5.2 A reagent or chemical that does not meet the method specifications or is beyond the expiration date shall not be used.

8.5.3 The purity of reagents and solvents shall be monitored through reagent blanks that are analyzed with each set of samples.

8.5.4 Reference materials (standards) used to calibrate instruments or validate and monitor analytical methods must be National Institute of Standards Technology (NIST) traceable or equivalent.

8.5.5 When the laboratory receives a chemical the chemical is labeled with the following information:

8.5.5.1 Date of receipt

8.5.5.2 Open date

8.5.5.3 Expiration date

8.5.5.4 Analyst initials

8.5.5.5 Unique Trace ID

8.5.6 Reagents are prepared in a controlled room for most analytical procedures. All procedures are documented and reagents are labeled prior to use in the laboratory.

8.5.7 Buffers are discarded 6 months after being opened or after the manufacturer's expiration date. All other chemical reagents are maintained for six years after receipt, or according to manufacturer's expiration date, which ever comes first.

9.0 Sample Receipt and Handling

9.1 Samples analyzed within the Analytical Services Departments are not limited to pretreatment samples, plant influent, plant effluent, plant process control samples and receiving water from the treatment facility. Other sample types include sludge, soils, sediments and industrial wastes.

9.2 Samples are collected in designated containers, labeled with the date and delivered to the laboratory.

9.3 Chain of Custody procedures are defined in **SOP-5005-X Chain of Custody**.

9.4 Laboratory personnel track samples by the sampling location, sample ID and the sampling date. A unique sample identifier is assigned by the LIMS.

9.5 If analysis is delayed samples are preserved and/or stored in refrigeration units until processed. Individual standard operating procedures specify preservation and holding times. The hold time for grab samples starts from the time of sampling. The hold time for composite samples is measured from the time the sampling was completed.

9.6 Samples transferred to contract laboratories will be collected in bottles provided by the contract laboratory and their chain of custody forms will be used. Sample storage will be performed at the instruction of the contracting laboratory.

10.0 Facility and Equipment

10.1 The laboratory facility is heated and cooled to maintain stable conditions throughout the year. Thermostats are programmable and provide control for laboratory and office spaces.

10.2 Hot and cold water are provided throughout the laboratory. Sinks are located throughout the laboratory to accommodate need. Laboratory water consists of a main Deionization water system and an ultra-pure DI water system utilized for trace metals and mercury analysis.

10.3 Laboratory areas are limited access areas. Safety design was given top priority in the facility. Emergency showers, eye wash stations, and fire extinguishers are located throughout the laboratory.

10.4 Exhaust hoods are located in the laboratory for use when fume or odors are of concern. General fume hoods and local dedicated venting systems are located throughout the laboratory to provide adequate space for safe handling of materials and to prevent exposure.

11.0 Equipment Calibration and Maintenance

11.1 Preventive maintenance is a scheduled program of actions taken to maintain analytical instruments and equipment and is performed whether or not the performance of the equipment indicates a need for it. This maintenance is designed to eliminate the downtime that might occur from instrument failure.

11.2 The Management Staff of Analytical Services is responsible for ensuring all preventive maintenance is performed according to laboratory procedures.

Instrument specific Standard Operating Procedures detail the maintenance program that is in place at the Northeast Ohio Regional Sewer District Laboratory.

11.3 Analytical balances are serviced under contract by the manufacturer. The calibration records are maintained as specified in the document control system.

11.4 Thermometers are calibrated annually and traceable to the National Institute of Standards. The maintenance and calibration of thermometers is addressed in specific standard operating procedure(s).

11.5 Ovens, refrigerators and incubators are monitored daily for acceptable performance. Adjustments are made as needed to meet specifications. Equipment needing continual adjustment is scheduled for servicing. The Quality Assurance Officer is responsible for reviewing records for performance compliance.

12.0 Data Verification and Internal Quality Control Activities

12.1 Each analyst is responsible for verifying the correctness of the data produced by any method. This verification includes reviewing the acceptability of produced data with respect to:

12.1.1 Correctness of numerical input

12.1.2 Numerical correctness of calculations

12.1.3 Acceptability of quality assurance/quality control data

12.1.4 Instrument operation according to method specifications (calibrations, performance checks, etc.)

12.1.5 Documentation of dilutions, standard concentrations, etc.

12.2 The analyst is further required to perform data review for each batch of samples. This review includes the prescribed QC activities, calculations and supporting documentation as specified by internal procedures. If changes are made to data or reports the changes will be clearly marked to show that they are to replace previously submitted data.

12.3 Data will be archived to allow the easy retrieval for submittal when requested. Raw data shall be kept with batch records. All files will be archived for five years, unless previous arrangements have been made with the customer.

12.4 Method Blanks (MB) are processed and analyzed with each analytical batch. Method blanks are used in the evaluation of contamination control practices. Method blanks with values ± the method reporting level are considered in control and related data can be reported without qualifiers. Data associated with method blanks that do not meet acceptance criteria can only be reported as specified in specific procedures.

12.5 Initial Calibration Verification (ICV) standards are analyzed with each batch in order to evaluate stability of the calibration curve. This standard must be from an independent source.

12.6 Continuing Calibration Verification Standards (CCV) are analyzed with each batch in order to evaluate stability of the calibration curve. The acceptance criteria for each analytical method are specified in individual SOPs.

12.7 Laboratory Control Standard (LCS) is analyzed with each batch as required by standard operating procedures. An LCS is used to evaluate the methodology. If an LCS is in control it is considered evidence that the procedure was in control when performed. The limits for the control standard are specified in individual method SOPs. An LCS may not be available for some methods such as dissolved oxygen. Individual SOPs will specify activities to be performed.

12.8 Matrix Spikes and Matrix Spike Duplicates (MS/MSD) are analyzed in order to determine matrix effect and to evaluate precision. Alternatively, a duplicate and a spike, if appropriate, are performed per batch. The limits for spike recovery and precision are dependent on the analyte and method. Individual SOPs specify limits and actions to be taken. Methods such as pH and suspended solids cannot be spiked. Individual SOPs will specify activities to be performed.

12.9 Raw analytical data are recorded, dated, initialed, or signed on analytical data sheets. Data from instrument output is dated and initialed. Analytical data sheets include provisions for the QC data, including calibration data, method blank data, duplicate data, spike data, and laboratory control standard data, as appropriate for each analytical procedure.

12.10 On-going quality control data generated is tracked per standard operating procedures. Generation of control charts is the responsibility of the analysts. Review of the control charts is the responsibility of the Supervising Chemist. When anomalies or out of control conditions arise, the Quality Control Specialist is contacted to initiate required corrective action as prescribed in individual standard operating procedures. Control limits are used for trend analysis of data. Method control limits supersede laboratory control limits for data validation.

12.11 Reagents and chemicals used are of the purity specified in the procedure. Method blanks are carried through analysis procedures as an evaluation of contamination and stability of reagents.

13.0 Corrective Actions

13.1 The Quality Assurance Specialist is responsible for the administration of the corrective action system. The system is to be used to assign responsibility, document action taken and to track activities in order to ensure completion of assignments and meeting of deadlines.

13.2 Method specific corrective action is specified in individual procedural SOPs. Method specific corrective actions mainly address quality control activities that do not meet acceptance criteria specified in the individual standard operating procedures. If these actions fail to correct the observed non-compliance then the corrective action system is to be followed.

13.3 The corrective action system can be used to respond to findings of internal, customer or regulatory audits. The corrective action system can be used to respond to adverse events in the processing of materials. Corrective action may be used to respond to customer complaints. The corrective action system is used whenever departures from documented policies or procedures occur. Changes in the Quality System are documented using the Corrective Action System.

13.4 Completed corrective action are documented and maintained by the Quality Assurance Specialist. Records are maintained with the other controlled documents for 5 years.

14.0 Control of Data Generated from non-Conforming Activities

14.1 The Quality Assurance Specialist is responsible for responding to activities (i.e. calibration, analysis) that are non-conforming to policy and specifications. The Quality Assurance Specialist is to be responsible for the gathering of information needed to assess the impact of the non-conformance on data and laboratory performance.

14.2 The Manager of Analytical Services, the Quality Assurance Specialist and additional individuals, at the discretion of the Superintendent, are to evaluate the significance of the non-conformance and the corrective action.

14.3 The review must include if client notification is necessary, if work must be recalled and when work can resume.

14.4 The response to the non-conformance is to be documented and handled through the corrective action system.

15.0 Complaints

15.1 Complaints are to be directed to the Manager of Analytical Services or the Quality Assurance Specialist. The Manager of Analytical Services or the Quality Assurance Specialist will determine if the complaint merits a response.

15.2 When a complaint raises doubt concerning the laboratory's compliance with the laboratory's policies or procedures or with the quality of the laboratory's results, those areas involved will be audited.

15.3 When the complaint meets the criteria above the corrective action system will be used to initiate, track and respond to the complaint and its findings.

16.0 Confidentiality and Public Access

16.1 Northeast Ohio Regional Sewer District Laboratory is part of a public entity and, as such, the information generated by the laboratory may be public information.

16.2 All external requests for laboratory data from agencies not currently working with the District must be directed to the District's Legal Department. All other request can be directed to the Manager of Analytical Services for resolution.

17.0 Data Review and Audits

17.1 The Quality Assurance Specialist will be responsible for audits. Northeast Ohio Regional Sewer District Laboratory personnel may perform audits or an outside auditor may be contracted to perform audits.

17.2 The audits are to verify if the laboratory is in compliance with the requirements of the laboratory's quality system as defined in the Quality Manual and standard operating procedures. The results of the audits are considered internal information and not released during audits or inspections.

17.3 Response to findings during an audit is handled through the Corrective Action System.

18.0 Training and Demonstration of Capability

18.1 The Quality Assurance Specialist is responsible for an annual review of the performance records of the laboratory personnel.

18.2 A review of the performance on required quality control activities on each analytical procedure will be used to evaluate an analyst's capability. If the last four laboratory control samples are in control this will be considered sufficient evidence that the analyst is capable of performing the procedure.

18.3 If one of the last four laboratory control samples do not meet the method acceptance criteria, then training may be required by the Quality Assurance Specialist. Required training is to be documented as corrective action.

18.4 Demonstration of capability to add a new method will be accomplished by analyzing a laboratory control sample four times. The average recovery and standard deviation will be calculated and if the laboratory values are within the published limits the procedure can be performed in the laboratory. Corrective action must be performed and the analysis repeated until it can be demonstrated that the laboratory can generate the expected performance data.

19.0 Ethical Conduct

19.1 It is the policy of Northeast Ohio Regional Sewer District Laboratory to perform our duties in a manner that will reflect our commitment to the highest possible ethical standard. We will perform and report our work in a manner that accurately reflects the results obtained in the laboratory.

19.2 Management will provide and document training on the ethical conduct expected in the performance of laboratory duties. Ethics training includes examples of unacceptable conduct, how to report observed misconduct and possible penalties.

19.3 It is the responsibility of every employee to report only his or her own data and to report it accurately. Every employee has the responsibility to notify management when they become aware of unethical conduct by another employee.

20.0 Reporting of Data

20.1 Northeast Ohio Regional Sewer District Laboratory provides service to the Director of Operations and Maintenance for regulatory reporting and facility operation. Report services for the pretreatment and stream monitoring programs are provided to the Manager of Water Quality and Industrial Surveillance. Reports will be in a format that will allow the Manager of Water Quality and Industrial Surveillance to meet business objectives. Release of information to a third party is at the instruction of the Superintendent of Environmental Services and the District's Legal Department.

20.2 Reports will clearly reflect the sample identification; date sampled, results obtained and reporting units.

21.0 Estimation of Uncertainty

21.1 The policy of the Northeast Ohio Regional Sewer District's Analytical Services Department is to not calculate and report estimation of uncertainty on a routine basis. Our customers are all internal and do not request that an estimate of uncertainty be provided with analytical reports. Since this is not a requirement of our current customers the laboratory staff will calculate the estimated uncertainty for all NELAC Accredited methods annually based on the control limits generated for the Laboratory Control Sample (LCS) or the Initial Calibration Verification standard (ICV) if an LCS is not present.

21.2 The laboratory routinely analyzes a Laboratory Control Sample or an ICV in the absence of an LCS with every batch of samples processed. The LCS and in some cases the ICV are used to evaluate overall method performance based on the ability of a method to recover a specified analyte in a matrix free of interference. Analysts plot LCS and ICV recoveries on control charts daily to assess if the method is in control. LCS results are used to determine if a method is in control and the bias for these samples are already being complied and charted.

21.3 The management staff has chosen to estimate uncertainty using the LCS for each method. Control charts are updated daily and control limits are calculated annually.

21.4 In order to estimate analytical uncertainty utilizing the LCS or ICV recovery there must be a sufficient number of sample points (> 20) and the bias must be calculated to determined if the average recovery of the standard is statistically different from the true value.

21.4.1 Bias will be determined using a 95% confidence limit using the following equations. (t =2), (R=Average %Recovery), (s= Standard Deviation of the %Recovery)

21.4.1.1 $\bar{R} = 100\%: |\bar{R} - 100| / s_{\bar{R}} \leq t$

21.4.1.2 $\bar{R} \neq 100\%: |\bar{R} - 100| / s_{\bar{R}} > t$

21.4.2 If equation 21.4.1.1 is true then it can be assumed that the bias is minimal and the LCS can be used to determine the uncertainty for the method without correcting results for bias.

21.4.3 If equation 21.4.1.2 is true the LCS cannot be used to estimate uncertainty without correcting for bias. The following equation is used to correct all results for bias prior to determining an estimate of uncertainty. (c = concentration), (r=Ratio of relative recovery)

21.4.3.1 $\textit{Bias corrected result} = c / f \qquad f = R/100 \text{ or } \bar{R}/100$

21.5 Assuming there is a normal distribution of the average recovery of the LCS and after calculating if bias contributes to the results value the relative uncertainty can be determined from in-house control limits using the equations.

21.5.1 Bias Corrected Estimated Uncertainty

$$100\,(c / \bar{R})\ (1 \pm L / \bar{R})$$

21.5.1.1

21.5.2 Estimated Uncertainty w/o bias correction

21.5.2.1 $c(1 \pm U/100)$

21.5.3 Determination of the half width of the control limits

21.5.3.1 $L_{95\%} = (UCL - LCL)/2 = 3\,s_R$

21.5.4 LCS recovery (Cm is the measured analyte concentration and Cs is the "known" or "theoretical" concentration)

21.5.4.1 $R = \frac{C_m}{C_s} \times 100$

21.6 The laboratory will use an Excel spreadsheet to calculate and track the estimate of uncertainty for all NELAC Accredited methods, Form 5033 "Estimate of Uncertainty."

21.7 The spreadsheet contains all the calculations in section 21.4 and 21.5, to determine if bias correction is needed and to estimate the uncertainty for the given method.

21.8 The spreadsheet will also list the annual control limits, standard deviation of the % recovery of the LCS, the relative standard deviation of the LCS.

21.9 The supervisory staff will evaluate and calculate new control limits annually based on the previous year's data.

21.10 The Quality Assurance Officer will review all the control limits for accuracy before entering them into Form 5033- Estimate of Uncertainty to compute uncertainty for each analyte.

21.11 The Quality Assurance officer will review the new values for estimated uncertainty with the Manager of Analytical Services.

21.12 The uncertainty limits will be printed and stored as an appendix in the quality manual.

21.13 If a customer requests results with uncertainty factors the QA Officer will prepare a report that estimates uncertainty for each analyte requested based on the most recent calculation of estimated uncertainty using Form 5034 COA WUncertainty.xls. This spreadsheet will be attached to the original COA released by the QA Officer.

22.0 Quality Control Charts and Calculations

22.1 The laboratory uses various charts and calculations to prove processes are in control and data are within acceptable criteria. Precision and accuracy charts are utilized with all testing parameters, which are used as management tools to determine if current test data relate with previously established test data populations.

22.2 The variability associated with multiple analysis of a given sample is examined. Our laboratory verifies precision of a sample set by plotting one of the three

calculated formulas-- relative percent difference, percent relative standard deviation or logarithmic range of associated duplicate or dup/spike samples on a quality control chart.

22.2.1 Precision for Microbiological, using logarithmic range

22.2.2 Logarithmic Range (Rlog) = L1 - L2

22.2.3 L_1 = The logarithmic of the number of colonies in duplicate sample 1

22.2.4 L2 = The logarithmic of the number of colonies in duplicate sample 2

22.2.5 Relative Percent Difference (RPD)

22.2.6 RPD = $|A - B| / (A-B) \times 100$

22.2.7 Percent relative standard deviation (%RSD)

22.2.8 (%RSD) = $S / x_{(mean)} \times 100$

22.2.9 x(mean) = sum of sample measurements /(N measurements in the sample)

22.3 Accuracy relates to how well a test performs on average relative to a known value. For those parameters that can be spiked, a known amount of constituent is added to the sample. The percent recovery is calculated to verify accuracy. During routine analyses each group of samples should contain a spiked sample for those parameters for which spiked samples are required. Results from spike analyses are on Accuracy Quality Control. Percent recovery is calculated as follows

$$\textbf{\% Recovery} = \frac{\textbf{(observed value of spike - background value) x 100}}{\textbf{calculated spike}}$$

22.4 Control Charts are a graphical or tabulated tool which plots results of samples to monitor the stability of a process over a period of time. Control charts are simple and effective tools to achieve statistical control. They lend themselves to being maintained at the work station by the chemist. They give the chemists reliable information on when action should be taken and on when action should not be taken. Our laboratory uses control charts to plot precision and accuracy as a tool to evaluate data quality.

22.5 For the warning and control limits, the standard deviation is multiplied by 2 and 3, respectively. The value obtained from 2 times the standard deviation will be added to the mean to derive the upper warning limit and subtracted from the mean to obtain the lower warning limit. The value obtained from 3 times the standard deviation will be added to the mean to derive the upper control limit and subtracted from the mean to obtain the lower control limit. Precision is observed from zero to the upper control limit only.

22.6 QC sample results are stored in LIMS and available to be reviewed in the worksheets, in summary reports, or on QC charts. Limits are calculated on the most recent data sets and are re-evaluated either annually, or when a new

procedure is instituted.

23.0 References

23.1 *Standard Methods for the Examination of Water and Wastewater. 20th Edition.*

23.2 National Environmental Laboratory Accreditation Conference (NELAC) Standard, EPA/600/R-04/003, 2003.

23.3 Georgian, Thomas, Ph.D., *"Estimation of Laboratory Analytical Uncertainty Using Laboratory Control Samples"*, Environmental Testing & Analysis, November/December, 2000.

24.0 Revision History

24.1 Signature page changed.

24.2 Modified Section 2.0 Organization and Management Structure: reference to sample collection was removed for the Biologist, Chemist and Wastewater Analyst II. (MEC 3/14/2007)

24.3 Modified Section 2.0 Organization and Management Structure: separated the Wastewater I and Wastewater II responsibilities. (MEC 3/14/2007)

24.4 Added section 3.3.3: All controlled copies distributed to laboratory employees will be stamped or have a watermark on the copy that states "Controlled Copy".

