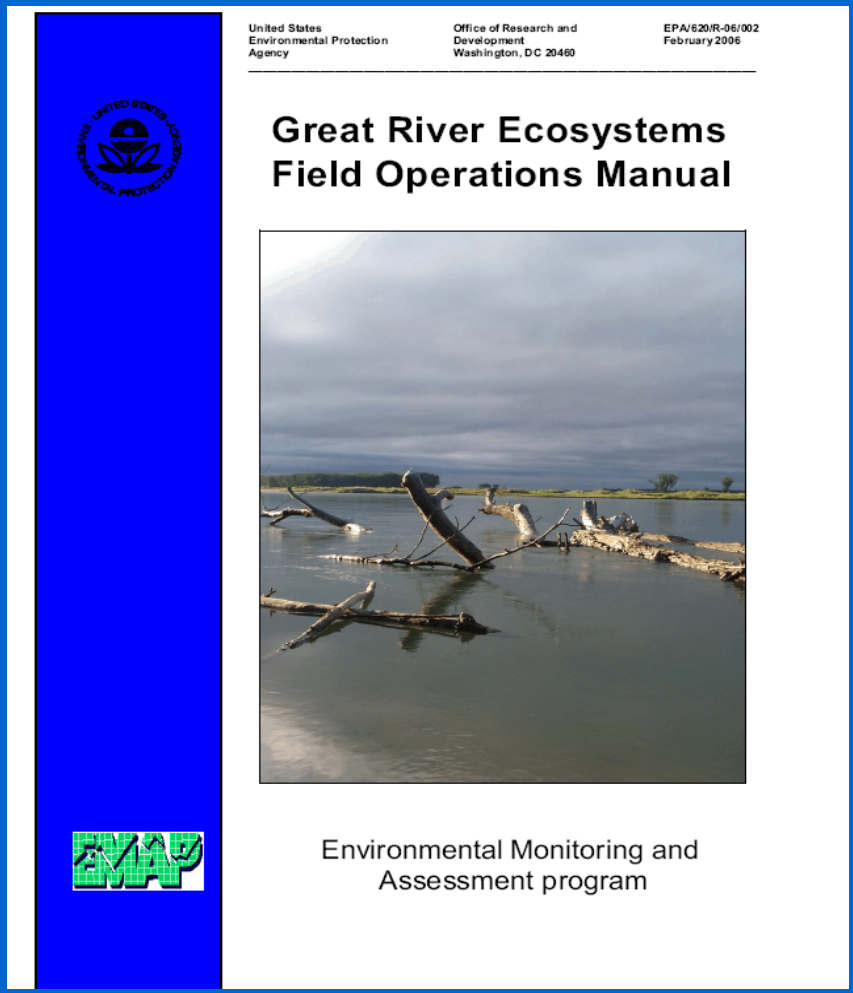
Restoring America's Greatest River

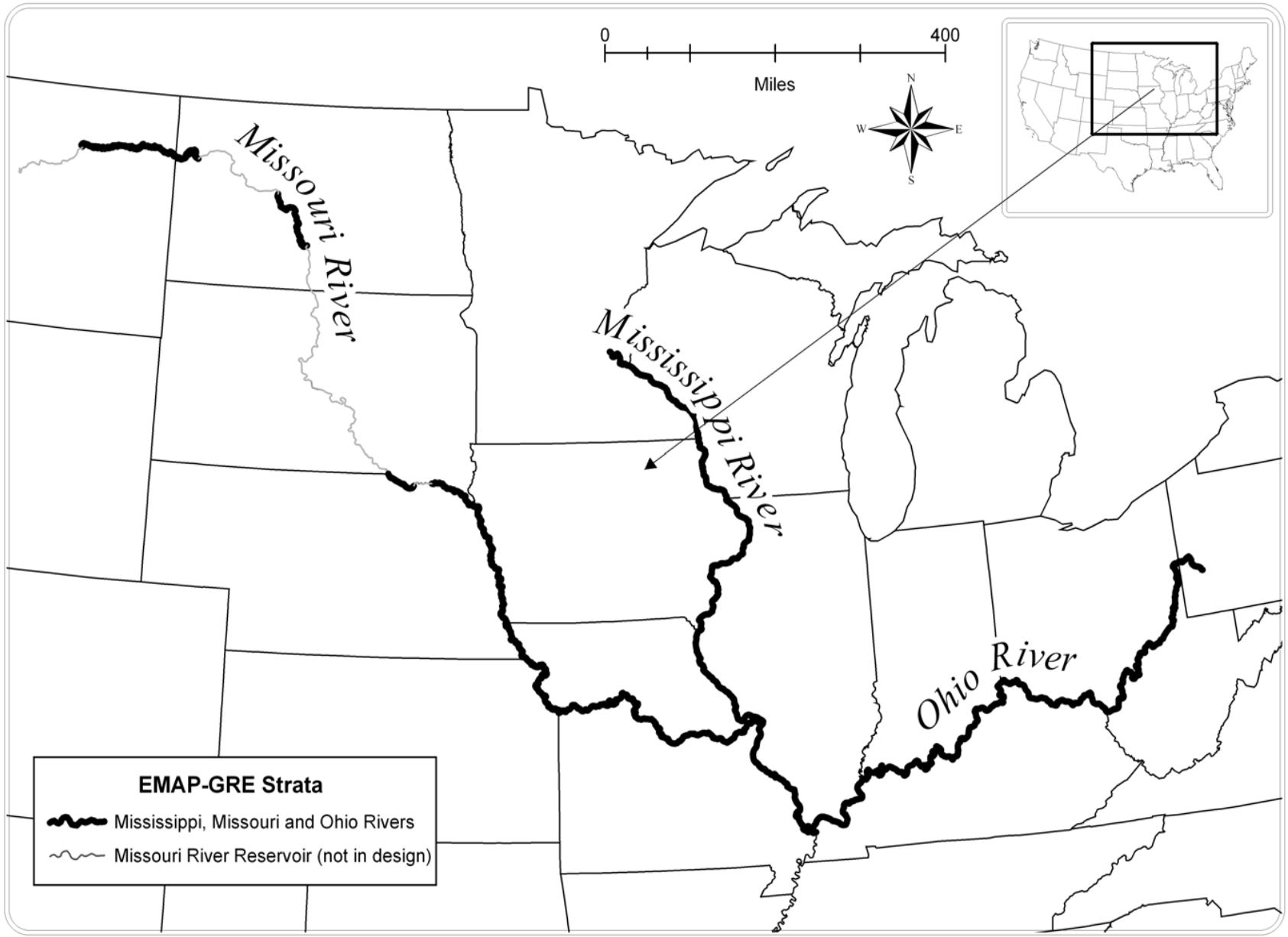
Presented at the water quality technical section of the annual meeting of the LMRCC, 9/16/06 at Vicksburg, MS

Overview of Existing EMAP-GRE Field Operations



http://www.epa.gov/emap/greatriver/fom.html

Extent of EMAP-GRE Phase I



Field Operations

- Current EMAP-GRE methods are the default for LMR unless unsafe, unfeasible, or clearly suboptimal with regard to program objectives
- LMR methods will be a compromise between program continuity and optimization for LMR
- Basic program framework and functions the same for LMR
- Changes based on consensus of EPA and LMR collaborators

EPA provides:

- Probability sample design
- Site dossiers/GIS data
- Field operations manual
- Initial and annual training
- QA field audits
- Preprinted field forms and sample labels
- Specialized supplies (certain filters and vials)
- Sample tracking and IM functions
- Laboratory analyses
- Data entry
- Validated data
- Hosting technical meetings and workshops
- Final assessment report

Cooperator responsibilities:

- Crews
- Gear
- Most supplies
- Data collection
- Shipping/sample transport
- Data Verification
- Workshop attendance; collaboration on report preparation

Section I - Basics

- Survey design
  - Sites randomly located based on probability sample
  - Goals of the design are to insure representativeness and prevent bias
- Index period
  - July 1 through September 30

Basics, cont.

- Habitats sampled
  - Main channel
  - Main-channel littoral zone to 6 m depth
  - Main-channel terrestrial riparian
  - Integrative assumption: *Presence and quality of off-channel habitats influences ecological integrity of main-channel at some spatial scale*

EMAP features multiple indicators:

- Biotic assemblages (fish)
- Chemical indicators ([nutrients])
- Exposure indicators (fish tissue contaminants)
- Function indicators (sediment metabolism)
- Physical habitat indicators (riparian vegetation structure)

Biotic assemblage indicators:

- Littoral
  - Fish
  - Benthos
  - Periphyton
  - Aquatic vegetation
- Channel
  - Snag surface Invertebrates
  - Zooplankton
  - Phytoplankton

Water chemistry

On boat: DO, conductivity, pH, temperature, Secchi depth

In field: Turbidity

In lab: cations, anions, nutrients, metals, DIC, DOC, TSS, seston geomarkers, chl *a*

Exposure indicators

- Fish tissue contaminants
  - Pesticides, PCBs, PBDEs, Hg
- Sediment toxicity and chemistry

Physical Habitat Indicators

- Riparian vegetation
- Riparian land use
- Human disturbance
- Fish cover
- Channel and bank morphology

QA is a priority

Table 1-1. Generic QA activities for EMAP-GRE field operations.

Category	Considerations
Training	All crews will be thoroughly and consistently trained for assigned field tasks, safety, and project QA procedures. Initial training is supplemented by annual "booster" training.
Standardization	Crews will receive standardized training based on this manual. Standardized field forms and labels will be used by all crews. Field instruments, sampling equipment, and supplies will be specified or supplied.
Calibration	Calibration of field instruments will be integrated with field operations.
Objectivity	Field operations are designed to minimize unnecessary subjectivity in measurements. To the extent possible, rules will be provided for site verification and other field decisions.
Communication Biggest challenge	Regular communication between field crews and coordinating EPA personnel forestalls problems, misinterpretations, and supply shortages and promotes inter-river and among-crew uniformity. Field-season QA audits and post-field-season debriefings improve QA.
Documentation	Non-standard or unusual situations or conditions are documented with data quality flags and notes on the field forms and by communication with EPA scientists and IM personnel.
Information management	Web-based sample tracking and 100% data proofing are fully integrated into the program

Training is a priority

Training flotilla on Upper Miss near Alton, IL

Duluth EMAP-GRE core team

- David Bolgrien: Sample design, program administration, GIS
- Ted Angradi: Ops manual, benthos, reference
- Mark Pearson: fish, training
- Terri Jicha: IM, water chemistry
- Debra Taylor: Physical habitat and vegetation
- Brian Hill: Branch chief and algae
- Allan Batterman: QA officer

EPA ORD Duluth 218-529-5000

Section 2 Field Operations

- Crew configuration and responsibilities
- Flow of daily operations
- Guidelines for recording field data

Crew Responsibilities

Table 2-1. Outline of the responsibilities of each field crew.

