

## A Pipeline in Paradise - Introduction

It's early morning in beautiful Madison County, Virginia. 100-year-old Culton Goodall is enjoying his usual cup of coffee on his front porch as he gazes at Old Rag Mountain - a sight he has enjoyed since he was a little boy. Culton's farm is a gem in a county known for its beautiful scenery. Owned for two generations, the Goodall farm is several hundred acres of pristine meadows, beautiful streams, and spectacular mountain views.

This morning Culton will be faced with a very difficult decision. An unexpected visitor from a large gas pipeline company will arrive and ask him to cooperate in a project that has regional, even national implications. In addition, that project could bring many high-paying jobs and businesses to the county. But, if Culton chooses to cooperate, his dearly loved farm and Madison County will also be changed - possibly in ways that may not be so good.

Watch the video entitled "[It's Complicated](#)"<sup>1</sup> to hear the full story (narrated by Culton's son, Paul, a faculty member at James Madison University). After watching the video, proceed on to the next section to find out what **Your Task** is.

### **Your Task**

Your task is to help Mr. Goodall and the Madison County Board of Supervisors find and use the most reliable and useful information available in order to make the best decision about whether to allow Spectra to run the pipeline through their community.

Be careful! This isn't an easy decision to make. There are good reasons to support Spectra's venture, but there are also some risks and possibly negative impacts on the community. You will have to learn some science about the problem, and you will have to learn about the legal, political, and social landscape that will affect and be affected by the decision.

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<sup>1</sup>[http://jmutube.cit.jmu.edu/users/goodalpb/presentations/It\\_s\\_Complicated\\_PBG\\_10\\_16\\_14\\_20141016\\_111046\\_12.zip.content/](http://jmutube.cit.jmu.edu/users/goodalpb/presentations/It_s_Complicated_PBG_10_16_14_20141016_111046_12.zip.content/)

# Activity 1: Brainstorming Exercise

## What kind of knowledge is needed?

### Purpose

To describe the wide range of disciplines and knowledge that are needed to help the Goodall Family and Madison County Board of Supervisors make the best decision possible about the Spectra pipeline.

### Directions

Your team will be given a stack of colored post-it notes. Use these post-its to do the following (times in parentheses are approximate)

- (5 minutes)** *What questions does Mr. Goodall need to have answered?*  
Imagine that you are in Mr. Goodall's shoes and that you need to make a decision about this pipeline. What questions would you want to have answered before you make a decision? Work together as a team to brainstorm and write down as many questions as you can think of - writing one question per post-it note.
- (5 minutes)** *What questions does the Madison County Board of Supervisor need to have answered?*  
Now imagine that your group is the Madison County Board of Supervisors, the governing body over the the county where Mr. Goodall's farm is located. Your group makes decisions about local taxes, land use, road construction, etc., and you will have to decide whether to let Spectra Energy build the pipeline through the county. What questions would you want to get answers to in order to make the best decision possible? Brainstorm on your team and write down as many questions as you can think of - one question per post-it note.
- (5 minutes)** *What types of experts do you need?*  
Now arrange all your post-it note questions (from steps (a) and (b)) into groups, where the questions in one group require one kind of "expert" to find answers and the questions in another group require another kind of expert. You should have at least 3-5 such "expert" groups. If not, go back and think of more questions. After all, this problem has social, environmental, economic, and political dimensions, so you should be able to identify a wide variety of questions.
- (5 minutes)** Stick your post-it notes up on the board, placing post-its in the same "expert group" close to one another. Name each "expert group" by writing a descriptive label indicating the sort of expert needed to answer those questions.
- (5 minutes)** Once all the teams have their note groups up on the board, try and combine the work from all the teams to try and agree on the "expert groups" that would cover all the questions listed across all the teams. See if some of the "expert groups" or individual questions from other teams could fit under one of your team's "expert groups," or if some of your team's questions should be moved into their "expert groups." Your class might even identify a whole new "expert group" once all teams' questions are up on the wall for everyone to see. Move the post-its around to form these groups. Give the expert groups labels as before.

