# APPENDIX A

# Chain of Custody Form

US Army Corps of Engineers
Buffalo District

# Chain of Custody Record

COC No.: BufRiv-1

Page 1 of 1 Date: 9/7/05

Name: USACE - Buffalo District
Address: 1776 Niagara Street
Phone Number: (716) 879-4431
Project Manager: Byron Rupp
Project Name: Buffalo River
Job/Contract/P.O. #: Engineering & Environment
Sampler (Signature) (Printed Name) Jay Miller

Laboratory Name: ASCI Corporation
Address: 4444 Airpark Blvd
~~Phone~~ Duluth MN 55811
Contact: Kurt Anderson

| Field Sample # | Container Type | # Jars | Date | Time | Matrix | Metals | PAHs | Pesticides/PCBs | TOC | Dioxin/Furan | Mirex | Elutriate | Elutraite Water | Particle Size | Hyalella azteca | Chironomus tentans | Lumbriculus variegatus | Pore water pH | Pore water ammonia | | OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-785-00-R00 | 1 gal | 1 | 9/6/05 | 13:45 | sed | | | | | | | | | | X | X | | X | X | | |
| 11-780-00-C00 | 1 gal | 1 | 9/6/05 | 13:53 | sed | | | | | | | | | | X | X | | X | X | | |
| 11-773-00-R00 | 1 gal | 1 | 9/6/05 | 13:55 | sed | | | | | | | | | | X | X | | X | X | | |
| 11-760-00-R00 | 1 gal | 1 | 9/6/05 | 14:10 | sed | | | | | | | | | | X | X | | X | X | | |

Subtotal Number of Containers:

Preservatives for above requested parameters:
A. C.
B. D.

Methods for above requested parameters:

| Relinquished by | Date | Received by | Date |
|---|---|---|---|
| David Melfi (Signature) | 9/7/05 | (Signature) | 9/8/05 |
| David Melfi (Printed Name) | Time 9:40 | CLAYTON ALLEN (Printed Name) | Time 1010 |
| USACE (Company) | | ASCI (Company) | |
| Relinquished by | Date | Received by | Date |
| Signature | | Signature | |
| Printed Name | Time | Printed Name | Time |
| Company | | Company | |

Shipment Method:
Airbill No.:

USACE Location

PA 37 4287

US Army Corps of Engineers
Buffalo District

# Chain of Custody Record

COC No.: BufRiv-3
Page 1 of 1 Date: 9/7/05

Name: USACE - Buffalo District
Address: 1776 Niagara Street
Phone Number: (716) 879-4431
Project Manager: Byron Rupp
Project Name: Buffalo River
Job/Contract/P.O. #: Engineering & Environment
Sampler (Signature): [signature] (Printed Name): Jay Miller

Laboratory Name: ASCI Corporation
Address: Duluth MN 55811
Phone:
Contact: Kurt Anderson

| Field Sample # | Container Type | # Jars | Date | Time | Matrix | Metals | PAHs | Pesticides/PCBs | TOC | Dioxin/Furan | Mirex | Elutriate | Elutriate Water | Particle Size | Hyalella azteca | Chironomus tentans | Lumbriculus variegatus | pore water pH | pore water $NH_3$ | | OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-690-00-C00 | 1 gal | 1 | 9/6/05 | 14:49 | sed | | | | | | | | | | X | X | | X | X | | |
| 11-673-00-L00 | 1 gal | 1 | 9/6/05 | 14:54 | sed | | | | | | | | | | X | X | | X | X | | |
| 11-658-00-L00 | 1 gal | 1 | 9/6/05 | 15:02 | sed | | | | | | | | | | X | X | | X | X | | |
| 11-647-00-C00 | 1 gal | 1 | 9/6/05 | 15:08 | sed | | | | | | | | | | X | X | | X | X | | |

Subtotal Number of Containers:

Preservatives for above requested parameters:
A. C.
B. D.

Methods for above requested parameters:

| Relinquished by | Date | Received by | Date |
|---|---|---|---|
| David Melfi (Signature) | 9/7/05 | [signature] (Signature) | 9/8/05 |
| David Melfi (Printed Name) | Time 10:05 | CLAYTON ALLEN (Printed Name) | Time 1010 |
| USACE (Company) | | ASCI (Company) | |
| Relinquished by | Date | Received by | Date |
| (Signature) | | (Signature) | |
| (Printed Name) | Time | (Printed Name) | Time |
| (Company) | | (Company) | |

Shipment Method:
Airbill No.:

USACE Location

Pg 38 of 67

# Chain of Custody Record

COC No.: BuffRiv-4

Page 1 of

Date: 9/7/05

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]ering & Environment

(Printed Name)

Jay Miller

| [redacted]ner Type | # Jars | Date | Time | Matrix | Metals | PAHs | Pesticides/PCBs | TOC | Dioxin/Furan | Mirex | Elutriate | Elutraite Water | Particle Size | *Hyalella azteca* | *Chironomus tentans* | *Lumbriculus variegatus* | pore water pH | pore water $NH_3$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [redacted]llon | 2 | 9/6/05 | 15:16 | Sed | | | | | | | | | | x | x | | x | x | |

Requested Parameters

Laboratory Name: ASCI Corporation

Address: Duluth MN 55811

Phone:

Contact: Kurt Anderson

OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS

| | Received by | Date | Time |
|---|---|---|---|
| [redacted]/05 | Signature: [signature] | 9/8/05 | 10/0 |
| [redacted]10 | Printed Name: CLAYTON ALLEN | | |
| | Company: ASCI | | |
| | Received by | Date | |
| | Signature | | |
| | Printed Name | Time | |
| | Company | | |

Subtotal Number of Containers:

Preservatives for above requested parameters:

A. C.

B. D.

Methods for above requested parameters:

Shipment Method:

Airbill No.:

USACE Location

US Army Corps of Engineers
Buffalo District

# Chain of Custody Record

COC No.: Buf Riv -2
Page 1 of 1 Date: 9/7/05

Name: USACE - Buffalo District
Address: 1776 Niagara Street
Phone Number: (716) 879-4431
Project Manager: Byron Rupp
Project Name: Buffalo River
Job/Contract/P.O. #: Engineering & Environment
Sampler (Signature): [signature] (Printed Name): Jay Miller

Laboratory Name: ASCI Corporation
Address: Duluth MN 55811
Phone:
Contact: Kurt Anderson

| Field Sample # | Container Type | # Jars | Date | Time | Matrix | Metals | PAHs | Pesticides/PCBs | TOC | Dioxin/Furan | Mirex | Elutriate | Elutraite Water | Particle Size | *Hyalella azteca* | *Chironomus tentans* | *Lumbriculus variegatus* | pore water pH | pore water $NH_3$ | OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-695-00-R00 | 1 gal | 1 | 9/6/05 | 14:34 | sed | | | | | | | | | | X | X | | X | X | |
| 11-733-00-L00 | 1 gal | 1 | 9/6/05 | 14:15 | sed | | | | | | | | | | X | X | | X | X | |
| 11-730-00-R00 | 1 gal | 1 | 9/6/05 | 14:20 | sed | | | | | | | | | | X | X | | X | X | |
| 11-712-00-L00 | 1 gal | 1 | 9/6/05 | 14:29 | sed | | | | | | | | | | X | X | | X | X | |

Requested Parameters

| Relinquished by | Date | Received by | Date |
|---|---|---|---|
| David Melfi (Signature) | 9/7/05 | [signature] (Signature) | 9/8/05 |
| David Melfi (Printed Name) | Time 9:52 | CLAYTON ALLEN (Printed Name) | Time 1010 |
| USACE (Company) | | ASCI (Company) | |
| Relinquished by | Date | Received by | Date |
| Signature | | Signature | |
| Printed Name | Time | Printed Name | Time |
| Company | | Company | |

Subtotal Number of Containers:

Preservatives for above requested parameters:
A. C.
B. D.

Methods for above requested parameters:

Shipment Method:
Airbill No.:

USACE Location

pg 4 of 87

# APPENDIX B

# Raw Data Sheets

**Buffalo River Harbor Sediment Toxicity**
**Study I.D. 3600-006**
**Inlt. 10/28/05**

**Exposure System Observations/Activities Sheet for Sediments Initiated 10/28/05**

| Date | Day of Test | | Observations |
|---|---|---|---|
| 10/27/2005 | -1 | Head Flow (ml/min): — | Loaded 100 mL homogenized sed/water |
| 10/28/2005 | 0 | Head Flow (ml/min): 320 | Load 10 HA (heater) + 10 CT (heater). |
| 10/29/2005 | 1 | Head Flow (ml/min): 318 | Everything looks good. Fed at 1300. Chems collected at 1230. |
| 10/30/2005 | 2 | Head Flow (ml/min): 322 | Everything looks good. Fed. |
| 10/31/2005 | 3 | Head Flow (ml/min): 312 | Looks good. Fed. |
| 11/1/2005 | 4 | Head Flow (ml/min): 316 | Looks good. Fed. |
| 11/2/2005 | 5 | Head Flow (ml/min): 312 | Looks good Fed. |
| 11/3/2005 | 6 | Head Flow (ml/min): 316 | Looks good. Fed. |
| 11/4/2005 | 7 | Head Flow (ml/min): 308 | Looks good. |
| 11/5/2005 | 8 | Head Flow (ml/min): 314 | Looks good. → Roots 11/10/05 Fed. |
| 11/6/2005 | 9 | Head Flow (ml/min): 318 | Looks good. Fed. |
| 11/7/2005 | 10 | Head Flow (ml/min): 320 | Terminated test. CT dried @ 90°C for 23 hrs, then ashed @ 550°C for 2 hours |

D.O.

**Table Overlying Water ~~Temperature Values~~ (oC) for Buffalo River Sediments During 10-Day Hyalella Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 7.7 | 7.8 | 7.7 | 7.3 | 7.1 | 7.2 | 7.3 | 7.2 | 6.9 | 7.1 | 7.1 | 6.6 | 7.0 | 7.6 |
| 1 | 8.1 | 8.1 | 7.3 | 7.3 | 7.1 | 7.2 | 7.3 | 7.2 | 6.5 | 6.7 | 6.9 | 6.6 | 7.0 | 7.5 |
| 2 | 7.8 | 7.9 | 7.1 | 7.0 | 6.7 | 6.9 | 6.8 | 6.9 | 6.5 | 6.3 | 6.8 | 6.4 | 6.9 | 7.1 |
| 3 | 7.7 | 7.0 | 6.8 | 6.5 | 6.6 | 6.8 | 6.6 | 6.8 | 5.3 | 6.5 | 5.1 | 6.5 | 6.7 | 7.0 |
| 4 | 8.0 | 7.2 | 7.3 | 7.3 | 7.4 | 7.3 | 7.1 | 7.2 | 5.3 | 6.9 | 5.2 | 6.7 | 7.4 | 8.6 |
| 5 | 7.8 | 7.3 | 7.1 | 7.4 | 7.4 | 7.4 | 7.0 | 7.0 | 6.1 | 5.2 | 5.1 | 6.5 | 7.1 | 7.4 |
| 6 | 7.2 | 7.3 | 6.5 | 6.4 | 6.3 | 6.6 | 6.4 | 6.5 | 6.2 | 6.5 | 6.6 | 5.8 | 6.6 | 6.9 |
| 7 | 7.0 | 7.0 | 6.4 | 6.0 | 6.2 | 6.3 | 6.3 | 6.2 | 6.2 | 6.1 | 6.0 | 5.9 | 5.8 | 6.2 |
| 8 | 7.1 | 7.2 | 6.6 | 6.6 | 6.6 | 6.5 | 6.5 | 6.5 | 6.5 | 6.0 | 6.3 | 5.6 | 5.7 | 6.4 |
| 9 | 7.0 | 7.1 | 6.1 | 6.5 | 6.5 | 6.2 | 6.1 | 6.6 | 6.1 | 5.2 | 5.1 | 5.9 | 5.8 | 6.1 |
| 10 | 7.0 | 7.0 | 6.2 | 6.4 | 6.4 | 6.4 | 6.2 | 6.0 | 6.4 | 6.2 | 6.4 | 6.1 | 6.0 | 6.0 |

**Table Overlying Water ~~D.O.~~ Values (mg/L) for Buffalo River Sediments During 10-Day Hyalella Exposures**

Temp

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 23.0 | 22.3 | 22.3 | 22.3 | 22.2 | 22.2 | 22.3 | 22.4 | 22.3 | 22.4 | 22.2 | 22.4 | 22.3 | 22.5 |
| 1 | 22.5 | 22.3 | 22.3 | 22.4 | 22.3 | 22.3 | 22.3 | 22.3 | 22.3 | 22.4 | 22.3 | 22.3 | 22.5 | 22.3 |
| 2 | 22.8 | 22.5 | 22.5 | 22.5 | 22.7 | 22.5 | 22.6 | 22.5 | 22.6 | 22.6 | 22.8 | 22.5 | 22.6 | 22.5 |
| 3 | 22.8 | 22.7 | 22.5 | 22.5 | 22.7 | 22.6 | 22.6 | 22.8 | 22.8 | 22.7 | 22.7 | 22.8 | 22.7 | 22.8 |
| 4 | 22.8 | 22.5 | 22.6 | 22.6 | 22.7 | 22.6 | 22.6 | 22.7 | 22.6 | 22.7 | 22.3 | 22.3 | 22.3 | 22.8 |
| 5 | 22.9 | 22.7 | 22.7 | 22.8 | 22.8 | 22.7 | 22.7 | 22.6 | 22.6 | 22.7 | 22.7 | 22.8 | 23.0 | 22.9 |
| 6 | 22.6 | 22.4 | 22.4 | 22.4 | 22.5 | 22.4 | 22.5 | 22.5 | 22.4 | 22.4 | 22.3 | 22.4 | 22.4 | 22.5 |
| 7 | 22.5 | 22.6 | 22.7 | 22.7 | 22.6 | 22.7 | 22.6 | 22.6 | 22.6 | 22.6 | 22.6 | 22.5 | 22.5 | 22.6 |
| 8 | 22.6 | 22.5 | 22.4 | 22.4 | 22.3 | 22.5 | 22.5 | 22.4 | 22.5 | 22.3 | 22.5 | 22.4 | 22.5 | 22.4 |
| 9 | 22.4 | 22.4 | 22.3 | 22.4 | 22.3 | 22.5 | 22.5 | 22.3 | 22.5 | 22.3 | 22.3 | 22.3 | 22.3 | 22.5 |
| 10 | 22.5 | 22.5 | 22.4 | 22.4 | 22.3 | 22.6 | 22.6 | 22.5 | 22.5 | 22.4 | 22.4 | 22.4 | 22.5 | 22.4 |

Suspend feeding if DO < 40% saturation (3.4 mg/L)

**Table Overlying Water pH Values for Buffalo River Sediments During 10-Day *Hyalella* Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 6.90 | 7.48 | 7.27 | 7.25 | 7.31 | 7.24 | 7.29 | 7.16 | 7.26 | 7.24 | 7.29 | 7.28 | 7.13 | 7.70 |
| 10 | 7.03 | 7.38 | 7.39 | 7.44 | 7.46 | 7.49 | 7.41 | 7.35 | 7.41 | 7.42 | 7.46 | 7.49 | 7.51 | 7.50 |

**Table Overlying Water Cond. Values (umhos/cm) for Buffalo River Sediments During 10-Day Hyalella Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 83 | 255 | 273 | 231 | 240 | 274 | 229 | 219 | 314 | 323 | 273 | 210 | 301 | 175 |
| 10 | 141 | 192 | 188 | 189 | 193 | 199 | 172 | 192 | 223 | 179 | 287 | 183 | 189 | 142 |

**Table Overlying Water Alkalinity Values (mg/L) for Buffalo River Sediments During 10-Day *Hyalella* Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 24 | 100 | 110 | 86 | 82 | 96 | 74 | 76 | 120 | 133 | 106 | 80 | 120 | 52 |
| 10 | 44 | 60 | 70 | 66 | 68 | 68 | 70 | 62 | 110 | 74 | 130 | 68 | 74 | 58 |

**Table Overlying Water Hardness Values (mg/L) for Buffalo River Sediments During 10-Day *Hyalella* Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 26 | 88 | 86 | 96 | 116 | 88 | 88 | 84 | 112 | 106 | 106 | 76 | 100 | 64 |
| 10 | 44 | 80 | 68 | 64 | 74 | 74 | 66 | 64 | 98 | 74 | 118 | 76 | 70 | 68 |

**Table Overlying Water Ammonia Values (mg/L) for Buffalo River Sediments During 10-Day *Hyalella* Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | <1 | 3.1 | 5.5 | 2.5 | 3.6 | 4.8 | 3.4 | 2.1 | 6.5 | 7.3 | 1.4 | 1.5 | <1 | 4.3 |
| 10 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 1.2 | <1 | <1 | <1 | <1 | <1 |