24.5 Add reference to EPA Method Total Metals by 6010B(MEC 3/14/2007)

24.6 Added Section 8.3.3 Controls charts are generated for long term tracking of analytical trends. Method specific quality control limits supersede system generated quality control limits unless specified in the specific standard operating procedure. (MEC 3/14/2007)

24.7 Added Section 8.4.3 Controls charts are generated for long term tracking of analytical trends. Method specific quality control limits superseded system generate quality control limits unless specified in the specific standard operating procedure. (MEC 3/14/2007)

24.8 Added to section 10.2 reference to the DI water system in the clean room area. (MEC 3/14/2007)

24.9 Added Section 2.1 Qualifications for laboratory personnel are kept on file by the District's Employee Resources Department and can be reviewed on-site upon request. Copies of all pertinent employee information and qualifications are kept on file in the employees personnel file at Analytical Services. The originals documents are property of the Employee Department as per the District's Records Management Policy. (MEC6/5/2007)

24.10 Added Section 2.2 Education requirements are included in all of the Districts job descriptions. Job descriptions are managed by the District's Employee Resources department. A signed copy of the employee's job description is available within the employee's personnel file. (MEC6/5/2007)

24.11 Added Section 3.2 A complete list of all supporting Quality System operating procedures are include as Appendix A. (MEC6/5/2007)

24.12 Added Section 3.3 A complete list of analytical methods performed and supporting operating procedures are included as Appendix B. (MEC6/5/2007)

24.13 Added Section 3.3.3 All controlled copies distributed to laboratory employees will be signed by the Manager of Analytical Services and the Quality Assurance Office. These documents will also be stamped or have a watermark on the copy that states **"Controlled Copy".** (MEC6/5/2007)

24.14 Added Section 3.3.5 **"Controlled Copies"** are not distributed to third party customers or auditors. All third parties will receive and unsigned copy for review. All "Controlled Copies" can be reviewed or audited on-site. (MEC6/5/2007)

24.15 Added section 3.5.5.1 Documents can be printed from the LIMS system for review. These documents are only valid for review. Only documents stamped controlled can be used for analytical methods. (MEC6/5/2007)

24.16 Added Section 5.7 Changes to electronic data are captured by the audit trail system included with the LIMS software package. (MEC6/5/2007)

24.17Added Section 6.0 Analytical procedures are performed according to issued Standard Operating procedures derived from Standard Method for the Examination of Water and Wastewater, 19,th ed, 20th ed, Methods for Chemical Analysis of Water and Wastes EPA 600/4-79-020 and sited ASTM or AWWA methods. A complete list of methods can be found in Appendix B(MEC6/5/2007)

24.18 Added Section 6.1 All methods that are modified methods are formatted in italics and bold. Modified methods are not used for NPDES reporting. (MEC6/5/2007)

24.19Added Section 6.2 Details regarding detection limits, precision and accuracy are included in the cited operating procedures. (MEC6/5/2007)

24.20 Added Section 6.3 A list of testing performed by NEORSD is include in Appendix C. (MEC6/5/2007)

24.21Added Appendix A: Added and Organizational Chart(MEC6/5/2007)

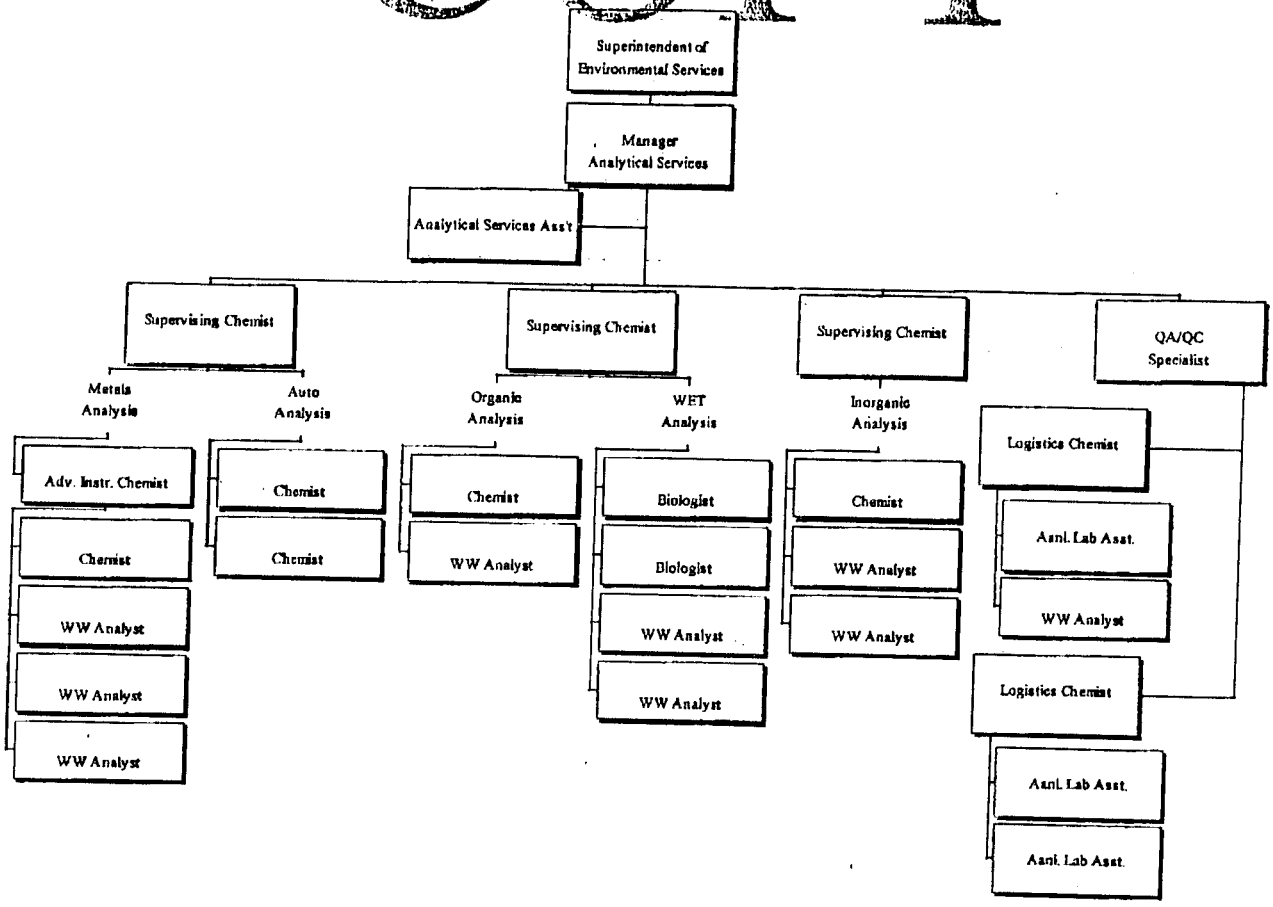
24.22Added Appendix B: List of support Quality System Documents(MEC6/5/2007)

24.23Added Appendix B: List of acceptable methods(MEC6/5/2007)

24.24Added Section 21.0 Estimation of Uncertainty (MEC12/26/2007)

24.25Added Section 22.0 Control Charting (MEC12/26/2007)

Appendix A: Organizational Structure



Appendix B: Quality System Operating Procedures

SOP Number	Revision	SOP Title	Effective Date
5000	1	Operating Procedures for Corrective Actions	10/13/2006
5001	4	Quality Assurance Manual	1/8/2008
5002	5	General Laboratory Guidelines and Policies	1/10/2008
5003	1	SOP and Forms Control	10/13/2006
5004	0	Ethical Conduct	4/7/2006
5005	3	Sample Chain of Custody	8/31/2007
5006	1	Analytical Balance Use and Calibration Verification	1/17/2007
5007	2	Auto-Pipette Calibration Verification	6/25/2008
5008	0	Temperature Monitoring of Incubators, Refrigerators, and Freezers	1/25/2006
5009	0	Themometer Calibration Verification	1/25/2006
5010	0	Sample Batch Determination	3/16/2006
5011	1	Laboratory Positions - Duties and Reporting	3/26/2007
5012	1	Reporting Data/Data Confidentiality	8/23/2007
5013	2	Traceability of Reagents, Chemicals, and Standards	1/30/2008
5014	0	Quality Control Performance; Non-Method Specific	11/9/2006
5015	0	Training of Laboratory Personnel	10/31/2006
5016	0	Facility Care	10/13/2006
5017	0	Scheduled QA Assignments	10/13/2006
5018	1	Verification of Test Procedures	2/22/2008
5019	0	Determination of Method Detection Limits	11/13/2006
5020	1	Control and Release of Non-Conforming Data	9/27/2007
5021	0	Equipment Calibration and Maintenance	10/13/2006
5022	2	Internal Audits	9/27/2007
5023	1	Data Verification	2/22/2008
5024	0	Certification of Sample Containers	10/31/2006
5025	2	Managerial Review	2/22/2008
5027	1	Capabilities Review and Method Addition	2/22/2008
5028	0	Complaints	10/31/2006
5031	1	Sample Receiving, Non-Plant Samples	8/31/2007
5029	0	4500 Reporting	Draft
5030	0	Significant Figures and Rounding Rules	Draft
5036	0	Subcontracting Analytical Services	8/23/2007
5037	0	Inhibitory Residue Test	8/30/2007
5040	0	Graduated Cylinder Calibration Verification	9/10/2007
5041	0	Disposable Pipette Calibration Verification	9/10/2007

Appendix C: Methods Lists

Test Name	Method	SOP Number	SOP Effective Date	Accreditation Status	Accreditation Effective Date
Acidity	EPA 305.1	2061	PA		
Alkalinity as CaCO3 mg/L Autoanalyzer	EPA-310.2	2060	11/29/2007	NELAP	11/29/2007
Alkalinity as $CaCO_3$ mg/L Manual	EPA 310.1	2010	12/18/2008		
Bisulfite	AWWA-B601-93	2064	PA		
BOD-Carbonaceous - 5 DAY	SM5210-B (20th Ed.)	2002	2/5/2008	NELAP	11/29/2007
BOD-Soluble - 5 Day	SM5210-B (20th Ed.)	2002	2/5/2008		
BOD-Total - 5 Day	SM5210-B (20th Ed.)	2002	2/5/2008	NELAP	11/29/2007
Chloride Titrametric	EPA 325.3	2068	PA		
Chlorine Residual Total	SM4500Cl-E	2018	3/26/2007	NELAP	11/29/2007
Chromium VI	SM3500-Cr B (20th Ed.)	2011	2/26/2007	NELAP	11/29/2007
COD (Chemical Oxygen Demand)	EPA 410.4	2038	8/16/2007	NELAP	11/29/2007
Cyanide Available	OIA 1677	2036	8/31/2007	NELAP	11/29/2007
Cyanide Total Semi-Automated	Lachat 10-204-00-1-C	2037	4/5/2007	NELAP	11/29/2007
Cyanide Total 4500 E	SM4500CN-E (20th Ed.)	2058	3/16/2007	NELAP	11/29/2007
Cyanide Amenable 4500 G	SM4500CN-G (20th Ed.)	2058	3/16/2007	NELAP	11/29/2007
E. Coli	EPA 1603	2014	4/25/2006	NELAP	11/29/2007
E. Coli Colilert	Colilert	2021	5/1/2007	NELAP	11/29/2007
Coliform Fecal	SM9222-D (20th Ed.)	2012	8/11/2008	NELAP	11/29/2007
Coliform Total	9222-B	2013	8/11/2008		
Coliform Total/Fecal (MPN)	9221-E / 9221-B	2023	4/19/2006		
Fecal Streptococcus	9230 C	2015	6/11/2008		
Fluoride	EPA 340.2	2062	PA		
Hypochlorite	AWWA-B300-64	2066	PA		
Mercury 1631	EPA 1631	2055	3/7/2007	Interim Chapter 252	10/3/2007
Mercury Semi-Automated Cold Vapor	EPA 245.2	2031	8/30/2007	NELAP	11/29/2007
Mercury Sample Preperations ($KMnO_4$)	EPA 7470	2032	1/26/2007	NELAP	11/29/2007
Metals Digestion (Preconcentration Acid)	EPA 3005A	2028	10/20/2008	NELAP	11/29/2007
Metals Digestion Hot Plate (HNO3)	EPA 3020A	2028	10/20/2008	NELAP	11/29/2007
Metals Digestion Hot Plate (HNO_3+ HCl)	EPA 3010A	2028	10/20/2008	NELAP	11/29/2007
Metals Digestion Microwave (HNO_3)	EPA 3015	2028	10/20/2008	NELAP	11/29/2007
Nitrogen Ammonia as N	EPA-350.1	2009	2/29/2008	NELAP	11/29/2007
Nitrogen Kjedahl Total (TKN)	EPA-351.1	2056	2/28/2007	Interim Chapter 252	12/19/2006
Nitrogen Nitrate	EPA 353.2	2053	12/18/2008	NELAP	11/29/2007
Nitrogen Nitrite	SM4500NO2-B (20th Ed.)	2054	12/18/2008	NELAP	11/29/2007
Oil and Grease	EPA 1664 rev A	2039	8/31/2007	NELAP	11/29/2007
pH Aqueous Samples	SM 4500H^+ -B (20th Ed.)	2001	4/7/2006	NELAP	11/29/2007
pH Semisolid / Solid Samples	SW846 9045D	2020	4/7/2006		
Phenolics Total	***EPA 420.1***	***2057***	***3/16/2007***	***NELAP***	***11/29/2007***
Phosphorus Ortho	EPA 365.1	2025	8/16/2007	NELAP	11/29/2007
Phosphorus Total	EPA 365.4	2008	12/18/2008	NELAP	11/29/2007
Phosphorus-Soluble Reactive	EPA 365.1	2025	8/16/2007		
Setteable Residue	SM2540-F (20th Ed.)	2034	2/23/2007	NELAP	11/29/2007
Solids Dissolved	SM2540-C (20th Ed.)	2003	1/11/2008	PA Ch 252 / NELAC	
Solids Total	SM2540-B (20th Ed.)	2005	1/11/2008	PA Ch 252 / NELAC	
Solids Total Suspended	SM2540-D (20th Ed.)	2004	1/11/2008	PA Ch 252 / NELAC	
Solids Fixed and Volatile	SM2540-E (20th Ed.)	2033	1/11/2008		
Solids Total, Fixed and Volatile (Semisolid)	SM2540 G (20th Ed.)	2067	PA		
Specific Conductance	SM 2510-A (20th Ed.)	7002	6/20/2005		
Sulfate Semi-Automated	EPA 375.2 (20th Ed.)	2041	4/3/2007	PA Ch 252 / NELAC	
Temperature	SM2550-B	7002	6/20/2005		
Total Organic Carbon (TOC)	EPA5310-C	2059	9/27/2007	NELAP	11/29/2007
Total Organic Carbon (TOC)	EPA 960	2059	9/27/2007	NELAP	11/29/2007
Toxicity Ceriodaphnia dubia	EPA 1002	2045	4/17/2007	Interim Chapter 252	12/19/2006
Toxicity Pimephales promelas	EPA 1000	2046	8/4/2008	Interim Chapter 252	12/19/2006
Turbidity	EPA 180.1	2007	11/25/2008	Interim Chapter 252	10/3/2007

Appendix C: Methods Lists Continued

Test Name	Method	SOP Number	Effective Date	Accreditation Status	Accreditation Effective Date
Silver	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Aluminum	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Arsenic	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Beryllium	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Calcium	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Cadmium	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Cobalt	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Chromium	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Copper	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Iron	EPA 200.7	2029/2030	8/31/2007	Interim Chapter 252	10/3/2007
Potassium	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Magnesium	EPA 200.7	2029/2030	8/31/2007	Interim Chapter 252	10/3/2007
Manganese	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Molybdenum	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Sodium	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Nickel	EPA 200.7	2029/2030	8/31/2007	Interim Chapter 252	10/3/2007
Lead	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Antimony	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Selenium	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Titanium	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Thallium	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Vanadium	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Zinc	EPA 200.7	2029/2030	8/31/2007	NELAP	11/29/2007
Hardness	EPA 200.7	2029/2030	8/31/2007	Interim Chapter 252	10/3/2007
Tin	EPA 200.7	2029/2030	8/31/2007		
Silver	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Aluminum	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Arsenic	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Beryllium	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Calcium	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Cadmium	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Cobalt	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Chromium	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Copper	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Iron	EPA 6010B	2051/2052	8/31/2007	Interim Chapter 252	10/3/2007
Potassium	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Magnesium	EPA 6010B	2051/2052	8/31/2007	Interim Chapter 252	10/3/2007
Manganese	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Molybdenum	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Sodium	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Nickel	EPA 6010B	2051/2052	8/31/2007	Interim Chapter 252	10/3/2007
Lead	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Antimony	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Selenium	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Titanium	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Thallium	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Vanadium	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Zinc	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007
Hardness	EPA 6010B	2051/2052	8/31/2007	Interim Chapter 252	10/3/2007
Tin	EPA 6010B	2051/2052	8/31/2007	NELAP	11/29/2007

Lake County General Health District
Bathing Beach Monitoring Project
September 2010 Report

Introduction

The Lake County General Health District (Ohio), conducted a monitoring program during the summer of 2010 at Lake County's two recognized public swimming beaches, Mentor Headlands State Park, and Fairport Harbor Lake Metroparks, both located on the southern shore of Lake Erie. The goals were to identify times when *E. coli* bacteria exceeded established standards at these beaches and provide notification to beach management and the public concerning the potential hazard to bathers.

An Environmental Supervisor and the Director of Environmental Health provided program oversight throughout the July 1 – September 6, 2010 contract period. In addition to the Supervisor and Director, either a Registered Sanitarian or Environmental Health Technician conducted the sampling, transportation and analysis of the samples and reported the results. At all times, the samples were in custody of the Lake County General Health District.

The Health District improved the QA/QC program this season. The sample collection and laboratory analysis was conducted under the additional guidance of the USGS with the goal of working toward developing a predictive model in mind. Turbidity samples were collected and analyzed in-house. Past data was shared with USGS to attempt to establish a baseline for each beach of the unique combination of environmental and water quality variables that will help predict *E. coli* levels for the purposes of posting timely advisories. A process of collecting and analyzing duplicate samples for twelve percent of the routine samples was implemented. In addition, a representative from USGS observed sample collection procedures and laboratory techniques to assure compliance with established protocol.

Sample Locations

Fairport Harbor Beach is located on the south shore of Lake Erie off High Street in Fairport Harbor and is operated by Lake Metroparks. This sheltered beach is east of the mouth of the Grand River and is protected by a breakwall. Lake Metroparks utilizes a beach grooming machine to maintain the sandy beach.

Mentor Headlands Beach is located on the west side of the mouth of the Grand River, and is operated by the Ohio Department of Natural Resources. Due to the size of this large beach, two water samples were collected in the lake from opposite ends of the guarded portion of the beach.

Sampling Season

The Health District began collecting beach samples for the Ohio Department of Health on July 1, 2010 and ended for this contract period on September 6, 2010. Samples were collected daily, weekends and holidays inclusive, in the morning generally prior to 9 a.m. before bathers routinely entered the water.

Beach Water Sample Collection Procedures

The following procedures were utilized to collect beach water samples for bacteriological analysis:

1. Label sterilized single-use 120 ml water sample collection bottles with the name of the sample collection locations and any duplicate samples, if the schedule indicates one is required. Bring three clean and labeled 500 ml Nalgene bottles for turbidity sample collection. Place all bottles in cooler with ice packs and an extra120 ml bottle in the event of breakage.
2. After arriving at the established sampling location, evaluate the conditions and complete the field notes section on the sample collection form. Use an accurately calibrated metal stem thermometer to measure the ambient air temperature.
3. After first assessing the wave height for safety, carefully enter the water to a depth of 3 or 4 feet while causing minimal disruption of the sediment. Measure the water temperature with the metal stem thermometer. With the 120 ml bottle in one hand and the cap in the other, remove the seal and uncap the bottle, using care to only touch the outside of the bottle, and holding the lid from the outside to keep it free from contaminants also. Invert the bottle and immerse to a depth of 12 to 18 inches below the surface of the water, tilt the bottle toward an upright position, and sweep toward the surface to allow the air to escape and water to enter the bottle. Carefully replace the cap once the container has been filled to the base of the neck and brought out of the water. There should be a small amount of air in the bottle. Immediately place the bottle in the cooler and record the water temperature on the field notes. Repeat the procedure with the 500 ml Nalgene bottle.
4. Return to the Health District after all the samples have been collected and begin the sample analysis.

