



2019 ANNUAL
CONFERENCE & EXHIBIT



NEWEA
WORKING FOR WATER QUALITY

January 29, 2019

SESSION 22
WATER REUSE

SAVE WATER, SAVE MONEY: THE ARCADIS WATER KAIZEN BLITZ™ PROCESS

PRESENTER

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Agenda



- Drivers for Industrial Water Sustainability
- True Cost of Water
- Water Kaizen Blitz™ Process
- Project Case Studies
- Q & A

Why Conserve?

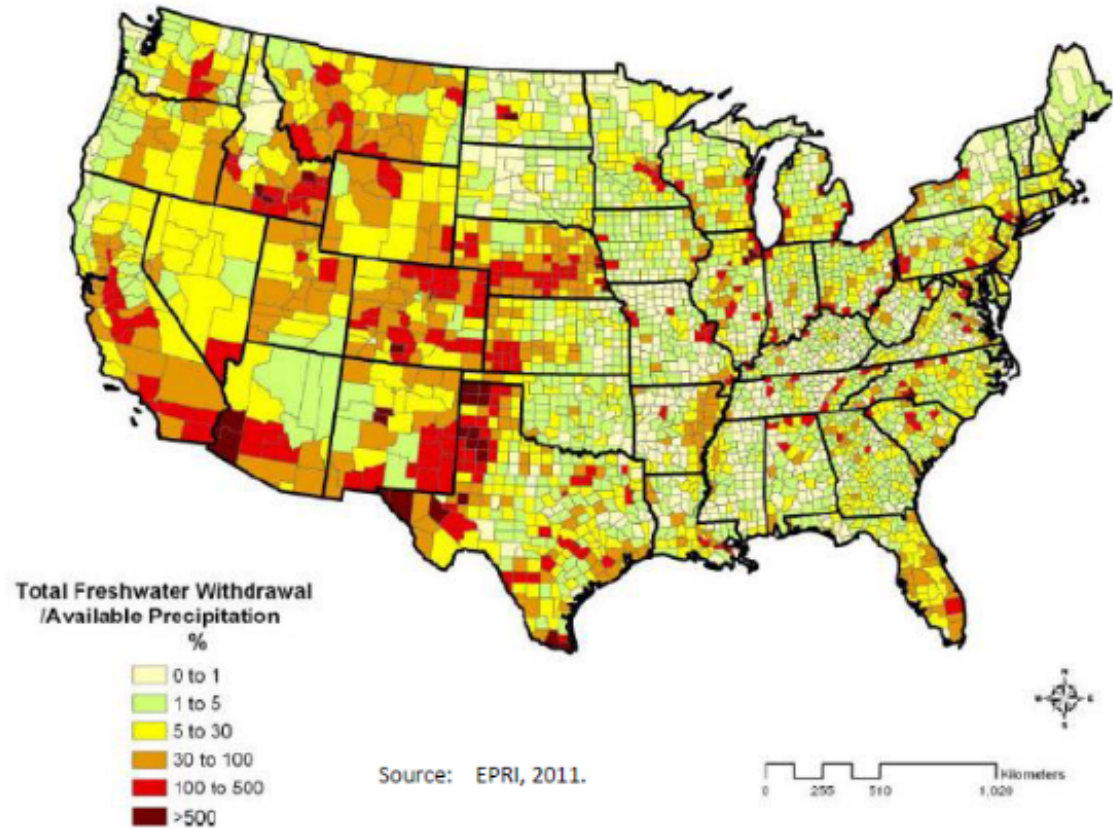
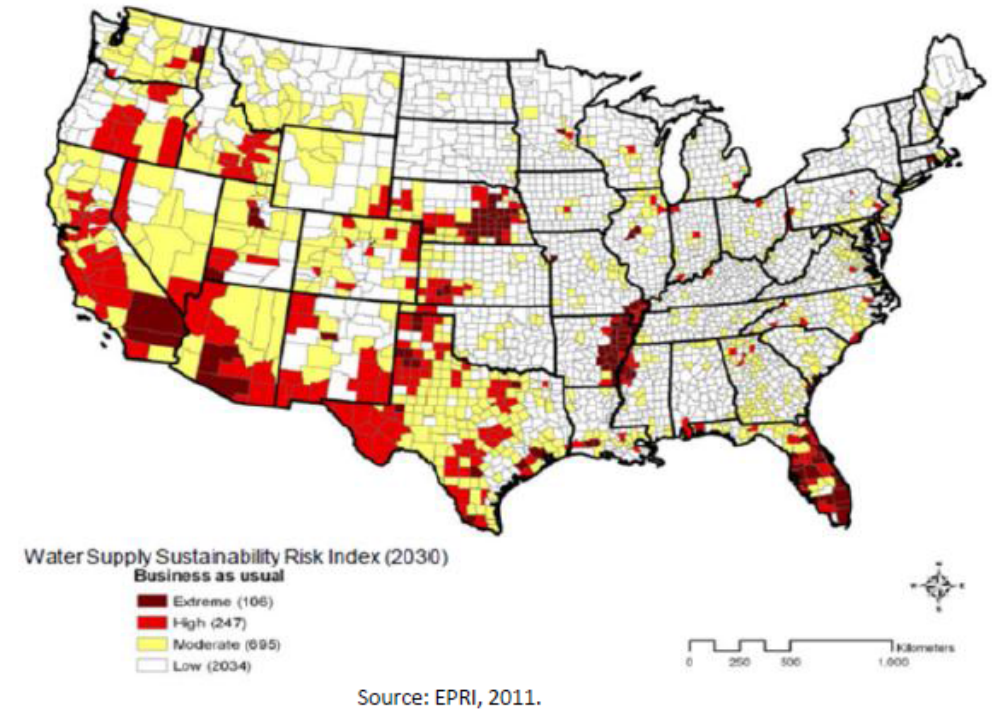


EXHIBIT 5. WATER SUPPLY SUSTAINABILITY RISK INDEX, 2030 PROJECTIONS




US water withdrawals are near or outpacing water replenishment in many areas...real or imminent water supply risk

Why Conserve?

