

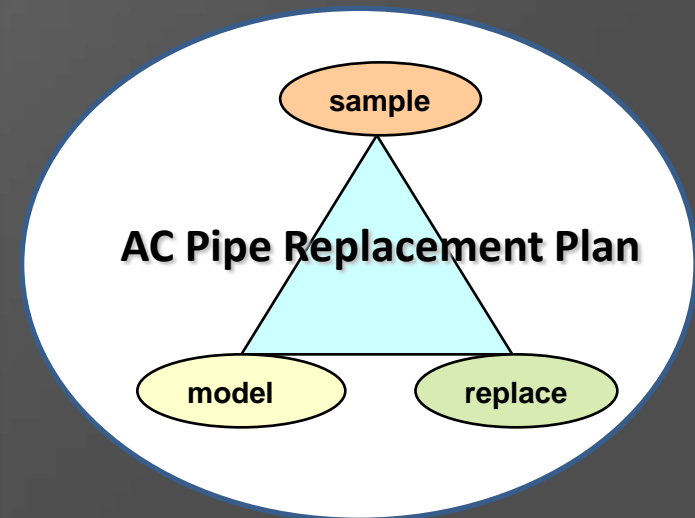


*EAST BAY MUNICIPAL UTILITY DISTRICT*

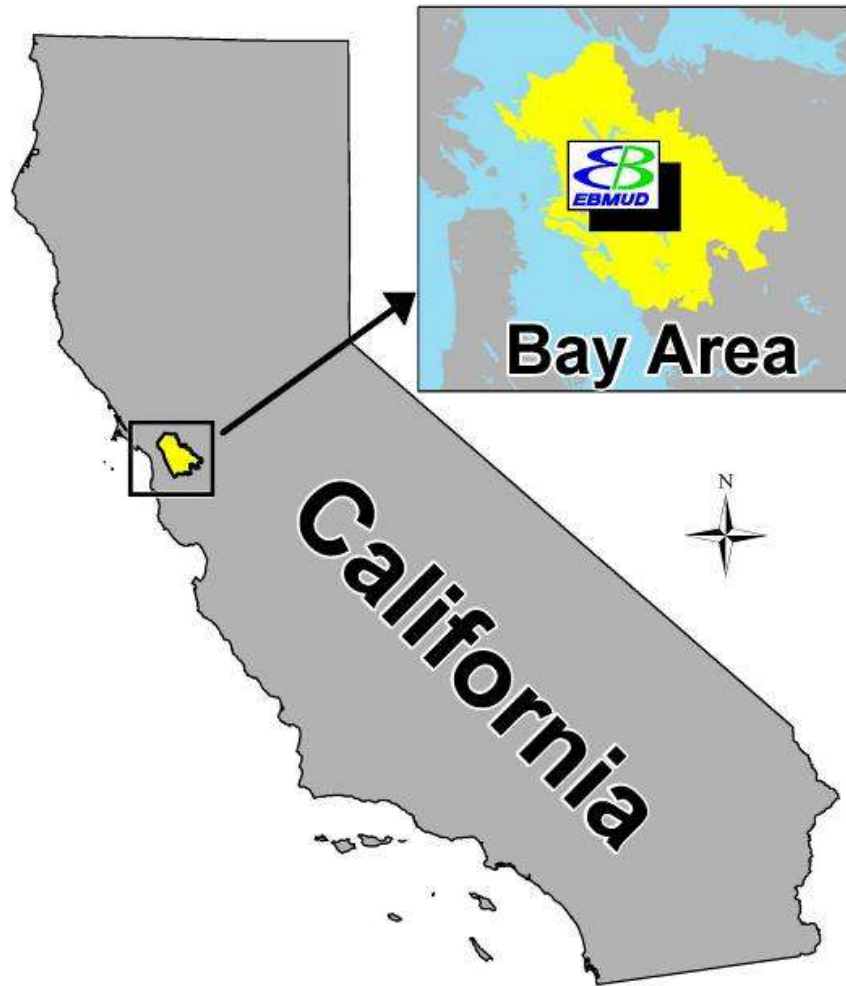
# **Asbestos Cement Pipe Study**

# Outline

- EBMUD's Asbestos Pipe Inventory and Leak History
- Asbestos Pipe Corrosion Studies to date
- Identification of an AC Pipeline Replacement Plan

