### Assessment of the Fish Assemblage and Habitat Quality in the Red River of the North



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NORTH DAKOTA DEPARTMENT of HEALTH

# Outline

Study Area Background Objectives Study Design Methods Results Conclusions









 Concept developed following a 2005 Red River Ecosystem Assessment Workshop

Originally planned sampling for 2009
River conditions precluded sampling

Focused first on fish and habitat – also collected macroinvertebrate and water quality samples

54 sites visited from Aug. 18 – Sep 1, 2010



Can the fish community effectively be sampled on the Red River?

Develop Biocriteria for Red River

Evaluate longitudinal trends of Red River
 Upstream to downstream

# **Study Design**

**Intensive Pollution Survey Design** 

-Inventory of potential stressors

-Wastewater treatment

-Industrial discharges

-Dams

-Intermittent sources





# **Sampling Locations**



**Fish Methods** 

Smith-Root 5.0 GPP Electrofishe

500 Meter reach length

Pulsed DC

Downstream direction - outside bend of river

Daytime electrofishing

# Habitat – (QHEI)

| Stream & Location:   | and the second   |  | RM:Date: _   |
|--|--|--|--|
|  | Scorer   | s Full Name & Affiliation:   | Office verified  |
| River Code:  | STORET #:  | (NAD 83 - decimal °)   | 18 location  |
| SUBSTRATE Check ONLY To<br>estimate % or r   | wo substrate TYPE BOXES;<br>note every type present  | Check ON   | E (Or 2 & average)   |
| BEST TYPES POOL RI   | FFLE OTHER TYPES POOL  |  | QUALITY  |
| BLDR /SLABS [10]   | HARDPAN [4]  |  |  |
| BOULDER [9]  |  | WETLANDS [0]   | SILT INORMAL [0]   |
| GRAVEL [7]   |  | HARDPAN [0]  |  |
| SAND [6]   |  |  | MODED MODERATE [-2]  |
|  | 4 or more [2] sludge from poin   | it-sources)  | SS NORMAL [0] 20   |
| Commonts   | 3 or less [0]  |  | NONE [1]   |
| 20mments   |  | COAL FINES [-2]  |  |
| quality; 3-Highest quality in modera<br>diameter log that is stable, well dev<br>UNDERCUT BANKS [1]<br>OVERHANGING VEGETATI<br>SHALLOWS (IN SLOW WAT<br>ROOTMATS [1]<br>Comments   | ; 2-Moderate amounts, but not of hi<br>te or greater amounts (e.g., very la<br>eloped rootwad in deep / fast water<br>POOLS > 70cm [2]<br>DN [1]ROOTWADS [1]<br>[ER] [1]BOULDERS [1]   | ignest quality or in small amounts of<br>rige boulders in deep or fast water, le<br>, or deep, well-defined, functional pr<br>OXBOWS, BACKWATER:<br>AQUATIC MACROPHYTE<br>LOGS OR WOODY DEBR   | Inignessi<br>arge       Check ONE (Or 2 & average)         sols.       EXTENSIVE >75% [1]         sols.       MODERATE 25-75% [7]         is [1]       SPARSE 5-         sis [1]       NEARLY ABSENT <5% [1]   |
| I MODERATE [3] [] GOOD [5]<br>] LOW [2] [] FAIR [3]  |  |  |  |
| Comments   |  | COVERY [1]   | Channel<br>Maximum<br>20   |
| INORE [1]         INORE [1]           Comments           BANK EROSION AND RI           River right tooking downstream           EROSION           BONE ( LITTLE [3]           I MODERATE [2]           I HEAVY SEVERE [1]           I HEAVY SEVERE [1]   | RECENT OR NO REC           IPARIAN ZONE Check ONE in e           RIPARIAN WIDTH           WIDE > 50m [4]           B           MODERATE 10-50m [3]           SNARROW 5-10m [2]           PRY NARROW < 5m [1]   | ECOVERY [1]<br>Each category for <i>EACH BANK</i> (Or 2<br>FLOOD PLAIN QUALIT<br>FOREST, SWAMP [3]<br>HRUB OR OLD FIELD [2]<br>ESIDENTIAL, PARK, NEW FIELD [1<br>EENCED PASTURE [1]<br>OPEN PASTURE, ROWCROP [0]   | Channel<br>Maximum<br>20<br>2 per bank & average)  |
