Watershed Partnership Seminar

Assessing the Impacts of Storm Water Infiltration:

Los Angeles Basin Water Augmentation Study

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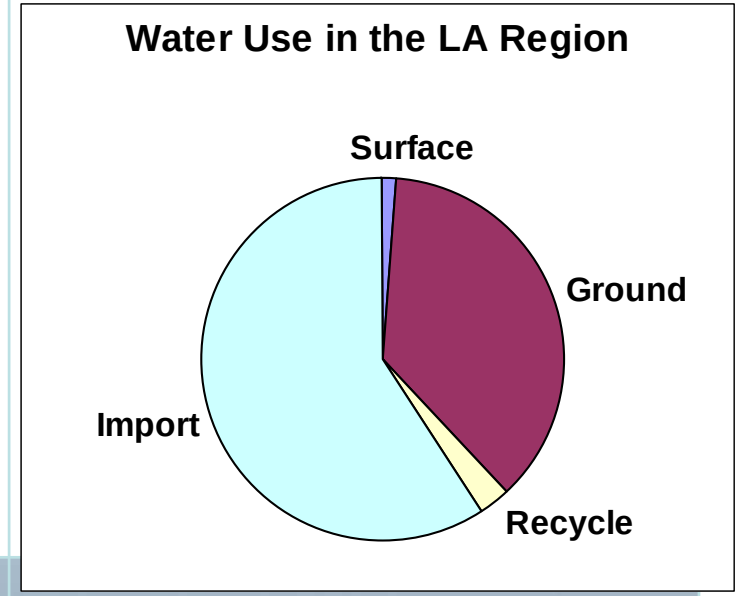
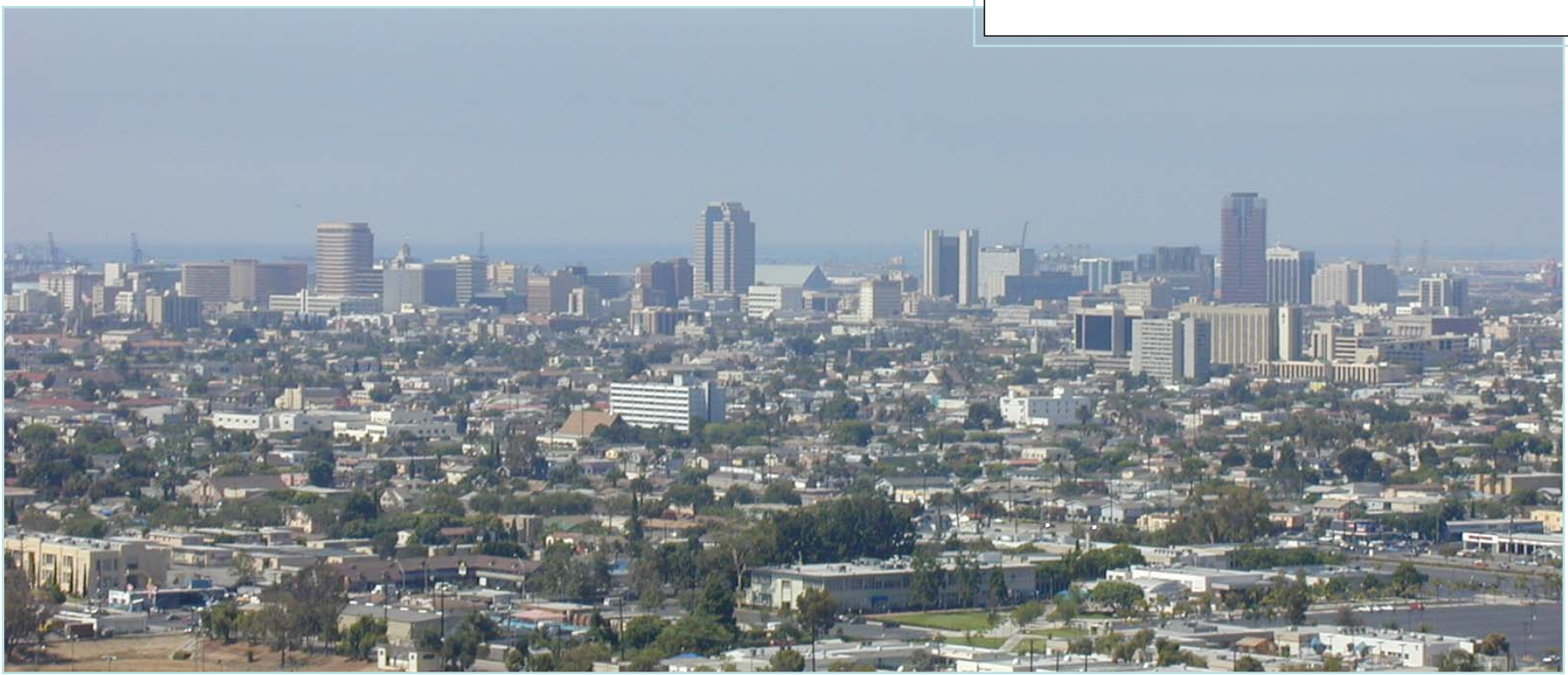
Los Angeles & San Gabriel
Rivers Watershed Council

