Department of Public Utilities

Enterprise Asset Management

August 26, 2010
Kevin Campanella,
DPU Assistant Director
and Asset Manager

Ohio Water Environment Association
Preserving & Enhancing Ohio's Water Environment

Webinar on Asset Management
(Part 2 of 3)

Water Environment Federation
the water quality people®

Columbus DPU – Customers and Assets

Department of Public Utilities

DOSD
Division of Sewerage and Drainage

DOPW
Division of Power and Water

Serve over 1 million customers with sewer, water

- 2 WWTPs, 480 MGD total
- 6,000 miles of sewers and storm drains

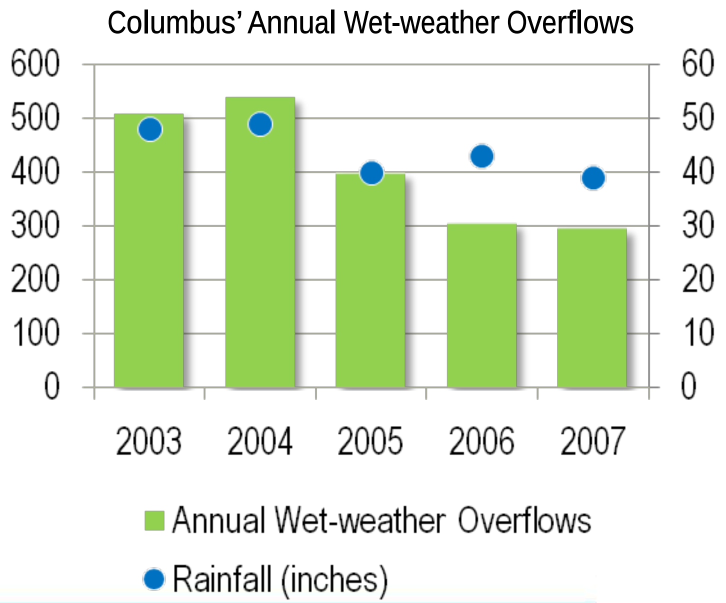
- 3 WTPs, 240 MGD total
- 3,700 miles of water mains

Serve 13,000 electric customers

- 370 circuit miles (distribution)
- 1,330 street light miles
- 55,000 street lights

Drivers for Comprehensive AM Implementation

- DOSD: SSO Consent Order (2002) based on draft CMOM language
- AM approach used to address CMOM requirements
- AM approach brought structure and results
  - Preventive maintenance cleaning
  - Predictive maintenance CCTV
  - Large sewer condition assessment
  - Revamped FOG program
  - Performance tracking

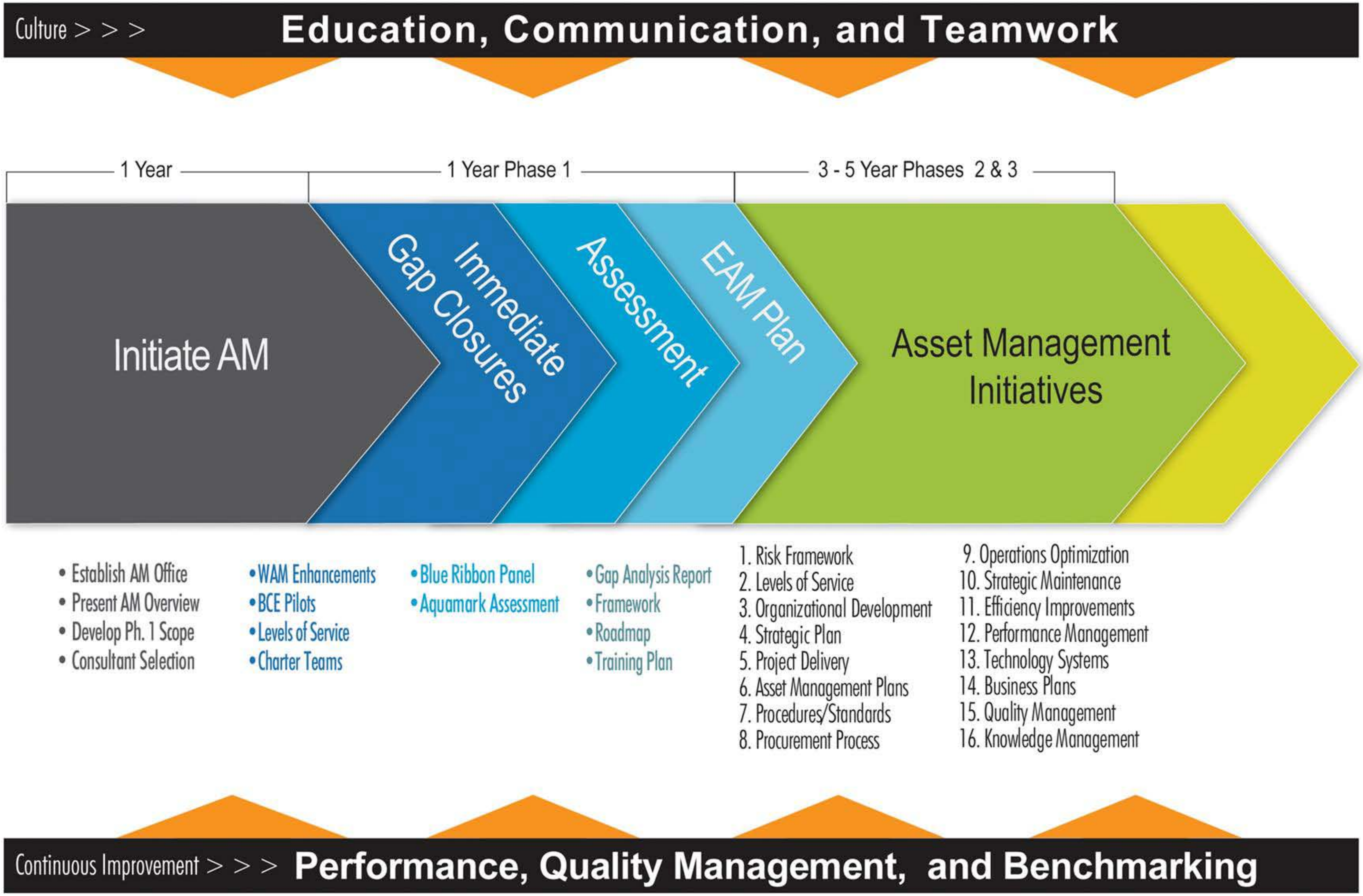


Agenda for Presentation

- Columbus' Asset Management Foundation
- Levels of Service, Strategic Planning and Performance Management
- Risk
- Applications of Risk:
  - Condition Assessment Planning
  - Replacement Planning
  - Business Case Evaluations
- Benefits / Results
- Q&A

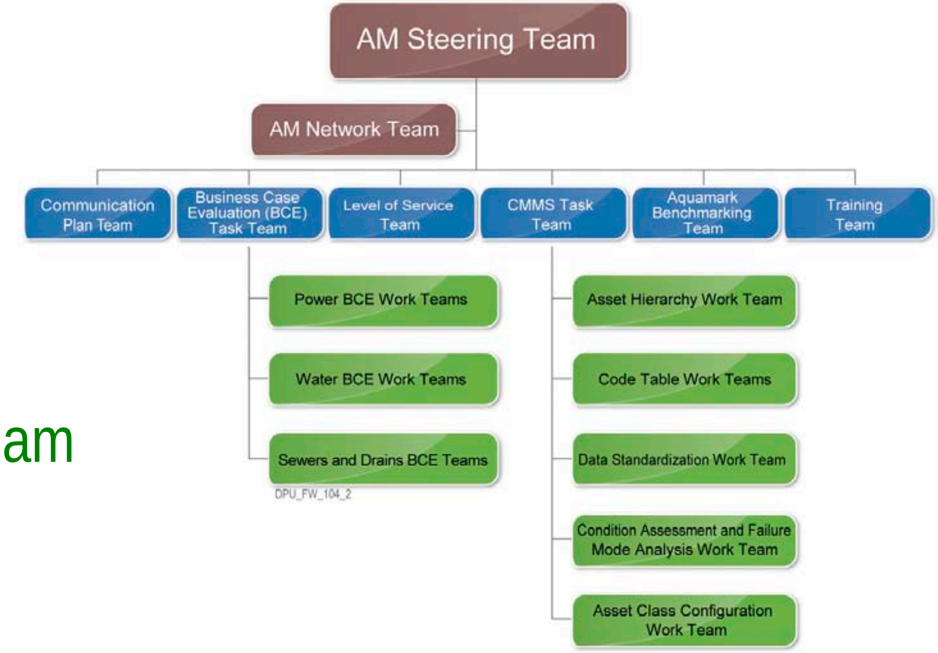
Columbus DPU's
AM Program Foundation

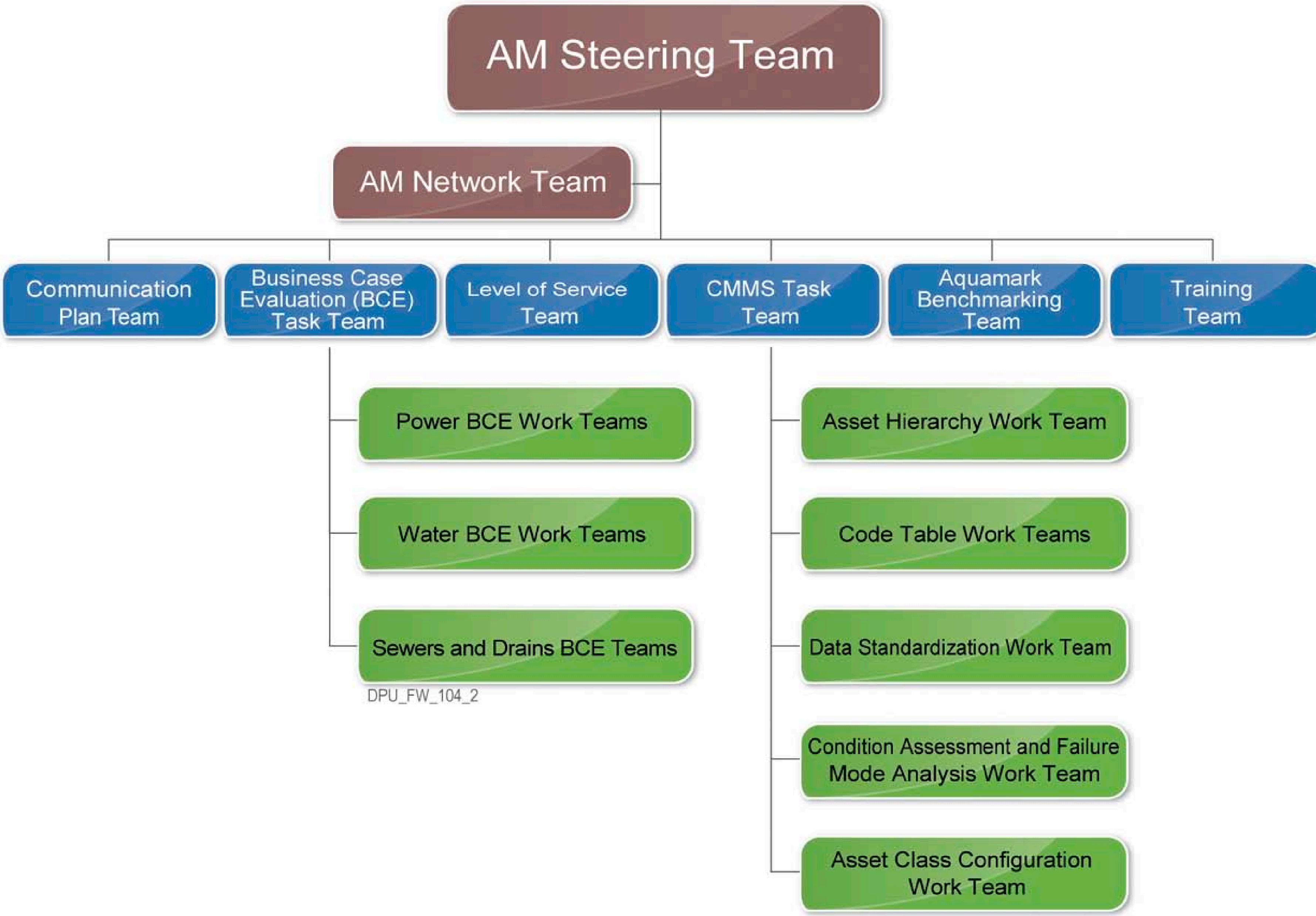
DPU's EAM Journey



Phase 1 Work

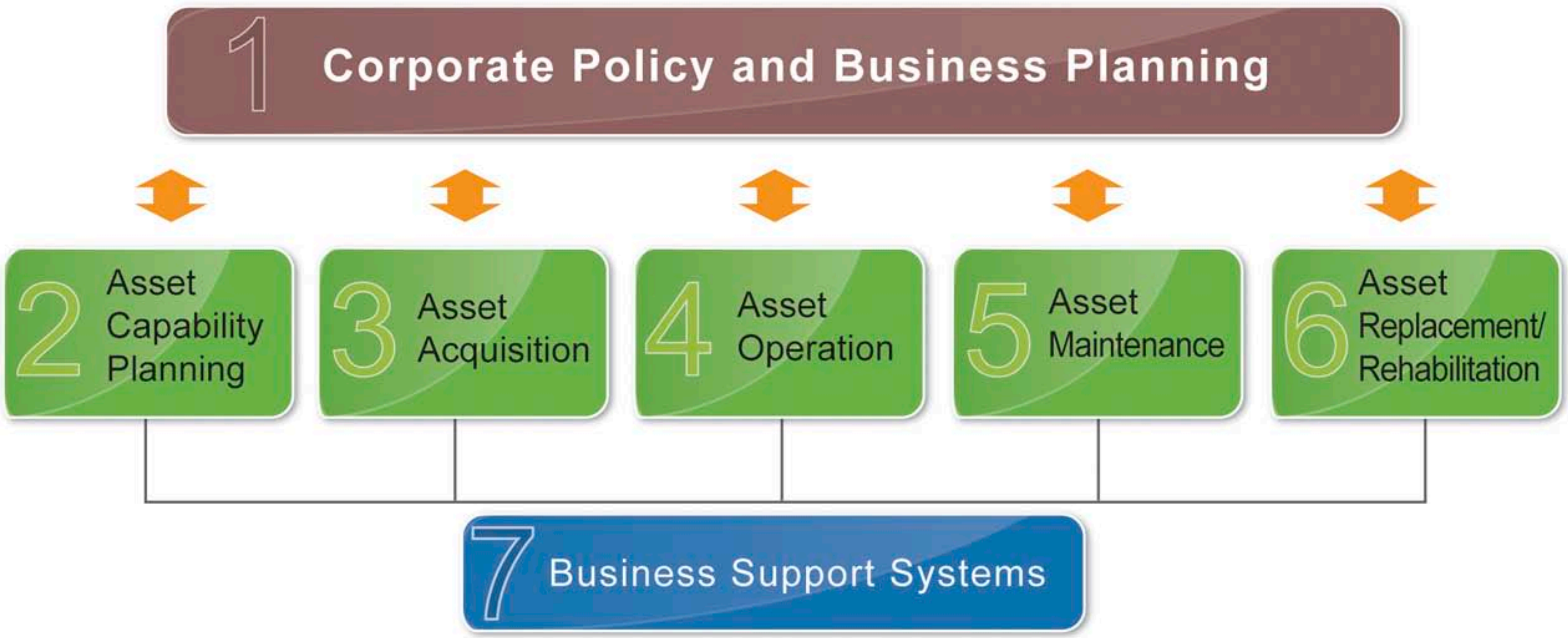
- Focus on Early Gains to Build General Understanding and Confidence
- Team-based Learning & Growth
  - Steering Team
  - BCE Teams
  - LOS Team
  - WAM Enhancement Teams
  - Implementation/Network Team
  - Communication Plan Team
  - Benchmarking Teams




