



Instructions for

The Watershed Game - Stream Model

A simulation exercise exploring the connection between land use and water quality and the impact of our choices.

About this version of the Watershed Game - Stream Model

This version of the Watershed Game focuses on looking at an entire watershed and the land uses associated with a typical watershed in Minnesota. It includes a watershed boundary and four principal land uses: farmland, forest, city, and residential and also an area representing undeveloped land.

Objectives

Players will:

- Understand what a watershed is and recognize and encourage the need for watershed planning to solve larger water quality issues.
- Build their understanding about how land use and land management decisions affect water quality. Build knowledge about local development and municipal operations that affect water quality.
- Participants will be able to identify major sources of sediment or/and phosphorus.
- Increase their knowledge about stormwater and land use best management practices (BMPs) and how those practices are used to reach pollutant load reductions. Learn how their choices can prevent or reduce impacts.
- Understand that water bodies have limits - they can only take so much before water quality, habitat, and designated uses are degraded. Understand water quality impairments, regulations, impaired water designations, and how local land use & management has a key role to play in reaching goals towards clean water.
- Understand the need for individual and community level solutions for protecting water quality and habitat.
- *And other local objectives as appropriate...*

Goal of game

Achieve a water quality and pollutant load standard (TMDL) for sediment by reducing sediment pollution from all land uses in the watershed through application of a variety of Best Management Practices or BMPs. Alternatively, a phosphorus standard may be substituted for sediment, depending on the needs of the audience.

Materials

- Game board
- BMPs for four land uses
- Watershed planning cards
- Chance cards
- 5 **Black** dry erase markers & wipe cloth
- Candy pieces to act as "money" (min. 35-40 pieces per game board)
- Large banquet style table (min of 6 feet)
- Weights or clamps to hold the game board on a table.

Background for Game Facilitators

The Game Board - Stream Model

- This is an example “watershed.” A watershed is...(represented by the green dashed line here)
- Sediment is a naturally occurring part of stream ecosystems, but like many things, when too much of it enters our waterways, it causes a number of problems for recreation and aquatic life in particular. Excessive sediment can clog fish’s gills, smother spawning habitat, scour susceptible organisms from the stream bottom, and fill in habitat for stream “bugs” that provide food for fish. Erosion of stream banks from increased runoff can be a major source of sediment, and this erosion can also lead to loss of property and endangerment of infrastructure near waterways.
- Phosphorus is also naturally occurring, and a necessary element for stream ecosystems. When excessive phosphorus enters a stream, it can cause large growths of algae, reduced habitat for fish, and reduced oxygen levels as the algae dies and decomposes.
- Typical land-uses in a watershed include farmland, forests, residential areas, and cities (*explain what makes up each of these land uses categories.*)
- Typical impacts you could expect from these land-uses are:
 - Farmland – no buffer between cropping and the stream; wetlands drained for cropping; cows allowed uncontrolled access to the stream; and no conservation tilling.
 - Forests – Clear cutting; harvesting in or near sensitive storage areas; harvesting above highly eroding slopes; numerous stream crossings and extensive forest roads.
 - Residential – Vegetation along the water edge removed; extensive removal of vegetation and soil grading on construction sites with no erosion control.
 - City – Wide streets; curb and gutter; removal of natural vegetation; loss of storage; and high percentage of impervious surface.
 - At any place along the stream in the watershed there can be pollution contributions from such things as eroding banks that can be a function of the natural landscape, but increasing the amount and speed of runoff can increase these contributions.
 - Even undeveloped land contributes a small amount of sediment & phosphorus to water bodies.

The Game Pieces

A variety of BMPs can be used to prevent or mitigate pollution in the watershed. The ones represented in the game are not the only ones available, but represent a number of innovative and traditional stormwater management practices that have been used and shown to be effective in the appropriate situation. The costs represent a relative estimate of cost as compared to the other BMP’s, but this will vary depending on circumstance and situation. Likewise, the effectiveness should be treated as relative, and depends on specific situations and appropriate implementation. In the future,

additional BMP game pieces may be developed and shared with game users. If you wish to add or modify an existing game piece, feel free, but please inform Northland NEMO, to ensure that your contribution can be shared with others.

Ready, Set, Play !

