This presentation premiered at WaterSmart Innovations

watersmartinnovations.com

watersmart
INNOVATIONS

Using Project Based Learning to Promote Water Efficiency on School Grounds

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University of Arizona

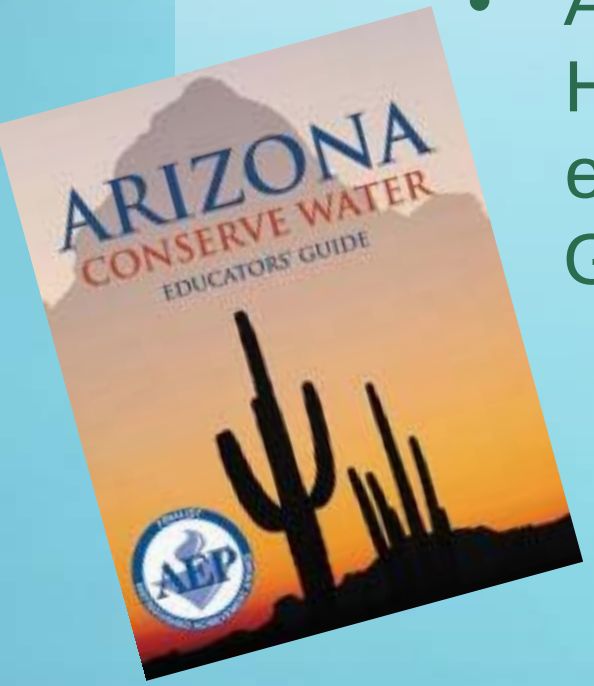
Water Resources Research Center

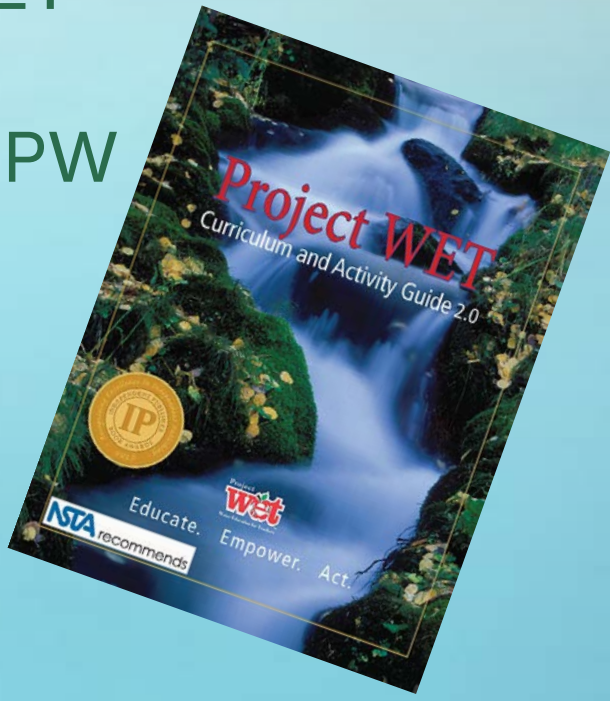
THE UNIVERSITY OF ARIZONA Cooperative Extension

COLLEGE OF AGRICULTURE & LIFE SCIENCES
COOPERATIVE EXTENSION
WATER RESOURCES RESEARCH CENTER

Arizona Project WET - History

- 1989 third state to pilot Project WET lessons
- 1995 Project WET Curriculum & Activity Guide published with assistance from USBR
- APW developed the Arizona Project WET Handbook and began delivering water education programs prior to the 1995 PW Guide





Project WET
Water Education for Teachers

Worldwide Water Education

Educate. Empower. Act. We envision a world in which action-oriented education enables every child to understand and value water, ensuring a sustainable future.

Arizona Project WET Develops Water Stewardship and STEM Learning through:

- Teacher professional development that evolves instructional practices and deepens content knowledge
- Direct student outreach that is embedded in or extends in-classroom instruction
- Community engagement with volunteers

ARIZONA Wet Water Education

Our Primary Water Conservation Programs

SWAP
School Water Audit Program

WSI
Water Scene Investigation

Other Popular Programs

Aqua
STEM Program

Teacher
Academies

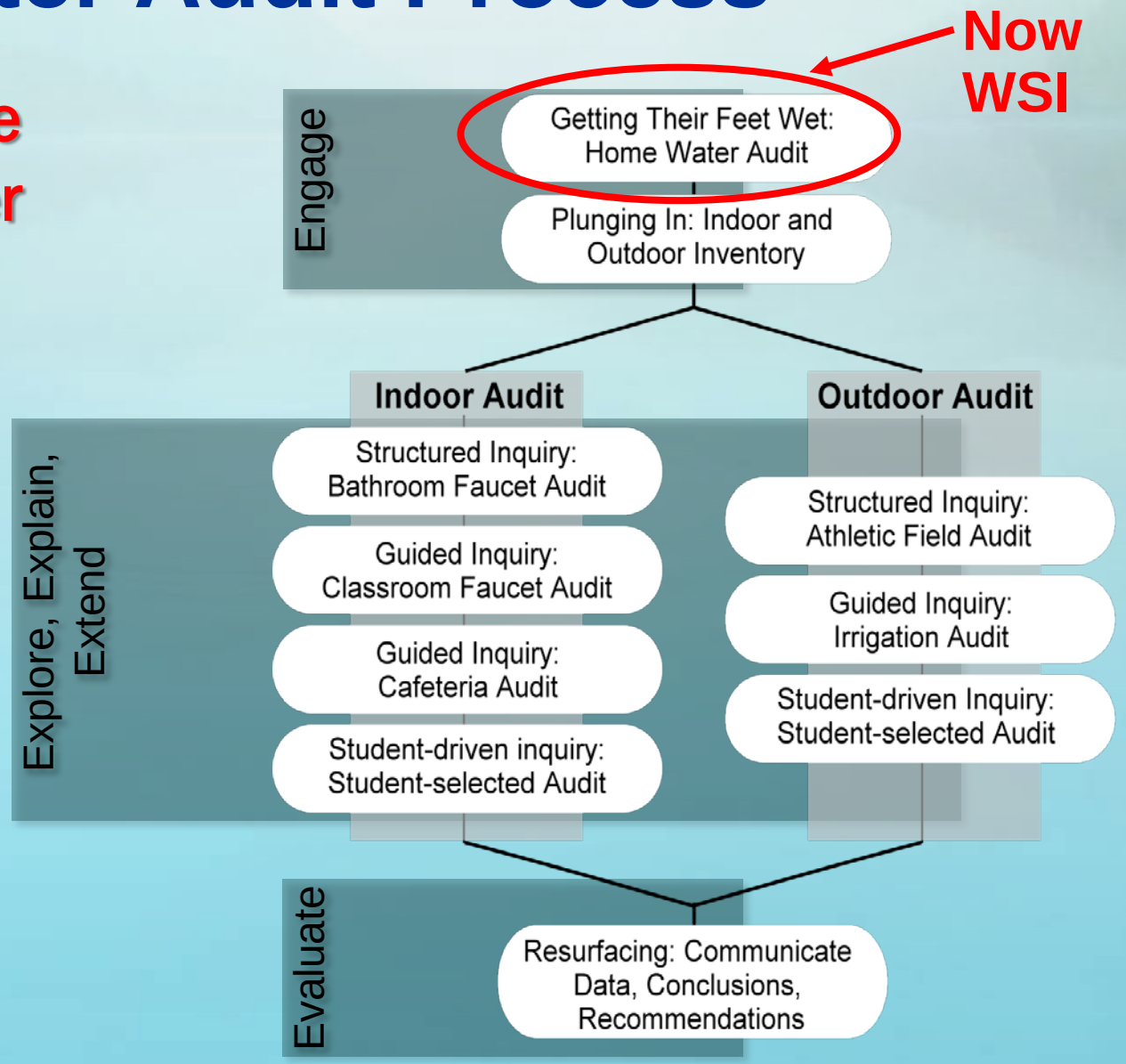
AWF
Arizona Water Festival

School Water Audit Process

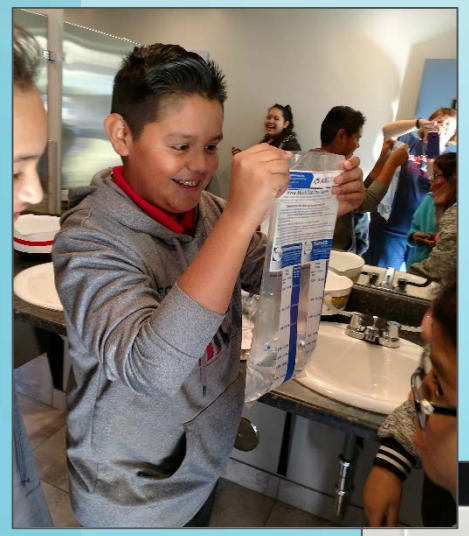
Driving Question: How can we reduce water use or use water more efficiently at schools?

