



Stormwater Resource Plan and Reasonable Assurance Analysis

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SAN MATEO COUNTYWIDE
**Water Pollution
Prevention Program**

Clean Water. Healthy Community.
www.flowstobay.org

**C/CAG Stormwater Committee
November 17, 2016**

Stormwater Resource Plan (SRP)

- Senate Bill 985 states that a Stormwater Resource Plan (SRP) is required for municipalities to receive funding for stormwater and dry weather runoff capture projects
- **Purpose:** to provide detailed analysis of stormwater and dry weather capture projects for San Mateo County

Watershed-Based Approach

- San Francisco Bay & San Francisco Coastal South Watersheds
 - Watershed processes
 - Surface and groundwater quality
 - Water usage
 - Land use characteristics
 - Natural habitats
- Built on previous planning efforts



Project Prioritization Process

1. Identify suitable public parcels and rights-of-way
2. Use Hydrologic Response Units (HRUs) to prioritize projects
 - Land use, impervious cover, hydrologic soil groups, slope
3. Screen and prioritize through a ranking method, with emphasis on projects with multiple benefits



Legend

- 303(d) Listed Waterbodies
- Watershed boundaries
- County line
- Slope (%)
 - < 0.5
 - < 10
 - < 20
 - < 30
 - > 30



Project Types

Regional Projects



Green Streets



Low Impact Development



Green Streets

Total # of Screened ROW segments: 16,366

Median Segment Length: 320 ft

Low score: 11,086

Medium score: 4,547

High score: 733

Rank	Score	Street Name	TIGER Census Roads ID (STNA_ID)	Length (ft)
1	49	Airport Blvd	322632	374
2	49	Santa Cruz Ave	1717	225
3	48	Grand Ave	269532	235
4	48	Airport Blvd	322632	370
5	48	Chestnut St	284618	145
6	47	Alma St	235064	798
7	47	E Grand Ave	327309	228
8	47	Meadow Ct	3011441	135
9	47	San Miguel Way	3010534	303
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Green Streets

