California Stormwater Quality Association

Stormwater Panel Meeting

September 14, 2005

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Overview

Geoff Brosseau, CASQA Executive Director

CASQA Presentation Outline

- Overview (Geoff Brosseau)
- Technical/Scientific Issues (Susan Paulsen)
- Implementation Issues
  - Industry (Timothy Simpson)
  - Construction (Sandy Mathews)
  - Municipal (Richard Boon)
  - Caltrans (Michael Flake)
- Quantifiable Measures of Compliance (Karen Ashby)

Why Are We Here?

- Challenges
  - Need for accountability
  - Resources required for program
  - Difficult compliance determination
- Why is the Question being asked now?
- Progress has been made
- Proactive and progressive approach is being pursued
- We want our efforts to make a difference

Statewide Stormwater Policy

- "The Question" is a fundamental component
- Challenges
  - Stormwater is a non-point source addressed within a point source regulatory framework
  - Unique aspects must be recognized, accepted, and considered
- Goals
  - Establish proactive and progressive approach
  - Identify when it is appropriate to shift from one regulatory approach to another

What Do Numeric Limits Mean to Dischargers?

- Counter to USEPA Approach
- Can not comply with limits as they are being proposed in permits
- Dischargers are asked to control pollutants from sources beyond their control
- Major economic ramifications
- Subject to mandatory minimum penalties
- Pre-emptive of stormwater policy development

Key Messages

- If numeric effluent limitations are necessary, identify data and methodology needed to derive and comply
- Must consider how feasible and meaningful to implement
- Viable quantifiable measures / options are available

Technical/Scientific Issues

Susan Paulsen

Outline

- California Hydrology and Storm Flow Variability
- What information is required to calculate a numeric limit for use in permits?
- Applicable Water Quality Standards

California Hydrology: Storm Flows are Intermittent and Highly Variable

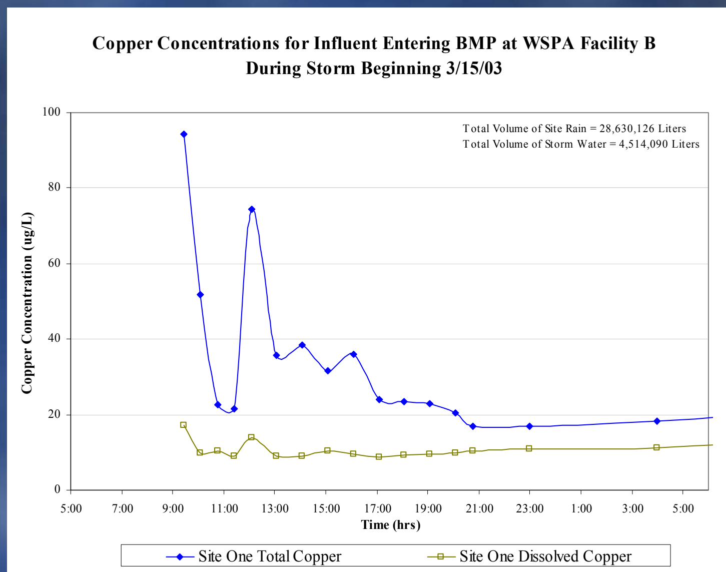
- So Cal is arid and system is "flashy"
  - Dry conditions about 90+% of time
  - Storm flows are intermittent, system response is rapid, and velocities are high
- Northern California rivers have year-round flow, but storm size and intensity are also highly variable
- Many receiving waters are tidal
- Actual beneficial uses may differ in wet and dry conditions, even though designations are constant (and may only be "potential")
- Many channels are designed for flood control

Southern CA Streams During Dry and Storm Conditions (CV for daily flow, LA River ~ 6)

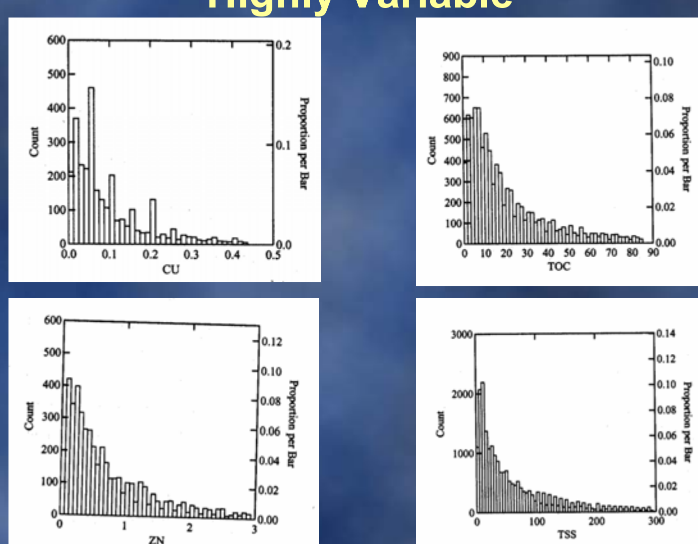
Summary of Available Data

- Data sources
  - Statewide General Industrial Permit data
  - Land use data (constituent concentrations in flows from different land use types)
  - Receiving water data
- Stormwater sampling generally includes:
  - Mostly grab sample data
  - Little information on time dependence of storm flows, concentrations

