



# ASABE G.B. Gunlogson Fountain Wars Student Design Competition

2020 Rules  
FINAL – dated 09-09-2019

## Contest Format and Information

*Fountain Wars* is a hands-on, real-time design competition where students design and model their entry before the Annual International Meeting (AIM) and build and test their actual entry under time pressure during the competition at the AIM to accomplish technical tasks. Teams will present an oral presentation on their fountain design as well construct their system during a 120-minute “build” period. The fountain will be evaluated on the written report, video abstract, oral presentation, construction, technical tasks, and aesthetic display.

## ASABE Committee and Contact Person

Fountain Wars is competition administered by the P121 GB Gunlogson Environmental Design Competitions Committee. The committee consists of ASABE members in both private industry and academic professions. The committee member who will serve as the contact person for the teams is:

**Gayle Baker - [gayleb88@hotmail.com](mailto:gayleb88@hotmail.com)**

## Competition Rules and Procedures

### Entry Deadlines

**April 15, 2020** is the deadline to email your team’s intent to enter the competition to the competition contact person. Late entries will be penalized at a rate of 0.5 points per day after the entry deadline. The email should include:

- A contact name, phone number, and email for the student team member representative.
- A contact name, phone number and email for the team’s primary faculty advisor.

**May 15, 2020** is the deadline to email the following team information to the competition contact person. The email should include:

- The name, phone number and email of the team member designated to represent the team at the ASABE awards banquet.
- The name(s), phone number and email of the team’s faculty advisor(s).
- The names of all team members (**please review member eligibility in the next section**).
- A file with a team or university logo.
- Late team information will be accepted up to May 31, 2019 but may result in the team information not being published in the ASABE programs or shown in the power point awards presentations.
- Written report. Late reports will be accepted until May 31, 2019 but will be penalized 2 points per day for each day it is late. Requirements for the written report follow below.
- A link to the online video abstract on a file share site that can be downloaded by contest officials.

### Team Membership and Eligibility

1. All team members must hold International ASABE student membership and have been enrolled at the team school during the previous academic year. **Please make certain all team members are ASABE members. There will be a 10 point penalty for each team member that is listed on the roster that is not an ASABE member, even if the team member is later dropped. The penalty will be reduced to 5 points if the team member becomes an ASABE member before the June 1, 2020.**
2. The fountain must be designed entirely by the student team members without direct involvement from outside professionals or faculty. However, faculty, vendor technical support, or other professionals may be consulted for design mentoring.
3. Advisors are prohibited from any form of supervision during the construction period.
4. Each participating institution may field up to two teams. Schools fielding two teams must have two significantly different designs. Each team must be completely independent.
5. There is no limit on the number of team members, but only six persons may participate on the “construction crew.”

- 5.1. Teams unable to bring six members for the construction will be allowed to use up to three construction “ringers.” Ringers may be any person from the same school and registered for the meeting with the exception of the team advisor(s).
- 5.2. All on-site fabrication and construction must be completed by the “construction crew.”
- 5.3. The demographics of the “construction crew” must reflect the overall team membership.

## Written Report

Each team must compile and electronically submit a design report. Reports must adhere to the requirements listed below.

The following limitations will be placed on the reports:

1. Reports are to use 12 pt or larger font size on letter size pages.
2. Reports must have 1” margins.
3. Reports must be 15 pages or less (excluding pump specifications and title page). Additional pages (in excess of 15) may not be reviewed.
4. Reports must be submitted in a single PDF file to ensure figures are viewed properly.
5. Reports will contain the following information:
  - 5.1. A title page with the university name and the name and role of the team members.
  - 5.2. A page with any acknowledgements the team wishes to make (optional).
  - 5.3. A complete narrative of design objectives, processes and results.
  - 5.4. A complete parts list with the price of each purchased component (including donated and recycled parts and their value).
  - 5.5. A piping design including piping layout, dimensions and construction details.
  - 5.6. Design drawings and fabrication technique of any custom parts used.
  - 5.7. Calculations of flow rates, pipe friction and expected technical test performance. A pump performance curve must be included for each technical task.
  - 5.8. A statement of the aesthetic philosophy and objectives.