AM Steering Team
AM Network Team
Communication Plan Team
Business Case Evaluation (BCE) Task Team
Level of Service Team
CMMS Task Team
Aquamark Benchmarking Team
Training Team
Power BCE Work Teams
Water BCE Work Teams
Sewers and Drains BCE Teams
Asset Hierarchy Work Team
Code Table Work Teams
Data Standardization Work Team
Condition Assessment and Failure Mode Analysis Work Team
Asset Class Configuration Work Team
DPU_FW_104_2

"Blue Ribbon Panel"

AquaMark
Benchmarking "Functions"



Benchmarking Team

Participants

Function 1 **Corporate Policy and Business Planning**	Gary Kohli, Susan Wilson, Steve Salay, Jeff Holmes, Dax Blake, Rick Westerfield, Kevin Campanella, Dominic "Dan" Hanket, Joyce Bushman, Herb Johanson, Craig Charleston
Function 2 **Asset Capability Planning**	Jeff Hubbard, Mark Wade, Jeff Robertson, John Satala, Robert Schneider, James Gross, Steve Salay, Lynn Kelly, Joe Clouse, Dax Blake, David Kanning, Dwayne Maynard, Duffy McSweeney, Kevin Campanella
Function 3 **Asset Acquisition**	Robert Schneider, Chris Vogel, Steve Salay, Jeff Hubbard, Mike McCloud, Robert Herr, Herb Johanson, James Gross, Keith Gilbert, John Newsome, Danella Pettenski, Ron Christian, Lynn Kelly, Miriam Siegfried, Brian Haemmerle, Kevin Campanella, Duffy McSweeney

Benchmarking Team, cont’d

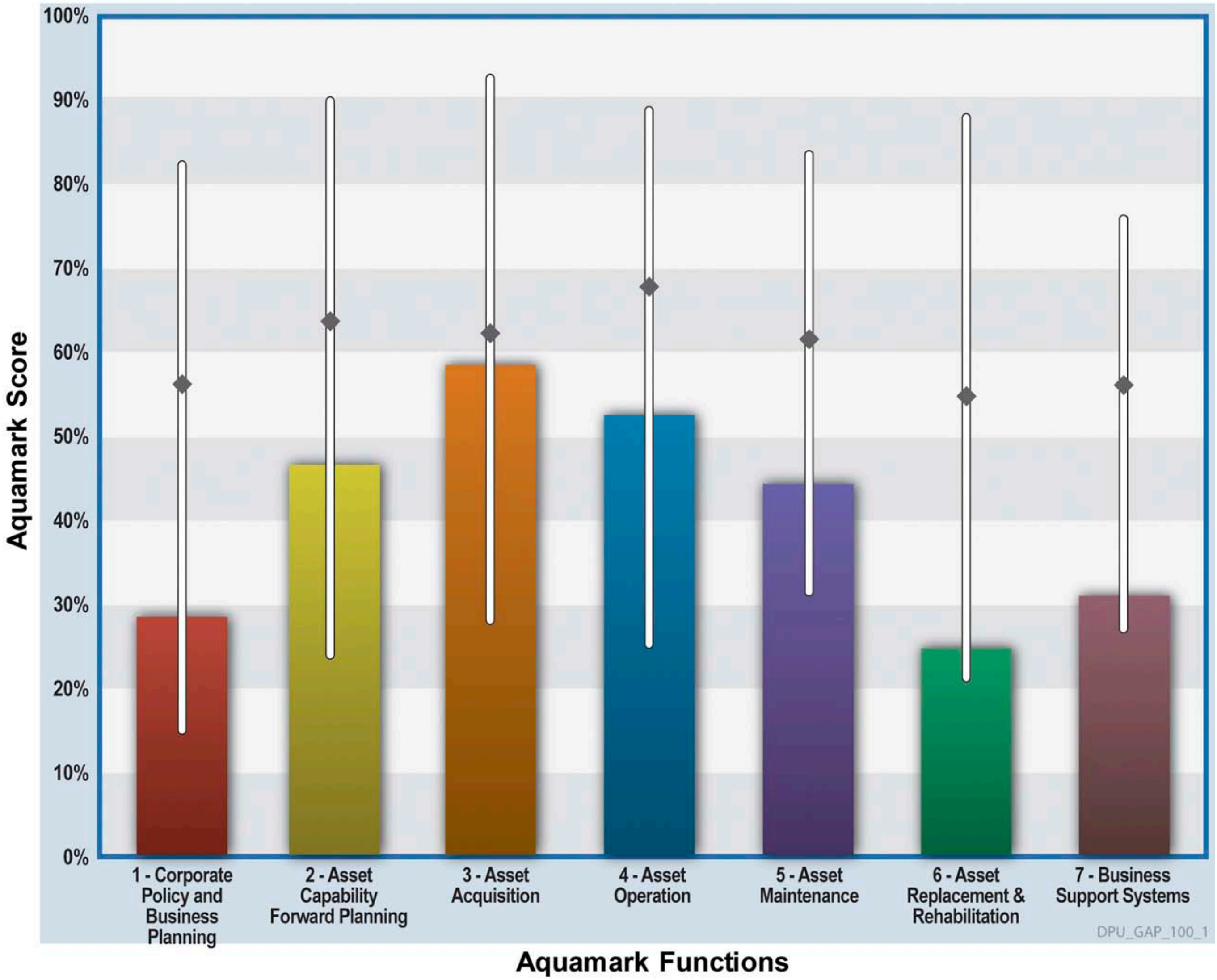
Function 4 **Asset Operation**	Will Roy, Carnell Felton, Steve Salay, Mike Heniken, William Tippery, Bob Ellinger, Mike Hupp, Mike Foster, Kevin Campanella, Duffy McSweeney
	Terry Nichols, Mike Colley, William Ratliff, Steve Hainen, Randy Warner, Cindi Fitzpatrick, Bill Adkins, Jim Tindle, Mike Spriggs, Kathy Taylor
	Mihai Orbocea, Mark Wade, Jeff Robertson, Jeff Holmes, Jeff Hubbard, Rick Clay, Chris Vogel
Function 5 **Asset Maintenance**	Mike Foster, John Rubadue, Mike Smith, Bob Ellinger, Darryl Gibson, Jeff Vesco, Matt Lovsey, Martin Wollenslegel, Tom Thomas, Jeff Bartoe, Rick Wilkinson, William Tippery, Greg Martinez, Duffy McSweeney
	Jeff Lloyd, Dan Davis, Russ Allen, Larry Krall, Dwayne Maynard, Gene White, Chris Kehlmier, Mike Spriggs, Duffy McSweeney, Kevin Campanella
	Rick Clay, Mark Wade, Denny Ferkan, Joe Rice, Jeff Robertson, John Satala, Joyce Bushman, Kevin Campanella
Function 6 **Asset Replacement / Rehabilitation**	William Tippery, Rick Wilkinson, Tom Thomas, Steve Salay, Rick Reinhold, Herb Johanson, Nick Domenick, James Gross, Mike Foster, Bob Ellinger, George Zonders, Duffy McSweeney, Kevin Campanella
	Gene White, Joe Clouse, Miriam Siegfried, Roger Huff, Craig Charleston, Larry Krall, Brian Haemmerce, Bill Adkins, Dwayne Maynard, Bob Arnold, Lynn Kelly, Russ Allen, Danella Pettenski, George Meyers, Duffy McSweeney
	Rick Clay, Robert Schneider, Denny Ferkan, Mark Wade, Dan Hill, Jeff Robertson, John Satala

Benchmarking Team, cont'd

Function 7 **Business support systems**	Financial – Melinda Cunningham, John Funk, Joe Lombardi, Steve Snedaker, Bernie Burnheimer, Deborah Murphy, Sue Young, Paul Myres, Keena Smith, Kevin Campanella, Duffy McSweeney Miscellaneous – George Meyers, Paul Roseberry, John Satala, Paul Washburn, Rob VanEvra, Tim Evan, Greg Barden, John Gilmore, Marin Wollenslegel, Jeff Hall, Ed Sizemore, Matt Lovsey, Steve Salay, Joe Clouse, Duffy McSweeney, Kevin Campanella CMMS & GIS – Craig Charleston, John Rubadue, Dennis Dickerson, Rick Schomaker, Mark Wade, Bernie Burnheimer, Mike Merchant, Larry Moore, Greg Horch, Jeff Richards, Steve Salay, Tom Thomas, Don Cruden, Denny Ferkan, Steve Gooding, George Meyers, Kinney Gibson, Paul Roseberry, Jeff Holmes, Steve Snedaker, Tim Huffman, Kevin Campanella

Performance Comparisons

DPU to North America



16 Improvement Initiatives

1. Risk Framework
2. Levels of Service
3. Performance Management
4. Strategic Plan
5. Project Delivery
6. Asset Management Plans
7. Procedures/Standards
8. Procurement Process
9. Operations Optimization
10. Strategic Maintenance
11. Org. Development
12. Technology Systems
13. Business Plans
14. Quality Management
15. Knowledge Management
16. Efficiency Improvements

AM Definition

Asset Management is a business model comprised of an integrated set of processes that minimize the life-cycle cost of owning, operating, and maintaining assets, at an acceptable level of risk, while continuously delivering established levels of service.

- Levels of Service
- Cost
- Risk

Levels of Service (LOS), Strategic Planning, and Performance Management

Definitions

- Service Level: A measure of the effectiveness of a particular activity or service area **perceived by customers**.

- Performance Measure: A measure of a service or activity used to compare actual performance against a standard or other target. Key performance indicators are measures of how well a utility is conducting its duties (**inward focus**)

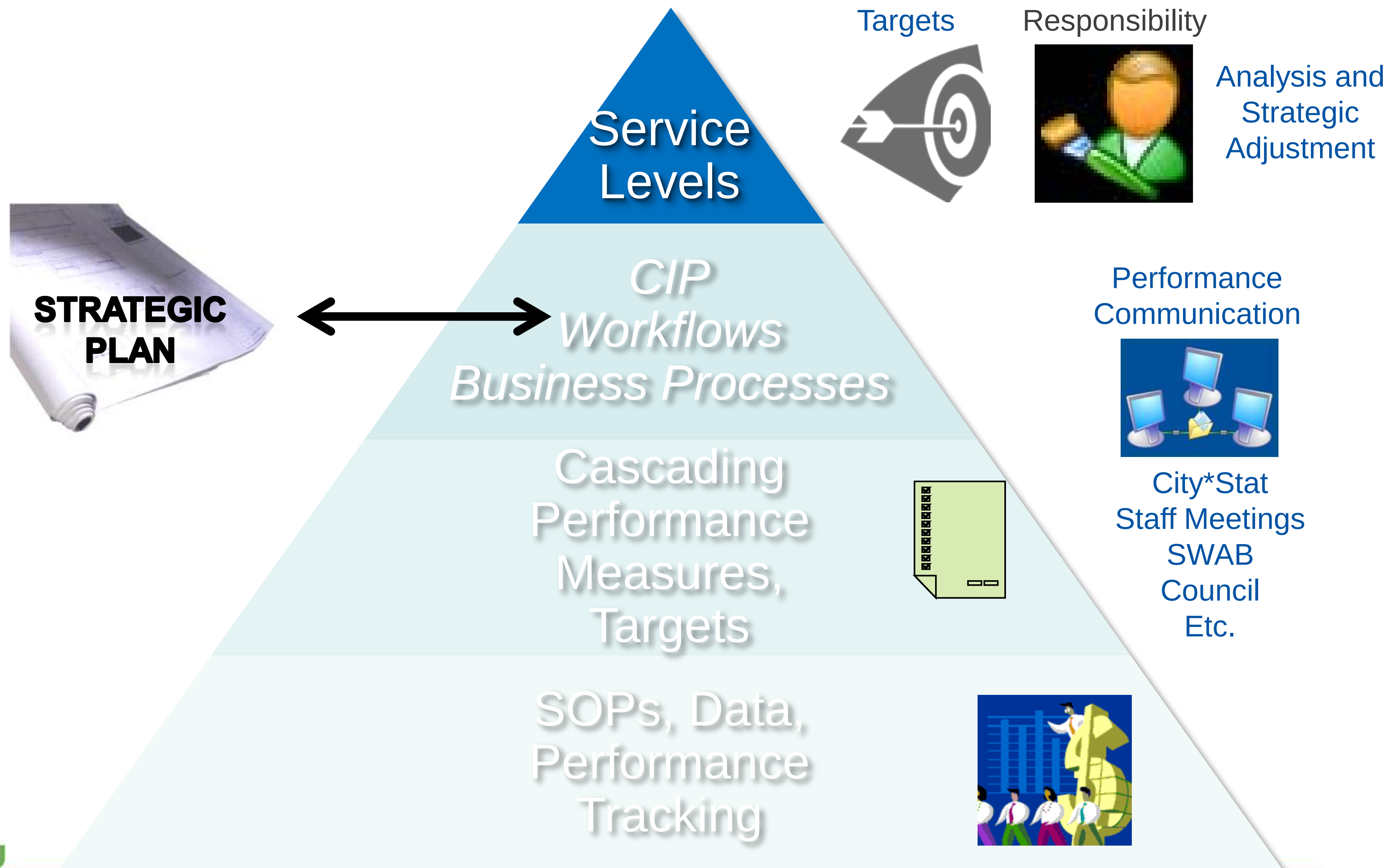
Sample Service Levels (Wastewater)

