

IN THE AIR

www.intheair.org

Connecting Activity #1

"PEE Yew!
Is That You?"

6-8 EDUCATION MODULE



 MISSOURI
BOTANICAL
GARDEN

Correlation with Education Standards Summary

Connecting Activity #1 “Pee-Yew! Is That You?”

For a narrative description of these standards please refer to the Teacher's Guide.

National Standards

SOURCE: www.education-world.com/standards

Grades K-4:

NPH-H.K-4 .1 .4 .7
NM-PROB.REP.PK-12 .3
NS.K-4 .6
NSS-C.K-4 .5
NSS-G.K-12 .1 .5

Grades 5-8:

NPH-H.5-8 .1 .2
NM-PROB.REP.PK-12 .3
NS.5-8 .6
NSS-C.5-8 .5
NSS-G.K-12 .1 .5

Missouri Show-Me Standards

SOURCE: www.dese.mo.gov/standards

Performance Standards:

GOAL 1: 6
GOAL 2: 3, 5
GOAL 3: 1
GOAL 4: 1, 2, 4, 7

Knowledge Standards:

CA 1, 3, 6
HPE 5
MTH 1
SC 7, 8
SS 5, 6, 7

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IN THE AIR

Connecting Activity #1

OVERVIEW

In this activity, students use map skills to investigate how wind direction is one factor that determines exposure to air pollutants. In the process of their measurements, students discover the significant contribution mobile sources make to air pollution. This activity does not attempt to calculate risk but only inventory exposure.

The “Town Hall Meeting” option of this lesson demonstrates how environmental issues such as air pollution interplay with other economic and social issues to influence decision-making processes. The optional activity begins with a skit. Students conduct the map activity as described and conclude the skit by holding a vote. A follow-up discussion allows students to evaluate how they came to their decision.

GOALS

- To illustrate that exposure to air pollution is influenced by factors such as wind and the location of pollution sources
- To identify the pervasiveness of pollution from mobile sources

OBJECTIVES

By the end of this activity, students will be able to do the following:

- Describe how wind affects the path of pollutants.
- Identify that mobile sources make a significant contribution to air pollution.
- Analyze what factors other than pollution might be considered in a community decision. (See “Town Hall Meeting” skit)
- Explain that we all share the same air.

MATERIALS

Each student will need:

- Worksheet (master has three per sheet)
- Activity Map
- Map Tool
- Colored Pencils or Crayons (Seven colors will be used)
- Highlighter Marker (Optional)
- Regular Pencil

“PEE-YEW! IS THAT YOU?”

Recommended Grade Level:

3-8

Preparation:

The teacher will need approximately 30 minutes to make photocopies and the map tool copies. Students will need 10-20 minutes to color the map prior to the activity presentation. See number one under procedure for specific instructions.

Presentation Time:

The classroom activity requires 60 minutes. Presented with the “Town Hall Meeting” skit, it will require a total of 90 minutes.

MAP TOOL

Prior to the activity you will need to make the map tool. To make the map tool you will need the following:

- Master Pattern
- Overhead transparencies, one for every three students
- Scissors

Photocopy or trace the pattern onto transparency sheets and cut them out.

“TOWN HALL MEETING” SKIT

This requires all of the above plus a copy of the script for each student and a blackboard for the teacher to take notes. Only one copy of the Outcome Page is needed for the end of the skit.

VOCABULARY

If you are not using the skit, please discuss the following vocabulary with your students prior to the activity so they understand these terms.

The sources of air pollution are divided into three groups:

Mobile Sources: Cars, trucks, and buses

Point Sources: Large sources of pollution, such as a factory or coal fired power plant

Area Sources: Any pollution that cannot be traced to a single point source or mobile source, e.g., farm dust, exhausts from home furnaces and fireplaces, small businesses

Brownfield: An abandoned, idle, or under-used industrial and commercial site where expansion or redevelopment is complicated by real or perceived environmental contamination that can add cost, time, or uncertainty to a redevelopment project (U.S. EPA definition). A Brownfield scenario is included in the “Town Hall Meeting” script.

PROCEDURE

1. Distribute map and have your students color it. Instruct them to use a yellow highlighter, pencil, or crayon, to color each car, truck, and bus first and then color the rest of the map with the color that is labeled in each region. Explain they will need to represent both colors in the striped area where toxics from two areas overlap. Cars, trucks, and buses should stand out within the colored areas. They are classified as **mobile sources**.