Concentrations are Highly Variable Within Individual Storm Events



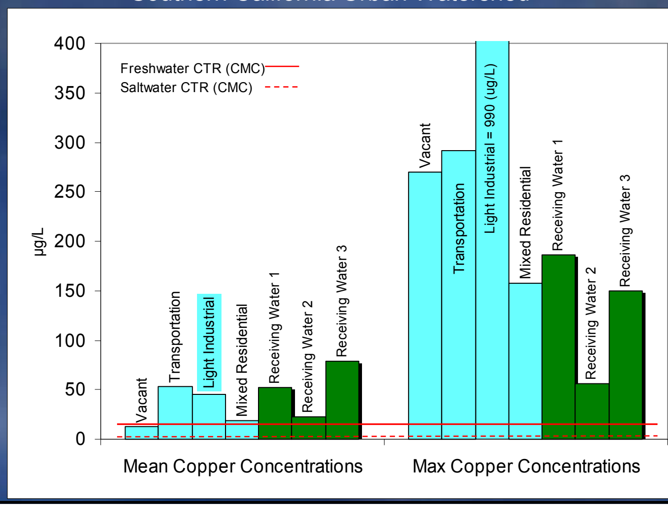
Grab Sample Concentrations Are Highly Variable



Plots from Stenstrom and Lee (2005); data from 1992-2001; all concentrations in mg/l.

Stormwater Quality Varies by Land Use and in Receiving Waters

Total Copper Concentrations from Land Uses and CTR in Southern California Urban Watershed



What information is required to develop numeric limits for stormwater?

Effluent Limits

- Need for effluent limits is triggered by a reasonable potential determination
- Technology-based effluent limits (TBELs)
  - Limits based on the technology available to treat the pollutants
- Water quality-based effluent limits (WQBELs)
  - Limits based on the protection of beneficial uses of the receiving water
- By law, narrative limits may be utilized where numeric limits are infeasible

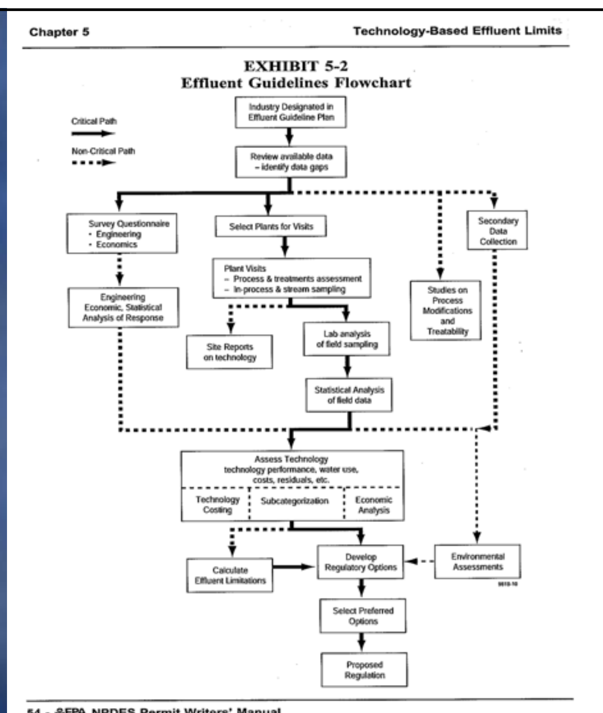
Effluent Limits (Narrative or Numeric) Must Be Developed for Constituents That Have "Reasonable Potential"

- A "reasonable potential" determination is a finding that a discharge has the potential to cause or contribute to an exceedance of water quality criteria
- Procedures exist for specified steady-state conditions
- Depends upon effluent and receiving water concentrations, flows, and dilution
- No reasonable potential procedures have been defined for storm flows

What Information and Data Would Be Required for TBELs?

- Existing USEPA approach includes
  - Data collection
  - Industry and site profile
  - Technology assessment
  - Regulatory options
  - Economic analysis

From EPA's NPDES Permit Writer's Manual



WQBELs are Designed to Achieve Water Quality Objectives (WQO)

- WQOs are defined in terms of frequency, magnitude, and duration
- Need to specify whether to use acute or chronic objectives for stormwater, and to recognize exceedance frequency (once in three years)
- Translating objectives to numeric limits requires consideration of the frequency, magnitude, and duration of a discharge and of receiving water conditions, including mixing

Direct Use of WQOs (e.g., CTRs) as Effluent Limits is Inappropriate

- CTR values have been inappropriately applied as end-of-pipe effluent limits to be met at all times
- If all grab samples are to meet CTR limits, the entire distribution must fall below CTR levels
- If achievable, CTR effluent limits would result in a mean concentration below CTR levels – because of variability in storm flows, would be far below CTR
- Direct application of MSGP benchmarks is similarly inappropriate

What Sampling Will Be Required to Develop Numeric Effluent Limits?

- Will extensive sampling be required *for each individual discharge* to develop the data necessary to set limits?
- How much variability is there from discharge to discharge:
  - Within a given facility type or land use category?
  - Dependent upon site characteristics (slope, elevation, soil type, vegetative cover, etc.)?

