This presentation premiered at WaterSmart Innovations

watersmartinnovations.com

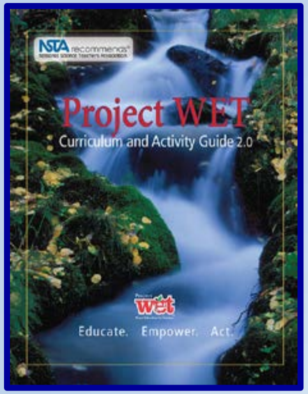
Teachers Work with Professionals to Understand Tucson's Water Distribution System:

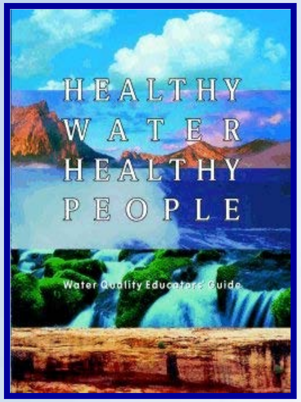
The Tucson STEM Academy

Water Smart Innovations Conference
Las Vegas, NV
October 9, 2014

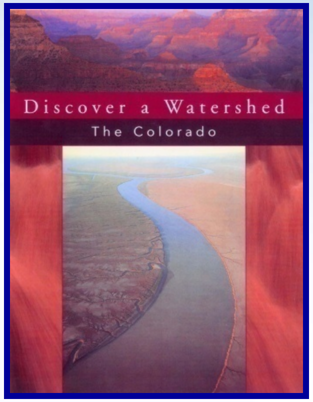
ARIZONA WET Water Education
TUCSON WATER
Teacher Academies
WRRC WATER RESOURCES RESEARCH CENTER
THE UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE & LIFE SCIENCES
COOPERATIVE EXTENSION

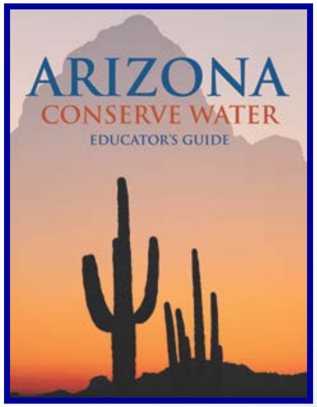
Curriculum & Lesson Guides: Content & Method





- Developed in group writing events with teachers and specialists working together
- Use research-based pedagogy
- Address multiple intelligences and learning styles
- Develop critical thinking and problem solving skills





Tucson STEM Academy

- Water Professionals
- Site Visits
- Resources

- Education Experts
- Applied Lessons
- Curriculum Guides

Teacher Academies

ARIZONA wet Water Education

Offer multiday professional development that evolves teachers' instructional practice and water-related content mastery through STEM integration, interdisciplinary standards inclusion, project based learning, real-world and relevant application, and collaborative work with teachers.

94% agree or strongly agree that the information, strategies, and instructional methods presented during the academy were helpful.

Teacher Academies

arizonawet.arizona.edu/programs/teacher_academies

Tucson STEM Academy

Teachers explore Tucson Water's Reliability Mission:

1. **Water Supply**
2. **Operations & Systems**
3. **Water Quality**
4. **Water Conservation & Efficiency**

water.tucsonaz.gov/water/conservation

Working STEM Definition

STEM education is an interdisciplinary approach to learning which removes the traditional barriers separating the four disciplines of science, technology, engineering and mathematics, and integrates them into <u>real world</u>, <u>rigorous</u> and <u>relevant</u> learning experiences for students.

from Helios Foundation

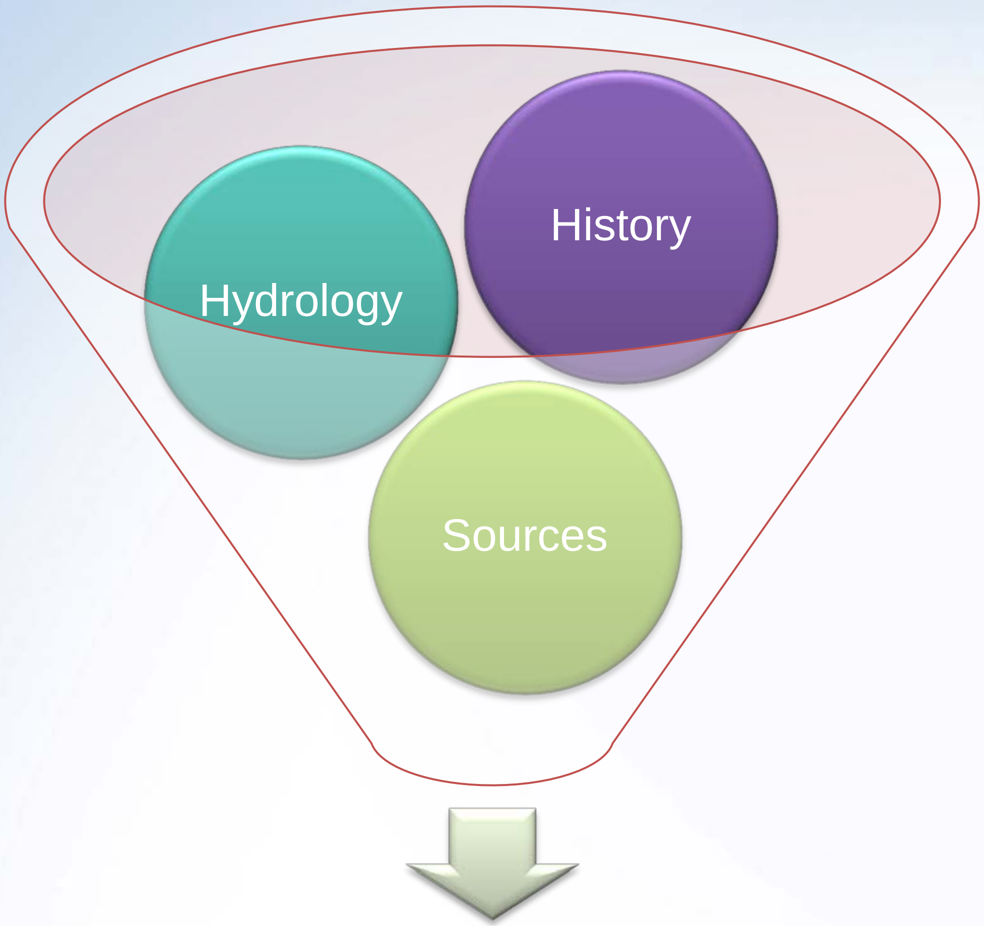
Workshop Objectives
Critical Thinking – Problem Solving

- *Integrate real-world content into instruction*
- *Explore STEM careers*
- *Use APW lessons to bring local relevancy in to the classroom*
- *Engage in engineering projects/lessons in relation to water topics*
- *Implement water conservation projects that save water*
- *Utilize a wide variety of Technology Tools*

STEM Academy Overview

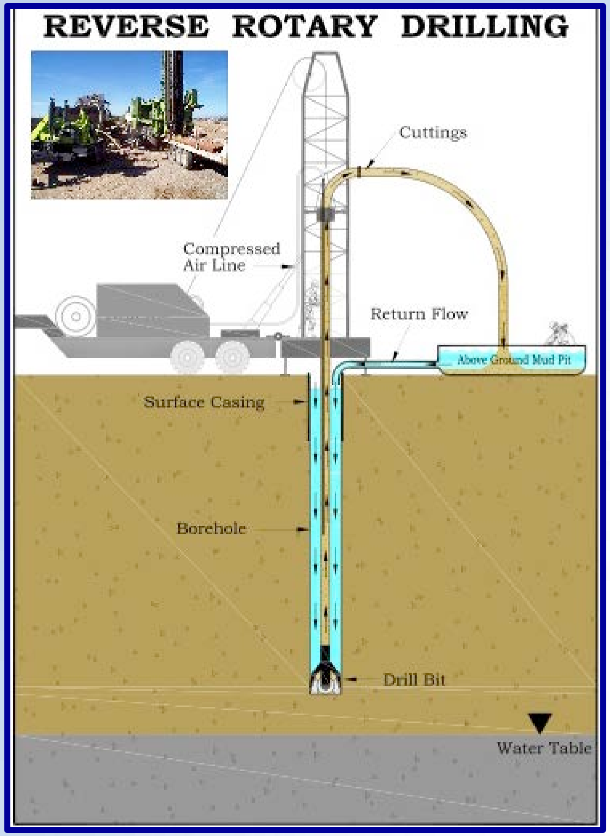
1. Water Supply
2. Operations & Systems
3. Water Quality
4. Water Conservation & Efficiency