- Treatment facilities meets all permit requirements
- Number of customers reporting odors from the wastewater system per year
- Number of overflows on customer’s property, reaching receiving waters, etc. per year
- Number of back-ups of sewerage within customers’ premises (“flooding”) per year

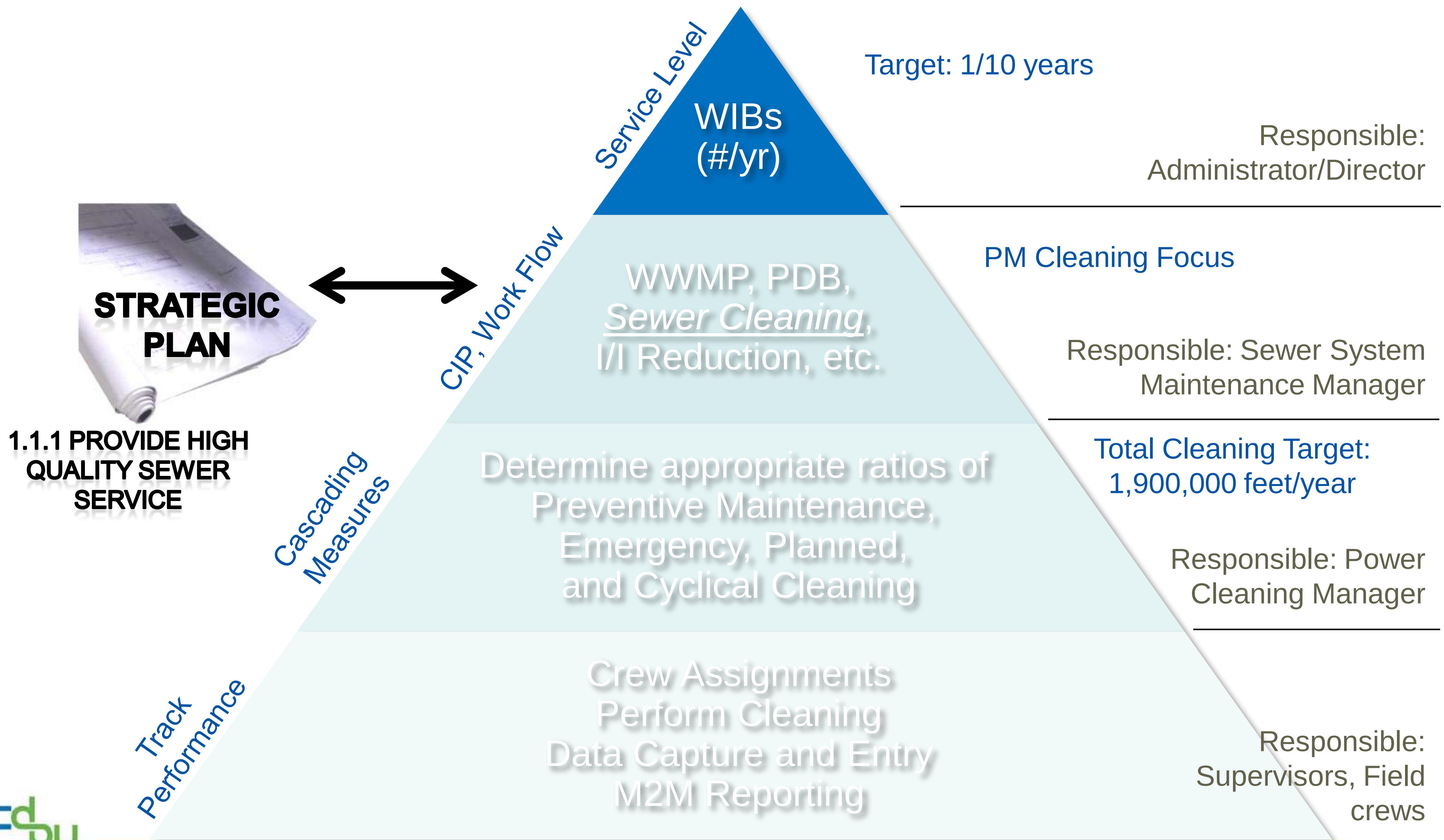
Sample Performance Measures (Wastewater)

- Volume of chemicals used at WWTPs
- Number of manhole and sewer inspections
- Ratio of Total Backlog: New Work Orders per Month
- Length of sewer pipes cleaned per month
- Volume of debris removed from sewers per month

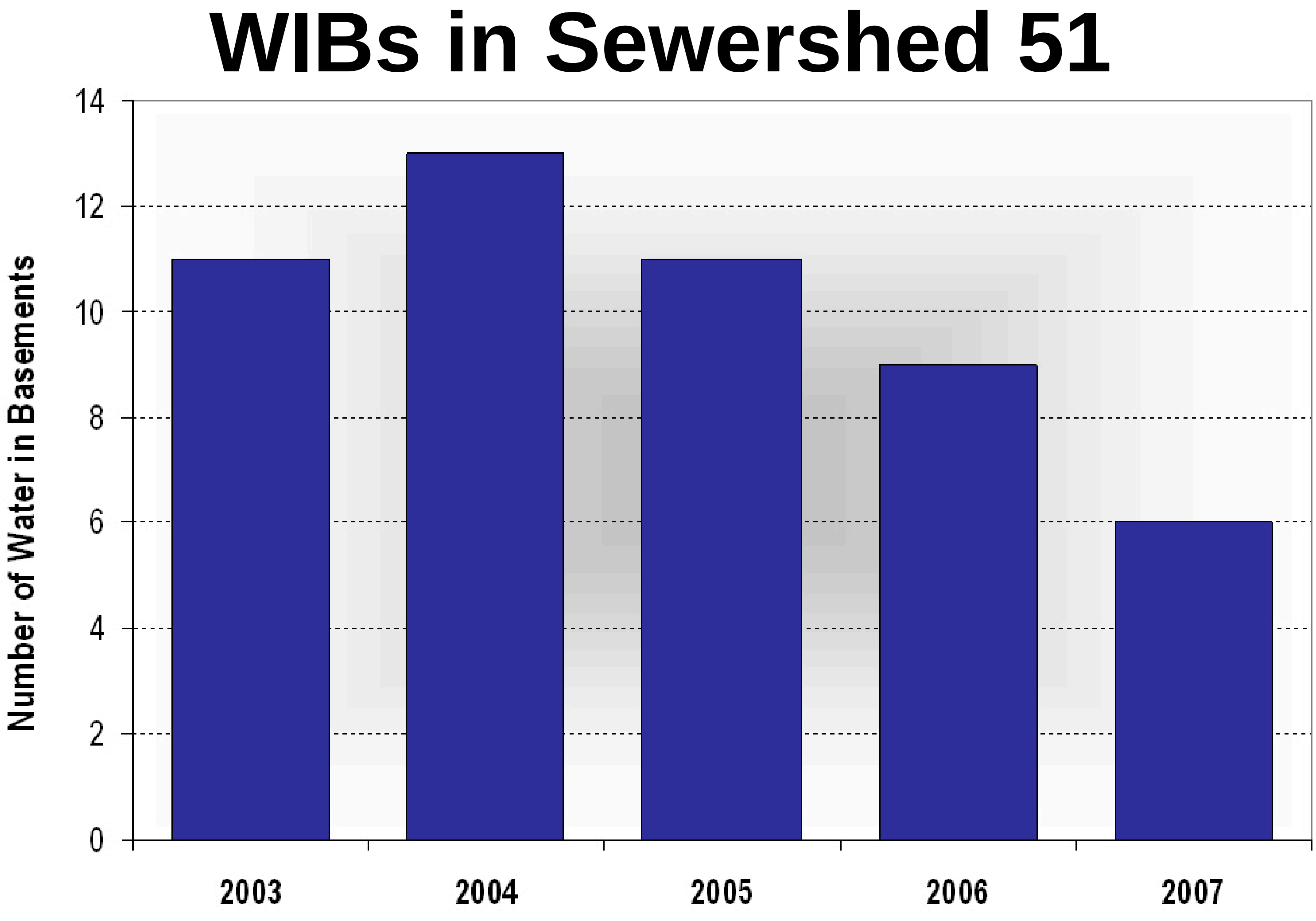
Levels of Service and Performance Management Framework



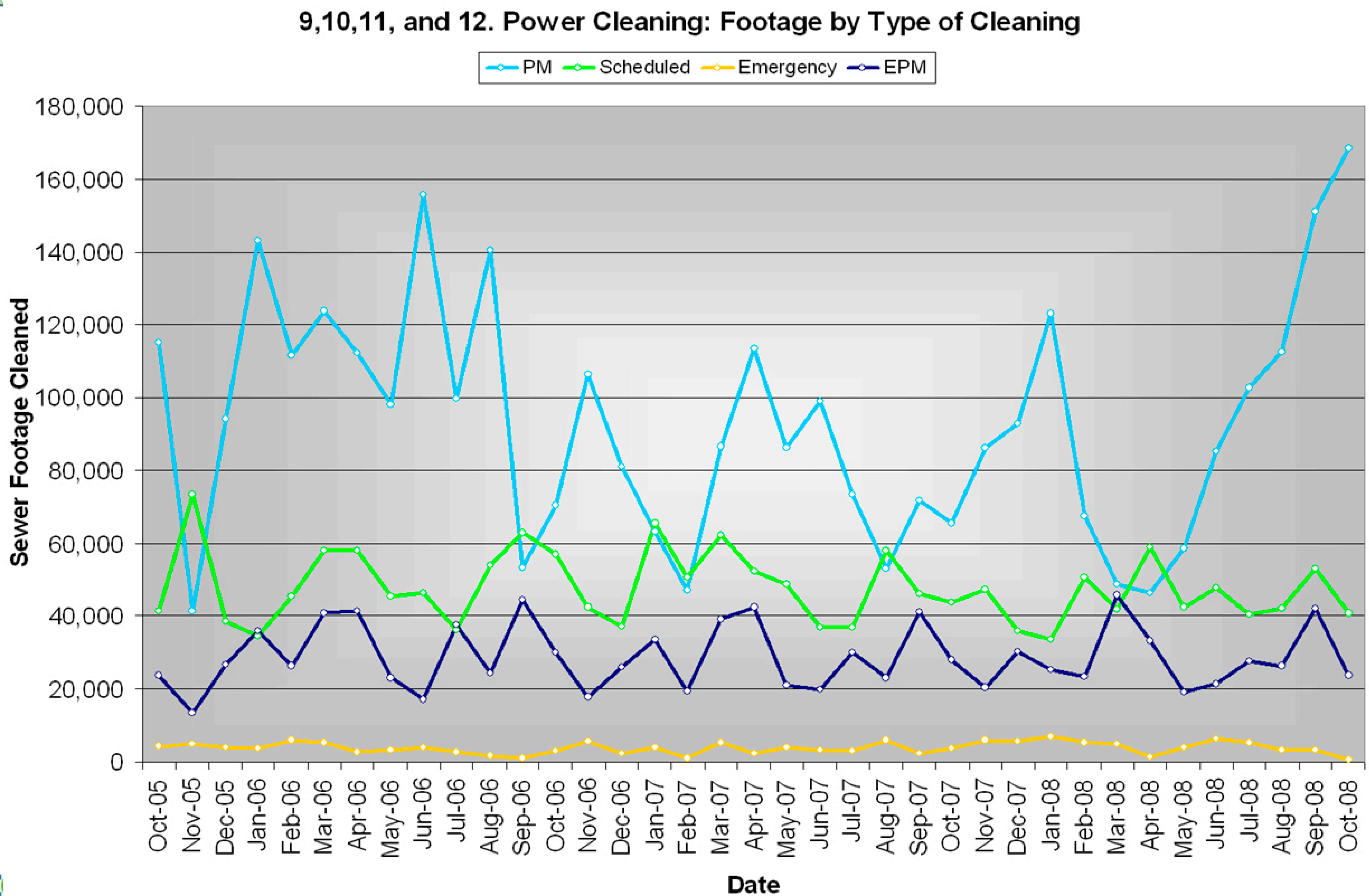
DOSD Performance Management Framework



DOSD Service Level Example: WIB



DOSD Performance Measure



Expected Benefits

- Enhanced customer service focus
- Greater staff understanding of service levels and their relationship to day-to-day activities
- Alignment between customer expectations and DPU's mission, strategic plan, services provided

- *WIB Example: Reduced WIBs **and** cost savings for customers!*

Achievements to Date - LOS

- Selected and defined 30 LOS across the organization
- Assigned ownership, data collection responsibilities
- Collecting data, reviewing benchmarks
- Target setting in Fall, 2010

LOS Selection Process

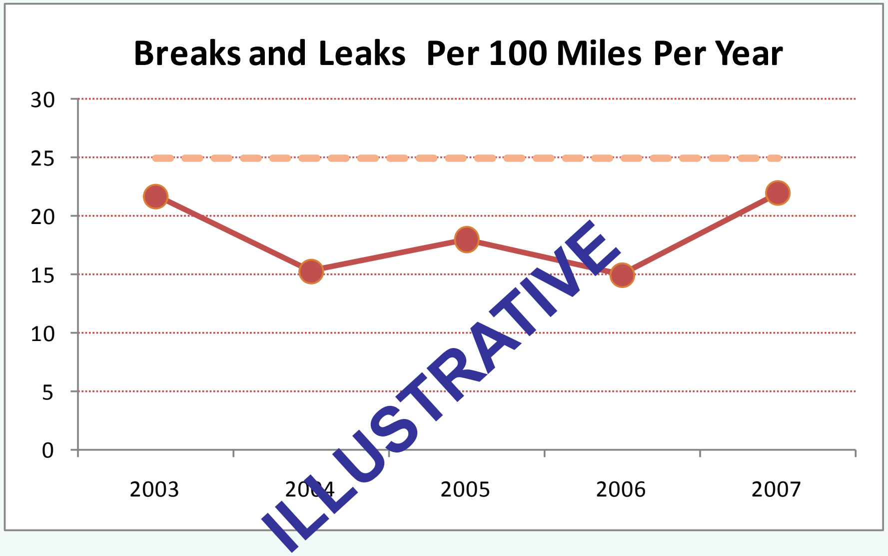
Line of Business: Customer Service

	Category / Measure	Description / Comments
1	**Average Speed of Answer / Wait Time** (Average Minutes of Hold / Wait Time From Connection Until a Call is Answered by Call Center Representative)	Enables tracking of overall call center performance, and can support decisions on staffing levels, coverage, and shifts. Measure can vary during peak periods of the day and can also be driven by significant short term events (i.e. change in billing procedures or widespread outages)
2	**Percent of Total Calls Answered Within Specified Goal** (Percent of Calls Answered Within Target of xx Seconds or Minutes / Total Calls Received)	Related to average speed of answer measure above, but with an established target percentage (typically 90-99%) to allow for some variation, unexpected peaks, or events.
3	**Abandoned Calls as A Percent of Total Calls** (Total Calls That Are Abandoned Before Speaking to a Representative / Total Calls Received)	Measure is related to average speed of answer measure above. Callers typically abandon the call after they are on hold for a greater than expected period of time. High call abandonment rates suggest that average wait time is beyond customer's normal service expectations.
4	**Percent First Call Resolution Rate** (Total Calls That Are Resolved On First Contact / Total Calls Received)	Measures successful issue resolution on first contact with the call center. Measure of overall responsiveness and timely resolution of issue. Can be difficult to track - assumes ability to assign a unique work order to each open issue with caller identity.
5	**Average Response Time For Customer Correspondence** (Average Response Time In Working Days From Customer Inquiry)	Measures the average response time in days for a utility customer service rep to respond to a customer inquiry via mail or e-mail from the time it is received. Measures responsiveness to customer inquiries not made through call center.