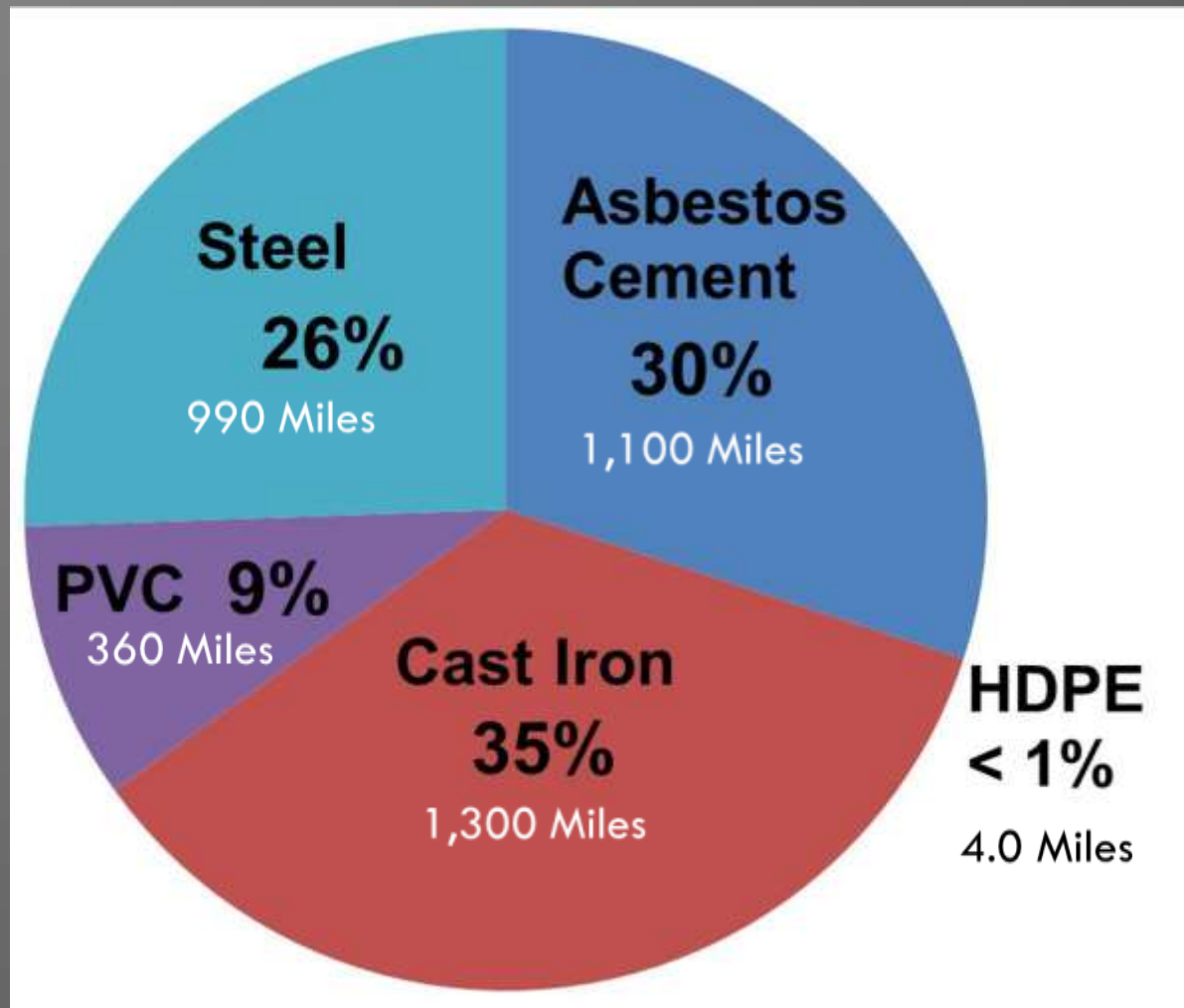


# EBMUD: East Bay Municipal Utility District

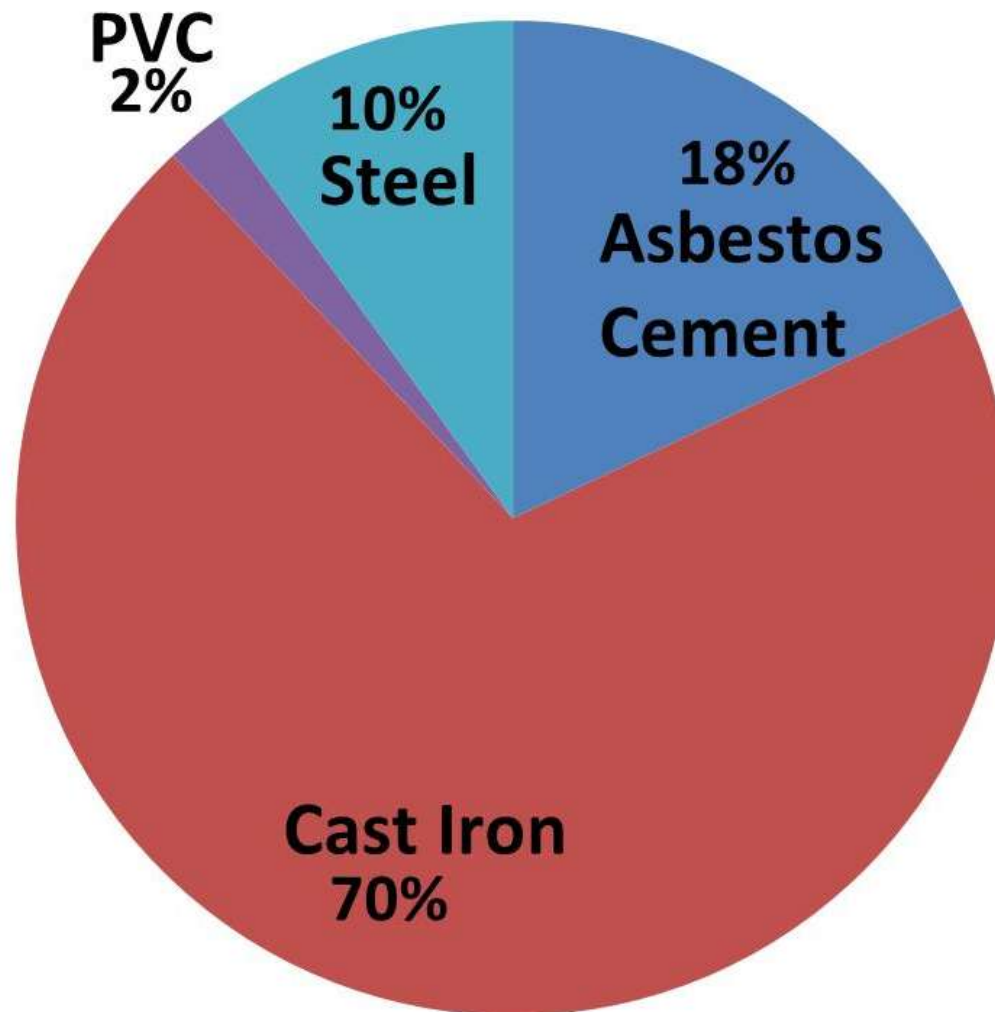


- 4,200 miles of pipe
- 1.3 million people
- 90% of water supply from Sierra foothills
- Alameda and Contra Costa Counties
- 331 square miles of service area

