Evaluation Documents

School:

Age:

Date:

Tip of the Mitt Watershed Council
426 Bay Street
Petoskey, MI 49770
231-347-1181

Watershed Knowledge and Opinion Survey

Please take a few minutes to fill out this survey about your knowledge and opinions of your watershed. Your answers will remain confidential. Please only circle ONE answer for each question.

1. A watershed is _____
   A. The headwaters, tributaries and mouth of the river
   B. All of the land area that drains water to a lake or river
   C. A drainage basin
   D. Both B and C

2. Where does the water in our watershed come from?
   A. Glaciers
   B. Great Lakes
   C. Underground
   D. Rainfall/Snowmelt in Northern Michigan

3. Water pollution may occur from _____
   A. Dumping garbage
   B. Erosion
   C. Cutting down shoreline trees
   D. Fertilizing shoreline lawns
   E. All of the above

4. How many *average* gallons of water do you personally use per day, not counting water used to make the products you use and the food you eat? _____ Gallons

5. Do you think your watershed is generally healthy? Yes/No – Why or why not?

Name:
Date:
Grade:
School:
Age:

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Watershed Knowledge and Opinion Survey

Please take a few minutes to fill out this survey about your knowledge and opinions of your watershed. Your answers will remain confidential and be compared with a post-survey to evaluate our program's effectiveness.

Watershed Knowledge

6. Which statement best describes how water quality standards are used?
   - A. Water quality standards make sure that all water is clean enough to drink
   - B. Water quality standards describe how to remove pollutants from water
   - C. State and federal water quality standards remove pollutants from water
   - D. A and B

7. Water pollution may occur from _____
   - F. Dumping garbage
   - G. Erosion
   - H. Cutting down shoreline trees
   - I. Fertilizing shoreline lawns
   - J. All of the above

8. If you find only pollution-tolerant macroinvertebrates in a stream, what does that indicate?
   - A. The water quality of the stream has been degraded
   - B. Fish ate all of the pollution-sensitive macro-invertebrates
   - C. You can drink the water
   - D. You don't need to test other parts of the stream
   - E. All of the above

9. Which of the following is the best way to determine the health of a stream?
   - A. Measure the pH and the temperature of the water
   - B. Count the number and types of macroinvertebrates living in the stream
   - C. Count the number and types of trees, shrubs, grass, and other plant species growing near a stream
   - D. Count the number and types of fish, amphibians and other aquatic animals living in a stream
   - E. C and D

10. Which of the following lists of products ALL require water to produce?
    - A. Blue jeans, automobiles, computers, paper
    - B. Gasoline, plastic bags, electricity, glass
    - C. Hamburger, apples, medicines, milk
    - D. B and C

E. All of the above

11. Which of the following is a source of NON-point source pollution?

A. The water from a sewage treatment plant flowing out of a pipe directly into a lake.
B. Rainwater runoff carrying fertilizers, pesticides, and sediment from a farm field or lawn into a river.
C. A power plant discharging very warm water from a pipe into the Great Lakes.
D. Oil leaking from a damaged or broken underwater oil pipeline.
E. C and D

12. Your watershed quality impacts your drinking water.

A. True
B. False

13. Which of the following could contaminate drinking water in wells?

A. Too much fertilizer on lawns and crops.
B. Leaking underground gasoline storage tanks at gas stations.
C. Animal wastes from a livestock feedlot.
D. Failing septic systems nearby.
E. All of the above

Watershed Opinions

14. What is *one thing* that students like you can do to improve your watershed?

15. Do you think you have an effect on our watershed? Y/N – Why or why not?

16. What would you be willing to do **this year** to improve the quality of our watershed? *(Check all letters that apply.)*

A. Talk to you friends and family about their behaviors that are harmful to the watershed.
B. Volunteer for a beach cleanup
C. Volunteer for water quality monitoring activities
D. Do more walking and biking and less driving
E. Other (please specify)_____

17. What activities do we use our watershed for? *(Check all letters that apply.)*

A. Motorized boating
B. Canoeing/kayaking
C. Swimming
D. Camping
E. Hunting
F. Fishing
G. Other (Please Specify)_____

Tip of the Mitt Watershed Academy
Program Evaluation

We need your help to improve the experience participants have in the Watershed Academy. **Please read the questions and circle the number on the scale that best reflects your experience.** *Only respond if applicable.

	Strongly disagree				Strongly agree
I feel confident speaking to others about the education and skills gained through my participation on my watershed team.	1	2	3	4	5
Overall, the Watershed Academy was a good experience.	1	2	3	4	5
The learning sessions were well organized.	1	2	3	4	5
The sessions offered enough time for learning and working on our project.	1	2	3	4	5
My team had the support we needed from Watershed Academy staff.	1	2	3	4	5
The student teams were about the right size.	1	2	3	4	5
I was prepared for the stream monitoring experience.	1	2	3	4	5
The information in our resource binder and power point was useful and helpful with our project.	1	2	3	4	5
The final watershed project was a useful learning experience for me.	1	2	3	4	5
*The field trip at nature preserve increased my understanding of the connection between land conservation and water quality.	1	2	3	4	5
*The field trip at nature preserve was a valuable experience.	1	2	3	4	5

******Please take time to respond to the questions below with detailed answers.**

1. What is the most important thing that you learned, or learned how to do, in this program?

2. Did any of your ideas or feelings about nature, your watershed, or the state of the environment change? *If yes,* what changed, and in what way?

3. What was your favorite part of this program?

4. What was your least favorite part of this program?

5. Do you think the final watershed project is the *best way* to share your Watershed Academy experience with other students and the community? Why or why not?

6. Would you recommend participation in the Watershed Academy to classmates? Why or why not?

7. Please describe in **some detail** any changes that you feel would improve the Watershed Academy.

Tip of the Mitt Watershed Academy
Program Evaluation- Biology Teacher

Please provide us with feedback on the Watershed Academy by sharing your experience and observations of your student's experience. Your responses are important and will help improve future programming.

***Please describe in detail your responses to all questions, in particular "yes or no" questions. If you have participated previously, please respond with current reflections.*

Student Focus:

1. What do you believe were the motivations for student participation in the Watershed Academy?

2. Did Watershed Academy member participation cause any unintended effects in the regular classroom population, whether positive or negative?

3. Do you have any evidence (observation, discussion, etc.) that students participating in the Watershed Academy have increased their **knowledge of water quality and skills** in monitoring water quality?

4. Do you have any evidence (observation, discussion, etc.) that students participating in the Watershed Academy have changed their **attitudes and behaviors** regarding water resource stewardship?

5. Did you feel Watershed Academy members were adequately prepared for the field experience?

6. What was the time investment for students/members (number of hours) and is this an appropriate amount of time?

Program Focus:

7. Did the initial visit and "mini-labs" experience appeal to the students and help promote the program?

8. Was the program organized well and was there clear communication of program goals?

9. What was the time investment for you as the biology teacher (number of hours) and was this an appropriate amount of time?

10. In an effort to minimize school disruption, please consider what training option(s) would you choose for your team:

    - Three separate class room sessions
    - Two extended class room sessions (current schedule)
    - One ½ day training (includes all sessions)
    - Afterschool session(s)
    - Other?

    Briefly explain your selection(s):

11. Would you recommend participation in the Watershed Academy to other school districts? Why or why not?

12. Please describe in some detail any suggestions or ideas you have to improve the program or its fit in your district.

Watershed Academy Program Reflection Questions - Instructor

1. What were your initial expectations of helping to develop and implement the Watershed Academy program? Have these expectations changed? How? Why?

2. What specific skills have you used during the implementation of this program?

3. Describe a person/situation you've encountered during the program who made a strong impression on you, positive or negative.

4. Has your view of the student population with whom you have been working changed? How?

5. What have you tried or changed in the program that seemed to be effective or ineffective?

6. How has your understanding of environmental education/PBE changed as a result of your participation in this program?

7. What are the most difficult or satisfying parts of your work with co-instructors and students in the Watershed Academy? Why?

8. Were there any disappointments or successes in your work in this program? What did you learn from it?

9. What sorts of things make you feel uncomfortable when you are working with co-instructors and students? Why?

Equipment List by Session

Introductory

- "Watershed Promotional- Mini Lab" Printed out (enough copies for one copy for instructors, one copy to be placed at the appropriate station, and one for each student participating in the promo)
- Applications (enough for every biology students)
- Pre-test for Great Lake Fishery Trust Grant
- Writing Utensils
- Candy/incentive

Station 1

- Sheet of white paper (enough for one page per student in promo visit)
- 2 Shallow pan (yellow sorting dishes work well
- 3 different colors of Water-based markers
- 2 Spray bottles of water

Station 2

- 5 samples of water with different pH levels
- 400 Narrow range pH strip
- pH poster from Students Experience Lake Charlevoix
- masking tape

Station 3 (students go through on their own no need for supplies)

Station 4

- 8 different macro invertebrate specimens (there should be 2 Groups, A and B, labeled 1-4 ie. 1A, 1B, 2A ect.)
- Microscope/magnifying glass
- 2 or 3 Bug Identification Mats
- 8 petri dishes

Folder assembly for session 1

- Program overview (one page) has school schedule at the bottom
- Roles and Responsibilities
- Visual calendar
- Session 1 overview
- Session 2 overview
- Session 3 overview
- Permission slip
- Project rubric and template

