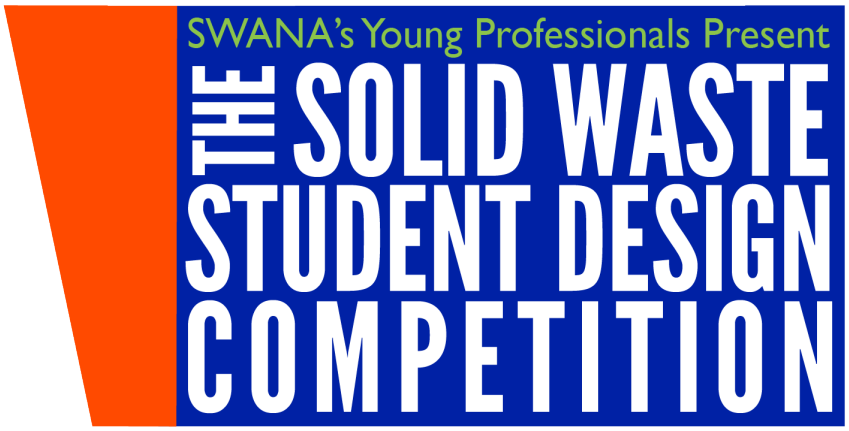
SOLID WASTE DESIGN COMPETITION (SWDC)

SWANA's International Student Competition



PROBLEM STATEMENT AND PROTOCOL

VIRTUAL EVENT
January - April 2024

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1. Introduction

SWANA's International Solid Waste Design Competition (SWDC) is a student team competition focused on solving a "real world" problem faced by solid waste professionals. The competition aims at providing a professional experience to students pursuing an education and/or career in solid waste management. The goals of the SWDC are to:

- Provide students with real world experience in solving complex solid waste management issues in a supportive and fun environment.
- Provide students an opportunity to display their problem-solving, professional writing and presentation skills.
- Encourage student involvement in SWANA.

This document outlines the problem statement and guidelines for the competition. **Participants are advised to read the entire document as guidelines detailed in this document must be followed.**

2. Problem Statement & Competition Format

The problem statement is provided under **Attachment 1**. In general, the SWDC is organized as explained below:

- Students will review the Problem Statement and existing information. Interested teams will send completed Team Commitment Form.
- SWANA will organize a virtual kick-off meeting to explain the Problem Statement and associated data.
- Students will be guided by the SWANA SWDC committee and upon request, paired with a mentor to assist teams with the project.
- Student teams will present their solutions through an infographic, report, and virtual presentation by meeting the deadlines (Section 4).

The solution to the Problem Statement must be detailed in a design report, infographic, and presentation. Guidelines for each of the three components are provided in Sections 5 through 7.

3. Eligibility to Participate

Participating teams must comply with the following criteria:

- Students must be a member of SWANA at the time of registration. Activate your FREE student membership here: SWANA Student Membership.
- Each participating team can have a minimum of two (2) and a maximum of eight (8) team members. The recommended team size is a four (4) member team.
- Every participant must be enrolled as a full-time or a part-time student during competition enrollment. We understand that some students may graduate or be near graduation at time of

the presentation. However, to ensure participation, **we require at least one student in the team to anticipate graduation after the scheduled date for presentations**.

- Preferably all team members should be from the same school/university; however, exceptions can be made. An exception request must be made using the *Team Commitment Form* provided as **Attachment 2**, and the participant should reach out to the contacts provided for further discussion.
- The maximum number of student design teams is limited to ten (10) teams. The first ten (10) eligible entries received via *Team Commitment Form* will be entered into the competition.
- The *Team Commitment Form* must be signed by a school faculty member as their sponsor.

4. Deadlines

The deadlines for the competition are detailed below. Submissions must be made electronically (unless specified otherwise) to the contact person identified in Section 11.

