

Learn the Drains

SUMMARY INFORMATION

Keywords

Urban landscapes, drainage systems, stagnation, annual rainfall (in mm)

Topics Covered

Biology, Physics

Target Grade(s)

7, 8

Estimated Time Required

4 hours

LESSON

Goals and Pre Requisites

Goals

- To enable students analyse the design and construction schemes used to develop drainage systems
- To help students' present drainage models that would improve the current situation.

Instructional Objectives

Through this activity, students would be able to:

- Analyse and observe
- Demonstrate critical thinking
- Develop strategic planning

Instructional Resources

Problem Statement

As of December 2015, Chennai witnessed heavy rainfall of 537mm, virtually breaking a 100 year record. However, the aftermath of the calamity was alarming as there was a heavy overflow of water from drains and manholes.

Can we design a drainage system that would enable better management of water in case of a disastrous situation?

Background

Drainage systems

In geomorphology, **drainage systems**, also known as **river systems**, are the patterns formed by the streams, rivers, and lakes in a particular drainage basin. They are governed by the topography of the land, whether a particular region is dominated by hard or soft rocks, and the gradient of the land. Geomorphologists and hydrologists often view streams as being part of drainage basins. A drainage basin is the topographic region from which a stream receives runoff, through flow, and groundwater flow. The number, size, and shape of the drainage basins found in an area vary and the larger the topographic map, the more information on the drainage basin is available.



Procedure

1. Introduce the **Problem Statement** to students.
2. Form students into groups of four.

3. Allow them to brainstorm with their groups, on the given **Problem Statement**.
4. Each group must come up with their unique solution(s) to the given problem.
5. Each group can compare their solutions with fellow groups and with their teacher to check on the feasibility of their solution.
 - In order to check on feasibility, instruct students to discuss with their team mates and have a rough sketch of their plan before constructing it. Students must be able to provide justification for their choice of materials.
6. Ask students to build a timeline (within the estimated amount of time provided under summary information) and ensure that all members of each group are involved in planning the project in terms of availability and cost of materials.
7. Students must make sure that the design incorporated in their process would address the existing problem.
8. Each group can present their solution and evaluate feasibility with peer groups and the teacher.

Sample Methodology

Note: The following is an example of how the given **Problem Statement** might be addressed. **For Teacher Reference only.**

Materials Required

Large Plastic Container

Cardboard sheet

Plaster of Paris

Water

Sharp Object (scissor, knife) – for the purpose of drilling

Procedure

1. Student groups are required to choose a particular area (within the city) and study the drainage system i.e. the number of drains, the number of manholes, the road inclination angle towards each drain, records of the highest amount of rainfall received in that area, cases of water stagnation in that area and its reason(s).
2. Keeping their analysis in mind, they are required to develop a model that would better the drainage system of that area.
 - Take a large plastic container. Now create a single layered, moderately thick deep U shaped mould using plaster of Paris. This

mould should fit into the approximate centre of the plastic container.

- Cover the opening of the plastic container using the cardboard sheet. Visualize the cardboard sheet to be the area you observed.
- Drill a hole (try to replicate the topography of your visited area as much as possible) on the cardboard sheet. The hole would represent a drain, so make sure it is of a small diameter. Carve another hole (that is approximately of the same diameter) through the plaster of Paris.
- Pour the amount of water that would mimic the observed water overflow (in cm/mm) from your area.
- Calculate the time taken by the water to trickle down to the base of the container.
- Now strategically place more number of drains on the cardboard sheet and the layer of Plaster of Paris, so that water would drain out quickly without any stagnation and overflow.

Conclusion

Better drainage systems are vital to prevent stagnation and wastage of water.

Extension

- Case Studies on Drainage systems in foreign countries.

<http://www.expressdrainagesolutions.co.uk/news/drainage-system-compares-rest-world/>

<http://en.rocketnews24.com/2011/05/13/the-fantastic-underground-world-of-tokyo-drainage-systems/>

- Students may propose their solutions to the Municipal Corporation/Council of the area which they visited.

Assessment and Rubric

Define the need or problem – Did students identify the need to resolve this problem? Were they able to relate the problem to their own environment?

Come up with ideas - Did students weigh various possibilities brainstorm on various ideas before arriving at a solution? Did each group collaborate effectively to (1) work within the time given (2) give equal opportunity for participation (3) consolidate relevant information (4) provide rationale for their decisions and choices.

Select the most promising idea or design - Were students able to evaluate the feasibility of their solution to the given problem statement? On what basis was the feasibility of the solution determined?

Communicate and plan the project – Were groups able to provide justification for their choice of materials? Were students able to see completion of the activity within the estimated time?

Create/Build and test a design –Were all members of the team participative during the course of the activity?

Evaluate and revise the design – Were student groups able to present their solutions in a clear and distinct manner with other groups? Were they keen on improving their model further?

Credits

- http://www.tutorialspoint.com/geography/geography_india_drainage_system.htm
- <http://www.physicalgeography.net/fundamentals/10aa.html>
- <http://www.tradeindia.com/fp295137/Sewage-Drainage-System.html>
- <http://www.thehindu.com/news/cities/Coimbatore/underground-drainage-works-hit-traffic-flow/article3861619.ece>
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