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THE GREAT SHAKE

TEACHER'S GUIDE

Napa Sanitation District

2/16/2018

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COVER SHEET

The Napa "Great Shake" Coversheet

Introduction: The following lessons introduce students to algebra equations in order to determine hydraulic detention time, conversion of a flow and concentration into pound and mathematic ratios.

Materials:

- Projector connected to a computer with internet to play video of incident
- Copies of each of the following:
  - Warm-Up and Exit Ticket
  - The Napa Shake up Worksheet
  - Applied Wastewater Math Formula Sheet and Conversion Factors
  - Student Surveys

Estimated Timeframe:

- 45 minutes to an hour, depending on how you spread and imbed your think time

Prior Knowledge/Skills Needed:

Before this application lesson, students must be able to:

- Calculate the result of an algebra equation using multiplication
- Calculate the result of one equation divided into another
- Calculate the ratio of one equation over another
- Conversion of a percentage to a decimal

Common Core State Standards:

CCSS.MATH.HS.A-CED.2: Create equations in two or more variables to represent relationships between quantities;

CCSS.MATH.HS.A-REI.3: Solve linear equations and inequalities in one variable, including equations with coefficient represented by letters.

Additional Common Core State Standards:

CCSS.MATH.HS.N-1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas;

CCSS.MATH.HS.A-CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

Implementation Suggestions:

- Ask students to think/write/pair/share often so students can verbalize and communicate their mathematics
- Students should do work on the board in groups or pairs

Accommodations/Modifications:

- For English Language Learners:
    - Be sure to have precise definitions of content vocabulary ready ahead of time.
    - Be sure to include think time when appropriate
    - Ask students to Think/Write/Share between for each question
- SPED/504:
    - Allow students to use a calculator for calculations
    - Allow students to use applied math formula sheet
    - Focus on having students verbalize the process in their own words
    - While students are finding solutions you may ask students for estimated solutions first, this helps students see if they are headed in the right direction with their answers

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WARM-UP EXERCISE

The Napa "Great Shake" WARM-UP

Calculating hydraulic detention time and organic loading are two important factors treatment plant operators have to understand in order to operate a wastewater treatment plant.

Hydraulic detention time (HDT) also known as hydraulic retention time (HRT) is a measure of the average length of time that a compound (in this case wastewater) remains in a treatment tank or unit. Simply stated if you started to fill a tank with wastewater the detention time is the average amount of a time that a drop of that water will remain in the treatment tank before the tank fills and that drop of water flows out of it. This is important because as wastewater passes through a treatment tank it must stay in the tank for the necessary period of time in order to be adequately treated. For example, in most aeration treatment systems, 4 to 8 hours of detention time is necessary in order for the microorganisms in the aeration system to absorb, adsorb and remove the contaminants (bacteria food) in the wastewater.

Like humans, animals and other organisms, the microorganisms used to treat wastewater need the right amount of food in order to survive and thrive. Organic loading in wastewater is measured as BOD (Biochemical Oxygen Demand) which is a test run in a lab which measures the concentration or strength of the organic loading of a volume of wastewater. Think of the BOD or organic load as wastewater contamination which serves as bacteria food that the microorganisms in the treatment system consume and remove from the wastewater. Treatment plant operators must understand the relationship between the contaminant (organic load) in the wastewater relative to the amount of microorganisms in the treatment system that are available to remove that organic load. Therefore, operators must calculate the pounds of organic load contained in a volume of wastewater then calculate the pounds of microorganisms that are in the treatment system which is available to consume and remove the organic load. The operator then compares the pounds of organic loading to the pounds of microorganisms. This comparison is referred to as the Food to Microorganism (F/M) ratio. Most treatment plants operate at an F/M ratio of 0.2 to 0.5. This means for every 2 to 5 pounds of organic load in a volume of wastewater the treatment system must contain 10 pounds of microorganisms in order to stabilize and remove that organic load.

