

The Groundwater Game Facilitator Script

Note to the Facilitator: The highlighted text are actions for you, as facilitator, to complete. The rest of the text is your script – what you should say as you facilitate the game. Please try to stay as close as possible to this script.

In advance of the game, please refer to the ‘Groundwater Game Overview and Instructions’ for a list of game materials and set-up instructions.

“Welcome to the Groundwater Game – an interactive exercise that allows participants to experience the impacts and tradeoffs associated with groundwater management! For the purposes of this game, you will each be a stakeholder who uses groundwater from a common aquifer to meet your needs – either irrigating fields, providing water to residents or meeting household needs.

In the first several rounds, your group will manage your groundwater use in different ways. The first two rounds are known as **open access** in which players pump as fast as they choose. Then you will experience **historical allocation**, where the total amount players are allowed to pump depends on past use, but will not exceed the amount of new water to the groundwater basin that year. Next, your group will try combining a historical allocation with the chance to trade water beads. After testing all of these options, your group will discuss and decide which management strategies you want to use in the final one to two rounds.

Note: You have the choice to play 5 or 6 rounds. Game play will take approximately 60 to 90 minutes, depending on number of rounds played and length of discussion.

There are six roles in the game: Almond Grower, Broccoli Grower, Alfalfa Grower, a Rural Family, a Community Water System, and an Urban Water Utility”.

“If you are a grower, your objective is to maximize your long-term income. You earn income for each unit of water that you extract from the aquifer, which depends on the type of crop you grow. For some of you, each unit of water is worth \$10, and for others, it is worth \$5 or \$2. If you are a grower and you have more water than you need, you can grow more crops.

For the other three roles (Rural Family, Community Water System, and Urban Water Utility), your objective is to obtain enough water to meet your specific needs. For non-growers, the water beads you pump from the aquifer do not generate any income, but you can make money by selling extra water during some rounds to other players. You must have sufficient water to meet your needs. All players will start the game with some money in the bank.

This central bowl represents the groundwater aquifer for your shared water basin, and the blue beads are groundwater. This game is played in five to six rounds. Each round represents one year. In each round, you have an opportunity to pump water from the aquifer and place it in your holding tank (the cup in front of you).

OPTIONAL: If using red beads to represent poor water quality, add, “You will also notice that there are red beads mixed into the bowl. These beads represent water that is of poor quality, and if scooped, the red beads will not be counted toward scooping totals.”

At the end of each round, there is a rainy season where some water is restored to the aquifer. When it rains, the water seeps into the ground, adding to the aquifer. This process is referred to as “recharge.” The recharge rate of this aquifer for this game is 114 blue beads per year.

Water in the aquifer is pumped out for use through wells. Each of you has access to an individual well. Some wells may be deeper than others, and able to extract more water at a time; that is, some wells are able to more easily access the groundwater in the aquifer.”

| Point out the measuring spoon in front of each player.

“When the group pumps out more water than can be recharged, the aquifer use is not sustainable. This means that eventually, over time, there will be no more water in the aquifer. As a result, players will run out of water.

Some of you have access to surface water, such as a river, based on geography. The amount of surface water you receive will be determined each round by rolling a die to indicate this year’s rainfall (which will range from drought conditions to moderate rainfall). To keep things simple, you must use (or trade) all of your water each round.

As I mentioned, the growers earn money for each unit of water pumped, but the rural family, community water system and urban water utility do not earn money for water pumped. Instead, they focus on getting their minimum number of beads to provide water for home use. Please review your role card now to see how much your own water is worth and how many beads you need each year.

Now, let’s go around the table and say your role, need and water revenue so that you know where everyone stands in relation to the other players.”

| Ask players to read out their names, water needs, and water revenues from their role sheets.

“Remember: Growers, your goal is to maximize your long-term incomes; non-growers, your goal is to meet your needs. I will keep track of your water pumped, needs and income electronically, and you can see whether each player is meeting their needs at the end of each round (or year). You are welcome to keep track of your own results on the role sheet provided.”

| Throughout the game, when players make comments about the results or graphs, respond generically to all observations – “That’s interesting” “Good point”. These points can be reintroduced during the discussion phase of the game.

