



**WPI**

# GLASS RECYCLING IN CAÑO MARTÍN PEÑA

WORCESTER POLYTECHNIC INSTITUTE  
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SPONSOR: CAÑO 3.7





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# PRESENTATION OVERVIEW

- Project Overview
- Project Methodology
- Results and Findings
- Conclusions and Recommendations
- Guidebook Deliverable
- Acknowledgements
- Question & Answers



# PROJECT OVERVIEW

The goal of our project is to research the feasibility of glass recycling in Caño Martín Peña, specifically on the north side of the canal. Recycled glass has many possibilities and uses that we believe could be beneficial to ENLACE and the Caño Martín Peña area.





# PROJECT OBJECTIVES

Understand the recycling conditions in Caño Martín Peña

Explore potential uses for recycled glass

Estimate the number of glass bottles sold per week via surveys

Provide a deliverable to support implementation of glass recycling



# RESULTS AND FINDINGS

## What we aimed to achieve:

- What recycling conditions are in the Caño Martin Peña area
- How many glass bottles were sold in the north of the Caño Martin Peña per week
- Business's willingness to recycle
- Incentives to encourage businesses to recycle
- Possible uses for recycled glass







# INTERVIEW WITH MIGUEL NAVEIRA: COORDINATOR AT MARTÍN PEÑA RECICLA, INC.

Martín Peña Recicla, INC. has been recycling cardboard, paper, plastics, and aluminum since 2011, but has **never recycled glass** in the Martín Peña area.

The image to the left shows MPR's recycling process to motivate the community to recycle.



# INTERVIEW WITH JOSE MERCADO QUINTANA FROM BLOQUES CARIBE INC.

Bloques Caribe Inc. produces cement blocks with 10-12% weight glass aggregate. They shred glass bottles from the surrounding community using an Andela glass pulverizer.

This glass pulverizer would cost \$38,450 to purchase and deliver to San Juan.

Bloques Caribe Inc. sold 9.7 million cement blocks last year across Puerto Rico.





# INTERVIEW WITH RUBÉN GONZÁLEZ ABREU FROM RECICLAJE DEL NORTE

Reciclaje del Norte recycles 12 different materials from the Caño Martín Peña area and surrounding communities.

They used to recycle glass, but now only collect and export it.





# INTERVIEW WITH REBECCA POPOWSKY FROM OLIN LABS

OLIN Labs has been researching the soil-less soil for four years.

With sand and soil becoming more scarce, OLIN has developed a way to use glass as a substitute for sand to create soil.

The composition is made of a 60/20/20 ratio of sand, compost, and natural soil respectively.

They've experimented with substituting parts of the sand with glass in different ratios.





# SURVEY (8 Responses)



8 Minutes



Multiple choice,  
optional free response

9

Questions

Measuring the number of glass bottles sold, business's willingness to recycle, and their opinions on recycling incentives.

## Marina Neighborhood - Restaurant and Local Business Survey

This survey aims to understand how local business and restaurants contribute to glass waste in the Marina Neighborhood via glass bottles.

Informed Consent Script for restaurant and business owners/mangers/workers:

Hi, my name is \_\_\_ and this is \_\_\_, \_\_\_, and \_\_\_. We are a group of students from Worcester Polytechnic Institute in Massachusetts. We are inviting you to participate in a research study regarding glass recycling in the Marina neighborhood in Puerto Rico. We strongly believe this kind of research will ultimately enhance recycling procedures in place, as well as improve community understanding of recycling. This research will be published as a requirement for our graduation. This survey will likely take around fifteen minutes. We would prefer to use names and short descriptions such as "Manager of local restaurant" in our report, but this is not necessary if you would like to remain anonymous. No addresses will be used in our report. Please remember that your answers will remain Anonymous if you please, so no identifying information would appear in any of the project reports or publications. Your participation in this interview is completely voluntary and you may withdraw at any time. This is a collaborative project between Caño 3.7 and Worcester Polytechnic Institute, and your participation is greatly appreciated. You can contact us with any questions you may have by emailing [gr-cano\\_pr\\_d22@wpi.edu](mailto:gr-cano_pr_d22@wpi.edu). At this point, do you have any questions for us before we begin?