In-House Beach Bacteriological Water Sample Analysis Procedure

The following procedures were used to analyze the beach water samples:

1. Turn on the incubator, if not already on. Read the thermometer to assure the internal temperature reads 35°C on an accurately calibrated thermometer.
2. Turn on the Idexx Quanti-Tray Sealer to warm up.
3. Wash hands and locate a clean area to prepare the samples.

4. Empty the Colilert presence/absence reagent granules into each water sample bottle. Recap and shake to completely dissolve the granules.
5. Label Quanti-Trays with sample location and date, and note if the sample is a replicate. Pour the entire contents of the prepared sample bottle into the appropriately labeled tray that has been squeezed from the edges to form an opening, taking care not to touch the inside of the tray.
6. Gently tap the cells of the Quanti-Tray to remove any air bubbles.
7. Observe the tray sealer to see if the green light is on to indicate it is ready for operation. Insert the tray with the plastic wells facing down into the rubber template and press the switch for the tray to enter the sealer. Wipe off any water that spilled during the sealing process before sealing the next tray. Turn off the sealing machine when finished.
8. Place Quanti-Trays, wells down, into the incubator. Allow to incubate for 24 hours.
9. Enter data onto the Laboratory Analysis form, including date of sample, time incubation began, and lot number of Colilert reagent. Add field notes to the laboratory binder.
10. Read results in 24 hours. Count the number of large and small wells that fluoresce under ultraviolet light and refer to the Quanti-Tray MPN table to find the most probable number (MPN).
11. Record results on Laboratory Analysis form and Beach Sample result form that is used to communicate results to the clerical staff.

In-House Beach Turbidity Sample Analysis Procedure

The following procedures were used for turbidity analysis:

1. Always refer to the Hach 2100Q Portable Turbidimeter instructions for calibration and verification standard frequencies and instructions.
2. Turn on the turbidimeter.
3. Shake the sample bottle.
4. Immediately after shaking, pour an aliquot from the sample into a clean glass test vial and fill to the line. Place the cap on the glass test vial.
5. Cap and shake the sample bottle again and pour an aliquot from the sample into the second glass test vial. Place the cap on the second glass test vial.
6. Handle the vials by the lids only. Gently remove any moisture by gently wiping the vial with a laboratory wipe or soft paper towel.
7. Add a small drop of silicone oil to the area just below the diamond on the vial. Use the black lint-free cloth to clean the vial with silicone oil.
8. Invert the first vial gently a few times and place in the turbidimeter. The diamond on the vial must align with the orientation mark on the front of the well.
9. Close the turbidimeter cover and press "read".
10. Record the result.

11. Repeat with the second vial. The two measurements must meet the following criteria, or a third and fourth sample must be read until tow consecutive readings meet the criteria.
    a. For values less than 10 NTU, they must agree within 1.5 NTU.
    b. For values greater than 10 NTU, they must agree within 1.5 %.
12. Record both turbidity values on the Laboratory Analysis fo , then calculate and record the average.
13. Carefully clean the test vials immediately after use, as they scratch easily. Wash with laboratory detergent and rinse three times with deionized water. Store the vials with deionized water in them and the caps in place. Do not allow the vials to air dry.

Public Notification and Risk Communication

Sample results were forwarded daily by e-mail or faxed to Lake Metroparks, ODNR Headlands Beach and the Ohio Department of Health. In the event of technical difficulty, telephone calls were placed to communicate results. Beach results were posted daily, weekends and holidays inclusive, on the Lake County General Health District web site at www.LCGHD.org. The clerical staff answered inquiries regarding beach water quality, and the Supervisor or Director were available to provide detailed information and answer questions relative to beach safety and current conditions.

A beach safety pamphlet was used as an educational tool to inform the public of Lake County General Health District's efforts to sample the beach water. The fact card featured English on one side and Spanish on the other due to the beaches being heavily used by the local Hispanic population. Fact cards were distributed at a number of public locations within Lake County in addition to the beaches.

Measures to Notify the Public

There were minimal water quality standard exceedences in this bathing season that required posting advisory signs to warn bathers of surface water quality. When the bacterial count exceeded the single sample standard of 235 E. coli colonies /100 ml sample, Health District staff notified staff at the affected beach by telephone, if possible. A request was made to post advisory signs in prominent places visible to the general public upon entering the beach. Each beach is in possession of signs with language as suggested by the Ohio Department of Health, reading:

WATER QUALITY ADVISORY

BACTERIA LEVELS HERE CURRENTLY EXCEED STATE STANDARDS. CHILDREN, ELDERLY, AND THOSE IN ILL HEALTH ARE ADVISED NOT TO BATHE OR SWIM

Due to a local Hispanic population, Spanish advisory signs are also available for posting in conjunction with the English language signs at the beaches, reading:

AVISO DE CALIDAD DEL AGUA

LOS NIVELES DE BACTERIA EN ESTA AREA SOBREPASAN LAS NORMAS DEL ESTADO DE OHIO. LOS NIÑOS, ANCIANOS, Y LAS PERSONAS QUE TIENE MAL SALUD LAS AVISAMOS QUE NO DEBERIAN BAÑARSE NI NADAR

The Health District verified the presence of the advisory signs when posting was required. The beach supervisors were notified when conditions improved and the advisory signs could be removed. Occasionally the staff at Headlands Beach failed to remove advisory signs when notified it was appropriate to do so.

Recreational Water Illness

Close communication is maintained between both the environmental and nursing staff at the Health District. To date, there have been no reports of suspect recreational water illness attributed to bathing in the waters of Lake Erie within Lake County. Further, education as well as a close watch for Harmful Algal Blooms was instituted to keep bathers safe

Beach Sampling Data

Fairport was requested to post advisories eight times during the 67-day sampling period due to exceeding the single sample standard of 235 E. coli /100 ml sample. On only one occasion, the advisory was posted for two consecutive days, and the remaining advisories occurred on a single day.

Headlands East and West both exceeded the standard on the same seven days during this sampling period. One advisory spanned two consecutive days, but the other advisories were single day events.

Frequency of Lake County Beach Advisories July 1-Sept 6, 2010

Lake County Beach	Number of Days Exceeding Standard	Number of Sampling Days	Percentage of Days Advisory was Posted
Fairport	8	67	11.9%
Headlands East	7	67	10.4%
Headlands West	7	67	10.4%

Lake County Beach Sampling Results
July –September 2010

Date	Fairport	Headlands West	Headlands East
07/01/10	38.4	48.7	35.0
07/02/10	38.8	63.7	24.3
07/03/10	21.6	21.2	14.2
07/04/10	6.3	18.3	17.1
07/05/10	17.1	13.4	18.5
07/06/10	6.3	21.1	98.7
07/07/10	117.8	14.6	17.6
07/08/10	127.4	28.8	54.6
07/09/10	53.8	238.2	248.9
07/10/10	31.8	27.8	18.3
07/11/10	35.0	3.1	35.4
07/12/10	10.7	7.4	33.6
07/13/10	177.6	14.6	26.5
07/14/10	829.7	771.7	313.0
07/15/10	33.6	18.5	35.0
07/16/10	78.0	435.2	488.4
07/17/10	95.8	59.4	65.7
07/18/10	26.2	25.6	58.3
07/19/10	88.2	150.0	228.2
07/20/10	29.5	14.5	172.3
07/21/10	59.5	124.6	127.4
07/22/10	185.0	41.9	21.3
07/23/10	206.3	235.9	238.2
07/24/10	378.4	103.4	95.9
07/25/10	172.3	70.0	14.6
07/26/10	45.5	5.2	13.5
07/27/10	16.1	24.6	25.6
07/28/10	178.9	16.9	48.0
07/29/10	517.2	156.5	64.4
07/30/10	27.5	123.6	88.4
07/31/10	515.4	13.2	20.3
08/01/10	23.1	20.3	160.7
08/02/10	410.6	93.3	111.2
08/03/10	22.8	8.6	8.4
08/04/10	23.1	40.1	25.6
08/05/10	1046.2	178.5	196.8
08/06/10	686.7	90.6	90.5
08/07/10	139.6	19.7	43.8
08/08/10	3.1	43.5	29.2
08/09/10	9.8	5.2	17.4
08/10/10	8.4	16.0	13.2
08/11/10	25.9	7.3	24.6
08/12/10	8.5	65.7	45.7
08/13/10	63.8	178.5	165.8

08/14/10	5.2	20.7	17.1
08/15/10	46.4	73.8	214.3
08/16/10	53.8	461.1	517.2
08/17/10	65.0	52.1	56.5
08/18/10	17.1	13.5	21.9
08/19/10	20.3	23.3	17.1
08/20/10	261.3	38.4	52.9
08/21/10	14.8	5.2	12.1
08/22/10	80.1	33.5	13.2
08/23/10	16.7	20.3	15.8
08/24/10	20.1	14.6	25.9
08/25/10	20.3	7.4	3.1
08/26/10	141.4	33.1	24.6
08/27/10	31.7	16.0	50.4
08/28/10	8.6	14.6	7.7
08/29/10	86.0	4.1	4.1
08/30/10	1.0	2.0	1.0
08/31/10	15.8	8.6	12.2
09/01/10	4.7	2.0	82.0
09/02/10	6.3	6.3	2.0
09/03/10	18.5	9.6	16.1
09/04/10	74.9	281.9	272.3
09/05/10	49.6	238.2	248.9

Erie County Health Department
2010 Bathing Beach Program

Introduction

During 2009 the Erie County Health Department (ECHD) worked closely with the US Geological Survey (USGS) to research the reliability rapid assessment methods used to assess water quality on area beaches. IMS-ATP, which provides reported results within 4 hours of sample collection, was the method that showed the greatest promise when compared with the existing standard, Colilert IDEXX 18-24 hour. IMS-ATP when compared the IDEXX method showed definite correlation, which warranted further research and data collection going into the 2010 beach season. Beginning in 2010 the ECHD continued sampling the 25 coastal beaches using the Colilert IDEXX test and began collecting IMS-ATP comparison sample at four local area beaches. Predictive Modeling was another new initiative embarked upon during 2010, which also held great potential for providing real time results regarding water quality on area beaches. The program retained Ian Mansor as a program coordinator during 2010 who had worked with us in 2009 during the implementation of IMS-ATP. Three additional temporary part-time employees were hired to oversee the day to day activities within the program who were trained between 5/24/2010 to 5/28/2010. Training included sample collection, analyses and reporting using IDEXX Quanti-Tray testing as well as protocols for operating the autoclave, incubator, and turbidity meter.

IDEXX

IDEXX Colilert-18 is a test used for the detection of coliforms, *E. coli* or fecal coliforms in water that gives you results in 18 hours. The *E. coli* colilert method- Colilert-18 uses Defined Substrate Technology® (DST®) nutrient indicators ONPG and 4-methylumbelliferyl-B-D-glucuronide (MUG) to detect total coliforms and *E. coli*. Coliforms use their *β*-galactosidaseenzyme to metabolize ortho-nitrophenyl-p-D-galactopyranoside ONPG) and change it from colorless to yellow. The Erie County Health Department(ECHD) has used the IDEXX colilert sampling protocol in our department lab since the beginning of our 2008 sampling season. It is a very accurate method for measuring *E. coli* counts in bathing beach water. Conducting a sampling analysis and collection program at our department has reduced our sampling cost by about 50%. The one draw back in using this method is the excessive lag time between sample collection and result reporting, which is approximately 20 to 22 hours. This is the main reason why our department is and continues to conduct research into rapid or real-time water quality result reporting.

IMS/ATP

In 2010 working with USGS are goals for IMS-ATP were to develop the capability and demonstrate the proficiency to analyze samples by use of the IMS/ATP method. To compare results obtained from IMS/ATP to results obtained by Colilert. The major procedure change in the rapid assessment arena from 2009 to 2010 was in IMS-ATP and

involved the use of one antibody, as apposed to the two used in 2009, which reduced analysis time by approximately 20 minutes in each sample run. The IMS-ATP method is based on the selective capture of target bacteria by the use of an antibody attached to magnetic beads. A magnet is used to separate the target bacteria bound to the antibody coated beads from the rest of the sample. The bacteria concentration is determined by measuring the amount of ATP present in the sample using bioluminescent assay. The contamination of beach waters occurs from the discharge of storm water and sanitary sewer overflows containing fecal material. The problem is that the traditional culture-based methods cannot meet this goal because it takes to long (>24hours), so the results are not available until a day later. Rapid method for testing beach water for Escherichia coli within 1 hour has been developed, immunomagnetic separation (IMS). IMS-ATP was used for the selective capture of target bacteria and their quantification, respectively. IMS-ATP utilizes uniform superparamagnetic polystyrene beads coated with antibodies that bind to the desired bacteria, forming a bead-bacteria complex that is easily separated from the heterogeneous bacteria suspension by exposure to a magnetic field. IMS has been documented as a useful separation tool for downstream applications. In conjunction with this procedure turbidity and predictive modeling was routinely analyzed as well. Quantitative Polymerase Chain Reaction (QPCR) samples were collected as well and the analysis was done by the USGS Laboratory. As was stated in our 2009 report, these methods are being tested as a pilot to help he USGS test the efficacy of the 2-4 hour procedure. Testing procedures were done in the ECHD Laboratory with oversight by representatives of the USGS Columbus office.

The USGS provided training, supplies, and quality-control samples and ECHD provided

the equipment, facility, and technician analytical time. Samples were collected at Erie County beaches (Huron West, Huron East & Vermilion East) 4 days a week at the beginning of the season and 3 days/week at end of season analyzed for *E. coli* by IMS/ATP and by the standard Colilert Quanti-Tray® method (IDEXX Laboratories, Inc., Westbrook, Maine). IMS/ATP samples were processed by using antibody B is a polyclonal antibody. Polyclonal antibodies are produced by immunizing animals and are complex mixtures of different types of antibodies.

Predictive Modeling

In 2009 ECHD collected two parameters for predictive modeling, which were wave height and wind speed and direction. The overriding goal in 2010 for the implementation of Predictive Modeling was to provide an accurate method to assess water quality, which correlated directly with the IDEXX Colilert 18 standard. In 2010 predictive modeling became part of our daily sampling schedule. Employees went to the sampling sights and collected data on wave height, wind speed and direction, weather conditions, concentration of bird activity, water temperature, and bather load during sampling. Data was collected at three beaches which included Huron East, Huron West and Vermilion West. These data factors were entered into the USGS web site for comparison with both IMS-ATP and IDEXX. Predictive modeling allowed ECHD and USGS to determine if these factors caused a change in results. ECHD had a phone conference with USGS Wisconsin to learn how to enter our predictive modeling results on to their web site. This data is currently being analyzed by the USGS and will hopefully allow us to derive predictable sample outcomes based on reported concentrations.

Results

Graph 1A and 1B below show results from the IDEXX sampling method in 2010. The rating system for IDEXX is dictated by the number of positive large well cells and the number of positive small well cells. After those numbers are determined, with using a cross point method on the IDEXX Quanti-Tray/ 2000 Table shows the daily rating for that individual beach. Graph 1A illustrates all 25 beaches sampled and how many results were "good" for each beach or were identified with a rating between 0-64 MPN. There were 599 "good" results for all 25 beaches in the 2010. Graph 1B illustrates all of the "advisories" or an MPN number of 235 and above. There were a total of 329 advisories recorded in 2010 sampling season. Edson Creek had the largest number of advisories during 2010 with 33 and was therefore investigated for point source contaminants as stated above.

Thirty-seven sampling events where collected and analyzed using IMS/ATP during the 2010 beach sampling season. The data was examined qualitatively and quantitatively for errors prior to performing the regression analysis. Large discrepancies in the IMS/ATP values were noted for the first and last 5 sampling events and these data were removed. Then the data was examined for outliers using R version 11.1.1 and one additional value was removed from each of the three data sets; Huron East, Huron West, and Vermilion West. After the initial data cleaning, all three datasets were subjected to the Shapiro-Wilk test for normality and determined to be normally distributed. Simple linear regression was performed on all three data sets to determine the correlation between the Colilert and IMS/ATP tests for *E. coli*. No statistically significant relationship was found for any of

the three sampling locations – refer to graphs labeled Huron West, Huron East and Vermilion West.

Conclusion

Major progress was made from 2009 to 2010 with contamination issues and incubator problems; the ECHD was able to demonstrate proficiency of sample technique using the IMS/ATP method. Sample blanks were recorded at acceptable levels (data not shown) and split replicate samples for antibody B (r=0.845). Used for antibody with samples collected from Huron West beach , statistically significant relations were found between IMS/ATP results, reported in relative light units per 100 milliliters (RLU/100 mL), and Colilert method results, reported in most-probable number per 100 milliliters (MPN/100 mL). The loss of data due to collection or experimental error is an unfortunate reality of scientific work. Approximately 30% of the collected data was rejected following a rather *mild* data cleaning process. With some analytical techniques data fidelity is less of an issue however linear regression is highly sensitive to these large variations. While fidelity can explain some of the more obvious data flaws it may not entirely explain the discordance between the Colilert and IMS/ATP methods. Minor changes in protocol could assist in identifying whether the source of error related to experimental manipulation or experimental antibody. Specific recommendations based on these findings will be addressed prior to the 2011 season.

In 2011 ECHD will continue to improve on rapid method protocol, with respect to contamination issues. ECHD will implement new changes in testing procedures given by USGS in IMS/ATP, with new reagents along with procedure methods. Continued data collection will strengthen the validation of IMS-ATP as a reliable and feasible alternative

for local health districts involved in beach water quality sampling. Efforts continued throughout the 2010 sampling season to identify sources of contamination upstream of the beaches such as Edson Creek on the west side of Vermilion, where advisories were issued 33 times during 2010. Examples of sources found and corrected are as follows: bypass of raw sewage from the municipal sewer system, grinder pumps not operating, laundry waste from a residence discharging to creek.

ECHD continues to conduct the HB110 program to provide operation and maintenance inspections of all wastewater treatment systems (1-25,000 gallons per day) discharging to waters of the state, thereby lessening the impact of these systems on the Lake Erie watershed. The value of our beach sampling program is demonstrated where our data collection efforts are utilized to declare public health nuisances and identify corrective action. This has been true most recently in Bay View, Ohio where our beach sampling results have been the driving factor in the pursuit of a public sewage treatment utility. Without sample data funding for projects such as this would be less readily available and make projects of this scope much less likely to occur.