Indoors

Outdoors

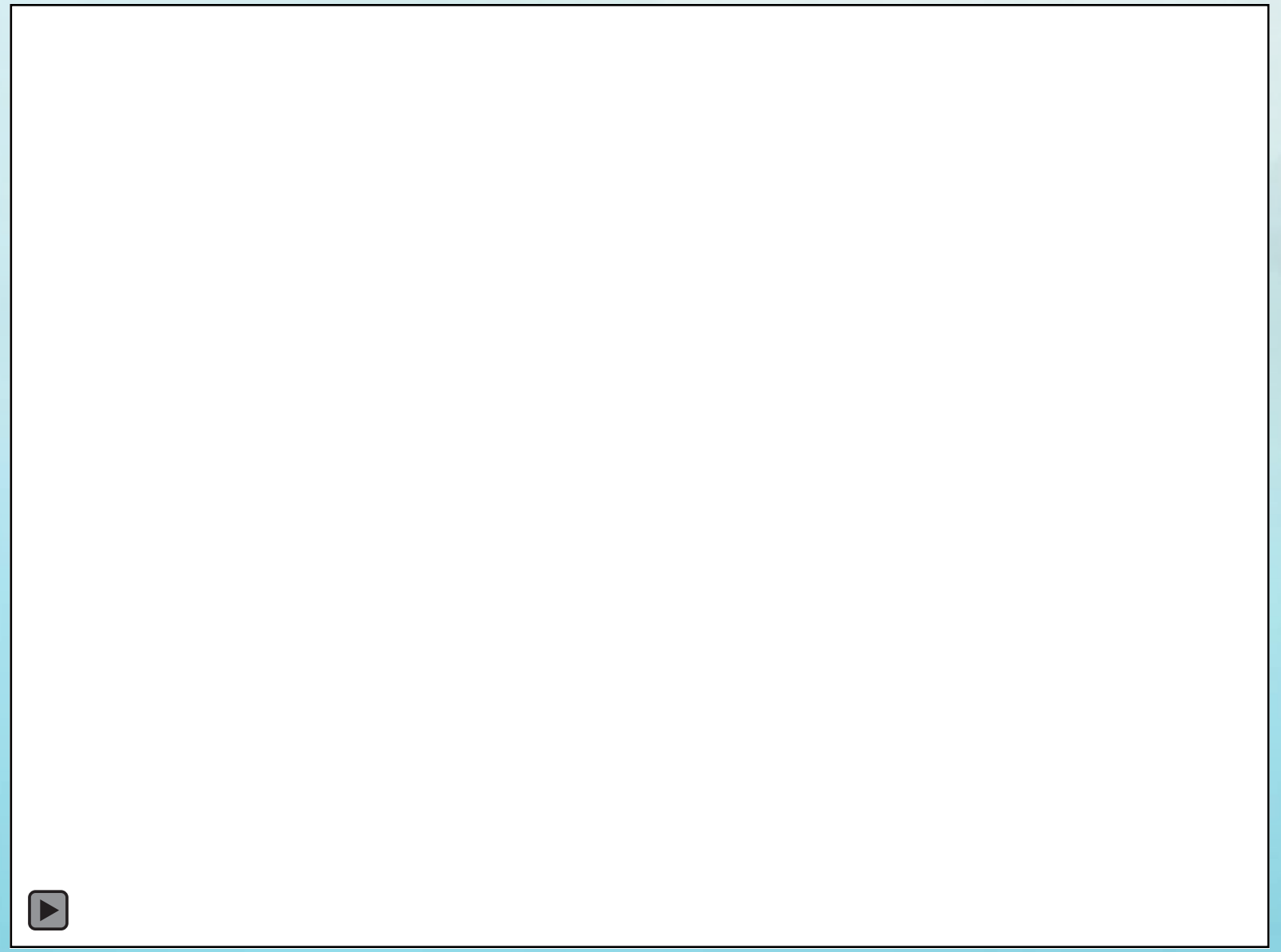


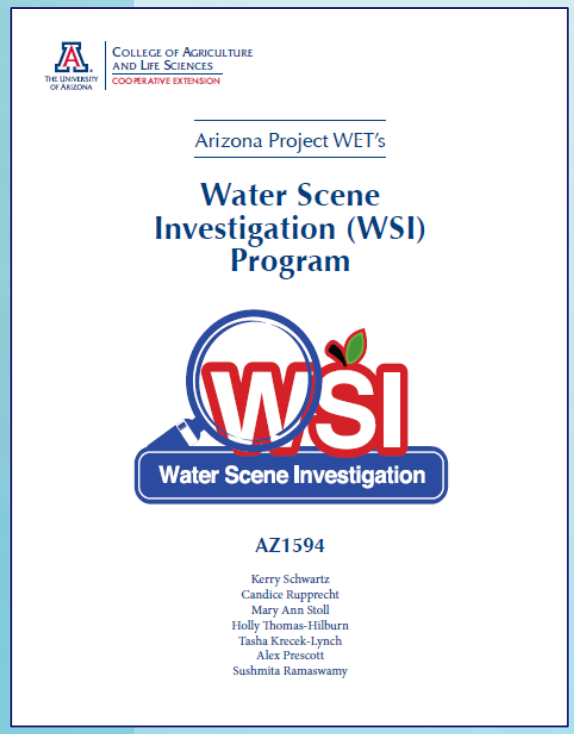
SWAP
School Water Audit Program



School Water Audit Program

STEM education that incentivizes school and community water conservation through student-driven inquiry and students acting to install technology that saves water or recommend water savings initiatives.




College of Agriculture and Life Sciences
Cooperative Extension
The University of Arizona

Arizona Project WET's

Water Scene Investigation (WSI) Program

Water Scene Investigation

AZ1594

Kerry Schwartz
Candice Rupprecht
Mary Ann Stoll
Holly Thomas-Hilburn
Tasha Krecek-Lynch
Alex Prescott
Sushmita Ramaswamy

Water Scene Investigations

2-day in-classroom presentation by APW Coordinators, inspires participants to adopt home water conservation practices through the installation of water efficient technology and comparison of their savings with other water users.

Bringing Water Savings Home

Parents learn about water efficient technology!

Water Scene Investigation

ARIZONA Wet Water Education

Arizona Project WET

Promoting responsible water stewardship through excellent and effective water education.

Home | About APW | APW Programs | Sponsors | Calendar | Blog | Login | Search | GO

Create Report Water Savings

You received an aerator as a part of a: *

- student group
- public event
- I'm not sure.

Faucet Flow Data

You will report the data for ONE faucet here: how long the water flows and ho
The system will calculate the amount of water you will save in one year by kee
If you wish to report the same data for another faucet, submit another water s

Have you figured out your faucet flow rate? *

- Yes, I used a flow rate bag.
- Yes, I measured and calculated it on my own
- No, I need some help.