## Activity 2

### Knowledge Domains: Learning the Relevant Science

#### Purpose

To learn some of the basic science (natural science, engineering technology, politics, social impacts) that could affect Mr. Goodall's and the Madison County Board of Supervisors' decisions about the Spectra Energy Pipeline.

#### Directions

You are a "knowledge domain expert" that is part of an interdisciplinary team that is going to help Mr. Goodall and the Madison County make an informed decision about the proposed Spectra Energy pipeline through Madison County and Mr. Goodall's farm. In order to do this, your team will do the following.

1. **Before the next class session**, each person on the team will develop answers to the questions in your assigned knowledge domain (see Table 1 below). You develop answers by doing the following.
  - a. Review the following to gain some some general background on natural gas production from hydraulic fracturing, environmental risks, impact on communities, and the role of natural gas on national energy security. Note that this document has a nice bibliography at the end that might lead you to other useful resources.  
**Natural Gas from Shale: Questions and Answers.** U.S. Dept of Energy, 2013.  
[http://www.energy.gov/sites/prod/files/2013/04/f0/complete\\_brochure.pdf](http://www.energy.gov/sites/prod/files/2013/04/f0/complete_brochure.pdf)
  - b. Read the background material listed under your assigned knowledge domain.
  - c. Find one other credible source (either from a government agency or reputable research organization) to help in your research.
  - d. Prepare a roughly 400-word summary that you will bring to the next class and share with your team members. See the section on **Guidelines for Your 400-Word Knowledge Domain Summary** later in this document.
  - e. Bring enough copies of your summary with you to the next class to make one available to your instructor and one to each of your team mates. This will be used during class and then collected for a grade.
2. During the next class session, your team will meet for the entire session to accomplish the following.
  - a. Each team member will combine their research findings to develop a common understanding of the relevant science that impacts the pipeline decision. Each team member will pass out copies of their research summary from step 1 and briefly go over their findings with the rest of the team.
  - b. You team will start developing a concept map that integrates what you've learned from the five knowledge domains in Table 1. Your concept map should provide a big-picture summary of what these areas of knowledge have to offer to Mr. Goodall and the Madison County Board of Supervisors as they consider the Spectra Energy pipeline proposal. See the directions

below about **Creating Your Team’s Concept Map and Narrative for the Five Knowledge Domains** to help you do this.

3. Before the due date indicated by your instructor, your team must **meet and finish up your concept map**. Your team will **write a 1-2 page narrative** that “tells the story” represented in the concept map. This story should answer the question: “How can concepts and ideas from these five knowledge domains help the Goodall family and Madison County Board of Supervisors make a good decision?”
4. **Turn in your concept map and narrative** for a grade.
5. Make sure you **bring both the map and narrative to class** on the due date so your entire team can participate in a Round Robin Poster Session with all the other teams.