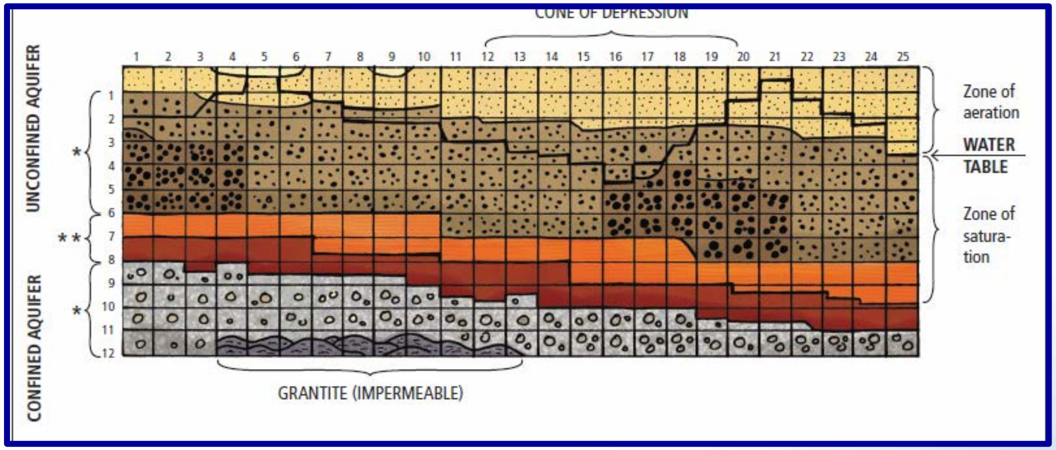
1 Water supply



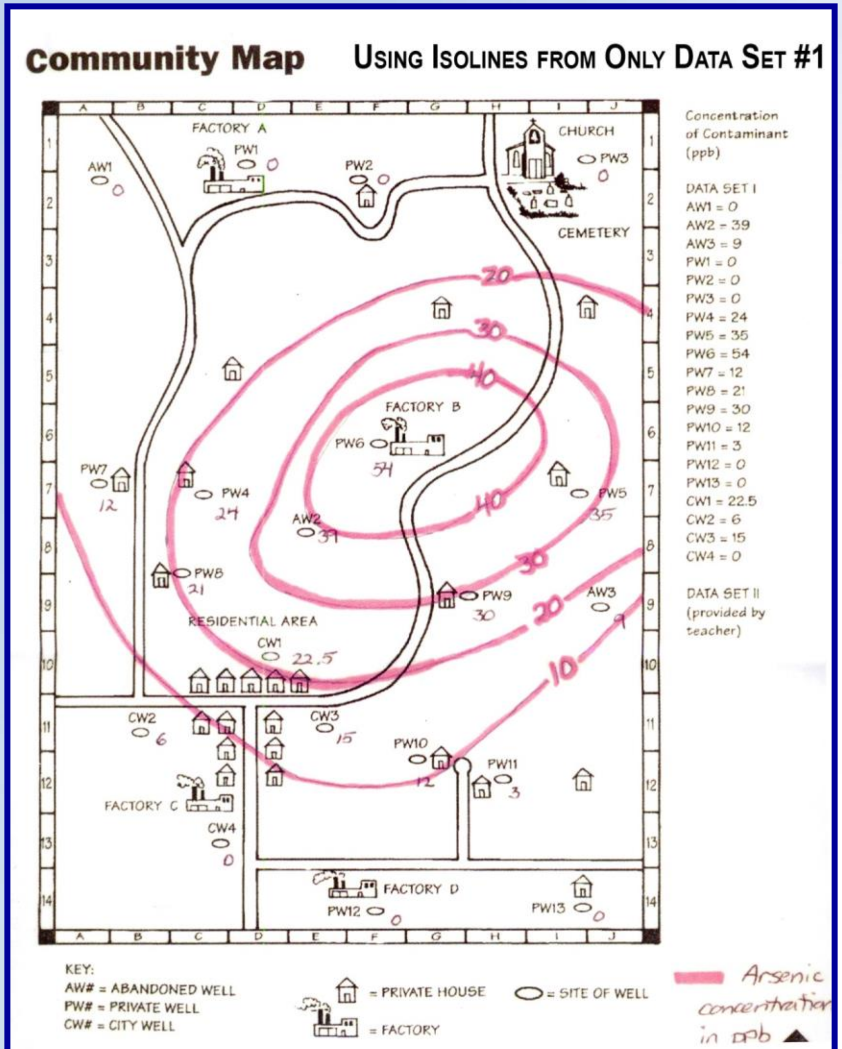
Future

Hydrology - Groundwater

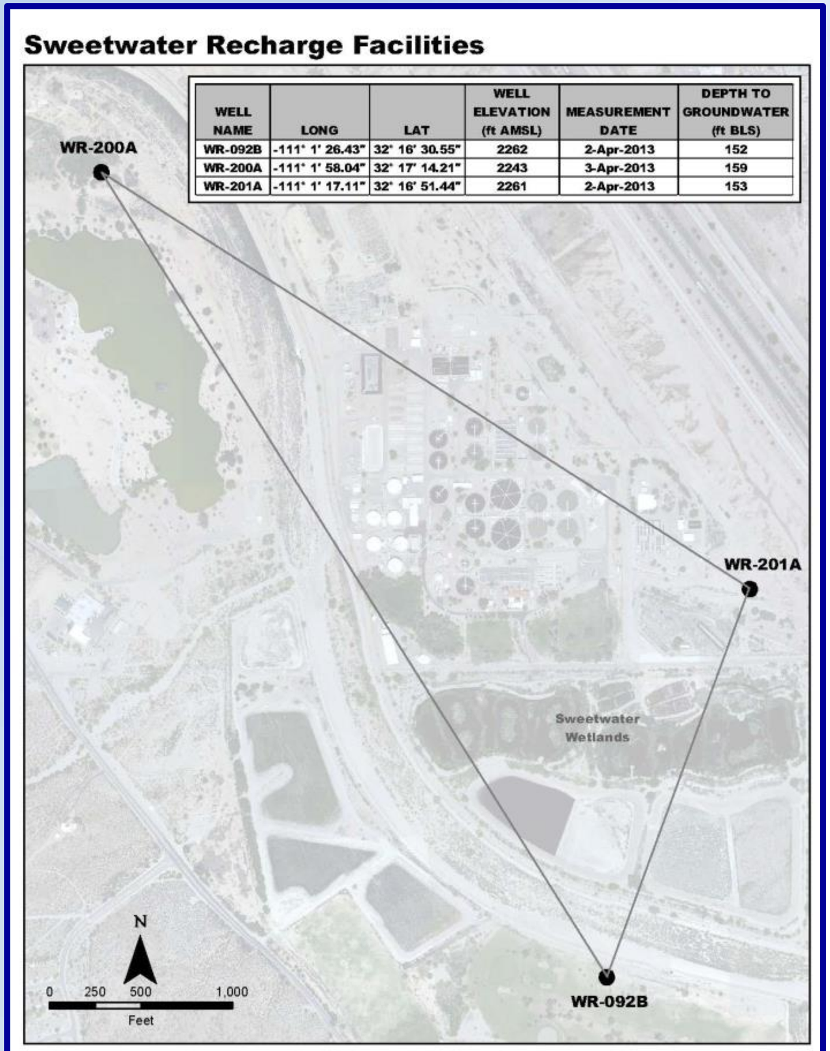


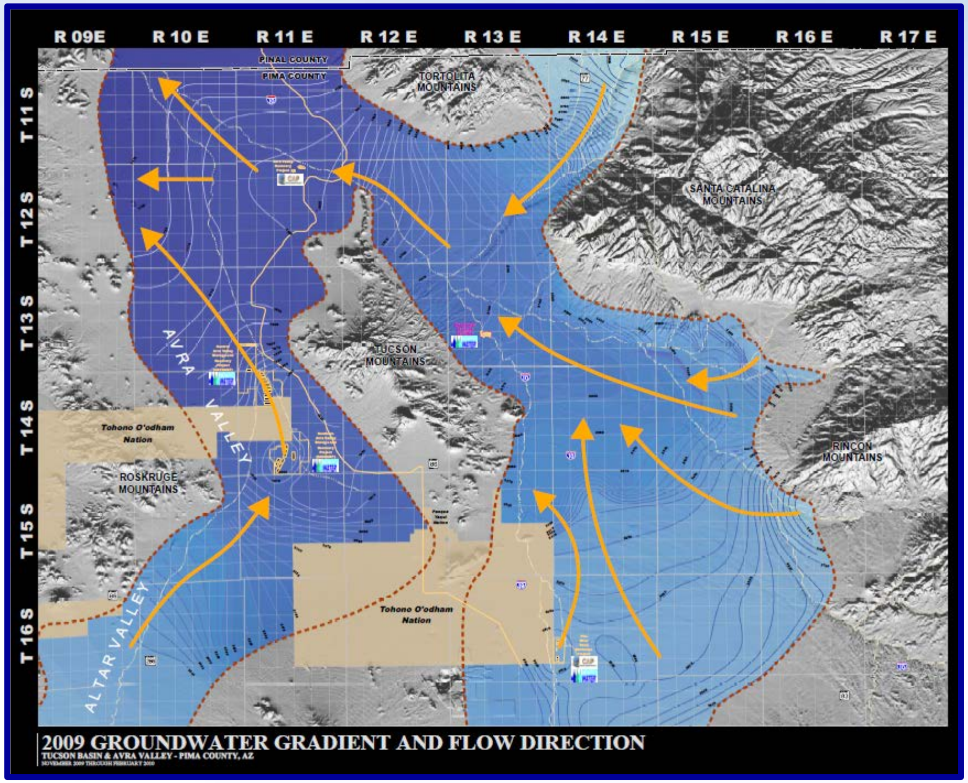


Hydrology – Groundwater Movement



Hydrology – Groundwater Movement

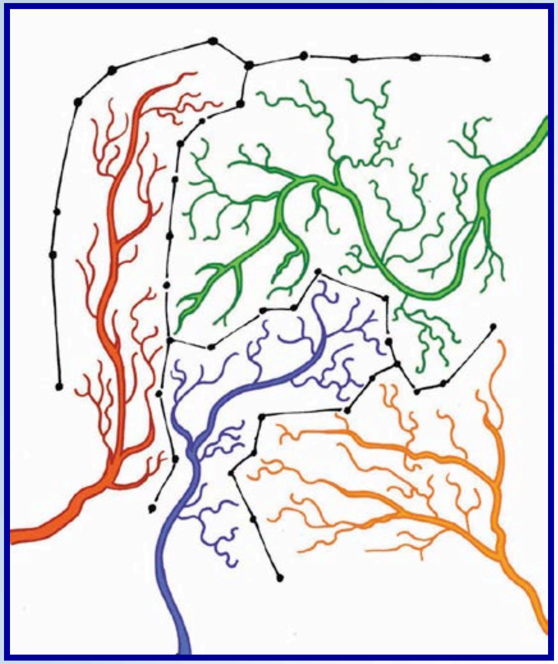




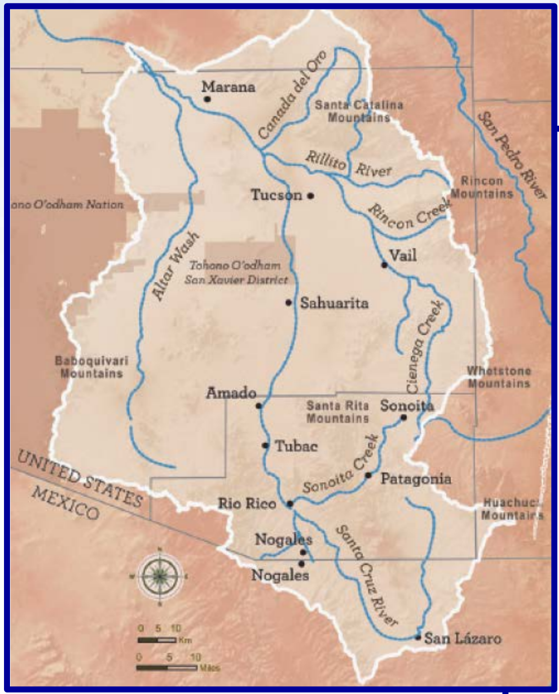
Well Name	Latitude	Longitude	Well Elevation (Ft AMSL)	Depth to Groundwater (ft. BLS)	Water Table Elevation (Ft AMSL)