2. On their maps, have students locate the following features:
 - Three monitoring stations. Notice lines intersecting the center of each monitor.
 - Large producers of pollutants, such as the power plant and the paint factory, classified as **point sources**.
 - Businesses that produce smaller amounts of pollution, classified as **area sources**. Several sources may be present within a region that produce the same pollutants, i.e., more than one dry cleaner or more than one gas station. Roads and farms that cause dust are considered area sources because the dust cannot be tracked to one single source. Have students identify the area sources labeled on the map.
 - Ask what type of source would our homes be considered? *The answer is area.*

Note: The different colors on the map represent selected airborne toxics produced by sources within that area. Not all sources of pollution are labeled or represented.

Tip: Because of multiple similar measurements, we recommend your students follow these procedures. Students will make twelve measurements, four at each monitor, for each wind direction. This may also be done as a class with the students measuring and the teacher recording. If using the “Town Hall Meeting” skit, students are divided into teams and will make only four measurements at one monitor.

3. Distribute a worksheet and map tool to each student.
4. If using the “Town Hall Meeting” skit, distribute script pages (have the students color the maps before beginning). Only one copy of the outcome page is needed and should not be distributed to students but read by the City Planner at the end of the activity. As the Mayor explains the vocabulary, use the opportunity to reinforce understanding of the concepts and terms as needed. There will be a stopping point in the skit where you will proceed to the next step in the mapping procedure.
5. Instruct students: Look at your map tool. Near the point of the tool you will see a short, straight line. You will use this line to position your tool correctly. Hold the map tool to the cross hairs of the monitor (explain what the cross hairs are). Match the line on the tool

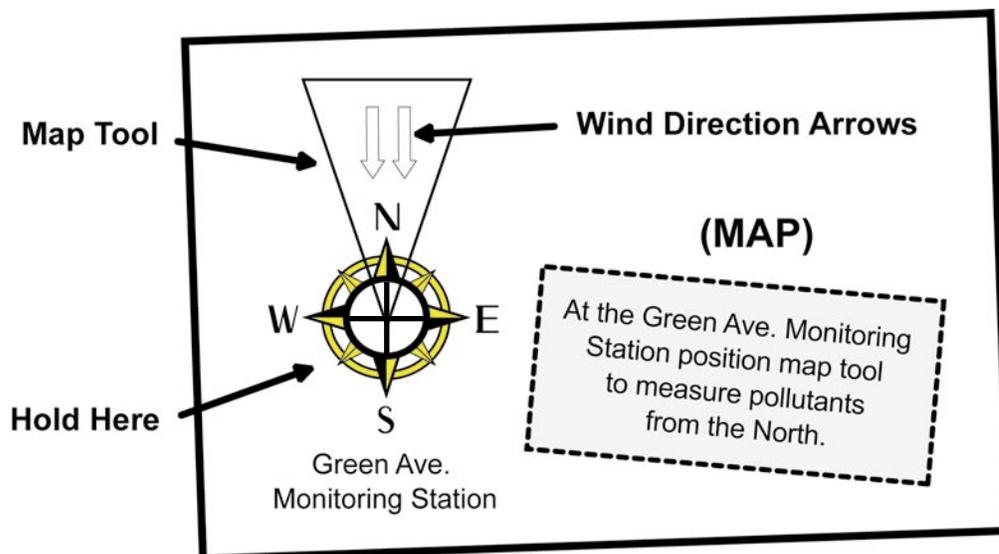


figure 1

with the N (for North) at the top of the monitor compass.

6. Do the first monitor reading along with the students. Begin at the air monitor at Green Avenue. Start with the wind direction coming from the North. Position the map tool as shown in *figure 1*. With the map tool held in place, students are to identify which colors (representing pollutants) the tool is covering.

Point out to the students that some of the mobile sources (cars, trucks, and buses) can be tricky to spot. The order in which they make their observations is not important.

Ask the following:

- Looking at the area of the map covered by the tool how many colors do you see?
Brown (pick up your brown pencil or crayon)
Yellow (pick up your yellow pencil or crayon)
Purple (pick up your purple pencil or crayon)

On your worksheet you will fill in only one box for every color that you see in the covered area. Always begin at the bottom box. As the measurements are taken, a bar graph will be made showing the results.