Table 1: Background Reading and Questions to Address in Each Knowledge Domain

Knowledge Domain	Questions and reading resources
Technology and natural science	<p><b>BACKGROUND READING</b></p> <ul style="list-style-type: none"> <li>• <b>Shale Gas and Hydraulic Fracturing In Depth</b>, U.S. Dept of Energy. <a href="http://www.energy.gov/sites/prod/files/2013/04/f0/hydraulic_fracturing_poster.pdf">http://www.energy.gov/sites/prod/files/2013/04/f0/hydraulic_fracturing_poster.pdf</a></li> <li>• <b>Water Resources and Natural Gas Production from the Marcellus Shale</b> (5 pp + bibliography). USGS. <a href="http://pubs.usgs.gov/fs/2009/3032/pdf/FS2009-3032.pdf">http://pubs.usgs.gov/fs/2009/3032/pdf/FS2009-3032.pdf</a></li> <li>• <b>One more credible source that you find.</b></li> </ul> <p><b>QUESTIONS TO ADDRESS</b></p> <ul style="list-style-type: none"> <li>• <i>What is hydraulic fracturing? How does it work?</i></li> <li>• <i>My is there so much gas in the marcellus shale?</i></li> <li>• <i>How would a pipeline be built in the county? Where would it go? What effect would it have on land and animals?</i></li> <li>• <i>One additional question that you identify from this knowledge domain.</i></li> </ul>
Environment Issues	<p><b>BACKGROUND READING</b></p> <ul style="list-style-type: none"> <li>• <b>Facts on the Hydraulic Fracturing Process</b>, Exxon Mobile (includes a 2 min video). <a href="http://www.exxonmobilperspectives.com/2011/06/17/facts-hydraulic-fracturing-process/?gclid=CjwKEAjw-8ihBRD2t9qT3NaW7igSJAD3_sNVa7nMCa67KxXPuVXfzNoGFFrG0mDHWLTZwkN5ZVbhshoCDtnw_wcB&amp;qclsrc=aw_ds">http://www.exxonmobilperspectives.com/2011/06/17/facts-hydraulic-fracturing-process/?gclid=CjwKEAjw-8ihBRD2t9qT3NaW7igSJAD3_sNVa7nMCa67KxXPuVXfzNoGFFrG0mDHWLTZwkN5ZVbhshoCDtnw_wcB&amp;qclsrc=aw_ds</a></li> <li>• <b>How it Works: Water for Natural Gas</b>, Union of Concerned Scientists, <a href="http://www.ucsusa.org/clean_energy/our-energy-choices/energy-and-water-use/water-en-ergy-electricity-natural-gas.html#_VDMh3SldV5o">http://www.ucsusa.org/clean_energy/our-energy-choices/energy-and-water-use/water-en-ergy-electricity-natural-gas.html#_VDMh3SldV5o</a></li> <li>• <b>One more credible source that you find</b></li> </ul> <p><b>QUESTIONS TO ADDRESS</b></p> <ul style="list-style-type: none"> <li>• <i>What are the possible environmental risks associated with fracking and a pipeline?</i></li> <li>• <i>What is the evidence that those risks are real? How strong is that evidence?</i></li> <li>• <i>What questions are still unanswered about the risks from fracking or the pipeline?</i></li> <li>• <i>One additional question that you identify from this knowledge domain.</i></li> </ul>
Governance	<p><b>BACKGROUND READING</b></p> <ul style="list-style-type: none"> <li>• “DMME - Division of Gas and Oil - Hydraulic Fracturing.” Accessed October 31, 2014. <a href="http://www.dmme.virginia.gov/dgo/HydraulicFracturing.shtml#DMME">http://www.dmme.virginia.gov/dgo/HydraulicFracturing.shtml#DMME</a>.</li> <li>• Rosenberg, Andrew A., Pallavi Phartiyal, Gretchen Goldman, and Lewis M. Branscomb. “Exposing Fracking to Sunlight.” <i>Issues in Science &amp; Technology</i> 31, no. 1 (Fall 2014): 74.</li> <li>• “Nelson County Residents Suing Dominion to Stop Gas Pipeline.” Accessed October 31, 2014. Access at: <a href="http://www.newsplex.com/home/headlines/Nelson-County-Residents-Suing-Dominion-to-Stop-Gas-Pipeline-277692721.html">http://www.newsplex.com/home/headlines/Nelson-County-Residents-Suing-Dominion-to-Stop-Gas-Pipeline-277692721.html</a>.</li> </ul>

#### QUESTIONS TO ADDRESS

- What are the “legal ground rules” that dictate where a pipeline might go?
- What decisions about the pipeline can be made at the individual level (i.e. by individual landowners), the county level (by the Board of Supervisors), the state level, and the national level? Which decisions “trump” the others?
- One additional question that you identify from this knowledge domain.

