Arizona Watermelons

A packaging and distribution system case scenario

The case scenario that follows was developed around a Full Disclosure® model. The information used to create the model was provided by a large watermelon grower/shipper operating in south-central Arizona.

The *Arizona Watermelons* model is a fair and accurate representation of a real-world packaging and distribution system. It compares the economics of shipping in bulk bin corrugated containers (CCs) vs. bulk bin returnable plastic containers (RPCs).

The Commodity

Watermelon is thought to have originated in Africa's Kalahari Desert. The first recorded watermelon harvest occurred about 5,000 years ago in Egypt and is depicted in hieroglyphics.

From Egypt, watermelons spread along the Mediterranean Sea via merchant ships. By the 10th century, watermelon had made its way to China, which is now the world's number one producer of watermelons.[1]

The United States currently ranks fourth in worldwide production of watermelon. Watermelons are grown in 44 U.S. states with Florida, Texas, California, Georgia and Arizona consistently leading the country in production.[2]

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[1] Source: U.S. Department of Agriculture, ERS from data reported by Food and Agriculture Organization, United Nations (2002).

[2] Source: National Agricultural Statistics Service (NASS), 01/03.

This case scenario focuses on a large grower and shipper of watermelons in south-central Arizona. For the purposes of the discussion, we'll call the grower/shipper **Arizona Watermelon Farms**.

What is a Case Scenario?

What's the difference between a *case study* and a *case scenario*? A *case study* typically concentrates on a real-world situation or commodity, which is then brought to light through a thorough interpretation of actual data.

A *case scenario*, on the other hand, still uses real-world situations and data. But it "recasts" this information in a way that maintains the subject's anonymity and protects confidential information. This case scenario contains accurate information, however it has been "generalized" to protect sensitive information.

The Case

In 2002, about four billion pounds of watermelon were grown in the United States. Arizona's watermelon harvest totaled over 256 million pounds.[3]

The subject of this case scenario, **Arizona Watermelon Farms**, is one of the largest growers and shippers of watermelons in the state. In operation for over half a century, Arizona Watermelon Farms is located on 750 acres in south-central Arizona.

Arizona Watermelon Farms grows many types of watermelons, including traditional "picnic type" seeded watermelons, round seedless, and elongated seedless varieties. Depending on variety, the harvest and shipping season typically begins in March and continues through November.

Elongated "long" seedless watermelons

Why grow elongated (long) seedless watermelons?

The elongated seedless variety comprises about 75% of the Arizona Watermelon Farms' acreage. Why? "For several reasons," according to Arizona Watermelon Farms' owner, "The elongated seedless watermelons are easier to stack on bins, easier to count, and don't bruise as easily as round melons."

In addition, according to some retailers, a 20-pound elongated seedless watermelon offers 15% more edible product (compared to a round seedless of the same weight) because elongated varieties have thinner rinds.

[3] Source: National Watermelon Promotion Board (12/03).

The packaging and distribution system for Arizona Watermelon Farms typifies that of a large produce grower/shipper.

Before picking, growers look for a pale or yellow spot on the bottom of the watermelon, indicating ripeness. Ripe watermelons are picked by hand at the field (although they appear hardy, watermelons are actually quite fragile). Watermelons are passed hand-to-hand from the field to trucks, which take the melons to packing sheds, where they are cleaned, sorted and packed into trucks, crated into bins or placed in cartons for shipment.

An Arizona Watermelon Farms packing facility

Semi-trailer trucks transport the watermelons to distribution centers (DCs). At the DC, pallets of watermelon are loaded onto delivery trucks and distributed to retail outlets.

At retail outlets, bulk bin corrugated containers are often re-used (sometimes for many months or years), to hold other commodities or for a variety of storage purposes in the warehouse. Worn-out bulk bin corrugated containers are eventually knocked down, placed into balers and recycled for the positive economic value of old corrugated containers (OCC).

Bulk bin RPCs, on the other hand, must complete the return trip, which requires sorting, washing, sanitizing, warehousing and redistributing to Arizona Watermelon Farms.

For more details on Arizona Watermelon Farms' distribution system and the bulk bin RPC backhaul leg, go to the section "Distribution Profile."

Container Profile

This case scenario assumes that watermelons are packed into either 800-pound capacity bulk bin corrugated containers, or 800-pound capacity bulk bin returnable plastic containers.

Bulk bin corrugated containers are triplewall construction, "tube and cap" style, and weigh 11.5 pounds each (tare weight).

Bulk bin returnable plastic containers are constructed from injection-molded plastic, are collapsible, and weigh 112 pounds each (tare weight). Note that the bulk bin RPCs have an integrated pallet design.

Watermelon "tube and cap" style bulk bin container
(Photo provided by corrugated manufacturer)

Watermelon bulk bin returnable plastic container
(Container photo provided by Arizona Watermelon Farms)

Container	External Dimensions L x W x H (inches)	Tare Weight (lbs)	External Cube (inches^3)
Watermelon Bulk Bin Corrugated	48 x 40 x 24 (no pallet) 48 x 40 x 28 (w/pallet)	11.5 (no pallet) 51.5 (w/pallet)	53,760
Watermelon Bulk Bin RPC	48 x 40 x 33 (incl. pallet)	112 (incl. pallet)	63,360

Packing Materials

The 800-pound capacity bulk bin corrugated containers and 800-pound capacity returnable plastic containers can accommodate from two to four layers of watermelons.

Neither the bulk bin corrugated containers nor the bulk bin RPCs require any other packing materials.

