California NPS Conference
Hydromodification Workshop

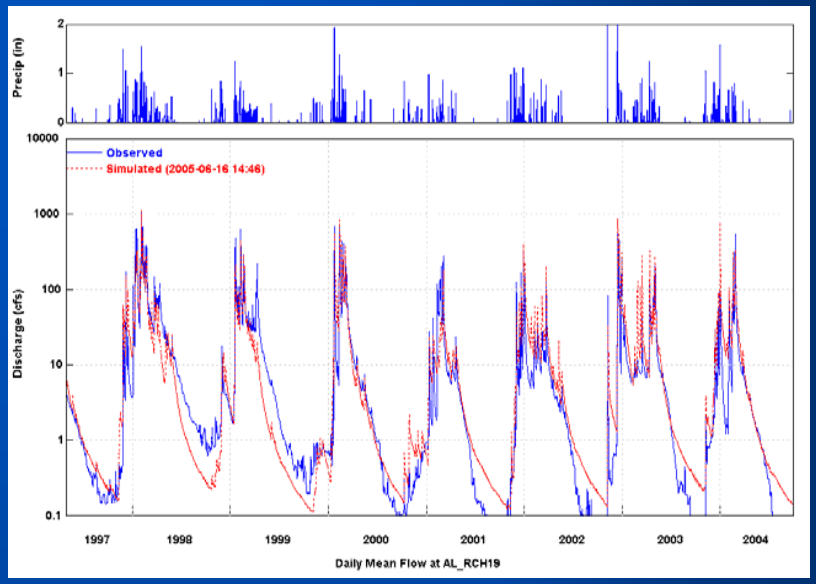
Hydromodification Management Tools

Jill C. Bicknell, P.E., EOA, Inc.
SCVURPPP Assistant Program Manager

Presentation Overview

- What is continuous simulation modeling and why is it needed for hydromod management analyses?
- Applicable hydrologic models
- Bay Area Hydrology Model
- Contra Costa IMP Sizing Tool
- Tools under development
- References

Continuous Simulation Hydrologic Modeling



- Simulates long-term response of a watershed to rainfall

- Inputs: Long-term rainfall & evaporation records; data on landform, land cover, soil properties
- Outputs: Time series of runoff flows; accounting of water balance; storage/flows in pipes and other facilities
- Requires calibration of parameters to match existing flow data

Advantages of Continuous Simulation Models

- Ability to determine antecedent conditions (e.g., soil moisture, ground-water table, surface storage, etc.)
- Ability to generate a long-term flow record for statistical analyses
- Ability to more explicitly represent interactions of surface runoff with interflow and groundwater

Process for Evaluating Hydromod Requirements

Hydrologic Analysis

- Generate pre- vs. post-project flow duration curves using hydrologic model
- Continuous simulation required
- Most widely used models in U.S.:
  - EPA HSPF
  - EPA SWMM
  - Corps of Engineers' HEC-HMS

Design Challenges

- **Challenge #1:** Flow duration control design
  - Requires use of continuous simulation hydrologic model
  - Use of these models is data intensive and time consuming
  - Lack of knowledge and experience
- **Challenge #2:** Integrating flow controls with site design and treatment controls
  - How to estimate flow reduction benefits of other BMPs