### National Energy Security

#### BACKGROUND READING

- **A First Peak at Our Energy Future** (2014). Department of Energy. <http://www.energy.gov/articles/first-peek-our-energy-future>
- Riley, Alan. “The Shale Revolution’s Shifting Geopolitics.” *The New York Times*, December 25, 2012, sec. Opinion / Global Opinion. <http://www.nytimes.com/2012/12/26/opinion/global/the-shale-revolutions-shifting-geopolitics.html>.

#### QUESTIONS TO ADDRESS

- What role does **gas production from hydraulic fracturing** play in our nation’s energy strategy? In it’s foreign policy? In our nation’s environmental stewardship?
- What are the long-term prospects for our nation’s energy needs as a result of **gas production from marcellus shale**?
- What role does the **pipeline** play in helping our nation achieve more energy security while reducing the impact on the environment?
- One additional question that you identify from this knowledge domain.

### Society

#### BACKGROUND READING

- *Risks to Communities from Shale Gas Production (with discussion)* by Jeffrey Jacquet (2014), in **Risks and Governance in Shale Gas Development: Summary of Two Workshops** (2014), pp. 51-57 National Academies Press, Washington, DC
- Kinchy, Abby J., and Simona L. Perry. “Can Volunteers Pick up the Slack-Efforts to Remedy Knowledge Gaps about the Watershed Impacts of Marcellus Shale Gas Development.” *Duke Envtl. L. & Pol’y F.* 22 (2011): 303.

#### QUESTIONS TO ADDRESS

- What possible effects (positive or negative) might the pipeline have on the well-being of the land and citizens of Madison County? What evidence is there that these effects are real?
- What are the possible effects (positive or negative) of the **pipeline or hydraulic fracturing** on the the well-being of communities beyond the Goodall family, or Madison County?
- One additional question that you identify from this knowledge domain.

### Guidelines for Your 400-Word Knowledge Domain Summary

- Typed; single-spaced
- 12 point font; Times New Roman
- Top line (14 point font, centered): “Research Summary for the XXXX Knowledge Domain” (where you substitute “XXXX” with the name of your assigned knowledge domain)
- Skip one line
- Next line (12 point font from this point on): Your name and section number
- Skip one line
- List the text of each question that you addressed (including the question you added to the list). Use bold face font for the question text.
- Below the question (not bold face font), write a brief paragraph (or 2) summarizing how you would answer the question, based on your research.
- Skip one line before starting the next question.

- (not counted in the 400-word limit) List your references, providing full citation information so that your instructor could look up the reference, if needed.

The criteria for grading your summary are provided below.

**Evaluation Rubric: 400-Word Summary of Your Assigned Knowledge Domain**

Criterion	0 - Missing	1 Unacceptable; major flaws	2	3 Acceptable, many minor flaws	4	5 Outstanding; no notable flaws
Accuracy of answers						
Quality of additional sources						
Clarity of explanation						
Depth (lack of superficiality)						

Grade Scale (based on total points)

- A 18-20 pts
- B 16-17 pts
- C 14-15 pts
- D 12-13 pts
- F less than 12 pts

**Creating Your Team’s Concept Map & Narrative for the Five Knowledge Domains**

What is a concept map?

A concept map is a diagram that displays concepts and ideas, along with the ways they are connected or influence one another. To make a concept map, you need to have a purpose for it. In this assignment, your team will develop concept map whose purpose is to show what the sorts of information and ideas are provided from five different Knowledge Domains that would help the Goodall family and the Madison County Board of Supervisors make the best decisions about the Spectra Pipeline in their farm or county, respectively.

