Evaluation of Bacteriological Data from Southern California Watersheds

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Presentation Overview

- Background on regulatory environment
- Goals of the present study
- Findings
- Findings from other sources
- Conclusions

Background

- Current Santa Ana Basin Plan bacteria objectives based on 1948-1950 studies
  - Total and fecal coliform regulated
  - These early studies were flawed
- 1986 EPA recommended using *E. coli* or Enterococci standards for fresh waters
  - Based on acceptable risk level and statistical distribution, not single sample max

Study Goals

- Determine trends, if any, in bacteriological data
  - Does weather make a difference?
    - Wet weather versus dry weather
  - Does level of development in the watershed make a difference?
    - Developed versus undeveloped
  - Does season make a difference?
    - Winter versus summer
  - Are there any long term trends?

Cutoff Levels used for this Study

- Total Coliform (beach posting level)
  - Single Sample: 10,000 MPN/100mL
  - Geometric Mean: 1,000 MPN/100mL
- Fecal Coliform (existing water quality standards and beach posting level)
  - Single Sample: 400 MPN/100mL
  - Geometric Mean: 200 MPN/100mL
- Enterococci (EPA recommended criteria)
  - Single Sample: 247 MPN/100mL
  - Geometric Mean: 54 MPN/100mL
  - Values based on 1.0% risk, 95th percentile
- Wet weather = 0.1" or more of rain within two days of sample date

Data Used in this Study

Collected by Orange County Health Care Agency

Data available for period of:

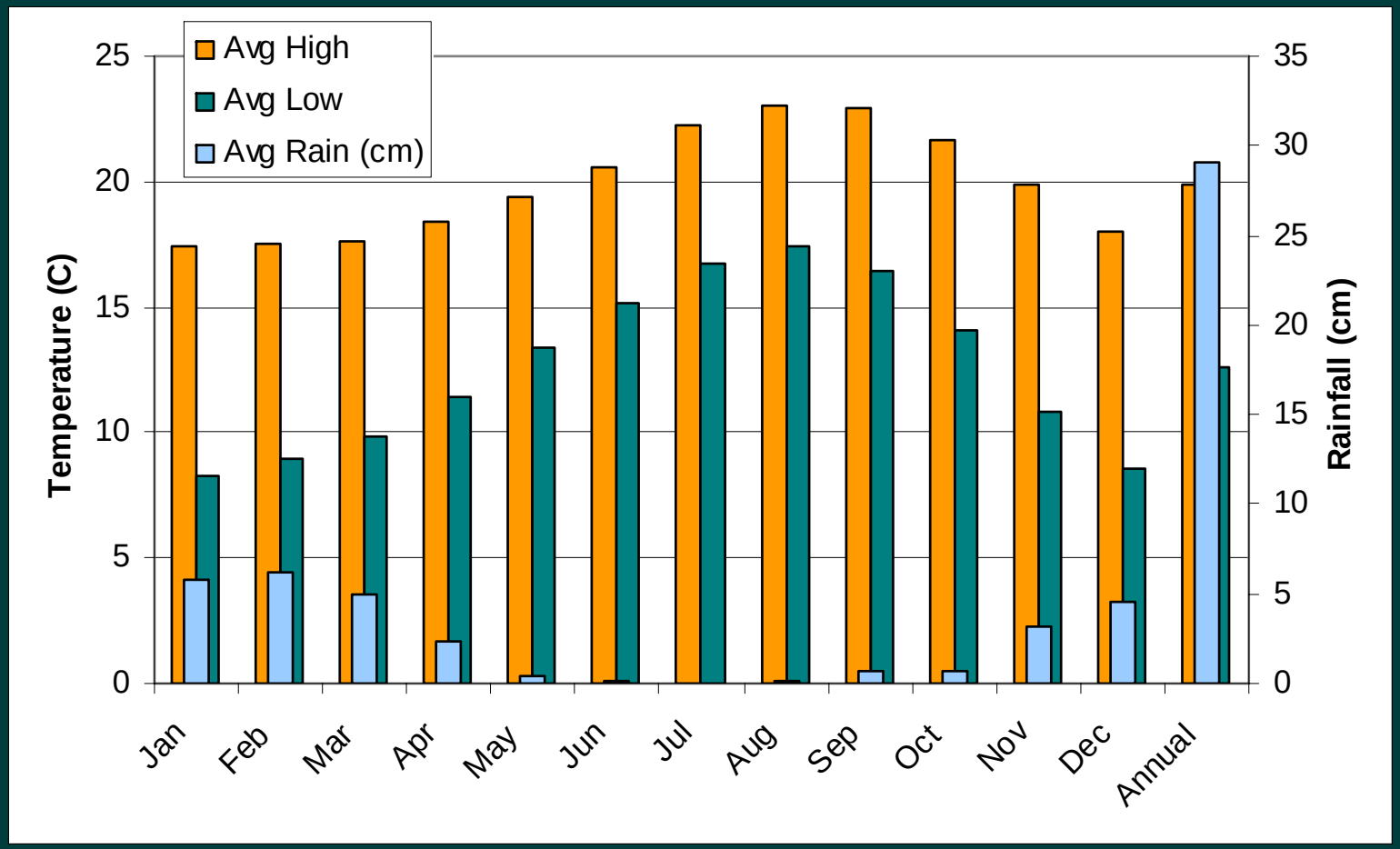
- Enterococci: 1999-2004
- Fecal Coliform: 1986-2004
- Total Coliform: 1986-2004