WR-092B	32° 16' 30.46"	-111° 1' 26.14"	2262	152	
WR-200A	32° 17' 14.21"	-111° 1' 58.04"	2243	159	
WR-201A	32° 16' 51.44	-111° 1' 17.11	2261	153	

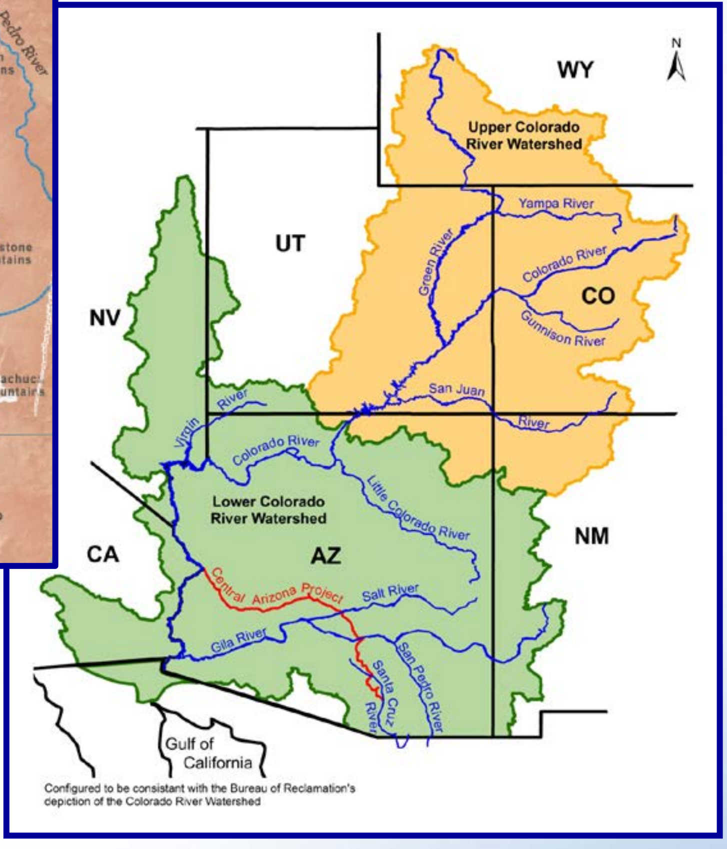
Hydrology - Watersheds

Conceptual understanding with Project WET lesson

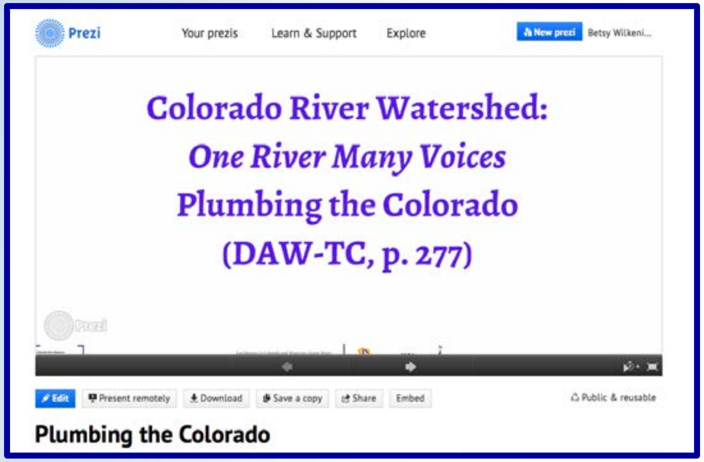


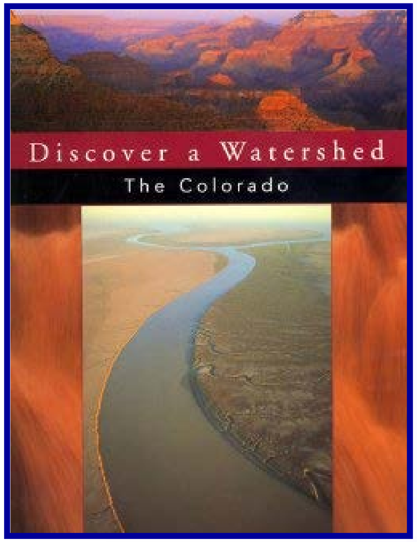
Expands into understanding Tucson's watersheds