- Fill in one brown box (put your brown pencil or crayon down)
- Fill in one yellow box (put your yellow pencil or crayon down)
- Fill in one purple box (put your purple pencil or crayon down)

This procedure will help you keep track of the colors. You are ready to take your next reading.

7. Rotate the map tool so that the line at the tip will line up with the line leading to the E (for East). This measurement will show you the types of pollution blowing into the monitor from the East. As before, you will observe the colors under the tool, picking up a pencil or crayon as you identify them, and marking your boxes.
8. Repeat this procedure for the South and for the West. Continue with the Parkway Place Monitor near the middle of the map. Complete the activity with measurements from the O'Day Street Monitor near the bottom of the map on the right side.
9. Review the results with students identifying the sources of pollution measured at each monitor and within the city overall.



Exposure is only one factor in determining the health risk associated with pollution. Risk factors include how we are exposed to a specific chemical, the concentration of the chemical we are exposed to, and the length of time that we are exposed to it. Certain groups of people are more sensitive to air pollutants than others, such as those with respiratory or heart disease, young children, and older adults.

DISCUSSION QUESTIONS

1. What color appeared most often? *Yellow*
2. How many yellow squares did you color in? *12*
3. What pollution source does the color yellow represent? *Mobile: cars, trucks, and buses.*
4. Usually the wind does not blow from all directions an equal amount of time. From what direction does the wind mostly blow where you live? How might this affect the types of pollution you may be exposed to?

5. Which statement do you agree with? Give a reason for your choice.
 - There is one best location in the town as far as exposure to air pollutants is concerned.
(or)
 - All locations are relatively the same as far as air pollution is concerned.
6. Mobile sources represent 50 percent of air toxics in our suburban and urban communities, and some studies suggest that it may be a greater percentage. Was anyone surprised by how often mobile sources were measured? What might be done to reduce the amount of pollution from mobile sources?
7. Compare and contrast your community with Hopeful City. What are some of the point and area sources where you live? Do you have areas where you see a lot of traffic?
8. In your community, what options do people have to reduce pollution?

For older students:

What else would we need to know to understand the health risk posed by the pollutants people were exposed to in this town? Possible answers might include: How harmful the pollutant is (toxicity), how much of the pollution was in the air (concentration), how often was the exposure (wind direction, did the pollution occur only at certain times or was it constant?) and for what period of time was the exposure?

CONCLUSION

After completing the activity, students should conclude that wind effects the transport of pollutants in the air throughout the entire town. Mobile sources are responsible for more than fifty percent of the air pollution in the town. This is usual for many communities, especially in urban and suburban areas.

EXTENSION

See EPA New England Region's Project A.I.R.E. Lesson 9 & 10 to conduct a mapping activity in your neighborhood:
<http://www.epa.gov/region01/students/teacher/aire.html>.

FOR MORE INFORMATION

- Environmental Defense Fund
For a community search in your area by zip code, see <http://www.scorecard.org>. You can link to an EPA Envirofacts web page that will give you specifics about businesses in your area. Only point sources that file a Toxic Release Inventory will be in this database (for more advanced students).
- For information on an air monitoring project in St. Louis, see <http://www.stlcap.org>.
- National Library of Medicine and the National Institutes of Health "ToxTown" and listings of additional information about toxic chemicals and environmental health risks where you live and work, see <http://www.toxtown.nlm.nih.gov> or call 1-888 FIND-NLM (1-888-316-3656).

Pee Yew! Is That You?

Activity Option - Town Hall Meeting Skit

OUTCOME PAGE

Copy for Teacher Only —

After the skit is concluded this page is to be given to the CITY PLANNER and read aloud to the class.

WHAT IF?

IF STUDENTS VOTED YES TO INVESTIGATING THE BROWNFIELD SITE:

Ten Years Later...

The site at Green Avenue was eliminated from the possible locations because it was too expensive and was too small for the preschool.