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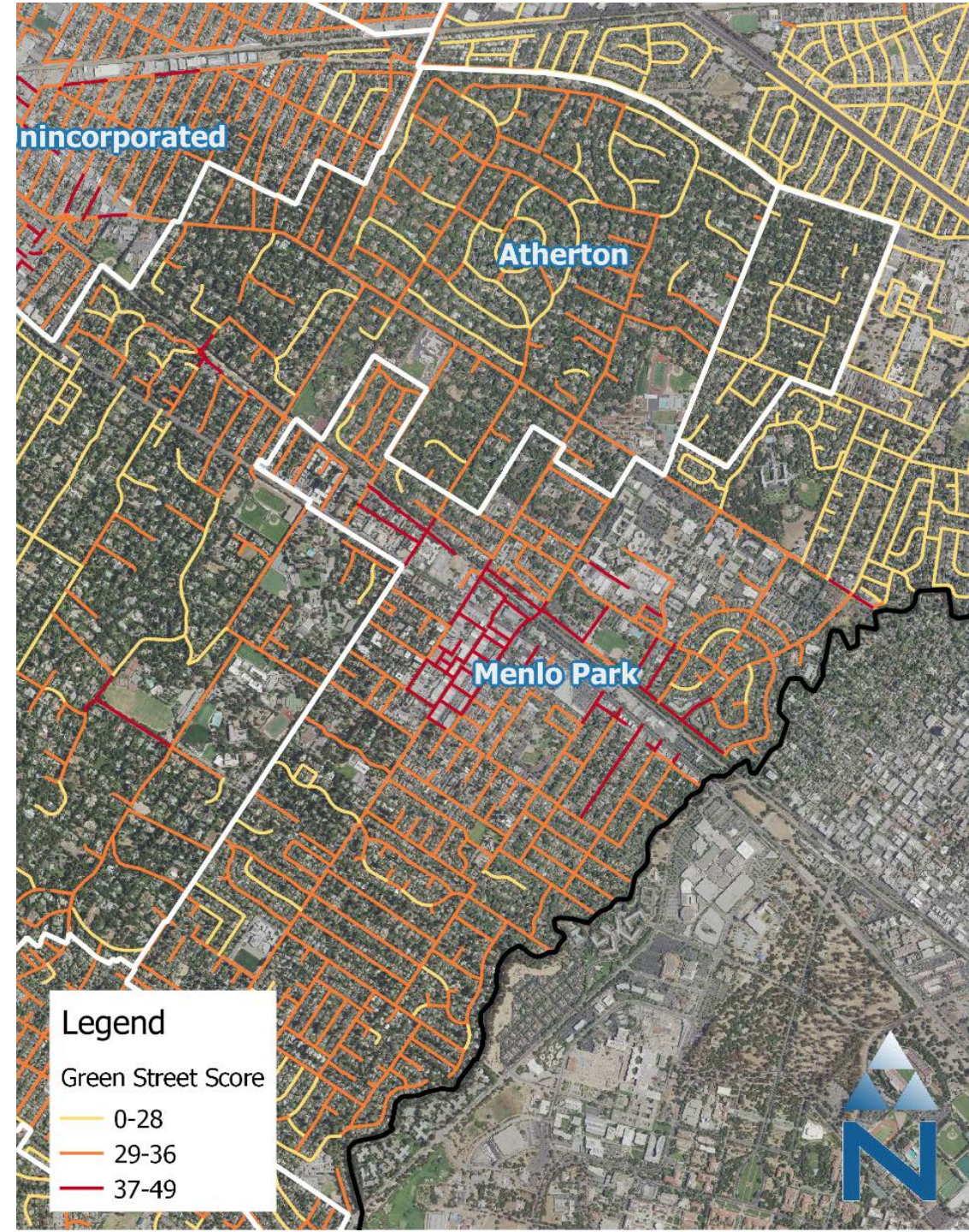
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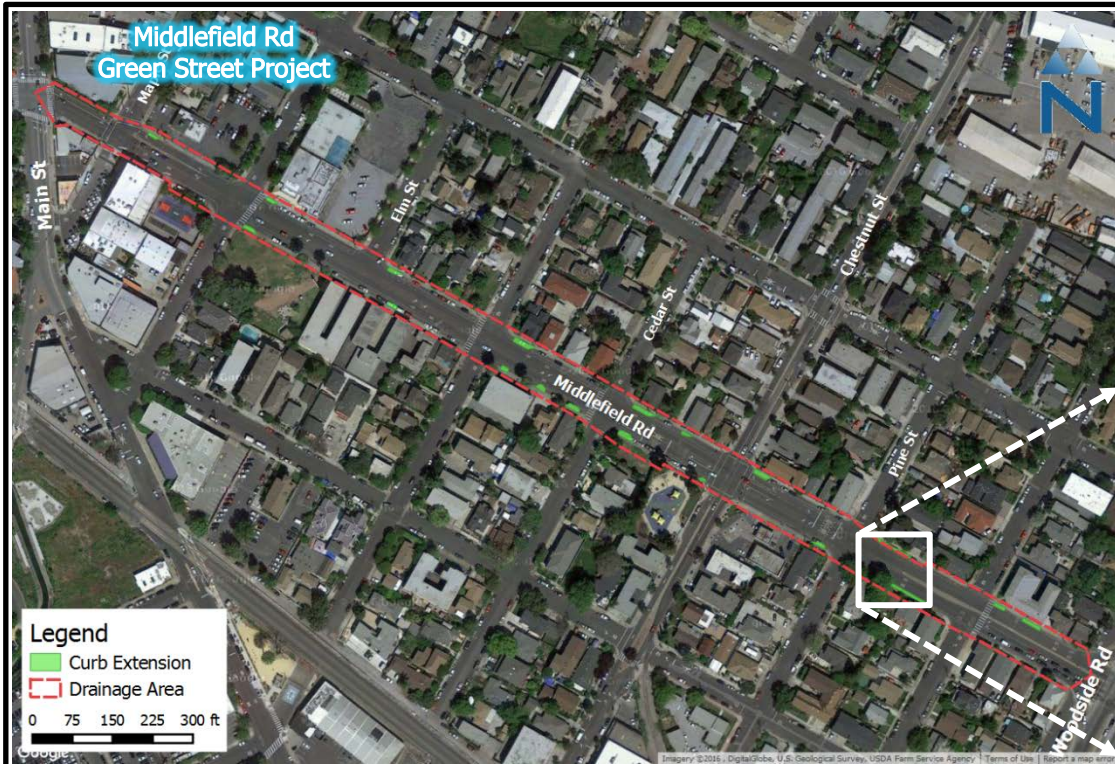
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Site Information	
Jurisdiction	City of Redwood City
Street Name	Middlefield Rd
Bounding Streets	Main St / Woodside Rd
Street Typology	Arterial
Co-Located Project	Middlefield Streetscape Project
Capture Area (acres)	4.16
Impervious Area (%)	90
85 th Percentile Rainfall (in)	0.85
Generated Runoff (ac-ft)	0.27



