LID

Low Impact Development – Latest Trends and Approaches

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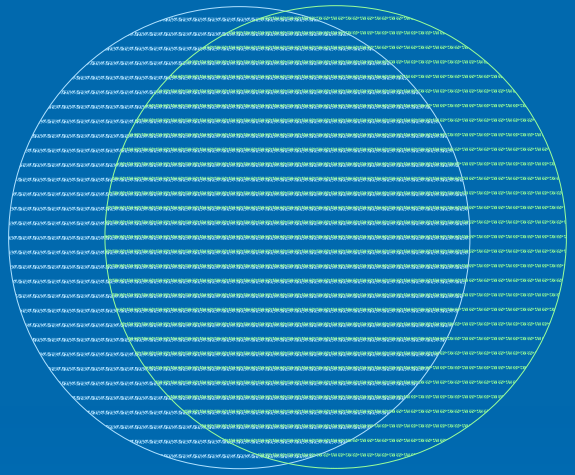
Presentation Overview

- How are we integrating LID techniques into Bay Area development projects?
- How are we designing LID features to help projects meet C.3. requirements?
- What design tools and resources are available?
- What else is going on around the State?

“LID” vs. “Site Design”

LID:
Onsite BMPs
Regional Planning
Smart Growth

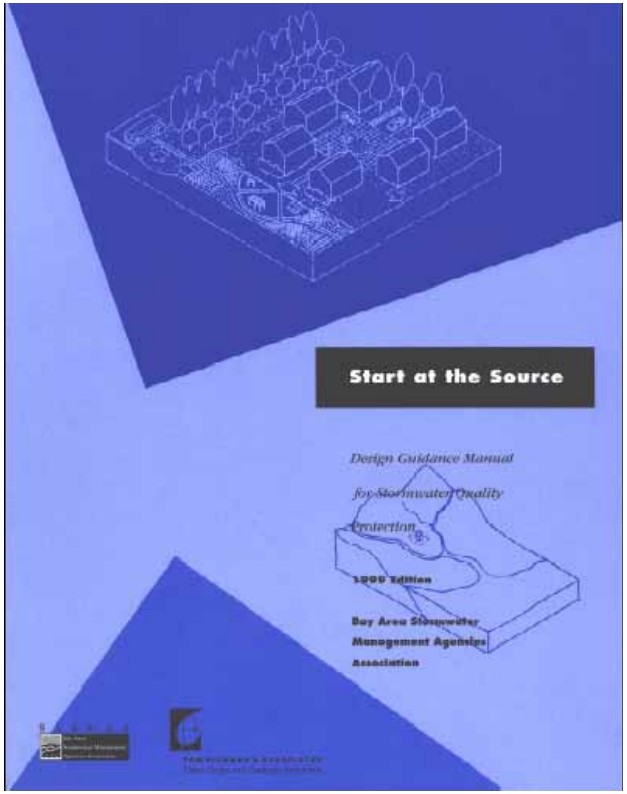


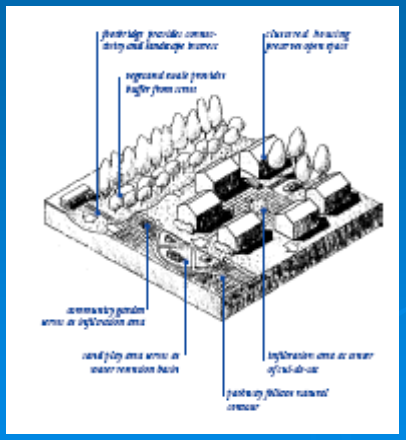
Site Design:
Onsite BMPs
Site Planning
Conservation

*** For the purposes of this presentation,**
LID = Site Design

Integrating LID into Projects: Early Efforts

- 1994 – SF Bay Regional Water Board "Staff Recommendations for New and Redevelop-ment Controls for Stormwater Programs" (emphasized site design practices)
- 1997, 1999 - BASMAA produces "Start at the Source" (1st LID Manual)
- 1997 – Bay Area stormwater programs begin to include site design requirements in performance standards
- 2001 – 1st Bay Area MS4 permit adopted with requirements for site design in development projects