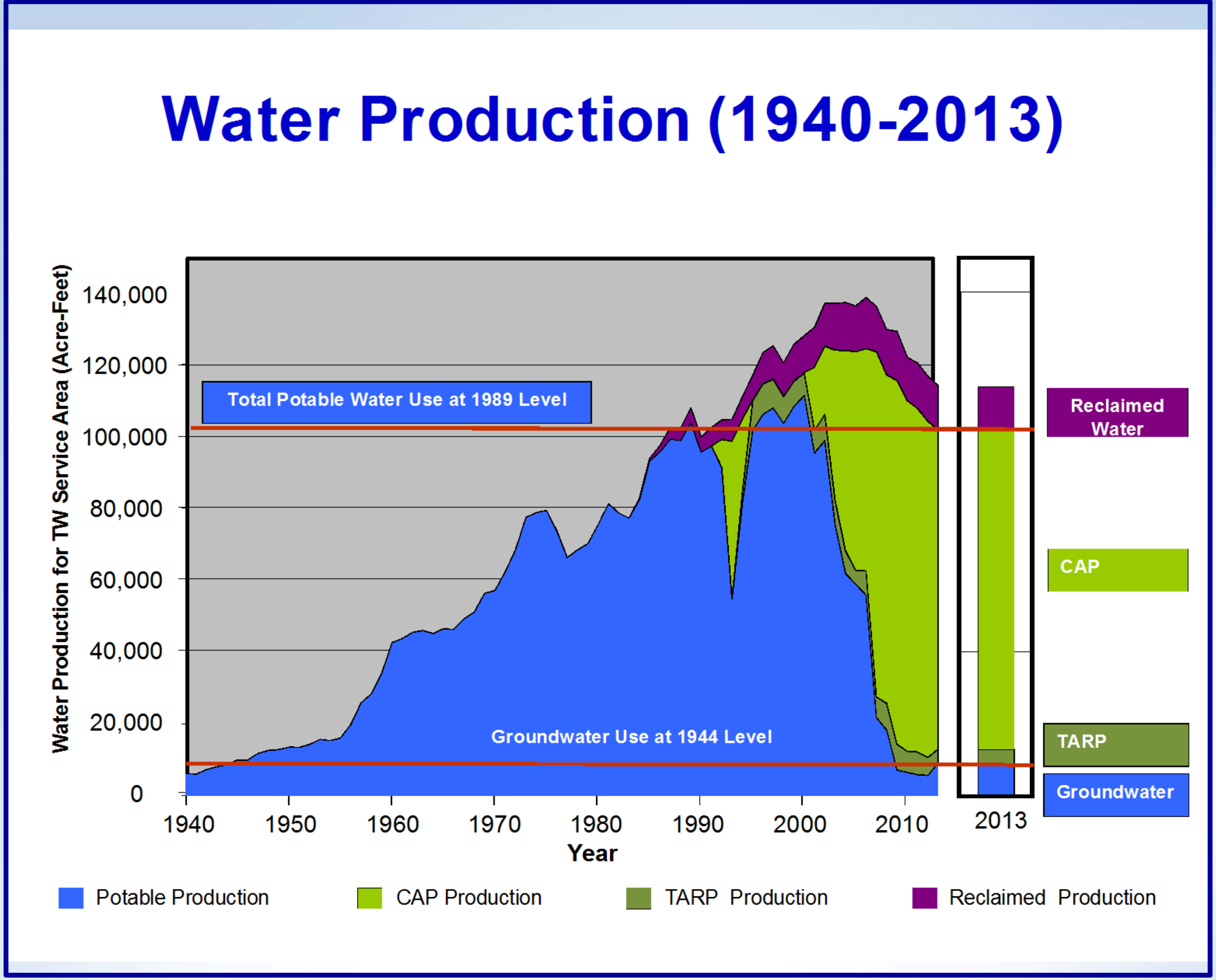
Colorado River Watershed





Central Avra Valley Storage and Recovery Project

Water Sources



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Operations & systems

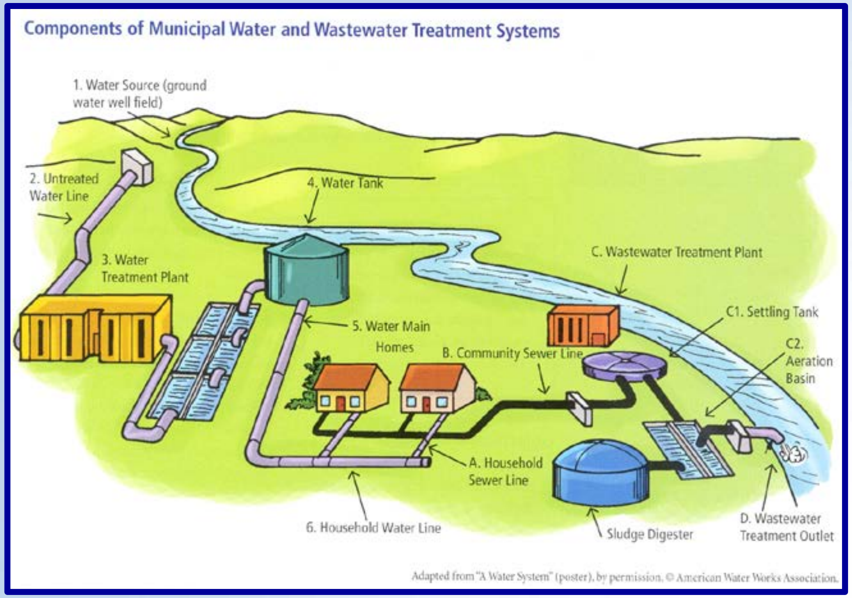
SCADA Control Center

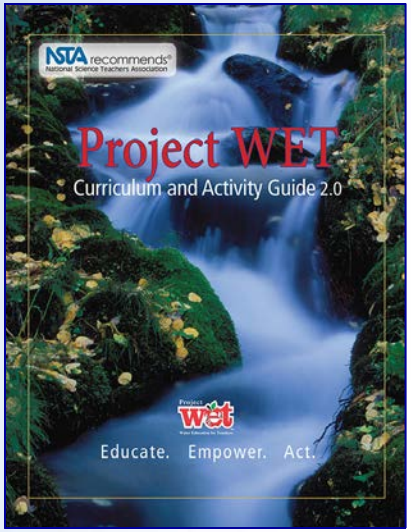
Engineering

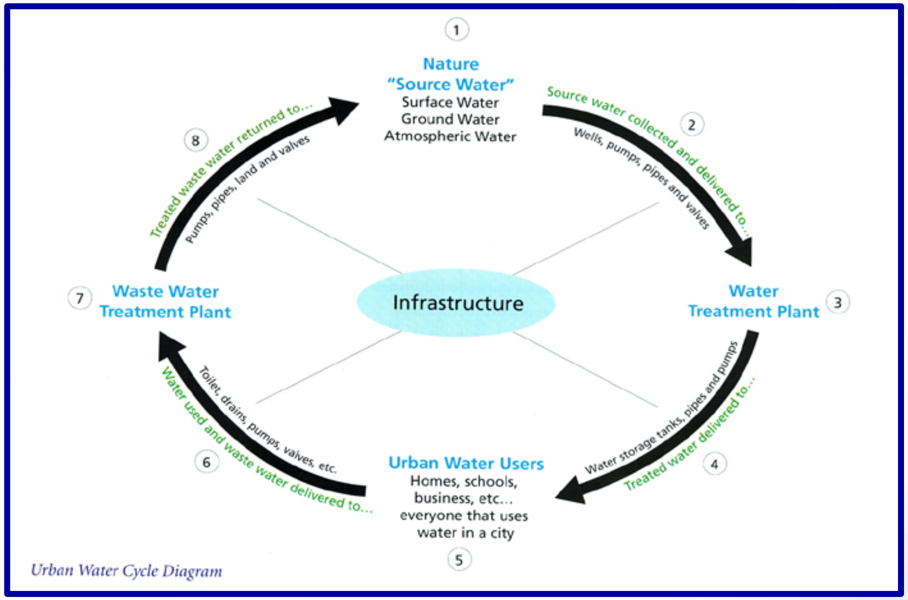
Water Distribution System

STEM Careers

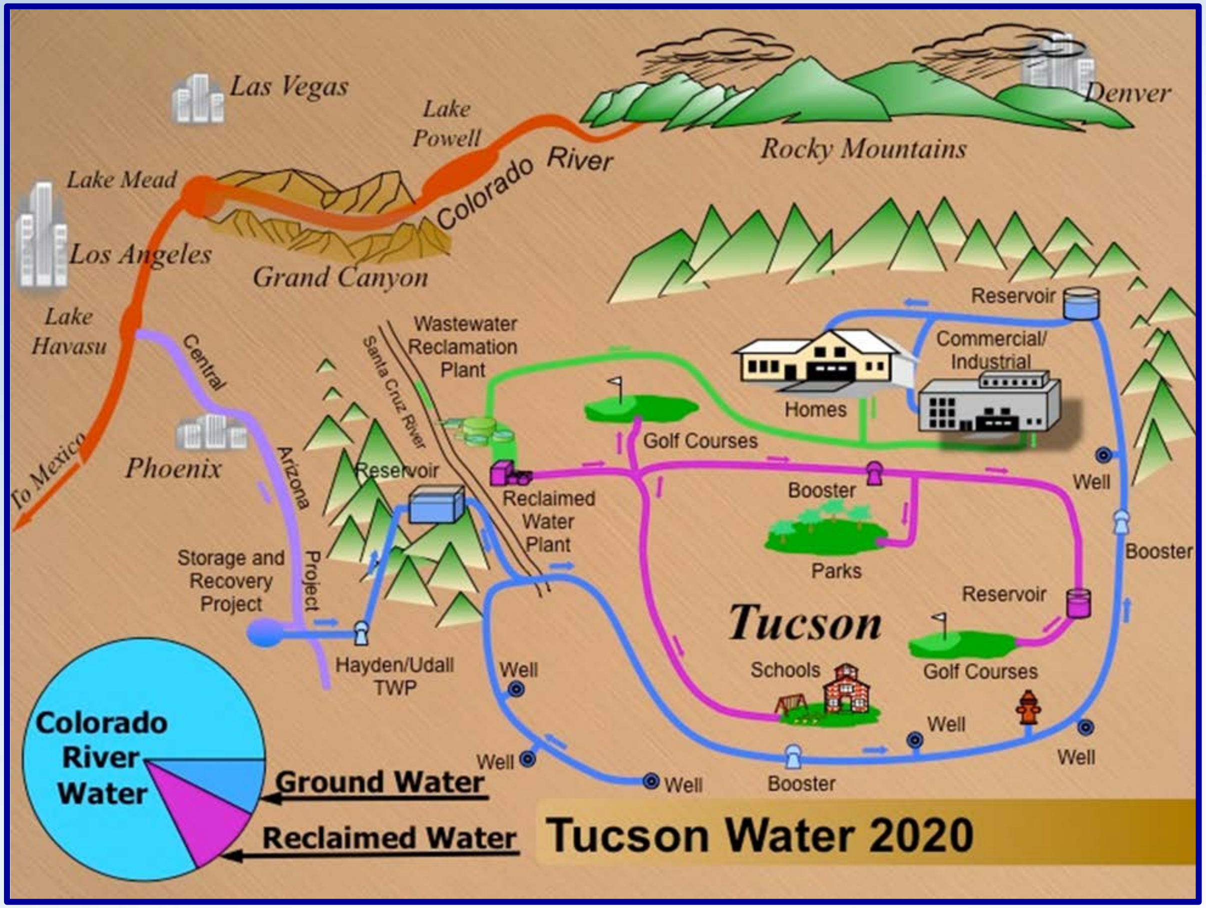
Urban Water Cycle







Tucson's Urban Water Cycle



Lessons

Operating Recharge Basins

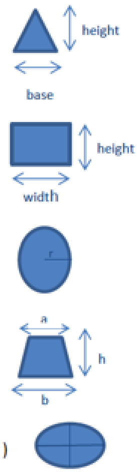
Focus Question:

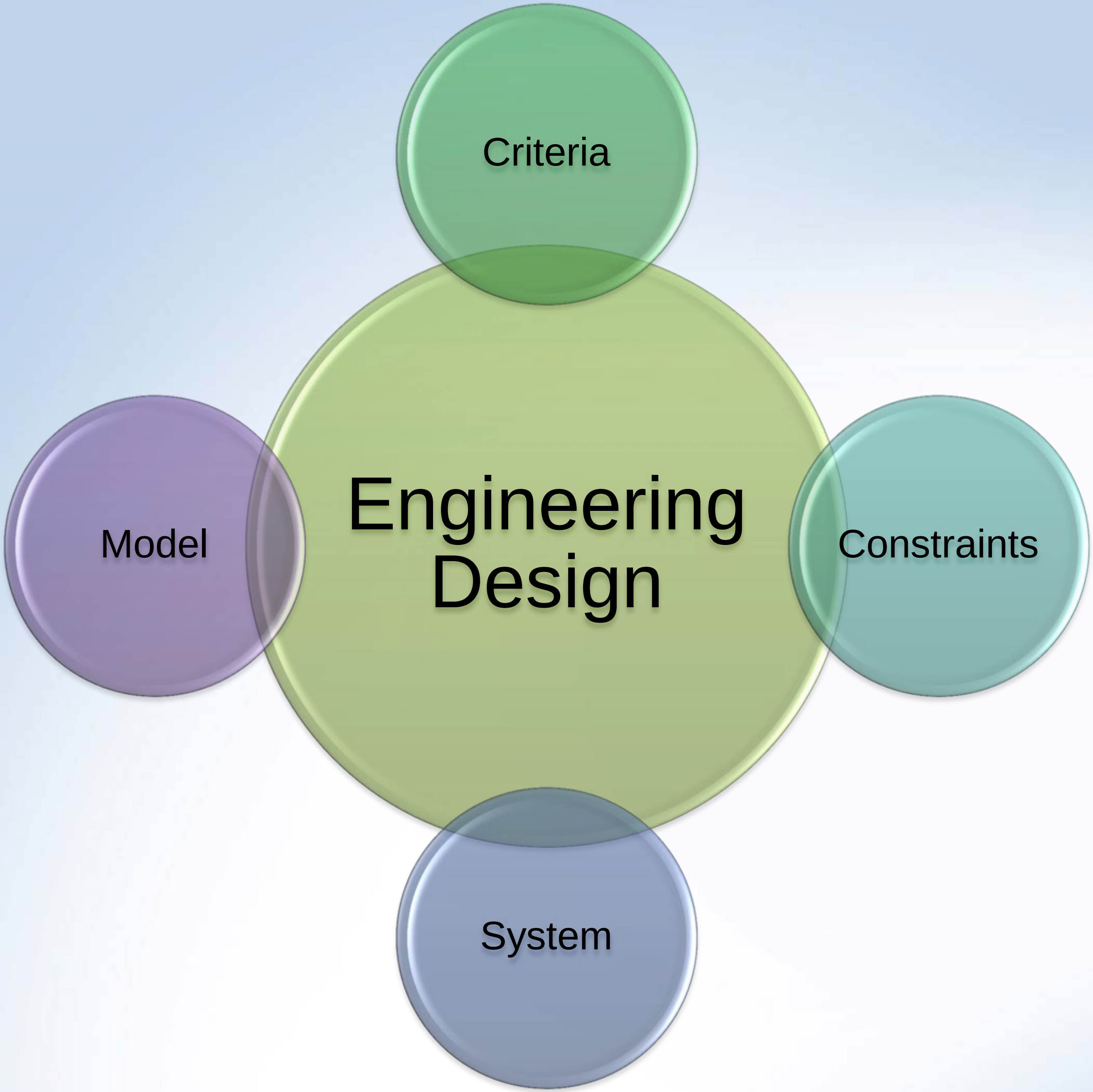
How do water managers calculate the amount of reclaimed water being intentionally recharged through a basin?

Recharge Basin	Area (ft^2)	Depth (ft)	Volume (ft^3) Area x Depth	Volume x 7.48 (gal)	Volume Recharged (gal) Volume x 0.98
Total	*Total Volume of water recharged through all basins for each filling event.*				

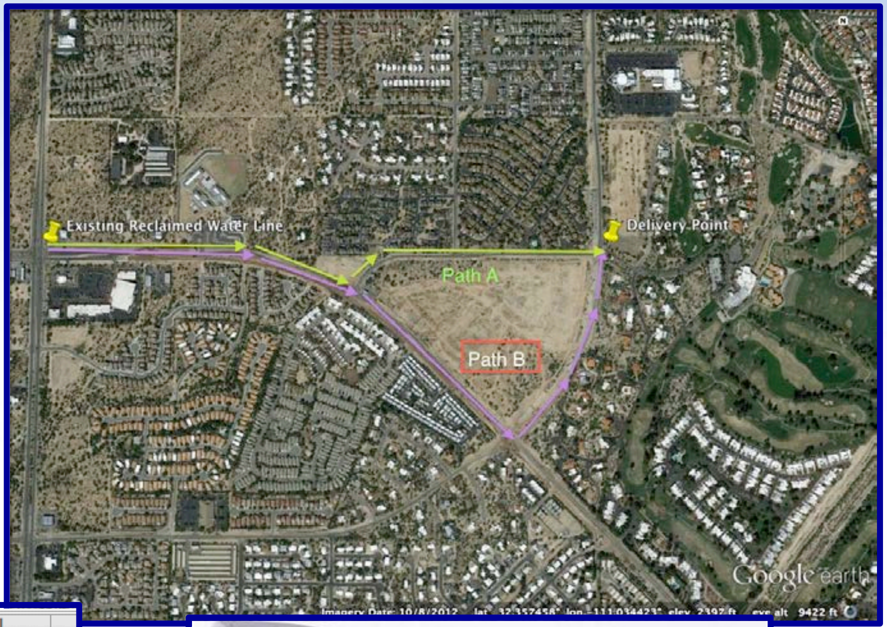
Areas

Triangle	$\frac{1}{2} \times b \times h$	(h=vertical height)
Rectangle	$w \times h$	(w=width)
Circle	πr^2	(r=radius)
Trapezoid	$\frac{1}{2}(a+b) \times h$	(h=vertical height)
Ellipse	πab	(π x ½ width x ½ length)