Proper Development of Numeric WQBELs

- Analysis must consider
  - Mixing and dilution in receiving waters
  - Variability of discharge and receiving water concentrations and flow rates
- Steady-state approaches cannot be applied to highly variable storm flows
- Dynamic (modeling) approaches are appropriate, but are data-intensive

Data Collection Required to Develop Methodology and Calculate WQBELs

- Basic data requirements on an hourly or sub-hourly time step:
  - Effluent concentration
  - Effluent flow rates
  - Receiving water concentration
  - Receiving water flow rates
- Information on the storm event during which data collection occurs – e.g., rainfall amount, antecedent dry period, storm hydrograph

Methodology to Determine Numeric WQBELs

- Development would require significantly more data than currently available
- Use dynamic modeling approaches
- Would need to specify
  - Methods to determine reasonable potential
  - Methods to calculate permit limits
  - Data collection/monitoring requirements
  - Methods for assessing compliance

Beneficial Uses Should Be Reviewed

- Are beneficial uses applicable and appropriate during wet weather events?
  - In many streams, conditions are unsafe for recreation (and some high flow REC-1 suspensions have been adopted)
  - In some streams, aquatic life is absent during flood conditions
  - Flood control is primary purpose of many streams during flood conditions

Application and Translation of Water Quality Objectives

- Bacteria
- California Toxics Rule (CTR) primary pollutant objectives to protect aquatic life and human health
- Narrative objectives
  - Sediments (suspended, settleable solids)
  - Turbidity
  - Trash
  - Toxicity

Objectives May Not Be Appropriate During Storm Conditions

- Bacteria
  - Ubiquitous during storm conditions, even in natural areas
  - Sediments, regrowth, and wildlife are sources
  - Epidemiological data indicate that bacteria concentrations do not always correlate with health risk or presence of pathogens
- Metals
  - Site-specific objectives may be more appropriate (high levels of ligands and solids present in storm flows)
  - Potential to cause toxicity varies from dry weather conditions
- Organics
- Objectives need to consider frequency, magnitude, duration of exposure

Some Sources of Variability

- Sample collection: location/time, sampling technique and storm conditions
- Storm-specific variabilities: rate, volume, and duration of flows
- Storm sequence behavior: number of storms, magnitudes, and time intervals between them
- Pre-storm state of water bodies receiving flows
- Dilution variability
- Lab analysis
- CONCLUSION: Data distribution “heavy-tailed” - probably more so than the lognormal

Some Statistical Issues

- High measurement variability over time and locations --> monitoring needs
- Modeling difficulties: cause and effect
- Availability of sufficient data to determine reasonably accurate probability curves
- 800-pound gorilla: the storm itself
- Limit-setting: grab samples, locations, frequency of exceedance

Illustration of Lognormal Variability

- Suppose a sample of n is taken from a lognormal with coefficient of variation CV, and we calculate a 95% confidence upper bound on the 95th percentile.
- Suppose the upper bound is required to be smaller than a fixed limit.

In order to have a 90% chance to meet the requirement, the TRUE 95th percentile must be BETTER than the limit by a factor, e.g.

CV	factor (n=20)	factor(n=40)
2	3.5	1.9
3	4.5	2.2
5	5.9	2.5

Implementation Issues:
Industry

Timothy Simpson, PE

Implementation Issues

- If "Numeric Limits" are established what will it mean to the industrial discharger?
- For industrial dischargers, Numeric Limits mean limits that are "*never to be exceeded*" pollutant levels in stormwater that leaves a facility
- State and federal laws require they must be met 100% of the time under all conditions
- In California, mandatory penalties for exceedance of a limit

Implementation, Compliance, and Enforcement Issues That Need to be Addressed

- Where is compliance measured? – all facilities are different, multiple outfalls, sheet vs. pipe discharges, facilities that infiltrate vs. completely paved sites
- When is compliance measured? - stormwater occurrence, quality, quantity and duration highly variable during the storm event, when is sample taken?
- How is compliance measured? – How will sampling be done? How often, how long, when do you start?
- How is compliance determined? - Availability of certified labs, low level of limits vs detection levels, variability, statistical considerations for evaluating compliance

Implementation & Compliance Practical Considerations

- How is compliance of a discharge determined when testing results are provided after the fact?
- What does a facility do if it determines the discharge is not meeting limits and the discharger can no longer retain the stormwater? Can you knowingly discharge in violation? Dischargers cannot turn off the storm
- Do you plan/design for a certain size storm?
- How are pollutants beyond the control of facility (aerial deposition, run-on from neighboring sites, etc.) handled?

Challenges to Compliance Sampling

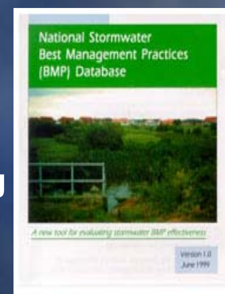
- Reliance on individual grab sampling is not technically defensible for measuring against numeric limits
- More sophisticated sampling, such as automated samplers, will require extensive retrofit
- Automated sampling equipment requires a high level of expertise to install and operate
- Monitoring costs will increase substantially

Treatment Challenges

- Efforts to comply with numeric limits will force many dischargers towards advanced treatment
  - Most facilities will require extensive retrofit – Drainage, Storage, Treatment Infrastructure
  - Most facilities lack the room for storage prior to treatment/discharge – greatly limiting treatment alternatives

Can Treatment Consistently Meet Numeric Objectives?