Site Design Concepts:

1. Define development envelope and protected areas
2. Minimize directly connected impervious areas
3. Maximize permeability
4. Maximize choices for mobility
5. Use drainage as a design element

Use of LID BMPs to Meet Treatment Requirements

- Many LID techniques provide effective storm water treatment
  - Examples: vegetated swales/buffer strips, bioretention, landscaped detention areas, planter boxes, green roofs
- Landscaped-based treatment systems are encouraged by permitting agencies
- Soil and plants are excellent treatment media
  - Native soils filter, adsorb and break down pollutants near surface
  - Soil mixtures enhance infiltration capacity and adsorption (local soil specifications are available)
  - Plant materials filter and uptake pollutants

Flow-Based BMP Sizing Criteria

Flow-based BMPs – Systems that remove pollutants from a moving stream of water by filtration, infiltration, and/or biological processes.

Sizing Criteria:

- 10% of the 50-year peak flowrate;
- Runoff produced by 2 times the 85th percentile hourly rainfall intensity; OR
- Runoff produced by a rainfall intensity of 0.2 inches/hour

Volume-Based BMP Sizing Criteria

Volume-based BMPs – Structures that detain a volume of stormwater for a period of time, treating the stormwater primarily through settling and infiltration.

Sizing Criteria:

- The maximized stormwater capture volume as determined by the WEF/ASCE Manual of Practice (approx. 85th percentile 24-hour storm event)
- The volume representing 80% capture of the annual runoff volume, based on the CASQA BMP Handbook methodology.

Examples of Flow & Volume-Based LID Treatment BMPs

Flow-Based

- Vegetated Swale
- Vegetated Buffer or Filter Strip

Volume-Based

- Pervious Paving
- Landscape Detention Areas and Ponds
- Infiltration Trench

Flow & Volume-Based

- Bioretention Area

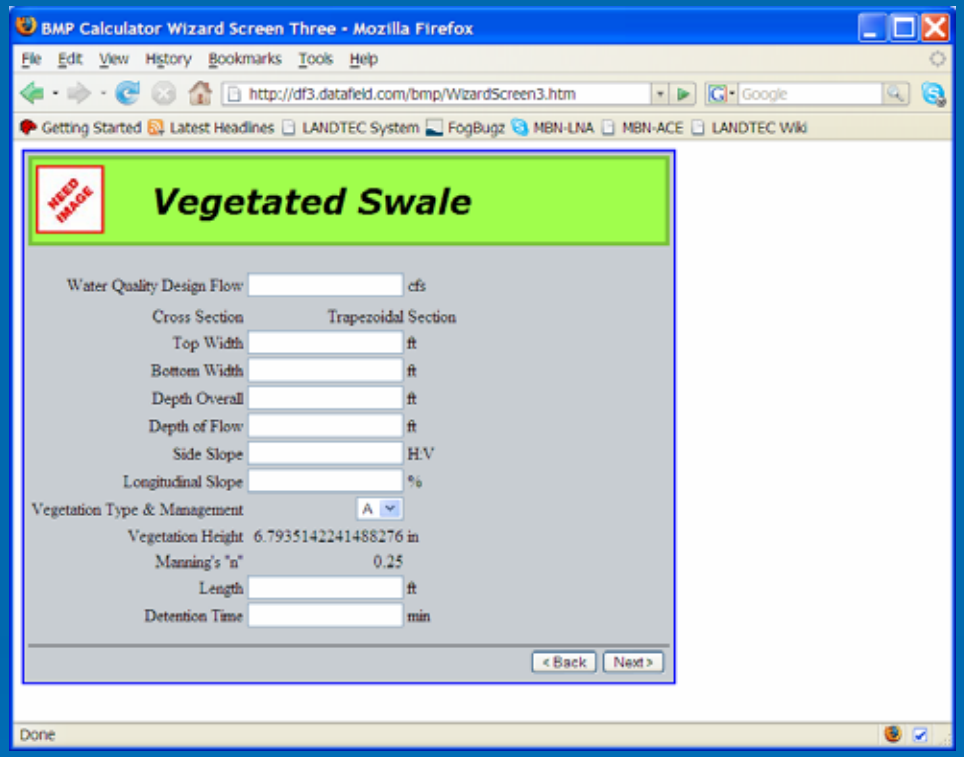
Using Site Design Techniques to Meet Development Standards for Stormwater Quality – *A Companion Document to Start at the Source*

