

Tucson Water Turnaround: Crisis to Success

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Outline

- Converting from Groundwater to CAP water
- Organizational Issues
- Water Treatment
- Distribution System Problems
- Debacle
- Turnaround and Success
- Lessons Learned

You have heard about the problems in Flint, MI, but may not be aware of what happened 22 years earlier in Tucson. We are making this presentation and have written a book about Tucson so that this does not happen again—anywhere.

Objectives

- To present policy decisions by the Tucson City Council that caused many of the problems
- To explore the lack of technical planning and management errors made by Tucson Water before and during the colored water crisis in 1992-94
- To explain how a successful management team turned failure into a singular success
- To present the “lessons learned” that are applicable to any utility or organization

Sources of Information

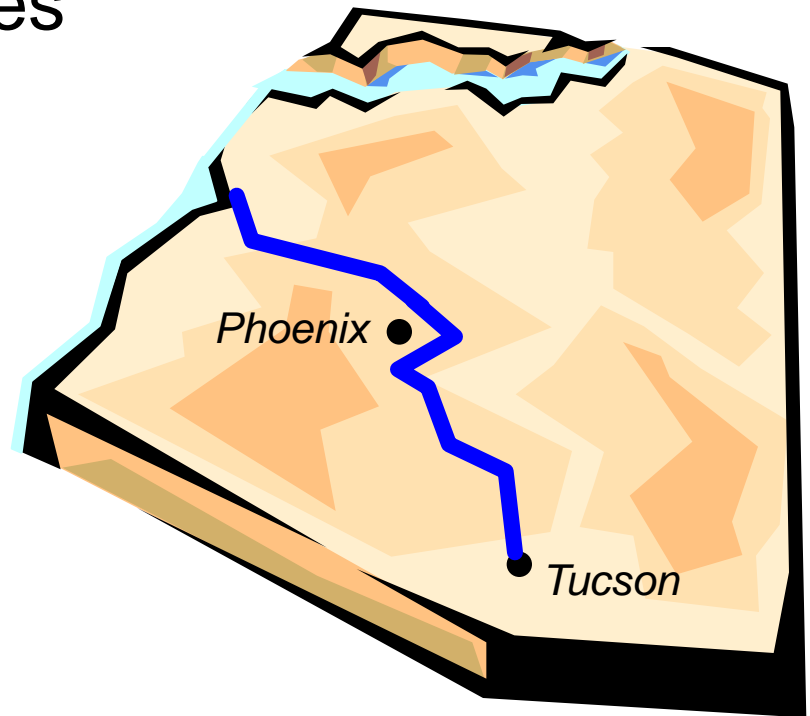


- Thousands of documents
- Over 40 interviews with people who were there
- Secondary sources
- Interviews with experts

CAP Timeline

Tucson Water was a groundwater utility prior to CAP!

- 1968--Congress approves CAP
- 1973--Groundbreaking
- 1985--Water arrives in Phoenix
- 1991--Water delivered to Tucson area
- Nov. '92--Water served to Tucson customers

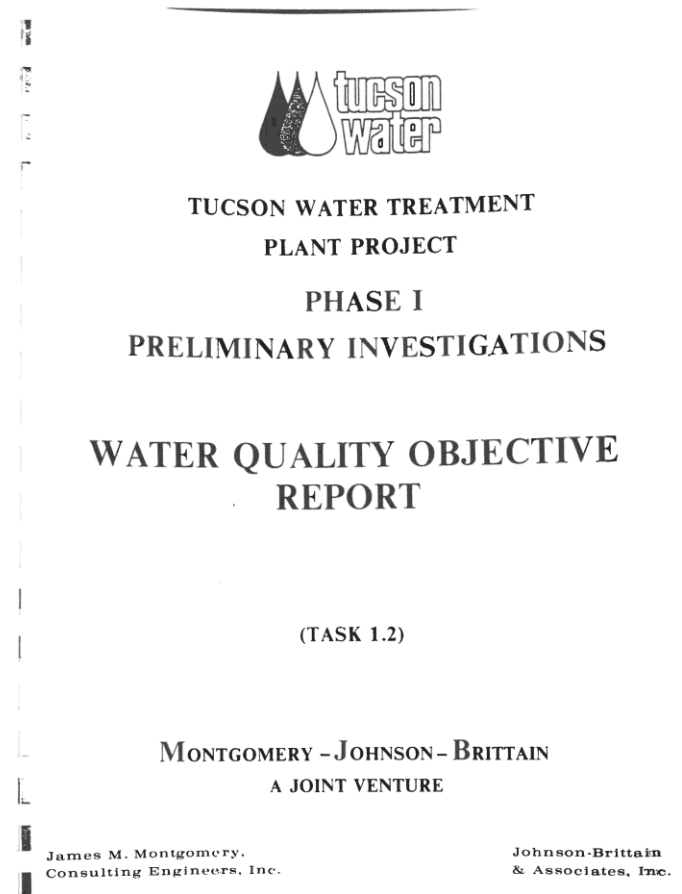


CAP and GW Quality

Parameter	Median Raw CAP (a)	Median Groundwater (b)
pH, units	8.3	7.6
Total Dissolved Solids	691	276
Hardness	330	110
Sodium	105	37
Sulfate	295	33
Chloride	92	12
Nitrate	0.07	0.9
Iron	0.08	<0.05
Manganese	0.01	<0.05
Fluoride	0.34	0.3
Total Organic Carbon	2.9	0.24