# Distribution Pipeline Inventory

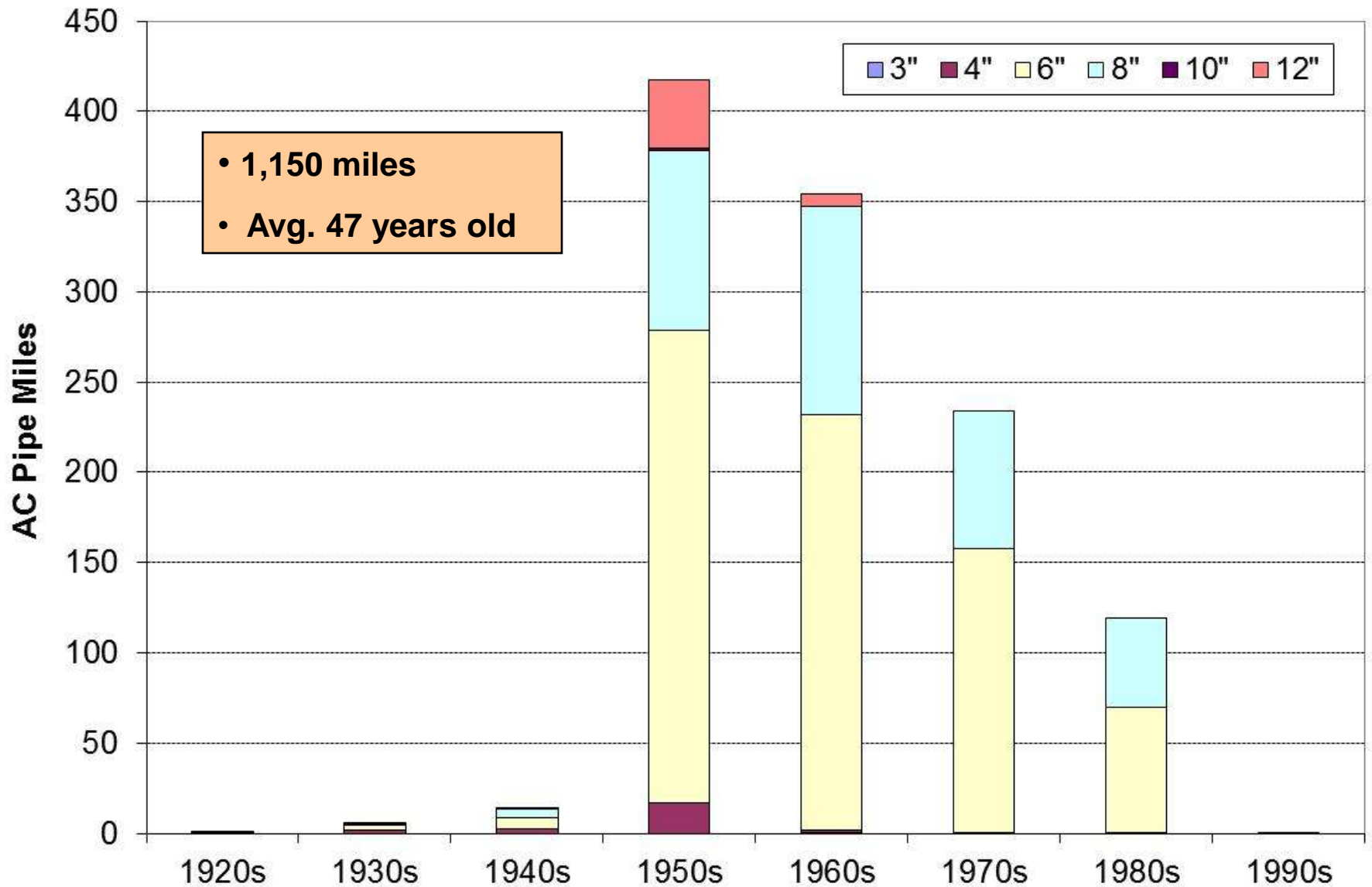


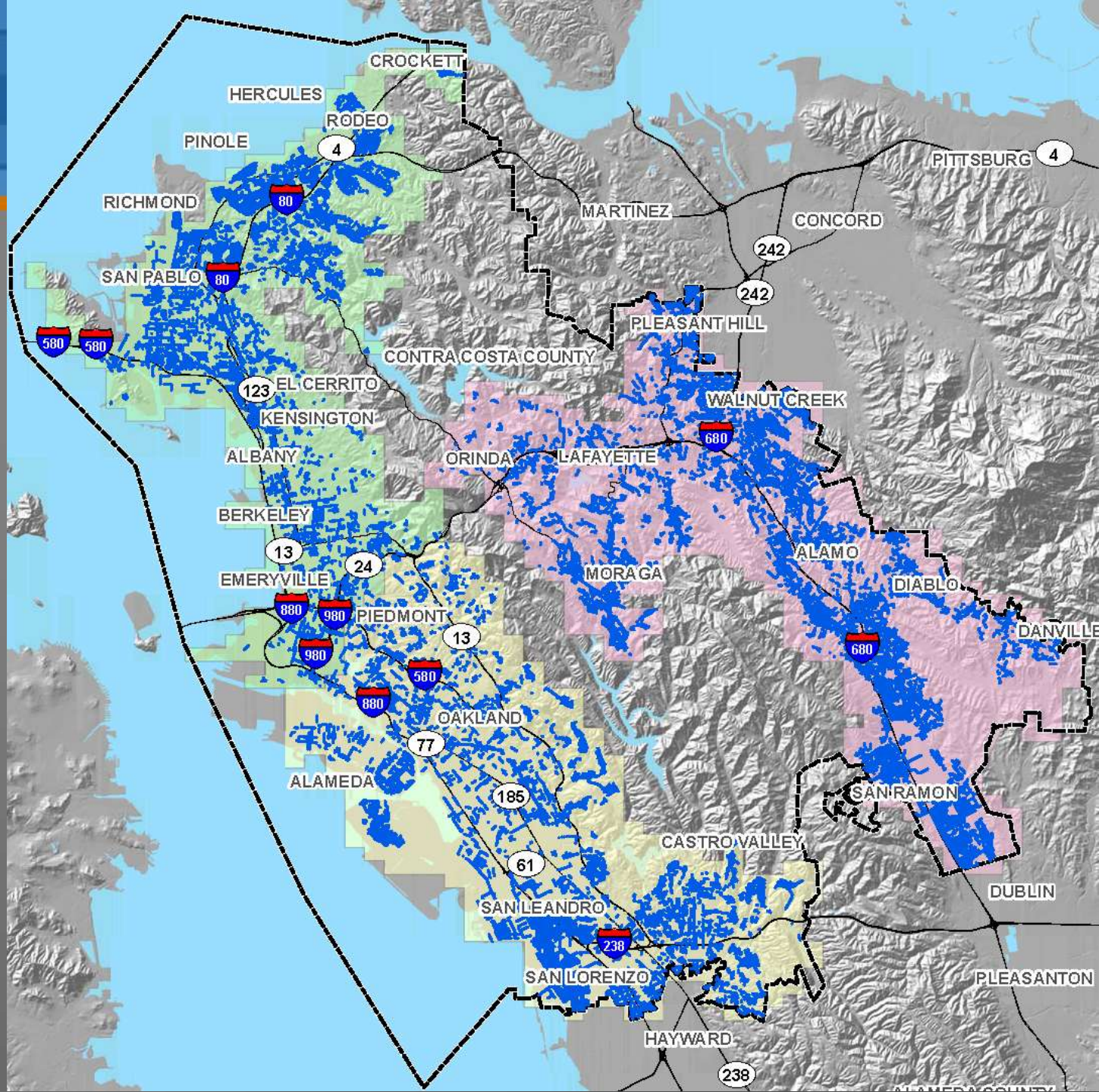
# Leak Summary





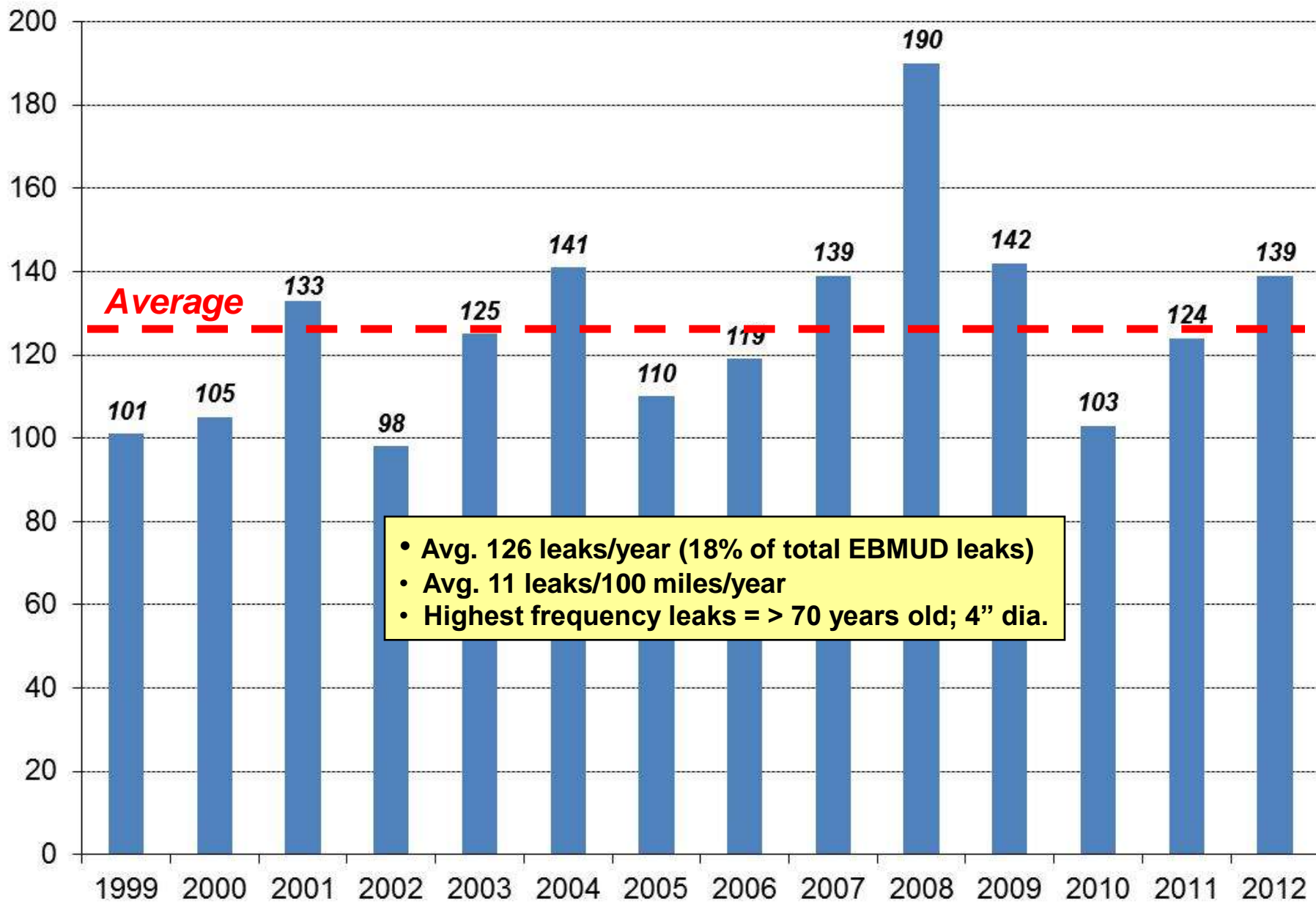
# AC Pipe Inventory



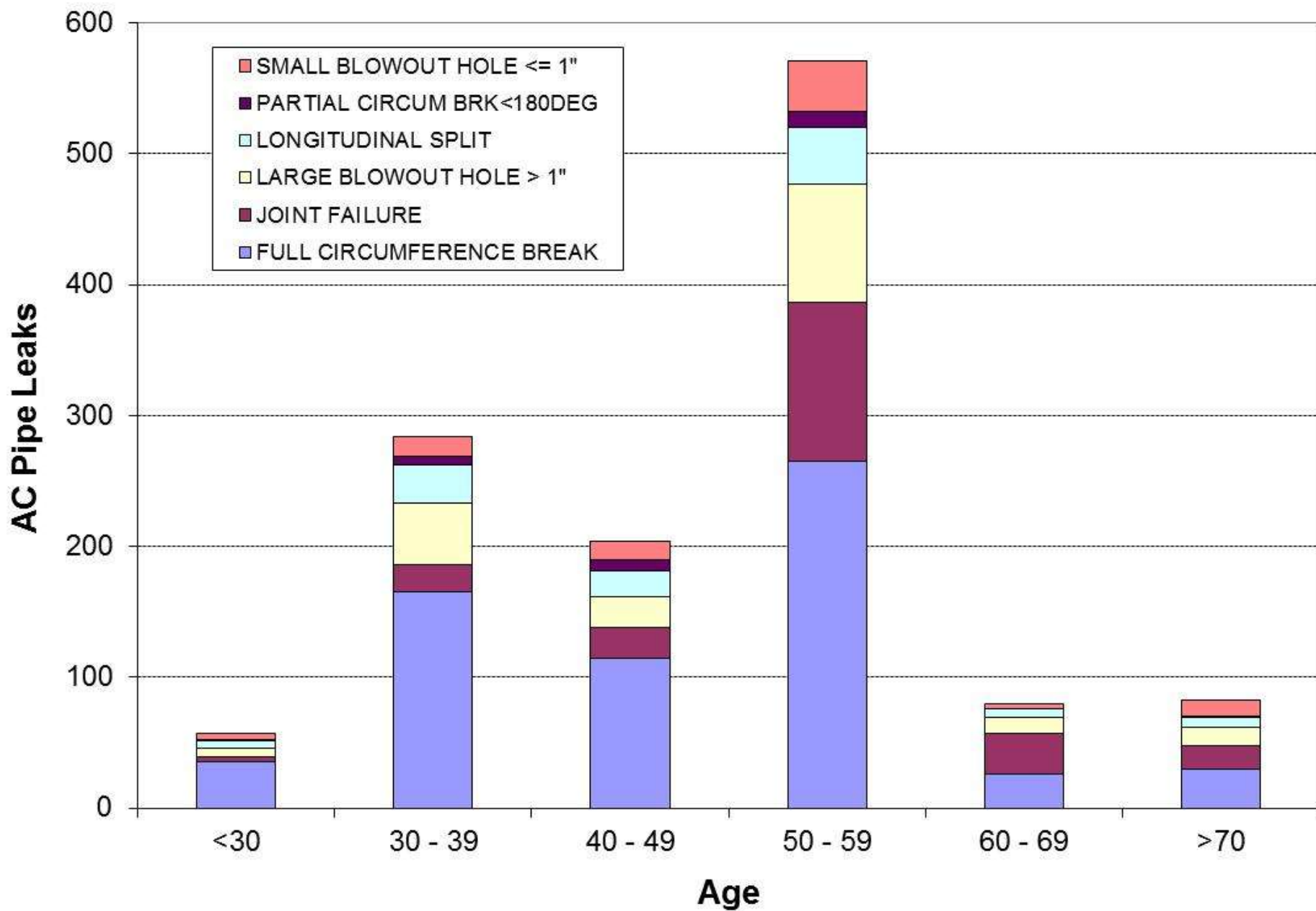