I. Setting the Stage Before play begins.

** Note: This section should take you no more than 5 minutes. Previous experiences and feedback from participants indicate that the game facilitators should talk less! Therefore, although the facilitator must address the following sections (Setting the Stage, Background, Rules, and Explanations), it is important to allow for participants to talk freely and discuss the BMPs and situations amongst themselves. Facilitators should promote inquiry based learning.*

- Introductions of presenters
- Game is a fictional landscape.
- Intent is not to point fingers at any one land use as the main culprit of sediment or phosphorus and other pollutants, but recognize all land uses contribute, and point out what each land uses can do to limit sediment and phosphorus pollution in the watershed.
- Describe land uses & typical impacts expected from each one (may vary, depending on if Sediment or Phosphorus is used):
 - Farmland
 - Forest
 - City
 - Residential
- Describe game piece BMPs including the cost and point reductions on the front side and the description and outcome on the backside (*hold on to all game pieces, candy, and markers until the game begins*). Some BMPs cost more candy than others. Some are simple and easy, so they cost nothing. Each BMP has a label that describes what it does and how much it costs.
- Describe **goal of game**, which is to reduce the pollution (sediment or phosphorus) load in the river to a set limit (*see above. Currently set at a goal of 75 "points"*)
- Define key terms and their relevance: watershed, land use, sediment or phosphorus, Best Management Practice.
- We have 3 years or rounds on which to meet this goal, in the case of the Game, implementing 1 BMP per year.
- Describe yourself as the facilitator and another assistant as the banker. *Experience has found that having an assistant who serves as the banker to collect the money (chocolate and add the points up during the rounds affords the facilitator to focus on leading the game, discussions, and learning objectives.*

Background narrative- example of narrative

Runoff from developed landscapes carries pollutants in it. One of the most widespread is sediment and phosphorus. While both natural and essential parts of a stream ecosystem, when too much of either enters our waterways, they can cause serious harm. Sediment clogs fish gills, smothers eggs and aquatic organisms, decreases light penetration, carries nutrients and toxic compounds, and isn't fun to swim in or drink. High amounts of fast stormwater runoff cause erosion and carry sediment to the river.

Another source of sediment in rivers comes from unstable, eroding river banks. A river can only take so much sediment before it starts to show poor water quality and habitat degradation. Phosphorus pollution is often associated with sediment because the nature of phosphorus binds itself to soil - and when sediment pollutes waters it often carries with it excessive phosphorus to the receiving water. Excessive phosphorus pollution can lead to algae booms, excessive native & non-native plant growth, decreased light penetration, and reduced oxygen levels.

The game board before us shows the entire watershed for this creek; all the lands within this boundary (indicating the watershed boundary line on the map) drains to, and contributes to this creek. Looking around, we see a number of different land uses, and while we could debate who contributes the most sediment, research clearly tells us that all of these land uses do contribute sediment (or phosphorus) to waterways, and so each land use has a role to play in restoring this stream. (You may wish to review individual land uses and how each can contribute to pollutant.) For our purposes, each land use starts out contributing the same amount of pollutant; 50 “points” to the stream.

Your goal, as “administrators” of these lands, is to try to restore this ecosystem back to a level that can support a healthy fishery, and be a recreational asset to your community for swimming, fishing, and other uses. Researchers have told us that in order to achieve this goal, sediment contributions throughout the watershed must be at 130 pts or less. To do this, you will have at your disposal a number of Best Management Practices, or “BMP’s”, and on each is listed a cost and an effectiveness. You will have a budget of 5 candies, and can play ONE BMP per round, and we will have three rounds. (achieving goal can be associated with some “prize”, but not necessary)

Setup:

- Divide players among land uses (* at least two players per land use)
- Give each land use a budget of five candies
- Assign points 50 pollutant points for each land use
- 75 is the limit (for example our TMDL goal)

II. Play the Game !

- Pass out the BMP cards to each group
- Pass out 5 candies to each group. This is “money” to buy BMPs
- Instruct each team to quickly review them, and lay them out in front of them. Allow the teams 2-4 minutes.
- **Rules: explain the rules**
 - Players can not swap BMPs between land use areas
 - Each team / player chooses one BMP per round (or per year of TMDL implementation.
 - Pay banker/instructor for BMP selected
 - Each round, the BMP points are subtracted from the land use total

