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ENGINEERS, PLANNERS AND LAND SURVEYORS

June 5, 1996

Victoria C. Thompson, Coordinator
Office of Environmental Services
NJDEP
CN-402
Trenton, New Jersey 08625

Re: FINAL REPORT
Mansfield Environmental Commission
1994 Matching Grant Program
Environmental Education Curriculum in School
NJDEP Project No. 94038

Dear Ms. Thompson:

We are submitting herewith three (3) copies of our FINAL REPORT on the Mansfield Environmental Commission's "Environmental Education Curriculum in School Program" conducted under NJDEP's Office of Environmental Services Project No. 94038. This REPORT is submitted in compliance with the Mansfield Environmental Commission's Proposal and the Grant Agreement between the Mansfield Environmental Commission and the NJDEP.

I. INTRODUCTION

The Project was undertaken in collaboration with the Staff at the John Hydock Elementary School in Mansfield Township under the aegis of Mrs. Carol Tenner, the Fifth Grade Science Teacher. The Fifth Grade Class was selected as the Program Group. The School Staff recommended that the Program not be presented at the High School Level due to scheduling and

teacher resource allocations. Accordingly, the Program concentrated on the Fifth Grade Level and was expanded to include Soils along with Air and Water Sampling and Testing.

II. STATEMENT OF PROJECT PURPOSE

The initial Proposal stated the Project Purpose as:

"To enhance the Science and Social Studies Curriculum relating to Water and Air Pollution for one grade at both the Elementary and High School Level by providing professional technical assistance and new material for testing methods and hands-on field experience."

As indicated in the INTRODUCTION to this REPORT, the Program was expanded to include soil testing. Mansfield Township is primarily a farming community. Many of the Fifth Grade students come from families whose primary, and, in some cases, secondary income source, is farming. The Program clearly enhanced both the scientific and socioeconomic awareness of the students to pollution sources. The Program focused on how the students can contribute, both directly and indirectly, to a reduction in air, water and soil pollution. The students were advised to dispel the notion that; "the way to treat pollution is through dilution."

III. PROGRAM TASKS

- A. Meetings were convened with the School Staff in March of 1995 to prepare and finalize the curriculum enhancement units on water quality, air quality and soil quality.

The curriculum unit was summarized in my letter dated April 3, 1995 to the School Staff (ATTACHMENT "A").

In subsequent meetings with the Staff, the "Winkler Method" for measuring dissolved oxygen was deemed too ambitious for the Fifth Grade students. Instead, various test kits from suppliers of equipment to educators were evaluated for specific application to the Sampling and Testing Program.

B. The following Test Kits were acquired through the "Science Kit & Boreal Laboratories" of Tonawanda, New York, for use in the Sampling and Testing Program:

1. RAPITEST Soil Test Kit to test for pH, nitrogen, phosphorus and potassium carbonate (potash).
2. RAPITEST Pond Test Kit to test for ammonia, nitrite, nitrate and pH.
3. ENVIRONMENTAL TEST KIT to test for ozone, carbon dioxide and carbon monoxide.

C. A final meeting was convened with the School Staff at which time the date and format for the in-class lesson and field hands-on Sampling and Testing Program was set. A "Course Outline" was presented and reviewed with the School Staff (ATTACHMENT "B").

D. The "Student Questionnaire" was prepared and reviewed by the School Staff (ATTACHMENT "C").

E. On Thursday, May 30, 1996, the Program was implemented as follows:

1. Francis Pandullo presented the in-class lesson from 9:00 a.m. to 9:40 a.m.
2. The students then departed the School and were escorted through a tour of the Burlington County Landfill in the Township. During the class lecture preceding the tour, the students were alerted to the purposes of an environmentally secure landfill with leachate collection and treatment. Their tour of the landfill facility, therefore, was correlated to the concerns for soil pollution from indiscriminate disposal of solid waste, and to the resultant pollution to groundwater from leachate discharge.
3. The students returned to the Civic Center outdoor facility where the field hands-on program was conducted.

In preparation for the outdoor program, three Test Kits for each of the quality testings were procured. This facilitated a division of the Class into three groups which were supervised by Francis Pandullo and members of the School Staff.

4. The first test was for carbon dioxide. The Civic Center is located along New Jersey State Highway (NJSH) Route 206. Because of the high passenger vehicular and truck traffic utilizing Route 206, the Site was considered suitable for the possible detection of carbon dioxide.

The presence of carbon dioxide using a solution of calcium hydroxide and water was employed. The mixture, commonly known as "limewater," was prepared prior to deploying into the field. During the field test program, each student group received a saucer into which limewater was placed. The saucers were situated in proximity to Route 206 which was the test area. The students were briefed on the reaction between carbon dioxide in the air and limewater to form a "crust." The students were instructed to observe the time of reaction in forming the crust. The faster the reaction, the higher the carbon dioxide concentration.