- **Team Commitment Form**: Teams must submit the Team Commitment Form (**Attachment 2**) to participate in the competition. It is recommended to send the Team Commitment Form as soon as possible as the number of teams is limited to ten (10). Applications are due by January 8, 2024.
- The selected participants will be notified by January 9, 2024.
- A kickoff meeting will be held mid-January 2024 to provide the teams an overview of the competition, review the SWDC problem statement, requirements, and answer general questions. An additional follow up meeting will be scheduled for the end of February 2024. Further information will be provided to the selected teams.
- **Design Report**: The final design report must be submitted by March 24, 2024. The guidelines presented in Section 5 must be followed for the design report.
- **Infographic**: Infographic must be submitted by March 24, 2024. The guidelines presented in Section 6 must be followed for the infographic.
- **Presentation**: The student design teams will present their solutions virtually the second week of April 2024. The date and time for the presentation(s) are to be scheduled. The guidelines listed in Section 7 must be followed for the presentation. All presentations will be recorded and become the property of SWANA.

5. Design Report Guidelines

The Design Report must follow the structure listed below:

- Report must be submitted in pdf format.
- Font must be Times New Roman,12-point font and double-spaced text.
- Recommended format for Citations/References: Chicago Style.
- The maximum number of pages is limited to 30 pages.
- Tables and figures can be provided as attachments in addition to the 30-page limit. There is no page limit on the attachments (tables and figures).

Refer to the judging sheet provided as **Attachment 3** to gauge the expectation of the judges.

6. Infographic Guidelines

The following guidelines must be followed.

- Infographics should be geared toward the general public and should condense the key points of your report and presentation into an engaging and informative summary.
- All infographics must be created in a desktop page layout software (PowerPoint, Adobe InDesign, QuarkXPress) or an online infographic design site that can produce high-res images. Infographics created in Microsoft Word or PageMaker will not be accepted.
- All art must be formatted as CMYK, hi-res images at least 266 dpi in RAW .jpg format.
- Final document must be saved as a hi-res PDF with all art and images embedded.
- Infographic file shall be submitted using Dropbox link or other similar online file sharing.
- Be clear and concise with infographic design and content. Overcrowding the infographic makes it difficult to read.
- Your infographic must include the university represented and all team member names. Figures, graphs, and tables should be uncluttered and simple and arranged in the sequence in which you want them to be viewed.
- Provide clear labels or headings for each section of your infographic.
- Remember contrast. Put light-colored text on dark backgrounds and dark text on light-colored backgrounds so that your viewer can see your text clearly.
- Drawings, illustrations, and/or diagrams (with the exception of open-source icons and clipart available through the design software of your choice) must be the student's own work.

Tips for imbedded graphics:

- Use high-resolution images.
- Do not cut and paste art or screen-filled shapes from PowerPoint.
- Text may be copied and pasted from PowerPoint into the layout software, but it will require applying the "create to outline" setting after pasting.

Refer to the judging sheet provided as **Attachment 3** to gauge the expectation of the judges.

7. Presentation Guidelines

Each of the participating teams will present their design solution virtually. Presentation dates and times will be posted on the SWANA Website by the end of March 2024 and participating teams will be informed and provided with further instruction. Presentation order will be chosen randomly, and all team members need to be active in the presentation. Plan for a 20-minute presentation followed by 10 minutes for question and answer.

Presentation Guidelines and Tips:

- REMEMBER that the judges are your client and your firm is hired to solve their "real world" problem.
- The presentation needs to flow in a way that makes sense. Similar to writing a paper it should present the problem, discuss the alternatives, and provide a solution.

- Don't read word-for-word from the slides. Slides should contain a summary of what students will say.
- Don't overwhelm the slide with too many images or complicated animations. Slides should be clean and easy to read with a common theme.
- Be sure to thank anyone who provided mentorship throughout the project.
- Each speaker should have somewhat equal time presenting. We recommend at least 50% team members to participate in the oral presentations, with a minimum of 2 presenters each team. For a team of two (2) members, both members must present. It is expected that most (if not all) team members participate when responding to questions from the judges.
- Clearly state the main points, assumptions, and conclusions. You will have to make assumptions in the real world, so the judges need to understand your thought process.
- Understand that there is a balance to the amount of background information that should be presented. You can assume there might be people in your audience (including judges) that will not be familiar with the topic, so a little background is helpful, but it should be limited, since it is not the main purpose of the competition.
- Discuss the challenges that you were faced with and how that affected the outcome. Practice presenting and answering questions in front of an audience. The judges understand that you are a student but like to see that you understand the basic engineering principles, and that you can think about their questions and come up with a thoughtful answer.
- Consider recording yourself during a practice presentation and make notes of distracting mannerisms (i.e. saying "ummm" or "like" too often). Practice timing yourself.
- Make sure you dress for the part. You are presenting as though you are trying to win a job. Attire is business professional.