| I NONE [1]         I POOR [1]           Comments         BANK EROSION AND RI           BANK EROSION         B           I NONE / LITTLE [3]         B           I MODERATE [2]         B           I MODERATE [3]         B   | RECENT OR NO REC      PARIAN ZONE Check ONE in 6      RIPARIAN WIDTH     R      WIDE > 50m [4]     B      NODERATE 10-50m [3]     B      NARROW 5-10m [2]     B      NONE [0]     C    | ECOVERY [1]<br>each category for <i>EACH BANK</i> (Or 2<br>FLOOD PLAIN QUALIT<br>FOREST, SWAMP [3]<br>HRUB OR OLD FIELD [2]<br>RESIDENTIAL, PARK, NEW FIELD [1<br>FENCED PASTURE [1]<br>OPEN PASTURE, ROWCROP [0]  | Channel<br>Maximum<br>20<br>Per bank & average)<br>B CONSERVATION TILLAGE [1]<br>URBAN OR INDUSTRIAL [0]<br>URBAN OR INDUSTRIAL [0]<br>Indicate predominant land use(s)<br>past 100m riparian<br>Maximum<br>10   |
| I NORE [1]         I POOR [1]           Comments         BANK EROSION AND RI           BANK EROSION         B           BANK LEROSION         B           BANK LITTLE [3]         B           B MODERATE [2]         B           Comments         B           B POOL [ GLIDE AND RIFF           MONE [2]         B   | RECENT OR NO REC      PARIAN ZONE Check ONE in 6      RIPARIAN WIDTH     R      WIDE > 50m [4]     B      NODERATE 10-50m [3]     B      NARROW 5-10m [2]     B      VERY NARROW < 5m [1]     C      TE / RUN QUALITY      CHANNEL WIDTH      CHANNEL WIDTH  | COVERY [1]<br>each category for EACH BANK (Or 2<br>FLOOD PLAIN QUALITY<br>FOREST, SWAMP [3]<br>HRUB OR OLD FIELD [2]<br>ESDENTIAL, PARK, NEW FIELD [1<br>EENCED PASTURE [1]<br>OPEN PASTURE, ROWCROP [0]<br>CURRENT VELOCITY<br>CORRECT VELOCITY   | Channel<br>Maximum<br>20<br>Per bank & average)<br>B CONSERVATION TILLAGE [1]<br>URBAN OR INDUSTRIAL [0]<br>URBAN OR INDUSTRIAL [0]<br>Indicate predominant land use(s)<br>past 100m riparian<br>Maximum<br>10<br>Recreation Potential<br>Primary Contact  |
| INONE [1]         □ POOR [1]           Comments         □           □         BANK EROSION AND RI<br>River right tooking downstream           □         ■ ROSION           □         ■ ROSION           □         ■ NONE / LITTLE [3]           □         ■ MODERATE [2]           □         ■ HEAVY / SEVERE [1]  | RECENT OR NO REC           (PARIAN ZOWE Check ONE in G           RIPARIAN WIDTH           WIDE > 50m [4]           B           MODERATE 10-50m [3]           NARROW S-10m [2]           P           NONE [0]           CHANNEL WIDTH           CHANNEL WIDTH           CHANNEL WIDTH           Netrope           L wIDTH > RIFFLE WIDTH [2]  | COVERY [1]<br>each category for EACH BANK (Or 2<br>FLOOD PLAIN QUALITY<br>FLOOD PLAIN QUALITY<br>COREST, SWAMP [3]<br>INRUB OR OLD FIELD [2]<br>RESIDENTIAL, PARK, NEW FIELD [1]<br>RESIDENTIAL, PARK, NEW FIELD [1]<br>PPEN PASTURE, ROWCROP [0]<br>CURRENT VELOCITY<br>Check ALL that apply<br>TORRENTIAL [-1] SLOW [1]  | Channel<br>Maximum<br>20<br>Per bank & average)<br>Conservation tilLage [1]<br>Conservation tilLage [1]  |
| DORR [1]         DORR [1]           Comments           ] BANK EROSION AND RI<br>River right tooking downstream           B EROSION           [] DI NONE / LITTLE [3]           [] MODERATE [2]           [] MODERATE [2]           [] HEAVY / SEVERE [1]           [] Comments           [] POOL / GLIDE AND RIFF           [] Check ONE (ONLY)           [] 0.7.4 im [6]           [] 0.7.4 im [6]  | RECENT OR NO REC      REPARIAN ZONE Check ONE in 6     RIPARIAN WIDTH     B F MODE > 500 [4]     B F MODERATE 10-50m [3]     B F MODERATE 10-50m [3]     B F MODERATE 10-50m [3]     C      CHANNEL WIDTH     CHANNEL WIDTH     CHANNEL WIDTH     AIFFLE WIDTH [2]     L     WIDTH > RIFFLE WIDTH [1]  | COVERY [1]<br>Bach category for EACH BANK (Or 2<br>FLOOD PLAIN QUALIT<br>OREST, SWAMP [3]<br>BHRUB OR OLD FIELD [2]<br>RESIDENTIAL, PARK, NEW FIELD [1<br>TENCED PASTURE [1]<br>SPEN PASTURE, ROWCROP [0]<br>CURRENT VELOCITY<br>Check ALL that apply<br>TORRENTIAL [-1] SLOW [1]<br>VERY FAST [1] INTERSITIN  | Channel<br>Maximum<br>20<br>Per bank & average)<br>Conservation TiLLAGE [1]<br>URBAN OR INDUSTRIAL [0]<br>Indicate predominant land use(s)<br>past 100m riparian. Riparian<br>Maximum<br>10<br>Recreation Potential<br>Primary Contact<br>Secondary Contact<br>Secondary Contact<br>Secondary Contact  |