Due to the high barometric pressure dominating the region on the afternoon of May 30, 1996, along with high winds, the students were briefed on the potential for rapid dissipation of contaminants into the atmosphere, leaving little to detect at ground level. This condition dominated the air testing program for ozone and carbon monoxide as well.

5. The test for carbon monoxide was performed using a sensitized "test paper" made available with the Test Kit. The students were briefed on the procedure wherein the sensitized paper, which is yellow before exposure, will go to orange when the chemical in the paper reacts with carbon monoxide in the air.

A similar sensitized test paper was utilized to detect ozone in the atmosphere. The sensitized paper will change color to blue if the test is positive due to the presence of ozone.

6. In each of the three tests for air quality, none of the contaminants of carbon dioxide, carbon monoxide and ozone was detected as present in the atmosphere. The students concluded that atmospheric conditions on the day of the test contributed to a rapid dissipation of any of the above three pollutants. The students were cautioned to not conclude that the three pollutants for which the tests were being conducted might not be present given different atmospheric conditions.
7. The second test program was for soil quality. The RAPITEST Soil Test Kit utilized by the students is designed for simplicity in evaluating the condition of soil samples. The Test Kit utilizes specially designed testing devices commonly known as "color comparators." The Kit is supplied with a color comparator for pH, nitrogen, phosphorus and potassium carbonate (potash).

A sample of the soil from the Site was obtained and prepared in a soil/water solution. Each student group had the opportunity to place a sample of the soil/water supernatant and analyze the sample for the presence of the compounds indicated above. Based on the observations made, the students were able to conclude on the relative concentrations of the respective compounds in the soil.

8. The Civic Center contains an isolated pond which appears to be fed by a combination of springs and surface run-off. The students were briefed on testing a sample of the pond water for ammonia, nitrite, nitrate and pH.

During the class lecture preceding the field hands-on testing program, the students were briefed on the sources and resultant impacts on aquatic life from disproportionate concentrations of the above pollutants.

The color comparator results enabled the students to observe pH levels in terms of a range from "VERY ALKALINE" to "VERY ACID." Similarly, ammonia levels were observed from a range of "FATAL" to "IDEAL."

Nitrite levels were observed ranging from "DANGER" to "IDEAL." Finally, nitrate levels were observed to range from "VERY POOR" to "VERY GOOD."

Upon conclusion of the pond testing, each of the student groups concluded that the condition of the pond was acceptable and that they would have no difficulty in allowing goldfish to be placed in the pond.

- F. The School Staff and students reported an enthusiastic response to the Program. The School Staff inquired as to whether the Mansfield Environmental Commission would repeat the Program in the coming year. It is the

recommendation of this writer that the Program be replicated on an annual or bi-annual basis as a means of enhancing the Science and Social Studies curriculum at the elementary school level.

Respectfully submitted,

OMEGA ENGINEERING SERVICES

A handwritten signature in cursive script that reads "Francis Pandullo".

Francis Pandullo, PE, PP, PWS, DEE
Environmental Commission Consultant

cc: Mansfield Environmental Commission
c/o Marge Case, Secretary

FP:dmd

**omega engineering services**

ENGINEERS, PLANNERS AND LAND SURVEYORS

April 3, 1995

Mrs. Ruthe Martz
Mrs. Carol Tenner
Columbus Elementary School
19 Locust Avenue
Columbus, NJ 08022

**Re: Mansfield Environmental Commission (MEC)
NJDEP Grant
Air and Water Pollution Demonstration Program**

Dear Ruthe and Carol:

I wish to first thank you for the courtesies extended to me during our visit on March 28, 1995. The following is a summary of our meeting and the recommended follow-up course of action:

- A. The Mansfield Environmental Commission (MEC) applied for and received a "Matching Grant" from NJDEP's Office of Environmental Services to sponsor an Environmental Awareness Project in conjunction with the Elementary School. The Project's purpose may be summarized as follows:
1. To enhance the Science and Social Studies curriculum;
 2. To relate the curriculum to water and air pollution;
 3. To select one (1) grade at the Elementary School and one (1) grade at the High School;
 4. To provide technical assistance and material;
 5. To expose the students to some limited testing methods;
 6. To provide the opportunity for the students to have some hands-on field experience.
- B. We agreed to conduct the Program for the fifth-grade at the Columbus Elementary School, which I understand will comprise approximately 40-45 students between the ages of 10 and 11. We will dispense with attempting to conduct the Program at the High School Level.
- C. We discussed the possibility of conducting the Program on the same day that you customarily schedule a visitation to the County Land Fill in the Township. It is my understanding that a bus trip is normally scheduled, during which the students are taken to the Civic Center for a visitation and lunch.