- Comparison of treatment BMP effluent to MSGP benchmarks
  - Zinc: 20% of samples above benchmarks
- Treatment to CTR is even more challenging
  - Forcing dischargers to attempt batch treatment/chemical flocculation and precipitation
  - Forcing dischargers to retain all stormwater



Even with advanced treatment, there will be no assurances of compliance with numeric limits

Industrial Perspective – Conclusions

- Beyond the question whether numeric limits are feasible, also need to address feasibility of complying with numeric limits and how implementation and compliance issues will be addressed
  - Grab sampling data too imprecise for measuring compliance with numeric standards
  - More precise monitoring beyond means and expertise of most dischargers
  - Retrofits to accommodate treatment may not be possible at many facilities
  - Even with advanced treatment, there will be no assurances of compliance with numeric limits

Implementation Issues: Construction

Sandy Mathews

Additional Complexities for Construction Stormwater

- The nature of construction presents additional complexities to the technical challenge of establishing numeric limits beyond that which has been presented for other industrial activities
  - Dynamic - specific activities and pollution risks on a construction site change daily and weekly as construction progresses
  - Nomadic - construction activities are typically completed in a year or less

Available Construction Storm Data Show High Variability

- Extended monitoring study conducted by Caltrans attempted to characterize construction discharge quality
  - High quality control program implemented in research project
  - Data showed similar variability to industrial stormwater monitoring
- The study indicates that stormwater constituent concentrations are highly variable

Given Variability, Individual NPDES Permits Would Be Needed

- Construction sites differ in location, slope, soil type, climate, soil erosivity, storm intensity,…
- Temporal and spatial disconnect between site and water body
- Differences in basin plans, WQOs

Effluent limits established at one construction site would not be applicable at another = individual permits

USEPA Conducted an Effluent Limitations Guideline Rulemaking

- The ELG at the outset eliminated from consideration a numeric effluent guideline focusing on a BMP approach.
- The April 26, 2004, Final Rule concluded that a national ELG was not warranted as sediment was adequately controlled by the current federal and state permits.
  - Uniform requirements would be very costly with little incremental pollutant reduction

Implementation & Compliance Issues That Need to be Addressed

- Where, when and how would samples be taken and compliance be measured on a nomadic dynamic construction site
- What does a site do, if it determines the discharge is not meeting limits, and the discharger can no longer retain the stormwater? Can you knowingly discharge in violation? <u>Dischargers cannot turn off the storm</u>
- Large number of permitted construction sites (~14K) challenges available sampling and analytical resources

Construction Perspective Conclusion

- The nature of construction presents significant technical challenges to challenge of establishing numeric limits
  - Development of the numeric limit will be a data intensive process applied individually to each project
  - Implementation of compliance determinations based on a numeric limit are also data intensive and will challenge the available objective analytical resources

Implementation Issues: Municipal

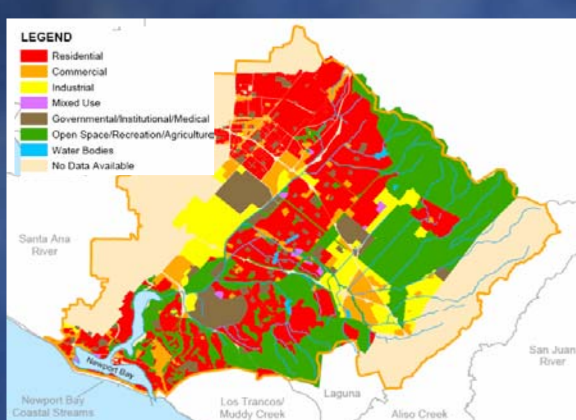
Richard Boon,
Orange County Stormwater Program

Key Issues

- **Accountability** (of MS4)
- **Feasibility** (Technical & Economic)
- **Applicability** (of current WQS)
- **Ecological Integrity** - Sustainability (The Goal)

Accountable: Subject to giving an account: ANSWERABLE 2: Capable of being accounted for: EXPLAINABLE *syn* see RESPONSIBLE

Responsibility is contingent upon control



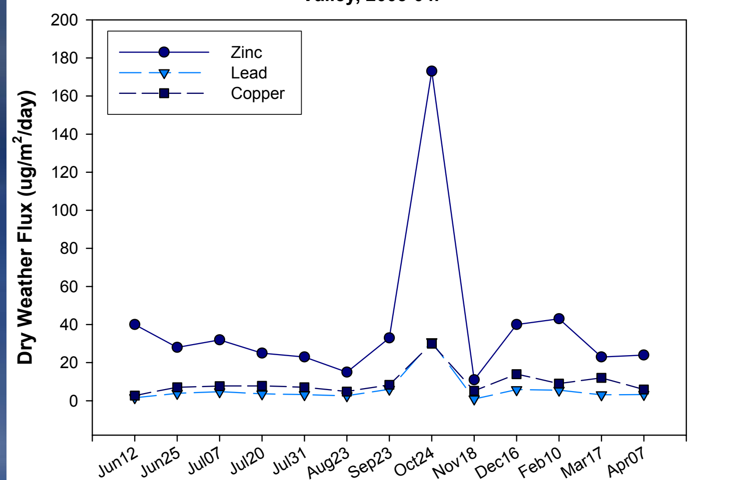
MS4 system integrates multiple sources:
- Non-Urban Land Uses
- Permitted Discharges
- Aerial Deposition
- Shallow Groundwater
- Natural & Wildlife Sources
- Sanctioned Activities