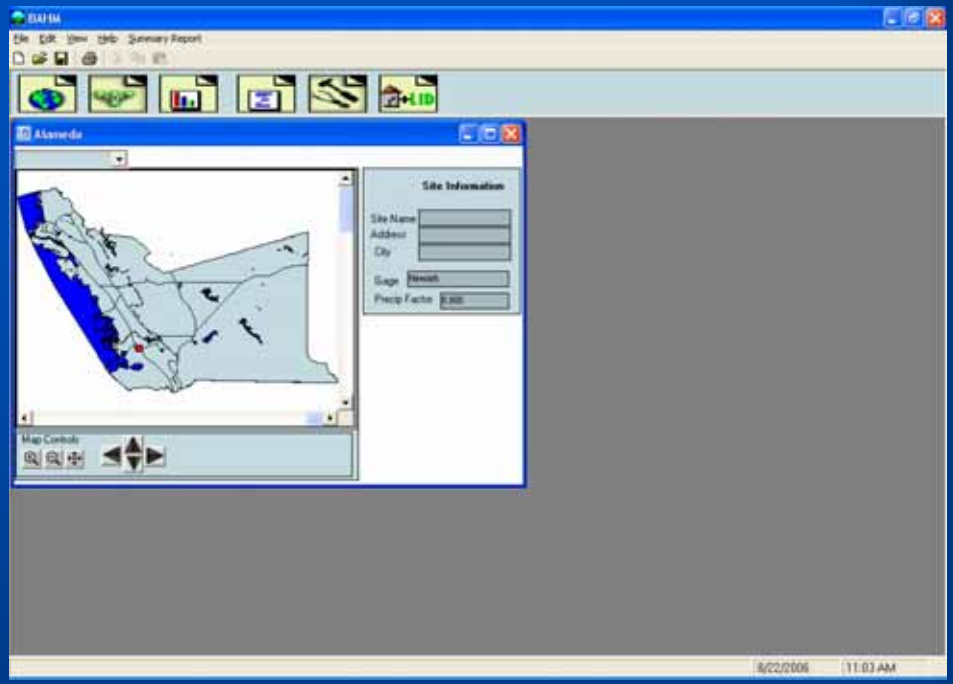
Bay Area Hydrology Model

- 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

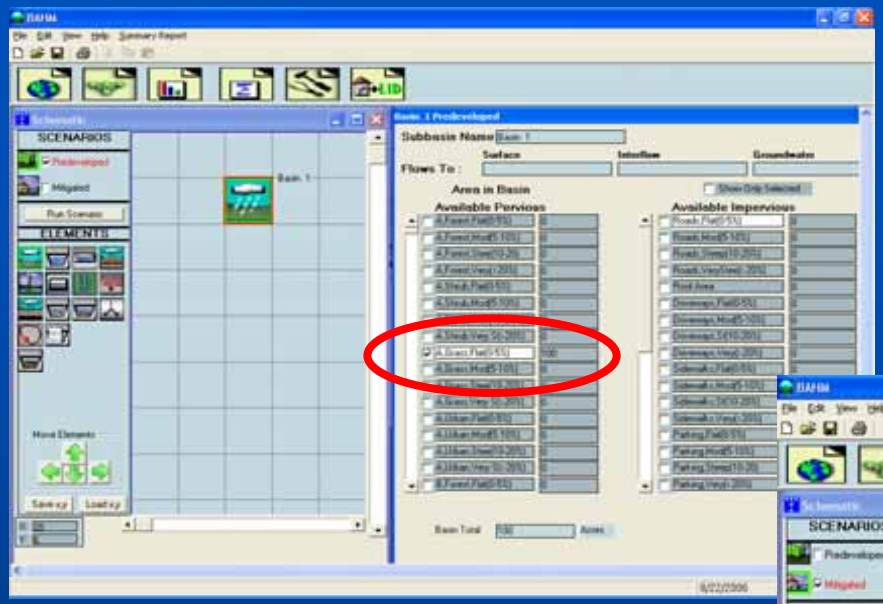
Features:

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

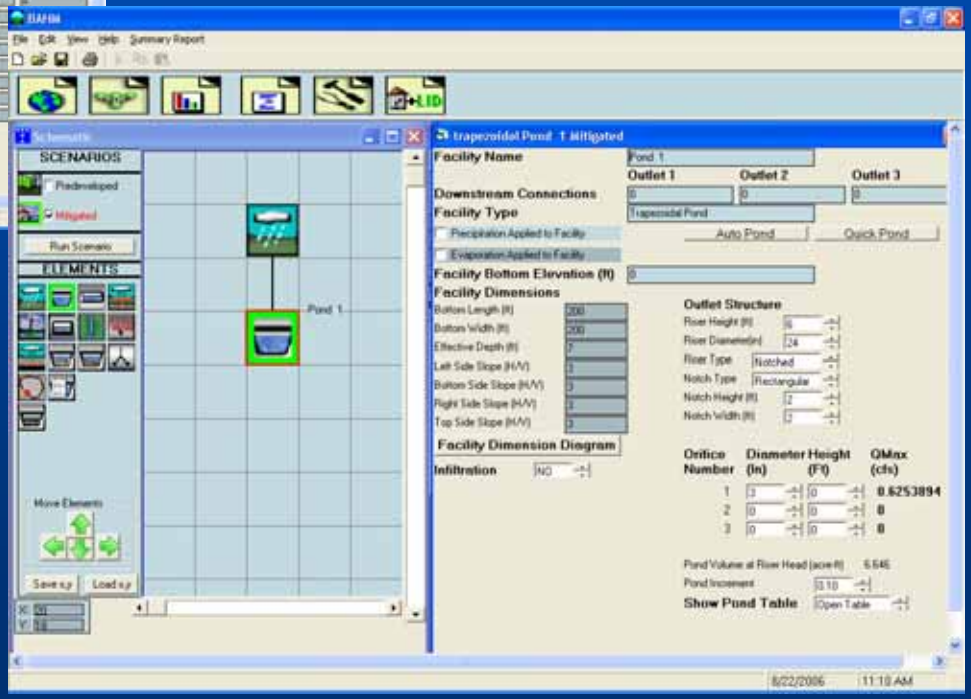


- Simulates pre- and post-project hydrology and automatically sizes a facility to match pre- and post-project flow duration curves

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:

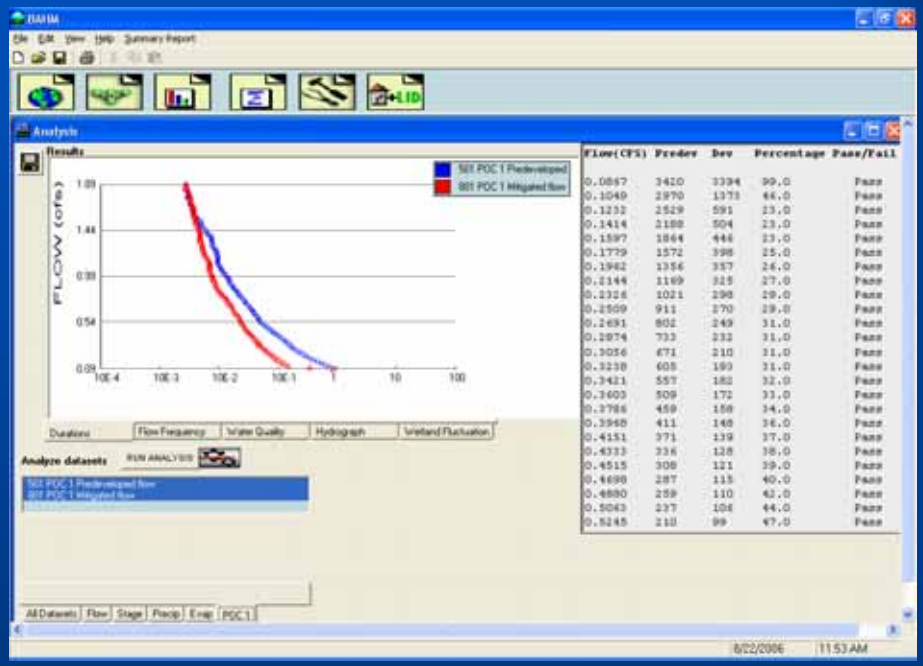
- Permeable Pavement
- Dispersion
- Green Roof
- Rainwater Harvesting
- Rain Garden
- In-Ground (Infiltration) Planter
- Flow-Through Planter
- Bioretention Area
- Vegetated or Grassy (Dry) Swale
- Dry Well
- Infiltration Trench
- Infiltration Basin/Pond