 **WATER SHORTAGE LIMITATIONS ON CALIFORNIA'S
'NEW GOLD RUSH'**

 ENVIRONMENT
**Water crisis in Brazil: Why the largest city in the
Americas is drying out**

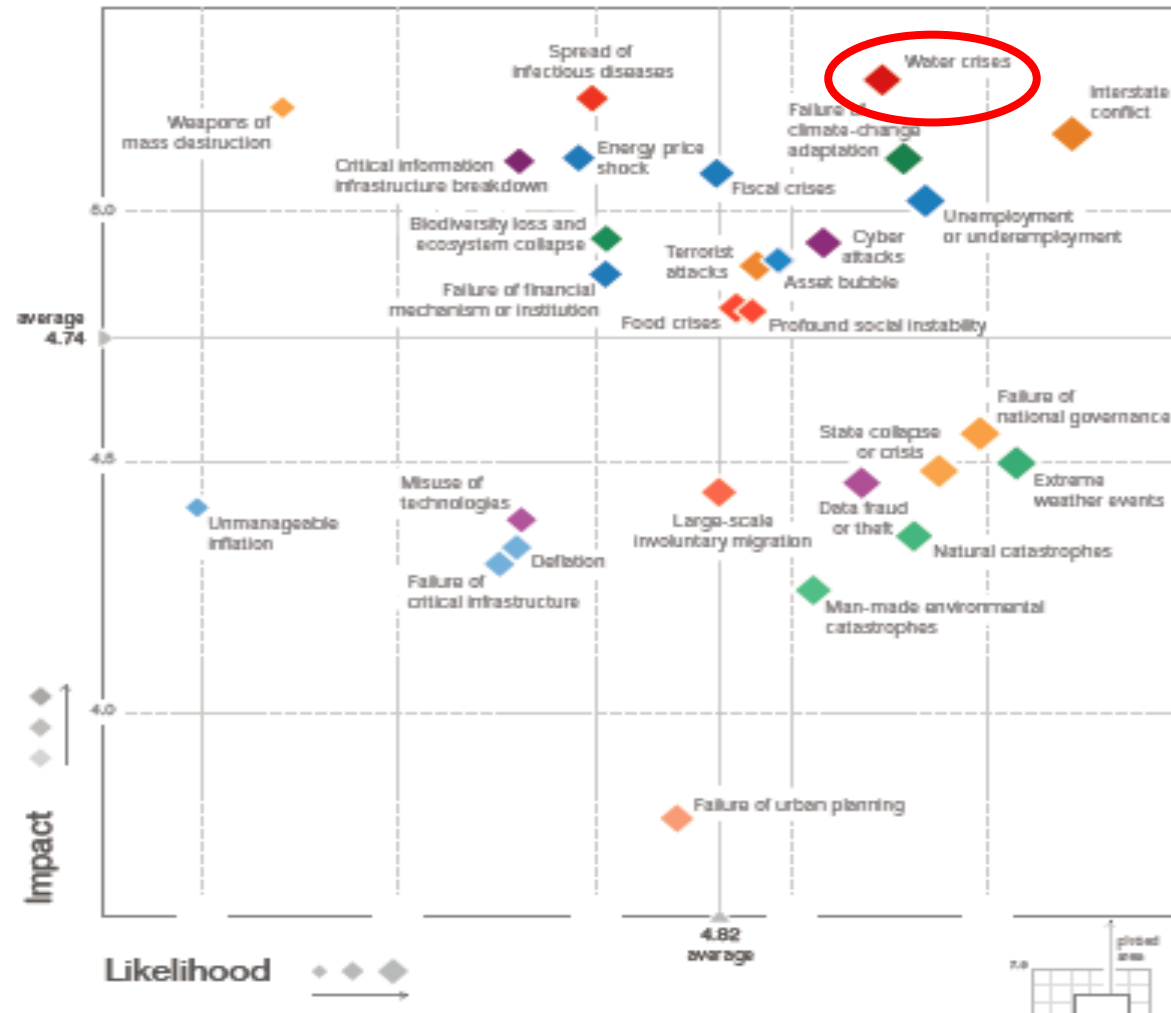
 **Water shortage looms in
2021, Manila Water warns**

 **Parched: Delhi doesn't have enough water for
its ever-growing needs**

 **No water in Maldives' capital, government
seeks help**

 **Water crisis shut down many thermal power
plants: Government**

Why Conserve?



Where is industry heading?

Business Risks and Opportunities

Sustainable Water Management = Business Value



Understanding the Water Problem

- Increased demand
- Limited supply
- More stringent regulations
- Flooding
- Drought



Defining Business Risks

- Limited access
- Raising cost
- Supply chain interruptions
- What is the value of water?



Sustainable Water is a Business Decision

- Prioritize risks
- Definition of true cost of water
- Clarity on water use and actual needs
- Improved efficiency

The Business Case – Driving Water Sustainability at the Site Level

When companies evaluate what projects to invest in, they may consider several financial metrics. *Among those often considered are:*

- Total cost of the project (i.e. CapEx)
- Net present value of the investment
- Anticipated return on investment (ROI)
- Payback period

Water use reduction projects typically have to compete with all other investments at the site.

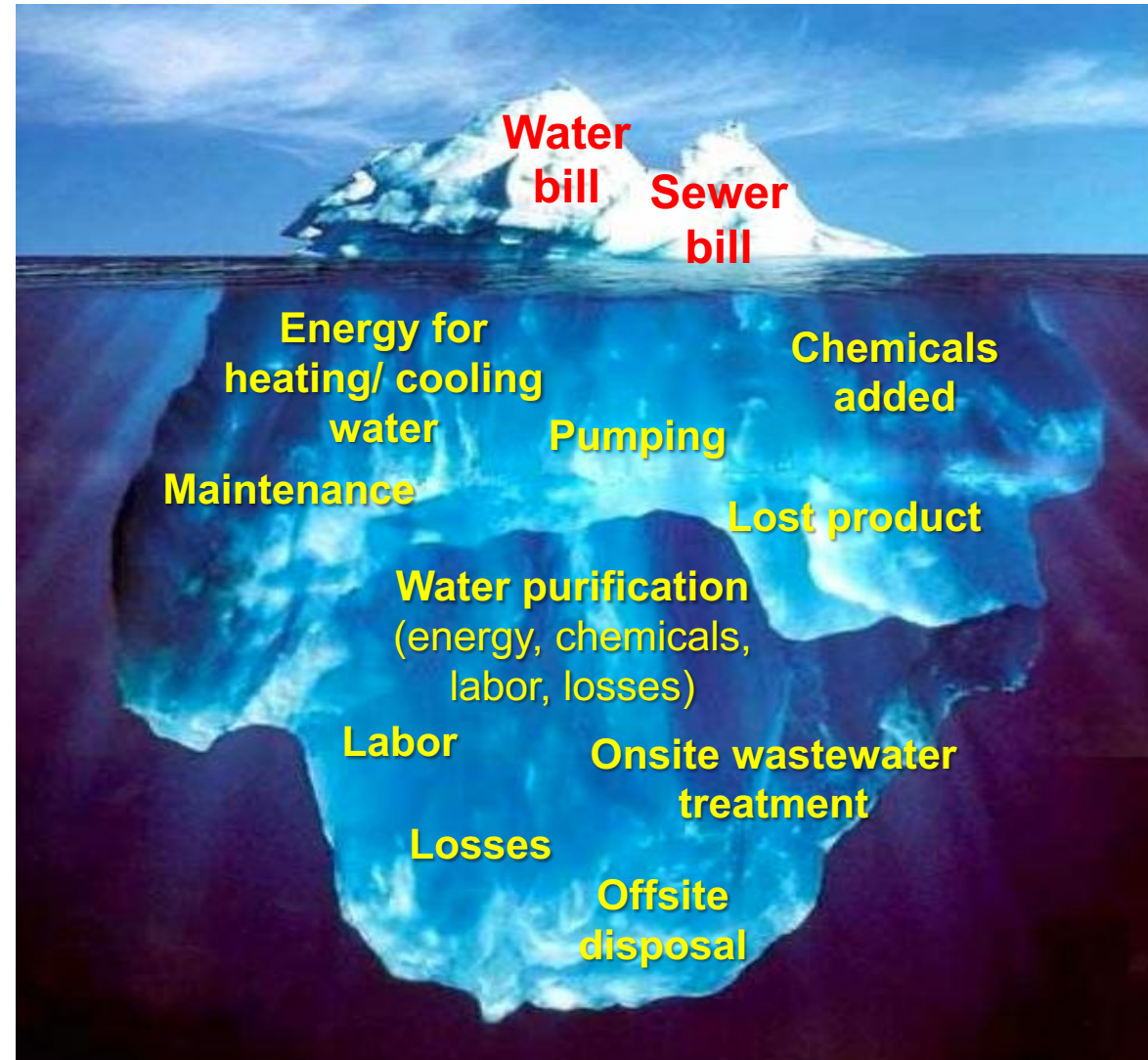
Need to focus on ROI when developing projects.