Addendum

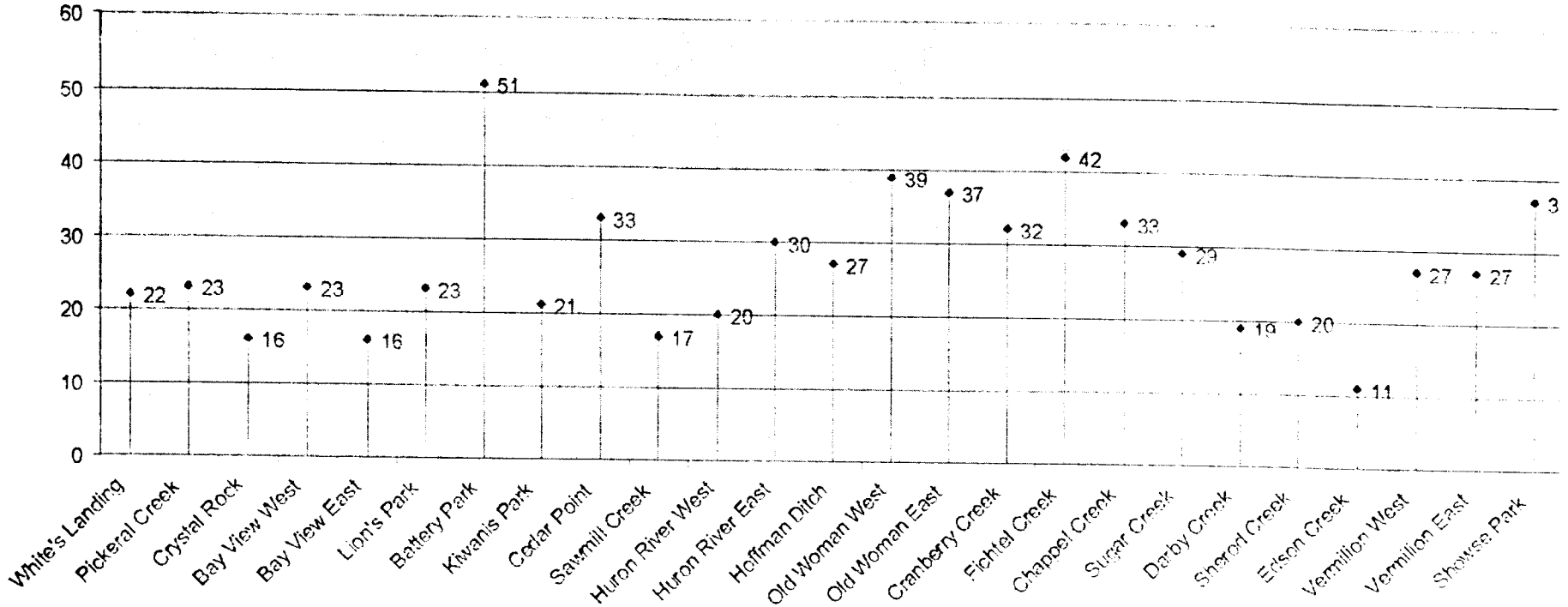
ECHD used different methods of informing the public of our IDEXX results for the 2010 sampling season. The main method of informing the public was through the use of the ECHD website. There a link was provided to all results for the entire sampling season. Results were reported by email to local media such as the Lorain Morning Journal News, Sandusky Register, Huron Home Towne News and WLEC 1450 AM that broadcasts results throughout Erie County.

All public and private beach locations receive e-coli counts as well as our water quality ranking: good, fair, poor or advisory. Huron East (Nickel Plate Beach) posts their own sign at their entrance so the bathers are aware of recent water quality conditions prior to swimming. During 2010 as in all years ECHD received phone calls with questions relating to safety for children or family pets. Several calls were also received in reference to Harmful Algal Blooms and possible exposure. Samples of algae were collected on two beaches during 2010, and all were all below the limit of detection for Microcystin toxin but upon visual inspection identified as duck weed.

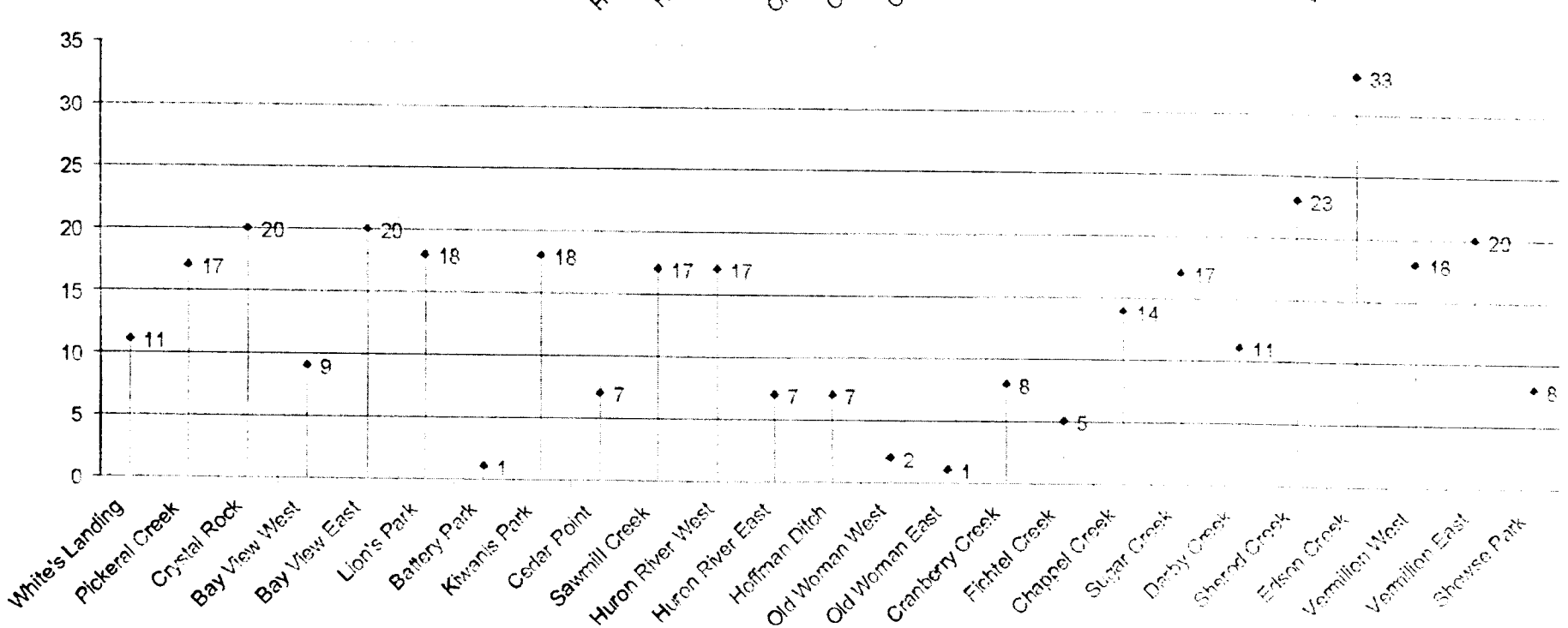
The City of Sandusky is in the process of renovating a public park and beach area at Lions Park, which is a location sampled routinely by ECHD. The City of Sandusky is considering a reporting process for 2011 similar to the one employed at Nickel Plate Beach in Huron.

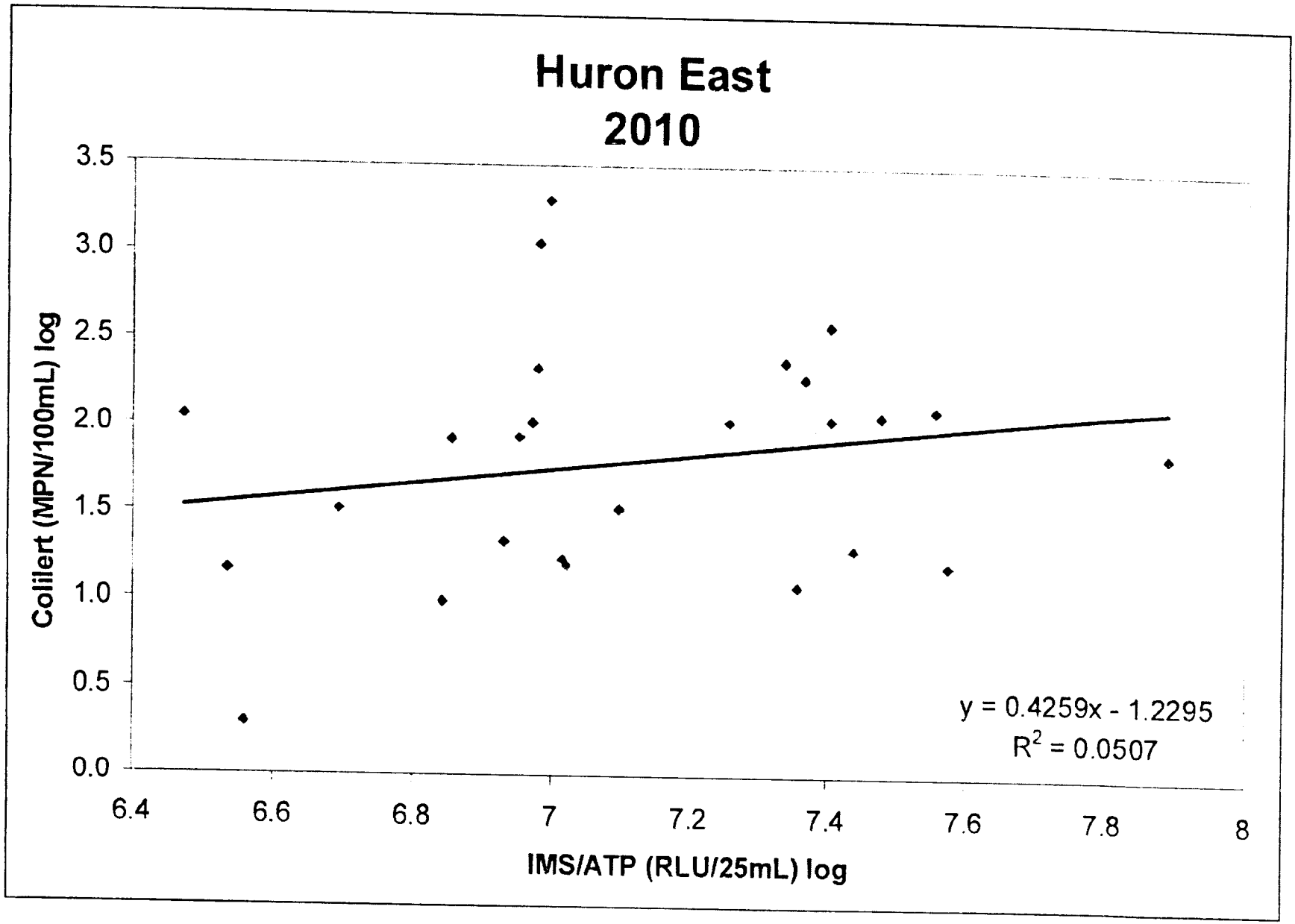
2010 Beach Sample Results

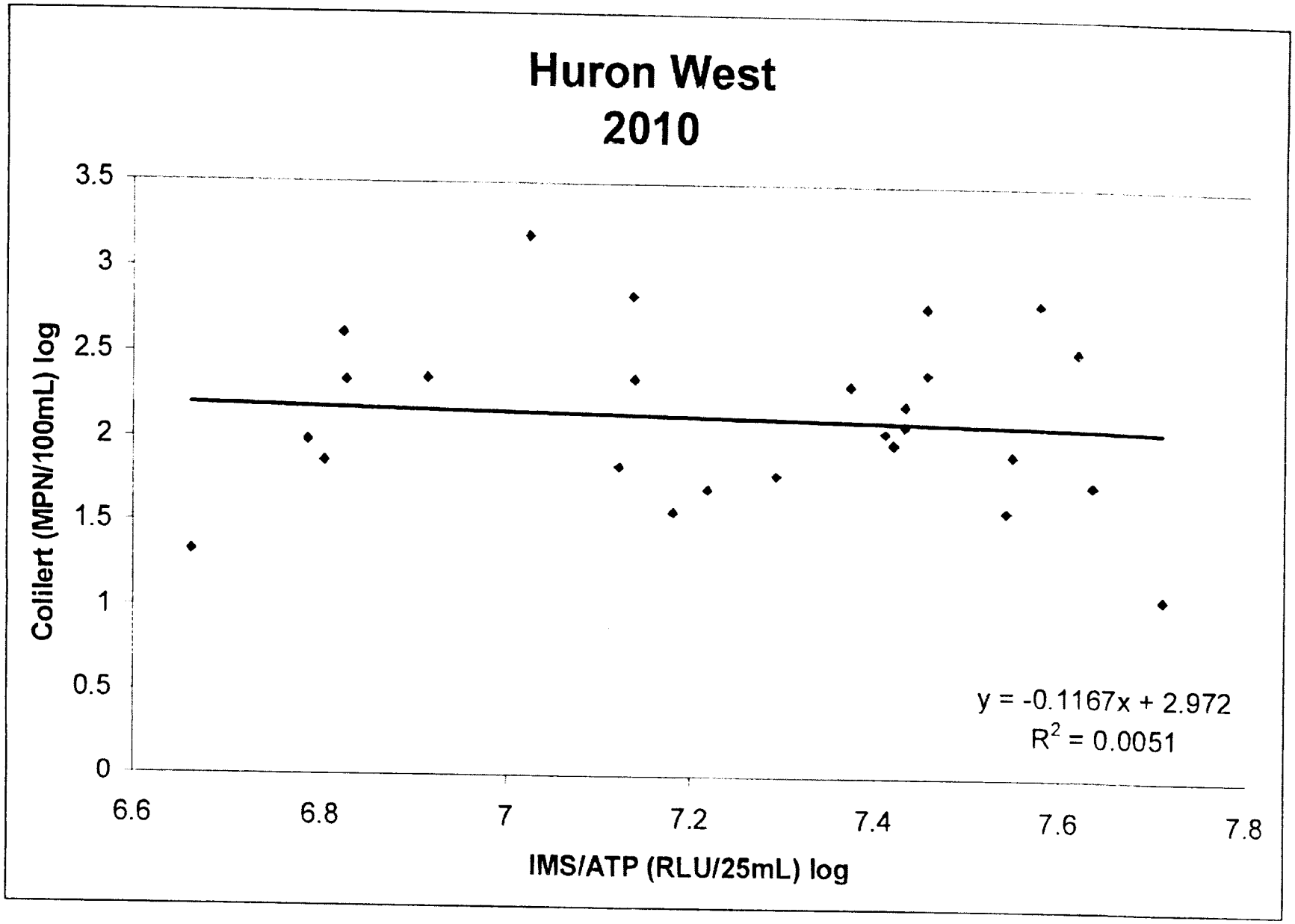
Graph 1A

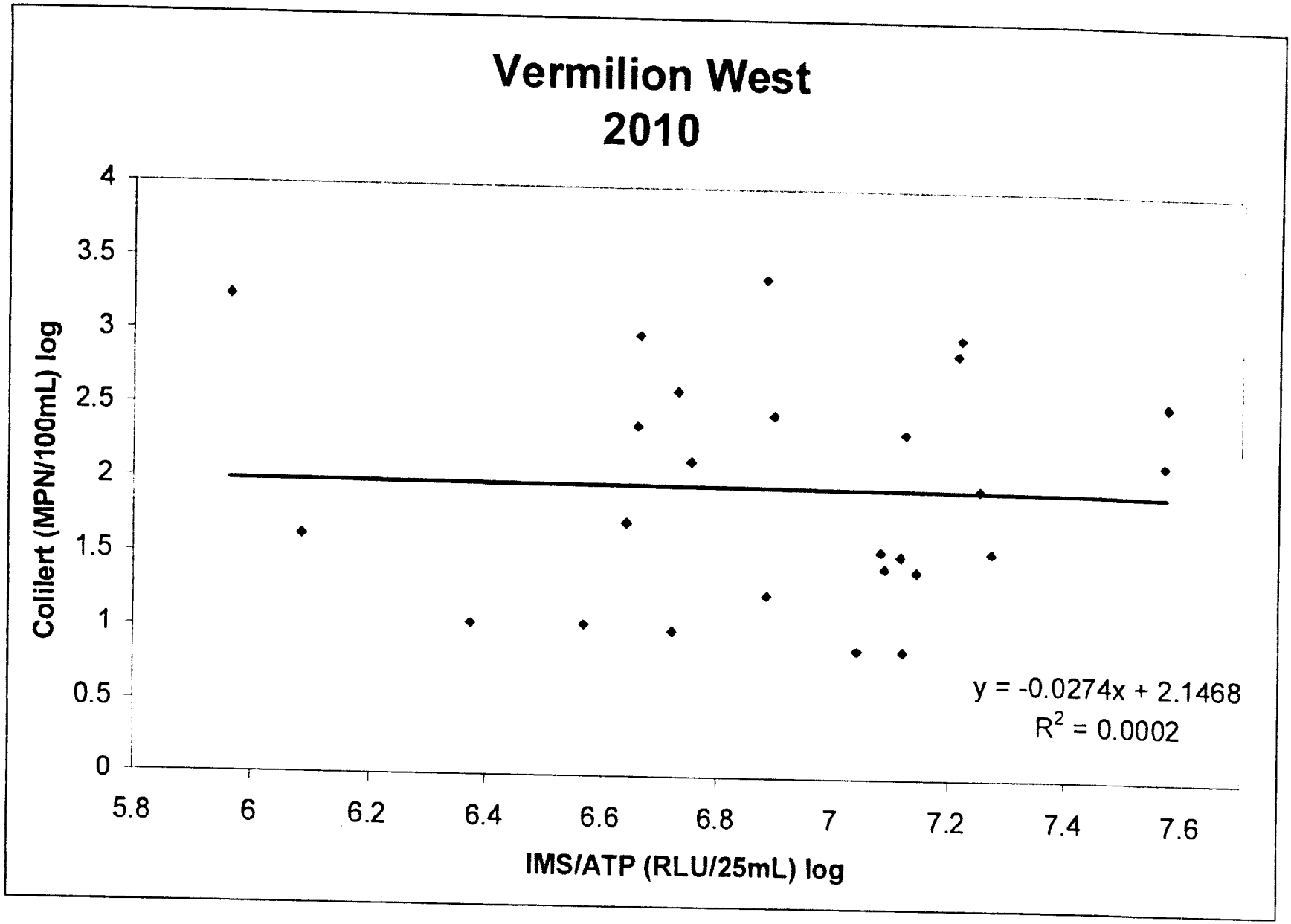


Graph 1B




Huron East
2010
Colilert (MPN/100mL) log
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
6.4
6.6
6.8
7
7.2
7.4
7.6
7.8
8
IMS/ATP (RLU/25mL) log
y = 0.4259x - 1.2295
R2 = 0.0507


Huron West
2010
Colilert (MPN/100mL) log
3.5
3
2.5
2
1.5
1
0.5
0
6.6
6.8
7
7.2
7.4
7.6
7.8
IMS/ATP (RLU/25mL) log
y = -0.1167x + 2.972
R2 = 0.0051


Vermilion West
2010
Colilert (MPN/100mL) log
IMS/ATP (RLU/25mL) log
y = -0.0274x + 2.1468
R2 = 0.0002
0
0.5
1
1.5
2
2.5
3
3.5
4
5.8
6
6.2
6.4
6.6
6.8
7
7.2
7.4
7.6