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

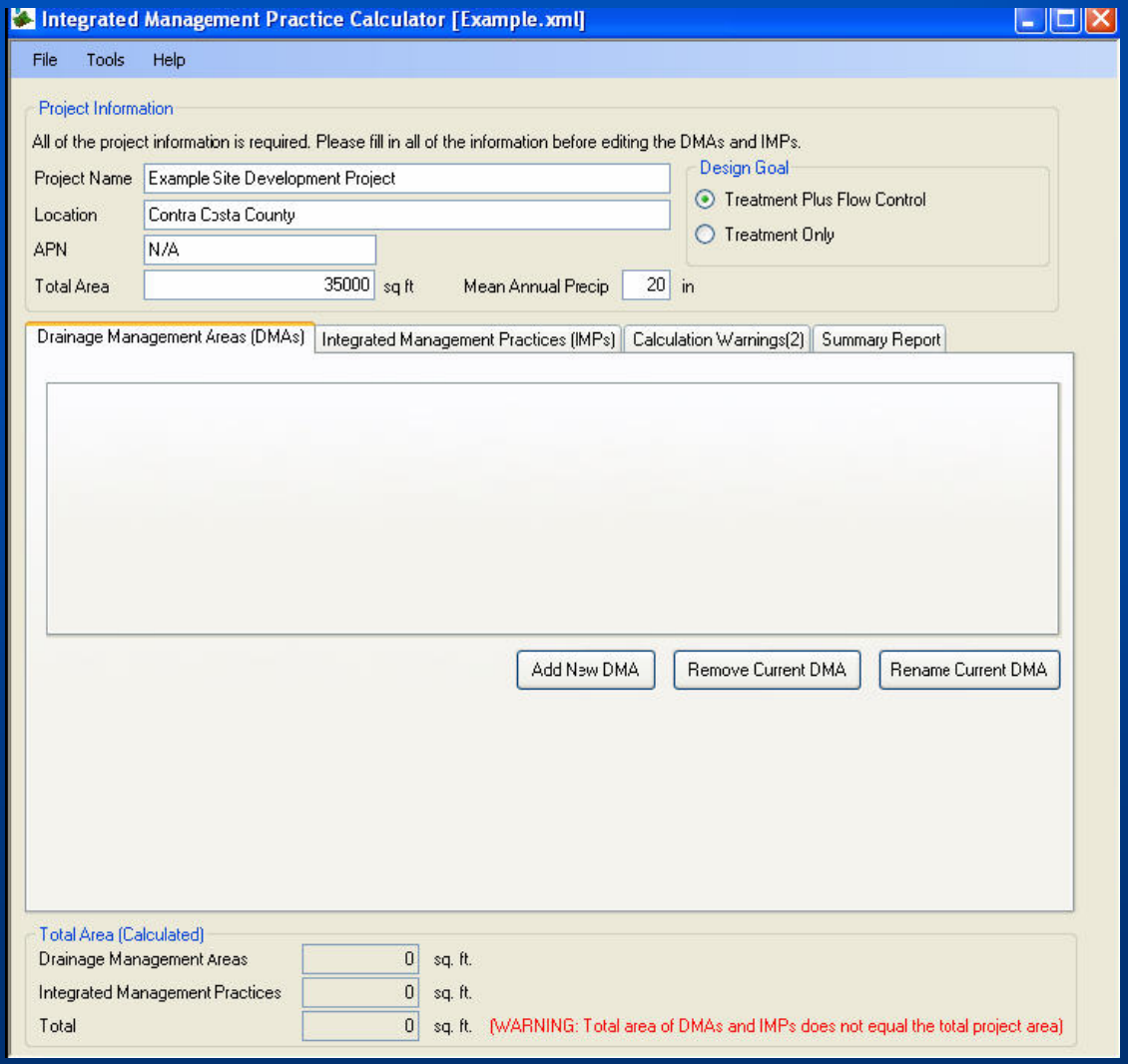


Sizing Factor Approach for Flow Control

- 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

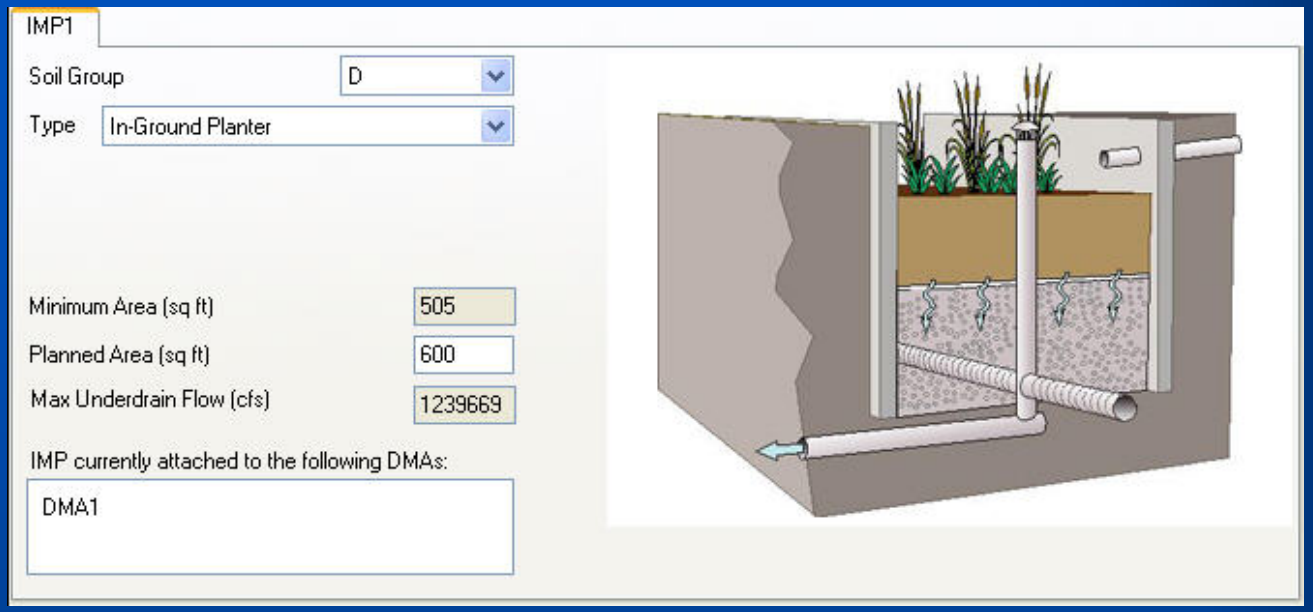
CCCWP IMP Sizing Tool

Opening Screen: Project Information



CCCWP IMP Sizing Tool

IMP-Specific Sizing Information



IMP Types

In-Ground Planter

Flow-Through Planter

Vegetated Grassy (Dry) Swale

Bioretention Area

Dry Well

Infiltration Trench

Infiltration Basin

Tools Under Development: SCCWRP Prop 50 Project

"Development of Tools for Hydromodification Management and Assessment"

- *Principal Investigators:*
  - *Eric Stein, Southern California Coastal Water Research Project*
  - *Brian Bledsoe, Colorado State University, Fort Collins*

