

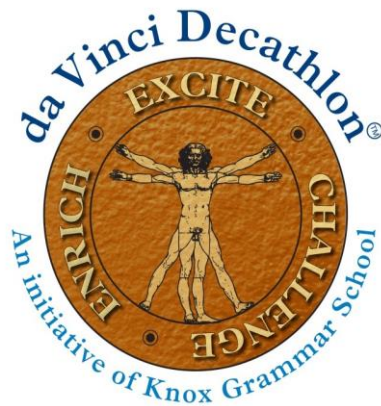


KNOX
GRAMMAR
SCHOOL

STATE

DA VINCI DECATHLON 2019

CELEBRATING THE ACADEMIC GIFTS OF STUDENTS
IN YEARS 7 & 8



ENGINEERING

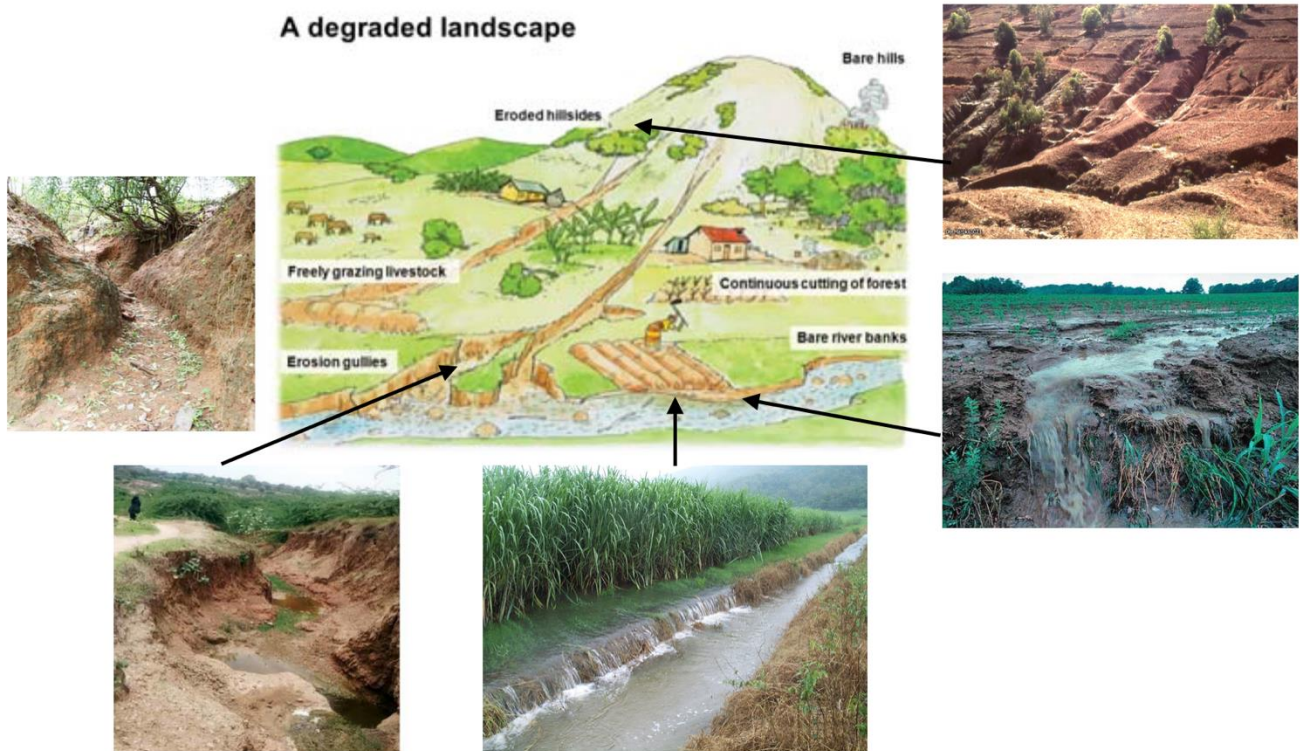
TEAM NUMBER _____

Total	Rank
/50	

A DAMAGED LANDSCAPE

BACKGROUND

As society continues to exploit the natural resources around us, irreparable harm is being done to natural landscapes. Below is an example of a degraded landscape caused by a nearby agricultural development.



There are a few major issues that the farmer on the property has. In particular:

1. The hillsides are eroding, and landslides occur often, causing large amounts of soil to slide down the hill and into the farmland (top right).
2. This is producing erosion gullies in farmable land, making it impossible to farm. The gullies have also made it impossible to cross some parts of the farm, by foot or by vehicle (left and beneath left).
3. Currently the water run-off from agricultural fields is running straight into the local river due to bare river banks (bottom right and beneath).
4. Currently the livestock graze freely around the property, but the farmer is finding that grass doesn't have to time regrow and some livestock have been injured by approaching the erosion gullies.