## Oral Presentation

1. An oral presentation will be made at the annual meeting prior to the building and performance competition.
2. Presentations will be geared toward promotion of the design and should contain enough information to enable the audience to be familiar with the entry.
3. With the exception of students participating in a conflicting ASABE sponsored event, all team members attending the meeting must be present, and at least two of the team members must speak.
4. Presentations should be between 9 and 11 minutes long. Teams will be penalized 5 points per minute outside of this range.
5. Questions will be allowed at the end of the presentation from judges only.
6. **Pools for use in the competition should be brought to the oral competition to be given to a contest official.**

## Video Abstracts

Each team must compile and electronically submit a video abstract. The following limitations will be placed on the videos:

1. Each team is to prepare a video abstract of 2 to 4 minutes in length. Many resources and guides can be found online to assist you with this process.
2. Abstracts should briefly introduce the technical tasks, highlight the aesthetic philosophy of the fountain, describe the approaches used to address the technical tasks, and demonstrate your fountain in action.

## Aesthetics Display

1. Pumped water must be used for the aesthetics display.

2. The main display must be a continuous display or other pattern without human intervention (only requires turning on water source). Additional features can be utilized that require human interaction, such as motion sensors.
3. In honor of the 100-year anniversary of the Nebraska Tractor Testing Laboratory (NTTL), aesthetic displays should celebrate this event.
4. Teams are required to complete the aesthetics portion of the competition to receive Technical Task Points.

## Technical Tasks, Materials and Construction

In honor of the 100<sup>th</sup> anniversary of the Nebraska Tractor Testing Laboratory, this year's technical tasks will incorporate test principals utilized at the Testing Laboratory.

### Technical Task #1: Drawbar Power

The challenge is to create a pulling system that will accomplish different pulling strengths at 3 different water flow rates.

1. The three "pulls" must be completed in within 2 minutes. The time limit will begin once the pump is started for the first pull.
2. Three pulls at three different flow rates must be completed to receive points for this technical task. Multiple pulls may be completed for each flow rate as long as they are completed within the 2-minute period. The best pull will be recorded for the final score.
3. The flow rate must be reported using a flow meter. The reading of the flow meter must be visible to the judges in gallons/minute. Flow rates should exhibit the minimum flow rate of 1 gpm, maximum flow rate capable by the fountain, and an intermediate flow rate at the discretion of the design.
4. The "pull" must originate inside the pool but can conclude outside the pool.
5. The power for the pull must be generated by water from the pump. A location for a hanging scale must be provided to record the pulls. The following hanging scale will be used at competition: Escali - H115 - Hanging Scale-22lb / 5kg
6. Manual operation of valves and nozzles is allowed.
7. Scoring:
  - 7.1. The team completing the largest pulls with the least flow rate will receive 75 points.  

$$\text{Maximum} = (\text{Pull 1 (lbs)} / \text{Flowrate1 (gpm)}) + (\text{Pull 2} / \text{Flowrate 2}) + (\text{Pull 3} / \text{Flowrate 3}) = 75 \text{ pts}$$
  - 7.2. Other teams will be scored based upon the following formula:  

$$\text{Score} = 75 \times ( (\text{Pull 1 (lbs)} / \text{Flowrate1 (gpm)}) + (\text{Pull 2} / \text{Flowrate 2}) + (\text{Pull 3} / \text{Flowrate 3}) ) / \text{Winner Formula}$$

### Technical Task #2: Three Point Lift Tests

This task will require a fountain design capable of lifting three different weights.