**Table Overlying Water Temperature Values (oC) for Buffalo River Sediments During 10-Day Chironomus Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 23.0 | 22.3 | 22.3 | 22.3 | 22.2 | 22.2 | 22.3 | 22.4 | 22.3 | 22.4 | 22.2 | 22.4 | 22.3 | 22.5 |
| 1 | 22.5 | 22.3 | 22.3 | 22.4 | 22.4 | 22.3 | 22.3 | 22.3 | 22.3 | 22.3 | 22.3 | 22.4 | 22.5 | 22.4 |
| 2 | 22.6 | 22.6 | 22.7 | 22.6 | 22.6 | 22.6 | 22.6 | 22.8 | 22.6 | 22.6 | 22.6 | 22.7 | 22.5 | 22.8 |
| 3 | 22.8 | 22.7 | 22.5 | 22.5 | ~~22.7~~ 22.7 | 22.6 | 22.6 | 22.8 | 22.8 | 22.7 | 22.7 | 22.8 | 22.7 | 22.8 |
| 4 | 22.8 | 22.5 | 22.6 | 22.6 | 22.7 | 22.6 | 22.7 | 22.7 | 22.6 | 22.7 | 22.8 | 22.8 | 22.8 | 22.8 |
| 5 | 22.9 | 22.7 | 22.7 | 22.8 | 22.8 | 22.7 | 22.7 | 22.6 | 22.6 | 22.7 | 22.7 | 22.8 | 23.0 | 22.9 |
| 6 | 22.6 | 22.3 | 22.4 | 22.5 | 22.5 | 22.4 | 22.6 | 22.4 | 22.5 | 22.4 | 22.3 | 22.4 | 22.5 | 22.6 |
| 7 | 22.5 | 22.6 | 22.7 | 22.7 | 22.6 | 22.7 | 22.6 | 22.6 | 22.6 | 22.7 | 22.6 | 22.5 | 22.5 | 22.6 |
| 8 | 22.5 | 22.5 | 22.4 | 22.4 | 22.3 | 22.5 | 22.5 | 22.4 | 22.5 | 22.3 | 22.5 | 22.4 | 22.5 | 22.4 |
| 9 | 22.4 | 22.4 | 22.3 | 22.4 | 22.3 | 22.5 | 22.5 | 22.3 | 22.5 | 22.3 | 22.3 | 22.3 | 22.3 | 22.5 |
| 10 | 22.5 | 22.5 | 22.4 | 22.4 | 22.3 | 22.6 | 22.6 | 22.5 | 22.5 | 22.4 | 22.4 | 22.4 | 22.5 | 22.4 |

ca 10/31/05

**Table Overlying Water D.O. Values (mg/L) for Buffalo River Sediments During 10-Day Chironomus Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 7.7 | 7.8 | 7.7 | 7.3 | 7.1 | 7.2 | 7.3 | 7.2 | 6.9 | 7.1 | 7.1 | 6.6 | 7.0 | 7.6 |
| 1 | 7.3 | 7.0 | 7.3 | 7.3 | 7.1 | 6.6 | 7.1 | 7.1 | 6.8 | 6.3 | 6.0 | 6.5 | 6.8 | 7.5 |
| 2 | 6.9 | 7.0 | 7.3 | 7.3 | 6.10 | 6.5 | 6.4 | 6.4 | 6.6 | 6.5 | 6.0 | 6.5 | 6.5 | 6.9 |
| 3 | 5.2 | 6.4 | 6.4 | 5.0 | 5.0 | 5.0 | 7.1 | 5.1 | 4.2 | 5.5 | 4.3 | 4.2 | 4.0 | 4.1 |
| 4 | 6.7 | 6.7 | 6.9 | 6.5 | 6.5 | 6.0 | 7.0 | 5.7 | 5.8 | 4.9 | 3.5 | 5.4 | 4.4 | 7.1 |
| 5 | 7.1 | 6.8 | 6.8 | 6.7 | 6.7 | 6.6 | 7.1 | 6.3 | 5.3 | 6.7 | 4.5 | 5.2 | 5.1 | 6.9 |
| 6 | 6.6 | 6.5 | 6.3 | 5.5 | 5.4 | 5.5 | 6.6 | 6.0 | 5.5 | 5.5 | 5.0 | 5.2 | 5.5 | 5.4 |
| 7 | 5.5 | 5.4 | 5.5 | 5.3 | 5.5 | 6.0 | 5.2 | 6.3 | 6.2 | 5.4 | 5.0 | 5.3 | 5.4 | 5.8 |
| 8 | 6.7 | 5.8 | 6.0 | 5.8 | 5.2 | 5.6 | 6.0 | 6.1 | 5.4 | 5.0 | 5.0 | 5.2 | 5.2 | 5.4 |
| 9 | 6.9 | 5.5 | 6.1 | 5.6 | 5.2 | 5.8 | 6.5 | 6.4 | 5.8 | 5.2 | 5.2 | 5.1 | 5.0 | 5.2 |
| 10 | 6.5 | 6.5 | 6.0 | 5.4 | 5.5 | 5.5 | 5.4 | 5.0 | 5.0 | 4.8 | 4.9 | 4.8 | 4.4 | 6.0 |

Suspend feeding if DO < 40% saturation (3.4 mg/L)

**Table Overlying Water pH Values for Buffalo River Sediments During 10-Day *Chironomus* Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 6.90 | 7.48 | 7.27 | 7.25 | 7.31 | 7.24 | 7.29 | 7.16 | 7.26 | 7.24 | 7.29 | 7.28 | 7.13 | 7.70 |
| 10 | 7.00 | 7.24 | 7.21 | 7.22 | 7.22 | 7.21 | 7.23 | 7.21 | 7.20 | 7.23 | 7.22 | 7.27 | 7.19 | 7.49 |

**Table Overlying Water Cond. Values (umhos/cm) for Buffalo River Sediments During 10-Day Chironomus Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 83 | 255 | 273 | 231 | 240 | 274 | 229 | 2A | 314 | 323 | 273 | 210 | 301 | 175 |
| 10 | 143 | 194 | 192 | 190 | 190 | 189 | 179 | 189 | 222 | 196 | 252 | 191 | 218 | 154 |

**Table Overlying Water Alkalinity Values (mg/L) for Buffalo River Sediments During 10-Day *Chironomus* Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 24 | 100 | 110 | 86 | 82 | 96 | 74 | 76 | 120 | 153 | 106 | 80 | 120 | 52 |
| 10 | 40 | 72 | 82 | 84 | 72 | 74 | 62 | 72 | 106 | 96 | 114 | 88 | 98 | 68 |

**Table Overlying Water Hardness Values (mg/L) for Buffalo River Sediments During 10-Day *Chironomus* Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 26 | 88 | 86 | 96 | 116 | 88 | 88 | 84 | 112 | 106 | 106 | 76 | 100 | 64 |
| 10 | 44 | 76 | 80 | 70 | 68 | 74 | 66 | 70 | 90 | 84 | 100 | 82 | 92 | 76 |

**Table Overlying Water Ammonia Values (mg/L) for Buffalo River Sediments During 10-Day *Chironomus* Exposures**

| Day | West Bearskin | 11-695 | 11-733 | 11-730 | 11-712 | 11-610 | 11-690 | 11-673 | 11-658 | 11-647 | 11-780 | 11-773 | 11-760 | 11-785 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | <1 | 3.1 | 5.5 | 2.5 | 3.6 | 4.8 | 3.4 | 2.1 | 6.5 | 7.3 | 1.4 | 1.5 | <1 | 4.3 |
| 10 | <1 | <1 | 1.1 | 1.3 | <1 | <1 | <1 | <1 | ~~5.1~~ 3.5 | ~~3.5~~ 3.0 | ~~3.0~~ 2.2 | ~~2.2~~ <1 | 2.0 | <1 |

4 ERRORS
CA 11/7/05
RC

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# West Bearskin

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 10 | 0 | 10 | 1.25096 | 1.26523 | 1.25279 |
| B | 9 | 1 | 9 | 1.24840 | 1.26349 | 1.25039 |
| C | 0* | 10 | 0 | 1.26094 | — | — |
| D | 8 | 2 | 8 | 1.25533 | 1.26978 | 1.25711 |
| E | 9 | 1 | 9 | 1.25846 | 1.27374 | 1.26041 |

0* - Mayfly larvae present.

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# West Bearskin

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 10 | 0 |
| B | 10 | 0 |
| C | 9 | 1 |
| D | 10 | 0 |
| E | 10 | 0 |

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# 11-695

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 5 | 5 | 5 | 1.24919 | 1.25507 | 1.25080 |
| B | 8 | 2 | 8 | 1.25130 | 1.25980 | 1.25332 |
| C | 10 | ~~10~~ 0 | 10 | 1.24995 | 1.25878 | 1.25212 |
| D | 9 | 1 | 9 | 1.25186 | 1.26359 | 1.25467 |
| E | 7 | 3 | 7 | 1.24821 | 1.25758 | 1.25033 |

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# 11-695

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 10 | 0 |
| B | 9 | 1 |
| C | 9 | 1 |
| D | 8 | 2 |
| E | 9 | 1 |

## *Chironomus tentans* 10-day Survival and Growth Data

Site ID# 11-733

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 16 | 0 | 10 | 1.26214 | 1.28190 | 1.26936 |
| B | 5+2 | 3 | 5 | 1.25467 | 1.26694 | 1.25698 |
| C | 9+1 | 0 | 9 | 1.24911 | 1.26618 | 1.25444 |
| D | 7+2 | 1 | 7 | 1.25714 | 1.27221 | 1.26251 |
| E | 9 | 0 | 7 | 1.24978 | 1.26904 | 1.25449 |

## *Hyalella azteca* 10-day Survival and Growth Data

Site ID# 11-733

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 10 | 0 |
| B | 10 | 0 |
| C | 9 | 1 |
| D | 10 | 0 |
| E | 10 | 0 |

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# 11-730

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 10 | 0 | 10 | 1.25921 | 1.27475 | 1.26422 |
| B | 9 | 1 | 9 | 1.24935 | 1.26121 | 1.25266 |
| C | 7 | 3 | 7 | 1.25629 ~~1.24192~~ | ~~1.26947~~ 1.25674 | 1.26026 |
| D | 8 | 2 | 8 | 1.24192 ~~1.25629~~ | 1.26947 | 1.24573 |
| E | 16 | 6 | 10 | 1.25255 | 1.26746 | 1.25640 |

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# 11-730

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 10 | 0 |
| B | 9 | 1 |
| C | 10 | 0 |
| D | 10 | 0 |
| E | 10 | 0 |

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# 11-712

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 9 | 1 | 9 | 1.25898 | 1.27531 | 1.26487 |
| B | 8 | 2 | 8 | 1.26555 | 1.28298 | 1.27189 |
| C | 9 | 1 | 9 | 1.26065 | 1.27741 | 1.26601 |
| D | 8 | 2 | 8 | 1.25007 | 1.26452 | 1.25443 |
| E | 10 | 0 | 10 | 1.24646 | 1.26355 | 1.25204 |

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# 11-712

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 10 | 0 |
| B | 8 | 2 |
| C | 10 | 0 |
| D | 9 | 1 |
| E | 9 | 1 |

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# 11-610

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 8 | 2 | 8 | 1.25935 | 1.27751 | 1.26546 |
| B | 2* | 8 | 2 | 1.25547 | 1.25987 | 1.25668 |
| C | 10 | 0 | 10 | 1.24769 | 1.27058 | 1.25524 |
| D | 8 | 2 | 8 | 1.25893 | 1.27783 | 1.26436 |
| E | 9 | 1 | 9 | 1.25090 | 1.27000 | 1.25716 |

rep B- 2 pupae

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# 11-610

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 9 | 1 |
| B | 10 | 0 |
| C | 10 | 0 |
| D | 10 | 0 |
| E | 8 | 2 |

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# 11-690

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 9 | 1 | 9 | 1.24539 | 1.26394 | 1.25204 |
| B | 10 | 0 | 10 | 1.26032 | 1.27965 | 1.26783 |
| C | 9 | 1 | 9 | 1.25070 | 1.26755 | 1.25638 |
| D | 9 | 1 | 9 | 1.26795 | 1.28722 | 1.27478 |
| E | 9 | 1 | 9 | 1.25726 | 1.27653 | 1.26452 |

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# 11-690

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 9 | 1 |
| B | 8 | 2 |
| C | 9 | 1 |
| D | 10 | 0 |
| E | 9 | 1 |

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# 11-673

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 6 | 4 | 6 | 1.25073 | 1.26620 | 1.25634 |
| B | 10 | 0 | 10 | 1.24477 | 1.25931 | 1.24973 |
| C | 9 | 1 | 9 | 1.25092 | 1.26813 | 1.25754 |
| D | 10 | 0 | 16 | 1.25029 | 1.26824 | 1.25703 |
| E | 5 | 5 | 5 | 1.24859 | 1.26175 | 1.25265 |

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# 11-673

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 9 | 1 |
| B | 7 | 3 |
| C | 9 | 1 |
| D | 7 | 3 |
| E | 8 | 2 |

HA smaller than WAS organisms

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# 11-658

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 8 | 2 | 8 | 1.25723 | 1.27664 | 1.26476 |
| B | 9 | 1 | 9 | 1.24843 | 1.26878 | 1.25578 |
| C | 7 | 3 | 7 | 1.24495 | 1.26244 | 1.25204 |
| D | 8 | 2 | 8 | 1.25853 | 1.27800 | 1.26628 |
| E | 10 | 0 | 10 | 1.24099 | 1.26335 | 1.25015 |

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# 11-658

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 10 | 0 |
| B | 8 | 2 |
| C | 7 | 3 |
| D | 9 | 1 |
| E | 10 | 0 |

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# 11-647

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 10 | 0 | 10 | 1.24310 | 1.26230 | 1.24889 |
| B | 8 | 2 | 8 | 1.25369 | 1.27050 | 1.25842 |
| C | 9 | 1 | 9 | 1.25419 | 1.27615 | 1.26182 |
| D | 8 | 2 | 8 | 1.26121 | 1.28208 | 1.26884 |
| E | 6 | 4 | 6 | 1.25102 | 1.26946 | 1.25715 |

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# 11-647

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 10 | 6 |
| B | 8 | 2 |
| C | 10 | 0 |
| D | 9 | 1 |
| E | 9 | 1 |

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# 11-785

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 7 | 3 | 7 | 1.25164 | 1.26418 | 1.25335 |
| B | 10 | 0 | 10 | 1.25342 | 1.26600 | 1.25537 |
| C | 6 | 4 | 6 | RKB 1.24335 ~~1/10/05 1.244~~ | 1.25330 | 1.24596 |
| D | 7 | 3 | 7 | 1.25682 | 1.26603 | 1.25842 |
| E | 5 | 5 | 5 | 1.25713 | 1.26533 | 1.25862 |

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# 11-785

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 8 | 2 |
| B | 10 | 0 |
| C | 8 | 2 |
| D | 10 | 0 |
| E | 8 | 2 |

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# 11-780

| Rep | # Organisms Alive | # Organisms Dead | # Organisms Weighed | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| A | 9 | 1 | 9 | 1.25031 | 1.27122 | 1.25678 |
| B | 10 | 0 | 10 | 1.25203 | 1.27343 | 1.25828 |
| C | 10 | 0 | 10 | 1.25484 | 1.27178 | ~~1.25~~ 1.26051 |
| D | 10 | 0 | 10 | 1.26314 | 1.28872 | 1.27063 |
| E | 9 | 1 | 9 | 1.25346 | 1.27593 | 1.26037 |

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# 11-780

| Rep | # Organisms Alive | # Organisms Dead |
|---|---|---|
| A | 10 | 0 10 |
| B | 10 | 0 ~~10~~ |
| C | 9 | 1 |
| D | 10 | 0 |
| E | 9 | 1 |

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# 11-773

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 7 | 3 | 7 | 1.24663 | 1.26627 | 1.25384 |
| B | 9 | 1 | 9 | 1.25266 | 1.27240 | 1.25931 |
| C | 8 | 2 | 8 | 1.24991 | 1.26720 | 1.25616 |
| D | 10 | 0 | 10 | 1.24833 | 1.26824 | 1.25550 |
| E | 8 | 2 | 8 | 1.25134 | 1.27055 | 1.25809 |

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# 11-773

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 8 | 2 |
| B | 10 | 0 |
| C | 10 | 0 |
| D | 8 | 2 |
| E | 9 | 1 |

***Chironomus tentans* 10-day Survival and Growth Data**

Site ID# 11-760

| Rep | # Organisms | | | Ashed Pan Wt. (g) | Pan + Dried Org. Wt. (g) | Pan + Ashed Org. Wt. (g) |
|---|---|---|---|---|---|---|
| | Alive | Dead | Weighed | | | |
| A | 7* | 3 | 6 | 1.257666 | 1.27847 | 1.266614 |
| B | 10 | 0 | 10 | 1.24530 | 1.27125 | 1.25627 |
| C | 10 | 0 | 10 | 1.25048 | 1.27684 | 1.26126 |
| D | 10 | 0 | 10 | 1.25814 | 1.28055 | 1.26662 |
| E | 10 | 0 | 10 | 1.24481 | 1.27101 | 1.25619 |

Rep A - 1 pupae

***Hyalella azteca* 10-day Survival and Growth Data**

Site ID# 11-760

| Rep | # Organisms | |
|---|---|---|
| | Alive | Dead |
| A | 9 | 1 |
| B | 9 | 1 |
| C | 9 | 1 |
| D | 10 | 0 |
| E | 8 | 2 |

# APPENDIX C

# Statistical Analyses

Title: BUFFALO RIVER HYALELLA SURVIVAL
File: BR1HS Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

---

D = 0.2992
W = 0.9207

Critical W = 0.9100 (alpha = 0.01 , N = 35)
W = 0.9340 (alpha = 0.05 , N = 35)

---

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: BUFFALO RIVER HYALELLA SURVIVAL
File: BR1HS Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

---

Calculated B1 statistic = 3.3209 (p-value = 0.7676)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

---

Critical B = 16.8119 (alpha = 0.01, df = 6)
= 12.5916 (alpha = 0.05, df = 6)

Title: BUFFALO RIVER HYALELLA SURVIVAL
File: BR1HS Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA Table

| SOURCE | DF | SS | MS | F |
|---|---|---|---|---|
| Between | 6 | 0.1033 | 0.0172 | 1.6112 |
| Within (Error) | 28 | 0.2992 | 0.0107 | |
| Total | 34 | 0.4025 | | |

(p-value = 0.1810)

Critical F = 3.5276 (alpha = 0.01, df = 6,28)
= 2.4453 (alpha = 0.05, df = 6,28)

Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

Title: BUFFALO RIVER HYALELLA SURVIVAL
File: BR1HS Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

| GROUP | IDENTIFICATION | TRANSFORMED MEAN | MEAN CALCULATED IN ORIGINAL UNITS | TRANS T STAT | SIG 0.05 |
|---|---|---|---|---|---|
| 1 | WBS | 1.3794 | 0.9800 | | |
| 2 | 11-695 | 1.2533 | 0.9000 | 1.9299 | |
| 3 | 11-733 | 1.3794 | 0.9800 | 0.0000 | |
| 4 | 11-730 | 1.3794 | 0.9800 | 0.0000 | |
| 5 | 11-712 | 1.2859 | 0.9200 | 1.4313 | |
| 6 | 11-610 | 1.3185 | 0.9400 | 0.9327 | |
| 7 | 11-690 | 1.2533 | 0.9000 | 1.9299 | |

Dunnett critical value = 2.4300 (1 Tailed, alpha = 0.05, df [used] = 6,24)
(Actual df = 6,28)

Title: BUFFALO RIVER HYALELLA SURVIVAL
File: BR1HS Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

| GROUP | IDENTIFICATION | NUM OF REPS | MIN SIG DIFF (IN ORIG. UNITS) | % OF CONTROL | DIFFERENCE FROM CONTROL |
|---|---|---|---|---|---|
| 1 | WBS | 5 | | | |
| 2 | 11-695 | 5 | 0.0816 | 8.5 | 0.0800 |
| 3 | 11-733 | 5 | 0.0816 | 8.5 | 0.0000 |
| 4 | 11-730 | 5 | 0.0816 | 8.5 | 0.0000 |
| 5 | 11-712 | 5 | 0.0816 | 8.5 | 0.0600 |
| 6 | 11-610 | 5 | 0.0816 | 8.5 | 0.0400 |
| 7 | 11-690 | 5 | 0.0816 | 8.5 | 0.0800 |