2010		Date	5/27/10	Date	6/1/2010	Date	6/2/2010	Date	6/3/2010	Date	6/7/2010
Beach #	**Beach Location**	**MPN**	**Rating**	**MPN**	**Rating**	**MPN**	**Rating**	**MPN**	**Rating**	**MPN**	**Rating**
1	White's Landing	33	6 Good	>2419.6	Advisory	178.9	Poor	15.2	Good	313	Advisory
2	Pickeral Creek	7.50	Good	980.4	Advisory	275.5	Advisory	648.4	Advisory	686.7	Advisory
3	Crystal Rock	167.00	Poor	119.9	Advisory	70.3	Fair	49.5	Good	>2419.6	Advisory
4	Bay View West	13.50	Good	45.2	Good	325.5	Advisory	85.5	Fair	261.3	Advisory
5	Bay View East	4.10	Good	133.3	Poor	23.3	Good	>2419.6	Advisory	1203.3	Advisory
6	Lion's Park	9.60	Good	124.6	Fair	19.7	Good	55.9	Good	139.6	Poor
7	Battery Park	2.00	Good	37.3	Good	47.1	Good	11	Good	23.8	Good
8	Kiwanis Park	1203.30	Advisory	>2419.6	Advisory	>2419.6	Advisory	1203.3	Advisory	770.1	Advisory
9	Cedar Point	27.20	Good	104.6	Fair	63.1	Good	104.3	Fair	119.1	Advisory
10	Sawmill Creek	70.30	Fair	**98.1**	Fair	109.2	Fair	88	Fair	N/A	
11	Huron River West	24.10	Good	24.1	Good	76.3	Fair	52	Good	1203.3	Advisory
12	Huron River East	3.00	Good	31.3	Good	4.1	Good	47.8	Good	387.3	Advisory
13	Hoffman Ditch	63.10	Good	39.7	Good	135.4	Poor	<1	Good	1046.2	Advisory
14	Old Woman West	41.70	Good	150	Poor	1299.7	Poor	14.5	Good	74.4	Fair
15	Old Woman East	1.00	Good	27.5	Good	45.4	Good	81.6	Fair	75.4	Fair
16	Cranberry Creek	2.00	Good	22.6	Good	8.4	Good	21.3	Good	816.4	Advisory
17	Fichtel Creek	1.00	Good	24.9	Good	3.1	Good	21.1	Good	866.4	Advisory
18	Chappel Creek	1.00	Good	980.4	Advisory	686.7	Advisory	35	Good	1413.6	Advisory
19	Sugar Creek	17.10	Good	>2419.6	Advisory	114.5	Fair	290.9	Advisory	>2419.6	Advisory
20	Darby Creek	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	>2419.6	Advisory
21	Sherod Creek	9.80	Good	>2419.6	Advisory	201.4	Poor	435.2	Advisory	>2419.6	Advisory
22	Edson Creek	478.60	Advisory	>2419.6	Advisory	261.3	Poor	816.4	Advisory	1553.1	Advisory
23	Vermilion West	>2419.6	Advisory	>2419.6	Advisory	18.7	Good	24.1	Good	1986.3	Advisory
24	Vermilion East	48.00	Good	218.7	Poor	436	Advisory	95.9	Fair	920.8	Advisory
25	Showse Park	2.00	Good	137.4	Poor	<1	Good	23	Good	1203.3	Advisory

Beach #	Beach Location	Date	6/8/2010	Date	6/9/2010	Date	6/10/2010	Date	6/14/2010	Date	6/15/2010
		MPN	Rating	MPN	Rating	MPN	Rating	MPN	Rating	MPN	Rating
1	White's Landing	31.5	Good	83.6	Fair	1299.7	Advisory	74.3	Fair	141.4	Poor
2	Pickeral Creek	93.3	Fair	41.1	Good	435.2	Advisory	74.9	Fair	1119.9	Advisory
3	Crystal Rock	45.5	Good	48	Good	547.5	Advisory	139.6	Poor	70.3	Fair
4	Bay View West	38.4	Good	75.4	Fair	547.5	Advisory	79.4	Fair	51.2	Good
5	Bay View East	61.3	Good	28.5	Good	248.9	Advisory	191.8	Poor	344.8	Advisory
6	Lion's Park	21.1	Good	235.9	Advisory	16.8	Good	29.5	Good	13	Good
7	Battery Park	21.6	Good	8.1	Good	3	Good	3.1	Good	344.8	Advisory
8	Kiwanis Park	238.2	Advisory	143.5	Poor	96	Fair	151.5	Poor	866.4	Advisory
9	Cedar Point	517.2	Advisory	142.1	Poor	54.6	Good	39.5	Good	1203.3	Advisory
10	Sawmill Creek	241.5	Advisory	28.5	Good	42.8	Good	148.3	Poor	980.4	Advisory
11	Huron River West	387.3	Advisory	41	Good	37.7	Good	224.7	Advisory	344.8	Advisory
12	Huron River East	206.4	Poor	67	Fair	14.5	Good	18.7	Good	240	Advisory
13	Hoffman Ditch	235.9	Advisory	26.5	Good	116.2	Fair	1203.3	Advisory	235.9	Advisory
14	Old Woman West	110.6	Fair	35.9	Good	18.5	Good	99	Fair	74.3	Fair
15	Old Woman East	93.2	Fair	196.8	Poor	228.2	Poor	81.6	Fair	98.1	Fair
16	Cranberry Creek	64.5	Fair	20.9	Good	39.7	Good	344.8	Advisory	579.4	Advisory
17	Fichtel Creek	120	Fair	27.5	Good	79.4	Fair	34.5	Good	920.8	Advisory
18	Chappel Creek	235.9	Advisory	88	Fair	151.5	Poor	39.3	Good	648.8	Advisory
19	Sugar Creek	260.3	Advisory	55.4	Good	456.9	Advisory	298.7	Advisory	1299.7	Advisory
20	Darby Creek	214.2	Poor	344.8	Advisory	378.4	Advisory			2419.6	Advisory
21	Sherod Creek	387.3	Advisory	261.3	Advisory	292.4	Advisory	>2419.6	Advisory	1299.7	Advisory
22	Edson Creek	770.1	Advisory	866.4	Advisory	866.4	Advisory	2419.6	Advisory	>2419.6	Advisory
23	Vermilion West	90.8	Fair	76.7	Fair	547.5	Advisory	>2419.6	Advisory	410.6	Advisory
24	Vermilion East	298.7	Advisory	36.4	Good	547.5	Advisory	>2419.6	Advisory	>2419.6	Advisory
25	Showse Park	65.7	Fair	387.3	Advisory	34.7	Good	99	Good	111.8	Fair

Beach #	Beach Location	Date	6/16/2010	Date	6/17/2010	Date	6/21/2010	Date	6/22/2010	Date	6/23/2010
		MPN	Rating	MPN	Rating	MPN	Rating	MPN	Rating	MPN	Rating
1	White's Landing	410.6	Advisory	116.2	Fair	12	Good	145.5	Fair	43.5	Good
2	Pickeral Creek	>2419.6	Advisory	133.3	Poor	16.1	Good	235.9	Advisory	73.8	Fair
3	Crystal Rock	1299.7	Advisory	83.3	Fair	25.6	Good	365.4	Advisory	648.8	Advisory
4	Bay View West	64.4	Fair			68.3	Fair	648.8	Advisory	435.2	Advisory
5	Bay View East	547.5	Advisory	12.1	Good	648.8	Advisory	186	Poor	>2419.6	Advisory
6	Lion's Park	34.1	Good	11	Good	4.1	Good	189.2	Poor	9.8	Good
7	Battery Park	14.6	Good	78.9	Fair	7.5	Good	3.1	Good	2	Good
8	Kiwanis Park	260.3	Advisory	156.5	Poor	66.3	Fair	39.3	Good	45.7	Good
9	Cedar Point	53.8	Good	42.6	Good	185	Poor	5.2	Good	<1	Good
10	Sawmill Creek	74.9	Fair	727	Advisory	167	Poor	88.4	Fair	36.4	Good
11	Huron River West	195.6	Poor	49.6	Good	34.5	Good	12.2	Good	16.1	Good
12	Huron River East	72.8	Fair	12.1	Good	39.7	Good	9.7	Good	NA	
13	Hoffman Ditch	157.6	Poor	33.6	Good	19.9	Good				
14	Old Woman West	118.7	Fair	77.1	Fair	6.3	Good	9.8	Good	27.2	Good
15	Old Woman East	21.3	Good	90.6	Fair	4.1	Good	5.2	Good	3.1	Good
16	Cranberry Creek	84.7	Fair	151.5	Poor	307.6	Advisory	12.2	Good	<1	Good
17	Fichtel Creek	770.1	Advisory	191.5	Poor	7.5	Good	38.9	Good	4.1	Good
18	Chappel Creek	1119.9	Advisory	231	Advisory	9.6	Good	26.2	Good	13.2	Good
19	Sugar Creek	1119.9	Advisory	1553.1	Advisory	20.9	Good	201.4	Poor	579.4	Advisory
20	Darby Creek	1553.1	Advisory	770.1	Advisory	139.6	Poor	123.6	Fair	87.8	Fair
21	Sherod Creek	>2419.6	Advisory	1203.3	Advisory	74.3	Fair	307.6	Advisory	74.4	Fair
22	Edson Creek	>2419.6	Advisory	1203.3	Advisory	547.5	Advisory	>2419.6	Advisory	84.2	Fair
23	Vermilion West	1732.9	Advisory	579.4	Advisory	193.5	Poor	285.1	Advisory	307.6	Advisory
24	Vermilion East	1119.9	Advisory	866.4	Advisory	101.4	Fair	51.2	Good	46.2	Good
25	Showse Park	488.4	Advisory			39.9	Good	1203.3	Advisory	61.3	Good
										53	Good

Beach #	Beach Location	Date	6/24/2010	Date	6/28/2010	Date	6/29/2010	Date	6/30/2010	Date	7/1/2010
		MPN	Rating	MPN	Rating	MPN	Rating	MPN	Rating	MPN	Rating
1	White's Landing	165.7	Poor	214.3	Poor	186	Poor	307.6	Advisory	203.3	Poor
2	Pickeral Creek	488.4	Advisory	83.3	Fair	770.1	Advisory	43.5	Good	109.7	Fair
3	Crystal Rock	517.2	Advisory	1732.9	Advisory	378.4	Advisory	65.7	Fair	307.6	Advisory
4	Bay View West	201.4	Poor	24.9	Good	920.8	Advisory	235.9	Advisory	104.6	Fair
5	Bay View East	2419.6	Advisory	104.6	Fair	>2419.6	Advisory	>2419.6	Advisory	101.7	Fair
6	Lion's Park	1203.3	Advisory	218.7	Poor	61.3	Good	32.3	Good	15.8	Good
7	Battery Park	26.5	Good	2	Good	15.6	Good	18.7	Good	5.2	Good
8	Kiwanis Park	39.5	Good	165.8	Poor	547.5	Advisory	866.4	Advisory	60.2	Good
9	Cedar Point	26.5	Good	110.6	Fair	198.9	Poor	64.3	Fair	105.4	Fair
10	Sawmill Creek	547.5	Advisory	920.8	Advisory	613.1	Advisory	36.8	Good	261.3	Advisory
11	Huron River West	248.9	Advisory	95.5	Fair	410.6	Advisory	210.5	Poor	55.4	Good
12	Huron River East	579.4	Advisory	111.9	Fair	86	Fair	83.3	Fair	14.6	Good
13	Hoffman Ditch	172.3	Poor	2419.6	Advisory	214.2	Poor	101.9	Fair	151.5	Poor
14	Old Woman West	517.2	Advisory	105	Fair	93.3	Fair	24.9	Good	9.7	Good
15	Old Woman East	128.1	Poor	8.6	Good	54.6	Good	16.1	Good	12.1	Good
16	Cranberry Creek	178.2	Poor	547.5	Advisory	547.5	Advisory	93.3	Fair	137.4	Poor
17	Fichtel Creek	579.4	Advisory	9.7	Good	1986.3	Advisory	110	Fair	11	Good
18	Chappel Creek	920.8	Advisory	387.3	Advisory	>2419.6	Advisory	224.7	Poor	161.6	Poor
19	Sugar Creek	648.8	Advisory	488.4	Advisory	816.4	Advisory	172.3	Poor	27.9	Good
20	Darby Creek	1119.9	Advisory	517.2	Advisory	613.1	Advisory	461.1	Advisory	55.6	Good
21	Sherod Creek	>2419.6	Advisory	613.1	Advisory	686.7	Advisory	>2419.6	Advisory	159.7	Poor
22	Edson Creek	816.4	Advisory	>2419.6	Advisory	2419.6	Advisory	325.5	Advisory	488.8	Advisory
23	Vermilion West	240	Advisory	218.7	Poor	980.4	Advisory	360.9	Advisory	90.8	Fair
24	Vermilion East	172.5	Advisory	488.4	Advisory	1986.3	Advisory	238.2	Advisory	214.2	Advisory
25	Showse Park	210.5	Poor	90.5	Fair	410.6	Advisory	108.1	Fair	16.9	Good

Beach #	Beach Location	Date	7/6/2010	Date	7/7/2010	Date	7/8/2010	Date	7/12/2010	Date	7/13/2010
		MPN	Rating	MPN	Rating	MPN	Rating	MPN	Rating	MPN	Rating
1	White's Landing	125.9	Poor	60.5	Good	26.2	Good	37.9	Good	83.3	Fair
2	Pickeral Creek	13.4	Good	33.6	Good	13.4	Good	101.9	Fair	22.8	Good
3	Crystal Rock	193.5	Poor	83.9	Fair	285.1	Advisory	184.2	Poor	28.2	Good
4	Bay View West	9.8	Good	35	Good	128.1	Fair	114.5	Fair	59.4	Good
5	Bay View East	29.5	Good	770.1	Advisory	25.6	Good	1986.3	Advisory	721.5	Advisory
6	Lion's Park	2419.6	Advisory	410.6	Advisory	1046.2	Advisory	N/A	N/A	648.8	Advisory
7	Battery Park	7.5	Good	7.4	Good	57.3	Good	18.5	Good	9.6	Good
8	Kiwanis Park	61.3	Good	40.8	Good	N/A	N/A	67.7	Fair	34.1	Good
9	Cedar Point	45.7	Good	4.1	Good	5.2	Good	53.8	Good	17.5	Good
10	Sawmill Creek	104.6	Fair	727	Advisory	42.8	Good	35.9	Good	127.5	Poor
11	Huron River West	63.1	Good	224.7	Poor	1553.1	Advisory	410.6	Advisory	161.6	Poor
12	Huron River East	15.8	Good	2	Good	214.2	Poor	20.1	Good	33.6	Good
13	Hoffman Ditch	2	Good	1	Good	1	Good	16.9	Good	N/A	N/A
14	Old Woman West	<1	Good	2	Good	10.8	Good	48.7	Good	10	Good
15	Old Woman East	156.5	Poor	3.1	Good	2	Good	N/A	N/A	<1	Good
16	Cranberry Creek	45.7	Good	14.4	Good	435.2	Advisory	6.3	Good	23.1	Good
17	Fichtel Creek	<1	Good	2	Good	2	Good	67	Fair	4	Good
18	Chappel Creek	1	Good	33.6	Good	13.5	Good	28.5	Good	59.4	Good
19	Sugar Creek	1	Good	<1	Good	25.9	Good	32.3	Good	39.3	Good
20	Darby Creek	48	Good	18.1	Good	35.9	Good	137.6	Fair	35.9	Good
21	Sherod Creek	13.5	Good	12	Good	30.9	Good	435.2	Advisory	547.5	Advisory
22	Edson Creek	517.2	Advisory	2419.6	Advisory	461.1	Advisory	11	Good	57.6	Good
23	Vermilion West	32.7	Good	135.4	Poor	52	Good	86	Fair	10.8	Good
24	Vermilion East	517.2	Advisory	387.3	Advisory	32.3	Good	34.5	Good	488.4	Advisory
25	Showse Park	9.8	Good	2	Good	9.7	Good	46.4	Good	36.4	Good

Beach #	Beach Location	Date	7/14/2010		Date	7/15/2010		Date	7/19/2010		Date	7/20/2010		Date	7/21/2010	
		MPN	Rating		MPN	Rating		MPN	Rating		MPN	Rating		MPN	Rating	
1	White's Landing															
2	Pickeral Creek	44.1	Good					298.7	Advisory		1553.1	Advisory		116.9	Fair	
3	Crystal Rock	1046.2	Advisory		66.3	Fair		160.7	Poor		1119.9	Advisory		248.9	Advisory	
4	Bay View West	148.3	Poor		9.7	Good		1986.3	Advisory		201.4	Poor		365.4	Advisory	
5	Bay View East	161.6	Poor		137.6	Poor		52	Good		120.1	Fair		64.4	Fair	
6	Lion's Park	1413.6	Advisory		81.6	Fair		108.1	Fair		>2419.6	Advisory		410.6	Advisory	
7	Battery Park	648.8	Advisory		>2419.6	Advisory		98.3	Fair		727	Advisory		96	Fair	
8	Kiwanis Park	7.5	Good		6.3	Good		8.5	Good		5.2	Good	N/A	N/A		
9	Cedar Point	>2419.6	Advisory		52	Good		64.4	Fair		235.9	Advisory		42	Good	
10	Sawmill Creek	238.2	Advisory		21.1	Good		35.9	Good		139.1	Poor		32.3	Good	
11	Huron River West	248.1	Advisory		10.9	Good		35	Good		456.9	Advisory		125.9	Poor	
12	Huron River East	122.3	Fair		83.3	Fair		105.4	Fair		613.1	Advisory		38.4	Good	
13	Hoffman Ditch	107.1	Fair		16	Good		24.6	Good		127.4	Poor		19.9	Good	
14	Old Woman West	165.8	Poor		344.8	Advisory		115.3	Fair		105	Fair		27.9	Good	
15	Old Woman East	161.6	Poor		10.8	Good		50.4	Good		150	Poor		21.3	Good	
16	Cranberry Creek	39.3	Good		4.1	Good		68.3	Fair		7.5	Good		10.9	Good	
17	Fichtel Creek	74.4	Fair		8.6	Good		48.8	Good		80.9	Fair		161.6	Poor	
18	Chappel Creek	71.2	Fair		4.1	Good		24.6	Good		21.3	Good		9.8	Good	
19	Sugar Creek	121.1	Fair		1046.2	Advisory		49.6	Good		24.6	Good		5.2	Good	
20	Darby Creek	>2419.6	Advisory		42.8	Good		613.1	Advisory		178.5	Poor		36.4	Good	
21	Sherod Creek	201.4	Poor		55.4	Good		184.2	Poor	N/A	N/A		N/A	N/A		
22	Edson Creek	488.4	Advisory		77.1	Fair		331.4	Advisory		61.3	Good		209.8	Poor	
23	Vermilion West	1413.6	Advisory		1413.6	Advisory		2419.6	Advisory		1299.7	Advisory		>2419.6	Advisory	
24	Vermilion East	980.4	Advisory		9.8	Good		307.6	Advisory		17.3	Good		35	Good	
25	Showse Park	365.4	Advisory		18.7	Good		159.7	Poor		77.1	Fair		47.3	Good	
		42.5	Good		21.6	Good		101.4	Fair		98.7	Fair		17.3	Good	

Beach #	Beach Location	Date	7/22/2010	Date	7/26/2010	Date	7/27/2010	Date	7/28/2010	Date	7/29/2010
		MPN	Rating	MPN	Rating	MPN	Rating	MPN	Rating	MPN	Rating
1	White's Landing	39.9	Good	16	Good	48	Good	24.6	Good	63.7	Good
2	Pickeral Creek	118.2	Fair	29.5	Good	22.8	Good	1413.6	Advisory	2419.6	Advisory
3	Crystal Rock	26.6	Good	178.5	Poor	648.8	Advisory	>2419.6	Advisory	>2419.6	Advisory
4	Bay View West	122.3	Fair	47.1	Good	53	Good	73.3	Fair	290.9	Advisory
5	Bay View East	48.8	Good	75.4	Fair	131.4	Poor	>2419.6	Advisory	866.4	Advisory
6	Lion's Park	104.6	Fair	272.3	Advisory	272.3	Advisory	161.6	Poor	579.4	Advisory
7	Battery Park	2	Good	75.4	Fair	17.1	Good	12.1	Good	29.5	Good
8	Kiwanis Park	35.5	Good	125	Fair	17.3	Good	461.1	Advisory	325.5	Advisory
9	Cedar Point	<1	Good	63.3	Good	18.7	Good	25.3	Good	727	Advisory
10	Sawmill Creek	478.6	Advisory	61.7	Good	435.2	Advisory	547.5	Advisory	344.8	Advisory
11	Huron River West	648.8	Advisory	290.9	Advisory	68.3	Fair	36.8	Good	686.7	Advisory
12	Huron River East	110.6	Fair	26.2	Good	32.7	Good	17.1	Good	1119.9	Advisory
13	Hoffman Ditch	93.3	Fair	209.8	Poor	10.9	Good	116.2	Fair	121.1	Fair
14	Old Woman West	36.9	Good	52	Good	22.8	Good	14.6	Good	106.7	Fair
15	Old Woman East	6.3	Good	11	Good	4.1	Good	7.4	Good	115.3	Fair
16	Cranberry Creek	34.1	Good	150	Poor	5.2	Good	22.8	Good	260.3	Advisory
17	Fichtel Creek	13.1	Good	51.2	Good	2	Good	3.1	Good	178.5	Poor
18	Chappel Creek	120.1	Fair	228.2	Advisory	6.3	Good	36.4	Good	613.1	Advisory
19	Sugar Creek	30.9	Good	15.8	Good	17.3	Good	15.2	Good	365.4	Advisory
20	Darby Creek	N/A	N/A	198.9	Poor	8.5	Good	145.5	Poor	816.4	Advisory
21	Sherod Creek	770.1	Advisory	410.6	Advisory	13.4	Good	35	Good	613.1	Advisory
22	Edson Creek	1986.3	Advisory	1299.7	Advisory	73.8	Fair	125.9	Poor	1732.9	Advisory
23	Vermilion West	35	Good	36.4	Good	235.9	Advisory	25.6	Good	770.1	Advisory
24	Vermilion East	14.5	Good	54.5	Good	5.2	Good	11	Good	1299.7	Advisory
25	Showse Park	83.3	Fair	34.1	Good	44.8	Good	5.2	Good	248.9	Advisory

