

Kevin Kelleher
Assistant County Administrator
Broward County
115 S. Andrews Avenue, Room 409
Ft. Lauderdale, FL 33301

Arcadis U.S., Inc.
150 South Pine Island
Road, Suite 315
Plantation
Florida 33324
Phone: 954 761 3460
Fax:
www.arcadis.com

Date: July 23, 2021
Our Ref: 30091134
Subject: Solid Waste Generation and Composition Study Proposal

FL Engineering License #7917
FL Geology License #GB564
FL Surveying License #LB7062

Dear Mr. Kelleher,

Arcadis U.S., Inc. and Kessler Consulting Inc., collectively referred to as the Arcadis Team, are excited for the opportunity to again work with Broward County and the Solid Waste Working Group (SWWG), as you move forward with the advancement of your solid waste disposal planning and furthering the recommendations developed by the Arcadis Team in the 2018 Solid Waste and Recycling Issues Study Report (Study Report). As nationally-recognized leaders in the industry, providing solid waste consulting services throughout Florida and the United States, we believe we are the most qualified Team to support the County and SWWG, given our institutional knowledge of the issues at hand and our historical role working with the County and SWWG in a collaborative process through the development of the Study Report.

The Arcadis Team has developed this proposal in response to your Request for Proposals issued on July 2, 2021, for development of a Solid Waste Generation and Composition Study (Study). This Study will be used to determine the amount and composition of the waste generated within Broward County and serve as a statistically-valid basis for the development of special assessments that will serve as one of the major funding sources associated with the development and operation of a new solid waste disposal organization (New System) that the County and SWWG is currently considering.

The Arcadis Team is uniquely qualified to assist with the development of this Study. In addition to our extensive experience in conducting waste generation studies specifically, as demonstrated within this response, our Team members assisted in the development of the Study Report completed in 2018, and also provided solid waste consulting services to the Former Solid Waste Disposal District (Former District) for decades in addition to many municipalities within Broward County.

As requested, please find our Solid Waste Generation and Composition Study Proposal Matrix (Matrix) included as Attachment A to this cover letter. Attachment A includes the items requested in your July 2nd letter, as follows:

1. Names and resumes of the Arcadis Team members that will be working on the project.
2. References of the Arcadis Team's most recent waste generation and composition studies performed, including the municipality or district for which the work was completed; population or amount of waste disposed by the entity; as well as contact information of individuals familiar with the projects.
3. The Arcadis Team's approach to completing the Study. We have provided a overall summary within the Attachment A Matrix, as well as provided a more detailed description of the Arcadis Team's approach as a supplement in Attachments B and C.

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4. Estimate of the time and resources required to complete this Study.

Solid waste management consulting is a core practice at Arcadis with a long history of local municipal government advocacy. Broadly based and comprehensive service offerings aligned with highly specialized technical and regulatory expertise have enabled us to assist in the development and implementation of facilities and infrastructure with an estimated asset value exceeding \$5 billion in the past 10-years alone. Arcadis provides consulting services for all aspects of solid waste planning, development, permitting, finance, design, construction and operations. Services have been provided to clients ranging from small municipalities to large metropolitan cities generating anywhere from 100 to greater than 13,000 tons per day (tpd). Arcadis has long recognized that a comprehensive, integrated, practical and cost-effective approach to solid waste management issues is critical and we have the knowledge, experience, support systems and commitment to provide it.

For more than 100 years, Arcadis has been providing client environmentally safe and economically sound solutions. With 27,000 people worldwide and \$4.2 billion in revenue, we rank in the top 20 engineering consultancies in the world and top 10 in the United States.

Engineering News Record 2020 Rankings



Given our decades of history in the solid waste and resource recovery industry in Florida, and Broward County specifically, we have a profound understanding of regional and local issues, and we also offer the County and SWWG the capabilities of a large, diversified firm.

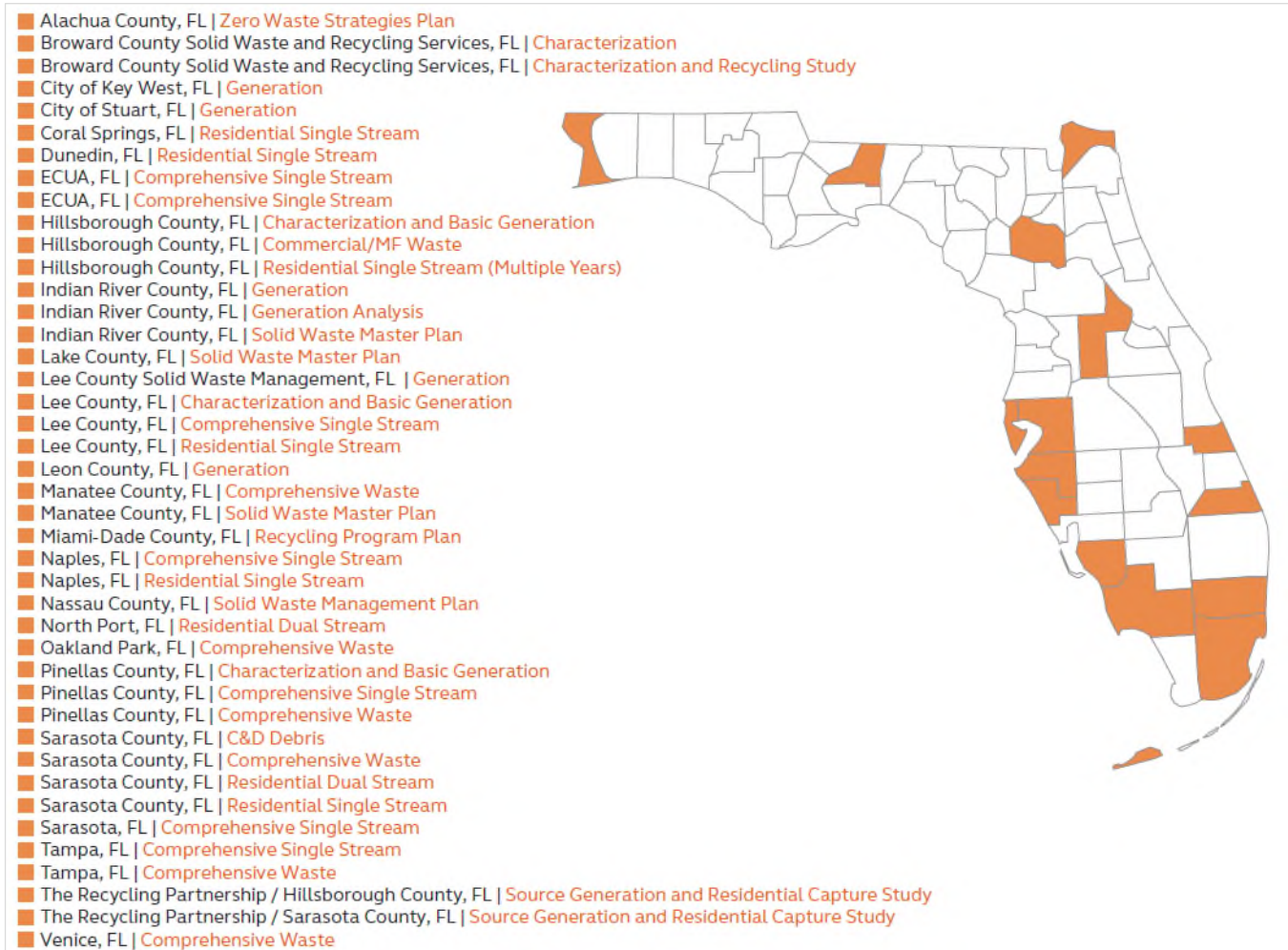
The Arcadis Team includes experienced solid waste professionals with long history of performing the exact services being requested, as well as the deep regional perspective and knowledge unique to Broward County, the



SWWG and all the municipalities. In addition, Arcadis has a multi-disciplinary staff of more than 5,000 in over 120 offices across the U.S., including our local Plantation office, with a staff of over 25 professionals, supplemented by more than 250 staff throughout Florida. We have the additional depth of resources to supplement completion of this Study.

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Although not specifically requested in your July 2nd letter, the Arcadis Team is pleased to present for reference a summary of our solid waste management experience. The following map illustrates the breadth of the Arcadis Team’s experience in conducting solid waste generation and composition studies, recycling composition studies, as well as developing overall comprehensive solid waste management plans, in Florida alone.



Beyond Florida, below we provide a sampling of the other representative projects we’ve completed around the country.

Client	Description
Augusta, GA	Comprehensive Waste
Boston Mountain SWD, AK	Waste Reduction and Recycling Plan
Carrboro, NC	Comprehensive Waste

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Client	Description
Carrboro, NC	Residential Solid Waste Study & Plan
Cary, NC	Residential Single Stream
Charleston County, SC	Comprehensive Single Stream
Chatham County, NC	Drop-off Waste (Multiple Years)
Chatham County, NC	Drop-off Single Stream
City of Buffalo, NY	Generation and User Fee Development
Denver, CO	C&D Debris - visual
Denver, CO	Commercial Single Stream
Denver, CO	Commercial Waste
Denver, CO	Comprehensive Single Stream
Denver, CO	Residential Single Stream
Denver, CO	Residential Waste
Elon University, NC	Solid Waste Master Plan
Elon University, NC	Waste, Compost, Recyclables
Fayetteville, AR	Solid Waste Master Plan
Greensboro, NC	Comprehensive Single Stream
Horry County, SC	Comprehensive Waste
Large Metropolitan Confidential Client	Characterization
Large Metropolitan Confidential Client	Generation
Monroe County, IN	Comprehensive Waste

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Client	Description
Onondaga County Resource Recovery Agency, NY	Generation and User Fee Development
Orange County, NC	Comprehensive Single Stream
Orange County, NC	Comprehensive Waste
The Recycling Partnership / Peoria, AZ	Source Generation and Residential Capture Study
The Recycling Partnership / San Diego, CA	RCS Coordination
Wake County, NC	Comprehensive Waste

You also requested that the Arcadis Team describe our proposed approach as well as the estimate of time and resources needed for completion of the Study. We understand the collaborative nature associated with the development of the New System. As such, we recognize that the proposed approach, duration and resources described below may change if we are ultimately selected to conduct the Study as we move through the negotiation process. Therefore, the duration and costs represent a planning level estimate that can be used by the County and SWWG to facilitate decision making and cost sharing discussions.



Approach for Waste Generation and Composition Study

The County and SWWG have expressed interest in working collaboratively to analyze the amount and composition of solid waste produced in Broward County and ultimately intends to develop special assessment rates of waste generation by residential and commercial property categories that could be used to assess these properties and ultimately provide a funding source for the New System. To that end, the County, on behalf of the collective group, is seeking a Consultant to prepare a Solid Waste Generation and Composition Study ("Study"), as described in your July 2nd letter. In response, the Arcadis Team has prepared a detailed approach to determine the waste generation rates and the composition of solid waste and recycling collected by the municipalities and private haulers through data analysis, sampling and visual auditing, which is provided as Attachment B, and is referred to as our Base Proposed Approach.

Alternate Proposed Approach – Potential Cost and Time Savings Option for Consideration

In addition, as we have been intimately involved in the SWWG meetings over the last two years, and prepared the prior 2018 Study Report, we recognized that several of the items that are being requested in your July 2nd letter were previously completed as a desktop level assessment and the results were included in our 2018 Study Report. Therefore, we believe that the County and SWWG may find value and benefit, and significant cost and time savings, with a similar desktop exercise, through updating the historical data on a desktop basis in order to reduce the upfront investment cost associated with the establishing the waste generation and special assessment rates. As such, in addition to our Base Proposed Approach, the Arcadis Team is pleased to provide an alternate

approach, based on a desktop level assessment, for your consideration, which is provided as Attachment C, and is referred to as our Alternative Proposed Approach. We believe this alternate approach will provide a very similar result given the intended purpose for this assessment and offers the opportunity for significant cost and time savings for the County and SWWG.



Study Time Schedule and Resources

The following section summarizes the estimated time and resources needed for completion of this Study, as proposed in the Base and Alternative Proposed Approaches presented in Attachments B and C. We understand that due to the collaborative process that is required to develop the special assessments the schedule will need to be flexible and also take into consideration the budgetary planning needs for the County and SWWG. The table below summarizes the estimated duration range for the Base and Alternative proposals.

Task	Task Description	Base Proposed Approach		Alternate Proposed Approach	
		Estimated Duration from Notice to Proceed	Estimated Fee	Estimated Duration from Notice to Proceed	Estimated Fee
1	Project Planning and Preparation	1-2 months	\$50,000	1-2 months	\$35,000
2	Solid Waste Generation Study	3-4 months	\$15,000	3-4 months	\$20,000
3	Solid Waste Materials by Generator Type	5-6 months	\$85,000	5-6 months	\$85,000
4	Waste Composition Analysis	15-18 months	\$200,000 (\$100,000 for one-time sort)	7-9 months	\$50,000
5	Recycling Composition Analysis		\$110,000 (\$60,000 for one-time sort)		\$30,000
	Total Estimated Fee		\$460,000 (\$310,000 for one-time sort)		\$220,000

We are looking forward to answering any questions and to further discuss and coordinate with the County and SWWG on this Study. We welcome discussing further so that we can address any questions which may arise around the approach and options, as well as ultimately refine the level of effort and detail the scope and fee, which are dependent on the availability of data, data format and completeness, and coordination with the County and SWWG.

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Assistant Broward County Administrator
July 23, 2021

We greatly appreciate the opportunity to submit our qualifications, approach, schedule and estimated fee to the County and SWWG for consideration. We look forward to and are prepared at your direction to proceed with the appropriate next steps.

Sincerely,
Arcadis U.S., Inc.