Session 1

- Watershed Model
- Kool Aid Refill
- Watershed Model parts
- Spray bottles
- Resource binders for each school
- PowerPoint of Volunteer stream monitoring
- PowerPoint for specific school
- Google Community/Gmail Instructions
- Check if you need anything for grants
- Laminated watershed map
- Labeling activity instructions
- Attendance sheet

Session2

- Water Chemistry test kits (Earth Force Low Cost Water Quality Monitoring kit)
    - Classroom Water Chemistry Kit should be stocked with enough supplies to do three sets of test (BOD will not be done and only 1 coliform bacteria test will be done during the classroom visit)
        - 12 large plastic test tubs with caps
        - 6 small glass vials with black caps
        - 3 silver sleeves
        - 6 indicator card (you may need to print and laminate extra cards)
        - 1secchi disk sticker if one is available
        - 2 extra coliform bacteria test
        - 16 DO testabs
        - 4 Nitrate test tabs
        - 4 pH test tabs
        - 4 PHOS test tabs
- 3 copies of Water Chemistry test instructions on brightly colored card stock- laminated
- Water Samples from 2 rivers and a well water sample in (collected in 2 gallon buckets with lids)
- 3 thermometers
- 5 Sorting pans
- 5 ice cube trays
- Pencils (enough for kids to use)
- 10 Forceps
- 10 Eye-droppers

- 3 Squirt bottles filled with water at collection site
- 5 Magnifying lenses
- 5 magniscopes
- 5-10 Petri dishes
- White copy paper (for student to place petri dishes on and view bug)
- Taxonomic keys (3 sets) laminated
    - One set includes (Location-N:\WaterPro\Monitoring and Research\Volunteer Stream Monitoring\Training)
        - Bug Dichtomous Key_IWL5 (green)
        - Bug ID Guide_Ohio Scenic Rivers (blue)
        - Bug ID_IWL 2 (yellow)
- 1 Gallon milk jug scoop
- Cooler for collecting bugs
- Bugs that were collected immediately before session
- 2 Large poster of Water Quality data sheets
- Vis a vi marker to write on posters (dry erase markers do not work well)
- Datasheets for all students in the session

For collecting macroinvertebrates (some of these items can be taken from the classroom session 2 bin and used for collection)

- Cooler
- Waders for collector
- Nets for collector
- 3 squirt bottle
- 2 gallon bucket to collect water from collection site for Water Chemistry Testing
- 1 Gallon milk jug scoop

Session 3

- 5 D frame nets
- 5 Sorting pans
- 6 ice cube trays
- 1 box of pencils
- 10 Forceps
- 10 Eye-droppers
- 5 Squirt bottles
- 10 Magnifying lenses
- Flags (10)
- 3 wide mouth 500 mL Nalgene bottle
    - 1-BOD and Coliforms bacteria test
    - 1- conductivity
    - 1-waste bottle
- Measuring tape
- 4 Clipboards
- Data sheet
- Maps preserve specific to each team

- 3 color coded Taxonomic keys
- 3 bug mats
- Waders
- Tarp
- 2, two gallon buckets
- 1 thermometers
- 11 small glass vials filled with ethanol for pickling macro invertebrates
- Water chemistry tests
- Water Chemistry test kits (instructor and school specific one)
- Instructions:
    - Captains
    - Water chemistry tests
    - Site artists
    - Macroinvertebrate team
    - Water Chemistry team
- Camera
    - Go Pro
- Banner
- First Aid kit
- Any supplies the schools have requested
- Yard stick
- Stream monitoring binder
- Name tags
- 11 petri dishes
    - Field day chemistry kit should be stocked with
        - 4 large plastic tubes with caps
        - 2 small glass vials with black caps
        - 2 silver sleeves
        - 1 indicator card
        - Secchi disk sticker should already be on the bottom of the bucket
        - 1 coliform bacteria test
        - 6 DO testabs (teams will take at least 2 tablet back to school to do BOD)
        - 4 Nitrate test tabs
        - 4 pH test tabs
        - 4 PHOS test tabs
        - 1 thermometer

Promotional Visit Documents

Promotional Visit Overview

Materials:

- General Assessment Survey – 5 Questions (copies per # of biology students)
- WA Applications – 30-50 (depending on group size)
- Mini-labs student lab sheet (Students work in pairs – ½ Total # biology students)
- Lab materials
- Tip of the Mitt Watershed Council newsletters and other materials
- Watershed brochures (10-15)
- WA video and PPT on jump drive
- Candy – Jolly ranchers?

Arrival: 10-15 minutes prior to session

Set –Up: Four Labs set around the classroom with room to walk around.

Ready video for viewing, set out surveys, lab sheets, reading materials, applications.

General:

15 minutes

- Introduction of TOMWC staff, general information about Watershed Council and WA, show video and PPT.
- Write mini-lab plan on board (maybe create poster?)

45 minutes

- Describe mini-labs, time limits, session end.
- Handout General Assessment Survey. (5 minutes)
- When students complete survey, students pick partner and get lab sheet.
- Student pairs move through mini-labs (20 minutes – 5 minutes per lab)
- When finished, hand in lab sheet, look at newsletters, brochures, etc.
- One instructor clean-up while class reviews answers.
- Review General Survey – Answers.
- Pass out applications and set due date for submission.

Promotional Session – Mini Lab Stations

Materials

- “Watershed Promotional- Mini Lab” Printed out – 1 per lab pair
- Writing Utensils
- Candy/incentive
- Station number “tents”
- Laminated instructions for each station

Station 1 – Watershed Model

- Copy paper -
- 2 Shallow pans- yellow collecting trays from bug ID
- 3-5 different Water-based colored markers
- 2 Spray bottle of water
- Paper towel

Station 2 – Water Chemistry

- 5 samples of water with different pH levels (baking soda, lemon juice, bleach, tap water, vinegar)
- Wide-range pH paper (enough for each pair of students to do 5 tests)
- pH poster from Students Experience Lake Charlevoix
- masking tape
- 15 plastic beakers – labelled #1-5

Station 3 Point Source/Non-Point Source Pollution

- Laminated list with actions and photos (2 copies)

Station 4 – Macroinvertebrate ID

- 9 different macro invertebrate specimens (there should be 3 Groups, A, B,C labeled 1-3 ie. 1A, 1B, 2A ect.)
- Microscope/magnifying glass
- 3 Bug Identification Mats
- 9 petri dishes
- 6 forceps

Station #1 - What is a Watershed?

READ:

During a rainstorm, water that flows over the land collects in channels such as streams, canals, rivers, etc. **The land area that drains water is called a watershed**. Areas of higher elevation, called divides, separate watersheds from each other. Water flows through a series of channels and eventually it collects in a wide river that empties into a body of water such as an ocean or lake.

From an aerial view, drainage patterns in a watershed resemble a network similar to the branching pattern of a tree. Tributaries, similar to twigs and small branches, flow into streams, the main branches of the tree. Streams eventually empty into a large river, comparable to the trunk. Like other branching patterns (e.g. road maps, veins in a leaf, the human nervous system), the drainage pattern consists of smaller channels merging into larger ones.

DO:

1. Crumple sheet of paper, then partially smooth it out leaving some ridges.
2. Using markers, color along the crease using different colors.
3. The colors will represent pollutants such as fertilizers, pesticides, litter, pet waste, etc.
4. Lay sheet of paper in pan and shape it so it looks like a watershed.
5. Spray papers with water and watch colors begin to flow.
6. **DRAW** the patterns created by the flowing “water”, using arrows to show direction.
7. Throw away your paper, dry tray for next team.

Answer Questions on Lab Sheet:

1. What happened at the highest and lowest point in the watershed?
2. Did the different pollutants mix together?
3. Where did the mixing happen?

Station #2: Water pH and Fish Survival

The pH scale is a way of measuring how acidic or alkaline a substance is. We use indicators to show us the pH of a substance. Indicators change color depending on whether a substance is acid or alkaline. **If it changes red, orange or orangish yellow (pH 1-6), it tells us the substance is acidic. A color change of greenish blue, blue or purple (pH 8-14) indicates an alkali. If it turns yellow, then the substance is neutral (pH 7).** Most fish prefer water with a pH between 7 and 8. If the pH is outside the range 5 to 8.5 the water is seriously polluted with acid or alkali.

DO:

1. Write the numbers 1 – 5 on the top of the pH paper.
2. Dip the bottom end of the pH paper in each water sample
3. Observe and note the color change and pH value.
4. Check the pH scale to determine whether it is acid or alkaline.
5. Record your results

Water Sample	Color Change	pH value	Acid or Alkaline
1			
2			
3			
4			
5			

Answer Question on Lab Sheet:

1. Did you find any pattern to your results? Were samples mostly acidic, alkaline or neutral?
2. Which sample would be best for fish to live?

Station #3: Macroinvertebrates Classification

READ:

Macroinvertebrates (organisms that lack an internal skeleton and are large enough to be seen with the naked eye) are an important indicator of the health of a stream. Identifying macroinvertebrates found in a specific stream or river help to monitor changes in stream conditions over time.

DO:

1. Select a specimen in numbered petri dish **and record letter in blank.**
2. Move petri dish to **"Start" on the Bug Mat**.
3. **Move** the petri dish along the mat, **answering questions in red** as you move.
4. When you identify the specimen, write the common name in the correct blank.
5. Write the order in the correct blank.
6. Move petri dish off bug mat and select another specimen.
7. Rinse, repeat☺

Specimen	Common Name of Macroinvertebrate	Scientific name Order
Ex.	Soldier Fly Larvae	Diptera (True Flies)
1____		
2____		
3____		

Station #4: Point Source and Non-Point Source Pollution

READ:

Point source is pollution that flows from pipes or comes **from specific points,** such as an industrial plant pipe pumping waste into a river. **Nonpoint sourc.e pollution** is not from a specific or single location, but generally results from land runoff or drainage, after a rain event.