Disastrous Policy Decision

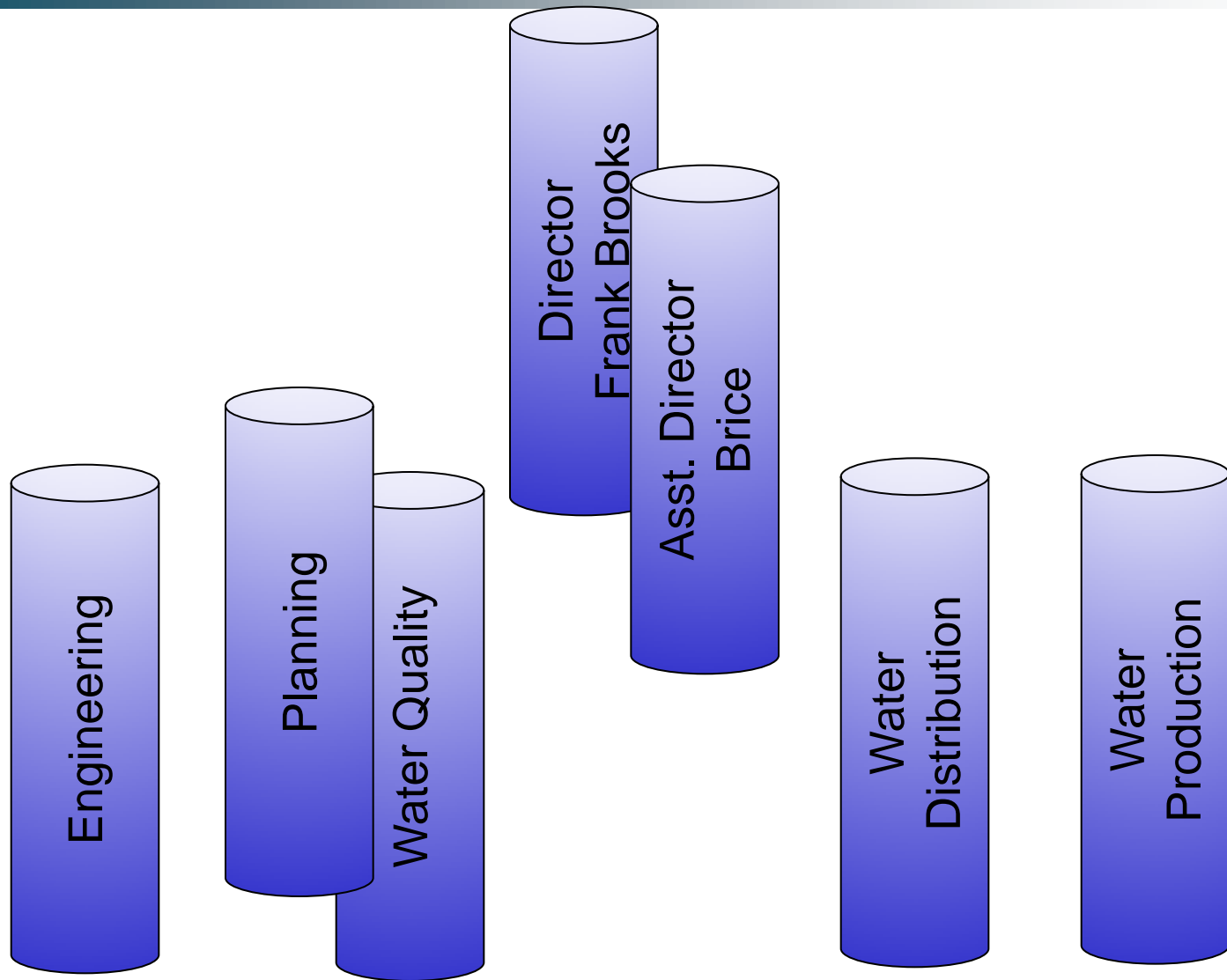
- On May 29, 1984, the Tucson City Council adopted a THM goal of 20 $\mu\text{g/L}$
- Existing THM MCL was 100 $\mu\text{g/L}$
- Drove the design of the WTP
- Consequences were severe