Leah K. Richter, PE
Vice President

Email: Leah.Richter@arcadis.com
Mobile: 954-599-7368

CC. Cooper City Mayor Greg Ross, Chair of the SWWG
County Commissioner Beam Furr, Vice Chair of the SWWG
Notosha Austin, Interim Director, Solid Waste Management

Enclosures:

Attachment A – Proposal Matrix
Attachment B – Base Proposed Approach
Attachment C – Alternative Proposed Approach
Attachment D – Detailed Resumes

Solid Waste Generation and Composition Study Matrix

Proposer: Arcadis U.S., Inc. and Kessler Consulting Inc. (Arcadis Team)

Requested Information	Proposer's Response
<p>Names and brief description on background of individuals working on the project. Please include their role on the project and attach resume.</p>	<p>Leah Richter, P.E. – Project Manager/Solid Waste Practice Lead – Leah Richter has a diverse background in environmental and civil engineering. She specializes in solid waste projects involving waste-to-energy, materials recovery, recycling, and landfilling. She is primarily responsible for assisting municipal clients with managing their solid waste management planning, operational, and capital program needs. Her experience includes program management and delivery, transactional consulting and due diligence, vendor procurement, contract compliance, regulatory permitting, public outreach, annual reporting to bondholders/trustees, litigation support services, solid waste advisory committee support, environmental compliance, debris management oversight, and operation and maintenance evaluation. Most recently, Leah served as the Project Manager for Broward County's Recycling Study focusing on the future of solid waste management in the county, as well as has worked with Broward County for the entirety of her career in our role as Consulting Engineer for the County's solid waste management system for decades.</p> <p>Mitch Kessler – Waste and Recycling Composition Technical Advisor – Mitch Kessler has 36 years of solid waste experience and has managed or directed more than 300 projects for over 200 clients. Mitch is a nationally recognized expert in the procurement and operations of solid waste collection systems and materials recovery programs and facilities. He is especially knowledgeable in collection and market development issues as they relate to the economic viability of solid waste and recycling programs.</p> <p>Joseph Krupa, P.E. – Waste Generation Technical Manager – Joseph (Joe) Krupa specializes in solid waste, recycling, transfer station, waste-to-energy, innovative waste processing, biogas and biosolids management projects. He currently serves as the national resource recovery technical lead for Arcadis. His experience spans all project life phases including: conducting feasibility studies; providing permitting assistance; preparing conceptual, detail and final design drawings and specifications; preparing procurement documents; evaluating equipment and contractor bids; providing technical support during equipment vendor and contractor negotiations and design/construction, and operation phases; evaluating equipment, construction and operations contract compliance; providing technical assistance in support of bond financing to secure more than \$1B USD in capital project funding; evaluating acceptance test results; and comparing operations to contractual performance metrics.</p> <p>Chas Jordan – Waste and Recycling Composition Technical Manager - Chas Jordan has over 15-years of solid waste consulting experience, which includes solid waste collection operations, sustainability action plans, LEED and Envision certification, waste management strategic plans, recycling capture composition study preparation and oversight, recycling operations planning and implementation, grant preparation and implementation, data analysis, and studies, processing contract management, educational material development, training, rate/fee reviews and analysis, and more.</p>

Jane Wu – Waste Generation, Waste Composition and Recycling Composition Technical Specialist - Ms. Wu is an innovation-orientated Management Consultant and Data Scientist. She has experience working with consulting firms, research institutions, and community organizations in the areas of policy implementation, waste management, renewable energy, wastewater, green infrastructure, data science, environmental outreach, and diversity & inclusion. She developed data-driven policy reforms and implemented new technologies in the field such as live data collection, management dashboards, robotic process automation, machine learning, and image recognition technology.

Please refer to Attachment D for the full Arcadis Team organization chart that identifies the key individuals and their intended role for this Study. Their resumes follow the organization chart. Please note that Arcadis has a multi-disciplinary staff of more than 5,000 in over 120 offices across the U.S., including our local Plantation office, with a staff of over 25 professionals, supplemented by more than 250 staff throughout Florida. The proposed Arcadis Team includes experienced solid waste professionals with long history of performing the exact services being requested, as well as the deep regional perspective and knowledge unique to Broward County, the SWWG and all the municipalities.

References of the most recent waste generation and composition studies performed by your firm (Provide at least 3 references and use additional sheets to provide more):

Reference 1

Municipality or District Name: Broward County
Type of Study: Solid Waste and Recycling Characterization and Composition Study
When Completed: December 2018
Population or Amount of Waste Disposal by Entity: 1,900,000
Contact Information of Individuals familiar with the project: Notosha Austin, Interim Director, Solid Waste Management, NAUSTIN@broward.org

Reference 2

Municipality or District Name: NYC Department of Sanitation
Type of Study: Waste Management Planning / Data Analysis and Characterization
When Completed: 2017 and On-going
Population or Amount of Waste Disposal by Entity: 8,400,000
Contact Information of Individuals familiar with the project: Justin Bland - Director of Commercial Waste Zoning - jbland2@dny.nyc.gov

Reference 3

Municipality or District Name: The Recycling Partnership
Type of Study: Basic Generation and Capture Studies for Hillsborough County, Sarasota County, City of Peoria, AZ and City of San Diego, CA
When Completed: Hillsborough – 2019, Sarasota – In Progress, Peoria – 2021, San Diego – In Progress
Population or Amount of Waste Disposal by Entity: Hillsborough County – 1,229,226; Sarasota County – 379,448; Peoria, AZ – 175,961; San Diego, CA – 1,423,852
Contact Information of Individuals familiar with the project: Scott Mouw – Senior Director of Strategy and Research- smouw@recyclingpartnership.org

Reference 4

Municipality or District Name: Sarasota County
Type of Study: Waste and Recycling Characterization Studies
When Completed: Waste Study – 2017, Recycling Study - 2020
Population or Amount of Waste Disposal by Entity: 379,448
Contact Information of Individuals familiar with the project: Brian Usher – Solid Waste Director - busher@scgov.net

<p>Reference 5</p>	<p>Municipality or District Name: Lee County Type of Study: Recycling Characterization Study When Completed: 2021 Population or Amount of Waste Disposal by Entity: 770,577 Contact Information of Individuals familiar with the project: Tim LaMontagne – Public Utilities Operations Manager - tlamontagne@leegov.com</p>
<p>Describe your firm’s approach to completing the study:</p>	<p><i>The below provides a task level overview of our Proposed Approach. Please refer to Attachment B for a more detailed description of the Arcadis Team’s approach to the Study. In addition, we have offered an Alternative Proposed Approach, included as Attachment C, which we believe will also meet the intended objectives of the Study, at a significant cost and time savings for the County and the SWWG.</i></p>
<p>Task 1</p>	<p><u>Project Planning and Preparation</u> During the 2018 Recycling Study development for the County and the SWWG, the Arcadis Team successfully demonstrated that a collaborative approach to kick-off the project and in developing the planning approach is integral to another successful project. In general, this task includes conducting a kick-off meeting and preparing the waste generation, waste composition and recycling composition study plan (Plan). A meeting with the County and SWWG to discuss comments and to finalize the Plan will be held. The Plan will be developed based on a one time sort or inclusive of a seasonal sort (two sorts) depending on the results of the comments and discussions at the meetings in this task.</p>
<p>Task 2</p>	<p><u>Quantifying Solid Waste and Recyclables Generation</u> The Arcadis Team issued the Final Solid Waste and Recycling Issues Study Report in December 2018. The data in this report related to waste generation quantities was based on available information from 2014 through 2016. Under this task, the Arcadis Team will update the available data through 2020.</p> <p>* The Arcadis Team is also proposing an Alternative Proposed Approach, in which we offer to update the future waste generation quantities based on available population projections, as described and provided in Attachment C.</p>
<p>Task 3</p>	<p><u>Quantifying Solid Waste by Generator Type</u> The Arcadis Team will quantify by weight the aggregate amount of municipal solid waste generated by single family, multifamily and commercial establishments property categories. The Arcadis Team will propose waste generator rates for the selected property categories and match them to similar rates in other jurisdictions in a side-by-side comparison. Based on data related to the number of properties within the given property categories selected and other metrics, the waste generation rate by generator type will be quantified.</p>
<p>Task 4</p>	<p><u>Waste Material Composition and Generation Stream (as listed in Exhibit B to the Letter)</u> Under this task, the Arcadis Team will perform the waste material composition analysis. We will conduct field work planning activities to organize the sorting operations at a designated facility. For each of two seasonal sorts, the Arcadis Team has budgeted for a two-week waste composition analysis (WCA); one-week bulky waste visual audit; and, a one-week recycling composition analysis (RCA). After the first seasonal sort, the Arcadis Team will prepare an interim deliverable of results and issue to the County and SWWG. After the second seasonal sort, the Arcadis Team will develop a summary report describing the results and analyses performed under all the tasks. We will present the findings to the County and SWWG and issue the Final Report incorporating the comments received.</p> <p>*The Arcadis Team is also proposing an Alternative Proposed Approach, which would instead conduct this task as a Desktop Study, as described and provided in Attachment C.</p>

Task 5	Source-Separated Recyclable Material Composition	
	<p>Under this task, the Arcadis Team will perform the source-separated recyclable material composition analysis (RCA). We will conduct field work planning activities to organize the sorting operations at a designated facility. After the first seasonal sort, the Arcadis Team will prepare an interim deliverable of results and issue to the County and SWWG. After the second seasonal sort, the Arcadis Team will develop a summary report describing the results and analyses performed under all the tasks. We will present the findings to the SWWG and the County and issue the Final Report incorporating the comments received.</p>	
<p>*The Arcadis Team is also proposing an Alternative Proposed Approach, which would instead conduct this task as a Desktop Study, as described and provided in Attachment C..</p>		
Time Estimate and Cost Proposal		
<p><i>Arcadis recognizes that the proposed approach, duration and resources described may change as we move through the negotiation process if we are ultimately selected to conduct the Study. Therefore, the duration and costs below represent planning level estimates that can be used by the County and SWWG to facilitate decision making and cost sharing discussions.</i></p>		
Task 1	<u>Estimated Time (One-Time):</u>	<u>Estimated Time (Seasonal):</u>
	<p>Base Approach: 1-2 months *Alternative Approach: 1-2 months</p>	<p>Base Approach: 1-2 months *Alternative Approach: 1-2 months</p>
Task 1	<u>Cost Proposal (One-Time):</u>	<u>Cost Proposal (Seasonal):</u>
	<p>Base Approach: \$50,000 *Alternative Approach: \$35,000</p>	<p>Base Approach: \$50,000 *Alternative Approach: \$35,000</p>
Task 2	<u>Estimated Time (One-Time):</u>	<u>Estimated Time (Seasonal):</u>
	<p>Base Approach: 3-4 months *Alternative Approach: 3-4 months</p>	<p>Base Approach: 3-4 months *Alternative Approach: 3-4 months</p>
Task 2	<u>Cost Proposal (One-Time):</u>	<u>Cost Proposal (Seasonal):</u>
	<p>Base Approach: \$15,000 *Alternative Approach: \$20,000</p>	<p>Base Approach: \$15,000 *Alternative Approach: \$20,000</p>
Task 3	<u>Estimated Time (One-Time):</u>	<u>Estimated Time (Seasonal):</u>
	<p>Base Approach: 5-6 months *Alternative Approach: 5-6 months</p>	<p>Base Approach: 5-6 months *Alternative Approach: 5-6 months</p>
Task 3	<u>Cost Proposal (One-Time):</u>	<u>Cost Proposal (Seasonal):</u>
	<p>Base Approach: \$85,000 *Alternative Approach: \$85,000</p>	<p>Base Approach: \$85,000 *Alternative Approach: \$85,000</p>
Task 4 - Waste Composition Analysis	<u>Estimated Time (One-Time):</u>	<u>Estimated Time (Seasonal):</u>
	<p>Base Approach: 9-15 months *Alternative Approach: 7-9 months</p>	<p>Base Approach: 15-18 months *Alternative Approach: 7-9 months</p>
Task 4 - Waste Composition Analysis	<u>Cost Proposal (One-Time):</u>	<u>Cost Proposal (Seasonal):</u>
	<p>Base Approach: \$100,000 *Alternative Approach: \$50,000</p>	<p>Base Approach: \$200,000 *Alternative Approach: \$50,000</p>
Task 5 - Recycling Composition Analysis	<u>Estimated Time (One-Time):</u>	<u>Estimated Time (Seasonal):</u>
	<p>Base Approach: 9-15 months *Alternative Approach: 7-9 months</p>	<p>Base Approach: 15-18 months *Alternative Approach: 7-9 months</p>
Task 5 - Recycling Composition Analysis	<u>Cost Proposal (One-Time):</u>	<u>Cost Proposal (Seasonal):</u>
	<p>Base Approach: \$60,000 *Alternative Approach: \$30,000</p>	<p>Base Approach: \$110,000 *Alternative Approach: \$30,000</p>

SOLID WASTE GENERATION AND COMPOSITION STUDY – BASE PROPOSED APPROACH

The following tasks outline our general approach to completing the activities as originally outlined in the County and Solid Waste Working Group (SWWG) Request for Proposals (RFP) letter, dated July 2, 2021. The goal of this scope of work is to determine the waste generation rates and the composition of solid waste and recycling collected by the municipalities and private haulers through sampling and visual auditing. This will be completed through a Waste Composition Study (WCS), Visual Audit of bulky waste such as Construction & Demolition (C&D) debris, and Recyclables Composition Study (RCS). The results of these studies will serve as the basis for the development of special assessments that will serve as one of the major funding sources associated with the development and operation of a new solid waste disposal organization that the County and SWWG is currently considering.

This scope of work is prepared with tasks for both a one-time sorting event as well as a second seasonal sorting event, each of which will include a WCS, RCS, and Visual Audit. The first sorting event will be conducted during the summer (i.e., outside of seasonal resident timeframe); the second sorting event will be conducted during the fall/winter (i.e., during seasonal resident timeframe).

The studies will include residential and commercial waste and recyclables from Broward County municipalities, as well as private haulers providing service to unincorporated County areas.