| NONE [1]         POOR [1]           Comments           ]         BANK EROSION AND R           River right tooking downstream         R           B         EROSION         R           1         MONE / LITTLE [3]         1           1         MONERATE [2]         1           1         MORERATE [2]         1           1         HEAVY / SEVERE [1]         1           2         HEAVY / SEVERE [1]         1           3         HEAVY / SEVERE [1]         1           4         Comments         1           6         COL / GLIDE AND RIFF         1           1         Check ONE (ONLY!)         C           1         0.0.7         1         1           0         0.7         7         1  | RECENT OR NO REC   | COVERY [1]<br>Bach category for EACH BANK (Or 2<br>FLOOD PLAIN QUALIT<br>FOREST, SWAMP [3]<br>SHRUB OR OLD FIELD [2]<br>BESIDENTIAL, PARK, NEW FIELD [1<br>ENCED PASTURE [1]<br>DPEN PASTURE, ROWCROP [0]<br>CURRENT VELOCITY<br>Check ALL that apply<br>TORRENTIAL [-1] SLOW [1]<br>VERY FAST [1] INTERSTITI<br>FAST [1] INTERSTITI<br>FAST [1] INTERSTITI<br>FAST [1] DINTERSTITI<br>FAST [1] DINTERSTITI<br>FAST [1] DINTERSTITI  | Channel<br>Maximum<br>20<br>2 per bank & average)<br>Conservation tilLage [1]<br>Conservation tilLage [1]<br>C   |
| NONE [1]         POOR [1]           Comments         POOR [1]           BANK EROSION AND RI           River right looking downstream           EROSION           I           MODERATE [2]           I           MODERATE [2]           I           HEAVY / SEVERE [1]           I           POOL / GLIDE AND RIFF           MAXIMUM DEPTH           Check ONE (0NLY)           Check ONE (0NLY)           > 1m [6]           POO           0.2.4<0.7m [2]  | RECENT OR NO REC<br>PARIAN ZONE Check ONE in (<br>RIPARIAN WIDTH<br>MODERATE 10-50m [3]<br>NARROW 5-10m [2]<br>VERY NARROW 5-10m [2]<br>NONE [0]<br>CHANNEL WIDTH<br>heck ONE (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [2]<br>L WIDTH > RIFFLE WIDTH [1]<br>L WIDTH < RIFFLE WIDTH [0]<br>L WIDTH [0]  | EVERY [1]<br>Each category for EACH BANK (Or 2<br>FLOOD PLAIN QUALIT<br>FOREST, SWAMP [3]<br>BHRUB OR OLD FIELD [2]<br>RESIDENTIAL, PARK, NEW FIELD [1<br>ENCED PASTURE [1]<br>DPEN PASTURE [1]<br>CURRENT VELOCITY<br>Check ALL that apply<br>TORRENTIAL [-1] SLOW [1]<br>VERY FAST [1] INTERMITTE<br>MODERATE [1] INTERMITTE<br>Indicate for reach - pools and riffle  | Channel<br>Maximum<br>20 Construction TilLage [1]<br>Conservation TilLage [  |
| NONE [1]         Comments           ]         BANK EROSION AND RI<br>River right looking downstream           ■         EROSION           □         NONE / LITTLE [3]           □         NONE / LITTLE [3]           □         NONE / LITTLE [3]           □         HODERATE [2]           □         HEAVY / SEVERE [1]           □         HEAVY / SEVERE [1]           □         DEPTH           Comments           □         POOL / GLIDE AND RIFF           MAXIMUM DEPTH           Check ONE (ONLY!)           □         > 1m [6]           □         POOL           □         0.0.4-0.7m [2]           □         0.2.4-0.7m [1]           □         0.2.2m [0]           Comments  | RECENT OR NO REC   | COVERY [1]<br>each category for EACH BANK (Or 2<br>FLOOD PLAIN QUALITY<br>FOREST, SWAMP [3]<br>HRUB OR OLD FIELD [2]<br>RESIDENTIAL, PARK, NEW FIELD [1<br>ENCED PASTURE [1]<br>OPEN PASTURE [1]<br>CURRENT VELOCITY<br>Check ALL that apply<br>TORRENTIAL [-1] SLOW [1]<br>VERY FAST [1] INTERSTITU<br>FAST [1] INTERSTITI<br>MODERATE [1] DODIES [1]<br>Indicate for reach - pools and riffle  | Channel<br>Maximum<br>20  Per bank & average)  Conservation tilLage [1]<br>Conservation tilLage [1]<br>Conservation tilLage [1]<br>Conservation tilLage [1]<br>Conservation tilLage [1]<br>Conservation tilLage [1]<br>Conservation tilLage [1]<br>Maximum<br>10  Conservation tilLage [1]<br>Conservation tilLage [1]<br>Conservation tilLage [1]<br>Conservation tilLage [1]<br>Maximum<br>12  Conservation tilLage [1]<br>Conservation tilLage [1]<br>Maximum<br>12  Conservation tilLage [1]<br>Conservation tilLage [1]  |
| I NONE [1]         Comments           ] BANK EROSION AND RI           ] BANK EROSION           BEROSION           BEROSION           BID NONE / LITTLE [3]           BODERATE [2]           Comments           BODERATE [3]           BODE [0,4-co.7m [2]           BODE [0,4-co.7m [2]           BODE [0,2-co.4m [1]           Comments           Indicate for functional  | RECENT OR NO REC<br>PARIAN ZONE Check ONE in (<br>RIPARIAN WIDTH<br>MODERATE 10-50m [3]<br>NARROW 5-10m [2]<br>NARROW 5-10m [2]<br>NONE [0]<br>CLE/RUN OUALITY<br>CHANNEL WIDTH<br>ANDRE (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [3]<br>L WIDTH > RIFFLE WIDTH [1]<br>L WIDTH < RIFFLE WIDTH [0]<br>CHANNEL (07 2 & average)<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>L WIDTH > RIFFLE WIDTH [1]<br>CHANNEL (07 2 & average)<br>CHANNEL (07 | ECOVERY [1]<br>each category for EACH BANK (Or 2<br>FLOOD PLAIN QUALIT<br>FLOOD PLAIN QUALIT<br>FOREST, SWAMP [3]<br>HRUB OR OLD FIELD [2]<br>EESIDENTIAL, PARK, NEW FIELD [1<br>ENCED PASTURE [1]<br>OPEN PASTURE, ROWCROP [0]<br>CURRENT VELOCITY<br>Check ALL that apply<br>TORRENTIAL [-1] SLOW [1]<br>VERY FAST [1] INTERMITTE<br>MODERATE [1] DODIES [1]<br>Indicate for reach - pools and riffle<br>large enough to support a   | Channel<br>Maximum<br>20<br>Per bank & average)<br>Conservation tilLage [1]<br>Conservation tilLage [1]  |
| I NONE [1]         □ POOR [1]           Comments         □           □         BANK EROSION AND RI<br>River right tooking downstream           ■         EROSION           □         Interfailt tooking downstream           ■         EROSION           □         INTELE [3]           □         MODERATE [2]           □         MODERATE [2]           □         HEAVY / SEVERE [1]           □         □           Comments           □         POOL / GLIDE AND RIFF           MAXIMUM DEPTH           Check ONE (0/NL/?)           □         0.7- <tm [4]<="" td="">           □         0.04-&lt;0.7m [2]</tm>  | RECENT OR NO REC   | EVERY [1]<br>Each category for EACH BANK (Or 2<br>FLOOD PLAIN QUALIT<br>FOREST, SWAMP [3]<br>HRUB OR OLD FIELD [2]<br>EESIDENTIAL, PARK, NEW FIELD [1<br>EENCED PASTURE [1]<br>OPEN PASTURE [1]<br>OPEN PASTURE, ROWCROP [0]<br>CURRENT VELOCITY<br>Check ALL that apply<br>TORRENTIAL [-1] SLOW [1]<br>VERY FAST [1] INTERSITI<br>MODERATE [1] BLOW [1]<br>Indicate for reach - pools and riffle<br>large enough to support a<br>(Or 2 & average).<br>RUN SUBSTRATE RIFFI   | Channel<br>Maximum<br>20<br>Per bank & average)<br>Conservation tilLage [1]<br>Conservation tilLage [1]<br>Maximum<br>10<br>Recreation Potential<br>Primary Contact<br>Correl<br>Secondary Contact<br>Correl<br>Secondary Contact<br>Correl<br>Maximum<br>12<br>Secondary Contact<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Correl<br>Cor |
