



**Montgomery County Public Schools
Green Building Program
Food & Nutrition Services**



**Request for Proposal - RFP No. IS7-100
Hydroponic System Design Plan**

BACKGROUND

Conventional methods of growing food require water, energy and land. Agriculture consumes the majority of the world's fresh water. However, fertilizers and animal wastes found in soil runoff are polluting our fresh water sources. Energy, in the form of fossil fuels, is used to run the tractors that help to plant and harvest crops. It is further used to process and ship crops to far away places. The use of fossil fuels contributes to climate change.

It takes approximately three acres of land to feed one person. With a population of 930,000 people (and growing), it would take 2.79 MILLION acres of farmland to feed just the residents of our county. That's greater than 30% of the land in Maryland! What about feeding the people in the other 22 counties in Maryland? How can the food supply of our growing area be met **without negatively** impacting our environment?



REQUEST

MCPS's Green Schools Program in conjunction with Food & Nutrition Services would like to produce locally grown produce for use in their cafeterias in an effort to decrease usage of natural resources, such as water and land in Montgomery County. Your RFP plan is to research, construct, and evaluate a hydroponics system that will allow you to grow basil plants without using soil in the classroom.

CRITERIA AND CONSTRAINTS

I. HYDROPONICS SYSTEM DESIGN

- a. Diagram of front, side, and top views that have all components and materials clearly labeled
- b. Measurements are to scale and meet design constraints.
- c. Research and explore at least two types of hydroponic systems
- d. Identify the type of hydroponic system chosen
- e. Justify the materials chosen for system
- f. Explain how the system you designed is to work

II. SCIENTIFIC EXPLANATIONS

- a. Identify cell parts needed for growth and reproduction
- b. Identify the plant parts needed for growth and reproduction
- c. Identify nutrients needed for plant growth
- d. Explain how the plant uses the nutrients and water to produce food
- e. Explain how the plant uses the food to grow and develop
- f. Explain how nutrients and water enter the plant
- g. Benefits of using hydroponics vs. planting in soil

III. HYDROPONICS SYSTEM PROTOTYPE

- a. Materials must come from kit provided, and/or recycled or repurposed items
- b. System must be no larger than **?? x ??**, or must fit on planter cart provided.
- c. Develop a budget for creating **??** systems. (optional)

IV. DATA COLLECTION AND EVALUATION

- a. Create and maintain data table(s) to monitor plant growth.
- b. Communicate results and gather feedback on design.
- c. Evaluate system design based on results and feedback.

Scientific and Engineering Practices	Requirements of the Project/Problem
<p>Obtaining, Evaluating and Communicating Information</p> <p>Communicate scientific and/or technical information in writing and/or through oral presentations.</p>	<ul style="list-style-type: none"> ○ Create and maintain a portfolio of research on hydroponic system designs and plant growth. ○ Evaluate system design based on results, feedback, and communicate results to others. ○ Explain how science and technology and be used to solve problems.
<p>Constructing Explanations and Designing Solution</p> <p>Construct an explanation using models or representations</p> <p>Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.</p> <p>Apply scientific ideas, principles, and/or evidence to construct, revise, and/or use an explanation for real world phenomena, examples, or events.</p>	<ul style="list-style-type: none"> ○ Articulate the plant parts needed for growth and reproduction, nutrients needed for growth, and the cell parts needed for photosynthesis and cellular respiration ○ Explain how the plant uses nutrients and water to produce food, and uses the food to grow and develop (ie. explain photosynthesis and cellular respiration). ○ Create and maintain data table(s) to monitor plant growth. ○ Justify design decisions made in the creation of hydroponics system. (ie. type of system, type of medium, etc)
<p>Developing and Using Models</p> <p>Evaluate limitations of a model for a proposed object or tool.</p> <p>Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales.</p>	<ul style="list-style-type: none"> ○ Diagram of front, side, and top views that have all components and materials clearly labeled ○ Developed models measurements are to scale and meet design constraints. ○ Allow appropriate inputs for plant growth (water, light, nutrients, etc) ○ Explain how system is designed to work, justify the design decisions, and indicate any limitations of the model