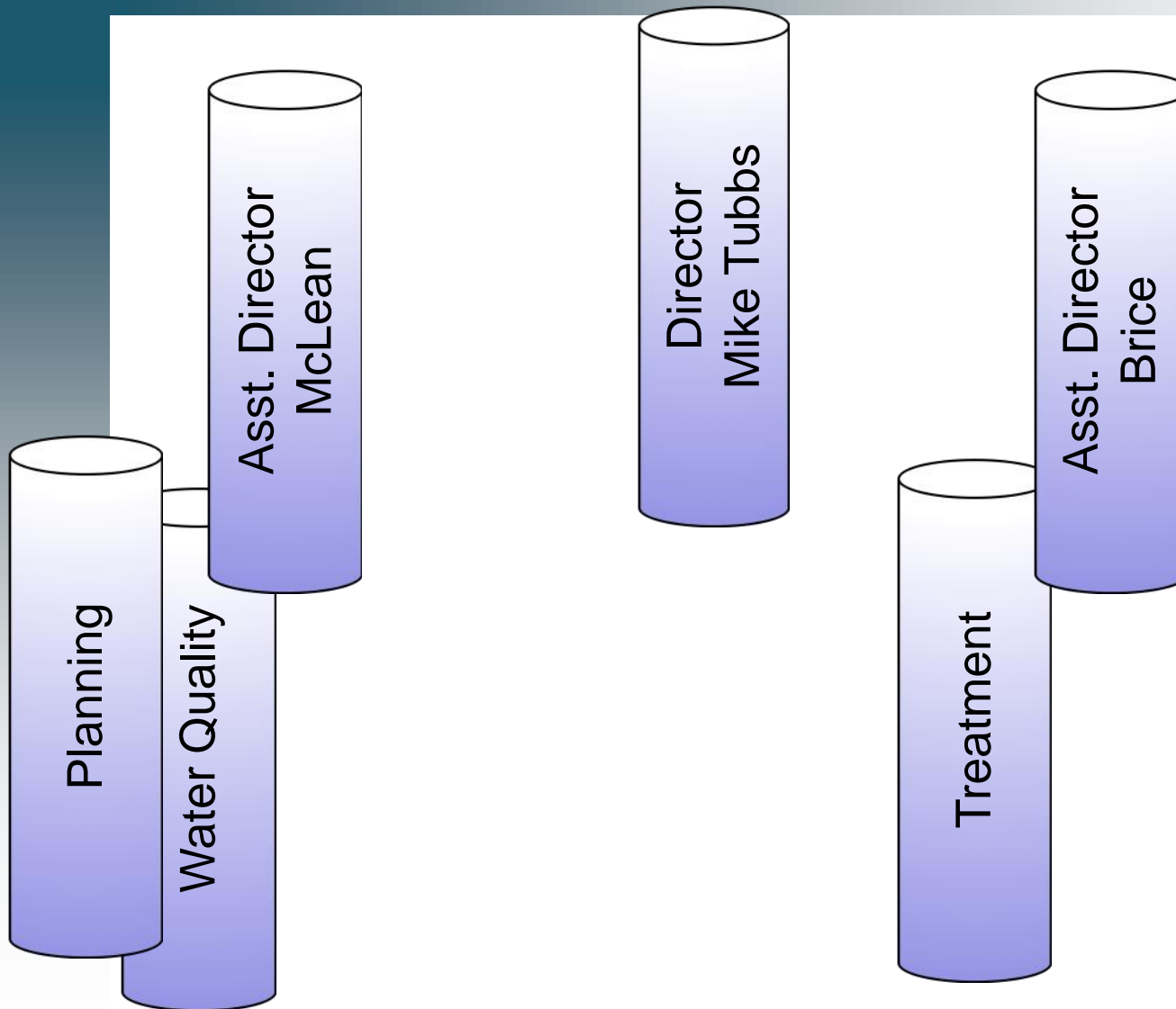
Tucson Water Table of Organization, 1990-94



Tucson Water Table of Organization, pre-1988



Tucson Water Table of Organization, 1990-94



Questions a Manager Should be Asking About the Treatment and Distribution Systems

- How are other utilities treating Colorado River water?
- What are the advantages and disadvantages of an ozone/direct filtration plant versus a more conventional water treatment plant?
- How should we control for corrosivity of treated CAP water? Use pH adjustment or ZNOPO₄?
- ***Has treated CAP water been tested on the materials in Tucson's distribution system?***

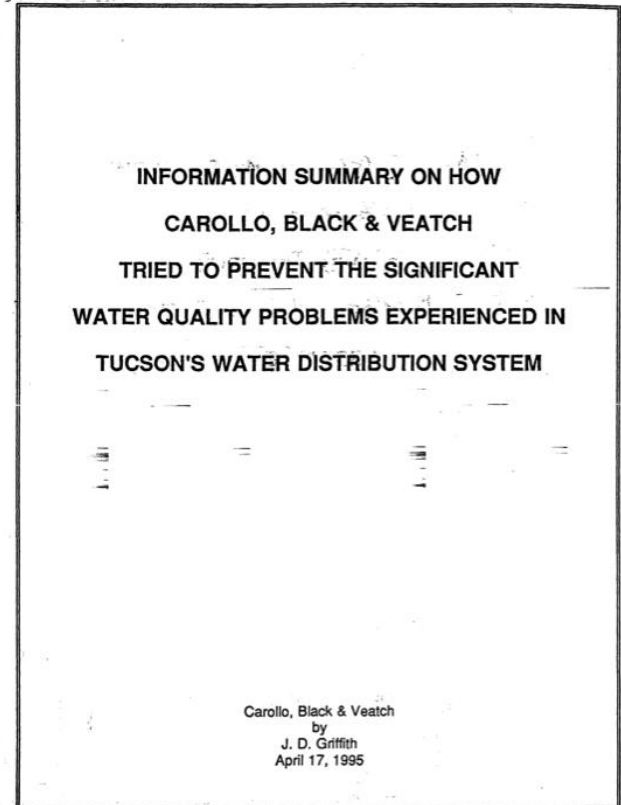
Not one manager in Tucson Water had ever converted a groundwater utility to a mixed surface water/groundwater system. Not one.

Managing the Conversion

- What does a utility do in this situation?
Hire the best consultants it can find.
- Two top-level joint ventures were contracted:
 1. Montgomery-Johnson-Brittain, 1981-84, to work with the community to set finished water quality
 2. Carollo, Black & Veatch, 1985-1994, to design and build the treatment plant

Plea for Distribution Studies

- On numerous occasions in the 1980s, Carollo, Black & Veatch practically begged Tucson Water to authorize them to study the impact of CAP water on the distribution system.