ARIZONA Wet Water Education

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Water Savings for Andrada

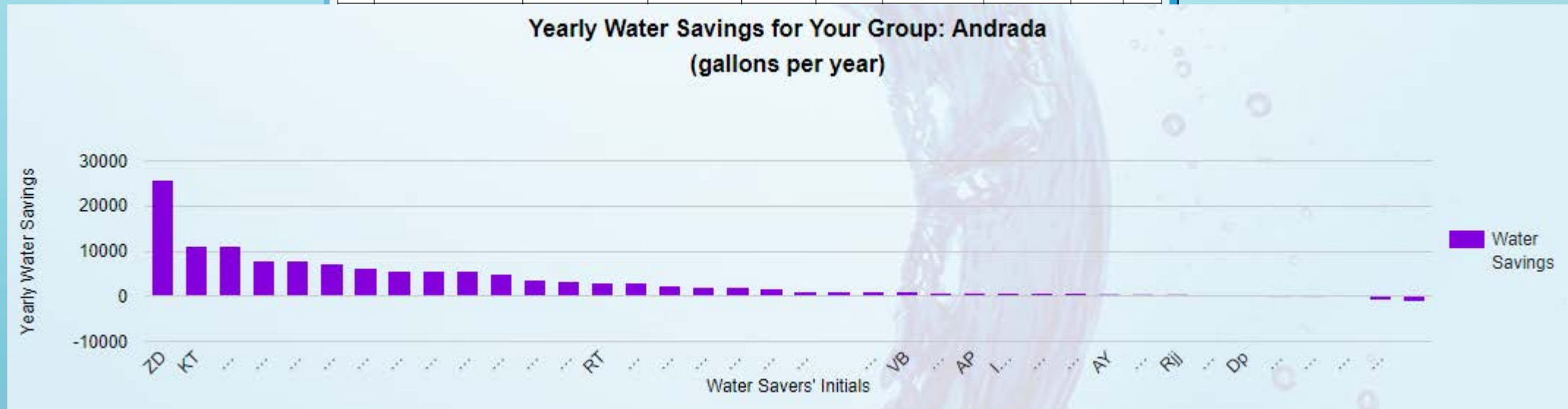
Choose a Group ID to display the group's water savings data. - Choose -

38 members of the group Andrada have reported their water savings. They will save a total of 127,962.40 gallons per year (gpy) of water because of their Water Scene Investigations.

Edit	Title	Water Savings For	Flow Time	FR Before	FR After	Water Savings	Last Update	Delete	Edit
Edit	Water Savings For		3.60 min/day	1.30 gpm	0.52 gpm	1024.92 gal/yr	08/13/2018		Edit
Edit	Water Savings For Dp	Dp	0.80 min/day	1.83 gpm	1.16 gpm	195.64 gal/yr	08/13/2018		Edit
Edit	Water Savings For J.A.	J.A.	2.61 min/day	1.00 gpm	1.00 gpm	0.00 gal/yr	08/13/2018		Edit
Edit	Water Savings For AM	AM	1.41 min/day	2.60 gpm	1.80 gpm	411.72 gal/yr	08/13/2018		Edit
Edit	Water Savings For JCL	JCL	7.03 min/day	1.25 gpm	0.50 gpm	1924.46 gal/yr	08/13/2018		Edit