Title: BR2 HYALELLA SURVIVAL
File: BR2HS Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

---

D = 0.5655
W = 0.9207

Critical W = 0.9190 (alpha = 0.01 , N = 40)
W = 0.9400 (alpha = 0.05 , N = 40)

---

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: BR2 HYALELLA SURVIVAL
File: BR2HS Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

---

Calculated B1 statistic = 5.6164 (p-value = 0.5852)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

---

Critical B = 18.4753 (alpha = 0.01, df = 7)
= 14.0671 (alpha = 0.05, df = 7)

Title: BR2 HYALELLA SURVIVAL
File: BR2HS Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA Table

| SOURCE | DF | SS | MS | F |
|---|---|---|---|---|
| Between | 7 | 0.2538 | 0.0363 | 2.0521 |
| Within (Error) | 32 | 0.5655 | 0.0177 | |
| Total | 39 | 0.8193 | | |

(p-value = 0.0786)

Critical F = 3.2583 (alpha = 0.01, df = 7,32)
= 2.3127 (alpha = 0.05, df = 7,32)

Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

Title: BR2 HYALELLA SURVIVAL
File: BR2HS Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

| GROUP | IDENTIFICATION | TRANSFORMED MEAN | MEAN CALCULATED IN ORIGINAL UNITS | TRANS T STAT | SIG 0.05 |
|---|---|---|---|---|---|
| 1 | WBS | 1.3794 | 0.9800 | | |
| 2 | 11-673 | 1.1175 | 0.8000 | 3.1153 | * |
| 3 | 11-658 | 1.2343 | 0.8800 | 1.7264 | |
| 4 | 11-647 | 1.2859 | 0.9200 | 1.1129 | |
| 5 | 11-785 | 1.2291 | 0.8800 | 1.7881 | |
| 6 | 11-780 | 1.3794 | 0.9800 | 0.0000 | |
| 7 | 11-773 | 1.2575 | 0.9000 | 1.4505 | |
| 8 | 11-760 | 1.2533 | 0.9000 | 1.5006 | |

Dunnett critical value = 2.4500 (1 Tailed, alpha = 0.05, df [used] = 7,30)
(Actual df = 7,32)

Title: BR2 HYALELLA SURVIVAL
File: BR2HS Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

| GROUP | IDENTIFICATION | NUM OF REPS | MIN SIG DIFF (IN ORIG. UNITS) | % OF CONTROL | DIFFERENCE FROM CONTROL |
|---|---|---|---|---|---|
| 1 | WBS | 5 | | | |
| 2 | 11-673 | 5 | 0.1136 | 11.8 | 0.1800 |
| 3 | 11-658 | 5 | 0.1136 | 11.8 | 0.1000 |
| 4 | 11-647 | 5 | 0.1136 | 11.8 | 0.0600 |
| 5 | 11-785 | 5 | 0.1136 | 11.8 | 0.1000 |
| 6 | 11-780 | 5 | 0.1136 | 11.8 | 0.0000 |
| 7 | 11-773 | 5 | 0.1136 | 11.8 | 0.0800 |
| 8 | 11-760 | 5 | 0.1136 | 11.8 | 0.0800 |

Title: BUFFALO RIVER C. TENTANS SURVIVAL
File: BRCS1 Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

---

D = 0.9106
W = 0.9551

Critical W = 0.9080 (alpha = 0.01 , N = 34)
W = 0.9330 (alpha = 0.05 , N = 34)

---

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: BUFFALO RIVER C. TENTANS SURVIVAL
File: BRCS1 Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

---

Calculated B1 statistic = 7.1772 (p-value = 0.3048)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

---

Critical B = 16.8119 (alpha = 0.01, df = 6)
= 12.5916 (alpha = 0.05, df = 6)

---

Using Average Degrees of Freedom
(Based on average replicate size of 4.86)

Calculated B2 statistic = 5.4066 (p-value = 0.4928)

Data PASS B2 homogeneity test at 0.01 level. Continue analysis.

Title: BUFFALO RIVER C. TENTANS SURVIVAL
File: BRCS1 Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA Table

| SOURCE | DF | SS | MS | F |
|---|---|---|---|---|
| Between | 6 | 0.1505 | 0.0251 | 0.7437 |
| Within (Error) | 27 | 0.9106 | 0.0337 | |
| Total | 33 | 1.0611 | | |

(p-value = 0.6194)

Critical F = 3.5580 (alpha = 0.01, df = 6,27)
= 2.4591 (alpha = 0.05, df = 6,27)

Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

Title: BUFFALO RIVER C. TENTANS SURVIVAL
File: BRCS1 Transform: ARC SINE(SQUARE ROOT(Y))

Bonferroni t-Test - TABLE 1 OF 2 Ho: Control<Treatment

| GROUP | IDENTIFICATION | TRANSFORMED MEAN | MEAN CALCULATED IN ORIGINAL UNITS | TRANS t STAT | SIG 0.05 |
|---|---|---|---|---|---|
| 1 | WBS | 1.2543 | 0.9000 | | |
| 2 | 11-695 | 1.1090 | 0.7800 | 1.1800 | |
| 3 | 11-733 | 1.2627 | 0.9000 | -0.0677 | |
| 4 | 11-730 | 1.2343 | 0.8800 | 0.1626 | |
| 5 | 11-712 | 1.2249 | 0.8800 | 0.2389 | |
| 6 | 11-610 | 1.1120 | 0.7800 | 1.1551 | |
| 7 | 11-690 | 1.2816 | 0.9200 | -0.2218 | |

Bonferroni t critical value = 2.5525 (1 Tailed, alpha = 0.05, df = 6,27)

Title: BUFFALO RIVER C. TENTANS SURVIVAL
File: BRCS1 Transform: ARC SINE(SQUARE ROOT(Y))

Bonferroni t-Test - TABLE 2 OF 2 Ho: Control<Treatment

| GROUP | IDENTIFICATION | NUM OF REPS | MIN SIG DIFF (IN ORIG. UNITS) | % OF CONTROL | DIFFERENCE FROM CONTROL |
|---|---|---|---|---|---|
| 1 | WBS | 4 | | | |
| 2 | 11-695 | 5 | 0.2511 | 27.8 | 0.1200 |
| 3 | 11-733 | 5 | 0.2511 | 27.8 | 0.0000 |
| 4 | 11-730 | 5 | 0.2511 | 27.8 | 0.0200 |
| 5 | 11-712 | 5 | 0.2511 | 27.8 | 0.0200 |
| 6 | 11-610 | 5 | 0.2511 | 27.8 | 0.1200 |
| 7 | 11-690 | 5 | 0.2511 | 27.8 | -0.0200 |

Title: BUFFALO RIVER C. TENTANS SURVIVAL
File: BRCS2 Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

---

D = 0.6560
W = 0.9797

Critical W = 0.9170 (alpha = 0.01 , N = 39)
W = 0.9390 (alpha = 0.05 , N = 39)

---

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: BUFFALO RIVER C. TENTANS SURVIVAL
File: BRCS2 Transform: NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

---

Calculated B1 statistic = 8.9604 (p-value = 0.2555)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

---

Critical B = 18.4753 (alpha = 0.01, df = 7)
= 14.0671 (alpha = 0.05, df = 7)

---

Using Average Degrees of Freedom
(Based on average replicate size of 4.88)

Calculated B2 statistic = 6.8655 (p-value = 0.4430)

Data PASS B2 homogeneity test at 0.01 level. Continue analysis.

Title: BUFFALO RIVER C. TENTANS SURVIVAL
File: BRCS2 Transform: NO TRANSFORMATION

ANOVA Table

| SOURCE | DF | SS | MS | F |
|---|---|---|---|---|
| Between | 7 | 0.2414 | 0.0345 | 1.6299 |
| Within (Error) | 31 | 0.6560 | 0.0212 | |
| Total | 38 | 0.8974 | | |

(p-value = 0.1640)

Critical F = 3.2806 (alpha = 0.01, df = 7,31)
= 2.3232 (alpha = 0.05, df = 7,31)

Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

Title: BUFFALO RIVER C. TENTANS SURVIVAL
File: BRCS2 Transform: NO TRANSFORMATION

Bonferroni t-Test - TABLE 1 OF 2 Ho: Control<Treatment

| GROUP | IDENTIFICATION | TRANSFORMED MEAN | MEAN CALCULATED IN ORIGINAL UNITS | t STAT | SIG 0.05 |
|---|---|---|---|---|---|
| 1 | WBS | 0.9000 | 0.9000 | | |
| 2 | 11-673 | 0.8000 | 0.8000 | 1.0248 | |
| 3 | 11-658 | 0.8400 | 0.8400 | 0.6149 | |
| 4 | 11-647 | 0.8200 | 0.8200 | 0.8198 | |
| 5 | 11-785 | 0.7000 | 0.7000 | 2.0495 | |
| 6 | 11-780 | 0.9600 | 0.9600 | -0.6149 | |
| 7 | 11-773 | 0.8400 | 0.8400 | 0.6149 | |
| 8 | 11-760 | 0.9400 | 0.9400 | -0.4099 | |

Bonferroni t critical value = 2.5961 (1 Tailed, alpha = 0.05, df = 7,31)

Title: BUFFALO RIVER C. TENTANS SURVIVAL
File: BRCS2 Transform: NO TRANSFORMATION

Bonferroni t-Test - TABLE 2 OF 2 Ho: Control<Treatment

| GROUP | IDENTIFICATION | NUM OF REPS | MIN SIG DIFF (IN ORIG. UNITS) | % OF CONTROL | DIFFERENCE FROM CONTROL |
|---|---|---|---|---|---|
| 1 | WBS | 4 | | | |
| 2 | 11-673 | 5 | 0.2533 | 28.1 | 0.1000 |
| 3 | 11-658 | 5 | 0.2533 | 28.1 | 0.0600 |
| 4 | 11-647 | 5 | 0.2533 | 28.1 | 0.0800 |
| 5 | 11-785 | 5 | 0.2533 | 28.1 | 0.2000 |
| 6 | 11-780 | 5 | 0.2533 | 28.1 | -0.0600 |
| 7 | 11-773 | 5 | 0.2533 | 28.1 | 0.0600 |
| 8 | 11-760 | 5 | 0.2533 | 28.1 | -0.0400 |

Title: BUFFALO RIVER C. TENTANS SURVIVAL
File: BRCS1 Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

---

D = 0.5400
W = 0.9281

Critical W = 0.9080 (alpha = 0.01 , N = 34)
W = 0.9330 (alpha = 0.05 , N = 34)

---

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: BUFFALO RIVER C. TENTANS SURVIVAL
File: BRCS1 Transform: NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

---

Calculated B1 statistic = 11.1143 (p-value = 0.0849)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

---

Critical B = 16.8119 (alpha = 0.01, df = 6)
= 12.5916 (alpha = 0.05, df = 6)

---

Using Average Degrees of Freedom
(Based on average replicate size of 4.86)

Calculated B2 statistic = 8.4167 (p-value = 0.2091)

Data PASS B2 homogeneity test at 0.01 level. Continue analysis.

Title: BUFFALO RIVER C. TENTANS AFDW
File: BRAFDW1 Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

---

D = 0.7493
W = 0.9549

Critical W = 0.9080 (alpha = 0.01 , N = 34)
W = 0.9330 (alpha = 0.05 , N = 34)

---

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: BUFFALO RIVER C. TENTANS AFDW
File: BRAFDW1 Transform: NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

---

Calculated B1 statistic = 10.0784 (p-value = 0.1214)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

---

Critical B = 16.8119 (alpha = 0.01, df = 6)
= 12.5916 (alpha = 0.05, df = 6)

---

Using Average Degrees of Freedom
(Based on average replicate size of 4.86)

Calculated B2 statistic = 7.4030 (p-value = 0.2852)

Data PASS B2 homogeneity test at 0.01 level. Continue analysis.

Title: BUFFALO RIVER C. TENTANS AFDW
File: BRAFDW1 Transform: NO TRANSFORMATION

ANOVA Table

| SOURCE | DF | SS | MS | F |
|---|---|---|---|---|
| Between | 6 | 1.6351 | 0.2725 | 9.8203 |
| Within (Error) | 27 | 0.7493 | 0.0278 | |
| Total | 33 | 2.3844 | | |

(p-value = 0.0000)

Critical F = 3.5580 (alpha = 0.01, df = 6,27)
= 2.4591 (alpha = 0.05, df = 6,27)

Since F > Critical F REJECT Ho: All equal (alpha = 0.05)

Title: BUFFALO RIVER C. TENTANS AFDW
File: BRAFDW1 Transform: NO TRANSFORMATION

Bonferroni t-Test - TABLE 1 OF 2 Ho: Control<Treatment

| GROUP | IDENTIFICATION | TRANSFORMED MEAN | MEAN CALCULATED IN ORIGINAL UNITS | t STAT | SIG 0.05 |
|---|---|---|---|---|---|
| 1 | WBS | 1.4400 | 1.4400 | | |
| 2 | 11-695 | 0.8720 | 0.8720 | 5.0828 | * |
| 3 | 11-733 | 1.5100 | 1.5100 | -0.6264 | |
| 4 | 11-730 | 1.1620 | 1.1620 | 2.4877 | |
| 5 | 11-712 | 1.2460 | 1.2460 | 1.7360 | |
| 6 | 11-610 | 1.5500 | 1.5500 | -0.9843 | |
| 7 | 11-690 | 1.2900 | 1.2900 | 1.3423 | |

Bonferroni t critical value = 2.5525 (1 Tailed, alpha = 0.05, df = 6,27)

Title: BUFFALO RIVER C. TENTANS AFDW
File: BRAFDW1 Transform: NO TRANSFORMATION

Bonferroni t-Test - TABLE 2 OF 2 Ho: Control<Treatment

| GROUP | IDENTIFICATION | NUM OF REPS | MIN SIG DIFF (IN ORIG. UNITS) | % OF CONTROL | DIFFERENCE FROM CONTROL |
|---|---|---|---|---|---|
| 1 | WBS | 4 | | | |
| 2 | 11-695 | 5 | 0.2852 | 19.8 | 0.5680 |
| 3 | 11-733 | 5 | 0.2852 | 19.8 | -0.0700 |
| 4 | 11-730 | 5 | 0.2852 | 19.8 | 0.2780 |
| 5 | 11-712 | 5 | 0.2852 | 19.8 | 0.1940 |
| 6 | 11-610 | 5 | 0.2852 | 19.8 | -0.1100 |
| 7 | 11-690 | 5 | 0.2852 | 19.8 | 0.1500 |

Title: BUFFALO RIVER C. TENTANS AFDW
File: BRAFDW2 Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

---

D = 1.5643
W = 0.9765

Critical W = 0.9170 (alpha = 0.01 , N = 39)
W = 0.9390 (alpha = 0.05 , N = 39)

---

Data PASS normality test (alpha = 0.01). Continue analysis.

pg 84 of 87

Title: BUFFALO RIVER C. TENTANS AFDW
File: BRAFDW2 Transform: NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

---

Calculated B1 statistic = 10.5935 (p-value = 0.1574)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

---

Critical B = 18.4753 (alpha = 0.01, df = 7)
= 14.0671 (alpha = 0.05, df = 7)

---

Using Average Degrees of Freedom
(Based on average replicate size of 4.88)

Calculated B2 statistic = 7.9524 (p-value = 0.3368)

Data PASS B2 homogeneity test at 0.01 level. Continue analysis.

Title: BUFFALO RIVER C. TENTANS AFDW
File: BRAFDW2 Transform: NO TRANSFORMATION

ANOVA Table

| SOURCE | DF | SS | MS | F |
|---|---|---|---|---|
| Between | 7 | 0.5144 | 0.0735 | 1.4562 |
| Within (Error) | 31 | 1.5643 | 0.0505 | |
| Total | 38 | 2.0787 | | |

(p-value = 0.2193)

Critical F = 3.2806 (alpha = 0.01, df = 7,31)
= 2.3232 (alpha = 0.05, df = 7,31)

Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

Title: BUFFALO RIVER C. TENTANS AFDW
File: BRAFDW2 Transform: NO TRANSFORMATION

Bonferroni t-Test - TABLE 1 OF 2 Ho: Control<Treatment

| GROUP | IDENTIFICATION | TRANSFORMED MEAN | MEAN CALCULATED IN ORIGINAL UNITS | t STAT | SIG 0.05 |
|---|---|---|---|---|---|
| 1 | WBS | 1.4400 | 1.4400 | | |
| 2 | 11-673 | 1.3440 | 1.3440 | 0.6371 | |
| 3 | 11-658 | 1.4380 | 1.4380 | 0.0133 | |
| 4 | 11-647 | 1.6300 | 1.6300 | -1.2609 | |
| 5 | 11-785 | 1.2520 | 1.2520 | 1.2476 | |
| 6 | 11-780 | 1.5580 | 1.5580 | -0.7831 | |
| 7 | 11-773 | 1.4880 | 1.4880 | -0.3185 | |
| 8 | 11-760 | 1.5380 | 1.5380 | -0.6503 | |

Bonferroni t critical value = 2.5961 (1 Tailed, alpha = 0.05, df = 7,31)

Title: BUFFALO RIVER C. TENTANS AFDW
File: BRAFDW2 Transform: NO TRANSFORMATION

Bonferroni t-Test - TABLE 2 OF 2 Ho: Control<Treatment

| GROUP | IDENTIFICATION | NUM OF REPS | MIN SIG DIFF (IN ORIG. UNITS) | % OF CONTROL | DIFFERENCE FROM CONTROL |
|---|---|---|---|---|---|
| 1 | WBS | 4 | | | |
| 2 | 11-673 | 5 | 0.3912 | 27.2 | 0.0960 |
| 3 | 11-658 | 5 | 0.3912 | 27.2 | 0.0020 |
| 4 | 11-647 | 5 | 0.3912 | 27.2 | -0.1900 |
| 5 | 11-785 | 5 | 0.3912 | 27.2 | 0.1880 |
| 6 | 11-780 | 5 | 0.3912 | 27.2 | -0.1180 |
| 7 | 11-773 | 5 | 0.3912 | 27.2 | -0.0480 |
| 8 | 11-760 | 5 | 0.3912 | 27.2 | -0.0980 |

# Attachment C

## Sediment Material Analysis

# McCALLUM
## TESTING LABORATORIES, INC.
*Geotechnical Engineering, Materials Testing & Environmental Services*


**October 24, 2005**

**Engineering and Environment, Inc.**
195 S. Rosemont Road
Suite 118
Virginia Beach, VA 23452

Attention: **Fred Kozminski**

Subject: **Laboratory Test Results**
Sediment Material Analysis
Buffalo River
Buffalo, New York
MTL Project 057051

Dear **Mr. Kozminski:**

**McCallum Testing Laboratories, Inc.** is pleased to present this report of laboratory testing performed on the sediment material obtained by representatives of Engineering and Environment, Inc. and received by this office on September 9, 2005, for the above referenced project. Included in this report are:

1) The Results of Particle Size Analysis of Soils Tests;
2) The Results of Specific Gravity of Soils Tests;
3) Particle Size Analysis of Soils Test Curves; and
4) Chain-Of-Custody Record & Analytical Request Form No. 48178.