- Methods to calculate how site design measures can achieve stormwater treatment or reduce the amount of runoff needing treament

Use LID measures to reduce the amount of runoff needing to be treated

- **Zero Discharge Areas** – areas that have been designed to infiltrate or retain the volume of runoff requiring treatment
- **Self-Treating Areas** – areas that have been designed to provide “self-treatment” without additional BMPs
- **Runoff Reduction Areas** – areas that have been designed using alternative materials or surfaces that reduce the volume of runoff

BASMAA BMP Sizing Tool



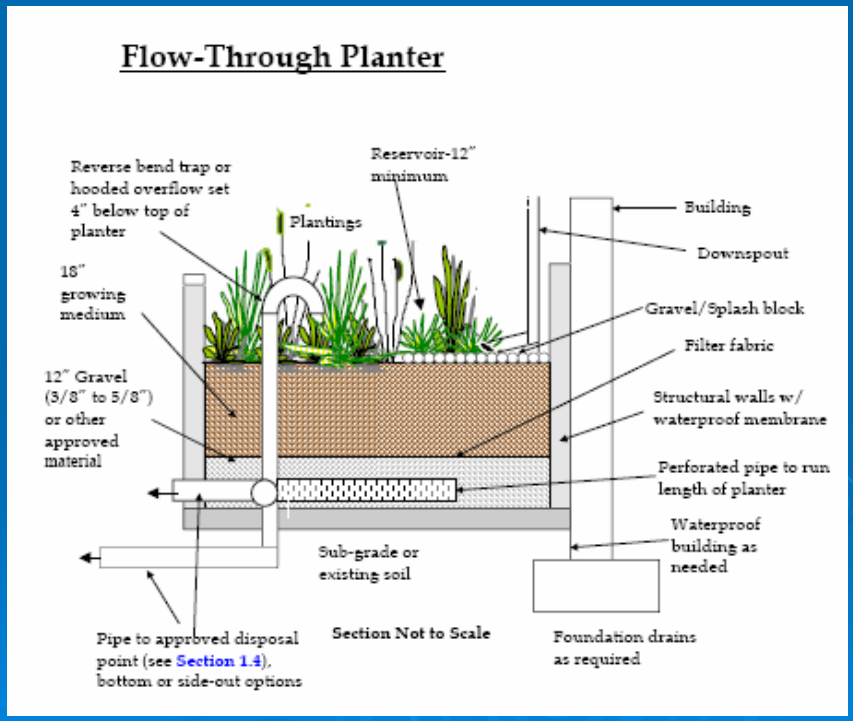
Standard Practice for Preliminary Design of:

- **Vegetated Swale**
- **Infiltration Trench**
- **Pervious Paving**
- **Bioretention Areas**

- **Web-based tool**
- **User provides design volume/flow, site-specific data**
- **Available summer 2008**

Sizing Factor Approach

- Also known as “simplified approach”, originated in City of Portland, OR
- Uses standard designs with sizing factors to to adjust the surface area of the BMP based on the amount of impervious surface draining to the BMP



Sizing Factor Approach

- Contra Costa Clean Water Program Stormwater C.3. Guidebook has sizing factors for various “IMPs”
- Sizing factor for planters and bioretention areas = 0.04, based on design rainfall of 0.2 in/hr and 5 in/hr infiltration rate through engineered soil mix
- Different sizing factors for other IMPs
- Have “IMP Sizing Calculator” design tool

LID and Hydromodification

Hydromodification is:

- Change in the runoff hydrograph from an area due to development
- A major cause of creek/channel erosion in urban areas

Hydromodification Control Requirements

NPDES Permit Provision C.3.f.:

