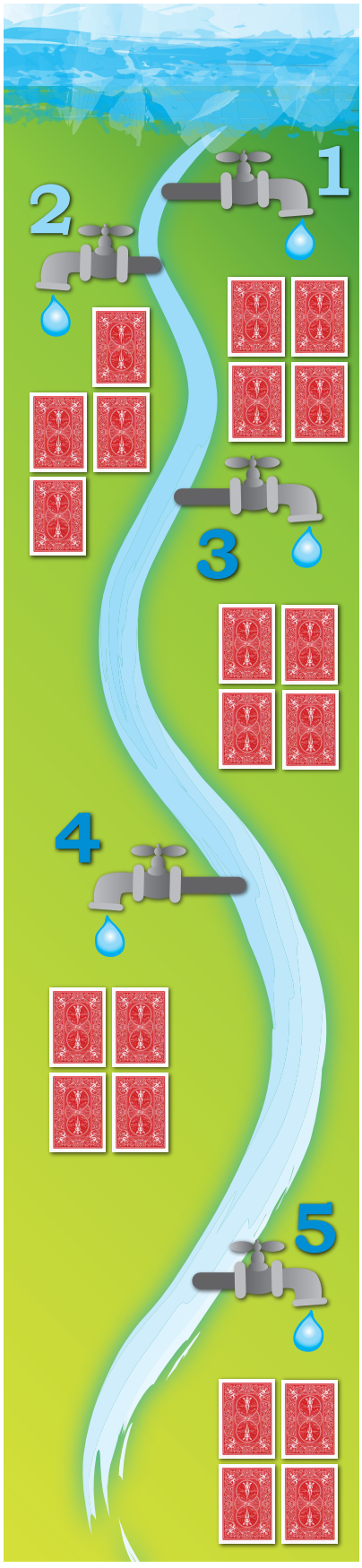

Tragedy of the Common Canal[1]

Name: _____

Canal Address: _____

In this game, you have four fields that can be planted.

You get four numbered playing cards, which you can keep secret if you like. These cards represent the value of the dry season crops from each your fields.

For example, if your cards are numbered 7, 5, 4 and 3, then the first field that you plant yields a crop worth 7, the second yields 5, the third yields 4 and the fourth yields 3 (think of these numbers as thousands of dollars).

If irrigation is available, you can triple the value of your fields. For example, fields yielding 7, 5, 4 and 3 without irrigation would yield 21, 15, 12, and 9 with irrigation.

The watershed for all participants is a canal that flows by each person's farmland, one farm at a time. Does everyone have a envelope with a number on it? The number on this envelope tells you how close you are to the source of water. The lower the number, the closer you are to the source of water. For example, the water flows by "#1" first, "#2" second, and so on. There are ____ of you located along each canal, so the address numbers go from 1 to ____.

Water is represented by water cards that we will put in a large sac and pass to each of you according to your address along the irrigation canal, starting with #1 then to #2, and so on. Each person may take 0, 1, 2, 3 or 4 water-cards from the bag when it is his or her turn to select the amount of irrigation for his or her four fields. You may not capture more water than the number of fields you have.

The total amount of water is unpredictable, due to variations in upstream water flow. But it is highly unlikely that there are enough water-cards in the bag for everyone to irrigate all their fields.

You can put your water-cards in your envelope before taking them out of the bag, so that your irrigation decision is not observed by others.

If you take fewer than four cards, then only the fields for which you have irrigation cards will have tripled crop value.

Please use the table for each season to organize your irrigation decisions.

Begin by writing your card numbers in the first column (1), ordered from high at the top to low at the bottom, since you will be irrigating the high-value fields

As you withdraw water (water-cards) from the canal (bag), check the fields you are able to irrigate in the second column.

First Season

(1) Card Number	(2) Irrigation	(3) Final Crop Value (tripled for irrigated fields)
	❑	
	❑	
	❑	
	❑	
Total value earned for all fields:		

The crop values in the third column (3) are either

- the card value or
- tripled card value if you can irrigate.

When you are finished, add up the final crop values from the last column to determine your total earnings. Write this amount in the bottom row.

Second Season

Canal Address: _____

We will now collect the 4 numbered playing cards from each person, shuffle them, and give everybody 4 new cards.

Please record your card numbers in the first column below, highest first, lowest last.

When the bag with the water-cards arrives, please decide how many cards to take out. Record your irrigation in the second column, your resulting crop values in last column, and add up the values and record your total earnings in the bottom row.

(1) Dry Season Crop Value	(2) Irrigation	(3) Final Crop Value (tripled for irrigated fields)
	❑	
	❑	
	❑	
	❑	
Total value earned for all fields:		

Third Season with Town Meeting

Canal Address: _____

We will now collect the 4 numbered playing cards from each person, shuffle them, and give everybody 4 new cards.

As before, please record your card numbers in the first column below, highest first, lowest last.

This time, there will be a general discussion before we pass the bag with the water-cards.

During this "town meeting," anyone is free to make suggestions about how others should make their irrigation decisions, as long as these suggestions are made politely. Again, no one is obliged to show his or her crop-cards.

Then we will pass the bag as before, and you will continue to use the envelopes as before.

When the bag with the water-cards arrives, decide how many cards to take out, using the envelopes as before. Record your irrigation in the second column, your resulting crop values in last column, and add up the values and record your total earnings in the bottom row.

