














# Using Orlando's Recycling Quality Index to Determine Changes in Recycling Behavior

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# Recycling Quality Index (RQI)

**RQI** : is a numerical value that is inversely related to the quantity of categories of contaminants that the residents have in their recycling cart and is directly related to their recycling quality

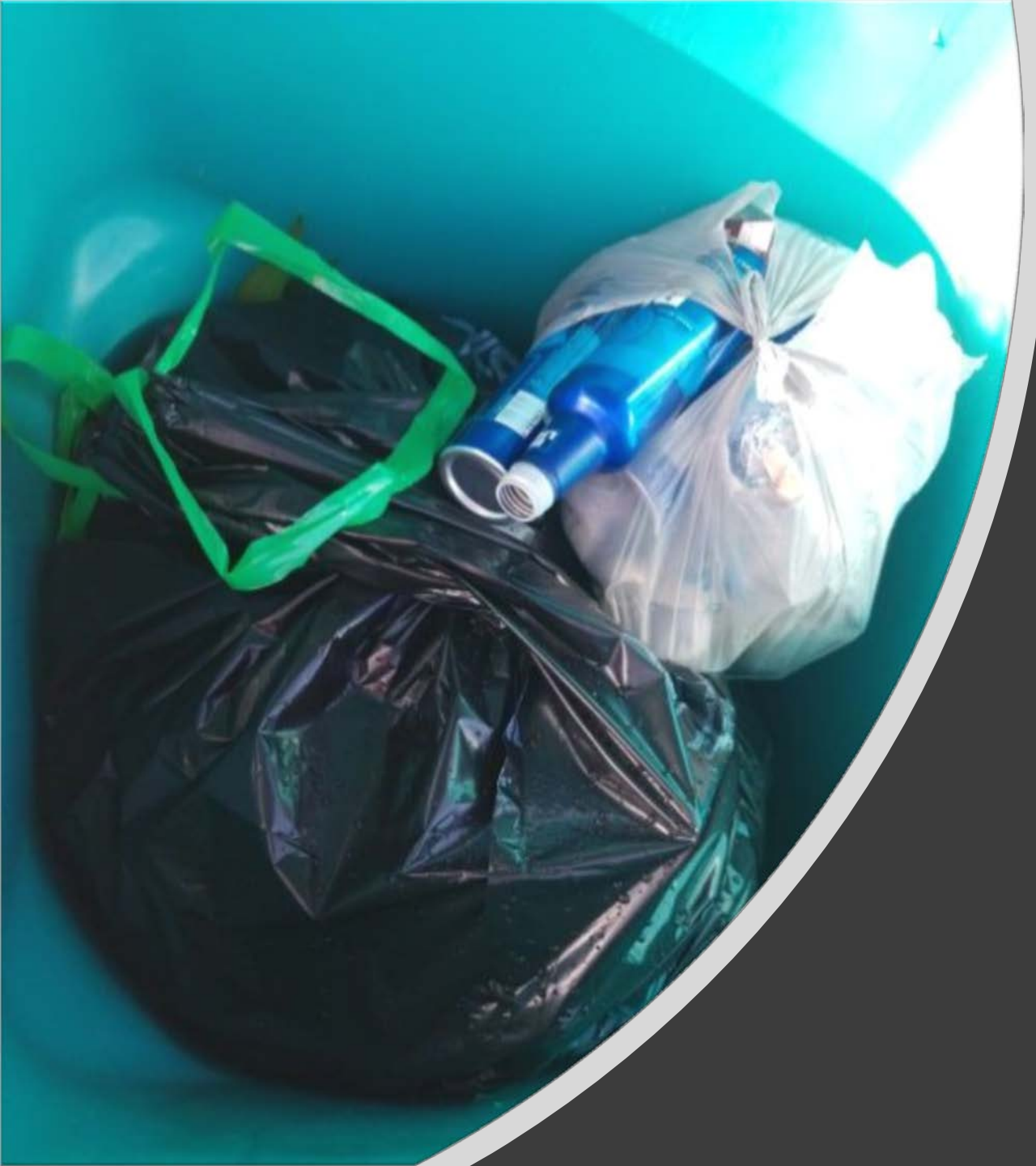
# categories of contaminants	0	1	2	3	4	5	6	7	8	9	10
RQI	10	9	8	7	6	5	4	3	2	1	0
Recycling quality											
	Good					Bad					

**Application:** Measure the change after any type of intervention is applied within a neighborhood

- Communication strategies
  - Labeling (Bi-lingual)
  - Door to door education
  - Promo activity
  - Mail and email distribution
  - Cart tagging
- Operational Change
  - Adjust collection frequency
  - Removing cart for a probationary period
  - Adjust container size
  - Providing alternative equipment

# Contamination categories

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Bagged  
recycling(BR)



Plastic bags-thin(PB-THIN)



Plastic bags-thick (PB-THICK)



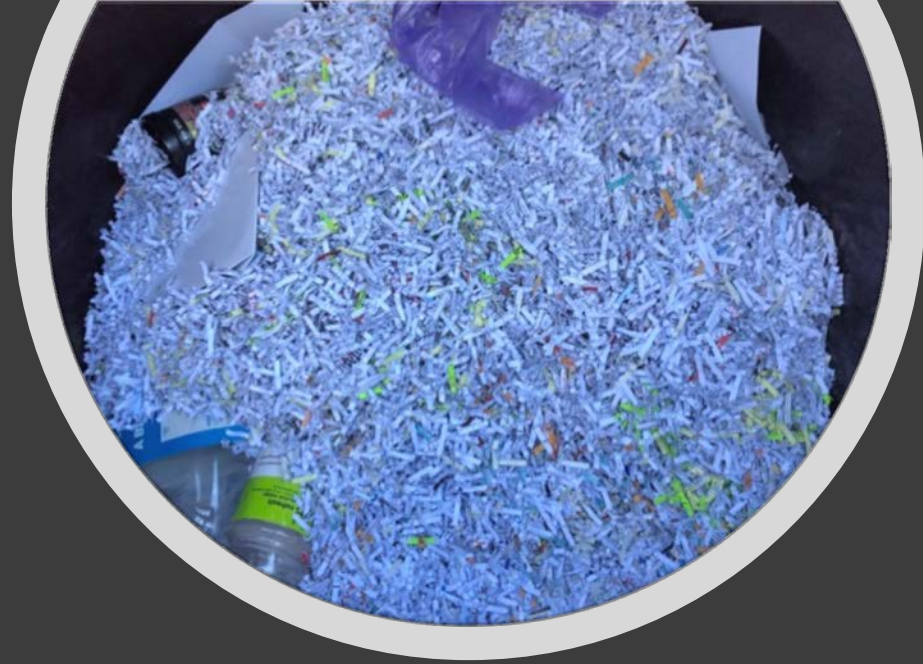
Flexible plastic items(FPI)

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Food waste(FW)