LOS Future Reporting Templates

- Annual report to stakeholders / customers
- Present a transparent picture of utility performance
- Include narrative to describe the relevance and implications of each measure
- Future formation of "citizen advisory committees"

Water Distribution



Current Performance Trends and Issues

- Stable performance driven by rehabilitation and renewal program of 100 miles per year.
- Continued focus on oldest cast iron pipe and worst served areas.
- 2007 performance impacted by spike of 75 third party damage incidents during downtown light rail construction
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Risk

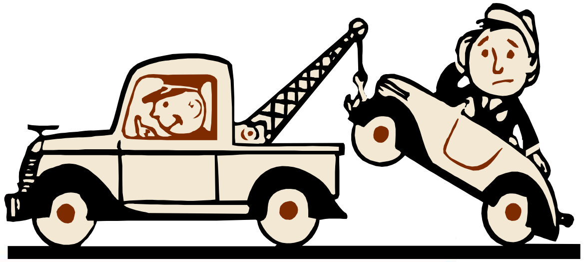
“How do you manage risk?”

Risk Defined

Risk = Likelihood of Failure X Consequence of Failure

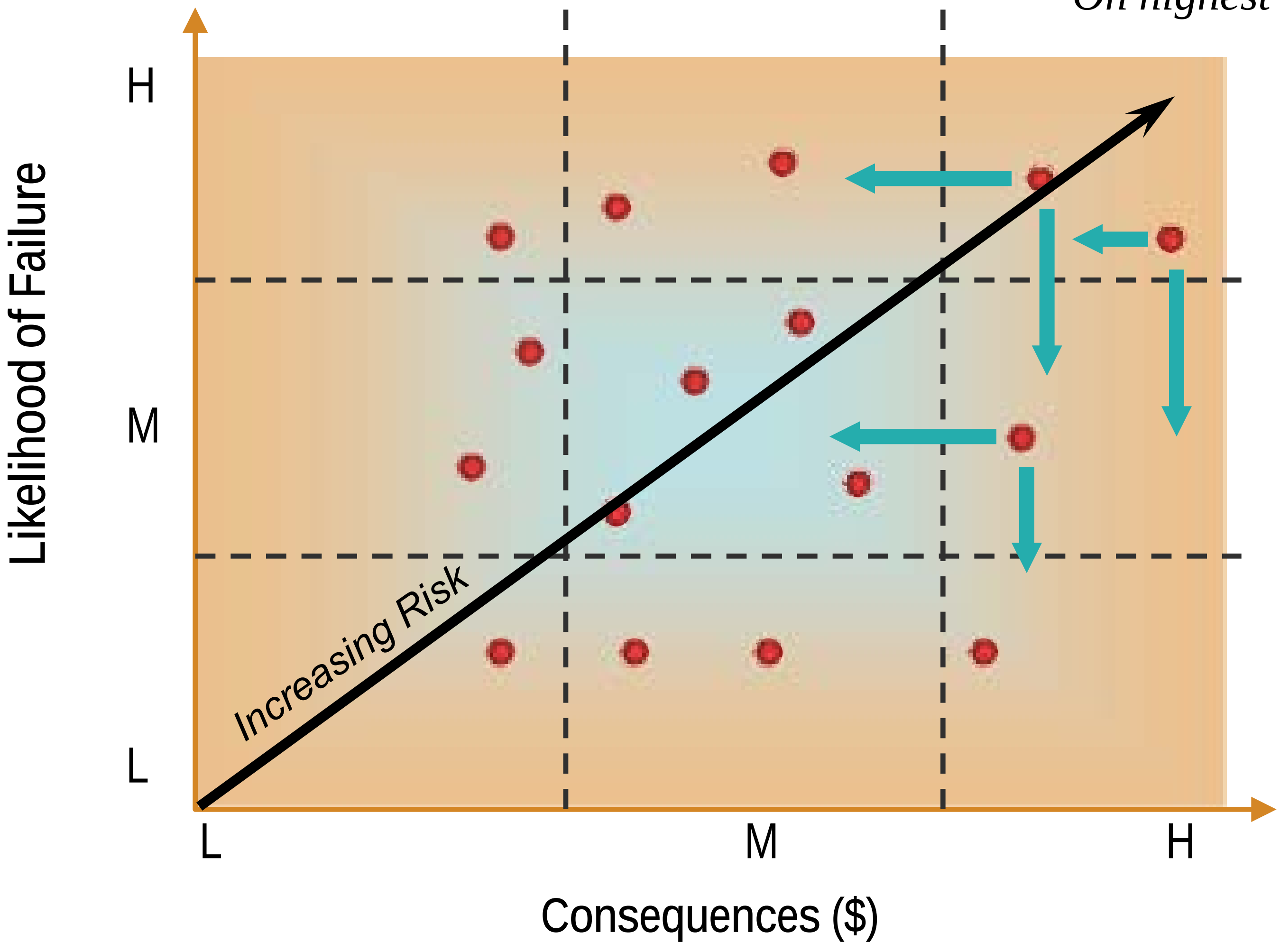
Example of Risk Cost: Car Towing

- Average frequency of needing a tow for your make/model of car: 8 years
- Average towing bill: $240
- Annualized risk cost = $240 x 1/8 = $30

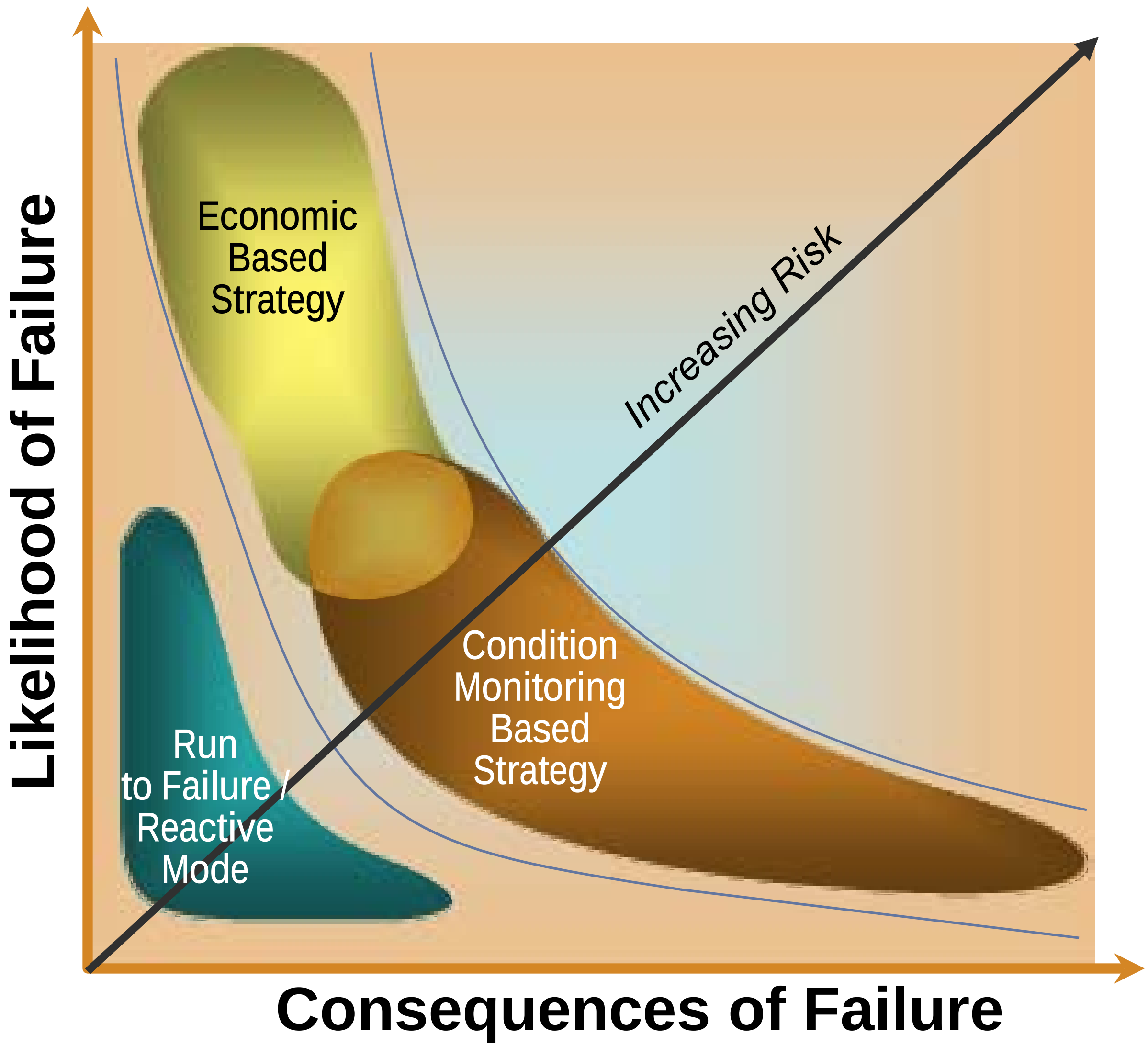


Managing Risk

Concentrate your efforts
On highest risk assets



Risk "Signature" → Asset-Based Decisions



Risk COST Definition

Annual Risk Cost (Dollar cost per year)	=	Probability of Failure (Projected events per year)	X	Consequence of Failure (Dollar cost of each event)

Example of Risk Cost Calculation

- An agency is attempting to decide whether to proactively or reactively clean a segment of sewer
- With no cleaning, failure would involve one basement backup every 10 years
- Cost per basement backup is $10,000

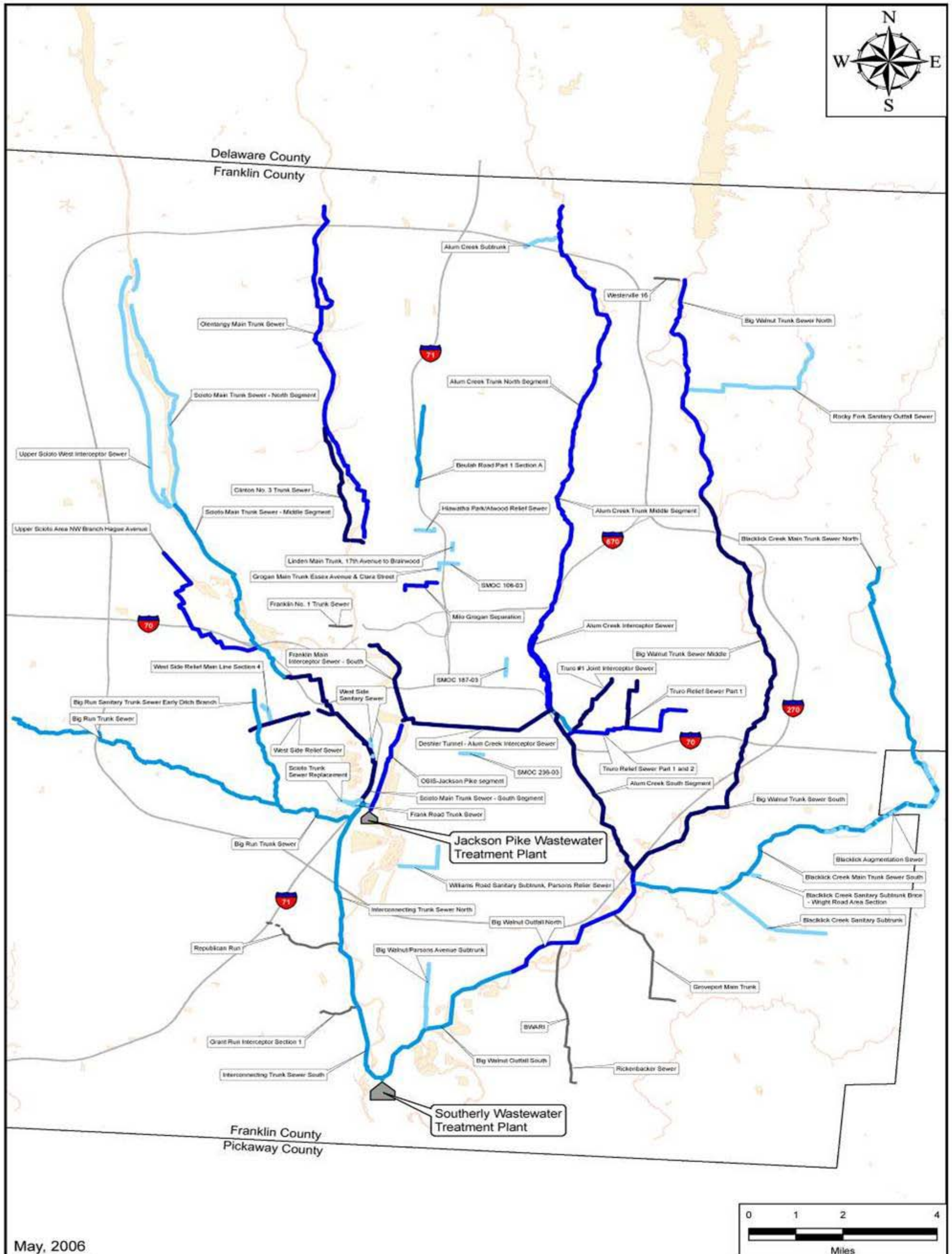
Annual Risk Cost ($1,000 per year) = Probability of Failure (10% per year) X Consequence of Failure ($10,000 per event)

Risk Application: Prioritizing Large Diameter Condition Assessment and Cleaning Program

Large Diameter Pipe
Risk Management Program

Program Goals

- Satisfy Consent Order
- Establish a comprehensive sewer PM Program
  - Sewer Shed Based PM progressing (small diameter)
  - Large Diameter Pipes addressed under this effort
- Gather inspection data
- Identify and prioritize R&R projects
- Identify cleaning to yield increased capacity