Samples collected once per week at all sites, rain or shine

Study Area

Orange County, Southern California

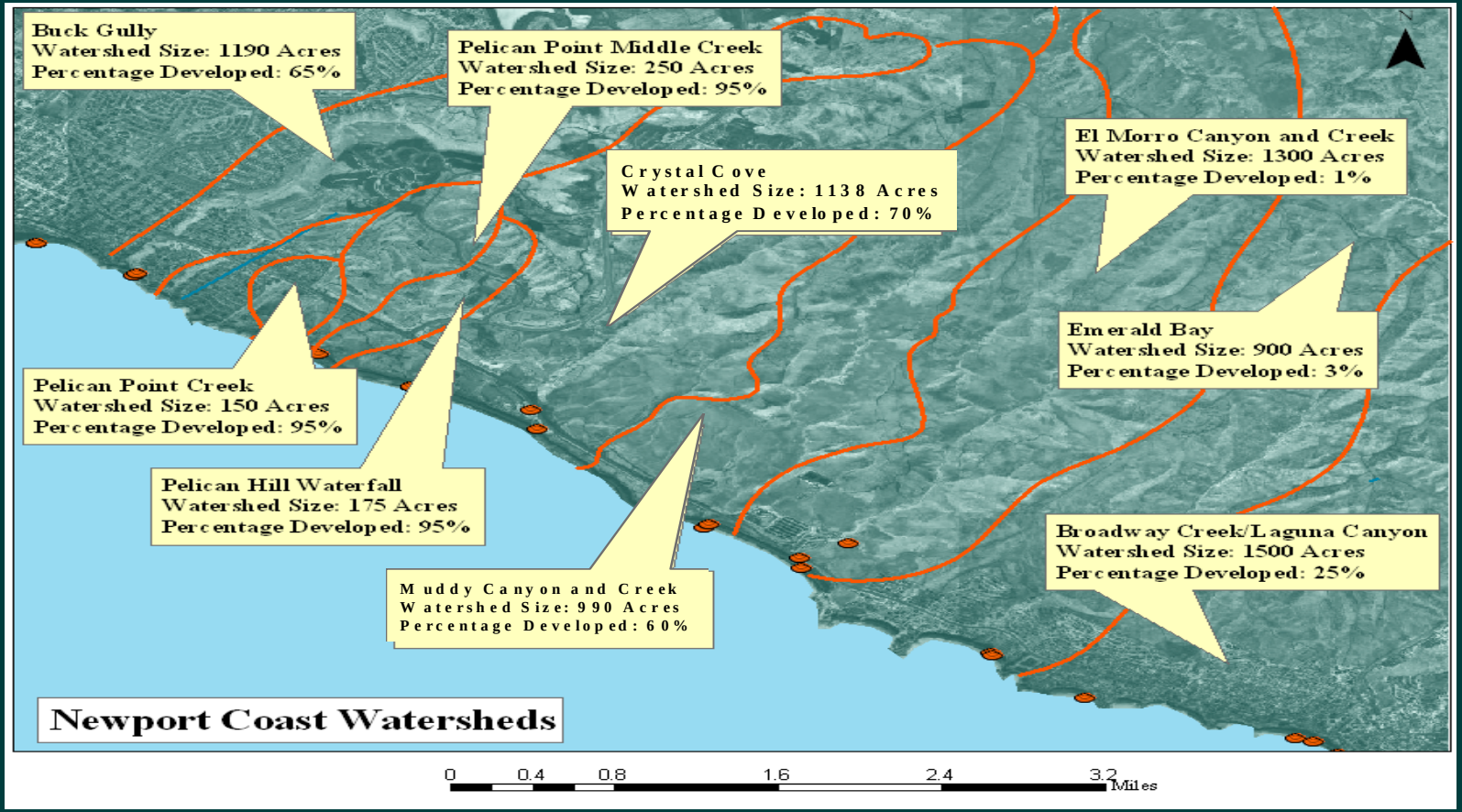
Mediterranean Climate



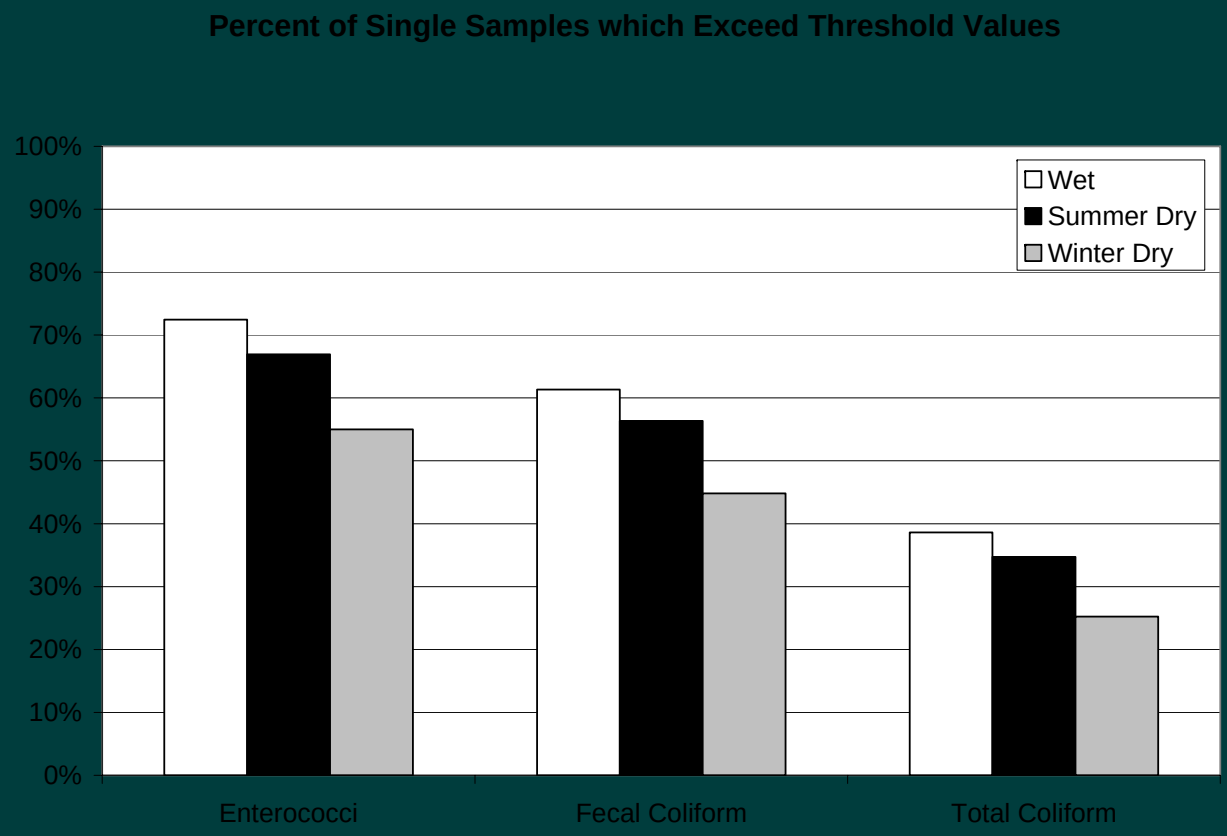
Newport Beach (Harbor) 11/1/1934 to 7/31/2003