October 17, 2006

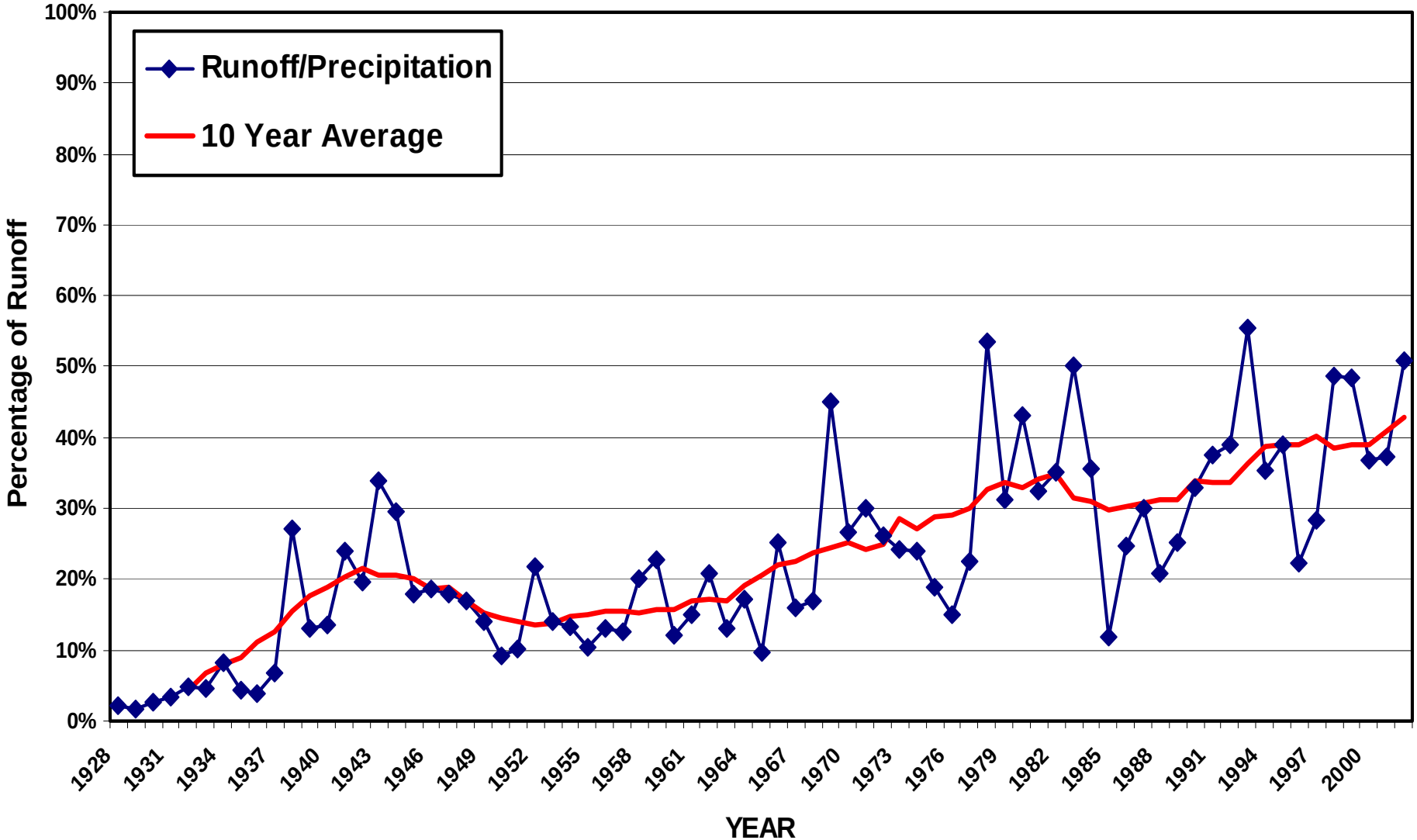
CALFED BAY-DELTA PROGRAM

Development of Water in the West Encouraged Urban Development in Arid Regions





Hydromodification In Los Angeles



LA Basin Water Augmentation Study

- **Managing stormwater as an asset**
- **Purpose:** to explore the practical potential for increasing local water supplies and protecting receiving waters by capturing stormwater runoff for infiltration and groundwater recharge
- **Research questions:**
  - Impact on groundwater quality and quantity
  - Accessibility of recharged water
  - Cost effectiveness
  - Other potential benefits: social, economic, environmental
  - Potential for region-wide implementation
- **Multi-year study with multiple agency partners**