Beach #	Beach Location	8/2/2010 Date MPN	Rating	8/3/2010 Date MPN	Rating	8/4/2010 Date MPN	Rating	8/5/2010 Date MPN	Rating	8/9/2010 Date MPN	Rating
1	White's Landing										
2	Pickeral Creek	40.2	Good	113.7	Fair	50.4	Good	93.3	Fair	192.5	Advisory
3	Crystal Rock	27.2	Good	23.1	Good	21.1	Good	137.6	Poor	18.9	Good
4	Bay View West	24.3	Good	206.4	Poor	488.4	Advisory	222.4	Poor	113	Fair
5	Bay View East	156.5	Poor	37.9	Good	98.7	Fair	31.1	Good	93.2	Fair
6	Lion's Park	93.2	Fair	145	Poor	1119.9	Advisory	172.5	Poor	201.4	Poor
7	Battery Park	26.9	Good	260.3	Advisory	344.8	Advisory	83.9	Fair	248.1	Advisory
8	Kiwanis Park	4.1	Good	3.1	Good	3.1	Good	7.3	Good	<1	Good
9	Cedar Point	49.6	Good	42.6	Good	26.2	Good	42.6	Good	248.1	Advisory
10	Sawmill Creek	13.4	Good	9.7	Good	18.7	Good	8.4	Good	17.5	Good
11	Huron River West	105	Fair	727	Advisory	1732.9	Advisory	142.1	Poor	25.6	Good
12	Huron River East	42.2	Good	50.4	Good	95.9	Fair	111.2	Fair	21.3	Good
13	Hoffman Ditch	7.4	Good	104.6	Fair	1986.3	Advisory	387.3	Advisory	21.6	Good
14	Old Woman West	6.3	Good	6.3	Good	54.8	Good	N/A	N/A	18.5	Good
15	Old Woman East	>2419.6	Advisory	51.2	Good	166.4	Poor	33.6	Good	26.2	Good
16	Cranberry Creek	110	Fair	40.8	Good	118.7	Fair	48	Good	2	Good
17	Fichtel Creek	9.8	Good	45.7	Good	9.8	Good	53.6	Good	28.1	Good
18	Chappel Creek	4.1	Good	2	Good	13.5	Good	48.3	Good	5.2	Good
19	Sugar Creek	7.5	Good	39.3	Good	6.3	Good	33.6	Good	7.4	Good
20	Darby Creek	7.3	Good	53.8	Good	5.2	Good	146.7	Poor	27.5	Good
21	Sherod Creek	N/A	N/A	14.5	Good	N/A	N/A	124.6	Fair	14.8	Good
22	Edson Creek	166.4	Poor	14.6	Good	21.3	Good	104.3	Fair	14.5	Good
23	Vermilion West	155.3	Poor	151.6	Poor	127.4	Poor	>2419.6	Advisory	15.6	Good
24	Vermilion East	12.1	Good	7.4	Good	10.8	Good	143	Poor	26.9	Good
25	Showse Park	8.5	Good	21.1	Good	8.4	Good	58.3	Good	4.1	Good
		2	Good	9.7	Good	3	Good	64.4	Fair	5.2	Good

Beach #	Beach Location	8/10/2010 Date MPN	Rating	8/11/2010 Date MPN	Rating	8/12/2010 Date MPN	Rating	8/16/2010 Date MPN	Rating	8/17/2010 Date MPN	Rating
1	White's Landing	52.1	Good	27.2	Good	727	Advisory	435.2	Advisory	146.7	Poor
2	Pickeral Creek	8.4	Good	31.5	Good	461.1	Advisory	307.6	Advisory	88	Fair
3	Crystal Rock	17.1	Good	14.5	Good	307.6	Advisory	>2419.6	Advisory	920.8	Advisory
4	Bay View West	307.6	Advisory	52.9	Good	218.7	Poor	54.6	Good	111.9	Fair
5	Bay View East	64.4	Good	73.3	Fair	365.4	Advisory	51.2	Good	51.2	Good
6	Lion's Park	>2419.6	Advisory	1553.1	Advisory	280.9	Advisory	19.9	Good	28.2	Good
7	Battery Park	19.9	Good	<1	Good	58.3	Good	17.1	Good	7.4	Good
8	Kiwanis Park	16.9	Good	43.2	Good	461.1	Advisory	435.2	Advisory	32.7	Good
9	Cedar Point	290.9	Advisory	155.3	Poor	8.6	Good	21.6	Good	8.4	Good
10	Sawmill Creek	313	Advisory	131.4	Poor	98.5	Fair	>2419.6	Advisory	120.1	Fair
11	Huron River West	72.7	Fair	218.7	Poor	98.7	Fair	1046.2	Advisory	98.7	Good
12	Huron River East	191.8	Poor	116.9	Fair	63.8	Good	42.8	Good	12.1	Good
13	Hoffman Ditch	344.8	Advisory	78.9	Fair	49.6	Good	26.9	Good	7.3	Good
14	Old Woman West	63.1	Good	6.3	Good	11	Good	38.4	Good	4.1	Good
15	Old Woman East	2	Good	9.6	Good	5.2	Good	56.3	Good	1	Good
16	Cranberry Creek	23.1	Good	13.2	Good	65	Fair	73.3	Fair	<1	Good
17	Fichtel Creek	8.5	Good	2	Good	2	Good	47.3	Good	11	Good
18	Chappel Creek	7.5	Good	12.1	Good	4.1	Good	74.9	Fair	7.4	Good
19	Sugar Creek	13.4	Good	4.1	Good	47.3	Good	686.7	Advisory	70.3	Fair
20	Darby Creek	N/A	N/A	2	Good	N/A	N/A	112.4	Fair	58.1	Good
21	Sherod Creek	53.6	Good	4.1	Good	28.8	Good	222.4	Poor	16.1	Good
22	Edson Creek	39.9	Good	111.2	Fair	517.2	Advisory	275.5	Advisory	38.4	Good
23	Vermilion West	7.5	Good	41.4	Good	60.2	Good	770.1	Advisory	32.7	Good
24	Vermilion East	307.6	Advisory	3.1	Good	14.6	Good	209.8	Poor	7.5	Good
25	Showse Park	6.3	Good	<1	Good	15.8	Good	461.1	Advisory	11	Good

Beach #	Beach Location	8/18/2010 Date MPN	Rating	8/19/2010 Date MPN	Rating	8/23/2010 Date MPN	Rating	8/24/2010 Date MPN	Rating	8/25/2010 Date MPN	Rating
1	White's Landing										
2	Pickeral Creek	15.8	Good	81.6	Fair	103.9	Fair	55.6	Good	N/A	
3	Crystal Rock	21.8	Good	50.4	Good	140.8	Poor	45.9	Good	N/A	
4	Bay View West	145.5	Poor	13.4	Good	1119.9	Fair	35	Good	N/A	
5	Bay View East	24.3	Good	23.3	Good	105.9	Poor	39.5	Good	N/A	
6	Lion's Park	107.6	Fair	45	Good	140.8	Poor	25.3	Good	N/A	
7	Battery Park	127.4	Poor	101.9	Fair	156.5	Poor	2	Good	N/A	
8	Kiwanis Park	1	Good	3.1	Good	36.8	Good	40.8	Good	N/A	
9	Cedar Point	39.9	Good	66.3	Fair	1299.7	Advisory	58.1	Good	N/A	
10	Sawmill Creek	613.1	Advisory	19.3	Good	90.8	Fair	104.6	Fair	N/A	
11	Huron River West	12	Good	125.9	Poor	98.4	Fair	71.2	Fair	N/A	
12	Huron River East	387.3	Advisory	62	Good	103.9	Fair	791.5	Advisory	72.7	Fair
13	Hoffman Ditch	547.5	Advisory	37.3	Good	108.1	Fair	14.5	Good	10.9	Good
14	Old Woman West	86.2	Fair	7.5	Good	178.9	Poor	25.9	Good	11.9	Fair
15	Old Woman East	28.1	Good	10.9	Good	178.5	Poor	4	Good	0.0	Good
16	Cranberry Creek	22.6	Good	3.1	Good	131.4	Poor	8.4	Good	N/A	
17	Fichtel Creek	35	Good	5.2	Good	77.6	Fair	15.6	Good	5.2	Good
18	Chappel Creek	6.3	Good	2	Good	74.9	Fair	30.5	Good	3.1	Good
19	Sugar Creek	7	Good	7.5	Good	435.2	Advisory	33.1	Good	36.9	Good
20	Darby Creek	435.2	Advisory	3.1	Good	96	Fair	37.9	Good	24.7	Good
21	Sherod Creek	14.8	Good	2	Good	93.3	Fair	33.6	Good	27.9	Good
22	Edson Creek	10.8	Good	<1	Good	290.9	Advisory	70.3	Fair	39.9	Good
23	Vermilion West	27.5	Good	9.8	Good	224.7	Poor	113	Fair	17.1	Good
24	Vermilion East	35.9	Good	31.7	Good	365.4	Advisory	105	Fair	14.8	Good
25	Showse Park	19.9	Good	3.1	Good	275.5	Advisory	125.9	Fair	16.0	Good
		14.5	Good	<1	Good	37.7	Good	41	Good	7.5	Good

Beach #	Beach Location	8/26/2010 Date MPN	Rating	8/30/2010 Date MPN	Rating	8/31/2010 Date MPN	Rating	9/1/2010 Date MPN	Rating	9/2/2010 MPN	Rating
1	White's Landing	30.5	Good	3.1	Good	82.0	Fair	74.3	Fair	248.1	Advisory
2	Pickeral Creek	172.3	Poor	4.1	Good	24.9	Good	9.0	Good	10.9	Good
3	Crystal Rock	48.1	Good	3.1	Good	5.2	Good	8.5	Good	16.1	Good
4	Bay View West	51.2	Good	2.0	Good	6.3	Good	2.0	Good	17.6	Good
5	Bay View East	121.1	Fair	5.1	Good	28.2	Good	6.3	Good	13.1	Good
6	Lion's Park	8.6	Good	3.0	Good	27.9	Good	10.9	Good	13.1	Good
7	Battery Park	3.1	Good	2.0	Good	7.5	Good	4.1	Good	3.0	Good
8	Kiwanis Park	178.9	Poor	3.1	Good	77.6	Fair	80.1	Fair	113.7	Fair
9	Cedar Point	157.6	Poor	17.1	Good	9.6	Good	8.5	Good	5.1	Good
10	Sawmill Creek	38.4	Good	17.1	Good	13.4	Good	18.7	Good	21.6	Good
11	Huron River West	38.8	Good	13.5	Good	60.2	Good	240.0	Advisory	90.8	Fair
12	Huron River East	27.2	Good	18.7	Good	95.9	Fair	206.4	Poor	133.3	Poor
13	Hoffman Ditch	24.1	Good	46.5	Good	21.6	Good	62.0	Good	12.0	Good
14	Old Woman West	29.2	Good	10.9	Good	8.6	Good	19.1	Good	5.2	Good
15	Old Woman East	59.1	Good	14.8	Good	4.1	Good	151.5	Poor	9.5	Good
16	Cranberry Creek	208.4	Poor	16.1	Good	2.0	Good	167.4	Poor	10.9	Good
17	Fichtel Creek	50.4	Good	20.1	Good	24.1	Good	2.0	Good	6.3	Good
18	Chappel Creek	52.9	Good	41.0	Good	1.0	Good	1.0	Good	53.8	Good
19	Sugar Creek	48.1	Good	36.4	Good	0.0	Good	N/A		19.7	Good
20	Darby Creek	62.0	Good	54.8	Good	2.0	Good	15.5	Good	67.6	Fair
21	Sherod Creek	58.1	Good	36.8	Good	107.1	Fair	8.5	Good	79.8	Fair
22	Edson Creek	87.3	Fair	41.4	Good	4.1	Good	7.4	Good	93.3	Fair
23	Vermilion West	120.3	Fair	30.1	Good	9.8	Good	6.2	Good	6.3	Good
24	Vermilion East	79.8	Fair	36.4	Good	4.1	Good	4.1	Good	1.0	Good
25	Showse Park	53.8	Good	34.5	Good	53.0	Good	17.1	Good	5.2	Good

Northeast Ohio Regional
Sewer District
Protecting Your Health and Environment

September 29, 2010

Mr. W. Gene Phillips
Administrator - Contract Manager
Ohio Department of Health
Bureau of Environmental Health
246 North High Street
Columbus, Ohio 43215

Dear Mr. Phillips,

The Northeast Ohio Regional Sewer District (NEORSD) appreciates the opportunity to participate with the Ohio Department of Health's Beach Monitoring Program. This year NEORSD has completed all the work that was stated under Article I , Section A, parts 4 and 5 of Contract #Prev-30741-04, ADTS#42071.

- Item 4 of Article I, of the proposal was for the NEORSD laboratory to continue to collecting and analyzing samples from July 1, 2010 through September 6, 2010 using qPCR and IMS/ATP rapid methods. Additionally the NEORSD laboratory provided results daily in an electronic format for all samples analyzed for *E. coli* by the traditional method. The results for these samples were used for public notification for beach water quality advisories. A total of total of 273 samples were collected at Edgewater beach. A total of 264 samples were collected from Euclid beach, and 274 samples were collected from Villa Angela beach. The sample collection period was from May 3, 2010 through September 6, 2010.

- Item 4 of Article I, of the proposal requires that the NEORSD laboratory prepare and submit a detailed final report on all activities associated with services performed as part of this contract. This includes all results of sampling, methods utilized, quality control procedures and chain of custody documentation.

Details outlining the activities of this year's project are discussed in the attached report. Included are all the sampling information, analysis bench sheets, and final data from samples collected between July 1, 2010 and September 6, 2010, along with any educational or promotional materials.

Sincerely,

Mark Citriglia
Manager of Analytical Services
NEORSD

Introduction

Microorganisms from urban runoff, combined sewer overflows (CSOs), wildlife, bather shedding, and nonpoint sources are potentially a determinant of illness for individuals swimming in contaminated water. The U.S. Environmental Protection Agency has defined *Escherichia coli (E. coli)* as one of the best indicator organisms at freshwater bathing beaches because the presence of these bacteria indicates that pathogenic microorganisms may also be present. *E. coli* densities were monitored at Edgewater, Euclid, and Villa Angela beach during the recreational season. The data obtained from this sampling was reported to the Ohio Department of Health (ODH) daily and used for public notification of water quality advisories. In addition to beach sampling, water samples were collected at two locations on Euclid Creek to determine the impact on water quality at Villa Angela and Euclid Beaches.

Sampling Summary

Water samples were collected from an east and west location at each of the three beaches. The samples were analyzed separately and a portion of the east and west sample were combined at the laboratory to serve as an integrated grab sample. All samples were collected at a depth of 3 feet at each location and approximately 6-12 inches below the surface (approximately two feet from the bottom). At the time of collection, field parameters were taken and field observations were made pertaining to the beach and water conditions. All observations were recorded on a daily sampling form. All water samples and field parameters were collected as specified in NEORSD SOP 3004 Beach Sampling and the 2010 sampling plan approved by the Ohio EPA for the Credible Data Program.

Sampling was performed seven days a week Monday through Sunday from May 17, 2010 until September 6, 2010. Samples were collected at Euclid Creek from June 1, 2009 to September 3, 2010, Monday through Friday only. Due to increased beach usage samples were collected during the following holidays, Memorial Day, 4th of July, and Labor Day. NEORSD utilized two sampling crews which consisted of two NEORSD employees. One crew was assigned to sample Edgewater beach and the other crew was assigned to collect samples at Euclid and Villa Angela Beach.

A total of 487 samples were collected from two locations from all three beaches from May 17, 2010 through September 6, 2010. A total of 135 samples were collected from the two locations on Euclid creek from June 1, 2009 through September 3, 2010. There were a total of 56 integrated grab samples collected for all three beaches. The integrated grab samples were analyzed to determine if multiple grab samples were a better representation of the water quality at the

beaches verses a single sample. The laboratory combined equal portions of water from of the east and west samples collected at each beach to make an integrated grab. Table 1, Sampling Locations summarizes the exact point of sample collection for each beach.

Table 1: Sampling Locations

Location	Latitude	Longitude	Description
Edgewater East	N41.4893°	W81.7392°	Eastern half of beach in line with the brick stack on the other side of the freeway.
Edgewater West	N41.4887°	W81.7404°	Western half of beach in line with the large metal pole that is on the other side of the freeway.
Euclid East	N41.5843°	W81.5686°	Eastern half of beach inline with the East side of the pile of stones on the beach.
Euclid West	N41.5838°	W81.5694	Western half of beach between the 2 break walls at the second set of stairs from the structure at Euclid Beach.
Euclid Creek	N41.5831°	W81.5594°	Downstream of Lakeshore Avenue
Euclid Creek	N41.5854°	W81.5641°	Downstream of Wildwood Bridge
Villa Angela East	N41.5851°	W81.5677°	Eastern half of beach mid-distance between the 3rd and 4th break walls.
Villa Angela West	N41.5861°	W81.5667°	Western half of beach at the beginning of the 2nd break wall.

Sampling Results Summary Edgewater

Historically, the Ohio Department of Health has used the *E. coli* results from the samples collected at the East sampling location to determine if a water quality advisory should be posted. During the period of May 17, 2010 through September 6, 2010, Edgewater Beach had 100 days in which sample results indicated that the bacteria levels were less than the Single Sample Maximum criteria (SSM) of 235 colony forming units per 100 milliliters (cfu/100ml). There were 15 days (13% of the samples) when the levels exceeded the SSM criteria and a water quality advisor was posted. During the 2009 recreation season there were 28 days (25% of the samples) that were over the SSM criteria. Some factors that can influence the bacteria density at the beach are wave height and rainfall. In 2010, there were 29 days where the wave height was over 1.0-foot and 28 days in 2009. There was approximately 12.9 inches of rainfall in 2010 and 14.5 inches of rain in 2009. The majority of the rainfall for 2009 (8.38 inches) was encountered between the date ranges of June 9 through August 10. During this time period, there was a total of 18 days where the bacteria results were greater than the SSM. It appears that rainfall may affect the water quality at Edgewater more than wave height. Table 2, Edgewater Sampling Summary, summarizes the sampling results for the samples collected at Edgewater beach.