Primary Vegetation: Chaparral

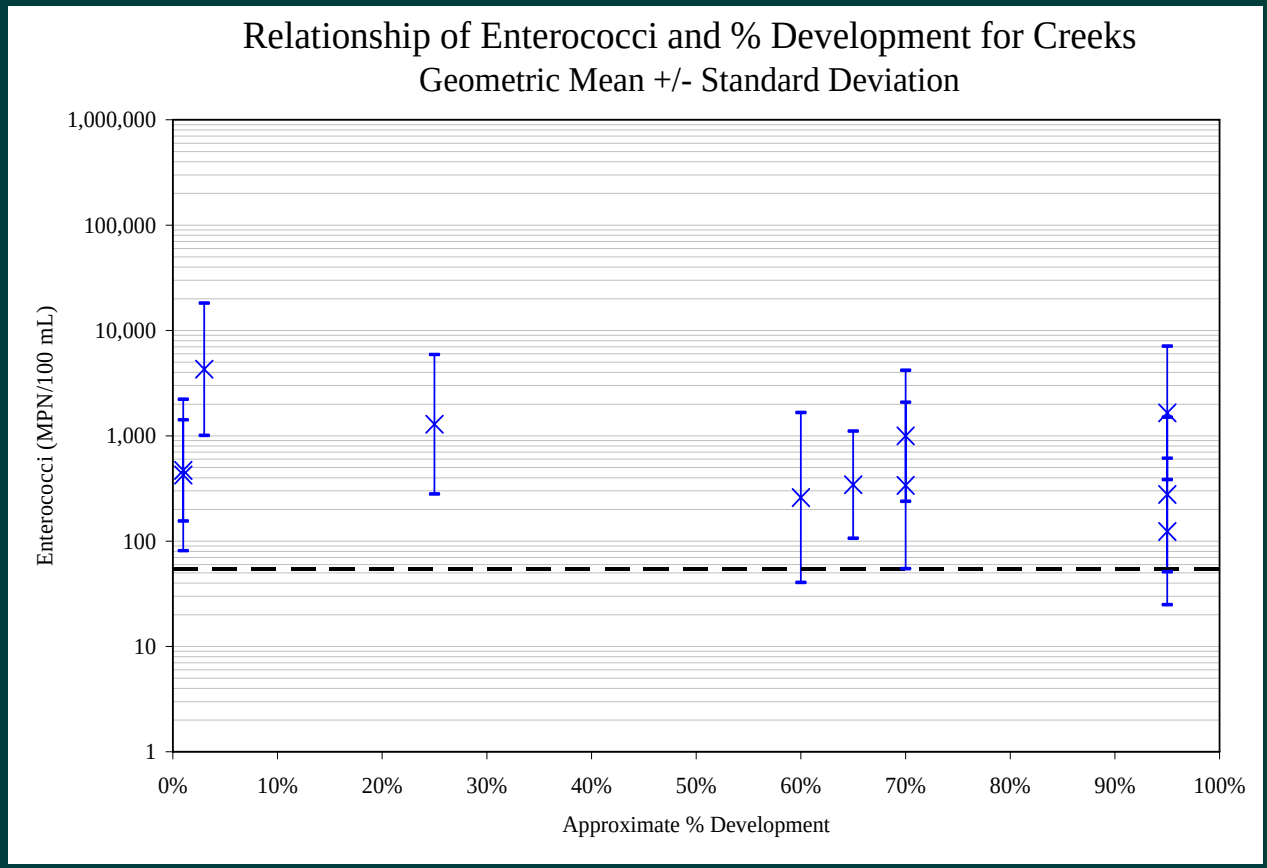
Study Watersheds- Orange County Coast



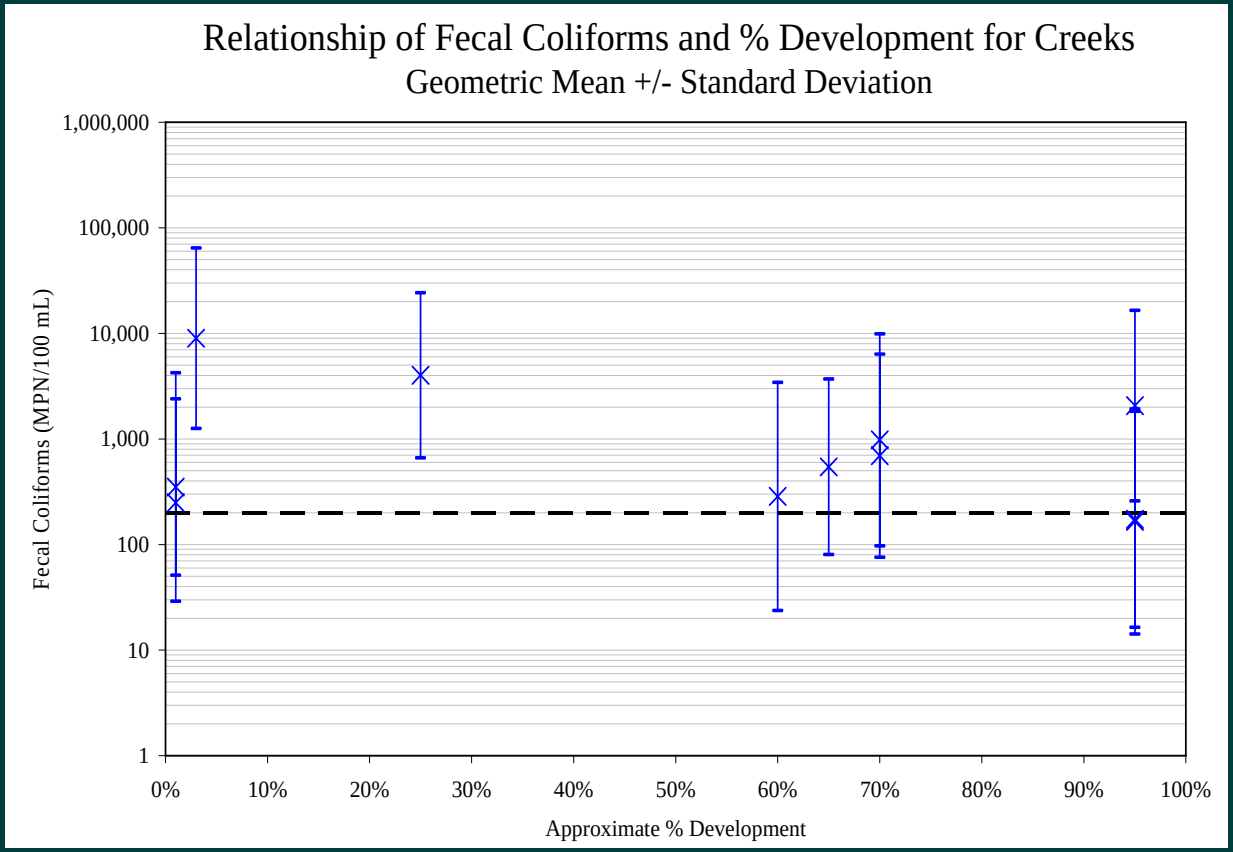
Weather Effects- Wet vs. Dry Samples



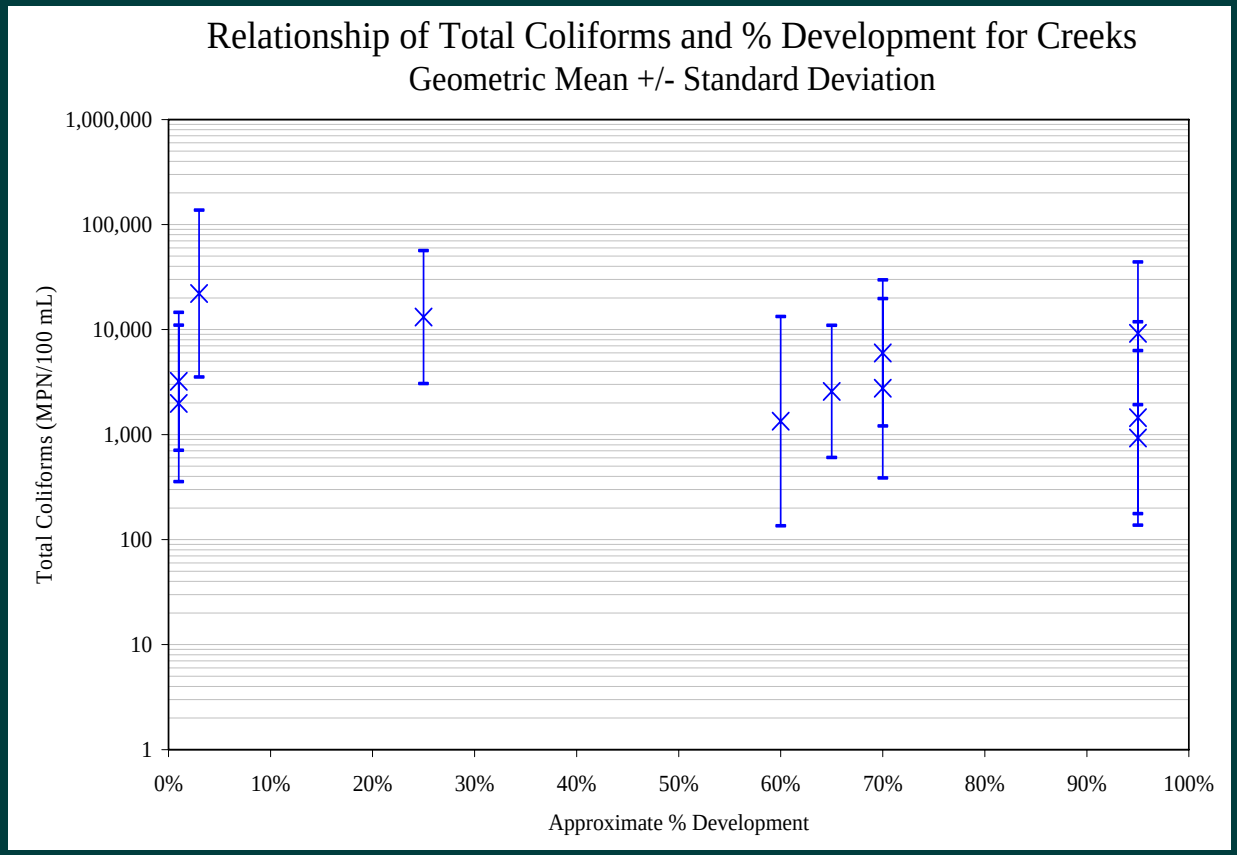
Percent Development and Enterococci



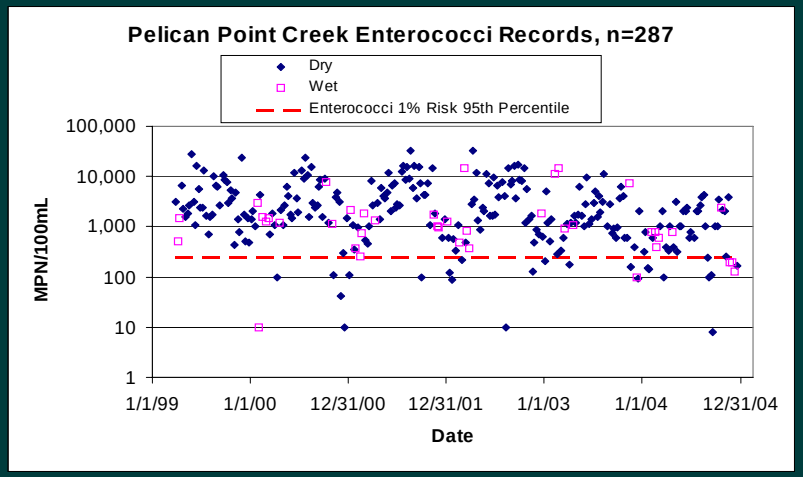
Percent Development and Fecal Coliform

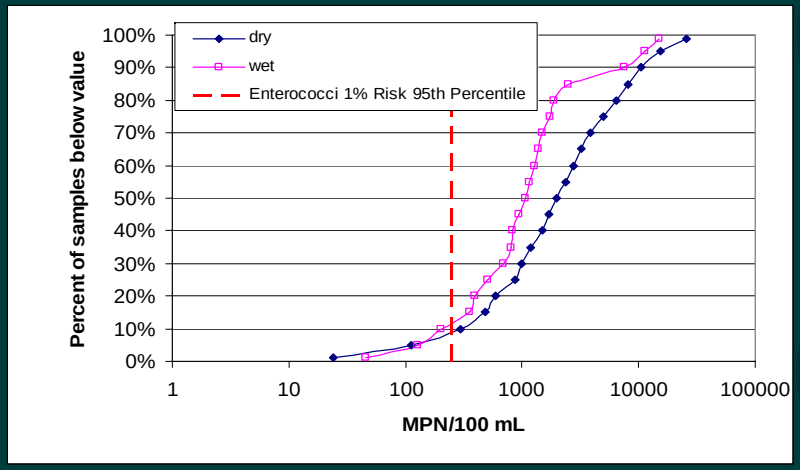


Percent Development and Total Coliform

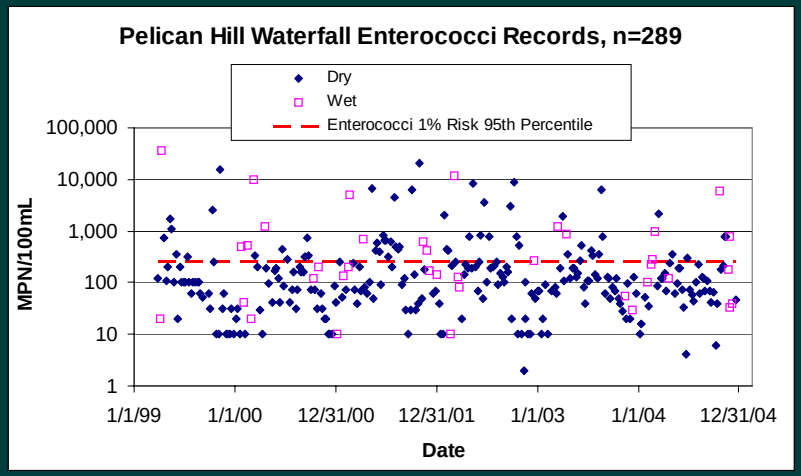


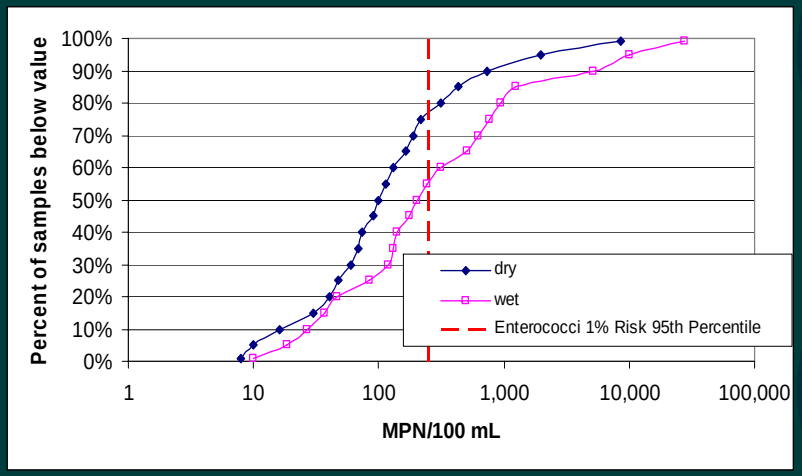