Due to the large items and heterogeneity of bulky waste, obtaining samples for hand sorting and weighing may not be feasible or provide the most comprehensive data. The Visual Audit will provide an estimated composition by volume and weight of bulky waste, including C&D debris and other bulky material streams as to be determined upon discussions with the County and SWWG.

These studies will provide important and up-to-date data to meet the following objectives:

- Determine the composition of municipal solid waste and recyclables generated in the County.
- Characterize materials by types set forth by the County and SWWG for inclusion in these studies.
- Determine the aggregate amount of recovered materials from material streams designated by the County and SWWG.
- Determine opportunities to minimize waste disposal and maximize recycling and recovery.

Assumptions

The Arcadis Team proposes conducting two sorts (one per season) that will include a two-week WCS sorting event, a one-week RCS sorting event, and one-week Visual Audit to ensure statistical validity in the results, at a designated facility, as identified in coordination with the County and SWWG. This scope of work assumes that pre-selected trucks will be re-routed to the designated facility for sampling during the sorting event.

During the sorting event, the Arcadis Team will provide the following:

- An experienced Field Manager as well as a Sorting Supervisor to oversee all sampling, sorting, weighing, and data recording.
- Two scales (primary and backup), calibrated to 0.02 pounds.
- All sorting equipment, including a customized sorting table, bins, hand tools, and tarps.
- All safety equipment, which includes inner and outer gloves, disposable coveralls, safety glasses, safety vest, and hard hat.
- Primary and backup tablet computers for electronic data recording.
- Laborers to assist with sorting activities at the direction of the Arcadis Team.
- For the effectiveness, efficiency, and safety of workers, drinks, snacks, and lunch will be provided.

SOLID WASTE GENERATION AND COMPOSITION STUDY – BASE PROPOSED APPROACH

The Arcadis Team has assumed the County and SWWG will provide the following:

- A safe, secure location at a designated facility at which loads can be tipped and all sorting activities conducted. The study site location will need to be on a paved area and include a push wall to facilitate mixing, sampling, and loading materials with the loader. It is estimated that a maximum of 12 loads of recyclables and 10 loads of waste could be received in a single day and would need to be sampled and removed.
- A front-end loader and operator to mix loads of recyclables, pull a sample of material, and load roll-off containers at the direction of Arcadis Team staff.
- Roll-off container(s), or a similar apparatus, for the purpose of removing loads of recyclables and waste from the study site after sampling and sorting occurs. These containers may need to be emptied and returned several times throughout each day to prevent a backup of tipped material at the site.
- Assistance in coordinating with municipalities and haulers to provide current collection route information and to reroute selected trucks to the sort location at the designated facility.

Scope of Services

The following tasks describe the anticipated activities necessary for completing the studies.

Task 1 – Project Planning and Preparation

Task 1.1 – Kick-off Meeting and Pre-Planning Activities

Following issuance of Notice-to-Proceed, the Arcadis Team Project Manager will schedule a kickoff meeting with the County and SWWG staff that will be responsible for managing and monitoring the project. It is assumed that the County and SWWG will designate one individual that will serve as the Point of Contact (POC) and will provide all requested data and information. The purpose of the kick-off meeting is to discuss and confirm project goals and expectations, identify available information needed to plan and conduct the studies and audit, project assumptions and constraints, and the proposed methodology for establishing the solid waste generation study.

The Arcadis Team will work with members of the County and SWWG, and representatives of the various municipalities to determine the appropriate parameters for use in implementing studies of this size and scope. In preparation for the kickoff meeting, the Arcadis Team will develop and issue an agenda to be circulated to the Working Group in advance. The agenda will include a list of invitees and their associated email addresses, phone numbers as well as a preliminary information request.

The data to be requested by the Arcadis Team includes, but is not limited to, the following:

- Most recent annual solid waste report issued to the FDEP.
- Data regarding the quantities of solid waste and recyclables collected in the County during the current calendar year to date and previous two calendar years including garbage, recyclables, yard waste, metals/white goods, household hazardous waste, C&D debris, and hand-unload materials. If possible, tonnage data should be broken down by hauler, generator sector, and jurisdiction.
- Current contact information (name, phone number, and e-mail address) for the haulers operating in the unincorporated County.

SOLID WASTE GENERATION AND COMPOSITION STUDY – BASE PROPOSED APPROACH

- Information regarding solid waste and recyclables collection in each municipality, including the name, number, and email of a contact for each municipality and for each municipality's collection service provider.
- Additional information that may be requested as noted in the Tasks below.

Discussion items will include, but not be limited to project goals and expectations, project constraints, such as use of readily-available existing data, time and budgetary constraints, project assumptions, proposed project schedule, and proposed methodology for developing the Plan. A project schedule will be developed and provided to the Working Group within five (5) business days of the Kickoff Meeting.

Deliverables

Sign-In Sheet Noting Attendees

Summary Notes Identifying Key Project Decisions, Goals and Expectations

Project Schedule

Preliminary Request for Information

Task 1.2 – Plan Development

The Arcadis Team shall develop a plan for the review, research, and analysis necessary to prepare a waste generation and composition study ("Plan"). Prior to starting work on any other Task below, the Arcadis Team shall provide the Plan to the County and SWWG for approval, which shall be granted at the County and SWWG's sole discretion. The Plan shall highlight statistically valid sampling methods of the local waste stream from various generation points within the County and aim to represent the entirety of Broward County, inclusive of unincorporated County, and all municipalities, including those that were not party to the original Resource Recovery System. The Plan shall include but not be limited to the proposed methodology to complete the remaining tasks as further described below and in each task description:

1. Review data provided by the County and SWWG on the municipal waste and recycling tonnages, collection providers, and processors.
2. As part of Task 2 below, develop an overview of historical waste quantity data, including seasonality and any impacts as a result of COVID-19. The Plan shall review sources of data to determine the aggregate amount of municipal solid waste and recyclables broken down by disposal, incineration, and recycling, as well as generation streams. The summary and analyses of the historical waste quantity data will be completed under Task 2 below.
3. Coordinate with County and SWWG staff to identify potential dates and confirm location for the sorting events.
4. Develop a preliminary sampling schedule specifying the proposed number of waste and recyclables samples to be pulled from each generator sector and jurisdiction.
5. Develop a draft sampling and sorting protocol. The protocol will detail the following:
 - a. Responsibilities of the SWWG, County and Arcadis Team staff throughout the sorting events.
 - b. Method by which samples will be taken from selected loads (i.e., mixing of loads and grab sample location).
 - c. Sorting procedures to be followed throughout the sorting events to complete the studies safely and successfully.
 - d. Weighing and analytical procedures by which sorted materials will be weighed during and analyzed following the sorting events.
 - e. Visual Audit procedures, methodologies, and material categories.

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6. Develop a draft list of material categories, along with definitions and examples, into which waste and recyclables will be sorted. The material categories provided as Exhibit B to the July 2nd letter will be used as a template for the draft list.
7. Develop a draft site safety plan.
 8. Provide the draft sampling schedule, sampling and sorting protocol, material categories list, and site safety plan to County and SWWG staff to review.
 9. Develop the methodology used to analyze waste generation and composition.
 10. Develop the methodology used to analyze recycling generation and composition.
 11. Work with County and SWWG staff to revise and finalize the planning documents based on comments received.
 12. Conduct a site visit to the proposed sorting location at the designated facility to review logistics of the studies.
 13. Work with County and SWWG staff to finalize the logistics of conducting the sorting events at the County and SWWG designated facility and coordinate equipment needs and plans for project mobilization.

The Arcadis Team will submit a draft Plan for County and SWWG review, and will schedule a meeting to discuss comments and next steps. The Arcadis Team will incorporate comments and issue the Final Plan.

Deliverables

Draft and Final Plan

Draft and Final Sampling Schedule

Draft and Final Materials Categories List with definitions and examples

Draft and Final Site Safety Plan

Plan Review Meeting Agenda, Sign-in Sheet Noting Attendees and Meeting Summary Notes

Task 2 – Solid Waste Generation Study



Task 2.1 – Historical Solid Waste Generation Data Review

The Arcadis Team will quantify by weight the aggregate amount of municipal solid waste and recyclables as defined by Florida Statutes, generated in Broward County. The information shall be gathered as detailed in the Plan and include waste intended for disposal, incineration, or recycling.

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The Arcadis Team, as part of a prior Recycling Study effort for the County and Working Group, issued a Final Study Report in December 2018. The data in this report related to waste generation quantities was based on available information from 2014 through 2016. The Arcadis Team will expand on this information to present the same waste quantity data through the latest available information which is assumed to be 2020.

As part of the historical waste generation update, the Arcadis Team will request and review the following (as available):

- Annual reports to the Florida Department of Environmental Protection (FDEP), focusing primarily on 2016-2020;
- Backup information and documentation from the 2017 through 2020 annual reports, including certified and non-certified recycling tonnage, C&D debris reports, County's MSW Management Worksheets, and facility reports; and
- Tonnage clarifications provided by SWWG staff and County Solid Waste and Recycling Services (SWRS) staff, if such clarifications are available.

Based on this data, the Arcadis Team will compile the following information for each of the four years since prior Study Report was completed (2017 through 2020):

- Types and quantities of materials recycled; and
- Quantities of solid waste disposed or incinerated, broken down by Class I solid waste, bulky waste, C&D debris, and yard trash.

The information will be updated and provided in tabular format and included as a section in the Task 3 deliverable.

Deliverables

Draft Section for Task 3 Deliverable

Task 3 – Solid Waste Materials by Generator Type



The Arcadis Team will quantify by weight the aggregate amount of municipal solid waste generated from the multiple generation streams. The generation streams primarily consist of single family, multifamily and

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commercial establishments. We have an understanding of the various definitions of what comprises single family, multifamily and commercial establishments with Broward municipalities and how their waste is collected.

Using the data as available provided by County to the FDEP, the Arcadis Team will summarize the waste generated and recycled by single-family residential, multi-family residential, and commercial establishments and how their waste is collected.

The Arcadis Team will request and review information from the Broward County Property Appraiser related to existing use codes. These codes will serve as the basis for developing the property categories to be used for the desktop waste generation rates by property code. We will ultimately coordinate the categories into five waste generator rate ranges.

Based on our understanding of the County and SWWG goal, which is to develop a special assessment, waste generator rates by generator type category including sub-categories, will be developed. The approach we have outlined here uses a generator-based waste generation rate category assessment to develop waste generation rates by property type.

The Arcadis Team will issue an information request to determine if the following metrics are available as applicable:

- Number of residential and commercial properties serviced within each property code.
- Number of employees and staff (part-time and full time).
- Square footage of improved property.
- Number of parking spots.
- Other metrics used by other waste generation studies that may be relevant for this study.

The Arcadis Team will match the Broward County property codes with other communities' waste generation and property codes in order to conduct a side-by-side comparison. During this process, the Arcadis Team will work with the County and SWWG to propose a methodology for classifying and grouping categories based on similar waste generation rates.

Using the data provided, and the waste generation rates established as part of this Task, the Arcadis Team will calculate the estimated total waste generated by generator type (i.e., property category). The total waste generated will be compared to the historical waste generation data summarized in Task 2.1 to determine the percentage difference and reasonableness of the initial waste generation rate assumptions. Adjustments in rates will be considered if required to correspond to the estimated method versus the measured value.

The Arcadis Team will prepare and issue a memorandum summarizing the waste generation quantification study approach, data sources, validation and results. This memorandum will also summarize the existing waste generation study methodologies as well as identify the other communities waste generation rates by property codes that were used for the side-by-side comparison. A meeting with the County and SWWG will be held in order to discuss the results.

Deliverables

- Draft Solid Waste Materials by Generator Type Memo
- Waste Generation Study Methodologies for Grouping Generator Type Review Meeting

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- Final Solid Waste Materials by Generator Type Memo
- Meeting Summary Notes and Sign-In Sheet

Tasks 4 & 5 – Waste and Recycling Composition Analyses

The following presents the Arcadis Team's approach to performing the waste and recycling composition analyses.

Task 4.1 – Field Work Planning

Using the Plan that Arcadis Team, County and SWWG staff developed and finalized under Task 1, the Arcadis Team will work with County and SWWG staff to conduct all logistical planning activities for conducting the field work for the studies including the following:

1. Work with County and SWWG staff to finalize the details regarding the timing and sorting location at the designated facility and to coordinate equipment needs and plans for project mobilization.
2. Work with municipalities and haulers to coordinate for the delivery of selected routes during the studies.
3. Prepare placards to be distributed to drivers of selected routes notifying them of their inclusion in the studies.
4. Conduct all pre-field work mobilization activities including obtaining necessary equipment and supplies, coordinating for temporary labor, and communicating with appropriate County and SWWG staff.

Task 4.2 - Conduct the Season One Sorting Event

The Arcadis Team will mobilize its crew and sorting equipment to conduct the onsite sampling and hand-sorting of waste and recyclables in accordance with the County and SWWG-approved Plan. The Arcadis Team anticipates for budgeting purposes to conduct a two-week WCS and one-week RCS. The exact dates will be determined in Task 1. The activities included in this subtask include the following:

1. Mobilize the Arcadis Team's Field Manager, Sorting Supervisor, and sorting equipment.
2. Provide local day laborers to assist with the sorting event. If the County and SWWG or municipalities are able to provide dedicated staff for the duration of the sorting event, the number of day laborers will be reduced accordingly.
3. Conduct the sorting event. The sorting event will take place Monday through Friday over a two-week period for the WCS and a one-week period for the RCS. The Arcadis Team will follow the County and SWWG-approved Plan detailed and approved under Task 1. For budgeting purposes, we assume the following to be performed during the event:
 - a. The Arcadis Team's Field Manager leads daily training sessions to review proper sorting techniques and safety protocols. While we encourage our day laborers to work the entire sort with us, the daily training sessions ensure that all workers understand their roles and responsibilities if the day laborers change.
 - b. The Arcadis Team's Field Manager and Sorting Supervisor continually observe the material category bins to ensure proper sorting and record weight data on our iPad® tablet to ensure accurate data recording. The spreadsheet for each sample is immediately saved to the tablet, and all data is backed up to the cloud each evening for data security.