Projects should make good business sense.



It is Critical to Understand the True Cost of Water!

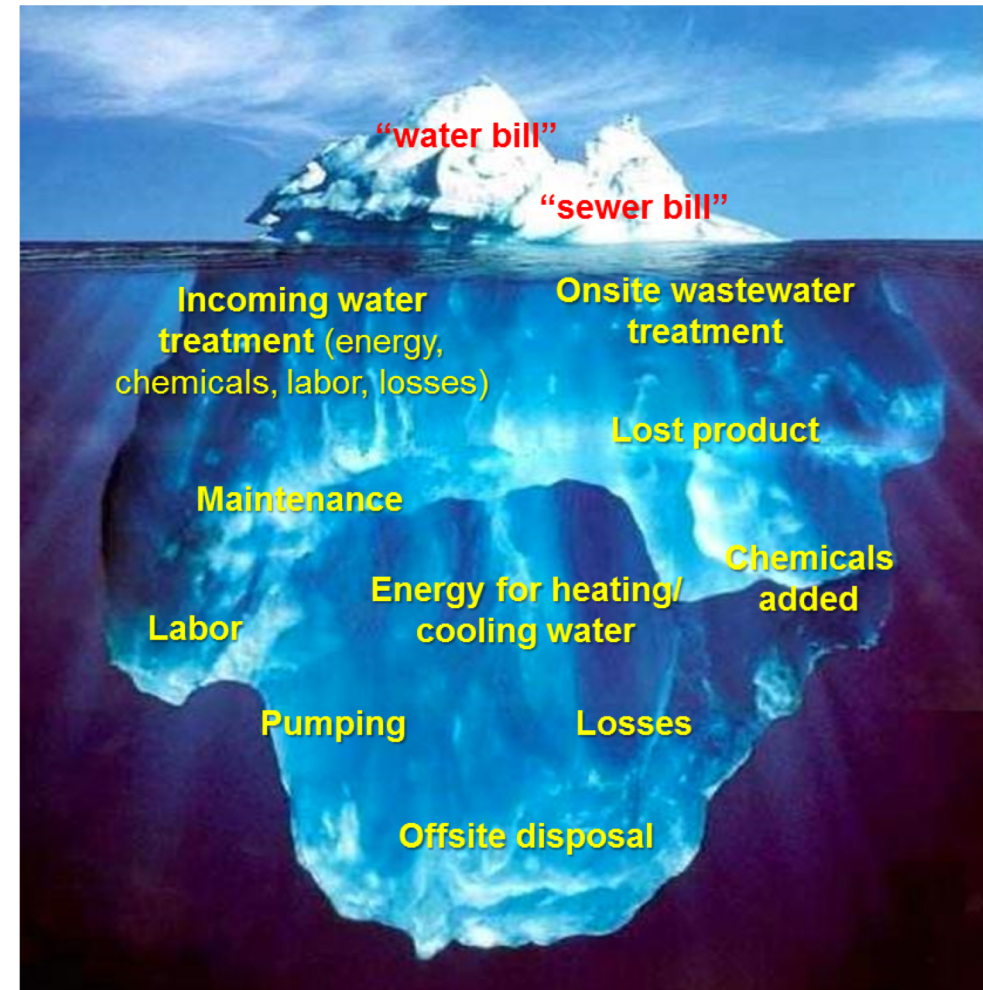
- General perception that “water is cheap”
- True cost of water use generally much higher than people realize



Consider full industrial water cycle to ensure all aspects of water cost are included...

Example: 1 million gallon savings/yr

- Water-using process (e.g. rinsing operation or parts washer)
 - Deionized/RO water
 - Elevated temperature (120°F)
- Onsite WWTP
- Site has idea that would reduce this water usage by 1 MG per year, but costs \$30,000 to implement
- To get approval, ROI must be ≤ 2 years.