DO:

Discuss with your partner **what type of pollution** each "event" describes.
Classify the following as either point (PS) or nonpoint source pollution. (NPS)

_____ Runoff from a parking lot.

_____ Oil dumped in a pond.

_____ Animal owners neglecting to clean up a pet's waste.

_____ Automobiles leaking brake fluid.

_____Using fertilizer on a lawn everyday.

_____ Spraying a garden with pesticide to eliminate bugs.

_____ Pouring antifreeze down the storm drain.

_____ Boats in a lake.

_____ Construction site runoff.

_____Microplastics from a waste water management plant.

Watershed Mini-Labs **Name(s)_____**

Collect data and answer questions on this sheet.

Station #1 - What is a Watershed?

Draw a simple copy of the watershed you created using arrows to show drainage.

Questions: What happened at the highest and lowest point in the watershed?

When different pollutants mix together, where did the mixing happen?

Station #2: Water pH and Fish Survival

Question: Which sample would be best for fish to live?

Water Sample	Color Change	pH value	Acid or Alkaline
1			
2			
3			
4			
5			

Station # 3 Macroinvertebrate Classification

Specimen	Common Name of Macroinvertebrate	Scientific name Order
Ex.	Soldier Fly Larvae	Diptera (True Flies)
1____		
2____		
3____		

Station #4: Point Source and Nonpoint Source Pollution

Write "PS" for point source and "NPS" nonpoint source pollution

_____ Runoff from a parking lot.

_____ Oil dumped in a pond.

_____ Animal owners neglecting to clean up a pet's waste.

_____ Automobiles leaking brake fluid.

_____Using fertilizer on a lawn everyday.

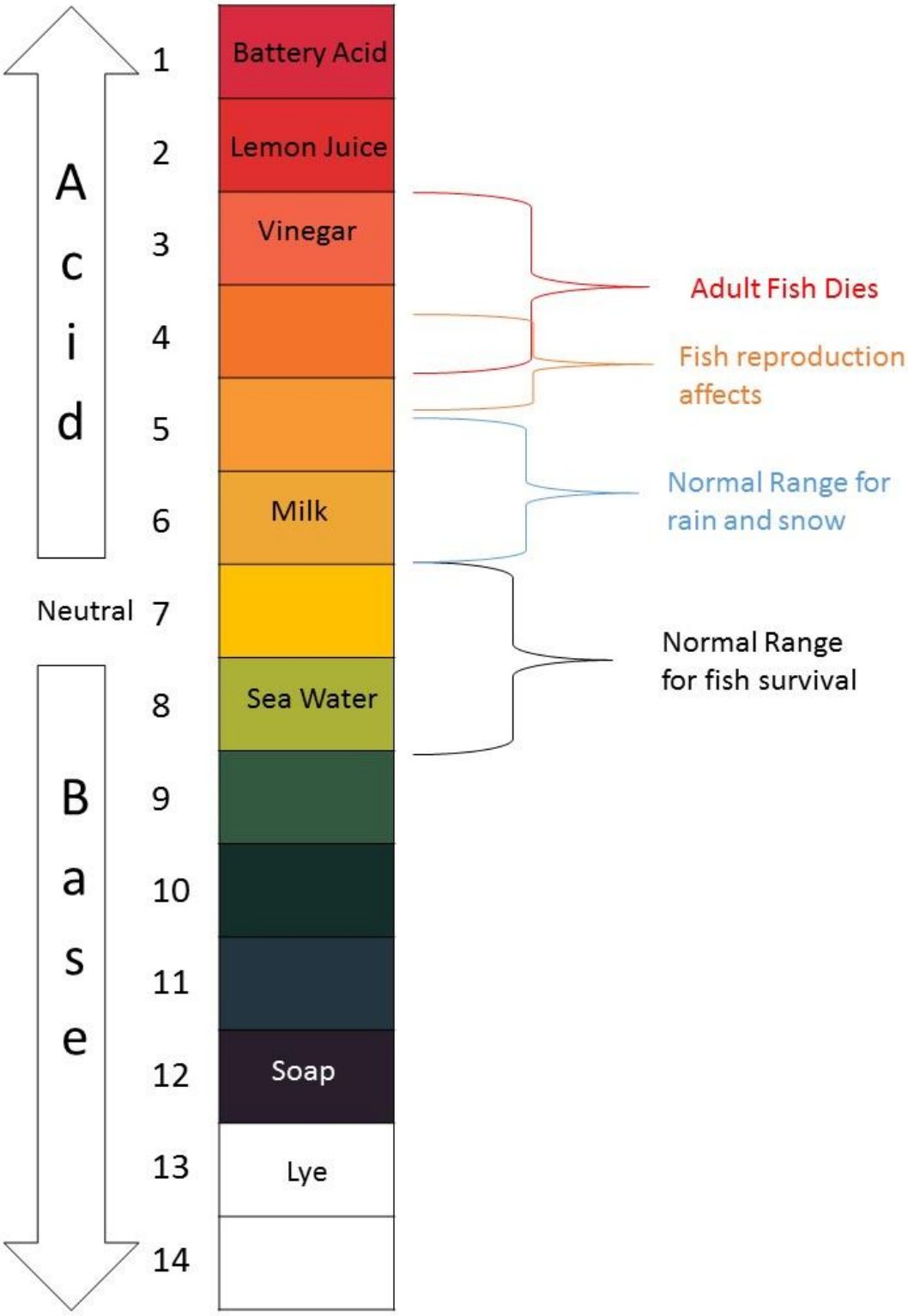
_____ Spraying a garden with pesticides to eliminate bugs.

_____ Pouring antifreeze down the storm drain.

_____ Boats in a lake.

_____ Construction site runoff.

_____Microplastics from a waste water management plant.


Acid
Base
Neutral
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Battery Acid
Lemon Juice
Vinegar
Milk
Sea Water
Soap
Lye
Adult Fish Dies
Fish reproduction affects
Normal Range for rain and snow
Normal Range for fish survival

Runoff from a parking lot.

Oil dumped in a pond.

Animal Owners Neglecting to clean up a pet's waste.

Automobiles leaking brake fluid.

Using fertilizer on a lawn every day.

Spraying a garden with pesticides to eliminate bugs.

Pouring antifreeze down the storm drain.

Boats on a lake.

Construction site runoff.

Microplastics from a wastewater management plant.

Tip of the Mitt Watershed Academy

Student Application

Interested students must be able to fulfill the following requirements:

- Attend Watershed Academy training during school.
- Agree to make-up work for any missed coursework or class time.
- Participate in field trip at the designated stream monitoring site.
- Attend the Stream Team Share Gathering for sharing pizza and your experience.

Up to ten students per school will be selected by your biology teacher to participate in the Watershed Academy. Participation in the Watershed Academy will mean you will miss other classes, either academic or elective. You will have a calendar for the scheduled sessions prior to the first meeting.

Please fill out the application below and return to your biology teacher ASAP!

Name _____ Grade _____

Student Gmail/email_____

Student Home Address: (for youth membership at Tip of the Mitt Watershed Council)

Street Address_____

City_____State_____ Zip Code_____

T-Shirt Size Circle - Adult S M L XL Shoe Size _____

Teacher _____ School _____

Student Signature_____

Parent Signature_____

*Signatures above indicate permission to participate in this program and allow for the release/use of photos or video that involve the named participant. Any restrictions or requests can be submitted to Watershed Council staff if needed.

Why do you want to participate in the Watershed Academy?

_____

_____

Session One Documents

Watershed Academy

Session 1 Introduction to Watershed Science (120 min.)

- Overview of program, project and monitoring/watershed presentation.
- Introduction of model PPT, PPT template and resource binder
- Online forum account set up/Complete online pre-assessment
- Intro to watershed (map) and watershed concept (hands-on model) (Student led exploration)
- Selection of team leader, review of expectations
- Begin filling out PPT template using resource binder and rubric review
- Hand out Field day permission slips

Focus:

What is a watershed? Why care about watersheds? How does water in your watershed reach the Great Lakes? What is pollution? What are sources of pollution? What is point source and nonpoint source pollution?

Project brainstorming: What issues would be interesting to research? How would you go about solving this problem? What are some ways to keep this problem from getting worst?

Experience:

- Discussion/PPT of both general watershed and specific watershed.
- Students work as a team, using model to learn about watersheds.
- Discuss specifics of watershed and possible focus of team (two areas)
- Establish online account and respond to session evaluation.

Materials:

- Watershed Model, User Guide, Resource Binder, Watershed Maps, Watershed PPT, Project Rubric, Permission Slips, computer access.

Roles and Responsibilities

Team member:

- Communication - Team members are responsible for communicating with captains, instructors and teachers.
    - Respond to captain's texts or emails
    - Let teachers or instructor know if you need help

- Participation - Team members are responsible for actively being involved in the program.
    - Attend all sessions. If you can't, let captains and instructors know ASAP.
    - Be fully engaged in session discussions
    - Contribute to final project and practice presentation
    - Attend Watershed Academy Summit

Captain:

- Communication - Captain(s) are responsible for communicating with the whole team, watershed academy instructors and your teacher.
    - Respond to all emails from instructors (even if it's just an "ok" or a "thanks") just let us know you got the email and read it.
    - Create a group text or a way to communicate with **all** members of the academy.
    - Let instructors know when your team needs more support.
    - Let instructors know when/if you need materials.
    - Check in with your teacher if you or your team needs support.