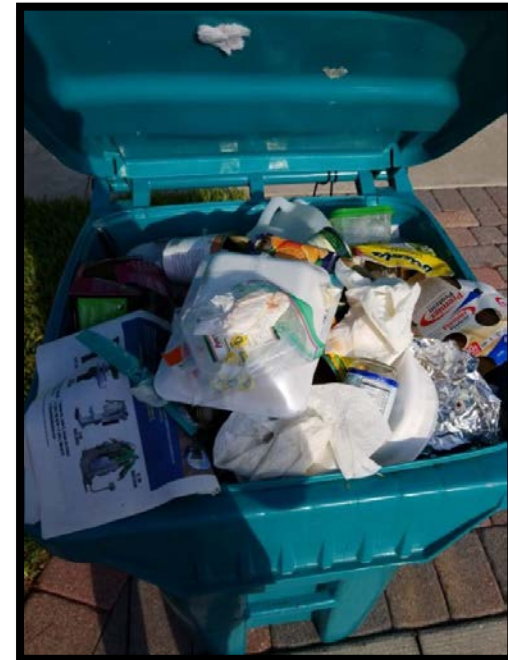


Paper products(PP)

# Cardboard(CB)



# Styrofoam(SF)



Yard waste(YW)





Textile (TE)

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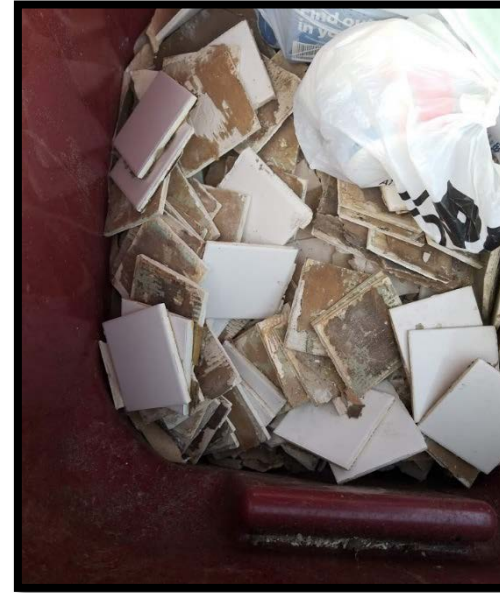
Metal items that are not a can(ME)



Tanglers (TA)

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# Construction debris (CD)







Household garbage(HG)

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Engelwood Recycling Stu...

Address

Residence number not visible

Location

Capture Location

Barcode

Capture Barcode

Cart ID

New Photo

Capture Photo

50%

Next



Lake Nona Recyclin...

Contamination

- None
- BR-Bagged Recycling
- PB-THIN-Thin plastic bags
- PB-THICK-Thick plastic bags
- FPI-Flexible plastic items
- FW-Food waste
- PP-Paper products
- SF-Styrofoam
- YW-Yard Waste
- TE-Textile
- ME-Metals that are not a can

50%

Next

# Data capture

# RQI calculations

Single family Recycling  
Contamination Study

# Study case: Engelwood Neighborhood Contamination Study

## Objectives

- Determine if education is an effective communication tool to improve the quality of recycling
- Contrast different types of communication strategies to identify which is more effective at addressing contamination
  - Personal communication
  - Door hangers
- Test if RQI is an effective tool to determine changes in recycling behavior after an intervention

## Methodology

- Data entry to establish baseline
- Pre-education Inspection
- Recycling carts labeling
- Pre education RQI
- Recycling Education(door hangers and flyers)
- Post-education inspections
- Post education RQI

# KNOW BEFORE YOU THROW!

## ¡ASEGÚRESE ANTES DE BOTAR!

Include only these items in your recycle cart:  
Solo recicle:

				
<b>PLASTIC</b> Bottles and containers labeled #1 - #5 Caps stay on Envases y botellas #1 - #5, con tapa	<b>GLASS</b> Bottles and jars Remove lids Botellas y jarras, sin tapa	<b>METAL</b> Tin, aluminum, steel and empty aerosol cans Lata, aluminio, acero y latas vacías de aerosol	<b>CARDBOARD</b> Flattened boxes Cajas desarmadas	<b>PAPER</b> Newspapers, paper bags, junk mail, sheets of paper and drink cartons Periódicos, bolsas y hojas de papel, correo basura y cajas de jugo

**DO NOT** place these items in your recycle cart:  
NO coloque en su recipiente para reciclar:

			
Don't bag your recyclables. Leave items loose. Bolsas, ponga sus artículos sueltos	No plastic bags or film plastic Plástico para envolver	No styrofoam (packing materials, egg cartons, to-go containers) Poliestireno (material para empacar, envases para llevar comida, cartones de huevos)	No household garbage Basura

### RECYCLE RIGHT, ORLANDO!

#### ¡ORLANDO RECICLA BIEN!

Learn more recycling tips at [orlando.gov/recycling](http://orlando.gov/recycling).  
Más consejos para reciclar en [orlando.gov/recycling](http://orlando.gov/recycling).



Cart labeling

# Door to door education

Flyers distributed with surveys-Active direct education

Door hangers- Active indirect education

**KNOW BEFORE YOU THROW!**  
¡ASEGÚRESE ANTES DE BOTAR!

**Include only these items in your recycle cart:**  
*Solo recicle:*

 <b>PLASTIC</b> Bottles and containers labeled #1 - #5 Caps stay on Envases y botellas #1 - #5, con tapa	 <b>GLASS</b> Bottles and jars Remove lids Botellas y jarras, sin tapa	 <b>METAL</b> Tin, aluminum, steel and empty aerosol cans Lata, aluminio, acero y latas vacías de aerosol	 <b>CARDBOARD</b> Flattened boxes Cajas desarmadas	 <b>PAPER</b> Newspapers, paper bags, junk mail, sheets of paper and drink cartons Perifoneos, bolsas y hojas de papel, correo basura y vasos de jugo
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Más consejos para reciclar en [orlando.gov/recycling](http://orlando.gov/recycling).

**CITY OF ORLANDO**  
SOLID WASTE

<p><b>Plastic bags and sheets of plastic do not belong in your recycling cart.</b></p> <p>Plastic bags and other flexible plastics get tangled in recycling sorting equipment and shut down operations. Instead, take plastic bags to your local grocery retailer.</p>      <p>When these items are put in your cart, they tangle the machines.</p> <p><b>RECYCLE RIGHT, ORLANDO!</b></p> <p><b>CITY OF ORLANDO</b> SOLID WASTE</p> <p>Learn more recycling tips at <a href="http://orlando.gov/recycling">orlando.gov/recycling</a>.</p>	<p><b>No ponga bolsas de plástico o plástico flexible en su recipiente para reciclar.</b></p> <p>Se enredan en las máquinas y paralizan las operaciones. Lleve sus bolsas y plástico flexible (limpio) a su almacén de viveres local.</p>       <p>Las bolsas de plástico que pone en su recipiente para reciclar atascan el equipo.</p> <p><b>¡RECICLA BIEN, ORLANDO!</b></p> <p><b>CITY OF ORLANDO</b> SOLID WASTE</p> <p>Vea más consejos para reciclar en <a href="http://orlando.gov/recycling">orlando.gov/recycling</a>.</p>
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**PLASTIC BAGS AND SHEETS OF PLASTIC DO NOT BELONG IN YOUR RECYCLING CART.**

Plastic bags and other flexible plastics get tangled in recycling sorting equipment and shut down operations. Instead, take plastic bags to your local grocery retailer.





Grocery bags    Bagged items    Food storage bags





Newspaper bags    Air pockets from shipping    Plastic case wrap

When these items are put in your cart, they tangle the machines.