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Task 4.3 - Conduct the Season One Bulky Waste Visual Audit

The Arcadis Team will provide a staff person to conduct the on-site Visual Audit of bulky waste materials in accordance with the County and SWWG-approved Plan. The Arcadis Team anticipates conducting a five-day Visual Audit. The exact dates of the audit will be determined during Task 1 and may or may not be concurrent with the Season One sorting event (Task 4.2). The activities to be conducted include the following:

1. Obtain and mobilize the necessary equipment and supplies.
2. Mobilize Arcadis Team's visual auditor.
3. Conduct the Visual Audit. The Visual Audit will take place Monday through Friday over a one-week period. The Arcadis Team estimates that approximately 70-90 loads will be audited over the five days, depending on arrival frequency of loads and ability to hold loads on the ground until they are audited, if necessary. The Arcadis Team will follow the Visual Audit methodology developed in the County and SWWG-approved Plan.

Task 4.4: Analyze Data and Prepare Interim Technical Memorandum

The Arcadis Team will analyze the sorting event data in order to determine the Broward County waste and recyclable composition. The following activities will be performed under this subtask:

1. Analyze data to calculate the average composition for each generator sector, as well as the County and SWWG-wide composition. Additionally, 90 percent confidence intervals will be calculated as appropriate.
2. Prepare a draft report based on the results that includes the following:
 - a. Summary of goals, objectives, and methodologies.
 - b. Statistically valid composition of County and SWWG-wide waste and recyclables.
 - c. Discussion of findings and conclusions.
 - d. Discussion of major types of contamination in the recyclables stream. These include both contaminants that constitute a significant proportion of the material, as well as more problematic contaminants for recyclables processing.
 - e. Discussion of major types of recoverable materials in the waste stream. These include accepted recyclables, compostable materials, and other potential recoverables.
 - f. Analyze the Visual Audit data to calculate the percentage by volume of each material category for each generator sector. Results will be converted from volume to weight using industry-developed conversion factors. This analysis will include estimating the percentage of recoverable or recyclable C&D debris.
3. Discuss the report with appropriate County and SWWG personnel.
4. Finalize and submit the report based on comments and discussions with County and SWWG staff.

Deliverables

Draft and final Season One Composition Study Technical Memorandum.

Task 4.5: Development of Protocols and Schedule for Season Two Field Work

The Arcadis Team will develop the parameters, methodology, and schedule to be used during the Season Two field work for obtaining statistically valid results. These will be largely similar or identical to Season One as developed under Task 1 and refined based on the previous Season One Task 4 sub-tasks.

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Task activities listed under Tasks 1 and 2 will be repeated as necessary based on updated information from the County and SWWG or as a result of the Season One field work.

Task 4.6: Conduct the Season Two Sorting Event

The Arcadis Team will mobilize its crew and sorting equipment to conduct the onsite sampling and hand-sorting of waste and recyclables in accordance with the County and SWWG-approved Plan. The Arcadis Team anticipates conducting a two-week WCS and one-week RCS. The exact dates will be determined in Task 4.5. Task activities will be identical to Task 4.2 above.

Task 4.7: Conduct the Season Two Visual Audit

The Arcadis Team will provide a staff person to conduct the onsite Visual Audit of bulky waste in accordance with the County and SWWG-approved Plan. The Arcadis Team anticipates conducting a five-day Visual Audit. The exact dates of the audit will be determined during Task 4.5 and may or may not be concurrent with the Season Two sorting event (Task 4.6). Task activities will be identical to Task 4.3 above.

Task 4.8: Analyze Season Two Data and Prepare Report

The Arcadis Team will analyze the data from the Season Two sorting event and combine it with Season One data to determine the composition of waste and recyclables received by the County and SWWG. The activities performed under this task will include the following:

1. Analyze data using the same methodology as Task 5.
2. Combine data from Season One and Two sorting events to calculate the annual solid waste and recycling composition for each generator/material stream.
3. Using information provided by County and SWWG staff, incorporate the tonnages of all other County and SWWG waste received at all facilities into the results to estimate the overall composition of waste generated within the County and SWWG to be used for FDEP's annual Solid Waste Report.
4. Prepare a draft report that includes the goals, objectives, methodologies, results, findings, and recommendations. The report will include a comparison of data from each season and a summary of any seasonal differences.
5. Discuss the report with appropriate County and SWWG personnel.
6. Finalize and submit the report based on comments and discussions with County and SWWG staff.

Task 4.9 Findings and Presentation

In accordance with the results of all previous tasks, the Arcadis Team will prepare a Draft Solid Waste Generation and Composition Report. The Draft Report will be issued to the County and SWWG via e-mail and a PowerPoint Presentation will be developed and delivered as part of a 2-hour meeting. A presentation will be prepared to present the findings to the County and SWWG as well as solicit comments. The Final Report, incorporating County and SWWG comments, will then be issued.

Deliverables

- Draft Waste Generation and Composition Report
- Meeting Agenda and Presentation summarizing results of the Draft Waste Generation and Composition Report
- Meeting Summary Notes, Sign-In Sheet
- Final Waste Generation and Composition Report

SOLID WASTE GENERATION AND COMPOSITION STUDY – BASE PROPOSED APPROACH

Task 5 – Recycling Composition Analysis

The Task 5 Recycling Composition Analyses were grouped with the Task 4 Waste Composition Analysis to avoid repetition of similar tasks. The estimated fee is separated to understand the differences in budget required. The results will be provided in the Draft and Final Waste Generation and Composition Report as part of Task 4.

COMPENSATION AND SCHEDULE

Arcadis Team estimates to complete all Tasks in this Base Proposed Approach to be approximately \$310,000 for a one-time sorting event and approximately \$460,000 for seasonal sorting events. The table below summarizes the estimated fee by task separated between One-Time and Seasonal (second sort) and estimated duration.

Task Number	Task Description	One-Time Proposal		Seasonal Fee	
		One-Time Estimated Fee	Schedule	Seasonal Estimated Fee	Schedule
1	Project Planning and Preparation	\$50,000	1-2 Months	\$50,000	1-2 Months
2	Quantifying Solid Wastes and Recyclables Generation	\$15,000	3-4 Months	\$15,000	3-4 Months
3	Quantifying Solid Waste by Generator Type	\$85,000	5-6 Months	\$85,000	5-6 Months
4	Waste Material Composition and Generator Stream	\$100,000	9-15 Months	\$200,000	15-18 Months
5	Source-Separated Recyclable Material Composition	\$60,000	9-15 Months	\$110,000	15-18 Months
Total		\$310,000	15 Months	\$460,000	18 Months

SOLID WASTE GENERATION AND COMPOSITION STUDY – ALTERNATIVE PROPOSED APPROACH

As we have been intimately involved in the SWWG meetings over the last two years, and prepared the prior 2018 Study Report, we recognized that several of the items that are being requested in your July 2nd letter were previously completed as a desktop level assessment and the results were included in our 2018 Study Report. Therefore, we believe that the County and SWWG may find value and benefit, and significant cost and time savings, with a similar desktop exercise, through updating the historical data on a desktop basis in order to reduce the upfront investment cost associated with the establishing the waste generation and special assessment rates. As such, in addition to our Base Proposed Approach, the Arcadis Team is pleased to provide this alternate approach, based on a desktop level assessment, for your consideration. We believe this alternate approach will provide a very similar result given the intended purpose for this assessment and offers the opportunity for significant cost and time savings for the County and SWWG.

The following tasks outline our general approach to completing the activities as originally outlined in the County and Solid Waste Working Group (SWWG) Request for Proposals (RFP) letter, dated July 2, 2021. The goal of this scope of work is to determine the waste generation rates and the composition of solid waste and recycling collected by the municipalities and private haulers through desktop analysis. This will be completed through a Waste Composition Study (WCS), and Recyclables Composition Study (RCS). The results of these studies will serve as the basis for the development of special assessments that will serve as one of the major funding sources associated with the development and operation of a new solid waste disposal organization that the County and SWWG is currently considering. The Arcadis Team, as part of a prior Recycling Study effort for the County and Working Group, issued a Final Study Report in December 2018. The data in this report related to waste generation quantities was based on available information from 2014 through 2016. As part of this alternative proposed approach, instead of conducting a waste sort, the Arcadis Team will expand on the information presented in the 2018 Recycling Study by conducting a desktop level assessment utilizing most recent existing waste quantity data which is assumed to be 2020, therefore, no sorting activities will be required.

The studies will include residential and commercial waste and recyclables from Broward County municipalities, as well as private haulers providing service to unincorporated County areas.

These studies will provide important and up-to-date data to meet the following objectives:

- Determine the composition of municipal solid waste and recyclables generated in the County.
- Characterize materials by types set forth by the County and SWWG for inclusion in these studies.
- Determine the aggregate amount of recovered materials from material streams designated by the County and SWWG.
- Determine opportunities to minimize waste disposal and maximize recycling and recovery.

Scope of Services

The following tasks describe the anticipated activities necessary for completing the studies.

Task 1 – Project Planning and Preparation

Task 1.1 – Kick-off Meeting and Pre-Planning Activities

Following issuance of Notice-to-Proceed, the Arcadis Team Project Manager will schedule a kickoff meeting with the County and SWWG staff that will be responsible for managing and monitoring the project. It is assumed that the County and SWWG will designate one individual that will serve as the Point of Contact (POC) and will provide all requested data and information. The purpose of the kick-off meeting is to discuss and confirm project goals and expectations, identify available information needed to plan and

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conduct the studies and audit, project assumptions and constraints, and the proposed methodology for establishing the solid waste generation study.

The Arcadis Team will work with members of the County and SWWG, and representatives of the various municipalities to determine the appropriate parameters for use in implementing studies of this size and scope. In preparation for the kickoff meeting, the Arcadis Team will develop and issue an agenda to be circulated to the Working Group in advance. The agenda will include a list of invitees and their associated email addresses, phone numbers as well as a preliminary information request.

The data to be requested by the Arcadis Team includes, but is not limited to, the following:

- Most recent annual solid waste report issued to the FDEP.
- Data regarding the quantities of solid waste and recyclables collected in the County during the current calendar year to date and previous two calendar years including garbage, recyclables, yard waste, metals/white goods, household hazardous waste, C&D debris, and hand-unload materials. If possible, tonnage data should be broken down by hauler, generator sector, and jurisdiction.
- Current contact information (name, phone number, and e-mail address) for the haulers operating in the unincorporated County.
- Information regarding solid waste and recyclables collection in each municipality, including the name, number, and email of a contact for each municipality and for each municipality's collection service provider.

- Additional information that may be requested as noted in the Tasks below.

Discussion items will include, but not be limited to project goals and expectations, project constraints, such as use of readily-available existing data, time and budgetary constraints, project assumptions, proposed project schedule, and proposed methodology for the desktop assessment. A project schedule will be developed and provided to the Working Group within five (5) business days of the Kickoff Meeting.

Deliverables

- Sign-In Sheet Noting Attendees
- Summary Notes Identifying Key Project Decisions, Goals and Expectations
- Project Schedule
- Preliminary Request for Information

Task 1.2 – Plan Development

The Arcadis Team shall develop a plan for the review, research, and analysis necessary to prepare a waste generation and composition study ("Plan"). Prior to starting work on any other Task below, the Arcadis Team shall provide the Plan to the County and SWWG for approval, which shall be granted at the County and SWWG's sole discretion. The Plan shall highlight statistically valid data analysis methods of the local waste stream from various generation points within the County and aim to represent the entirety of Broward County, inclusive of unincorporated County, and all municipalities, including those that were not party to the original Resource Recovery System. The Plan shall include but not be limited to the proposed methodology to complete the remaining tasks as further described below and in each task description:

1. Review data provided by the County and SWWG on the municipal waste and recycling tonnages, collection providers, and processors.

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2. As part of Task 2 below, develop an overview of historical waste quantity data, including seasonality and any impacts as a result of COVID-19. The Plan shall review sources of data to determine the aggregate amount of municipal solid waste and recyclables broken down by disposal, incineration, and recycling, as well as generation streams. The summary and analyses of the historical waste quantity data will be completed under Task 2 below.
3. Summarize the methodology used to analyze waste generation and composition.
4. Summarize the methodology used to analyze recycling generation and composition.
5. Work with County and SWWG staff to revise and finalize the planning documents based on comments received.

The Arcadis Team will submit a draft Plan for County and SWWG review, and will schedule a meeting to discuss comments and next steps. The Arcadis Team will incorporate comments and issue the Final Plan.

Deliverables

- Draft and Final Plan
- Plan Review Meeting Agenda, Sign-in Sheet Noting Attendees and Meeting Summary Notes

Task 2 – Solid Waste Generation Study



Task 2.1 – Historical Solid Waste Generation Data Review

The Arcadis Team will quantify by weight the aggregate amount of municipal solid waste and recyclables as defined by Florida Statutes, generated in Broward County. The information shall be gathered as detailed in the Plan and include waste intended for disposal, incineration, or recycling.

The Arcadis Team, as part of a prior Recycling Study effort for the County and Working Group, issued a Final Study Report in December 2018. The data in this report related to waste generation quantities was based on available information from 2014 through 2016. The Arcadis Team will expand on this information to present the same waste quantity data through the latest available information which is assumed to be 2020.

As part of the historical waste generation update, the Arcadis Team will request and review the following (as available):

- Annual reports to the Florida Department of Environmental Protection (FDEP), focusing primarily on 2016-2020;

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- Backup information and documentation from the 2017 through 2020 annual reports, including certified and non-certified recycling tonnage, C&D debris reports, County's MSW Management Worksheets, and facility reports; and
- Tonnage clarifications provided by SWWG staff and County Solid Waste and Recycling Services (SWRS) staff, if such clarifications are available.