- Organizing your team - Captains are responsible for making sure everyone on your team is on track to complete the Power Point presentation.
    - Make sure everyone knows when sessions are happening.
    - Keep a copy of team Power Point and arrange practice.
    - Make sure everyone contributes to final project and practices presentation.
    - Motivate your team during ALL sessions.

Teacher:

- Communication – Teachers should communicate with the team captains about sessions and field day permission slips.
    - Respond to emails, requests for help and guide presentation practice.
    - Establish room and time for sessions. *Each session needs technology access.
    - Support and encourage team throughout the program.

Session 1 Breakdown of tasks/objectives (120 min.) _____

Overview of program: 15 minutes (_____)

- Handout folders, explain program goals, program schedule, **fill in meeting dates**
- Review of expectations and overall goal of program
- Online Watershed Academy Blog @ www.watershedcouncil.org
- Complete online survey

Watershed Activity: 45 minutes (_____)

- Intro to watersheds and team watershed map – **Label Map activity review**
- Watershed Model – **Student led, large Post-It** for collecting information, flip chart

Break: 10 minutes (_____)

Team Project: 50 minutes (_____)

- Selection of captain(s) – Decide on contact method (cell # and/or email)
- Introduction of project focus, introduce resource binder and watershed PPT
- Begin filling out PPT template and research for stream site
- Create schedule for practice of presentation – other science classes
- Divide responsibilities for project completion (leader w/assigned roles)
- Hand out Field day permission slips
- Show VSM PPT – part or all if time to prepare for Session #2

Session #1 Checklist –CHECK BEFORE SESSION IS OVER!

1. Review folders, especially scheduled times and dates for sessions.
2. Team leader selected, cell #'s and emails exchanged
3. Watershed Academy Blog on website - access **verified**
4. Completion of online survey and check out Session #1 challenges
5. Watershed PPT started/explained -
6. All members know responsibilities for project, timeline, storage
7. Check with bio teacher regarding next session and scheduling bus for field trip

Tip of the Mitt Watershed Academy
Fall 2016

Welcome and thanks for participating! You are part of a special team that will focus on becoming experts about your watershed!

Your responsibilities:

- Participate in training sessions – (in school)
- Take notes, engage in activities and support learning.
- Agree to make-up work for any missed coursework or class time.
- Participate in field work at the designated stream monitoring site – Be there to apply your knowledge!
- Become an expert about your watershed!
- Review all the materials in your folder! This information will help you become a better stream monitor!

Your training includes:

- Learning about YOUR specific watershed. You will have a map, watershed binder and a virtual watershed tour, along with using the watershed model for hands-on experience with point source and non-point source pollution.
- Water Chemistry Testing: Learn about the chemical make-up of local stream water by testing for eight different chemicals in the water.
- Macroinvertebrate Collection and Identification: Find out how to collect those small aquatic bugs that live in the water and identify them to indicate water quality.

Tip of the Mitt Watershed Academy

Field Trip Permission

Watershed Academy **Team** _____will be conducting stream monitoring during a field trip on _____. A tentative schedule of the day's events is attached, including what to bring and wear for the greatest comfort. Field trips will be conducted rain or shine (or cold☺).

The stream monitoring will begin at a monitoring site at 9:00 am and will end at the designated Little Traverse Conservancy Nature Preserve around 2:30 pm. Every effort will be made to accommodate needs of the students, although we will be in a remote location and as such, have limited bathroom facilities. Please contact Maria maria@watersehedcouncil.org, or Eli eli@watershedcouncil.org

If you have any questions about the field trip.

Field Trip Location: _____

Please fill out the permission slip and return to your biology teacher ASAP!

Name _____ Grade _____

Teacher _____ School _____

Student Signature_____

Parent Signature_____

*Signatures above indicate permission to participate in this program and allow for the release/use of photos or video that involve the named participant. Any restrictions or requests can be submitted to Watershed Council staff if needed.

Tip of the Mitt Watershed Academy

Field Experience

Tentative Schedule

Arrival at Site: **9:00 am – 9:15 am**

- Introduction of Resource Experts/Overview of activities
- Review safety procedures, equipment use and site protection
- Assign jobs to team members, plan for data collection.

Conduct Stream Monitoring: **9:15 am – 12:00 am**

- Team captains are responsible for data collection on monitoring paperwork
- Water Quality Monitoring - Working in teams, students collect water quality data including collecting macro-invertebrates, apply chemistry for water testing, and measure physical attributes of stream.

Lunch **12:00 am – 1:00 pm**

- Eat lunch at stream site. Pack up equipment and travel to preserve.

****LTC Preserve – Navigation Activity** **1:00 pm – 2:30 pm**

- Navigation Activity – Working in teams, students create a map locating and answer questions about habitats and land use examples in the preserve to shown connections in land use and water quality.

What to Bring:

- Sack Lunch with snacks!
- Dress in layers (base layer, tee-shirt, fleece, rain coat, hat ect), bring a rain jacket (rain or shine)
    - Bring extra clothes in case you want to change your clothes at the end of the day
- Cell phone camera or camera
- Great attitude!

What to Remember:

- You are scientists collecting data on your watershed!
- Be aware of your actions at all times. Wading in rivers and streams can be dangerous! This is NOT a day for fooling around.
- Leave only footprints (as few as possible!) and carry out all trash!
- Take only pictures, DO NOT pick plants or handle living organisms
- Treat all resource experts and each with respect and kindness

Watershed Model

How Water Pollution Occurs

1. Working as a team, read the questions, respond with answers and use the model to understand.

2. Create a poster of team understanding on big post-it.

3. This experience should take 30-40 minutes.

4. Using Diagram A, complete the model set-up

- **Locate/place buildings, bridges, vehicles, and cows**
- **Locate/place trees in trunks on clear-cut forest housing**
- **Plug lake hole and fill with 1 cup water**

How Water Pollution Occurs

Write team responses to the questions on your poster.

- **Pollution? What do you think when you hear this word?**
- **What is a watershed?**
- **What is a water body?**

Read aloud the answers:

Pollution **is a generic word for any type of contamination of water, land or air.**

A *watershed* is a region or area draining to a particular watercourse or body of water.

A w*aterbody* is any river, lake, stream, ocean, pond or basin; waterbodies receive runoff waters from a watershed.

Everyone lives in a watershed. Watersheds drain rainfall and melting snow into the nearest waterbody that lies at the lowest point of the watershed.

Watersheds can be small or large, and most are interconnected, eventually draining to the ultimate waterbodies – bays, gulfs or oceans.

Water cycles continuously through our environment. It's recycled through evaporation which enters our air and is then cycled back to the land as rainfall, snow or other precipitation.

Sources of Water Pollution

<u>Point Source</u> (PS) is pollution that flows from pipes or comes from specific points, such as (locate on model):

- **Industrial Plant in top right corner**
- **Sewage Treatment Plant near forest and golf course**
- **Stormwater Drain on residential road between houses**

Demonstrate Point Source Water Pollution

#1. <u>Industrial Plant</u> – squirt cocoa and water mixture (waste) at the top of the building and watch it run from plant into ditch or stream

Is the plant in compliance?

Discuss.

Read Aloud: All industrial plants must comply with regulations and secure permits. Permits allow plants to discharge a maximum percentage of pollutants. If maximum limit is exceeded, the plant is in violation of permit.

#2 <u>Sewage Treatment Plant</u> – squirt cocoa and water mixture (waste) in each clarifier tank. Spray water into clarifier tanks to make them overflow.

What happens to the overflow from the clarifier tanks?

Is this point source pollution or not?

Discuss.

Read Aloud:

It's common for water to overflow clarifier tanks. This overflow is normally treated wastewater that flows 24 hours a day into receiving waters.

Two examples of untreated or incomplete treatment of wastewater before discharge:

A Combined Sewer Overflow (CSO) is when *excess flow bypasses treatment*. Some treatment systems in cities have stormwaters flowing into the wastewater treatment plant. When rainfall is excessive, too much stormwater runoff goes to the treatment plant and the excess flow is bypassed directly to the river, stream or lake.

An Upset is when water *is not treated adequately* because of a plant malfunction. Sometimes, the biological processes that are used to treat wastewater stop working, and the waste is not treated properly. Incompletely treated wastewater is discharged to the river, stream or lake.

#3 Stormwater Drain and Sewer Pipe – pour some "oil" down the stormwater drain.

Where might the "oil" come from and why might it be a problem if it flowed into the stormwater drain and/or sewer pipe?

Discuss.

Read Aloud:

Most storm drains are directly connected to storm sewers. Therefore, they are considered Point Sources because they are part of a piping system and are subject to federal, state and local regulation.

Some storm drains are connected to a water treatment plant. If this occurs, the water tends to overflow with the water treatment during a storm event.

However, storm drains often carry water (or melting snow) directly off the land into the waterbody.

Nonpoint Source Water Pollution

Nonpoint Source Pollution (NPS) does not result from a discharge at a specific, single location, but generally results from land runoff, drainage or seepage, after a rain event.

Nonpoint sources come from many different human activities on and with the land, and occur when rainfall (or melting snow) carries contaminants, such as fertilizers and pesticides, oils, grease and trash, from yards, fields and roads to the nearest waterbody.