Should you have any questions concerning this report, please do not hesitate to contact this office at your earliest convenience.

Very truly yours,

**McCALLUM TESTING LABORATORIES, INC.**

**Peter J. Keane**
**Laboratory Supervisor**

COMMONWEALTH OF VIRGINIA
DAVID P. REDIGER
No. 039562
10/24/05
PROFESSIONAL ENGINEER

**David P. Rediger, P.E.**
**Geotechnical Engineer**


*1808 HAYWARD AVENUE, CHESAPEAKE, VA 23320 ✦ P.O. BOX 13337, CHESAPEAKE, VA 23325-0337*
*PHONE (757) 420-2520 ✦ FAX (757) 424-2874*

## *McCALLUM TESTING LABORATORIES, INC.*

**LABORATORY TEST RESULTS**
**SEDIMENT MATERIAL ANALYSIS**
**BUFFALO RIVER**
**BUFFALO, NEW YORK**
**MTL PROJECT 05-7051**

| PARTICLE SIZE ANALYSIS OF SOILS TEST (ASTM D 422) | | | | | |
|---|---|---|---|---|---|
| PARTICLE SIZE DISTRIBUTION | SAMPLE IDENTIFICATION - SAMPLES RECEIVED 9/8/05 | | | | |
| | 11-610-00-C00 | 11-647-00-C00 | 11-658-00-L00 | 11-673-00-L00 | 11-690-00-C00 |
| % CLAY (<0.005 mm) | 28.7 | 30.5 | 30.4 | 24.4 | 21.9 |
| % SILT (0.005-0.075 mm) | 68.0 | 69.3 | 67.8 | 58.4 | 68.6 |
| % FINE SAND (0.075-0.425 mm) | 3.0 | 0.2 | 1.8 | 12.4 | 9.2 |
| % MEDIUM SAND (0.425-2.00 mm) | 0.2 | 0.0 | 0.0 | 3.1 | 0.2 |
| % COARSE SAND (2.00-4.75 mm) | 0.1 | 0.0 | 0.0 | 1.7 | 0.1 |
| % FINE GRAVEL (4.75-19.0 mm) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| % COARSE GRAVEL (19.0-76.2 mm) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| % COBBLES (>76.2 mm) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SPECIFIC GRAVITY OF SOILS TEST (ASTM D 854) | | | | | |
| SPECIFIC GRAVITY | 2.64 | 2.66 | 2.63 | 2.62 | 2.63 |

## *McCALLUM TESTING LABORATORIES, INC.*

**LABORATORY TEST RESULTS**
**SEDIMENT MATERIAL ANALYSIS**
**BUFFALO RIVER**
**BUFFALO, NEW YORK**
**MTL PROJECT 05-7051**

| PARTICLE SIZE ANALYSIS OF SOILS TEST (ASTM D 422) | | | | |
|---|---|---|---|---|
| PARTICLE SIZE DISTRIBUTION | SAMPLE IDENTIFICATION - SAMPLES RECEIVED 9/8/05 | | | |
| | 11-695-00-R00 | 11-712-00-L00 | 11-730-00-R00 | 11-733-00-L00 |
| % CLAY (<0.005 mm) | 28.5 | 28.4 | 26.9 | 24.4 |
| % SILT (0.005-0.075 mm) | 55.1 | 68.9 | 60.5 | 64.9 |
| % FINE SAND (0.075-0.425 mm) | 15.2 | 2.6 | 12.1 | 10.1 |
| % MEDIUM SAND (0.425-2.00 mm) | 1.0 | 0.1 | 0.4 | 0.6 |
| % COARSE SAND (2.00-4.75 mm) | 0.2 | 0.0 | 0.1 | 0.0 |
| % FINE GRAVEL (4.75-19.0 mm) | 0.0 | 0.0 | 0.0 | 0.0 |
| % COARSE GRAVEL (19.0-76.2 mm) | 0.0 | 0.0 | 0.0 | 0.0 |
| % COBBLES (>76.2 mm) | 0.0 | 0.0 | 0.0 | 0.0 |
| SPECIFIC GRAVITY OF SOILS TEST (ASTM D 854) | | | | |
| SPECIFIC GRAVITY | 2.65 | 2.66 | 2.62 | 2.61 |

## *McCALLUM TESTING LABORATORIES, INC.*

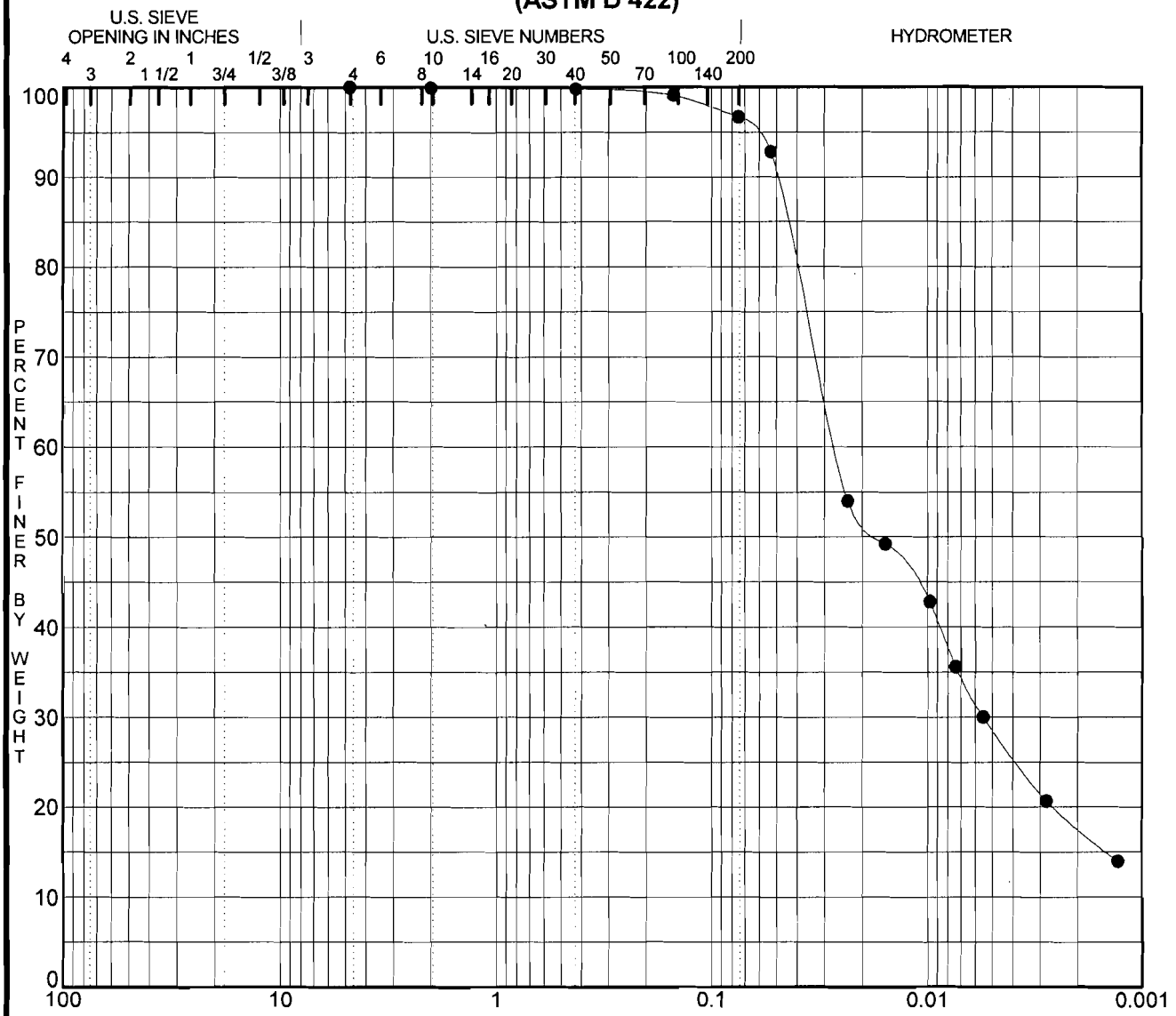
**LABORATORY TEST RESULTS**
**SEDIMENT MATERIAL ANALYSIS**
**BUFFALO RIVER**
**BUFFALO, NEW YORK**
**MTL PROJECT 05-7051**

| PARTICLE SIZE ANALYSIS OF SOILS TEST (ASTM D 422) | | | | |
|---|---|---|---|---|
| PARTICLE SIZE DISTRIBUTION | SAMPLE IDENTIFICATION - SAMPLES RECEIVED 9/8/05 | | | |
| | 11-760-00-R00 | 11-773-00-R00 | 11-780-00-C00 | 11-785-00-R00 |
| % CLAY (<0.005 mm) | 20.7 | 16.0 | 2.6 | 0.0 |
| % SILT (0.005-0.075 mm) | 51.2 | 35.9 | 8.2 | 0.3 |
| % FINE SAND (0.075-0.425 mm) | 28.1 | 46.4 | 25.5 | 27.7 |
| % MEDIUM SAND (0.425-2.00 mm) | 0.0 | 1.6 | 4.6 | 1.8 |
| % COARSE SAND (2.00-4.75 mm) | 0.0 | 0.1 | 15.3 | 31.4 |
| % FINE GRAVEL (4.75-19.0 mm) | 0.0 | 0.0 | 39.7 | 30.4 |
| % COARSE GRAVEL (19.0-76.2 mm) | 0.0 | 0.0 | 4.1 | 8.4 |
| % COBBLES (>76.2 mm) | 0.0 | 0.0 | 0.0 | 0.0 |
| SPECIFIC GRAVITY OF SOILS TEST (ASTM D 854) | | | | |
| SPECIFIC GRAVITY | 2.63 | 2.62 | 2.66 | 2.67 |

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
### (ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | 11-610-00-C00 | Gray, fine sandy clayey silt, ML | --- | --- | --- | --- | | |

| | Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | 11-610-00-C00 | 4.75 | 0.03 | 0.02 | 0.005 | | 0.0 | 3.3 | 68.0 | 28.7 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

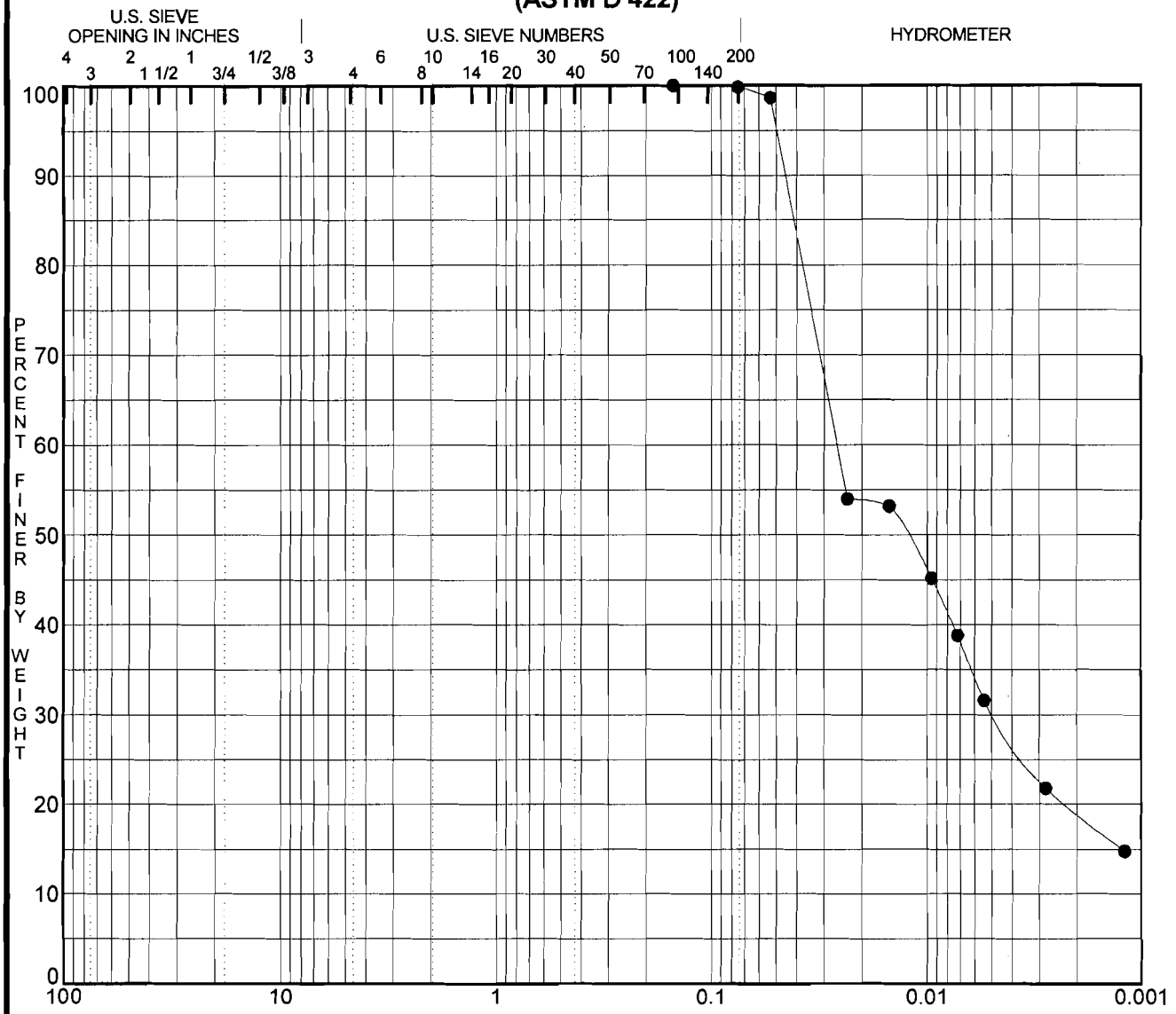
JOB NO. **05-7051**

DATE **11/29/05**

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
### (ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | 11-647-00-C00 | Gray, fine sandy clayey silt, ML | --- | --- | --- | --- | | |

| | Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | 11-647-00-C00 | 0.15 | 0.03 | 0.01 | 0.005 | | 0.0 | 0.2 | 69.3 | 30.5 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

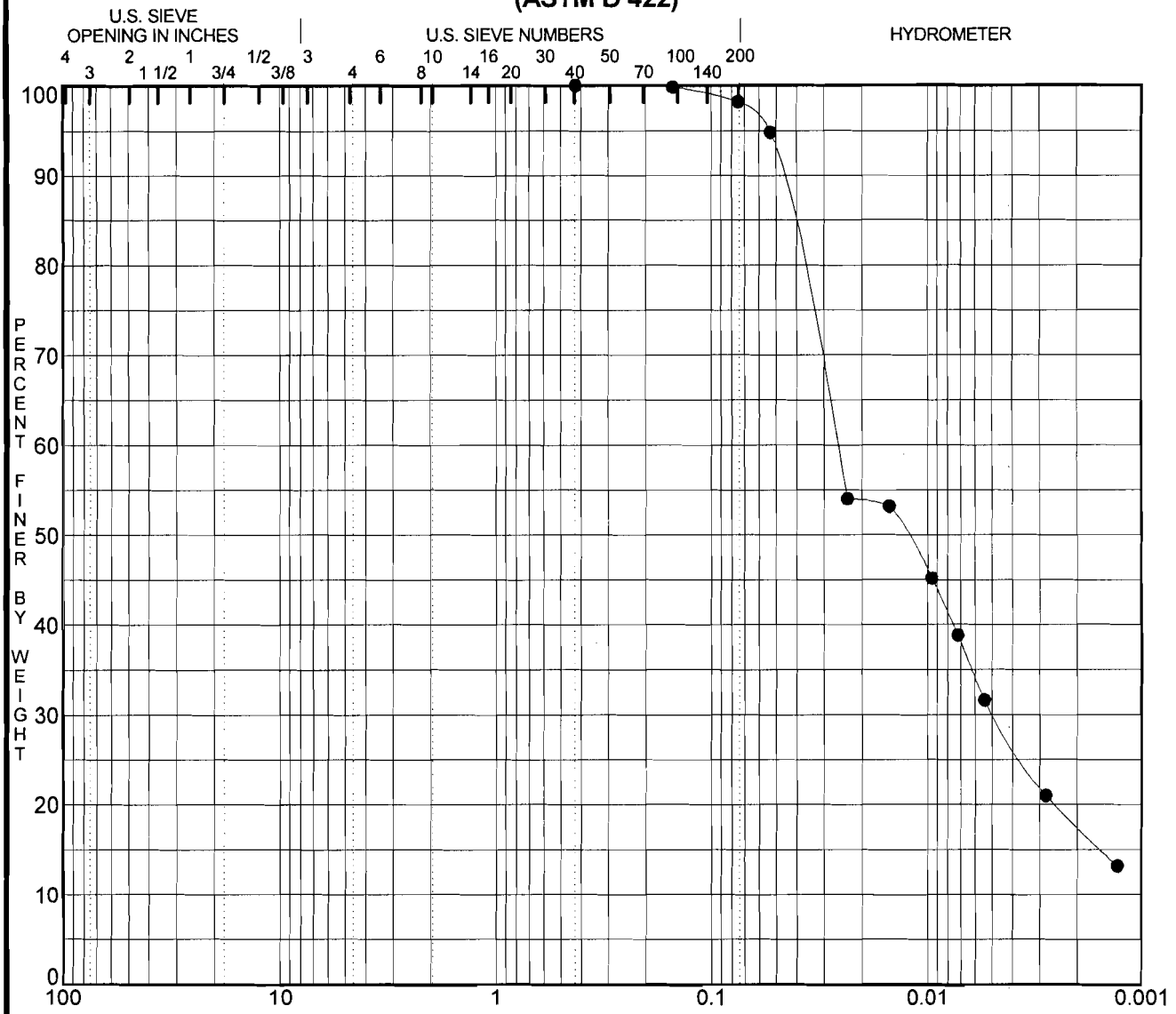
JOB NO. **05-7051**

DATE **11/29/05**

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
### (ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | 11-658-00-L00 | Gray, fine sandy clayey silt, ML | --- | --- | --- | --- | | |

| | Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | 11-658-00-L00 | 0.43 | 0.03 | 0.01 | 0.005 | | 0.0 | 1.8 | 67.8 | 30.4 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