Pelican Point Creek: ~95% Developed



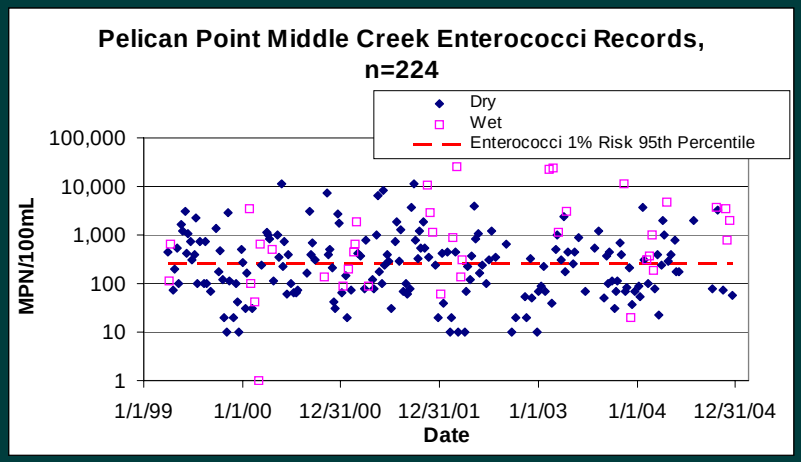


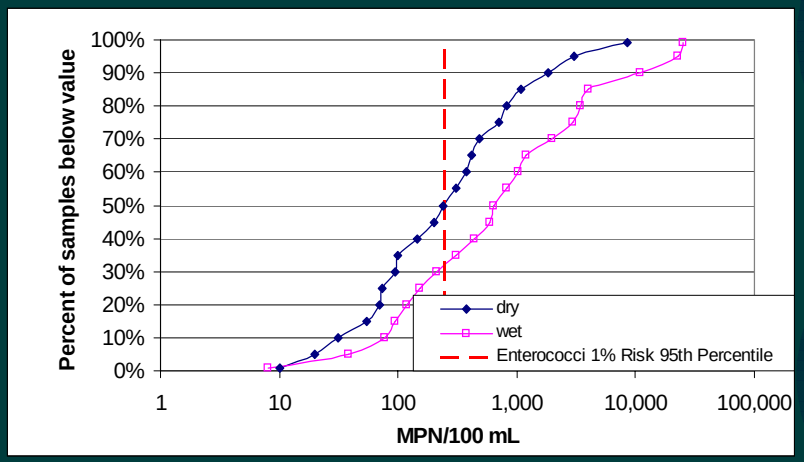
Pelican Hill Waterfall: ~95% Developed



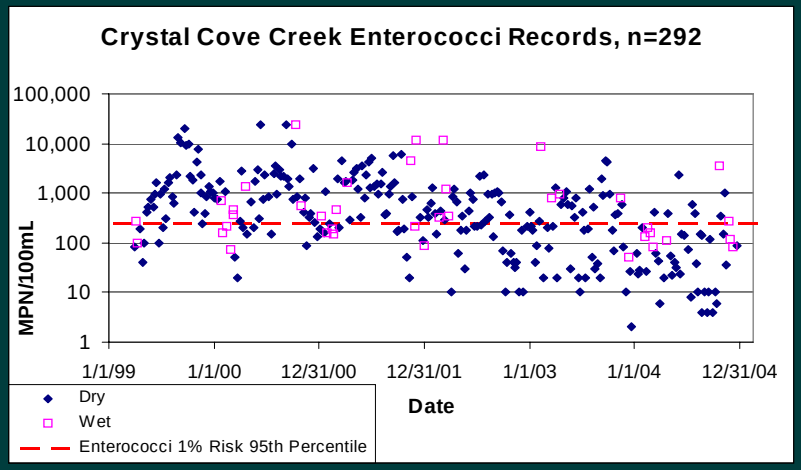


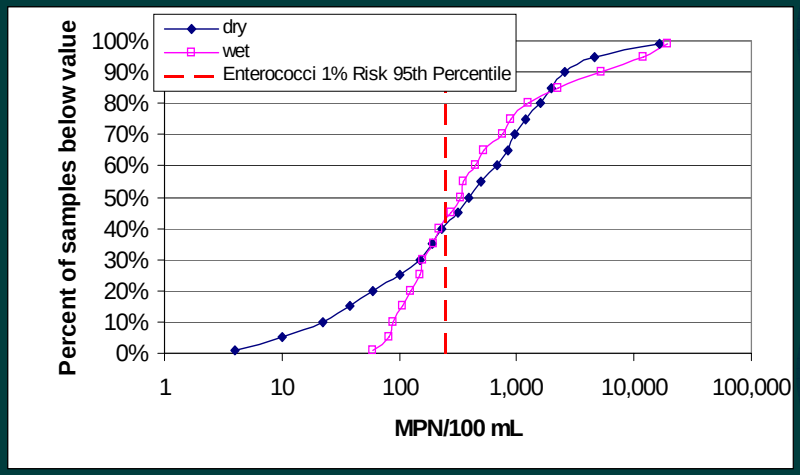
Pelican Point Middle Creek: ~95% Developed





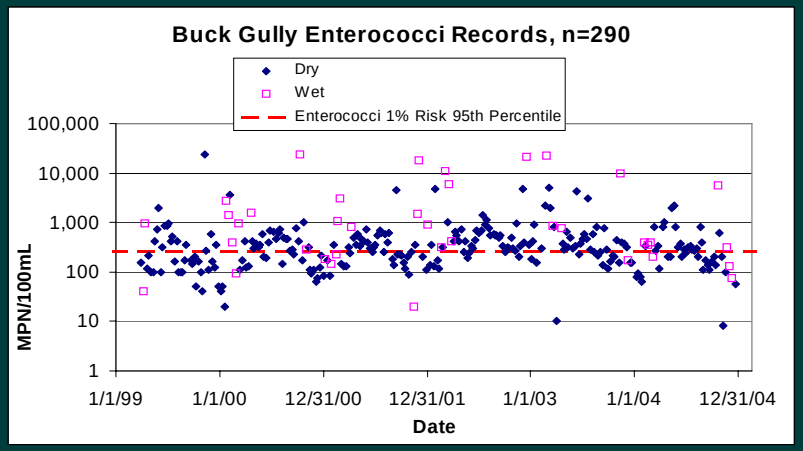
Crystal Cove Creek: ~70% Developed*

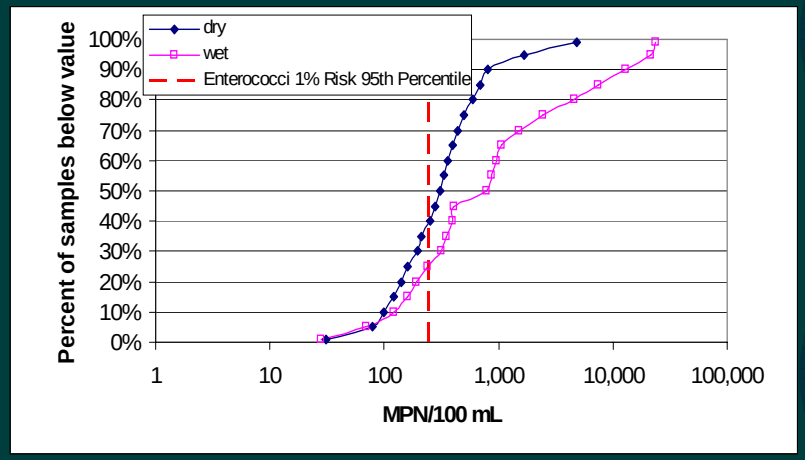




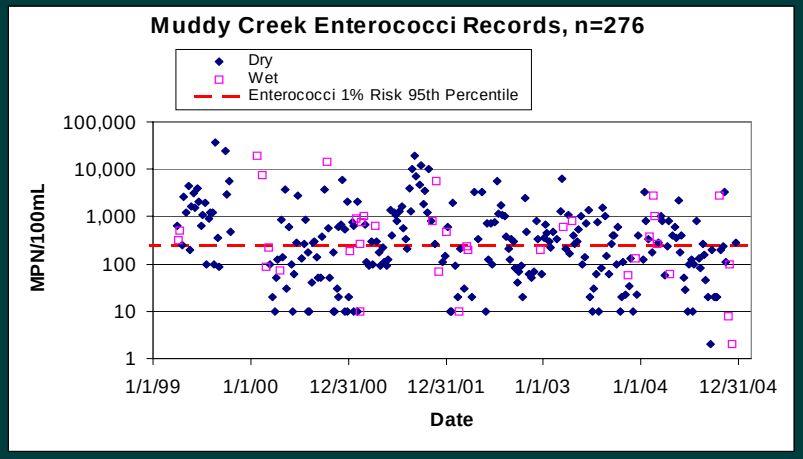
*Crystal Cove Creek increased from ~5% to ~70% developed between 1999 and 2005