**CITY OF ORLANDO**  
SOLID WASTE

Learn more recycling tips at [orlando.gov/recycling](http://orlando.gov/recycling).

**NO COLOQUE BOLSAS DE PLÁSTICO O PLÁSTICO FLEXIBLE EN SU RECIPIENTE PARA RECICLAR.**

Se enredan en las máquinas y paralizan las operaciones. Lleve sus bolsas y plástico flexible (limpio) a su almacén de viveres local.





Bolsas para mercado    Bolsas con basura    Bolsas para almacenar alimentos





Bolsas para diarios    Bolsas con aire para embalar    Plástico para embalar

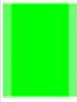










Estos artículos atascan la maquinaria si los pone en su recipiente para reciclar.

**CITY OF ORLANDO**  
SOLID WASTE

Vea más consejos para reciclar en [orlando.gov/recycling](http://orlando.gov/recycling).

# Data sheet

	K	L	N	O	P	R	S	U	X	Y	Z
1	Device Date/Time	Submission Form Name	Residence number	Street name	Location	Cart ID	New Photo	Contamination	Time	Device ID	
114	12/12/2019 13:12	Lake Nona Recycling Study	11949	Charlton Ln	28.394430,-81.263541	5001963	<a href="http://www.gocanvas.com/values/7">http://www.gocanvas.com/values/7</a>	FPI-Flexible plastic items Plastic Bags packaging wrap	8:12 AM	0afbd10e23996056	
115	6/13/2019 12:02	Lake Nona Recycling Study	11950	Charlton Ln	28.394037,-81.263964		<a href="http://www.gocanvas.com/values/6">http://www.gocanvas.com/values/6</a>	Other	8:00 AM	1ec07cf6c105b6d7	
116	6/20/2019 11:57	Lake Nona Recycling Study	11950	Charlton Ln	28.393997,-81.264053		<a href="http://www.gocanvas.com/values/6">http://www.gocanvas.com/values/6</a>	None	7:56 AM	fc0a0bd3d8ff008d	
117	6/27/2019 11:57	Lake Nona Recycling Study	11950	Charlton Ln	28.394034,-81.264021		<a href="http://www.gocanvas.com/values/6">http://www.gocanvas.com/values/6</a>	Plastic Bags	7:56 AM	0afbd10e23996056	
118	12/12/2019 13:13	Lake Nona Recycling Study	11950	Charlton Ln	28.393992,-81.263936		<a href="http://www.gocanvas.com/values/7">http://www.gocanvas.com/values/7</a>	FPI-Flexible plastic items PB-THIN-Thin plastic bags	8:12 AM	fc0a0bd3d8ff008d	
119	12/19/2019 13:05	Lake Nona Recycling Study	11950	Charlton Ln	28.394132,-81.264034		<a href="http://www.gocanvas.com/values/7">http://www.gocanvas.com/values/7</a>	HG-Household garbage	8:04 AM	fc0a0bd3d8ff008d	
120	1/9/2020 13:07	Lake Nona Recycling Study	11950	Charlton Ln	28.394003,-81.263993		<a href="http://www.gocanvas.com/values/7">http://www.gocanvas.com/values/7</a>	FPI-Flexible plastic items	8:05 AM	fc0a0bd3d8ff008d	
121	6/13/2019 12:07	Lake Nona Recycling Study	11957	Charlton Ln	28.394236,-81.263400	07 052559	<a href="http://www.gocanvas.com/values/6">http://www.gocanvas.com/values/6</a>	Plastic Bags Pizza boxes	8:05 AM	e5151b5761973302	
122	6/20/2019 11:51	Lake Nona Recycling Study	11957	Charlton Ln	28.394267,-81.263438	07 052559	<a href="http://www.gocanvas.com/values/6">http://www.gocanvas.com/values/6</a>	None	7:49 AM	0afbd10e23996056	
123	6/27/2019 11:51	Lake Nona Recycling Study	11957	Charlton Ln	28.394100,-81.263373	07 052559	<a href="http://www.gocanvas.com/values/6">http://www.gocanvas.com/values/6</a>	None	7:50 AM	0afbd10e23996056	
124	11/21/2019 13:20	Lake Nona Recycling Study	11957	Charlton Ln	28.393902,-81.263300	7052559	<a href="http://www.gocanvas.com/values/7">http://www.gocanvas.com/values/7</a>	None	8:20 AM	0afbd10e23996056	
125	12/12/2019 13:19	Lake Nona Recycling Study	11957	Charlton Ln	28.394118,-81.263365	7052559	<a href="http://www.gocanvas.com/values/7">http://www.gocanvas.com/values/7</a>	None	8:18 AM	0afbd10e23996056	
126	12/19/2019 13:09	Lake Nona Recycling Study	11957	Charlton Ln	28.394143,-81.263356	7052559	<a href="http://www.gocanvas.com/values/7">http://www.gocanvas.com/values/7</a>	None	8:08 AM	0afbd10e23996056	
127	6/13/2019 12:04	Lake Nona Recycling Study	11962	Charlton Ln	28.394062,-81.263960	06 052451	<a href="http://www.gocanvas.com/values/6">http://www.gocanvas.com/values/6</a>	Plastic Bags packaging wrap Other	8:02 AM	1ec07cf6c105b6d7	
128	6/20/2019 11:59	Lake Nona Recycling Study	11962	Charlton Ln	28.394128,-81.263688	06 052451	<a href="http://www.gocanvas.com/values/6">http://www.gocanvas.com/values/6</a>	Plastic Bags Other	7:56 AM	0afbd10e23996056	
129	6/27/2019 11:55	Lake Nona Recycling Study	11962	Charlton Ln	28.394061,-81.263999	06 052451	<a href="http://www.gocanvas.com/values/6">http://www.gocanvas.com/values/6</a>	Plastic Bags Textile Other	7:54 AM	0afbd10e23996056	
130	7/18/2019 12:17	Lake Nona Recycling Study	11962	Charlton Ln	28.394031,-81.263880	06 052451	<a href="http://www.gocanvas.com/values/6">http://www.gocanvas.com/values/6</a>	Plastic bags(thin, usually transparent): Paper: bags FPI-Flexible plastic items	8:16 AM	0afbd10e23996056	
131	12/12/2019 13:16	Lake Nona Recycling Study	11962	Charlton Ln	28.394269,-81.263639	6052451	<a href="http://www.gocanvas.com/values/7">http://www.gocanvas.com/values/7</a>	PP-Paper products	8:15 AM	fc0a0bd3d8ff008d	
132	1/16/2020 13:03	Lake Nona Recycling Study	11962	Charlton Ln	28.394056,-81.263762	6052451	<a href="http://www.gocanvas.com/values/7">http://www.gocanvas.com/values/7</a>	FPI-Flexible plastic items	8:02 AM		
133	6/13/2019 12:09	Lake Nona Recycling Study	11965	Charlton Ln	28.394138,-81.263223	04 000018	<a href="http://www.gocanvas.com/values/6">http://www.gocanvas.com/values/6</a>	Other	8:06 AM	1ec07cf6c105b6d7	
134	6/20/2019 11:52	Lake Nona Recycling Study	11965	Charlton Ln	28.393990,-81.263230	04 000018	<a href="http://www.gocanvas.com/values/6">http://www.gocanvas.com/values/6</a>	None	7:51 AM	0afbd10e23996056	