Round 1: Open access



“In the first round, there are no regulations about water use. You are allowed to pump as much as you physically can during this round. To pump water, you must use your spoon (that is, your “well”) to scoop beads from the aquifer and place them in your “holding tank” (that is, your cup). To begin, place your cup one hand’s distance away from the aquifer. Do not hold onto your cup. Any beads that fall (on the table or floor) will not count toward your total. These will be returned at the end of the round to the aquifer. You may not pick up any beads with your hands.”

Check positions of cups around bowl to make sure everyone has placed their cup appropriately.

“Again, you may not move or hold onto your cup. The pumping year (that is, the round) will begin when I say ‘start,’ and end after 15 seconds when I say ‘stop.’ Any beads in your spoon at the end of the round may be placed in your cup, but you may not make any additional scoops when time is up. After pumping, I will ask you to count your beads to determine how much you earned (if applicable), and if you met your water needs. Does anybody have any questions?”

Answer any logistical questions. Set the timer to 15 seconds.

“Before we start the timer, we will first see whether those of you who have surface water rights will get any...”

SURFACE WATER: ROLL DIE, ENTER NUMBER IN SPREADSHEET & HAND OUT BEADS. The surface water roll is entered on the ‘Facilitator’ tab next to ‘surface water roll’ – select number from drop down menu.

If roll 1 or 2 – players receive 0 beads (Drought), 3 or 4 – 5 beads (Minimal rain), 5 or 6 – 10 beads (Moderate rain). Only Almond Grower, Alfalfa Grower, and Urban Water Utility role players get these extra beads.

“If surface water was received, each person can take the appropriate number of beads from the surface water reserve.”

Pass around the cup that holds the separate supply of beads used to allocate surface water.

“Alright, now we are ready to start. You may begin pumping when I say go. On your marks, get set, GO!”

Wait 15 seconds, then stop players.

“Stop! OK, now please go ahead and count the beads in your cup.

Optional: If using red beads to represent poor water quality, remind participants that these beads do not count towards the scooping total.

Now let’s go around the table to hear how many beads you pumped and whether you met your need (surface water beads and groundwater beads).”

Record scooping results in ‘Facilitator’ tab. Surface water beads have already been recorded into the Excel sheet, so only record scooped beads.

“Let’s take a look at the results from this round.”

Select ‘Results to Report during game’ tab and report how much money players earned – ‘Dollars Earned’ table

Next, select ‘Graphs’ tab.

‘Aquifer’ results graph:

“Now let’s take a look at the aquifer. After one year of extraction and recharge, the water level has declined.”

| ‘Total Water Use’ – graph:

“This second graph shows how much surface water and groundwater each of you used. Looks like some of you scooped more than others. “

| Scroll to ‘Water Goal’ graph.

“Who is meeting their goal?”

| Scroll to ‘Earnings’ and ‘Bank Account’ graphs.

“Seems like some of you are earning more than others.

Now we have reached the end of Round 1. Please dump all of your surface and groundwater beads , including the red beads, into this discard bin to represent their use over the year.”

| Collect discarded water beads.

“I’m going to recharge the aquifer at the rate of 114 beads per year.”

| Recharge aquifer

Round 2: Open access

“OK, let’s start the next round. There is still no regulation on groundwater use, so the rules are the same as the last round. Feel free to pump as much as you are able to in 15 seconds.

Before we start the timer, we will first see whether those of you who have surface water rights will get any...”

SURFACE WATER: ROLL DIE, ENTER NUMBER IN SPREADSHEET & HAND OUT BEADS. If roll 1 or 2 – 0 beads (Drought), 3 or 4 – 5 beads (Minimal rain), 5 or 6 –10 beads (Moderate rain). Only Almond Grower, Alfalfa Grower, and Urban Water Utility role players get these extra beads.

“If surface water was received, each person can take the appropriate number of beads from the surface water reserve.”

Pass around the cup that holds the separate supply of beads used to allocate surface water.

Check positions of cups around bowl to make sure everyone has placed their cup appropriately.

Set timer to 15 seconds.

“Alright, now we are ready to start. You may begin pumping when I say go. On your marks, get set, go!”

| Wait 15 seconds, then stop players.

“Stop! OK, now please go ahead and count the beads in your cup.

| Optional: If using red beads to represent poor water quality, remind participants that these beads do not count towards the scooping total.