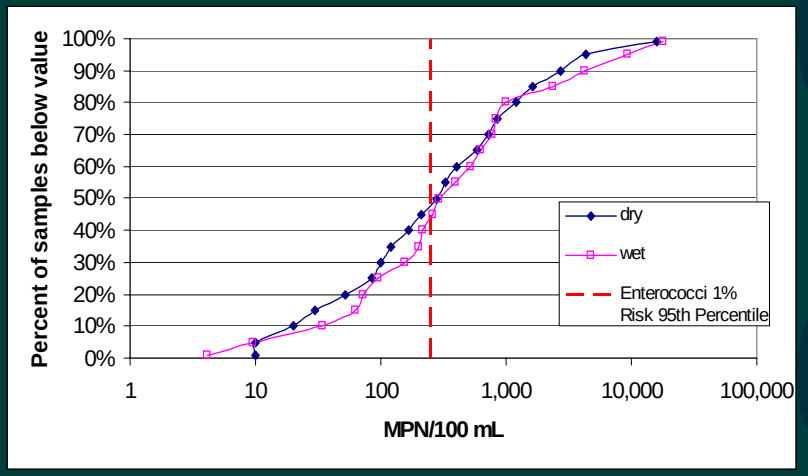
Buck Gully: ~65% Developed





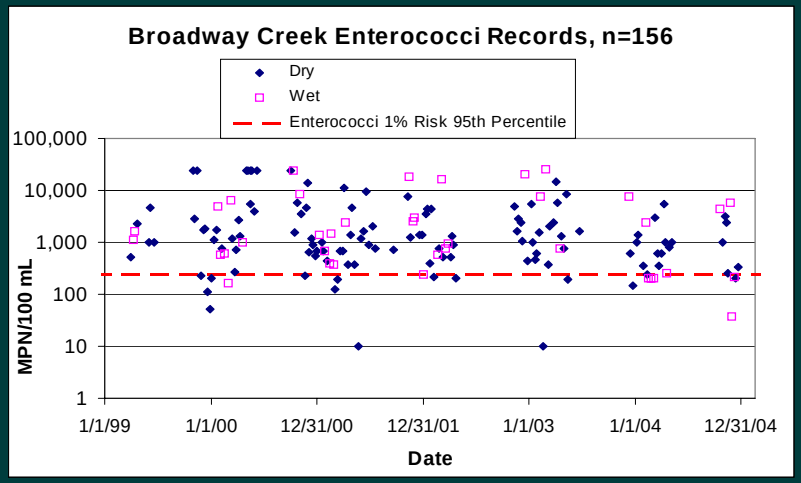
Muddy Creek: ~60% Developed*

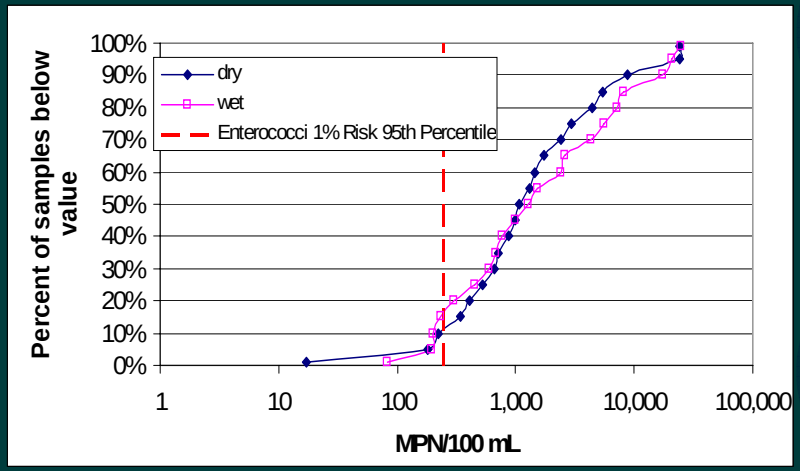




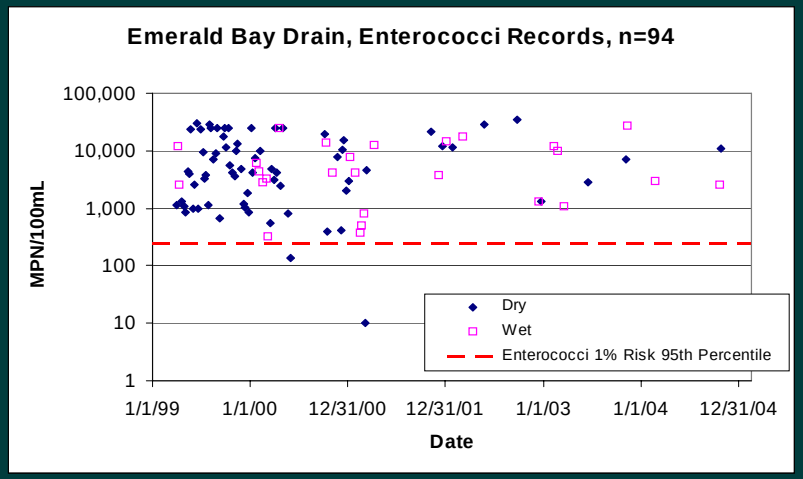
*Muddy Creek increased from ~1% to ~60% developed between 1999 and 2005