Ten sources of nonpoint source pollution demonstrated on model:

1. Construction site **2. Streambank and Lakeshore**

3. Forest **4. Plowed fields** **5. Lawns and Golf Course**

6. Crops **7. Highways, Roads, Parking Lots** **8. Manure**

9. Cows and domestic animals **10. Household practices/waste disposal**

Demonstrate Nonpoint Source Water Pollution

#1. To illustrate soil, sprinkle ½ tsp of cocoa (soil) on

- **Construction site**
- **Lakeshore**
- **Forest**
- **Plowed field on the farm**

#2. To illustrate pesticides (red powder) and fertilizer (blue powder) sprinkle ½ tsp of each on

- **Lawns and golf course**
- **Plowed field on the farm**

#3. To illustrate oils and grease, squirt a few drops of "oil" on

- **Highways and roads**
- **Industrial plant parking lot**

#4. To illustrate manure, mix cocoa and water to form a paste.

- **Place 1 tsp of manure on the grass next to the road on the farm**
- **You can also make pet waste to place on lawns**

Make It Rain!

Spray each area using the spray bottle filled with water to simulate RAIN. Watch the rain as it runs off the streets, parking lots and the land. You can see it pick up the soil and contaminants, carrying them to the waterbody.

This flow is called runoff. Why does this happen?

Construction Site: **There is not vegetation or silt fencing on the construction site to hold the soil, and therefore it erodes or wears away and is carried off by the runoff.**

Lawns and Golf Course: **When too much pesticide or fertilizer is used, it may not be absorbed by the plants and therefore can be carried off by rain. These chemicals can also seep into the ground, reaching groundwater.**

Highways, Roads, and Parking Lots: **These paved surfaces are impermeable and collect oil and antifreeze from vehicles. Rain can carry these contaminants into the waterbody and can also seep into groundwater.**

Streambanks and Lakeshore: Bare ground banks with no vegetation to hold the soil are subject to erosion by water, wind and snowmelt.

Forest Clearings: A forest that has been cleared of its trees leaves its soil vulnerable to being washed away by the rain or melting snow. Even wind can carry soil away.

Clearing the trees is the only problem shown on the model, but transporting the timber off the property causes erosion and disruption of the land.

<u>Plowed Field</u>: If fields are not plowed properly, or if no vegetation or plants remain, rain can carry loose soil into the waterbody.

<u>Crops</u>: Farm lands are like lawns and gardens, improperly or excessively used pesticides or fertilizers are washed into waterbodies by the rain.

<u>Manure</u>: Daily spreading of animal waste is a common practice on farms since manure is a natural fertilizer. Overapplying or applying at the wrong time of year (when the ground is frozen) causes excess manure and the contaminants to be easily carried away by rain into the waterbody.

All these areas – not just one in particular – can affect the waterbody.

Why are these nonpoint sources of pollution potentially harmful?

The invisible components of the runoff may be damaging, such as

- **Nutrients – Although essential to life, excess nutrients in fertilizers such as nitrogen and phosphorus can cause excessive growth in algae and aquatic plants. Growth leads to overcrowding, die off and decay then depleting the oxygen needed by fish and other aquatic life. Excess nutrients are potential pollutants; not the nutrients themselves. Two famous examples the impacts of nutrient pollution are the "dead zones" in Lake Erie and the Gulf of Mexico.**

- **Toxic substances (toxins) – are poisonous substances, such as metal compounds and chemicals. Toxins can be found in household cleaners and pesticides used on crops, lawns, gardens that can be carried in runoff when it rains. Toxins like sulfuric acid, nitric acid and carbonic acid released into the air from burning fossil fuels such as coal fall to the earth as acid rain. Too many toxic substances in the water can cause allergic reactions and illness in humans and animals that live in the water.**

- **Bacteria – are a large group of microscopic organisms that can be helpful and cause harm as diseases like typhoid fever and dysentery in humans. Swimmer's itch is caused by a tiny microscopic bacteria found in the water, causing itching on the skin and sores on the body. Bacteria can also infect shellfish such as oysters and Salmonella in fish poisoning. Health risks in water can close or restrict use of beaches and fishing areas.**

- **Even soil (sediment) itself – can carry toxic substances and bacteria into water. When soil becomes sediment as it settles at the bottom of a waterbody it can affect recreational use of waterways requiring dredging, cause flooding by blocking storm drains, kill fish by increasing solar heat reducing oxygen, and disrupt reproduction of spawning fish and macroinvertebrates.**

Demonstrate Turbidity – Stir up the sediment in the lake with your finger. Turbidity creates a cloudy effect that decreases light affecting plants, can smother fish and impair the ability to find food. Livestock, boating, and commercial operations cause turbidity.

How do you contribute to water pollution?

- **Improper or careless use and disposal of household chemicals, oils and cleaning solutions.**
- **Excessive use of water for car washing, watering your lawn.**
- **Failure to maintain septic systems and overuse of systems.**
- **Abandoned wells used for dumping or drainage.**
- **Pet waste in a collective area, the accumulation is the problem.**
- **Storm drain – It's a point source that carries nonpoint source pollution.**
- **We all live in a watershed that contributes pollutants, either by point sources or nonpoint sources, to a waterbody.**
- **<u>Nonpoint sources of pollution generate over 50%</u> of all water pollution.**

Which is easiest to identify, point source or nonpoint source?

What does this mean for the health of YOUR WATERSHED?

Team Maple River

Watershed Academy

Label your watershed!

Using Google Earth, road maps and your own knowledge, label Maple River Watershed map with **at least 10** landmarks and natural features.

Locate farms, businesses, factories, schools, housing, waste treatment centers and marshes, wetlands, lakes, rivers, creeks and beaches.

Write the name of the landmark or natural feature on a Post-It, take a photo and post it on the Watershed Academy student forum

http://www.watershedcouncil.org/student-forum.html#!/

Your watershed map will be checked for labels at our next Watershed Academy session.

Questions? Email Maria or Eli

maria@watershedcouncil.org

eli@watershedcouncil.org

Session 2 Documents

Watershed Academy Session One Review

Fill in the Blanks

A _____ is a region or area draining to a particular watercourse or body of water.

_____ is a generic word for any type of contamination of water, land or air.

The boundaries of a watershed are defined by _____.

Water enters the air through _____ , forms clouds through _____ , then falls back down as _____.

Evaporation	Pollution	Precipitation
Watershed	Condensation	Elevation

Point Source VS. Non-Point Source

Draw a line to the type of pollution that is occurring in each scenario.

Point Source

Pollution that comes from a single

Non-Point Source

Pollution that is a result of runoff

Industrial waste flowing downstream of plant.

Bacteria from pet waste.

Excess fertilizers in a lake from agriculture.

Sewage treatment plant overflow.

Short Answer

Name three human impacts on your watershed.

1.
2.
3.

How can you improve the health of your watershed? Be prepared to share your answer.

Session 2 Breakdown of tasks/objectives (120 min.) _____

Overview of program: 20 minutes _____

- Review Session #1 with handout – Overview of Session #2
- Review copy of Power Point Template – Hard copy
- Review watershed map for labels of land use.
- Introduce VSM data collection handouts and MiCorps poster

Water Chemistry Activity: 30 minutes _____

- Goal: Identify chemical make-up & physical attributes of 3 samples of water bodies.
- Introduce Water Monitoring Test Kits
    - Members review 8 test cards
    - Team conduct six tests (no BOD or coliform) and record data on VSM sheet

Macroinvertebrate ID: 60 minutes _____

- Goal: Practice identification through use of bug mats, id information
- Review use of bug id mats and MI Corp form, break into pairs.
- General sorting of Macroinvertebrate samples
- Sort to order at least five (5) specimens
- Review collection methodology for field study

Team Project: 10 minutes _____

- Review team project – Use template to check progress
- Brochure/handout for Summit – Is this started?
- What does the team need to be successful?
- Deadline for project – Captains need to have project in by Monday Nov. 2nd.

Session #2 Checklist

8. Check on field trip forms – Bus scheduled (teacher)
9. Check MI Corps Data – Team poster
10. Reviews Field day equipment/instructions – Flip chart

TOMWC Site ID#:_____

Watershed Academy Datasheet

Stream Name: _____ **Major Watershed:**_____

Location:_____(Please circle: *Upstream* or *Downstream* of road?)

Date:_____ **Water Sample Collected** Yes No **#of Glass Jars Used:**_____

Collection Start Time:_____(AM/PM) **Collection End Time**:_____(AM/PM)

Monitoring Team {please put number of years with program in parentheses, e.g. "Mary Smith (3)"}:

Name of Person Completing Datasheet:_____

Collector:_____

Other Team Members:_____

Stream Conditions: Water temperature: _____ (°C) Average Water Depth: _____ (ft)

Air Temperature:_____ Weather (today and note rain from last few days):_____

Is the substrate covered with excessive silt? ____ No ____ Yes (describe: _____)

Substrate Embeddedness in Riffles: ____ 0-25% ____ 25-50% _____ > 50% ____ Unsure

Water turbidity/clarity (circle): Clear Somewhat turbid (cloudy) Very turbid (muddy)

Water Chemistry: Turbidity: _____JTU pH: _____ BOD: _____ppm

Dissolved Oxygen: _____ppm _____% saturation

Nitrates:_____ ppm Phosphates:_____ ppm

Bacteria/Coliform (circle): positive / negative

_____

Macroinvertebrate Collection: Check the habitats that were sampled. Include as many as possible.