Monitoring Feedback

Newport Bay Watershed – Land Use

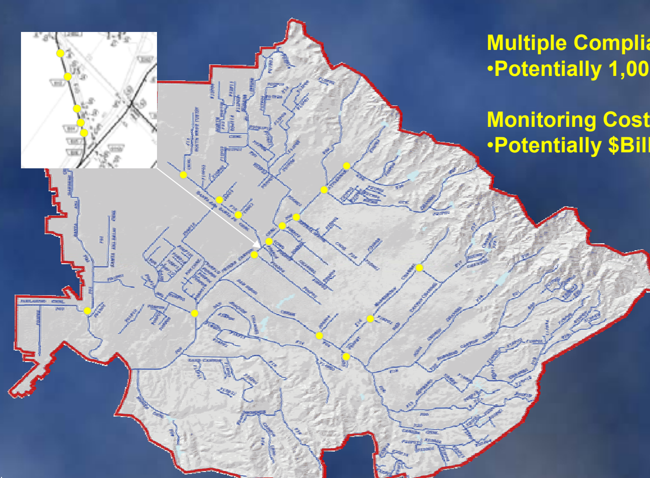
Atmospheric Deposition after Southern California Wild Fire Season

Figure 2. Dry weather metals atmospheric deposition in the San Fernando Valley, 2003-04.



Source: Sabin, L.D., Lim, J.H., Stolzenbach, K.D., Schiff, K.C., "Contribution of trace metals from atmospheric deposition to stormwater runoff in a small impervious urban catchment." Water Research, accepted 4 July 2005.

Accountability (Continued)
Where is Compliance Determined?



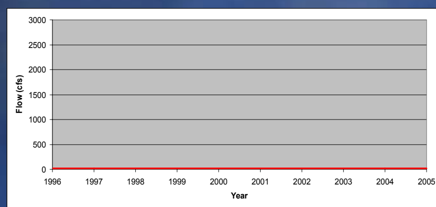
Multiple Compliance Points:
•Potentially 1,000s in an MS4

Monitoring Costs
•Potentially $Billions

Newport Bay Watershed - Drainage

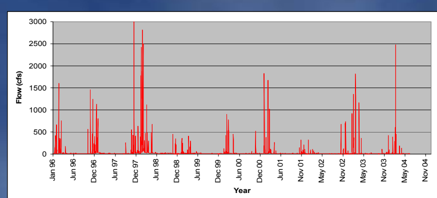
Feasible: 1: Capable of being done or carried out 2: Capable of being dealt with successfully syn POSSIBLE (Technical)

Orders of Magnitude Variation in flow



POTW (IRWD) Influent

Range =
15.9 cfs – 21.1 cfs



Newport Bay Watershed Average Daily Flow (Campus Drive)

Range =
2.2 cfs – 9220 cfs

Feasibility (Economic)
Costs of Complying with WQBELs Will Be Significant

Treatment Control BMP Program

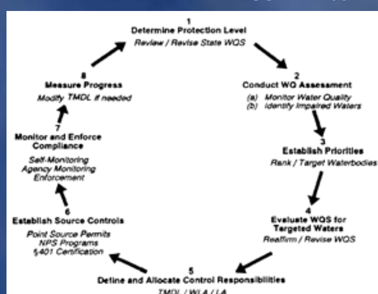
- Orange County BMP Retrofit Investigation
  - $313 Million Construction Costs for 29% of Urbanized County Area
- $245 Million to $4.5 Billion for Ballona Creek metals TMDL (CTR limits)
- $1.1 Billion for trash TMDL on LA River
- $1.4 Billion for metals TMDL for LA River (CTR limits)

Applicable capable of or suitable for being applied
APPROPRIATE syn see RELEVANT

Water Quality Standards must be appropriate/ relevant and have the confidence of the regulated community

It is often appropriate to re-evaluate the appropriateness of the WQS

USEPA 1994



Beneficial Use

Objective

The risk of illness was uncorrelated with levels of traditional water quality indicators. Of particular note, the state water quality thresholds were not predictive of swimming-related illnesses.

Recreational Water Contact and Illness in Mission Bay California

SCCWRP, 2005

Ecological Integrity & Sustainability
Need to Shift to Ecological Outcomes

SEC. 101. (a) The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.

Planning for a Greener LA River

A series of 18 public meetings will help set priorities for restoring habitat, creating parks……..

LA Times 9/12/05

We are not striving for Statewide watershed homogeneity

Conclusion

"Would you tell me, please, which way I ought to go from here?"

"That depends a good deal on where you want to get to," said the Cat.