Example (cont'd) – Perceived Cost

City water cost at
\$3.75 / 1000 gallons =

Sewer cost at
\$3.79 / 1000 gallons =

Total Savings = \$7,540.00



$$\text{Perceived Cost ROI} = \frac{\$30,000}{\$7,540} \approx 4 \text{ years}$$

Example (cont'd) – True Cost

City water cost at
\$3.75 / 1000 gallons =

Sewer cost at
\$3.79 / 1000 gallons =

De-ionizing/RO at
\$1.25 / 1000 gallons =

Heating water at
\$3.50 / 1000 gallons =

Onsite WWT at
\$5.90 / 1000 gallons =

Total Savings = \$18,190



True Cost ROI =

$$\frac{\$30,000}{\$18,190} \approx 1.6 \text{ years}$$

Arcadis Water Kaizen Blitz™ Process

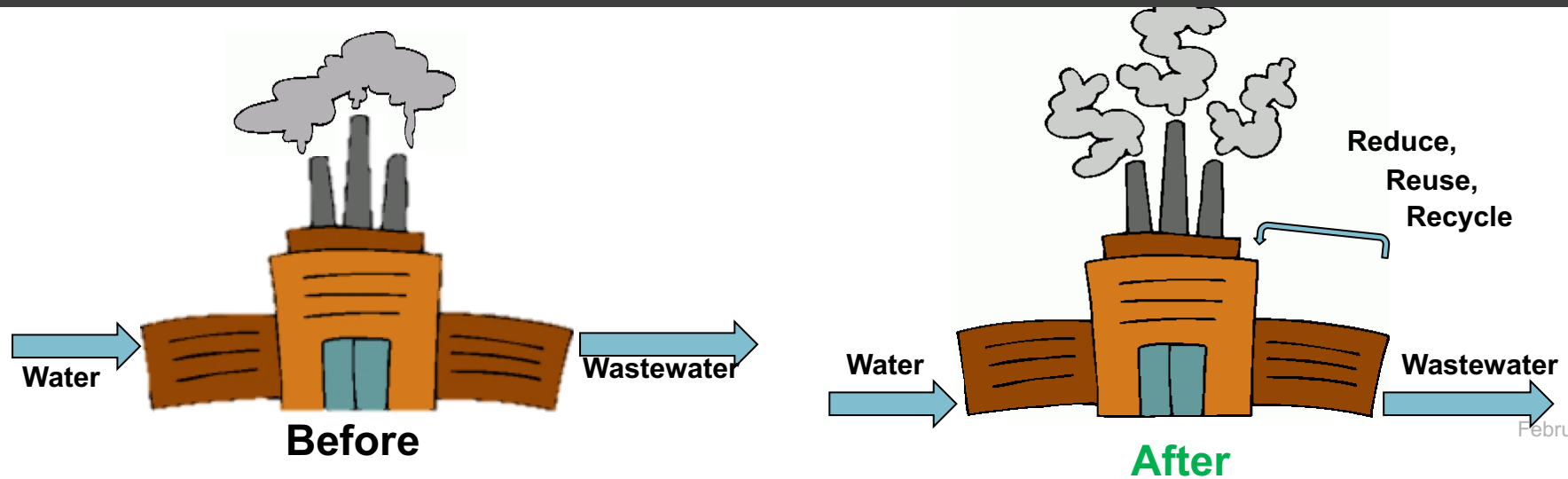
Water Kaizen Blitz™

Lean manufacturing (or *Lean*) is a systematic method for the elimination of waste within a manufacturing system.

Based on the premise that as waste is eliminated, quality improves while production time and cost are reduced.

Kaizen, 改善 (*Japanese for “improvement”*). When used in the business sense and applied to the workplace, kaizen refers to activities that continuously improve all functions and involve all employees from plant leadership to the plant operators.

A “Water Kaizen Blitz” applies the principles of lean manufacturing to minimize water use (or water wastage) throughout a manufacturing or operating facility.

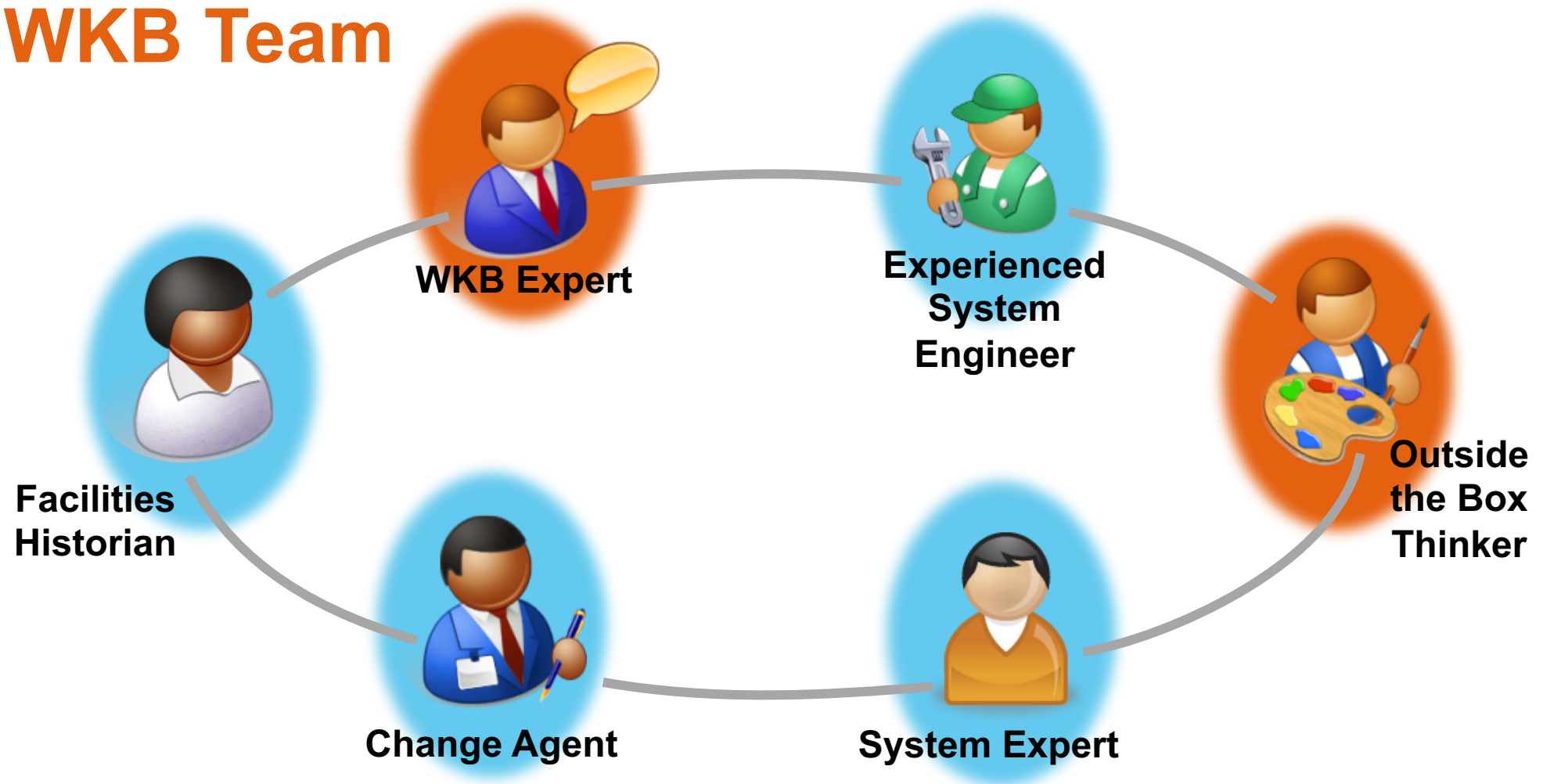


Water Kaizen Blitz™ (WKB) Process

- Systematic, LEAN Six Sigma process
- Developed by industry for industry
- Team-based
- Focused on water-using processes within an industrial site
- Identifies water savings opportunities with attractive cost-benefit ratio



The WKB Team



*The WKB team includes participants from the **client site** as well as **Arcadis** experts.*

Roadmap to Efficient Water Management

1. REDUCE

- Can we reduce flowrate or duration of flow to a unit?
- Can we reduce the amount of wastewater generated by process?

