Final Report
Benthic Macroinvertebrate Survey of the Lower Genesee River in the Vicinity of the CSXT Derailment and Chemical Spill at Charlotte, New York

Prepared by:

IT Corporation
2200 Cottontail Lane
Somerset, NJ 08873

Prepared for:

CSX Transportation Inc.
500 Water Street
Jacksonville, FL 32202

April 1, 2002

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1.0 Introduction

Benthic macroinvertebrate communities are influenced by present and past environmental conditions, and will reflect stresses imposed by natural habitat parameters, as well as organic or chemical pollutants. Analysis of benthic macroinvertebrate communities is often incorporated as an important component of long-term environmental monitoring programs, and as a means of evaluating the effect of short duration events such as chemical spills. IT Corporation (IT) was retained by CSX Transportation (CSXT) to provide technical support and evaluate possible impacts from the December 23, 2001 train derailment and spill of acetone and methylene chloride into the Genesee River. As a component of the impact assessment, sediment sampling for benthic macroinvertebrate community analysis was conducted on January 10, 2001. Samples were collected from bottom sediments adjacent to the spill location, from two downstream locations, and from an upstream reference location. Samples for particle size and total organic carbon (TOC) were also collected. Potential benthic impacts were evaluated using several standard metrics of benthic macroinvertebrate community quality. All taxonomic and analytical work was performed by IT.

2.0 Methods

Samples were collected in accordance with the Genesee River Benthic Macroinvertebrate Sampling Plan included as **Appendix A** of this document. The methods of data analysis are presented below.

2.1 Sampling Locations

Samples were collected at four locations (sampling stations) on the lower Genesee River (**Figure 1**). These were selected to be co-located with previous sampling of bottom water. The stations were located as follows:

Station 1 – located upstream of bridge (under construction at time of field work) located upstream of spill area.

Station 2 – located directly adjacent to the spill, approximately 25 feet offshore, east of burned dock.

Station 3 – located mid-channel near Coast Guard Station, approximately half way between spill location and the river mouth.

Station 4 – located at the river mouth near mid-channel.

These stations were called Upstream +20, Middle +20, Downstream +20 and Channel/Lake respectively in field notes and previous sample collection. All samples were collected in a water depth of approximately 20-25 feet.

2.2 Sample Collection

Three replicate samples were collected at each location. Replicate samples were placed into individual three-gallon plastic buckets. Approximately 3 liters of sediment was collected for each replicate sample. Multiple grabs were sometimes necessary to obtain the necessary volume. Approximately 500 ml of sediment from each of the three replicate samples was placed into a pan and mixed thoroughly to create a composite sample for each of the four locations. The remaining sediment in each replicate was not composited, but was sieved as an individual sample for benthic macroinvertebrate analysis. The composite samples were placed in glass sample jars for grain size and TOC analysis.

2.3 Sample Handling in the Field

Each replicate benthic macroinvertebrate sample was passed through a 0.5 mm sieve, and the material retained on the sieve was retained for laboratory sorting and identification. The sieved samples were placed in 1-liter glass jars, and sufficient buffered formalin was added to preserve the samples. The jars were closed and inverted several times to insure adequate mixing of the

sample and preservative. All sample containers were labeled with the location, time of collection, date and sample type, and method of analysis.

2.4 Field Quality Assurance/Quality Control

IT Field Activity Daily Logs (FADLs) were used to record all essential information for each sampling station. Included were descriptions of the sampling locations, total number and types of samples collected, time, date, weather and other pertinent information. Chain of Custody forms were prepared in the field and sealed in coolers with the samples for shipment to the laboratories.

2.5 Macroinvertebrate Identification

Organisms were identified in the laboratory to Genus or to the lowest practical taxon. Identification of organisms was made using keys developed by Merritt and Cummins (1984), Peckarsky, et al (1990) and Pennak (1989 and 1978). Each family of organisms identified at each location was placed into separate vials containing ethanol as a preservative in order to assemble a reference collection for the project.

2.6 Methods of Data Analysis

Six metrics were calculated for the benthic macroinvertebrate data presented in Tables 2, 3, 4 and 5. These metrics are described below.

Taxa Richness

Taxa richness is calculated by counting the number of taxa (discrete different kinds of invertebrates) present in the sample. In general, taxa richness increases with increasing water quality.

Total Abundance

Total Abundance is the number of organisms present in the actual grab samples. Abundance that is either very high, or very low can be an indicator of environmental stress affecting benthic community composition.

Diversity: Diversity is composed of two distinct components: (i) the total number of species, (i.e. richness) and (ii) how the abundance data are distributed among the species (i.e. evenness). Diversity indices incorporate both species richness and evenness into a single value. Diversity is considered to be an indicator the health or quality of a community. Stressed communities will generally be dominated by a very few tolerant species, resulting in a low diversity index. The Shannon-Wiener Index (H') is one of the most widely used diversity indices. It is based on information theory and is a measure of the average degree of "uncertainty" in predicting to what species an individual chosen at random from a collection of S species and N individuals will

belong. This average uncertainty increases as the number of species increases and as the distribution of individuals among the species becomes even. Therefore, H' incorporates both the number of species and the relative abundance of organisms among the species. H' equals zero if, and only if, there is one species in the sample. The maximum possible value of H' is the log of the total number of species in a sample. H' is maximum only when all S species are represented by the same number of individuals (i.e. when there is a perfectly even distribution of abundances). Thus, three perfectly evenly distributed samples of 3, 8 and 21 species each would have H' values of 1.09, 2.08 and 3.04 respectively. For this investigation, H' was calculated using logarithmic base e. It should be noted that other studies might use logarithmic base 2 or 10 for the calculation. All are correct, but will yield somewhat different H' values for a given data set. For example, an H' of 1.09 calculated using base e would equal 1.57 using base 2, and 0.48 using base 10. The equation for estimating H' is:

$$H' = \sum_{i=1}^{S} \left(\frac{n_i}{n}\right) \ln\left(\frac{n_i}{n}\right)$$

where n_i is the number of individuals belonging to the i^{th} of S species in the sample and n is the total number of individuals in the sample. H' is a dimensionless number.

Modified Family Biotic Index

This index summarizes the tolerances of the benthic arthropod community to organic pollutants with a single value. This index was developed by Hilsenhoff (1988). Tolerance values used in the calculation of the Family Biotic Index (FBI) were obtained from Hilsenhoff (1988) and Bode (1988). The FBI is calculated by multiplying the number of organisms in each taxon by the tolerance value for that taxon, summing the products, and dividing by the total number of organisms in the sample for which an index is calculated. Values for the FBI range from 0.00 to 10.00 with higher values corresponding to greater levels of organic pollution as shown in the following table:

Family Biotic Index	Water Quality	Degree of Organic Pollution
0.00-3.75	Excellent	Organic pollution unlikely
3.76-4.25	Very good	Possible slight organic pollution
4.26-5.00	Good	Some organic pollution probable
5.01-5.75	Fair	Fairly substantial pollution likely
5.76-6.50	Fairly poor	Substantial pollution likely
6.51-7.25	Poor	Very substantial pollution likely
7.26-10.00	Very poor	Severe organic pollution likely

Although designed to reflect impacts from organic pollution, the FBI will also reflect stress from other factors such as chemical stressors or natural habitat variability.

3.0 Results and Discussion

The composition of the aquatic benthic macroinvertebrate community is controlled by the characteristics and quality of the available habitat. These characteristics include nature and stability of the substrate, dissolved oxygen and pollutant concentrations in the ambient and interstitial waters, food availability, predation and other factors.

The potential ecological value of an aquatic habitat is dependent upon the quality and composition of the habitat's physical components. Healthy, high quality systems are characterized by a diverse habitat that has many ecological niches available. In flowing waters, important components of the physical habitat include:

- Variation in the stream bed including sinuosity and patterns of velocity and depth
- Vegetative condition of the stream banks and riparian zone
- Diversity of natural features such as rocks, cobbles, gravel and logs
- Degree to which gravel, cobbles and rocks are covered with sand, silt or mud
- Uniformity of substrate and depth
- Sediment deposition
- Channelization (straightening, deepening, diversion into concrete channels, etc.)
- Bank Stability.

The Genesee River deep benthic habitat sampled in this investigation was uniformly silty, lacking the heterogeniety that is characteristic of high gradient stream habitats. This uniformity likely contributed to the low number of taxa found in the samples. The physical substrate characteristics are discussed below, as well as specifics of the benthic communities present at the four sampling locations.

3.1 Physical Characteristics of Substrate

The results of the physical characterization of the Genesee River substrate (particle size and total organic carbon (TOC) are shown in **Table 1**. The physical habitat was similar at the three locations within the river (see Site Map, **Figure 1**), with the particle size distribution being predominantly silt/clay. The field observations characterized the sediment as "very silty" and "greenish gray" in color. The field observations made during sampling at the river mouth ("Channel/Lake" sampling location), were that the substrate was quite sandy. The laboratory analysis (**Table 1**) found a somewhat higher percentage of sand in the river mouth sample. This location also had the highest TOC concentration. The lowest sand percentage and TOC

concentration was found at the location adjacent to the acetone/methylene chloride spill ("Middle" sampling location).