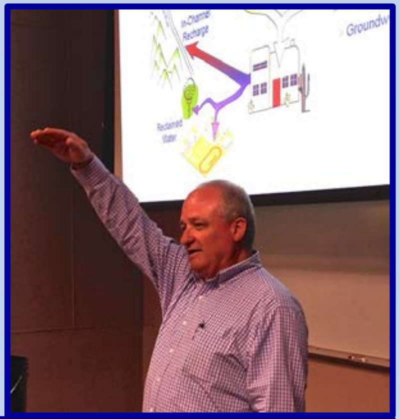

Criteria
Model
Engineering Design
Constraints
System

Engineering Design Challenge



	A	B	C	D	E	F	G	H	I
1	Calculating Pressure Loss - Equivalent Pipe Length Method								
2									
3	**Project:**		Tucson STEM Academy		**Note!**				
4	**Date:**		6/17/13		**Adapt to the flow and pressure loss units to the data available for your system**				
5	**Piping Material:**		Steel Schedule 40		Equivalent Length of Component				
6					Pressure Loss				
7	**Imperial Units**								
8	**Section**	**Pipe Size (inches)**	**Flow (gal/min)**	**Pressure Loss (ft/100ft)**	**System Components**	**Equivalent Length of Component (ft)**	**Number of Components**	**Equivalent Length (ft)**	**Total Pressure Loss (ftH2O)**
9	Path A	10			90 deg Elbows	18.0	2.0	36.0	
10									
11					45 deg Elbows	9.0	8.0	72.0	
12									
13					Gate Valves	3.2	5.0	16.0	
14									
15					Globe Valve	310.0	2.0	620.0	
16									
17					Straight Pipe	1.0		0.0	
18									
19		10	750.0	0.26				744.0	1.9
20					Elevation Delivery Point (ft)=				
21					Elevation Starting Point (ft)=				
22					Total Elevation Change (ft)=		0.0		
23						**Total Pressure Loss Path A**			1.9
24									