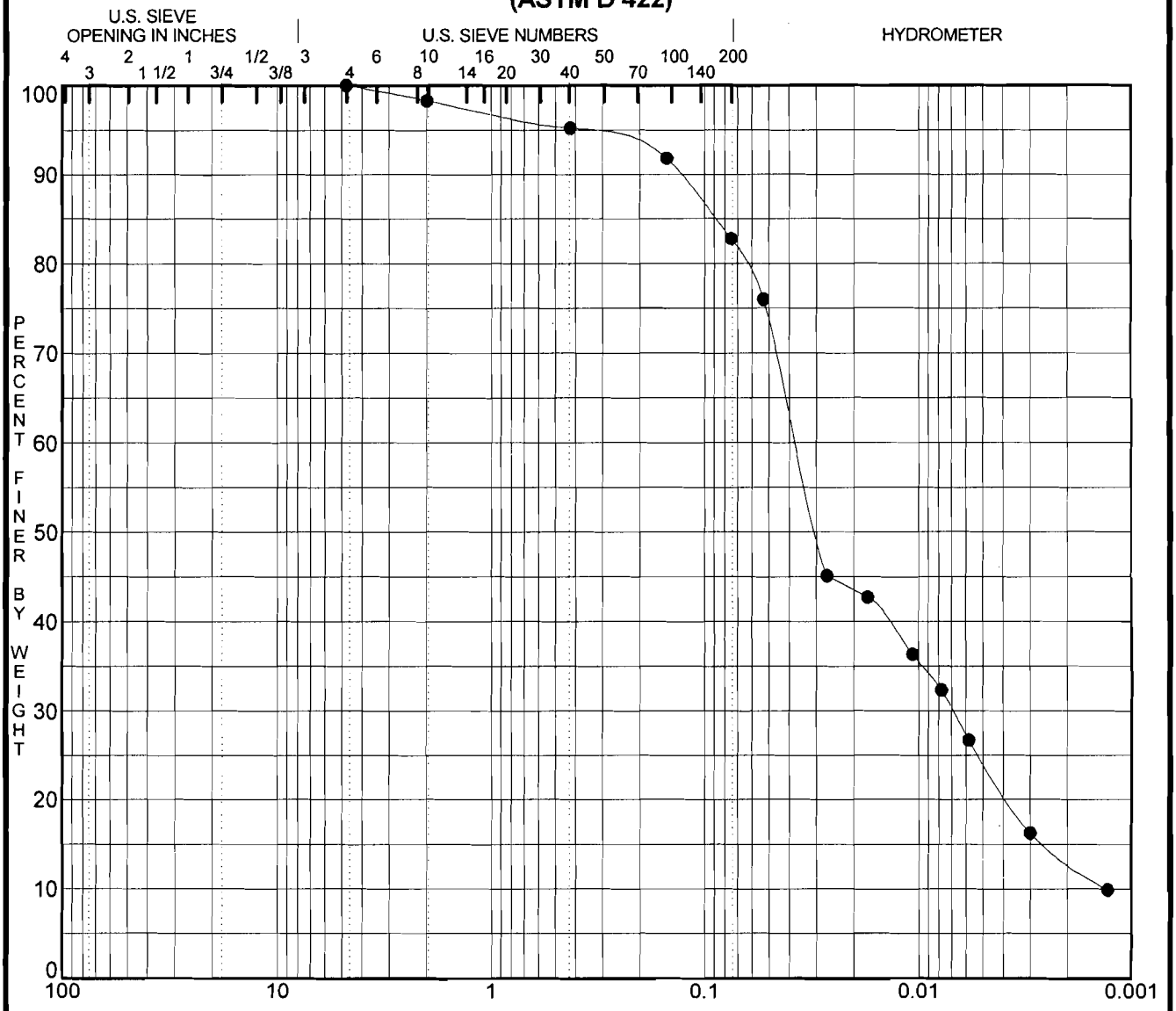
JOB NO. **05-7051**

DATE **11/29/05**

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
### (ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | 11-673-00-L00 | Gray, silty fine to medium sandy clay with traces of coarse sand, CL | --- | --- | --- | --- | 0.97 | 28.2 |

| | Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | 11-673-00-L00 | 4.75 | 0.04 | 0.03 | 0.007 | 0.0013 | 0.0 | 17.2 | 58.4 | 24.4 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

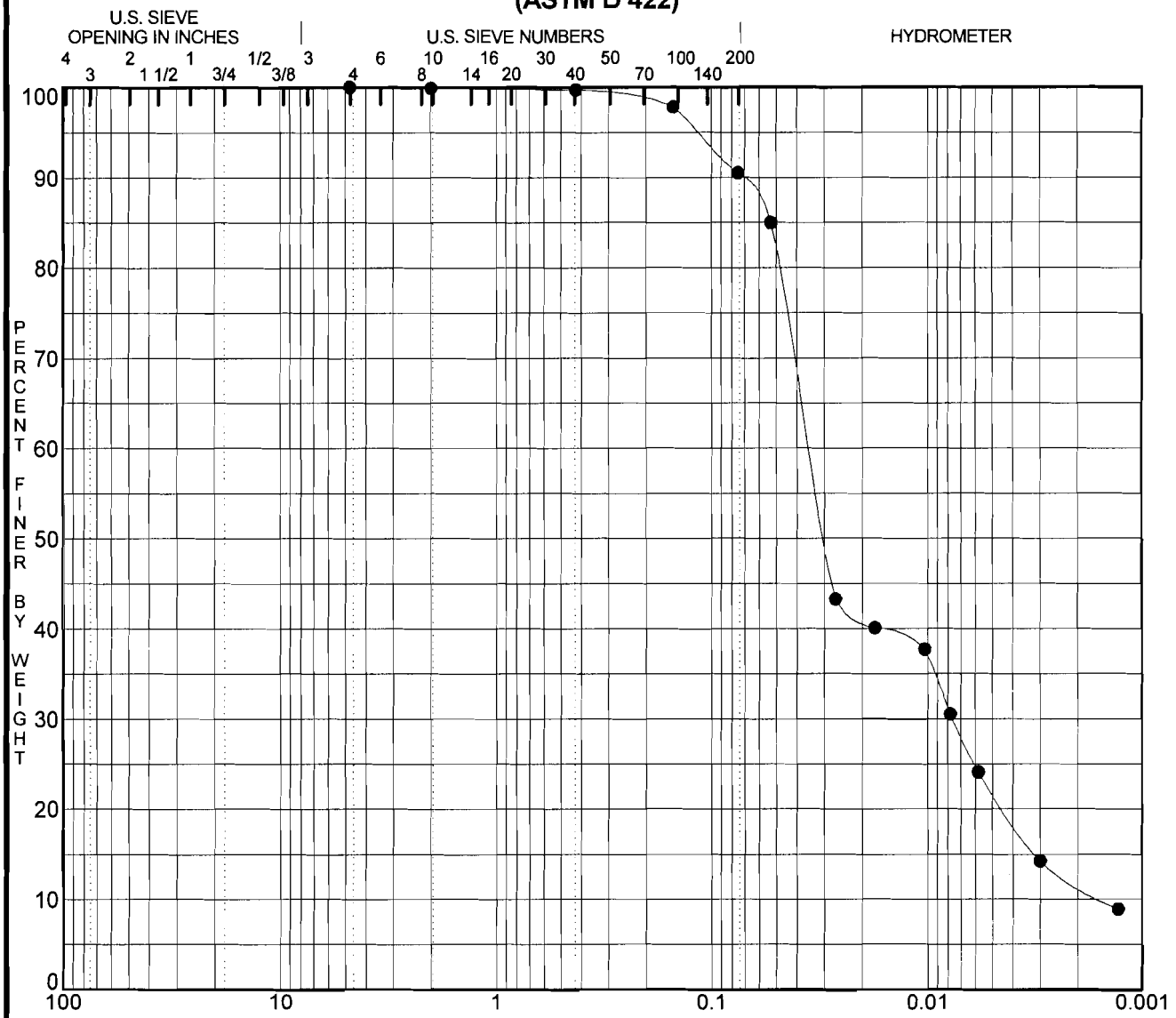
JOB NO. **05-7051**

DATE **11/29/05**

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
### (ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | 11-690-00-C00 | Gray, fine sandy clayey silt, ML | --- | --- | --- | --- | 1.07 | 22.8 |

| | Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | 11-690-00-C00 | 4.75 | 0.04 | 0.03 | 0.008 | 0.0015 | 0.0 | 9.5 | 68.6 | 21.9 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

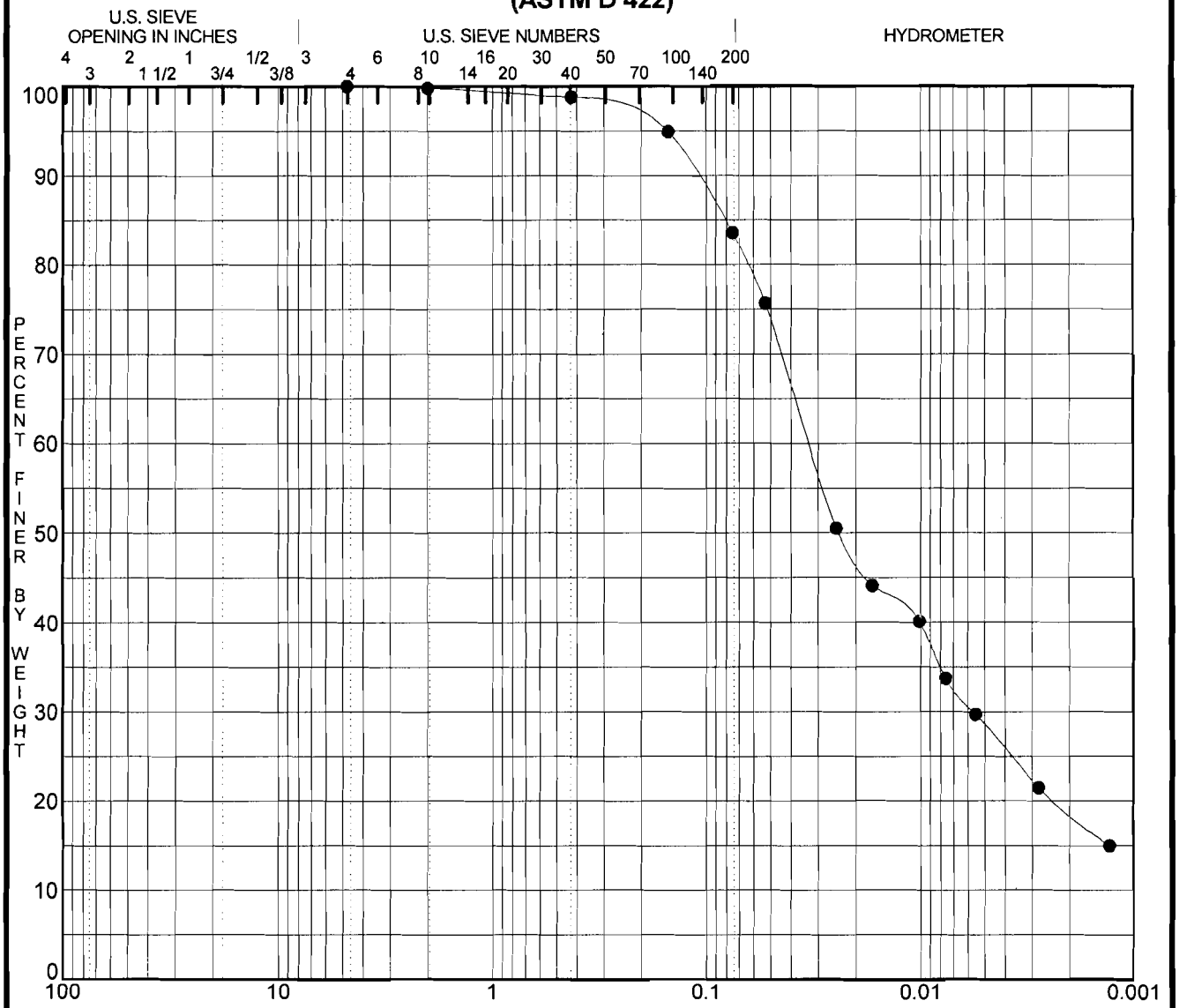
JOB NO. **05-7051**

DATE **11/29/05**

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
### (ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | 11-695-00-R00 | Gray, silty fine sandy clay with traces of medium sand, CL | --- | --- | --- | --- | | |

| | Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | 11-695-00-R00 | 4.75 | 0.03 | 0.02 | 0.006 | | 0.0 | 16.4 | 55.1 | 28.5 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

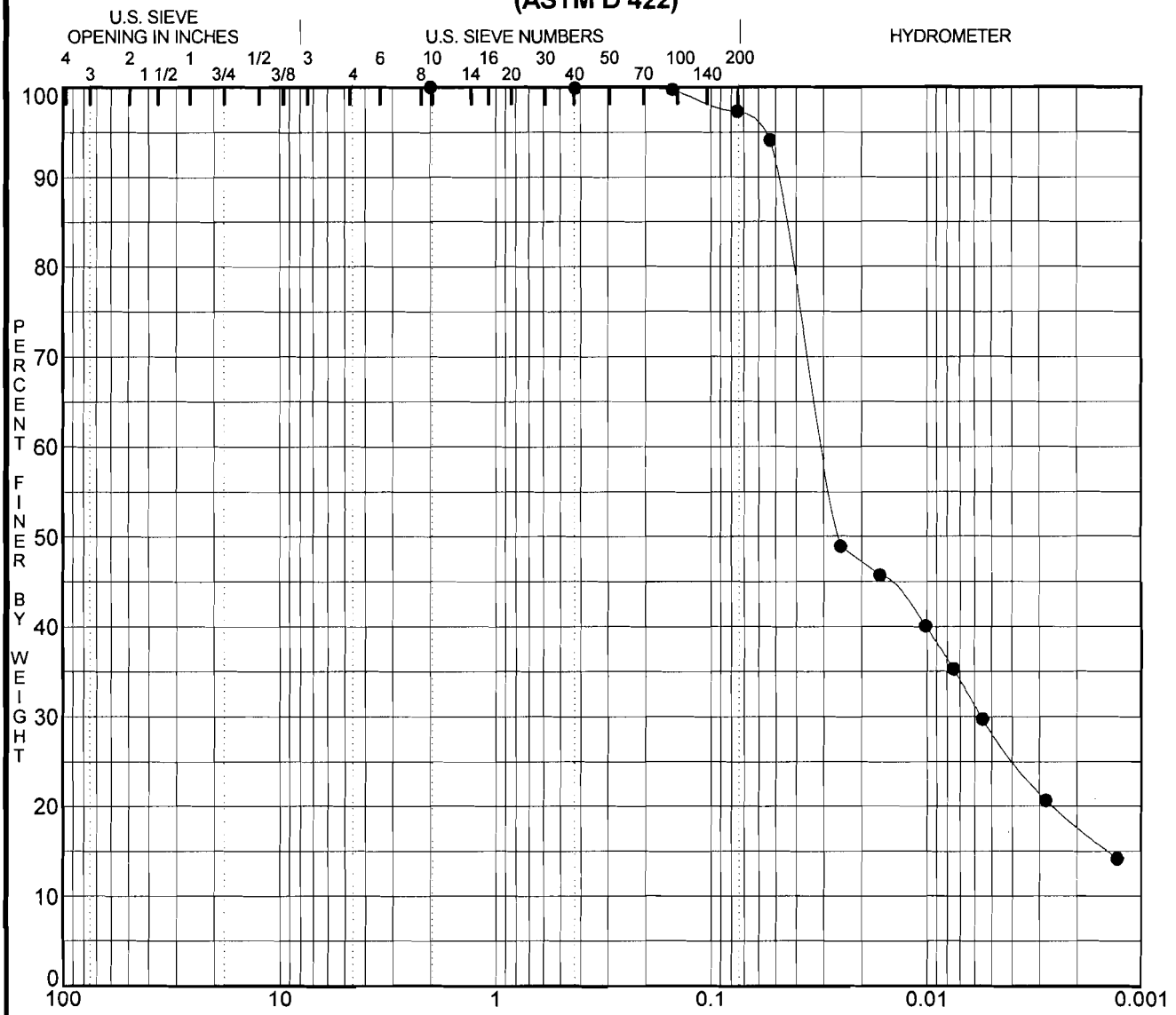
JOB NO. **05-7051**

DATE **11/29/05**

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
### (ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | 11-712-00-L00 | Gray, fine sandy clayey silt, ML | --- | --- | --- | --- | | |

| | Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | 11-712-00-L00 | 2.00 | 0.03 | 0.03 | 0.006 | | 0.0 | 2.7 | 68.9 | 28.4 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