8. Judging

Judging sheet is provided as **Attachment 3**. The following Table provides a breakdown of the total points:

Item	Maximum Points
Design Report	100
Infographic	25
Presentation	125
TOTAL	**250**

9. Award

Two team awards will be presented to the top teams with maximum overall scores. Students must attend the Awards Ceremony to be eligible for award. The Awards Ceremony is to be scheduled at the kick-off meeting.

The **minimum** award money is listed in the table below. In addition to these awards, every participating student will receive:

- Conference registration for a SWANA Annual National Conference (WASTECON 2024 or SOAR 2025).

Rank	Prize
First Place Prize	$2,000 (anticipated)
Second Place Prize	$1,500 (anticipated)
Third Place Prize	$1,000 (anticipated)

Smaller monetary awards will also be given out for Best Team Presentation and Emerging Leader/Rising Star. It may be possible for a team to receive more than one award.

Please note: Cash prizes are subject to the laws of the winning team's country including Somalia, Iran, Cuba, Sudan, Syria, North Korea, or any other nation that may be under sanction by the United States at the time of the competition or award distribution.

10. Closing Remarks

Although most information may be available online, participants should note that additional information may require contacting vendors. If this is the case, please remember that you are acting as a consultant. Be professional, polite, persistent, and concise in the requests to obtain necessary information.

At the end of the day, a consultant may need to contact the client for data requests. If you run into an issue that requires critical information that you believe is not provided, please contact the persons listed below.

11. Contact Persons

All submissions must be made electronically (unless specified otherwise) to **all contacts** listed below. Any question regarding the competition must be directed to Mateja and Sarah.

- Mateja Vidovic Klanac (mvidovicklanac@scsengineers.com)
- Sarah Gustitus-Graham (sgustitusgraham@geosyntec.com)

12. Use of Material

License: Team hereby grants to SWANA a royalty-free license to use, reproduce and distribute the infographic and presentation (including all handouts and PowerPoint presentations) to SWANA members and customers through the SWANA website, with appropriate attribution to Team.

Promotion: It is understood that SWANA may use Team's University name, photograph, and biographical material solely for the purpose of advertising and promoting Team's participation and appearance SWANA's Student Design Competition.

Recording: Team provides consent for SWANA to record the presentation in audio and/or visual form. Team understands that SWANA will be the sole copyright owner of the recording and can distribute it, along with any supporting materials. Teams will receive a link to the recording.

Warranty: Team warrants and represents that, to the best of Participant's knowledge, nothing in the presentation violates any proprietary or personal rights of others (including, without limitation, any copyright or privacy rights), the presentation is factually accurate, and contains nothing libelous or otherwise unlawful. Team further represents and warrants that the presentation is Team's own original work or has obtained all necessary permissions or licenses from any persons or organizations whose material is included or used in the presentation.

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ATTACHMENT 1 – Problem Statement

Problem Statement:
Sustainably Reducing Landfilled Plastic Waste

Background:

Across the United States, approximately 35,680,000 tons of plastic waste is generated per year, comprising 12.2% of the total waste stream[1]. Plastic materials can last hundreds of years without degrading[2]. Recycling is commonly touted as a solution to managing plastic waste, but in the aftermath of China's Operation National Sword in 2017 many municipalities have ended curbside recycling programs as pressures related to cost and/or contamination mount[3]. In 2018, an estimated 8.7% (3,090,000 tons) of plastic waste in the US was recycled compared to 75.5% (26,970,000 tons) that was landfilled and 15.8% (5,620,000 tons) that was combusted to produce electricity[4]. Cost is a major factor affecting whether municipalities maintain or end recycling programs. The Producer Price Index (PPI) for recycled plastics hit a low in October 2020, but rebounded to pre-National Sword levels by summer of 2022. However, since then the recycled plastics PPI has steadily declined again[5].