- Increases in runoff peak flow, volume, and duration shall be managed for all Group 1 Projects*, where such increased flow and/or volume can cause increased erosion of creek beds and banks…
  - * Group 1 = > 1 acre impervious surface

Hydromodification Control Requirements, continued

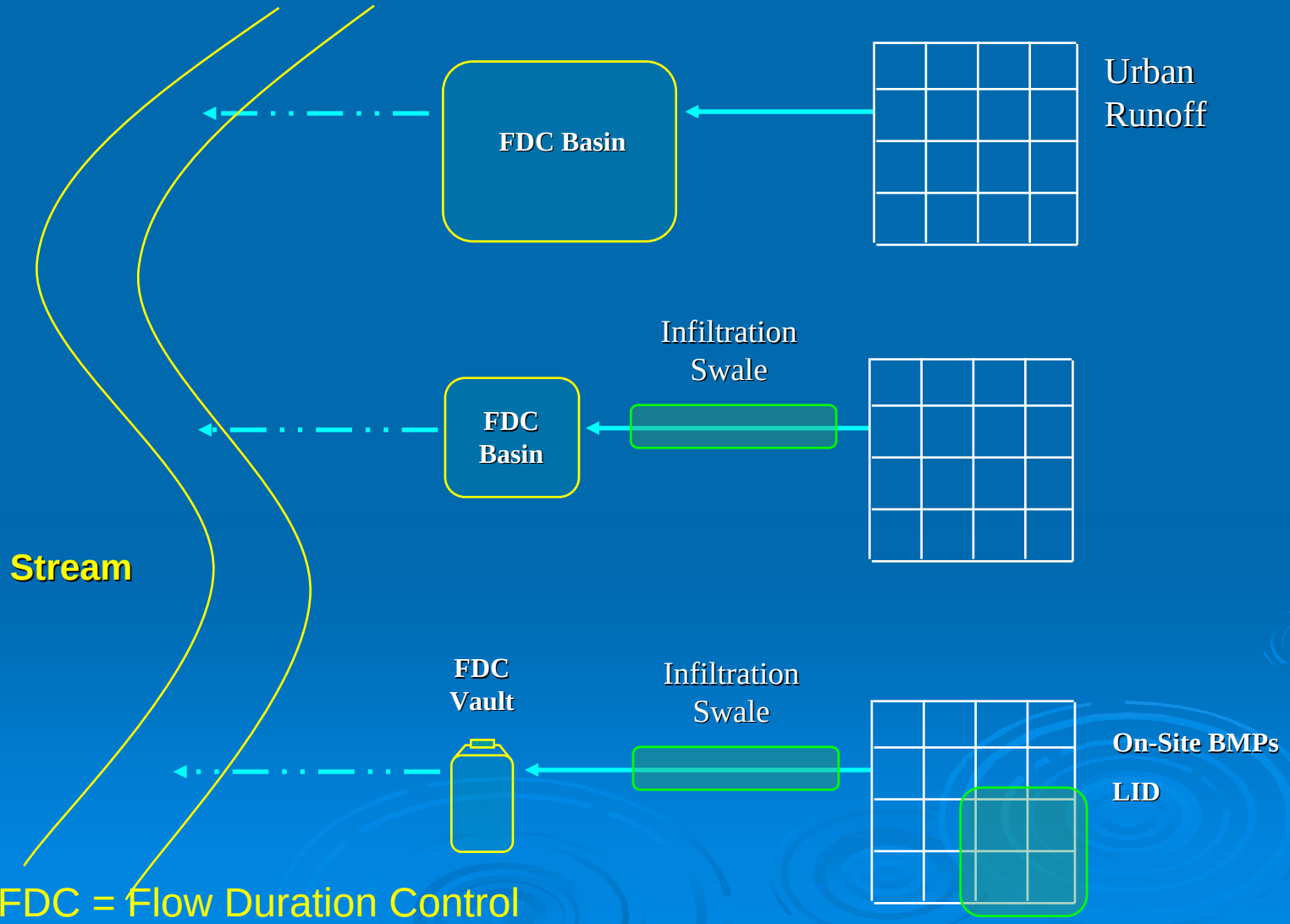
NPDES Permit Provision C.3.f.:

- Post-project runoff shall not exceed estimated pre-project rates and durations, where the increased stormwater discharge rates and durations will result in increased potential for erosion…

Flow Control Strategies

- Peak flow control - not effective for erosion control (low flows matter)
- Single event/design storm approaches – not adequate hydromod control
- Flow duration control - recommended
  - Match pre-project conditions over a range of flows resulting from multi-year rainfall record
- Site design (LID) measures – can be used to reduce hydromodification effects and/or supplement other facilities

Integrating Detention Facilities with LID to Control Hydromod



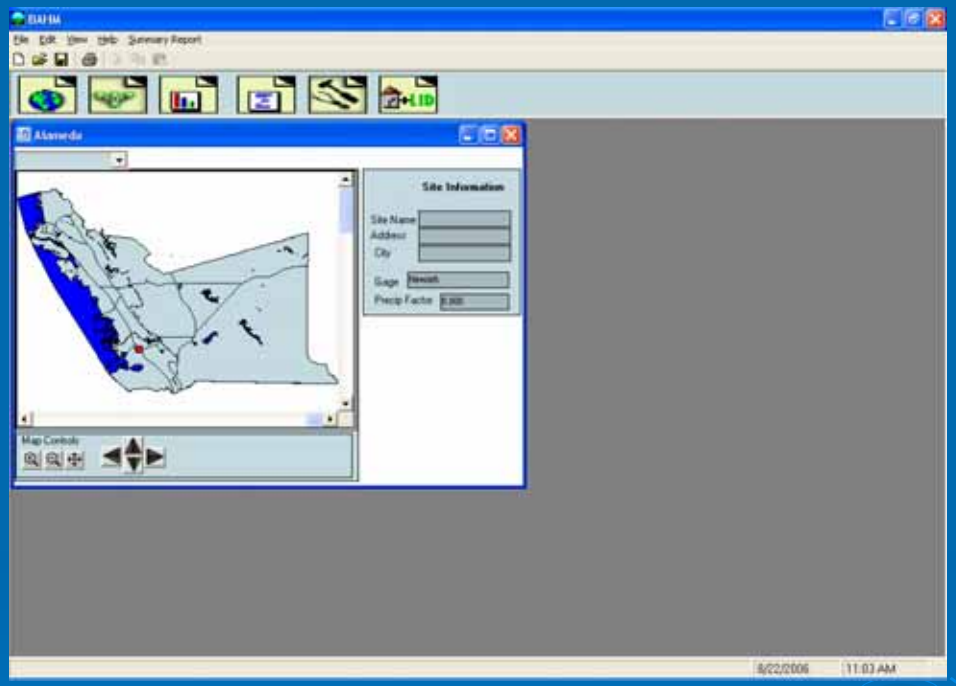
Bay Area Hydrology Model

- Tool to size flow control facilities to meet hydromodification requirements
- Developed based on the Western Washington Hydrology Model and HSPF
- Jointly funded by the Santa Clara, Alameda, and San Mateo countywide stormwater programs
- Calibrated to local watersheds