Alice in Wonderland

Implementation Issues: Caltrans

Michael Flake

Caltrans

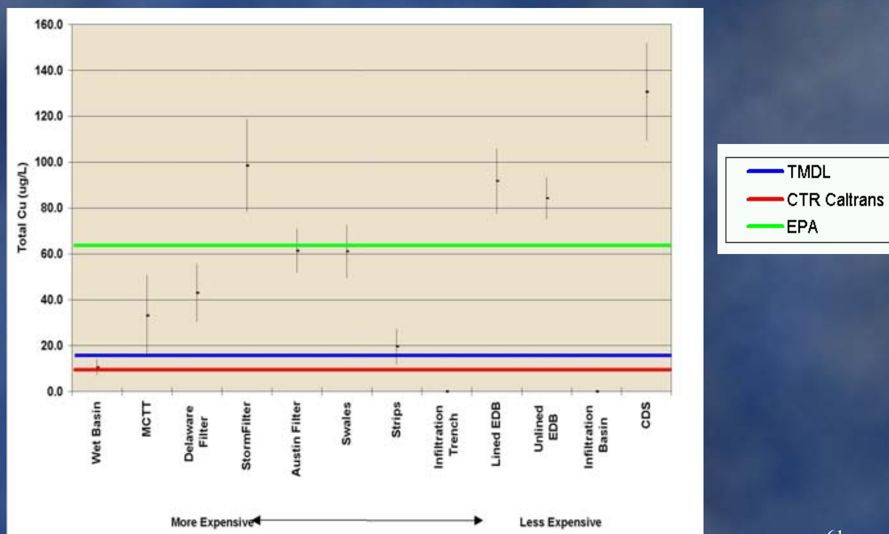
BMP Retrofit Pilot Program

FINAL REPORT

REPORT ID CTSW - RT - 01 - 050
JANUARY 2004
California Department of Transportation
CALTRANS, DIVISION of ENVIRONMENTAL ANALYSIS
1120 N Street
Sacramento, CA 95814

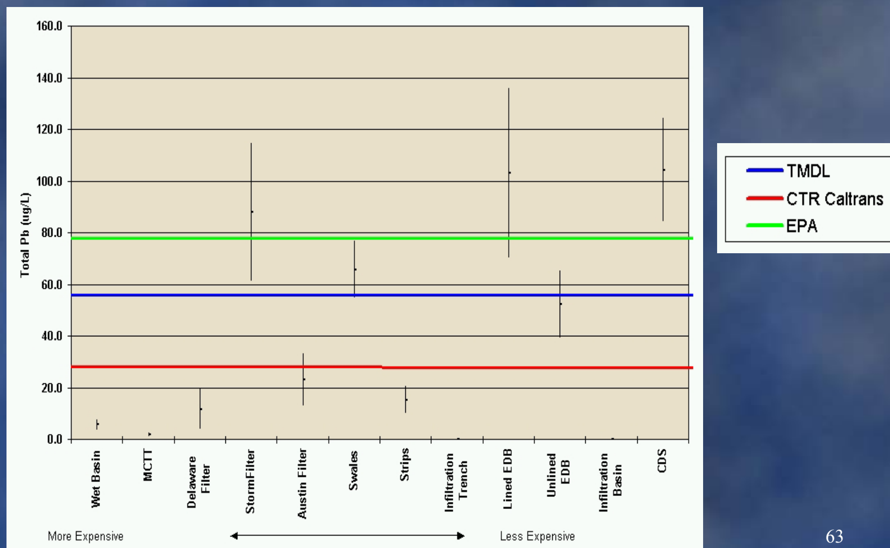
Sand Media Filter

Total Cu Effluent (94 µg/L influent)



Total Zn Effluent (355 µg/L influent)

Total Pb Effluent (87 µg/L influent)



BMP Cost Ranked by Performance
Rank by TSS removal

BMP	Capital Cost	Maintenance Cost	Total Cost
	$/m3	$/m3	$/m3
Infiltration Basin	369	81	450
Infiltration Trench	733	71	804
Austin Sand Filter	1,447	78	1,525
MCTT	1,875	171	2,046
Wet Basin	1,731	452	2,183
Delaware Sand Filter	1,912	78	1,990
Biofiltration Strip	748	74	822
Extended Detention Basin	590	83	673
Biofiltration Swale	752	74	826
CDS	264	99	363
StormFilter	1,572	204	1,776
Drain Inlet Inserts	10	29	39
OWS	1,970	21	1,991

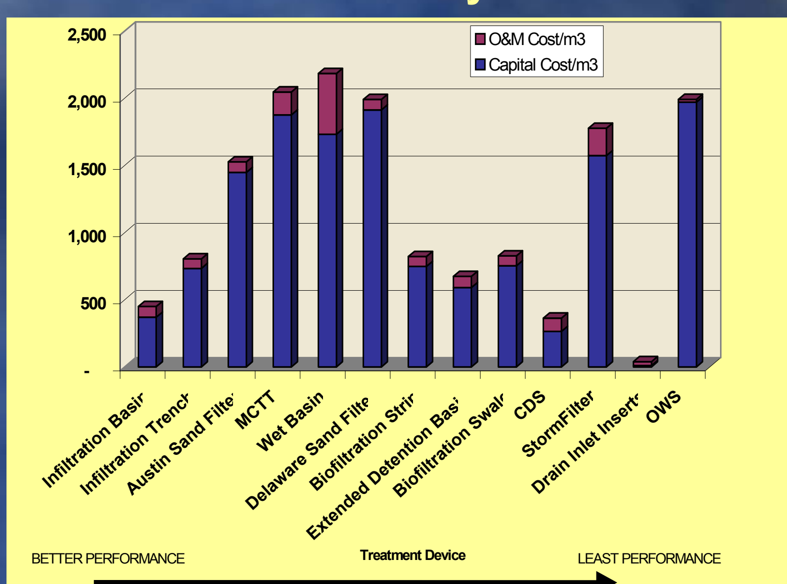
Total maintenance cost based on life cycle of 20 years and 4% discount rate.