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Mrs. Carol Tenner
April 3, 1995
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It is my belief that scheduling our Program on the same date as the bus trip is an excellent approach. It will afford the students an opportunity to conduct some air quality measurement tests at the Land Fill Site, or a location in close proximity to the Site. In addition, the visit to the Civic Center will allow the students to sample water within the existing pond at the Center.

My lecture will touch on the significance of dissolved oxygen within water from the standpoint of sustaining fish and plant life. Accordingly, because of the importance of dissolved oxygen to living organisms, it is one of the first chemical measurements to be made to characterize any body of water.

The chemical method of measuring the amount of oxygen dissolved in water, to which I am referring, is the "Winkler Method". The test will involve a sequence of chemical reactions utilizing metal manganese, a strong acid, a starch compound, and thiosulfate.

If you feel the use of the above chemicals is within the capability of some of the fifth-grade students, I will obtain further information on the test methodology.

However, please comment on whether you believe sampling for dissolved oxygen may be too ambitious for the students at this time.


- D. We agreed that the Program would be set for a Tuesday in the first or second week of May. We will dedicate the entire day for the Lecture and Demonstration Project. The following is a suggested time-frame for the day's Program:

9:00 A.M. - 9:40 A.M.	Classroom Lecture on Air and Water Pollution by F. Pandullo
10:00 A.M. - 12 Noon	Bus Trip to the County Land Fill
12 Noon - 1:00 P.M.	Air Quality Testing
1:00 P.M. - 2:00 P.M.	Visit to the Civic Center for a box lunch
2:00 P.M. - 3:00 P.M.	Water Quality Testing Demonstration
3:00 P.M.	Return to School for Dismissal

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- E. I will furnish you with an outline of the lecture I intend to present for your review and comment. I will require your assistance in making certain that my lecture targets the age bracket of the fifth-grade students.

Very truly yours,


Francis Pandullo, PE, PP, DE

FP/cm

c: Mansfield Environmental Commission

COURSE OUTLINE

I. Introduction:

A. Ask class what they think is meant by "the environment."

- 1. Lead discussion to the identification of the aspects of air, water and soil.**

B. Introduce the term "ecosystem."

- 1. Explain how all life forms are linked within the "ecosystem."**
- 2. The Sun is the source of all life.**
- 3. It provides the energy to drive life forms within the "ecosystem."**
- 4. Plants convert sunlight into living matter.**

Animals eat plants.

Other Animals eat plant-eaters.

Animals die.

Bacteria convert dead animals into nutrients which feed the plants and the cycle starts over.

C. Present Life Cycle Hand-Out.

1. Review the process in B1 through B4.
2. Stress importance of preserving the quality of air, water and soil to keep the "ecosystem" in balance.

II. Present Elements That Degrade (Pollute) the Environment:

A. Water

1. ph - This is a measure of the acidity of water. Industrial discharges to streams and rivers sometimes contain acid-producing compounds.
2. Ammonia - It is a by-product of the decomposition of waste discharged into streams. Primarily municipal waste or malfunctioning septic systems.

High ammonia levels can be fatal to fish.

3. Nitrites - These are also a by-product of the decomposition of waste which is discharged into streams. Nitrites are particularly harmful to fish. They tend to deplete the amount of oxygen in water causing fish to gasp at the surface for oxygen and to make fish more susceptible to disease.

4. Nitrates - Nitrates stimulate the growth of algae in water. When algae cells die, oxygen is used in the decomposition and fish kills often result. Nitrates can also be found in groundwater.

B. Explain test procedure which we will conduct today for ammonia, nitrite, nitrate and ph.

C. Air

1. Carbon Dioxide - Explain the need for the carbon dioxide to support plant life. Explain that too much carbon dioxide causes the atmosphere to retain more of the heat from the Sun. The class may know this as the "greenhouse effect."

We try to limit the amount of carbon dioxide which is emitted into the atmosphere from fuels like coal, oil and gasoline and many times from the burning of vegetation and forests.

2. Carbon Monoxide - Its presence is invisible and in sufficient quantities can kill. Moderate amounts can cause severe illness.
3. Ozone - Ozone occurs in thunderstorms and generally in the upper atmosphere when the Sun's radiation acts on free oxygen. Ozone can have a damaging effect on plants and animals by its presence in smog.

D. Soil

1. Discuss the sources of pollution within the soils.
2. Discuss the tests which will be performed to measure the presence of positive and healthy elements in the soil consisting of nitrogen, phosphorus and potash.