1. **Hydraulic Detention Time**

A. Calculate the Hydraulic Detention Time in a treatment tank given the following:

Flow to a rectangular aeration basin is 3.0 million gallons per day. The clarifier is 100 ft in length, 50 ft wide, and 15 ft deep. Calculate the aeration basin's hydraulic detention time.

$$\text{Volume of Rectangular or circular tank of uniform depth, } \{ft^3\} = \text{area, } \{ft\}^2 \text{ x depth, } \{ft\}$$

$$\text{Detention time, } \{hr\} = \left[\frac{\text{tank volume, } \{ft^3\} \times 7.5 \{\frac{gallons}{ft^3}\} \times 24 \{\frac{hrs}{day}\}}{Q, \ \{gallons/day\}}\right]$$

B. Is this an adequate amount of treatment time?

2. Organic Loading

a. Convert a concentration of wastewater contaminants to pounds.
   i. A wastewater flow rate is 6 MGD (million gallons/day) has an organic loading concentration of 250 mg/l BOD (Biochemical Oxygen Demand).

<u>BOD or SS</u>, {lbs/day} = 8.34 {lbs·L/MG·mg} x Q,{MGD} x conc,{mg/L}

b. Determine microorganism population in pounds.
   i. A wastewater treatment tank has a volume of 3.0 (MG) million gallons and has a solids concentration of 2500 mg/l (parts per million) which is 81% volatile (microorganisms).

Bacteria under Aeration (lbs) = 8.34 (lbs*L/MG*mg) x Vol,(MG) x Conc. (mg/l) x Volatile %

c. Comparing pounds of wastewater contamination (bacteria food) to pounds of bacteria in the treatment system what is the Food to Microorganism Ratio?

$$F/M = \frac{\text{CBOD applied}}{\text{Organic solids under aeration}}$$

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VIDEO

“The Great Shake” Contextualized Learning video

April 19, 2016

Levi Fuller, Operations Supervisor and Chief Plant Operator, Dublin San Ramon Services District

June 17, 2016

Details

File Type:

Author:

Organization:

Signatory:

Organizational Processes:

Tara McClinton, Wastewater Laboratory Technician, Napa Sanitation District

October 12, 2016

Andrew Jellison, Operator-in-Training, Napa Sanitation District

June 16, 2016

Sinzee Tran, Wastewater Treatment Operator 1, Dublin San Ramon Services District

May 26, 2016

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Rodrigo Montanez, Lab Tech at Napa Sanitation District

October 12, 2016


Rodrigo Montanez, Lab Tech at Napa Sanitation District ...
EXIT
Rodrigo Montanez, Lab Technician
Napa Sanitation District
MORE VIDEOS
0:05 / 3:16
YouTube

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WORKSHEET

The Napa “Great Shake” Worksheet

Wastewater treatment plant operators have to make numerous calculations in order to make adjustments to treatment processes in order to produce well treated water that can be safely placed back into the environment. Two of those calculations are hydraulic detention time which is a measure of the average amount of time a volume of wastewater is in a treatment unit. Wastewater treatment plants use microorganisms in the treatment process. These microorganisms consume contaminants in the wastewater using that contamination as their food source. Operators most insure that there is the proper amount of microorganisms to remove the contaminants in the incoming wastewater. Therefore, wastewater operators must calculate the food to microorganism (F/M) ratio. F/M ratio is a calculation that compares pounds of contamination in volume of wastewater to the pounds of microorganisms in a wastewater treatment tank that are available to consume and remove that contamination.

The City of Napa Wastewater Treatment Plant operates well with a determined hydraulic detention time and organic loading rate (Food/Microorganism Ratio). As a result of the Napa Earthquake staff estimates that approximately 360,000 gallons of wine spilled and made its way into the wastewater treatment plant. This 360,000 gallons increased both the detention and organic loading (Food to Microorganisms ratio).

If we assume the following:

Normal Flow: 6 million gallons per day

Normal Flow BOD: 250 mg/l

Aeration Total Volume: 3 million gallons

Aeration Mixed Liquor Suspended Solids: 2500 mg/l

Volatile Content: 81% (% of material in the treatment unit that is organic. i.e. bacteria)

Normal Detention Time: 4.5 hours

Normal Food/Microorganism Ratio: 0.24

Refer to the warm-up exercise where the normal detention time and food to microorganism ratio was determined for the City of Napa's Wastewater Treatment Plant. August 24, 2014 the *South Napa Earthquake* resulted in a spill of 360,000 of wine making its wat into the City of Napa's sewer and eventually that wine along with the normal wastewater flowed into the Napa Wastewater Treatment Plant.