(1) Dry Season Crop Value	(2) Irrigation	(3) Crop Value (tripled for irrigated fields)
	❑	
	❑	
	❑	
	❑	
Total value earned for all fields:		

Fourth Season with Public Irrigation Decisions

Canal Address: _____

We will now collect the 4 numbered playing cards from each person, shuffle them, and give everybody 4 new cards. Please record your card numbers in first column below.

This time, there will be a general discussion before we pass the bag with the water-cards.

During this "town meeting," any one is free to make suggestions about how others should make their irrigation decisions, as long as these suggestions are made politely.

Then we will pass the bag as before, *but this time you will be required to hold up the water-cards so that others can see how many you retrieve from the bag and how many remain to passed downstream.*

Then calculate earnings and record them as before.

(1) Dry Season Crop Value	(2) Irrigation	(3) Crop Value (tripled for irrigated fields)
	❑	
	❑	
	❑	
	❑	
Total value earned for all fields:		

Fifth Season with a Water Fee

Canal Address: _____

We will now collect, shuffle, and redistribute the playing cards, so that you can enter the dry season values in the first column (1).

When the bag of water comes to you, you can draw out a water card only if you are willing to pay for it.

The fee is _____ per card.

Before the water bag is passed, determine what irrigation is worth to you by comparing the productivity of your fields with irrigation and the productivity without. The table below is for figuring out what your best options are. Your earnings table is on the next page.

Value of Irrigation

(1) Dry Season Crop Value	(2) Wet Crop or Irrigated Crop Value	(3) What irrigation is worth to you?	(4) Your willingness to buy if the fee is _____.
			❑
			❑
			❑
			❑

We will now pass the bag of water cards. Keep in mind how many units of water you will want to pay for.

Turn to the next page and note your dry season field values in the first column of your Earnings Table.

Triple dry season value *only* if you hold a water card for that field

Only if you hold a water card for that field

Earnings Table

Dry value and Irrigation	*Mark the number water cards extracted from canal*	(5) Actual Crop Value	(6) - Fee paid for water	(7) = Earnings on each field
	❑			
	❑			
	❑			
	❑			
			Sum of all your earnings:	

Finally, the money collected from the fees will be split equally among all of you. Everyone will get an equal share, which will be announced to everyone once the season is over. You may add this amount to the crop earnings from the table above.

Total earnings with Fee for Water:

_____	+	_____	=	_____
Your Earnings from growing crops (from table above)		Your share of the fee receipts (announced to everyone)		Total Earnings

Sixth Season with an Auction for Water Permits

Canal Address: _____

We will now collect, shuffle, and redistribute the playing cards, so that you can enter the dry season values in the first column (1).

Instead of passing the bag, we will let you submit bids to purchase water-cards.

A bid must be above 0, and it cannot be higher than *twice* the card number for that field, since bidding above the value of the irrigation is not a profitable strategy. *Why is twice the card value the maximum willingness to pay to irrigate?*

You can bid any amount in $0.25 increments.

Before submitting your bids, determine what irrigation is worth to you by comparing the productivity of your fields with irrigation and the productivity without. The table below is for figuring out what your best options are. Your earnings table is on the next page.

Value of Irrigation

(1) Dry Season Crop Value	(2) Wet Crop or Irrigated Crop Value	(3) What irrigation is worth to you?	(4) Your bid to water that field

To submit your bids, copy them to four index cards labeled with your canal address. This way, we know who won the water-cards in the auction.

How does the auction work?

All the bid cards are sorted from high to low.

The highest bids win the water. The winners must pay for the water. They must pay the highest bid that didn't win any water. Note that the highest rejected bid will never be above any winning bid.

Say there were 12 fields and just four units of water available for purchase and the bids were 10, 9, 8, 8, 7, 7, 6, 6, 6. Those who bid the four highest bids, 10, 9, 8, 8, will get one unit of water for each of those bids. The people who bid the remaining lower bids – the non-winning bids – 7, 7, 6, 6, 6, will get no water for those bids. The four highest bids will pay $7 for their water units because $7 was the highest non-winning bid.

What if there is a tie?

If there is a tie for the winning bids, those bids that are identical and on the border between winning and loosing will be shuffled and the losers will be drawn out.

For example, say there were just four units of water available and the bids were 10, 9, **8, 8, 8**, 7, 6, 6, 6. The cutoff between high bids and low bids is $8. Those tying $8 bids will be collected and shuffled and one card will be drawn out as the losing bid. The people who bid the four highest bids, 10, 9, and the two surviving bids of 8, will get one unit of water for each of those bids.

The four highest bids will pay $8 for their water units because $8 was the highest non-winning bid.

After the winners are determined, the water-cards will be handed to each of the winning bidders, and you can mark the irrigation status (checkbox) for each of your fields.

Triple dry season value *only* if you hold a water card for that field

Only if you hold a water card for that field

Earnings Table

Dry value and Irrigation	*Mark the number water cards extracted from canal*	(5) Actual Crop Value	(6) - Fee paid for water	(7) = Earnings on each field
	❑			
	❑			
	❑			
	❑			
			Sum of all your earnings:	

Finally, the money collected from the auction will be split equally among all of you. Everyone will get an equal share, which will be announced to everyone once the auction is over. You may add this amount to the crop earnings from the table above.

Total earnings with Auction:

Your Earnings from growing crops (from table above)	+	Your share of the auction receipts (announced to everyone)	=	Total Earnings