Based on this data, the Arcadis Team will compile the following information for each of the four years since prior Study Report was completed (2017 through 2020):

- Types and quantities of materials recycled; and
- Quantities of solid waste disposed or incinerated, broken down by Class I solid waste, bulky waste, C&D debris, and yard trash.

Task 2.2: Estimate Solid Waste Quantity Projection

The Arcadis Team will update the previous review of population projections throughout the County to determine future population centers and densities from existing data. To update this estimate, the Arcadis Team will:

- Review population data acquired or obtained from other publicly available sources.
- Develop a methodology to forecast population growth, which will be reviewed and discussed with the Working Group.
- Forecast population growth over the planning period. Forecasts may be further broken down into high, low and most probable population estimates within specific geographic zones.
- Based on population projections, estimate future waste and recycling volumes, which may also be broken down in into specific geographic zones. The high, low, and probable estimates will be used to evaluate and determine the general location of solid waste facilities within a minimum of six separate geographic zones.
- Prepare a section for the deliverable in the next task summarizing the results of the above.

The information for these two subtasks will be included and updated in tabular and/or graphic format and included as a section in the Task 3 deliverable.

Deliverables

- Draft Section for Task 3 Deliverable

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Task 3 – Solid Waste Materials by Generator Type



Using the data as available provided by County to the FDEP, the Arcadis Team will summarize the waste generated and recycled by single-family residential, multi-family residential, and commercial establishments and how their waste is collected.

The Arcadis Team will request and review information from the Broward County Property Appraiser related to existing use codes. These codes will serve as the basis for developing the property categories to be used for the desktop waste generation rates by property code. We will ultimately coordinate the categories into five waste generator rate ranges.

Based on our understanding of the County and SWWG goal, which is to develop a special assessment, waste generator rates by generator type category including sub-categories, will be developed. The approach we have outlined here uses a generator-based waste generation rate category assessment to develop waste generation rates by property type.

The Arcadis Team will issue an information request to determine if the following metrics are available as applicable:

- Number of residential and commercial properties serviced within each property code.
- Number of employees and staff (part-time and full time)
- Square footage of improved property
- Number of parking spots
- Other metrics used by other waste generation studies that may be relevant for this study

The Arcadis Team will match the Broward County property codes with other communities' waste generation and property codes in order to conduct a side-by-side comparison. During this process, the Arcadis Team will work with the County and SWWG to propose a methodology for classifying and grouping categories based on similar waste generation rates.

Using the data provided, and the waste generation rates established as part of this Task, the Arcadis Team will calculate the estimated total waste generated by generator type (i.e., property category). The total waste generated will be compared to the historical waste generation data summarized in Task 2.1 to

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determine the percentage difference and reasonableness of the initial waste generation rate assumptions. Adjustments in rates will be considered if required to correspond to the estimated method versus the measured value.

The Arcadis Team will prepare and issue a memorandum summarizing the waste generation quantification study approach, data sources, validation and results. This memorandum will also summarize the existing waste generation study methodologies as well as identify the other communities waste generation rates by property codes that were used for the side-by-side comparison. A meeting with the County and SWWG will be held in order to discuss the results.

Deliverables

- Draft Solid Waste Materials by Generator Type Memo
- Waste Generation Study Methodologies for Grouping Generator Type Review Meeting
- Final Solid Waste Materials by Generator Type Memo
- Meeting Summary Notes and Sign-In Sheet

Tasks 4 & 5 – Waste and Recycling Composition Analyses

Task 4.1: Update Solid Waste and Recycling Composition

The Arcadis Team will analyze previous report data and update the estimate of Broward County's Solid Waste and Recycling Composition. In order to update the information, the Arcadis Team will:

- Review existing data on the quantities and, to the extent available, composition of waste disposed within the County.
- Use available waste composition data from other neighboring or urban Florida counties to assist in estimating the County's waste composition.
- Update the calculations upon which the Arcadis model is based specifically for the County to obtain more current and useful output data.

A section of the report to update the solid waste and recycling composition will be developed based on the outputs from the above-noted activities. This section of the report will note the estimated waste composition (materials, estimated tonnage, and sources), and document the methodology by which the estimate was made.

Task 4.2 Findings and Presentation

In accordance with the results of all previous tasks, the Arcadis Team will prepare a Draft Solid Waste Generation and Composition Report. The Draft Report will be issued to the County and SWWG via e-mail and a PowerPoint Presentation will be developed and delivered as part of a 2-hour meeting. A presentation will be prepared to present the findings to the County and SWWG as well as solicit comments. The Final Report, incorporating County and SWWG comments, will then be issued.

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Deliverables

- Meeting Agenda and Presentation summarizing results of the Draft Waste Generation and Composition Report
- Draft Waste Composition Report
- Meeting Summary Notes, Sign-In Sheet
- Final Waste Composition Report

COMPENSATION AND SCHEDULE

The Arcadis Team estimates to complete all Tasks in this Alternative Proposed Approach to be approximately \$220,000. The table below summarizes the estimated fee by task and estimated duration.

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Task Number	Task Description	Estimated Fee	Schedule
1	Project Planning and Preparation	\$35,000	1-2 months
2	Quantifying Solid Wastes and Recyclables Generation	\$20,000	3-4 months
3	Quantifying Solid Waste by Generator Type	\$85,000	5-6 months
4	Waste and Recycling Composition Analyses	\$80,000	7-9 months
Total		\$220,000	9 Months

**Broward County
and
Solid Waste Working Group**

**Project Manager/
Solid Waste Practice Lead**

Leah Richter, PE

Solid Waste Generation Study

Leah Richter, PE
Joseph Krupa, PE
Jane Wu
Mitch Kessler
Chas Jordan
Ryan Gaunke
Alicia Archibald

Waste Composition Analysis

Chas Jordan
Ryan Gaunke
Alicia Archibald
Joseph Krupa, PE
Jane Wu
Garth White

Recycling Composition Analysis

Chas Jordan
Ryan Gaunke
Alicia Archibald
Joseph Krupa, PE
Jane Wu
Garth White



Leah Richter, PE

Project Manager / Solid Waste Practice Lead

Key Information

Education/Qualifications

- MS, Civil Engineering, Florida Atlantic University, 2002
- BS, Environmental Engineering, University of Florida, 1997
- Program Management, Academy - Leading Complexity University of Oxford - Said Business School

Years of Experience

Total – 24

Professional Registrations/ Certifications

- Professional Engineer – FL

Office Location

Plantation, FL

Ms. Richter has a diverse background in environmental and civil engineering. She specializes in solid waste projects involving waste-to-energy, materials recovery, recycling, and landfilling. She is primarily responsible for assisting municipal clients with managing their solid waste management planning, operational, and capital program needs. Her experience includes program management and delivery, transactional consulting and due diligence, vendor procurement, contract compliance, regulatory permitting, public outreach, annual reporting to bondholders/trustees, litigation support services, solid waste advisory committee support, environmental compliance, debris management oversight, and operation and maintenance evaluation. Most recently, Ms. Richter served as the Project Manager for Broward County's Recycling Study focusing on the future of solid waste management in the county, as well as has worked with Broward County for the entirety of her career in our role as Consulting Engineer for the County's solid waste management system for decades.

Relevant Experience

Recycling Study and Renewable Energy Facility Feasibility Broward County, FL

Served as Project Manager for the County's study focused on how to achieve the state mandated 75% recycling goal and developing a path forward for the future governance and infrastructure necessary for long-term solid waste management within Broward County. Evaluated whether retaining public ownership of a county-owned property would facilitate the meeting of that recycling goal or would provide other benefits in connection with solid waste disposal within Broward County. Prepared conceptual-level construction cost estimates of facilities required to meet a 75% recycling goal as a decision-making tool for the purpose of evaluating the relative financial impact of different alternatives based on parameters such as the current and projected quantity and quality of solid waste and recyclables, required daily processing capacity of solid waste or recyclable materials and estimated size of the proposed alternatives. Presented results to all stakeholders, including County and municipal partner representatives, in support of long-term decision making and governance planning.

Solid Waste Visioning and Strategic Planning

**Broward County Waste and Recycling Services,
Broward County, FL**

Served as Deputy Project Manager for the visioning and strategic planning undertaken by Broward County upon the expiration of the ILA between the County and the member cities for solid waste. Broward County was approaching a critical turning point in which the management of their solid waste which would require stakeholder alignment and business/financial analyses to determine the next generation of solid waste management. In support of the County and building from our decades of working with the County as their Owner's Agent for their solid waste management system, Arcadis facilitated a "Trash Summit" to bring city managers, mayors, and other key stakeholders together to review the past, present, and potential future scenarios for the District.

Broward County Resource Recovery and Solid Waste Management Consulting Engineer of Record

Broward County, Florida

Served as Deputy Project Manager and Project Manager for the waste-to-energy facilities' operations monitoring and solid waste program management for more than 15 years. Responsible for preparing annual reports which included analyses of operating trends, assessments of facility physical conditions, and opinions of environmental compliance and maintenance practices. Other projects included Waste Composition Studies, Technical Advisory Committee assistance, Resource Recovery Board assistance, landfill gas evaluation, ash monofill life expectancy evaluation and expansion design, miscellaneous landfill improvements, materials recycling facility assessment, and leachate management evaluation.

FY 2015 Waste Stream Recyclables Analysis

City of Miramar

Conducted a third-party review of the recyclable material sampling plan, methodology and protocol to determine the quantity of recyclable materials in the City's waste stream. Conducted a review of the sampling results and provided comments to the city for review and consideration.

2020 Master Planning Activities Preliminary Feasibility Report

**Solid Waste Authority (SWA) of Palm Beach County,
West Palm Beach, FL**

Served as Principle in Charge for the development of the Authority's 2020 Master Plan, focusing on Renewable Energy Facilities (REFs), ash reuse, and ash metals recovery over a 40-year planning period. The overall objective of this study, relative to the planning period, is to determine the size, site options, and implementation schedule of the required REF expansion capacity and to provide a preliminary planning analysis of the potential options for and fatal flaws that would inhibit developing that capacity preferably within the boundaries of the Authority's existing 1,300-acre Palm Beach Renewable Energy Park (PBREP). Analysis also included waste generation modeling, waste capacity projections.

Waste-to-Energy Feasibility Study

King County, Seattle, WA

Served as Principle in Charge and QA/QC for the completion of a feasibility study focused on identifying an alternative waste disposal strategy for King County, WA as the County's current disposal option will reach its capacity in the coming years. Arcadis evaluated the feasibility of using waste-to-energy as the County's next disposal method. Key outcomes of our analysis included: comparison of waste to energy and waste export by rail; development of several realistic WTE and intermodal scenarios on which to base comparison; a realistic assessment of the barriers and risks to successfully implementing each scenario; development of conceptual site layouts for the WTE options; evaluation of the comparative permitting and greenhouse gas impacts of each scenario; and preliminary planning level cost estimates for each scenario to provide a basis for comparison and long term decision making.

New Renewable Energy Facility

Solid Waste Authority of Palm Beach County, West Palm Beach, FL

Serves as Principle in Charge and Program Manager for the planning, permitting, procurement, financing, public outreach and conceptual design for the overall implementation of a new 3,000-ton-per-day (tpd) waste-to-energy facility adjacent to the authority's existing

North County Resource Recovery Facility (NCRRF). Key activities include development of a request for qualifications and request for proposals of a design-build-operator, development of application documents required under the Power Plant Siting Act, development of a design criteria package to be utilized during the procurement process, development and implementation of an extensive public outreach program and overall program management activities to support the development of this estimated \$700 million capital project, the first of its kind in more than 15 years.

Miami-Dade County Bond Engineering Services
Department of Solid Waste Management, Miami-Dade County, FL

Serves as Principle in Charge for all of Arcadis' activities conducted under the Bond Engineering contract, which provides for comprehensive oversight and support related to all facets of the County's integrated solid waste management system, which includes waste to energy, resource recovery, landfilling, recycling, as well as residential and commercial collections. Key projects and activities include: Resources Recovery Facility Operations Monitoring and Annual Reporting, Annual System Inspections and Reporting, Revenue Bond Refunding and Issuance Consulting Engineer's Feasibility Reports, Annual Adequacy of Rates and Fees, Munisport Landfill Closure, Virginia Key Landfill Closure.

Waste to Energy Facility Inspections
Solid Waste Authority of Palm Beach County, West Palm Beach, FL

Serves as Principle in Charge for the operations monitoring program for the refuse-derived fuel (RDF) waste-to-energy facility PBREF No. 1 and the new mass burn Facility PBREF No. 2. Responsible for overall project management and assists with performing facility inspections both facilities.

This includes assessing the operation of the facilities, as well as addressing safety concerns, maintenance issues, environmental compliance, and adherence to service agreements as well as preparation of Annual Reports documenting condition for the bondholders.

Program Feasibility Assessment
Emerald Coast Utilities Authority, Pensacola, FL

Served as Project Manager to support the Emerald Coast Utilities Authority (ECUA) with its planning for the development and implementation of enhanced recycling and energy recovery programs, which was conducted in two phases. Building upon the due diligence review of Envirepel's proposal to ECUA, Phase 2 included the review of the broader feasibility of the overall program envisioned by ECUA and a review of the technical, financial, regulatory and institutional concerns to evaluate the proposed program against ECUA requirements.

Utilities Waste Rate Study
City of Key West, Key West, FL

Developed a financial model for the City's solid waste utility department. Activities included reviewing revenue characteristics (historical and budget), and other documentations provided to support revenue and expense projections; developed a comprehensive financial model to project cash flow for a five-year period, completed pricing surveys, and developed rate recommendations. Presented recommendations to the City.