Prop 50 Project Tasks

- Develop protocols for mapping and classification
  - Susceptibility evaluation
- Develop protocols for monitoring and assessment
  - Additional data for model development
- Develop and calibrate predictive models
- Develop management tools

Prop 50 Project – Management Tools

- Screening tool – evaluate whether or not a project is likely to be of concern for hydromodification
  - Checklists
- Effects tools – evaluate the expected magnitude or intensity of effect
  - Models, decision tree, nomograph or plots
- Mitigation tools – guide recommended mitigation and management measures
  - Fact sheets, design criteria, sizing standards

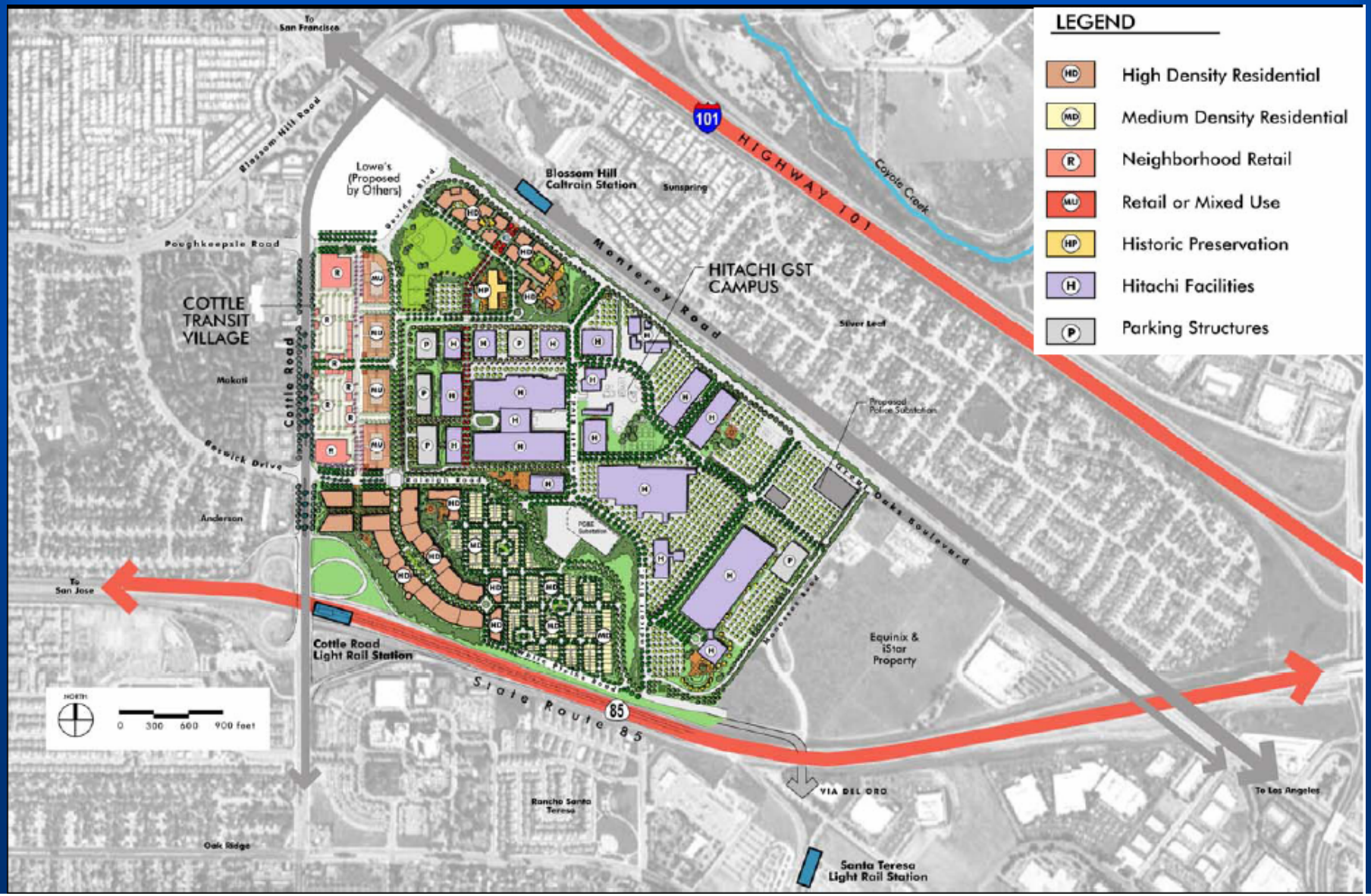
For More Information...