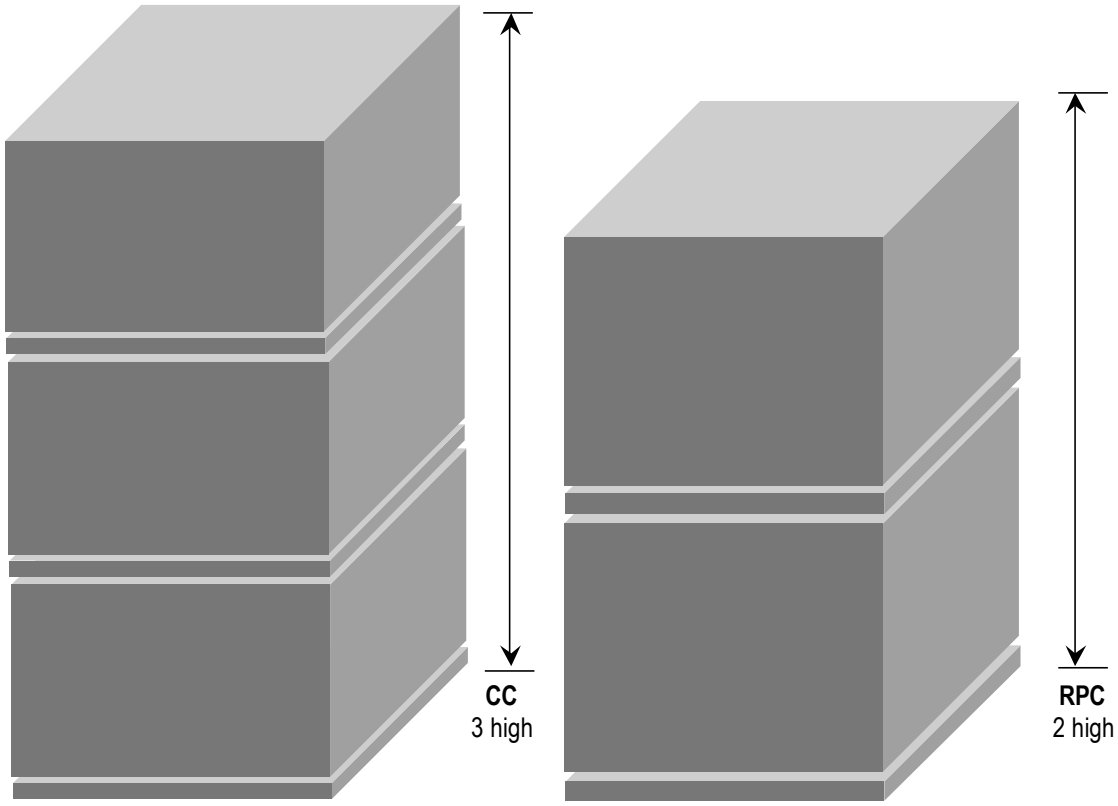
RPCs also require an identification label that appears on the outside of each container. The labels bearing these tote numbers cost $0.08 each. In addition, the bulk bin RPCs also have a "header card" inserted into a slot on the side of each bin (to identify the commodity to the consumer). These header cards cost $0.72 each, making the total additional packing material cost for RPCs $0.80 per container.

Pallet Configuration

Pallets are loaded by forklift or pallet jack onto trailers as double- or triple-level loads (as opposed to single-level loads where only one layer of pallets are used).

Corrugated bulk bins are stacked three high. Bulk bin RPCs can only stack two high, due to height constraints. Arizona Watermelon Farms uses standard 40" x 48" GMA pallets for corrugated bulk bins (RPCs have integrated pallets).

Pallets loaded with bulk bin corrugated containers are configured one down (one box per tier), three layers high. Pallets loaded with bulk bin RPCs are configured one down, two layers high. Pallets loaded with RPCs are lower because they are height-constrained (refer to the table that follows).



Container	Stacking Pattern (containers/layer x number of layers)	Container Gross Weight (lbs)	Containers per Pallet	Full Pallet Weight (lbs)	Stacked Pallet Height (inches)[4]	Pallets per Trailer
Watermelon corrugated	1 per layer, 3 high	851.5*	1	851.5	84**	51***
Watermelon RPC	1 per layer, 2 high	912	1	912	66	48***

* Corrugated bin weighs 11.5 lbs., pallet weighs 40 lbs, 800-lb capacity = 851.5 lbs total pallet weight.

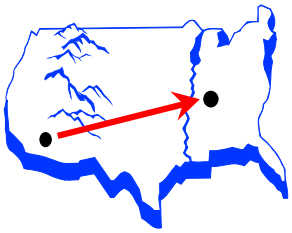
** Includes 4" wooden pallet

*** Trailers carrying both bulk bin corrugated containers and bulk bin RPCs are weight-constrained at 51 and 48 pallets/trailer (or 43,427 pounds and 43,776 pounds, respectively).

[4] Pallets with RPCs are height-constrained (in this case limited to two layers), due to a 92-inch trailer door height limitation.

Distribution Profile

This case scenario assumes that watermelons are shipped 2,000 miles. For the sake of illustration, that's the approximate distance from Red Bluff, Arizona to Cincinnati, Ohio.



The distribution profile for Arizona Watermelon Farms consists of several steps. After cleaning and sorting at a packing facility near the field, watermelons are placed into bulk bin shipping containers (either corrugated or plastic).

From the packing facility melons are trucked via 53-foot refrigerated trucks to distribution centers, where they are unloaded by forklift and prepared for distribution to retail outlets.

Note: Watermelons ship FOB (free on board) from the Arizona Watermelon Farms packing facilities. That is, the retailer purchasing the watermelons pays for the freight costs. This is important to keep in mind, as costs are being allocated later on in the modeling process.

The 1800-mile trip from the Arizona Watermelon Farms' packing facility to the DC takes about four days (approximately 38 hours).

At the DC, the process of taking the unitized loads from the grower/shipper, placing them into storage, then subsequently "picking" orders to ship to the retail store can involve many more steps. For this case scenario, the analysts assumed that the containers are stored in the DC using the original shipper's unit load (one bulk bin per pallet). Containers are then shipped to retail stores along with mixed pallets containing similar commodities, such as other produce items requiring refrigeration.

The bulk bin pallets leaving the DC are loaded onto 53-foot, refrigerated delivery trucks for transportation to retail outlets. Once at the retail stores, pallets are unloaded from the trailers and prepared for retail presentation.

Empty corrugated containers are reused for another commodity, "re-purposed" for another use within the warehouse, or broken down and recycled for their old corrugated container (OCC) value ($0.37 per container[5]). At this point, the corrugated container's function in the distribution of Arizona Watermelon Farms' products is complete.

In 2002, more than 74% of all corrugated containers in the US were recycled. It is estimated that this recycling rate grows to over 90% at the retail level. [6]

[5] $0.37 per container is based on an OCC value of $65/ton. The value of old corrugated containers fluctuates according to time and geographic location.

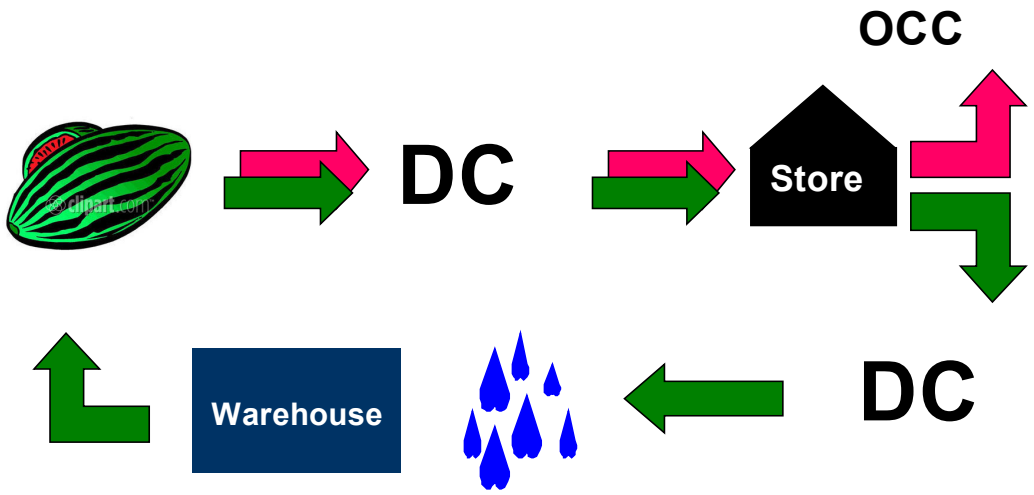
[6] American Forest & Paper Association, 2003.