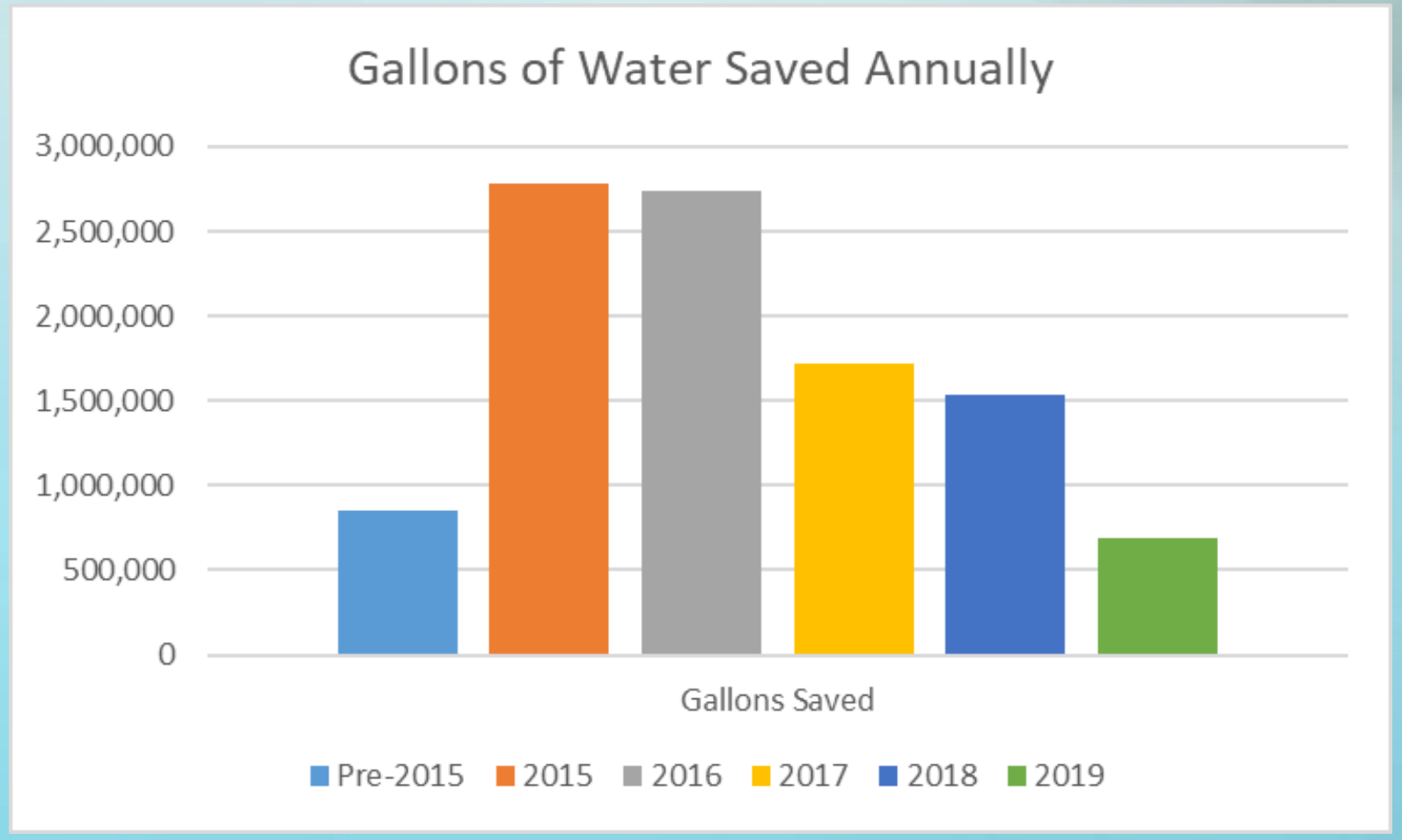
WSI Water Scene Investigation

Bringing Water Savings Home



Phoenix WSI Program

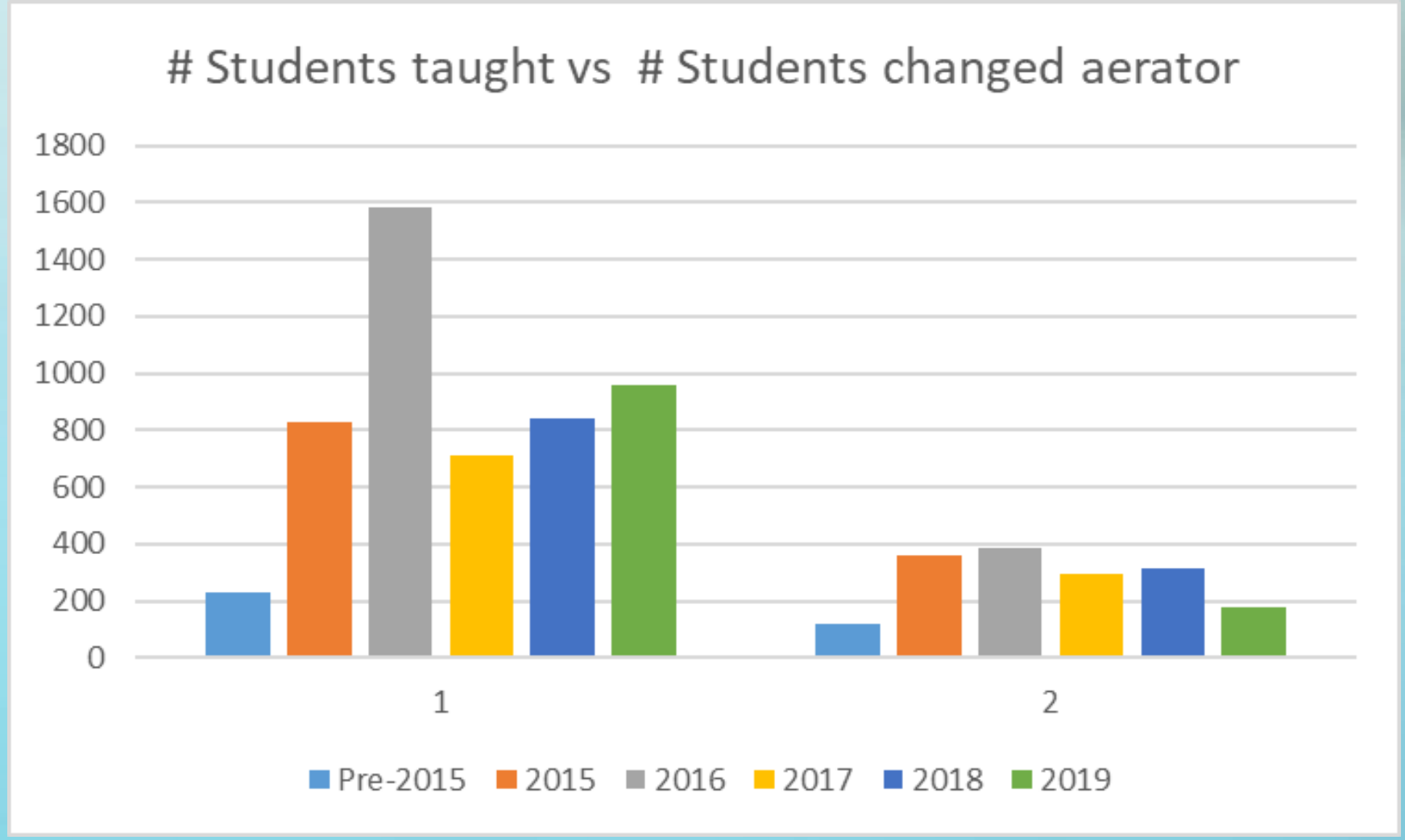
- ✓ 196 Classes
- ✓ 5,150 Students Taught
- ✓ 2094 aerators changed



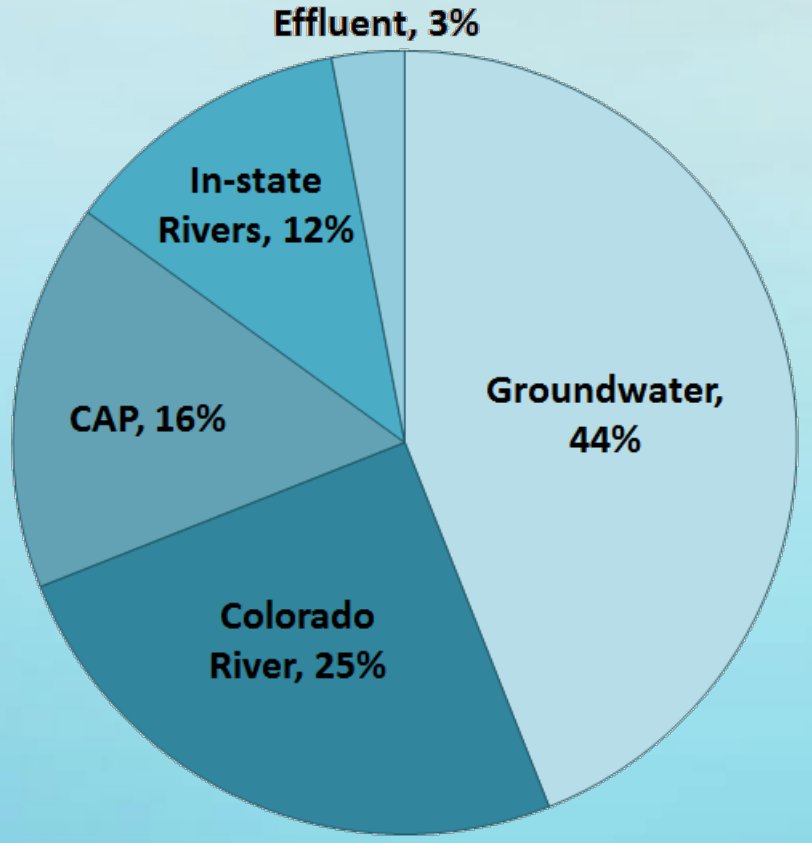
Phoenix WSI Program

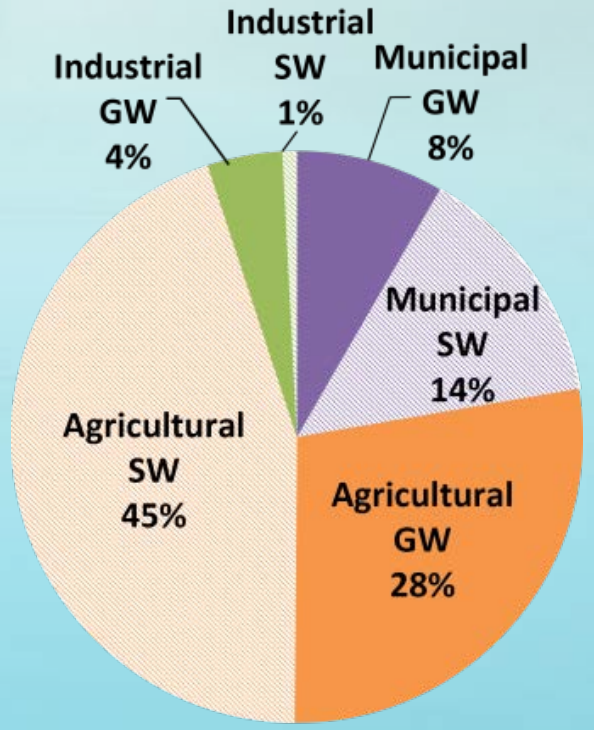
49,642,812* gallons saved annually from simple aerator changes!!