1. Each team will have 2 minutes to complete the task for all three weights of 1.25 lb, 2.5 lbs, and 5 lbs.
2. More than one lift can be completed for each weight. The maximum lift for each weight will be recorded.
3. The fountain design must provide a location for a weight plate to be placed prior to the lift. Example weight plate: CAP Barbell Standard Cast Iron Weight Plate (Walmart)
4. The weight must originate from the top of pool level at the beginning of the lift.
5. A 2" x 4" x 12' marked with measurements shall be provided at competition for each team to incorporate and fasten into the fountain. The 2x4 end shall be placed at the bottom of the pool. A lift that exceeds 12' will be considered a full lift at 12'. The 2x4 can be incorporated into other tasks and can be modified, as long as measurement marks can still be read by the judges.
6. Manual operation of valves and nozzles is allowed.
7. Scoring:
  - 7.1. 
$$\text{Maximum} = \text{Lift 1 Height} + \text{Lift 2 Height} + \text{Lift 3 Height}$$
  - 7.2. The scores for the remaining teams will be calculated as follows:  

$$\text{Score} = 75 \times ( \text{Lift 1 Height} + \text{Lift 2 Height} + \text{Lift 3 Height} ) / (\text{Winner Sum of Lift Heights})$$

## Building Materials Supplied

1. Contest officials will provide PVC primer and cement. **PVC primer and glue will be provided. Primer and glue should not be brought to the contest.**
2. A nominal 2" x 4" x 12' piece of lumber with measurement increments marked will be provided at check in to each team.
3. The officials will provide a hanging scale: Escali - H115 - Hanging Scale-22lb / 5kg
4. The competition will provide weight plates: CAP Barbell Standard Cast Iron Weight Plate (Walmart)
5. Access to fused 110 V AC, 20-amp service. Extension cords may be needed to bring the service to pool pump location. Each team should bring an appropriately rated extension cord(s).
6. Teams **will not** be provided pipe at the contest. Each team must bring all building supplies except for PVC primer and cement.
7. Each team will provide a new pool (pool in an unopened box) to the Fountain Wars officials at the oral presentation. The pools shall be an approximate 999L reservoir, which will have an approximate diameter of 6 feet and be approximately 15 inch high. This will allow contest officials to begin set up of the contest site prior to team check in. The pool brought by a team will be assigned to a building site at the contest location. The pools and building site are assigned to teams by random draw, therefore the pool brought by a team may not be assigned to that team.
8. **Water to fill the reservoir will be provided prior to or during construction to the degree possible but filling may continue throughout the construction period.**

## Materials Requirements

1. Teams will supply their own pumps, pipe, nozzles, fittings, valves, controllers, flow meters, aesthetic components, etc.
2. The contest officials do not supply extension cords. Each team should bring an appropriately rated extension cord. If the team is also using computers or other water sensitive electronic equipment, they would be advised to bring plastic sheeting or other materials to protect their equipment from inadvertent overspray. The contest officials cannot guarantee sufficient spacing separation to prevent overspray from all fountains.
3. Teams must also supply as many UL listed ground fault interrupters (GFIs) as needed for their design. They must be wired so the power supply feeds directly into them. Teams must demonstrate to the safety judges that their GFI(s) works and are advised to bring an extra GFI unit(s) because of GFI failures in the past. A team will not be allowed to compete without a working unit.
4. Only 2-feet of flexible hose may be used in a design as part of the fountain's conveyance system. Small diameter flexible hose of less than 0.5 inches O.D. is not subject to the 2 foot limitation and is intended to allow use of various controllers and/or valves.
5. All materials provided by the team including, parts, equipment and tools must fit within five (5) cases.
  - 5.1. Each case must have the sum of its linear dimensions (length + height + width) less than 62 inches and weigh less than 20 kg (44 lb), including the case and all packing. If the case has non-uniform dimensions, the greatest dimension of the case will be used.
  - 5.2. Cases exceeding the specified size limit will not be allowed
  - 5.3. Items will be removed from overweight cases until they are under the limit
  - 5.4. Teams traveling by auto must also adhere to these requirements. The cases must be closed cases and can be checked for airline travel.
6. Materials not allowed in airline checked bags are prohibited.
7. Restricted articles include, but are not limited to, acids, explosives, flammables, oxidizers, corrosives, compressed gases, and poisons.