Now let’s go around the table to hear how many beads you pumped and whether you met your need (surface water beads and groundwater beads).”

| Record scooping results in ‘Facilitator’ tab. Surface water beads have already been recorded into the Excel sheet, so only record scooped beads.

“Let’s take a look at the results from this round.”

| Select ‘Results to Report during game’ tab and report how much money players earned – ‘Dollars Earned’ table. The ‘Total Dollars Earned’ tables shows cumulative earnings.

| Next, select ‘Graphs’ tab.

| Scroll to ‘Aquifer’ graph.

“Uh oh! The aquifer is in danger of running out of water in the next few years. The dotted line projects the average rate of depletion. That is, if we continued pumping as in the past two rounds, the aquifer level would decline at the rate of the dotted black line.”

| Scroll to ‘Total Water Use’ Graph.

“Where there any changes to the amounts each of you could scoop?”

| Scroll to ‘Water Goal’ graph.

“Who is meeting their goals?”

| Scroll to ‘Earnings’ and ‘Bank Account’ graphs.

“Seems like some of you are continuing to earn more than others. Now we have reached the end of Round 2. Please dump all of your surface and groundwater beads into this discard bin.”

| Collect discarded water beads.

“I’m going to recharge the aquifer at the rate of 114 beads per year.”

| Recharge aquifer.

Round 3: Historical allocation

“Now, we are going to try something new. In order to ensure the aquifer level remains sustainable, (that is, that pumping does not exceed recharge), I am going to implement a regulation that limits total pumping to equal the annual recharge rate. Each of you will be allocated the right to pump a certain number of beads.

There are many possible ways to allocate water. We are going to use a historical allocation, which the game defines as the average amount you pumped in rounds 1 and 2 (without considering surface water allocation) proportional to the cap of 114..”

Go to the ‘Facilitator’ tab and select “1” for historical allocation (next to row 22 ‘Allocation’ – under the ‘Facilitator Data Entry’ table – Round 3). Tell each player what their historical allocation will be.

Have each player take their allocated beads from the bowl using their scoop.

“Now, we will see whether those of you who have surface water rights will get any..”

SURFACE WATER: ROLL DIE, ENTER NUMBER IN SPREADSHEET & HAND OUT BEADS (if roll 1 or 2 – 0 beads (Drought), 3 or 4 – 5 beads (Minimal rain), 5 or 6 –10 beads (Moderate rain). Only Almond Grower, Alfalfa Grower, and Urban Water Utility role players get these extra beads.

“Now let’s go around the table to hear how many beads you pumped, whether you met your need (surface water beads and groundwater beads), and how much the growers earned.”

Ask players to say how many beads they ended up with and whether they met their needs.

Allocation results (which combine surface water beads and groundwater beads) are provided in the ‘Facilitator’ tab under the “Total Water Use Summary’ table – Round 3.

“Let’s take a look at the results from this round.”

Select ‘Results to Report during game’ tab and report how much money players earned – ‘Dollars Earned’ table. The ‘Total Dollars Earned’ tables shows cumulative earnings.

Next, select 'Graphs' tab.

Scroll to 'Aquifer' graph

"Looks like the aquifer remained stable."

| Scroll to 'Total Water Use' Graph.

"There's still a significant difference in pumping between some stakeholders, but the total amount of pumping was less than during the first two rounds".

| Scroll to 'Water Goal' graph.

"Who is meeting their goals?"

| Scroll to 'Earnings' and 'Bank Account' graphs.

"And here are Earnings for this round.

Now we have reached the end of Round 3. Please dump all beads in your holding tank into this discard bin to represent their use over this year."

| Collect discarded water beads.

"I'm going to recharge the aquifer at the rate of 114 beads per year."

| Recharge aquifer.

Round 4: Allocation with water trading

"Now, we are going to add the ability to trade water. You will now have the opportunity to buy and sell water amongst yourselves. In this round, you may add to your income by selling some or all of your allocated beads to another player.

The sum of the allocated beads will be equal to the sustainable recharge. Similar to Round 3, we will use a historical allocation."

Go to the 'Facilitator' tab and select "1" for historical allocation (next to row 22 'Allocation' – under the 'Facilitator Data Entry' table – Round 4). Tell each player what their historical allocation will be.

Have each player take their allocated beads from the bowl using their scoop.

"Now, we will see whether those of you who have surface water rights will get any..."