Tucson's Disastrous Relationships with Consultants

- Consultants were viewed as the “enemy” by some Tucson Water managers
- Montgomery-Johnson-Brittain was fired
- Carollo, Black & Veatch was sued after WTP completion
- David Johnson, the project manager for the design of the WTP, called the design consultant “avaricious”
- He personally rejected recommendations for studying impacts of CAP water on distribution materials

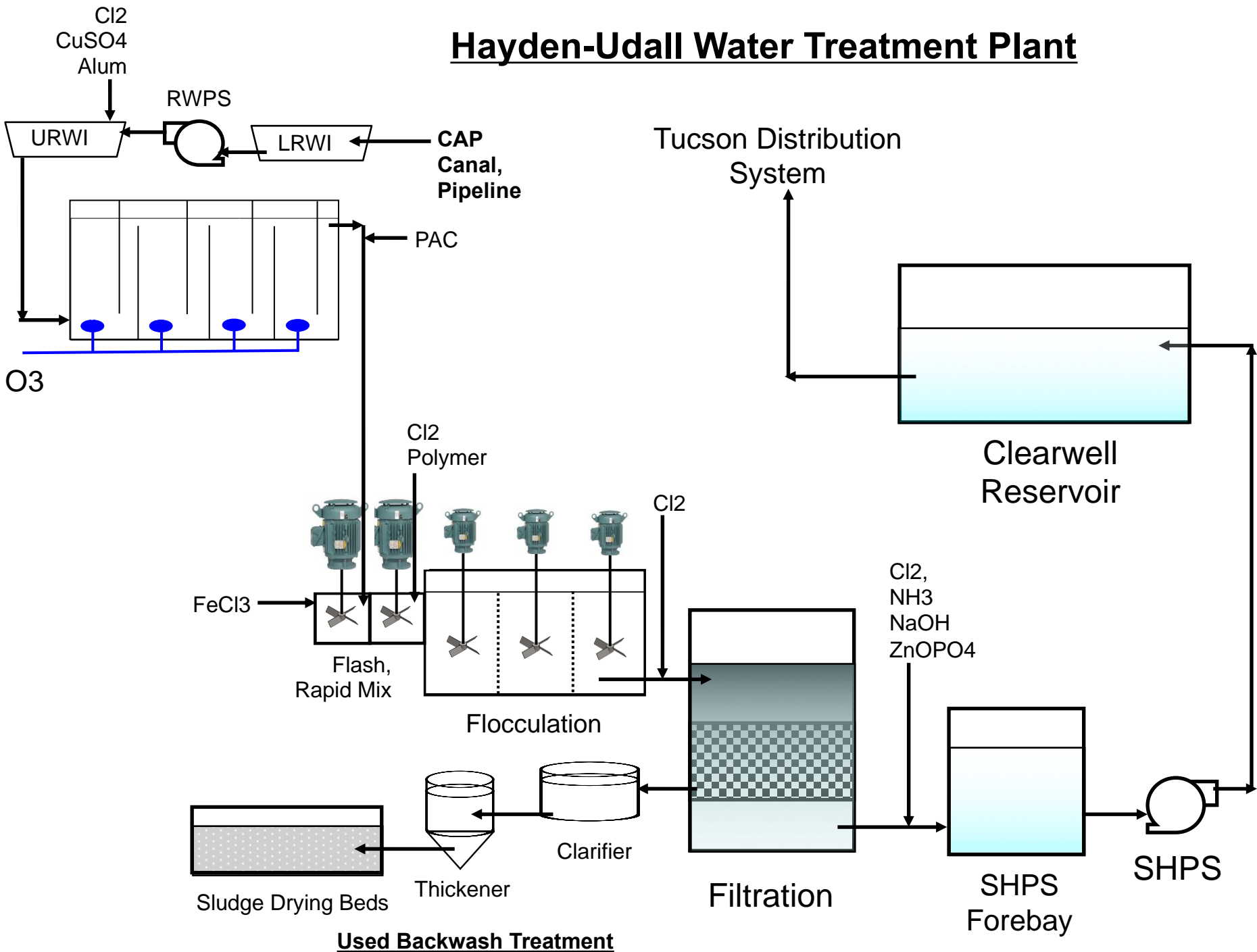
Hayden-Udall Water Treatment Plant

- Montgomery-Johnson-Brittain strongly recommended a HRCT plant with sedimentation basins typically designed to treat CRW
- Tucson Water wanted a “Ferrari:” a cutting-edge ozone/direct filtration/chloramine plant for water quality purposes



Tucson Water chose the DF plant

Hayden-Udall Water Treatment Plant



This map of Tucson, Arizona, illustrates the CAP Service Area and the Colored Water Area. The CAP Service Area is shaded in light gray, while the Colored Water Area is shaded in black. The map includes major highways 10 and 19, and various neighborhoods and landmarks such as the Davis-Monthan Air Force Base, Tucson International Airport, and Coronado National Forest. A legend in the top right corner defines the shaded regions, and a north arrow is located in the bottom left corner.

Legend:

- CAP Service Area
- Colored Water Area

Geographic Features and Labels:

- Highways:** 10, 19
- Neighborhoods:** Linda Vista, Silverbell, Sunset, Sweetwater, Ironwood Hills, Bopp, Snyder, Kinney, Valencia, Mission, 12th Ave, Park, 36th St, Los Reales, Houghton, Valetia, Irvington, Escalante, Golf Links, 22nd, Broadway, Tanque Verde, Skyline, Cloud, Craycroft, Swan, Grant, Alverton, Country Club, Ft. Lowell, Roger, River Rd, Concordia, Oraclie, Thornydale, Ina, La Cholla, La Canada, Kolb, Sabino Canyon, Melpomene.
- Landmarks:** Coronado National Forest, Davis-Monthan Air Force Base, Tucson International Airport.