The City chose to investigate the brownfield site

Upon investigation, the leaking barrels in the warehouse were found to contain flavorings that were used in candy making. An old sign for the company was found inside the warehouse. A local librarian searched in old newspapers and discovered that the yellow and black stripes were not caution stripes but from a cartoon of a honeybee, the company's logo. The only contamination found were walls that had been painted with lead paint and some asbestos that was used to cover pipes. Both substances were removed at an affordable cost to the city. The warehouse was successfully remodeled into a new preschool. The preschool, with its fenced playground has improved the appearance and desirability of the neighborhood and has attracted new business. Expansion of the pre-school is underway as the population of the town is increasing. As Councilwoman Christensen predicted, the property values in the area have improved.

IF STUDENTS VOTED NO TO INVESTIGATING THE BROWNFIELD SITE:

Ten Years Later...

The site at Green Avenue was eliminated from the possible locations because it was too expensive and was too small for the preschool.

The City chose not to investigate the brownfield site

Residents chose to build on the Parkway Place site that did not require a separate playground. The preschool construction did cost less to build and was constructed sooner than it would have on any other site. Unfortunately, the city outgrew the preschool facility as Councilwoman Thomas predicted and was unable to afford building a new facility. Potter Paint left Hopeful City and relocated in a different town. As a result many people are out of work and the buildings are empty. The city has been unable to attract new businesses because of the appearance of the area. Property values have dropped. Residents are calling the O'Day area a slum.

Pee Yew! Is That You?

Activity Option - Town Hall Meeting Skit

CAST OF CHARACTERS - 12 Students, 1 Teacher, and unlimited additional students

(Note: The gender of the roles may be changed to suit your needs.)

Mayor of Hopeful City - Gloria Martinez Jefferson .. (played by a student)

Consultant to Hopeful City (played by the classroom Teacher)

City Planner (played by a student)

Mr. Smith - Resident (played by a student)

Ms. Jordan - Resident (played by a student)

Mr. Jones - Vice President of Potter Paints (played by a student)

City Council Members: (all played by students)

Ms. Thomas favors Green Avenue

Mr. Anders favors Parkway Place

Ms. Davis favors Parkway Place

Mr. McSwane favors O'Day Street

Mr. Tankson favors O'Day Street

Ms. Christensen favors O'Day Street

Props and materials:

Blackboard or wipe-off board on which the teacher can make notes.

Materials listed in the main activity, including a copy of the map that students have already colored, a map tool, and a copy of the skit for each student.

Suggested room arrangement:

Arrange the desks in a U shape or in a semicircle, open side facing the board. Have the city council members sit in the desks at the apex, opposite the board.

The skit begins.

PART ONE

Mayor of Hopeful City:

Welcome to our Town Hall meeting. Mr. Hodges, a long time city resident has donated money to Hopeful City to construct or re-develop a building for a pre-school. There are several issues to consider. We need to build a fairly large facility that ideally will include an outdoor playground. Our other major concern is cost. We need to plan responsibly and make the best long-term choice for our city.

Another issue has been brought to my attention. Some residents have expressed concerns over the location of the new pre-school because many of the young children in the town have asthma. They are worried that the air pollution in some parts of town may cause these children to have more trouble breathing.

Now I want to reassure residents that Hopeful City is not any different than any other city of its size in America. Our air may not be the cleanest but it's also not the worst.

We know that bad air affects some groups of people more than others. Those who are older, or have lung or heart disease, and young children are especially at risk.

Air pollution comes from three types of sources: Mobile sources, such as cars and trucks; point sources, such as our electric power plant and large businesses like Potter's Paints; Area sources which includes pollution from our homes, farm dust, exhausts from furnaces and fireplaces, and exhausts and fumes from small businesses too, like the gas station and the dry cleaners.

Mr. Smith:

(Raises hand, the Mayor calls on him)

Mayor Jefferson, my name is Henry Smith. My son has asthma. I think that we should locate the pre-school as far away from the business district as possible. We know they make most of our pollution.

Mayor Jefferson:

Now before we go blaming our businesses for all of our air pollution, I think we need to also consider mobile sources of pollution too. The busy interstates that surround our community and all of our local traffic add to our air pollution problem. We are monitoring the air at the three potential sites to learn more. We have hired *(name of Teacher)* as a consultant to help us understand these

issues. If we have a question we will direct it to the consultant.

(The teacher can make notes on the board as the discussion proceeds.)

City Planner:

Please take out your maps of Hopeful City. Looking at your maps you can see the three sites available in the town. An air monitor has been placed at each of the sites. Before we get started, I want to explain a few things about the maps. As you look at the maps you will notice circles around different areas of town. These circles represent areas of pollutants produced within the town.