## Pump Requirements

1. Teams will supply their own pumps.
2. Teams will supply complete manufacturer specification sheets for all pumps used as an appendix to their written report.
3. The sum of the manufacturers specified maximum amperage of all pumps utilized during any portion of the competition must not exceed 14 amps and must use 110 VAC.
4. The written report should state the maximum designed electrical supply current (at 110 VAC).
5. Judges may test the line current of a team's pump system at their discretion.
6. Modifications of a pump from the original design will result in team disqualification.
  - 6.1. Modifications may include but are not limited to; modifying or replacing the impeller, increasing the motor speed and replacing the motor.
  - 6.2. Cosmetic changes of paint finish and normal pump repair and maintenance will not be considered modifications
7. Pumps will be included in the weight and size limits as outlined in "Material Limitations"

## Biological Materials

1. Each design is encouraged to use biological materials in their design, and bonus points will be awarded for doing so.
2. Bio-matter includes: plants and plant leaves, flowers and seeds; processed plant fibers; paper and wood; animal feathers, hair, bones, horn, shells and hides; and edible foodstuffs.
3. Live animals are prohibited.
4. Bio-matter may be used as decoration and/or as an integral part of the apparatus, with the latter given the higher credit in judging.

## Safety Requirements

1. Power tools and equipment are prohibited with the exception of:
  - 1.1. Battery powered drills and drivers,
  - 1.2. Sensors, lighting, solenoids, limited motion actuators, and
  - 1.3. Computers and controllers.
  - 1.4. Electric saws, drills, and any tool or device using an AC motor are specifically prohibited. Use of prohibited tools will result in a penalty and continued use after a penalty will result in disqualification.
  - 1.5. Pumps being used in the design are the only exception.
2. Electric Service Safety.
  - 2.1. All 110 Volt equipment must be connected through a UL listed ground fault interrupter (GFI) and be in good condition so it does not pose a shock hazard. If a GFI is not used to connect 110 Volt equipment, the team will not be allowed to compete.
  - 2.2. All electronic controls (valves, actuators, etc) in or near the pool may not exceed 24V. All wires must be neatly bundled and routed to minimize the potential for tripping.
  - 2.3. Manual operation of any electrical valve must occur through an approved switch.
  - 2.4. The 110 volt service line that is supplied on site may not be connected or positioned near the pool until after the signed approval of the safety judge.
  - 2.5. All 110 volt devices including computer supply transformers must be positioned at least 10 feet from the pool and kept dry by a suitable weather tight enclosure. The enclosures must be positioned such that they may not accidentally be dragged or dropped in the pool. 110 Volt devices may not be powered at any time when their enclosures are open.
3. If a team uses compressed air for any reason, any portion of the fountain that contains compressed air must be rated and safe for that application. **Note: PVC pipe is not rated for compressed gasses.**
4. Personal Protective Equipment (PPE)

- 4.1. All members of the construction crew must wear closed toe shoes and should wear appropriate safety gear when necessary.
- 4.2. Eye protection MUST be worn when using battery powered tools, such as drills and during any gluing process, and is recommended for most other assembly activities.
5. Water outside the pool can be a slip hazard and extreme caution must be taken by all team members during all phases of the competition.
6. During competition any unsafe or hazardous behavior by team members will result in a warning from the judges. A second similar offense will result in penalty points.
7. No person shall be in the pool after the electrical service (pump) is activated.

## On-Site Competition

### Pool and Building Site Check in and Inspection

Thirty minutes before the announced start of the construction, each team will be assigned a pool and building site by a random draw. Each team will then position their five cases of materials and tools at their designated site for inspection. Once the size and weight of the cases are checked, all materials and tools must be displayed, for inspection of material limitations and safety requirements. The site assignment will also determine the order of the competition.