Scenario:

For the purposes of this design competition, student design teams will act as the Plastic Waste Task Force (Task Force) for the State of Swana (Swana). The Task Force has been assigned by the governor to develop a 10-year plan for reducing plastic waste across the state. Swana boasts a population of 3,704,000 people, with approximately 85% of the state's population concentrated in three major metropolitan areas: Bumpa, Majora Beach, and Dawnton. The remainder of the population is spread across rural areas . In 2023, a statewide waste characterization study was completed in Swana, the results of which are summarized in **Tables 1 and 2**. The proportion of plastics in Swana's waste stream was found to be 19.2%. The average contamination rate for recyclables across the state is 32%, with lower contamination rates in affluent and older neighborhoods, and higher contamination in less affluent and younger neighborhoods. Swana's waste is managed through a waste-to-energy (WTE) facility in Bumpa (20% by weight), and at two

[1] US Environmental Protection Agency (EPA). *National Overview: Facts and Figures on Materials, Wastes and Recycling*, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials

[2] Chamas, A., Moon, H., Zheng, J., Qiu, Y., Tabassum, T., Jang, J.H., Abu-Omar, M., Scott, S.L., and Suh, S. (2020). *Degradation Rates of Plastics in the Environment*. ACS Sustainable Chemistry & Engineering 8 (9), 3494-3511 https://pubs.acs.org/doi/10.1021/acssuschemeng.9b06635

[3] Waste Dive Team (2023). *Where curbside recycling programs have stopped and started in the US* https://www.wastedive.com/news/curbside-recycling-cancellation-tracker/569250/

[4] US Government Accountability Office (GAO) (2021). *Science & Tech Spotlight: Advanced Plastic Recycling* https://www.gao.gov/assets/gao-21-105317.pdf

[5] U.S. Bureau of Labor Statistics, Producer Price Index by Commodity: Rubber and Plastic Products: Recyclable Plastics [WPU072C], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/WPU072C , November 6, 2023.

landfills in Majora Beach and Dawnton (each receiving 40% by weight). The Majora Beach Landfill has 12 years of the remaining capacity, and the Dawnton Landfill has 34 years of the remaining capacity. The Bumpa WTE isn't expected to close for another 20 years.

In an initial meeting of stakeholders, the following concerns were raised:

- A coalition of residents from Majora Beach raised concerns that tourists are generating too much plastic waste without recycling, due in part to tourists' lack of concern regarding preservation of the state's landfill capacity;
- A coalition of residents from Bumpa raised concerns that increasing amounts of plastics were being combusted in the city's waste-to-energy facility, and they believe (based on anecdotal evidence) that this is adversely affecting the health of residents living near the facility;
- A coalition of residents from Dawnton raised concerns about the increasing costs of curbside recycling;
- Sugarfizz, a nationwide brand specializing in bottled drinks, voiced opposition to mandates related to extended producer responsibility (EPR) or minimum recycled resin content in new plastic containers on the basis that such mandates could raise costs and make their plastic container manufacturing plant in the state financially unsustainable;
- Two companies specializing in mechanical recycling and chemical recycling, respectively, both expressed interest in opening facilities in the Swana. Both companies requested that 50% of the Task Force's funds be given to them to start their facilities, and both said that they would require that contamination be no more than 10% in loads accepted at their facility.

Goals:

The Plastic Waste Task Force has a budget of $8 million to be spent over the course of 10 years on efforts to reduce plastic waste in Swana. The Task Force must address the following:

1. Create roadmap that identifies measurable, attainable goals for plastic waste reduction. Consider referencing the UN Sustainable Development Goals.
2. Identify one or more technologies and/or processes to allocate a portion of the $8 million towards.
3. Identify one or more community-based programs to allocate a portion of the $8 million towards.
4. Propose mandates, laws, or policies for the state government's consideration.

As a result of this analysis, design teams will make a recommendation to the governor based on consideration of the three tiers of sustainability (economic, environmental, and social).

The suggested solutions are highly dependent on the assumptions made by the design team. As shown in the Judging Form in **Attachment 3**, documentation of assumptions and data analysis are a highly weighted scoring criteria. Please note that contacts provided in Section 11 serve as Mentors. Do not hesitate to contact them to answer questions or clarify the data.