If 360,000 gallons of wine with a BOD content of 11,500 mg/l flows into the treatment plant along with the normal wastewater flow:

1. What is the impact on treatment detention time in the aeration system? Normal Range is 4 to 8 hours.

2. What do you think the operator may have to do in order to adapt to this change?

3. What is the impact on treatment food to microorganism ratio? Normal Range is 0.2 to 0.5.

4. What do you suspect the operators at Napa needed to do in order to adapt to this change in food to microorganism ratio?

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SOLUTION SHEET

The Napa "Great Shake" Solution Sheet

WARM-UP

Calculating hydraulic detention time and organic loading are two important factors treatment plant operators have to understand in order to operate a wastewater treatment plant.

Hydraulic detention time (HDT) also known as hydraulic retention time (HRT) is a measure of the average length of time that a compound (in this case wastewater) remains in a treatment tank or unit. Simply stated if you started to fill a tank with wastewater the detention time is the average amount of a time that a drop of that water will remain in the treatment tank before the tank fills and that drop of water flows out of it. This is important because as wastewater passes through a treatment tank it must stay in the tank for the necessary period of time in order to be adequately treated. For example, in most aeration treatment systems, 4 to 8 hours of detention time is necessary in order for the microorganisms in the aeration system to absorb, adsorb and remove the contaminants (bacteria food) in the wastewater.

Like humans, animals and other organisms, the microorganisms used to treat wastewater need the right amount of food in order to survive and thrive. Organic loading in wastewater is measured as BOD (Biochemical Oxygen Demand) which is a test run in a lab which measures the concentration or strength of the organic loading of a volume of wastewater. Think of the BOD or organic load as wastewater contamination which serves as bacteria food that the microorganisms in the treatment system consume and remove from the wastewater. Treatment plant operators must understand the relationship between the contaminant (organic load) in the wastewater relative to the amount of microorganisms in the treatment system that are available to remove that organic load. Therefore, operators must calculate the pounds of organic load contained in a volume of wastewater then calculate the pounds of microorganisms that are in the treatment system which is available to consume and remove the organic load. The operator then compares the pounds of organic loading to the pounds of microorganisms. This comparison is referred to as the Food to Microorganism (F/M) ratio. Most treatment plants operate at an F/M ratio of 0.2 to 0.5. This means for every 2 to 5 pounds of organic load in a volume of wastewater the treatment system must contain 10 pounds of microorganisms in order to stabilize and remove that organic load.

1. Hydraulic Detention Time

A. Calculate the Hydraulic Detention Time in a treatment tank given the following:

Flow to a rectangular aeration basin is 3.0 million gallons per day. The clarifier is 100 ft in length, 50 ft wide, and 15 ft deep. Calculate the aeration basin's hydraulic detention time.

$$\frac{(100 \times 50 \times 15)\ \text{ft3} * 7.5\ \text{gal/ft3} * 24\ \text{hrs/day}}{3{,}000{,}0000\ \text{gal/day}}$$

$$\frac{75000\ \text{ft3} * 7.5\ \text{gal/ft3} * 24\ \text{hrs/day}}{3{,}000{,}000\ \text{gal/day}}$$

$$\underline{13{,}500{,}000\ \text{gal/hrs/day}} \quad = \quad 4.5\text{hrs}$$

3,000,000 gal/day

B. Is this an adequate amount of treatment time?

Yes the normal range is 4 to 8 hours

2. Organic Loading

a. Convert a concentration of wastewater contaminants to pounds.

i. A wastewater flow rate is 6 MGD (million gallons/day) has an organic loading concentration of 250 mg/l BOD (Biochemical Oxygen Demand).

12,510 = 8.34 (lbs*L/MG*mg) x 6 MGD x 250 mg/l

b. Determine microorganism population in pounds.

i. A wastewater treatment tank has a volume of 3.0 (MG) million gallons and has a solids concentration of 2500 mg/l (parts per million). The solids are 81% volatile (microorganisms).

{lbs/day} = 8.34 [lbs x L/MG x mg] x Vol, [MGD] x conc, [mg/L] x % Volatile.

