

Activity 3: Ground Water and Development Siting

Maine Geological Survey



Objectives:

Students will demonstrate the relationships between ground water conditions, surface water conditions, and land surface conditions; they will distinguish between the types of aquifers that can exist; they will utilize available research materials to gather information on ground water conditions and use this information to evaluate the suitability of potential building sites. Students will also determine the meanings and correct usage of the following ground water terms:

water table, confined aquifer, runoff, artesian well, unconfined aquifer, surface water recharge, discharge, impermeable, permeable, porosity, dug well, drilled well, perched aquifer, percolation

Time Needed:

You will need at least four class periods of 60 minutes each for the research component and 1-2 class periods for the presentations. Following the presentations, the students whose plans were not approved were given one (1) class period to discover the problems in their site development plans and develop corrected plans.

Background:

This activity was developed for a Critical Skills classroom. Students in these classes are given activities which provide opportunities for the research of existing resources which deal with real world problems. They are not provided with the information in lecture

form prior to the activity. For this reason, the "debriefing" time subsequent to the presentations is vital to correct any incorrect or incomplete content components. It is also important to note that in a Critical Skills classroom, equal emphasis is placed on both the acquisition of essential knowledge and the development of "life skills" such as communication, cooperation, collaboration, problem solving, etc.

You will definitely want to assign textbook reading on ground water prior to this assignment. This assures at least minimal vocabulary and concept bank at the start of the activity.

Materials:

Each group of students will need:

- Direction sheets for phase 1, 2, and 3
- Resource materials on water and specifically ground water and/or a textbook
- Art materials such as poster paper and markers or access to computers with PowerPoint for making presentations
- Presentation evaluation sheets

Procedure:

PRIOR TO CLASS, establish a "Ground Water Resources Library" in your classroom which contains the information that the students will need to complete the activity. Be certain the sources contain the necessary information, but do not limit your library to only the most useful resources. If you have the option, you may wish to conduct this activity from the school's library so that the students have to discover where the necessary materials are located. This does take some additional time.

1. Divide the class into groups of three or four. Each group is responsible for a finished product (report and poster) to be presented.
2. Present students with the handout "Site Development Plans - Phase 1". Be certain to identify the members of each group and the specific due dates. Reiterate that groups will not be given the directions for Phases 2 and 3 until all groups have submitted the plot sketch and design for Phase 1.

3. Once all sketches are submitted, present students with the handout "Site Development Plans - Phases 2 and 3". Then sit back and watch. Provide feedback as you deem necessary. It is good practice to turn back student questions onto the students, especially if the questions can be answered with a little research. They are searching for adequate theory, but remember, if they are wrong you have the freedom to "deny their request for site approval" on the day of the presentations and evaluations. Then the students must go back to the resources again.
4. Be sure the students are adequately aware of the deadline. You may even remind them to assign themselves homework if it appears that they will not be finished in time.
5. PRESENTATION DAY: All students become evaluators of each other's presentations. Provide a simple evaluation sheet where Yes/No questions can be easily answered. These evaluation sheets insure you have an attentive audience.

Follow-Up:

Following the presentations, you must evaluate the material on the content criteria you had set. If you are not satisfied, "deny" development approval and send the group(s) back for more research for a period. They will not like it, but they'll learn from their mistakes. **Most of all encourage the students to answer their own questions.** They may hesitate to do this, but WILL do it if they cannot get anywhere with you. It is very hard for many teachers to step aside from their role as dispenser of answers in the classroom. Encourage and reinforce behavior that you would like to continue in specific students. This CAN be an enjoyable experience for both students and teachers alike.

Teachers may wish to use Activity # 11, ([Aquifer Maps and Maine Ground Water](#)), as either an introduction or an independent study follow up to this activity.

References:

Activity developed by Donna Casavant, in conjunction with the 1991 CREST intern program.

Name _____



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Student Sheet

Purpose:

You will develop the skills needed to evaluate prospective building sites with respect to ground water needs and conditions.

Procedure:

For the purposes of this activity, the class will be the FUJI Town Council. The Town Manager is your teacher. Small groups of council members will each produce a site development plan; each plan will be presented to the entire FUJI Town Council.