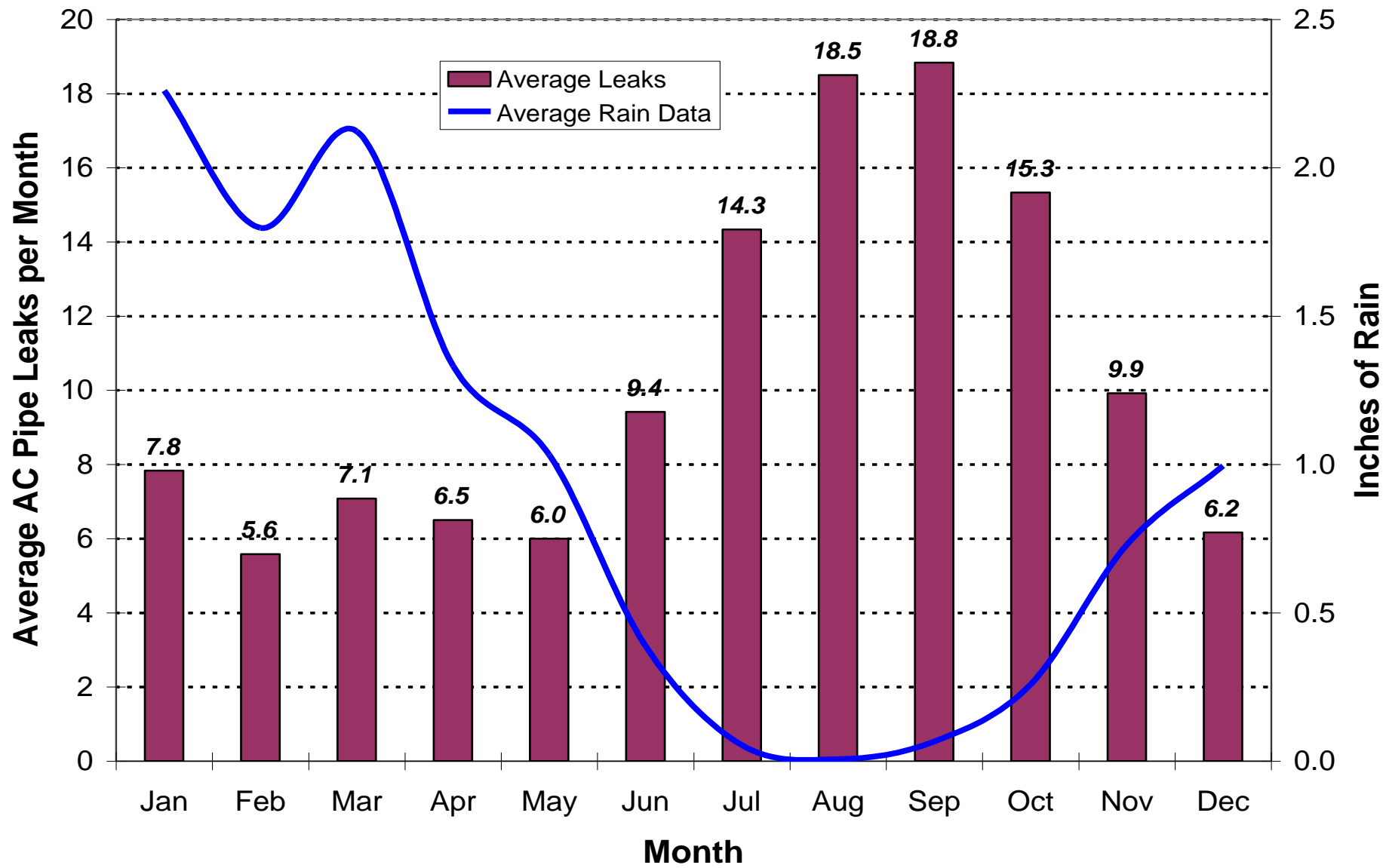


# AC Pipe Leaks per Year









# 2009-2011 Collection & Testing

- 2009-2010: Collected 21 samples
- 2011: Collected 16 additional samples
- Size – various pipe lengths
- All on Failed Pipes