“Right-size water use for current operation”

2. REUSE

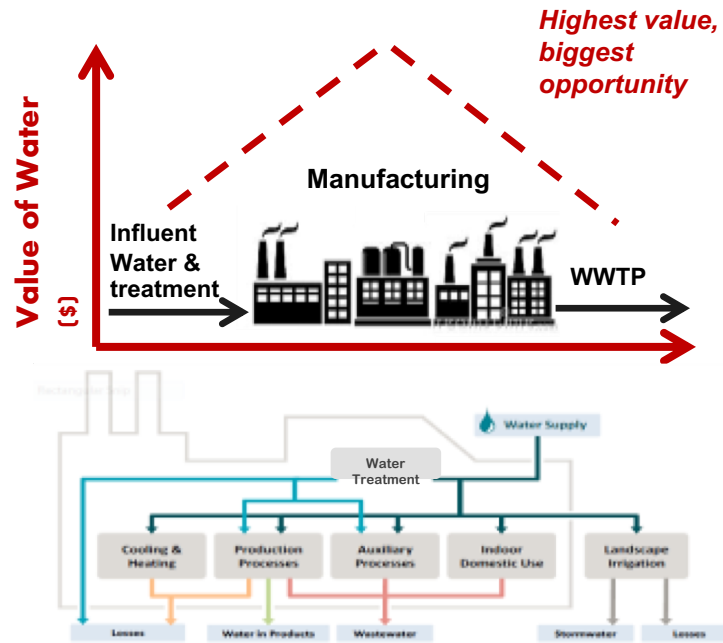
- Can we use the effluent from process ‘A’ as the influent for process ‘B’?

“One man’s waste is another man’s treasure”

3. RECYCLE

- Can we treat effluent from 1 or more processes to make it acceptable for re-use?

What Can be Achieved?



Lower Production Costs



Business Continuity Assurance



Positive Environmental Fingerprint

Improved Water Efficiency = Improved Business Efficiency

Industrial Case Studies

Results We Have Achieved

Production Facility WKB Outcomes: 2016-2017



SUMMARY OF RESULTS FOR ARCADIS WATER KAIZEN EVENTS

Site Location	Type of Site	ROI Cutoff	Percent water reduction	Annual water savings (m3/yr)	Annual OpEx savings (\$/yr)	Estimated CapEx to implement	15-yr Savings to the Business
OH, USA	Automotive (engine)	< 2 yrs	20%	30,919	\$ 774,400	\$ 951,600	\$ 11,616,000
MO, USA	Auto (assembly)	< 2 yrs	47%	616,459	\$ 1,608,094	\$ 383,866	\$ 24,121,410
CT, USA	Aerospace	< 3 yrs	24%	6,000	\$ 40,000	\$ 72,000	\$ 600,000
TX, USA	Chemical	< 2 yrs	17%	791,157	\$ 3,197,000	\$ 760,000	\$ 47,955,000
WA, USA	F&B (apple Juice)	< 2.5 yrs	56%	392,247	\$ 798,788	\$ 921,572	\$ 11,981,820
KY, USA	Detergent	< 2 yrs	18%	144,225	\$ 2,386,464	\$ 189,110	\$ 35,796,960
Ireland	Pharmaceutical	< 3 yrs	8%	8,695	\$ 167,215	\$ 188,977	\$ 2,508,225
Saltillo, MX	Automotive	< 2 yrs	35%	346,398	\$ 649,400	\$ 704,400	\$ 9,741,000
Sum				2,336,102	9,621,361	4,171,525	\$ 144,320,415

Fortune 100 Company

- **Goal:** 25% reduction in fresh water consumption by 2015 (vs. '06 baseline)
- Sites were not required to implement water reduction projects
- Any water saving projects had to compete head-to-head with other site investments (e.g., productivity improvements)

Approach: Leverage WKB process to identify cost-saving solutions for saving water



The Result

- By 2013, we had significantly exceeded the goal, reducing company water use by 46% (vs. target of 25% by 2015)
- A large portion of this reduction was from implementation of projects identified during WKB events
- Through 18-20 WKB events, we identified >\$12MM worth of annual cost savings opportunities with <2yr ROI (ROI cutoff target)

“On average, Kaizen events provide sites with an opportunity to reduce water usage by 30% to 50%, with less than two years’ payback” –
2014 Sustainability Report



Opportunities Identified During WKB at GM Wentzville, MO

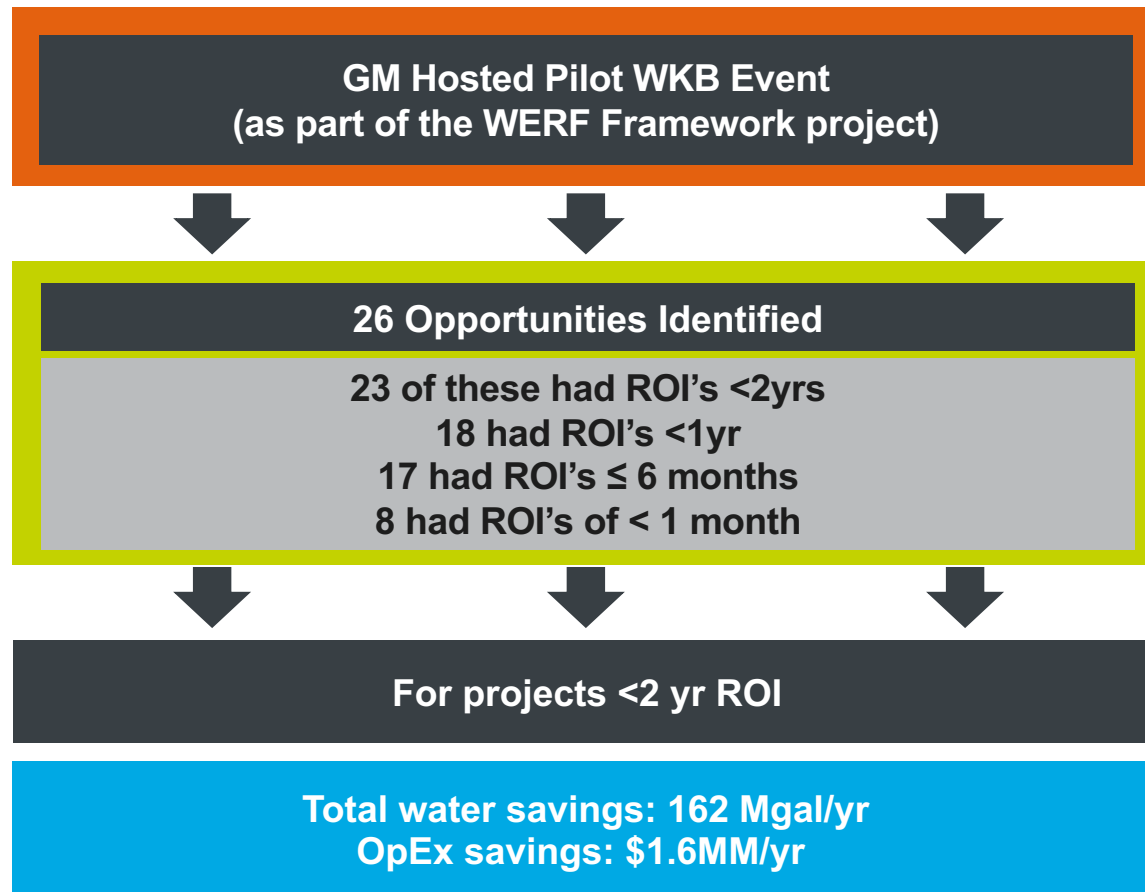


Table 3.3. Opportunities Identified by Water Kaizen Blitz at the GM Wentzville, MO Facility