RPC Backhaul Leg

Unlike corrugated bulk bin containers (which have been re-used or recycled at the retailer for their OCC value), RPCs now begin the long trip back to the watermelon grower/shipper.

First, bulk bin RPCs are transported back to a sorting area at the DC where they are sorted according to size, condition and pooler. From the DC, RPCs are transported to a washing station where they are washed, sanitized and repaired as necessary. From the washing depot, RPCs are transported to a warehouse for holding. When needed, they are shipped back to Arizona Watermelon Farms.

Product Distribution System



RPC Return Trip (Backhaul Leg)

Arizona Watermelon Farms estimates that it takes on-average 60 days (or about two months) for an RPC to make this round trip. Therefore, each RPC makes six complete cycles (or "turns") per year.

The RPC backhaul leg is an expensive and often time-consuming operation, and is thoroughly examined in the **Comparison** portion of the case scenario.

The Comparison

The Arizona Watermelon Farms case is a real-world situation that objectively compares supply chain costs of using bulk bin corrugated containers vs. bulk bin RPCs. Using the information provided by Arizona Watermelon Farms, the model development team started analyzing the case.

The model for Arizona Watermelon Farms was created using the Full Disclosure® modeling tool. Full Disclosure allows the user to accurately compare the distribution system economics of corrugated containers to RPCs (in this case, a bulk bin corrugated container to a bulk bin RPC).

The model developers carefully placed container and distribution system data provided by the grower/shippers into a Full Disclosure model of their situation. In addition to data provided by the grower/shippers, the model developers also used key data points, which are industry-accepted or commonly agreed-upon values. Arizona Watermelon Farms also accepted these data points.

Note: The information in the following table came from industry sources, and represents commonly agreed-upon values. For more information on these data points and how they were determined, see the Full Disclosure Tables of Common Values.[7]

Data Point	Defined As…	Value Used in Model
Full running rate per mile	Operating cost per mile when truck is fully loaded	$1.25/mile
Loading and unloading productivity at grower/shipper	Rate at which truck can be loaded/unloaded	112 pallets/hour (a combined rate of 56 pallets/hour, using two loaders)
Loading and unloading productivity at DC *	Rate at which a truck can be loaded/unloaded	30 pallets/hour
Loading and unloading productivity at retail store *	Rate at which truck can be loaded/unloaded	15 pallets/hour
Loading and unloading productivity at washing station *	Rate at which truck can loaded/unloaded	30 pallets/hour
Labor rate at grower/shipper	Hourly rate for one worker at Arizona Watermelon Farms	$8.50/hour
Labor rate at DC	Hourly rate for one worker at the distribution center	$14/hour
Labor rate at retail store	Hourly rate for one worker at the retail store	$15/hour
Labor rate at washing station#	Hourly rate for one worker at the washing station	$10/hour
Recycling Value per Unit	Value per container from recycling old corrugated	$0.37/corrugated container

[7] You must be a member of the AF&PA, FBA or CPA and have a member login to access this information.

* Source: Willard Bishop Consulting, "Understanding the Cost and Performance of Returnable Produce Shipping Containers," 1999.

	containers (assumes OCC value is $65/ton[8])	
RPC useful life	Number of years an RPC lasts before it breaks or wears out (assumes 24 lifetime trips x 60 days/trip = 1440 day useful life ÷ 360 day season = 4 years)	4 years
RPC washing costs	Cost to wash and sanitize one RPC	$1.75/container
RPC loss and theft rate	Percentage of RPCs that must be replaced annually due to lost (misplaced) containers or stolen containers	5%

Annual Containers & Cost per Container

This case scenario assumes that Arizona Watermelon Farms ships 110,250 bulk bin containers of watermelons annually.

Arizona Watermelon Farms currently pays $6.30 for each 800-pound capacity bulk bin corrugated container. In addition, Arizona Watermelon Farms pays $2.00 for each wooden pallet needed to ship the bulk bin container.

Arizona Watermelon Farms currently rents its RPCs from a third-party pool provider. They pay $14.00 per container, per trip to rent from the pool provider. Arizona Watermelon Farms also pays $145.00 per container to replace lost or stolen RPCs.

Why rent containers?

Some grower/shippers are required by the retailer to ship in RPCs. For that reason, some growers, like Arizona Watermelon Farms, have turned to leasing RPCs rather than purchasing a pool of containers.

In addition, there are often start-up costs involved in deploying RPCs. Many grower/shippers require major capital investments in specialized palletizing and handling equipment.

Plus, all parties involved in the distribution system may want to consider whether leasing costs are sustainable by the pool operator over time. To assist in understanding the implications of leasing and who bears the cost, the AF&PA commissioned the development of a Rental Analysis Excel® spreadsheet. This spreadsheet imports the results of a Full Disclosure model, and allows the user to assign owners and allocate rental costs to those owners.

Model Building with Full Disclosure

The model-building process using Full Disclosure involves taking all the information and data points supplied to this point and systematically applying

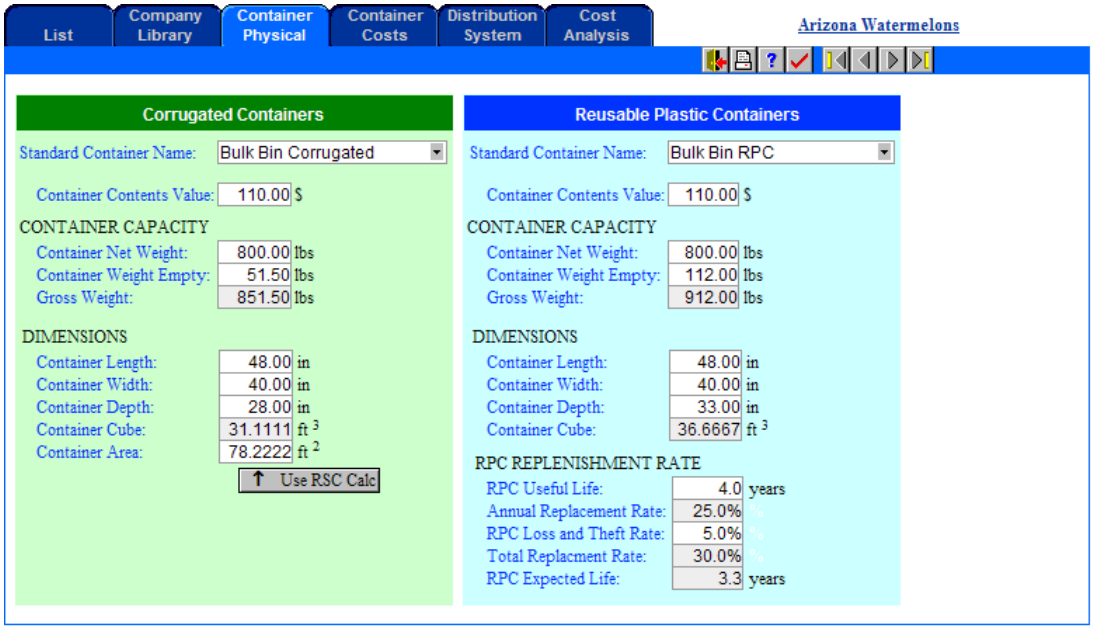
[8] Value as of 6/1/03. OCC value (like many of the values in the table) fluctuates according to time and geographic location.