3.2 Benthic Macroinvertebrate Communities

The different types of benthic invertebrates (taxa) and number of organisms found in each replicate sample are given in **Tables 2** through **5**. The Upstream sampling station, which could not have been impacted by the spill, functions as a reference location to which the other locations may be compared. The benthic communities at all four locations are dominated by tubificid worms, and the dominance increases in a downstream direction. Fair numbers of chironomid larvae were present at the Upstream and Middle locations, with fewer numbers at the Downstream and river mouth (Channel/Lake) sampling stations. Dominance by one or two taxa is generally indicative of a benthic community affected by anthropogenic or natural environmental stress.

Zebra mussels and Sphaerid clams were found at the Upstream and Middle locations, but not further downstream. Gammarid amphipods were present in low numbers at all locations sampled.

Also shown in these tables are the totals for the replicates and tolerance values (Hilsenhoff, 1988). The tolerance values range from 1 to 10; 1 assigned to taxa very sensitive to stress from pollutants and 10 assigned to organisms that are most tolerant of polluted environments. Tolerance values for the taxa found in this study (all locations) ranged from 4 to 10, with the very pollution tolerant Tubifex worms being by far the most abundant organism at all for locations.

The community metrics calculated for the data presented in Tables 2 through 5 are shown in **Table 6**. Density exceeded 4000 organisms per square meter at all locations, primarily due to the abundance of tubificid worms. This metric alone does not indicate differences in community quality among the locations sampled. Species richness and diversity are shown graphically on **Figure 2.** Species richness showed a decreasing trend proceeding from the reference station toward the lake, with 7 taxa at the Upstream station, 6 taxa adjacent to the spill (Middle), 5 at the Downstream station, and 4 taxa at Channel/Lake. This apparent decreasing trend in community quality was also reflected in the diversity index, which decreased at each location proceeding from the Upstream reference station toward the lake.

The final metric employed to evaluate the benthic data was the Family Biotic Index (Hilsenhoff, 1988). The values calculated for this index are shown in **Table 6** and graphically in **Figure 3**.

As previously stated, a higher index value indicates a poorer quality benthic community, and as shown in the table in Section 2, values calculated for all sampling locations indicate very poor habitat quality. As with the taxa counts and diversity, the FBI increased from Upstream to the Channel/Lake sampling station, indicating decreasing habitat quality in a downstream direction. However, it should be noted that the habitat being evaluated is a silty river bottom, a habitat that characteristically has sparse benthic assemblages.

It is also worth noting that the benthic community of the Genesee River in areas sampled (near the river mouth at Lake Ontario) resembles benthic communities of the Lake. Organism density, species composition, and number of taxa found in the present survey are quite similar to the data for benthic communities of Lake Ontario in surveys conducted by the EPA Great lakes National Program Office (USEPA, 2000).

4.0 Conclusions

Although the metrics used to evaluate the benthic community indicated steadily decreasing quality in a downstream direction, this does not indicate community effects resulting from the acetone/methylene chloride spill. The chemicals spilled into the river, acetone and methylene chloride, have been shown to exhibit very low toxicity in laboratory tests. Although initial sampling show elevated concentrations of both acetone and methylene chloride, all bottom samples, and surface samples collected several days after the spill were low (< 100 ppb) or non-detected. There are no National Ambient Water Quality Criteria for either of the chemicals. However, Tier II benchmarks published in Suter and Tsao (1996) are appropriate for use in estimating the likelihood of toxicity to aquatic invertebrates. The aquatic biota toxicological screening benchmarks for acetone are 28,000 ppb (acute) and 1,500 ppb (chronic). The benchmarks for methylene chloride are 26,000 ppb and 2,200 ppb (acute and chronic respectively). These concentrations are based on laboratory toxicity tests with sensitive invertebrates. Since both of these compounds will dissipate rapidly in the aquatic environment, chronic effects are very unlikely, and the higher acute benchmarks are relevant. Only acetone in a small number of surface water samples taken just after the spill had concentrations exceeding the acute benchmark. Since the density of acetone is less than that of water, it is unlikely that concentrations of either chemical approached the acute toxicity value in bottom waters where exposure of benthic invertebrates would have occurred. The density of methylene chloride is greater than water, and therefore the potential of chronic effects from this chemical cannot be excluded. Sediment sampling for chemical analysis is planned, and the results will be used to evaluate potential chronic impacts to benthic communities.

The likelihood of adverse effects to benthic invertebrate populations is likely to be very low based on the following factors:

1. Low ecological toxicity of both acetone and methylene chloride;
2. Brief time of potential exposure to elevated concentrations;
3. Time of year (cold water/low metabolic rates, absence of emerging insect life stages).

If the spill had impacted the benthic community, the data would likely have shown the greatest decrease in benthic community quality at the "Middle" station adjacent to the spill, with recovery at locations further downstream. Rather, the steady downstream decline is likely a result of the river widening and slowing as it nears the lake, becoming less lotic and more lentic in its characteristics. This is a natural process known as the river continuum concept (RCC), first described by Vannote et. al. (1980). The decline in a downstream direction in the lower reaches

of the Genesee River was noted by Bode et. al. (1993). That study, which used benthic invertebrate data to evaluate water quality of streams and rivers throughout New York State, used multi-plate samplers to collect benthic invertebrate data. The results are therefore not directly comparable to the present survey. However, the site judged to have the poorest water quality in the Bode study was the furthest downstream station, located a few miles from the river mouth. The habitat in this reach of the river is typical of larger rivers, where depth and slow currents allow the deposition of fine sediment. This habitat typically provides poorer substrate for benthic invertebrates than smaller, shallower rivers and streams. In a recent comparison of benthic assemblages in rivers and streams in British Columbia, Reese and Richardson (2000) found that the large river sites had low invertebrate abundance, species richness, and diversity, relative to the small streams. Also, as previously noted, the characteristics of benthic communities surveyed in this study were very similar to that reported for adjacent Lake Ontario. In conclusion, the lower Genesee River benthic community is representative of deep riverine habitat and does not appear to have been impacted by the acetone and methylene chloride spilled in the CSXT River Street derailment.

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Table 1
Genesee River Particle Size and TOC Results

Sample Location	Particle Size		Total Organic Carbon
	Percent Sand	Percent Silt/Clay	mg/kg
Upstream	3.6	96.4	20,000
Middle	2.9	97.1	15,000
Downstream	6.7	93.3	20,000
Channel/Lake	13.3	86.7	32,000

Table 2

Genesee River Benthic Macroinvertebrate Survey Results

Upstream (Upstream of Acetone/Methylene Chloride Spill)

Class	Order	Family	Genus&Species	Common Name	Tolerance	Life Stage	REP-A	REP-B	REP-C	Total
Oligochaeta	Tubificida	Tubificidae	not determined	tubifex worm	10	adult	164	264	142	**570**
	Lumbruculida	Lumbriculidae	not determined	lumbriculid worm	-	adult				
Bivalvia	Sphaeracea	Sphaeriidae	not determined	clam	8	juvenile	4	5	1	**10**
	Veneroida	Dreissenidae	*Dreissenea polymorpha*	zebra mussel	-	juvenile		3	1	**4**
Insecta	Megaloptera	Sialidae	*Sialis sp.*	alderfly	4	larva		1		**1**
	Diptera	Tanypodinae	not determined	midge	6	larva	16	64	36	**116**
		Chironomini	not determined	midge	8	larva	12	48	26	**86**
Crustacea	Amphipoda	Gammaridae	*Gammarus sp.*	side swimmer	4	adult		1		**1**
						Total	**196**	**386**	**206**	**788**

Table 3

Genesee River Benthic Macroinvertebrate Survey Results

Middle (Adjacent to Acetone/Methylene Chloride Spill)

Class	Order	Family	Genus&Species	Common Name	Tolerance	Life Stage	REP-A	REP-B	REP-C	Total
Oligochaeta	Tubificida	Tubificidae	not determined	tubifex worm	10	adult	160	224	236	**620**
	Lumbruculida	Lumbriculidae	not determined	lumbriculid worm	-	adult				
Bivalvia	Sphaeracea	Sphaeriidae	not determined	clam	8	juvenile	4	5		**9**
	Veneroida	Dreissenidae	*Dreissenea polymorpha*	zebra mussel	-	juvenile		1		**1**
Insecta	Megaloptera	Sialidae	*Sialis sp.*	alderfly	4	larva				
	Diptera	Tanypodinae	not determined	midge	6	larva	17	38	10	**65**
		Chironomini	not determined	midge	8	larva	12	12	16	**40**
Crustacea	Amphipoda	Gammaridae	*Gammarus sp.*	side swimmer	4	adult			1	**1**
						Total	**193**	**280**	**263**	**736**

Table 4

Genesee River Benthic Macroinvertebrate Survey Results

Downstream (downstream of acetone/methylene chloride spill)