STEM Careers





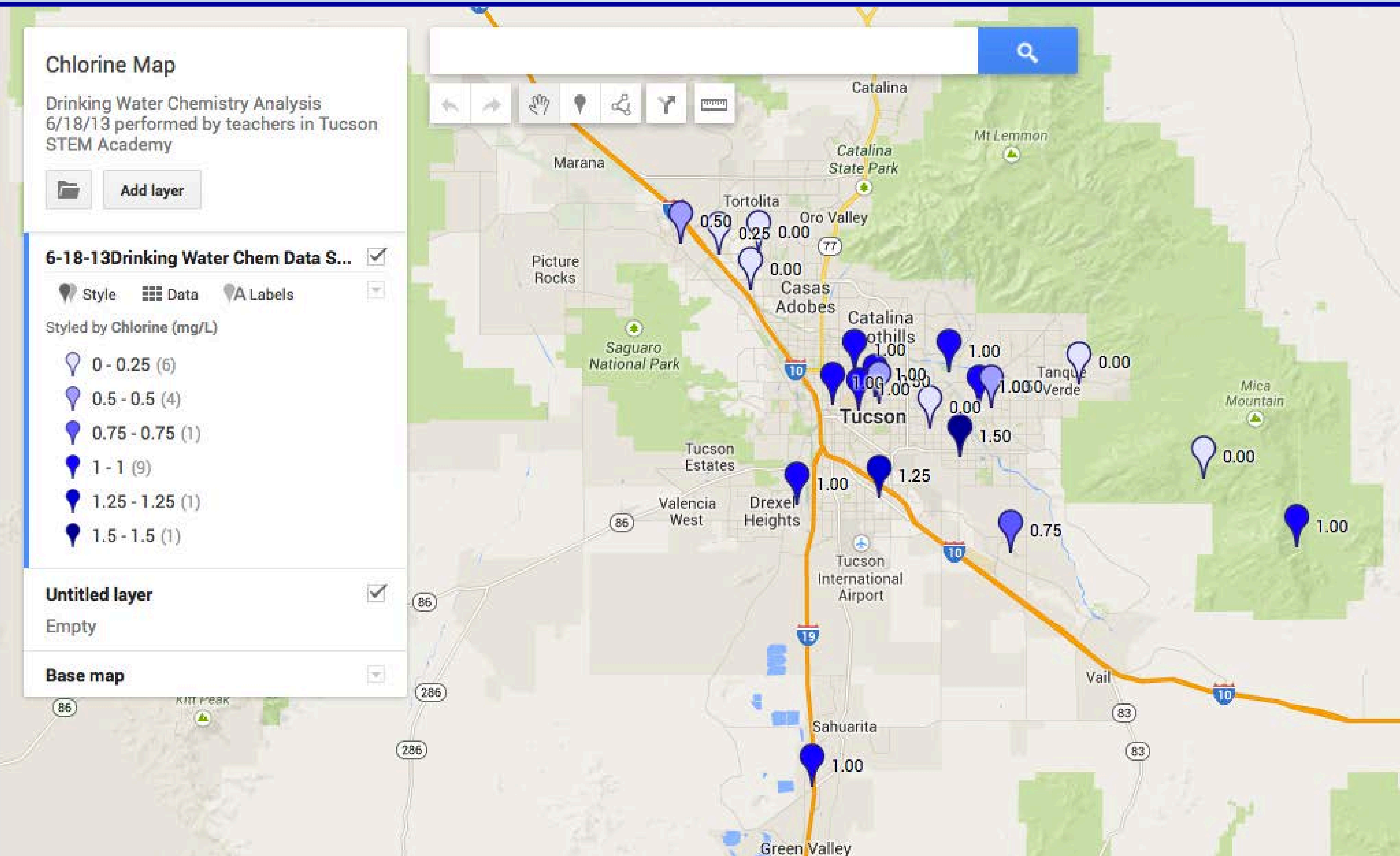




3

Water quality

Data Analysis with Google Maps Engine Lite



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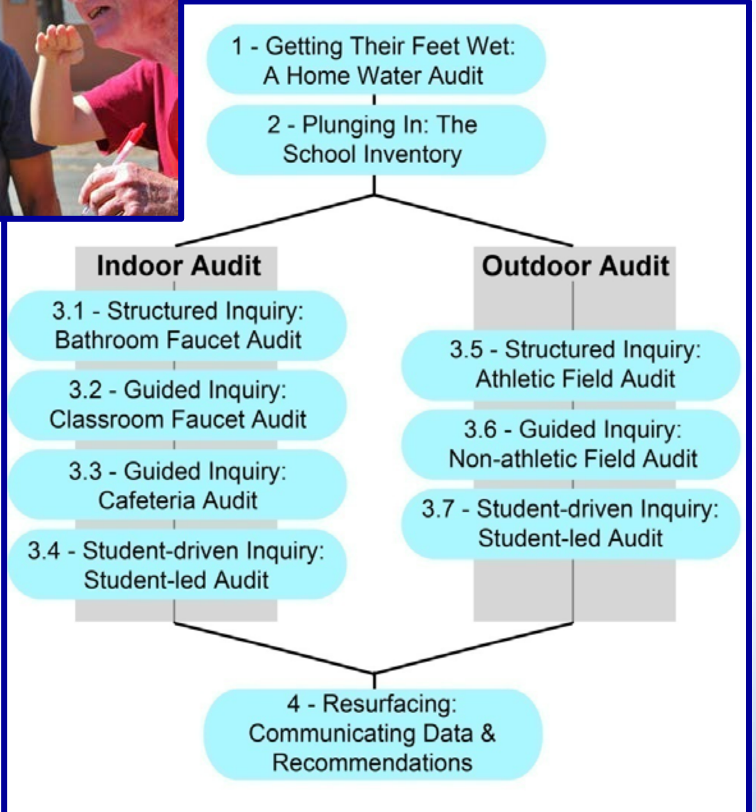
Water efficiency