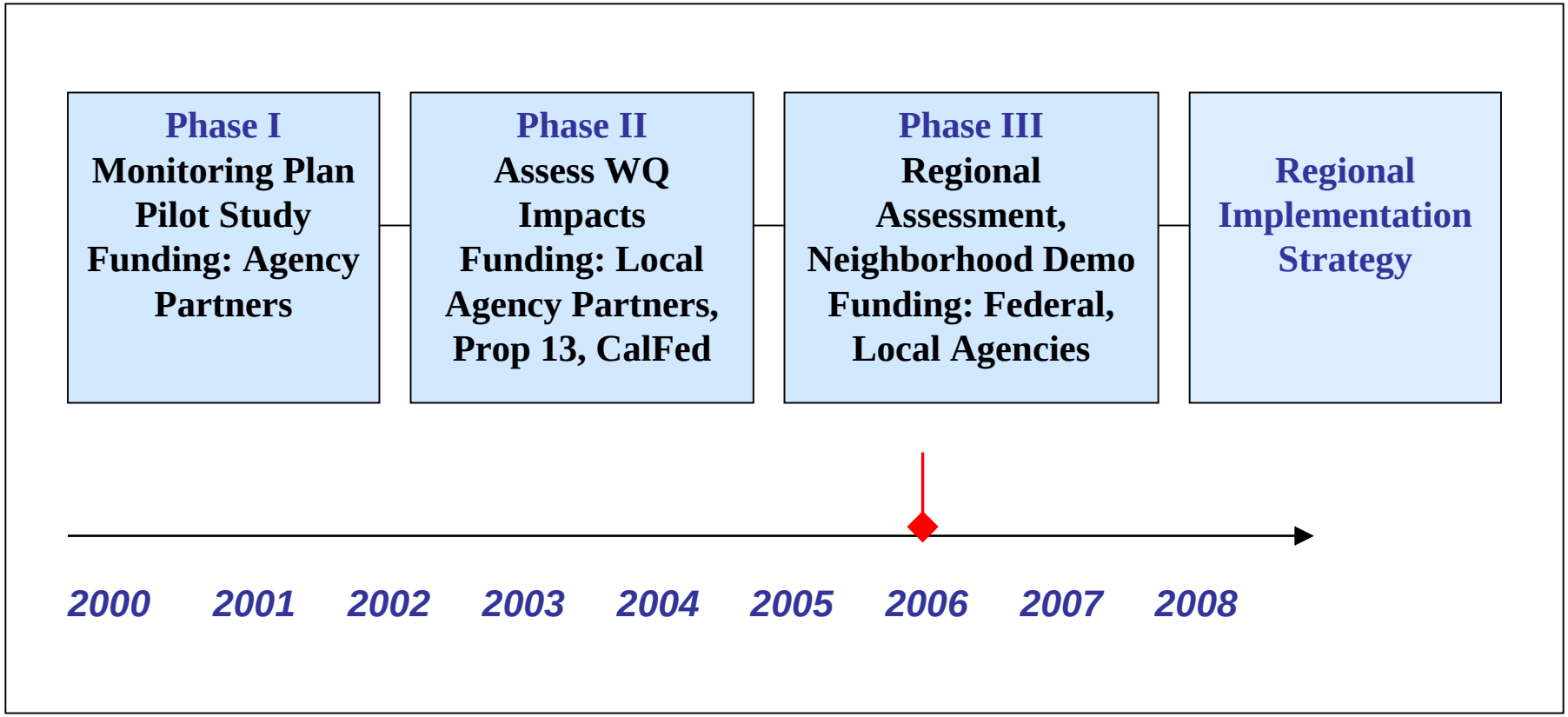
WAS Project Partners

City of Los Angeles Department of Water & Power
City of Los Angeles Watershed Protection Division
City of Santa Monica Environmental Programs
County of Los Angeles Department of Public Works
Metropolitan Water District of Southern California
Regional Water Quality Control Board, LA Region
TreePeople
University of California, Riverside
U. S. Bureau of Reclamation
Water Replenishment District of Southern California
State grants: Prop 13 SWRCB and CalFed

WAS Study Design

- ✓ **Initial Study (2000-01)**
  - Literature Review
  - Preparation of Monitoring Plan
- ✓ **Phase I (2001-02)**
  - Pilot Study: investigation of the groundwater quality impacts of infiltrating storm water by monitoring two BMP sites
- ✓ **Phase II (2002-05)**
  - Add additional sites, different land uses and site conditions, continued monitoring
- → **Phase III (2003-2008)**
  - Neighborhood-scale demonstration project (retrofit)
  - Regional runoff-infiltration model and economic models
  - Assess feasibility of region-wide infiltration in terms of physical constraints, social and institutional issues and economic factors