Class	Order	Family	Genus&Species	Common Name	Tolerance	Life Stage	SED-A	SED-B	SED-C	
Oligochaeta	Tubificida	Tubificidae	not determined	tubifex worm	10	adult	139	214	290	**643**
	Lumbruculida	Lumbriculidae	not determined	lumbriculid worm	-	adult				
Bivalvia	Sphaeracea	Sphaeriidae	not determined	clam	8	juvenile				
	Veneroida	Dreissenidae	*Dreissenea polymorpha*	zebra mussel	-	juvenile	1	2	1	**4**
Insecta	Megaloptera	Sialidae	*Sialis sp.*	alderfly	4	larva				
	Diptera	Tanypodinae	not determined	midge	6	larva	7	4	6	**17**
		Chironomini	not determined	midge	8	larva	4	10	4	**18**
Crustacea	Amphipoda	Gammaridae	*Gammarus sp.*	side swimmer	4	adult		2		**2**
						Total	**151**	**232**	**301**	**684**

Table 5

Genesee River Benthic Macroinvertebrate Survey Results

Channel/Lake (downstream of spill at river mouth)

Class	Order	Family	Genus&Species	Common Name	Tolerance	Life Stage	SED-A	SED-B	SED-C	
Oligochaeta	Tubificida	Tubificidae	not determined	tubifex worm	10	adult	290	230	250	**770**
	Lumbruculida	Lumbriculidae	not determined	lumbriculid worm	-	adult	1			**1**
Bivalvia	Sphaeracea	Sphaeriidae	not determined	clam	8	juvenile				
	Veneroida	Dreissenidae	*Dreissenea polymorpha*	zebra mussel	-	juvenile				
Insecta	Megaloptera	Sialidae	*Sialis sp.*	alderfly	4	larva				
	Diptera	Tanypodinae	not determined	midge	6	larva	4	2		**6**
		Chironomini	not determined	midge	8	larva				
Crustacea	Amphipoda	Gammaridae	*Gammarus sp.*	side swimmer	4	adult			1	**1**
						Total	**295**	**232**	**251**	**778**

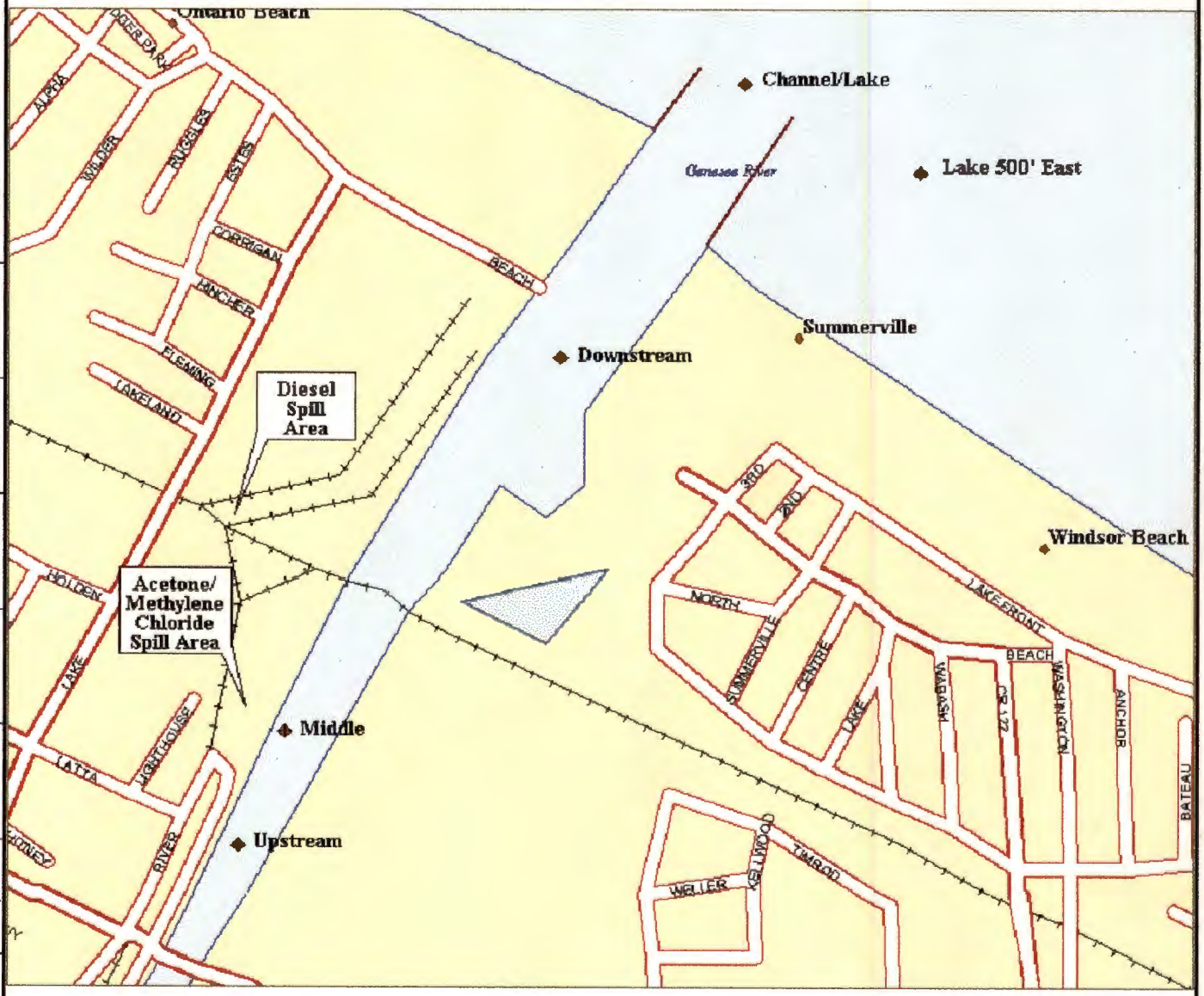
Table 6

Genesee River Benthic Macroinvertebrate Sampling Results

Community Metrics

Index	Upstream[a]	Middle[a]	Downstream[a]	Channel/Lake[a]
Total Abundance	788	736	684	778
Density (organisms/m^2)	4925	4600	4275	4863
Species Richness	7	6	5	4
Species Diversity (H')	0.86	0.59	0.29	0.065
Family Biotic Index	9.1	9.5	9.8	9.9
Community Loss Index	NA	0.17	0.4	1

a: See Figure 1 for sampling station locations



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Latham, NY	SSH/TPA 01-07-02			834540A1

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Plot Date/Time: 01/07/02 05:36pm
Format Revised: 12/15/99
Image: CSXRIVER
Xref: .

REFERENCE:

DeLORME MapExpert 2.0

IT CORPORATION

CSX TRANSPORTATION

FIGURE 1
SITE MAP AND
RIVER SAMPLING LOCATIONS
RIVER STREET DERAILMENT
480 RIVER ST. CHARLOTTE, NY

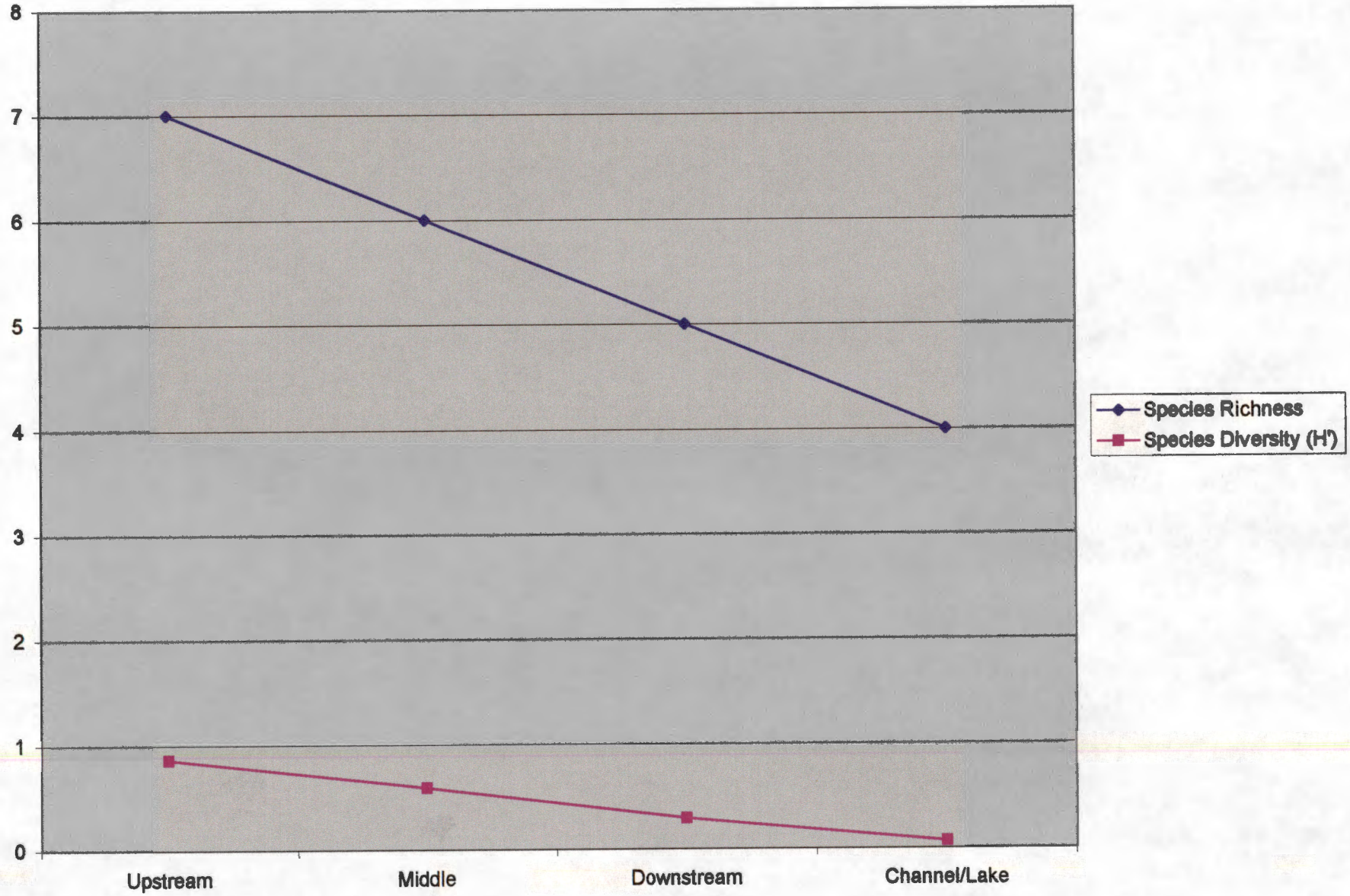

Figure 2

Genesee River Benthic Macroinvertebrate Species Richness and Diversity
CSXT River Street Derailment