Crew	Habitats	Sampling responsibilities	Section of manual
Fish sampling	Near-shore littoral	Fish assemblages	8
		Substratum	8
		Fish cover	8
		Fish tissue for contaminants	9
		Fish tissue for DNA	8
River sampling	Main channel	Water chemistry	5
		Phytoplankton	5
		Macrozooplankton	5
		Microzooplankton	5
		LWD	10
	Near-shore littoral	LWD	10
		Benthic macroinvertebrates	10
		Snag macroinvertebrates	10
		Sediment	11
		Periphyton	11
		Aquatic vegetation	6
	Riparian zone	Bank characteristics	7
		Riparian vegetation structure	7
		Human disturbance	7
		Invasive plants	7

Crew Configuration

- Two 3 person crews suggested
- Other configurations are acceptable
- Crew division of labor is flexible
- Safety first
- Need sufficient crew to complete a site in a day
- Everybody goes through training

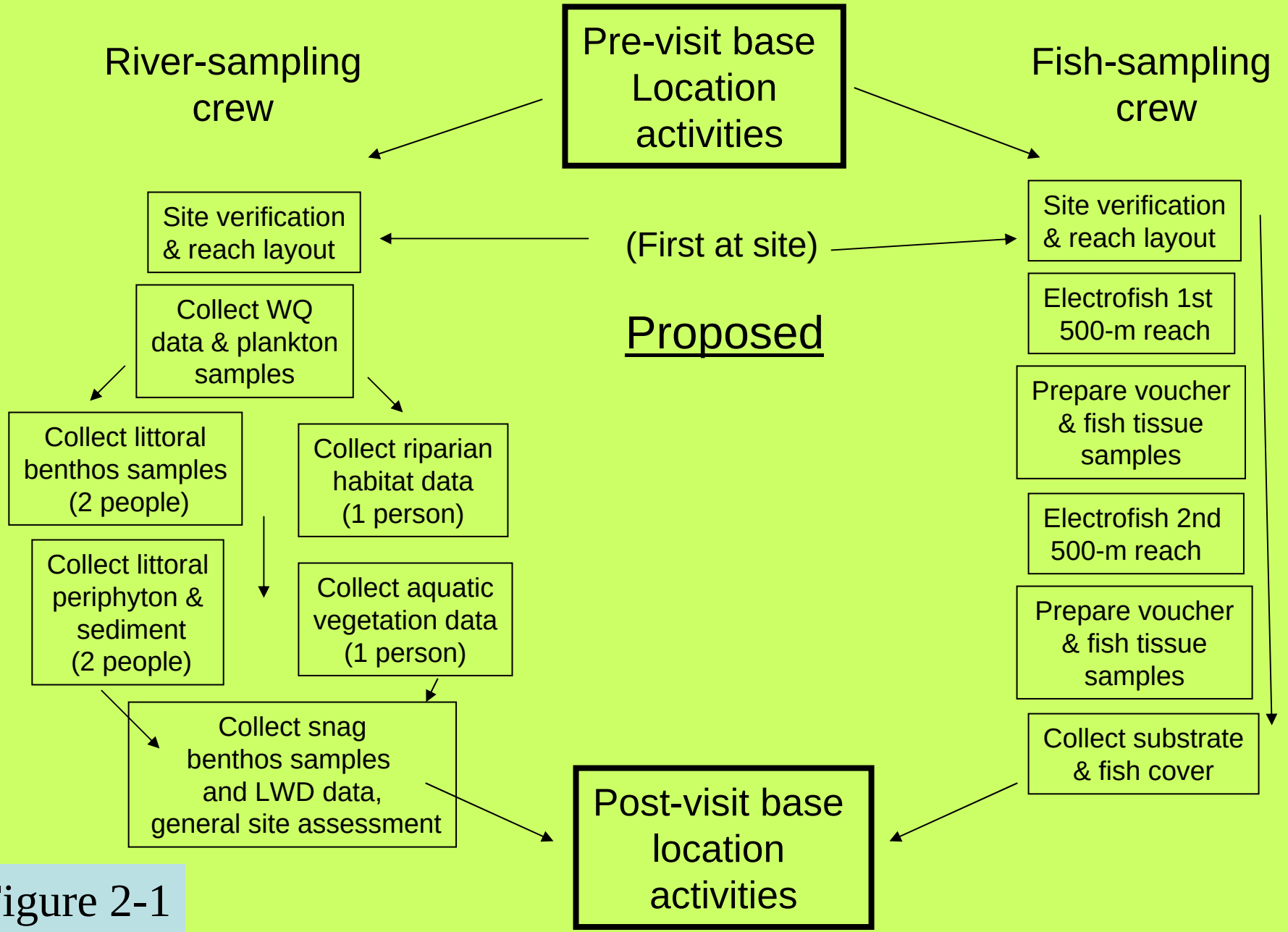

River-sampling crew
Pre-visit base Location activities
Fish-sampling crew
Site verification & reach layout
(First at site)
Site verification & reach layout
Collect WQ data & plankton samples
Proposed
Electrofish 1st 500-m reach
Collect littoral benthos samples (2 people)
Collect riparian habitat data (1 person)
Prepare voucher & fish tissue samples
Electrofish 2nd 500-m reach
Collect littoral periphyton & sediment (2 people)
Collect aquatic vegetation data (1 person)
Prepare voucher & fish tissue samples
Collect snag benthos samples and LWD data, general site assessment
Collect substrate & fish cover
Post-visit base location activities

Figure 2-1


USGS Rolla


USGS Lincoln


Ohio River contractor

MDC

Sampling platforms vary

EPA provides specialized field forms

Draft

EMAP-GRE WATER CHEMISTRY AND PLANKTON FORM (front)

SITE ID: GRW04449- DATE: / / 2 0 0 ANNUAL VISIT NUMBER: ☐ 1 ☐ 2 Reviewed by (Initials): _____

Water Chemistry

Water Sample			FLAG
Sample ID 2 L composite			
Sample	Collected?	Composite of 3 Stations?	FLAG
2 L composite 1	☐ Yes	☐ Yes ☐ No	
500 mL grab	☐ Yes	☐ Yes ☐ No	
2 L Composite Field Duplicate Sample ID			
DI Blank Sample ID			

DO/PH Calibration		FLAG
Altitude at Calibration (m)		
Was DO meter calibrated on day of sampling? ☐ Yes ☐ No		
Was pH meter calibrated on day of sampling? ☐ Yes ☐ No		
Alkalinity	Sample ID	
Alkalinity Duplicate	Sample ID	

Water Quality Measurements

* See below for rules on which depths to take readings; flag depths not used.	River Left			Thalweg			River Right		
	0.5 m from surface	Mid depth	0.5 m from bottom	0.5 m from surface	Mid depth	0.5 m from bottom	0.5 m from surface	Mid depth	0.5 m from bottom
	Total depth	*Sample depth*	*Sample depth*	*Total depth*	*Sample depth*	*Sample depth*	*Total depth*	*Sample depth*	*Sample depth*
Depth xx.x m									
DO (mg/L)									
Conductivity (uS/cm)									
Temperature (C)									
pH									
Flag									

Phytoplankton Composite Desired Sample (1935-ml composite excluding preservative)

Sample ID	Composite vol. (mL)		FLAG
		Number of Locations Sampled (0-3):	

63-um Macrozooplankton Composite Sample (180-L composite filtration desired)

Sample ID	Volume filtered (L)		FLAG
		Number of Locations Sampled (0-3):	

20-um Microzooplankton Composite Sample (18-L composite filtration desired)

Sample ID	Volume filtered (L)		FLAG
	.	Number of Locations Sampled (0-3):	

* If depth at the station >2m, collect meter readings and a subsample 0.5 m above the bottom, mid-depth, and 0.5m from the surface; subsample volumes: 445mLfor water; 215mL for phytoplankton, 20L for macrozooplankton, 2L for microzooplankton.

* If depth at the station ≤2m and ≥1m, collect meter readings and a subsample 0.5 m above the bottom, mid-depth, and 0.5m from the surface; subsample volumes: 665mLfor water; 325mL for phytoplankton, 30L for macrozooplankton, 3L for microzooplankton.

* If depth at the station ≤1m, collect meter readings and a sample at mid-depth 1.3L for water; subsample volumes: 650mL for phytoplankton, 60L for macrozooplankton, 6L for microzooplankton.

Flag codes: K=no measurement made, U=suspect measurement; F1, F2, etc=misc flags assigned by field crew. Explain in comments.

Section 3 Pre- and post-visit base location activities

Pre-visit base location activities

- Confirm site/ramp status and location
- Preload waypoints into GPS units
- WQ meter calibrations
- Ship previous samples
- Compile forms, load supplies
- Prepare preservatives

Post-visit base location activities

- Filter water, make turbidity readings
- Review data forms
- Download camera files
- Preserve/store samples
- Fill out sample tracking forms
- Fax tracking and field verification forms to Corvallis data center
- Arrange FedEx pickup for next day

Sample not preserved in formalin

- Water: shipped fresh next day
- Chlorophyll filters: frozen, shipped weekly
- DIC, DOC, Other filters: dried, shipped weekly
- Sediment: refrigerated, shipped fresh next day
- Fish tissue: frozen, shipped weekly

Samples preserved in formalin

- Benthos (10%): carried to MED at EOS
- Fish vouchers (10%): carried to MED at EOS
  Periphyton (4%): carried or shipped at EOS to MED
- Phytoplankton (4%): carried or shipped at EOS to MED
- Zooplankton (4%): carried or shipped to lab in batches

ZOOPLANKTON (4% formalin)

BZ (63µm) LZ (20µm)

GRW044449-___ ___ ___

___/___/ 200__

Volume filtered _____ L

Site visit number 1 2 3 4

300215

PHYTOPLANKTON (PP)
(4% formalin)

GRW04449-___ ___ ___

___/___/ 200__

Composite volume _____ L

Site visit number 1 2 3 4

300214

WATER CHEMISTRY

WC AL

GRW04449- ___ ___ ___

___/___/ 200__

Site visit number 1 2 3 4

300213

FILTERS

CF GF SS1 SS2

GRW04449-___ ___ ___

___/___/ 200__

Volume filtered _____ mL

Filter ID _____

Site visit number 1 2 3 4

300216

_____

Sample type

GRW04449- ___ ___ ___

___/___/ 200__

Comp/filtered vol._____

Site visit number 1 2 3 4

Sample ID_____

EPA provides specialized labels

Sample preservative recipes

Table 3-1. Stock preservative solutions and instructions for their preparation. All stock solutions should be stored in clearly-labeled non-breakable containers. Labels should include container contents, date of preparation, and the initials of the preparer.