= 8.34 (lbs x L/MG x mg) * 3MG * 2500 mg/l * 81%

50,665.5 = 8.34 (lbs x L/MG x mg) * 3MG * 2500 mg/l * 0.81

c. Comparing pounds of wastewater contamination to pounds of bacteria in the treatment system what is the Food to Microorganism Ratio?

0.24 = <u>**12,510 lbs of Wastewater Contaminants**</u>

50,665 Lbs of Treatment Microorganisms

(Normal Food to Microorganism Ratio is 0.2 to 0.5)

EXIT TICKET

What did you learn about detention and how it is calculated?

What did you learn about organic loading and how it is calculated?

What did you learn about the ratio of food (wastewater contamination) a wastewater treatment bacteria will consume relative to its body mass?

Did you find the concepts difficult to understand?

What aspect of this problem(s) was difficult to understand?

Given what we have reviewed about how wastewater is treated how do you suppose 360,000 gallons of wine spilled and flowing to the wastewater plant at the City of Napa's wastewater plant impacted the operation of wastewater treatment plant?

The Napa Shake Up

Wastewater treatment plant operators have to make numerous calculations in order to make adjustments to treatment processes. Two of those calculations are hydraulic detention time which is a measure of the average amount of time a volume of wastewater is in a treatment unit. Wastewater treatment plants use microorganisms in the treatment process. These microorganisms consume contaminants in the wastewater using that contamination as their food source. Operators most insure that there is the proper amount of microorganisms in order to remove the contaminants in the incoming wastewater. Therefore, wastewater operators must calculate the food to microorganism (F/M) ratio.

The City of Napa Wastewater Treatment Plant operates well with an historically established a determined hydraulic detention time and organic loading rate (Food/Microorganism Ratio). As a result of the Napa Earthquake staff estimates that approximately 360,000 gallons of wine spilled and made its way into the wastewater treatment plant. This 360,000 gallons impacted both the detention and organic loading (Food to Microorganisms ratio).

If we assume the following:

Normal Flow: 6 million gallons per day

Normal Flow BOD: 250 mg/l

Aeration Total Volume: 3 million gallons

Aeration Mixed Liquor Suspended Solids: 2500 mg/l

Volatile Content: 81% (% of material in the treatment unit that is organic. i.e. bacteria)

Normal Detention Time: 4.5 hours

Normal Food/Microorganism Ratio: 0.24

Refer to the warm-up exercise where the normal detention time and food to microorganism ratio was determined for the City of Napa's Wastewater Treatment Plant. August 24, 2014 the *South Napa Earthquake* resulted in a spill of 360,000 of wine making its way into the City of Napa's sewer and eventually that wine along with the normal wastewater flowed into the Napa Wastewater Treatment Plant.

If 360,000 gallons of wine with a BOD (biochemical oxygen demand) content of 11,500 mg/l flows into the treatment plant along with the normal wastewater flow:

1. What is the impact on treatment detention time in the aeration system? Normal Range is 4 to 8 hours. (Refer to Warm-up Exercise 1A)

$$\frac{\textbf{13,500,000 gal/hrs/day}}{\textbf{3,000,000 gal/day}} = \textbf{4.5hrs}$$

$$\frac{\textbf{13,500,000 gal/hrs/day}}{\textbf{3,360,000 gal/day}} = \textbf{4.0hrs}$$

2. What do you think the operator may have to do in order to adapt to this change?

No action required in regards to detention time. Detention time dropped from 4.5 hours to 4.0 hours but it is still within the target range for detention time which is 4 to 8 hours.

3. What is the impact on treatment food to microorganism ratio? Normal Range is 0.2 to 0.5.

{lbs/day} = 8.34 {lbs·L/MG·mg} x Q,{MGD} x conc,{mg/L}

12,510 lbs = 8.34 (lbs*L/MG*mg) x 6 MGD x 250 mg/l - normal WW organic load

(see warmup exercise 2a.)