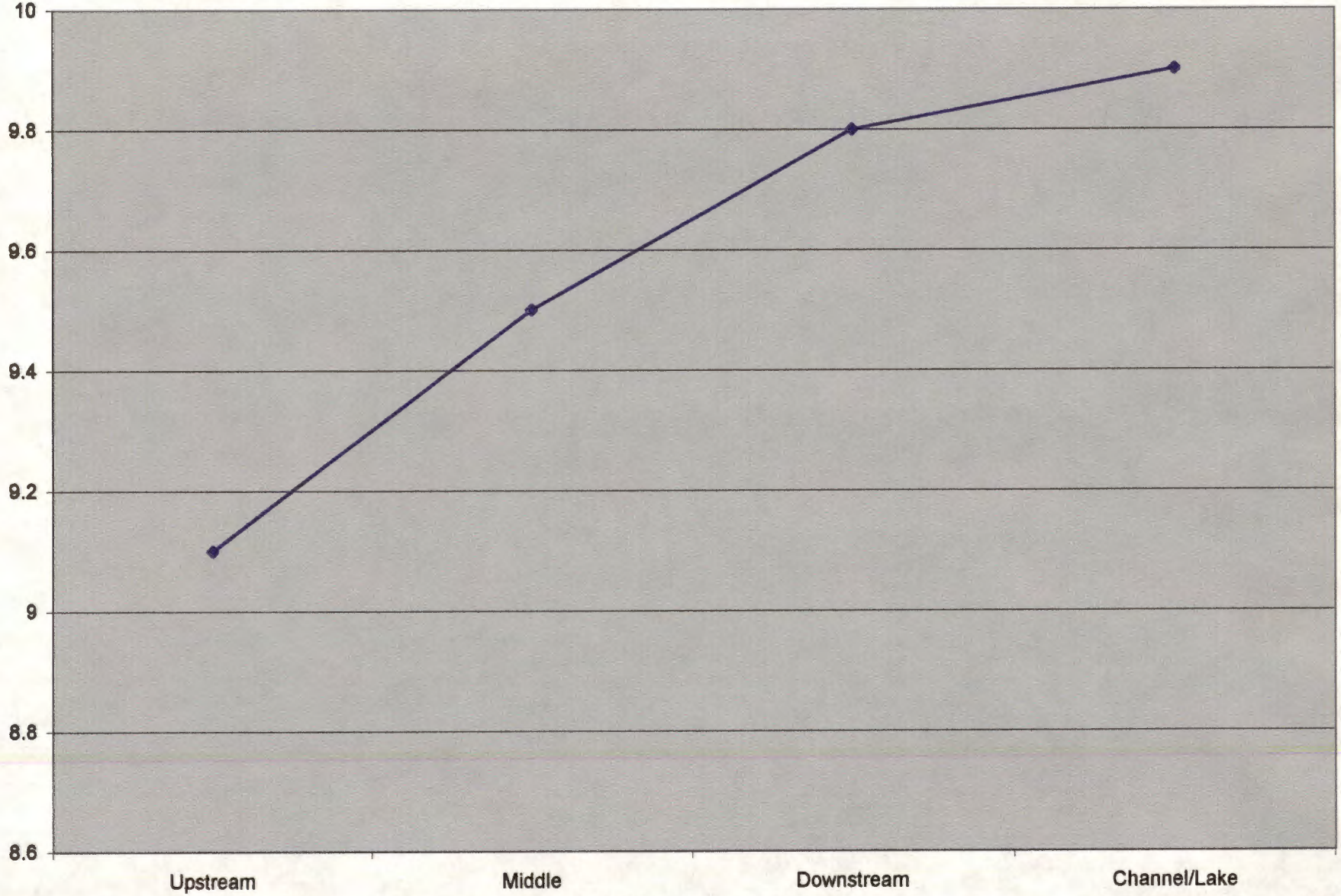

Figure 3

Genesee River Benthic Macroinvertebrate Family Biotic Index
CSXT River Street Derailment

Genesee River Benthic Invertebrate Sampling Plan

CSXT Charlotte - Project Number 834540 01000000

Safety:
PFDs must be worn at all times when on board the vessel. Sub-freezing air temperature will make the sampling work more hazardous due to icing on deck.

Documentation:
All activities must be recorded on FADL sheets or water proof note books. Chain of Custody forms must be filled out in the field and must accompany the samples to the laboratory.

Sample locations:
Samples to be collected from the four (4) locations in the river where deep water samples were collected. These locations are:

1. Directly offshore of the acetone/methylene chloride spill area;
2. Upstream of the spill area;
3. Approximately half way between the spill area and the mouth of the river;
4. At the river mouth.

The depth at these locations is expected to be approximately 20 feet. Preliminary sampling has indicated that the substrate is silt and should be suitable for collection using an Ekman dredge.

Number of samples and Sample Volume:
Three replicate samples to be collected at each location. For each replicate, the Ekman dredge is to be emptied into a 3 gallon plastic bucket. The amount of sediment to be collected and sieved for each replicate is 2.5 to 3 liters. The buckets are marked in liter increments. A 5 cm. deep grab will be approximately 2.6 liters of sediment. Multiple grams may be necessary to obtain sufficient volume. If excess sediment is collected, the surface sediment should be retained, the deeper sediment excluded from the samples.

Grain Size and TOC sampling:
Approximately 500 ml of sediment from each of the three replicate samples must be placed into a pan and mixed thoroughly to create a composite sample for each of the four locations. The composite samples are to be placed in glass sample jars for grain size and TOC analysis.

Sample Sieving and Preservation:
Each replicate sample must be passed through the 0.5 mm Nalgene sieve, which will retain the organisms and coarse sediment. This may be done from the vessel or on shore, as site conditions may indicate.

The sieved samples are placed in the 1 or 2 liter plastic jars, and sufficient buffered formalin is added to preserve the samples. Excess water should be poured from the

benthic samples and at least 250ml of formalin should be added. The jars should be closed and inverted several times to insure adequate mixing of the sample and preservative. Care should be taken to clean the jar threads to prevent leakage during transport. The jar lids should also be taped or sealed with parafilm and tape.

Sample Labeling:
The field crew must insure that all sample containers are clearly labeled with the location, time of collection, date and sample type and method of analysis. The sample identification information must also be recorded on the COCs and field notes. Labels should be covered with clear tape to prevent loss prior to analysis.

Sample Packing:
The glass jars should be placed in bubble wrap and put into ziploc bags. The lids of the benthic samples should be sealed with parafilm or tape. The benthic samples should be placed into large ziploc bags and sealed. They need to remain upright in the cooler. The jars should not be filled all the way to the top. There should be vermiculite in the coolers. The COCs also need to be in the coolers.

We do not need to ship the samples as hazardous because they contain less than 25% formalin. However, care must be taken to insure that they will not leak.

Sample Shipping:
The three sample types are to be packed in separate coolers with sufficient packing to prevent breakage during transport. The TOC samples must be packed with ice. Shipment should be via Federal Express to the addresses below.

Benthic invertebrate and TOC samples to:

Shirley Scarborough
IT Corp
304 Directors Drive
Knoxville, TN 37923-4700
Phone: (865) 690-3211

The grain size samples are shipped to:

Ralph Cole
IT Corp
1570 Bear Creek Road
Oak Ridge TN 37830
Phone: (865) 482-6497

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FIELD ACTIVITY DAILY LOG

DAILY LOG	DATE	1	10	02
	NO.			
	SHEET	1	OF	3

PROJECT NAME: CSXT CHARLOTTE | PROJECT NO.: 834540

FIELD ACTIVITY SUBJECT: BENTHIC SAMPLING - GENESEE RIVER - EMERGENCY RESPONSE

DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:

A ① Met Brian Murphy - IT TONAWANDA, NY - @ BOAT LAUNCH IN ROCHESTER @ 8:00. LOADED BOAT W/ SAMPLING EQUIPMENT - PRE-LABELED SAMPLE BOTTLES.