McKay Bay Solid Waste and Resource Recovery Engineer of Record
City of Tampa, Tampa, FL

Serves as Project Manager for the operations monitoring and environmental compliance of the 1,000 tpd mass burn waste-to-energy facility and attached transfer station and scalehouse owned by the City of Tampa. Oversees the operations monitoring efforts, inspections and punchlist development, including performance of annual and monthly facility inspections; general project management; monitoring of maintenance repairs and facility outages; review of spare parts inventory; development of facility punchlist reports; review of environmental and permit related issues; and general facility safety and environmental compliance. This work also includes assisting the City with various financial analysis, risk analysis and planning, and feasibility studies associated with operational and contractual long-term options.



Joseph Krupa, PE

Solid Waste Generation Study / Waste Composition Analysis / Recycling Composition Analysis

Key Information

Education/Qualifications

- ME, Environmental Engineering, Manhattan College, 1996
- BS, Mechanical Engineering, North Carolina State University, 1993

Years of Experience

Total – 27

Professional Registrations/Certifications

- Professional Engineer – NY

Office Location

White Plains, NY

Mr. Krupa specializes in solid waste, recycling, transfer station, waste-to-energy, innovative waste processing, biogas and biosolids management projects. He currently serves as the national waste-to-energy technical lead for Arcadis. His experience spans all project life phases including: conducting feasibility studies; providing permitting assistance; preparing conceptual, detail and final design drawings and specifications; preparing procurement documents; evaluating equipment and contractor bids; providing technical support during equipment vendor and contractor negotiations and design/construction, and operation phases; evaluating equipment, construction and operations contract compliance; providing technical assistance in support of bond financing to secure more than \$1B USD in capital project funding; evaluating acceptance test results; and comparing operations to contractual performance metrics.

Relevant Experience

Solid Waste Management Program

Broward County Waste and Recycling Services, Broward County, FL

Served as Lead Technical Advisor for development of 2018 Solid Waste and Recycling Issues Study Report and for Arcadis Operations Monitoring services other solid waste system planning services. Supported development of site requirements evaluation; solid waste facilities option analyses and cost estimation for the solid waste and recycling issues study for waste disposal options. Mr. Krupa was responsible for providing QA/QC services and reviewing annual resource recovery facilities operations monitoring and year-to-year trend analyses reports. Managed single-stream MRF demonstration test monitoring that included conducting a residue composition analysis to identify missed recovered recyclable material in the residue stream to be transferred to the WTE facility.

New York City Commercial Waste Zones

New York City Department of Sanitation, New York City, NY

Served as technical advisor by reviewing and providing comments and technical support for the Commercial Waste Zone Implementation Plan, commercial waste generation document and procurement strategy development.

Solid Waste Generation Rate Study

Onondaga County Resource Recovery Agency, North Syracuse, NY

Prepared the solid waste generation rates for development of a solid waste user fee. Surveyed commercial properties to validate proposed commercial waste generation rate category for specific property types. Compiled data and report.

Commercial Waste Generation and Disposal Procurement

Bergen County Utilities Authority, Bergen County, NJ

Developed commercial waste generation assessment. Performed visual audit of select commercial properties to verify waste generation rates. Developed report and graphics. Assisted in the preparation of an RFP for the lease, operation, maintenance, and management of the Authority's 3,750-tpd solid waste transfer station.

Solid Waste Generation Rate Study

Lee County, FL

Prepared the validation of solid waste generation rates used for assessing County solid waste user fee. Reviewed hauler route sheets for specific areas and compiled data to develop waste generation rates. Conducted surveys to validate information was accurate for select properties. Prepared report and graphics.

Solid Waste Management Plan and Procurement Support

Westchester County Department of Environmental Facilities, Westchester County, NY

Managed County solid waste management plan update development that included summarizing waste generation rates and developing waste projections based on population forecasts and waste and recycling composition; and identifying reuse, reduction and recycling programs for consideration to achieve the state's recycling goals. Managed County C&D debris recycling facility feasibility study. Managed the request for proposals RFP for the disposal of the County's municipal solid waste. Prepared the draft and final RFPs in accordance with New York State General Municipal Law 120-w. Reviewed vendor responses and participated in vendor contract negotiations. Prepared vendor proposal evaluation correspondence. Reviewed the financial pro forma for the County based on the

successful vendor's price proposal. Reviewed an emerging technology to develop secondary refined fuel from MSW for use as a fuel for cement kiln. Conducted due diligence site visit to enhance plastics 1-7 recycling. Managing MRF site and stormwater improvements construction administration and DSDC project for the MRF / Transfer Station facility.

Refuse Collection Route Study

Larchmont Mamaroneck Joint Garbage Disposal Commission, Mamaroneck, NY

Reviewed feasibility of consolidating the commercial establishment refuse collection into one commercial route for the Commission. Conducted refuse collection route review inspections to develop performance metrics. Summarized waste generation and composition data. Analyzed data for consolidating the remaining routes into residential only or a mix of residential and commercial customers. Prepared a summary report and presented results during meetings.

Solid Waste Management Consulting and Engineering Services

Fairfax County Department of Public Works and Environmental Services, Solid Waste Management Program, Fairfax County, VA

Served as a technical advisor in performing an independent review of the service agreement with Covanta Fairfax, Inc. and the project economics related to the evaluation of long term waste disposal options for the County.

Solid Waste Resource Recovery and Ash Processing Projects

York County Solid Waste Authority, PA

Served as lead technical advisor for the feasibility studies, pilot-testing, operating contract negotiations, and operator start-up and acceptance testing of the ash processing facility (APF) for the York County Resource Recovery Center (YCRRC) municipal solid waste-to-energy facility. Managed constructability review to expand waste pit, tipping floor and building and install public convenience drop-off area, reverse osmosis system, scalehouse and air compressor system at the YCRRC. For the APF project, performed technical feasibility review for proposed ash processing vendor. Developed ash processing acceptance test

requirements. Managed acceptance test plan review and test monitoring of the APF.

Solid Waste Technical Due Diligence and Condition Assessment

Confidential Client, Multiple sites on East Coast US

Managed technical due diligence investigation and report for potential purchase by confidential client of certain solid waste management assets of a private company. Conducted due diligence site visits to ten waste-to-energy facilities and three ash monofills. Developed long term operation and maintenance cost pro-formas as well as operating data for these facilities plus four transfer stations.

New Waste-to-Energy (WTE) Facility

Solid Waste Authority of Palm Beach County, West Palm Beach, FL

As part of the constraints and limitations analysis for siting a New Proposed 3,000 tpd WTE Facility adjacent to the Authority's North County Resource Recovery Facility (NCRRF), determined potable, well and reuse water demand for the Proposed WTE Facility, assisted in the development of the conceptual site layouts, developed a planning level schedule for the construction of the Proposed WTE Facility, and assisted with the cash flow analysis and bond financing review. Prepared the Design Criteria for the RFP for the new WTE Facility. Performed the technical evaluation of the technical proposal and prepared the technical proposal evaluation. Presented components of the technical proposal evaluation to the Selection Committee. Managed the technical services support during the design review phase; reviewed change orders and application for payments; responded to RFIs and managed the construction monitoring staff and currently performing operations monitoring.

North County Resource Recovery Facility (NCRRF) Refurbish Design-Build Procurement

Solid Waste Authority of Palm Beach County, West Palm Beach, FL

As part of the refurbishment of the Authority's NCRRF to provide for an additional 20-years of operations, developed technical specifications required for the refurbishment of the NCRRF; and, conducted vendor procurement activities related the evaluation of the Design-Build Contractor for the Refurbishment. Provided

technical oversight and management as part of the review of the design/build contractor's scope and cost estimate preparation and coordination with the Authority, Operator, boiler equipment manufacturer (B&W), and the D/B Contractor in review of shop drawings and submittals and schedule preparation for the construction effort. Assisted in the review of the PSD and NSPS non-applicability review to be submitted to the FDEP. Managed the team of construction monitoring staff and provided technical support as part of warranty administration and change order negotiation. Currently performing operations monitoring.

Resource Recovery Facility: Operations and Maintenance Monitoring

Union County Utilities Authority, Union County, NJ

Provided engineering services for the O&M monitoring of a 1,540-tpd waste-to-energy facility. Monitored compliance with contract and permit conditions, prepared for and attended monthly operations and environmental issues meetings, assessed the operations of the major components e.g., material recovery facility, hauling contractor facilities, ash disposal landfill of the Solid Waste Management Plan, and evaluated waste processing bids.

McKay Bay Retrofit/Reconstruction

City of Tampa, FL

Provided technical assistance for the retrofit of the 1,000-ton-per-day waste-to-energy facility. Responsibilities included evaluating demonstration test and acceptance results after the completion of retrofitting (initially two sets of two 250-tpd units and then all four units, respectively), reviewing previous reports regarding cost estimates to retrofit/ reconstruct the facility, preparing an updated cost estimate, assisting in the preparation of the RFPs, assisting in the technical evaluation of proposals, providing technical support during vendor negotiations, and participating in preliminary design review meeting.

Dynamic Itinerary for Solid Waste Infrastructure and Waste-to- Energy Facility Procurement

Solid Waste Authority of Puerto Rico, San Juan, PR

Managed Dynamic Infrastructure Plan development for solid waste management facilities. Summarized waste generation, composition and recycling composition data for the island. Developed three transfer stations, one

MRF, and one compost facility preliminary engineering reports. Analyzed different waste management technologies and assessed feasibility of implementation. Prepared guidelines for evaluating proposals from project sponsors of facilities using WTE technology. Prepared RFQ for the design, build and operation of a WTE facility.

Montgomery County Single Stream Recycling Feasibility Study

Northeast Maryland Waste Disposal Authority, Montgomery County, MD

Prepared the feasibility study for converting the existing dual stream processing materials recovery facility to a single stream operation by the addition of single stream screening and processing equipment. Summarized the recycling composition and generation rate data for the streams delivered to the MRF. The study included preparation of a cost estimate to compare potential alternatives, developing a recycling quantity projection for future recycleable product quantities, and preparing the feasibility study report.

USTDA/Solvi LFGTE Study

Multiple sites in Brazil

Conducted due diligence site visits to five Brazil sites for feasibility study report to implement landfill gas to energy.

AUS/Haztec Due Diligence

Haztec Tecnologia E Planejamento Ambiental S.A., Rio de Janeiro, Brazil

As part of the implementation of waste-to-energy facilities in Brazil, conducted technical due diligence site visit of waste-to-energy boiler reference facility in China.



Jane Wu

Solid Waste Generation Study / Waste Composition Analysis / Recycling Composition Analysis

Key Information

Education/Qualifications

- MS, Earth & Environmental Engineering, Columbia University, 2018
- BA, Earth Science, University of Pennsylvania, 2016

Years of Experience

Total – 5

Office Location

Long Island City, NY

Ms. Wu is an innovation-orientated Management Consultant and Data Scientist at Arcadis. She has experience working with consulting firms, research institutions, and community organizations in the areas of policy implementation, waste management, renewable energy, wastewater, green infrastructure, data science, environmental outreach, and diversity & inclusion. She developed data-driven policy reforms and implemented new technologies in the field such as live data collection, management dashboards, robotic process automation, machine learning, and image recognition technology.

Relevant Experience

Commercial Waste Zone Implementation

New York Department of Sanitation, New York, NY

As Project Manager, advising the New York City Department of Sanitation (DSNY) on the design and implementation of a commercial waste zoning system in New York City servicing all of the City's over 100,000 commercial customers. The program includes extensive data analysis, stakeholder engagement, and generation of traffic, solid waste and market pricing models to drive data-informed policy design decisions. The scope of work also includes environmental review, local law development and procurement strategy for DSNY, through bidding and negotiation. Responsible for project management, developing in-field and digital data collection systems, and analysis and communication of findings with the client team. Public information on the program can be found at nyc.gov/commercialwaste.

Zero Waste Design Thinking Workshop

New York Department of Sanitation, New York, NY

Provided insights and data during 4-day design thinking workshop ideating actionable steps towards Zero Waste by 2030 in the New York City commercial waste sector. The workshop helped inform programs such as modernized mandates for data collection and tracking, zero waste business training and certification, a marketplace for a local circular economy and to access waste collection resources, and others.

Commercial Waste Characterization Study

Confidential Public Sector Client, US

As Project Manager, led a commercial waste characterization study of food waste generators involving approximately 300 commercial waste sites, ranging from small cafes and restaurants to large manufacturing and warehousing locations. Developed the methodology for collection routes, coordination with businesses, setup and operation of the sorting site, management of sample disposal, and health and safety practices. Data was collected on a tablet system, which could feed into a live digital dashboard for the purposes of field work progress monitoring and communicating with the client on study progress. This study resulted in key insights for waste management planning, such as recycling and food waste programming.

Zero Waste Certification Benchmarking

Confidential U.S. Based Auto Industry Client, US

Benchmarked leading US zero waste certification and circular economy programs for a U.S.-based auto industry client to find the best fit based on costs, program eligibility requirements, scope of wastes covered, past clients, existing corporate and nonprofit partners, and media presence.

Solid Waste Image Recognition

Confidential Public Sector Client, US

As Project Manager, applying Arcadis' machine learning solid waste image recognition technology to identify on-street waste setouts and estimate waste volumes in a dense urban setting. The model can classify setouts by waste type, color, container type (ex. bag, bin), and shape. The use case for this client was to estimate waste volumes in large quantities without direct contact by field crews with setouts.

Capital Cost Comparison of Waste-to-Energy Facilities in China and the US

Columbia University, New York, NY

Reviewed capital cost elements of waste-to-energy combustion facilities built by companies in China and the US. The study discussed the factors contributing to China's ability to produce facilities at a third of the cost of US facilities and potential escalation factors when adapting the Chinese model to other countries.

Solid Waste Management Plan Development

New York City Public Housing Authority, New York, NY

Provided waste audit and program advisory services for the New York City Housing Authority (NYCHA). Responsible for data collection, analysis, and training components of the program. Led Arcadis teams on in-field recycling and bulk waste audits, and trained NYCHA Green City Force staff to conduct visual recycling assessments, and surveys of illegal dumping activities and community attitudes towards recycling. The findings of this partnership informed policies adopted in the NYCHA 2.0 Waste Management Plan.