34,527.6 lbs = 8.34 (lbs*L/MG*mg) x 0.360 MGD x 11500 mg/l – Wine Spill organic load

12,510 lbs(normal) + 34,527.6 lbs(wine) = <u>47,037.6</u> lbs of organic loading measured as BOD (Bacteria Food)

{lbs/day} = 8.34 [lbs x L/MG x mg] x Vol, [MGD] x conc, [mg/L] x % Volatile.

= 8.34 (lbs x L/MG x mg) * 3MG * 2500 mg/l * 81%

<u>50,665.5</u> = 8.34 (lbs x L/MG x mg) * 3MG * 2500 mg/l * 0.81 (see warmup exer. 2b.)

$$\textbf{0.92} = \frac{\textbf{47,036.6 lbs of organic load}}{\textbf{50,665.5 lbs of microorganisms}}$$

4. What do you suspect the operators at Napa needed to do in order to adapt to this change in food to microorganism ratio?

- **Add more treatment bacteria to the system**
- **Divert wastewater contaminated with wine to holding tanks a slowly bring through the treatment facility.**

- **Increase air(oxygen) , nutrients and other things necessary for microbial growth and metabolism**

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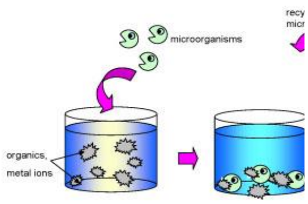
EXIT TICKET

Exit Ticket



1. What is the importance of detention time in a treatment tank?

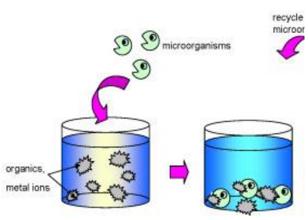
2. What is the significance or meaning of organic loading in a biological treatment process like one might find in a wastewater treatment plant?

3. What is food to microorganism ratio?

4. Why is food to microorganism ratio important?

5. How could a spill of wine impact the biological treatment process like one might find in a wastewater treatment plant?

Exit Ticket



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TEACHER'S FEEDBACK FORM

Feedback Form for Teachers (Online)

Online Version of Feedback Form:
https://goo.gl/forms/esHz2B0pokGqqSWP2

Feedback Form for Teachers

I. Information on Teacher and the Module Used

Name of Teacher

Date Module was Used

Name of Class in which module was used

Number of students in class

Name of school or other organization

Name of the Contextualized Learning Module Used

II. Components of the Contextualized Learning Module Used

Yes	No	
☐	☐	A. The Problem Illustration Video
☐	☐	B. The Warm-Up Ticket
☐	☐	C. The Cover Sheet
☐	☐	D. The Solution Sheet
☐	☐	E. The Exit Tickets
☐	☐	F. Videos of individual Subject Matter Experts
☐	☐	G. Feedback form for students

III. Feedback on components of the module

A. The Problem Illustration Video

1. What did you think worked in this component of the module?

2. What did you think didn't work as well?

3. Do you have any suggestion for how we could make this component of the module more effective in future modules?

4. Not applicable—this component of the module was not used

B. The Warm-Up Ticket

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?
4. Not applicable—this component of the module was not used

C. The Cover Sheet

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?
4. Not applicable—this component of the module was not used

D. The Solution Sheet

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?
4. Not applicable—this component of the module was not used

E. The Exit Tickets

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?
4. Not applicable—this component of the module was not used

F. Videos of individual Subject Matter Experts

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?
4. Not applicable—this component of the module was not used

G. Feedback form for students

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?
4. Not applicable—this component of the module was not used

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STUDENTS FEEDBACK FORM

Feedback Form for Students (Online)

Go here for the Online Version of Feedback Form:
https://goo.gl/forms/3vSjzMuzFDuxY1y73

Feedback Form for Students

Please rate each of the following aspects of this lesson:

	Excellent	Very Good	Good	Fair	Poor	Very Poor
1. Video						
2. Lesson Presentation						
3. Worksheet						
4. Time Allotted						

5. What aspect or part of this lesson do you believe was the most effective at helping you reach the learning goal?

6. Where would you have wanted more training or help on this?

7. Did this curriculum increase your awareness of the water/wastewater industry?

8. Additional Comments/Suggestions:

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SCRIPT

Napa Sanitation Earthquake - Video Script

Cast: Gabe – Control Room Operator Lead

Zee Tran – Panel Operator (SCADA)

Steve – Investigating Operator Lead

Levi Fuller - Investigating Operator

Andrew – OIT (Operator in Training)

Tara – Laboratory Chemist/Biologist

Rodrigo – Laboratory Chemist/Biologist/Bi-Lingual

Introduction Scene:

Steve : Hi. My name is Steve Chavis, I'm an Operator III at the Napa Sanitation District. Our work is very important for our community and the environment. Here we operate several treatment processes to remove pollutants from the water.