Recommendation	Savings (MGal/year)	Cost to Implement	Total Annual Cost Savings	Estimated Years to Achieve 100% Payback
Reduce Flow to Seal Flush Phosphate Recirculation Pump	1.3	\$0	\$12K	0
Shut off Manual Makeup Valve to Seal Flush (Near Phos Stages 3 & 4 in Paint Shop)	13.5	\$0	\$135K	0
Add Oil Absorbing Bag Filters (Phos Stages 1 & 2 Bag Filter Units)	2.4	\$0	\$149K	0
Improve Spray Booth Solvent Purge Recovery	0.0	\$0	\$58K	0
Water Running in Unoccupied and Inactive Can Weld Area	21.0	\$140	\$194K	0
Reduce RO Make-up Rate Stage 3	6.7	\$78-	\$67K	0.01
Adjust Level Setpoint in Stage 8B (Reduce Makeup and Reinitiate Collection System Recycle to Stage 6)	16	\$1120	\$160K	0.01
Use Stage 8A to Supply All Makeup Water to Stage 6	3.8	\$850	\$37K	0.02
Discontinue Use of Eye Wash for Foam Control (Utilize chemical agent for foam control and return eye wash station for safety purposes only.	1.0	\$1620	\$9K	0.18
Replace Damaged Bag Filter Drain Valves	2.0	\$4060	\$20K	0.2
Improvements to the Van Weld Closed Loop and Cooling Tower Loop	0.04	\$65	-\$1K	0.2
Steam Losses at Condensate Return System in the Tank Farm (Repair remaining steam traps within the facility to eliminate steam in the condensate return lines.	20.1	\$60,000	\$256K	0.23
Replace City Water Feed at the WWTP (Substitute city water with WWTP effluent for flocculent breakdown at the clarifier tanks and chemical mixing.				
Reuse Munsters Media Discharge in Sludge Pit	23.4	\$62,400	\$215K	0.29
Reduction in Pump Seal Flush at the Powhouse	0.7	\$2,151	\$6K	0.34
Replace Blowdown Valve on Spray Humidification	1.0	\$3390	\$9K	0.36
Install Sprayer with Timer at ELPO Exit Filters and Stop Use of Shower	0.4	\$1260	\$3K	0.38
Reuse Artesian Well Water for Makeup to Powhouse Cooling Towers	54	\$155,000	\$300K	0.52
Repair Stage 5 Condensate Return Receiver (New control valve will route condensate to the return line. Steam condensate is currently being diverted to drain.	3.2	\$50,000	\$59K	0.83
Reuse Stage 8A discharge in Seal Flush at Phosphate Stages 1, 2, & 3	0.6	\$5980	\$6K	1.04
Reuse Artesian Well Water for Sludge Pit Makeup	12.8	\$75,000	\$71K	1.05
Reuse RO Reject to Augment Cooling Tower Makeup (Reduce city water makeup with a 50/50 blend of RO reject and City Water	5.1	\$50,000	\$30K	1.67
Recycle Phosphate Tank Sanitizing Solution to the Sludge Pit	1.3	\$27,450	\$16K	1.68

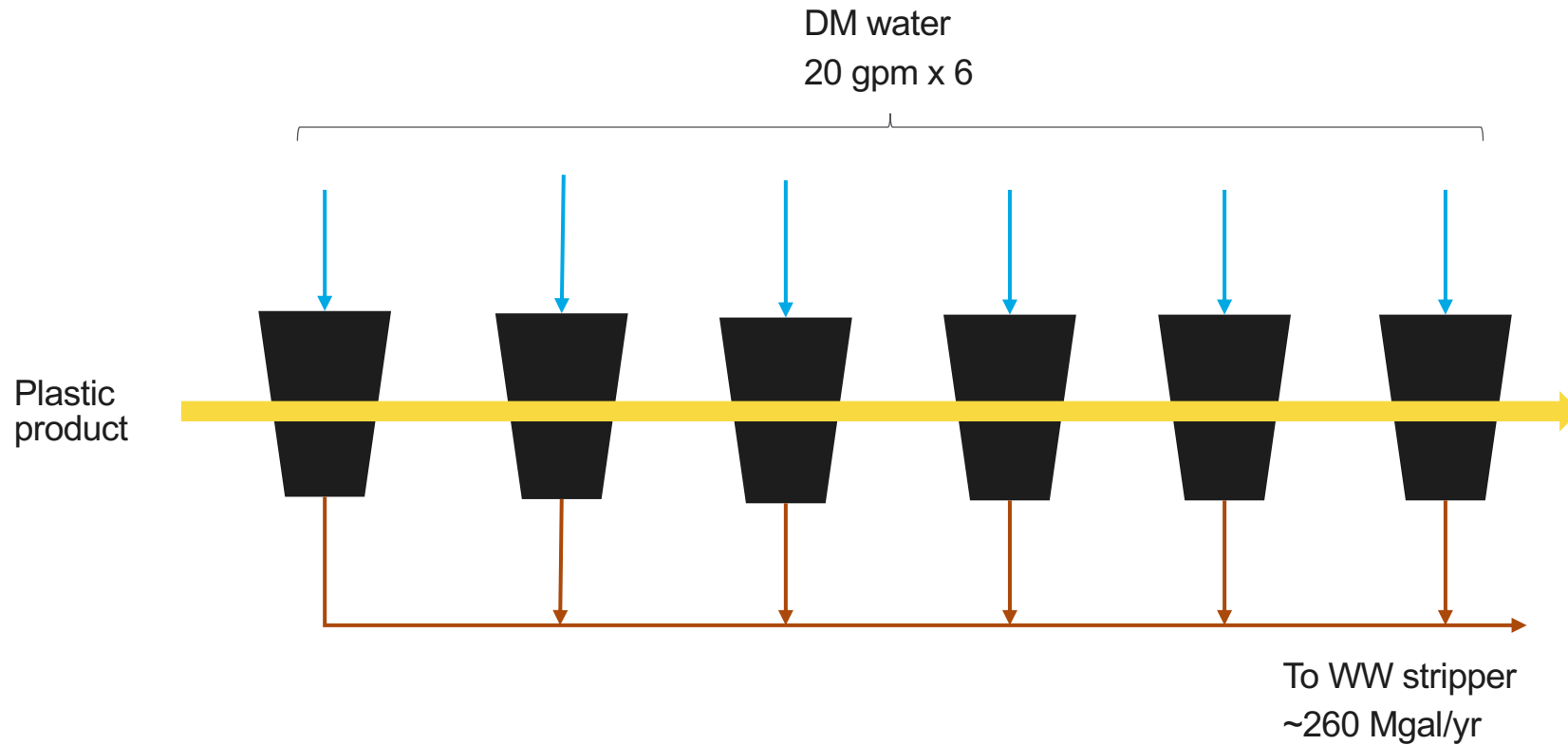
Automotive Campus

- Highly water stressed region
- Potential water rights challenge - Projected future needs exceed water rights authorized
- August 2017 – Arcadis executed a WKB to identify water conservation opportunities at the complex
- Interrelation between many of the opportunities identified—
 - Executing one kaizen may reduce water savings potential associated with one or more other kaizens, so...
 - Important to look at water conservation projects holistically to ensure water savings not overestimated and to correctly value project benefits
- Projects prioritized based on payback period, complexity, and benefit
- Project execution has been conceptualized through 3 phases