Name \*

Short answer text

Name of establishment \*

Short answer text

Job title \*

Short answer text

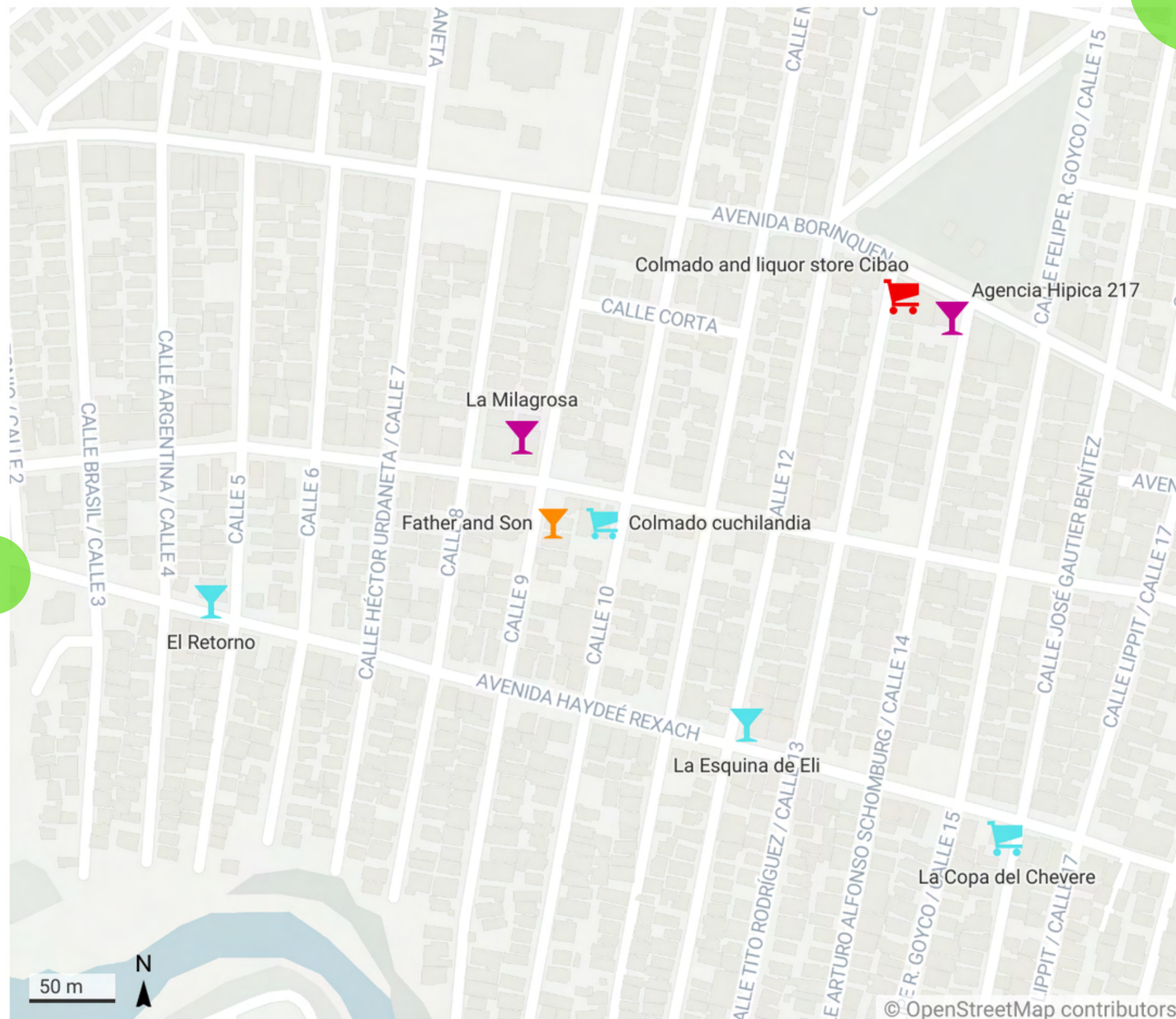
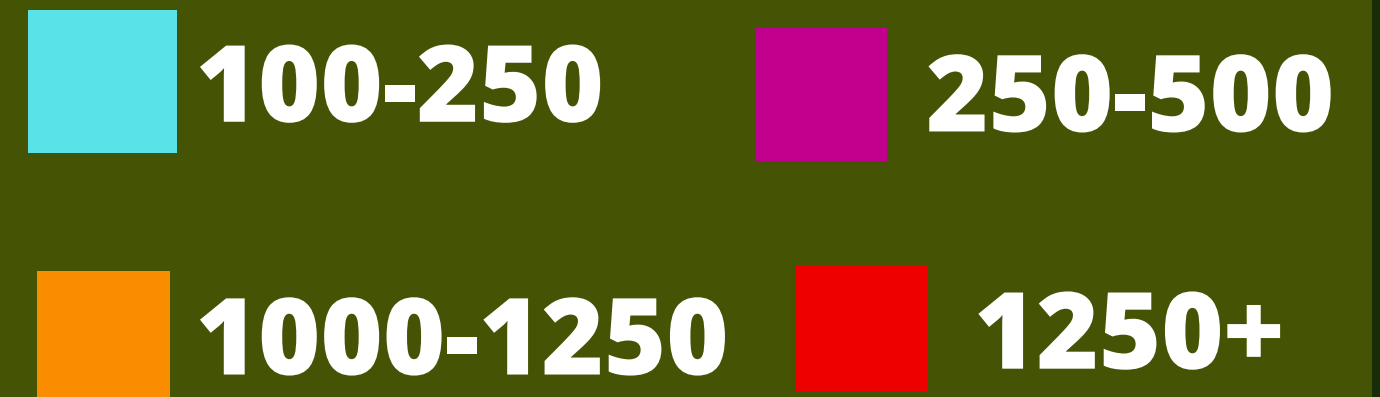