REACH Ambler

Penn Medicine Department of Family Medicine and Community Health, Philadelphia, PA

The project focused on the documentation of oral histories of residents in Ambler, Pennsylvania, a community impacted by several decades of asbestos manufacturing and open dumping. The former open dumps were classified as Superfund sites. Responsible for interview coding, community surveys, research on asbestos stability in soils, and documentation of materials shared in an online exhibit, which can be found at <https://reachambler.sciencehistory.org/>.

Design & Design Services During Construction for the Southeast Queens Flooding Mitigation Program

New York City Department of Environmental Protection (DEP), New York, NY

New York City is currently undergoing a \$1.9 billion initiative to reduce flooding in Southeast Queens. DEP has identified 50 priority grids, covering approximately 40 acres, that had the highest concentration of flooding complaints. These areas have been the focus of a parallel program that identifies short term, high priority projects to provide immediate relief to local residents in combination with a long-term effort to extend storm sewers and increase sewer capacity. Role was to develop guidance materials on the inspection and maintenance of porous pavement systems, including required maintenance activities, equipment specifications, and key maintenance issues.

Green Infrastructure Research & Development,
New York City Department of Environmental Protection,
New York, NY

An extensive multi-year research and development contract focused on understanding the design and impact of green infrastructure across New York City through dozens of independent experiments. Co-led an experiment focused on porous pavement performance and maintenance testing, including visual analyses, surface infiltration tests, run-on tests, stormwater modeling, and structural investigations.

Renewable Energy Power Generation Support for NJ TRANSITGRID Micro-Grid Central Facility
New Jersey Transit Corporation, NJ

Conducted a characterization of renewable technology alternatives to support electric traction power operations during both normal operations as well as during a commercial grid outage for a minimum of 14 days. This included a review of commercial and in-development level technologies, and technical feasibility and relative cost of implementation.

Program Management and Engineering Services for Bay Park STP Hurricane Sandy Recovery
Nassau County Department of Public Works, East Rockaway, NY

Project Management Support for the Joint-Venture Program Management of Bay Park Sewage Treatment Plant (STP) for Hurricane Sandy emergency recovery and flood resiliency designs. Responsibilities have included but are not limited to task management of field experimentation, developing budgets, timelines, meeting agendas, data collection, team coordination, health and safety assessments, and visualization of grant and financial reporting.

Greening the Bronx
New York State Energy Research & Development Authority, New York, NY

Conducted field assessments of urban tree health in the Bronx. Work included tree identification and documentation.

Diversity & Inclusion Steering Committee
Arcadis, North America

Developing and improving Arcadis North America's Diversity & Inclusion program across all industry sectors. The program's reach includes areas of reporting, recruitment, retention, communications, certification, professional development, and employee affinity groups. Responsible for inclusion-related professional development programs for all employees, and support of the Arcadis North America Pride Network (for LGBTQ+ employees and allies). Responsibilities include expansion of local recruitment efforts, trainings, and events.



Garth White

Waste Composition Analysis / Recycling Composition Analysis

Key Information

Education/Qualifications

- BS, Mechanical Engineer, California State University, 2001

Years of Experience

Total – 17

Office Location

Plantation, FL

Mr. White specializes in solid waste management, with specific focus on field activities and construction oversight. His experience includes waste and recyclable composition analyses, operations monitoring and inspections of material recovery facilities (MRF), waste to-energy facilities (WTE), debris management, inspection, cost estimating, and trend analysis.

Relevant Experience

Broward MRF Monitoring

Broward County Waste and Recycling Services, Broward County, FL

Preparation of a MRF residue composition analysis protocol. Scheduled residue deliveries. Presentation of policies, procedures, and safety briefings to a field team of seven temporary workers. Sorting of approximately 1,000 pounds of residue in one-day. Preparation of a cost estimate which included all components of the projects. Preparation of a final report to the client which summarized the activities and findings performed.

Broward MRF Relocation Project

Broward County Waste and Recycling Services, Broward County, FL

Involved in preparing the test protocol that contains the criteria and procedures for the single stream demonstration test. Responsible for recording all daily relevant events and updating data sheets. The data included daily processed tonnage, system run times, equipment performance, residue generated, test results and general observations. The final report accurately characterized the results of the demonstration test. Arcadis provided comments and/or discrepancies between the recorded data and the report in accordance with the outlined scope of work with the County as well as tabular and graphic summaries when appropriate.

FY 2015 Waste Stream Recyclables Analysis

City of Miramar

Conducted a third-party review of the recyclable material sampling plan, methodology and protocol to determine the quantity of recyclable materials in the City's waste stream. Conducted a review of the sampling results and provided comments to the city for review and consideration.

Waste-to-Energy Facility Operations Monitoring

**Broward County Waste and Recycling Services,
Broward County, FL**

Involved in operations monitoring efforts for Broward County evaluating the contract operator's (Wheelabrator) conformance with the terms of the service agreement, environmental regulations and accepted industry practices. Performed regular facility inspections, outage inspections, punchlist updates, reviewed environmental reports, and provided inspection reports, monthly, quarterly, and annual operations monitoring reports.

Broward WTE Facility Monitoring

**Broward County Waste and Recycling Services,
Broward County, FL**

Updated the trend analysis prepared for both the north and south facility which summarized the performance of each facility since the operation of the facilities commenced. The final report included the following: overview of processed waste, delivered waste, power production, downtime, ash production, emissions, and metals recovery for each facility through the current year of operations.

Miami-Dade County Bond Engineering Services

**Department of Solid Waste Management, Miami-Dade
County, FL**

Serves as Project Engineer supporting the Bond Engineering contract, which provides for comprehensive oversight and support related to all facets of the County's integrated solid waste management system, which includes waste to energy, resource recovery, landfilling, recycling, as well as residential and commercial collections. Key projects and activities include: Resources Recovery Facility Operations Monitoring and Annual Reporting, Annual System Inspections and Reporting, Revenue Bond Refunding and Issuance Consulting Engineer's Feasibility Reports, Annual Adequacy of Rates and Fees, Munisport Landfill Closure, Virginia Key Landfill Closure.

Solid Waste Authority (SWA) of Palm Beach County: SWA New WTE Facility: Operations

Monitoring Engineer, West Palm Beach, FL

Serves as inspection engineer for the design and construction of a \$700M renewable energy facility completed by the solid waste authority of Palm Beach County in 2015. Assisted with the development of RFP documents, design criteria, technical review of proposals, ranking of technical proposals, technical reviewer of: drawings, specifications, NCRs, RFIs, oversaw acceptance testing and other ongoing activities. Serves as a construction monitoring engineer for QA/QC, punchlists, and contract administration. This work includes generation of daily and weekly monitoring reports, contract overview and analysis to determine compliance of the design/build contractor with the contract documents and specifications, construction turnover package review, and oversight of commissioning, startup and acceptance testing. Currently also serves as an engineer for the ongoing annual operations monitoring and assists with additional as-needed engineering and construction related requests.

Consulting Engineering for North County Resource Recovery Facility

**Solid Waste Authority of Palm Beach County, West
Palm Beach, FL**

Serves as Project Engineer for the refurbishment of this refuse-derived-fuel (RDF) waste-to-energy facility. Assists with demolition and construction document review and coordination and oversight of demolition and construction activities. Responsibilities include construction document management, daily construction oversight, and assistance with contract compliance review of the design/build contractor



MITCH KESSLER

Solid Waste Generation Study

Mitch Kessler serves as the President of Kessler Consulting, Inc. (KCI). He will have final responsibility for the direction and coordination of all tasks assigned to KCI and will have ultimate responsibility for all services provided by our firm.

Mitch has 36 years of solid waste experience and has managed or directed more than 300 projects for over 200 KCI clients. His legal training is especially useful in understanding and interpreting local, state, and federal laws and regulations. His broad background in solid waste management and business makes him a Project Director who is an industry leader with the history and experience to deliver results for our clients.

Mitch is a nationally recognized expert in the procurement and operations of solid waste collection systems and materials recovery programs and facilities. He is especially knowledgeable in collection and market development issues as they relate to the economic viability of solid waste and recycling programs.

Mitch is the Immediate Past President of the Florida Sunshine Chapter of SWANA and current SWANA International Board member. He serves as an instructor for the Recycling, Collection, and Composting Certification Courses sponsored by SWANA National, and is a member of the SWANA committee that developed the Manager of Composting Operations Certification Course.

Mitch has worked on the following on-point projects with KCI:

- ✓ **Solid Waste and Recycling Issues Study, Broward County, FL**
Mitch was a part of a project team that developed a Solid Waste and Recycling Issues Study for Broward County. The study addressed three key issues: (1) how a 75% countywide recycling goal might be reached, (2) whether retaining public ownership of the Alpha 250 site would facilitate meeting that goal or provide other benefits in connection with solid waste disposal, and (3) general solid waste disposal issues including flow control and potential governance or contractual structures for collaborative management of solid waste disposal. KCI developed population and waste quantity projections through 2060, and also estimated waste composition. This information was used to identify short-term, mid-term, and long-term waste reduction and recycling strategies. Three scenarios were then

FORMAL EDUCATION

J.D. Environmental Law

University of New Hampshire
Durham, NH | 1984

M.A. American Studies

Purdue University
West Lafayette, IN | 1981

B.S. Management

Purdue University
West Lafayette, IN | 1979

A.A.S Horticulture

State University of New York
Albany, NY | 1976

CERTIFICATIONS

SWANA Certified:

- Recycling Systems
- Composting Programs
- Zero Waste Principles & Practices
- Collections Systems

AFFILIATIONS & LEADERSHIP

SWANA

- International Board (2015 – Current)
- Florida Sunshine Chapter, Board of Directors (2005-2019), President (2011-2015)

Recycle Florida Today (RFT)

- Board of Directors (8 yrs)
- Chair (2 yrs)

Florida Organics Recyclers Assoc.

- Founding Chair

National Recycling Coalition

- Florida Rep for RFT

United States Composting Council

modeled to estimate the potential to achieve the state recycling goal of 75% for counties. These strategies identified policies, programs, and facilities that would be needed to manage the waste generated within the county over the planning period.

✓ **Solid Waste Master Plan, Key West, FL**

Mitch directed a project to develop a comprehensive Solid Waste Master Plan for the city that included recommendations for putting the city on a pathway toward zero waste. The City Commission adopted the Phase 1 recommendations of the plan and directed staff to initiate implementation.

✓ **Characterization Study and Facility Development, Emerald Coast Utilities Authority, Pensacola, FL**

Mitch directed a waste and recyclables characterization study. The detailed study results were utilized to conduct a competitive procurement for development of a processing facility. The data provided vendors with an understanding of the types and quantities of materials that might feasibly be recovered. Facility development is underway.

✓ **Solid Waste Strategic Planning and Procurement, Hollywood, FL**

Mitch first assisted the City of Hollywood by evaluating a range of service and contracting options to improve its solid waste collection system. Service options included conversion to weekly collection, implementing a pay-as-you-throw system, placing limits on the quantity of bulk/yard waste collected, and eliminating alley collection. Contracting options included combining collection and disposal services into one or more contracts and incorporating commercial collection in the exclusive franchise agreement. KCI also developed an extensive model of the potential cost for the city to take over residential collection services and to compete to provide commercial collection. Based on the findings of this evaluation, Mitch then assisted the city in negotiating extensions to its recyclables processing and solid waste disposal agreements. Concurrently, we are assisting with a competitive bid process for residential collection services and bulk/yard waste processing and disposal. Future project assistance includes evaluating the bids, negotiating final agreements, and providing technical assistance during the service transition.

Mitch has received the following industry awards:

- **Professional Achievement Award – Private Sector**, 2012, SWANA
- **Distinguished Service Award**, 2008, SWANA
- **George Kirkpatrick Lifetime Commitment Award**, 2006, RFT
- **Outstanding Contribution Award**, 2002, SWANA FL
- **Exceptional Leadership Award**, 1997, Florida Organics Recyclers Association

Prior Employment History:

- **Organics Recycling Incorporated**, Chief Operating Officer and Director of Business Development
- **Resource Integration System**, Vice President and Director of Consulting Services
- **Malcolm Pirnie, Inc.**, Waste Reduction and Recycling Specialist



CHAS JORDAN

Solid Waste Generation Study

Chas Jordan will serve as the KCI Project Manager for this project.

Chas joined KCI after owning and operating his own sustainability-focused consulting firm and as a Florida city Assistant Public Works Director. He is a manager with technical skills and experience in project work including solid waste collection operations, sustainability action plans, LEED and Envision certification, waste management strategic plans, recycling capture composition study preparation and oversight, recycling operations planning and implementation, grant preparation and implementation, data analysis, and studies, processing contract management, educational material development, training, rate/fee reviews and analysis, and more.

Chas has a strong background in local government management from a 14-year public administration perspective. He also has a broad range of waste management, sustainability, and technical skill disciplines and brings a policy and public sector approach to concepts, ideas, and plans. His experience previously with multiple communities in Florida, has given him perspective and unique understanding of both municipal and county agencies, how they are managed, and how they need to operate effectively.

In his role as a Project Manager, Chas oversees all affairs of the project. He has managed the majority of on-site cart collection and composition studies for cities, counties, and private / non-profit agencies for KCI since coming on board in 2019.

Chas has worked on the following projects:

✓ **County-wide Recycling Composition and Generation Study, Pinellas County, FL**

Chas served as the project director for this project in which KCI sampled and sorted materials from across Pinellas County and its twenty-four separate municipalities to determine a representative composition for the entire county. This study also evaluated composition on a municipal level as well as an unincorporated collection district level. This provided the County generation data to assist in determining the feasibility of additional recycling processing options for the region.