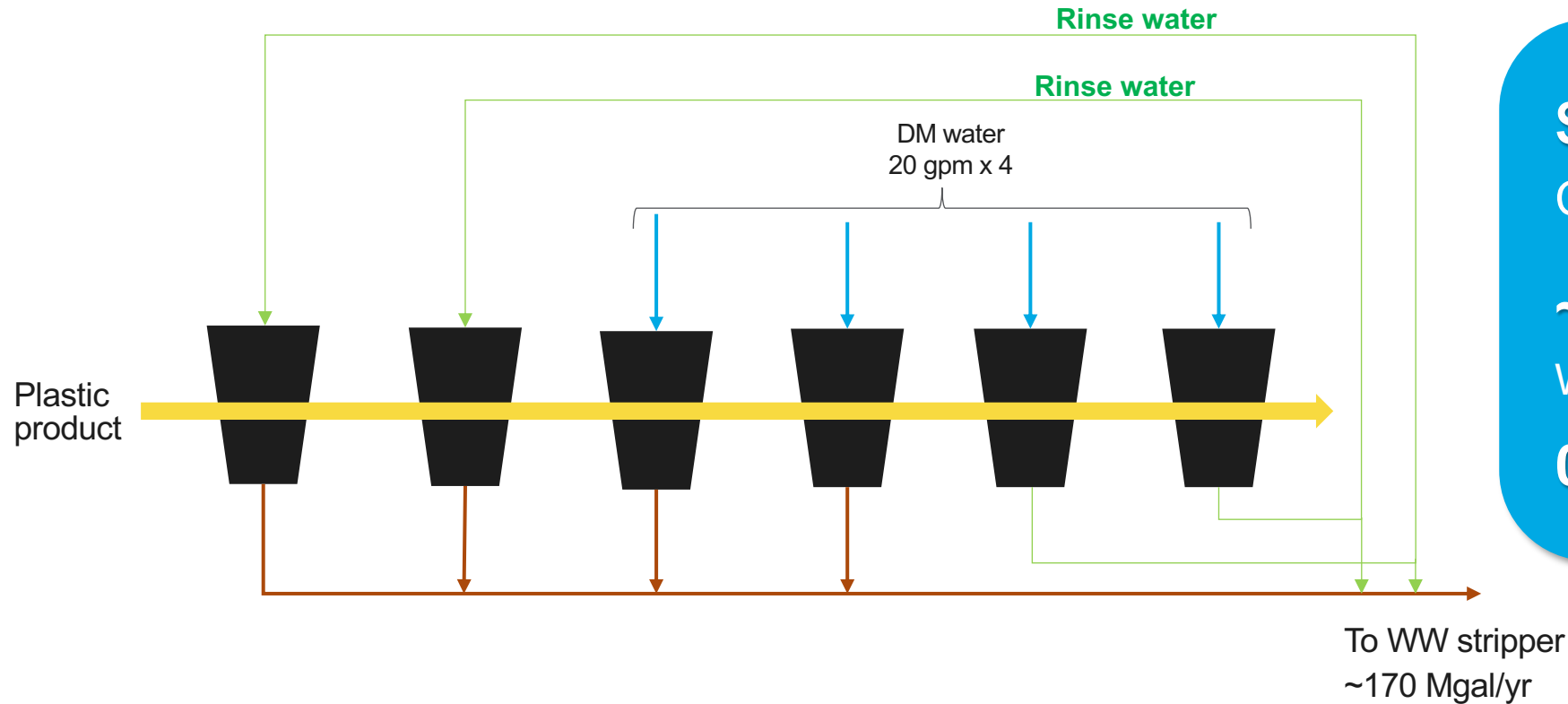
Projected water savings of almost 30%, saving 60 MG/yr and \$0.5MM/yr

After Phase:	Cumulative Water Savings (m ³ /yr)	Cumulative Water Savings (MG/yr)	% Water use Reduction for Saltillo Site*	Cumulative CapEx (USD)	Cumulative OpEx Savings (USD)	Cumulative ROI (yr)
Phase 0: AP1	44,700	12	6%	\$2,400	\$68,000	0.04
Phase 1: AP2	119,900	32	16%	\$9,500	\$204,500	0.05
Phase 1: AP1	144,300	38	19%	\$146,000	\$344,200	0.42
Phase 2: AP2	157,500	42	20%	\$231,800	\$372,500	0.62
Phase 2: AP1	207,200	55	27%	\$580,500	\$487,900	1.19
Phase 3: AP2	211,000	56	27%	\$603,700	\$495,700	1.22
Phase 3: AP1	226,900	60	29%	\$704,400	\$529,000	1.33

Ex. Kaizen: Centrifuge Wash - *Before*



Ex. Kaizen: Centrifuge Wash - *After*



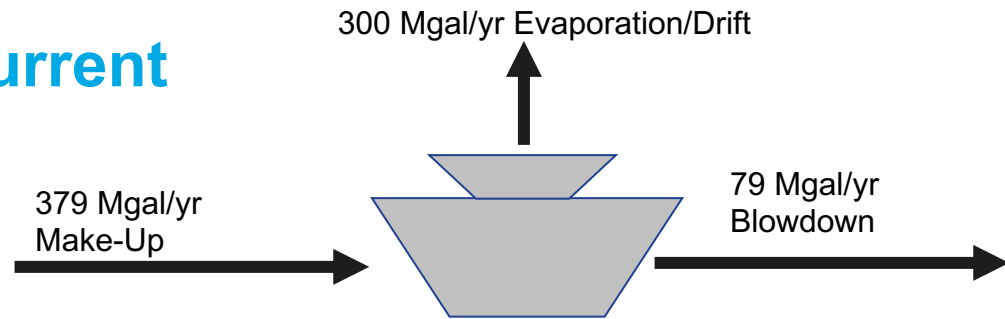
\$1.13MM
 Cost savings per year

~ 89 Mgal
 Water savings per year

0.07 yr ROI

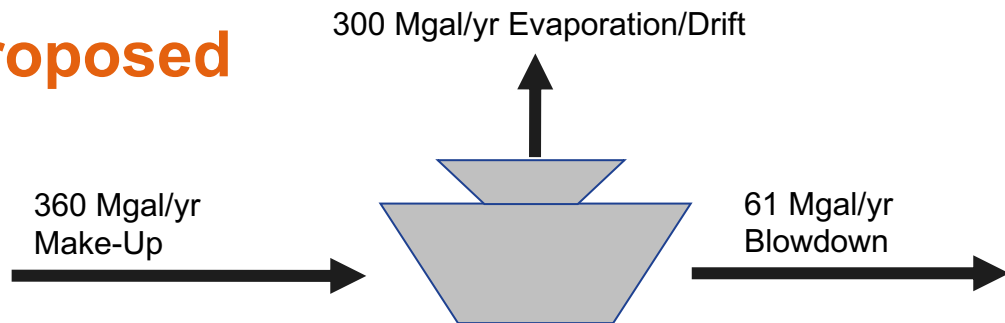
Ex. Kaizen: Standardize Cooling Tower Operation