Solution	Use	Recipe
100% borax-buffered formalin[a] (pH 7-8)	Preservative for phytoplankton and periphyton; stock solution for fish	Add 20 g borax (hydrated sodium borate: $Na_2B_4O_7$-$10H_2O$) detergent (20 Mule Team®) per L 100% formalin (37% formaldehyde). Test pH with paper.
100% carbonate-buffered formalin (pH 10)[b]	Stock solution for macroinvertebrate preservative	Add 35 g Na_2CO_3 (also called "washing soda") per L 100% formalin (37% formaldehyde). Test pH with paper.
12% buffered formalin-sugar solution[c] (pH 7-8)	Preservative for zooplankton	Add 600 mL 100% formalin, 5 tablespoons borax and 400 g table sugar (sucrose) to 4.4 L tap water (makes 5 L). Test pH with paper.
10% borax-buffered formalin	Preservative for fish[d]	Add 1 part 100% borax-buffered formalin to 9 parts tap water.
95% benzene-free ethanol	Stock solution for fish preservation (2005 DNA sites)[e]	Full strength agriculture-derived.
85% benzene-free ethanol	Field preservation of fish (2005 DNA sites)	Add 9 parts 95% ethanol to 1 part tap water.
75% benzene-free ethanol	Lab preservation of fish (2005 DNA sites)	Add 8 parts 95% ethanol to 2 parts tap water.
10% carbonate-buffered formalin (pH10)	Preservative for macroinvertebrates	Add 1 part 100% carbonate buffered formalin to 9 parts tap water. Test pH with paper.
Concentrated rose bengal solution	Stain added to macroinvertebrate samples	Add 1 teaspoon rose bengal powder to 1 L of 10% carbonate-buffered formalin stock solution.

Sample tracking

- Critical for for good QA!
- We use a Web-based system called SWIM
- There are multiple sample types going to multiple labs
- Relatively bombproof after 3 years

Field Data Loop

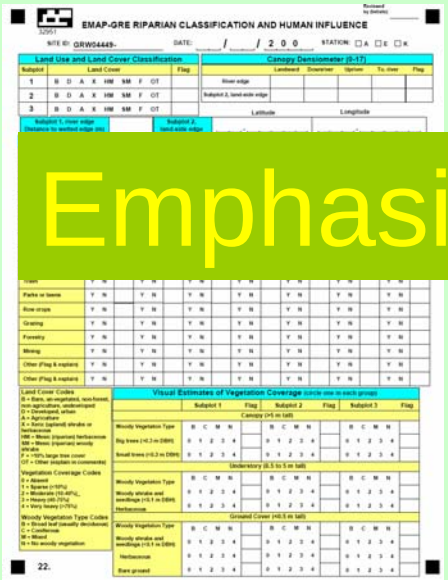
Field data collected by crew, recorded on field form

Crew reviews Forms

Original sent to Corvallis

Copy retained by Crew

Data forms are scanned



Emphasized in training!

Tracking Database

database

Lab data

Data entry checked by CSC

Crew Perform

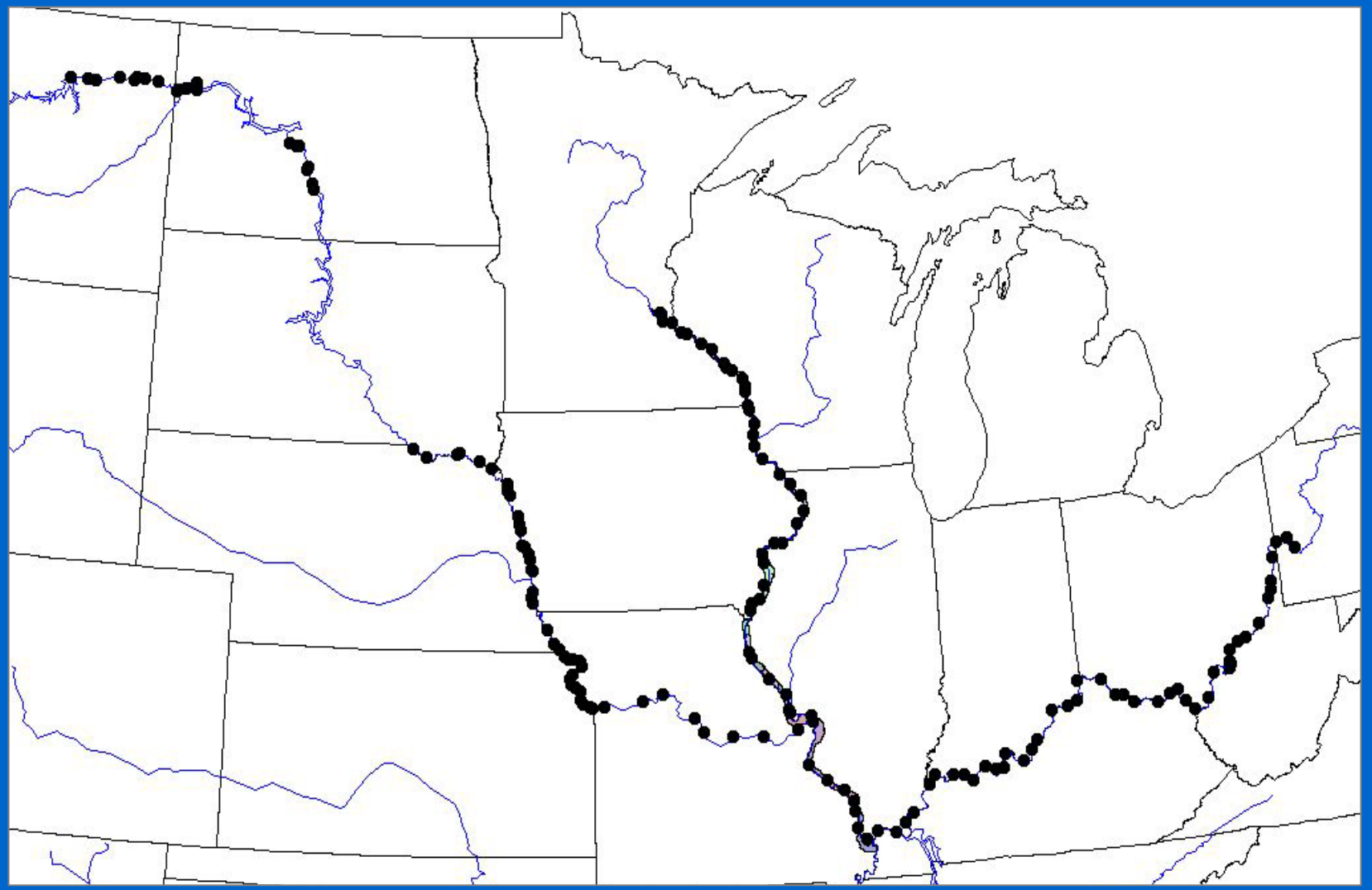
QA check

SWIM EMAP-GRE Raw Data Database

SWIM EMAP-GRE "Structured" Data Database

Chapter 4: Site Verification Process

The sample design puts sites on the river.
Site verification puts actual sample locations at each site.



Chapter 4 Site Verification

Site verification asks:

1. Should the site be sampled?
2. If it should be sampled, can it be sampled?
3. If it can sampled, how should it be laid out?

Site verification is an agreement on how crews will “lay out” the site for sampling.

Laying out the site without bias enhances data integrity.

Site verification

- Determine if site is in the population and can be safely sampled.
  - Not in a tributary or reservoir
  - Not above or below the reach
- All decisions verified with EPA
- Sample locations can be moved around to a limited (and proscribed) degree to avoid problems (safety, islands, tributary mouths)

The Site Dossier

The dossier is a document that guides the crew to the site and provides approximate nominal station locations

EMAP-GRE Site Dossier

GRW04449-300

River Thalweg Shoreline Transect
Points Lines: Attribute Information

NAME	NHD_ELEV	SECTION	SAMPLE BANK	CLOSEST RIVER MILE	# PLANNED VISITS	POOL/REACH
Mississippi River	165	Illinois/Iowa	Left	477	1	Pool 16

DETAIL	THAN	ID	DESIGN_NO	LON_DD	LAT_DD	OR_AZ	SB_DIST	NSB_DIST	CH_WIDTH
X-Site	X	901	300	-90.6555	41.4619	--	--	--	--
1/3 Point	X	902	300	-90.6526	41.4609	--	--	--	--
2/3 Point	X	905	300	-90.6545	41.4627	--	--	--	--
Cross Channel Transect/MCS Int.	X	904	300	-90.6512	41.4599	--	--	--	--
Cross Channel Transect/MCS Int.	X	905	300	-90.6555	41.4638	--	--	--	--
Transect X	X	906	300	--	--	315.94	255.52	248.58	544.50
25m Site	Y	907	300	-90.6513	41.4633	--	--	--	--
500m Site	Z	908	300	-90.6402	41.4620	--	--	--	--
Primary 500m Upstream MCS Transect	X	909	300	-90.6473	41.4621	--	--	--	--
Secondary 500m Downstream MCS Transect	X	910	300	-90.6562	41.4575	--	--	--	--

DATA DICTIONARY

DETAIL = Description
THAN = Transect
ID = ID number from map page 2
DESIGN_NO = Sample number
LON_DD = Longitude in decimal degrees
LAT_DD = Latitude in decimal degrees
OR_AZ = Orthogonal azimuth (degrees clockwise from north)
SB_DIST = Distance to sample bank in meters
NSB_DIST = Distance to non-sample bank in meters
CH_WIDTH = Total width of channel in meters

**All distance values are in meters
**All azimuth values are in degrees.
**All coordinate values were derived using
Projection: Geographic
Datum: NAD83
Spheroid: GRS1980
Units: Degrees