## Phase 1 Asbestos Cement Pipe Corrosion Study

### Technical Report



East Bay Municipal Utility District  
Design and Pipeline Infrastructure Divisions  
Engineering Department

July 2012



SAMPLE #13



SAMPLE #14



SAMPLE #15

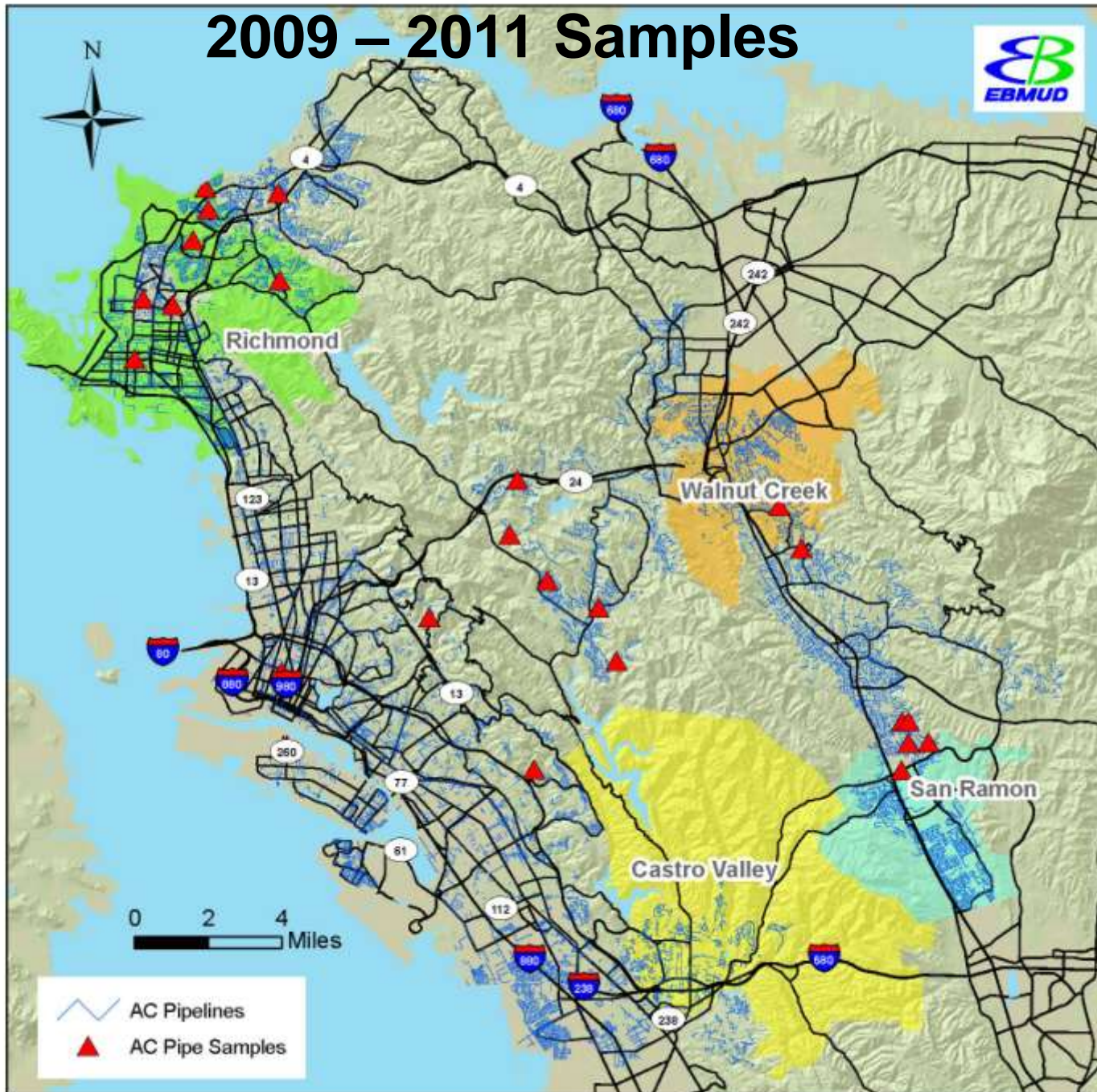


SAMPLE #16





# 2009 – 2011 Samples





# Current Sample Collection (2012-2013)



- Partnership with WRF
- Different Water Quality Zones
- 6" & 8" Diameters, Pre & Post 1970's
- Sizes: 3-in diameter coupons and 3-ft long sections
- 70 samples collected (to date), primarily from "live" pipes w/o leak history