* = combined Tucson & Phoenix programs



ARIZONA WATER SUPPLY AND DEMAND





Total Human Demand in 2006 = 6.8 maf*

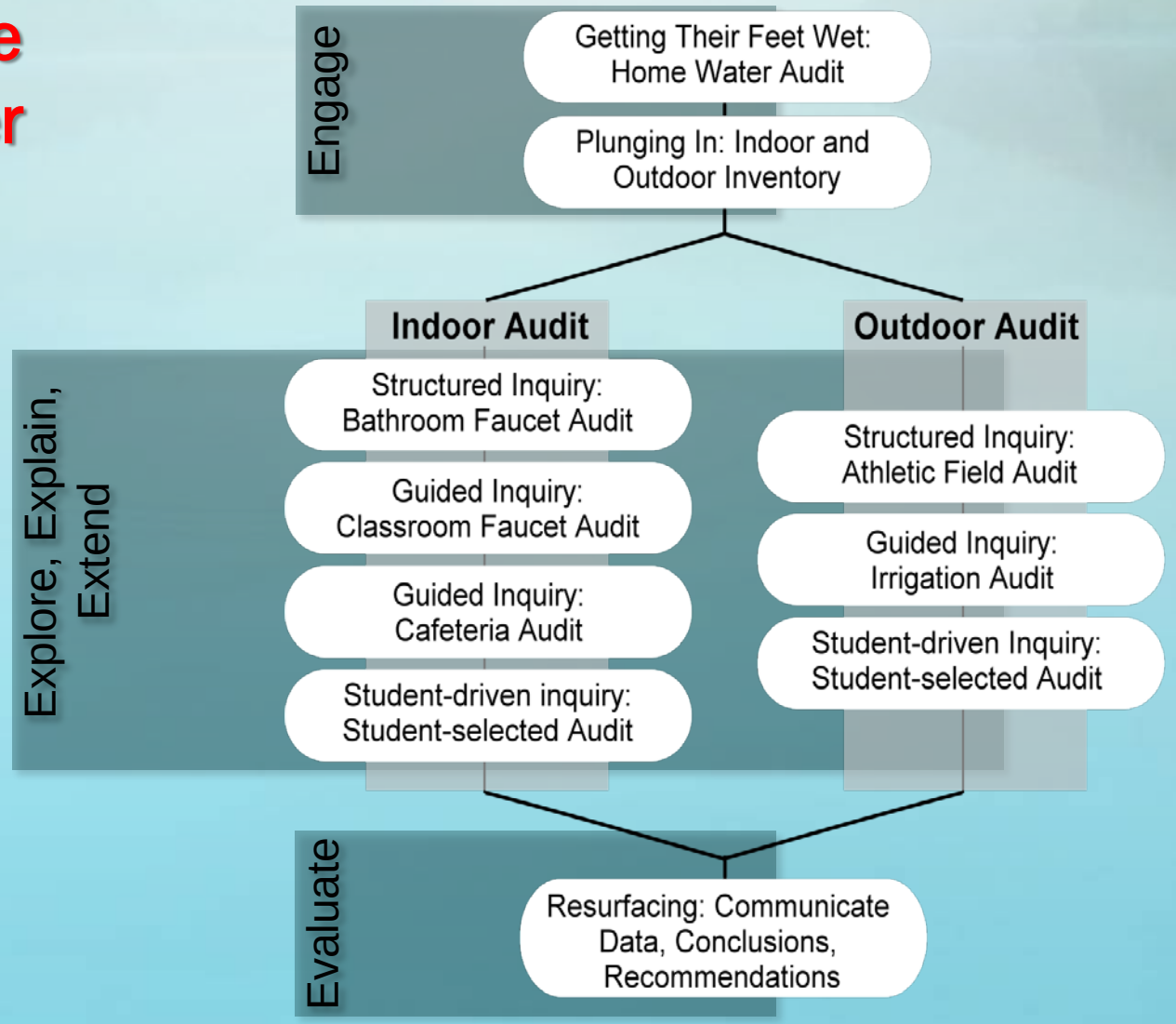
SW= Surface Water
GW= Groundwater
maf = Million acre-feet

Water Audit Process

Driving Question: How can we reduce water use or use water more efficiently at schools?