____ Riffles	____ Aquatic Plants	____ Submerged Wood
____ Runs	____ Leaf Packs	____ Root Wads
____ Pools	____ Stream Margins	____ Other (describe:_____
____ Cobbles	____ Undercut banks/Overhanging Vegetation	_____)

Did you see, but not collect, any **live crayfish**? (___ Yes ___ No), or **large clams**? (___ Yes ___ No)?
Other wildlife & fish? (___ Yes ___ No) Describe:_____

_____

TOMWC Site ID#:_____

Identification and Assesment:
Use letter codes [**R** (rare) = 1-10, **C** (common) = 11 or more] to record the approximate numbers of organisms in each taxa found in the stream reach.
*** Do NOT count empty shells, pupae, or terrestrial macroinvertebrates****

Group 1: Sensitive

____ Caddisfly larvae (Trichoptera)
EXCEPT Net-spinning caddis
____ Hellgrammites (Megaloptera)
____ Mayfly nymphs (Ephemeroptera)
____ Gilled (right-handed) snails (Gastropoda)
____ Stonefly nymphs (Plecoptera)
____ Water penny (Coleoptera)
____ Water snipe fly (Diptera)

Group 2: Somewhat-Sensitive

____ Alderfly larvae (Megaloptera)
____ Beetle adults (Coleoptera)
____ Beetle larvae (Coleoptera)
____ Black fly larvae (Diptera)
____ Clams (Pelecypoda)
____ Crane fly larvae (Diptera)
____ Crayfish (Decapoda)
____ Damselfly nymphs (Odonata)
____ Dragonfly nymphs (Odonata)
____ Net-spinning caddisfly larvae (Hydropsychidae; Trichoptera)
____ Scuds (Amphipoda)
____ Sowbugs (Isopoda)

Group 3: Tolerant

____ Aquatic worms (Oligochaeta)
____ Leeches (Hirudinea)
____ Midge larvae (Diptera)
____ Pouch snails (Gastropoda)
____ True bugs (Hemiptera)
____ Other true flies (Diptera)

STREAM QUALITY SCORE

Group 1:

____ # of R's * 5.0 = ____

____ # of C's * 5.3 = ____

Group 1 Total = _____

Group 2:

____ # of R's * 3.0 = ____

____ # of C's * 3.2 = ____

Group 2 Total = _____

Group 3:

____ # of R's * 1.1 = ____

____ # of C's * 1.0 = ____

Group 3 Total = _____

Total Stream Quality Score = _____

(Sum of totals for groups 1-3; round to nearest whole number)

Identifications made by:_____
Rate your confidence in these identifications:
Quite confident 5 4 3 2 1 Not very confident

Coliform Bacteria

Description: Fecal Coliform Bacteria are naturally present in the human digestive tract, but are rare or absent in unpolluted waters. Coliform bacteria should not be found in well water or other sources of drinking water. Their presence in water serves as a reliable indication of sewage or fecal contamination. Although coliform bacteria themselves are not pathogenic, they occur with intestinal pathogens that are dangerous to human health. The presence/absence total coliform test detects all coliform bacteria strains and may indicate fecal contamination.

The coliform test in this kit will indicate if you have above 20 coliform per 100 mL of river water.

Desirable	Permissible	Water use
0	0	Portable or well water (for drinking)
<200	<1,000	Primary contact (swimming
<1,000	<5,000	Secondary contact (for boating &fishing)

Procedure

1) Pour the water sample into the large test tube containing a tablet (4880) until it is filled to the 10 mL line.
2) Replace the cap on the test tube.
3) Stand the tube upright with the tablet flat on the bottom of the tube.
4) Incubate by storing the tube upright at room temperature out of direct sunlight for 48 hours. Store the tubes where the temperature will be fairly constant between 70 ° to 80 °f (21° to 27°C). Do not disturb, handle or shake tubes during the incubation period.
5) Compare the appearance of the tube to the picture on the coliform color chart. Record results as negative or positive.

Negative - Indicates less than 20 total coliform colonies per 100 mL if…

- Liquid above gel
- Gel remains at bottom of tube
- Indicator remains red or turns yellow with no gas bubbles

Positive- Indicates more than 20 total coliform colonies per 100 mL of water if…

- Many gas bubbles present
- Gel rises to surface
- Liquid below gel in cloudy
- Indicator turns yellow

Dissolved Oxygen

Description: Dissolved Oxygen (DO) is important to the health of aquatic ecosystems. All aquatic animals need oxygen to survive. Natural water with consistently high dissolve oxygen levels are most likely healthy and stable environments and are capable of supporting a diversity of aquatic organisms. Natural and human-induced changes to the aquatic environment can affect the availability of dissolved oxygen.

Dissolved Oxygen % saturation is an important measurement of water quality. Cold water can hold more dissolve oxygen than warm water quality. For example, 28°C will be 100% saturated with 8 ppm dissolved oxygen. However, water at 8°C can hold up to 12 ppm of oxygen before it is at 100% saturation. High levels of bacteria from sewage pollution or large amounts of rotting plants can cause the % saturation to decrease. This can cause large fluctuations in DO levels throughout the day, which can affect the ability of plants and animals to thrive.

Procedure

1) Record the temperature of the water sample.
2) Submerge the small tube (0125) into the water sample. Carefully remove the tube from the water sample, keeping the tube full to the top.
3) Drop two dissolved oxygen TesTabs (3976A) into the tube. Water will overflow when tablets are added.
4) Screw cap on the tube. More water will overflow as the cap is tightened. Make sure no air bubbles are present in the sample.
5) Mix by inverting the tube over and over until the tablets have disintegrated. This will take about 4 minutes.
6) Wait 5 minutes for the color to develop.
7) Compare the color of the sample to the Dissolved Oxygen color chart. Record as ppm Dissolved Oxygen and % Saturation.
8) Determine % saturation from the chart below

	Dissolved Oxygen			
		0 ppm	4 ppm	8 ppm
Temp °C	2	0	29	58
	4	0	31	61
	6	0	32	64
	8	0	34	68
	10	0	35	71
	12	0	37	74
	14	0	39	78
	16	0	41	81
	18	0	42	84
	20	0	44	88
	22	0	46	92
	24	0	48	95
	26	0	49	99
	28	0	51	102
	30	0	53	106

Biochemical Oxygen Demand (BOD)

Description: Biochemical Oxygen demand (BOD) is a measure of the quantity of dissolved oxygen used by bacteria as they break down organic wastes. In slow moving and polluted rivers, much of the available dissolved oxygen is consumed by bacteria, robbing other aquatic organisms of the dissolved oxygen needed to live.

Procedure

1) Submerge the small tube (0125) into the water sample. Carefully remove the tube, keeping the tube full to the top. Cap the tube.
2) Wrap the tube with aluminum foil and store it in a dark place at room temperature for 5 days.
3) Unwrap the tube. Add two dissolved Oxygen TesTabs (3976A) to the test tube.
4) Cap the tube. Make sure there are no air bubbles. Invert until tablets have disintegrated.
5) Wait 5 minutes.
6) Compare the color of the sample to the dissolved oxygen color chart.

Nitrate

Description: Nitrate is a nutrient needed by all aquatic plants and animals to build protein. The decomposition of dead plants and animals as well as the excretions of living animals release nitrate into aquatic systems. Excess nutrients like nitrate increase plant growth and decay, promote bacterial decomposition and therefore, decrease the amount of oxygen available in the water. Sewage is the main source of excess nitrate added to the natural water, while fertilizer and agricultural runoff also contribute to high levels of nitrate.

Procedure

1) Fill the test tube (0106) to the 5mL line with the water sample.
2) Add one *Nitrate Wide range CTA TesTab (3703A). Immediately slide the test tube into the protective Sleeve (0106-FP). (the TesTab is UV light sensitive)
3) Cap and mix by inverting for two minutes to disintegrate the tablet. Bits of material may remain in the sample.
4) Wait 5 minute for the red color to develop. Remove the tube from the protective sleeve.
5) Compare the color of the sample to the nitrate color chart. Record the result as ppm.

pH

Description: pH is the measure of the acidic or basic quality of water. The pH scale ranges from a value of 0 (very acidic) to 14 (very basic), with 7 being neutral. The pH of natural water is usually between 6.2 and 8.2. Most aquatic organisms are adapted to a specific pH level and may die if the pH of the water changes even slightly. pH can be affected by industrial waste, agricultural runoff, or drainage from improperly run mining operations.

Procedure

1) Fill the test tube (0106) to the 10 mL line with the water sample.
2) Add one pH Wide range TesTab (6459A).
3) Cap and mix by inverting until the tablet has disintegrated. Bits of material may remain in the sample.
4) Compare the color of the sample to the pH color chart. Record the results as pH.

Phosphate

Description: Phosphate is a nutrient needed for plant and animal growth and is also a fundamental element in metabolic reactions. High levels of this nutrient can lead to overgrowth of plants, increased bacterial activity and decreased dissolved oxygen levels. Phosphates come from several sources including human an animal waste, industrial pollution and agricultural runoff.

Procedure

1) Fill the test tube (0106) to the 10 mL line with the water sample.
2) Add one Phosphorus TesTab (5422A).
3) Cap and mix by inverting until the tablet has disintegrated. Bits of material may remain in the sample.
4) Wait 5 minutes for the blue color to develop.
   Note: if the sample does not develop a blue color (sample is colorless), record the result 0ppm
5) Compare the color of the sample to the phosphate color chart. Record the results as ppm Phosphate.