② Arrive @ 1ST SAMPLE SITE. "UPSTREAM +20" 0900
SITE IS LOCATED SOUTH OF BRIDGE (UPSTREAM OF BRIDGE) THAT IS UNDER CONSTRUCTION, ~ 20' WEST OF 1ST BOAT SLIP ON ~~EAST~~ (CNF) BANK.

Depth of Sampling Location ≈ 26'
Very silty substrate, greenish-gray. Good, DEEP GRABS W/ DAUGHERTY
General observations of Benthos: ANNELIDS, CHIRONOMIDS (MOSTLY) & COLEOPTERA (DYTISCID ?)
Finish Sampling @ 10:00

B ① Arrive @ Sample Location #2 - "Middle +20" - located 25' East of Spill Site, near burned dock
Start sampling @ 1015
Depth ≈ 22'
Very silty substrate - greenish-gray
General observations - many CHIRONOMIDS, SOME MUSSELS.
↑ SMALL (<½")
Finish Sampling @ 1100

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:
WEATHER CONDITIONS: MOSTLY CLOUDY, WINDY, T ≈ 30°F	IMPORTANT TELEPHONE CALLS: Called MIKE MURRAY @ 0930 TO DISCUSS AMOUNT OF SAMPLE NEEDED

IT PERSONNEL ON SITE: TONY FRONJIAN, CHRIS KOUTOURAKIS, BRIAN MURPHY

SIGNATURE: [signature] DATE: 1/10/02

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FIELD ACTIVITY DAILY LOG

DAILY LOG	DATE	1	10	02
	NO.			
	SHEET 2 OF 3			

PROJECT NAME: CSXT Charlotte | PROJECT NO.: 834340

FIELD ACTIVITY SUBJECT: BENTHIC SAMPLING - CATAWBA RIVER - EMERGENCY RESPONSE

DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:

C ① Arrive @ Sample Site #3 — "Downstream + 20" — Middle of Channel (River), Near Coast Guard Station.
Start Sampling @ 1120
Very silty substrate — greenish (GRAY) gray, some reddish brown coating as sample settles.
GENERAL OBSERVATIONS - SOME CHIRONOMIDS, ANNELIDS & MUSSELS ~ 1/2" - 3/4"
SAMPLE DEPTH ~ 25'

D ① Arrive @ Sample Site #4 - "Channel / LAKE"
Site near middle of channel, closer to west Jetty.
(SNOWY OWL OBSERVED RESTING ON JETTY — INTENTIONALLY FRIGHTENED TO FLIGHT BY WOMAN WALKING ON JETTY & CLAPPING HANDS LOUDLY AS SHE APPROACHED OWL)
STRONG CURRENT, STRONG WIND → BOAT DRIFTING.
DIFFICULT TO GET GOOD GRABS AS EKMAN APPARENTLY BEING DRAGGED ACROSS SEDIMENT. MANY GRABS RECOVERED.
(SUBSTRATE MOSTLY SAND. UP-ANCHOR & RETRIEVED SAME SEDIMENT FROM ANCHOR TO ADD TO SAMPLE. MOVED BOAT UPSTREAM ALONG TO ORIGINAL SAMPLE SITE #4 (BOAT ESTIMATED TO HAVE DRIFTED 25') FOUR SAMPLES SAND w/ SILT
GENERAL OBSERVATION OF BENTHOS: ANNELIDS, MUSSELS, NO CHIRONOMIDS OBSERVED - BUT MAY BE IN SAMPLE.

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:
WEATHER CONDITIONS: MOSTLY CLOUDY — T ~ 38°F MORE WIND) EFFECTS AS WE APPROACH LAKE	IMPORTANT TELEPHONE CALLS:

IT PERSONNEL ON SITE: TONY FRONJIAN, CHRIS KANTOUZAKIS, BRIAN MURPHY

SIGNATURE: [signature] DATE: 1/10/02

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FIELD ACTIVITY DAILY LOG

DAILY LOG	DATE	1	10	02
	NO.			
	SHEET 3 OF 3			

PROJECT NAME: CSXT - Charlotte | PROJECT NO.: 834540

FIELD ACTIVITY SUBJECT: BENTHIC SAMPLING - GENESEE RIVER - EMERGENCY RESPONSE

DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:

"SYNONYMY"

	SAMPLE SITE		SAMPLING PLAN LOCATIONS
①	"UPSTREAM +20"	=	"2. UPSTREAM OF SPILL AREA"
②	"MIDDLE +20"	=	"1. DIRECTLY OFFSHORE OF ... SPILL AREA"
③	"DOWNSTREAM +20"	=	"3. APPROXIMATELY HALFWAY ... RIVER"
④	"CHANNEL/LAKE"	=	"4. AT THE RIVER MOUTH"

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:
WEATHER CONDITIONS: MOSTLY CLOUDY, WINDY T N 28°F	IMPORTANT TELEPHONE CALLS:

IT PERSONNEL ON SITE: TONY FRONTIERO, CHRIS KONTOUZAKIS, BRIAN MURPHY

SIGNATURE: [signature] DATE: 1/10/02

INTERNATIONAL TECHNOLOGY CORPORATION

834540
01.00.00.00

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 414437
Page 1 of 2

Project Name/No.[1] CSX Charlotte
Sample Team Members[2] CSX / AJF
Profit Center No.[3]
Project Manager[4] Mike Murray
Purchase Order No.[6]
Required Report Date[11]

Samples Shipment Date[7] 1/10/02
Lab Destination[8] *Knoxville TN (IT)
Lab Contact[9] Shirley Starborough
Project Contact/Phone[12] 800-435-1588 ext. 317

Bill to:[5]
Report to:[10]

ONE CONTAINER PER LINE

Sample Number[14]	Sample Description/Type[15]	Date/Time Collected[16]	Container Type[17]	Sample Volume[18]	Pre-servative[19]	Requested Testing Program[20]	Condition on Receipt[21]	Disposal Record No.[22]
Upstream +20/SED-A	Sediment	1/10/02 0900	1L Glass		Formalin	Benthic Macroinvertebrate Analysis	FOR LAB USE ONLY	
Upstream +20/SED-B		0900						
Upstream +20/SED-C		0900						
Middle +20/SED-A		1015						
Middle +20/SED-B		1015					FOR LAB USE ONLY	
Middle +20/SED-C		1015						
Downstream +20/SED-A		1120						
Downstream +20/SED-B		1120						

Special Instructions:[23]

Possible Hazard Identification:[24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal:[25]
Return to Client ☐ Disposal by Lab ☐ Archive _____ (mos.)

Turnaround Time Required:[26]
Normal ☑ Rush ☐

QC Level:[27]
I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by[28] (Signature/Affiliation)	Date: 1/10/02 Time: 1700	1. Received by[28] (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments:[29]

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

MCA 3/15/91

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No.[30] 414437

Project Name CSX Charlotte

Project No. 734540 01.00.00.00

Samples Shipment Date 1/10/02

ONE CONTAINER PER LINE

Sample[14] Number	Sample[15] Description/Type	Date/Time[16] Collected	Container[17] Type	Sample[18] Volume	Pre-[19] servative	Requested Testing[20] Program	Condition on[21] Receipt	Disposal[22] Record No.
Downstream-20/SED-C	Sediment	1/10/02 1120	1L-Glass		Formalin	Benthic Macroinvertebrate Analysis		
Channel-Lake-20/SED-A		1210					FOR LAB USE ONLY	
Channel-Lake-20/SED-B		1210						
Channel-Lake-20/SED-C		1210					FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	

White: To accompany samples Yellow: Field copy

*See back of form for special instructions.

MCA 3/15/91

Project # 834546 c1.00.00.00

CHAIN OF CUSTODY RECORD

FACILITY/LOCATION:	METHOD OF SHIPMENT: Fed Ex
CSX Charlotte / Rochester NY	TO Knoxville, TN FROM Rochester NY

SAMPLING AND ANALYSES AUTHORIZED BY: Mike Murray 1-800-445-1554 ext. 317	DATE: 1/10/02

SAMPLE #	SAMPLING LOCATION AND DESCRIPTION	DATE	TIME	SAMPLE TYPE C	SAMPLE TYPE G	SAMPLE TYPE SOLID	# OF CONT.	ANALYSES REQUIRED
	Upstream TOC/SED	1/10/02	0900			Sediment	1	TOC
	Middle TOC/SED		1015				1	
	Downstream TOC/SED		1120				1	
	Channel Lake TOC/SED		1310				1	

SAMPLE COLLECTED BY:	EXACT SAMPLING LOCATION:
CSK / AJF	

SAMPLE RELINQUISHED BY:	SAMPLE RECEIVED BY:	DATE	TIME
[signature] 1/10/02 1700			
SAMPLE RELINQUISHED BY:	SAMPLE RECEIVED BY:	DATE	TIME
SAMPLE RELINQUISHED BY:	SAMPLE RECEIVED BY:	DATE	TIME
SAMPLE RELINQUISHED BY:	SAMPLE RECEIVED BY:	DATE	TIME

SAMPLE RELINQUISHED AFTER ANALYSES:	ANALYZED SAMPLE RECEIVED BY:	DATE	TIME
SAMPLE DESCRIPTION:	# OF CONTAINERS:		

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(908) 788-8700

INTERNATIONAL TECHNOLOGY CORPORATION

GEOTECHNICAL LABORATORY

CERTIFICATE OF ANALYSIS

Mike Murray
IT Corporation
2200 Cottontail Lane
Somerset NJ 08873

February 8, 2002

This is the Certificate of Analysis for the following samples:

Project ID:	**CSX Charlotte**
Project Number:	**834540.01000000**
Date Received by Lab:	January 11, 2002
Number of Samples:	Four (4)
Sample Type:	Soil

I. Introduction/Case Narrative

Four soil samples were received by the IT Geotechnical Laboratory on January 11, 2002. Requested testing particle-size distribution determination. A gradation (sieve analysis was used to classify coarse sample particles. A hydrometer analysis was used to estimate the quantity and size of silt- and clay-size particles. Moisture content data (dry basis) is provided as ancillary information. Sample results were originally transmitted on January 23, 2002.