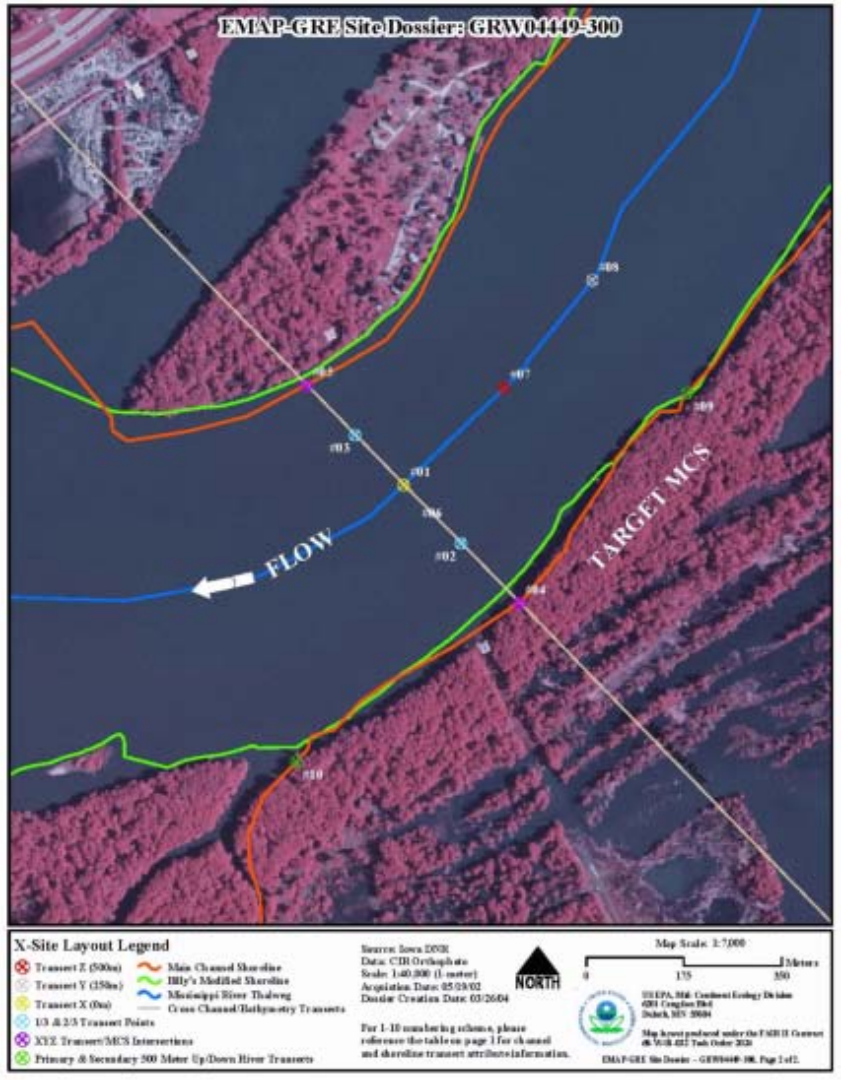
US EPA, Mid-Continent Ecology Division
6201 Congdon Blvd
Duluth, MN 55804

Map layout produced under the FAIR II Contract
68-W-03-032 Task Order 2004

EMAP-GRE Site Dossier

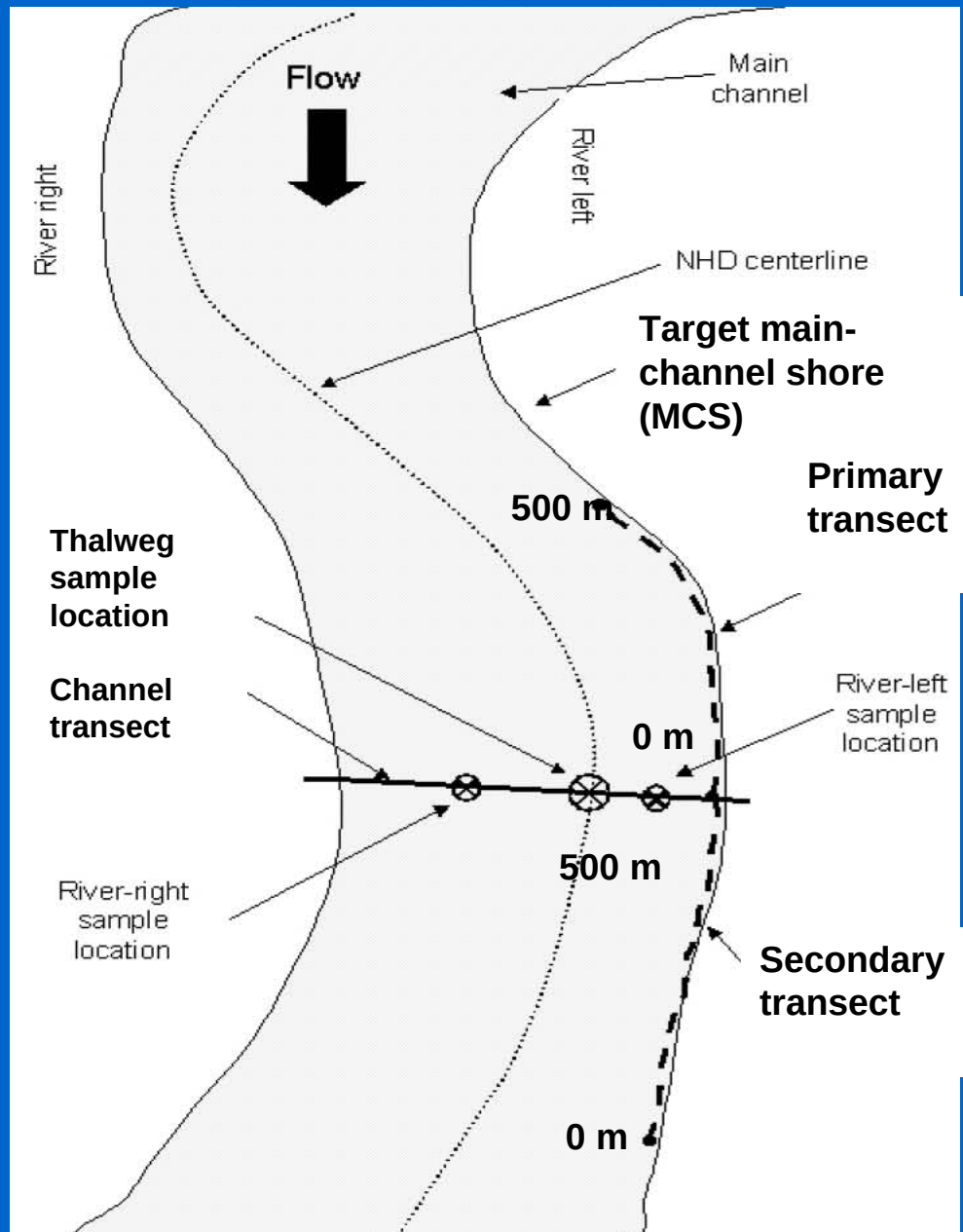
GRW04449-300

Page 1 of 2

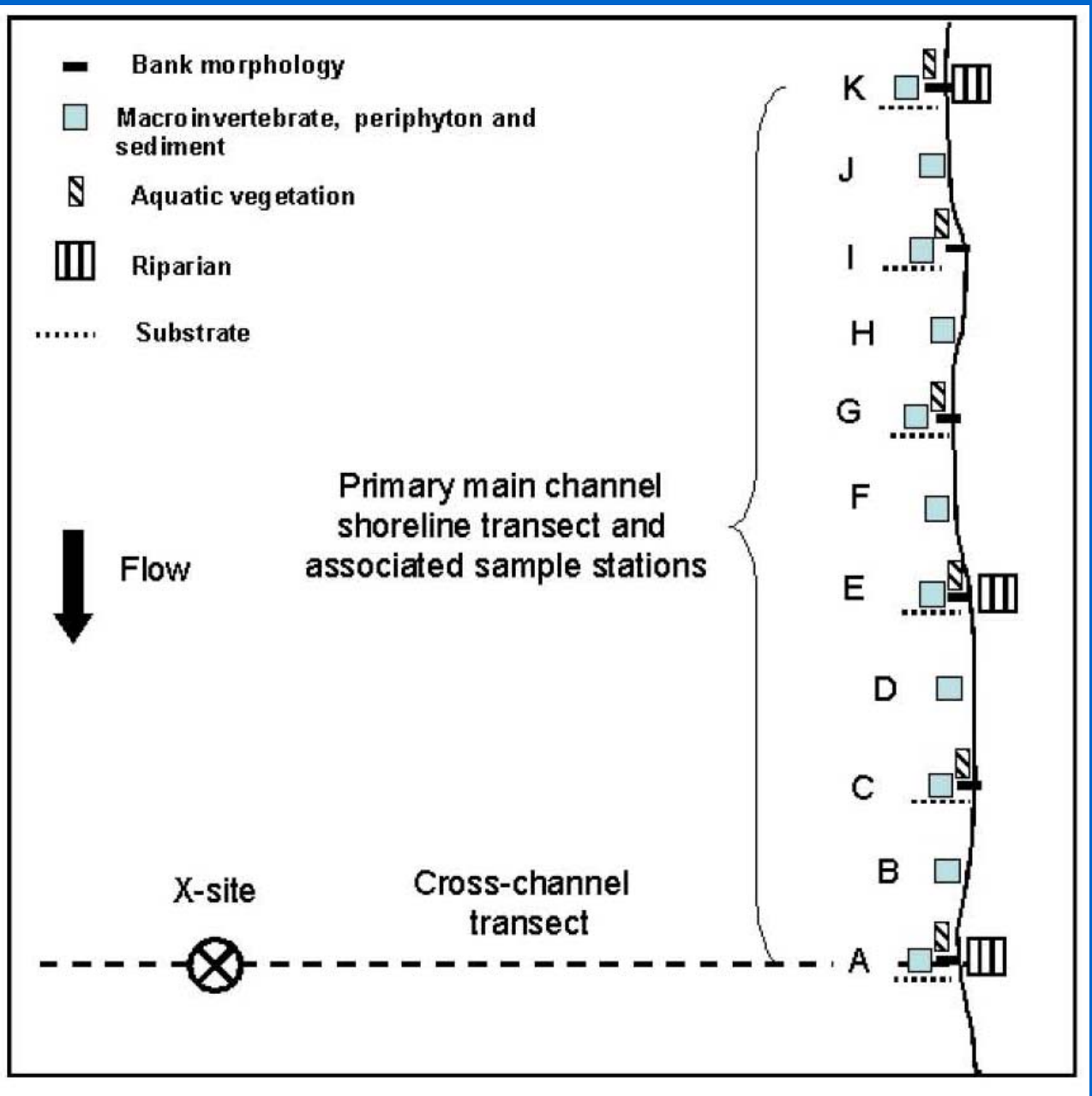


Site Anatomy (large scale)

- "X-site" comes from design file
- Channel transect
  - Transect is perpendicular to the main-channel and through the X-site.
  - Thalweg station is the deepest point of channel transect.
  - River-right and River-left stations are along transect half-way between thalweg and shore.
- Shore transects.
  - Primary transect
    - 500 m upstream (fish, littoral biota, WQ, habitat)
  - Secondary transect
    - 500 m downstream (fish and fish habitat only)



Site Anatomy (Primary transect)



Primary shore transect has 11 stations (A-K) at 50 m intervals. Different things happen at different stations.

Secondary transect has 6 fish habitat stations at 100 m intervals. Upstream end is 500 m and downstream end is 0 m.

Site verification involves a lot of rules and guidelines to minimize the possibility that bias in sample location will creep in.

Verification emphasized in training and EPA holds hands with cooperators through the process.