WAS Timeline & Funding



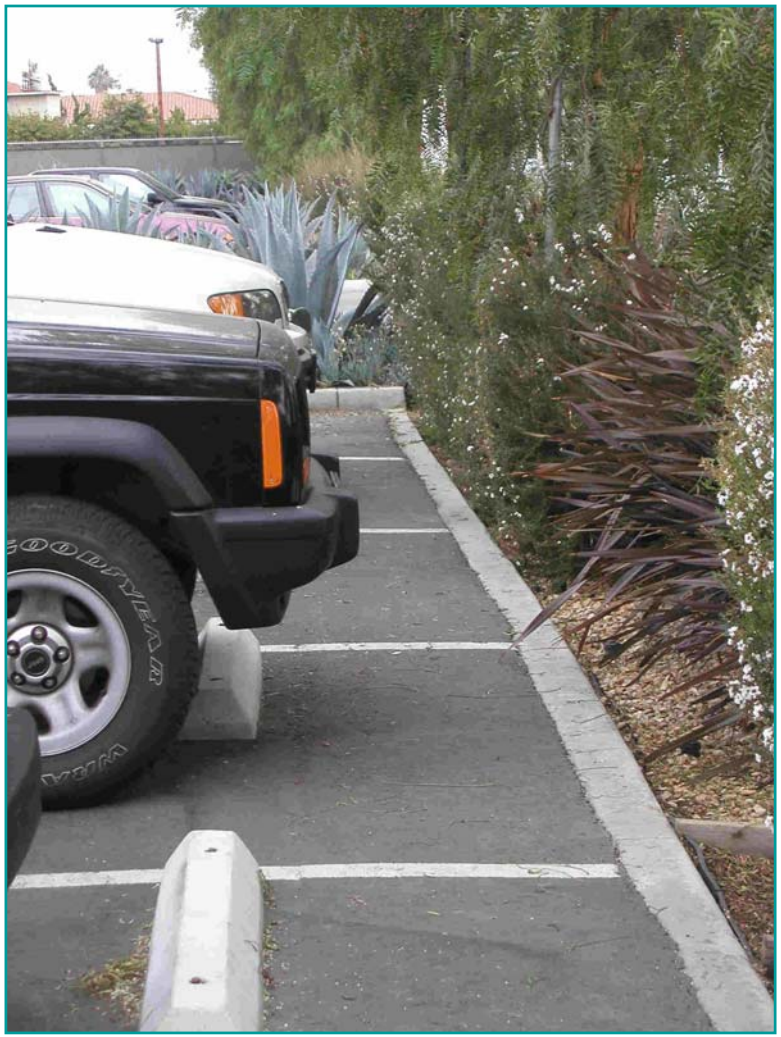
Phase I = $150k

Phase II = $ 2m

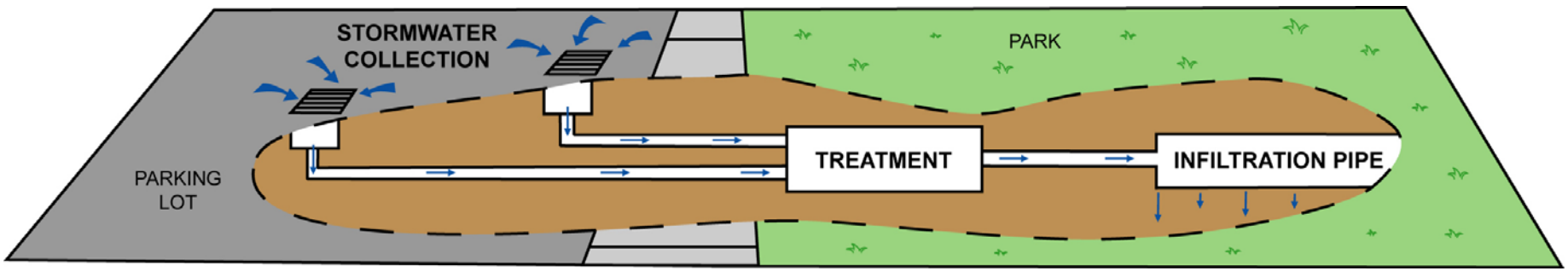
Phase III = $ 4m

Total Project Estimate = $6 million

BMPs to Capture Stormwater Runoff for Infiltration



City Park BMP Installation



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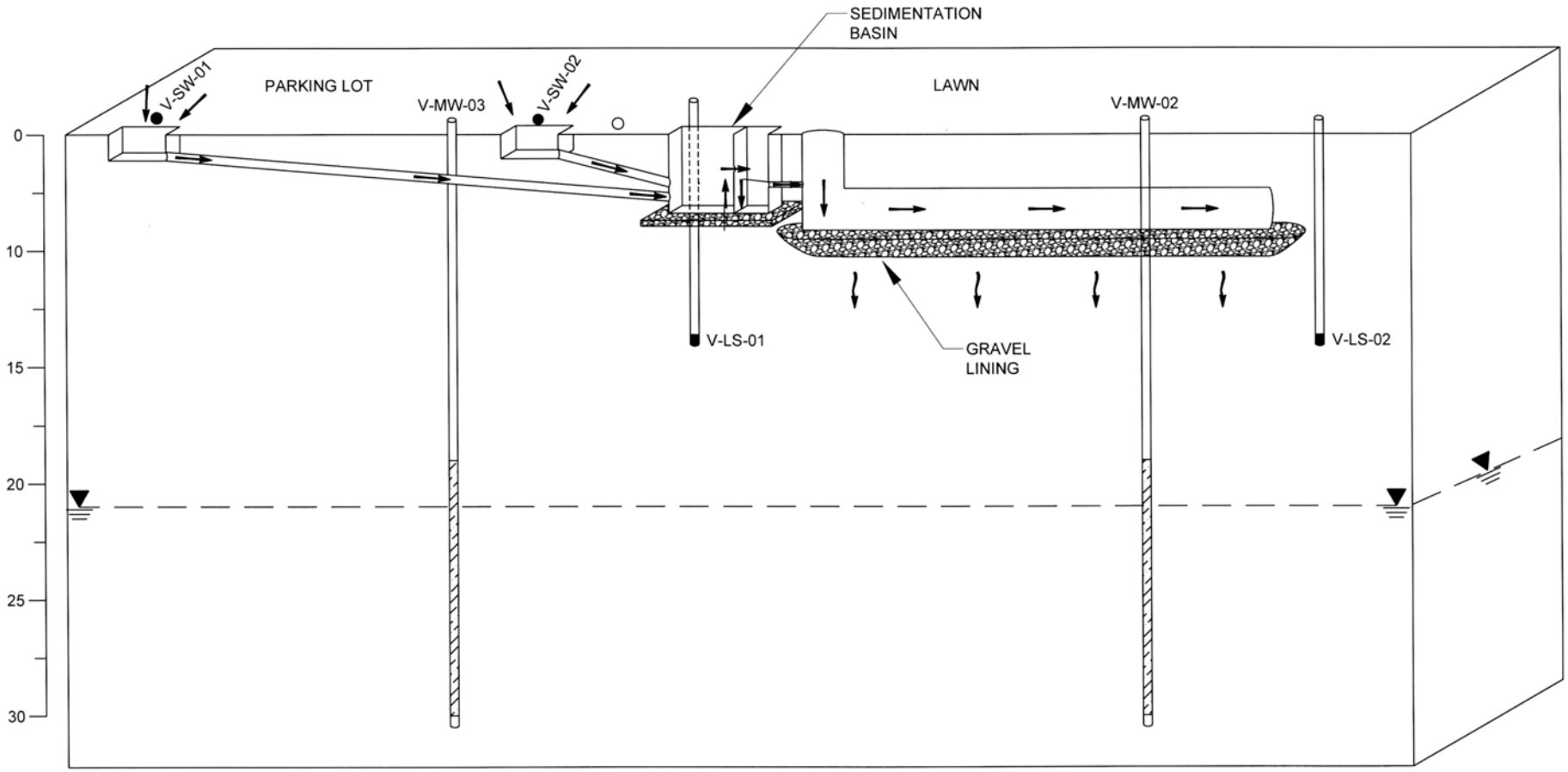