# SURVEYED ESTABLISHMENTS

This map indicates the businesses and restaurants our team surveyed throughout the north side of the Caño Martín Peña.

## MAP KEY

Number of glass bottles sold per week



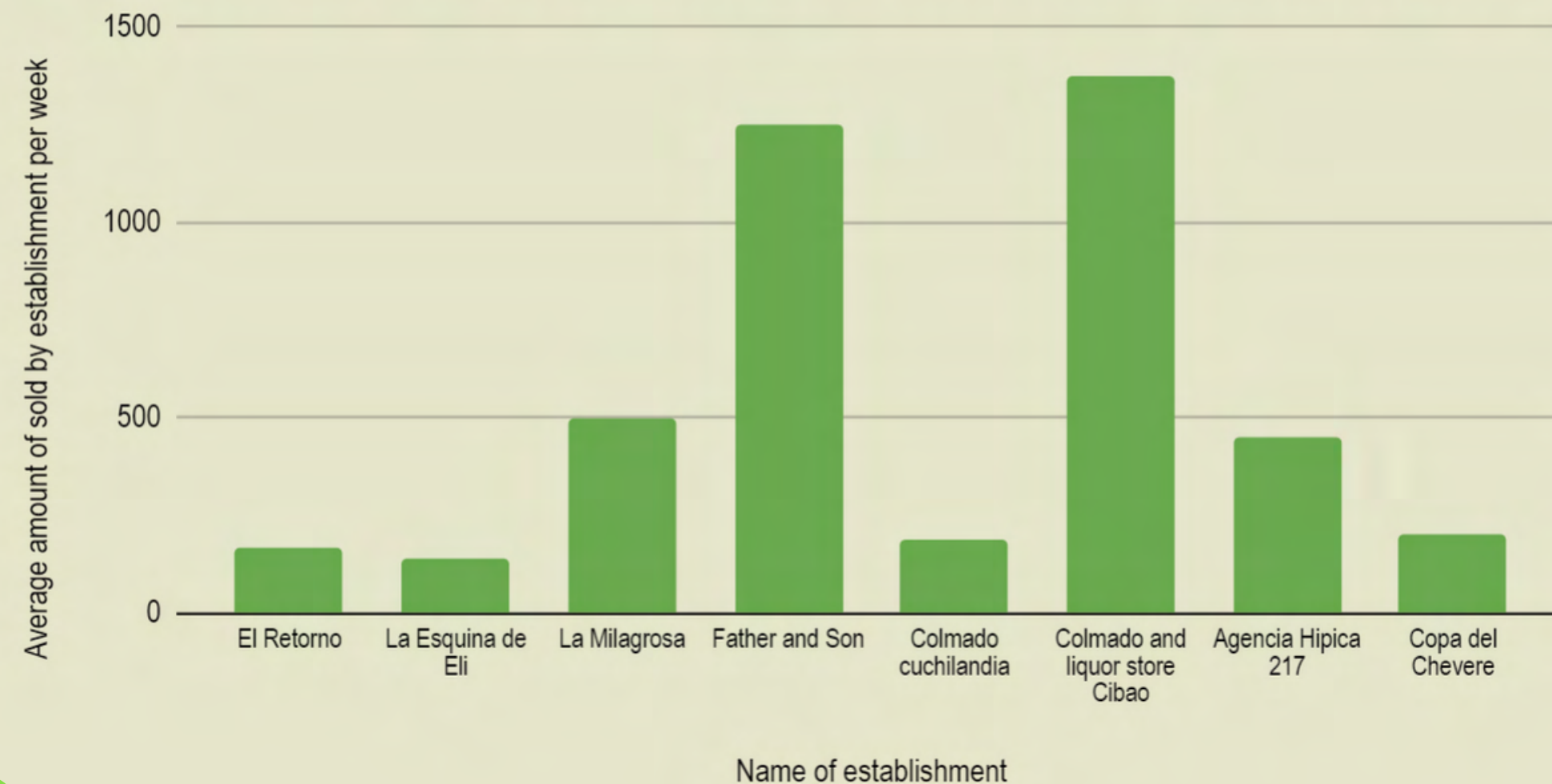
 Markets and Liquor Stores

 Bars



# SURVEY RESULTS

**Average number of bottles sold by establishment per week in the north side of the Caño Martín Peña**



0%

of businesses surveyed **currently recycle**.

100%

of businesses surveyed **are willing to recycle and promote recycling** in their establishments.

4 of the 8 businesses surveyed **would prefer business promotion over a monetary incentive** for recycling their glass waste.



# GLASS WASTE DATA FROM SURVEYED BUSINESSES

**4,264 bottles**

Estimated total  
weekly glass bottles  
sold



**221,728 bottles**

Estimated total  
yearly glass bottles  
sold



**44.35 tons**

Estimated  
metric tons of  
glass bottles  
thrown away  
yearly



# DATA ANALYSIS

How much would it cost to send the surveyed glass to a landfill?

The cost to send material to the San Juan landfill is \$42/ton

**\$1,863/year**

Does not include the collecting costs

How much money does Bloques Caribe save from substituting limestone with glass?

**11%**

cement block  
in weight is  
glass

8"x8"x16"  
block

1496 grams is  
made of glass

**\$0.05**

of limestone  
is saved per  
block

**\$507,892**

cost savings in raw  
materials from using  
glass for the year







# ANDELA GP-MINI

What would it cost to buy an Andela GP-Mini glass pulverizer?

**\$38,450**

Includes Shipping costs!



What is the electric operating cost and environmental impact of the Andela GP-Mini glass pulverizer?

4.1 kW	\$0.24	\$1024	1.8 tons
to run the pulverizer	per kWh Commercial Rate of electricity in San Juan	cost of electricity per year (assuming 20 hr weeks, 52 weeks a year)	yearly CO2 emissions





## CONCLUSIONS

- Businesses and residents around the Caño Martín Peña are **willing to recycle** if they **understand the purpose** behind it and the **process is feasible**.
- Recycling in Puerto Rico **relies primarily on non-profit organizations and/or environmental groups** because there is a **lack of support from the local government**.
- Glass recycling is **arduous to implement** since, unlike plastics and metals, **unrecycled glass has no monetary value**.