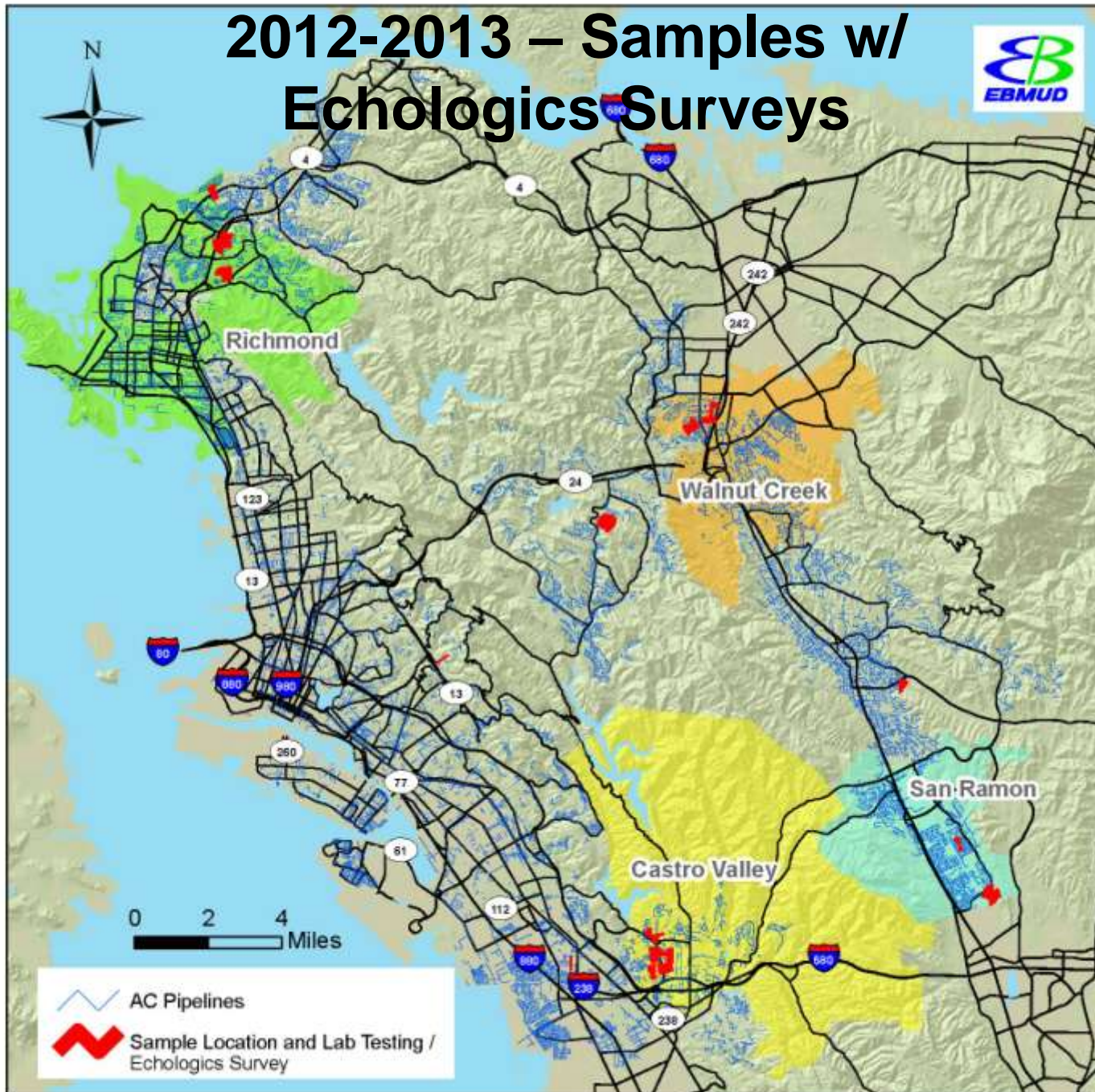


# Lab Testing and Acoustical Surveys

- JDH Corrosion: Laboratory Services
  - Contracted to test up to 100 Samples
  - Battery of tests conducted includes stain, crush, tensile, flexural, density, pH, Scanning Electron Microscope (SEM), petrographic
- Echologics: Pipeline Integrity Testing
  - Acoustical Pipeline Condition Surveys
  - Evaluated approx. 2 miles of pipe at 22 sites
- Stain tests conducted to correlate with Echologics survey results.



# 2012-2013 – Samples w/ Echologics Surveys





# Danville – AC Pipe Replacement





# Danville – AC Pipe Replacement



# Danville – AC Pipe Replacement





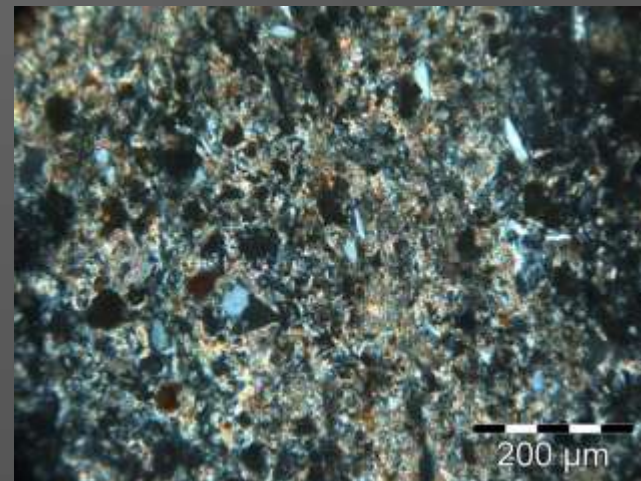
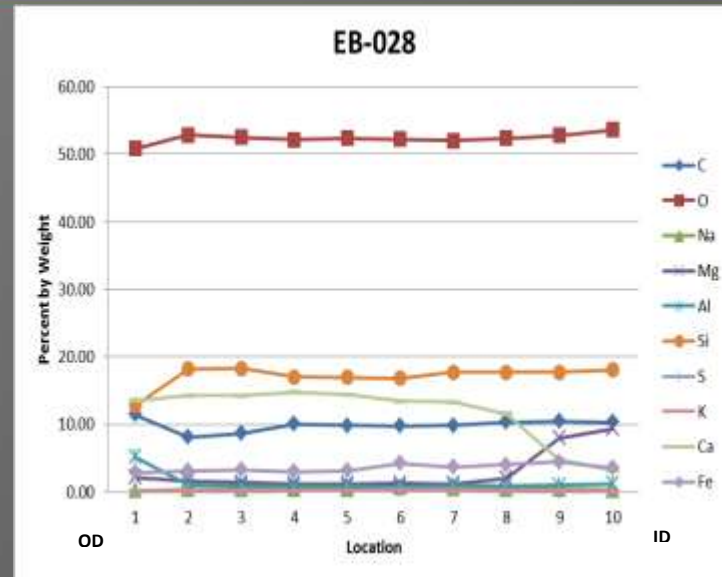
# AC Pipe Corrosion Measurements



Outer Diameter (OD) Thickness

Inner Diameter (ID) Thickness

# Stain Test and Elemental Composition





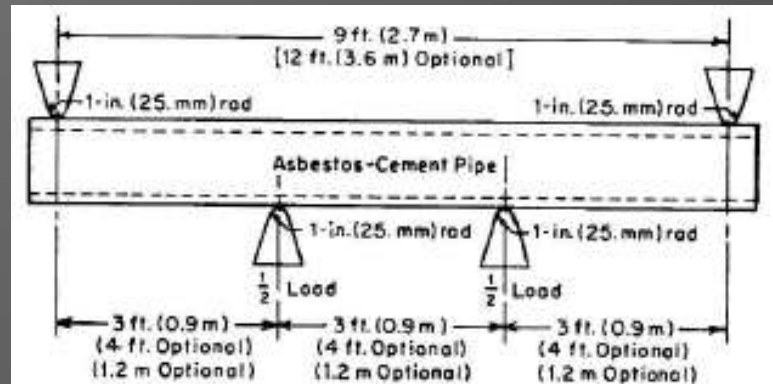
# Crush Strength Test



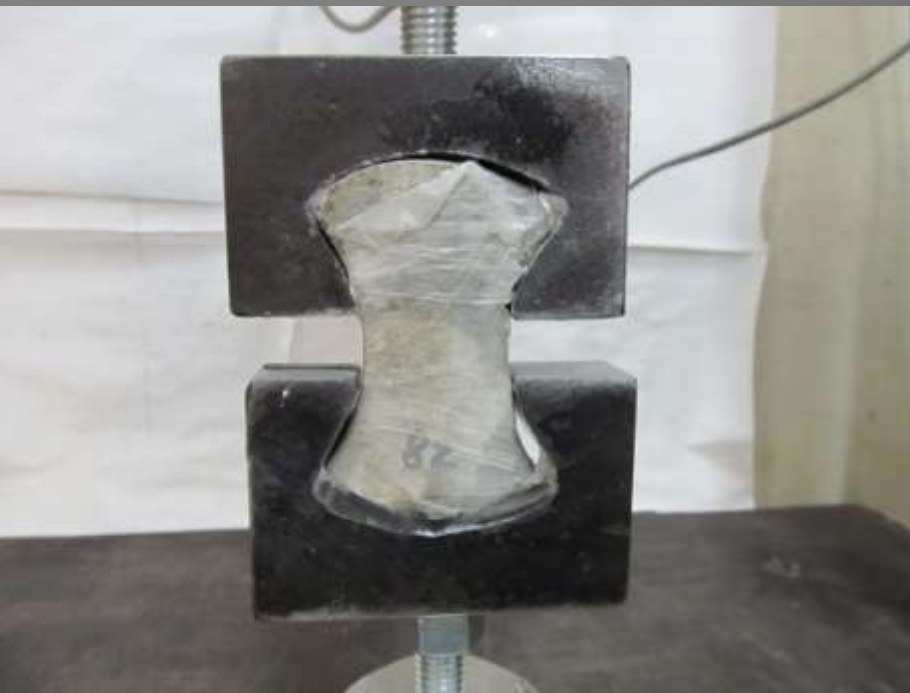
Crush strength tests conducted on the pipe samples indicated that all of the samples met the requirement of as-manufactured (new) pipe for Class 150 pipe