A plan for making a concept map that integrates the five knowledge domains

Begin by getting a stack of 30 or 40 post-it notes of different colors on which to write your ideas. Go some place where you can have a big board to write on. Then on that board, begin by drawing two big ovals in the center of the board. Inside one, write the label “Madison County B.O.S. decision.” Inside the other, write the label “Goodall Family

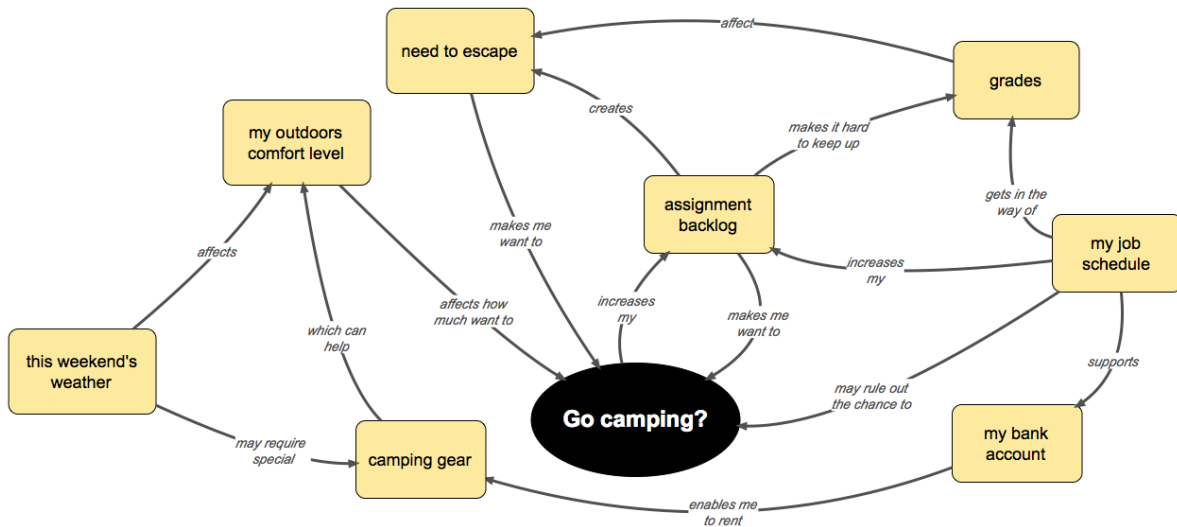
decision.” Place these two ovals a little ways apart, but near the center of the board. This is the start of your concept diagram.

Use the post-it notes to add your diagram those concepts, ideas or issues that your team has identified from your research that would be important to either decision (by the Board of Supervisors or by the Goodall Family). Write one concept, idea, or issue on each post-it note. Then place the post-it notes on the board. Think about arranging similar ideas/concepts/issues close to one another on the board, but leave lots of space for drawing arrows.

Adding and labeling connecting arrows

As you add post-it notes (concepts) to your diagram, draw arrows that show the interdependencies among the concepts. The arrows should point from a concept into another concept that in some way is affected or depends on the first. See the concept map below. This shows how one particular student is weighing the decision to go on a camping trip with their friends next weekend. Notice how each “node” (oval or rectangle) either has an arrow leading into it or out of it (a node with no arrows into or out of it is not relevant to your story). Also notice how the arrows are labeled with verb phrases (action phrases) that describe the relationship between the two connected nodes.

You can check yourself to see if your nodes and connections make sense by seeing if each pair of connected nodes and the labeled arrow can form a sentence that makes sense. For example, the arrow from “my job schedule” to “my bank account” can be translated to say “My job schedule supports my bank account.” The relationship between “my outdoors comfort level” and the “go camping?” concepts is this: “My outdoors comfort level affects how much I want to go camping.”



Writing a narrative to explain the “story” your concept map is telling

It’s important that you supplement your concept map with a written or oral narrative to help a viewer (and you!) understand the big picture - what the concept map is designed to represent. To do this, you need to “tell the story” that your map represents. For example, if you look at the above diagram for awhile, you can hopefully see that it’s

telling a story...the story about all the things this student is considering as they think about going camping.