# categories of contaminants	0	1	2	3	4	5	6	7	8	9	10
RQI	10	9	8	7	6	5	4	3	2	1	0
Recycling quality											
	Good										Bad

	Cat Pre Edu	Tot Cat Pre Edu	Pre Edu RQI		Δ RQI	Result
Week 1	PB, PC, HG	PB, PC, HG, TE, FW, SF	4		+3	Increase
Week 2	PB, TE, FW					
Week 3	PB, SF, PC					
	Cat Pos Edu	Tot Cat Pos Edu	Pos Edu RQI			
Week 1	PB	PB, PC, HG	7			
Week 2	PB, PC					
Week 3	HG					

# Calculations

House #1



# Results

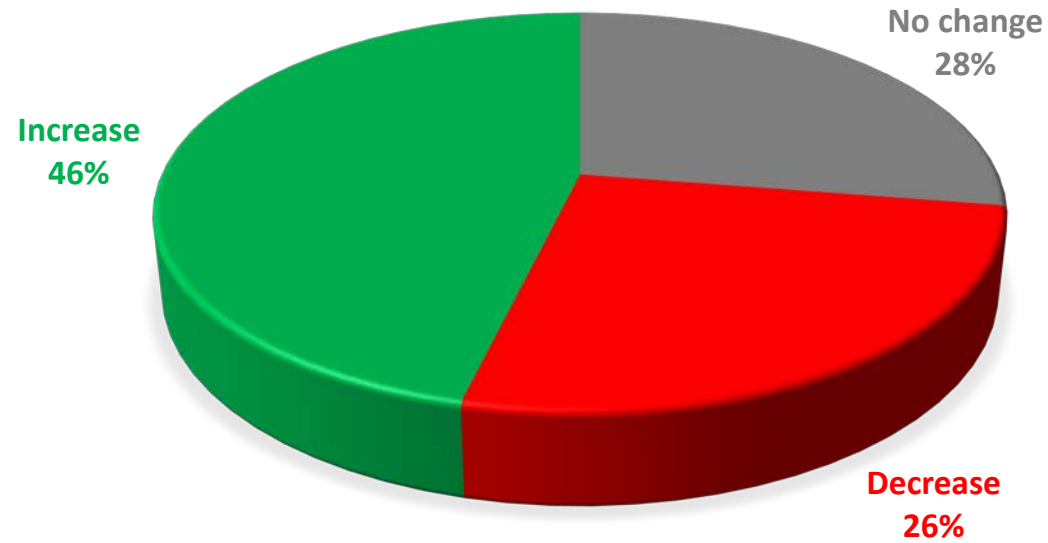
Door to door education		
Residences that increased their RQI (higher recycling quality post education)	Residences that decreased their RQI (lower recycling quality post education)	Residences that showed no changes
37	21	22

Door hangers		
Increase RQI (higher quality post education)	Decrease RQI (lower quality post education)	No change post education
21	11	11

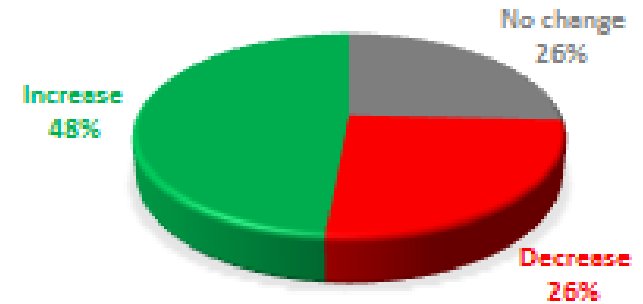
Personal Communication		
Increase RQI (higher quality post education)	Decrease RQI (lower quality post education)	No change post education
16	10	11

# Graph the results

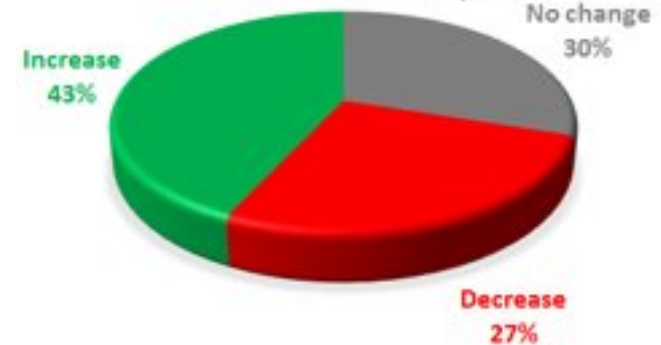
## POST EDUCATION CHANGE IN RQI (DOOR TO DOOR OR DOOR HANGERS)



### EFFECT OF EDUCATION STRATEGIES(DOOR HANGERS) IN RQI



### EFFECT OF EDUCATION STRATEGIES(PERSONAL COMMUNICATION) IN RQI



# RQI calculations

Multifamily recycling  
contamination study

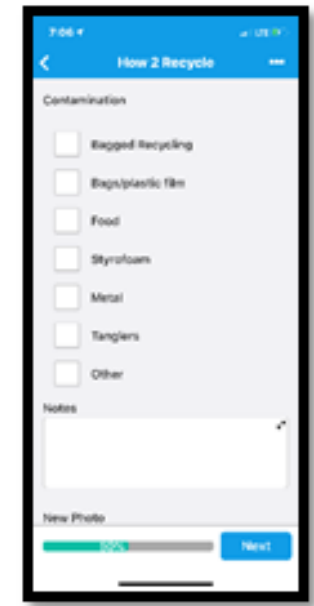
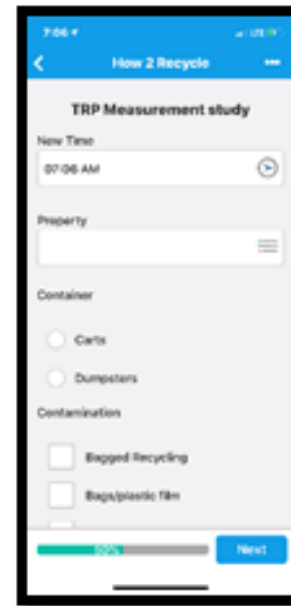


## Project Scope

- Focused on the successfulness of the How2Recycle label at reducing contamination when applied to a reusable tote bag with educational material.
- 13 properties and 2033 units
  - Mid-rise, High-rise, Garden-style
  - Apartment, condo
- Combination of different containers
  - Dumpsters, 95gal carts
- Minimum 3-week audit before and after tote distribution

# Methodology

- Conduct a baseline audit to determine extent of contamination
  - Data collection using GoCanvas
  - Pictures taken of each container
- Maintain uniformity between residential and multifamily
  - Used RQI and other indices.
    - CSI
- Distribute tote bags
  - Bilingual: English / Spanish
- Conduct a follow-up audit to determine change in contamination
  - Site visits take place on the day before collection
- Survey distribution
  - To include non-participating properties