Let's begin. The Green Avenue site is located at the North end of town across from the gas station. Can everybody find it?

(Allow time for everyone to locate this on their maps.)

The site itself is large but it is the most expensive property in town.

The next site is located near the middle of town on Parkway Place, across from our park.

(Allow time for everyone to locate this on their maps)

The land is less expensive here but the site is small. We would not have enough room for a playground or for future expansion if our population grows.

The third site is an abandoned building on the South side of town next to Potter Paint Company.

(Allow time for everyone to locate this on their maps.)

This site is large enough for future expansion. No one has paid taxes on the property for years so it would cost us next to nothing to purchase, but there may be a catch. It's considered a brownfield.

Mayor Jefferson:

Can you explain to us what a brownfield is?

City Planner:

According to the U.S. Environmental Protection Agency, a brownfield is a piece of property that is under used or abandoned because people believe it may contain an environmental hazard. On this property is an old abandoned warehouse. If we decided to use it, we would have to take care of any cleanup that the property might need before we could build on it. We don't really know how much that would cost or how much time it would take to clean it up. No one seems to know what the old warehouse was used for or what might have been dumped there.

Mayor Jefferson:

Don't we have records?

City Planner:

All of the records were destroyed in a courthouse fire fifty years ago. We have tried to get information on the property from the county and the state, but their records are incomplete. One of the older residents believes they may have made chemicals there. She remembers yellow and black caution stripes on the sign on the side of the building. I have been told that there are many barrels in the warehouse and some of them appear to be leaking.

Mayor Jefferson:

Have you visited the site?

City Planner:

Uh... well, no. I have only seen it from the street. The people who looked at the site said that the building itself appears to be in good shape. No trouble with the roof or the foundation. But they only looked at it from the outside.

Mayor Jefferson:

So, just about anything could be inside, even toxic chemicals. Thank you for the information. I would like to hear what everyone thinks.

Ms. Jordan:

(Raises hand, the Mayor calls on her)

My name is Geraldine Jordan. I live on Fourth street. I like the idea of building on Green Avenue. Even though the land is the most expensive, we would have a lot of space. I don't like the idea of building across from the park because the site is too small and our preschool needs its own fenced playground. It's a safety issue.

Councilwoman Thomas:

(Raises her hand, the Mayor points to her)

Green Avenue is the largest site and would allow for a fenced playground and future expansion. Our population is supposed to grow tremendously in the next ten years.

Mr. Smith - Resident:

(Raises hand, the Mayor calls on him)

I live on Main Street. I like the idea of building on Parkway Place. The land is cheaper, so we can afford it. Instead of spending the money to build a playground, the children can use the park across the street. I don't like the idea of building on Green Avenue. We have too much traffic. The fumes from the gas station stink and the land is too expensive.

Councilman Anders:

(Raises hand, the Mayor calls on him)

If I may make two points. We will not be able to purchase the land, build the school, and install the playground at the Green Avenue location. It will cost too much money. Another point is the pollution issue. I am sure that all of you will agree that the air is the best at the Parkway Place site – just look at the map.

Mayor Jefferson:

That's a good idea. Everyone look at your map. Does it appear that the Parkway Place site has the cleanest air? *(Allow time for everyone to examine map.)*

Consultant:

(Raises hand, the Mayor calls on him or her)

Mayor Jefferson, if I may add something to this discussion: different things can affect pollution. It sounds like it may be a good idea to investigate this issue further. We may find out that the air may be about the same everywhere in town. Wind direction plays an important role. Hopeful city is unique; we are the only city in the world where the wind blows equally from each direction throughout the year. We may find that the cleanest air is at the O'Day location.

Councilman Anders:

(Raises hand, the Mayor calls on him)

I know from looking at the map that the air in that part of town is the worst there is. Unless you can convince me otherwise, I am against building on O'Day Street. I do not want my baby to go to preschool in an industrial part of town. If we build on Parkway Place, we can save money by not installing the playground. Just let the kids use the park.

Councilwoman Thomas:

(Raises hand, the Mayor calls on her)

I don't agree with Councilman Anders. There are some very nice homes around the factories on O'Day Street. It is not an industrial part of town as he calls it. We are proud of the businesses in our neighborhood. We would like to have more of them. Many of the businesses have worked hard to make their buildings look attractive to those passing by.