In order to create this narrative, step back and ask “what story are we trying to tell with this map?” If you can tell this story in a concise way, it will help a viewer interpret the diagram and understand the main ideas you wish to communicate. BE CAREFUL! Your story narrative should provide something more informative than a simple bulleted list of disconnected sentences (one sentence for every pair of connected nodes). Instead, the narrative should provide a focused “Cliff Notes” summary of the main ideas and relationships you wish to communicate through the concept map.

Here’s one example of a narrative that could go along with the above diagram. We’ll write the story in 1st person, since the the diagram refers to “my bank account,” etc.

*As I think about going camping this weekend, I’m trying to consider four main things: (1) how comfortable I feel about being outside all weekend (given the weather conditions and the camping gear I have), (2) my need to escape and unwind (because I’ve had lots of homework lately, and my grades are suffering) , and my job schedule (which needs to take priority to so I can pay my bills...but which also makes it hard to keep up my grades). What shall I do? The jury is still out on this one!*

Notice that the story doesn’t refer to every single detail in the diagram, but it captures the essence of main ideas and their relationships. Also, the story has a focus. In this case, the story focuses on answering this question: “*How am I trying to work out whether or not to go camping?*” The story addresses the details in the only as they bear on that main point.

A good way to start creating your story or narrative is to think about what question you wish to answer through the concept map.

*So what is your team’s task?*

Your team must create a concept map of the relevant concepts, ideas, and issues that need to be considered by either the Goodall Family or the Madison County Board of Supervisors as they weigh their decisions about the Spectra pipeline. Your concept map should reflect the concepts, ideas, and issues that your team found in your research across the five Knowledge domains. Then you are to create a 1-2 page narrative (600 words maximum) that “tells the story” of your concept map. That story should address two themes: (1) *What should the County Board of Supervisors consider as they weigh the pipeline decision?* and (2) *What should the Goodall family consider?*

Your work will be evaluated using the criteria listed below. Use these criteria to guide your team as you do your work.

Once you complete the concept map and narrative, make a neat, poster-sized (3 ft x 4 ft) copy (hand-drawn, if you’d like) to bring to class on the due date. Also bring at least 5 printed copies of the narrative (collated and stapled). These will be used in the Round Robin Poster Session that is scheduled on the due date.

### **Evaluation Rubric: Integrated Concept Map and Narrative**



Criterion (CM = "Concept Map"; N = "Narrative")	0 - Missing	1 Unacceptable; major errors	2	3 Acceptable; many minor errors	4	5 Outstanding; no notable errors
CM: neat and easy to read						
CM: connected concept and labeled arrows form meaningful and correct statements						
CM: Considers concepts from all five knowledge domains						
CM: No obvious missing connections						
N: Focuses on telling the story of the two themes (B.O.S. and Goodall family decisions)						
N: Easy to follow; well written						
N: Consistent with the Concept Map						

Grade Scale (based on total points)

- A 32-35 pts
- B 28-31 pts
- C 24-27 pts
- D 20-23 pts
- F less than 20 pts

## Round Robin Rubric: Concept Map and Narrative

**Team member's whose map and narrative you are evaluating:**

**Your name:**

**Purpose of this rubric**

You will fill out one copy of the rubric for each team concept map and narrative that you reviewed during the Round Robin Poster Session. Your feedback will have no impact on that team's grade and your name will be hidden before they see your feedback. So be honest! Tell a team what they've done well and what they could improve. In this way, you will help them learn and improve their work. Simply checking boxes and giving only superficial feedback will rob them of useful feedback and harm your own grade.

**Assessment**

Your grade is based on the level of thought and energy you put into this evaluation activity. Turn all the forms into your instructor at the end of class.