Caltrans Costs are Retrofit Costs

BMP Type	Caltrans Capital Cost	EPA BMP Cost
Oil-Water Separator	**$136,700**	**$16,000**
Delaware Sand Filter	**$132,700**	**$11,000**
MCTT	**$130,100**	**$72,000**
Wet Basin	**$120,100**	**$2,400**
StormFilter	**$109,100**	**-**
Austin Sand Filter	**$100,400**	**$18,500**
EDB	**$40,900**	**$2,300**
Biofiltration Swale	**$52,200**	**$900**
Biofiltration Strip	**$51,900**	**$30,000**
Infiltration Trench	**$50,900**	**$19,400**
Infiltration Basin	**$25,600**	**$4,900**
CDS	**$18,300**	**-**
Drain Inlet Insert	**$700**	**-**

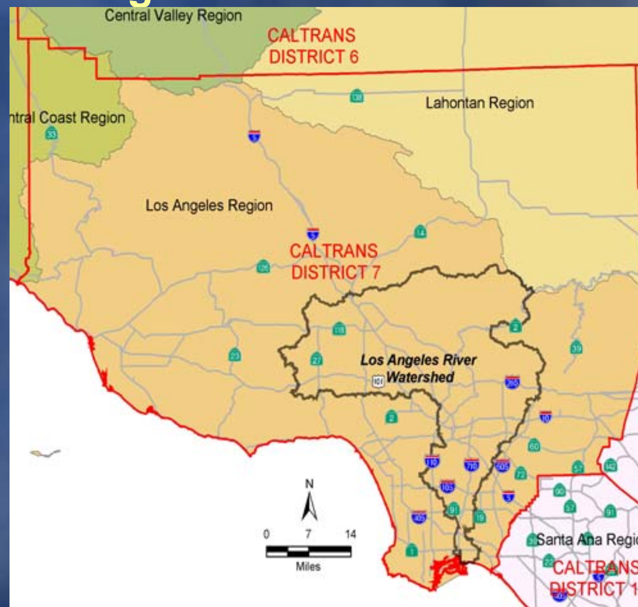
Based on BMP size needed for a 1 acre drainage area, 0.75 inch rainfall, 0.9 runoff coefficient.

BMP Cost Ranked by Performance



District 7 - Los Angeles

- 1200 miles of roadway.
- LA River is 19% of LA Region



Los Angeles River

- Watershed area 527,000 acres.
- 314 miles of freeway.
- Department area is 1.3% of watershed.
- Sand Filter cost for $750,000,000

Municipal

- Treatment doesn't become a consideration, it becomes mandatory. Thus each entity will need to invest in a major Capital Improvement Program.
- Cost for both a CIP and the O&M will detract from other efforts – flood control, transportation, police, fire, etc.
- Will effluent limits work with TMDLs? What will happen to infrastructure installed for a TMDL?
- How will an effluent limit for one constituent mesh with an effluent limit for another constituent?

Quantifiable Measures/Objective Criteria for Compliance

Karen Ashby
CASQA Chair

Quantifiable Measures/Objective Criteria:
Industrial

One Potential Approach…

Washington State Like "Adaptive Tiered Management Approach" that Focuses on Addressing Problem Sites

- Include Multi-Level "Tiered" Response Actions
- Use Adaptive Management Indicators (Benchmark/Action Level)
- Include Monitoring/Assessment of SW Discharges
- Documentation, Reporting, Inspection

Include Multi-Level "Tiered" Response Actions

- Require an Increasing Level of Response Actions Based on Adaptive Management Indictors and Assessment of Site SW Program Effectiveness. For Example, Possible Tiers could be as follows:
  - Tier 1 – Baseline monitoring
  - Tier 2 – Increased inspections, monitoring, and assessment for development of enhanced BMPs
  - Tier 3 – Increased scrutiny and response required, possibly including RWQCB inspections, professional review and assessment, schedules for implementation of additional measures, analysis of feasibility of engineered solutions

Use Adaptive Management Indicators (Benchmarks/Action Levels)

- Develop benchmarks/action levels for appropriate pollutants
  - Benchmark/action levels are not effluent limits
  - Monitoring results above benchmark/action levels are not permit violations

Monitoring/Assessment of SW Discharges

- Compare/evaluate monitoring results to benchmark/action levels over a period of time
  - One sample alone does not trigger Tiered Response
- Use standardize process to assess site stormwater program effectiveness
- Together monitoring and program effectiveness assessment are used to trigger tiered response

Documentation, Reporting, Inspection

- Identify "site tier level"
- Document inspections/assessments/actions taken
- Submit a timely report to Regional Board
- Regional Boards inspects priority "problem" sites on a regular basis