Section 5 Water chemistry and plankton

Objective is to characterize integrated water chemistry and plankton at the site as indicators of condition and stress (WC)

What is being collected:

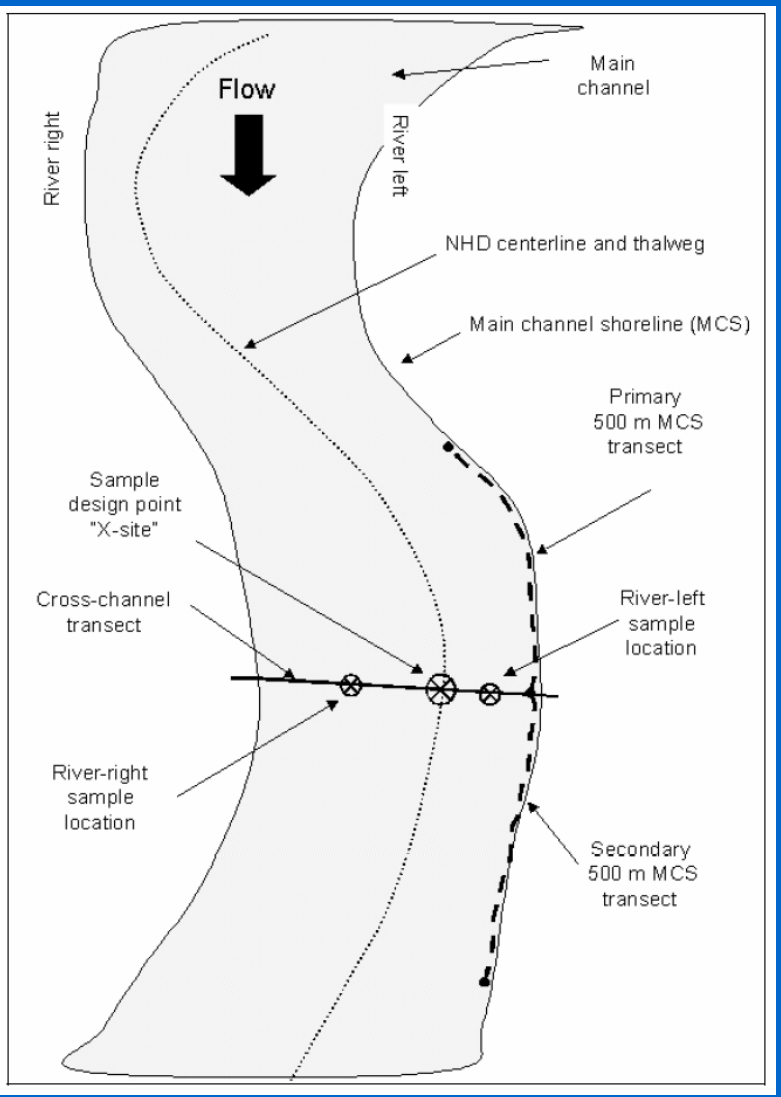
- Water Chemistry:
  - Bulk grab for analysis
  - Meter Chemistry

    DO, pH, conductivity, temperature, turbidity
  - Clarity - Secchi
  - Dissolved Inorganic Carbon (DIC) - grab
- Plankton:
  - Phytoplankton
  - Microzooplankton
  - Macrozooplankton

Lab analysis (Lab TBD)

- Alkalinity
- Metals (As, Pb, Se, Al, Fe, Ni, Zn)
- Ammonia, NOx, Total N
- Total P
- TOC
- SO4, Cl
- Na, Ca, K, Mg
- Chlorophyll a
- DOC, DIC
- 15N, 13C (of seston)

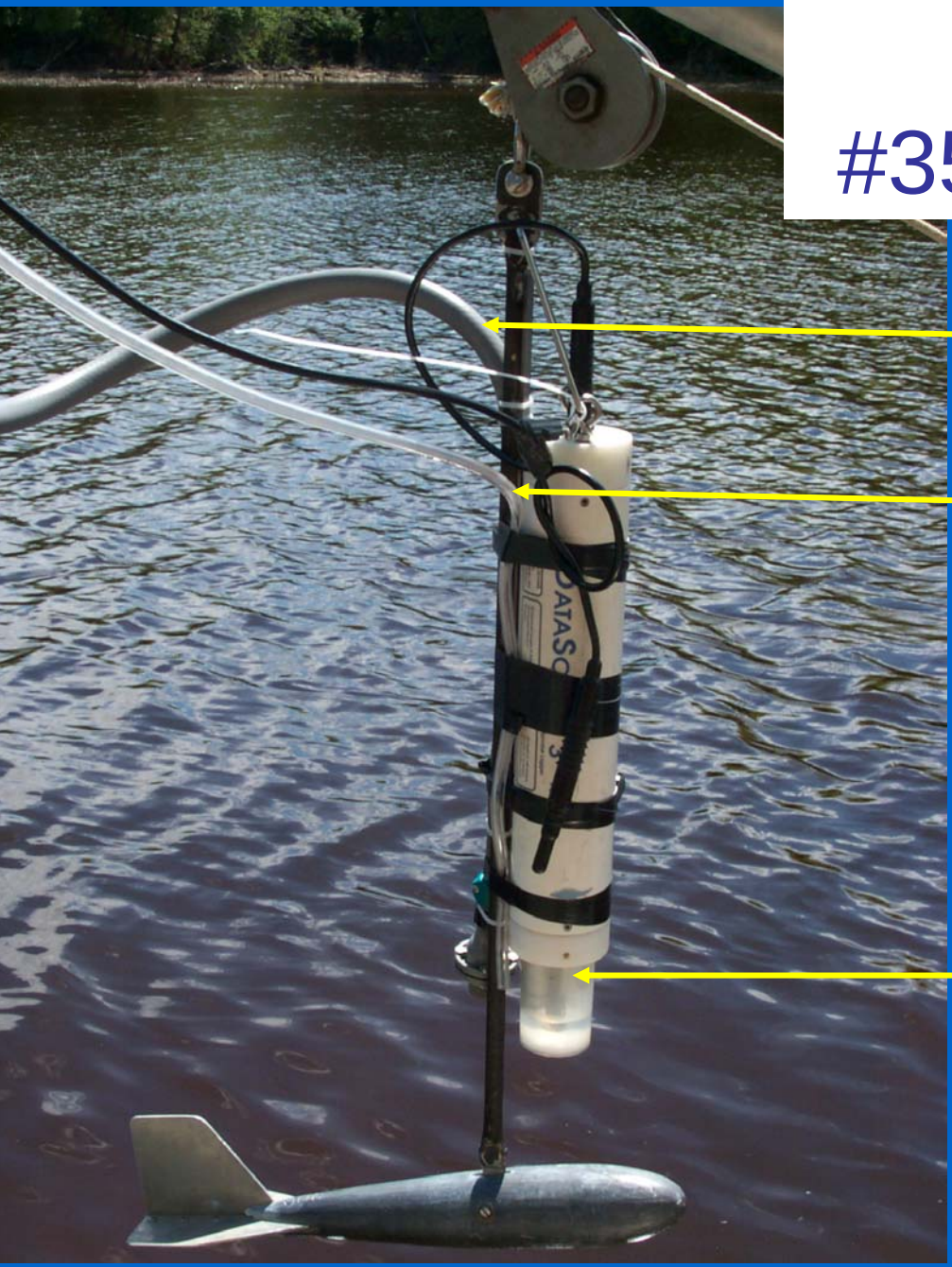
Depth and width integrated sampling



Samples and meter data collected at 3 depths at each of 3 stations

Samples composited for the site

Typical rig with #35 sounding weight



High volume hose for plankton

Low volume clean hose for water sample

Meter sensors

Volumes for water and plankton samples

Bulk water	8 L
Alkalinity	500 mL
Phytoplankton	2 L
Macrozooplankton (63-um mesh)	180 L filtered
Microzooplankton (20-um mesh)	18 L filtered

Plankton collection
(Macrozooplankton)

Guzzler pump

63-µm mesh plankton net

Water Quality “Field” Sample Processing

- Filter aliquots of churned bulk sample for Chl, TSS, geomarkers, etc.
- Extract churned aliquot for lab analysis
- Make replicate turbidity measurements

Lab processing for LMR

Water chemistry: TBD, currently UMESC

Zooplankton: TBD, currently INHS and SMSU

Phytoplankton: TBD, currently same lab as periphyton (UMD-Ely)

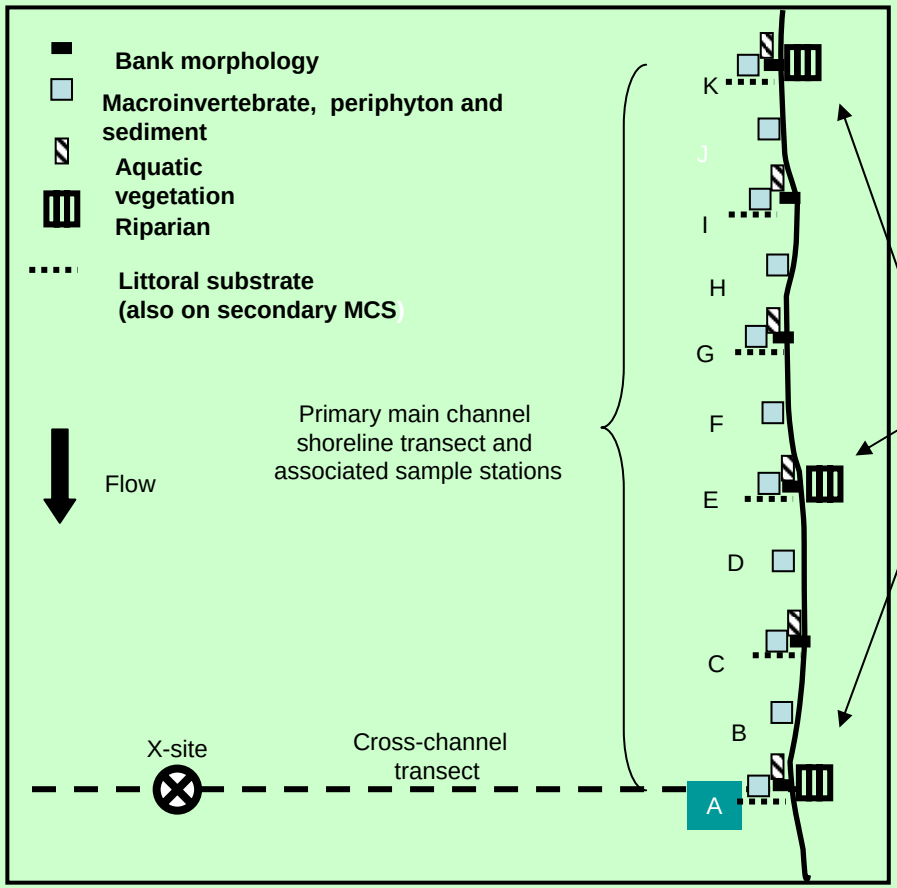
Section 6 Aquatic Vegetation

- Most relevant for impounded Upper Mississippi River
- Based on USGS LTRM methods
- Probably not applicable to LMR main channel habitats