### Construction

1. All teams must fabricate their fountain during a common 120-minute construction period.
2. The name of the University will be displayed on the fountain in a manner to be easily viewed by the audience.
3. Custom nozzles and nozzle assemblies may be prefabricated.
4. The fountain structure, piping, electronic controls and etc. can be brought to the degree of assembly possible but must adhere to the shipping requirements outlined in the Materials Limitations section of these contest rules. The use of threaded fittings to allow parts re-use will be awarded bonus points during construction judging. The teams will indicate to the construction judges the number of fittings in use and their location of use at the judges' request. Judges will award 1 point per fitting, if the use is deemed appropriate to the design, but limited to 20 total points.
5. Each team must keep all materials, parts and equipment within their building area. However space is often limited, so teams will need to be considerate and cooperative with regards to building area space.
6. **Each team will use a catchment system to hold the open pipe cleaner and glue containers and a protective cover of cardboard or plastic to prevent spillage to the floor while gluing pipe.**
7. Team members must provide any assistance requested by the judges, referees, or other contest officials.
8. The fountain or any structural portion or component of the fountain may not contact the ground outside the pool. (exception: an electrical control system that do not bear any structural support load)
9. **Building area cleanup is included in the 120 minute construction period.**
10. The end of construction will be determined when all team members have moved outside of their building area.
11. Teams going over time will be allowed to complete their design, but will be penalized points as specified on the score sheet.

### Performance Trials

1. Performance trials will consist of a testing period, the aesthetic display and two technical tasks.
2. Each team must be present during the entire performance period and team members must provide any assistance requested by the judges, referees, or other contest official.
3. The only tools allowed in the building area during trials must be carried at all times by team members.
4. Teams will be given a common 45 minute calibration period before testing begins to refine nozzle direction and component placement.
  - 4.1. This time will be in addition to the 120 minute building period.
  - 4.2. Construction or addition of components will not be allowed during this period.

- 4.3. Judges may make construction measurements during this period.
5. Reservoirs will be re-filled as needed at the end of the testing period.

### Aesthetic Display

1. Before the start of the aesthetic display, one team member will be required to give a brief introduction to the audience, including an introduction of the team members and a description of the team's aesthetic philosophy.
2. The aesthetic display must start within 60 seconds of the judge's order and last a maximum of 90 seconds.
3. The display must be *either a continuous display or other pattern that requires no human intervention, once initiated for the 90 second judged time period. Additional features of the fountain can utilize human interaction, such as motion sensors.*

### Technical Tasks

1. The Technical Task must start within 90 seconds of the judge's order.
2. Each team must have at least one member who can answer questions and address the crowd at the request of the emcee during the competition.
3. Adding water to the pool after the performance trials begin will be penalized as specified on the score sheet.
4. No physical changes to the fountain will be allowed between technical tasks, except for manually setting valves. Any other changes made will result in penalty points as specified on the score sheet.
5. Team members must stand outside the building area until instructed by the judges to begin a technical task.
6. A team composed of local celebrities and/or professional ASABE members may be selected to design, build and test their own fountain during the contest, however this team will be for exhibition; they will not be in direct competition with the participating teams.

### Proposed On-Site Competition Timeline

Elapsed Time	Event Description	Event Duration
½ hour	Check-In and Inspection	30 min
2 ½ hours	Construction	120 min
3 ¼ hours	Performance Trials	45 min
	Aesthetics Display	
	Break	
	Technical Task 1 Technical Task 2	

\*\* During the highlighted times team members are not allowed into the building area except when told by judges to complete that portion of the competition. The technical tasks may be judged concurrently.