Quantifiable Measures/Objective Criteria: Construction

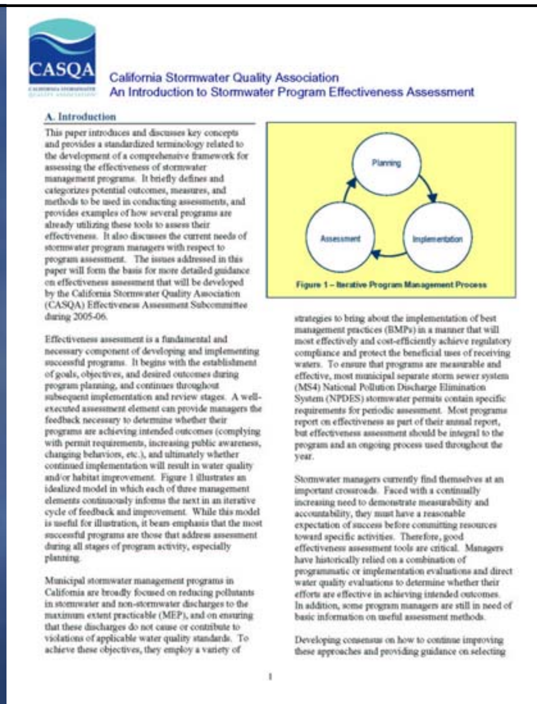
Measurable Goals for Compliance

- Establish a clear requirement for SWPPP management qualifications through certification of expertise (e.g. CPESC)
- SWPPP development must use a water quality management approach that accounts for the risk to receiving water posed by the specific activities at the construction site
  - Layered suite of BMPs, which includes contingency for any individual BMP failure, that address the identified risk
  - Evaluation of implemented BMPS to demonstrate effectiveness

Measurable Goals for Compliance (cont'd)

- Replace current annual report requirement with a documented comprehensive SWPPP review/update to be completed within 30 days of the start of the wet season (e.g. by September 15)
- Standardize BMP specifications for installation, maintenance, and inspection
- Establish performance standards for advance treatment techniques (such as chemical treatment of detained water)

Quantifiable Measures/ Objective Criteria: Municipal



California Stormwater Quality Association
An Introduction to Stormwater Program Effectiveness Assessment

A. Introduction

This paper introduces and discusses key concepts and provides a standardized terminology related to the development of a comprehensive framework for assessing the effectiveness of stormwater management programs. It briefly defines and categorizes potential outcomes, measures, and methods to be used in conducting assessments, and provides examples of how several programs are already utilizing these tools to assess their effectiveness. It also discusses the current needs of stormwater program managers with respect to program assessment. The issues addressed in this paper will form the basis for more detailed guidance on effectiveness assessment that will be developed by the California Stormwater Quality Association (CASQA) Effectiveness Assessment Subcommittee during 2005-06.

Effectiveness assessment is a fundamental and necessary component of developing and implementing successful programs. It begins with the establishment of goals, objectives, and desired outcomes during program planning, and continues throughout subsequent implementation and review stages. A well-executed assessment element can provide managers the feedback necessary to determine whether their programs are achieving intended outcomes (complying with permit requirements, increasing public awareness, changing behaviors, etc.), and ultimately whether continued implementation will result in water quality and/or habitat improvement. Figure 1 illustrates an idealized model in which each of three management elements continuously informs the next in an iterative cycle of feedback and improvement. While this model is useful for illustration, it bears emphasis that the most successful programs are those that address assessment during all stages of program activity, especially planning.

Municipal stormwater management programs in California are broadly focused on reducing pollutants in stormwater and non-stormwater discharges to the maximum extent practicable (MEP), and on ensuring that these discharges do not cause or contribute to violations of applicable water quality standards. To achieve these objectives, they employ a variety of

Figure 1 – Iterative Program Management Process

strategies to bring about the implementation of best management practices (BMPs) in a manner that will most effectively and cost-efficiently achieve regulatory compliance and protect the beneficial uses of receiving waters. To ensure that programs are measurable and effective, most municipal separate storm sewer system (MS4) National Pollution Discharge Elimination System (NPDES) stormwater permits contain specific requirements for periodic assessment. Most programs report on effectiveness as part of their annual report, but effectiveness assessment should be integral to the program and an ongoing process used throughout the year.

Stormwater managers currently find themselves at an important crossroads. Faced with a continually increasing need to demonstrate measurability and accountability, they must have a reasonable expectation of success before committing resources toward specific activities. Therefore, good effectiveness assessment tools are critical. Managers have historically relied on a combination of programmatic or implementation evaluations and direct water quality evaluations to determine whether their efforts are effective in achieving intended outcomes. In addition, some program managers are still in need of basic information on useful assessment methods.

Developing consensus on how to continue improving these approaches and providing guidance on selecting

1

Examples of Assessment Methods By Outcome Level

Outcome Level	Assessment Method Type	Assessment Measure	Examples
5 - Urban Runoff & Discharge Quality	Monitoring (Sampling)	◆ Benchmark ◆Loading change	◆Comparison of Cu to WQO ◆Phosphorous loading to MS4 (increase since 1993)
6 – Receiving Water Quality	Monitoring (Sampling) Monitoring (Observation)	◆Benchmark ◆Biological condition ◆Physical Habitat	◆Comparison of Cu to WQO ◆Stream biodiversity ◆Scouring of stream bank

Program Effectiveness Assessment Guidance Document

- Primary Goals
  - Identify measures (applicability, opportunities and constraints, costs, etc.)
  - Identify approaches for incorporating assessment into each program element
  - Develop conceptual approach for correlating effectiveness measures to the higher outcome levels (levels 4-6)
- Estimated Completion Mid 2006

Thank You

CALIFORNIA STORMWATER QUALITY ASSOCIATION

CASQA

We will be happy to answer any questions that you may have

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