Monitoring Program

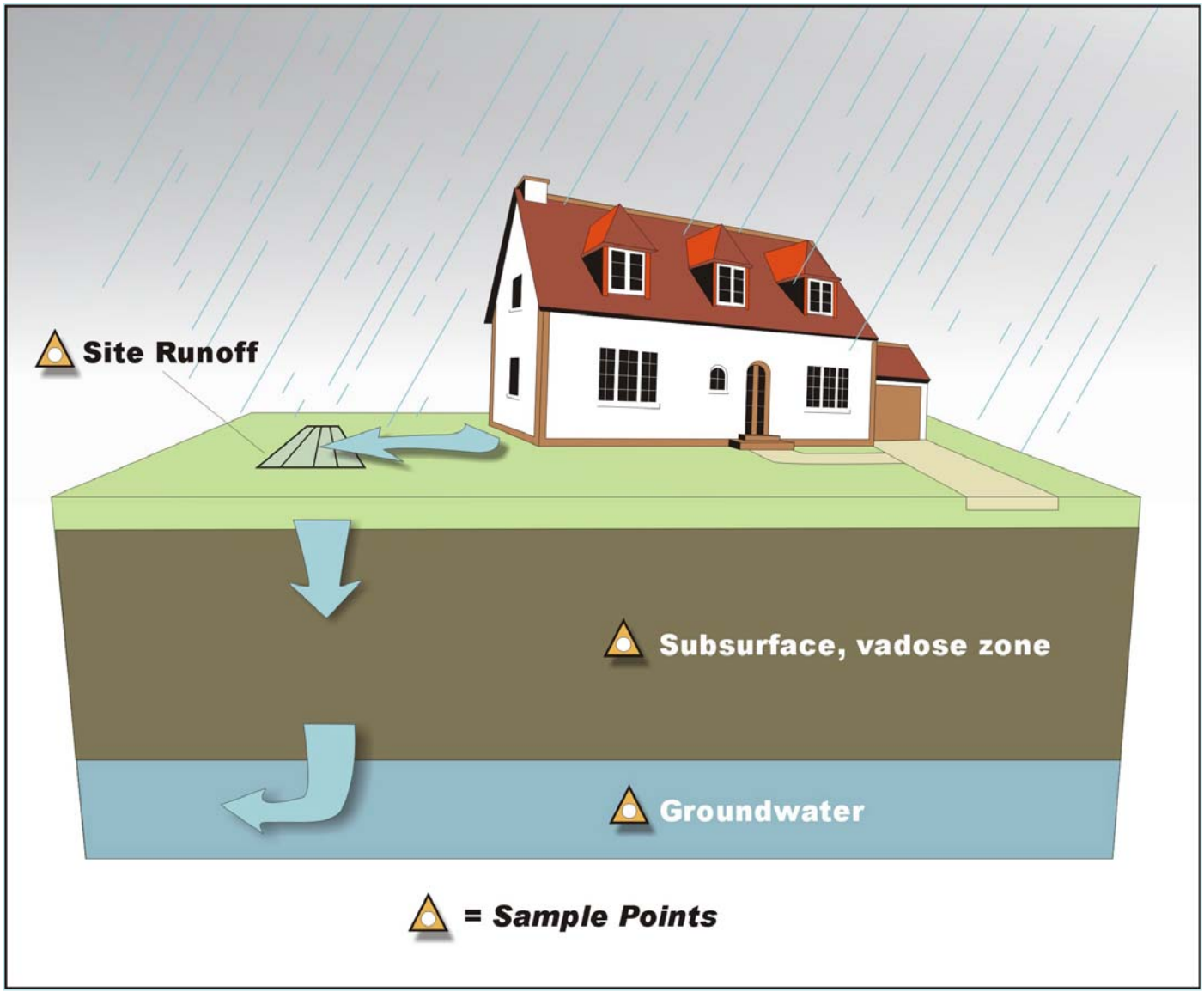
- Constituent list included pollutants of concern for stormwater and groundwater
- Six monitoring sites
  - Industrial (2), commercial, residential, school, park
  - Depth to groundwater varied from 22 to 350+ feet
  - Soil types varied from sandy soils to silty-clay soils
- Sampling plan: 3-4 storm events/season for 2-4 years
  - Sample site runoff during storm
  - Sample lysimeters and wells after
  - Monitor infiltration rates
- Continued subsurface monitoring (2 storm events/yr for 2 years)

Monitoring Program

Summary of Analytical Suite

Category	Stormwater and wells	Lysimeters
General Minerals	X	X
Trace Metals (total & dissolved)	X	X
Oil and Grease	X	residential
Perchlorate	X	X
Glyphosate	X	park
Volatile organic compounds (VOCs)	X	X
Semi-volatile organic compounds (SVOCs)	X	
NDMA	X	
Surfactants	X	
Bacteria (total coliform, fecal coliform, e. coli)	X	X

Monitoring Program



Monitoring Program Results

No trends indicating that infiltration is negatively impacting groundwater

- Constituents of concern detected in stormwater include lead, arsenic, chromium VI, perchlorate, some organics. Concentrations in groundwater did not correspond to stormwater detections.
- Other constituents of concern for groundwater not detected in stormwater: NDMA, PAHs, DBCP, 1,4-Dioxane.
- Soil is efficient at removing bacteria during infiltration