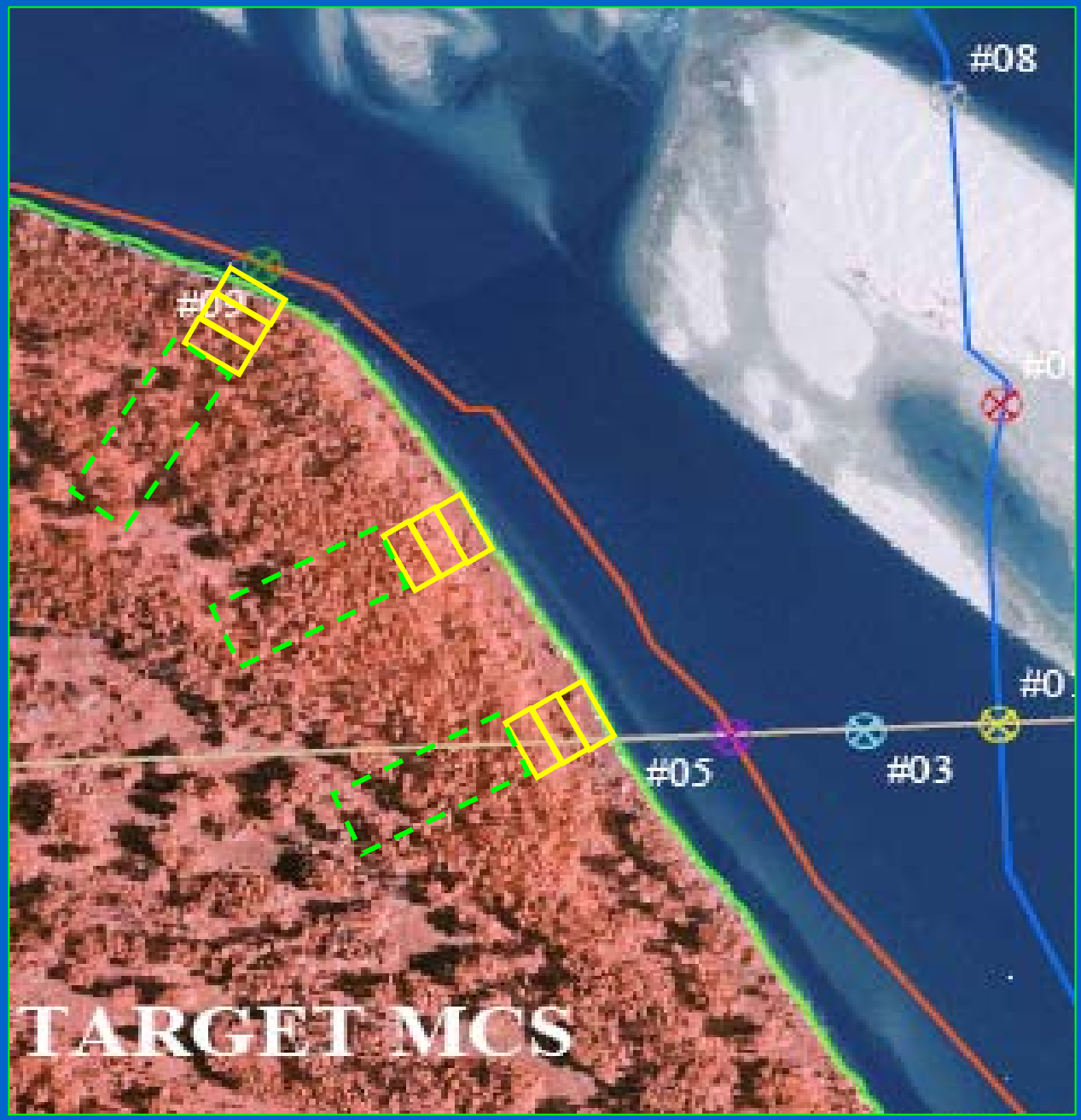
Section 7 Riparian Habitat

Objective is to characterize the riparian zone adjacent to the primary transect as an indicator of condition and stress

Riparian sample locations



3 riparian plots each with 3 subplots


#08
#05
#03
TARGET MCS

Riparian Measurements

- **Bank and channel width measurements**
  - **Bank heights and channel wetted widths**
  - **Shoreline type**
  - **Macrohabitat type**

- **Riparian measurements**
  - **Land cover**
  - **Canopy density**
  - **Vegetation structure**
  - **Invasive plant species**
  - **Human influence**

- **Channel form and general site assessment**

Issues

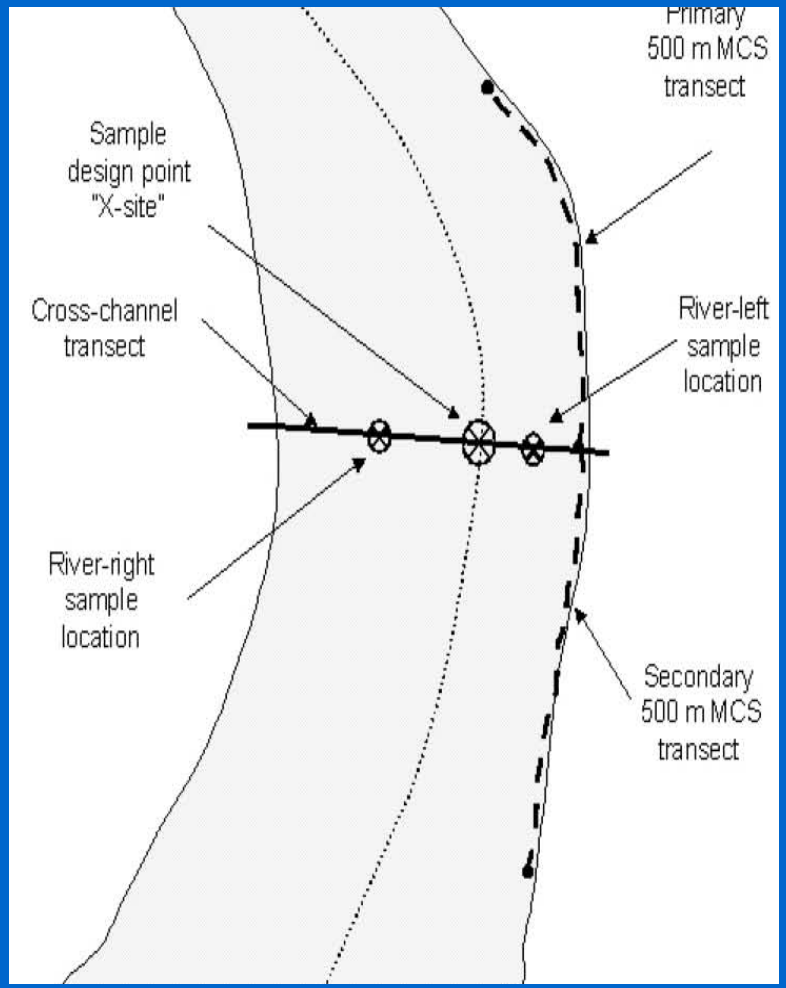
- Requires getting out of the boat and into the jungle
- Safety issues
- Measuring levees, batture lands…?
- May be able to characterize human disturbance of the riparian zone from the boat.

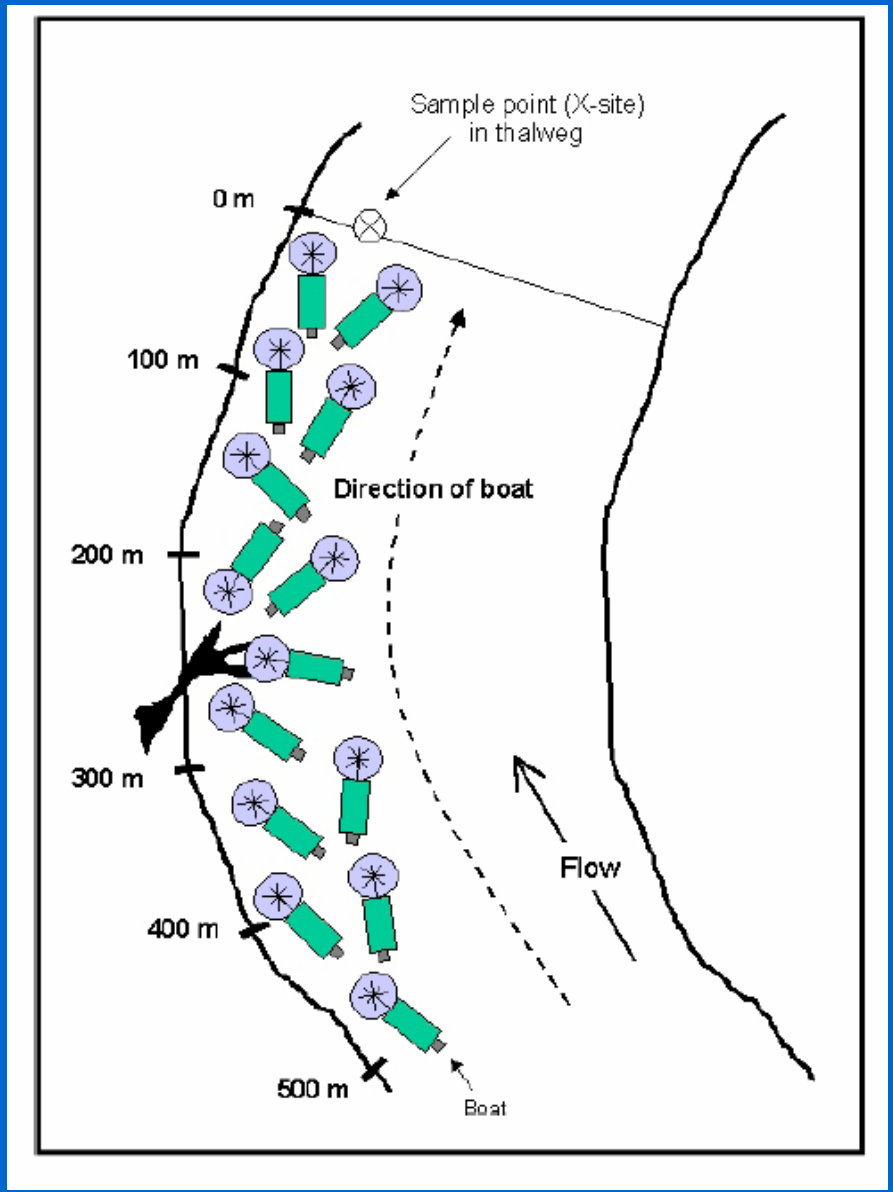
Section 8 Fish

Objective is to get a standardized representative sample of the near-shore fish assemblage. It is very important to avoid sampling bias toward large fish, game fish, rare fish, etc. Not every species in the river at a site will be collected.