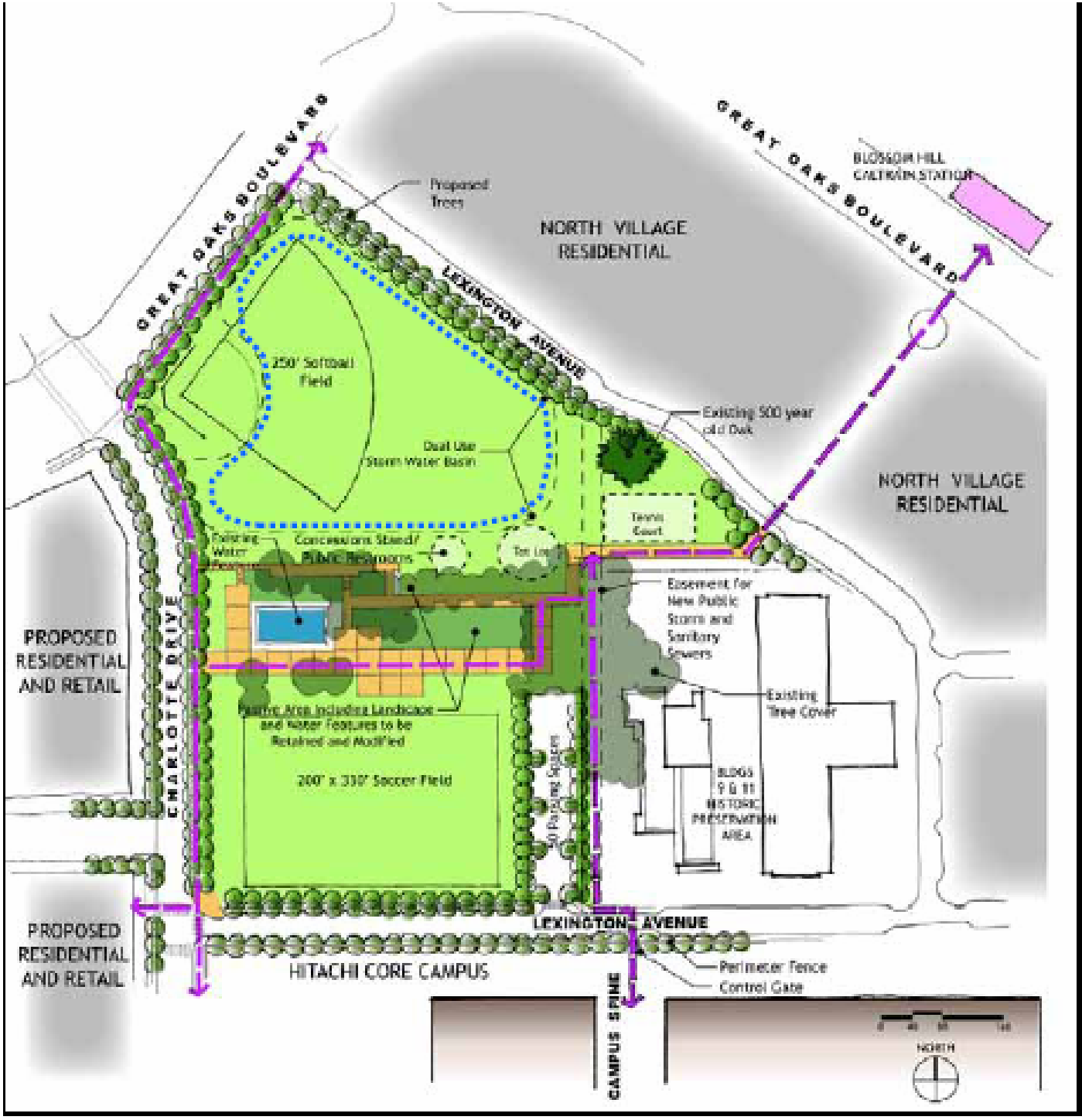
- SCVURPPP HMP: www.scvurppp.org
- Bay Area Hydrology Model: http://www.bayareahydrologymodel.org/
- Contra Costa IMP Sizing Tool: http://www.cccleanwater.org/new-developmentc3/stormwater-c3-guidebook/