200 Miles of Galvanized Steel Pipe in the DS



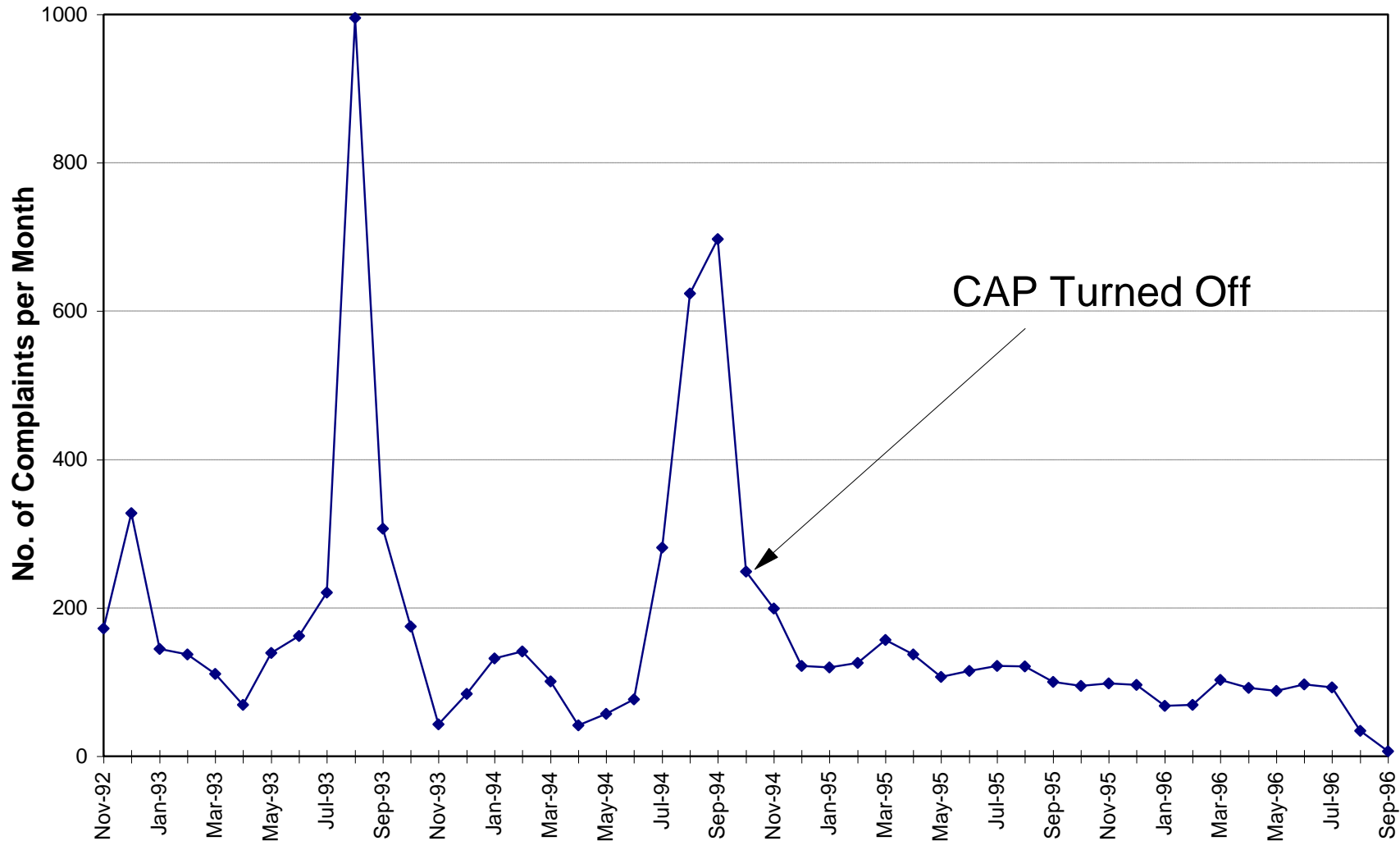
**Main replacement funding kept being stripped from
Tucson Water's budget by the City Council**