N
W
E
S
Delaware County
Franklin County
Alum Creek Subtrunk
Westerville 16
Big Walnut Trunk Sewer North
Olentangy Main Trunk Sewer
71
Alum Creek Trunk North Segment
Scioto Main Trunk Sewer - North Segment
Rocky Fork Sanitary Outfall Sewer
Upper Scioto West Interceptor Sewer
Beulah Road Part 1 Section A
Clinton No. 3 Trunk Sewer
Hiawatha Park/Atwood Relief Sewer
Alum Creek Trunk Middle Segment
Scioto Main Trunk Sewer - Middle Segment
Upper Scioto Area NW Branch Hague Avenue
670
Blacklick Creek Main Trunk Sewer North
Linden Main Trunk, 17th Avenue to Brainwood
Grogan Main Trunk Essex Avenue & Clara Street
SMOC 106-03
Franklin No. 1 Trunk Sewer
Milo Grogan Separation
70
Alum Creek Interceptor Sewer
Big Walnut Trunk Sewer Middle
Franklin Main Interceptor Sewer - South
West Side Relief Main Line Section 4
Truro #1 Joint Interceptor Sewer
SMOC 187-03
Truro Relief Sewer Part 1
West Side Sanitary Sewer
Big Run Sanitary Trunk Sewer Early Ditch Branch
270
Big Run Trunk Sewer
Deshler Tunnel - Alum Creek Interceptor Sewer
70
West Side Relief Sewer
SMOC 236-03
Truro Relief Sewer Part 1 and 2
Scioto Trunk Sewer Replacement
OSIS-Jackson Pike segment
Alum Creek South Segment
Scioto Main Trunk Sewer - South Segment
Big Walnut Trunk Sewer South
Frank Road Trunk Sewer
Jackson Pike Wastewater Treatment Plant
Big Run Trunk Sewer
Blacklick Augmentation Sewer
Blacklick Creek Main Trunk Sewer South
Williams Road Sanitary Subtrunk, Parsons Relief Sewer
Blacklick Creek Sanitary Subtrunk Brice - Wright Road Area Section
71
Interconnecting Trunk Sewer North
Blacklick Creek Sanitary Subtrunk
Big Walnut Outfall North
Republican Run
Big Walnut/Parsons Avenue Subtrunk
Groveport Main Trunk
SWARI
Rickenbacker Sewer
Grant Run Interceptor Section 1
Big Walnut Outfall South
Interconnecting Trunk Sewer South
Southerly Wastewater Treatment Plant
Franklin County
Pickaway County
0
1
2
4
Miles
May, 2006

Risk Factor Examples

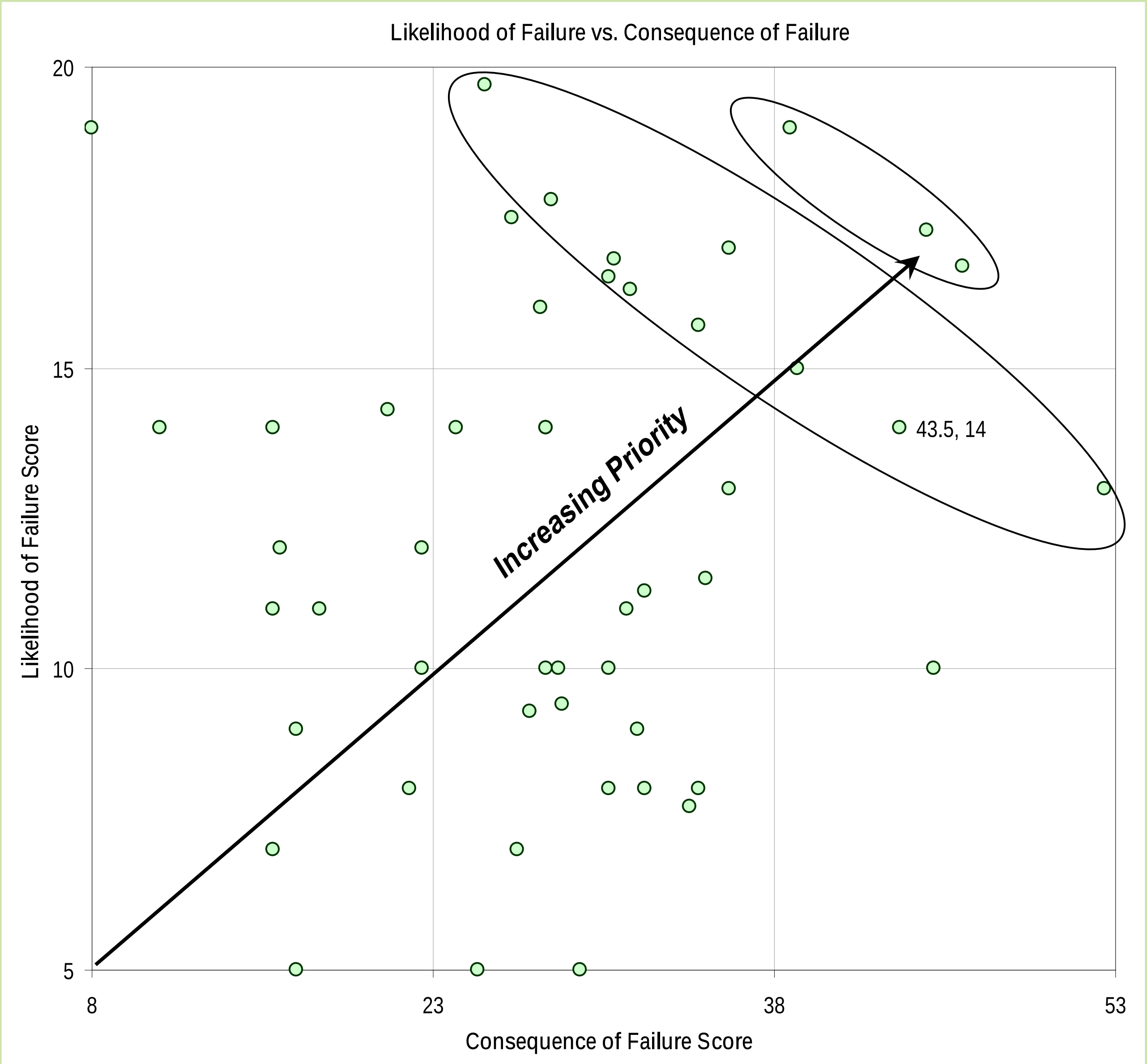
- Likelihood of Structural Failure
  – Material, Age, Tributary Wastewater Characteristics
- Likelihood of Operational Failure
  – Slope/Velocity, Debris in Tributary Area, Time Since Last Cleaning, Capacity Limitations
- Consequences of Failure
  – Depth, Diameter, Access, Overflow Potential, Proximity to Structures, Water, RR, etc.

Alum Creek Interceptor Sewer	Factors That Contribute to Debris Deposition							Consequence of Failure Factors								Likelihood of Structural Failure Factors					
Trunk Sewer Sections	Pipe Material	Slope / Velocity	Age	Suspected Deficiencies		Pump Stations	Total Debris Deposition	Diameter	Average Depth	Location (weighting factor)	Land Use	Accessibility	DSR Frequency	WIB Frequency	Total Consequence of Failure	Age	Pipe Material	H2S Prone	Total Likelihood of Failure	TOTAL	Last Cleaned (Year)
42 inch Section	3	3	5	0	0	0	11	1	1	3	3	5	0	0	14	5	3	0	8	33	
48 inch Section	3	3	5	2	0	0	13	1	1	2	3	5	0	0	12	5	3	0	8	33	
60 inch Section	3	3	5	4	0	0	15	2	1	4	3	3	0	0	18	5	3	0	8	41	

* Field knowledge that will affect this program includes knowledge of areas prone to debris or areas not prone to debris

** Conclusions from Last Cleaning should include an indication of whether or not Condition Assessment was Performed and if so, what pipe conditions were encountered. Please not if TV logs/tapes are a

Sewer System Evaluation Results



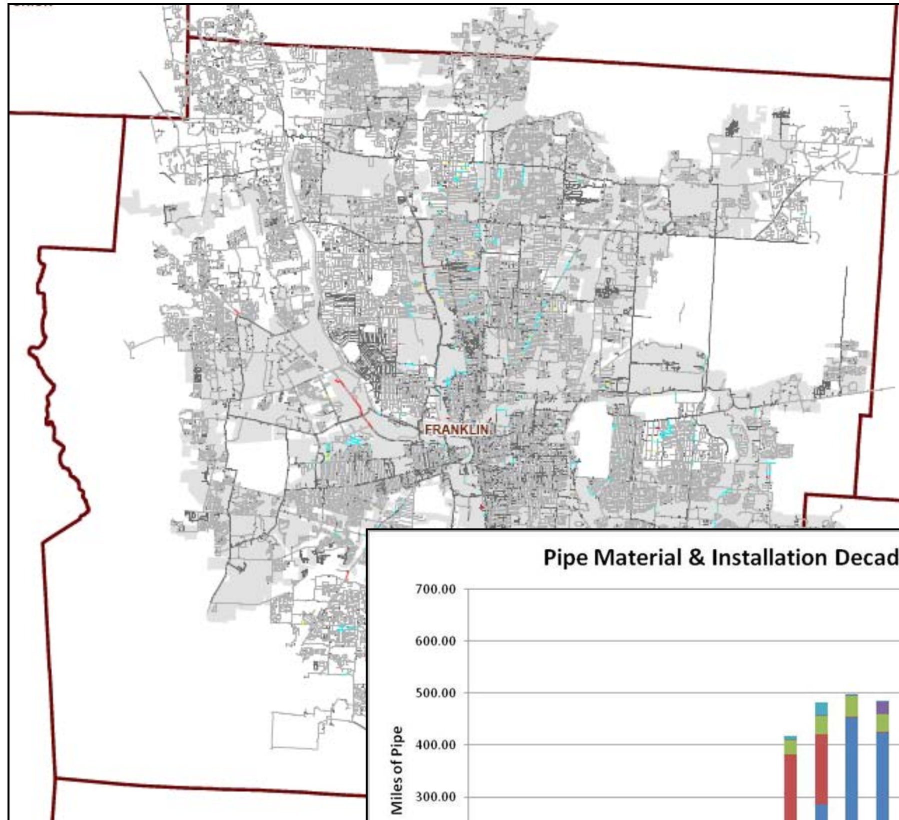
Progress on Large Diameter Sewer Inspection Program

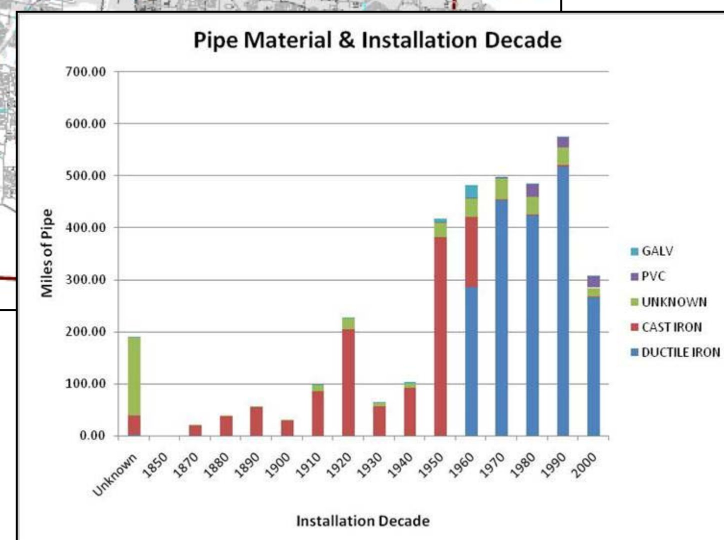
- Cost savings of over $5 million achieved to date by inspecting before cleaning (using sonar technology)
- Inspected nearly 30 miles of large-diameter sewers
- Identified significant structural defects that would have otherwise been undetected
- Condition data and cost estimates used to quantify risks of defects and compare risk-costs to the cost of mitigation projects

Risk Application: Prioritizing Water Main Replacement

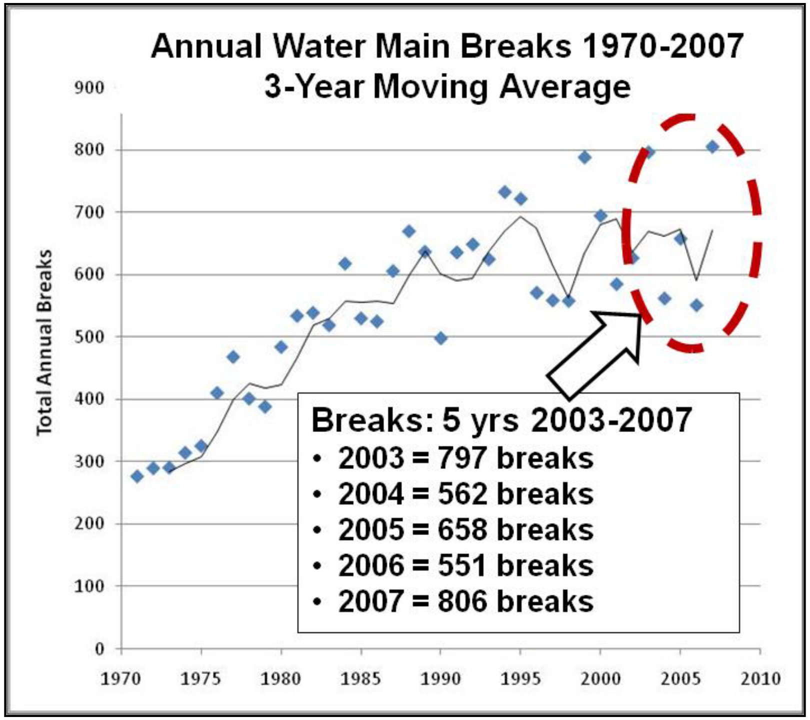
Columbus Water Distribution System

- **Miles of Water Main**
  - 3,665 total miles
  - 3,399 miles </= 16”
- **Materials**
  - 53% Ductile Iron
  - 31% Cast Iron
- **Size**
  - 65% is 6” to 8” pipe
- **Age**
  - 75% installed since 1970