Please see Appendix A, Sample Number Cross Reference List; Appendix B, Analysis Results; and, Appendix C, Chain-of-Custody and Request-for-Analysis Records.

Reviewed and Approved:

Ralph Cole
Laboratory Manager, Geotechnical Services

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OAK RIDGE, TN
(865) 482-6497**

II. Analytical Results/Methodology

REFERENCES: United States Army Corps of Engineers (USACE), Engineer Manual 1110-2-1906, *Laboratory Soils Testing*, appendix II, 1970; United States Environmental Protection Agency, SW846, *Test Methods for Examining Solid Waste, Physical/Chemical Methods*, 3rd ed., Nov 1986 (EPA SW-846). Annual Book of ASTM Standards, Section 4, Construction, Volume 04.08, *Soil and Rock (I)*, and Volume 04.09, *Soil and Rock (II)*, 2001.

Laboratory Determination of Water (Moisture) Content of Soil and Rock . **ASTM D 2216**
Particle-Size Distribution of Soils . . . . . **ASTM D 422**

III. Quality Control

Quality control checks such as duplicates and spikes (QC samples), are not normally applicable to geotechnical testing. This is due largely to the inability of obtaining samples with known characteristics, the heterogenous nature of the samples, and quality control procedures built-in to the analytical method.

QC measures to ensure accuracy and precision of test results include the following:

- 100% verification of all numerical results - raw data entries, transcriptions and calculations entered by lab technicians are checked, recalculated and verified. Most data calculations are performed by computer programs.
- Data validation through test reasonableness - summaries of all test results for individual reports are reviewed to determine the overall reasonableness of data and to determine the presence of any data that may be considered outliers.
- Quality control procedures are built into most standardized geotechnical procedures. For example, liquid limit and plastic limit analyses call for re-analyses and specify acceptance criteria.
- Routine instrument calibration - instruments, gauges and equipment used in testing are calibrated on a routine basis. All instrument calibration follows ASTM or manufacturer guidelines.
- Maintenance of all past calibration records - calibration records and certification

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documents of all instruments, gauges and equipment are updated routinely and maintained in the Quality Control Coordinators Quality/Operations files.

- Certified and trained personnel - all technicians are certified by the National Institute for Certification of Engineering Technicians (NICET) in geotechnical soil testing, and are trained in the application of standard laboratory procedures for geotechnical analyses as well as the quality assurance measures implemented by IT.

IV. Data Qualification

None.

Appendix A
Sample Cross-Reference List

Mike Murray
IT Corporation
February 8, 2002
IT Project ID: CSX Charlotte
IT Project No.: 834540.01000000

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SAMPLE NUMBER CROSS-REFERENCE LIST

LAB SAMPLE NO.	CLIENT SAMPLE NO.	MATRIX
ETDC-9845	Upstream +20/SED	Soil
ETDC-9846	Middle +20/SED	Soil
ETDC-9847	Downstream +20/SED	Soil
ETDC-9848	Channel-Lake +20/SED	Soil

Appendix B
Sample Test Results

Mike Murray
IT Corporation
February 8, 2002
IT Project ID: CSX Charlotte
IT Project No.: 834540.01000000

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PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name CSX Charlotte/Rochester NY

Client Sample No. Upstream +20/SED

Project No. 834540.01000000

IT Lab Sample No. ETDC-9845

Specific Gravity = 2.65
assumed for calculations

Moisture Content = 100.2%
based on dry sample weight

SIEVE ANALYSIS

COARSE

Sieve No.	Diameter mm	Percent Finer
3"	75.000	100.0%
1.5"	37.500	100.0%
0.75"	19.000	100.0%
0.375"	9.500	100.0%
#4	4.750	100.0%
#10	2.000	100.0%

FINE

Sieve No.	Diameter mm	Percent Finer
#20	0.850	100.0%
#40	0.425	100.0%
#60	0.250	99.9%
#100	0.149	99.6%
#140	0.106	99.0%
#200	0.075	96.4%

HYDROMETER ANALYSIS

HYDROMETER

Diameter mm	Percent Finer
0.02815	74.5%
0.01583	50.5%
0.01114	37.2%
0.00890	29.3%
0.00590	19.5%
0.00468	15.1%
0.00325	10.6%
0.00143	6.2%

0.0% Gravel 3.6% Sand 96.4% Silt/Clay

Mike Murray
IT Corporation
February 8, 2002
IT Project ID: CSX Charlotte
IT Project No.: 834540.01000000

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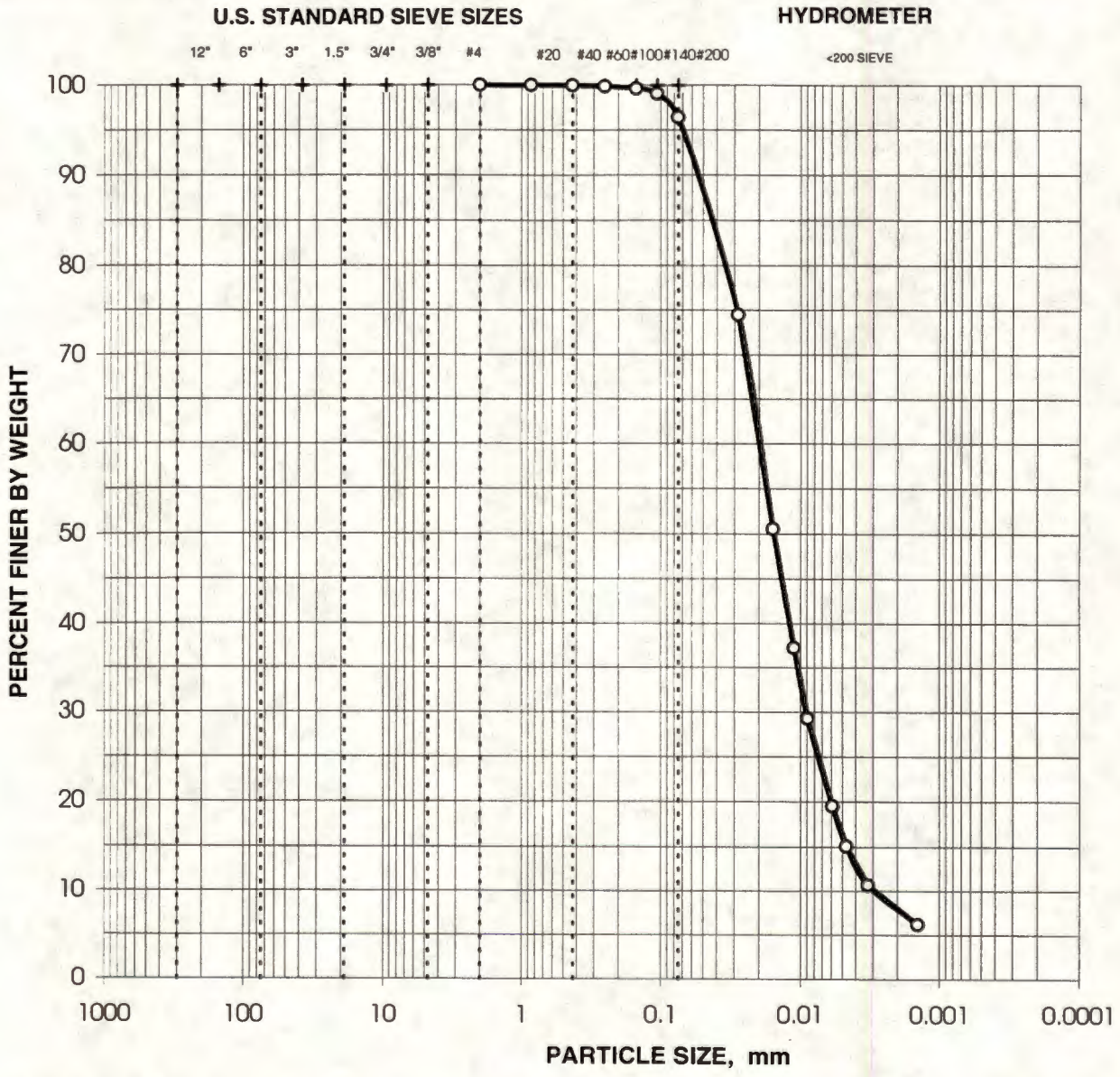
CSX Charlotte/Rochester NY