Monitoring Program Results

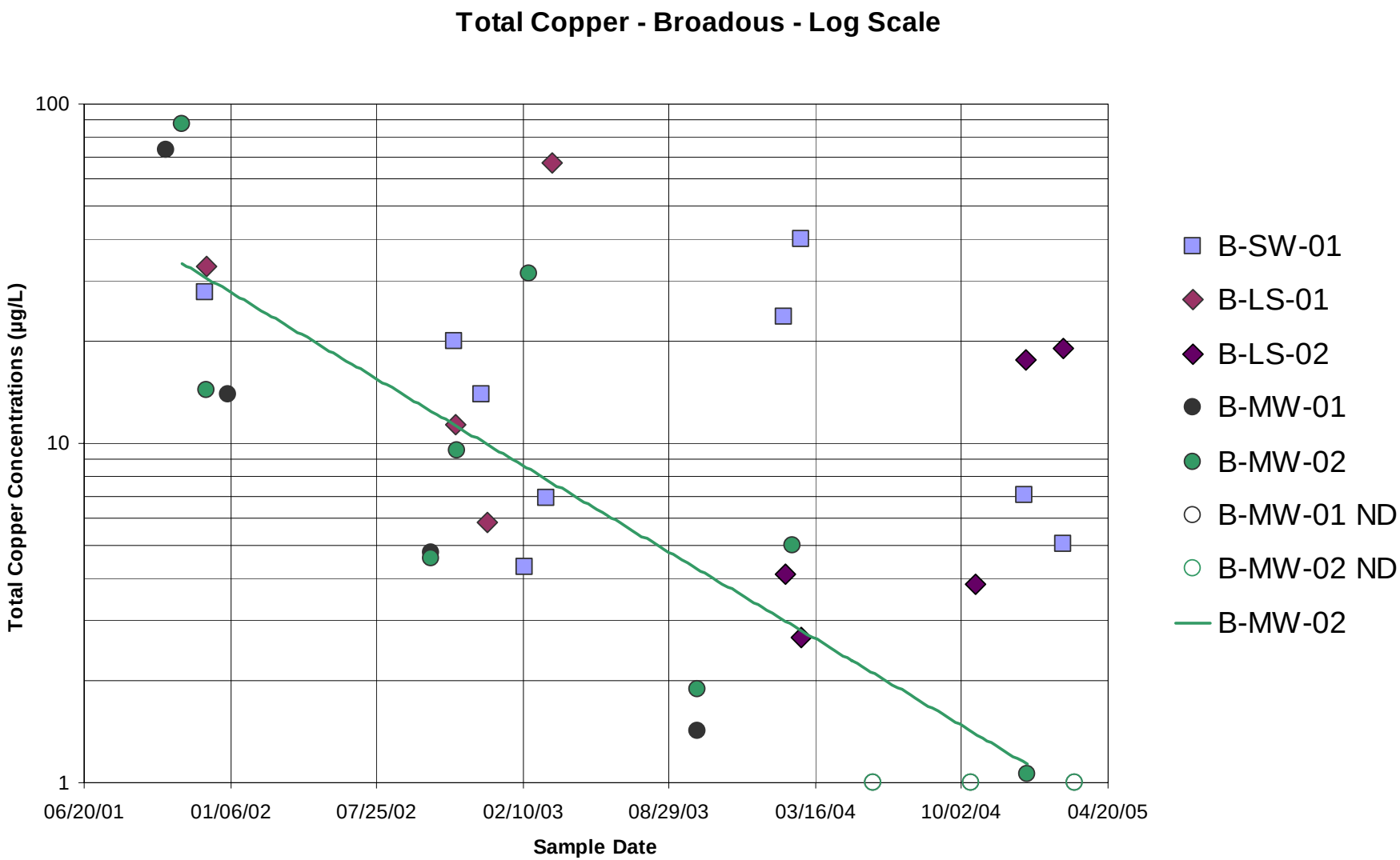
- VOCs detected in stormwater were routinely different than those detected in groundwater – no impacts detected from infiltration.
- Most inorganic groundwater quality constituents show no trends or show decreasing concentrations over the study period.

Groundwater quality has generally improved for most constituents at sites with shallow groundwater.

Mann-Kendall Trend Analysis

- Tests whether a value has changed over time, and whether that change represents an increasing or decreasing trend
- Of 400+ parameters tested, 62 pollutants representing 19 sample points (lysimeters and groundwater) showed a trend
- Increasing concentrations over time detected in 6 pollutant-site combinations; 2 in groundwater:
  - 1 = nitrate in 1 monitoring well at the park
  - 1 = chloride at the metal recycler

Concentration Trends Over Time



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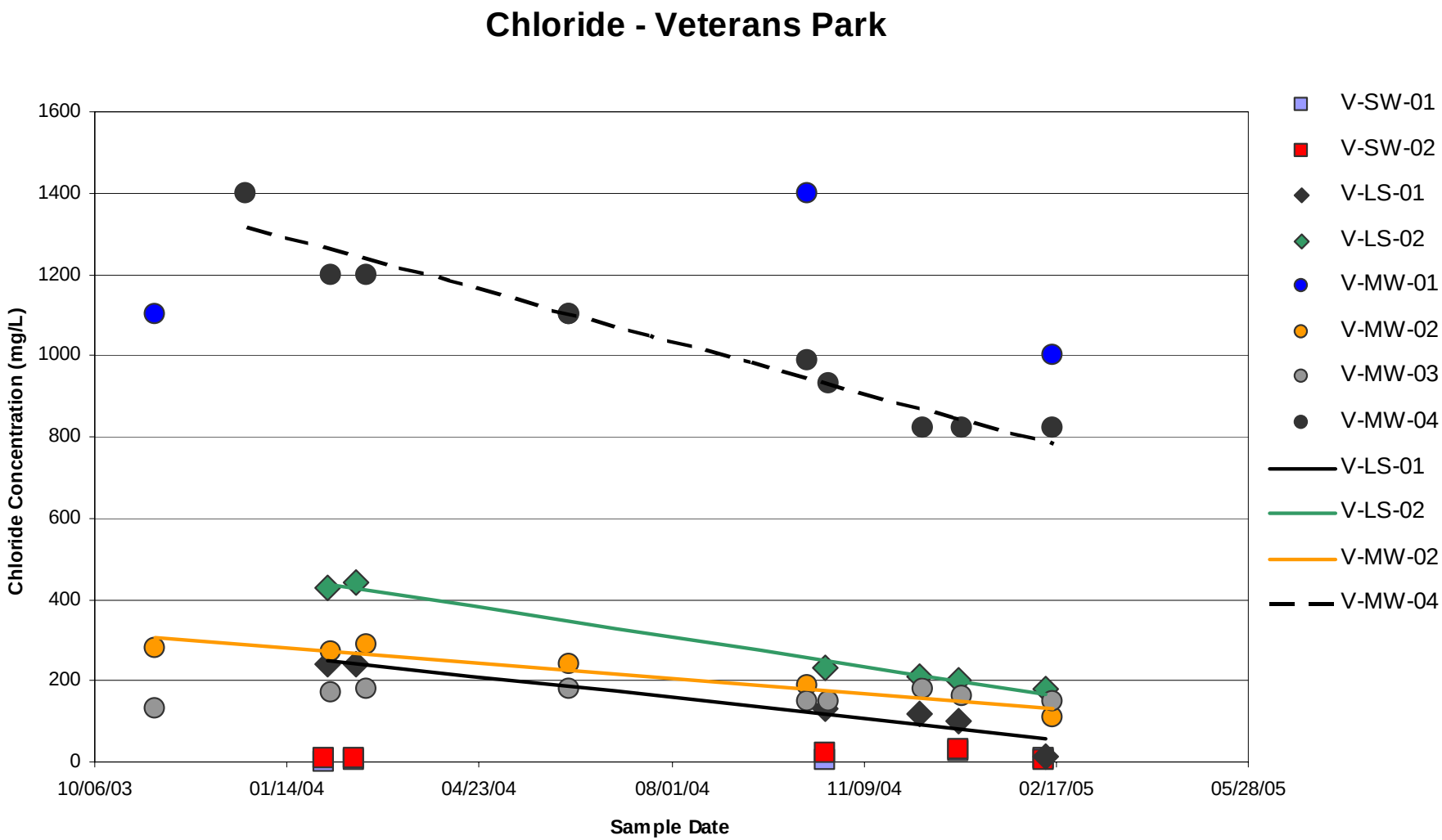