Gabe : I'm Gabe Snook. I'm also an Operator III with the District. In addition to what Steve said we also produce recycled water for use in irrigation. Additionally, we put the bio-solids we capture and the energy that's created into beneficial resuse. I guess you can say we are a resource recovery facility.

Andrew: I'm Andrew Jellison. I'm working at the District as an "Operator in Training" gaining qualified work experience as a Wastewater Operator.

Levi Fuller: Hi I'm Levi Fuller. (intro.)

Zee Tran: Hi I'm Zee Tran. (intro.)

Steve: We use math on a regular basis in the operation of our treatment plant to make sure they are working right and to tell us if changes need to be made.

Gabe : We thought we could share with you how we used math to help us through the earthquake we had in August 2014.

Scene 1

Open with video of parking lot and trucks.

When trucks start shaking show text " Napa Sanitation District Earthquake August 2014"

Scene 2 Control Room (Reference pictures Panel- 1, Panel- 2)

Show control room Gabe and Panel Operator at console.

Focus Gabe on phone, “They’re saying it was a 6.1 centered on the other side of the River…. No, so far we found no damage and the plant is operating well… I’ll keep you informed.” Hangs up.

Focus, Control area capturing Gabe and Panel Operator

Gabe to Panel Operator – “Hey did Steve and Andrew check in yet?”

Panel Operator – “They said they’d be up in a minute. Here they come now.”

Steve and Andrew can be seen coming up to the control room door and entering.

Steve, informing, “Everything looks good. We just checked out the Digester and Aeration Basin area. Everything looks good. We’re going to go check the influent.”

Gabe and Panel Operator acknowledge.

Steve and Andrew leave.

Scene 3 - Shot of Steve and Andrew walking using sky as background

Focus front shot of Steve and Andrew walking.

Andrew : “I’m really surprised the plant held up.”

Steve: “Yeah it was centered just across the River less than a mile away.

This is a real testament to seismic engineering…. Did you ever see all the math that goes into those calculations?”

Andrew: “ Yah, it’s almost as much math as I have to do to get certified!” (Both chuckle) “Hey, do you smell wine?”

Scene 4 - Influent Pumping Station, Steve and Andrew at open hatch (Reference pictures IPS-1, IPS-2)

Focus Steve and Andrew looking down into the influent

Andrew: “Wow, the flow is purple!”

Steve: “Looks like straight wine.”

“Man, that’s going to knock the plant out. Get ahold of panel and see if they can grab a sample.”

Scene 5 - Control Room

Control Room (Gabe, Panel Operator Rodrigo)

Shot of Panel Operator, alarm going off,

Panel Operator: “Hey the influent pH is in alarm and dropping!”

Phone rings. Gabe answers. “Wine? Makes sense, the pH went into alarm. I’ll notify the lab.”

Gabe to Rodrigo: “Rodrigo, puedes tomar una muestra de el influente”?(Can you grab a sample of the influent)

Rodrigo: Si Senor(Yes Sir)

Scene 6 – Laboratory – Plastic sample bottles on floor (Reference pictures Lab-1, Lab-2)

Shot of Tara cleaning up broken glass in the lab, fallen plastic bottles scattered across the floor

Tara answers phone, “ low pH? sure Gabe. I’ll head up there and grab a sample now.

Scene 7 – Influent Pumping Station

Back to Andrew and Steve

Andrew – “Maybe we should divert the flow to the pond.”

Steve – “Maybe, but first we need to do some of that math you were taking about.

ENDING:

Steve: I’ve found being a Wastewater Operator is a great job, very interesting and rewarding. Not only is there good pay and benefits and job security, you can do your share as a steward of the environment.