November 1992 to September 1994

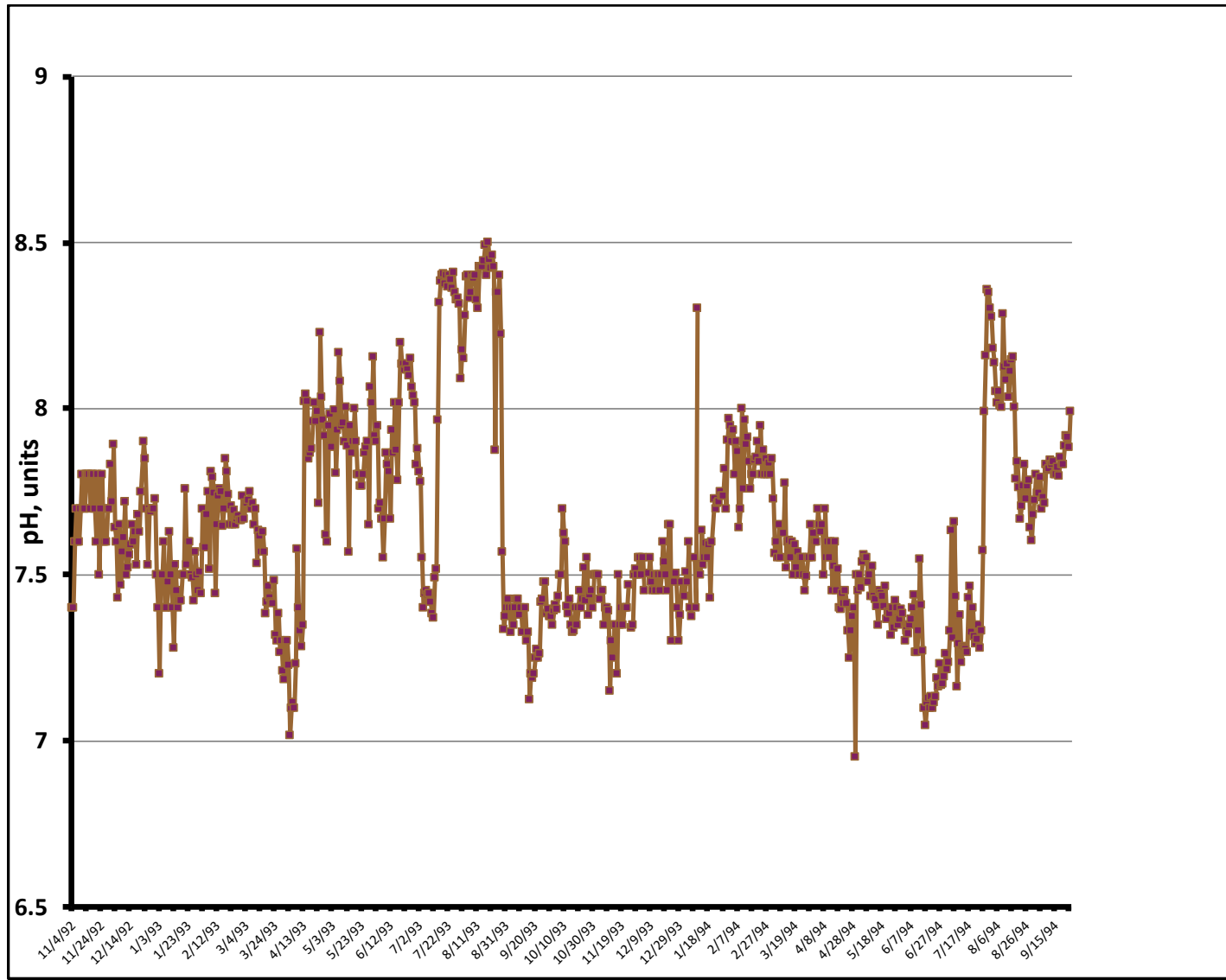
- CAP turned on
- Complaints begin
- The stonewall era
- Political solutions
- Bifurcation
- Continued complaints
- CAP turned off