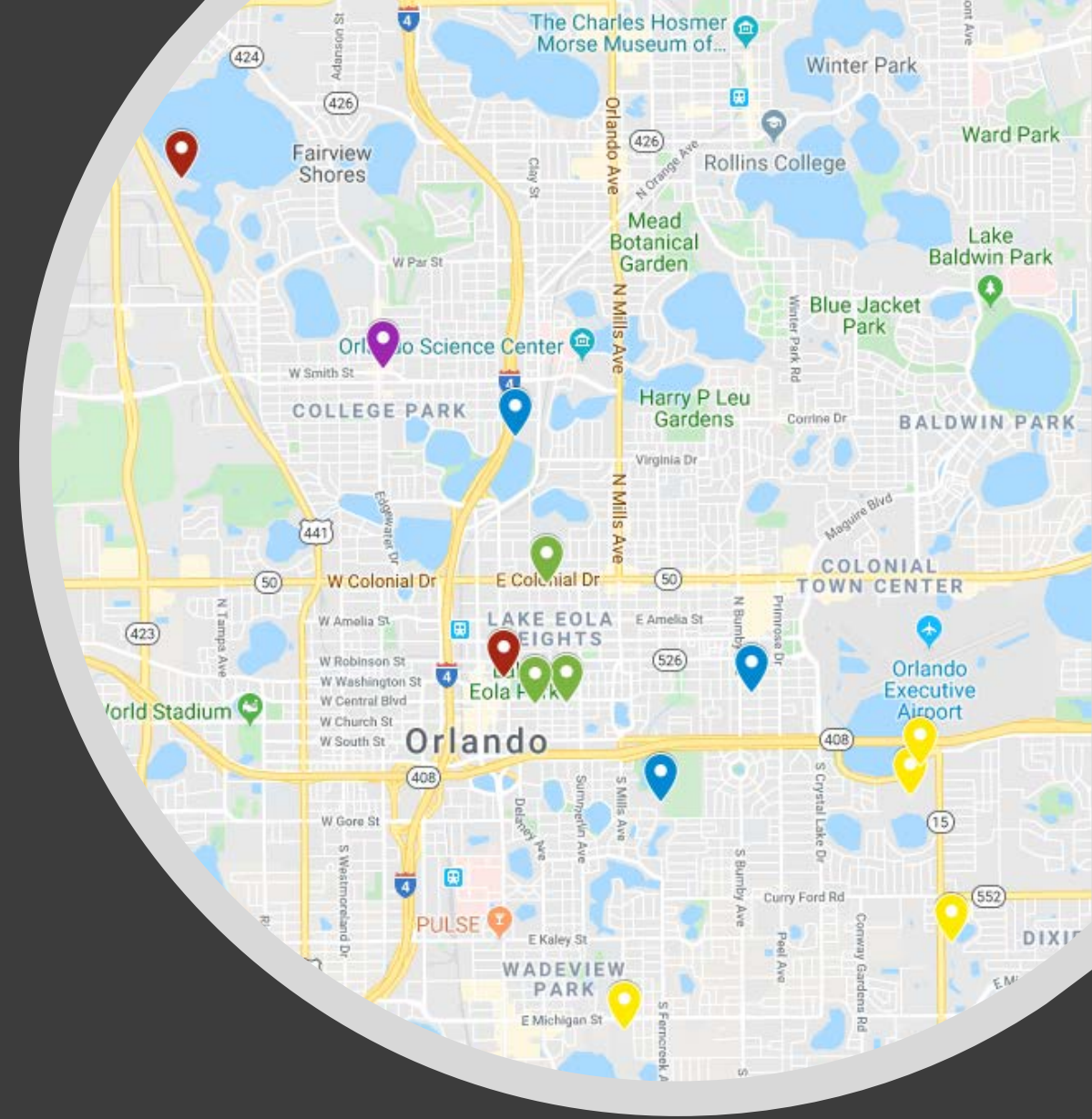


RQI Scale

# categories of contaminants	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
RQI	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Recycling quality															
	Good												Bad		

# Map of Participating properties in Orlando

- Garden Style
  - Dumpster
  - Cart
- High-Rise
  - Dumpster
  - Cart
- Mid-Rise
  - Cart



# Educational Material

## HOW TO USE THIS RECYCLING TOTE:

- 

**1.** Collect your accepted recycling materials in this tote
- 

**2.** Empty tote in recycling container
- 

**3.** Refill and repeat

Congratulations! Today you are receiving the tools you need to recycle successfully! This tote lists recyclables accepted locally and comes with a helpful magnet for your refrigerator. Know what to throw so you can waste less and recycle more.

 Find out more about what you can recycle at [orlando.gov/recycle](http://orlando.gov/recycle). Type the name of a waste item and we'll provide information on recycling or disposal. **Thank you for your recycling contribution!**



## LOOK FOR THE How2Recycle LABEL

Use this recycling tote to collect and carry to your collection bin

Recycle the following items:



**Cans**  
empty and rinse



**Glass**  
empty and rinse



**Paper**  
flatten cardboard boxes



**Plastic Bottles & Containers**  
empty bottles and containers and replace cap



**NO!**  
Not in your recycling.



No Food or Liquid  
(empty all containers)



No To-Go Containers



No bags, No trash,  
(do not bag recyclables)



No Batteries

Store drop-off only



Plastic Bags and Wrap  
cannot go in curbside recycling  
- take to store drop-offs

# RECYCLE

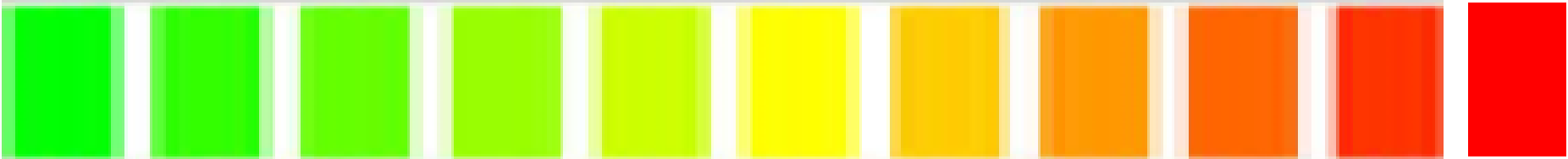


Learn more at [orlando.gov/recycling](http://orlando.gov/recycling)



## Flexibility of the RQI

### RQI Scale

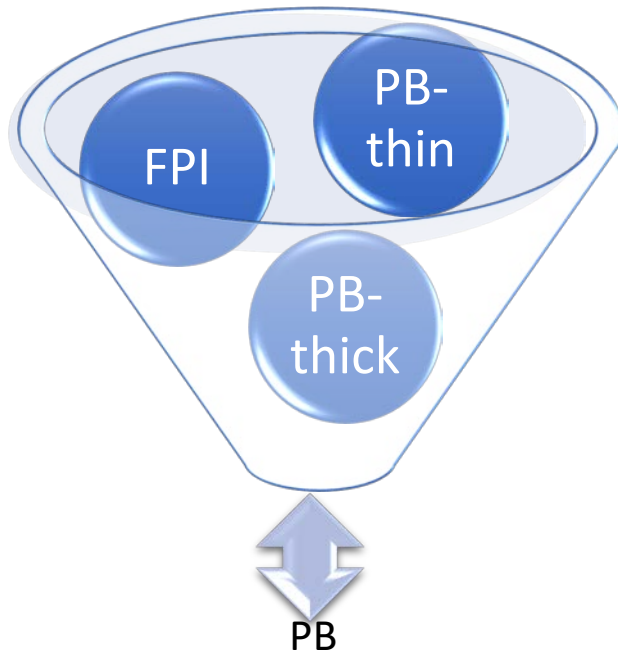
# categories of contaminants	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
RQI	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Recycling quality															
	Good											Bad			