them to the various screens in the application. Although the application is flexible enough to support many modeling approaches, the following descriptions follow the approach used to develop the Arizona Watermelon Farms Full Disclosure model.

Because Arizona Watermelon Farms rents containers, the model developers chose to build two models, one which depicts a scenario where RPCs are purchased by the grower/shipper (Steps 1-4), and one which analyzes the economics and cost owners in a rental scenario (Step 5).

Step 1. Define each container (size, weight, useful life).

The graphic shows the Full Disclosure **Container Physical** screen, where the modelers described the two containers – corrugated container and RPC. Notice that this screen displays all the critical dimensions, weight and RPC replenishment requirements. Replenishment requirements include useful life (expressed in years of service) and loss and theft rate.

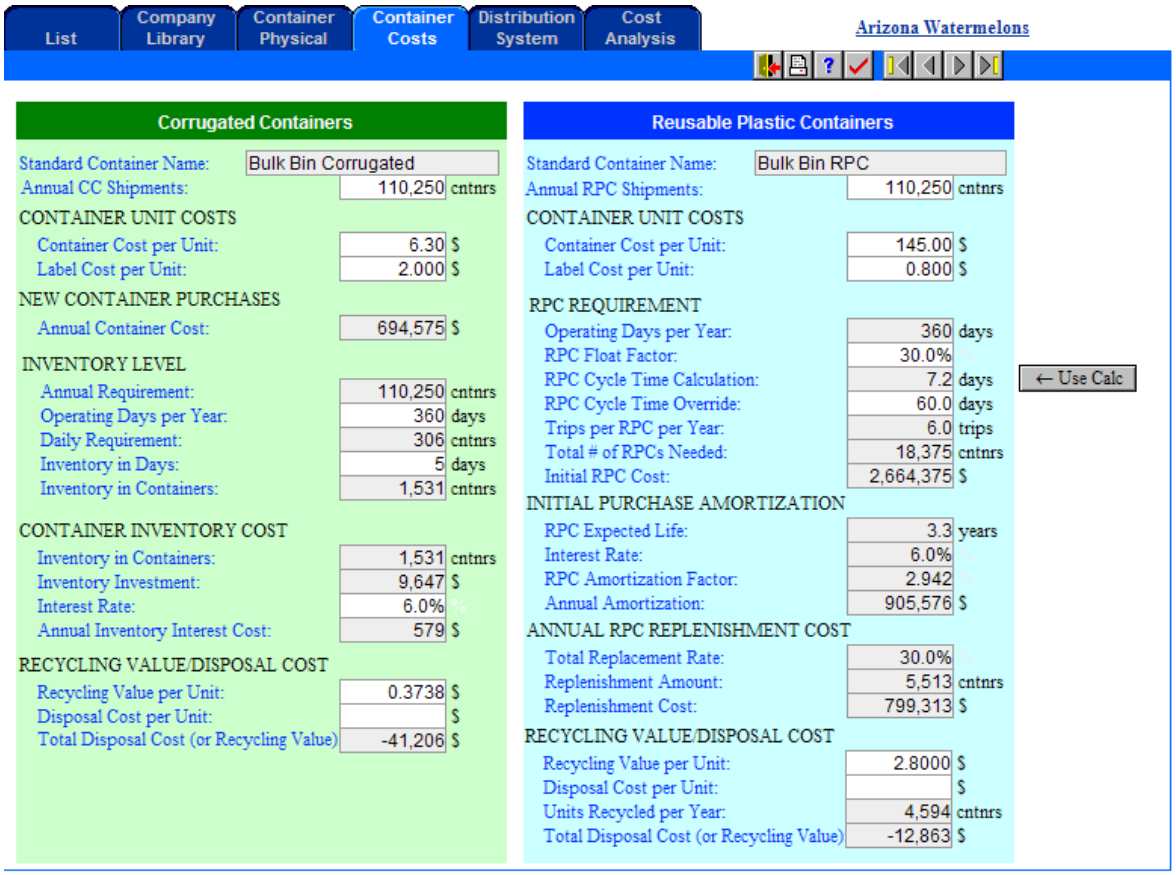


Container Physical screen

Step 2. Define container costs.

The Full Disclosure **Container Costs** screen displays the costs associated with the 800-pound capacity corrugated bulk bin container and the 800-pound capacity bulk bin RPC. In addition to costing information, this screen is where the modelers defined the inventory levels, recycling values and RPC cycle time.

Note that the values entered in Full Disclosure directly correspond to information provided by Arizona Watermelon Farms. The Label Cost per Unit for Corrugated Containers ($2.00) is the cost associated with purchasing wooden pallets. The Label Cost per Unit for RPCs ($0.80) is the cost associated with the header cards and ID cards.