| INONE [1]         □ POOR [1]           Comments           ] BANK EROSION AND RI<br>River right tooking downstream           ■ EROSION           □ NONE / LITTLE [3]           □ MODERATE [2]           □ MODERATE [2]           □ MODERATE [2]           □ HEAVY / SEVERE [1]           □ AVER / SEVERE [1]           □ HEAVY / SEVERE [1]           □ OCOMMENTS           Indicate for functional I           □ of riffle-obligate spec | RECENT OR NO REC           PARIAN ZONE Check ONE in 6           RIPARIAN WIDTH           B           MODE > 50m [4]           MODERATE 10-50m [3]           B           MODERATE 10-50m [3]           B           MODERATE 10-50m [3]           B           WIDE > 50m [4]           B           MODERATE 10-50m [3]           B           WIDE > 50m [1]           B           VERY NARROW < 5m [1]   | ECOVERY [1]<br>Each category for EACH BANK (Or 2<br>FLOOD PLAIN QUALIT<br>FOREST, SWAMP [3]<br>ENRUB OR OLD FIELD [2]<br>EESIDENTIAL, PARK, NEW FIELD [1<br>'ENCED PASTURE [1]<br>SPEN PASTURE, ROWCROP [0]<br>CURRENT VELOCITY<br>Check ALL that apply<br>TORRENTIAL [1] SLOW [1]<br>VERY FAST [1] INTERSTITH<br>FAST [1] INTERSTITH<br>FAST [1] EDDIES [1]<br>Indicate for reach - pools and riffle<br>large enough to support a<br>(Or 2 & average).<br>/ RUN SUBSTRATE RIFFI<br>e.g., Cobble, Boulder) [2]   | Channel<br>Maximum<br>20<br>Per bank & average)<br>Conservation tilLage [1]<br>Conservation tilLage [1]  |
| INONE [1]         INONE [1]           Comments           ]         BANK EROSION AND RI<br>River right tooking downstream           BEROSION         B           BANK EROSION         B           BROSION         B           BODE / LITLE [3]         B           BANNK EROSION         B           B         Comments           Comments         B           BODE / GLIDE AND RIFF           Check ONE (ONLY)         CI           B (6)         POO           D 0.7- <tm [4]<="" td="">         POO           D 0.7-<tm [4]<="" td="">         POO           Comments         Indicate for functional not of riffle-obligate specie           RIFFLE DEPTH         BEST AREAS &gt; 10cm [2]           BEST AREAS &gt; 10cm [2]         MA</tm></tm>  | RECENT OR NO REC           PARIAN ZONE Check ONE in 6           RIPARIAN WIDTH           Image: State of the sta  | EVVERY [1]<br>Each category for EACH BANK (Or 2<br>FLOOD PLAIN QUALIT<br>FOREST, SWAMP [3]<br>SHRUB OR OLD FIELD [2]<br>EESIDENTIAL, PARK, NEW FIELD [1<br>EESIDENTIAL, PARK, NEW FIELD [1]<br>ENCED PASTURE [1]<br>SPEN PASTURE, ROWCROP [0]<br>CURRENT VELOCITY<br>Check ALL that apply<br>TORRENTIAL [-1] SLOW [1]<br>VERY FAST [1]<br>INTERSTITI<br>MODERATE [1]<br>INTERSTITI<br>MODERATE [1]<br>INTERSTITI<br>Indicate for reach - pools and riffic<br>Iarge enough to support a<br>(Or 2 & average).<br>/ RUN SUBSTRATE<br>RIFFI<br>e.g., Cobbe, Boulder) [2]<br>BBLE (e.g., Large Gravel) [1]  | Channel<br>Maximum<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20   |
| NONE [1]         POOR [1]           Comments           BANK EROSION AND RI<br>River right tooking downstream           EROSION           BANK EROSION [1]           MODERATE [2]           MODERATE [2]           HEAVY / SEVERE [1]           HEAVY / SEVERE [1]           POOL / GLIDE AND RIFF           Comments           POOL / GLIDE AND RIFF           Check ONE (0/NLY)           Climents           POOL / GLIDE AND RIFF           Check ONE (0/NLY)           Climents           POOL / GLIDE AND RIFF           Check ONE (0/NLY)           Climents           Indicate for functional