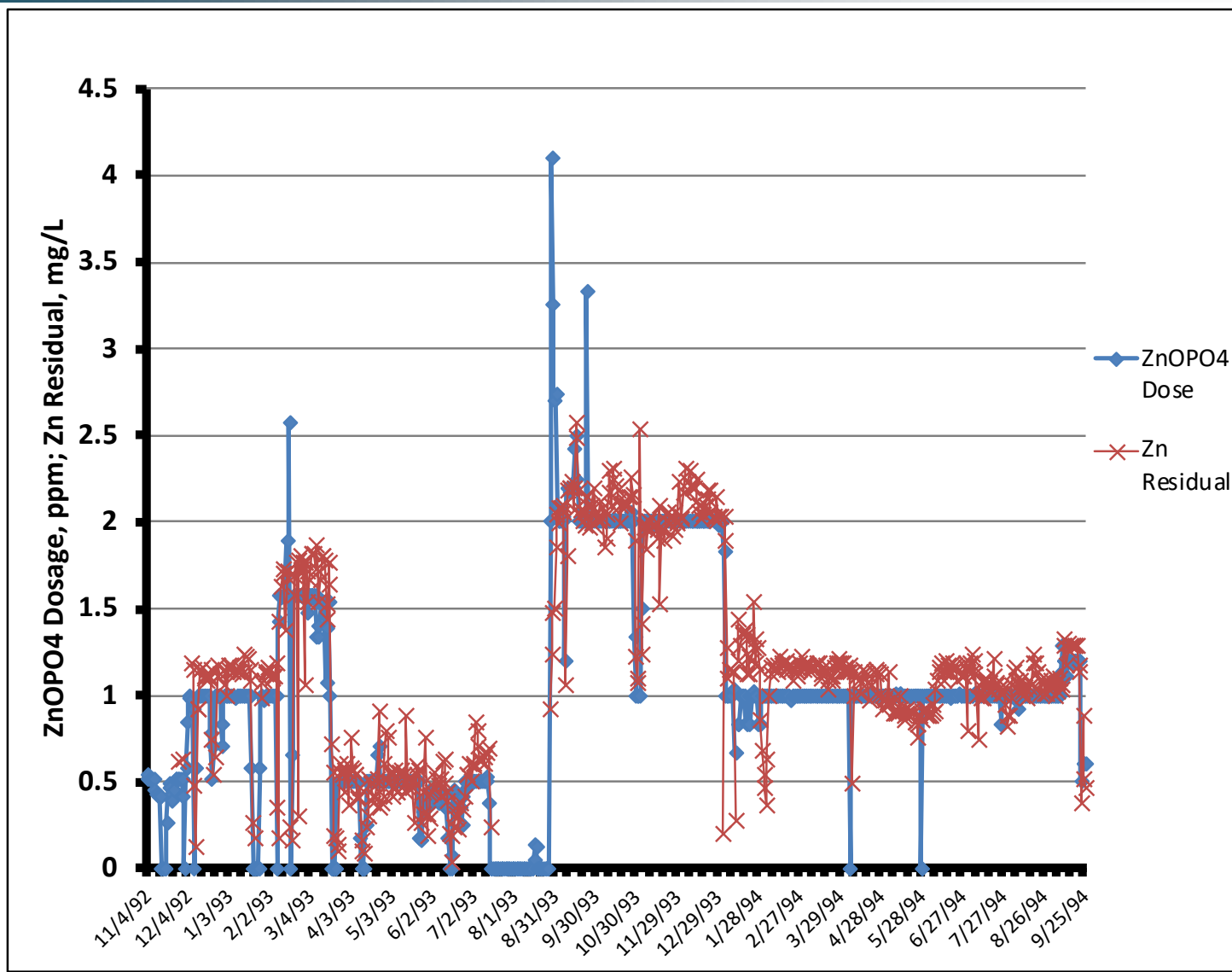
Total Monthly Color Complaints



Treatment Plant: Effluent pH, 1992-94



Treatment Plant: ZnOPO4 Dose, Zn Residual, 1992-94



The Biggest Mistake a Water Utility Manager Can Make

- When faced with this...



- Don't say this...

“The water meets all federal and state drinking water standards.”

Why?

Components of the Turnaround

- Developed GW storage of CAP water
- Created new technical approach—Customer Focus on Water Quality Program (CFWQP)
- Apologized to customers
- Hired new director: David Modeer
 - Changed the organizational culture
- Ambassador Neighborhoods Program
- Bottled Water Campaign
- CAVSARP/Clearwater facilities started—
May 3, 2001

CFWQP

Bench-Scale Corrosion Studies



Total Mass Iron, mg

pH 7.5, No Chlorine

pH 7.5, Free Chlorine

pH 7.5, Chloramines

pH 8.5, No Chlorine

pH 8.5, Free Chlorine

pH 8.5, Chloramines

Loop #1 48	Loop #2 49	Loop #3 96
Loop #4 61	Loop #5 39	Loop #6 16
Loop #7 66	Loop #8 21	Loop #9 145
Loop #10 20	Loop #11 13	Loop #12 34
Loop #13 35	Loop #14 13	Loop #15 26
Loop #16 26	Loop #17 10	Loop #18 20
No Phosphate	Polyphosphate	Zinc Orthophosphate

* Area of bubble proportional to value

CFWQP

Pilot-Scale Studies

- Pilot-scale corrosion studies included to determine non-corrosive, future water quality.
- **Result:** A blend of recharged CAP water and GW, pH of 8.2 and polyphosphate corrosion inhibitor



