CITY OF BADWATER
100 Main Street, Badwater, AZ

3/14/2015

Independent Mathematical Contractors
00 Anystreet
Anytown, Anystate 00000

Dear IMC

I recently contacted you regarding the blending of water from three different wells to lower the amount of arsenic. In examining your solutions to our problem, it occurred to us that there might be other contaminants in our drinking water. An analysis of our water found a problem with another contaminant, selenium, in addition to the arsenic you already are familiar with.

Selenium is a metal that is found naturally in ore deposits. It is used in the manufacture of electronics and photocopiers as well as in other industrial activities. While selenium is an essential nutrient at low levels, higher levels can cause damage if a person is exposed over a long period of time. Long term damage, such as that incurred by drinking water with high levels of selenium, can lead to kidney and liver damage.

The EPA has established a level of 0.05 part per million as the maximum allowable level in drinking water. Recall that the level for arsenic is 10 parts per billion. To insure a safety factor of 20%, we would like the blended water to have a level of selenium no higher than 0.04 parts per million and a level of arsenic no higher than 8 parts per billion.

The table below shows the three wells, their respective levels of arsenic and selenium.

Well	Arsenic Level (ppb)	Selenium Level (ppm)	Cost per thousand gallons ($)
1	9	0.03	1.33
2	12	0.02	2
3	c	0.05	$\frac{14}{c}$

The city has an average daily demand of $3.5+0.01\cdot M$ million gallons that must be supplied from these three wells. M is your team number. We need to make sure that we have at least this capacity to supply drinking water to our customers. The constant c is the potential level at which Well 3 may be filtered.

To meet this demand, we plan to blend water from these three wells. This is done by piping the water to a central location and then combining different amounts from each well together to get a mixture that no more than 8 ppb of arsenic and 0.04 ppm of selenium.

To help us write the plan for the EPA, we would like to know how much water we must pump daily from each of the wells and at what level of filtering from Well 3. Since the City of Bad Water has limited resources, we want to do this at as low a cost as possible.

Please utilize your team to examine several different levels of filtering in Well 3. Each member of your team will need to complete two technology assignments to help them analyze their level of filtering. Work wth your teammates to develop a standard approach to the problem so that your results will be easy to compare.

- Technology Assignment Write Out a Standard Minimization Problem - In this assignment you will identify the objective function and constraints for the project. Using some algebra, you will rewrite the linear programming problem as a standard minimization problem.
- Technology Assignment Solve the Standard Minimization Problem – The goal of this assignment is to carry out the row operations for the Simplex Method using Google Sheets.

As with your earlier project, you will present your team's findings in a project document. This document must contain enough detail so that we could modify your calculations should any of the numbers above change. This means that numbers alone will not be sufficient. We need to see your calculations and understand the steps you followed to solve the problem outlined above.

Sincerely,

Mortimer Bruster
Director of Utilities
City of Bad Water, Arizona