# Flexibility of the RQI categories

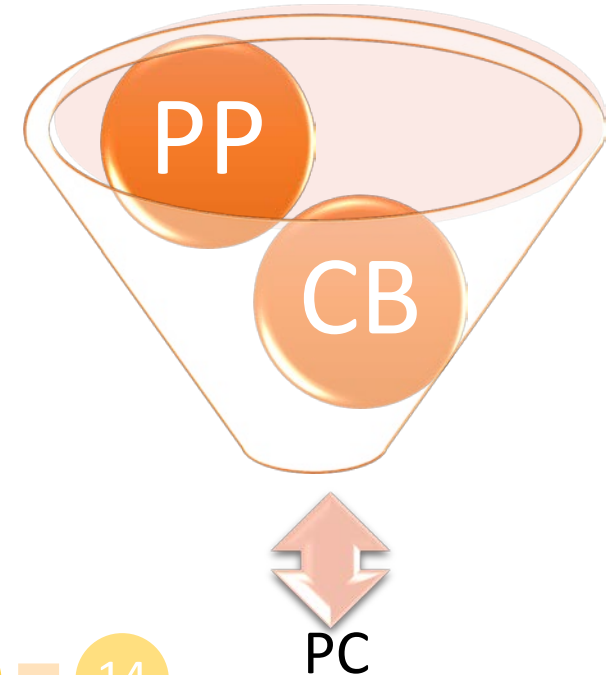
## 10 categories

- NC
- PB
- SF
- FW
- YW
- TE
- PC
- HG
- ME
- CD



## 14 categories

- NC
- PB-THIN
- PB-THICK
- FPI
- SF
- FW
- YW
- TE
- PP
- CB
- HG
- ME
- CD
- TA



$$13 + TA = 14$$

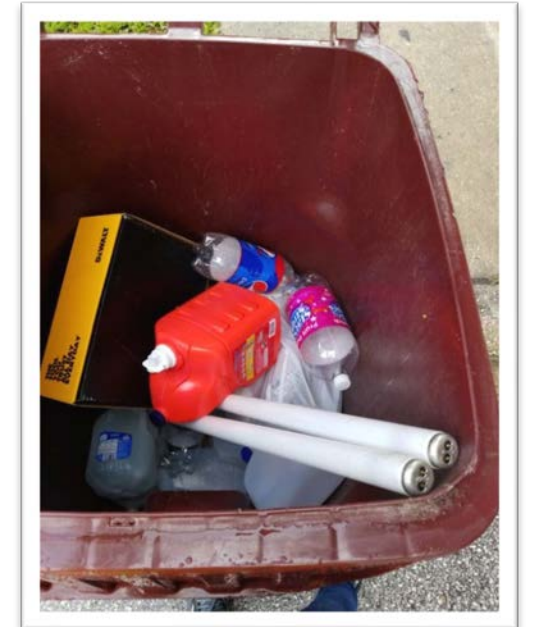
# Additional contamination categories

## Split Household garbage category

- Electric items
- Non-electric items