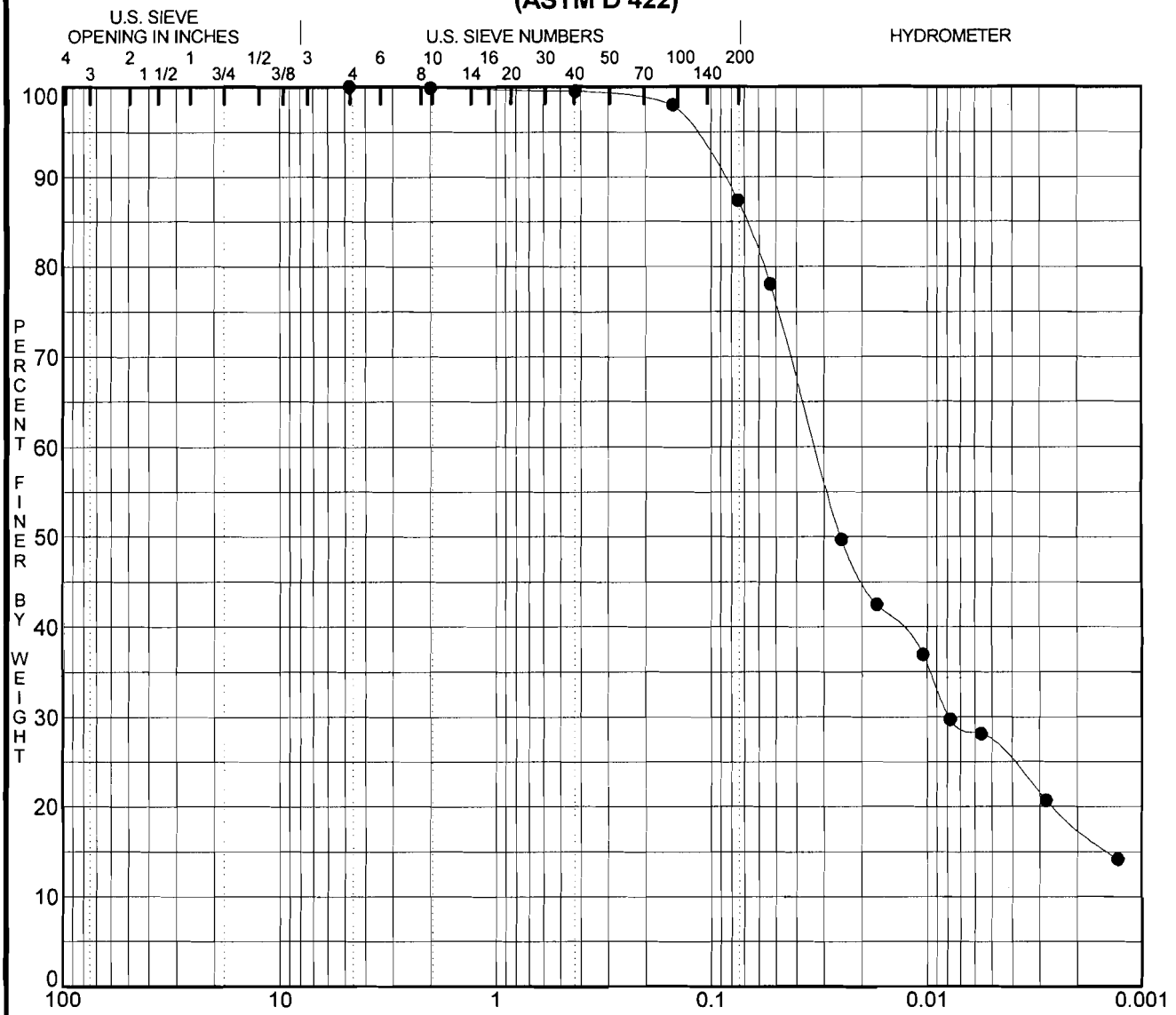
JOB NO. **05-7051**

DATE **11/29/05**

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
### (ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | 11-730-00-R00 | Gray, silty fine sandy clay, CL | --- | --- | --- | --- | | |

| | Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | 11-730-00-R00 | 4.75 | 0.03 | 0.03 | 0.008 | | 0.0 | 12.6 | 60.5 | 26.9 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

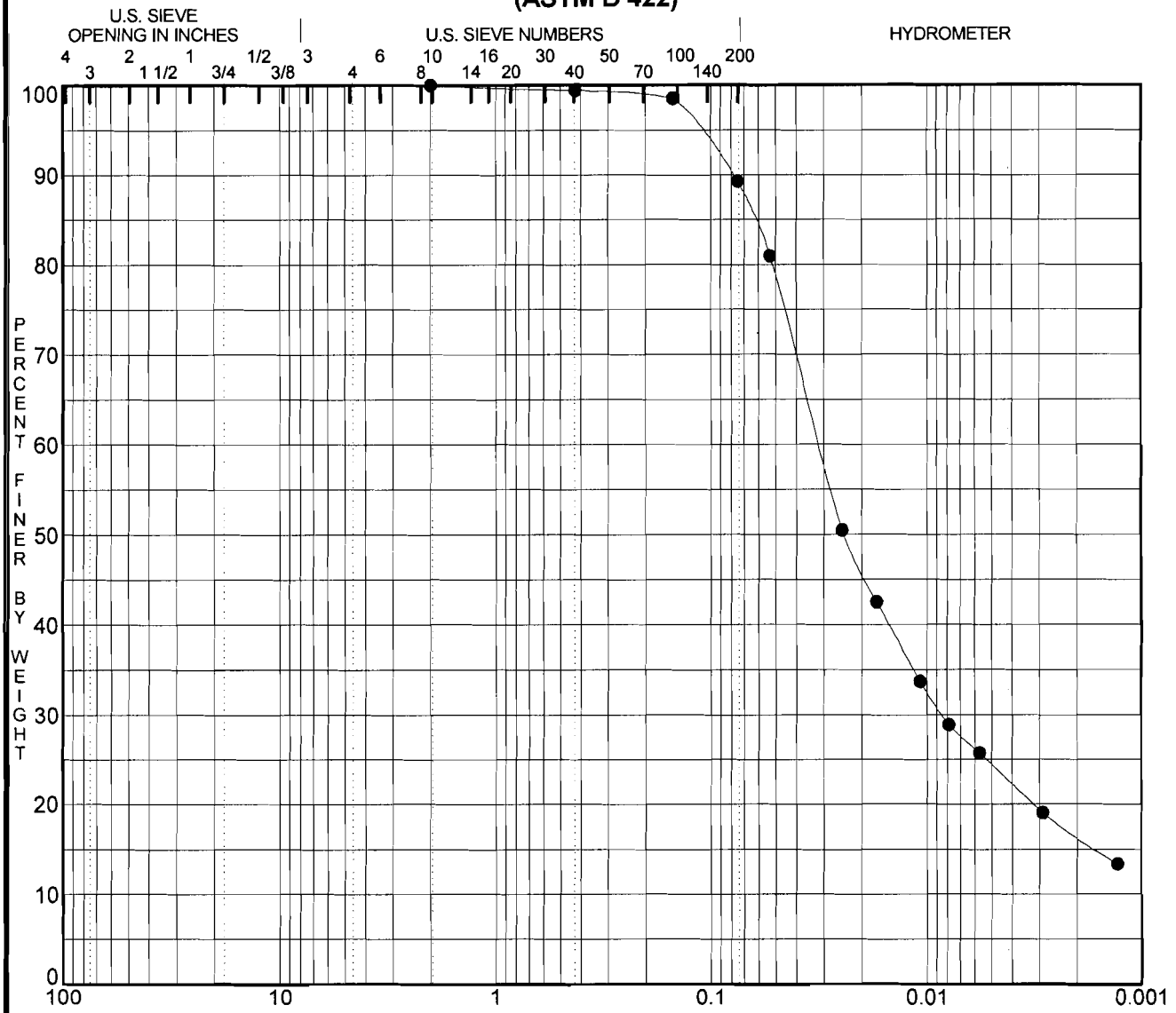
JOB NO. **05-7051**

DATE **11/29/05**

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
### (ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | 11-733-00-L00 | Gray, silty fine sandy clay, CL | --- | --- | --- | --- | | |

| | Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | 11-733-00-L00 | 2.00 | 0.03 | 0.02 | 0.008 | | 0.0 | 10.7 | 64.9 | 24.4 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

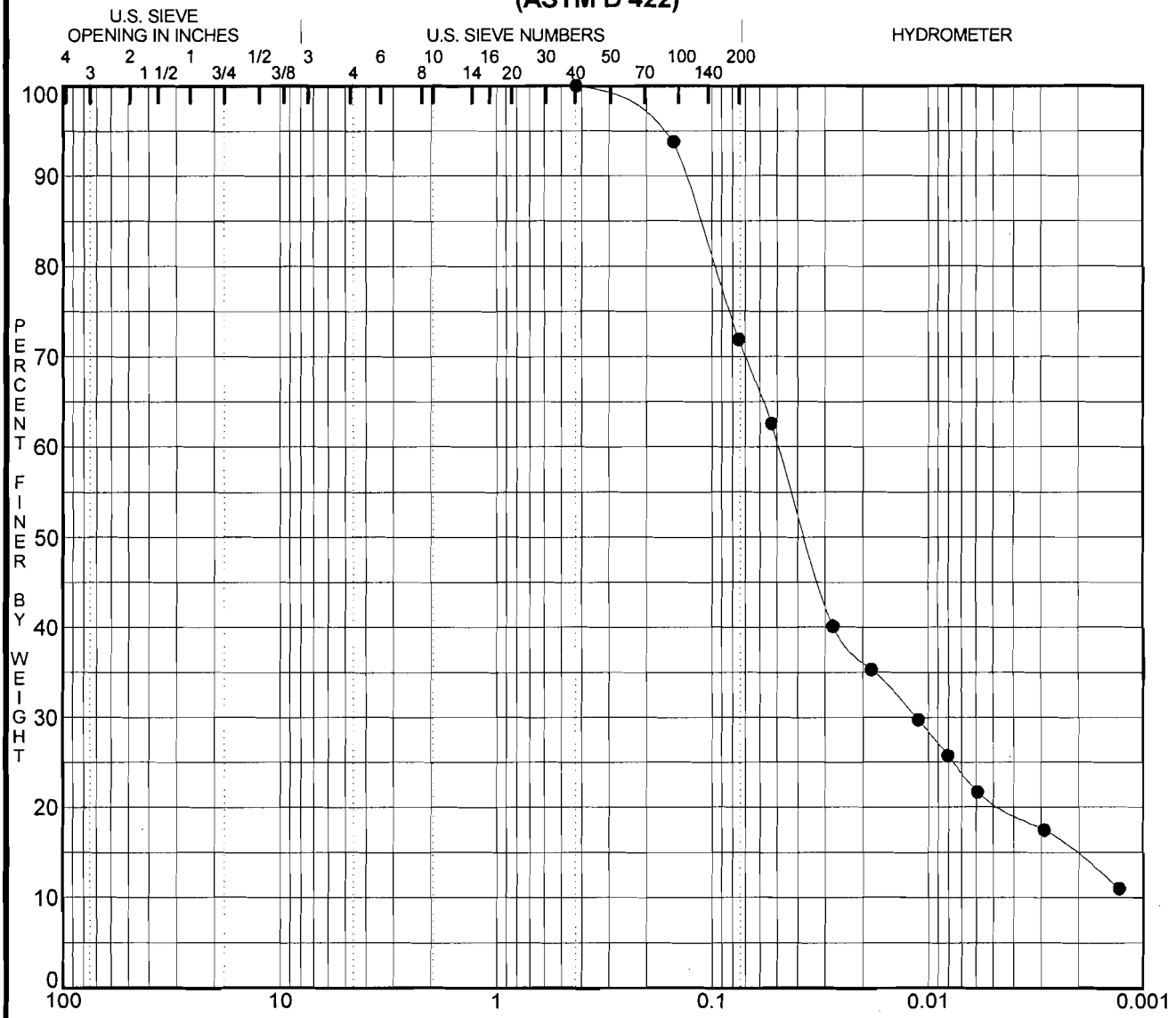
JOB NO. **05-7051**

DATE **11/29/05**

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
### (ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|
| ● 11-760-00-R00 | Gray, silty fine sandy clay, CL | --- | --- | --- | --- | | |

| Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|
| ● 11-760-00-R00 | 0.43 | 0.05 | 0.04 | 0.011 | | 0.0 | 28.1 | 51.2 | 20.7 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

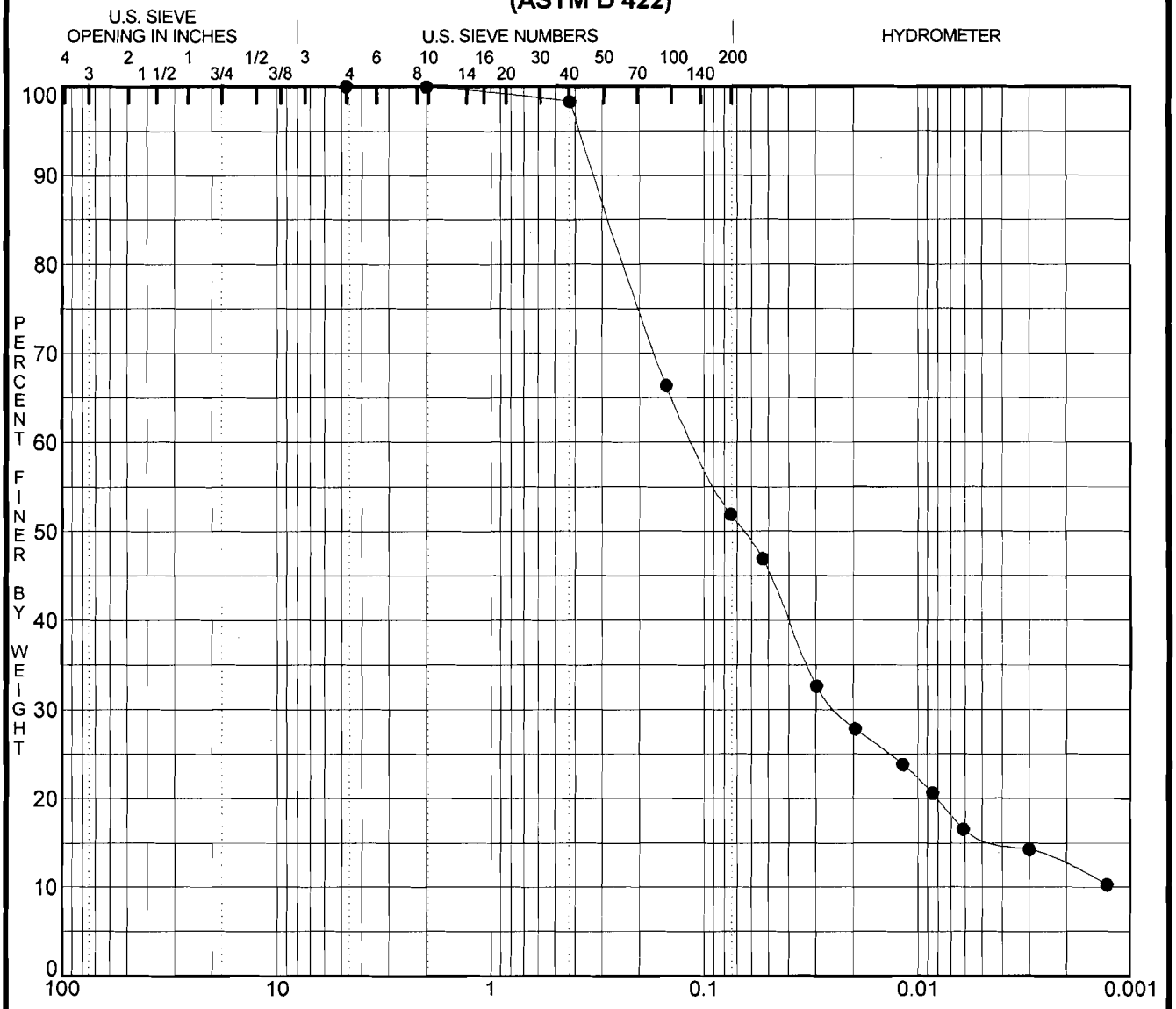
JOB NO. **05-7051**

DATE **11/29/05**

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
### (ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | 11-773-00-R00 | Gray, silty clayey fine sand with traces of medium sand, SC | --- | --- | --- | --- | | |

| | Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | 11-773-00-R00 | 4.75 | 0.11 | 0.07 | 0.024 | | 0.0 | 48.1 | 35.9 | 16.0 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

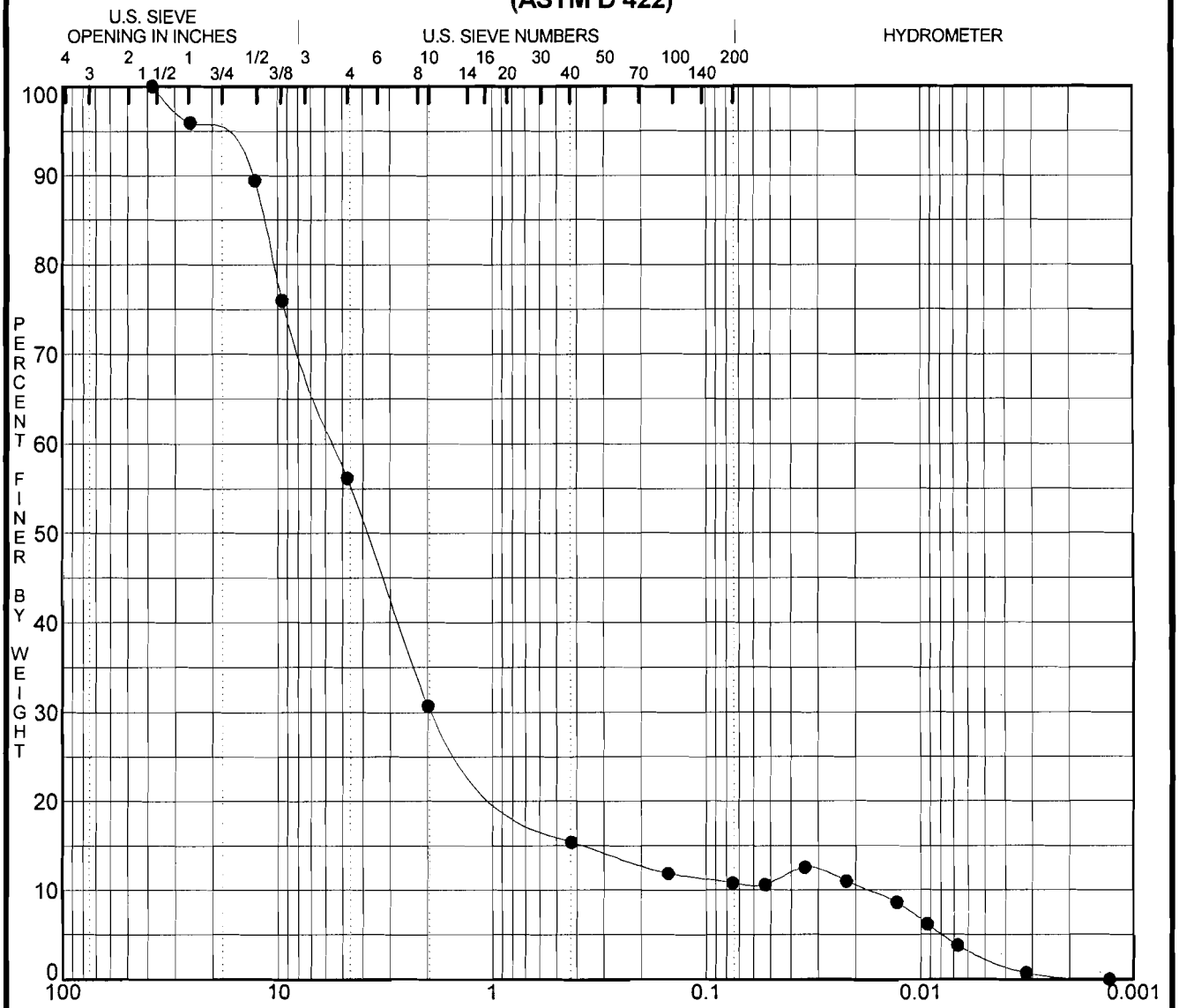
JOB NO. **05-7051**

DATE **11/29/05**

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
### (ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | 11-780-00-C00 | Gray, silty fine to coarse sand with gravel, SP-SM | --- | --- | --- | --- | 18.44 | 156.4 |

| | Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | 11-780-00-C00 | 38.10 | 5.43 | 3.85 | 1.863 | 0.0347 | 43.8 | 45.4 | 8.2 | 2.6 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