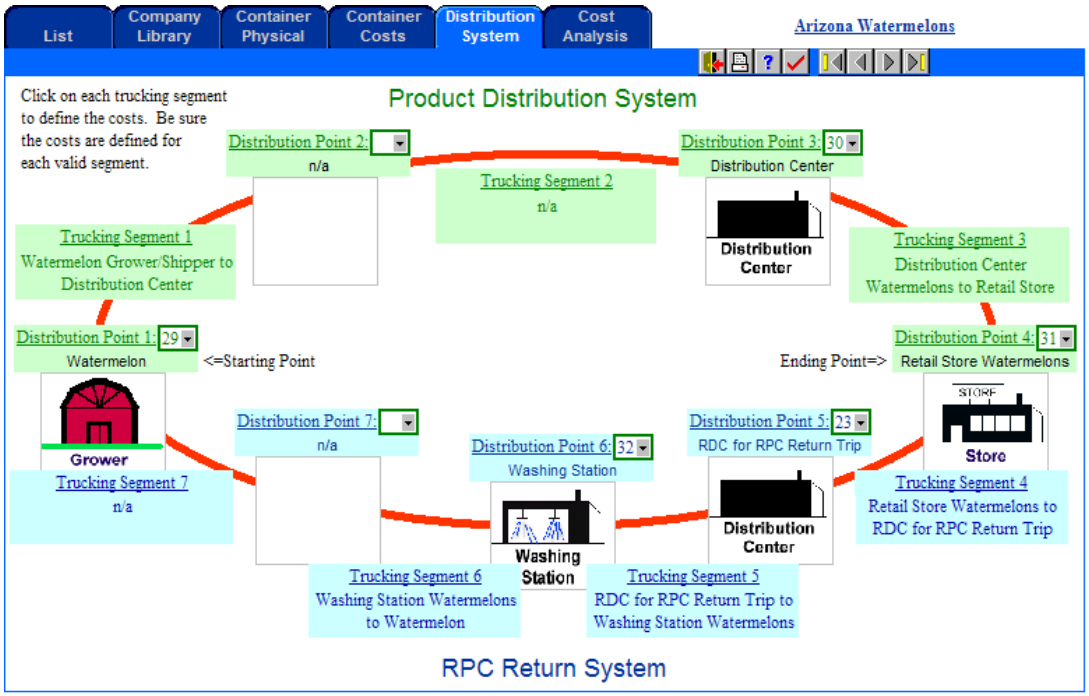


Container Costs screen

Step 3. Define the points and segments in the distribution system.

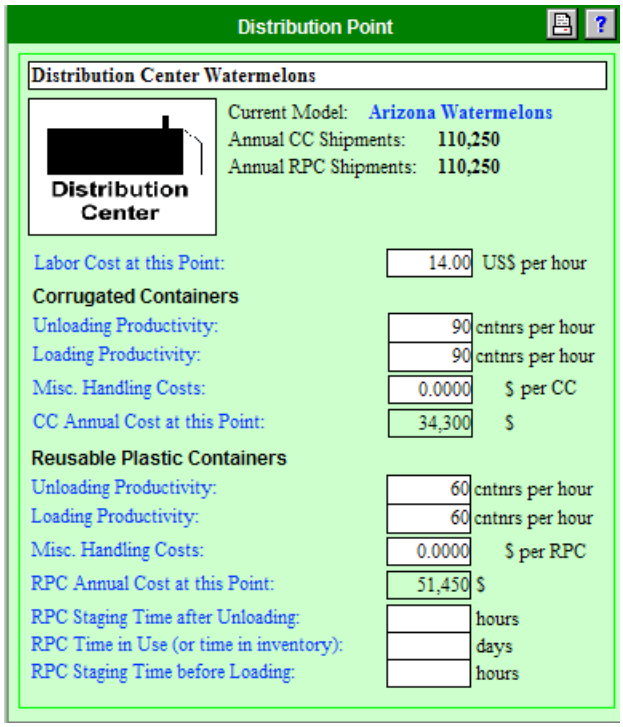
Full Disclosure's **Distribution System** map allows the user to define all the distribution points and trucking segments in the trip. Each distribution point (for example, grower, DC, retail store, washing station) in the system is first defined. Then costs associated with the point are determined. Finally, by drilling down on each segment (leg) of the trip, the user can define the specific details of that leg (such as distance traveled, payload, etc.).

Note that the Full Disclosure distribution map closely resembles the Product Distribution System flowchart.



Distribution System map

By drilling down on a Distribution Point in the map, the labor rates and loading and unloading productivity rates at that point were defined. The graphic below shows how the modelers specified these values for both containers at the distribution center.

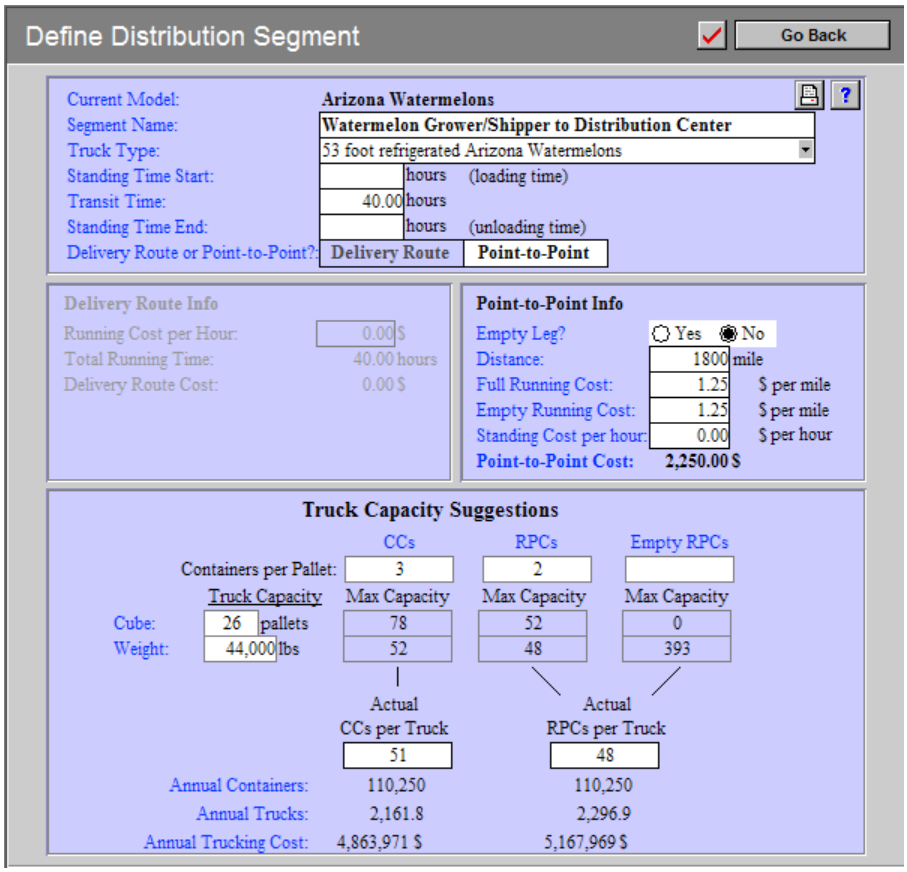


Drill down on map defines distribution point data

Defining Distribution Points

Appropriate distribution points were defined and representative data entered for every point in the system (including all points in the RPC return trip).

Defining distribution segments (legs) of the trip allows one to specify the number of miles traveled, running cost per mile, and the type of truck used. It's also where the user specifies the number of containers that can be loaded into a trailer before weighing out or cubing out. The graphic shows how one segment on the distribution map (the grower/shipper to DC leg) was defined.