TO: Members of the FUJI Town Council

FROM: The Town Manager

DATE: October 30, 2013

RE: Site Development Plans - Phase 1

You and the members of your group have the opportunity to design and develop a plot of land on which to build the house of your dreams. The Town Council will meet on Friday, November 8, 1991 to discuss and vote on each Site Development Plan.

The first phase of this development is to design that plot. You will be informed of the remaining phases of development once all groups have submitted a plot sketch and design.

PHASE I: PLOT DESIGN

Choose ONE condition from each of the following that describes your plot of land. Be certain that you have one parameter from each component in your description.

1. Location and Topography
 - a. On level ground
 - b. At the top of a hill
 - c. At the bottom of a hill
2. Surface Type:
 - a. Ledge
 - b. Sandy
 - c. Clay
 - d. Stratified mixture (please specify)
3. Location of Nearby Surface Water Sources:
 - a. No permanent surface water nearby
 - b. Wetlands (Contain water for at least 6 days following heavy precipitation)
 - c. Pond (less than 10 acres)
 - d. Lake (over 10 acres)
 - e. River
 - f. Stream
 - g. Natural Spring
 - h. Ocean
4. Climate - Temperature:
 - a. Hot, year round
 - b. Cold, year round
 - c. Warm or cool, year round
 - d. Seasonal variations
5. Climate - Humidity
 - a. Dry
 - b. Humid
6. Climate - Precipitation
 - a. Minimal
 - b. Ample
 - c. Excess

7. Vegetation:

- a. No vegetation nearby
- b. Forest
- c. Grassland
- d. Other (please specify)

Summary of Land Description:

Draw a simple sketch of the plot and the general location (include the appropriate components listed above). **REMINDER:** You will NOT receive information on the remaining phases of development until each group has submitted a description and sketch of their land use site.

PHASE II: Water Use

TO: Member of the FUJI Town Council

FROM: The Town Manager

DATE: October 30, 2013

RE: Site Development Plans -- Phases 2 and 3

You need water if you are going to build the house of your dreams. Phase 2 of the Site Development Plan relates to the location of ground water for the purposes of drilling and casing a well. A drilling company has just done an initial site evaluation of your lot's ground water conditions. A copy of their report is available for your inspection.

What did they find? Include a sketch of the local hydrology showing the water table, flow lines, recharge areas, and discharge areas.

What do you anticipate will be their recommendations for well types and locations?

If the town manager suggests more than one drilling site, which alternative would you choose? Why would you choose that alternative?

PHASE III: Presentations

You will be allowed up to ten minutes at the FUJI Town Council meeting to present your site development plan. Presentations should include:

1. A formal drawing of your location, with the designated components. Include well and septic system locations.
2. Diagrams or outlines of the ground water conditions discovered by the drilling company. Be certain to include information about the water table, surrounding surface water, water recharge and discharge flow lines.
3. A description of the two well alternatives recommended by the drilling company.
4. Your selection of the available alternatives with specific reasons explaining your selected choice.

The Council will evaluate each proposal on the criteria listed above. Successful proposals will be issued building permits at that time.

Presenters: _____

Evaluator: _____ Project: _____

I. CONTENT (Please circle)

Used ground water terminology Yes No

Circle the terminology heard:

Water table *confined aquifer* *unconfined aquifer*

Artesian well *drilled well* *dug well*

Surface water *runoff* *permeability*

Porosity *percolation rate* *discharge*

Gravity feed *perched aquifer* *zone of saturation*

Used ground water terminology correctly Yes No

Please explain:

Ground water description consistent with theory? Yes No

Ground water consistent with land shape? Yes No

Ground water consistent with surficial materials? Yes No

II. PRESENTATION COMPLETENESS

Included a formal drawing of location?	Yes	No
Included cross-sections of ground water?	Yes	No
Included two well alternatives?	Yes	No
Included well choice and reasons?	Yes	No
Presentation neat in appearance?	Yes	No
All presenters were well organized?	Yes	No
All group members involved in presentation?	Yes	No
Presenters spoke clearly and understandably?	Yes	No

III. SUMMARY

What were the strongest and weakest points of the presentation?

Strongest: _____

Weakest: _____

IV: APPROVAL

Based on the above criteria and evaluation, should the plan be approved? Justify your recommendation.