CLIENT SAMPLE NO.: Upstream

IT LAB SAMPLE NO.: ETDC-9845

BOULDERS	COBBLES	GRAVEL		SAND			SILT 2 - 75 microns
		COARSE	FINE	COARSE	MEDIUM	FINE	CLAY <2 microns

Mike Murray
IT Corporation
February 8, 2002
IT Project ID: CSX Charlotte
IT Project No.: 834540.01000000

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PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name CSX Charlotte/Rochester NY

Client Sample No. Middle +20/SED

Project No. 834540.01000000

IT Lab Sample No. ETDC-9846

Specific Gravity = 2.65
assumed for calculations

Moisture Content = 94.9%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	100.0%
	#60	0.250	99.9%
	#100	0.149	99.7%
	#140	0.106	99.3%
	#200	0.075	97.1%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.02849	80.9%
	0.01945	63.9%
	0.01169	45.0%
	0.00740	28.0%
	0.00607	22.0%
	0.00467	18.0%
	0.00325	12.0%
	0.00143	7.0%

0.0% Gravel 2.9% Sand 97.1% Silt/Clay

Mike Murray
IT Corporation
February 8, 2002
IT Project ID: CSX Charlotte
IT Project No.: 834540.01000000

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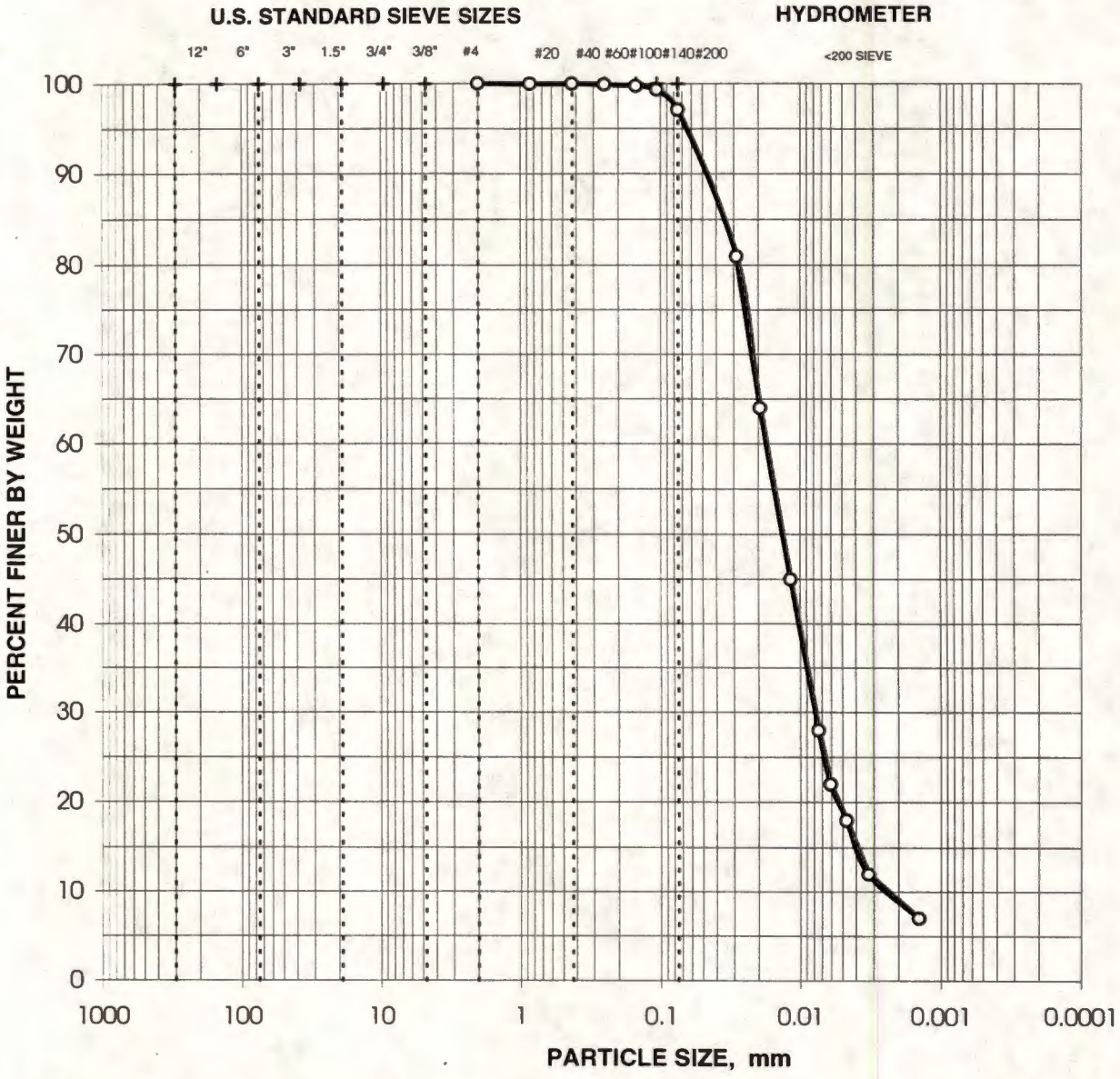
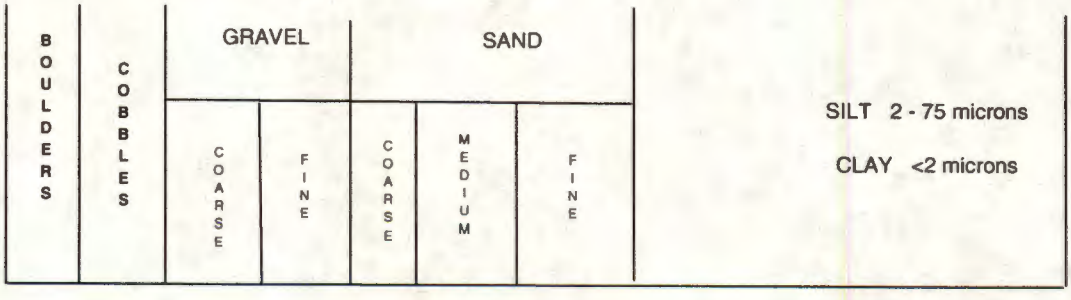
CSX Charlotte/Rochester NY



CLIENT SAMPLE NO.: Middle +20/SED

IT LAB SAMPLE NO.: ETDC-9846



Mike Murray
IT Corporation
February 8, 2002
IT Project ID: CSX Charlotte
IT Project No.: 834540.01000000

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PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name CSX Charlotte/Rochester NY

Client Sample No. Downstream +20/SED

Project No. 834540.01000000

IT Lab Sample No. ETDC-9847

Specific Gravity : 2.65
assumed for calculations

Moisture Content = 84.9%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.9%
	#40	0.425	99.8%
	#60	0.250	99.6%
	#100	0.149	98.9%
	#140	0.106	97.2%
	#200	0.075	93.3%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.02964	71.8%
	0.02012	55.8%
	0.01084	34.9%
	0.00899	29.9%
	0.00632	20.9%
	0.00469	16.0%
	0.00325	12.0%
	0.00143	7.0%

0.0% Gravel 6.7% Sand 93.3% Silt/Clay

Mike Murray
IT Corporation
February 8, 2002
IT Project ID: CSX Charlotte
IT Project No.: 834540.01000000

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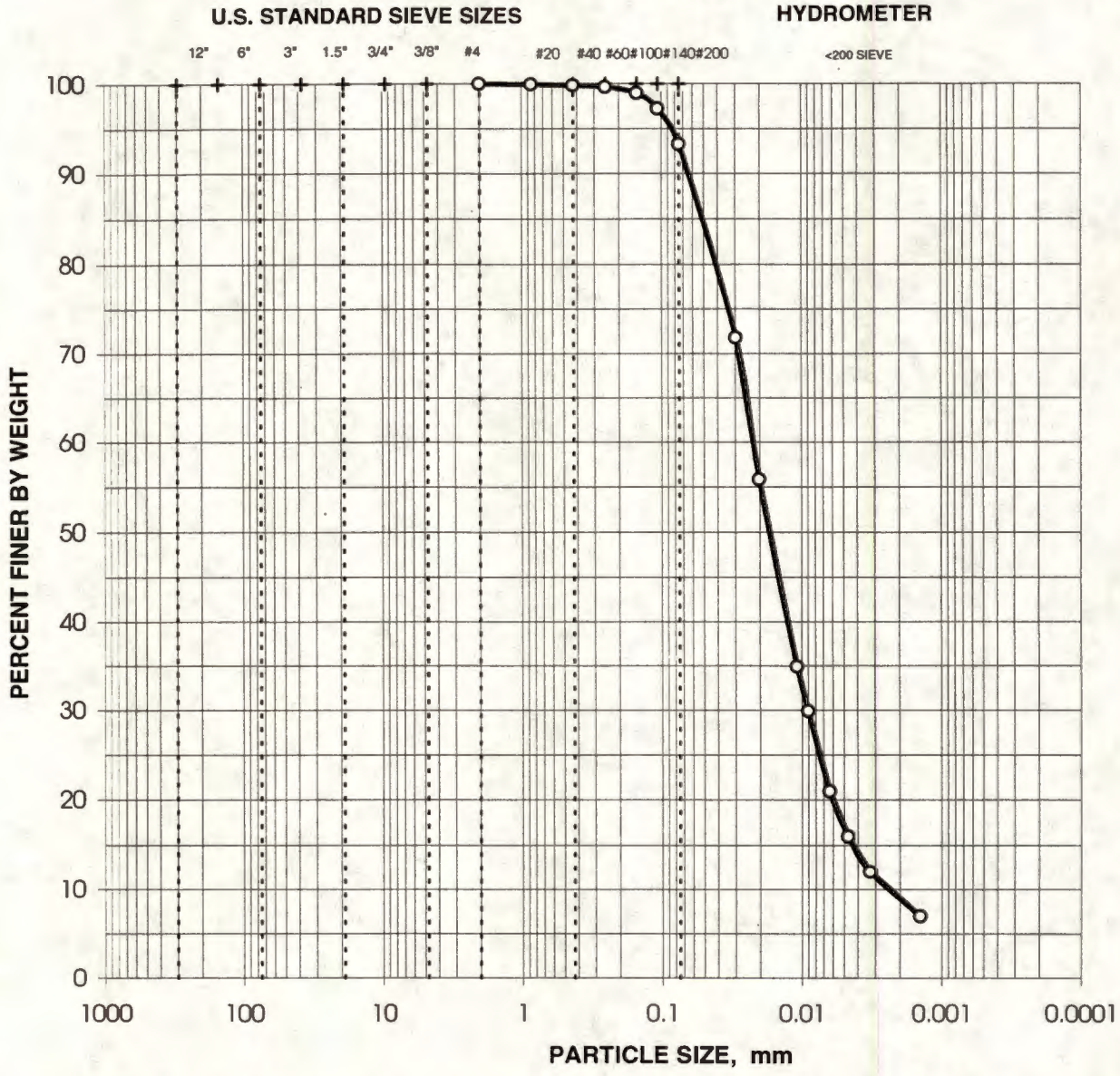
CSX Charlotte/Rochester NY