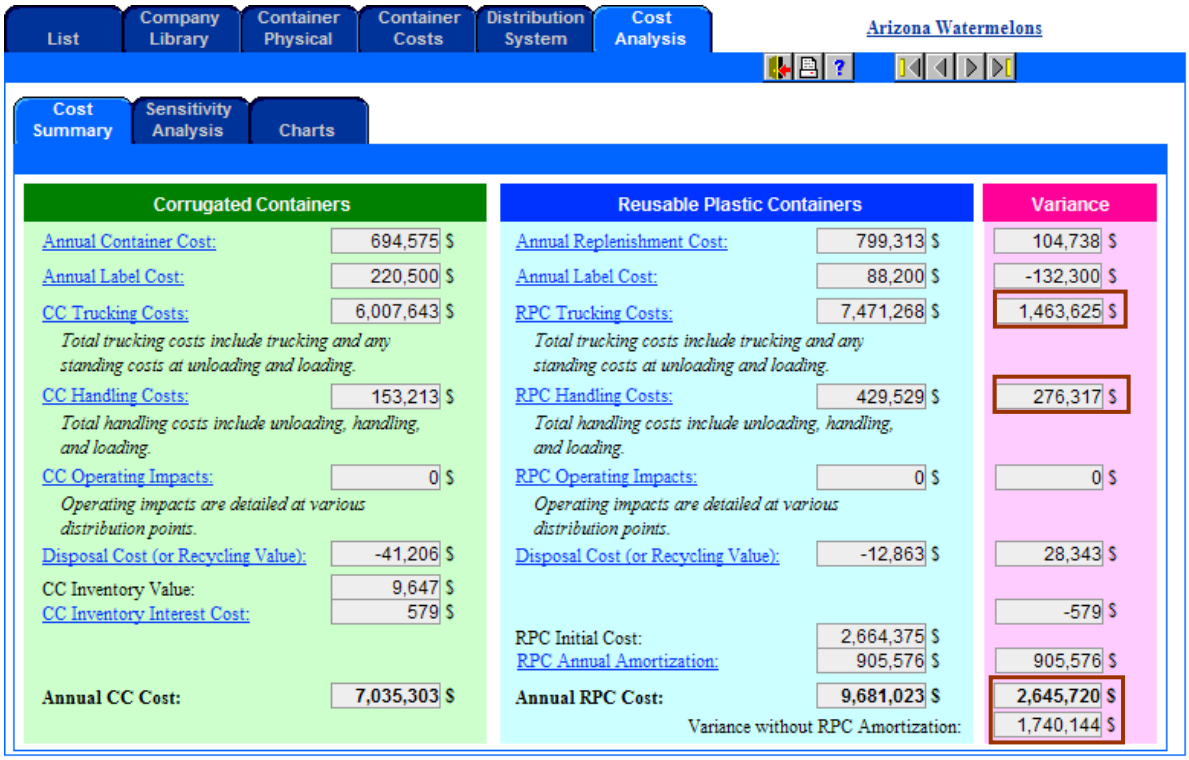
Drill down on map defines segment data

At this point, it is appropriate to view (and review) the results of the model building process.

Step 4. Analyze the results.

The Full Disclosure **Cost Analysis** screen allows the user to see a summary of the model results.

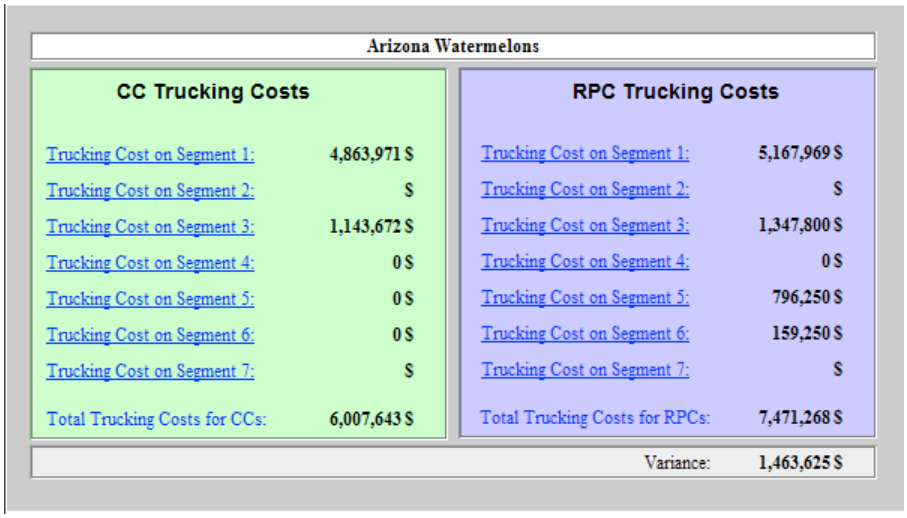
Here the user sees a summary of all the data entered into the model. Container costs are highlighted, as are annual label costs, trucking costs, handling costs, operating impacts, and disposal costs. Results are displayed by comparing a Corrugated column to an RPC column, and calculating the variance for each cost category. The accounting charge to amortize the initial container investment may be included or excluded.



Cost Summary screen

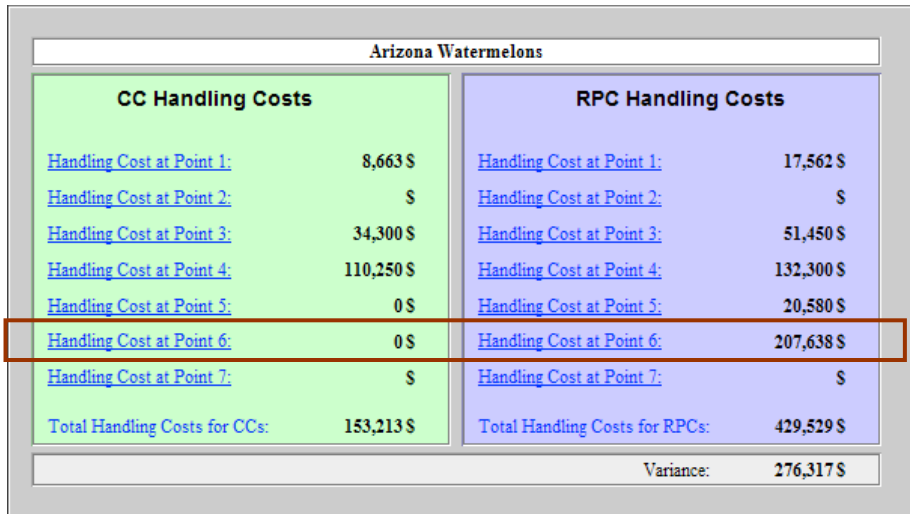
Note that RPCs incur higher costs associated with trucking (additional $1,463,625) and handling (additional $276,317). These cost differences are primarily the result of the RPC backhaul trip requirements, including washing and warehousing costs.