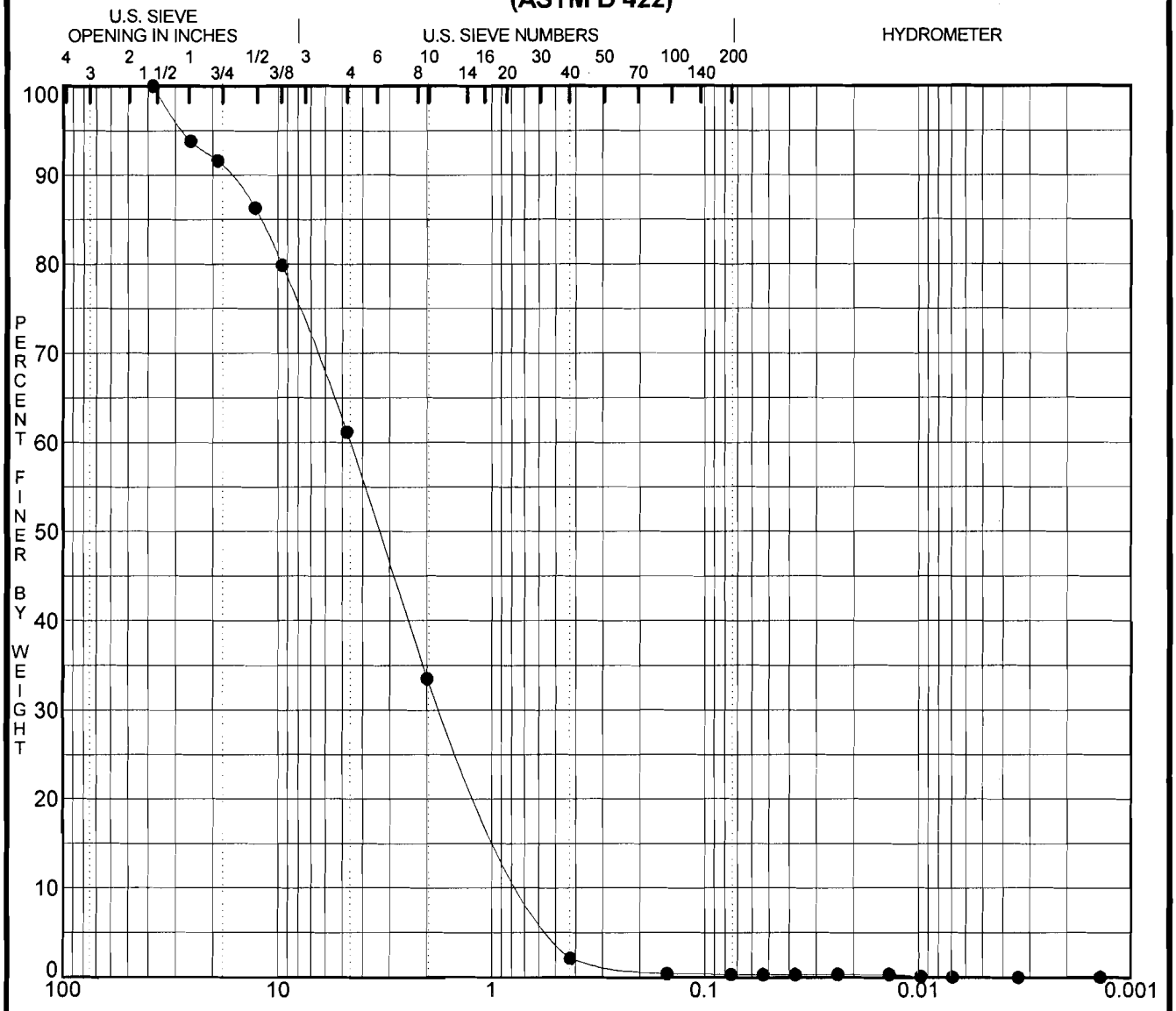
JOB NO. **05-7051**

DATE **11/29/05**

# McCallum Testing Laboratories, Inc.

1808 Hayward Avenue, Chesapeake, VA 23320

## PARTICLE SIZE ANALYSIS
(ASTM D 422)




| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | 11-785-00-R00 | Gray, fine to coarse sand with gravel, SP | --- | --- | --- | --- | 0.99 | 7.3 |

| | Specimen Identification | $D_{100}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | 11-785-00-R00 | 38.10 | 4.58 | 3.35 | 1.683 | 0.6275 | 38.8 | 60.9 | 0.3 | 0.0 |

PROJECT **Sediment Material Analysis - Buffalo River, Buffalo, New York**

JOB NO. **05-7051**

DATE **11/29/05**

# Attachment D

## Pore Water pH and Ammonia Analysis

ASci Corporation
Environmental Testing Laboratory

September 22, 2005

Mr. Fred Kozminski
EEI
Rosemont Interstate Ctr. 1
#118 195 S Rosemont Rd
Virginia Beach, VA 23462

Dear Fred,

Enclosed please find the table summarizing pore water pH and ammonia levels for Buffalo River sediments. Test sediments were centrifuged at 5000 RPM for 15 minutes and the supernatant was measured for the two requested analytes. I have also enclosed the invoice for this project.

If you have any questions, please call.

Respectfully,

Kurt Anderson
Senior Biologist
ASci-Environmental Testing Laboratory

Enc.

Laboratory Testing & Environmental Services
NELAP Certification #E87636
4444 AIRPARK BLVD. • DULUTH, Minnesota 55811 • PH 218-722-4040 • FX 218-722-2592
EMAIL: etl@ascicorp.com • WEBSITE: www.ascicorp.com

Pore Water pH and Ammonia for Buffalo River Sediments

| Site ID | pH | Ammonia (N:NH3) mg/L |
|---|---|---|
| **West Bearskin** | 5.40 | 6.5 |
| **11-785-0R00** | 7.44 | 1.2 |
| **11-647-0R00** | 7.23 | 50.3 |
| **11-673-0R00** | 7.13 | 7.1 |
| **11-712-0R00** | 7.02 | 40.0 |
| **11-690-0R00** | 7.16 | 25.6 |
| **11-658-0R00** | 6.97 | 29.2 |
| **11-733-0R00** | 6.95 | 31.5 |
| **11-780-0R00** | 6.87 | 4.3 |
| **11-773-0R00** | 6.99 | 8.8 |
| **11-760-0R00** | 6.92 | 22.4 |
| **11-610-0R00** | 7.05 | 27.0 |
| **11-730-0R00** | 7.08 | 17.5 |
| **11-695-0R00** | 7.22 | 15.1 |

**Pore Water Values for Buffalo River Sediments**

**SEDIMENTS During 10-Day C. tentans Exposures**

| Analyte | West Bearskin | 11-785-0R00 | 11-647-0R00 | 11-673-0R00 | 11-712-0R00 | 11-690-0R00 | 11-658-0R00 | 11-733-0R00 | 11-780-0R00 | 11-773-0R00 |
|---|---|---|---|---|---|---|---|---|---|---|
| pH | 5.40 | 7.44 | 7.23 ~~7.30~~ | 7.13 | 7.02 | 7.14 | 6.97 | 6.95 | 6.87 | 6.99 |
| NH3 | 6.5 | 1.2 | 50.3 | 7.1 | 40.0 | 25.6 | 29.2 | 31.5 | 4.3 | 8.8 |

| Analyte | 11-780-0R00 | 11-773-0R00 | 11-760-0R00 | 11-785-0R00 | 11-610-0R00 | 11-730-0R00 | 11-695-0R00 |
|---|---|---|---|---|---|---|---|
| pH | | | 6.92 ~~7.05~~ | 7.44 | 7.05 | 7.08 | 7.22 |
| NH3 | | | 22.4 | | 27.0 | 17.5 | 15.1 |

CALIBRATED AT 1830 AT 23.9

US Army Corps of Engineers
Buffalo District

# Chain of Custody Record

COC No.: BufRiv-2
Page 1 of 1 Date: 9/7/05

Name: USACE - Buffalo District
Address: 1776 Niagara Street
Phone Number: (716) 879-4431
Project Manager: Byron Rupp
Project Name: Buffalo River.
Job/Contract/P.O. #: Engineering & Environment
Sampler (Signature) (Printed Name) Jay Miller

Laboratory Name: ASCI Corporation
Address: Duluth MN 55811
Phone:
Contact: Kurt Anderson

| Field Sample # | Container Type | # Jars | Date | Time | Matrix | Metals | PAHs | Pesticides/PCBs | TOC | Dioxin/Furan | Mirex | Elutriate | Elutriate Water | Particle Size | Hyalella azteca | Chironomus tentans | Lumbriculus variegatus | Pore water pH | Pore water $NH_3$ | OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-695-00-R00 | 1 gal | 1 | 9/6/05 | 14:34 | sed | | | | | | | | | | X | X | | X | X | |
| 11-733-00-L00 | 1 gal | 1 | 9/6/05 | 14:15 | sed | | | | | | | | | | X | X | | X | X | |
| 11-730-00-R00 | 1 gal | 1 | 9/6/05 | 14:20 | sed | | | | | | | | | | X | X | | X | X | |
| 11-712-00-L00 | 1 gal | 1 | 9/6/05 | 14:29 | sed | | | | | | | | | | X | X | | X | X | |

Subtotal Number of Containers:

Preservatives for above requested parameters:
A. C.
B. D.

Methods for above requested parameters:

| Relinquished by | Date | Received by | Date |
|---|---|---|---|
| David Melfi (Signature) | 9/7/05 | (Signature) | 9/8/05 |
| David Melfi (Printed Name) | Time 9:52 | CLAYTON ALLEN (Printed Name) | Time 1010 |
| USACE (Company) | | ASCI (Company) | |
| Relinquished by | Date | Received by | Date |
| (Signature) | | (Signature) | |
| (Printed Name) | Time | (Printed Name) | Time |
| (Company) | | (Company) | |

Shipment Method:
Airbill No.:

USACE Location

US Army Corps of Engineers
Buffalo District

# Chain of Custody Record

COC No.: BufRiv-4
Page 1 of
Date: 9/7/05

Name: USACE - Buffalo District
Address: 1776 Niagara Street
Phone Number: (716) 879-4431
Project Manager: Byron Rupp
Project Name: Buffalo River
Job/Contract/P.O. #: Engineering & Environment
Sampler (Signature) (Printed Name) Jay Miller

Laboratory Name: ASCI Corporation
Address: Duluth MN 55811
Phone:
Contact: Kurt Anderson

| Field Sample # | Container Type | # Jars | Date | Time | Matrix | Metals | PAHs | Pesticides/PCBs | TOC | Dioxin/Furan | Mirex | Elutriate | Elutriate Water | Particle Size | Hyalella azteca | Chironomus tentans | Lumbriculus variegatus | Pore water pH | Pore water NH3 | OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-610-00-C00 | 1 gallon | 1 | 9/6/05 | 15:16 | Sed | | | | | | | | | | x | x | | x | x | |

Requested Parameters

Subtotal Number of Containers:

Preservatives for above requested parameters:
A. C.
B. D.

Methods for above requested parameters:

| Relinquished by | Date | Received by | Date |
|---|---|---|---|
| David Melfi (Signature) | 9/7/05 | (Signature) | 9/8/05 |
| David Melfi (Printed Name) | Time 10:10 | CLAYTON ALLEN (Printed Name) | Time 10:0 |
| USACE (Company) | | ASCI (Company) | |
| Relinquished by | Date | Received by | Date |
| (Signature) | | (Signature) | |
| (Printed Name) | Time | (Printed Name) | Time |
| (Company) | | (Company) | |

Shipment Method:
Airbill No.:

USACE Location

US Army Corps of Engineers
Buffalo District

# Chain of Custody Record

COC No.: BufRiv-3

Page 1 of 1 Date: 9/7/05

Name: USACE - Buffalo District
Address: 1776 Niagara Street
Phone Number: (716) 879-4431
Project Manager: Byron Rupp
Project Name: Buffalo River
Job/Contract/P.O. #: Engineering & Environment
Sampler (Signature): [signature] (Printed Name): Jay Miller

Laboratory Name: ASCI Corporation
Address: Duluth MN 55811
Phone:
Contact: Kurt Anderson

| Field Sample # | Container Type | # Jars | Date | Time | Matrix | Metals | PAHs | Pesticides/PCBs | TOC | Dioxin/Furan | Mirex | Elutriate | Elutriate Water | Particle Size | *Hyalella azteca* | *Chironomus tentans* | *Lumbriculus variegatus* | Pore water pH | Pore water $NH_3$ | OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-690-00-C00 | 1 gal | 1 | 9/6/05 | 14:49 | sed | | | | | | | | | | X | X | | X | X | |
| 11-673-00-L00 | 1 gal | 1 | 9/6/05 | 14:54 | sed | | | | | | | | | | X | X | | X | X | |
| 11-658-00-L00 | 1 gal | 1 | 9/6/05 | 15:02 | sed | | | | | | | | | | X | X | | X | X | |
| 11-647-00-C00 | 1 gal | 1 | 9/6/05 | 15:08 | sed | | | | | | | | | | X | X | | X | X | |

Requested Parameters

| Relinquished by | Date | Received by | Date |
|---|---|---|---|
| David Melfi (Signature) | 9/7/05 | [signature] (Signature) | 9/8/05 |
| David Melfi (Printed Name) | Time 10:05 | CLAYTON ALLEN (Printed Name) | Time 10:10 |
| USACE (Company) | | ASCI (Company) | |
| Relinquished by | Date | Received by | Date |
| Signature | | Signature | |
| Printed Name | Time | Printed Name | Time |
| Company | | Company | |

Subtotal Number of Containers:

Preservatives for above requested parameters:
A. C.
B. D.

Methods for above requested parameters:

Shipment Method:
Airbill No.:

USACE Location

US Army Corps of Engineers
Buffalo District

# Chain of Custody Record

COC No.: BufRiv-1

Page 1 of 1 Date: 9/7/05

Name: USACE - Buffalo District
Address: 1776 Niagara Street
Phone Number: (716) 879-4431
Project Manager: Byron Rupp
Project Name: Buffalo River
Job/Contract/P.O. #: Engineering & Environment
Sampler (Signature) (Printed Name) Jay Miller

Laboratory Name: ASCI Corporation
Address: 4444 Airpark Blvd
~~Phone~~ Duluth MN 55811
Contact: Kurt Anderson

| Field Sample # | Container Type | # Jars | Date | Time | Matrix | Metals | PAHs | Pesticides/PCBs | TOC | Dioxin/Furan | Mirex | Elutriate | Elutriate Water | Particle Size | Hyalella azteca | Chironomus tentans | Lumbriculus variegatus | pore water pH | pore water ammonia | OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-785-00-R00 | 1 gal | 1 | 9/6/05 | 13:45 | sed | | | | | | | | | | X | X | | X | X | |
| 11-780-00-C00 | 1 gal | 1 | 9/6/05 | 13:53 | sed | | | | | | | | | | X | X | | X | X | |
| 11-773-00-R00 | 1 gal | 1 | 9/6/05 | 13:55 | sed | | | | | | | | | | X | X | | X | X | |
| 11-760-00-R00 | 1 gal | 1 | 9/6/05 | 14:10 | sed | | | | | | | | | | X | X | | X | X | |

Subtotal Number of Containers:

Preservatives for above requested parameters:
A. C.
B. D.

Methods for above requested parameters:

| Relinquished by | Date | Received by | Date |
|---|---|---|---|
| David Melfi (Signature) | 9/7/05 | (Signature) | 9/8/05 |
| David Melfi (Printed Name) | Time 9:40 | CLAYTON ALLEN (Printed Name) | Time 1010 |
| USACE (Company) | | ASCI (Company) | |
| Relinquished by | Date | Received by | Date |
| Signature | | Signature | |
| Printed Name | Time | Printed Name | Time |
| Company | | Company | |

Shipment Method:
Airbill No.:

USACE Location

# Attachment E

## Ecology & Environment - Data Validation Summary Report

ecology and environment, inc.
International Specialists in the Environment

BUFFALO CORPORATE CENTER
368 Pleasant View Drive, Lancaster, New York 14086
Tel: 716/684-8060, Fax: 716/684-0844

March 2, 2006

Mr. Gregory Sutton
New York State Department of Environmental Conservation
Region 9, Buffalo
Division of Environmental Remediation
270 Michigan Avenue
Buffalo, NY 14203-2999

**Re: Data Validation Summary Report**
**Buffalo River Sediment Sampling Project, Site #NA**
**Work Assignment D003493-61**

Dear Mr. Sutton:

Ecology and Environment Engineering, P.C. (EEEPC) is pleased to submit the following data validation summary report for Work Assignment #D003493-61 for work with the Buffalo River Sediment Sampling Project. A compact disk of the other related information will be provided under separate cover.

EEEPC is pleased to provide these services to the Department. If you have any questions or comments, please call me or Mike Morgante at 716-684-8060.