Pre-Round 1 - an opportunity to “buy” a watershed plan

- Players have a chance to buy a watershed “plan” at start of the game for 1 candy. This is the only opportunity they have to do so.
 - *A plan may offer benefits in the future or it may be an expenditure of resources with little to no return. That is yet to be seen.*
 - *It may help guide their BMP selection the future,*
 - *it may cost a substantial investment of time and money,*
 - *it may lead to success.....*
 - *What we do know is that a Plan does not reduce their pollutant point total.*
- *Later, after round 1, those who purchased a “plan” may be rewarded by the instructor/banker giving candies or money back. One candy returned per round has worked well.*

Round 1

- Give teams/players 2-3 minutes to choose a BMP to implement.
- Ask teams/players to discuss the BMPs they chose. Why? Cost or type? Have players explain what the BMP does.
- Collect the money (candies) from the each team.
- Have each team subtract the points from their land use point box.
- Add up total pollutant points remaining. Compare total pollutant points remaining to goal and encourage group to meet goal
 - ** *Experience has found that having an assistant to the facilitator really helps. The assistant can collect money (chocolate and add up points and recalculate totals so the facilitator can concentrate on discussions, concepts, and learning objectives rather than spending valuable time on math.*

Planning Pays Off (sometimes) give candies to those who bought a “plan.”

Round 2

- Give players 2-3 minutes to choose a second BMP to implement.
- Ask teams/players to discuss the BMPs they chose why? Cost or type? Have players explain what the BMP does.
- Collect the money (candies) from the each team.
- Have each team subtract the points from their land use point box.
- Add up total pollutant points remaining. Compare total pollutant points remaining to goal and encourage group to meet goal
- Discuss that even though we have implemented all these BMPs (two rounds worth now) we still have not reached our goal.

Chance Cards - unforeseen circumstances and events.

Purpose: The injection of “chance cards” into the Watershed Game provides additional learning opportunities beyond BMPs. It also provides some dilemmas and unforeseen circumstances. Chance cards may either benefit or cost a team money (candy) OR may also add/subtract from point totals. Chance cards were also developed to ensure that the simulation or learning experience does not end too quickly nor is it always so easy just to buy and implement BMPs to prevent or cleanup pollution. Chance Cards

may be introduced at the facilitator's discretion at random. The Chance Cards are orange and are meant to be held by the Game Facilitator. They are a guide, not a rule and you may have the need to create your own as appropriate. *The Chance Cards are included at the end of this document.*

Examples of a chance include: 12 inch rainfall in 24 hrs blows out construction site erosion controls and plugs storm sewers which floods city & homes: take 1-2 candies

Planning Pays Off #2 (sometimes) give candies to those who bought a "plan."

Round 3

- Give players 2-3 minutes to choose a third BMP to implement. This round however, they should realize (or the facilitator should acknowledge) that they may not be able to use the BMPs they have left because they do not have enough money or candies. OR even if they do, they can start to see that they cannot reach the overall watershed goal.
- *Revisit the Game Rules.* Encourage players to work together to reach their pollutant goal without actually saying "work together with other teams."
 - *A suggested approach to this might be the following:* "We can see that we have implemented various BMPs, individual teams have reduced their contribution of pollution to the stream, and overall, together we have got closer to our target reduction. However, we still have not met our goal. We also see that we all have various BMPs remaining in our toolbox, but perhaps not enough candy or funding to implement them. Does anyone have any suggestions for how we might get closer to our target reduction?"
 - Hopefully participants discover and offer the suggestion of partnering or collaborating with adjacent land uses. Sharing/borrowing/giving candy or funds to adjacent, cooperating partners. Combining money/candy to buy the most effective BMPs for the overall watershed.
- Ask teams/players to discuss the BMPs they chose why? Cost or type? Have players explain what the BMP does.
- Collect the money (candies) from the each team.
- Have each team subtract the points from their land use point box.
- Add up total pollutant points remaining. Compare total pollutant points remaining to goal and encourage group to meet goal
- Summarize the wide mix of BMPs used

For undeveloped land near stream mouth, you may play a "Land for Sale – SOLD!" sign here, with a development plan that will increase sediment to just over the limit again; can use to generate discussion on what should have been done. Ask participants!