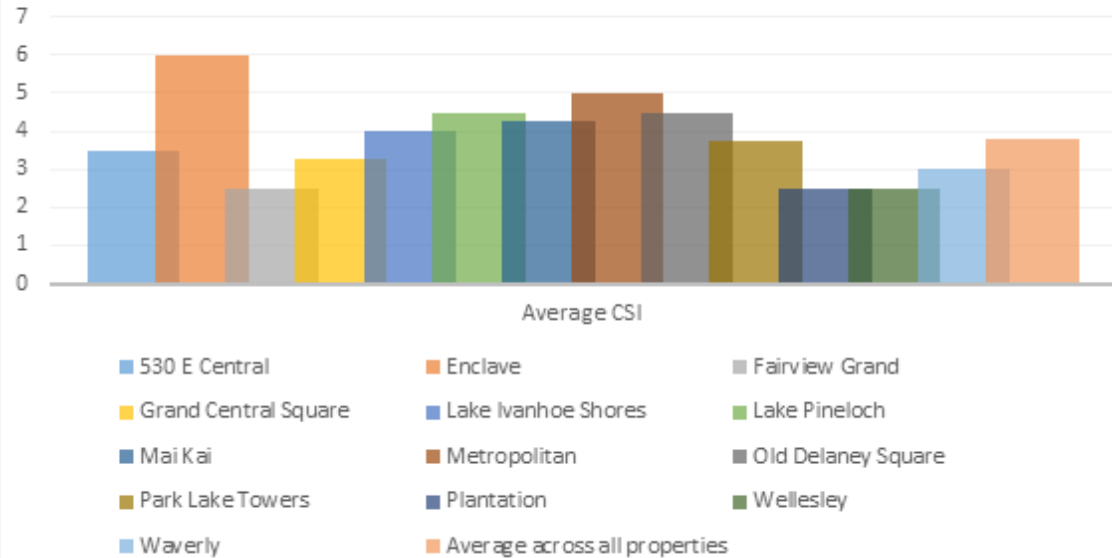


## Hazardous household wastes

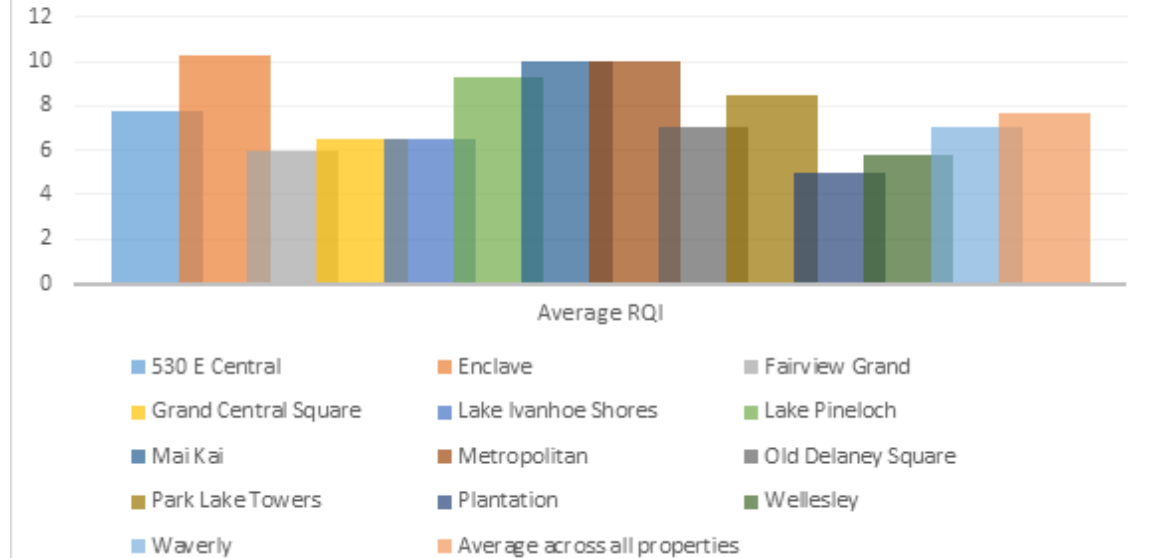


# RQI provides legitimacy to other indices

CSI Pre-tote Average



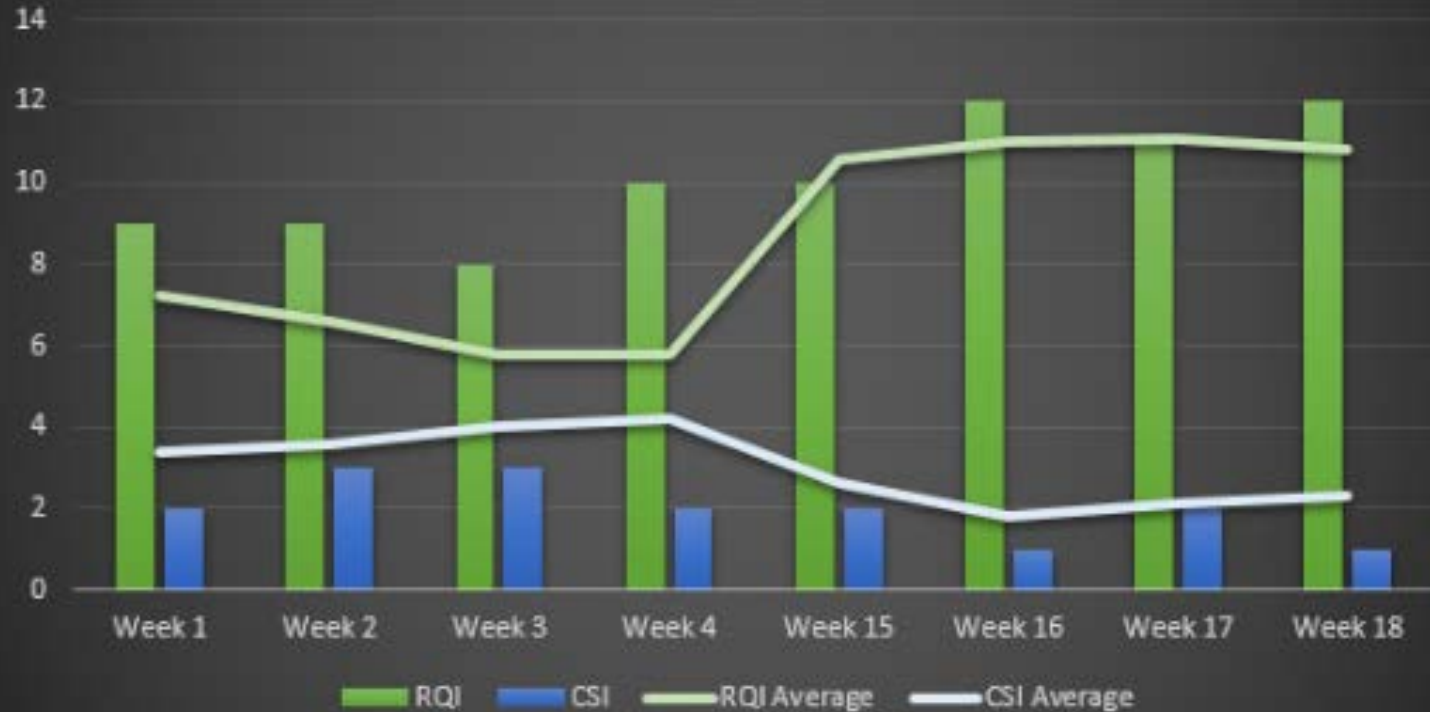
RQI Pre-tote Average



# Data interpretation and Results

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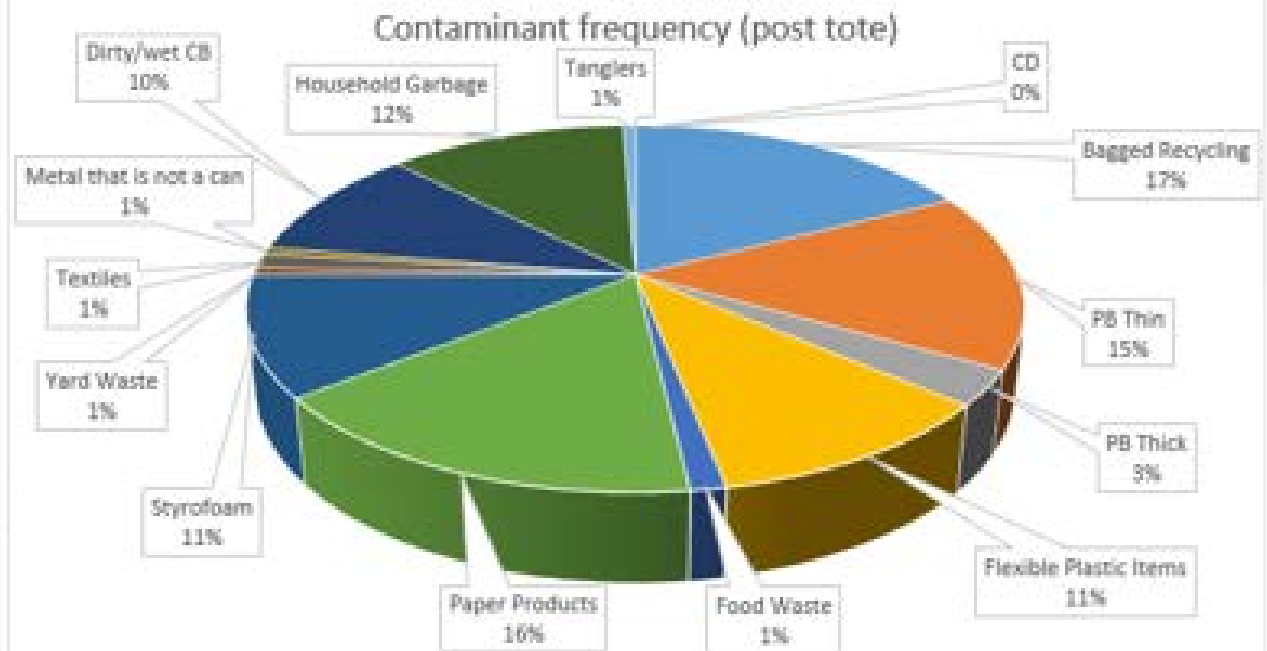
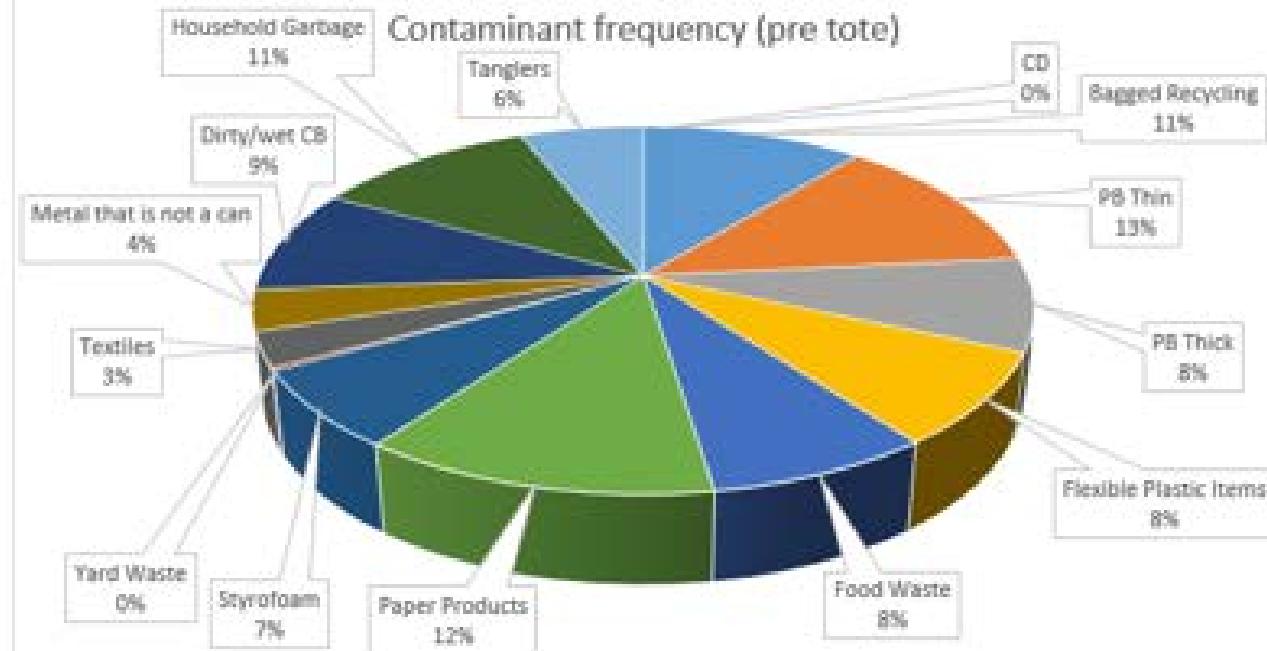
## Plantation Gardens [Diachronic]



