

STEM THE FLOW



**WATER, WATER,
EVERYWHERE!**



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WHAT IS STEM THE FLOW?

Climate Change is one of the biggest challenges the world faces and has an effect on everything from flooding to air quality and even green space. The impact it will have on us all needs creative, innovative and exciting ideas and solutions and we want you to be part of that process!

Glasgow City Council and Jacobs Engineering are joining forces to support “STEM the Flow”, three STEM challenges (Science, Technology Engineering and Maths) that will suggest engineering solutions to help tackle these climate issues in Glasgow. Climate change has caused major problem for the city and its residents and we need to continually look at new ways to protect ourselves from extreme weather and atmospheric events.

We are looking for you to research and develop your own ideas about tackling these issues. This could be flood prevention schemes, ways to measure air quality or creating new green spaces within the city. We're also looking for your solution to collect data and then display this for the people of Glasgow to see.

You will have to work as a team to create a timeline, conduct research, draw conclusions and build a model/produce a display to showcase your idea.

**OUR INDUSTRY
PARTNER:
JACOBS
ENGINEERING**

This year we are lucky to have top Engineering firm JACOBS work with us as our Industry Partners. Jacobs is committed to developing long lasting sustainable solutions that improve people's lives all over the world and one of the areas in which they do this is through flood and coastal management.



Planning is the Key to Success!

Before you get started there are a couple of planning activities your team should complete:

1. You should use the template at the back of this booklet to construct a Gantt Chart. This will give you a solid timeline to work to over the next 8 weeks.
2. Decide how often the team should meet and when. After school once or twice a week, during lunchtime?
3. You should choose team roles so that everyone knows what their responsibilities are within the team.
4. How often are you going to meet with your industry mentor and how will you keep in contact with them?

Good planning at the beginning means you will be more organised and structured as you move through your project. This will not only ensure that you finish the project on time but also make your team more likely to succeed!

WATER, WATER, EVERYWHERE: PROJECT OVERVIEW

There are two approaches to tackling climate change; Mitigation and Adaptation. *Mitigation* refers to actions that we take to reduce or prevent emissions of greenhouse gasses (one of the leading causes of climate change). *Adaptation* is when we come up with innovate ways to help lower risks caused by climate change. Both approaches are vital if we want to make a difference however, this project focuses on *Adaptation*.

One risk that we are often faced with (especially in this country) is flooding. Glasgow in particular has issues with flooding every year caused by heavy rain and the the three main rivers (Clyde, Kelvin and the Cart) that flow right through the centre of the city. This project focuses on one way that we could tackle this problem.

Your challenge is to develop and create a new flood defence system that will prevent high rainfall from flooding our city centre streets or green spaces. Surface flooding is a major issue in Glasgow as the city is built on multiple hills and large areas have been urbanised over time. We suggest you chose one of the following areas to focus on:

1. Buchanan Street - Due to the lack of green space and the incline of the street rain cannot be absorbed into the ground.
2. Glasgow Green - Even through it is one of the city's largest green spaces it can also be victim to flooding during high rain fall. This causes serious issues during large city event that are hosted in the park such at the commonwealth games or Trnsmt festival.
3. Bellahouston Park - Again the park is host to many outdoor concerts and sporting events and in time of high rainfall can become easily flooded.

One of the main issues you will face is how to transport the water as you do not have easy access to the rivers from the city centre or Bellahouston Park

Since you cannot control the amount of rain that falls onto the city your best approach is to develop a way to either redirect the surface water that gathers or develop a way to move the users out of harm's way;

- Could you develop a system that will pump some of the water out of these areas and into the river or a water reservoir?
- Could you create an artificial river in streets to keep the water contained or raise the pavement out of harm's way?
- Could you develop a type of pavement tile that can actually absorb water?
- Could you introduce more trees, plants and foliage that could absorb the extra water?
- Could find a way to harness the water and create a water feature(s) somewhere in the city.



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Getting Started

Types of Flooding

You should begin by researching the different types of flooding that Glasgow has to deal with. There are 3 main types; costal, river and surface flooding. What one will you primarily be dealing with? How have people tried to tackle this issue in the past?

City Centre Hotspots

Since this project is all about relieving the pressure on our overflowing drains it would be a good idea to identify areas that commonly flood after rainfall. Why do these areas flood and has anyone tried to fix the problem in the past? Could you do an experiment/research to see how flooding is different on ground that is already wet and soggy (like in the winter) compared to dry and hard (like in the summer)?