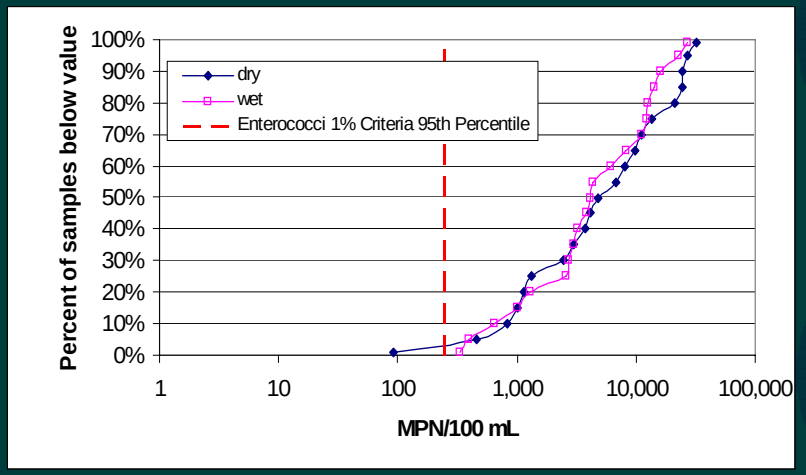
Broadway Creek: ~25% Developed



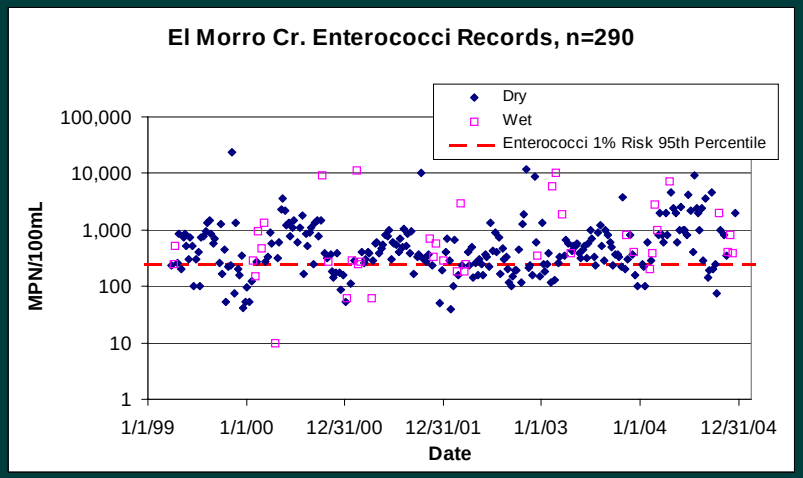


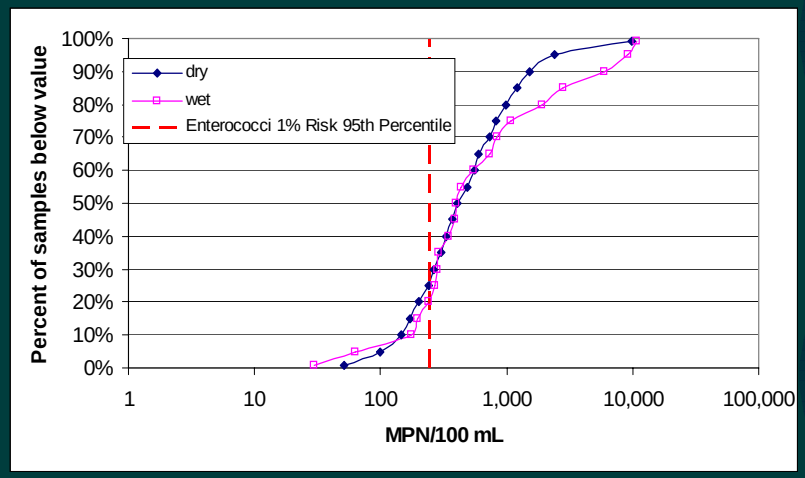
Emerald Bay Drain: ~3% Developed



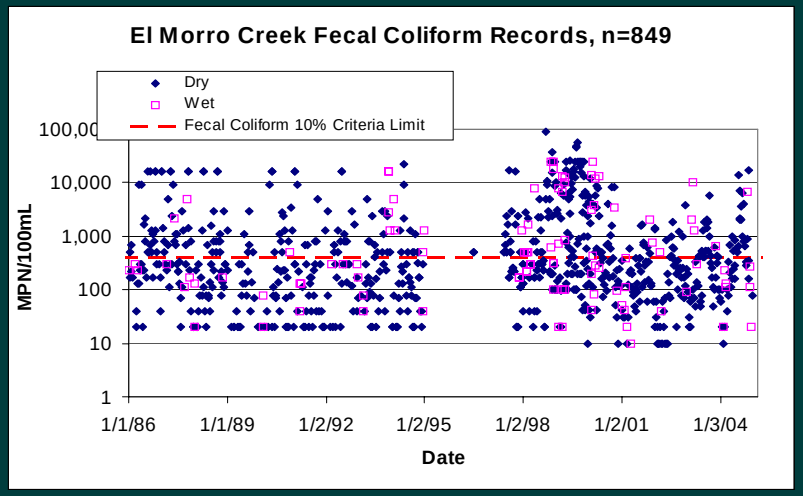


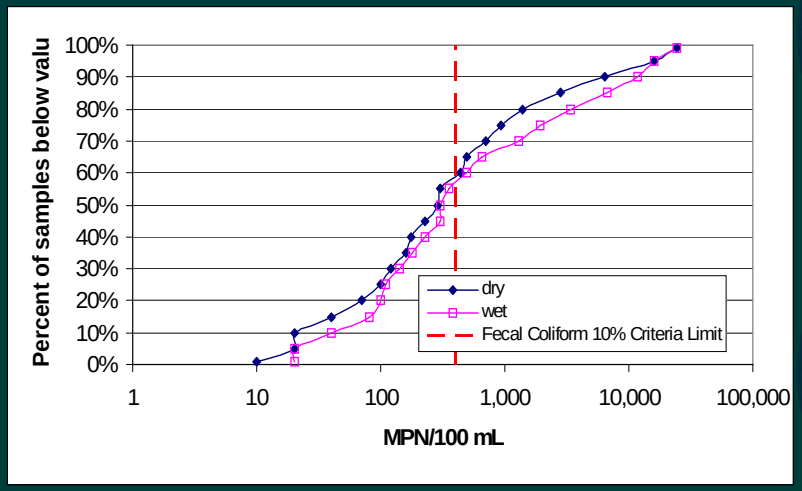
El Morro Creek: ~1% Developed





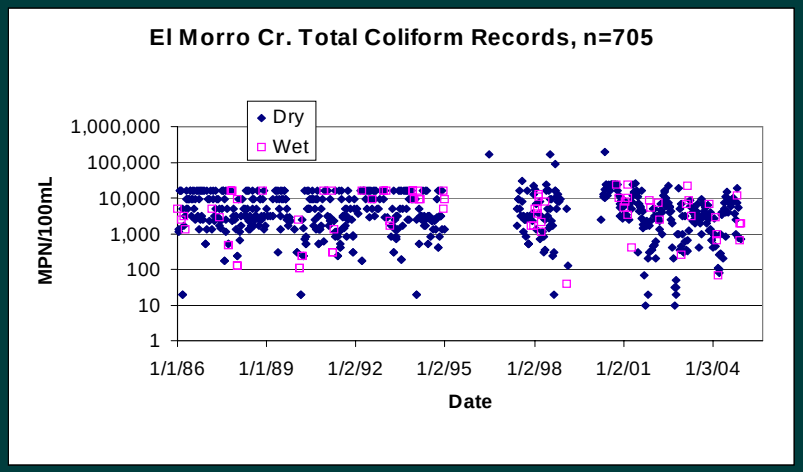
El Morro Creek: ~1% Developed

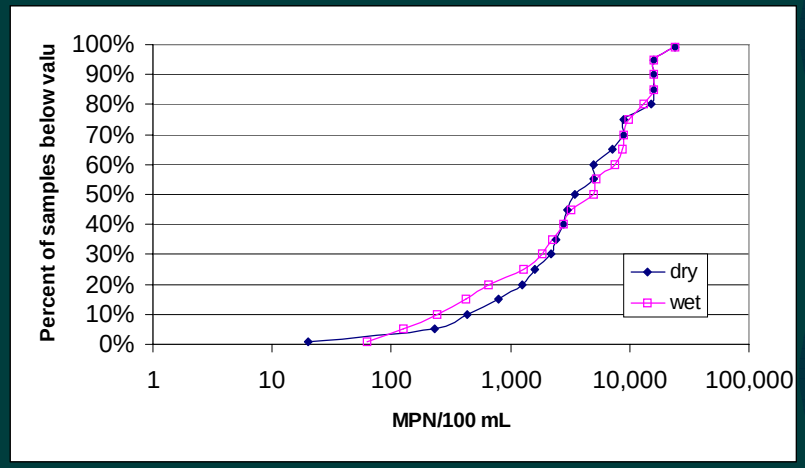




Fecal Coliform, 1986-2004

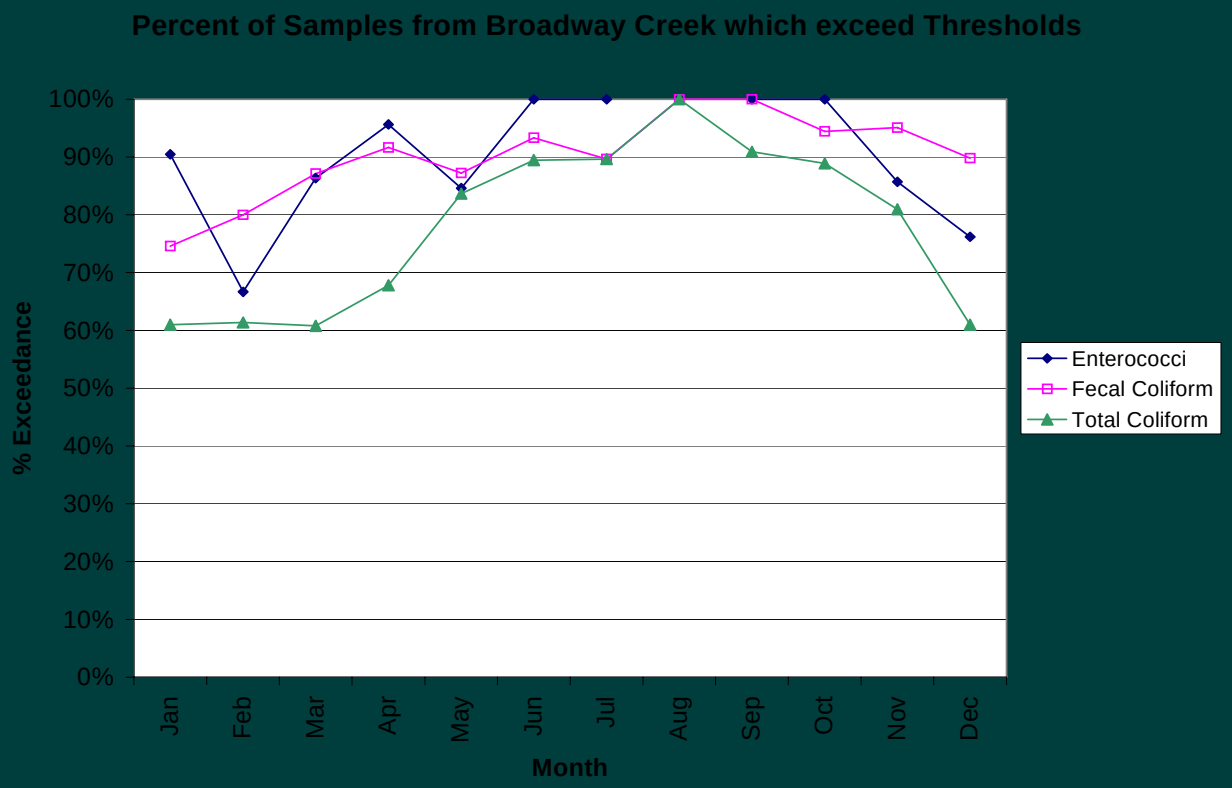
El Morro Creek: ~1% Developed



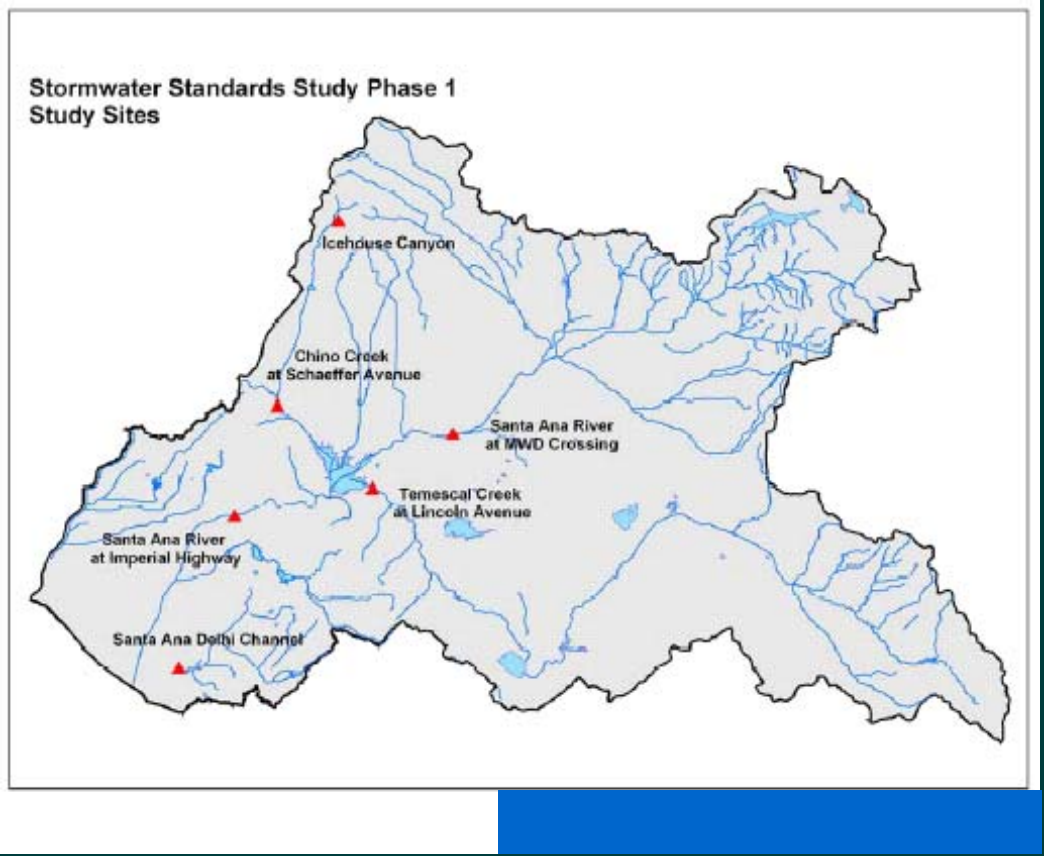


Total Coliform, 1986-2004

Other Indicator Bacteria…



Other Study Sites- CDM



Source: CDM, 2005

Data Sources for CDM Study

Data provided by…

Orange County Health Care Agency