Temperature

Description: Temperature is very important to water quality. Temperature affects the amount of dissolved oxygen in the water, the rate of photosynthesis by aquatic plants, and the sensitivity of organism to toxic wastes, parasites and diseases. Thermal pollution, the discharge of heated water from industrial operations, for example, can cause temperature changes that threaten the balance of aquatic systems.

Procedure

1) Place thermometer is water for 5 minutes.
2) Read temperature in degrees celcius.

Turbidity

Description: Turbidity is the measure of the relative clarity of water. Turbid water is caused by suspended and colloidal matter such as clay, silt, organic and inorganic matter, and microscopic organisms. Turbidity should not be confused with color, since dark colored water can still be clear and not turbid. Turbid water may be the result of soil erosion, urban runoff, algal blooms and bottom sediment disturbance which can be caused by boat traffic and abundant bottom feeders.

Procedure

1) Fill the jar to the turbidity fill line located on the outside of the kit label.
2) Hold the turbidity chart on the top edge of the jar. Looking down into the jar, compare the appearance of the secchi disk  icon in the jar to the chart. Record the result as turbidity in JTU.

Session 3 Documents

Watershed Academy

Session 3: Field Study at stream site/Navigation Activity (9:00 am – 2:30 pm)

Field Study Session: (9:00 – 12:00)

- Arrive at monitoring site, stage materials and equipment, brief introductions
- Team reviews instructions, divide into two teams (Macroinvertebrate and Water Chemistry teams), one member completes the Site Sketch
- Check completion of both teams' data collection, secure specimens, check site sketch.
- Organize and store materials for transport.

Experience: Apply stream monitoring skills, work as sub-group to accomplish tasks, engage with resource people to learn new information/perspectives.

Preserve Navigation Session: (1:00-2:30)

- Arrive at preserve, brief introductions, introduction to compass use
- Students divide into three groups, get materials, are assigned to a "coach"
- Group focus: Identify three examples (habitat/land use) to "navigate" to
- Group creates a map of the three examples within the preserve
- Answer questions, share answers/maps when groups return to starting point

Experience: Engage members in a LTC activity making connections between water quality and land preservation.

Materials:

- Stream monitoring form/packet, water chemistry sets, materials to collect and identify macroinvertebrates, materials to collect water chemistry data, buckets, Bug ID mats, magnifying glasses, sample bottles, petri dishes, and forceps, waders.
- Navigation Activity – LTC provides materials (Compasses, clipboards, preserve maps, examples of habitats/land uses)

Equipment for Watershed Academy field day

- 2 D frame nets
- 5 Sorting pans
- 6 ice cube trays
- 1 box of pencils
- 10 Forceps
- 10 Eye-droppers
- 5 Squirt bottles
- 10 Magnifying lenses
- flags
- 3 wide mouth 500 mL Nalgene bottle
    - 1-BOD and Coliforms bacteria test
    - 1- conductivity
    - 1-waste bottle
- Measuring tape
- 6 Clipboards
- Data sheet
- Maps
- Taxonomic keys
- Waders
- Tarp
- 2, two gallon buckets
- 2 thermometers
- 11 small glass vials for pickling macro invertebrates
- Water chemistry tests
- Instruction:
    - Captains
    - Water chemistry tests
    - Site artists
    - Macroinvertebrate team
    - Water Chemistry team
- Camera
    - Go Pro
- Watershed Academy Banner
- First Aid kit

Tip of the Mitt Watershed Academy

Field Experience

Tentative Schedule

Arrival at Site: **9:00 am – 9:15 am**

- Introduction of Resource Experts/Overview of activities
- Review safety procedures, equipment use and site protection
- Assign jobs to team members, plan for data collection.

Conduct Stream Monitoring: **9:15 am – 12:00 am**

- Team captains are responsible for data collection on monitoring paperwork
- Water Quality Monitoring - Working in teams, students collect water quality data including collecting macro-invertebrates, apply chemistry for water testing, and measure physical attributes of stream.

Lunch **12:00 am – 1:00 pm**

- Eat lunch at stream site. Pack up equipment and travel to preserve.

LTC Preserve – Navigation Activity **1:00 pm – 2:30 pm**

- Navigation Activity – Working in teams, students create a map locating and answer questions about habitats and land use examples in the preserve to show connections in land use and water quality.

What to Bring:

- Sack Lunch with snacks!
- Dress in layers (base layer, tee-shirt, fleece, rain coat, hat ect), bring a rain jacket (rain or shine)
    - Bring extra clothes in case you want to change your clothes at the end of the day
- Cell phone camera or camera
- Great attitude!

What to Remember:

- You are scientists collecting data on your watershed!
- Be aware of your actions at all times. Wading in rivers and streams can be dangerous! This is NOT a day for fooling around.
- Leave only footprints (as few as possible!) and carry out all trash!
- Take only pictures, DO NOT pick plants or abuse living organisms
- Treat all resource experts and each other with respect and kindness

Before you start sampling (Captains):

1. Talk to team about the tasks to complete monitoring.
2. Review equipment and materials on tarp. All equipment and materials are returned to tarp after each task is complete.
3. Assign people to two teams (macroinvertebrate team and water chemistry team) and assign a site artist to sketch the site.
4. Flip to next page and go over first things first tasks.

First things first

1. **Captains**- fill out the information you know on the final data sheet.
2. **Site Artist**- get final data sheet site sketch page and start sketching.
3. **Water Chemistry team** Measure turbidity first. Then take water sample with larger buckets before anyone get in the water. **Note** the location with a flag on the shore AND tell site artist where sample was taken from. Get water chemistry team instructions.
4. **Macroinvertebrate team** get macroinvertebrate team instructions
5. Everyone have a job? – If **you** don't, ASK!

Site Artist

Site Sketch

Sketch should show length and shape of stream. Identify where water samples are collected, habitat types, stream length and width, flow direction and have a north arrow.

Water Chemistry team

Conduct tests and record on final datasheet (Captains).
*There are extra copies of the datasheet for notes, but final data must make it to the final data sheet.
Read instructions and conduct tests. ***DO NOT*** **empty tested water use waste container!**
*BOD and Bacterial coliform cannot be completed at site (collect water to complete tasks at school)

Phosphate _____ pH _____ Nitrates_____

Temperature _____ Bacterial Coliform _____

D.O._____ B.O.D. _____ Turbidity _____

Macroinvertebrate team

Site Measurement and Flagging

Measure 300’ of stream, placing flags every 100’

Measure Average depth:

1. Extend tape measure across stream and affix to object on both sides.
2. Record depth at regular intervals at 5-10 locations across stream.
3. Record measurements on sketch -location of depth measurement transect and average of 5 measurement readings.

Collecting methods:

1. Always start downstream.
2. Collect to sample every habitat and sample each habitat several times.
3. Be aggressive and thorough.
4. Pull lots of woody debris and rocks out of the stream to check for critters.
5. Collect just a few of each type (100 total). **Use divider trays to pre-sort first.**
6. Do not collect large clams or crayfish, just remember to NOTE them.
7. Keep an eye out for small macroinverts like worms, mites and midges.

Team Clean Up:

After the macro-invertebrate collection and identification, all equipment needs to be rinsed and dried so nothing is transferred between monitoring sites.

1. Clean all collection trays with river water and set out to dry. Towel dry if needed.
2. Rinse all wader boots and shake excess water off.
3. Rinse all dip nets turning inside and out, then set out to dry.

Bottle Labels

Stream Name:
Location (road):
Date: ___/___/2016
Number of jars: Jar #:

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Date: ___/___/2016
Number of jars: Jar #:

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Date: ___/___/2016
Number of jars: Jar #

TOMWC Site ID#:_____

Stream Name: _____ **Major Watershed:**_____

Location:_____(Please circle: *Upstream* or *Downstream* of road?)

Date:_____ **Water Sample Collected** Yes No **#of Glass Jars Used:**_____

Collection Start Time:_____(AM/PM) **Collection End Time**:_____(AM/PM)

Monitoring Team {please put number of years with program in parentheses, e.g. "Mary Smith (3)"}:

Name of Person Completing Datasheet:_____

Collector:_____

Other Team Members:_____

Stream Conditions: Water temperature: _____ (°C) Average Water Depth: _____ (ft)

Air Temperature:_____ Weather (today and note rain from last few days):_____

Is the substrate covered with excessive silt? ____ No ____ Yes (describe: _____)

Substrate Embeddedness in Riffles: ____ 0-25% ____ 25-50% _____ > 50% ____ Unsure

Water turbidity/clarity (circle): Clear Somewhat turbid (cloudy) Very turbid (muddy)

Water Chemistry: Turbidity: _____JTU pH: _____ BOD: _____ppm

Dissolved Oxygen: _____ppm _____% saturation

Nitrates:_____ ppm Phosphates:_____ ppm

Bacteria/Coliform (circle): positive / negative

_____

Macroinvertebrate Collection: Check the habitats that were sampled. Include as many as possible.