Bay Area Hydrology Model

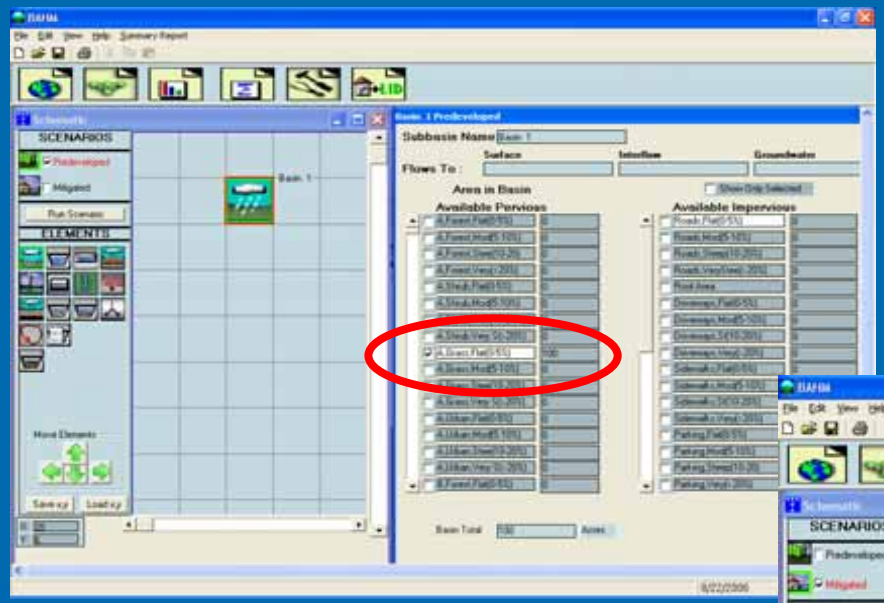
Features:

- Has user-friendly interface to HSPF
- Loads appropriate parameters based on project location
- Uses long-term local rainfall records

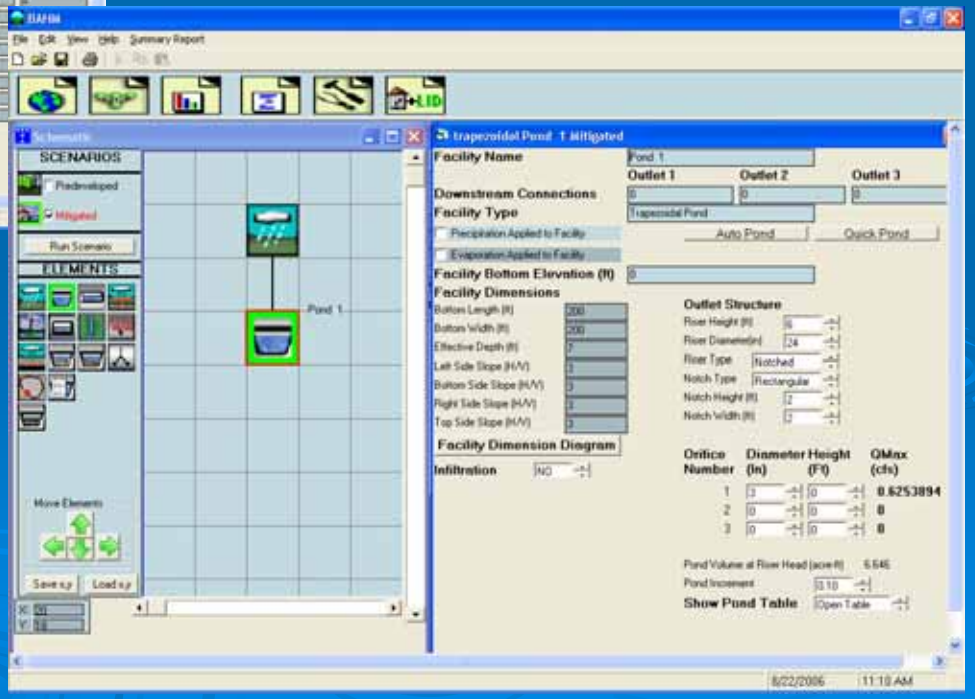


- Simulates pre- and post-project hydrology and automatically sizes a facility to match pre- and post-project flow duration curves

Bay Area Hydrology Model



Project Data Input Screen (Pre- and Post-Project)



Flow Control Facility Input Screen

Bay Area Hydrology Model
can represent the following LID BMPs:

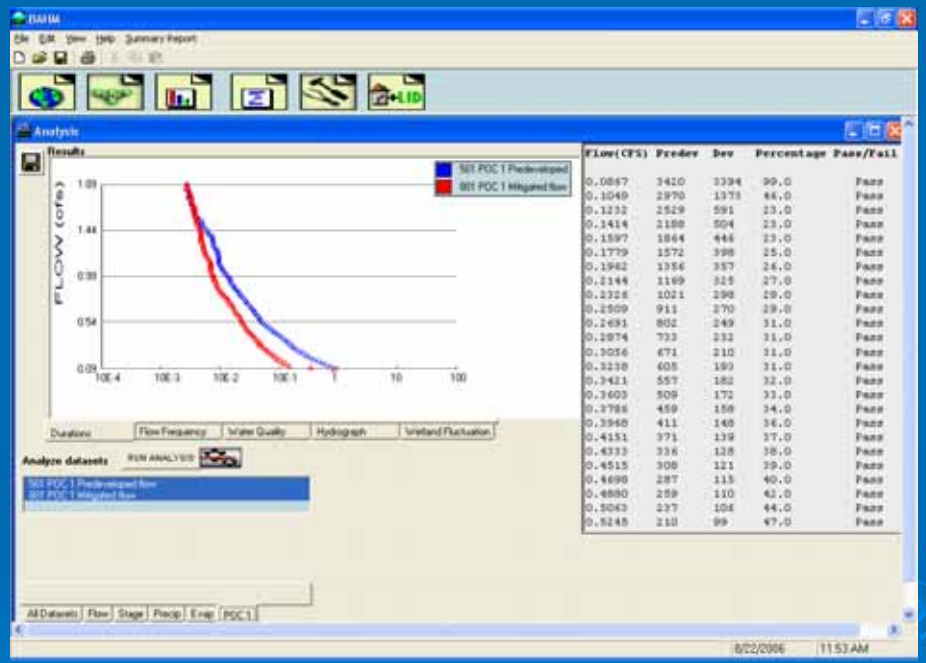
- Permeable Pavement
- Dispersion
- Green Roof
- Rainwater Harvesting
- Rain Garden
- In-Ground (Infiltration) Planter
- Flow-Through Planter
- Bioretention Area
- Vegetated or Grassy (Dry) Swale
- Dry Well
- Infiltration Trench
- Infiltration Basin/Pond

Bay Area Hydrology Model

The BAHM provides:

- **An easier, standardized way to do continuous simulation modeling**
- **A means to compute flow control benefits of site design and treatment measures**
- **Standardized reporting to assist municipal staff in design review**

Output Screen



Sizing Factor Approach for Flow Control

- Contra Costa Clean Water Program developed combined treatment and flow control sizing factors for IMPs
- Used HSPF models to simulate runoff for 30 years from hypothetical 1-acre site (undeveloped and completely impervious) to each IMP
- Factors reflect minimum size of IMP that matches pre-project flow duration

LID "Movement" in California

- State Water Resources Control Board - new policy on Sustainable Water Resources Mgmt
- Ocean Protection Council – LID Resolution
- California Coastal Commission – LID trainings
- U.C. Davis Office of Water Programs – trainings, research, outreach
- California Stormwater Quality Association (CASQA) – trainings, guidance
- California Water and Land Use Partnership (CA WaLUP) – coordination, outreach
- Environmental NGOs (NRDC and others) – promoting requirements for LID in permits

State Board Policy (May 2008)

- Continues commitment to sustainability as a core value for programs and policies
- Directs State Board to require LID and climate change considerations in future policies and regulatory actions
- Directs Regional Boards to aggressively promote LID and integrate into permits
- Gives higher grant priority to climate-related and LID projects
- Supports training and partnerships
- “It is critical that flexibility be allowed…”

Ocean Protection Council Resolution

- Promotes LID principles, including retrofit of existing impervious areas
- Advocates State government leadership (including LID in State projects, Caltrans standards, incentives in grant funding, review of building standards)
- Recommends that State/Regional Boards use NPDES permits to ensure LID is the “primary approach to satisfying post-construction runoff control requirements”
- Considers funding for retrofits, local policy updates, BMP effectiveness research, local incentives, stormwater recharge projects, and other technical assistance

CASQA Efforts

- Coordinate and assist with training throughout the State to ensure consistency of technical approach
- Update New/Redevelopment BMP Handbook to include LID practices
- Support Southern California LID Project (includes monitoring, guidance, training)
- Advocate flexible, rational, feasible LID language in MS4 permits

Questions?