## Scoring

- Overall scores will be computed by summing the scores from the *Written Report*, *Oral Presentation*, *Construction*, *Performance Trials*, and *Aesthetics* portions of the competition.
- Judges may apply additional penalties at their discretion *up to disqualification* for unforeseen design and competition issues or poor behavior or unsportsmanlike conduct. Penalties can be assessed for inadequate clean up following the contest. Each team is responsible to clean up their assigned areas and place all unwanted materials into the designated disposal container. Please ask a contest official for a site inspection before leaving the contest area.
- Penalties, however, may *not* be applied to fine a team that through creative design circumvents the intent, but not the letter of a rule, with the exception of safety.
- Judges may also award additional points at their discretion to reward teams for especially creative or good sportsman-like efforts.
- Sustainability (parts re-usability) and economy of design concepts are included in the scoring segments. Threaded fittings can be used in the fountain construction. Threaded fittings can be glued to pipe prior to the competition.

Written Report	Points Possible
Completeness of design narrative	+ 20
Completeness of parts list	+ 5
Quality and feasibility of the design as communicated by the report and supporting figures	+ 30
Accuracy and completeness of flow calculations, which includes a pump performance curve for each technical task	+ 25
Description of aesthetic philosophy and objectives	+ 10
Style (including organization, grammar, spelling, labeling of figures, etc.) , adherence to report requirements, and conciseness of writing	+ 10
Penalty for late submission	- 5 points/day
<b>Total</b>	<b>100</b>

Video Abstract	Points Possible
Content	+25
Production quality	+25
<b>Total</b>	<b>50</b>

Oral Presentation	Points Possible
Content & organization	+ 20
Style & appearance	+ 20
Delivery & audience awareness	+ 10
Over time penalty	- 5 x # minutes
Only one team member speaking penalty	- 10
Missing other presentations penalty	- 5 x # teams
<b>Total</b>	<b>50</b>

<b>Construction</b>	<b>Points Possible</b>
Conduct & safety	+ 15
Fabrication skill	+ 15
Teamwork	+ 15
Fittings & sustainability	+ 20
Bonus for use of bio-materials	up to 15
Penalty for unsafe or hazardous behavior	up to 20
Penalty for expanding building area	up to 10
Penalty for exceeding building time	- 5 x # minutes
<b>Total</b>	<b>65</b>

<b>Aesthetics</b>	<b>Points Possible</b>
Introductory presentation	+ 10
Adherence to reported design	+ 10
Creativity & originality	+ 20
Water display	+ 30
Lighting & sound	+ 20
Penalty for exceeding 90 seconds	- 1 x # seconds
Bonus for use of control system	up to 10
<b>Total</b>	<b>90</b>

<b>Technical Task Scoring</b>	<b>Points Possible</b>
Performance points	+ 75
Adherence to reported design	+ 15
Penalty for modifying fountain	up to 20 points
Penalty for adding water	- 10 each occurrence
Penalty for not assisting judges	up to 20 points
<b>Total</b>	<b>90</b>

<b>Total Points (plus bonus points)</b>	<b>585+</b>
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## Awards

Award values listed are minimum amounts for the competition. Actual award amounts will be determined by sponsorship. Awards will be presented at the Student Awards Breakfast at the Annual International Meeting (AIM).

### Competition Overall Awards

1<sup>st</sup>: \$1250, 2<sup>nd</sup>: \$1000, 3<sup>rd</sup>: \$750

### Special Awards

Special Awards of \$100 each are given in recognition of excellence in specific aspects of the competition, and may be granted in addition to the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> place awards.

- Economy of Design
- Most Attractive
- Innovative Design
- Best Use of Bio-Materials
- Judges' Recognition
- Best Use of Electronics

### Best Technical Task Proposal

Teams can submit one idea for a future Fountain Wars technical task. The proposal can be added as an appendix to the written report and is limited to one page. The proposal should use the format of the technical tasks of these Fountain Wars rules. Proposals do not have any effect on the current year contest scoring nor is there any penalty for not submitting a task. The proposal page does not count against the page limitation of the written report.