Possible points to bring up:

1. The importance of land use planning. How could this area have been developed to protect the stream?
2. The benefit of incorporating BMP's in to development plans; many of the BMP's used above would cost nothing (stream buffers), or save money (narrower streets), if required on this site.

Wrap up

Obviously this isn't a real-world situation. Different land-use contributes different pollutant loads and we don't all have the same bank account. Also, although we initially asked you approach this as an individual land use unit, many of these problems can't be solved alone. For instance, eroding bluffs aren't always caused by one landowner and things upstream can impact things downstream. This is where working together at a community or watershed level will be especially important. Communication is critical. Support and encourage your local officials. Working together you can find the most efficient and effective ways to control pollutants going to your streams so we can preserve or restore what we value about them for ourselves and for future generations. (Could mention...you might hear this type of limit on a stream called a TMDL)

- Possible questions for discussion:
- What did you learn?
- What would you do differently if you played again?
- How does this game apply to work you are doing/would like to do?
- There are other impairments of the watershed that are also being addressed through watershed management, planning, and the implementation of BMPs.
 - *Impairments include bacteria, temperature, chlorides, mercury, PCBs and nutrients.*
 - *Different impairments call for difference BMPs although some BMPs may provide a response to several different impairments.*

Storing the Game Board: Make sure you erase the points and any writing on the Game Board as soon as play finishes! Otherwise the ink impregnates into the lamination and it won't come off.

Land Use	BMPs	Chance Cards
Farmland	Manage manure properly	Clean Water Grant
	Restore wetlands	Flood
	Practice conservation tillage	Drought
	Establish filter strips	EAB
	Install stream fencing	Toxic Spill
City	Create bioretention basins (rain gardens)	Severe erosion or slump bank
	Sponsor storm drain stenciling programs	Good Housekeeping Practices
	Design/redesign streets to reduce runoff	Coordination / Partnership
	Sweep streets regularly	Road salt/sand runoff pollution identified
	Maintain stormwater ponds	Upstream pollution load change
Residential	Install rain gardens	New regulation imposed
	Minimize Clearing	Clean Water Grant
	Stabilize & revegetate shorelines	Flood
	Replace lawn with native plants	Drought
	Control erosion at construction sites	EAB
Forest	Replant trees	Toxic Spill
	Selective Cutting	Severe erosion or slump bank

	Prevent harvest on critical slopes	Good Housekeeping Practices
	Remove crossings and reclaim roads	Coordination / Partnership
	Protect sensitive storage areas	Road salt/sand runoff pollution identified
		Upstream pollution load change
		New Regulation Imposed

Acknowledgement & Credits

The game facilitator needs to verbally offer acknowledgment about the program, the development and origin of the Watershed Game tool.

Here is the acknowledgment text block found on the Game Board:

The Watershed Game helps individuals understand the connection between land use and water quality. Participants learn how a variety of land uses impact water and natural resources, increase their knowledge of best management practices (BMPs), and learn how their choices can prevent impacts. The Watershed Game was developed through Northland NEMO, a Minnesota-Wisconsin educational partnership. When using this tool, acknowledgment should be given to Northland NEMO, University of Minnesota Sea Grant, University of Minnesota Extension, University of Wisconsin Extension, Lake Superior Research Institute, and the Minnehaha Creek Watershed District. To learn more, visit www.northlandnemo.org. 2009.

Acknowledgement will also be in writing where suitable in the program materials.

Version October 2009. These instructions were updated October 30, 2009. Bilotta et al. The Game Board and the Game Pieces or BMPs were updated October 30, 2009. Bilotta et al.

Illustrations of the Watershed Game - Rivers version

Illustration of the Board Game Tool
Actual size is approximately 2 ½ x 5 feet.



Photograph of the Board Game Tool in use.



Photo by Brian Janstrom, Mississippi WMO, October 2007

Photograph of Board Game Tool in use.
Notice the game pieces.
Notice the water goal written with dry erase marker.



Photo by Brian Janstrom, Mississippi WMO, October 2007

Vocabulary (page to be developed in the future)

Watershed

Receiving water

Impaired water

TMDL