Orange County Water District

Santa Ana RWQCB

San Bernardino County

Riverside County

USGS

EPA

Orange County Coastkeeper

Santa Ana River at MWD Crossing

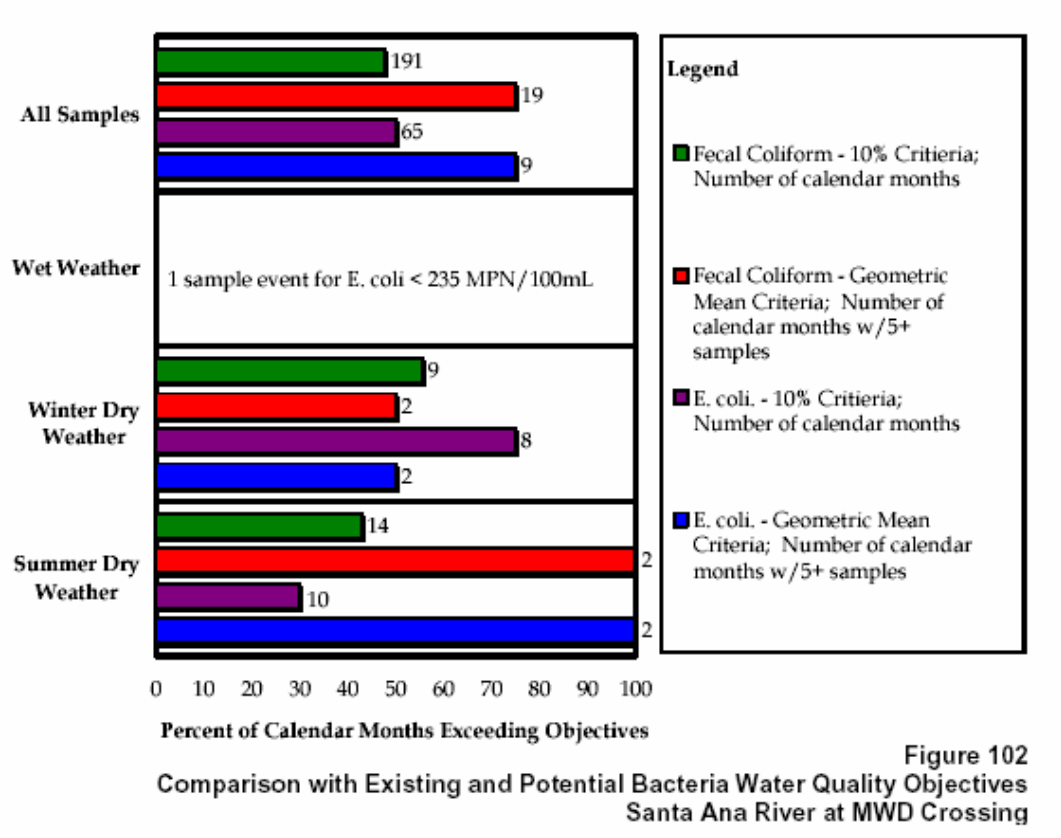


Figure 102
Comparison with Existing and Potential Bacteria Water Quality Objectives
Santa Ana River at MWD Crossing

Source: CDM, 2005

Icehouse Canyon Creek

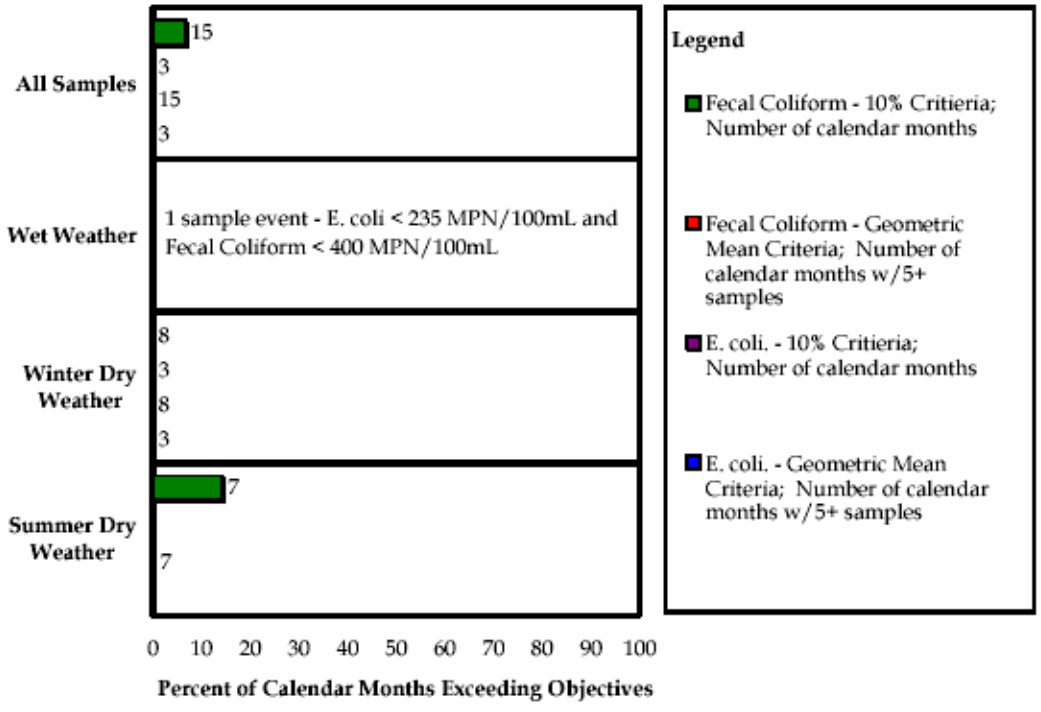


Figure 110
Comparison with Existing and Potential Bacteria Water Quality Objectives
Icehouse Canyon Creek

Source: CDM, 2005

Santa Ana River at Imperial Hwy

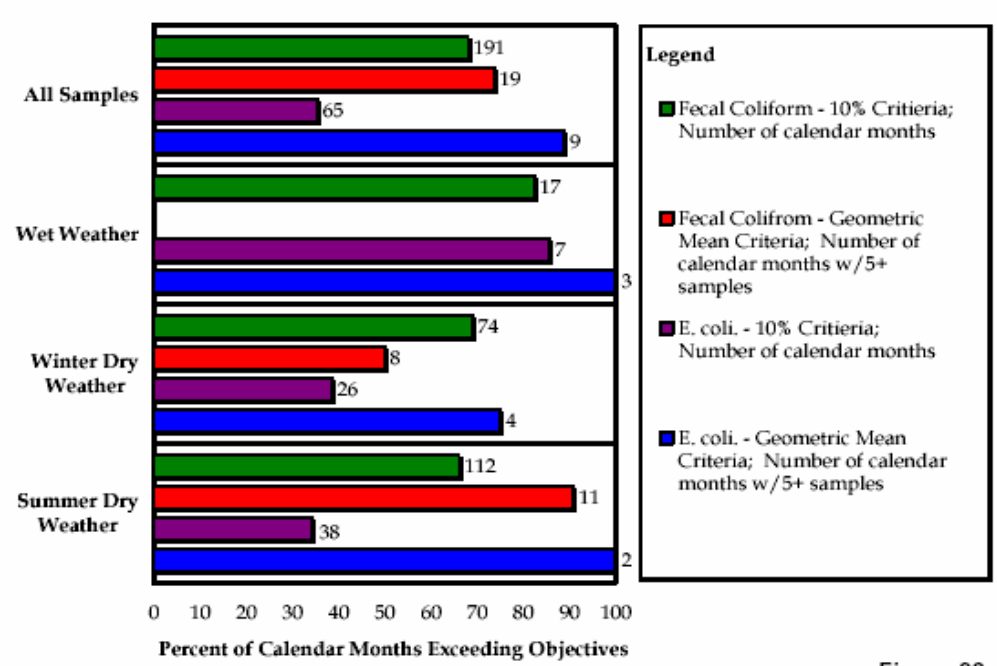


Figure 88
Comparison with Existing and Potential Bacteria Water Quality Objectives
Santa Ana River at Imperial Highway

Source: CDM, 2005

Temescal Creek near Lincoln Ave.