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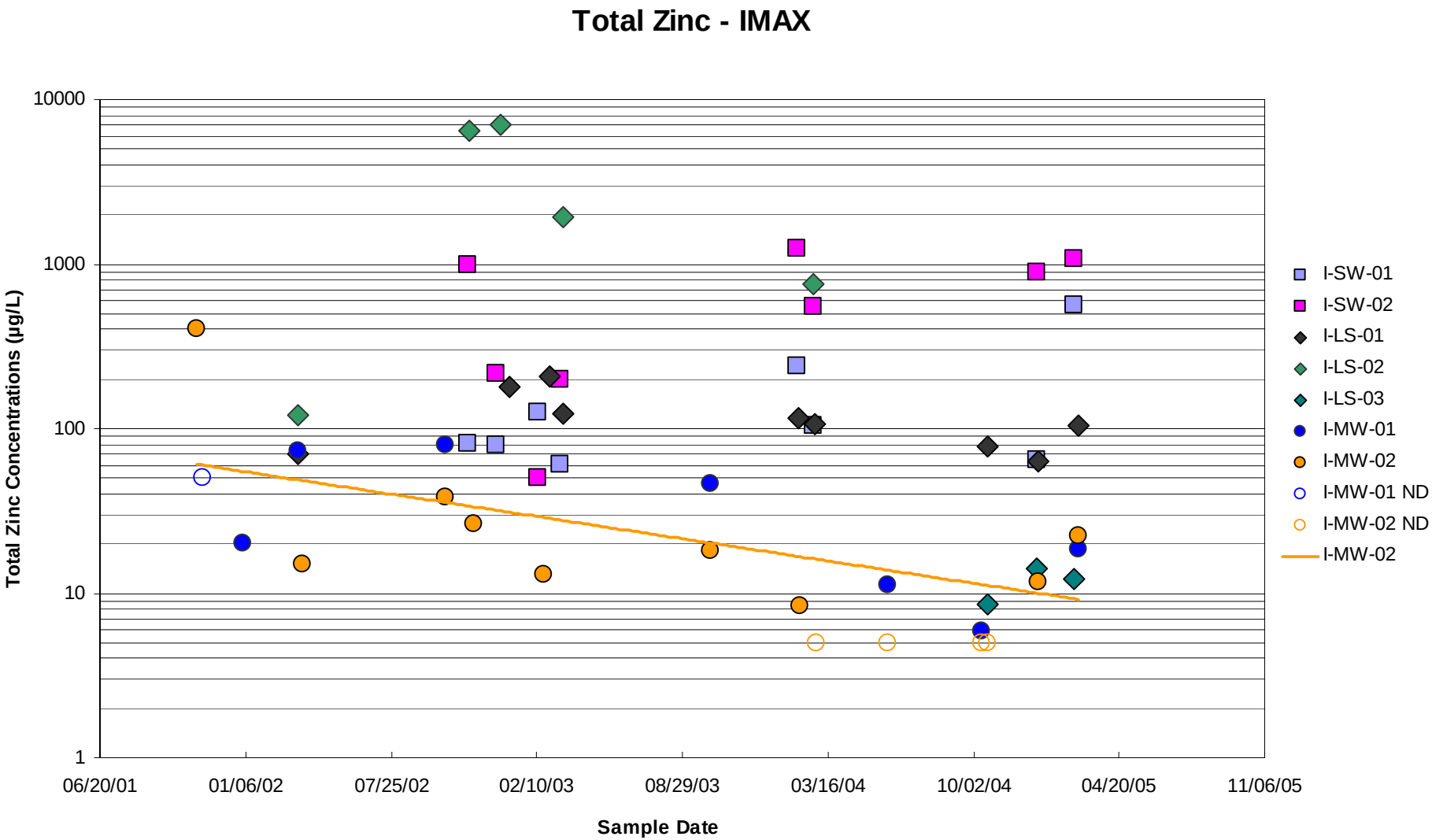