# Flexural Testing

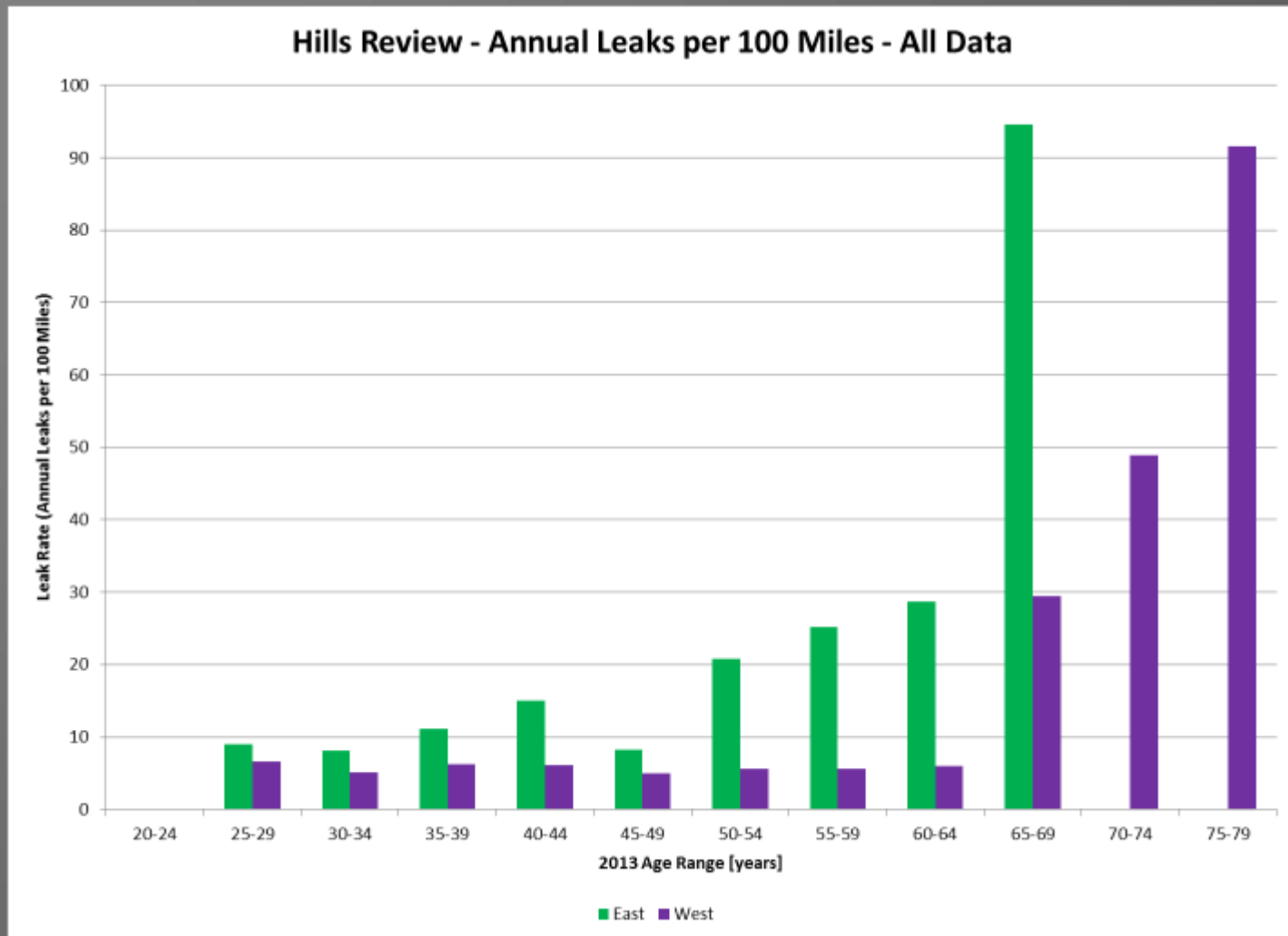


# Tensile Test



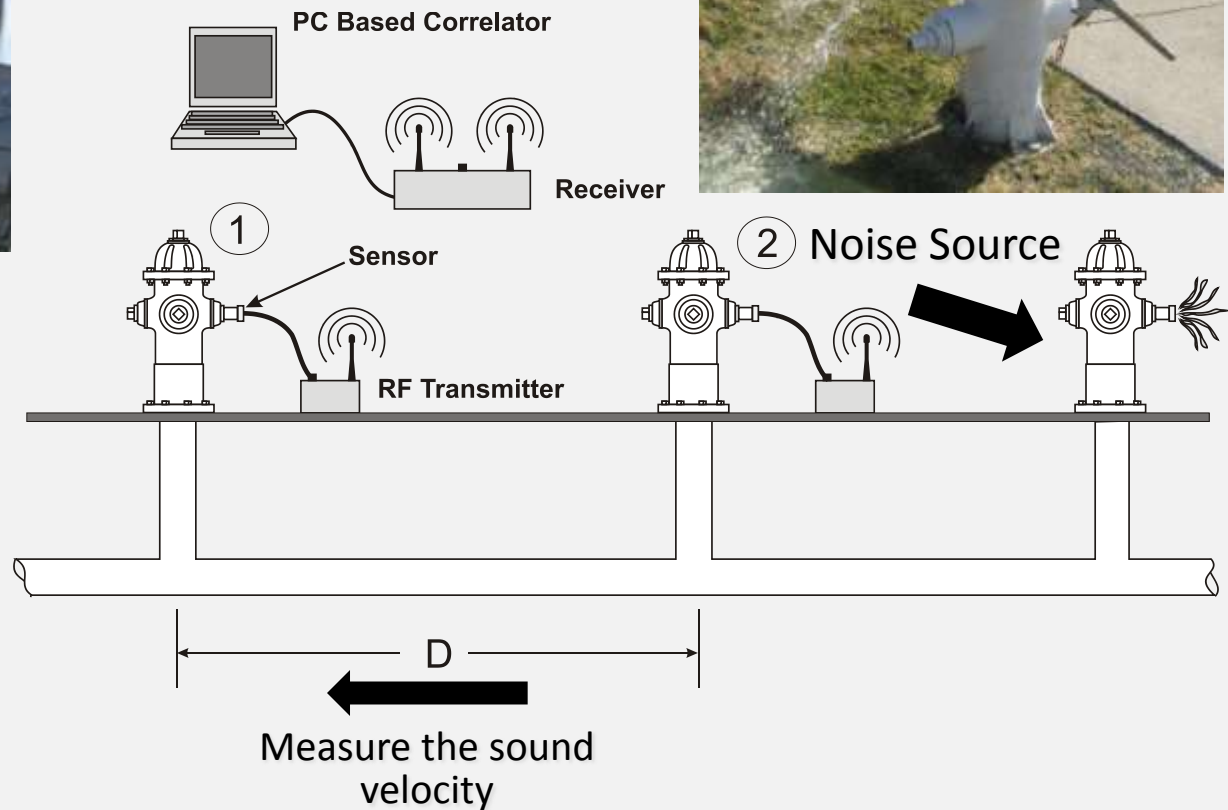


# EAST of HILLS versus West of Hills AC Pipe





# Echologics Acoustic Surveys



Street Name	Location	Coupon or 3' Sample	Diameter	Year Installed	Echologics % Loss	Stain % Loss	Good Correlation Ech v Stain
Narcissus Court	Castro Valley	Coupon	6	1978	40%	0%	No
Todd Court	Castro Valley	Sample	6	1976	58%	48%	Yes
Lakeridge Road/La Costa Avenue	Castro Valley	Sample	6	1985	38%	48%	Yes
Nordell Avenue	Castro Valley	Coupon	6	1953	60%	29%	No
Wisteria Street	Castro Valley	Coupon	8	1963	21%	21%	Yes
Greenway Drive	Richmond	Coupon	8	1977	11%	27%	No
Park Central Court	Richmond	Coupon	6	1978	15%	18%	Yes
Raton Court	Richmond	Coupon	6	1959	57%	38%	No
Dublin Drive	Richmond	Sample (Break)	6	1961	37%	84%	No
Encinal Drive	Walnut Creek	Coupon	6	1960	38%	48%	Yes
Montin Court	Walnut Creek	Coupon	6	1975	29%	33%	Yes
Leroy Lane	Walnut Creek	Coupon	8	1965	57%	19%	No