Sincerely,

Marcia Meredith Galloway

Marcia Meredith Galloway
Project Manager

Attachments

cc: M. Morgante (EEEPC)


recycled paper

# DATA VALIDATION SUMMARY REPORT
# WA D003493-61 - FEBRUARY 2006

## Introduction

Ecology and Environment Engineering P.C. (EEEPC) performed data validation of Buffalo River Sediment Sampling project in accordance with the work plan (EEEPC October 2005). The data validation was performed under contract to New York State Department of Environmental Conservation (NYSDEC) work assignment WA D003493-61. The tasks completed for this project include:

- **Automated Data Review (ADR) Set-up** – EEEPC set up the ADR software for all analytical parameters and quality control (QC) criteria according to the Quality Assurance Project Plan (QAPP) provided by NYSDEC. EEEPC provided the libraries to the project laboratories, Severn Trent Laboratories (STL)-Buffalo and STL-Burlington for pre-validation of their electronic data deliverable (EDD) submittals.

- **Completeness** - EEEPC performed a completeness check on all EDDs and compared the data to the hard copy deliverable to verify the data were reported consistently.

- **Compliance** - EEEPC processed EDDs using the ADR software to verify the data reported are compliant with the QAPP requirements. EEEPC performed an automated data validation of EDDs and generated reports of qualified data. EEEPC reviewed the ADR reports, checked the hard copy reports and case narratives, verified the automated qualifiers assigned by the program, reviewed calibration information, and developed a data usability summary report (DUSR) for each sample delivery group (SDG).

- **Third Party Data Validation** - EEEPC's third party data validation subcontractor, ChemWorld Environmental, Inc. (ChemWorld), performed an independent hard copy data review on two SDG data packages.

- **Reporting** - EEEPC assigned data qualifiers and flagged all reportable data. EEEPC generated summary tables of final qualified data and revised the data tables per NYSDEC comments. Complete data tables are provided in Attachment A.

- **Data Management** - EEEPC developed a project-specific database with all validated data stored in Microsoft Access format. Data in several electronic formats are provided in Attachment A.

This data validation summary report addresses the results of the data review process for all samples delivered by NYSDEC. This report presents the results of the analytical program and provides a summary of the completeness and quality of the data collected. The purpose of this QCSR is to identify any major issues that may impact data usability. A compact disc (CD) is provided with this report as Attachment A which includes electronic copies of all validation reports and validated data.

## Sampling and Analysis Performed

A total of 272 surface and subsurface samples and 18 surface water samples were reviewed and reported. Samples were collected by NYSDEC from 8/22/2005 to 9/16/2005. No field quality control (QC) samples were collected. Table 1 lists the total samples collected for each station location and depth. Table A-1 in Attachment A provides a listing of samples, as well as the sampling dates, sample depths, and analyses associated with the samples. The analytical methods reviewed also are summarized in Table 2.

**Table 1 Summary of Samples Reviewed**

| Station Location | Depth | Number of Samples |
|---|---|---|
| 1 | SB | 21 |
| 1 | SS | 1 |
| 2 | SB | 55 |
| 2 | SS | 76 |
| 3 | SB | 10 |
| 3 | SS | 14 |
| 4 | SB | 21 |
| 4 | SS | 22 |
| 6 | SB | 46 |
| 6 | SS | 3 |
| 7 | SB | 3 |
| 10 | | 18 |
| **Total Samples** | | **290** |

Key:

SB = Subsuface less than 1 foot.
SS = Surface 0 -1 foot.

**Table 2 Summary of Analysis Reviewed**

| Sample Matrix | Number of Samples | Lab Method ID | Analysis Description |
|---|---|---|---|
| SO | 4 | 310.13 | Petroleum Products Scan |
| SO | 266 | 8082 | Polychlorinated Biphenyls |
| SO | 266 | 415.1_LK | Total Organic Carbon by Lloyd Kahn |
| SO | 266 | 6010B | Metals - Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Nickel, Selenium, Silver, and Zinc |
| SO | 266 | 7471A | Mercury |
| SO | 266 | 8081A | Chlorinated Pesticides |
| SO | 6 | 8260B | Volatile Organic Compounds |
| SO | 266 | 8270C | Semivolatile Organic Compounds |

**Table 2 Summary of Analysis Reviewed**

| Sample Matrix | Number of Samples | Lab Method ID | Analysis Description |
|---|---|---|---|
| AQ | 18 | 8082 | Polychlorinated Biphenyls |
| AQ | 18 | 6010B | Metals - Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Nickel, Selenium, Silver, and Zinc |
| AQ | 18 | 7470A | Mercury |
| AQ | 18 | 8081A | Chlorinated Pesticides |
| AQ | 18 | 8270C | Semivolatile Organic Compounds |

Key:

AQ = Surface water.
SO = Soil.

## Sample Handling and Custody Procedures

All samples were collected by NYSDEC and sent to Severn Trent Laboratories (STL) in Burlington (SVTC) for analysis. A few samples for petroleum products and volatile organic compounds were analyzed by STL Buffalo (STLBUF). Sample collection was documented on the chain-of-custody (COC) and samples were analyzed as specified on the COC. Samples were packaged, shipped and received in good condition at the appropriate temperatures as documented on the Cooler Receipt Form.

The samples were grouped by the STL into SDGs of twenty samples. The SDGs are listed below. A few of the Sample Identifications were incorrect. The Sample Identifications were corrected in the final database and report tables. However, the original sample identifications appear on the laboratory hard copy reports. The sample identification corrections are summarized below.

**Summary of Work Orders**

| Lab Report Batch | Lab Report Date | Lab ID | Data Review Co. |
|---|---|---|---|
| A05-9525 | 11/23/2005 | STLBUF | EEEPC |
| 109801 | 11/30/2005 10:30:00 AM | SVTC | EEEPC |
| 109799 | 11/30/2005 9:51:00 AM | SVTC | EEEPC |
| 109798 | 11/23/2005 3:00:00 PM | SVTC | EEEPC |
| 109731 | 12/7/2005 10:04:00 AM | SVTC | EEEPC |
| 109728 | 11/21/2005 1:46:00 PM | SVTC | EEEPC |
| 109599 | 11/16/2005 4:51:00 PM | SVTC | EEEPC |
| 109566 | 11/15/2005 1:06:00 PM | SVTC | Chemworld |
| 109486 | 11/16/2005 10:14:00 AM | SVTC | EEEPC |
| 109481 | 11/10/2005 9:45:00 AM | SVTC | EEEPC |
| 109469 | 11/10/2005 9:05:00 AM | SVTC | EEEPC |
| 109420 | 11/10/2005 8:51:00 AM | SVTC | Chemworld |
| 109373 | 11/9/2005 5:25:00 PM | SVTC | EEEPC |

**Summary of Work Orders**

| Lab Report Batch | Lab Report Date | Lab ID | Data Review Co. |
|---|---|---|---|
| 109367 | 11/9/2005 5:06:00 PM | SVTC | EEEPC |
| 109347 | 11/9/2005 2:59:00 PM | SVTC | EEEPC |
| 109311 | 10/26/2005 6:15:00 PM | SVTC | EEEPC |
| 109144 | 11/9/2005 1:07:00 PM | SVTC | EEEPC |

**Summary of Client ID Changes**

| Lab Report Batch | Lab Report ID | Corrected ID |
|---|---|---|
| 109311 | 2-680-00-L06 | 2-680-00-R06 |
| 109367 | 2-760-00-R35 | 2-760-00-R06 |
| 109373 | 3-758-00-L23 | 3-728-00-L23 |
| 109481 | 6-705-50-R35 | 6-702-50-R35 |
| 109481 | 6-705-50-R56 | 6-702-50-R56 |

## Laboratory Data

The data quality was evaluated based on sample integrity, holding times, method blank results, spike recoveries, surrogate recoveries, and duplicate precision. A complete sample listing for the samples analyzed is provided in Table A-1 and the associated DUSRs (Attachment A). A copy of the summary data package including the case narrative and COC is provided under a folder with each DUSR. The DUSR includes attached outlier reports from the ADR data validation. The outlier reports list specific analytes outside control limits and associated samples. Many results were reported below reporting limits and flagged "J" as estimated by the laboratory. The results below the reporting limit also are listed as an attachment to the DUSR.

The following section summarizes the major findings of the data validation.

### 1.0 Holding Times

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. Exceeding the holding time for a sample generally results in a loss of the analyte due to a variety of mechanisms, such as deposition on the sample container walls or precipitation.

### Review Results

All samples were analyzed within the project-specified holding time except for several samples for Total Organic Carbon (TOC), a few dilutions, and the following sediment samples. The TOC holding time applied was for waters and there should be no impact on data usability for sediments. The dilutions were run outside analysis holding time with the original analysis within holding times. The associated positive results are flagged J- as estimated bias low. The following samples were extracted well outside holding times. The associated positive results are flagged J- as estimated bias low, but the reporting limits for non-detect results are rejected.

**EE List of Qualifiers - Holding Times**

| Client Sample ID | Sample Matrix | Lab Method ID | Sample Date | Prep Date |
|---|---|---|---|---|
| 4-673-00-L23 | SO | 8270C | 08/30/2005 14:15 | 10/11/2005 11:00 |
| 6-677-00-R35 | SO | 8270C | 08/30/2005 10:10 | 10/03/2005 18:04 |

## 2.0 Blanks

Laboratory blank samples are analyzed and evaluated to determine the existence and magnitude of possible contamination during the sampling and analysis process. Analyte concentrations in the blanks are generally below the practical quantitation limit (PQL). If the analyte is present in the sample at similar trace levels, then the analyte is likely a common background contaminant from some phase of the sampling, extraction, or analytical procedure and associated low level sample concentrations are not considered to be site related. If the analyte concentration is above the PQL, then there is a potential contamination problem and sample results may be biased high or the data unusable.

The analytes found in the method blanks and associated qualified results are presented as an outlier reported attached to the DUSR (if applicable).

### Review Results

All blanks were performed at the required frequency. Several compounds were detected in the method blanks as listed below. The associate sample results were qualified "U" as non-detect and the reporting limits elevated. The organic analytes detected do not have a significant impact on data usability because high levels of other compounds were detected and in many cases reporting limits were elevated due to matrix. Selenium results do impact data usability because of the low screening criteria for selenium in sediment.

**EE List of Qualifiers – Method Blank**

| Lab Method ID | Analyte Name | Number of Samples | Sample Matrix |
|---|---|---|---|
| 6010B | SELENIUM | 21 | SO |
| 8270C | ACETOPHENONE | 16 | SO |
| 8270C | BENZALDEHYDE | 1 | SO |
| 8270C | BIS(2-ETHYLHEXYL) PHTHALATE | 40 | SO |
| 8270C | DIETHYL PHTHALATE | 8 | SO |

## 3.0 Surrogate Spike Recovery

Laboratory performance for individual samples analyzed for organic compounds is established by means of surrogate spiking activities. Samples are spiked with surrogate compounds prior to preparation and analysis. Unusually low or high surrogate recovery values may indicate some deficiency in the analytical system or that some matrix effects exist, resulting in low or high sample results for target compounds. The surrogate results outside QC limits are presented as an outlier reported attached to the DUSR (if applicable).

### Review Results

The recoveries for surrogates were acceptable for most samples. In many cases recoveries were high due to matrix effects that indicated a potential high bias. The high bias will not have a significant impact on data usability. Several samples for PCBs had low surrogate recoveries that resulted in low bias for results (see list below). If PCBs are determined to be contaminant of concern this may impact data usability.

**EE List of Qualifiers – Method Blank**

| Lab Method ID | Sample Matrix | Client Sample ID |
|---|---|---|
| 8082 | SO | 2-725-00-L34 |
| 8082 | SO | 2-775-00-L89 |
| 8082 | SO | 2-780-00-L06 |
| 8082 | SO | 2-780-00-L06 |
| 8082 | SO | 2-780-00-L45 |
| 8082 | SO | 4-648-00-L06 |
| 8082 | SO | 6-608-00-R01 |
| 8082 | SO | 6-608-00-R01 |
| 8082 | SO | 7-645-00-C35 |

## 4.0 Matrix Spike and Matrix Spike Duplicate Analysis

The matrix spike and matrix spike duplicate (MS/MSD) analyses are intended to provide information about the affects that the sample matrix exerts on the digestion/extraction and measurement methodology. MS recovery values that do not meet laboratory QC criteria may indicate that sample analyte results are being attenuated in the analysis procedure. The potential sample bias may be estimated by noting the degree to which the MS concentration was elevated or lowered in the spike analysis. However, this bias should serve only as approximations; sample-specific problems may be the cause of the discrepancy, particularly in soil samples. Recoveries of a post-digestion spike or a laboratory control sample (LCS) are used to verify that the analytical methodology is acceptable and that MS recoveries are due to matrix effects. An MSD analysis is performed to evaluate the precision of the sample results. Precision is measured as the relative percent difference (RPD) between analytical results for duplicate samples. The laboratory's failure to produce similar results for MSD samples may indicate that the samples were non-homogeneous (particularly in soil samples), or that method defects may exist in the laboratory's techniques. The MS results outside QC limits are presented as an outlier reported attached to the DUSR (if applicable).

### Review Results

The MS/MSD sample analyses were performed at the required frequency. All MS/MSD recoveries indicated significant matrix problems that were anticipated with sediment samples. Results for about 30 samples for pesticides, PCBs, and SVOCs were flagged as estimated. The MS/MSD recoveries for pesticides and PCBs indicate a potential low bias that may impact data usability.

For metals analysis, results for selenium in most of the surface waters and twelve sediments were rejected. Results of arsenic, chromium, copper, iron, lead, manganese, zinc, and mercury were flagged as estimated in many samples due to matrix effects.

### 5.0 Laboratory Control Sample Analysis

The LCS is analyzed to monitor the efficiency of the digestion/extraction procedure and analytical instrument operation. The ability of the laboratory to successfully analyze an LCS demonstrates that there are no analytical problems related to the digestion/sample preparation procedures and/or instrument operations. The LCS results outside QC limits are presented as an outlier reported attached to the DUSR (if applicable). Sporadic and marginal QC failures for multiple component methods do not indicate an analytical concern. If recoveries are high and the compounds are not detected in the samples, then no data qualification is required. All recoveries should be above 10% or the non-detect results flagged "UR" as rejected.

### Review Results

All LCS analyses were performed at the required frequency and within control limits except for sporadic failures. One LCS was high for SVOCs in SDG 109801 and one LCS was low for PCBs in SDG 109731. The recoveries were within 50 to 100% and the associated sample results are not significantly impacted. The associated sample results are flagged as estimated with appropriate bias.

## Data Quality Evaluation

Overall the data quality was acceptable and the laboratory analysis and reporting procedures representative of appropriate methodology for sediment samples. The objectives for completeness were above 90% for all samples as summarized below.

| Sample Matrix | Lab Method ID | Total Number of Results | Data Qualifier | | | | | | | | Percent Complete |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | None | J | J- | J+ | NJ | U | UJ | R | |
| AQ | 6010B | 228 | 71 | - | 1 | - | - | 139 | - | 17 | 93% |
| AQ | 7470A | 19 | - | - | - | - | - | 19 | - | - | - |
| AQ | 8081A | 414 | - | - | - | - | - | 412 | 2 | - | - |
| AQ | 8082 | 162 | - | - | - | - | - | 162 | - | - | - |
| AQ | 8270C | 1170 | - | 1 | - | - | - | 1146 | 23 | - | - |
| SO | 310.13 | 28 | 4 | - | - | - | - | 24 | - | - | - |
| SO | 415.1_LK | 280 | 244 | 33 | 3 | - | - | - | - | - | - |
| SO | 6010B | 3348 | 1505 | 1211 | 132 | 140 | - | 274 | 72 | 14 | 100% |
| SO | 7471A | 279 | 128 | 114 | 5 | 13 | - | 13 | 6 | - | - |
| SO | 8081A | 6118 | 332 | 84 | 5 | 38 | 26 | 5326 | 307 | - | - |
| SO | 8082 | 2394 | 301 | 16 | 38 | - | - | 1836 | 203 | - | - |
| SO | 8260B | 285 | 19 | 18 | 4 | 2 | - | 233 | 9 | - | - |
| SO | 8270C | 17292 | 665 | 4045 | 16 | 49 | - | 10962 | 1453 | 102 | 99% |
| **Total** | | 32017 | 3269 | 5522 | 204 | 242 | 26 | 20546 | 2075 | 133 | 100% |

The qualifiers were added to the data in both electronic database and the final report tables. The qualifiers are defined as follows:

J - The qualifier indicates an estimated value because the associated QC data indicated a potential laboratory or matrix problem or interference. In addition, J flags assigned by the laboratory indicate the results are below the practical quantitation limit (PQL), but above the instrument detection limit (IDL) or method detection limit (MDL). A J flag with a "-" indicates negative bias and a J flag with + indicates a positive bias.

NJ – The compound identification is not confirmed and the result is estimated.
U - The result is considered non-detect at the reported value. The laboratory assigned this flag to analytes not present at detectable concentrations (above the IDL or MDL). The data validator assigned this flag when an analyte was considered non-detect due to blank contamination. If the result is above the PQL, the PQL is considered elevated.

UJ – The reported value for the PQL is estimated.

R – The reported value is rejected and not usable for environmental data assessment.

### Data Usability Concerns

Overall the data are usable for the environmental data assessment of the Buffalo River sediment. Laboratory QC concerns did not have a significant impact on the overall completeness and representativeness of the data set.

No problems were noted with the analytical methods used for the samples collected at the site except for the selenium. The selenium method 6010B used for analysis is a general technique for metals. Selenium is subject to matrix and spectral interferences by this method that may result in false positives or rejected data. The usability of the selenium data is questionable. The published criteria for acceptable levels of selenium in sediment and water are low primarily due to the high ecological sensitivity. The data set is not usable for comparison of selenium results to these criteria. If selenium results are critical to future results, a more selective method for achieving low detection levels of selenium should be used.

## Attachment A

Attachment A is CD that contains all the supporting data for the project. The following is list of files or folders included on the CD.

Buffalo River Sediment Study Attachment A Tables – A spreadsheet file that contains Table A-1 Sample Listing Summary, Table A-2 Complete Volatile results, and Table A-3 Complete Surface Water results.

DUSR Folder - Each folder is named for the SDG number assigned by the laboratory. The SDG folder contains the DUSR memo, Attachment 1 with sample listings for that report, and outlier reports. The SDG folder also contains a file named SDSP which contains the summary data package from the laboratory.

Electronic Data Folder – The electronic data folder contains three versions of the final validated data set.

The Electronic Data Management System (EDMS) Database folder contains the original data base that is only accessible from the EDMS program. EDMS is a product developed for the United States Corps of Engineers that stores all the data processed through ADR.

The Access Database folder contains a Microsoft Access database that was replicated from EDMS.

The Electronic Data, Comma Delimited Format folder contains a flat file data dump of the final validated data set.