✓ **County-wide Waste Composition and Generation Study, Pinellas County, FL**

Chas is serving as the project director for this project in which KCI will sample and sort materials from across Pinellas County determine a representative waste generation and composition for the entire county. This study, when coupled with the Recycling Composition Study performed in

FORMAL EDUCATION

Master of Public Administration
University of North Florida
Jacksonville, FL | 2007

Bachelor of Arts
University of North Florida
Jacksonville, FL | 2005

CERTIFICATIONS

- APWA Public Works Executive
- LEED Green Associate
- Envision Sustainability Professional
- Sustainability Transportation Professional
- SWANA –
Collection Systems Manager
Zero Waste Practitioner

AFFILIATIONS & LEADERSHIP

- American Public Works Assoc.**
 - National:* Past Leadership & Management Chairman
 - Florida:* Past Chapter President

SWANA

2020, will provide the County information on future disposal and processing needs and requirements for long term strategic and financial planning.

- ✓ **Cart Based Generation and Recovery Audit - Hillsborough County, The Recycling Partnership**
Chas served as the coordinator of the in-field pick up of both recycling and garbage samples from over one hundred and twenty residences throughout the County over the course of one full week. This included designating sample locations, recording them for sample review, collection and documentation of materials, and development of a technical memorandum documenting the findings and results of the project.
- ✓ **Source Based Generation and Recovery Audit – Sarasota County, The Recycling Partnership**
Chas served as the project manager of the in-field pick up of both recycling and garbage samples from over one hundred and forty residences throughout the County over the course of one full week. This included designating sample locations, recording them for sample review, collection and documentation of materials, and development of a technical memorandum documenting the findings and results of the project.
- ✓ **Pre and Post Transition Recycling Composition Studies, Sarasota County, FL**
Chas served as the project manager for the two composition studies performed prior to and after the transition to single-stream recycling, providing data and expert analysis on the changes in participation, contamination, and materials recycled due to the new program.
- ✓ **Waste Composition Study, Major Theme Park, Florida**
Chas served as the assistant field manager for a five-day waste characterization study for a confidential theme park. Over the course of the five-days, waste from 59 separate generation points, representing a cross section of activities within the park, were hand sorted into 38 material categories. Upon completion of the study, Chas performed analysis on the data to calculate the composition of waste from each generation point.
- ✓ **Contamination Intervention Capture Study – Peoria, AZ, The Recycling Partnership**
Chas serves as the project manager for this capture study authorized by The Recycling Partnership. This study will evaluate a pre- and post- transition capture review of materials in the garbage and recycling streams for specific routes in the City of Peoria, AZ. This project will also review the amount of captured films and flexibles in both streams for additional data to be provided to The Recycling Partnership.
- ✓ **Single Stream Recyclables Composition Study, Lee County, FL**
Chas served as the project director for this recyclables composition study intended to provide contamination and generation rates from around Lee County in-bound to the County-owned Material Recovery Facility (MRF). This study reviewed sources of material from multiple jurisdictions and audited the residue produced by the MRF's operator. This information assisted the County in determining future planning for the facility and countywide recycling educational and planning efforts.

Chas has received the following industry awards:

- **Young Leader of the Year Award - National, 2013, APWA**
- **Florida Chapter Member of the Year, 2018, APWA**
- **Florida Chapter Award of Excellence, 2018, APWA**



RYAN GRAUNKE

*Solid Waste Generation Study /
Waste Composition Analysis /
Recycling Composition Analysis*

Ryan has led KCI's composition studies and field work for the past five years. With KCI, Ryan has overseen over 35 studies, totaling over 140 days in the field, sorting more than 1,200 samples of solid waste and recyclables. He has a long-term passion for science and the environment, and for reducing society's waste. Ryan is a creative problem solver and fast learner with a relentless dedication for his work.

Ryan's experience with solid waste originated during his undergraduate studies at the University of Florida, where he interned with the university's Office of Sustainability. During his internship, Ryan assisted with the development of a recycling program for on-campus tailgating activities, as well as being responsible for launching a campaign to teach students about recyclable materials accepted on campus.

Ryan is a scientifically minded individual and an accomplished researcher with skills in designing experiments, data analysis and technical writing. In 2008, his undergraduate thesis won the Association for the Advancement of Sustainability in Higher Education's award for Student Research on Campus Sustainability. In 2011, Ryan's Master's thesis researching the effects of mechanical pretreatment on the anaerobic digestion of food waste won the University of Florida – Institute for Food and Agricultural Science's "Best Thesis" Award of Excellence for Graduate Research. He has authored two articles published by peer-reviewed scientific journals, including "Food Waste Auditing at Three Florida Schools."

Following graduate school, Ryan coupled his scientific skillset with experience in the regulatory field to work as an air permit writer for the Indiana Department of Environmental Management. As an air permit writer, Ryan became adept at interpreting and applying environmental air regulations, skills he easily translated to the solid waste industry.

Ryan has recently worked on the following projects with KCI:

✓ **Waste and Recycling Composition Studies, Hillsborough County, FL**

Ryan acted as primary consultant and field manager in designing and conducting two recyclables composition studies and a waste composition study for Hillsborough County. The recyclables study was conducted on residential recyclables collected by the County's franchisees. The goal of these studies was to develop a comprehensive composition of recyclables managed by the county to develop targeted outreach and education to reduce contamination and in ongoing recyclables processing negotiations with private processors. The waste composition study focuses on commercial and multi-family waste. The purpose of this study was to determine

FORMAL EDUCATION

M.S. Interdisciplinary Ecology
University of Florida
Gainesville, FL | 2011

B.S. Environmental Science
University of Florida
Gainesville, FL | 2008

AFFILIATIONS

Recycle Florida Today

- Organics Committee Member

PUBLICATIONS

- Wilkie, Ann & Graunke, Ryan & Cornejo, Camilo. (2015). Food Waste Auditing at Three Florida Schools. Sustainability. 7. 1370-1387. 10.3390/su7021370.
- Graunke, Ryan. and Wilkie A.C. (2008). Converting Food Waste to Biogas: Sustainable Gator Dining. Sustainability -The Journal of Record, 1 (6), 391-394.

potential to recover materials from these waste streams through implementing expanding multi-family and commercial recycling programs. For each study, Ryan worked with County staff to develop a sampling schedule that would provide statistically significant results. He was responsible for planning all field work logistics and managing both KCI staff and temporary labor during the field work. Ryan then analyzed the data to calculate the Countywide composition of waste and recyclables.

✓ **Waste and Recyclables Composition Studies, Pinellas County, FL**

Ryan was the lead consultant and field manager a three-week recyclables composition study for Pinellas County. The study consistent of two separate parts: one to measure the recyclables from all 24 municipalities in the county and one to measure recyclables managed by the county at their beach and park recycling and drop-off programs. For the municipal study, Ryan developed a comprehensive sampling plan consisting of 142 samples divided proportionally between all municipalities based on the amount of recyclables each generate, plus 21 samples of county recyclable. Ryan then coordinated with each municipality and/or their private haulers to reroute their trucks to tip at the study site. For the 15-days of field work, Ryan managed a sorting crew of 7 individuals or ensured all loads tipped and were sampled properly. Following the field work, Ryan compiled and analyzed all data to calculate the compositions of municipal and county recyclables, as well as a combined overall composition of all recyclables. He then prepared the two reports (one for the municipality and one for the county) detailing all aspects of the study. Ryan will be overseeing an upcoming two-season waste composition study for the county. Each season will consist two weeks of sampling and sorting waste materials from the county and municipalities and one week visually auditing bulky waste.

✓ **Recyclables Composition Study, Lee County, FL**

Ryan was a project manager and technical advisor for a one-week recyclables composition study for Lee County. Using his experience with composition studies, as well as conducting the county's previous recyclables composition study, Ryan assisted the primary consultant and field manager in all aspects of the study to ensure its successful completion from the initial planning phase to delivery of final report. The results of the study will assist the county in negotiating with the contracted operator of the county-owned MRF and will be used in the county's outreach and education efforts.

✓ **Recyclables Composition Study, Sarasota County**

Ryan was the field manager for a two-part recyclables composition comparing the impact of Sarasota County transitioning from dual stream bin collection to single stream carted collection. Ryan was responsible for all planning, field work, data analysis, and reporting activities. He worked closely with both County staff and staff at their processor's facility to ensure a safe, accurate, and successful study. The results of this study will provide valuable information to the County and will allow them to target future education and outreach activities. In addition, Ryan managed a comprehensive two-season waste composition study in 2017 for Sarasota County and led the County's previous RCS in 2015.

Prior Employment History

- **Indiana Department of Environmental Management, Air Quality Permit Writer**
- **University of Florida, Soil and Water Science Department, Graduate Research Assistant**



ALICIA ARCHIBALD

*Solid Waste Generation Study /
Waste Composition Analysis /
Recycling Composition Analysis*

Alicia Archibald has been developing partnerships and assisting communities across the United States for over 25 years. Alicia's love for people and systems thinking has assisted businesses, nonprofits, military communities, and municipalities with sustainability initiatives to include recycling, environmental management, and zero waste strategies. Alicia's analytical mind primes her for the work she enjoys which includes research, strategic planning, waste composition studies, data analysis and technical writing.

Alicia previously managed a transfer station for a private Colorado company where she provided complete oversight of operations, customer relations, and personnel management. Her other experience includes environmental education, public relations, logistics of marketing recycled commodities at a material recovery facility, and scale operation. Alicia joined Kessler in 2020, bringing with her experience managing recycling and waste operations and facilities, making her an invaluable resource in reviewing operational solid waste systems for efficiencies and innovation.

Her core work experience includes:

- ✓ Materials Management Plans
- ✓ Waste Collection System Operations
- ✓ Waste and Recycling Facility Operations
- ✓ Waste Composition Studies
- ✓ Stakeholder Engagement
- ✓ Environmental Education
- ✓ OSHA Standards and Safety Training
- ✓ Staff Training Program Development and Deployment

Examples of Alicia recent experience includes the following:

✓ **Single Stream Recyclables Composition Study, Greensboro, NC**

Alicia is serving as the project lead for this two-week study for the city of Greensboro. She developed all planning documents and coordinated the logistics necessary to gather and sort over 60 samples from residential and commercial recyclables in the city's collection program. Alicia managed the sorting crew and captured all the data in KCI's excel based data management tool. Additionally, Alicia will develop a final report that will provide critical information to the city for negotiations with their recyclables processor and provide insight of education needs to reduce contamination.

✓ **Route-based Capture and Contamination Intervention Study, The Recycling Partnership, Peoria, AZ**

Alicia is leading this study for The Recycling Partnership (TRP) by auditing materials collected from specified routes serviced by the City of Peoria, Arizona. The data will provide insight into

FORMAL EDUCATION

Business Administration
University of Phoenix, 2009

CERTIFICATIONS

ISO 14001:2004 Internal Auditor Training

OSHA 30 Hour General Industry

AFFILIATIONS & LEADERSHIP

Recycle Colorado

- Board of Directors

El Paso County Solid Waste Management Technical Committee

contamination rates based upon various interventions performed on individual routes. This project will have a pre-intervention study and a post-intervention study to determine impacts. Alicia has prepared all the planning documents, coordinated all the logistics, and served as the Field Supervisor during the sorting work. In addition to single stream recyclables, KCI sorted and sampled plastic films and flexible packaging as a part of TRP's national priorities. Alicia created a mid-term Technical Memorandum with the baseline results and will complete the project with a full report providing a comparison of before and after various interventions have taken place. The report will assist the City with future anti-contamination programs, utilizing the most effective strategies identified with this project.

✓ **Multi-Family Waste Composition Study Oversight, Coordination, and Data Analysis Services, The Recycling Partnership, San Diego, CA**

Alicia is providing oversight services to the City of San Diego, CA, in the development of a series of multi-family waste composition studies to be performed in the Summer of 2021 that will incorporate various interventions to increase generation of recyclables and decrease contamination. Alicia is providing technical expertise in developing the protocols for the sort, as well as directing City staff in the procurement of needed supplies. She will participate in their trainings and provide guidance during the sorts. Once all three (pre, mid, & post) sorting events have occurred, Alicia will analyze the data from the events and provide a technical memorandum identifying overall key findings, average generation and composition of recyclables, average recovery rate of individual recyclable materials and average contamination rate for recyclables.

✓ **Single Stream Recyclables Composition Study, Lee County, FL**

Alicia was the project lead for this recyclables composition study (RCS) of inbound single stream recyclables processed at the Lee County's material recovery facility (MRF). The 5-day study (analyzing 48 samples) had three components each with different objectives, in addition to assisting the County's education and outreach programs. After coordinating all planning and logistics needs, Alicia recorded and analyzed the recyclables samples to determine the inbound composition of recyclables and contamination. This data was used to calculate the average market value of the recyclables and develop a new processing procurement and contract. Alicia compared these results to the 2018 RCS that KCI conducted for the County. She also estimated the composition and total generation of single stream recyclables from multi-family properties in the County, as well as analyzing samples of materials in the MRF's residue compactors to evaluate the efficiency and effectiveness of the MRF.

✓ **Dual Stream Recyclables Composition Study, Northport, FL**

Alicia was the Field Supervisor for this project for the City of North Port (City). The City selected KCI to conduct a program recyclables composition study (RCS) to characterize the residential dual stream recyclables generated within the City, gathering 18 samples over the course of 8 days. Alicia led the sampling and sorting at the location and aggregated all the data from the sampling activity. In the final report of the project, she identified the types and quantities of accepted recyclable materials, potential recyclable materials, contaminants, and cross contaminants in the recycling streams currently collected by the City.

✓ **Waste Composition Study, Denver, CO**

In partnership with LBA Associates, Alicia assisted with updating the Denver Solid Waste Master Plan to address commercial, multi-family and C&D waste. Early project work included a comprehensive two-week waste composition study that quantified the amount of recyclables and organics in city-wide trash samples as well as trash in city-wide recyclables. As part of supervising this work, Alicia managed contract sorting crews and coordinated with private haulers.