El Suyo Drive	San Ramon	Sample	8	1976	22%	23%	Yes
Tangerine Road	San Ramon	Sample	8	1964	28%	26%	Yes
Wyndale Drive	Castro Valley	Sample	6	1955	35%	74%	No
Carlwyn Drive	Castro Valley	Sample	8	1955	26%	58%	No

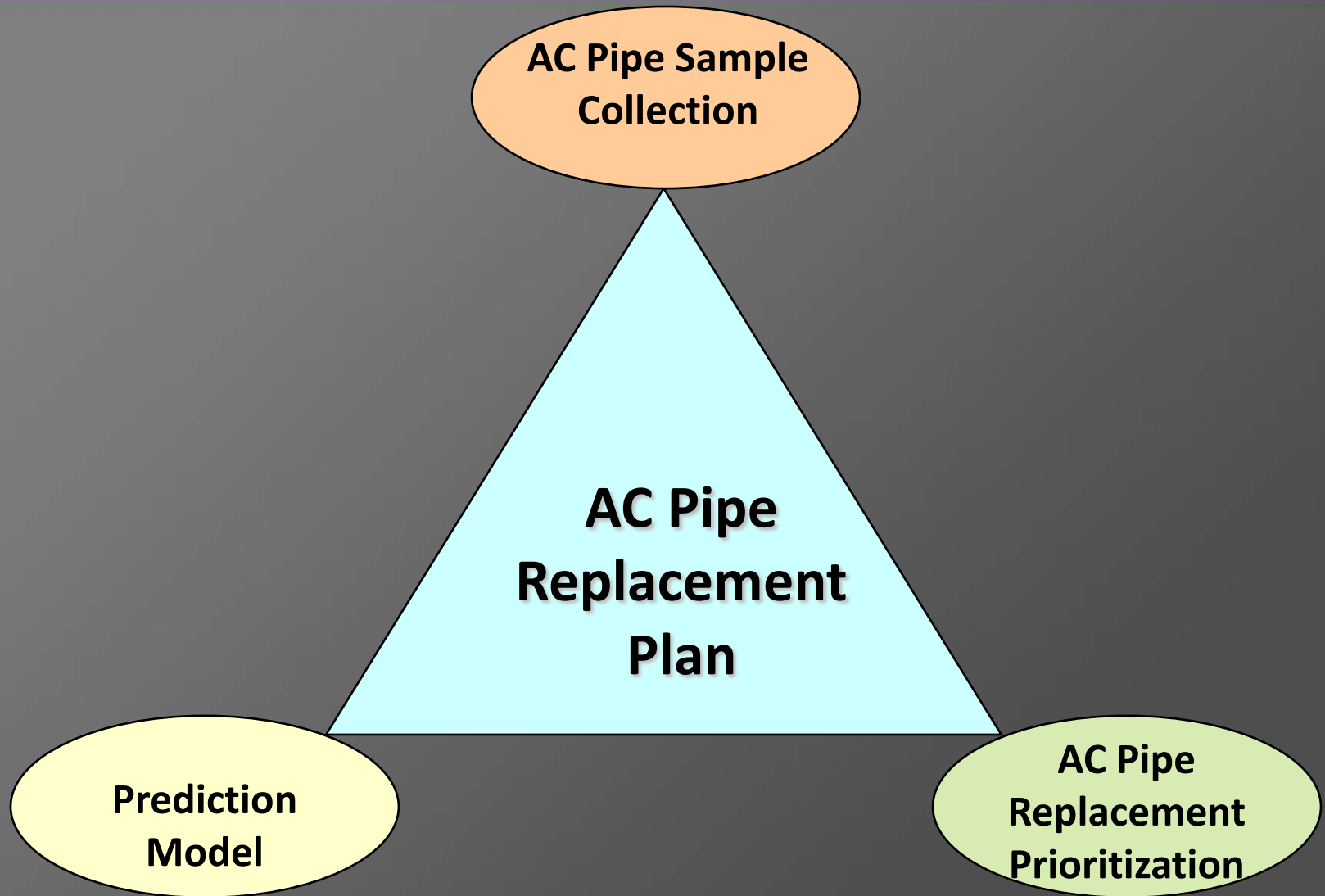
Stain Test results compared to Echologics Surveys.

4 out of 6 pipe samples (non-break) have good correlation

vs.

4 out of 9 for coupons

# Pipe Replacement Plan



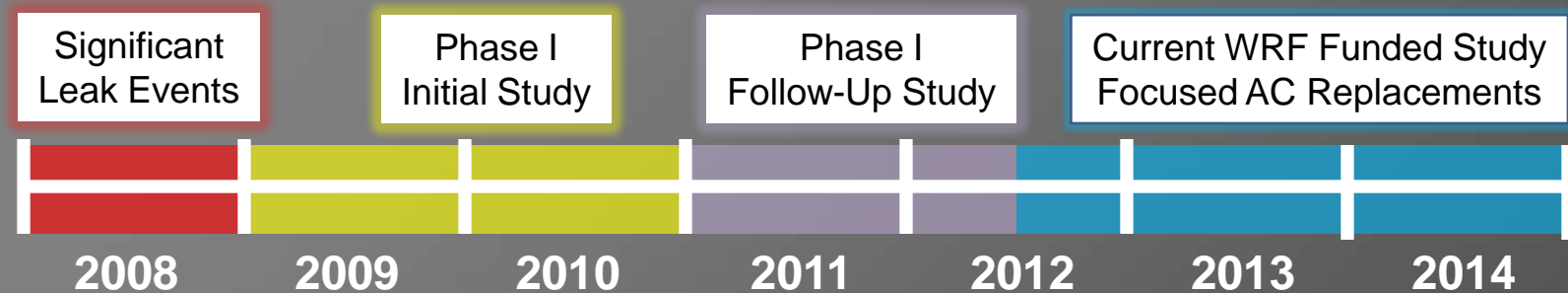


# Prediction Model

## Model Input Data:

1. AC Pipe Database – Installation Age Attribute
2. Agency-Specific Corrosion Rates for AC Pipe
3. Pipeline Class Safety Factor Tolerances

# AC Pipe Study Timeline & Next Steps



- Ongoing thru 2013
  - Collect and Test AC Samples
  - Investigate Replacement/Rehab Methods
  - Investigate Water Quality Optimization
- 2014
  - Complete WRF/EBMUD AC Pipe Study
  - Pilot replacement/rehab method



# Asbestos Cement Pipe Corrosion Study

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