# RECOMMENDATIONS

## Glass Recycling Next Steps

We recommend that ENLACE encourages businesses in the Caño Martín Peña area to recycle their glass bottles through an incentive program.





# RECOMMENDATIONS

## Glass Recycling Next Steps

We recommend that ENLACE and Bloques Caribe Inc. come to an agreement to recycle glass from the Caño Martín Peña area.

- Established Framework
- Short-term solution







# RECOMMENDATIONS

## Glass Recycling Next Steps

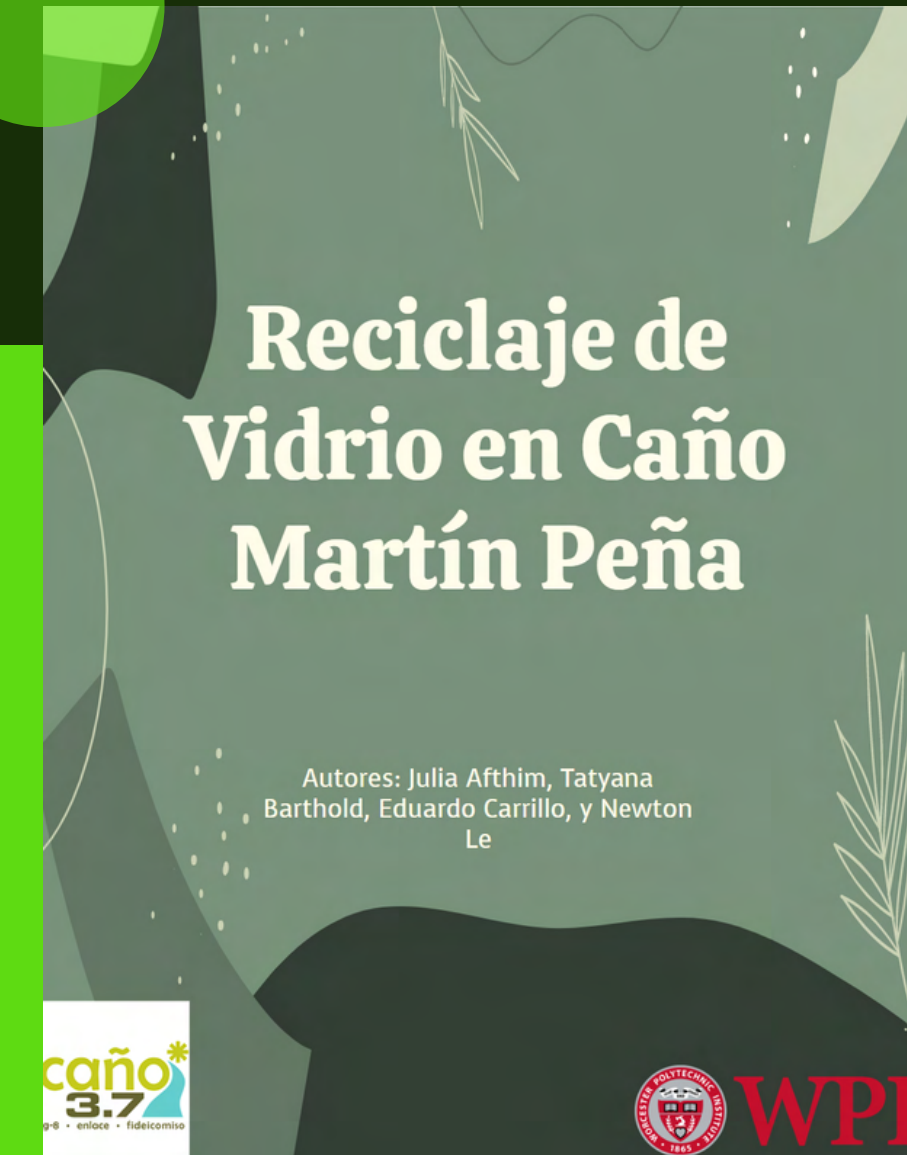
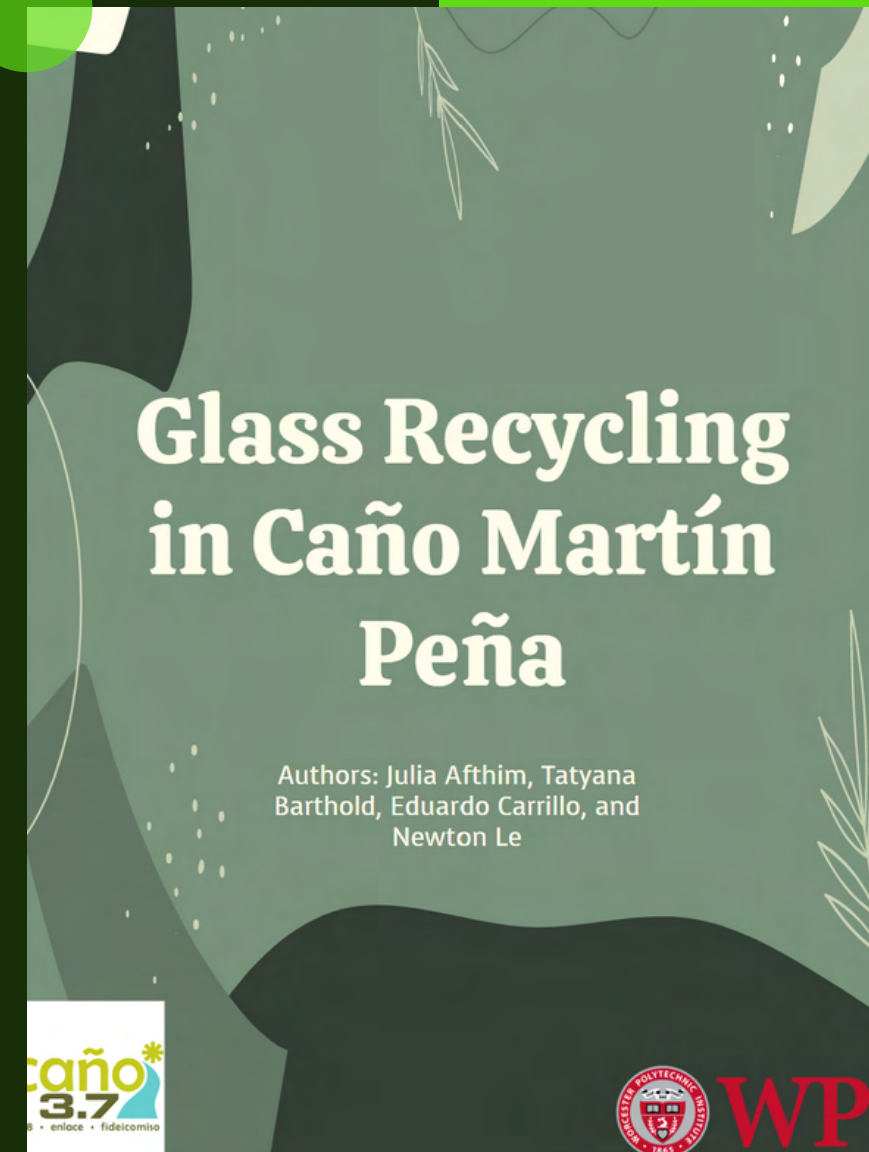
We recommend that ENLACE collects glass waste from businesses around the canal and starts a potential micro-business. This business would include a glass pulverizer and exploring the potential uses for glass cullets.



# GUIDEBOOK DELIVERABLE

Our team has prepared a guidebook to lay out the steps we have completed to result in the previously mentioned recommendations.

This guidebook has been translated to Spanish as well to provide accessibility to Spanish speakers at ENLACE.







# ACKNOWLEDGEMENTS

Our team would like to acknowledge the contributions of the following individuals for their role helping us complete our project. First and foremost, we would like to give a huge thank you to Francisco De La Cruz for his continual support and guidance with our project. We are very grateful for Francisco for connecting us with individuals and organizations that gave us valuable information to our project.

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Finally, we would like to thank the businesses around the Caño and the businesses around Puerto Rico that we interviewed for provided us enlightening and detailed responses.





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**THANK YOU!**  
**QUESTIONS?**  
**COMMENTS?**