Safety is my biggest concern. I believe that a fenced playground for the exclusive use of the preschool is important, but I believe that air quality is important too.

Councilwoman Davis:

(Raises hand, the Mayor calls on her)

I like the idea of a park setting for our preschool and the air issue is important to me. I agree that building on Green Avenue is out of the question. It will cost too much money.

Mayor Jefferson:

Thank you, Councilwoman Davis. Now we will hear from Mr. Jones, Vice President of Potter Paints.



Mr. Jones:

I work on O'Day Street. We have planted trees and redone the outside of our building so it looks much nicer. We often have investors visit from out of town and no matter how nice our place of business looks, the abandoned warehouse on the property next to our building is a real eyesore. We would sure like to get rid of it. We think that building the preschool next to our factory is the best thing for the city. We will donate a playground if you build on this site.

Ms. Jordan:

(Raises hand, the Mayor calls on her)

I'm suspicious of this offer. What's in it for Potter Paints?

Mr. Jones:

Potter Paints owns residential property in the neighborhood. Having the preschool nearby will increase the value of our properties and the preschool will be convenient for our employees to use.

Councilman McSwane:

(Raises hand, the Mayor calls on him)

I think that the Potter Paint's offer is the best deal we could hope for. That property has been abandoned for years.

Mr. Smith:

(Raises hand, the Mayor calls on him)

Mayor Jefferson, as I said before I don't care how much money we save. I want the best location for my son. We have enough things to worry about in this city. We do not need to worry about that old abandoned factory too. No one in town can even remember what it was used for. Let someone else take care of it.

Councilman Tankson:

I don't think anyone else is interested in taking care of it. The building probably hasn't been used in 75 years, but I think it's worth looking into.

Councilwoman Davis:

I disagree. That could cost Hopeful City thousands and thousands of dollars. I say let sleeping dogs lie. What we don't know won't hurt us. Let this be someone else's problem.

Councilman McSwane:

Even if we don't consider this site for the preschool, the abandoned factory may end up being our problem. Maybe what we don't know can hurt us. What if there is something on the property that is dangerous? Isn't it better to find out about it and take care of it?

Councilwoman Christensen:

Even if there is nothing dangerous on the property, that ugly old building is an eyesore. It's a problem for the residents that live in the area and for the businesses, too. I think that we should seriously consider the O'Day location. We could either fix up the old warehouse or tear it down and build new. Either way, having a nice new preschool in place of that run down building would help raise the property values.

Mayor Jefferson:

Okay. We've heard enough for now. I think we have some questions to answer before we can make a decision. Our consultant made a good point about investigating our air pollution issues. We will now have our teams study the maps and prepare a report for each monitor. Will our consultant determine our teams please? We will adjourn the meeting until the reports are ready.

(Teacher will divide the class into three groups. Assign each group one of the monitors. Have them complete steps 5-7 under the activity procedure recording for their monitor only)

PART TWO

Mayor Jefferson:

This meeting will come to order. We will now hear the reports from the monitor teams. Will a volunteer from each group report the results for Green Street, Parkway Place, and the O'Day Street monitors?

(Student volunteers record the results for their monitor on the board)

Hmm. Very interesting.

(At this time the the Teacher may conduct a class discussion about the results)

Councilman Tankson:

Mayor Jefferson, seeing that the air is not worse by the paint factory, I make a motion that we learn more about O'Day Street and maybe clean up the abandoned warehouse site.

Councilman McSwane:

I second the motion.

Mayor Jefferson:

There has been a motion made and seconded that the City investigates the brownfield site in our town. Is there any discussion? Hearing no discussion, all in favor?

(McSwane, Tankson, and Christensen raise their hands)

All opposed?

(Thomas, Anders, and Davis raise their hands)

We have a tie. I'm going to let the citizens have a say on this. It's my job as Mayor to cast the deciding vote, but I want to get everyone's opinion. Do we investigate the O'Day site and run the risk of an expensive cleanup, or do we let sleeping dogs lie, and build on the Green Avenue or Parkway Place location where we will be sure of our costs and can start construction right away? We will allow five minutes for discussion. After the discussion, I will cast the deciding vote. Councilman Anders will you keep track of our time?