SURFACE WATER: ROLL DIE, ENTER NUMBER IN SPREADSHEET & HAND OUT BEADS (if roll 1 or 2 – 0 beads (Drought), 3 or 4 – 5 beads (Minimal rain), 5 or 6 –10 beads (Moderate rain). Only Almond Grower, Alfalfa Grower, and Urban Water Utility role players get these extra beads.

“Now, you have the opportunity to trade your rights to water (signified by the beads in front of you) with one another. That is, you may trade your beads to another player for a certain price per bead. Although you all have some money in the bank, remember you do not want to lose money in the long run. Growers will probably not want to pay more than their income per bead. You may negotiate amounts and prices, but you may not sell more than your allocation. If you agree to purchase beads, please write down the price, quantity and with whom you made the trade, and I will record the transaction when we report out

after the completion of the round. I am going to give you three minutes to make trades.”

| Put 3 minutes on the timer. When 3 minutes is up...

“OK, now, please report back any trades that you made. Give me the name of the buyer, the seller, the amount sold, and the price per bead.”

| Record trades in spreadsheet, in ‘Facilitator’ tab – under ‘Trades’ – Round 4. Then, mark the cell labeled ‘ROUND 4 END’ with an ‘x’.

“After trading, let’s go around the table and hear how many beads you ended up with and whether that met your needs.”

| Ask players to say how many beads they ended up with after trading and whether they met their needs.

| The number of beads each player ends up with is also shown in the ‘Facilitator’ tab – ‘Total Water Use Summary’ table – Round 4

“Let’s take a look at the results from this round.”

| Select ‘Results to Report during game’ tab and report how much money players earned – ‘Dollars Earned’ table. The ‘Total Dollars Earned’ tables shows cumulative earnings.

| Next, select ‘Graphs’ tab.

| Scroll to ‘Aquifer’ graph.

“Looks like the aquifer remained stable. This isn’t surprising, given that we set the total allowable amount to be pumped equal to the recharge rate.”

| Scroll to ‘Total Water Use’ graph.

“What do you see?”

| **Scroll to 'Water Goal' graph.**

“How did the players do reaching their goals during this round?”

| **Scroll to 'Earnings' and 'Bank Account' graphs.**

“And here are Earnings for this round.

Now we have reached the end of Round 4. Please dump all beads in your holding tank into this discard bin to represent their use over this year.”

| **Collect discarded water beads.**

“I'm going to recharge the aquifer at the rate of 114 per year.”

| **Recharge aquifer.**

**Round 5 & 6:
Devising
your own
groundwater
management
strategy**

“So far, we have seen what would happen under three management scenarios: no regulation, historical allocation, and historical allocation with trading.

Next, as a group you will have the opportunity to decide how you want to manage your aquifer.

You will decide amongst yourselves how you would like to allocate groundwater beads. You may decide to go back to open access or you may choose to allocate a certain number of beads to each player. For example, you could decide to use a historical allocation as we used in the last two rounds, or you may want to divide beads equally across all players. You can also develop a customized allocation approach. You can combine any allocation approach with trading. As with the last two rounds, the sustainable yield will be set at 114 beads.

Your role cards provide information to help you determine your preferences for regulations. Take a few minutes to review this material. After you are familiar with your views, you will have ten minutes to deliberate about it, and agree as a group about which type of allocation you want (no regulation or a historical, equal, or custom allocation) and whether you want to be able to trade.”

| **Set timer for ten minutes. If the group has not decided on a management strategy at the end of the ten minute period, ask them to vote on the options.**

“What option for regulation have you chosen as a group?”

| **Have the group report back on the management strategy.**

Round 5

“Before we play the round, we will first see whether those of you who have surface water rights will get any...”

SURFACE WATER: ROLL DIE, ENTER NUMBER IN SPREADSHEET & HAND OUT BEADS (if roll 1 or 2 – 0 beads (Drought), 3 or 4 – 5 beads (Minimal rain), 5 or 6 –10 beads (Moderate rain). Only Almond Grower, Alfalfa Grower, and Urban Water Utility role players get these extra beads.

“Now, let’s now play the round with the option you have chosen.”

If players selected open access, conduct a 15 second pumping round.

OR

If players allocated groundwater beads, have each player scope the appropriate number of beads.

AND

If players elected to trade, give the group 3 minutes to complete trades. Remind the group to record the name of the buyer, the seller, the amount sold, and the price per bead.