Hitachi Project (San Jose)

- Hitachi campus being redeveloped as transit-oriented, mixed use residential
- Project currently under construction
- Will include two combination detention basins/parks for flow control and treatment
- Other treatment measures – vegetated swales, media filters, vortex separators
- Challenge: No infiltration allowed due to existing soil/groundwater contamination

Hitachi Project Master Plan



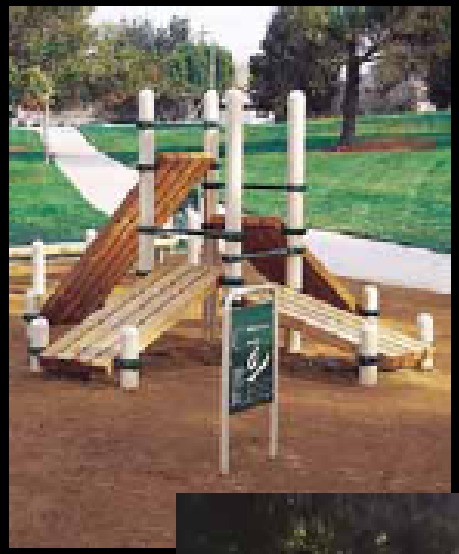


Active Park Preliminary Program & Amenities

- 10.6 acres
- Public turnkey park
- Active use program
- Components of existing landscape retained – mature trees, water feature, hardscape and seating areas
- 500 year old oak retained pending City Arborist approval
- 1 soccer field (night lighted)
- 1 softball diamond (night lighted)
- 1 tennis court
- Concessions stand / public restroom
- Children's Tot Lot
- 50 parking spaces within park, 70+ on street parking spaces
- 2.9 acre dual use storm water function

Linear Green Preliminary Program & Amenities

- 5.25 acres
- Publicly accessible
- Passive program
- Multiuse turf areas
- Parcourse Fitness Trail
- Barbeque, Picnic, Seating Areas
- 2.1 acre dual use storm water function



Flow Duration Basin Design Details

- Basins are ~2 to 5 ft. deep, 3:1 side slopes
- Cottle Road (softball field) D.A.=188 ac.
  - 6.4 AF storage for 29 ac. impervious area
  - Provides treatment for 96 ac.
- Highway 85 (linear park) D.A.=54 ac.
  - 8.0 AF storage for 22 ac. imperv + 3 ac. perv
  - Provides treatment for 54 ac.
- Designed by RBF – used XP-SWMM to simulate runoff with 50-yr rainfall record