Current



- Currently operating tower to blowdown at 1850 uS/cm
- Upper control limit is 2400 uS/cm
- Chemical cleaning of equipment every 6 to 8 years

Proposed



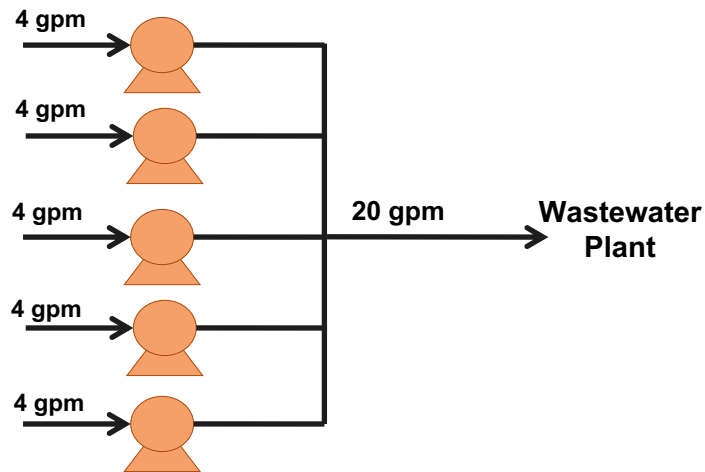
- Per discussions with cooling tower chemical provider, tower could be run at 2400 uS using proper treatment chemistry

NOTE: If any cooling water users are currently experiencing scaling issues and have concern over increasing cycles, alternate cooling tower chemistries are available to provide increased scale prevention

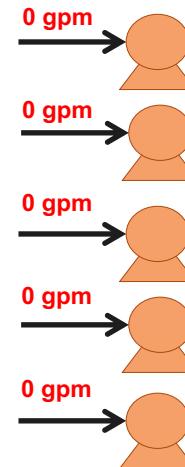
\$76K Cost savings per year	~ 19 Mgal (3 days worth of water for site) Water savings per year	0.4 yr ROI (cost of chemistry modification not evaluated)
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Ex. Kaizen: Retrofit Vacuum Pumps to Oil Rings

Before: Water sealed



After: Oil sealed



This modification will also improve vacuum efficiency; benefit to manufacturing

<p>\$106K Cost savings per year</p>	<p>10 Mgal Water savings per year</p>	<p>2.6 yr ROI</p>
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Continued Reduction in Water Use at Ford Motor Co: Chennai, India

Manufacturing operations at Site water efficient, use reclaimed water, but...

Hand washing largest fresh water consumer at Site: 32Mgal/yr (~50% of Site's freshwater usage)

~300 taps around site:

- Many manual - largely in need of repair / replacement
- Automatic taps use ~0.7 gal/cycle, vs. 0.2gal/cycle for CA Green Bldg Code

Employees use on average 2+ cycles per hand wash due to hot climate → part of water used for splashing on their bodies to cool off



Continued Reduction in Water Use at Ford Motor Co: Chennai, India *(cont'd)*

Step 1: Replace current taps with high water efficiency automatic taps



Step 2: Install misting fans at high traffic and heavy hand washing areas to cool employees
→ eliminate body splashing practice



\$155K

Annual savings

25 Mgal

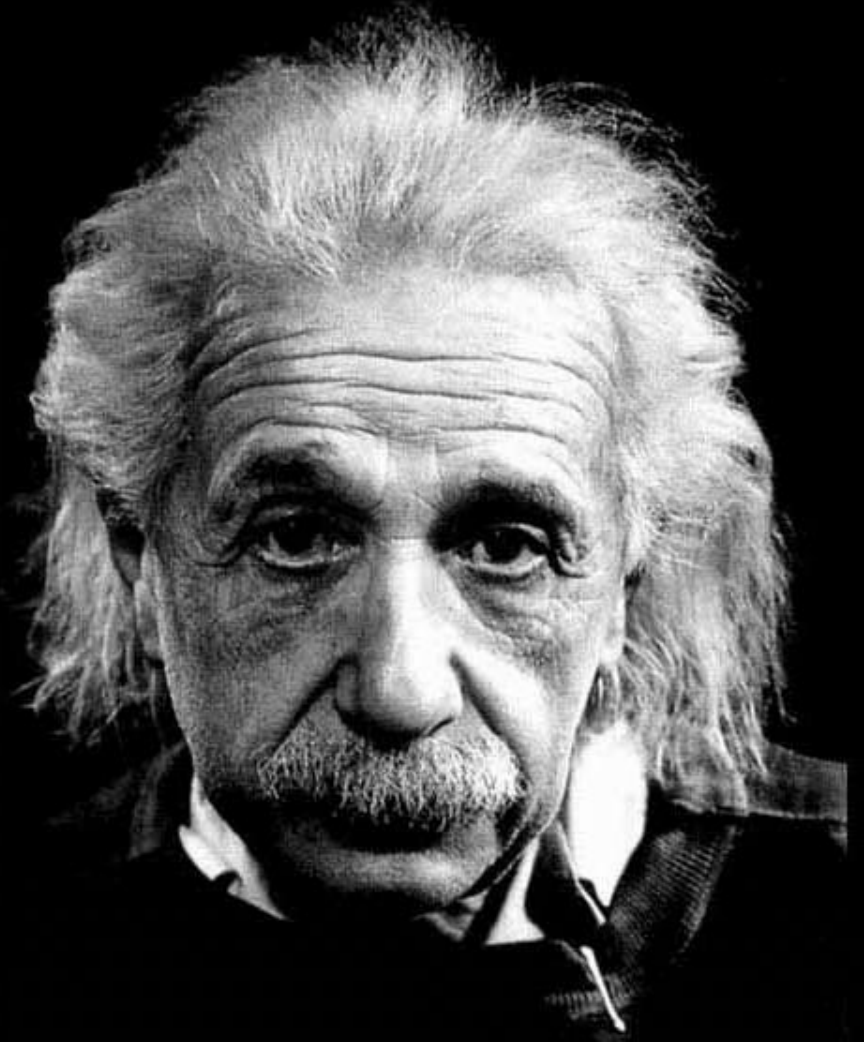
Water savings per year
→ 38% site freshwater use reduction

2.6 yr ROI

“Everything should be made
as simple as possible,
but not simpler.”

Albert Einstein

Questions?





Contact Information



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