To configure the spreadsheet for rounds 5 and 6:

- 1. In the facilitator tab, row 22, enter the allocation code using the drop down box: 1 = historical, 2 = open access or custom allocation, and 3 = equal allocation.**
- 2. If the group is using 2 = open access or custom allocation, enter the number of beads in the table where the previous scooping was entered (‘Facilitator Data Entry’ table, rows 14 through 19)**
- 3. If applicable, fill in the ‘Trading’ table.**
- 4. Regardless of whether any trades occur, mark the end of the round by placing an “x” below the trading area on the Facilitator tab.**

Ask players to say how much water they received, whether they met their needs, and how much they earned (listed in excel spreadsheet in ‘Results to report during game’ tab).

“Now, let’s go around the table and hear how many beads you ended up with and whether that met your needs.”

Ask players to say how many beads they ended up with and whether they met their needs.

(The number of beads each player ends up with is also shown in the ‘Facilitator’ tab – ‘Total Water Use Summary’ table – Round 5 [or 6])

“Let’s take a look at the results from this round.”

Select 'Results to Report during game' tab and report how much money players earned – 'Dollars Earned' table. The 'Total Dollars Earned' tables shows cumulative earnings.

Next, select 'Graphs' tab.

"Let's take a look at the graphs."

| Scroll to 'Aquifer' graph

"Has the water level increased or decreased based on your choices?"

| Scroll to 'Total Water Use' graph

"What do you see?"

| Scroll to 'Water Goal' graph

"How has your ability to meet your need changed?"

| Scroll to 'Earnings' and 'Bank Account' graph

"What do you see here? How has your choice impacted who is earning more revenues?"

Now we have reached the end of Round 5. Please dump all beads in your holding tank into this discard bin to represent their use over this year."

Collect discarded water beads.

If playing Round 6, follow the steps below. If not, skip to 'Game End':

Round 6 (optional)

"I'm going to recharge the aquifer at the rate of 114 beads per year."

| Recharge aquifer.

"We will use the regulations you decided."

Note: Round 6 can be played with the same or different rules as Round 5.

Please follow the same steps provided for Round 5

Game end

“The Groundwater Game is over!
Thank you for playing!”

Discussion questions

This section provides the questions to facilitate a discussion after completing the game.

General reflection questions

- What did you observe?
- What happened to the aquifer level in each round?
- What happened to your finances after each round?
- Was the simulation fair?

Real-world collaboration context

- Are stakeholders in the game present in your own community? Do you think their interests and perspectives are similar or different than those portrayed in the game?
- When managing a common resource, how should the public interest be defined? How can the interests of the powerful and marginalized be balanced?

General natural resource management

- What common pool resources are you aware of? How are they being managed, and do you think they could be managed better through some of the rules tested in this game?
- What should the goals of management be when managing a common-pool resource?
- When managing a natural resource, how might individuals' goals align with or not align with a manager's goals?

Water policy and management

- How did your access to the resource change throughout the game and under different management scenarios?
- What were some changes you saw when management conditions were implemented?
- In your opinion, which round resulted in the most sustainable use of groundwater? Please explain your answer.
- There are many dimensions of water management that we not explicitly incorporated into the groundwater game. What are some other factors that influence water use and management?
- How should the environment, and groundwater dependent ecosystems more specifically, be considered when developing groundwater management strategies.
- In this game, the dimension of water quality was brought into the game through the use of red beads. In the real world, what implications does poor water quality have on water resources and water management?

Collaborative planning and governance context

- What strategies did you use to ensure your water needs were met? That the needs of the group were met? Did the strategies you used change through game play? If so, how and why?
- To what extent does this game involve distributive (zero-sum) or integrative (expanding the pie) negotiation? In the real world, how could similar conflicts be addressed?

Tradeoffs

- When competition for water is high, but water resources are scarce, tradeoffs must be made. What type of tradeoffs did you face? What type of tradeoffs did other interest groups in your community face?
- Were the impacts of water scarcity more acute for some members of your community? If so, which players felt the impacts more acutely? Why?

Uncertainty

- Weather is chaotic and can add uncertainty to the management of water resources. Some players' surface water supplies were determined by the roll of a die representing dry, average or wet water years. Discuss how this uncertainty influenced your outcome, the outcome of other community members and the aquifer.