Criterion (CM = "Concept Map"; N = "Narrative")	0 Missing or unable to evaluate	1 Unacceptable; major errors	2	3 Average; a few major or many minor errors	4	5 Outstanding; no notable errors
CONCEPT MAP is neat and easy to read						
CONCEPT MAP arrows and nodes form meaningful and correct statements						
CONCEPT MAP integrates all five knowledge domains						
CONCEPT MAP has no obvious missing connections						
NARRATIVE focuses on telling the story of the two themes (B.O.S. and Goodall family decisions)						
NARRATIVE is well written and easy to follow						
Narrative tells a story that is consistent with the Concept Map						

Describe some aspect of this team's analysis that you thought was well done.
Describe some aspect of their analysis that you thought could be improved, and describe how.

## Wrap-up: Final Briefing Papers

### Purpose

To “put it all together” by writing two brief papers to help the Goodall family and the Madison County Board of Supervisors make good decisions about the proposed Spectra Pipeline.

### Directions

This assignment is to be completed by you individually, with no help from other students.

Your task is to write two 400-word brief papers. One will be addressed to the Goodall family, and the other will be addressed to the Madison County Board of Supervisors. Your job is to help each group identify those things that they should consider before making a decision about the Spectra Energy pipeline. f5678opi

**IMPORTANT:** It’s not your job recommend what each group should do about the pipeline.

### Guidelines for your two papers

In 12 point font, single spaced, using Times New Roman, include your name and your knowledge domain at the top. Also identify the audience: To: the Goodalls or To: The Board of Supervisors as a heading at the top. Give headings to each of your sections, like a official report.

Write two briefing papers of 400 words each. These are short pieces that identify, describe, and explain what, given the range of interests of the Goodalls and of Madison County Board of Supervisors, they should consider before making a decision about the pipeline. For example, the Goodalls will need to decide whether to let Spectra run the pipeline through their farm where as the Board of Supervisors needs to decide whether to allow the pipeline to run through the county (and its private and public lands). While both groups have some common concerns, they also are concerned about different things, because of their role in the decision making process.

- Briefly identify at least three possible priorities of each (the individual landowner and local) (~100 words). For example, based on what you know from the video, the Goodalls wish to preserve the integrity of the natural environment for future generations of Goodalls.
- Given these priorities, what are the major arguments for and against supporting the pipeline? Spend 250 words or less identifying and describing the major arguments for permitting the pipeline and for **not** permitting the pipeline.
- Explain why these arguments should be considered.

- Spend ~50 words identifying areas that need further research before a final decision can be made.

Do NOT make a recommendation. The information you provide is meant to be a starting point for others to examine the implications of a decision, in light of their **priorities and values**. More work would be needed before such a recommendation could be made. Instead, your job is to educate these groups so that they can know what questions they should be asking, what kinds of “rights” they have to make decisions, and what the science tells us about the potential benefits and risks of the pipeline and the hydraulic fracturing wells that it would service.

**Assessment: How your paper will be graded**

**Evaluation Rubric: Final Briefing Papers (BP) - Apply separately to each paper**

	0 - Not Present	1 <b>Developing</b>	2	3 <b>Acceptable</b>	4	5 <b>Outstanding</b>
Sentence level errors and formatting		includes many errors		includes minor errors		few notable errors
Identifies three possible priorities		1 or fewer		only 2		3 or more
Integrates multiple knowledge domains		1 or fewer		only 2		3 or more
Identifies the major arguments for the pipeline		most important details are missing		some details are missing		few additional details needed
Identifies the major arguments <b>against</b> the pipeline		most important details are missing		some details are missing		few additional details needed
Describes the major arguments for the pipeline		most important details are missing		some details are missing		few additional details needed
Describes the major arguments <b>against</b> the pipeline		most important details are missing		some details are missing		few additional details needed
Identifies additional research that's needed		most important details are missing		some details are missing		few additional details needed

Grade Scale (based on total points)

A: 25- 40 pts

B: 17-24 pts

C: 10-16 pts

Below 10: Redo for credit