Table 2: Edgewater Sampling Summary

Edgewater Samples	Integrated Grab	East Location	West Location
Count	17	115	115
Samples < SSM of 235 cfu/100ml	13	100	100
Samples > SSM of 235 cfu/100ml	4	15	15
Minimum Density cfu/100ml	14	1	3
Maximum Density cfu/100ml	1100	6700	3000
Geometric mean (5/3 - 9/10)	87	52	39

Sampling Results Summary Villa Angela

During the period of May 7, 2010 through September 6, 2010, Villa Angela Beach had 69 days in which sample results indicated that the bacteria levels were less than the SSM of 235 cfu/100ml and 41 days when the levels exceeded the SSM. Samples collected from the east location indicate that Villa Angela beach has exceeded the SSM in 37% of the samples collected. The data collected indicates that the bacterial density can be vastly different between the east and west side of the beach. The results from samples collected at the west location indicate that the 28% of the sample exceeded the SSM at this location. The *E. coli* results for samples collected in 2009 had a similar trend as in 2010, showing that the sampling location on the east side of the beach had higher *E.coli* concentrations than the west side of the beach. Table 3, Villa Angela Sampling Summary, summarizes the results for samples collected at Villa Angela beach.

Table 3: Villa Angela Sampling Summary

Villa Angela Samples	Integrated Grab	East Location	West Location
Count	16	112	111
Samples < SSM of 235 cfu/100ml	10	69	79
Samples > SSM of 235 cfu/100ml	6	41	32
Minimum Density cfu/100ml	33	3	2
Maximum Density cfu/100ml	2080	13400	5400
Geometric mean (5/3 - 9/10)	168	156	104

Sampling Results Summary Euclid Beach

During the period of May 7, 2010 through September 6, 2010, Euclid Beach had 111 samples collected for *E. coli* analysis. There were 46 days which exceeded the SSM of 235 cfu/100ml and 65 days in which the sample results indicated that the bacteria levels were less than the SSM. The geometric mean for this same time period is 117 cfu/100ml. Euclid beach appears to show similar trends with sampling variability as seen at Villa Angela. The data indicates that the east sampling location Euclid beach has higher *E. coli* concentrations when compared to the west sampling location. The east side of the beach had sample

results that exceeded the SSM 41% of the time while the west side had 28% of the samples that had exceeded the SSM. Table 4, Euclid Beach Sampling Summary, summarizes the sampling results.

Table 4: Euclid Beach Sampling Summary

Euclid Beach Samples	Integrated Grab	East Location	West Location
Count	17	111	112
Samples < SSM of 235 cfu/100ml	12	65	80
Samples > SSM of 235 cfu/100ml	5	46	32
Minimum Density cfu/100ml	11	3	2
Maximum Density cfu/100ml	2200	6300	8400
Geometric mean (5/3 - 9/10)	122	117	99

Sampling Results for Euclid Creek

Euclid Creek is a tributary to Lake Erie that is located adjacent to the Villa Angela and Euclid beached. The District has added two sampling locations on Euclid creek that are sampled Monday through Friday from June 1, 2010 through September 3, 2010 in conjunction with the daily samples take at the Villa Angela and Euclid beaches. The sample collection sites are EC-1, just north of the footbridge and EC-2, at river mile 0.5. A total of 143 samples were collected from June 1 through September 3. Data from these samples are used as part of the NEORSD water quality monitoring program and source tracking efforts are Euclid and Villa Angela beach. NEORSD believes that illicit discharges and combined sewer overflows along Euclid creek directly impact the water quality at Villa Angela and Euclid beaches.

Table 5: Euclid Creek Sampling Summary

Euclid Creek	EC-1 Bridge	EC-2 0.5
Count	72	71
Minimum Density cfu/100ml	160	108
Maximum Density cfu/100ml	45400	21600
Geometric mean (6/1 - 9/10)	1288	984

Summary of the Predictive Model "NowCast" – Edgewater Beach

NEORSD employees used a predictive model developed by USGS to predict the water quality at Edgewater Beach. The sampling crews were equipped with a laptop computer and a wireless card, to effectively and efficiently identify water quality issues using this model. The sampling crew entered several variables into the model and posted the appropriate beach signage based on the prediction from the model. The model used water quality variables which are expected to affect *E. coli* densities including turbidity, wave height, water temperature, and rainfall. Upon entering a combination of these variables, the model calculates the probability that the *E. coli* densities will be exceeded. Water

quality variables and results from the model are entered onto the NOWCAST Website located at http://www.ohionowcast.info.

The predictive model used by NEORSD personnel was broken into three seasons based on the correlation of the data from the previous year. Season-1 lasted from May 3, 2010 through June 15, 2010. Season-2 covered the period of June 16, 2010 through August 10, 2010. Season-3 lasted from August 11, 2010 through September 10, 2010. The predictive model developed by the USGS was executed daily throughout each of the seasons. A total of **121** predictions were made using the model, with an overall accuracy of **80%**. Using the previous days *E. coli* result to predict water quality resulted in an accuracy of **79%**. The models sensitivity, or the ability to accurately predict a water quality exceedence, was **81%** overall. Using the previous days *E.coli* result to accurately predict a water quality exceedence was only **25%** accurate.

EDGEWATER NOWCAST 2010

	Total Correct	Correct -	False +	Correct +	False -	Total	Accuracy	Sensi	Spec
Subseason 1 Model	31	27	2	4	1	34	91.2	80.0	93.1
Subseason 2 Model	45	41	11	4	0	56	80.4	100.0	78.8
Subseason 3 Model	21	16	8	5	2	31	67.7	71.4	66.7
Total Model	**97**	**84**	**21**	**13**	**3**	**121**	**80.2**	**81.3**	**80.0**
Previous day's E. coli	92	88	12	4	12	116	79.3	25.0	88.0

From 2005-09 data expected specificity 81.5 to 84.9% overall

expected sensitivity 61 to 68% overall

Summary qPCR data and MF data

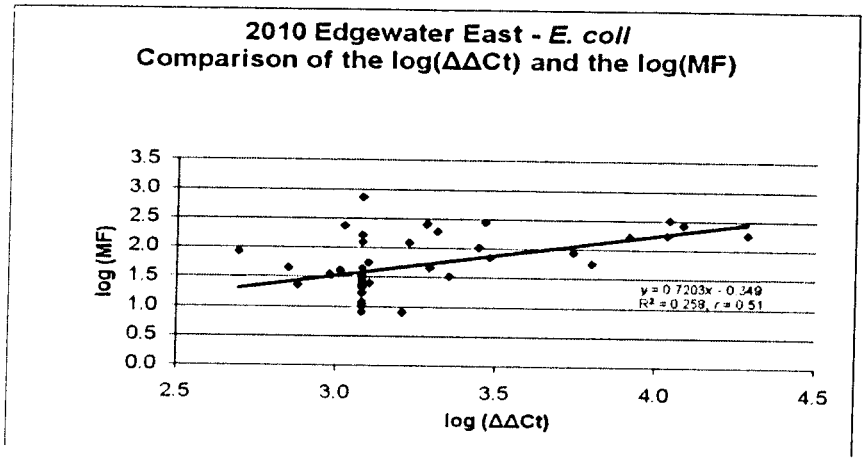
A portion of the beach samples were analyzed by Quantitative Polymerase Chain Reaction (qPCR). Samples that were collected Monday through Friday throughout the beach season were analyzed using qPCR methodology. A total of 110 samples were analyzed for *E. coli* using qPCR. The results from the qPCR are reported in Cycle Threshold (Ct) values. The final results are then calculated as ΔCt and Δ ΔCt. Values reported as ΔCt are corrected based on the results from a known *E. coli* calibrator standard. The calibrator standard is a pure culture of *E. coli* that was prepared in the laboratory. Values reported as Δ ΔCt are calculated using the Δ Ct and the Δ Δ Ct response of an internal standard. The internal standard is a segment of Salmon DNA that added to the sample and replicated using the same method conditions as the *E. coli* analysis. Suppression of the replication of the internal standard indicates the sample contains inhibitory compounds that are suppressing the replication. It is assumed that if the control shows suppression then similar suppression exists with *E. coli* DNA. If the suppression is minimal the Δ ΔCt calculation will correct for the inhibition. If there is a lot of inhibition present the sample must be diluted or purified to remove

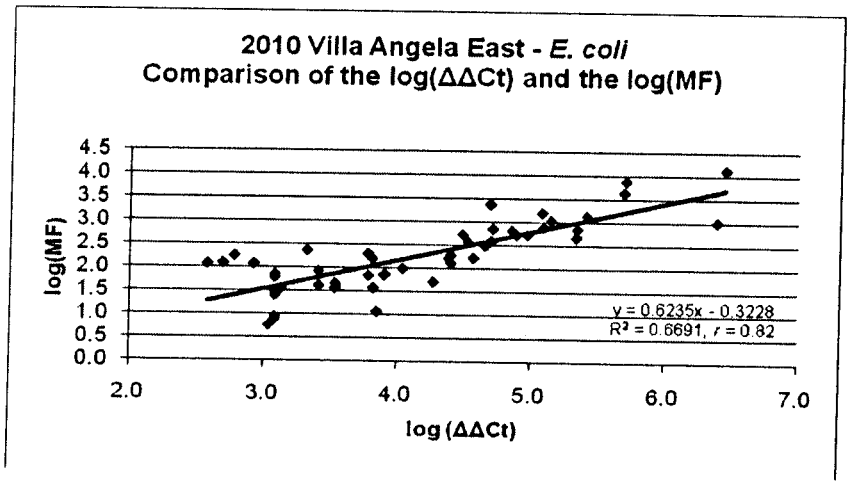
the inhibitory compounds. Additional information about these two calculations types can be found in the proposed USEPA Method A: *Enterococci in Water by Taqman Quantitative Polymerase Chain Reaction (qPCR) Assay USEPA method, April 2010.*

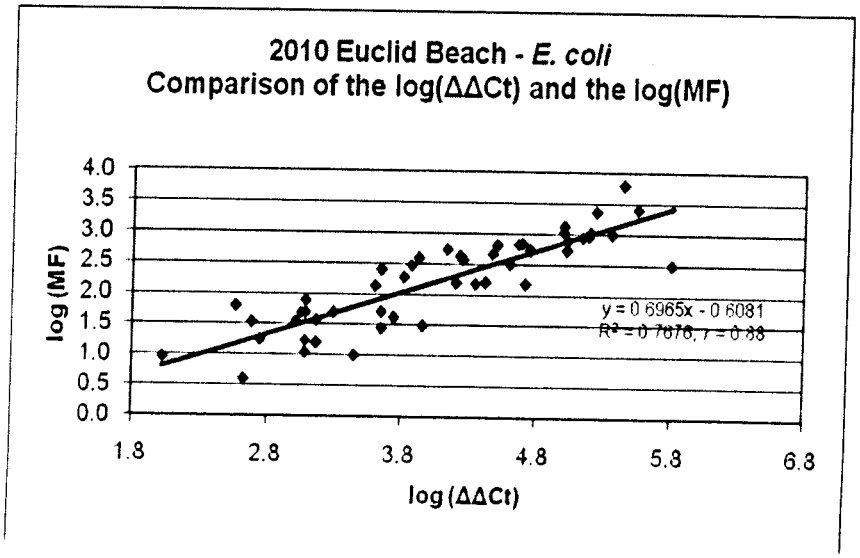
The actual *E. coli* concentration derived from the qPCR analysis cannot be easily converted into colony forming units per 100 ml of sample (cfu/100ml) and be compared to the culture based method. The culture based method (Membrane Filtration) is designed to determine the number of bacteria that can reproduce or replicate on specific media. These live bacteria (viable) form small colonies of growth on a host specific media and are enumerated to colonies per milliliter of sample used. qPCR technologies are designed to recognize a specific DNA sequence and replicate this sequence until it can be quantified. This specific DNA sequence is present in both viable and nonviable bacteria cells. The method cannot distinguish between viable and nonviable bacteria cells which makes it difficult to perform a direct correlation with the culture based method. The US EPA is currently performing epidemiological studies using qPCR methodology to determine a correlation between illness and bacterial cells. The result of this epidemiological study may result in new recreational water quality standards.

Regression analysis of qPCR data and MF data

The data generated by the qPCR method and the standard culture method were compared in two different ways. A regression analysis was performed using the log of the *E. coli* density from the Membrane Filtration (MF) method against the log of the Δ ΔCt results obtained from the qPCR analysis. The purpose of the regression analysis was to determine if there was any correlation between the data sets. The data generated from the samples collected indicated that there was a slight correlation between the MF and qPCR data with an $R = 0.508$. Both Villa Angela and Euclid beach had a much stronger correlation with an $R=0.82$ for Villa Angela and $R=0.88$ for Euclid beach. The qPCR method appeared to have a much stronger correlation at Villa Angela and Euclid beaches because the *E. coli* concentrations for the samples collected at these beaches were greater than those collected at Edgewater. The qPCR methodology appears to have some limitations with sensitivity. The method had difficulty quantifying samples with *E. coli* concentrations of less than 40 cfu/100ml. Edgewater beach had 15 samples with an *E. coli* concentration greater than 235 cfu/100ml. Approximately 20% of the samples collected at Edgewater beach had results that were not detectable by qPCR Analysis. The following graphs represent the correlation for Edgewater, Villa Angela and Euclid beaches.

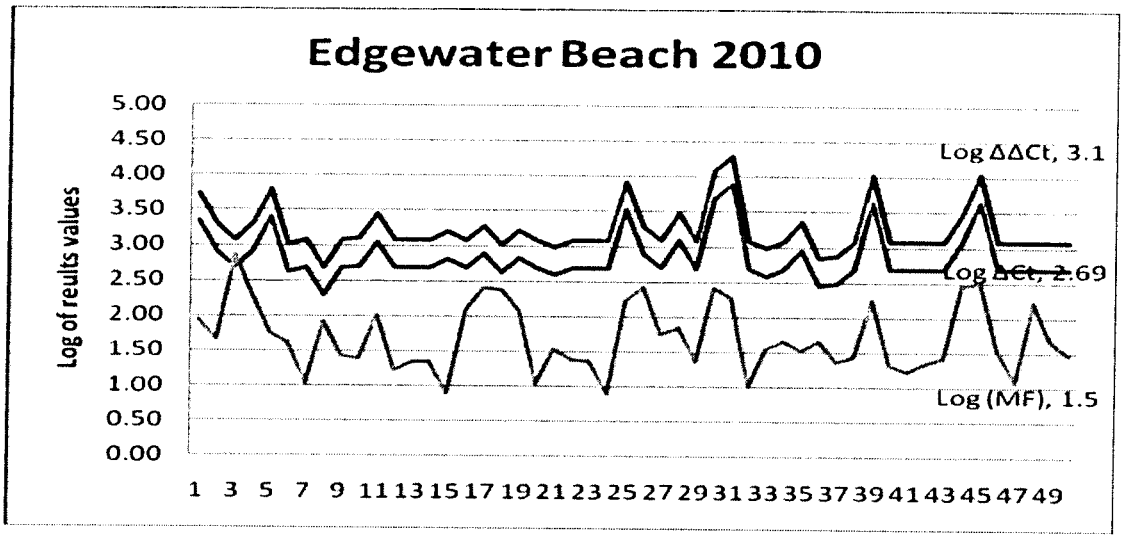

2010 Edgewater East - E. coli
Comparison of the log(ΔΔCt) and the log(MF)
log (MF)
log (ΔΔCt)
y = 0.7203x - 0.349
R² = 0.258, r = 0.51

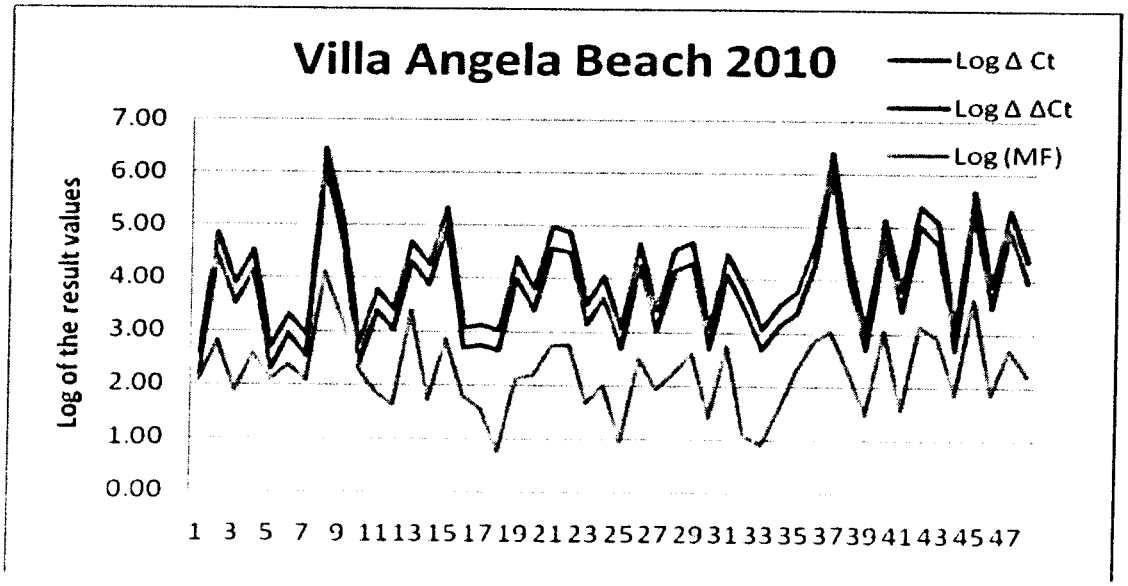

2010 Villa Angela East - E. coli
Comparison of the log(ΔΔCt) and the log(MF)
log(MF)
log (ΔΔCt)
y = 0.6235x - 0.3228
R² = 0.6691, r = 0.82

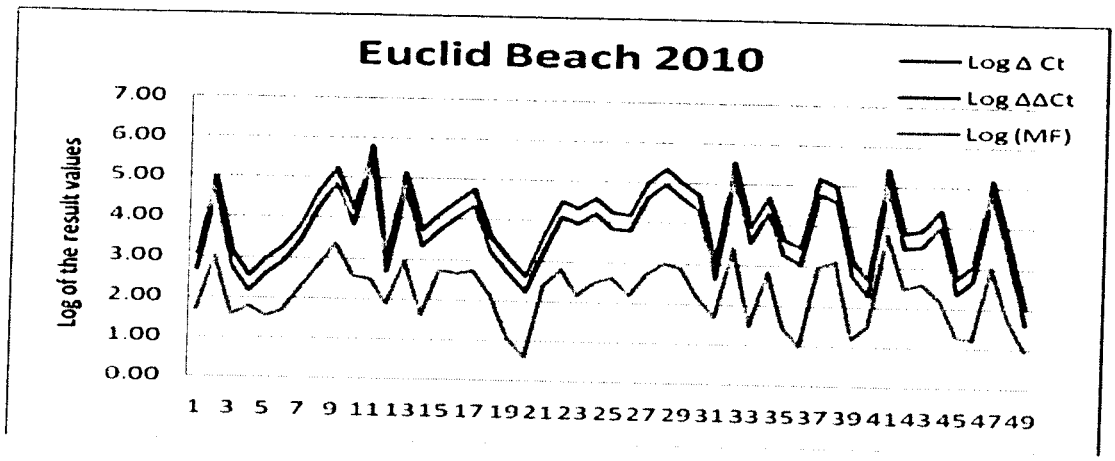

2010 Euclid Beach - E. coli
Comparison of the log(ΔΔCt) and the log(MF)
log (MF)
log (ΔΔCt)
y = 0.6965x - 0.6081

Trend analysis of qPCR data and MF data

The data from the MF and qPCR methods were also compared using a standard line graph. The line graph was used to determine if the results from the qPCR values trended in a similar fashion as the MF results. The following graphs represent the how well the results from both methods mirrored each other. The results between the methods appeared to trend very well for the samples collected at Villa Angela and Euclid beaches.