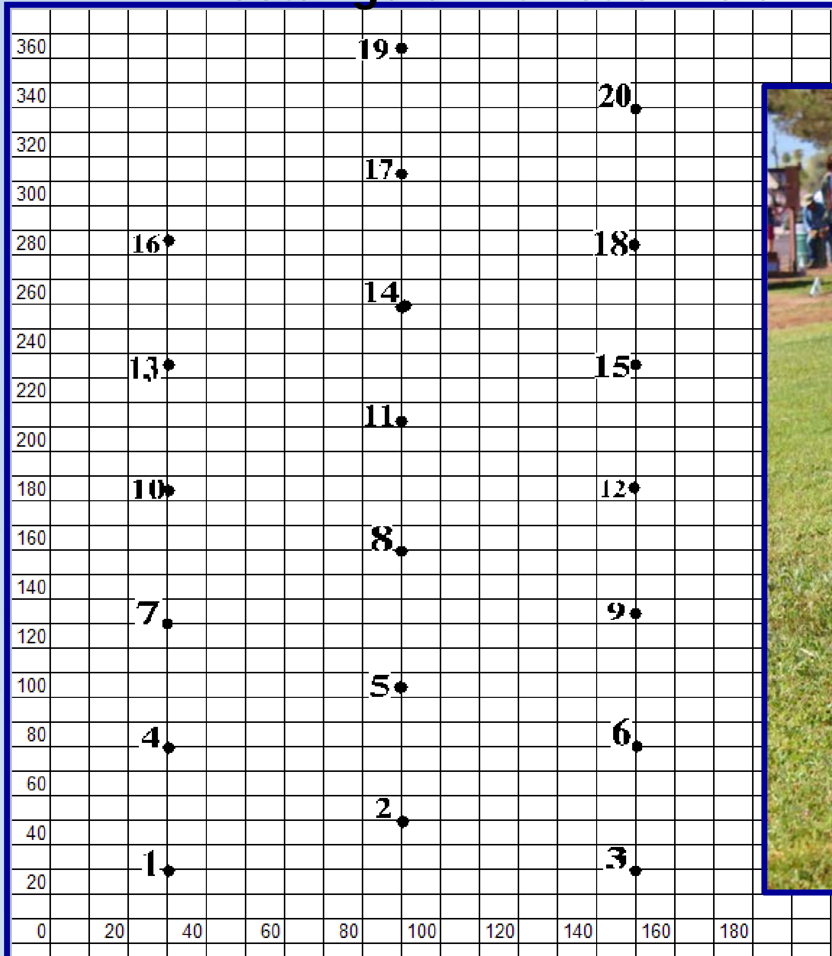
SWAP

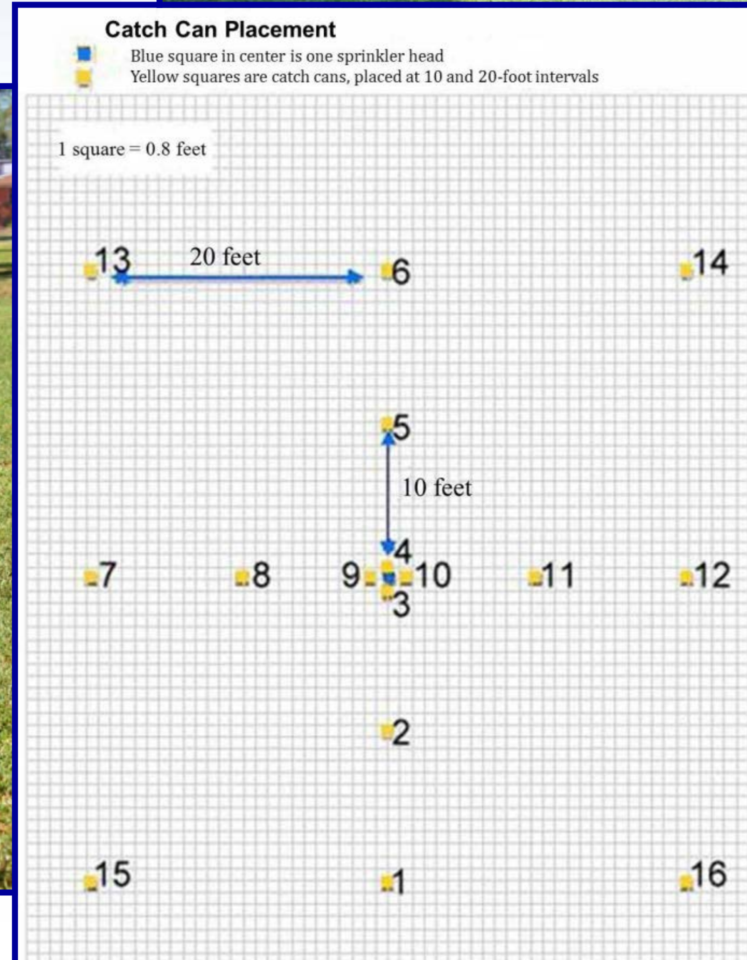
School Water Audit Program


NEWS
9:47 64°
3

Distribution Uniformity

Sprinkler Locations on a Rectangular Athletic Field





Indoor Audit

The School Water Audit -

Teacher Name: ______________________ Student Name: _________________________ Class Period: ___ Group #: ___ Date:__________

Appendix 3.1.D: Measure Bathroom Faucet Flow Rate Data Sheet

Inquiry Question	How much water is used by students and teachers washing their hands at bathroom faucets each year?
Location	Location 1: ___________________________________ Location 2: ___________________________________

A	B	C				D				E				F
Faucet # ☑ If metered	**☑ if Leak -ing**	**Baseline flow rate (existing condition i.e. with old aerator or no aerator)? (How many ml in 5 seconds?)**				**Flow rate without aerator? (How many ml in 5 seconds?)**				**Flow rate with new aerator? (How many ml in 5 seconds?)**				**Notes and Comments (Leak level / GPY)**
		1	**2**	**3**	**Avg**	**1**	**2**	**3**	**Avg**	**1**	**2**	**3**	**Avg**	
Location 1 ___ ☐	☐													
___ ☐	☐													
___ ☐	☐													
___ ☐	☐													
___ ☐	☐													
Location 2 ___ ☐	☐													
___ ☐	☐													
___ ☐	☐													
___ ☐	☐													
___ ☐	☐													
Total														
Average														

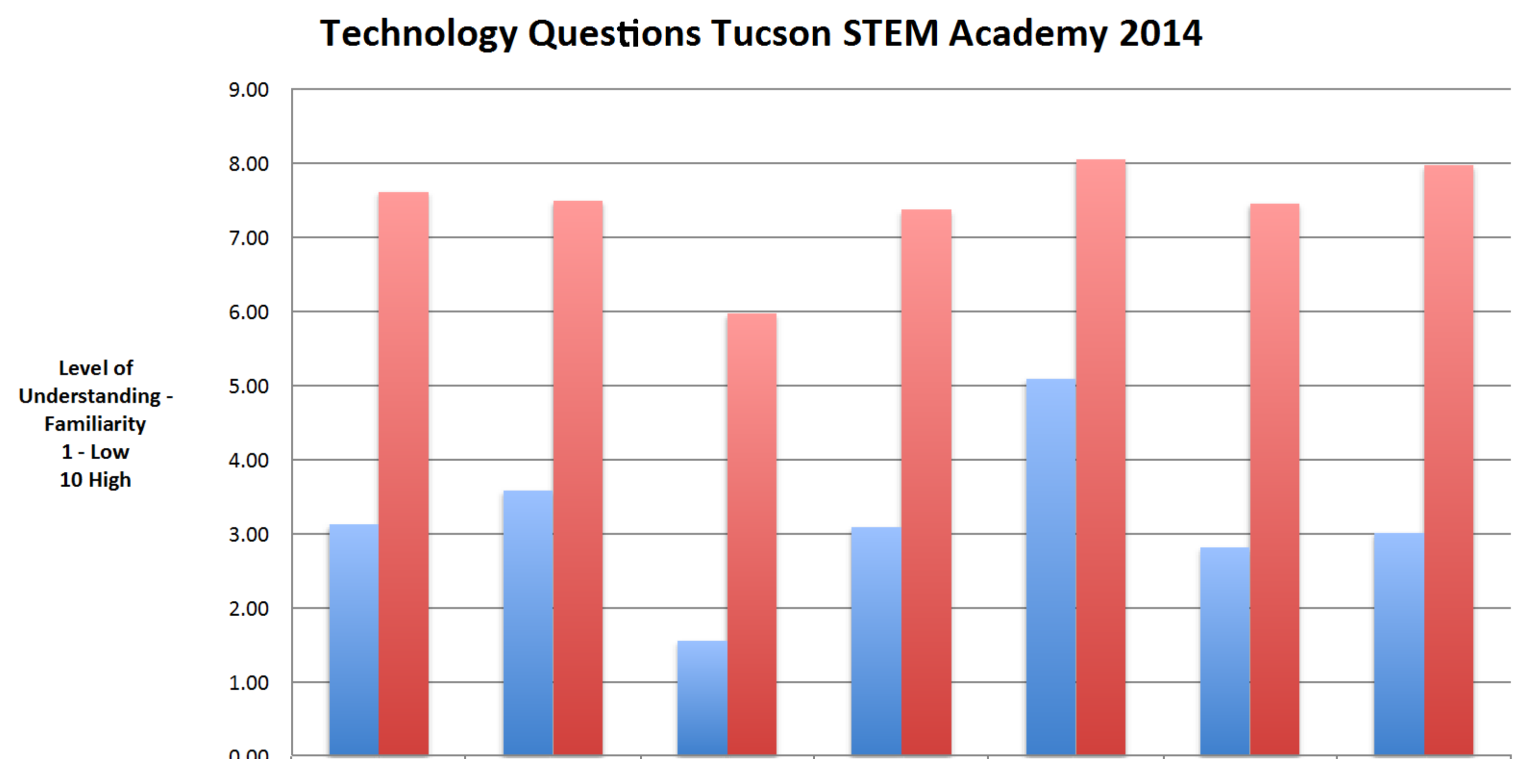
Excelets

- "*Excelets* are interactive Excel spreadsheets or simulations of mathematical models."