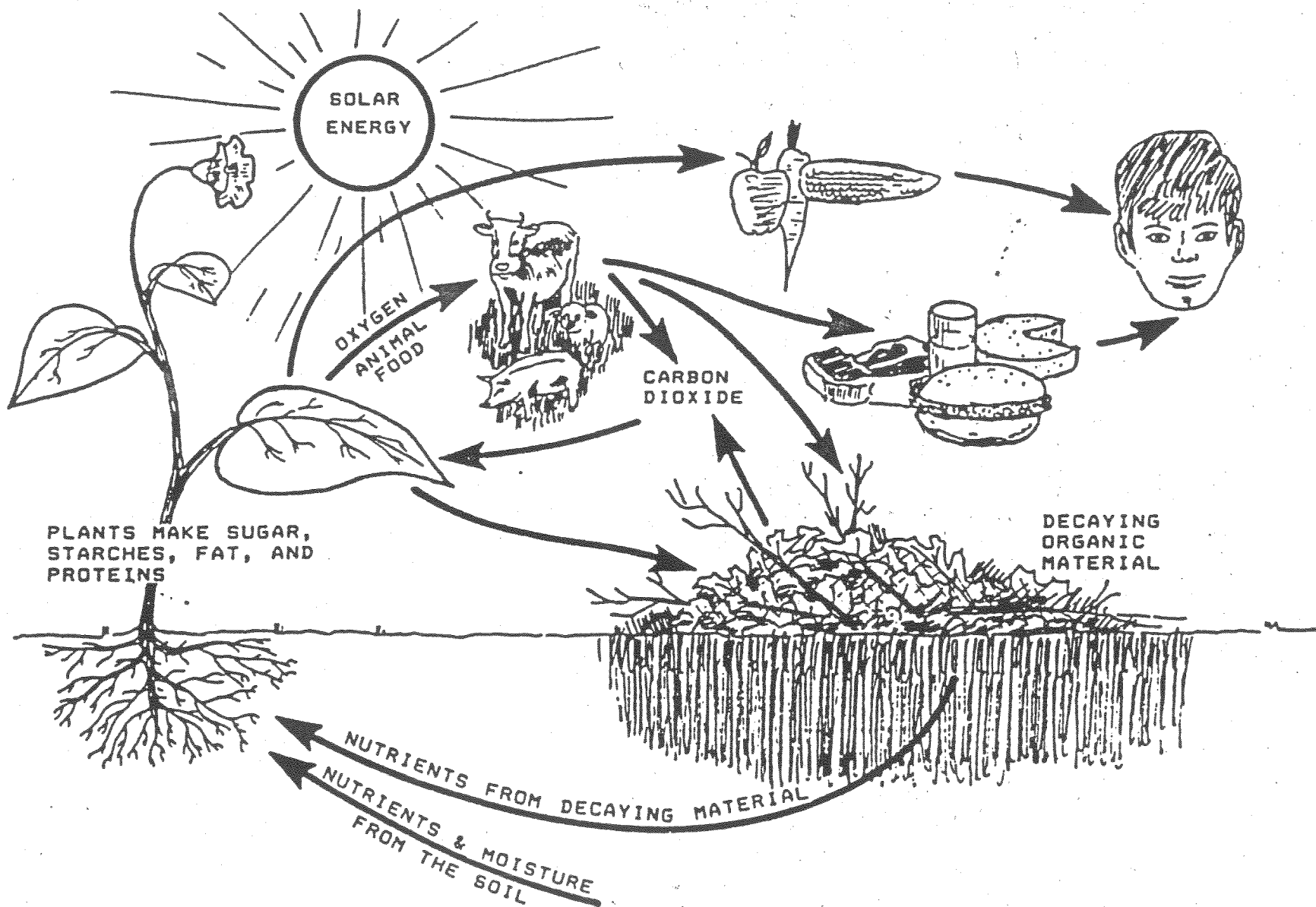


FIGURE 8

STUDENT QUESTIONNAIRE

Environmental Class Program
5th Grade
John Hydock Elementary School
Columbus, New Jersey

Air, Water and Soil Testing Demonstration Project

1. What are the three (3) elements of our environment that affect its quality?
2. The system that links all life forms is known as: (check one)
 - (a) Photosystem
 - (b) Planet System
 - (c) Ecosystem
 - (d) Dioxide System.
3. What is the source of all life within the system?
4. What is "pH" a measure of in water?
5. Which of the following are found in streams and ponds as by-products resulting from the decomposition of waste?
 - (a) Ammonia
 - (b) Nitrites
 - (c) Both of the Above.
6. The "greenhouse effect" results from too much of which of the following elements that cause the atmosphere to retain more heat from the Sun?
 - (a) Phosphorus
 - (b) Ammonia
 - (c) Carbon Dioxide
 - (d) pH.
7. What can happen in a stream, brook or river when oxygen in the water is used (depleted) and falls below a "good oxygen level?"
8. What can I do as a resident of Mansfield Township to prevent pollution of our environment?
9. During the field tests of the "pond" water at the Civic Center Site, what was the condition of the water for Ammonia, Nitrite, Nitrate and Acidity (pH)?