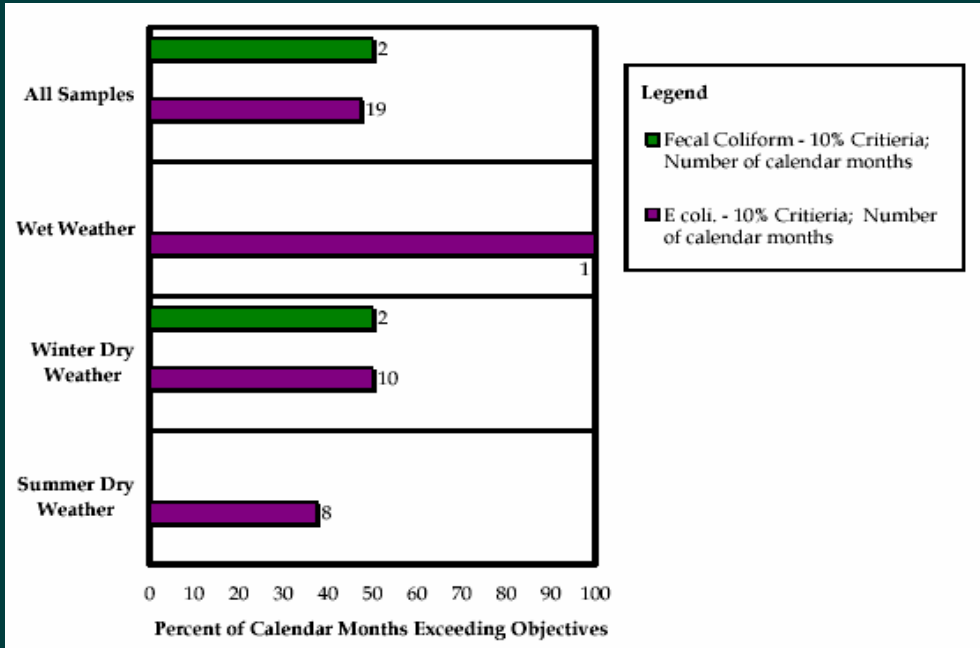


Figure 74
Comparison with Existing and Potential Bacteria Water Quality Objectives
Temescal Creek Near Lincoln Avenue

Source: CDM, 2005

Chino Creek at Schaeffer Ave.

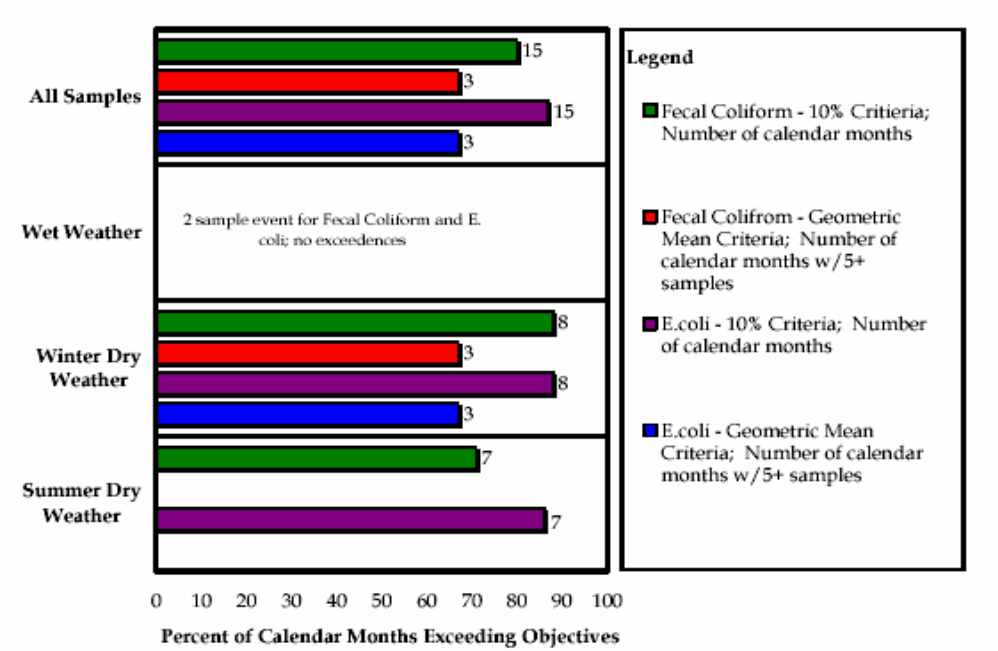


Figure 38
Comparison with Existing and Potential Bacteria Water Quality Objectives
Chino Creek At Schaeffer Ave.

Source: CDM, 2005

Santa Ana Delhi Channel near Irvine Ave.

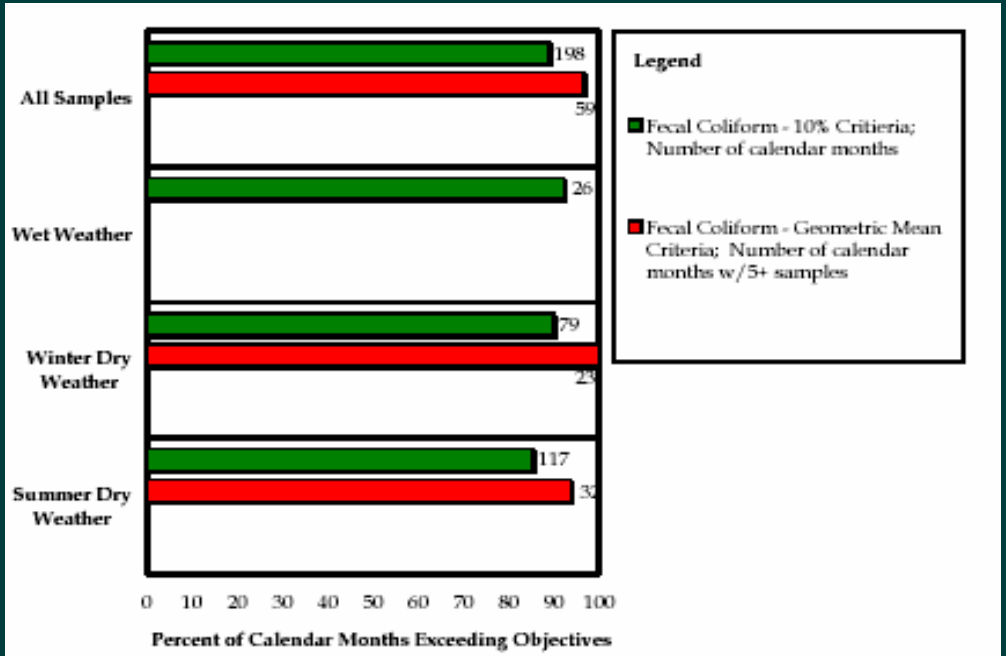


Figure 57
Comparison with Existing and Potential Bacteria Water Quality Objectives
Santa Ana Delhi Channel near Irvine Ave.

Source: CDM, 2005

Other Studies and Findings

- Los Angeles County, 2001
  - Vacant land has significantly less bacteria in runoff than other land uses, though all land use types exceed applicable criteria
    - Vacant land in study was inland, steep watershed near Monrovia
- Moore, 2001
  - Storm drains can be major sources of dry-weather bacteria
- LA RWQCB, 2004
  - Birds, beach itself may be sources of bacteria
- GeoSyntec, 2005
  - Bacteria re-growth occurs rapidly downstream of BMPs
- Colford et al, 2005
  - Mission Bay swimming illnesses not correlated with levels of indicator bacteria

Conclusions

- Wet-weather samples generally have greater bacteria concentrations than dry-weather samples
- Level of Development not a factor for OC coastal creeks
- No clear long-term trends
- Appear to be many sources, including natural, of bacteria
- Rapid regrowth occurs in the environment
- Nearly all watersheds exceed current and EPA recommended criteria
- Icehouse Canyon Creek (and perhaps other mountain watersheds) may have lower concentrations than OC coastal watersheds

Data Sources

www.ocbeachinfo.com

CDM. *Stormwater Quality Standards Study.* Phase I Study Report- Technical Memoranda. 2005.

Los Angeles County. 1994-2000 Integrated Receiving Water Impacts Report. 2001.

D. Moore. Bacteriological Survey of San Juan Creek Watershed, Task 3 Report. 2001.

Los Angeles Regional Water Quality Control Board. Los Angeles Harbor Bacteria TMDL- Inner Cabrillo Beach and Main Ship Channel. 2004.

GeoSyntec Consultants. Aliso Creek BMP Effectiveness Analysis. 2005.

Colford, J.M. et al. Recreational Water Contact and Illness in Mission Bay, California. SCCWRP Technical Report 449. 2005.