Councilman Anders:

I would be happy to. *(Discussion for five minutes)*

Mayor Jefferson:

Based on the discussion, I have decided...

(Mayor chooses one based on discussion)

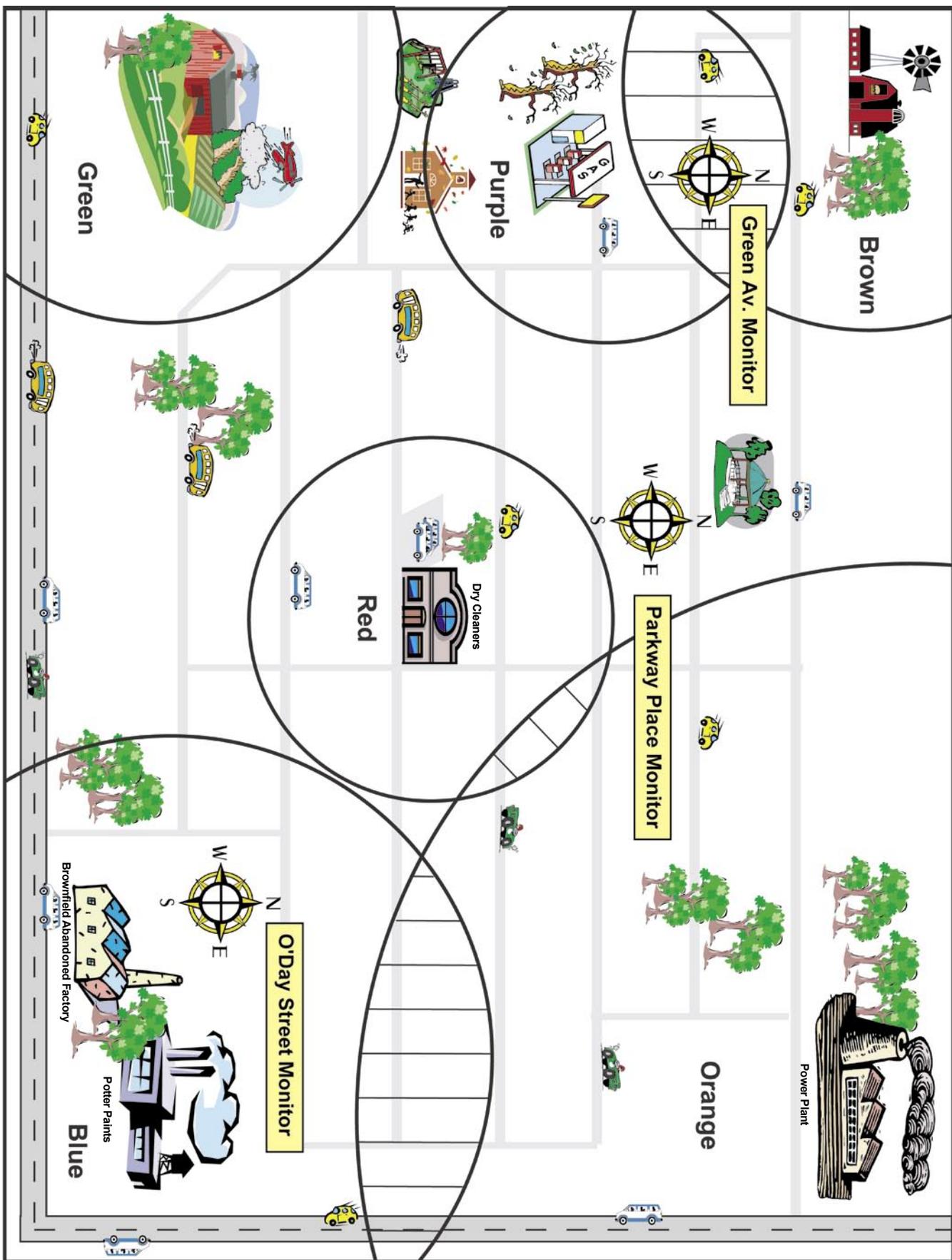
We will investigate the brownfield site for the preschool.

or

We will not investigate the brownfield site for the preschool and start construction immediately on another site.

Thank you, this meeting is adjourned.

“Hopeful City”



PEE YEW! ACTIVITY MAP

(Map not to scale)

PEE YEW! MAP TOOL

Please refer to the activity for directions.