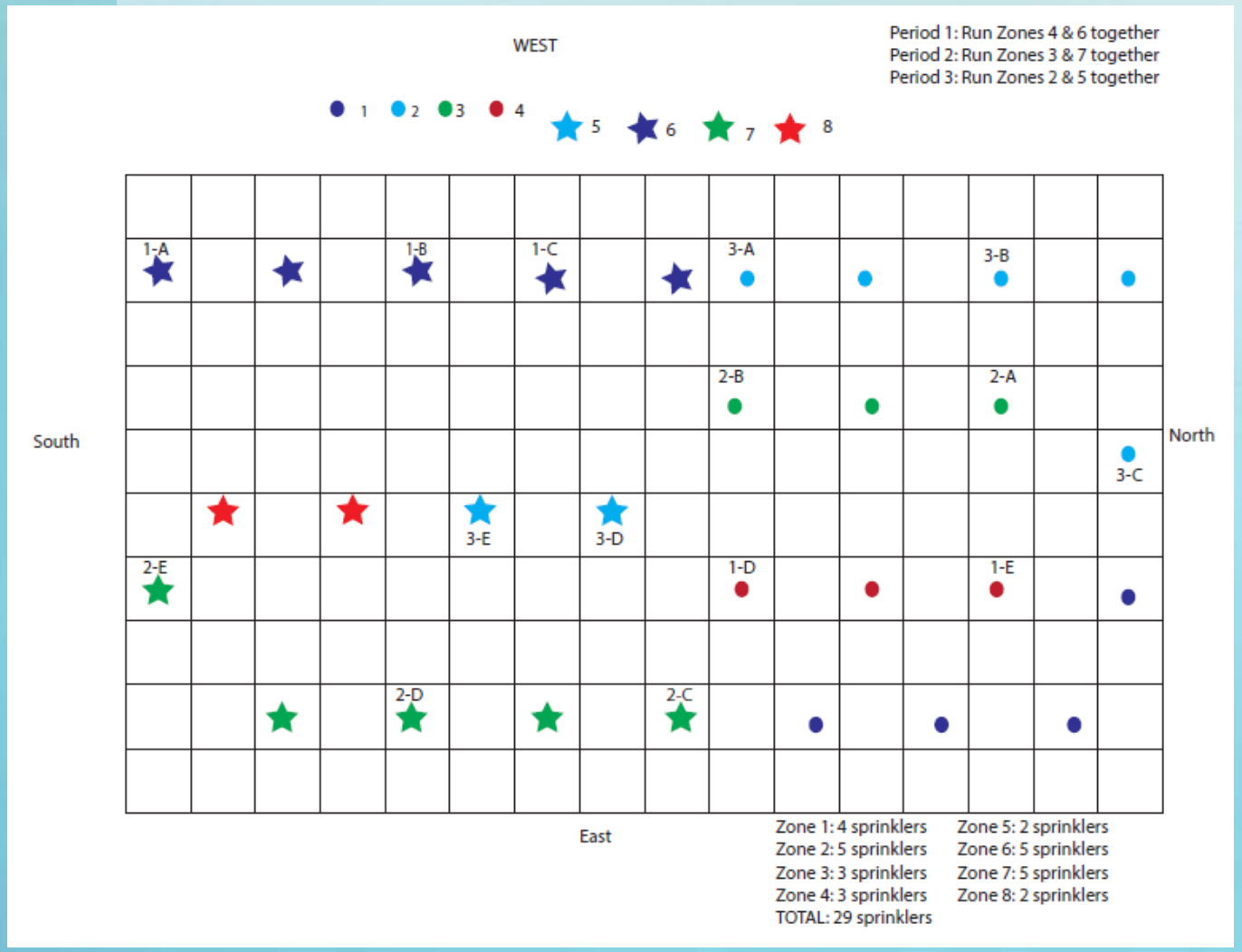
Indoors

Outdoors



Outdoor Water Audit

Determining Sprinkler Locations on Athletic Field

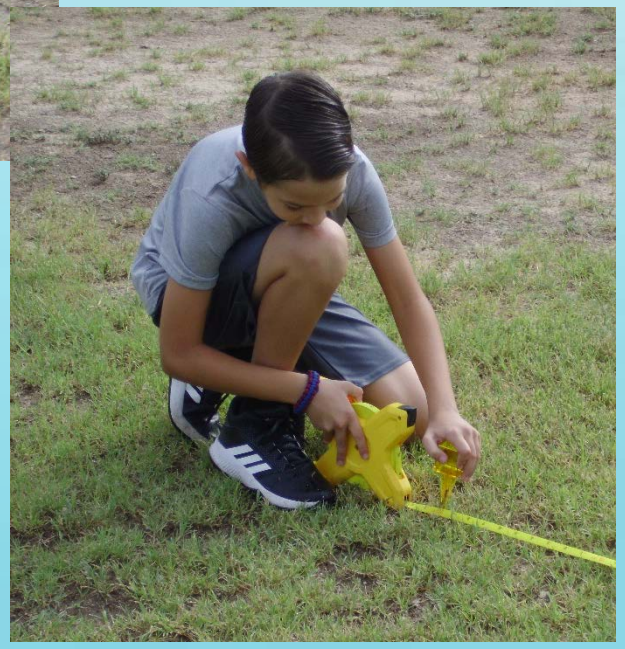


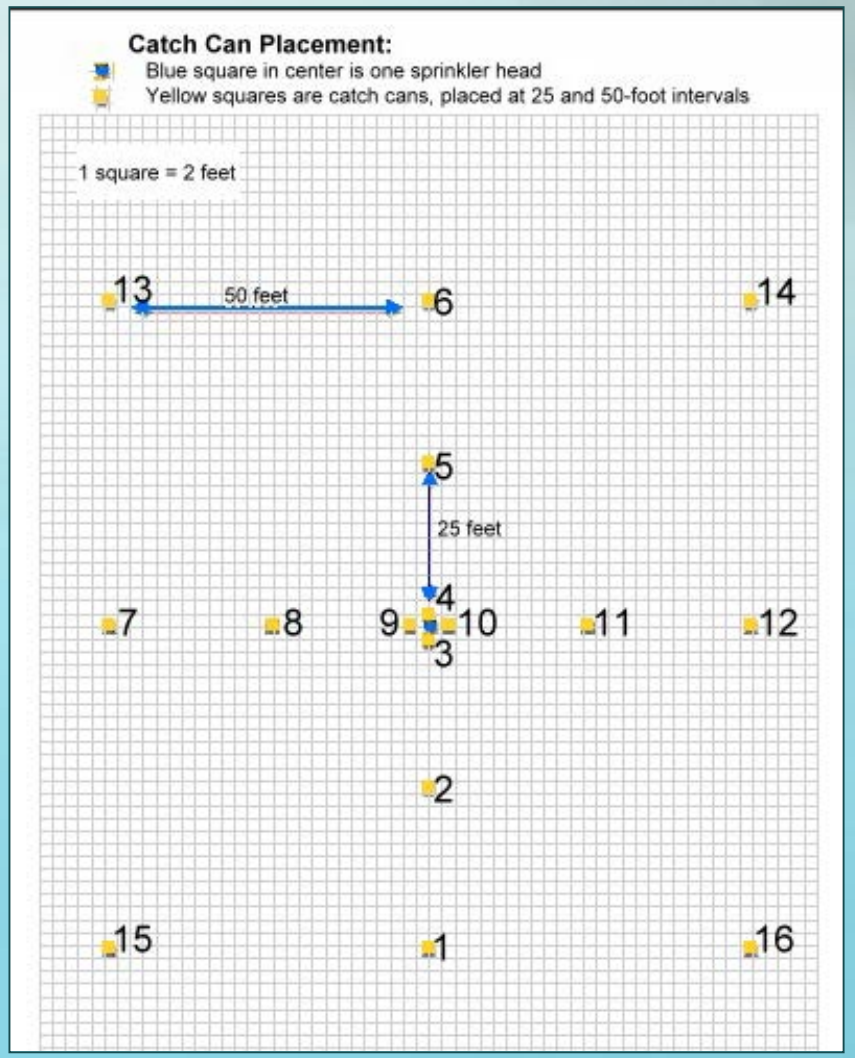
SWAP
School Water Audit Program

Sprinkler head marked with flag

Catch Can Placement

Calculating Distribution Uniformity



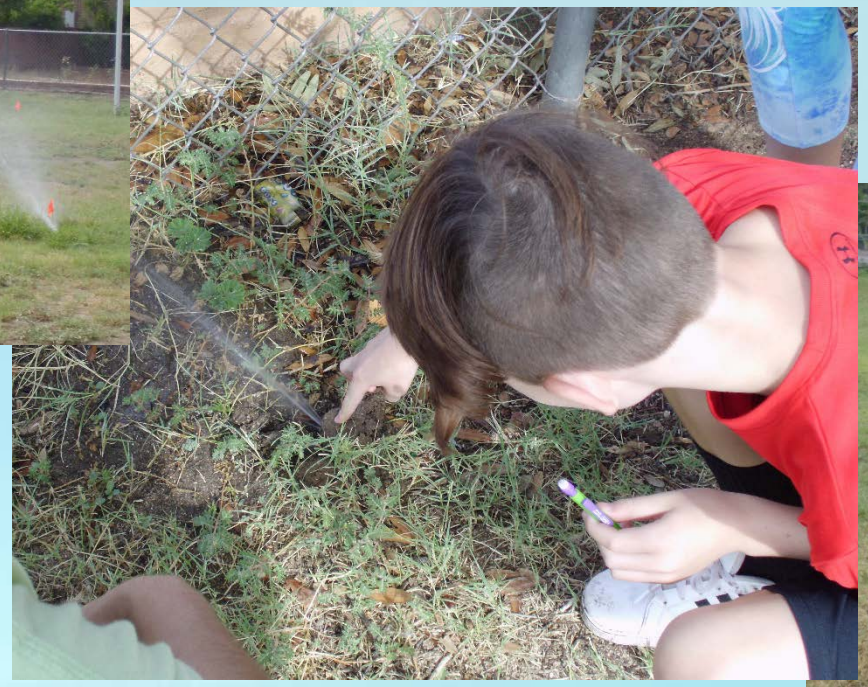


SWAP
School Water Audit Program

Outdoor Water Audit

Running the system

Checking the heads



Measuring catch can volume

SWAP
School Water Audit Program

Appendix 3.5.E:

Turf Irrigation Audit Data Sheet

Inquiry Questions: How much water is used to water our sports fields in a year?
Do we water this turf efficiently?

Materials: 10 ml graduated cylinder, clipboards, pencils, catch cans, stop watch, outdoor tape measure, metal flagging stake

Sprinkler #/Location:

Run time:

Catch Can #	Amount of water (ml)	Observations/Comments
1	0	no catchcan
2	7.8	There is no water in a spot and that is why there is a dry patch.
3	3.6	
4	1.6	
5	2	I don't think some
6	0	of them might not
7	1.4	be any water in
8	4.6	number 6.
9	3	no water at all
10	2	very wet, two of them
11	1.7	did not get any
12	4.2	water at all.
13	1	there was a ton of
14	.4	mud after the sprinklers
15	0	no catchcan I went on.
16	0	no catchcan

Average

Wind Speed Description: 1 #1

Speed in miles per hour: 4.1-5.5

morgan

Outdoor Water Audit Getting Results

Math that means something

5. How does your DU vary from the DU values calculated by the other groups for other sprinklers? Why do they vary?

   Class discussion

6. Combine all answers to questions 1 and 2 into one data set. Calculate the overall distribution uniformity (DU):

Average of the lowest values:	2.15 ml
Average Catch Overall:	3.65 ml
Overall DU: $DU = \left(\frac{Avg\ of\ Lowest\ values\ (mL)}{Avg\ Catch\ Overall\ (mL)}\right) * 100$	2.15 ml = 0.589 x 100 = 58.9 % 3.65 ml

7. What does this overall DU tell you about how uniformly water is applied to the whole field?
   The DU tells us that the field is not watered as uniformly as it could be. Though perfection (100%) could not be accomplished without needless expense and overuse of sprinklers, a value of above 80% would indicate very good distribution uniformity.