Considerations:

- Which portions of the plastic waste stream should be targeted?
- How will different groups in the community be impacted by any proposed changes? Consider environmental justice populations, businesses, tourists, and other groups.

- What are the projected costs of solutions? How do costs and benefits change based on changes in plastic commodity pricing?
- What are the environmental impacts of the proposed solutions?
- What are the limitations of new technologies or processes proposed?
- Consider how landfill operations influence and interact with the local community.

Municipal Solid Waste Generation in the State of Swana

Table 1. State of Swana Demographic and Waste Disposal Metrics

Metric	Bumpa	Majora Beach	Dawnton	Other	State-Wide
Population	1,111,200	1,296,400	740,800	555,600	3,704,000
Median Household Income	$64,876	$57,234	$56,784	$42,325	$57,200
Waste disposed (tons per week)	19,500	24,050	13,000	8,450	65,000
Waste disposed (tons per year)	1,014,000	1,250,600	676,000	439,400	3,380,000
Per capita waste disposal	5.0	5.3	5.0	4.3	5.0
% Residential	48.7%	41.2%	37.7%	66.3%	46.0%
% Industrial, Commercial and Institutional	51.3%	58.8%	62.3%	33.7%	54.0%
Annual projected increase in waste disposed	2.7%	2.8%	3.2%	0.8%	2.6%
Recycling contamination rate	20.4%	37.0%	35.2%	8.9%	28.0%
Recycling participation rate	42.0%	59.5%	48.9%	24.0%	46.8%

Table 2. State-Wide Average Solid Waste Composition for State of Swana

Waste Category		Residential		Industrial, Commercial and Institutional		Total	Total Annual Tons		
		Proportion	Annual Tons	Proportion	Annual Tons	Proportion	2023	2025	2030
Paper	Newspaper	1.7%	26,432	0.8%	14,602	1.2%	41,033	43,195	49,110
	Corrugated Cardboard	4.2%	65,302	10.7%	195,296	7.7%	260,598	274,325	311,891
	Office Paper/Kraft Paper	1.8%	27,986	2.5%	45,630	2.2%	73,616	77,494	88,106
	Boxboard/Paperboard	2.6%	40,425	1.7%	31,028	2.1%	71,453	75,217	85,517
	Polycoated Containers	0.5%	7,774	1.3%	23,728	0.9%	31,502	33,161	37,702
	Other Composite Paper	0.2%	3,110	0.5%	9,126	0.4%	12,236	12,880	14,644
	Other Paper	14.2%	220,782	14.5%	264,654	14.4%	485,436	511,006	580,983
Plastic	PET Bottles	3.2%	49,754	2.9%	52,931	3.0%	102,684	108,093	122,896
	HDPE Bottles	1.5%	23,322	0.9%	16,427	1.2%	39,749	41,843	47,572
	Other Plastic Containers	1.7%	26,432	1.3%	23,728	1.5%	50,159	52,801	60,032
	Plastic Film/Plastic Bags	7.1%	110,391	8.6%	156,967	7.9%	267,358	281,441	319,981
	Expanded Polystyrene	1.2%	18,658	1.7%	31,028	1.5%	49,686	52,303	59,466
	Rigid Plastics	1.9%	29,541	1.9%	34,679	1.9%	64,220	67,603	76,860
	All Other Plastics	1.8%	27,986	2.6%	47,455	2.2%	75,442	79,416	90,291
Glass	Mixed Glass	3.8%	59,082	3.2%	58,406	3.5%	117,489	123,678	140,614
Metals	Aluminum Cans/Other Aluminum	1.3%	20,212	0.9%	16,427	1.1%	36,639	38,569	43,851
	Steel/Tin Cans	0.9%	13,993	0.7%	12,776	0.8%	26,770	28,180	32,039
	Other Ferrous Metal	1.5%	23,322	1.7%	31,028	1.6%	54,350	57,213	65,048
	Other Non-Ferrous Metal	0.5%	7,774	0.3%	5,476	0.4%	13,250	13,948	15,857
Organics	Brush/Trimmings/Leaves/Grass	6.3%	97,952	2.5%	45,630	4.2%	143,582	151,146	171,843
	Food Waste	13.8%	214,562	14.9%	271,955	14.4%	486,517	512,145	582,277
	Animal By-Product	1.4%	21,767	0.6%	10,951	1.0%	32,718	34,442	39,158
	Other Organics	2.5%	38,870	2.5%	45,630	2.5%	84,500	88,951	101,132
C&D	Concrete/Bricks/Ceramics/Dirt	0.5%	7,774	0.4%	7,301	0.4%	15,075	15,869	18,042
	Tires/Rubber/Leather	0.6%	9,329	0.9%	16,427	0.8%	25,756	27,112	30,825
	Other C&D Waste	1.3%	20,212	1.5%	27,378	1.4%	47,590	50,097	56,957
	Treated/Untreated Wood	3.5%	54,418	3.6%	65,707	3.6%	120,125	126,453	143,769
Electronics	Electronics	1.2%	18,658	1.6%	29,203	1.4%	47,861	50,382	57,281
HHW	Special Waste	0.2%	3,110	0.1%	1,825	0.1%	4,935	5,195	5,906
	Medical Waste	0.1%	1,555	0.0%	0	0.0%	1,555	1,637	1,861
	Hazardous Waste	0.5%	7,774	0.5%	9,126	0.5%	16,900	17,790	20,226
Other	Clothing/Shoes/Textiles/Leather	6.5%	101,062	2.9%	52,931	4.6%	153,993	162,105	184,303
	Unclassified Fines	7.0%	108,836	6.5%	118,638	6.7%	227,474	239,456	272,247
	Other Unclassified MSW	3.0%	46,644	2.8%	51,106	2.9%	97,750	102,899	116,989
TOTAL		***100.0%***	***1,554,800***	***100.0%***	***1,825,200***	***100.0%***	***3,380,000***	***3,558,045***	***4,045,277***