CFWQP

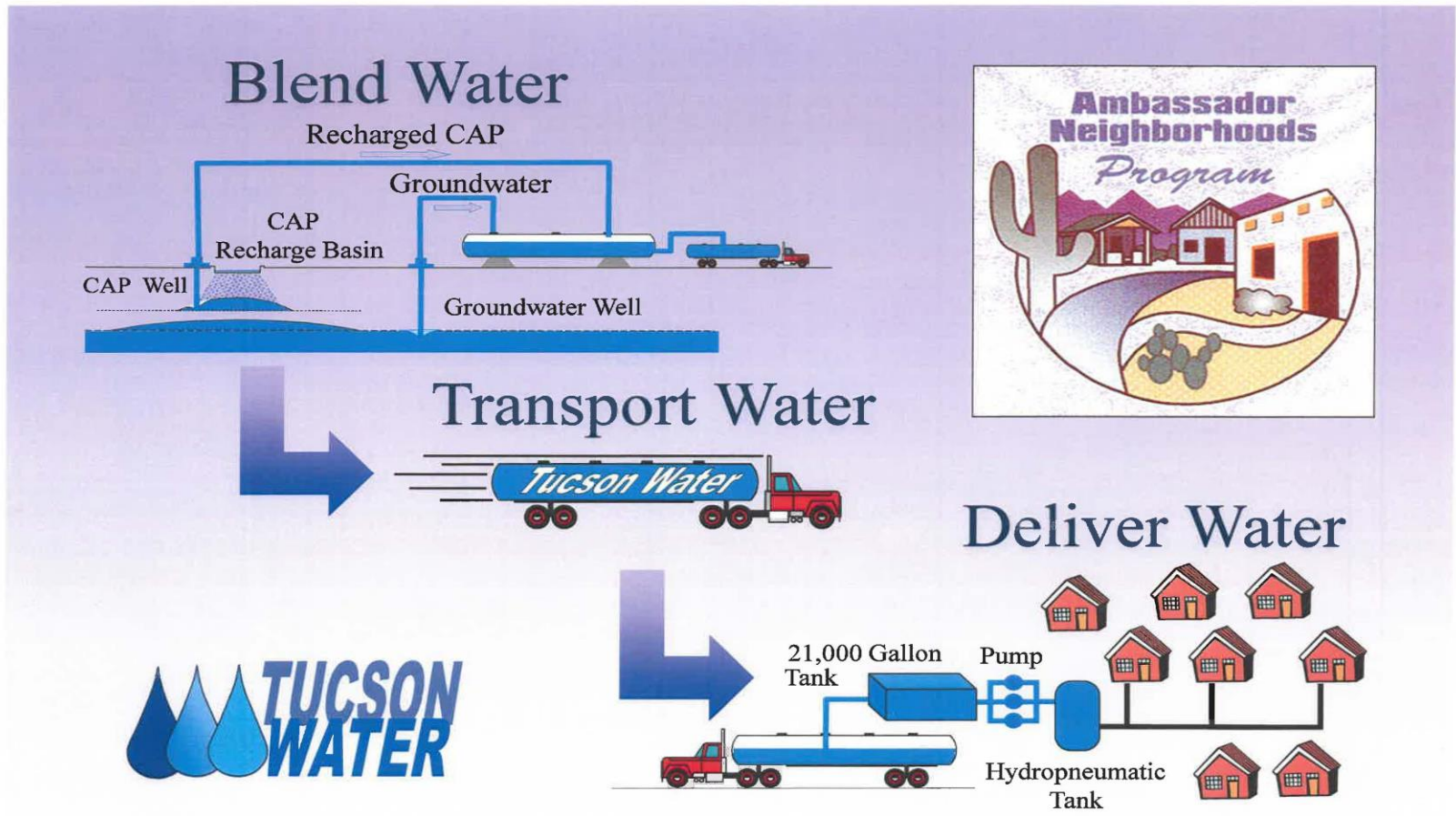
Customer Input on Water Quality



Flavor Profile
Analysis with
expert panels,
customers and
the media

At the Tap

Ambassador Neighborhoods Program



At the Tap

Bottled Water of CAP/GW Blend



A New Team in Town

David Modeer

- Open, approachable, teambuilder, strategic thinker, truth teller/believable, became the face of Tucson Water
- Hundreds of TW volunteers at events; Speakers Bureau; Info Van; PSAs; newsletters; web-based water quality info program
- Built partnerships in the community: Southern Arizona Leadership Council, UofA, businesses, organizations



On May 3, 2001, the Clearwater Facility was put into operation



Outcome

- Tucson's primary drinking water supply is now Colorado River Water.
- Tucson Water has banked excess CAP water for the future.
- Groundwater pumping has been curtailed (over 80 wells shut down) reducing the risk of land subsidence.
- Tucson has become one of the more drought-resistant cities in the Southwest.

Ultimately, this is a success story.

Lessons Learned

1. Consultants are your partners—not the enemy.
2. Leading edge can be the “bleeding edge.”
3. Stringent water quality goals can have severe, unintended consequences.
4. Listen to your customers.
5. Sampling customer opinion is fraught with problems. 51% is not a mandate.
6. Listen to your critics no matter how obnoxious.
7. Develop a comprehensive customer complaint database.

Lessons Learned (cont.)

8. Do the technical and public information work if you change supplies or treatment.
9. Break down management silos. If necessary, start firing and transferring people until they get the message.
10. If you are not out with your employees learning what they do and what their problems are, find another line of work.
11. If you do not take care of crumbling infrastructure, it will come back to haunt you. March on City Hall and demand funding.

An Example of Marching on City Hall



Lessons Learned (cont.)

- 12. Do not lie to your customers or policy makers. Lies will break you. Transparency matters.
- 13. Communicate with your staff, customers, and policy makers until they get tired of hearing from you.
- 14. Always give the credit to someone else.
- 15. Hire people who are smarter than you are.
- 16. Be honorable.
- 17. Be courageous and do what is right.

Lessons Learned (cont.)

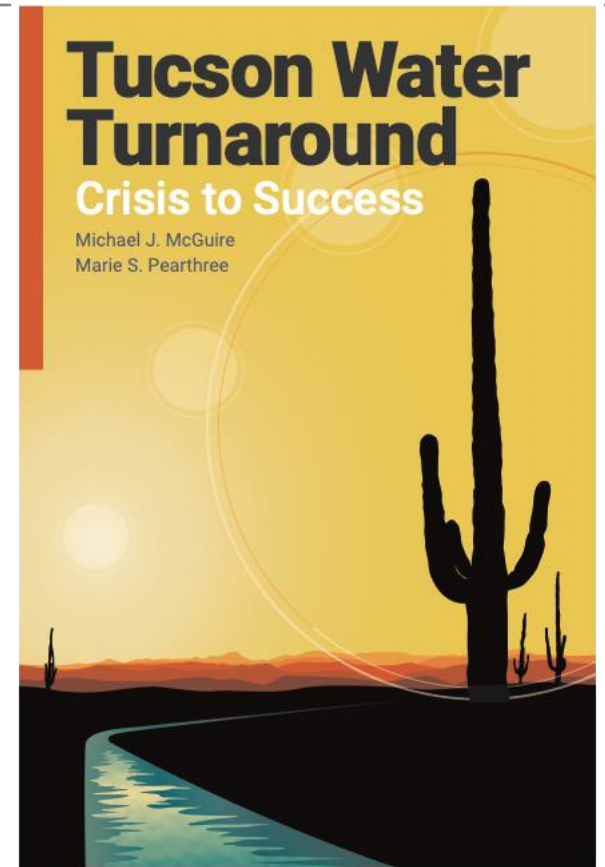
- 18. Show up at every major pipeline break or service interruption; not just for the photo op. Get into the trench. Walk the pipe.
- 19. Redundancies in water supplies and treatment processes are gifts that never stop giving.
- 20. Celebrate success.



Senior managers as
barbeque servers to
TW staff

If you want to know the whole story...

- Read our book "Tucson Water Turnaround: Crisis to Success"
- Published by AWWA
- You can get a signed copy today.



Thank you!