These issues are common to many agricultural developments and can cause significant harm to the local landscape, which will later affect the local ecosystem and the viability of flora and fauna to live in the area.

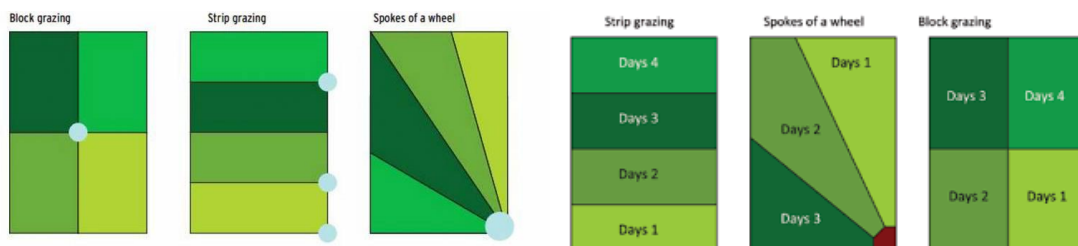
THE TASK

Your task is to engineer new infrastructure and systems in the above scenario to return the landscape to its natural sustainable state. There are two stages to this task:

1. Complete the Engineering Design Process on page 5 to develop solutions to each of the Farmer's concerns; and
2. Create a model that demonstrates each new development along with how these ideas **work together**.

Below are some images of solutions that have previously been engineered related to issues 1 and 4 on Page 2. Use these as inspiration and adapt ideas if you think useful to your design.

You also need to think about a general design that considers how all your solutions will work together. Remember that some issues **may link together**, and an engineering solution may fix many issues at once. For example, to solve parts of issue 1, 3 and 4 you might need to build a central drainage system that collects all the water from parts of the farm into one place, which then connects to the river. *Perhaps you could use something that we previously identified as an issue on page 2 to be the solution for this?*



DESIGN STATEMENT

Your model must satisfy the following conditions:

1. The property is to be represented by an A3 piece of paper. This will be the 'base' of your model.
2. You do not have to create a 3D terrain (you can presume the piece of paper will have a similar shaped and sloped ground to the one in the picture on Page 2).
3. Use the A3 paper to create a 2D plan/layout of your newly engineered property. You may annotate certain parts of the plan if you think it will help explain a design choice to the examiner.
4. **3D model components** must then be attached to the 2D A3 base that are related to **each of the four issues** listed on Page 2.

DESIGN PARAMETERS

You will have between **50-60 minutes** to design and construct your paper table. The table will be marked according to criteria that you can find on Page 6. Note: You will **not** be marked on the artistic qualities of your 2D drawing.

MATERIALS TO BE PROVIDED

You will be provided with a number of materials. It will be up to your team to decide what materials you will use to construct the model property. You are able to select from the following materials:

- 3 pieces of A3 paper
- 2 Pieces of A4 card
- 5 straws
- 10 toothpicks
- 1 Sandwich size resealable bag

You may also use your own sticky tape, but sparingly.

DESIGN PROCESS (10 MARKS)

For each of the issues identified on page 2, list the problems the farmer faces with his landscape, what we need to do in order to overcome the problem, and the engineering design to realise this solution. **Some** of issue 2 has been completed as an example.

ISSUE	RELATED PROBLEMS (1/2 MARK PER ISSUE)	WHAT NEEDS TO BE DONE (1 MARK PER ISSUE)	ENGINEERING SOLUTION (BE SPECIFIC AND DESCRIBE WHAT TYPES OF MATERIALS COULD BE USED) (1 MARK PER ISSUE)
1			
2	Can't cross gully by foot or vehicle Gullies are taking up valuable farming space...	Find a way to cross the gully	Build a bridge (you should add what type of bridge and materials to use)
3			
4			

MARKING MATRIX

Team No.: _____

	CRITERIA	SKILFUL	EFFECTIVE	SOUND	LIMITED	SCORE
1	Scale of 2D plan	3	2	1	0	
2	Accuracy and detail of 2D plan	5	4	3	2-0	
3	Aesthetics of overall 3D model	5	4	3	2-0	
4	Quality of model	5	4	3	2-0	
5	Solution(s) to Issue 1	4	3	2	1	
6	Solution(s) to Issue 2	4	3	2	1	
7	Solution(s) to Issue 3	4	3	2	1	
8	Solution(s) to Issue 4	4	3	2	1	
9	<i>Connectivity of ideas</i>	6	4	2	1	
11	Design Process (marked for <i>completion</i> and <i>form</i> (detail, comprehensiveness), not <i>quality</i> and <i>substantive</i> content of solution ideas)	10-8	7-5	4-2	1-0	

Note: Marks for 'solution(s) to Issue X' will include the quality of the solution idea along with how this is communicated and realised in the model. The description included in the design process will also aid the examiner in understanding your model for this criterion.

TOTAL /50

END OF PAPER