Outdoor Water Audit
Getting Results

Math that means something

12. Convert the water use calculated in question 10 from inches/year to gallons/year over the entire field.

$$Water\ Used\ \left(\frac{gal}{yr}\right) = Area\ (ft^2) * Water\ Used\ \left(\frac{in}{yr}\right) * \left(\frac{ft}{12\ in}\right) * \left(\frac{7.48\ gal}{ft^3}\right)$$

$$Water\ Used\ \left(\frac{gal}{yr}\right) = 3000\ (ft^2) * 43.21\left(\frac{in}{yr}\right) * \left(\frac{ft}{12\ in}\right) * \left(\frac{7.48\ gal}{ft^3}\right)$$

$$Water\ Used\ \left(\frac{gal}{yr}\right) = 80{,}803$$

- Using duration & frequency, they calculate water use in inches per year
- Convert it to gallons per year
- Compare their figures to recommended values from Irrigation Specialists for their area.

15. Compare this number to the amount of water being applied to your field each year (the amount calculated in question #12).

$$Water\ Used\ \left(\frac{gal}{yr}\right) = Area\ (ft^2) * \boldsymbol{Turf}\left(\frac{in}{yr}\right) * \left(\frac{ft}{12\ in}\right) * \left(\frac{7.48\ gal}{ft^3}\right)$$

$$Water\ Used\ \left(\frac{gal}{yr}\right) = 3000\ (ft^2) * \mathbf{61.94}\left(\frac{in}{yr}\right) * \left(\frac{ft}{12\ in}\right) * \left(\frac{7.48\ gal}{ft^3}\right)$$

$$Water\ Used\ \left(\frac{gal}{yr}\right) = 115{,}828/$$

Water Education Stats

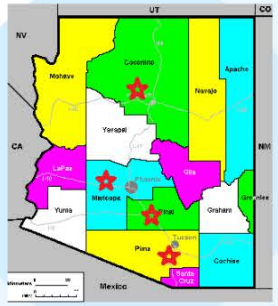
ARIZONA WET Water Education

Teacher Academies

12,082 Teachers

92% Agree "Best I've ever attended."

Direct Instruction



Instructed >845,740 Students

Students

Public Outreach

6,500 Adults Engaged

Student-Driven Projects

49,642,812 gal/yr Projected Water Savings

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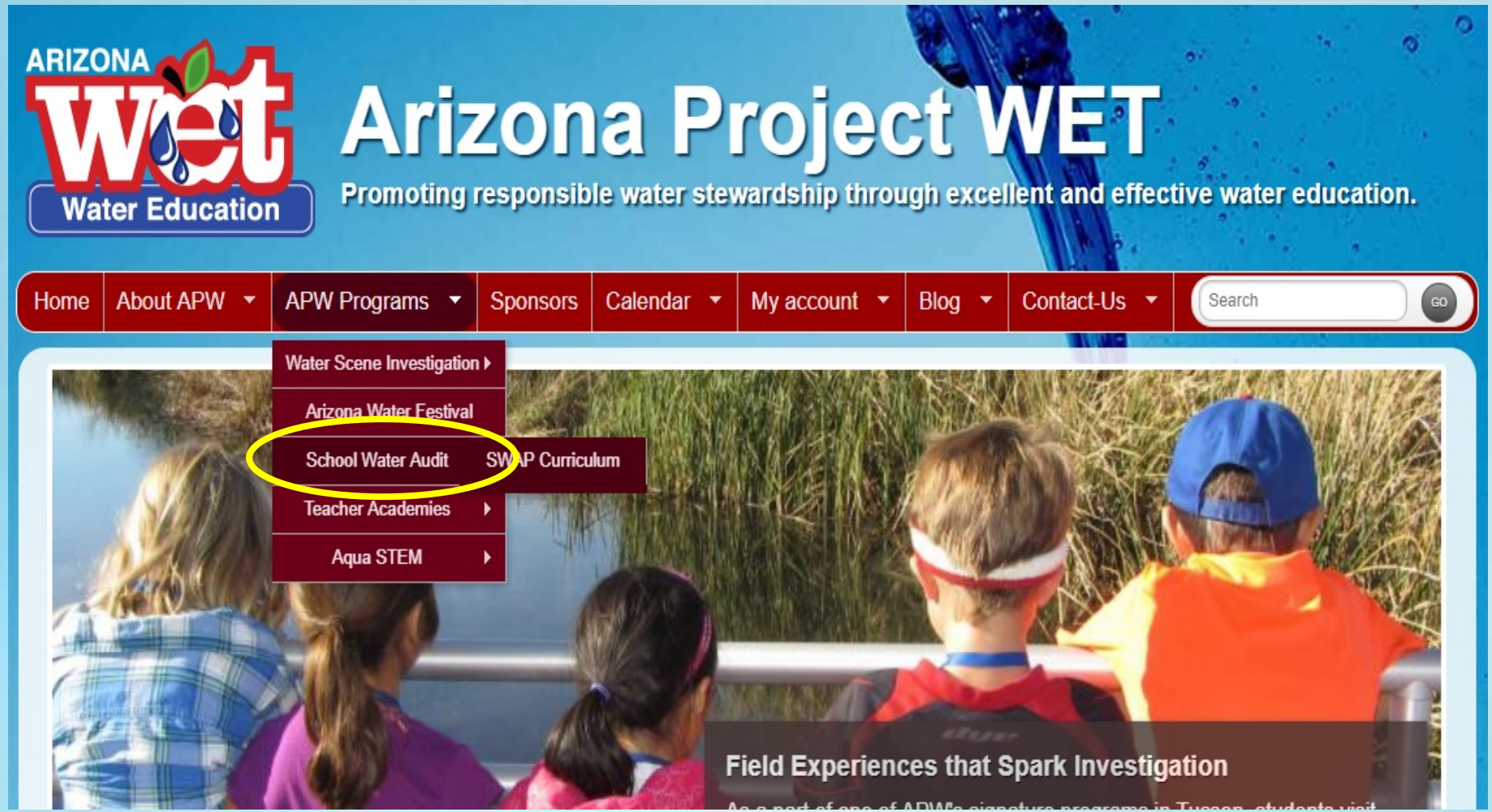
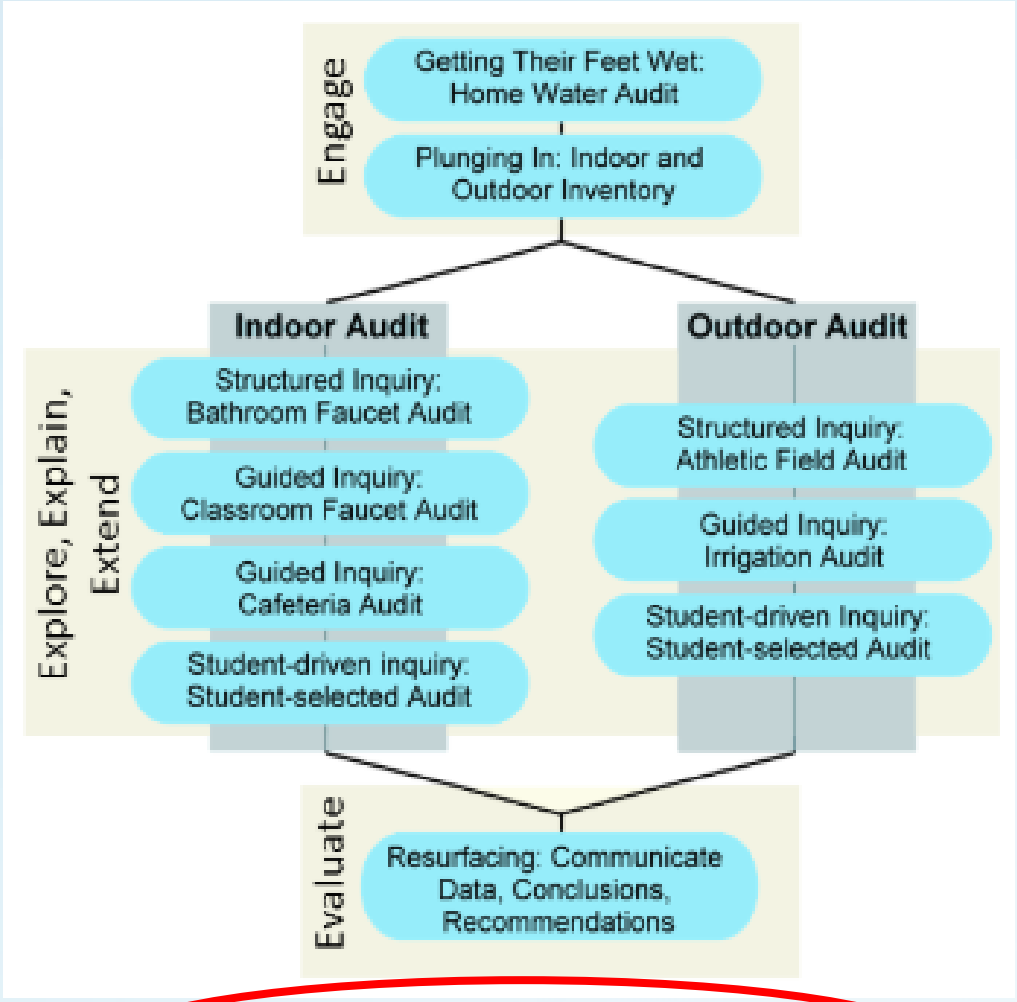
WATER RESOURCES RESEARCH CENTER