Gabe: If you’d like to hear more about how Steve and I got our jobs and how you could prepare yourself for a career in the Water or Wastewater industry, please visit the BAYWORK website to hear our personal stories. The career section of the website is full of information about great water industry jobs.

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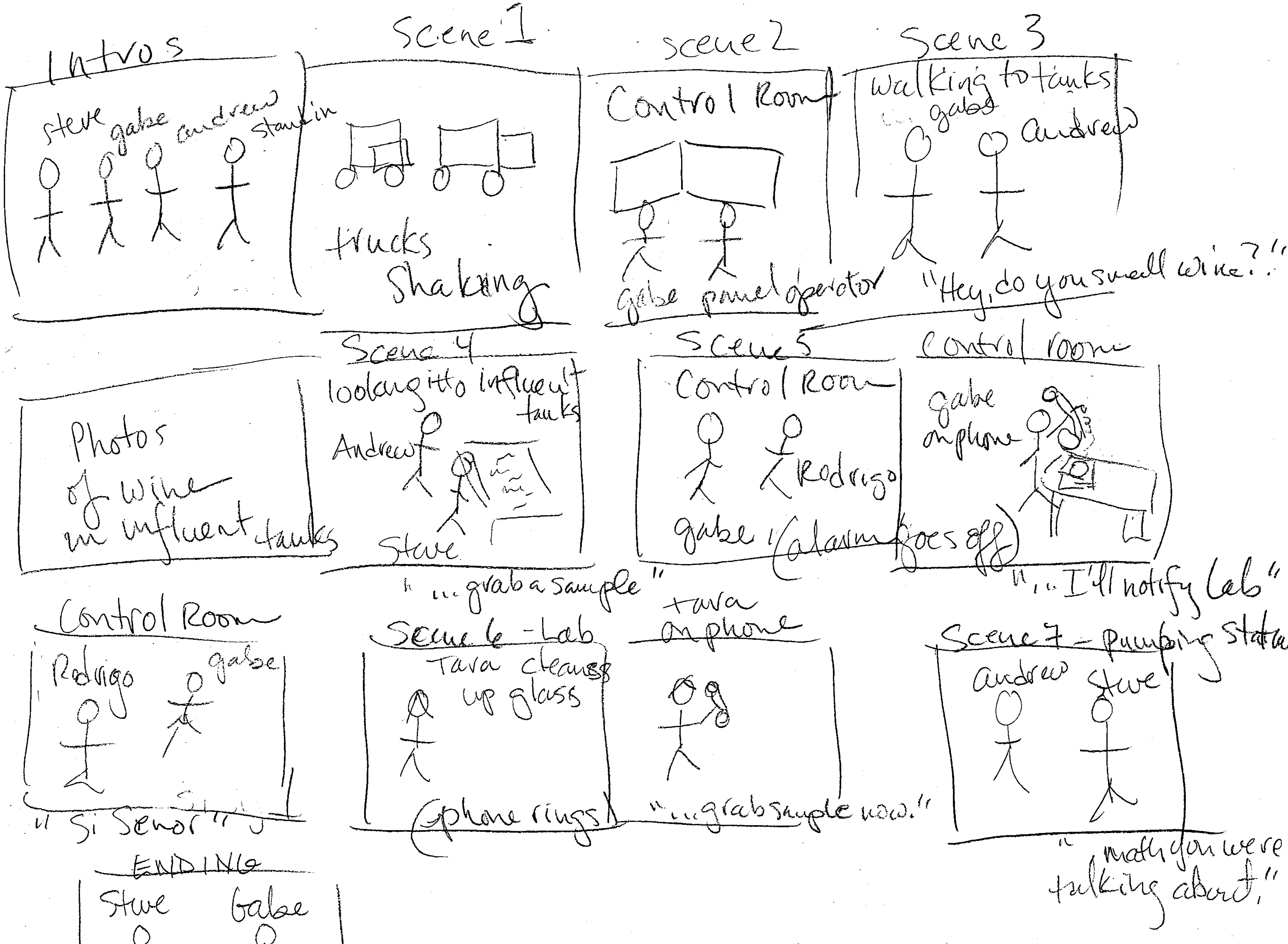
STORYBOARD



Napa San - Earthquake 2014