F4 =D4*E4

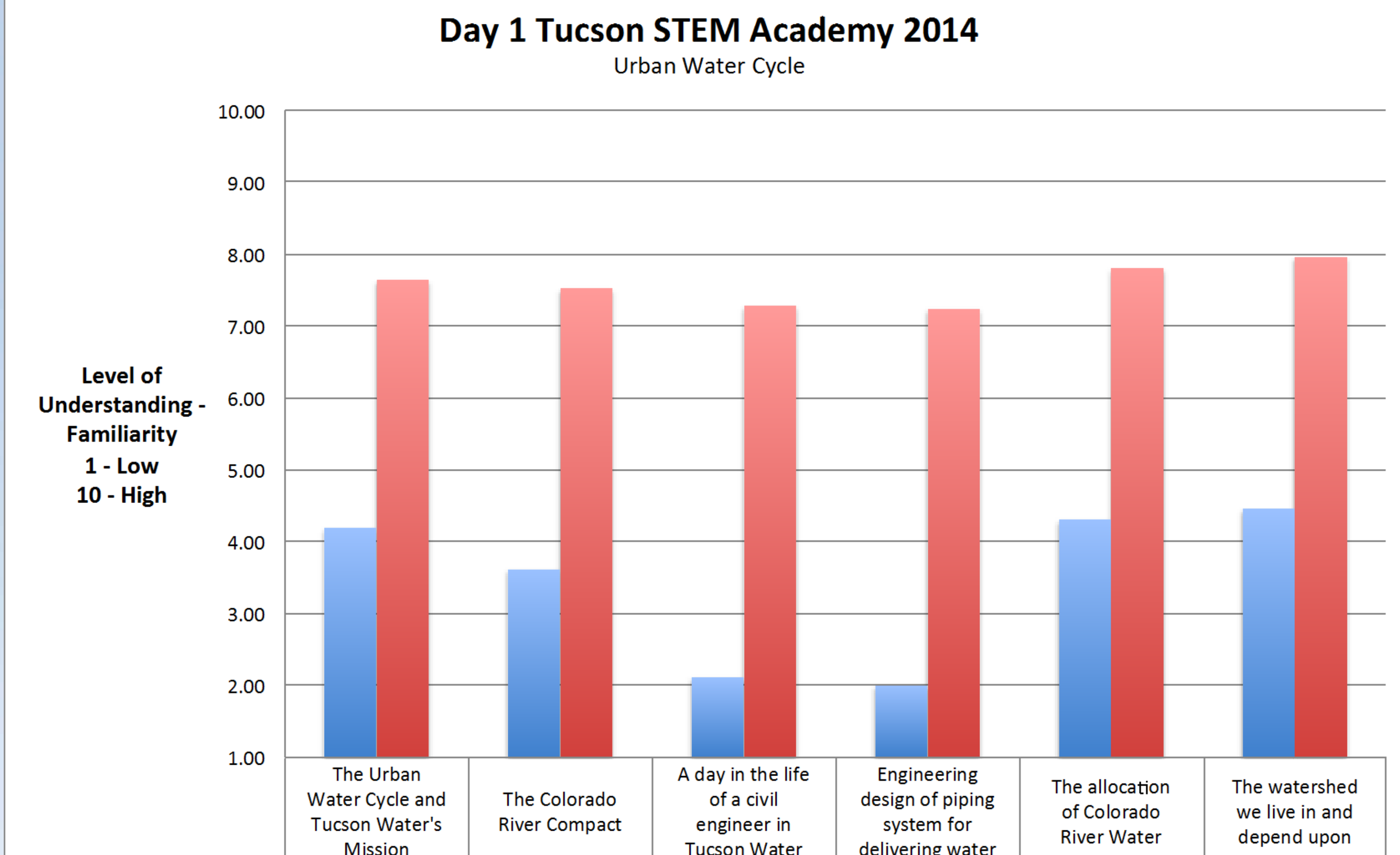
A	B	C	D	E	F
		Brushing Teeth			
Teeth Brushing Time with H2O Running (secs)	Amount of H_2O Used each time (gal)	# of Times Brush Teeth Each day	Amount of H_2O Used each week (gal)	# of People in Family	Amount of H_2O Used each week by Family (gal)
44	2.2	2	30.8	4	123.2
Based upon 3 gal/min flowrate					

Technology



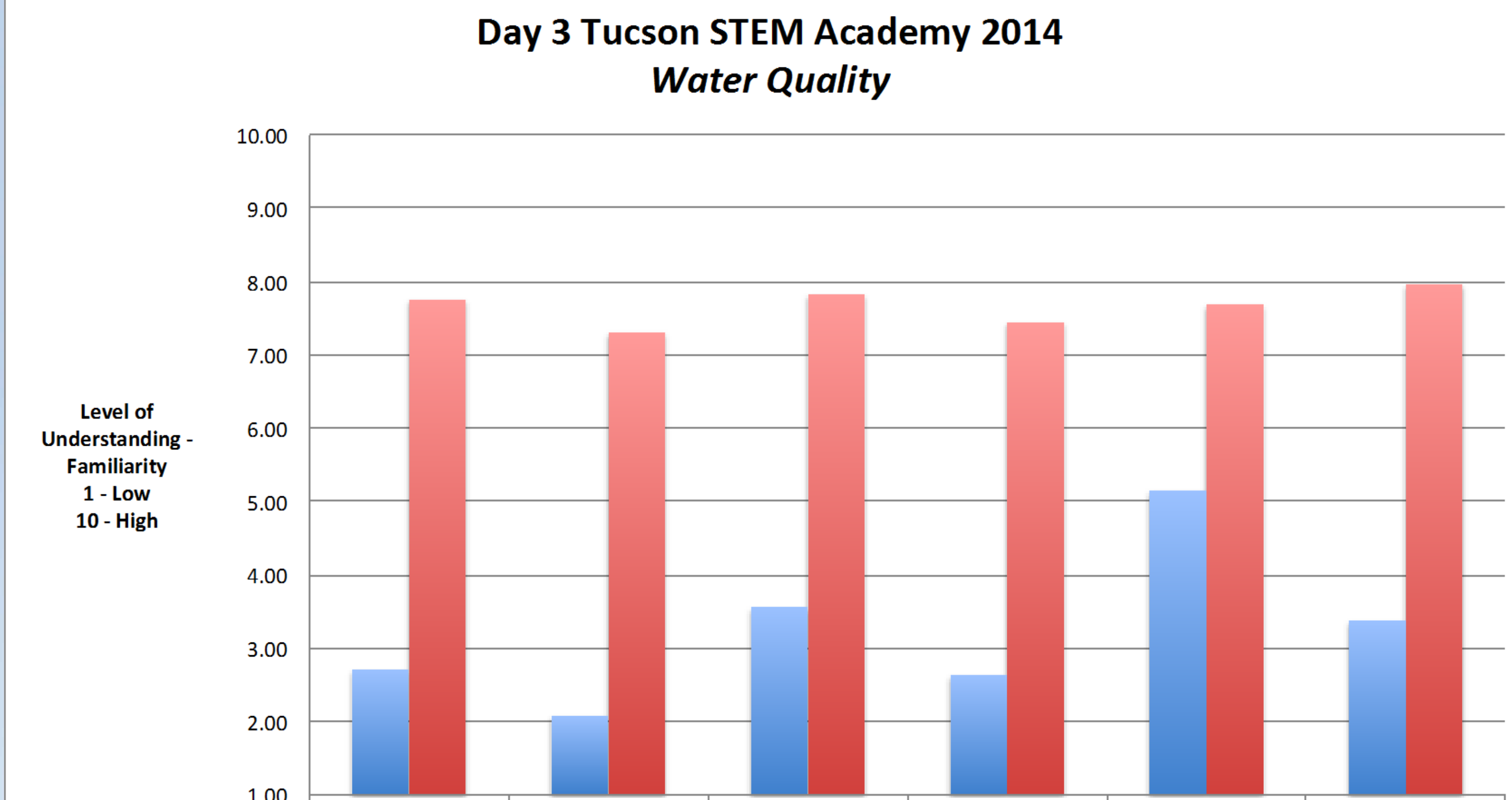
	Incorporating Google Earth into my lessons	Using Excel with my students for data recording and analysis	Creating Excelets for computational modeling	Producing a Prezi presentation incorporating audio and video	Online collaboration in a Professional Learning Community (PLC)	Using Google Drive to create and distribute surveys, and analyze data from surveys	Using Google Maps Engine to visualize data geographically
Pre-Workshop Average	3.12	3.58	1.54	3.08	5.08	2.81	3.00
Post-Workshop Average	7.60	7.48	5.96	7.36	8.04	7.44	7.96

Content Knowledge



	The Urban Water Cycle and Tucson Water's Mission	The Colorado River Compact	A day in the life of a civil engineer in Tucson Water	Engineering design of piping system for delivering water	The allocation of Colorado River Water	The watershed we live in and depend upon
Pre-Workshop Average	4.19	3.62	2.12	2.00	4.31	4.46
Post-Workshop Average	7.64	7.52	7.28	7.24	7.80	7.96

Content Knowledge



	Water quality indicators and monitoring performed by Tucson Water	STEM careers of water professionals that work at Hayden-Udall	Water quality testing and analysis	The interrelationship of some water quality indicators	Presenting scientific data in a concise meaningful manner	Water sampling protocol
Pre-Workshop Average	2.70	2.07	3.56	2.63	5.15	3.37
Post-Workshop Average	7.76	7.31	7.83	7.45	7.69	7.97

Summary

- Teachers' mastery/knowledge of water content increased an average 50.3%
- We have educated 48 teachers in Real World, Rigorous and Relevant learning that translates into quality STEM teaching for the 5,815 students they teach

Tucson STEM Academy

- Water Professionals
- Site Visits
- Resources

STEM

- Education Experts
- Applied Lessons
- Curriculum Guides

Contact Information

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