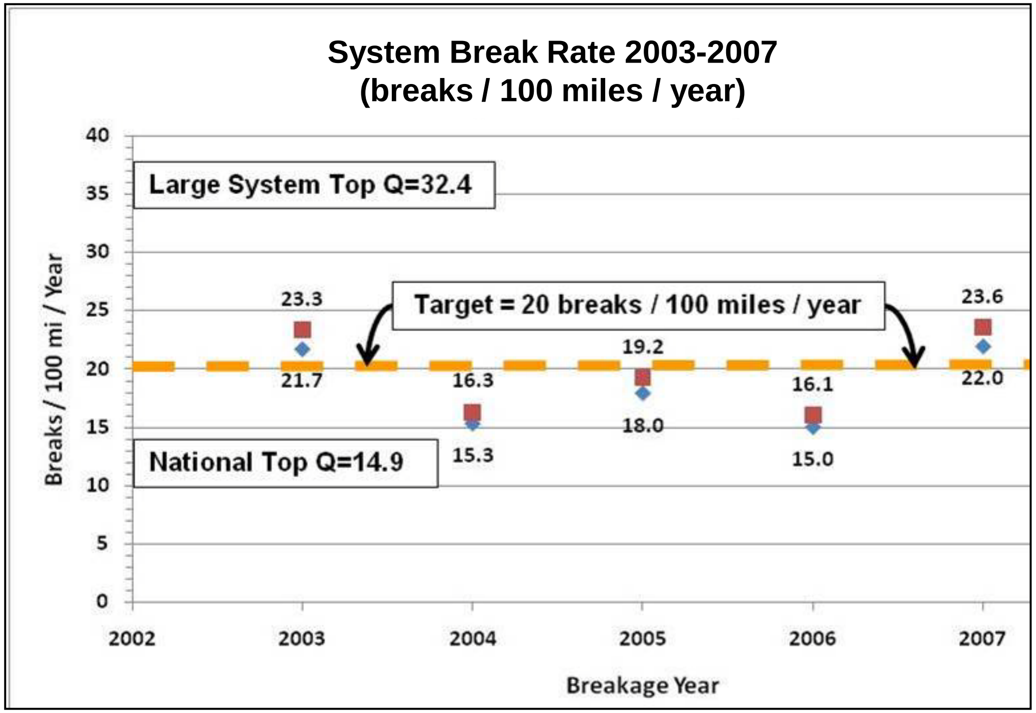




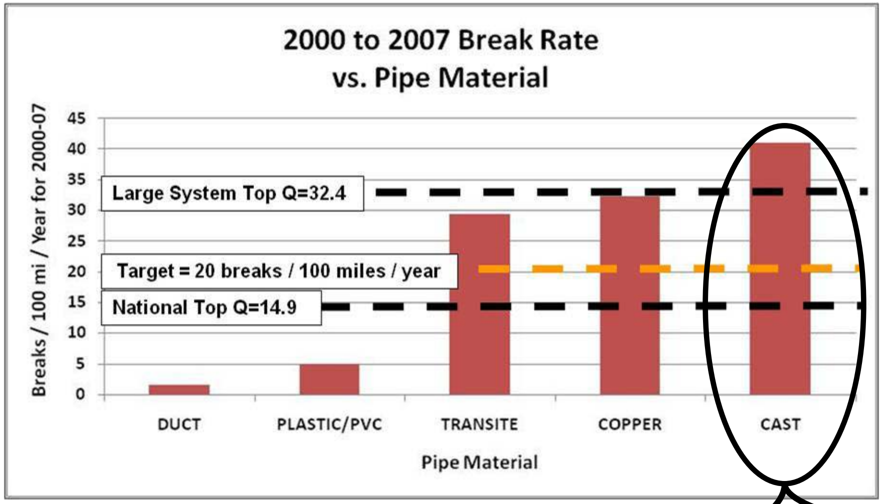
System Wide Breaks for 50-Yr Main Replacement Planning



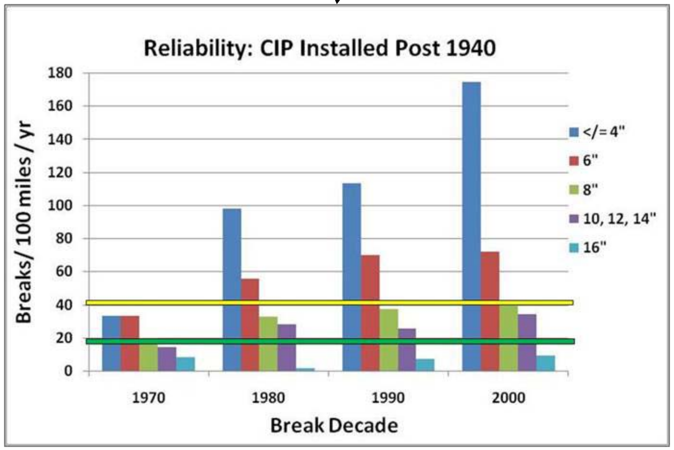
- System Wide – Preliminary Target:
  - 20 breaks / 100 miles / year

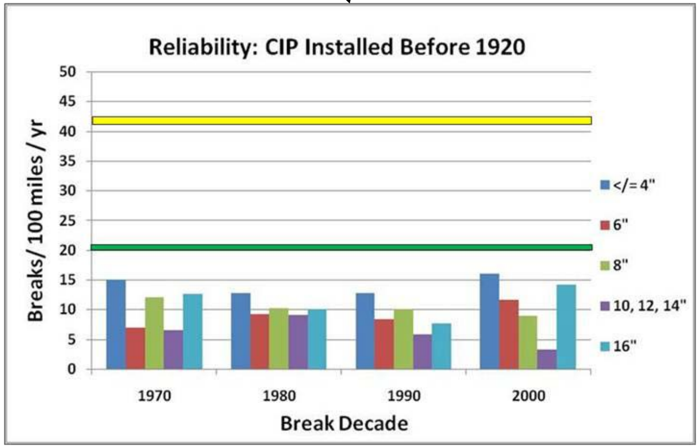


Evaluate Water Mains Compared to Service Level Targets

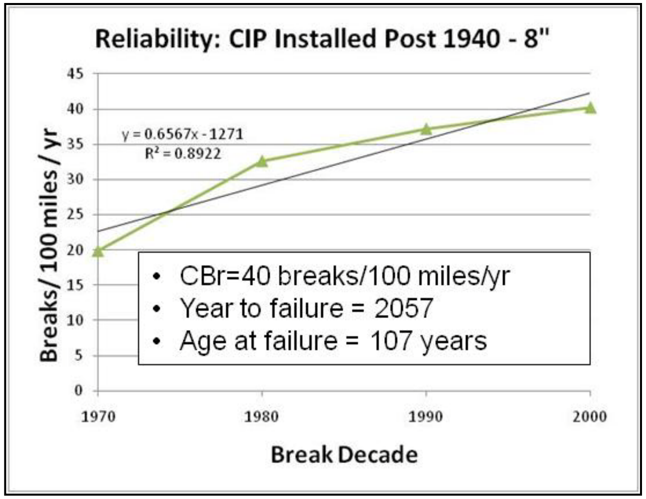


- Analyze break data
  - Different pipe materials
  - Different diameters
  - Era of Installation
- Identify "Worst Performers"

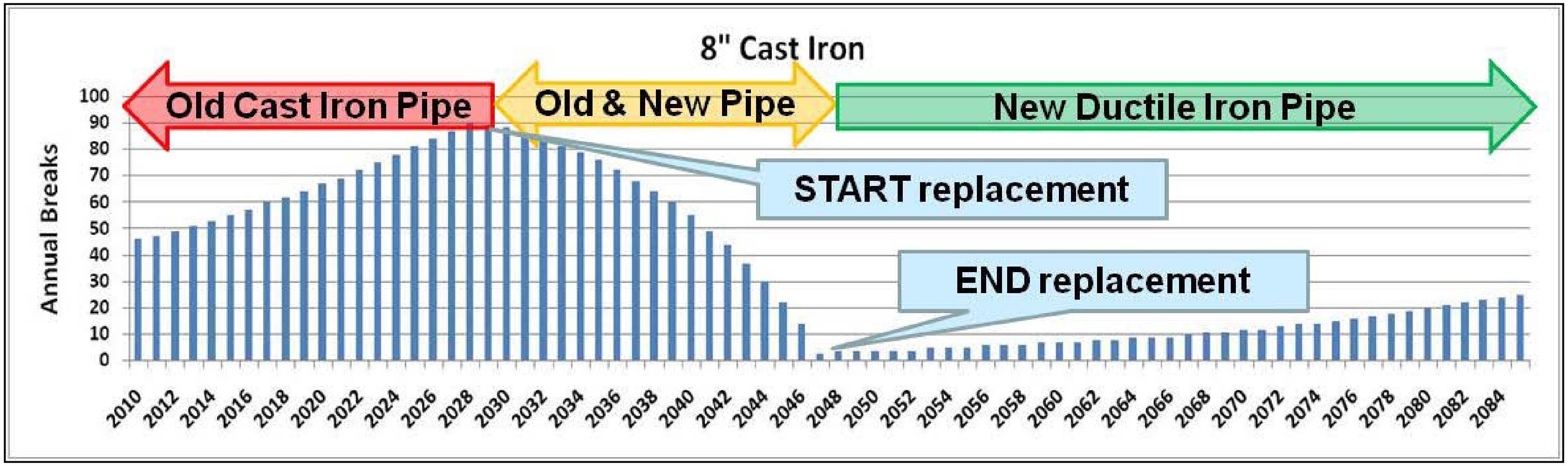




Develop Pipe Classes and Estimate Remaining Service Life



- Over 30 Pipe Classes Identified:
  - Material, Size, and Installation Era
- Pipe Effective Service Life:
  - Estimated based on break rate targets and system wide impacts



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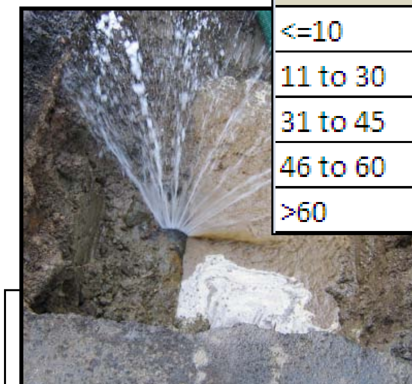
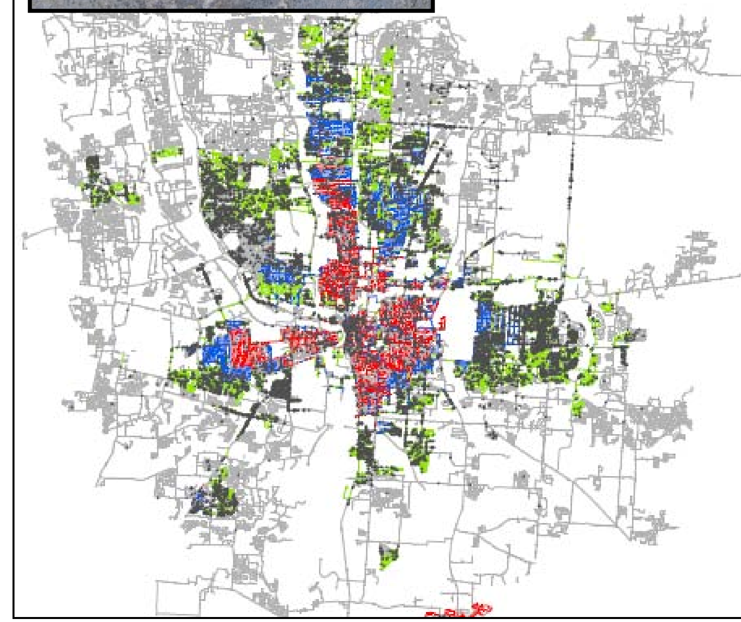
Develop Water Main Prioritization to Achieve Service Level Targets

- Pipe Condition: Score 1 - 5:
  - Age relative to effective life
  - Break rate relative to service levels
- Pipe Criticality: Score 1 - 5:
  - Pipe size, location, critical customer
- Priority = Condition x Criticality



Break Rate	BrScore	Miles
<=10	1	1964
11 to 30	2	209
31 to 45	3	353
46 to 60	4	141
>60	5	345

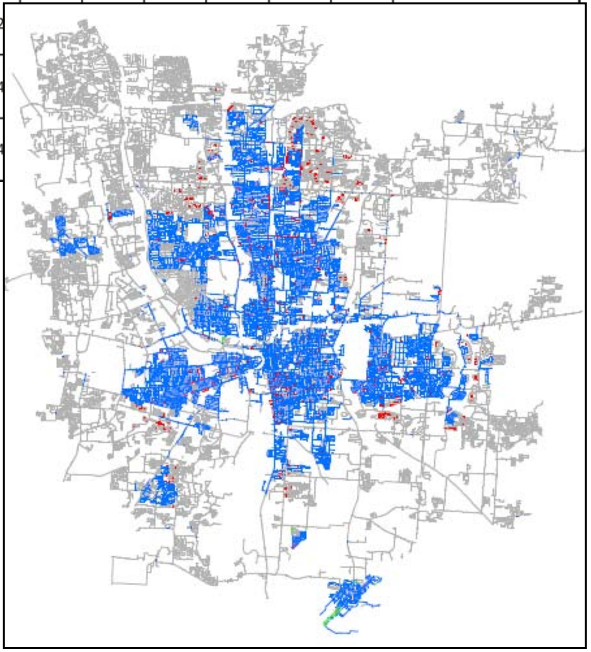


Water Main Priority		
Score	Priority Group	Pipe Length </=16" (miles)
2-10	Lowest Risk	2,241
11-20	Moderately Low Risk	699
21-30	Moderate Risk	35
31-40	Moderately High Risk	4.6
41-50	Highest Risk	3.4

Estimate Annual Replacement Required to Achieve Service Levels

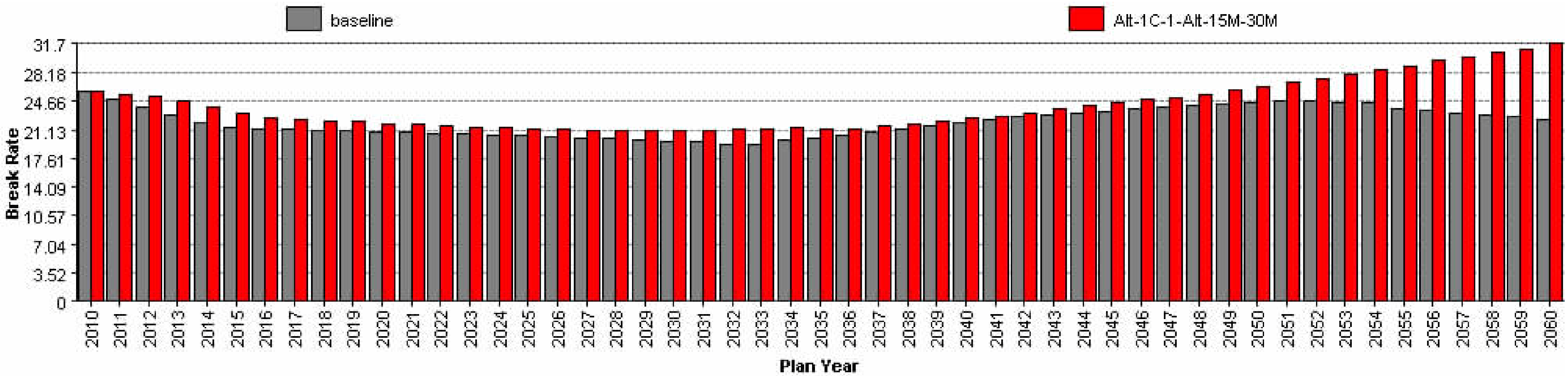
- Apply pipe priority scoring
- Locate pipes on GIS
- Evaluate replacement options
- Develop cost projections