Full Disclosure effectively shows where in the distribution system (which segment) costs are incurred. The graphic below is a drill-down on Trucking Costs and is derived from information in the **Distribution System** map. Segment 5 (the DC-to-washing station leg) and Segment 6 (the washing station-to-grower leg) accurately represent costs associated with the RPC return trip.



Drill down on Trucking Costs

Another area of interest is Handling Costs. Here again the additional handling costs incurred at every stop in the RPC return trip dramatically increase the overall annual cost to ship RPCs.



Arizona Watermelons			
CC Handling Costs		**RPC Handling Costs**	
Handling Cost at Point 1:	8,663 $	Handling Cost at Point 1:	17,562 $
Handling Cost at Point 2:	$	Handling Cost at Point 2:	$
Handling Cost at Point 3:	34,300 $	Handling Cost at Point 3:	51,450 $
Handling Cost at Point 4:	110,250 $	Handling Cost at Point 4:	132,300 $
Handling Cost at Point 5:	0 $	Handling Cost at Point 5:	20,580 $
Handling Cost at Point 6:	0 $	Handling Cost at Point 6:	207,638 $
Handling Cost at Point 7:	$	Handling Cost at Point 7:	$
Total Handling Costs for CCs:	153,213 $	Total Handling Costs for RPCs:	429,529 $
		Variance:	276,317 $

Washing Station

Drill down on Handling Costs

The impact of RPC washing costs is shown at Point 6. Note how Full Disclosure identifies the cost to wash a bulk bin container at this distribution point.

Initial Conclusions from Full Disclosure Analysis

This portion of the analysis reveals that bulk bin corrugated containers are economically favorable to bulk bin RPCs in distributing Arizona Watermelon Farms' products.

As shown in the cost summary, corrugated containers show an annual cost advantage of $1,740,144 (without RPC amortization). If you factor in the amortization cost of the RPCs over their useful life, the advantage to corrugated containers is even more pronounced. Here you see an annual cost advantage of $2,645,720 for corrugated containers. RPCs increase overall cash costs in this supply chain by 24.7%, or by 37.6% if you include RPC amortization.

Another way of thinking about this is to realize that if RPCs are used in this supply chain, overall costs will go up by over $1.7 million per year. The impact is even higher (over $2.6 million per year) if you include the amortization expense of paying for the original supply of RPCs.

There is more to be learned from this scenario, however. The next step uses the Excel-based Rental Analysis Spreadsheet to uncover more details on the economics of pool operations.

Who really pays the cost of renting an RPC?

Step 5. Analyze the economics and "owners" in a rental situation.

RPC system operators often make the following offer to a grower/shipper:

"If you pay a rental fee each time you ship a product in an RPC, we (the pool operator) will agree to furnish the containers; gather, transport, sort, inspect and clean the containers; and return them to the grower/shipper for the next shipping cycle."

The pool operator also agrees to make the investment to purchase the initial pool of containers and to replace containers that are lost or stolen outside of the grower/shipper's control.

This offer may seem appealing. However, the Full Disclosure analysts have found that a scrupulous investigation of "who really bears the cost" in a rental situation can provide great insight. To that end, the Rental Analysis Spreadsheet was used to determine exactly who is responsible for the various costs involved in shipping watermelons in rented RPCs.

Rental Analysis Details

The analysis of the Arizona Watermelon Farms rental arrangement with the RPC pool operator began by identifying which "player" (or participant) in the distribution system "owned" (was responsible for) the cost of each portion of the trip. This allowed the modelers to accurately determine who bears the cost of each activity, and where in the distribution system these costs arise.

The modelers imported the data from the Arizona Watermelon Farms model into the Rental Analysis spreadsheet. (This is an easy process, and is automated in Full Disclosure.)

The team defined three cost owners within the distribution system: Arizona Watermelon Farms (the grower/shipper), a major retailer and an RPC pool operator.

Once owners were defined, an owner was assigned to each of the following costs in the model:

- Container costs
- Trucking costs
- Handling costs
- RPC rental costs (including loss and theft)

Here's what the modelers saw when they imported data from Full Disclosure and assigned owners to all the container costs. Note that the values displayed in the ANNUAL CC COST row are exactly the same as those in the Full Disclosure **Cost Summary** screen for the Arizona Watermelon Farms model. Also note that owners for each of these areas have been assigned in the right hand column of the spreadsheet.

Cost Summary

	CCs	RPCs	Variance	Owner	
Annual Container Cost	694,575	799,313	104,738	Watermelon Grower	CC
				Pool Operator	RPC
Annual Label Cost	220,500	88,200	(132,300)	Watermelon Grower	CC
				Watermelon Grower	RPC
Trucking Costs	6,007,643	7,471,268	1,463,625	***Distributed by segment***	
Handling Costs	153,213	429,529	276,317	***Distributed by point***	
Operating Impacts	0	0	0	***Distributed by point***	
Disposal Cost/Recycling Value	-41,206	(12,863)	28,343	Major Retailer	CC
				Pool Operator	RPC
CC Inventory Interest Cost	579		(579)	Watermelon Grower	CC
RPC Amortization Cost		905,576	905,576	Pool Operator	RPC
ANNUAL CC COST	**7,035,303**	**9,681,023**	**2,645,720**		
		Variance without RPC Amortization	1,740,144		

Cost Summary data imported directly from Full Disclosure model

As another example, the graphic that follows shows how rental costs are apportioned for the various owners in the Arizona Watermelon Farms model.

Rental Costs

Distribution Point #	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Total for All Points
Point On/Off	*On*	*Off*	*On*	*On*	*On*	*On*	*Off*	*for comparison*
Distribution Point Name	Grower/Shipper		DC	Retail Store	DC (Return)	Washing Station		
Owner	Watermelon Grower		Major Retailer	Major Retailer	Major Retailer	Pool Operator		
Rental Fees								
Rental Fee per Container	$14							
Total Rental Fees at this Point	1,543,500	0	0	0	0	0	0	**1,543,500**
Non-Refundable Deposit Costs								
Deposit per Container	145.000		145.000	145.000	145.000			
Refund per Container	145.000		145.000	145.000	145.000			
Annual Cost of Non-Refundable Deposits	0	0	0	0	0	0	0	**0**
Lost and Stolen Container Costs								
RPC Time in Use (days)	7.0		4.0	21.0	14.0	14.0		**60.0**
Average Number of RPCs Required (at this point)	2,144	0	1,225	6,431	4,288	4,288	0	18,375
Safety Stock (*based on* RPC Float Factor)	0	0	0	0	0	0	0	0
Average Number of RPCs on Hand	2,144	0	1,225	6,431	4,288	4,288	0	**18,375**
Loss and Theft Rate (at this point only, % per year)	5.00%		5.00%	5.00%	5.00%	5.00%		**25.0%**
Annual Cost of Lost & Stolen RPCs	15,542	0	8,881	46,627	31,084	0	0	**102,134**
Capital Costs								
Total Deposits Paid during the Year	15,986,250	0	15,986,250	15,986,250	15,986,250	0	0	
RPC Time in Use (days)	7.0	0.0	4.0	21.0	14.0	14.0	0.0	
Deposit is debited X days in advance (days)	0.0		0.0	0.0				
Refund is credited Y days after return (days)	0.0		0.0	0.0				
Average Time a Deposit Remains Outstanding (days)	7.0	0.0	4.0	21.0	14.0	14.0	0.0	
Interest Rate on Capital								
Annual Capital Cost of Deposits	0	0	0	0	0	0	0	**0**
Other Costs								
Other Expenses per Container Trip	0.0200		0.0100	0.0100	0.0100	0.0800		
Annual Other Costs	2,205	0	1,103	1,103	1,103	8,820	0	**14,333**
Total Rental Costs at this Point	**1,561,247**	**0**	**9,984**	**47,729**	**32,187**	**8,820**	**0**	**1,659,967**