I           of riffle-obligate specie           RIFFLE DEPTH           BEST AREAS > 10cm [2]           BEST AREAS > 10cm [2]           BEST AREAS > 10cm [2]           BEST AREAS = 10cm [2]   | RECENT OR NO REC           PARIAN ZONE Check ONE in 6           RIPARIAN WIDTH           B           MODE > 500 [4]           MODERATE 10-50m [3]           MODERATE 10-50m [3]           NARROW S-10m [2]           VERY NARROW < 5m [1]  | EVVERY [1]<br>Each category for EACH BANK (Or 2<br>FLOOD PLAIN QUALIT<br>FOREST, SWAMP [3]<br>HRUB OR OLD FIELD [2]<br>EESIDENTIAL, PARK, NEW FIELD [1<br>EENCED PASTURE [1]<br>OPEN PASTURE [1]<br>CURRENT VELOCITY<br>Check ALL that apply<br>TORRENTIAL [-1] SLOW [1]<br>VERY FAST [1]<br>INTERSTITI<br>MODERATE [1]<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>RODERATE [1]<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>RODERATE [1]<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>RODERATE [1]<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>INTERSTITI<br>I | Channel<br>Maximum<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20   |
| NONE [1]         POOR [1]           Comments           ]         BANK EROSION AND RI<br>River right tooking downstream           BEROSION         B           Important Comments         B           Important Comments         B           Important Comments         B           Important Comments         B           Important Contract         B           Important         B                                 | RECENT OR NO REC           PARIAN ZONE Check ONE in 6           RIPARIAN WIDTH           B           MODE > 500 [4]           MODERATE 10-50m [3]           MODERATE 10-50m [3]           NARROW < 10m [2]   | ECVERY [1]<br>Each category for EACH BANK (Or 2<br>FLOOD PLAIN QUALIT<br>FOREST, SWAMP [3]<br>SHRUB OR OLD FIELD [2]<br>EESIDENTIAL, PARK, NEW FIELD [1<br>EESIDENTIAL, PARK, NEW FIELD [1]<br>ENCED PASTURE [1]<br>SPEN PASTURE, ROWCROP [0]<br>CURRENT VELOCITY<br>Check ALL that apply<br>TORRENTIAL [-1] SLOW [1]<br>VERY FAST [1] INTERSTITH<br>FAST [1] EDDIES [1]<br>Indicate for reach - pools and riffic<br>Iarge enough to support a<br>(Or 2 & average).<br>/ RUN SUBSTRATE RIFFI<br>e.g., Cobbe, Boulder) [2]<br>IBLE (e.g., Large Gravel) [1]<br>E (e.g., Fine Gravel, Sand) [0]  | Channel<br>Maximum<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20   |
| NONE [1]       POOR [1]         Comments       POOR [1]         BANK EROSION AND RIF       POOR [1]         River right tooking downstream       P         BROSION       P         I NONE / LITTLE [3]       III         I MODERATE [2]       IIII         I MODERATE [2]       IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII   | RECENT OR NO REC   | ECVERY [1]<br>Each category for EACH BANK (Or 2<br>FLOOD PLAIN QUALIT<br>FOREST, SWAMP [3]<br>BIRUB OR OLD FIELD [2]<br>EESIDENTIAL, PARK, NEW FIELD [1<br>EESIDENTIAL, PARK, NEW FIELD [1<br>ENCED PASTURE [1]<br>DPEN PASTURE, ROWCROP [0]<br>CURRENT VELOCITY<br>Check ALL that apply<br>TORRENTIAL [-1] SLOW [1]<br>CORENTIAL [-1] SLOW [1]<br>CORENTIAL [-1] INTERSTITI<br>MODERATE [1] INTERSTITI<br>MODERATE [1] INTERSTITI<br>Indicate for reach - pools and riffle<br>(or 2 & average).<br>/ RUN SUBSTRATE RIFFI<br>e.g., Cobble, Boulder) [2]<br>BLE (e.g., Large Gravel) [1]<br>E (e.g., Fine Gravel, Sand) [0]   | Channel<br>Maximum<br>20<br>Per bank & average)<br>Conservation TilLage [1]<br>URBAN OR INDUSTRIAL [0]<br>MINING / CONSTRUCTION [0]<br>Indicate predominant land use(s)<br>past 100m nparian. Riparian<br>Maximum<br>Maximum<br>10<br>Recreation Potential<br>Primary Contact<br>Secondary C   |