- An ideal scenario is one where both column values lie outside the delta created by the property averages.
  - Green(above)
  - Blue(below)
- Having values WITHIN the delta does not necessarily mean the property did not improve.
  - Only that they underperformed compared to the average.

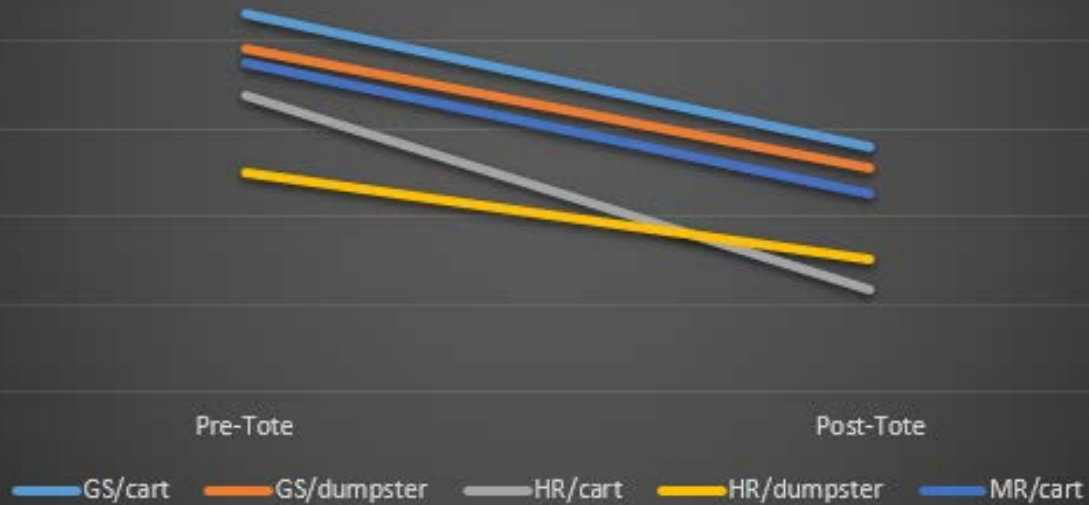
Comparison of auditing phases

# Changes in recycling assemblage

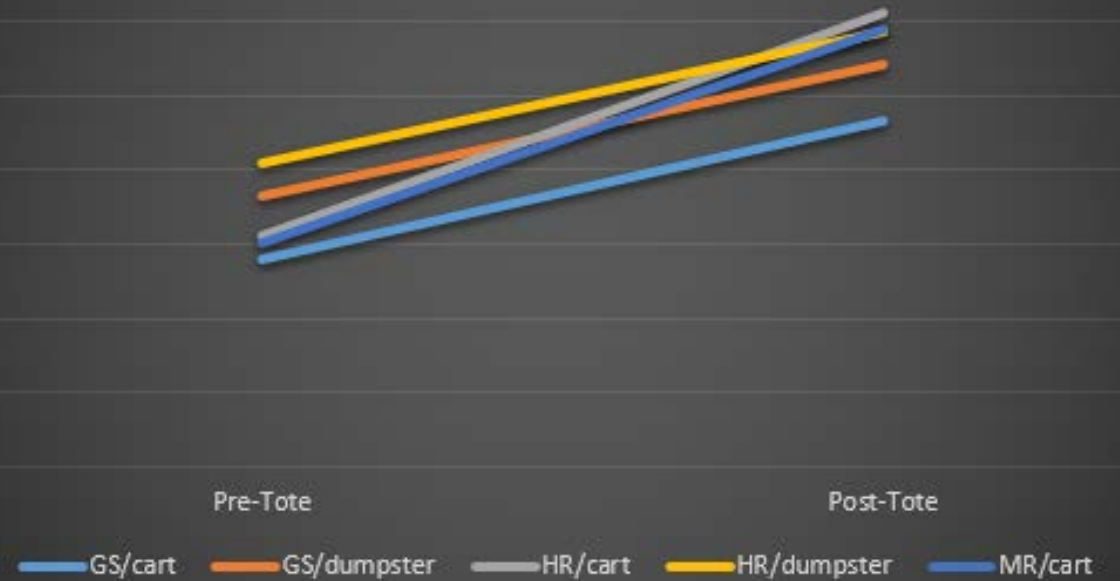


	BR	PB Thin	PB Thick	FW	PP	FPI	SF	YW	TX	MNC	DCB	HG	TA
<b>Pre</b>	43	49	31	31	49	32	27	1	12	14	36	43	24
<b>Post</b>	28	25	5	2	26	17	17	1	2	1	16	19	1
	-35%	-49%	-84%	-94%	-47%	-47%	-37%	0%	-83%	-93%	-55%	-56%	-96%

## Contamination Saturation Shift by Property Type



## Recycling Quality Shift by Property Type



## Index shifts

High-Rise properties with carts (grey) exhibited the highest success rate with the How2Recycle label.

# What the RQI does NOT show

- The “depth” of contamination
- The frequency of single contaminants
- Capture rate comparisons



# Multifamily Limitations

## Transient residency

- 50% of Orlando residents live in multifamily housing
- 40%-50% of apartment leases are NOT renewed annually.
  - Remedial strategies (including use of RQI) must be long-term.

## Point source ambiguity

- Unable to determine where contamination comes from
- Centralized location of recycling containers
- Containers available 24/7

## Insufficient yardage

- .5yd/ single family household
- 6yd for multifamily property of 250+ units
  - This disparity leads to greater and more diverse contamination



# Recap

RQI measures the change in recycling behavior

RQI allows for targeted educational campaigns

RQI can be adapted to multiple scenarios

Volumetric is strongly recommended in a multifamily setting