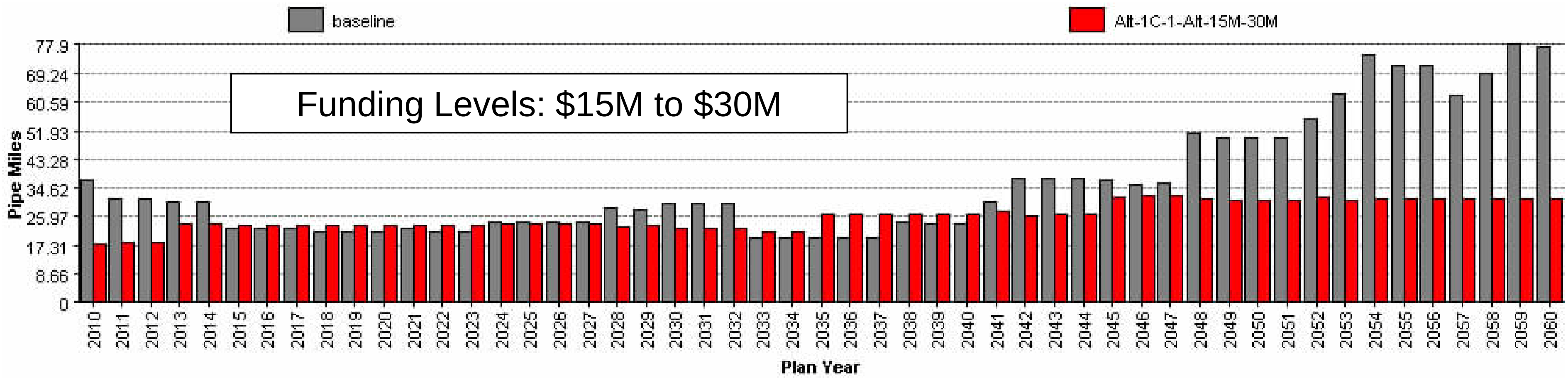
Comparison of Rehabilitation Options for Water Mains											
Criteria / Method	Structural (Internal)	Structural (External)	Requires Excavation for Connections	Diameter Range	Insertion Pit Required	Shot Lengths (LF)	Provides Internal Corrosion Protection	Provides External Corrosion Protection	Reduces Diameter (But Improves H-W C-value)	Service Life Extension (Years)	Comments
Epoxy Resin	No	No	No	Any	No	200 to 400	Yes	No	Yes	30	Not for pipes with joint leaks or holes, etc.
Cement Mortar Lining	Yes	No	Yes	4”-24”	No	300 to 700	Yes	No	Yes	50	Do not use for soft or acidic waters
Close Fit Sliplining	Yes/No Thickness Dependent	Yes/No Thickness Dependent	Yes/No iTAP Possibility	4”-24” Method Dependent	Yes	500 to 1200	Yes	Yes or No	Yes	20-50	Life extension depends on whether lining is structural/non-structural
Conventional Sliplining	Yes	Yes - No strength added to host pipe	Yes	8”-24”	Yes	200 to 1000	Yes	Yes	Yes	50	Can be done with D.I., PVC, HDPE, Steel, and FRP
Cured-In-Place Pipe (CIPP) Non or Semi Structural	Yes or No	No	No w/ iTAP	2”-12							
Cured-In-Place Pipe (CIPP) New Structural	Yes	Yes	No w/ iTAP	6”-24							
Pipe Bursting	Yes	Yes	Yes (very invasive)	4”-54							



Mat	Type	Diam	Decade	Miles	C-Age	CBr	Pty	LBr	HBr	SrtYr	EndYr	F-Age	Yrs	Mi/Yr
GALV	All	2	All	0.1	70	288	50	40	50	2010	2010	70	1	0.10
CI	All	6	>1940	1.7	60	73	50	40	50	2010	2014	64	5	0.34
CI	All	4	>1940	0.3	60	158	40	40	60	2010	2010	60	1	0.30
CI	All	6	>1940	1	60	73	40	40	60	2010	2010	60	1	1.00
CI	All	4	1920-40	0.3	80	60	40	40	60	2010	2010	80	1	0.30
CI	All	6	1920-40	1.7	80	51	40	40	60	2010	2012	82	3	0.57
CI	All	8	>1940	1	60	40	40	40	60	2010	2010	60	1	1.00
GALV	All	2	All	1.4	70	288	30	40	80	2010	2014	74	5	0.28
CI	All	4	>1940	0.3	60	158	30	40	80	2010	2010	60	1	0.30
CI	All	6	>1940	9.3	60	73	30	40	80	2010	2014	64	5	1.86
CI	All	4	1920-40	0.1	80	60	30	40	80	2010	2010	80	1	0.10
CI	All	6	1920-40	6.3	80	51	30	40	80	2010	2033	103	24	0.26
CI	All	8	>1940	6.8	60	40	30	40	80	2010	2057	107	48	0.14
CI	All	8	1920-40	2	80	36	30	40	80	2010	2048	118	39	0.05
CI	All	10	>1940	6	60	34	30	30	80	2010	2078	128	69	0.09
CI	All	10	1920-40	0.8	80	28	30	30	80	2010	2010	80	1	0.80
CI	All	16	1920-40	0.4	80	23	30	25	60	2010	2010	80	1	0.40
CI	All	16	<1920	0.2	105	14.3	30	25	60	2010	2010	105	1	0.20

"What If" Scenarios can Test Funding Strategies Versus Service Level Targets





Business Case Evaluations (BCE)

Business Case Evaluation

- BCE is a decision making process
- In private sector businesses, projects must benefit the “bottom line”
- For municipal utilities, decisions are made based on Level of Service, Cost, and Risk
  - Project costs must be lower than the value of increased service levels or reduction in cost or risk-cost

BCE Purposes: Utility Sustainability

- BCE's support utility sustainability by:
  - Filtering unneeded projects out of the CIP
  - Ensuring CIP has better value for customers
  - Enhancing prioritization of projects
  - Providing transparency in decision-making

Costs Include
Triple Bottom Line Values

- Triple Bottom Line:
  - Financial Costs/Benefits
  - Social Costs/Benefits
  - Environmental Costs/Benefits
- In a BCE, assigning dollar values to TBL costs allows for more consistent, less subjective decision making

Example of Multi-criteria Analysis

Consider a sewer replacement project that is evaluating open-cut versus tunneling construction methods

Alternative	Cost	Non-monetary factors score (traffic delay)
Open Cut	$150,000	1 (very bad)
Tunneling	$200,000	5 (great)

Example of Application of TBL Cost

1,000 vehicles/day delayed, average delay 15 minutes, construction takes 10 days, assume that the average vehicle would pay $10 to avoid a 15 minute delay:

(1,000 vehicles/day) x (10 days) x ($10/vehicle) = $100,000

Alternative	Cost	TBL Social Cost of a Traffic Delay
Open Cut	$150,000	$100,000
Tunneling	$200,000	$5,000

TBL Examples: Financial

	Criteria
1	Initial capital costs for design / construction
2	Depreciation or allowance for R&R (based on expected life)
3	Ongoing annual O&M costs
4	Asset Disposal / Salvage Value

TBL Examples: Social

	Criteria
1	Service level improvement/reduction (interruptions, leaks, power quality, backups, customer complaints, etc.)
2	Impact on community economic development
3	Traffic disruption
4	Impact on public / DPU health and safety
5	Other public nuisance (noise, aesthetics, etc.)

Other categories to consider for the future include: potential property damage, affordability, public image. Service level categories can be broken down in further detail.

TBL Examples: Environmental

	Criteria
1	Risk of environmental damage (from spills, overflows, etc.)
2	GHG and other emissions
3	Overall water quality / watershed sustainability
4	Overall biodiversity / aesthetics / public use

Other categories to consider for the future include: land use, water loss, wastewater and solid waste generation, chemical usage, habitat and wildlife

Business Case Framework

New Pumping Station X

1. Description and Purpose / Define Problem

2. Summary of Alternatives Evaluated

3. Service Level (Customer, Environmental, Regulatory) Impact

4. Condition, Criticality, and Risk Analysis

5. Project TBL Cost Analysis
   - Estimating guidelines and accuracy
   - Funding source
   - Financial Condition

6. Other Issues and Recommendations

BCE Pilot Process

- 10 pilot BCEs were conducted in 2009 – Pilot process goals:
  - Collect lessons learned
  - Improve the process
  - Understand resource demands
  - Set realistic thresholds for future BCEs
- Targeting full implementation by late 2011

BCE Case Study:

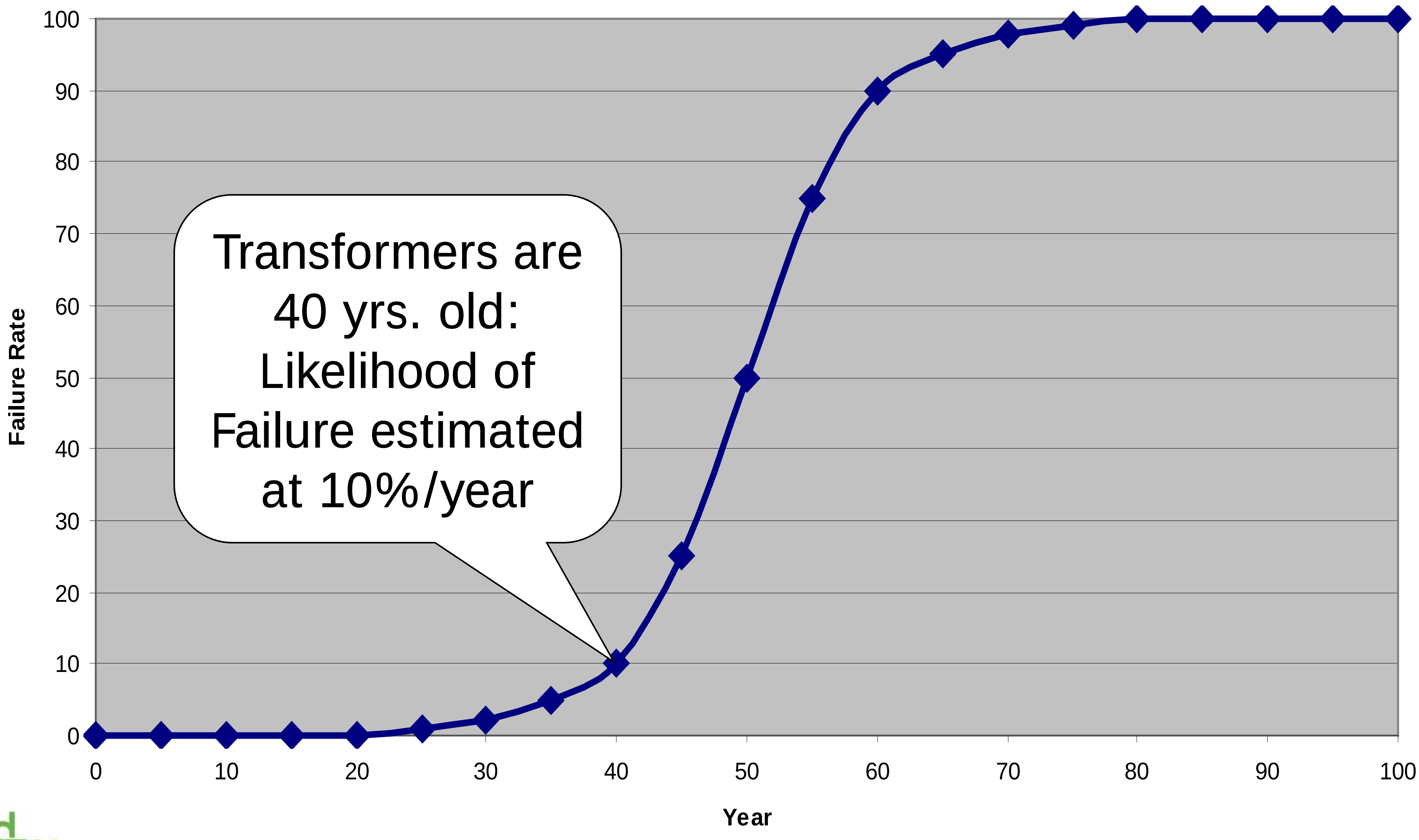
Addressing the Risk of Aging Transformers at a Water Treatment Plant

Dublin Rd. WTP Transformers

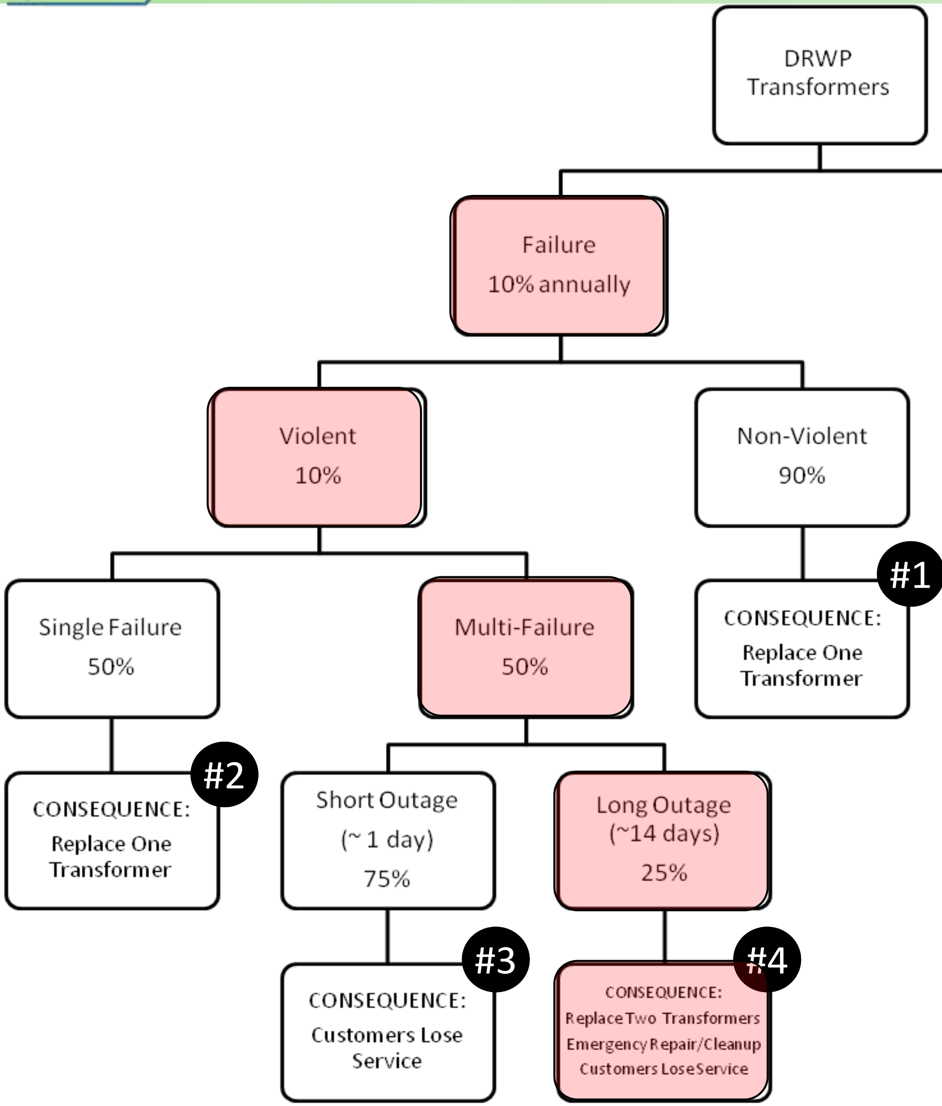
- Two 5 MVA Transformers (primary and backup)
- Both Installed in 1969
- If both fail, 32k customers lose water service
- Upgrade necessary by 2015 – plant expansion
- Transformers have good maintenance history

Plant staff: “We should replace the transformers now!”