Rainfall

Look into the amount of rainfall that the city normally has to deal with each year. You may even want to conduct a few of your own experiments and measure the rainfall over the course of this project. Could you measure the rainfall at your school and use it to estimate how much water might be landing on your chosen area during a storm?

Existing Drain System

What is the current drain system like. Are the drains too small or are there not enough of them on the street to deal with heavy rain fall throughout the year. Could you investigate how other cities with flooding problems have dealt with them?

Materials

What materials are you going to use? Is your focus going be on the strongest materials available, the most financially efficient or a balance of the two?

Costing

How much will your flood defence cost? Have you factored in construction costs and materials?

Sustainability

One of the most important aspects of this project is how sustainable your solution is. Can your flood defence pro-



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Summary of Project

Write a Report

Write a report about your chosen project. The easiest way to tackle the report is to write it as you go instead of leaving it to the last minute!

Create a Display

Make sure you have time to create an engaging display of everything your team has done. Sizes of the display board will be given to your teacher.

Prepare a Presentation

Your team will also have to prepare a presentation. The presentation should last no longer than 10 minutes and teams should be prepared to answer questions at the end.



Hints and Tips

- HAVE A WELL STRUCTURED PLAN FROM THE BEGINNING OF THE PROJECT
- WRITE THE REPORT AS YOU GO
- USE PHOTOGRAPHS AND SKETCHES TO HELP TELL YOUR STORY
- BUILD A MODEL TO VISUALLY DEMONSTRATE HOW YOUR PROJECT WILL WORK
- YOU CAN EVEN USE POWERPOINT OR VIDEOS IF YOUR SCHOOL HAS A LAPTOP YOU CAN USE!
- YOU CAN USE POWERPOINT OR VIDEO IF THEY ARE AVAILABLE
- ALL TEAM MEMBERS MUST CONTRIBUTE
- IT SHOULDN'T LAST LONGER THAN 10 MINUTES
- BE PREPARED FOR QUESTIONS!

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SUGGESTED TIMELINE

Week 1 Decide team roles and a team name. Complete Gantt Chart as a team and begin to discuss initial ideas and start to conduct research.

From your initial research decide as a team areas which you are going to focus on. Why do our cities drains overflow? Where are the main problem areas. What possible ways can we get rid of water?

Week 2 What are the main objectives of your drain relief system? Will it be aesthetically pleasing, hidden from view or have a secondary purpose such as city centre seating?

Week 3 Start to look further into materials and costing. This would be a good time to contract your Industry Mentor for some advice and information that you may not be able to find on the Internet!

Week 4 Begin to test some of your material choices. Look at aspects such as stress, strain, durability and water resistance. Start to write your report.

Week 5 You now have enough information to begin work on your model. How will you and your team best represent your idea? What materials do you think you'll need?

Week 6 Continue to work on model and report. Be sure to include any issues you have faced and how you overcame these as a team. Don't be afraid to alter your design as you go. This is all part of the learning process!

Week 7 Draw conclusions on what you have all learned. How did you work as a team and is there anything you would do differently next time?

Week 8 Finish Report

Week 9 Start to think about your display. How are you going to tell your teams journey though this project. Do you want to use PowerPoint or video? Have you taken any photographs while your team has worked through the project?

Week 10 Prepare your presentation and finalise your display and model!.



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Below is a suggested format for your team's Gantt Chart. It will help you plan out your week to week activities and give your project some structure. Whether you use this template or make your own you should include the final Gantt Chart in your written report.

Tasks	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10
Team Name and Team Roles										
Initial Ideas										
Research										
Site Visit										
Idea Generation										
Calculations and Experiments										
Analyse and Evaluate										
Draw Conclusions										
Report Writing										
Build Model										
Display										
Presentation										



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School Name

Industry Mentor and Contact Details

Important Dates

Some Useful Websites

1. <http://www.glasgowharbour.com/>
2. <http://www.sepa.org.uk/environment/water/>
3. <http://www.floodsite.net/juniorfloodsite/html/en/student/thingstoknow/hydrology/urbanfloods.html>
4. <http://www.jacobs.com/>
5. <http://thewire.in/63383/water-logged-cities-municipal-failure/>
6. https://www.youtube.com/watch?v=jTLdOZn_5TM