CLIENT SAMPLE NO.: Downstream

IT LAB SAMPLE NO.: ETDC-9847

BOULDERS	COBBLES	GRAVEL		SAND			
		COARSE	FINE	COARSE	MEDIUM	FINE	

SILT 2 - 75 microns

CLAY <2 microns

Mike Murray
IT Corporation
February 8, 2002
IT Project ID: CSX Charlotte
IT Project No.: 834540.01000000

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PARTICLE-SIZE ANALYSIS
ASTM D 422

Project Name	CSX Charlotte/Rochester NY	Client Sample No.	Channel-Lake +20/SEI
Project No.	834540.01000000	IT Lab Sample No.	ETDC-9848

Specific Gravity : 2.65
assumed for calculations

Moisture Content = 195.7%
based on dry sample weight

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.9%
	#40	0.425	97.4%
	#60	0.250	95.7%
	#100	0.149	93.1%
	#140	0.106	90.5%
	#200	0.075	86.7%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.04111	77.7%
	0.02996	70.7%
	0.02040	52.5%
	0.01272	30.3%
	0.00924	21.2%
	0.00665	15.1%
	0.00474	11.1%
	0.00328	9.1%
	0.00143	6.1%

0.0% Gravel 13.3% Sand 86.7% Silt/Clay

Mike Murray
IT Corporation
February 8, 2002
IT Project ID: CSX Charlotte
IT Project No.: 834540.01000000

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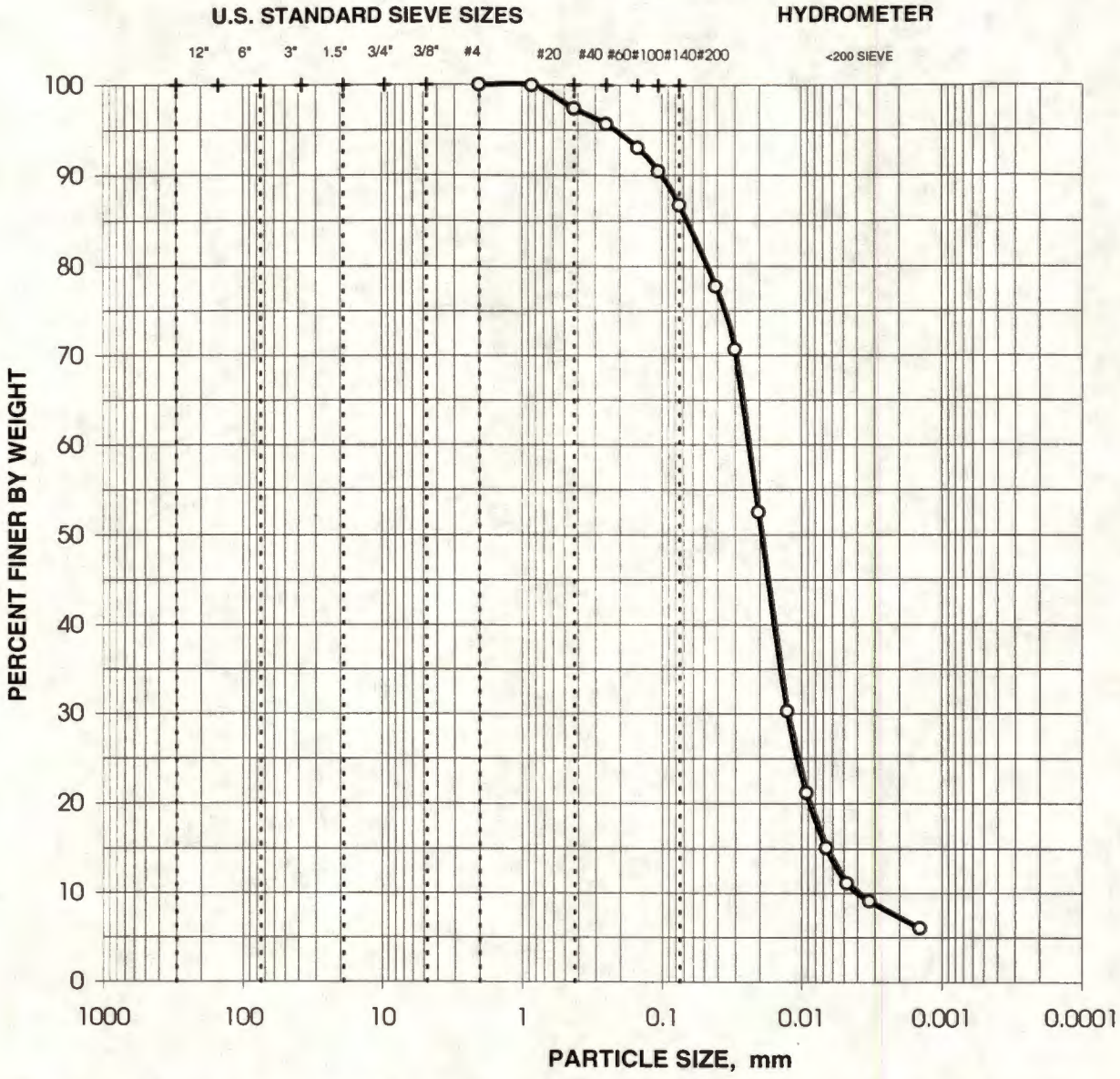
CSX Charlotte/Rochester NY



CLIENT SAMPLE NO.: Channel-Lake

IT LAB SAMPLE NO.: ETDC-9848

BOULDERS	COBBLES	GRAVEL		SAND			
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT 2 - 75 microns CLAY <2 microns

Appendix C
Chain-of-Custody and Request-for-Analysis Records

Project #
834540 01.00.00.00

CHAIN OF CUSTODY RECORD

FACILITY/LOCATION:	METHOD OF SHIPMENT: Fed Ex
CSX Charlotte / Rochester, NY	TO Oak Ridge, TN FROM Rochester, NY

SAMPLING AND ANALYSES AUTHORIZED BY: Mike Murray 1-800-445-1588 ext. 317	DATE: 1/10/02

SAMPLE #	SAMPLING LOCATION AND DESCRIPTION	DATE	TIME	SAMPLE TYPE C	SAMPLE TYPE G	SAMPLE TYPE SOLID	# OF CONT.	ANALYSES REQUIRED
ETDC 9845	upstream +20/SED	1/10/02	0900			Sediment	1	Grain Size
ETDC 9846	Middle +20/SED		1015				1	
ETDC 9847	Downstream +20/SED		1120				1	
ETDC 9848	Channel-Lake +20/SED		1210				1	

SAMPLE COLLECTED BY: CSK / AJF	EXACT SAMPLING LOCATION:		
SAMPLE RELINQUISHED BY: 1/10/02 1700	SAMPLE RECEIVED BY: Don Hasty IT/ETDC	DATE 1-11-02	TIME 0930
SAMPLE RELINQUISHED BY:	SAMPLE RECEIVED BY:	DATE	TIME
SAMPLE RELINQUISHED BY:	SAMPLE RECEIVED BY:	DATE	TIME
SAMPLE RELINQUISHED BY:	SAMPLE RECEIVED BY:	DATE	TIME

SAMPLE RELINQUISHED AFTER ANALYSES:	ANALYZED SAMPLE RECEIVED BY:	DATE	TIME
SAMPLE DESCRIPTION:	# OF CONTAINERS:		

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(908) 788-8700