## **Macroinvertebrate Methods**



Total reach length = 40 x mean wetted width (min = 150 m; max = 4 km)



### In Situ Measurements

#### Temperature

### Dissolved Oxygen

### ■ pH

### Conductivity



# Water Quality



# Logistics

Ð

### **Results - Fish**

-5,033 individuals collected

1 species represented

-Species richness ranged from 8-20 - Average of 14

-Channel catfish were most abundant numerically - 1,245 individuals (24.7%)

-Common carp represented greatest biomass - 32.2%

### Results - Macroinvertebrates

- Total taxa ranged from 7 40
  Average of 23
- Most abundant taxa
   Chironomidae (32%)
   Oligochaeta (16%)















### **Results - Water Quality**



### **Results - Water Quality**

Nutrients



### **Results – Habitat**

**QHEI Habitat Score** 



### Results - Fish and Macroinvertebrates



### **Data Analysis**



 Minnesota Pollution Control Agency (MPCA) has developed a Southern Rivers Index of Biotic
 Integrity (IBI) which includes the Red River of the North

### **Results - Use Attainment**

**MPCA - Southern Rivers IBI** 



### **Conclusions & Next Steps**

- Fish community was successfully sampled
- Habitat attributes a key component for fish community
- Most sites meet general use criteria
- Further macroinvertebrate and chemical analysis to be completed in near future

Identify potential stressors

# Acknowledgements

### Midwest Biodiversity Institue

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- US EPA
- Great Lakes Environmental Center

# **QUESTIONS?**