Daytime electrofishing

- Suggested crew configuration
  - 2 netters using ¼” mesh dip nets
  - 1 driver
- 1 EMAP site = two 500 meter shoreline electrofishing zones (Primary & Secondary)
  - Fish using ~3000 Watts of pulsed DC
  - Sample each 500 meter zone from upstream to downstream for a minimum of 1800 seconds
  - Zone is shore to 30 m out or 6 m depth, whichever is closer


Primary
500 m MCS
transect
Sample
design point
"X-site"
Cross-channel
transect
River-left
sample
location
River-right
sample
location
Secondary
500 m MCS
transect


Sample point (X-site)
in thalweg
0 m
100 m
200 m
300 m
400 m
500 m
Direction of boat
Flow
Boat

Sample Processing

- Identify all fish to species
  - Use AFS Common Name
- Record DELT anomalies
- Record Length & Weight
- Save target species for tissue analysis
- Fish smaller than 12 cm are preserved for identification in the lab
- Voucher photos and specimens

Examples of DELT Anomalies

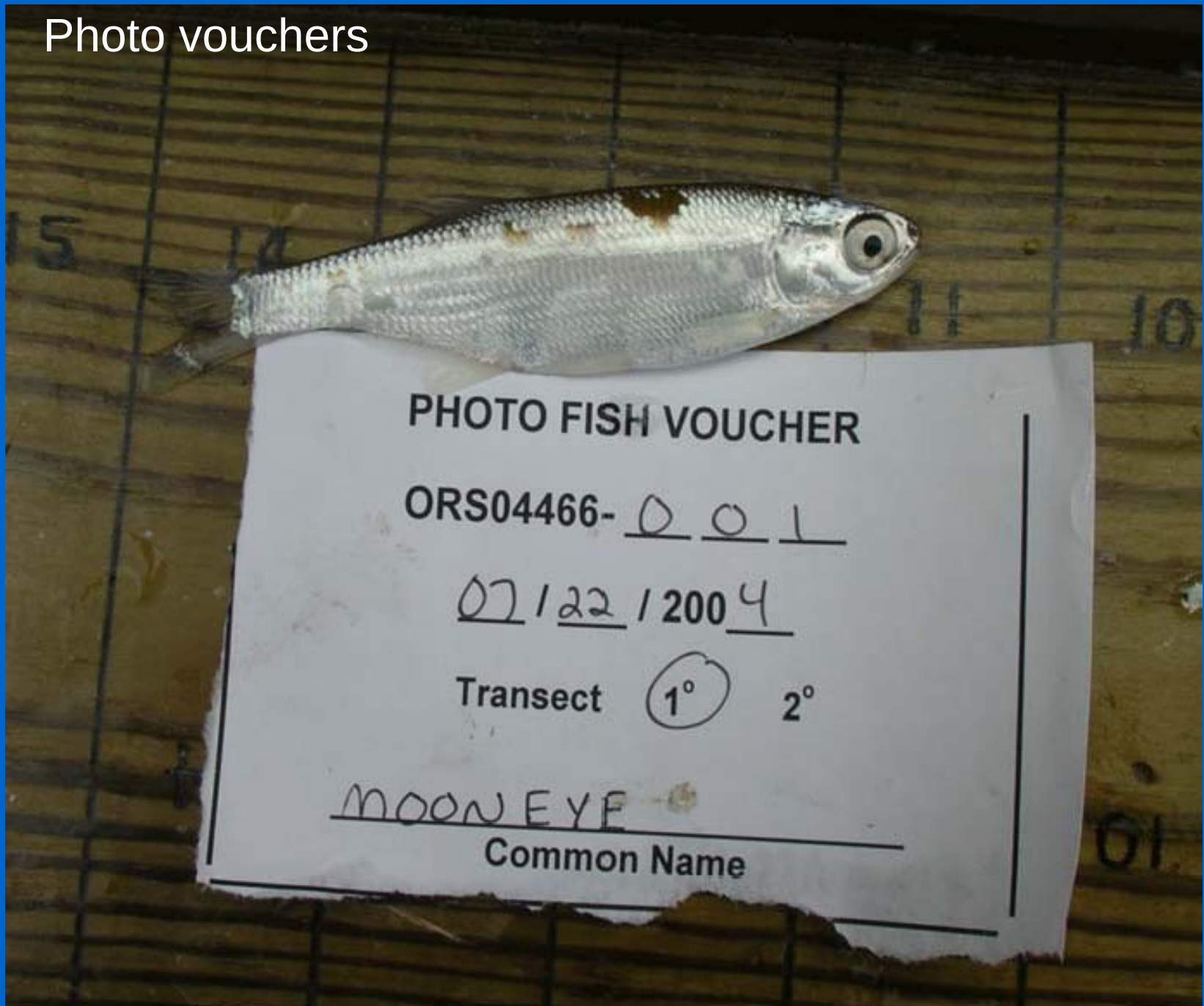
a. Example of deformities (DE) showing a normal spine (top) and curved spine (bottom).

b. Example of severe eroded fins (ER).

c. Example of body surface lesions (LE) (note reddened area in front of fins).

d. Example of raised tumors (TU) on the body surface.

Photo vouchers



Fish Habitat

- Near shore substratum characterized by tactile evaluation of bottom composition
- The “copper pole” technique
- Fish cover estimated by observation
- Based on ORSANCO methods

Section 9 Fish Tissue Contaminants

Objective: characterize whole-fish tissue contaminant load of target large and small fish species as indicator of exposure risk to piscivorous wildlife

Processing

- Analysis based on whole fish samples
- One large-fish sample from each site (5 fish < 2 kg ea)
- One small-fish sample from each site (50 – 400 g total)
- Fish retained from efishing catch based on a target species list
- Sampled shipped to EPA lab for analysis

Fish Species Priority List

Priority	Common name	Size range (mm)	3-cm size
	Primary target species		
1	emerald shiner	< 120	1 - 4
2	river shiner	< 120	1 - 4
3	spotfin shiner	< 120	1 - 4
4	bullhead minnow	< 120	1 - 4
5	silver chub	< 120	1 - 4
6	another minnow species	< 120	1 - 4
7	gizzard shad	< 150	1 - 5
	Secondary target species		
1	sauger	120 - 180	5 - 6
2	sauger	180 - 240	7 - 8
3	sauger	> 240	≥ 9
4	largemouth bass	180 - 240	7 - 8
5	largemouth bass	240 - 300	8 - 10
6	largemouth bass	> 300	≥ 11
7	other black bass	> 180	≥ 7
8	brown trout	> 120	≥ 5
9	rainbow trout	> 120	≥ 5
10	channel catfish	120 - 180	5 - 6
11	channel catfish	450 - 510	16 - 17
12	channel catfish	180 - 450	7 - 15
13	freshwater drum	>120	≥ 5
14	shorthead redhorse	>120	≥ 5
15	other redhorse species	>120	≥ 5
16	bluegill	>120	≥ 5
17	longear sunfish	>120	≥ 5
18	other sunfish species	>120	≥ 5
19	common carp	>180	≥ 7
20	smallmouth buffalo	>120	≥ 5
21	river carpsucker	>120	≥ 5

Target species list for Upper Basin may need to be re-evaluated for LMR

Table 9-1. Target analytes for composite fish tissue samples. Detection limit for mercury is 0.01 ppm. Detection limit for all other analytes is 0.001 ppm. Number in parentheses is the CAS number. Number followed by a # is the Ballschmitter-Zell number.

Mercury (7439-97-6)
Aldrin (309-00-2)
Chlordane-cis (5103-71-9)
Chlordane-trans (5103-74-2)
2,4'-DDD (53-19-0)
4,4'-DDD (72-54-8)
2,4'-DDE (3424-82-6)
4,4'-DDE (72-55-9)
2,4'-DDT (789-02-6)
4,4'-DDT (50-29-3)
Dieldrin (60-57-1)
Endosulfan I (959-98-8)
Endosulfan II (33213-65-9)
Endrin (72-20-8)
Heptachlor (76-44-8)
Heptachlor Epoxide (1024-57-3)
Hexachlorobenzene (118-74-1)
Hexachlorocyclohaxane [Gamma-BHC/Lindane] (58-89-9)
Mirex (2385-85-5)
trans-Nonachlor (3765-80-5)
cis-Nonachlor (5103-73-1)
Oxychlordane (27304-13-8)

PCB Congeners
2,4-Dichlorobiphenyl, #8 (34883-43-7)
2,2',5-Trichlorobiphenyl, #18 (37680-65-2)
2,4,4'-Trichlorobiphenyl, #28 (7012-37-5)
2,2',5,5'-Tetrachlorobiphenyl, #52 (35693-99-3)
2,2',3,5'-Tetrachlorobiphenyl, #44 (41464-39-5)
2,3',4,4'-Tetrachlorobiphenyl, #66 (32598-10-0)
2,2',4,5,5'-Pentachlorobiphenyl, #101 (37680-73-2)
3,3',4,4' Tetrachlorobiphenyl, #77 (32598-13-3) (coplaner)
2,3',4,4',5-Pentachlorobiphenyl, #118 (31508-00-6)
2,2',4,4',5,5'-Hexachlorobiphenyl, #153 (35065-27-1)
2,3,3',4,4'-Pentachlorobiphenyl, #105 (32598-14-4)
2,2',3,4,4',5-Hexachlorobiphenyl, #138 (35065-28-2)
2,2',3,4',5,5',6-Heptachlorobiphenyl, #187 (52663-68-0)
2,2',3,3',4,4'-Hexachlorobiphenyl, #128 (38380-07-3)
2,2',3,4,4',5,5'-Heptachlorobiphenyl, #180 (35065-29-3)
2,2',3,3',4,4',5-Heptachlorobiphenyl, #170 (35065-30-6)
2,2',3,3',4,4',5,6-Octachlorobiphenyl, #195 (52663-78-2)
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl, #206 (40186-72-9)
Decachlorobiphenyl, #209 (2051-24-3)
3,3',4,4',5 Pentachlorobiphenyl, #126 (coplaner)
Polybrominated Diphenyl Ethers (PBDE) congeners 47, 99, 100, 153 and 154