Slope Linear Regression of qPCR data and MF Data

There is no approved method for the analysis of *E. coli* by qPCR. Methods are still under development by the USEPA and USGS. Since 2007, NEORSD in conjunction with researchers at the USGS, have been testing the capability to perform *E.coli* analysis using qPCR. Since the current SSM of 235 cfu/100ml is based on *E. coli* it would be beneficial to have a rapid method that could be used for the current indicator organism. This method uses a slope linear regression to between the *E. coli* MF results and *E. coli* qPCR results. The equation from the line is then used to calculate a predicted *E. coli* concentration from the corresponding Ct values generated by qPCR.

The Ct values from the qPCR method were converted to a log predicted value using a standard curve calibration from a pure culture of *E. coli* bacteria. The log predicted value was plotted against the log of the *E coli* result for the membrane filtration method using an X-Y scatter plot. Each point on the scatter plot represents the value for each sample from the two methods. A linear regression line or trend line was plotted for each beach individually and then combined. Correlations for the trend line were obtained and evaluated and compared to the data from last year. Table 6, Slope Regression Correlations, summarizes the correlation and equation of the line used for each beach.

Table 6: Slope Regression Correlations

2009 & 2010 E. coli qPCR Slope Regression Correlations				
Beach	Year	Correlation R	Slope	Intercept
Edgewater	2009	0.65	0.566	0.9141
Edgewater	2010	0.43	0.453	1.263
Villa Angela	2009	0.79	0.782	-0.0913
Villa Angela	2010	0.81	0.652	1.0334
Euclid	2009	0.78	0.860	0.2469
Euclid	2010	0.79	0.696	1.1125

The correlation (R) and the slope generated for the 2010 data set for each beach is very similar to what was obtained in 2009. There was slight change with the correlation between Edgewater data from 2009 and 2010. The correlation in 2010 decreased slightly. This could be attributed to the sensitivity of the qPCR method and the number of samples that had non-detects for *E. coli.* There was a slight change between the 2009 and 2010 slope for Euclid beach. This change could be attributed to the large data set used in 2010.

The slope and intercept generated from the MF and qPCR data set was used to calculate a predicted *E. coli* concentration. This concentration was then compared to the *E. coli* concentration derived from the MF method. The qPCR predicted *E. coli* was used to determine how accurately this predicted value could be used to determine a water quality advisory. Tables 7 – 9 summarize how accurately the Slope Linear Regression (SLR) predicted the water quality compared to the current method using the *E. coli* result from the previous day.

Table 7: Villa Angela Beach SLR Data

	Accuracy	Correct -	False +	Correct +	False -	Sensitivity	Specificity
2010 MF	45%	37	30	12	30	29%	55%
2010 qPCR	83%	57	10	34	8	83%	85%
2009 qPCR	85%	62	5	31	11	76%	93%

Table 8: Euclid Beach SLR Data

	Accuracy	Correct -	False +	Correct +	False -	Sensitivity	Specificity
2010 MF	64%	34	21	43	22	96%	54
2010 qPCR	73%	42	22	18	0	40%	67
2009 qPCR	***57%***	***59***	***6***	***3***	***40***	***7%***	***94***

Table 9:Edgewater Beach SLR Data

	Accuracy	Correct -	False +	Correct +	False -	Sensitivity	Specificity
2010 MF	78%	83	12	2	12	14%	86%
2010 qPCR	86%	95	1	0	14	0%	99%
2009 qPCR	86%	95	1	0	14	0%	99%

The data summarized in the above tables indicates that the SLR developed for each of the beach can be used to accurately predict the water quality for that particular beach. Since the slope and intercept are not significantly different from year to year, the slope and intercept from the previous year could be used to accurately predict the water quality. The SLR appears to be a useful tool for developing a Nowcast model for Villa Angela and Euclid Beach. Sensitivity is defined by how well the SLR predicts values greater than the SSM, while Specificity indicates how well the SLR predict values less than the SSM.

Summary of IMS/ATP Activities

In a continuing effort to research new methods for the rapid detection of bacteria in recreational waters, Analytical Services analyzed 130 samples via the Immunomagnetic Separation/Adenosine Triphosphate (IMS/ATP) method. Developed in 2004 by Lee and Deininger, IMS/ATP utilizes simple equipment and procedures as well as portability when compared to other potential rapid techniques such as quantitative polymerase chain reaction (qPCR). Additional benefits to IMS/ATP are relatively lower costs than qPCR and more rapid results (1 hour as compared to 2.5-3 hours for qPCR).

This method involves the capture of the bioluminescence of ATP from bacterial cells. This technique uses 25 ml of sample which is mixed and coated with anti-body coated beads. Once the sample has been mixed properly and any bacterial cells have had sufficient time to attach to the beads, the beads are separated from the sample via magnetic attachment. After a series of washes in order to remove non-bacterial cells, Luciferin-luciferase, a solution that reacts with ATP to produce light, is added to the purified bacteria solution. This mixture is placed into a microluminometer and light readings are recorded. Results are reported in relative light units per 100 ml (RLU/100ml).

Results and Statistical Analysis

Samples were collected and analyzed from the East sites of Edgewater, Euclid, and Villa Angela beaches from May 27th to August 19th of 2010. Data analysis was performed comparing the results from both the traditional culture-based method for determining E. coli concentration using the modified mTEC method (US EPA, 2006b) and the IMS/ATP method. The data sets were compared by transforming the data values to log10 values and plotting them on a scatterplot. Correlation coefficients were then calculated to compare the linear relationship of the two sets of data. The data for each beach was analyzed separately because past studies have shown that IMS/ATP methods appear to be site specific (Bushon et al, 2009).

Edgewater Beach IMS/ATP Data

At Edgewater Beach, a total of 41 samples were analyzed for both methods. The site studied showed a weak correlation with traditional culture-based method ($r = 0.4379$). Figure 1 shows a graphical interpretation of each sites correlation.

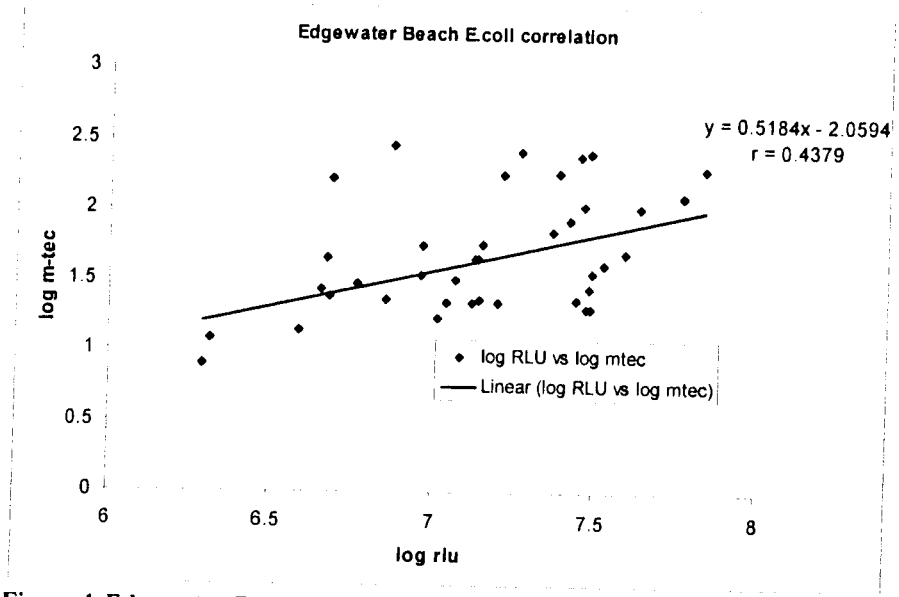


Figure 1-Edgewater Beach (log modified mTEC (CFU/100 ml) vs. log RLU/100 ml)

Euclid Beach IMS/ATP Data

At Euclid Beach, a total of 45 samples were analyzed for both methods. The site studied showed a weak correlation with traditional culture-based method (r = 0.4753). Figure 2 shows a graphical interpretation of each sites correlation.

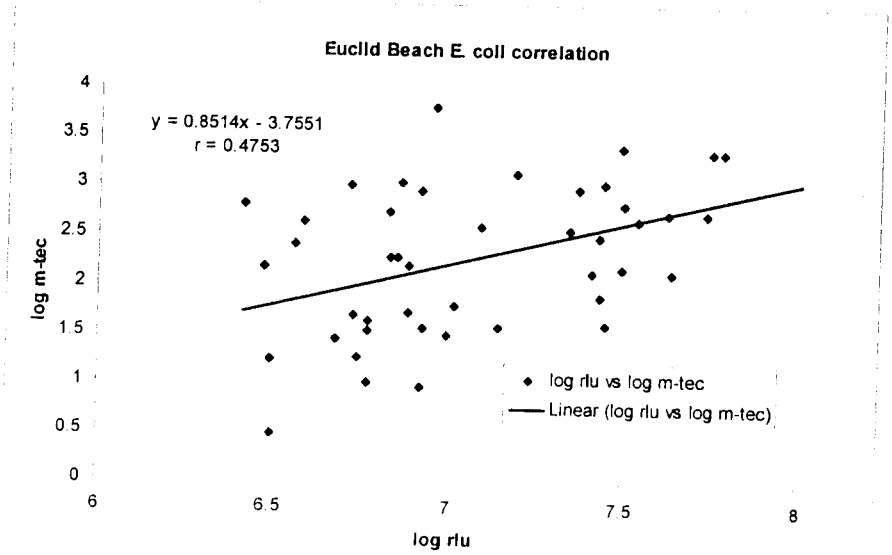


Figure 2- Euclid Beach (log modified mTEC (CFU/100 ml) vs. log RLU/100 ml)

Villa Angela Beach IMS/ATP Data

At Villa Angela Beach, a total of 44 samples were analyzed for both methods. The site studied showed a weak correlation with traditional culture-based method (r = 0.4780). Figure 3 shows a graphical interpretation of each sites correlation.

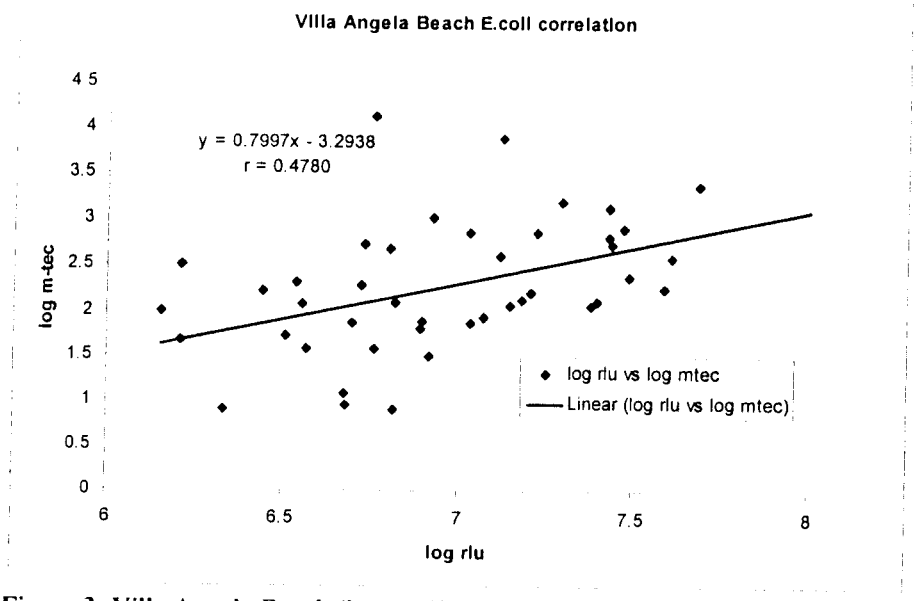


Figure 3- Villa Angela Beach (log modified mTEC (CFU/100 ml) vs. log RLU/100 ml)

Summary IMS/ATP Data

Though previous studies (Lee and Deininger, 2004) have shown significant correlations at freshwater beaches between IMS/ATP and traditional culture-based methods, the analysis performed by Analytical Services showed weak associations between both methods. See Figure 4.

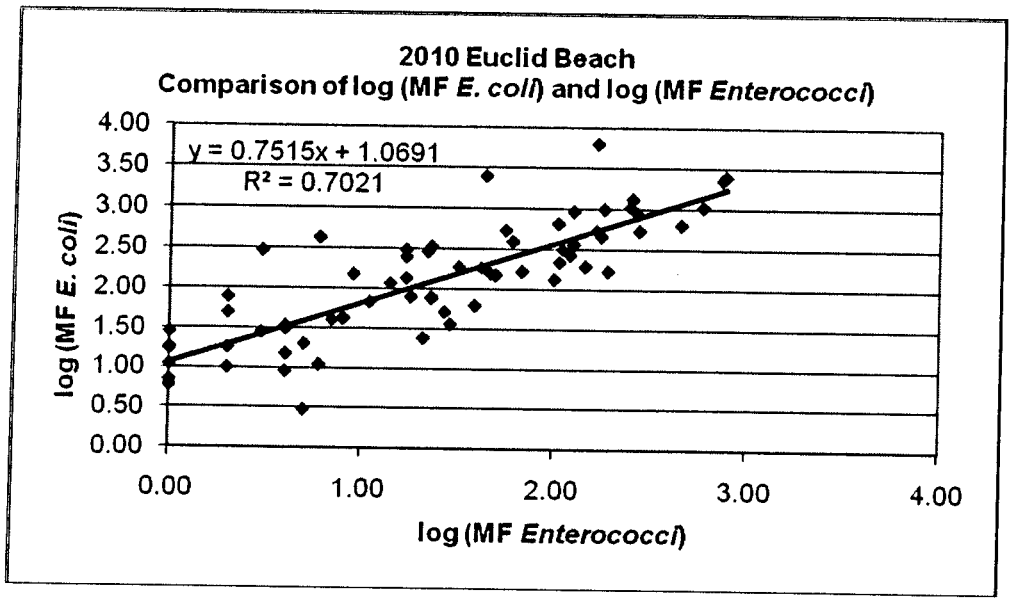
BEACH	r value
EDGEWATER EAST	0.4379
EUCLID EAST	0.4753
VILLA ANGELA EAST	0.4780

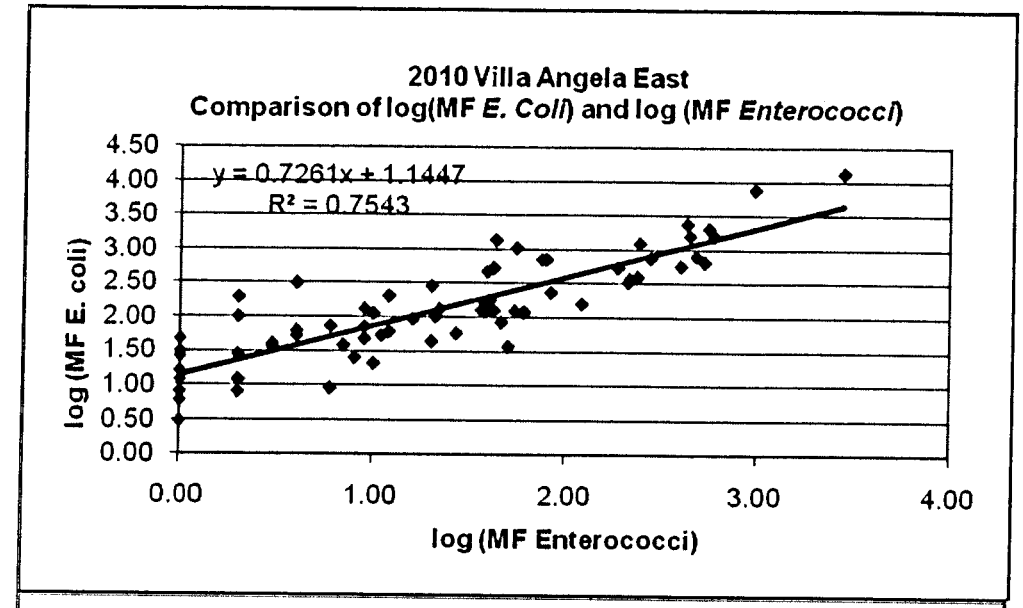
Figure 4- Correlation coefficients for all beaches.

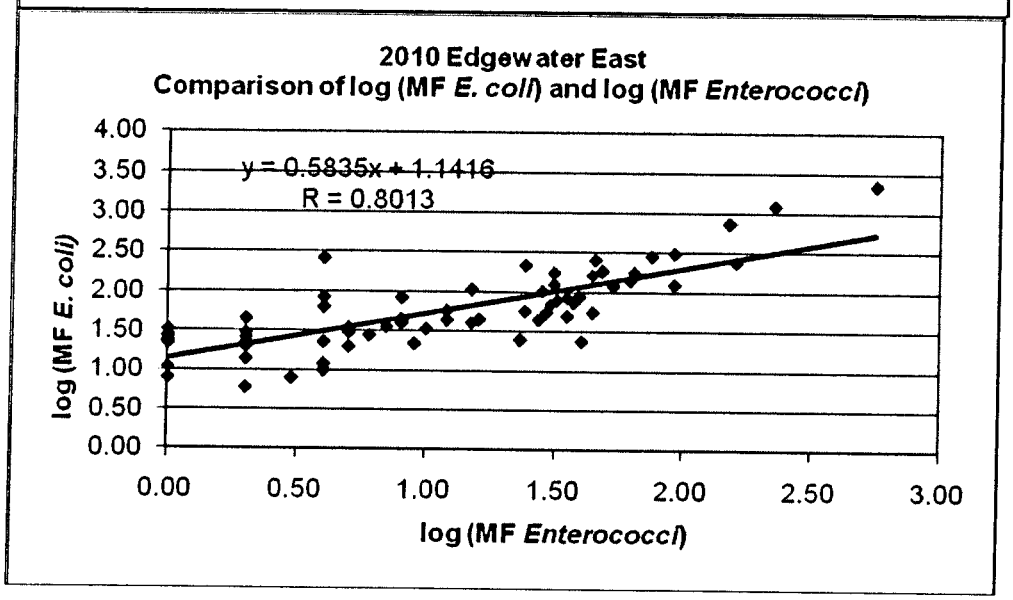
The poor relationship may be attributed to several factors. The polyclonal antibodies used may react with many differing organisms in a complex sample. The beaches studied are known to be some of the most polluted freshwater beaches in the Great Lakes. Further refinement of the method for specific sites may be needed. Sites in and around Cleveland may contain inhibitory compounds that affect method performance.

Enterococci compared to E. Coli

Part of the US EPA epidemiological study is to identify the best indicator organism along with a sufficiently accurate and rapid method to be used for public notification regarding bathing beach water quality. As part of the 2010 bathing beach monitoring program, NEORSD decided to analyze a subset of samples from each beach for *enterococci* in addition to *E. coli.* The goal was to generate a correlation between these two organisms at each beach. This correlation could then be used to as a factor to calculate the *enterococci* concentrations from the historical *E. coli* data collected over the past years. Additionally this data may serve as a baseline for determining compliance to a new water quality standard for bathing beaches using enterococci as an indicator organism. The regression analysis for Edgewater, Euclid and Villa Angela beaches are summarized in the following graphs.




2010 Villa Angela East
Comparison of log(MF E. Coli) and log (MF Enterococci)
y = 0.7261x + 1.1447
R² = 0.7543
log (MF E. coli)
log (MF Enterococci)
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
1.00
2.00
3.00
4.00


2010 Edgewater East
Comparison of log (MF E. coli) and log (MF Enterococci)
y = 0.5835x + 1.1416
R = 0.8013
log (MF E. coli)
log (MF Enterococci)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00