Arizona Project WET Resources https://arizonawet.arizona.edu/



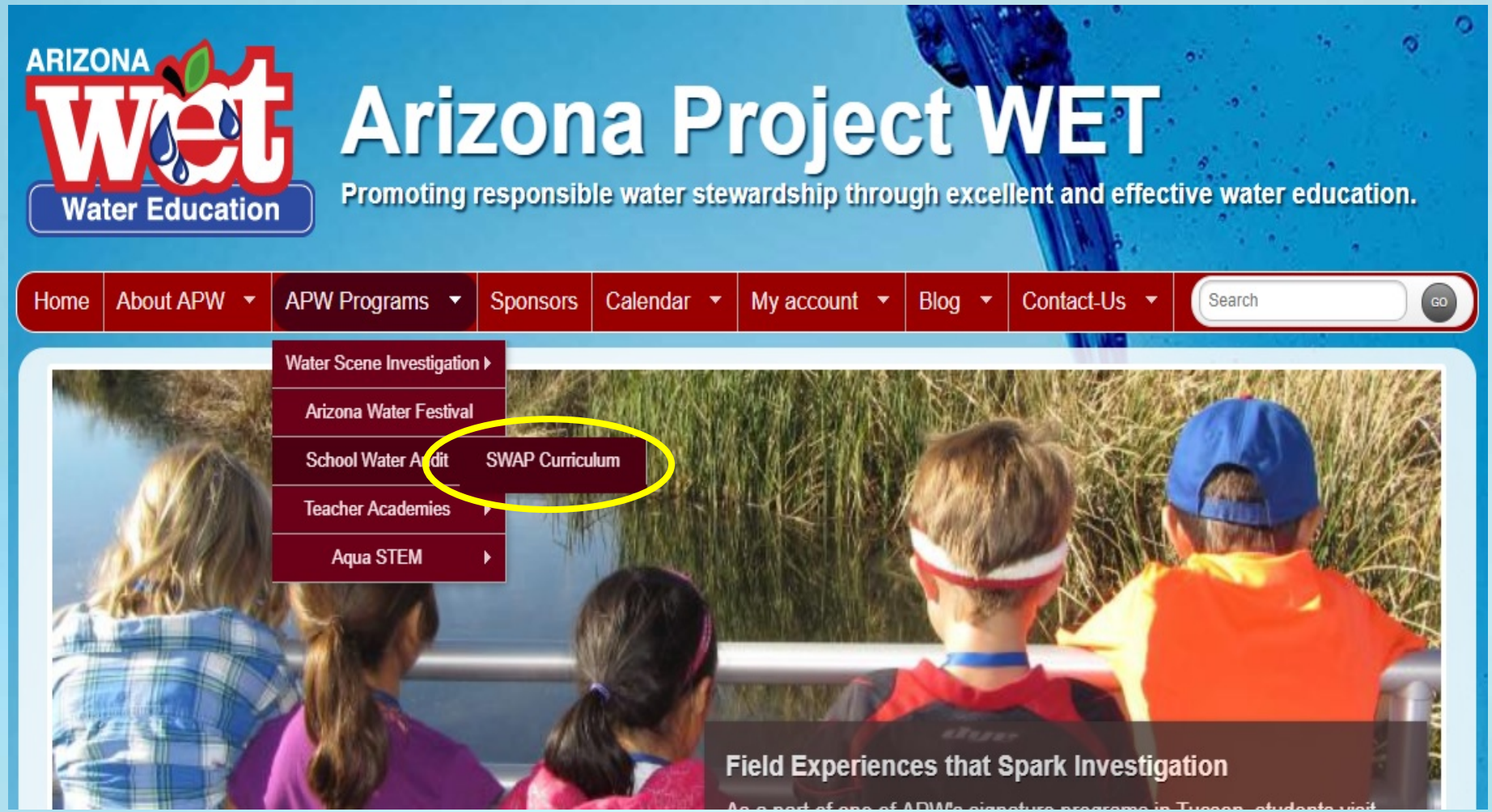
We’re happy to share!



Download the SWAP Curriculum

SWAP Curriculum The SWAP Curriculum was written to inspire student-driven inquiry through a meaningful scientific and engineering process. After the introductory Water Use Inventory, the audit branches to either indoor-focused or outdoor-focused investigations. The first unit of each branch is designed as a teacher-driven unit to teach scientific and mathematical thinking and investigation processes. As the project progresses through each investigation branch, the complexity of the variables that affect the focus questions increase. By the final unit on each side of the flow chart, students are tasked with designing their own inquiry; writing a procedure, data charts and equipment list; and with implementing their investigation. The culminating communication of their School Water Audit findings, water savings, ideas and recommendations is an essential component of this curriculum.

Arizona Project WET Resources https://arizonawet.arizona.edu/



We’re happy to share!

Arizona Project WET Resources

SWAP Curriculum

The SWAP Curriculum is effective STEM education that develops student's independence in inquiry as they learn investigation skills and apply them in pursuit of their own understanding and solutions.

Download the complete SWAP curriculum or individual units by clicking on the download links to the right. Also, click on the *more information* links for insight and guidance from experienced SWAP teachers.

▾ Where might you have seen this resource used?

In conjunction with an APW Program:

Teacher Academies

Water Scene Investigation

During a Workshop:

SWAP

https://arizonawet.arizona.edu/

How to Change a Faucet Aerator

Kerry's Systems Thinking TED-talk

PSA - Students Recycle

SWAP Curriculum

SWAP Unit 1 - Home Water Audit

- More Information
- Download .pdf (1.41 MB)

SWAP Unit 2 - School Inventory

- More Information
- Download .pdf (1.2 MB)

SWAP Unit 3.1 - Bathroom Faucet Audit

- More Information
- Download .pdf (1.3 MB)

SWAP Unit 3.2 - Classroom Faucet Audit

- More Information
- Download .pdf (1.02 MB)

SWAP Unit 3.3 - Cafeteria Audit

- More Information
- Download .pdf (1.11 MB)

Any Questions?

Thank You!

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