Lessons Learned from Monitoring

- Consistency matters
  - Sampling protocols
  - Analytical methods, detection limits, QC
- Monitoring methodology
  - Flow meters to quantify infiltration volumes and pollutant loads
  - Tracers studies or percolation tests
  - Design BMPs for automated samplers
- BMP design and maintenance considerations
  - Protecting equipment from damage
  - Access for maintenance

Next Step: Residential Retrofit

- Implement BMPs in public ROW and private property that will:
  - Capture stormwater and dry weather runoff to reduce runoff volume
  - Recharge groundwater
  - Increase conservation to reduce outdoor water use
  - Reduce impermeable surfaces to promote infiltration
  - Create habitat
  - Increase community awareness of watershed issues
- Monitor storm flow and water quality pre- and post- construction

Next Step: Residential Retrofit

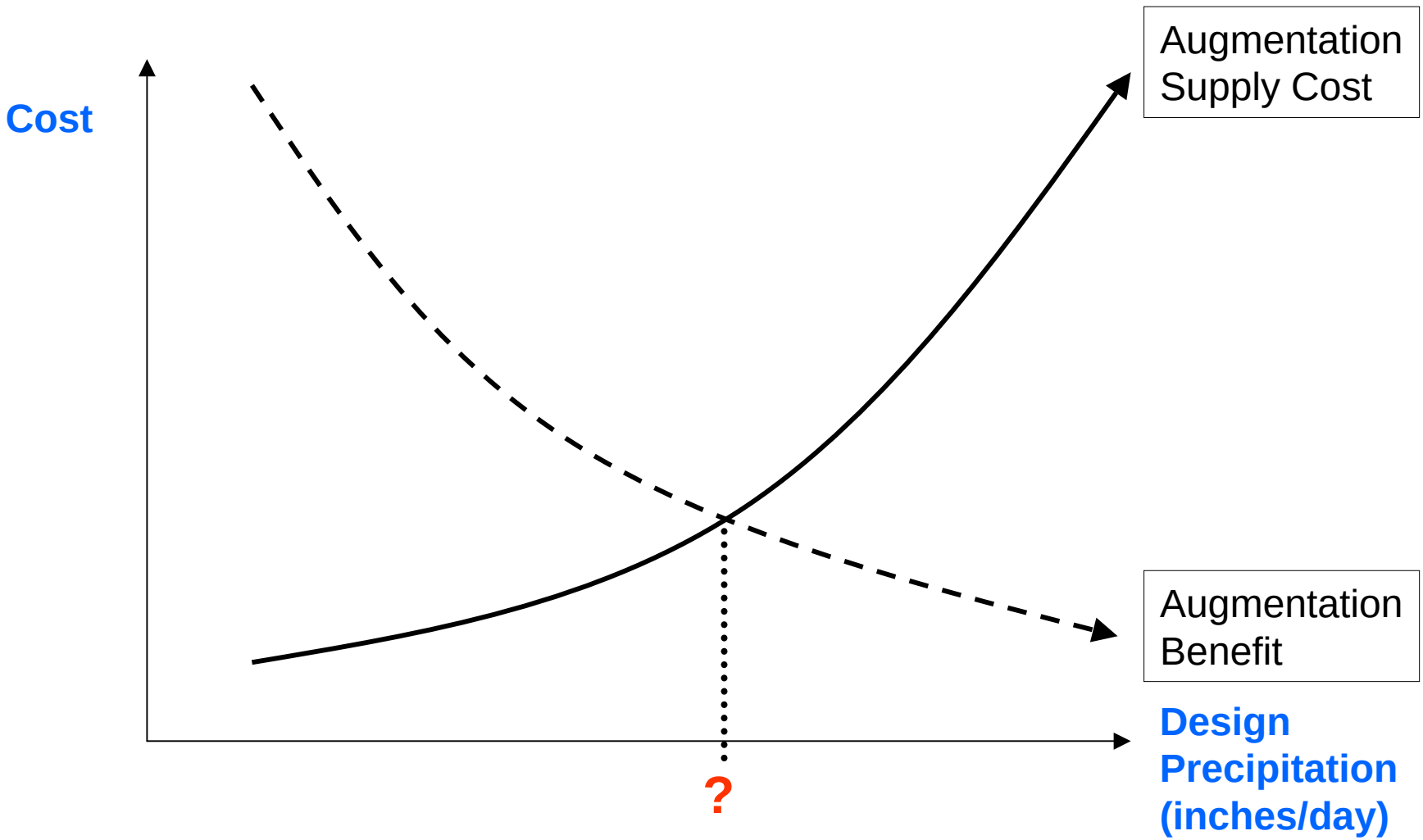
Economics of Information

- Monitoring program can reduce unknowns and minimize uncertainties of infiltration projects (e.g. water quality impacts)
- Value of Demonstration Projects:
  - Provide proof of concept
  - Reify a range of possible improvements
  - Site characteristics should determine appropriate scale (typical storm, size of drainage area, infiltration rates)
  - Design storm size: regulatory vs. real-world

Technical and Economic Analysis: tools to reduce the cost of figuring it out

- Runoff-infiltration model for scenario-building
  - If we capture an extra inch of runoff – how much more infiltration?
  - What areas are best for infiltration
- Economic models to assess benefits and costs
  - Cost of new water based on more than life cycle costs of BMP
  - Define cost-effective project scale
  - Considers indirect benefits: water supply reliability; runoff/pollutant load kept out of receiving waters; energy savings

Augmentation Design
Tradeoffs of Cost versus Benefit



Challenges to Regional Implementation

- (Mis)perception of benefits/risks of infiltration
- Assessing true costs and benefits
- Future regulations or other regulatory programs may impact feasibility:
  - Waste Discharge Requirements for stormwater
  - Class V injection well regulation

Ultimate Goal:

to help multiple agencies create cooperative strategies for water resource management

For more information:
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San Gabriel River at
Whittier Narrows