____ Riffles	____ Aquatic Plants	____ Submerged Wood
____ Runs	____ Leaf Packs	____ Root Wads
____ Pools	____ Stream Margins	____ Other (describe:_____
____ Cobbles	____ Undercut banks/Overhanging Vegetation	_____)

Did you see, but not collect, any **live crayfish**? (___ Yes ___ No), or **large clams**? (___ Yes ___ No)?
Other wildlife & fish? (___ Yes ___ No) Describe:_____

TOMWC Site ID#:_____

Identification and Assesment:
Use letter codes [**R** (rare) = 1-10, **C** (common) = 11 or more] to record the approximate numbers of organisms in each taxa found in the stream reach.
*** Do NOT count empty shells, pupae, or terrestrial macroinvertebrates****

Group 1: Sensitive

____ Caddisfly larvae (Trichoptera)
EXCEPT Net-spinning caddis
____ Hellgrammites (Megaloptera)
____ Mayfly nymphs (Ephemeroptera)
____ Gilled (right-handed) snails (Gastropoda)
____ Stonefly nymphs (Plecoptera)
____ Water penny (Coleoptera)
____ Water snipe fly (Diptera)

Group 2: Somewhat-Sensitive

____ Alderfly larvae (Megaloptera)
____ Beetle adults (Coleoptera)
____ Beetle larvae (Coleoptera)
____ Black fly larvae (Diptera)
____ Clams (Pelecypoda)
____ Crane fly larvae (Diptera)
____ Crayfish (Decapoda)
____ Damselfly nymphs (Odonata)
____ Dragonfly nymphs (Odonata)
____ Net-spinning caddisfly larvae (Hydropsychidae; Trichoptera)
____ Scuds (Amphipoda)
____ Sowbugs (Isopoda)

Group 3: Tolerant

____ Aquatic worms (Oligochaeta)
____ Leeches (Hirudinea)
____ Midge larvae (Diptera)
____ Pouch snails (Gastropoda)
____ True bugs (Hemiptera)
____ Other true flies (Diptera)

STREAM QUALITY SCORE

Group 1:

____ # of R's * 5.0 = ____

____ # of C's * 5.3 = ____

Group 1 Total = _____

Group 2:

____ # of R's * 3.0 = ____

____ # of C's * 3.2 = ____

Group 2 Total = _____

Group 3:

____ # of R's * 1.1 = ____

____ # of C's * 1.0 = ____

Group 3 Total = _____

Total Stream Quality Score = _____

(Sum of totals for groups 1-3; round to nearest whole number)

Identifications made by:_____
Rate your confidence in these identifications:
Quite confident 5 4 3 2 1 Not very confident

Watershed Academy

Session 4: Create Team Presentation (Variable times)

- Introduce model Power Point and McPhee Creek Example
- Fill out the MI-Corps data sheet and reflect on data
- Design your presentation, adding information from binder and experience
- Review methodology for field study – Focus on what the team DID
- Schedule a practice presentation for your team

Focus:

What is stream monitoring, and how is it done? How do you know if a stream is healthy? What makes good habitat for aquatic organisms, such as fish? Why is stream monitoring important? Why is it important to monitor streams/rivers within a specific watershed? How are bio-indicators used to evaluate the health of a stream? How does water quality influence the types of benthic macro-invertebrates that can live in a stream?

Experience:

- Introduce presentation PPT, share photos and video
- Teams provided with hard copy of template – for ideas and rough draft
- Team focus: "What did we find out about the water quality of the stream?"
- MAKE IT UNIQUE!!!! TELL A STORY!
- Total presentation time 10 min. – All members should contribute IN SOME WAY!
- FINAL COPY of presentation DUE ON JUNE 2ND!!!!!!! (If the file is too big, Eli or Maria will pick the team jump drive up from school that day)

Materials:

- Model PPT template copy, photos and video, previous and current MICorps datasheets, member evaluation, post knowledge and opinion survey, Bay Day sign – up sheet.

Letters

August 22, 2016

Principals and Biology Teachers,

Tip of the Mitt Watershed Council would like to invite your high school biology/science students to participate in the 2016-2017 Watershed Academy Program. Current participating schools include: Alanson, Boyne City, East Jordan, Elk Rapids, Harbor Springs, Onaway, Pellston, Bellaire and Mackinaw City High Schools.

The Watershed Academy is an opportunity where participants;

- **Belong to teams of up to ten (10) students** that become experts in their local water resources.
- **Receive specialized training from Watershed Council staff** on water chemistry and stream monitoring techniques in seminars conducted at school.
- **Apply new skills and knowledge** to collect data during field day stream monitoring.
- **Communicate team data and experience** with other Watershed Academy teams, parents, and the community at the **Watershed Academy Summit** in May 2017.

The responsibilities of participating teacher and school are to:

- **Meet briefly with Watershed Council education staff** regarding program.
- **Allow for a promotional visit** to share program with students.
- **Help schedule session dates** to have the least impact on students.
- **Make available a separate room** for school-based training seminars.
- **Schedule transportation** and **attend the field trips** in October and May.

Included in this information packet are a brochure and program overview. Team videos, projects and presentations at located on our website www.watershedcouncil.org.

If you would like to meet for further information, please contact us before September 6th, 2016.

Maria Affhalter
Watershed Education Program Specialist
(231) 347-1181 ext. 119
maria@watershedcouncil.org

Elijah Baker
HP AmeriCorps Member
Education and Outreach Specialist
(231) 347-1181 ext.119
http://www.watershedcouncil.org

Watershed Academy 2016-2017 Overview

Watershed Academy Seminar Description

Introduction to Watershed Science – School Seminar (Approx. 60-90 min)

- Overview of program, project focus- research stream/watershed for monitoring, methodologies overview.
- Introduction of team resource binder, watershed map, watershed concept with hands-on model and team watershed Google tour.

Water Quality Monitoring Basics – School Seminar (Approx. 120 min.)

- Water Quality Monitoring Basics – Areas of data collection, introduce equipment and methods for collection, and identify chemical make-up and physical attributes of samples of water bodies. Review on-site monitoring instructions. Review VSM PPT.
- Macroinvertebrate samples collected for in-class study, review methodology for field study session. Review macroinvertebrate VSM PPT

Field Study - Stream Side Data Collection – At Designated Stream Site (9:00 am – 1:00 pm)

- Water Quality Monitoring – Working in teams, students collect water quality data including collecting macroinvertebrates, apply chemistry for water testing, and measure physical attributes of stream.

Stream Data Project and Summit

- Teams analyze and compare stream data collected, then share Watershed Council created stream poster at a Summit in May.

Scheduling Options:

1. **<u>One team</u>** can monitor the stream **BOTH in the fall and spring.** (Advantage: only a refresher needed in the spring instead of full training)

2. **<u>Or</u> Separate teams for fall and spring**. (Advantage: More students participate)

3. **Schools can choose a schedule** that works best for their members:

    a. **Two separate days** for training and **field day**
    b. **One half day** training and **field day**
    c. **After school training** and **field day**
    An option of your creation for those teams in a unique situation

August 22, 2016

Watershed Academy Participating Teachers,

As we enter the fourth week of August, Eli and I wanted to take a moment to share some changes that we are proposing for the upcoming Watershed Academy 2016 Fall and 2017 Spring sessions. We are hoping that the options we have designed help your school team(s) successfully participate this year.

After *reviewing the overview and scheduling options on the second page*, please let us know how you would like to participate this year. We would like to have your program scheduled before school starts if possible.

Highlights:

- Choose one team or two for monitoring year
- Flexible scheduling for training seminars
- Condensed training
- No project – Compiled data and analysis shared through TOMWC posters/presentation
- One Summit in Spring

This past spring monitoring was incredibly successful and we look forward to working with your students this year! We truly appreciate the time and dedication you all have to helping Watershed Academy members have a unique and memorable experience learning about their watershed and becoming stewards of this precious resource.

Enjoy those last days of summer vacation – we hope to hear from you soon!

Best to you all!

Maria Affhalter
Water Resource Education Director
(231) 347-1181 ext.119
maria@watershedcouncil.org

Elijah Baker
HP AmeriCorps Member
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(231) 347-1181 ext.119
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Watershed Academy 2016 -2017 Seminar Overview

Introduction to Watershed Science (60-90 min.)

- Overview of program, project focus- research stream/watershed for monitoring, methodologies overview.
- Introduction of team resource binder, watershed map, watershed concept with hands-on model and Google virtual watershed tour.

Water Quality Monitoring Basics (120 min.)

- Water Quality Monitoring Basics – Areas of data collection, introduce equipment and methods for collection, and identify chemical make-up and physical attributes of samples of water bodies. Review on-site monitoring instructions. Review VSM PPT.
- Macroinvertebrate samples collected for in-class study, review methodology for field study session. Review macroinvertebrate PPT

Field Study– Data Collection (9:00 am – 12:00 pm/Land-Navigation Act. Optional)

- Water Quality Monitoring – Working in teams, students collect water quality data including collecting macroinvertebrates, apply chemistry for water testing, and measure physical attributes of stream.

Scheduling Options:

4. **Team participants selected** can monitor the stream **BOTH in the fall and spring.** (Advantage: *only a refresher needed in the spring instead of full training*)
   OR schools can choose <u>Separate</u> teams for fall and spring. (Advantage: *More students participate)*

5. **Schools can <u>choose</u> a schedule** that works best for their members:
   a. Two separate day training sessions and field day
   b. One half day training and field day
   c. After school training and field day
   d. An option of your creation for those teams in a unique situation!

New Changes:

6. **Training seminar(s) are concentrated** – Team project/Power Point completed in spring with minimal time investment regardless of team(s).
7. **Informal meeting after fall monitoring for data sharing** – Teams invited for pizza and data/ field day fun sharing. (Advantage: No pressure of project, just shared experience with teams)
8. **Summit after spring monitoring**. (Advantage: one event per year, all teams share)