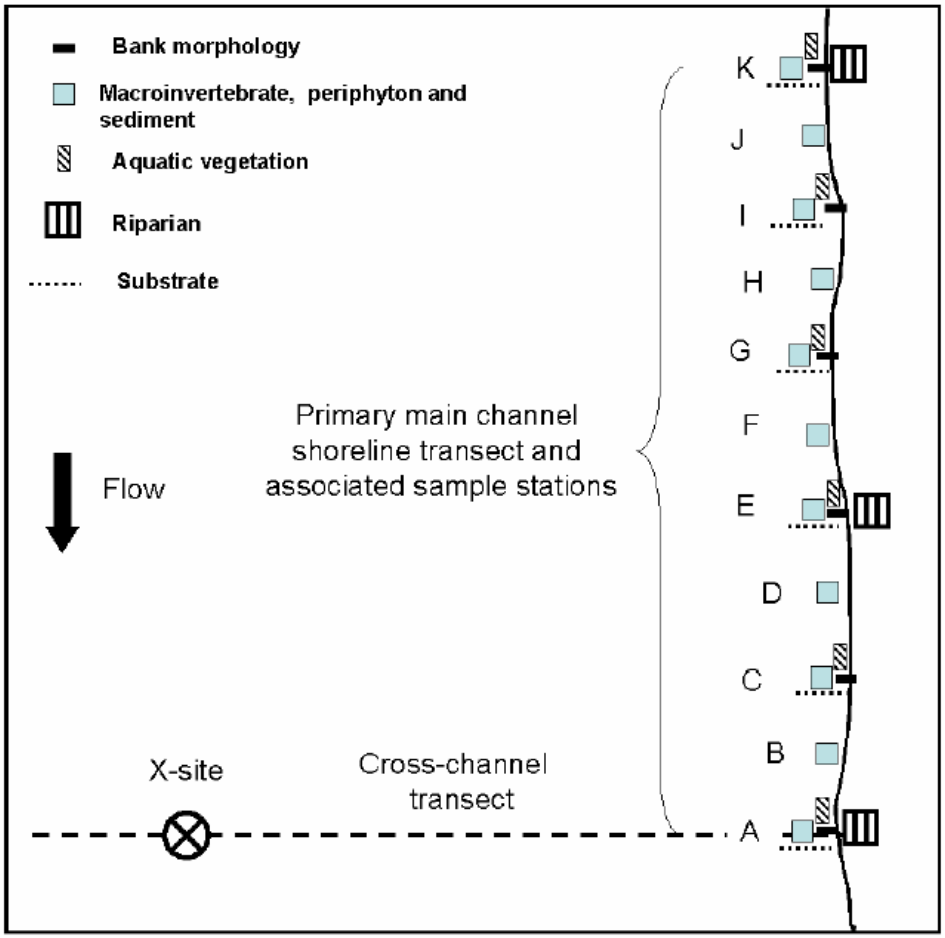
Percent Moisture and Lipid content

Analyte list needs to be updated

Section 10 Benthic macroinvertebrates

- Kick sampling (littoral)
- Snag sampling (channel)

Objective is to characterize nearshore benthos at site scale (kick)
and to evaluate usefulness of an alternative water-column method (snag)



Kick samples collected at all 11 littoral stations

Kick Sampling

- Sample is a composite of up to 22 0.26-m kicks
- Two 30-s kicks at each of 11 stations
- Standard kick net with 500-µm mesh
- Sample any littoral habitat (no targeted habitats) that can be safely sampled

Kick Sampling, cont.

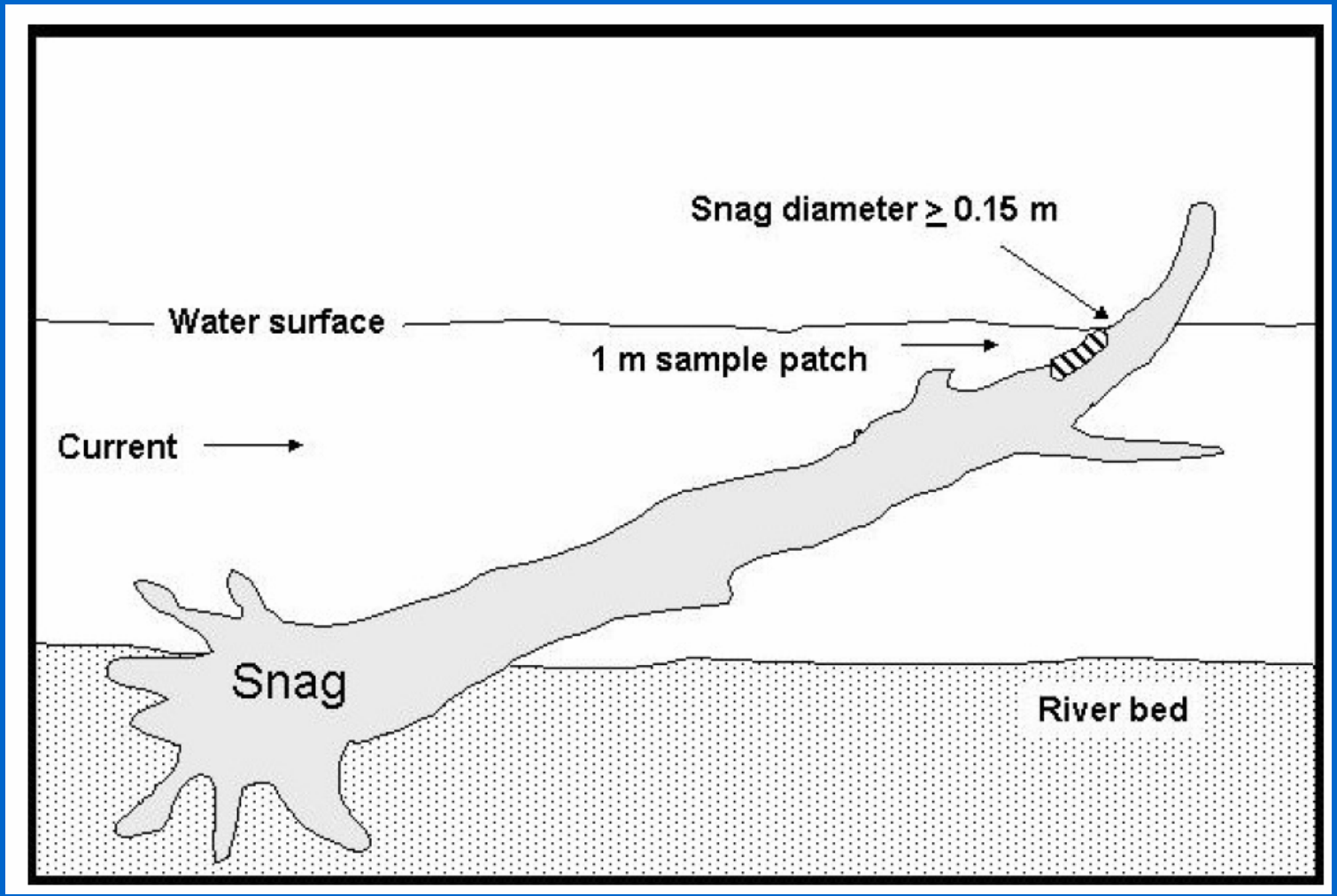
- Kick from low water mark to 0.6 m deep
- Sweep sample in slackwater areas
- Composite all 22 kicks
- Samples shipped to contract lab for sorting and identification

Is kick sampling in LMR a unsafe or sub-optimal approach?

Snag sampling

- Semi-quantitative water column adjunct to benthic sampling
- Specialized snag net

Typical “planter” snag configuration




Sample here

Snag surrogates (piles, markers, etc) acceptable

Quick survey of LWD debris along littoral transect

Section 11 Periphyton and Sediment

Objective is to collect a representative periphyton sample for taxonomic analysis and a representative fine sediment sample for toxicity testing (*Hyalella*)

Periphyton

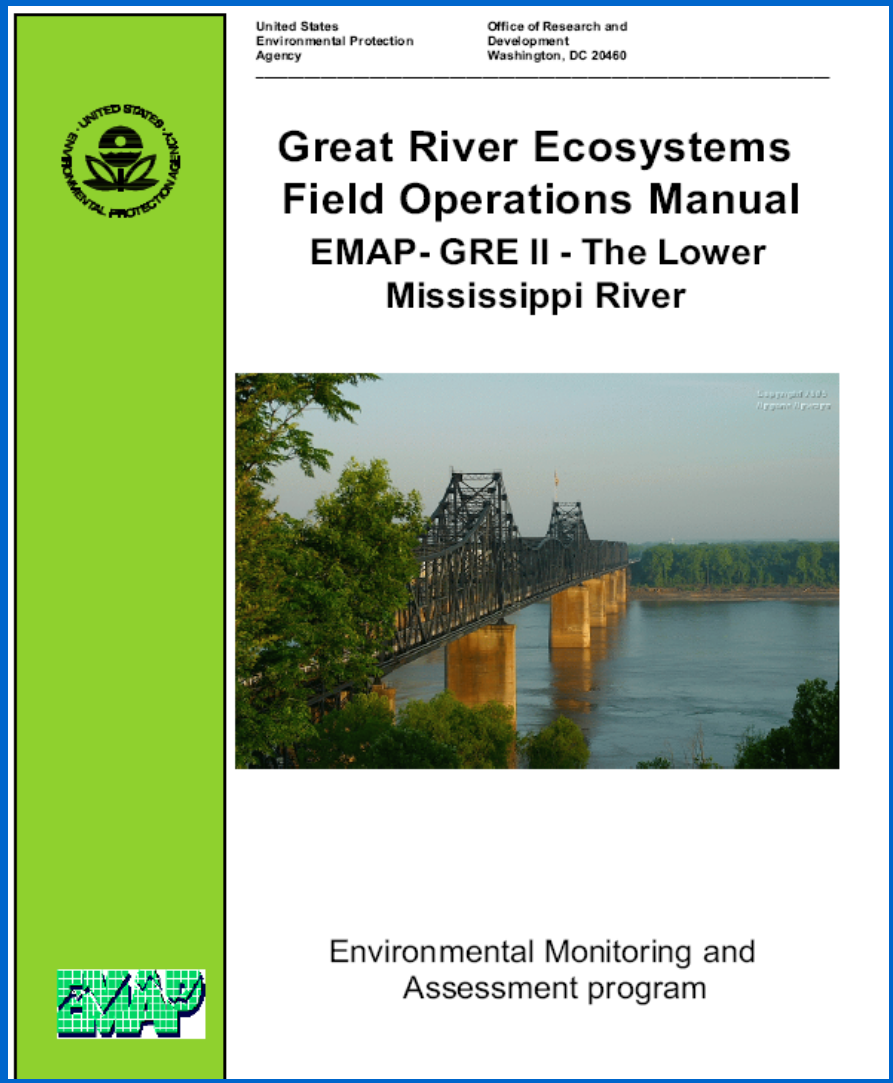
- Composite scrape, scoop, or brush samples from all littoral stations collected by wading
- Can mix substrates at site
- Shipped to cooperator for taxonomic analysis

Sediment

- Composite of fine sediment samples from all stations at a site collected by wading
- Target sample volume = 5 L
- Shipped to EPA lab for toxicity testing

Standard PONAR sampler option in nonwadeable areas

Will we need a new manual for LMR?



- New reaches
- New design
- New data forms?
- New sample labels?
- New Indictors ?
- New gears ?
- New methods?
- New logistics?
- New labs?

Discussion

- What won’t work at most sites?
  - Unsafe
  - Unfeasible
  - Suboptimal
- What are the alternatives?
- What indicators should be added?
  - Analytes
  - Indicator types
- Do we have the optimal Index period?
- Is there regional expertise we don’t know about?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