Rental costs apportioned between Arizona Watermelon Farms, the retailer and the pool operator

Rental fees ($14 per container) are owned by Arizona Watermelon Farms. Loss and theft of containers is 5% per year. Administrative costs incurred for the

RPC pool administration are assumed at $0.02 per container at the grower/shipper, $0.01 per container at the DC and the retail store, and $0.08 per container at the washing station.

Rental Analysis Results

A careful examination of the rental analysis summary shows higher overall supply chain costs, and the pool operator and Arizona Watermelon Farms bearing substantial additional costs.

Overall Summary of RPC Rental Costs vs. Corrugated

Arizona Watermelons	Full Disclosure Model			Rental Costs		Total RPC	RPC Rental
Cost Owner	Corrugated	RPC	Variance	Fees	Other	Rental Cost	vs. Corrugated
	(1)	*(2)*	*(3)=(2)-(1)*	*(4)*	*(5)*	*(6)=(2)+(4)+(5)*	*(7)=(6)-(1)*
|Pool Operator	0	2,855,164	2,855,164	(1,645,634)	8,820	1,218,349	1,218,349
Major Retailer	6,110,987	6,720,098	609,111	86,592	3,308	6,809,998	699,011
Unassigned	0	0	0	0	0	0	0
Watermelon Grower	924,316	105,762	(818,555)	1,559,042	2,205	1,667,009	742,692
Grand Total	**7,035,303**	**9,681,023**	**2,645,720**	**0**	**14,333**	**9,695,356**	**2,660,053**

Rental analysis summary

The costs shown in the **Full Disclosure Model** columns of the spreadsheet are as expected. We see the effect of the pool operator paying the cost to purchase, transport, clean and warehouse the containers. Plus, we see the effect of Arizona Watermelon Farms paying to purchase the bulk bin corrugated containers, pallets, and the tote labels and header cards for the RPCs.

The **Rental Costs** columns show how fees, forfeited deposits and other administrative costs were allocated across the three owners. Notice that the pool operator earns the rental fees being paid by Arizona Watermelon Farms as revenue or negative costs. (And, conversely, we see Arizona Watermelon Farms paying those rental fees.)

The **Total RPC Rental Cost** reflects RPC rental fees, RPC replacement costs, any forfeited deposits, and RPC administration expense required to track these expensive assets.

According to the analysis, the RPC pool provider is sustaining a loss of more than $1.2 million annually to operate this float of containers.

Why would an RPC system provider, choose to operate at a financial loss? How long can that rental rate be sustained?

Furthermore, the **RPC Rental vs. Corrugated** column shows that the retailer is spending an additional $699,000 each year to ship in RPCs. This equates to $6.34 more per container using RPCs. Some retailers who promote or require RPCs believe there are financial gains to be made in handling RPCs at the DCs, and that these gains outweigh the added cost to ship in returnable plastic containers (and the associated loss of recycle revenue). However, very little evidence exists to substantiate these claims.

And, finally, we turn to the costs incurred by Arizona Watermelon Farms. Owing mainly to the fact that Arizona Watermelon Farms pays a relatively high $14.00 per-container fee to rent bulk bin RPCs (in comparison to the per-container price of $8.30[9] for corrugated), the results of the analysis from their perspective is also negative. That is, Arizona Watermelon Farms sees its net costs increase by $742,692[10] (or an additional $6.74 per container) with bulk bin RPCs.

Even if the pool operator rented the containers for $8.30 per trip, the grower/shipper would still see a corrugated container cost advantage of $114,267 per year.

The Conclusion

Arizona Watermelon Farms operates a large growing, packing, warehousing and distribution system. The Arizona Watermelon Farms case scenario compared bulk bin corrugated containers to bulk bin RPCs in both a purchase situation and a rental situation.

The results demonstrate that the bulk bin corrugated container was more economical in both situations (buy and maintain a float of RPCs or rent RPCs). In addition, the rental analysis showed the true owners of the cost of each segment of the distribution system.

The perspective of this scenario was purposefully broad. The analysis was performed with an objective eye toward the overall system economics of each container type. The modelers did not take the perspective of the grower, nor the retailer, nor the pool operator.

But now may be a good time to consider the perspective that a grower/shipper might have. For example, as it pertains to this case scenario:

- From the grower/shipper's perspective, one might ask, "When seeing the results of the costs that are currently being borne by the pool operator, how long can that pool operator continue to 'operate in the red' as far as the rental rate on their containers?"

With that said, many conclusions can be drawn from this analysis:

- Overall costs (that is, cash costs not including amortization) increase 24.7% with the introduction of RPCs into the supply chain.
- The retailer's costs increase (11.4%), due mainly to higher RPC transportation costs.
- The grower/shipper's costs almost double (81% increase). This is primarily due to the per-container cost difference between purchased

[9] $6.30 for the bulk bin container + $2.00 for the pallet = $8.30 per container.

[10] This figure does not include the cost of any capital investments, such as RPC case erection and handling equipment.

bulk bin corrugated containers ($8.30 each) and rented bulk bin RPCs ($14 each).

- As a general rule, the distance traveled (in this case 2,000 miles) affects the economics of the case. RPCs are generally more expensive than corrugated containers when shipped at distances greater than 250 miles[11].

This case scenario clearly shows the economic advantages of bulk bin corrugated containers when objectively compared to bulk bin RPCs. If you'd like more information about this case, or information on developing a customized scenario for your needs, contact the Corrugated Packaging Alliance.

The Model

The Full Disclosure Arizona Watermelons model is available for download. However, you must have Full Disclosure 1.3 installed to import and display the model.

Download Arizona Watermelons model

More information on getting Full Disclosure

[11] Sensitivity Analysis White Paper, 2003, American Forest & Paper Association.