Transformer Failure Rate Curve

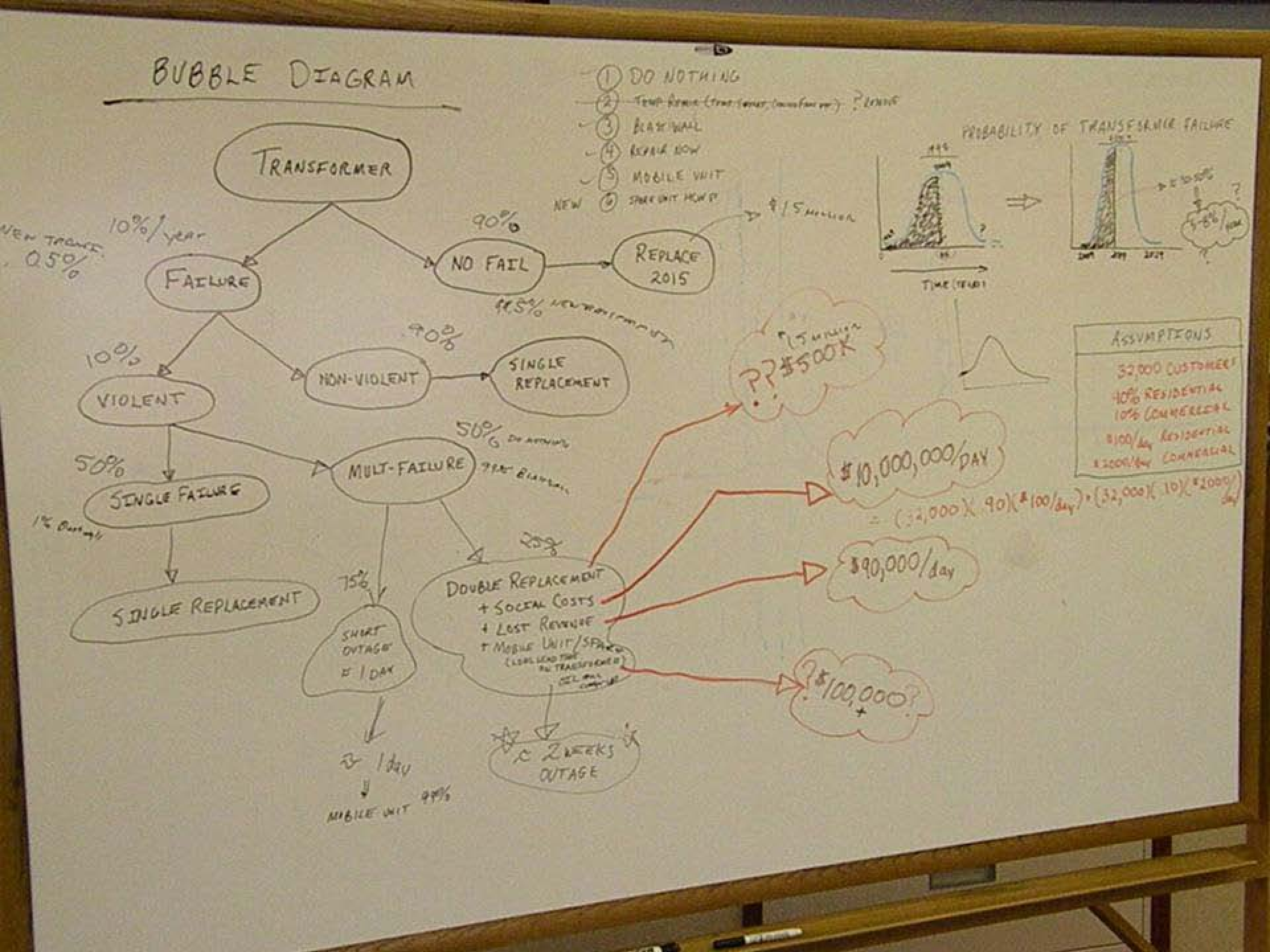


Risk Diagram



Scenario	Item	Cost	Cumulative Probability[1]	Risk Cost
#1	Replace One Transformer	$500,000	0.09	$45,000
#2	Replace One Transformer	$500,000	0.005	$2,500
#3	Social Damage – 1 day	$9,280,000	0.00375	$34,800
#4	Replace Two Transformers	$1,875,000	0.00125	$2,344
	Emergency Repair/Cleanup	$250,000		$313
	Social Damage – 14 days	$129,920,000		$162,400
			Total	$247,356

[1] The cumulative probability (CP) is the product of the probabilities (e.g. Scenario #2, CP = 10% x 10% x 50% = 0.005)


BUBBLE DIAGRAM
1 DO NOTHING
3 BLAST WALL
4 REPAIR NOW
5 MOBILE UNIT
NEW 6 SPARE UNIT NOW
PROBABILITY OF TRANSFORMER FAILURE
TIME (YEARS)
TRANSFORMER
10%/year
NEW TRANS. 0.5%
FAILURE
90%
NO FAIL
REPLACE 2015
$15 million
10%
VIOLENT
90%
NON-VIOLENT
SINGLE REPLACEMENT
50%
SINGLE FAILURE
SINGLE REPLACEMENT
50%
MULT-FAILURE
75%
SHORT OUTAGE ≈ 1 DAY
25%
DOUBLE REPLACEMENT
+ SOCIAL COSTS
+ LOST REVENUE
+ MOBILE UNIT/SPARE
≈ 2 WEEKS OUTAGE
1 day
MOBILE UNIT
??$500K
$10,000,000/DAY
= (32,000)(.90)($100/day) + (32,000)(.10)($2000/day)
$90,000/day
?$100,000?
ASSUMPTIONS
32,000 CUSTOMERS
90% RESIDENTIAL
10% COMMERCIAL
$100/day RESIDENTIAL
$2000/day COMMERCIAL

Microsoft Excel - DRWP TRANSFORMER EVAL - FINAL

File Edit View Insert Format Tools Data Window Help

N26 =0.4*upgrade+capital

	F	H	I	J	K	L	M	N	O	P
4	**Project Business Case Analysis**									
6	**Alternative 1**									
7	Project Name:	**Do Nothing**								
10		**10.0%**	Failure Rate (%)	**10.0%**	Violent Failure %	**50.0%**	Multi-Failure Rat	**25.0%**	Long Outage %	**75.0%** Sho
12		**Assumptions**						**14.0**	Days	**1.0** Day
14		**5.0%**	Discount Rate, or Cost of Capital (%)							
16		**3.0%**	Inflation Rate (%) (Optional)							
18	**No Risk Premium, Input dollars for year shown**									
20	**Financial Analysis**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
22	**1. Project Costs**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
24	**Financial Costs**									
26	Project Capital Costs							$ 900,000		
28	e for Rehab & Replacement / Depreciation									
30	Ongoing O&M Costs									
32	Asset Disposal Costs									
34	Lost Revenue if Failure		$ 1,913	$ 1,913	$ 1,913	$ 1,913	$ 1,913	$ 1,913		
36	Emergency Replacement if Failure		$ 313	$ 313	$ 313	$ 313	$ 313	$ 313		
38	Single Replacement if Failure		$ 47,500	$ 47,500	$ 47,500	$ 47,500	$ 47,500	$ 47,500		
40	Full Replacement if Failure		$ 2,344	$ 2,344	$ 2,344	$ 2,344	$ 2,344	$ 2,344		
42										
44	**Social Costs**									
46	i.e., Complaints, Outages, Breaks/Leaks)		$ 212,500	$ 212,500	$ 212,500	$ 212,500	$ 212,500	$ 212,500		
48	ct on Community Economic Development									
50	Travel Disruption									

City of Columbus: Assume $90000/day revenue for customers in subject area

City of Columbus: Assume $250,000 for emergeny repair (i.e. mobile unit or other repair)

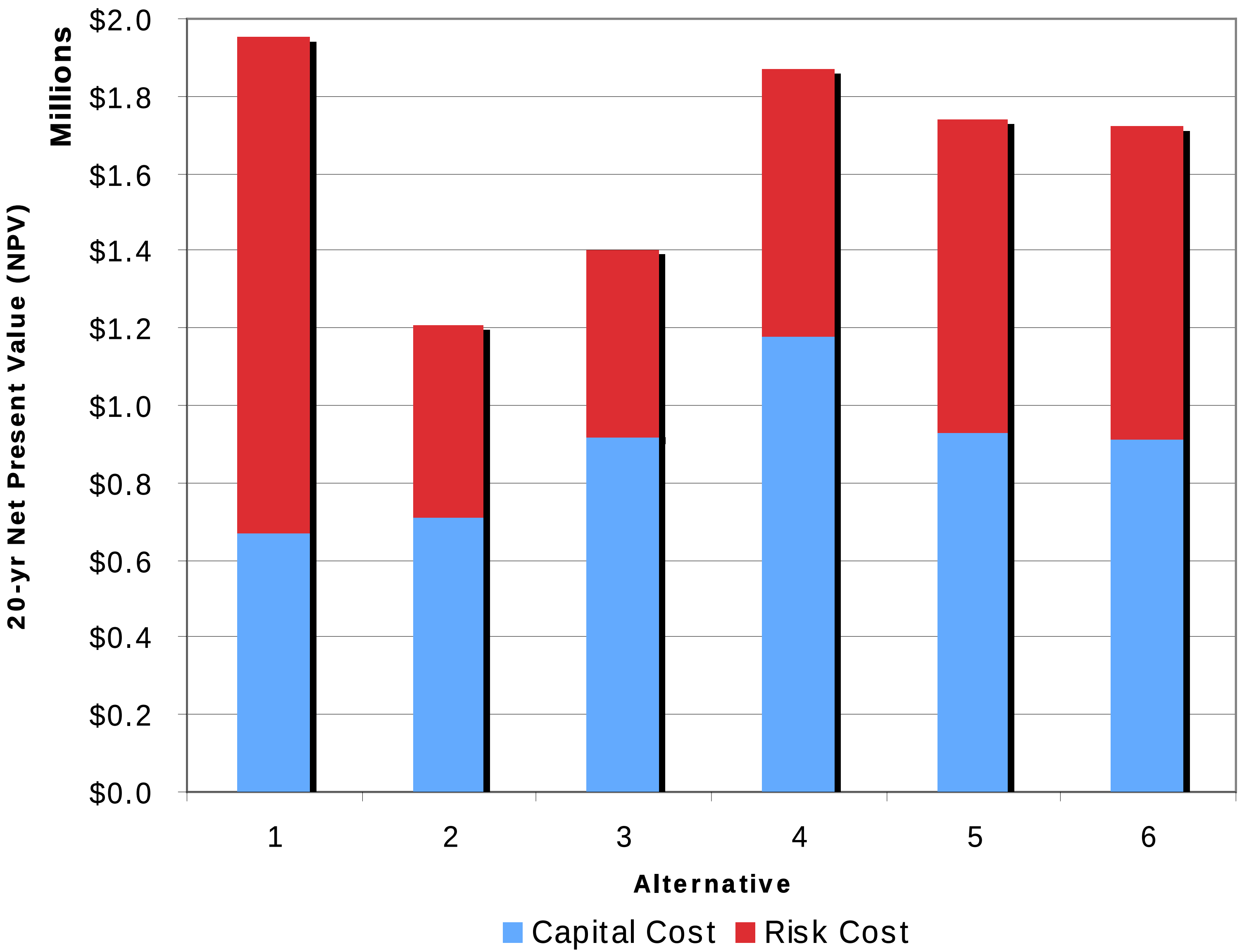
City of Columbus:

Summary | Do Nothing | On-Line Monitoring | Blast Wall | Replace Now | Mobile Unit | HCWP Spare | CALCUL

Ready NUM

start | Financials | Microsoft Excel - DR... | Search Desktop | 3:02 PM

Expected Life-cycle Costs



Alternatives

#1 Status Quo

#2 On-line Monitoring Sensor

#3 Blast Wall

#4 Replace Now

#5 Mobile Unit

#6 HCWP

Final Ranking of Alternatives

1. On-line Monitoring
2. Blast Wall
3. Spare from HCWTP
4. Mobile Unit
5. Replace Now
6. Do Nothing

Original 2 Options

Early Growing Pains with BCEs

- Risk diagram, statistical methods, and life-cycle costing are not commonly understood or practiced
- TBL: difficult to conceptualize and trust assignment of $ values to "externalities"
- Roles: Let your SMEs be SMEs, not economists or statisticians
- When data is not available, ownership of assumptions (e.g. TBL values) is important

Benefits Exceed BCE Results

- Staff realized defining the problem is critical
- BCEs fostered collaboration
- BCEs offered a practical application of risk, lifecycle cost analysis, and triple bottom line
- Decision making is more data driven
- Staff more comfortable making assumptions when data is not available

Conclusions / Results

Conclusions and Results

- AM Implementation can be comprehensive or can be implemented in phases
- AM is a change in how people think, and can takes time and solid commitment
- AM can bring results quickly, and results can take on many shapes
- AM is developing rapidly – learn from others' experiences

Questions?

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