ATTACHMENT 2
Team Commitment Form

Name of School: _____

Team Members and Contact Information:

Name	Email	Phone	Anticipated Graduation (MM/YY)

(Maximum team members = 8)

Chosen Name of Your Consulting Firm: _____

Designated Team Contact (Captain): _____

School Faculty Name/Phone Number/Email: _____/_____/_____

School Faculty Signature: _____

Any Requested Exception to Section 4 Criteria: Yes ☐ No ☐

If NO, we understand that the participant complies with requirements of Section 4. If YES, briefly state the requested exemption and reason below:

_____

_____

Use of Materials

I give SWANA permission to use any and all of my voice, image and likeness, with or without using my name, in connection with the products and/or services of SWANA for the purposes of advertising and promoting such products and/or services and/or SWANA and/or for other purposes deemed appropriate by SWANA in its reasonable discretion, except to the extent expressly prohibited by law.

Please check this box as part of your agreement to participate. ☐

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ATTACHMENT 3
Judging Form

Design Report (Maximum Points = 100)			
Description	**Max. Points**	**Awarded**	**Comment #**
Introduction	5		
Realistic / Innovative Assumptions and Data Analysis	25		
Strategic Delegation of Funds	20		
Non - Economic Comparison – Intangible Community Benefits	10		
Conclusion and Recommendations	10		
Feasibility of Recommended Solution	10		
References	5		
Formatting & Appearance	5		
Grammar, Spelling & Overall Technical Writing	5		
Visual Aids (Graphs, Pictures etc.) presented clearly	5		
Infographic (Maximum Points = 25)			
Proposed solutions are summarized succinctly in a communication appropriate for the general public	5		
All components of problem given appropriate level of attention	5		
Infographic includes motivational content that encourages the public to engage in solutions	5		
Visually attractive, legible text, effective use of figures, tables, & graphic devices	5		
Easy to follow, focused, and organized	5		
Presentation (Maximum Points = 125)			
Clear introduction that sets stage for presentation	15		
Main points are developed, organized, and well formulated	15		
Material presented at an appropriate level and pace for audience, yet includes relevant detail and clarity	10		
Visual aids are clear, well-constructed, and effective, aiding in understanding	15		
Realistic solution to problem with high likelihood of success	10		
Solution considers broad range of impacts such as environment, economics, society, and sustainability	15		
Questions answered competently, all members demonstrate a clear understanding of topic	20		

Team presents a professional image, projecting enthusiasm and competence	15		
Timing (presentation rehearsed and less than 20 min.)	10		