Site Description:

The proposed project consists of green street improvements along Middlefield Road between Main Street and Woodside Road. The street segment is approximately 2,250 feet long. Middlefield Road is an arterial street that is relatively narrow. Limited space is divided between bike lanes, multiple lanes each direction, turn lanes, and parking lanes. This presents a challenge with siting green infrastructure without sacrificing some usage of the roadway. Curb extensions are recommended as the primary treatment type. Segments of the street that feature two lanes may be reduced to single lanes to allow adequate area for improvements. Center medians can be removed to provide additional area. Curb extensions can also be placed at crosswalks to improve pedestrian safety while increasing stormwater capture capacity. Where lanes cannot be reduced, some parking may need to be removed.

The proposed improvements would capture 100% of the 85th percentile runoff volume (0.27 ac-ft) while providing flood risk mitigation, community enhancement, increased property values, safer pedestrian routes, and other multiple benefits.

green infrastructure shown in the map are preliminary and subject to further site assessment and design. Percent imperviousness is based on best professional judgement. All design assumptions/parameters and cost estimates must be re-evaluated during the detailed design process.

Design Summary

Green Infrastructure Type	Design Width (ft)	Design Length (ft)	Capture Volume (ac-ft)
Bioretention (Curb Extension)	8	780	0.270

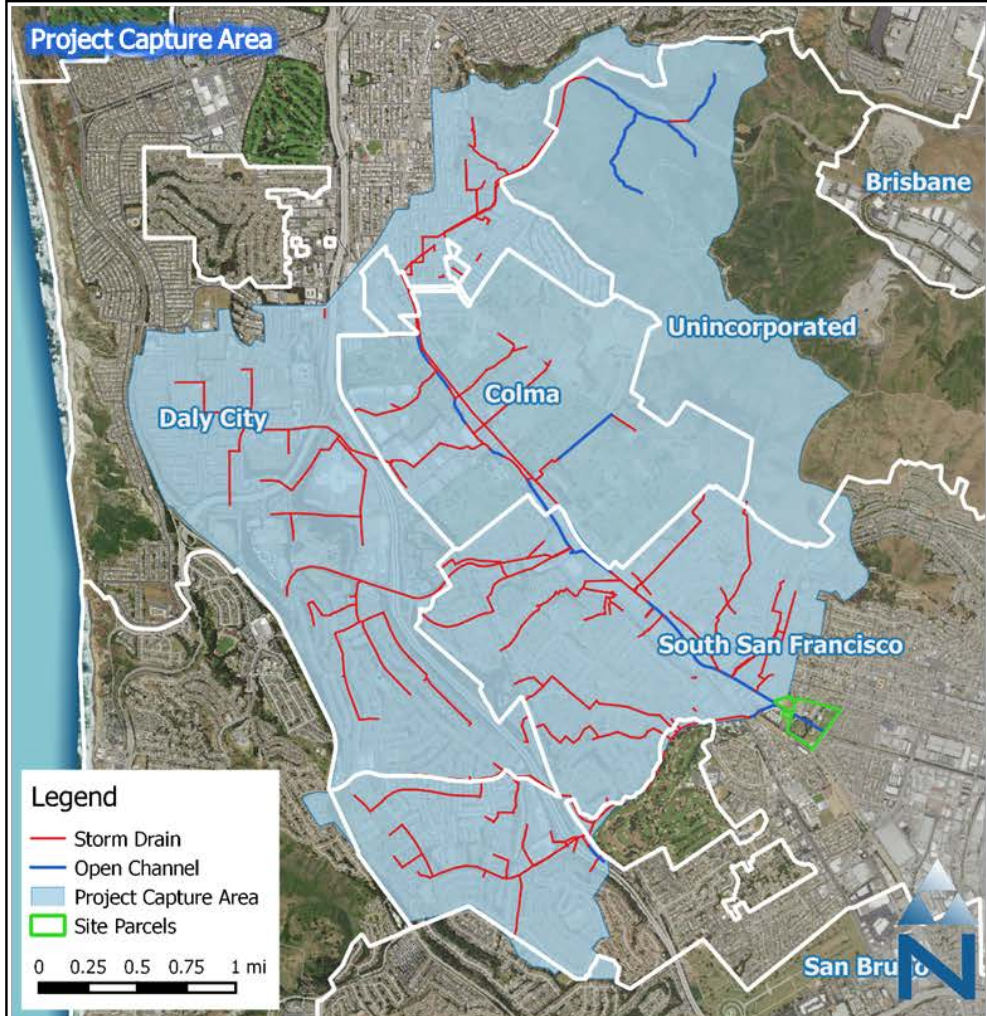
Cost Estimate

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
Excavation/Hauling	1,160	CY	\$50.00	\$58,000
Bioretention	6,240	SF	\$25.00	\$156,000
Curbs and Gutters	780	LF	\$17.25	\$14,000
CONSTRUCTION SUBTOTAL				\$228,000
Planning (20%), Mobilization (10%), Design (30%), Contingency (25%)				\$194,000
TOTAL COST				\$422,000

Concept for a Green Street Retrofit for Stormwater Capture

Site: Middlefield Road (City of Redwood City)





Site Description:

This project concept consists of two offline subsurface infiltration chambers at Orange Memorial Park. The park is a prime location to site a regional stormwater capture project and captures stormwater from large portion of the upper Colma Creek watershed and multiple city and county jurisdictions. The potential capture area of the project is roughly 6,300 acres that drains portions of the cities of South San Francisco, Colma, and Daly City and Unincorporated San Mateo County. A stormwater capture project at this location would aid these jurisdictions in meeting stormwater permit compliance and alleviate flooding in the lower reaches of Colma Creek. The project would also contribute to reductions of high-priority pollutants discharged to San Francisco Bay (including TMDLs that require reductions of mercury and PCB loads), augment water supply by recharging the Westside groundwater basin, and provide community enhancement through integration with the recreational facilities of the park. With the incorporation of a hydrodynamic separator for pretreatment of diverted water from the creek, the project also provides the reduction of trash transported through the creek to the San Francisco Bay. The Orange Memorial Park Master Plan (2007) was referenced in this design to ensure that the concept is consistent with the goals of future development for the park.

Although not specifically included within this project concept, the project also provides the opportunity for future integration of Low Impact Development (LID) within parking lots of the park to provide further community enhancement and opportunities for public education of LID and other project components.

Drainage Characteristics

Capture Area (acres)	6,300
Impervious Area (%)	38
Dominant Land Use	Residential
Jurisdictions	South San Francisco, Colma, Daly City, Unincorporated San Mateo County

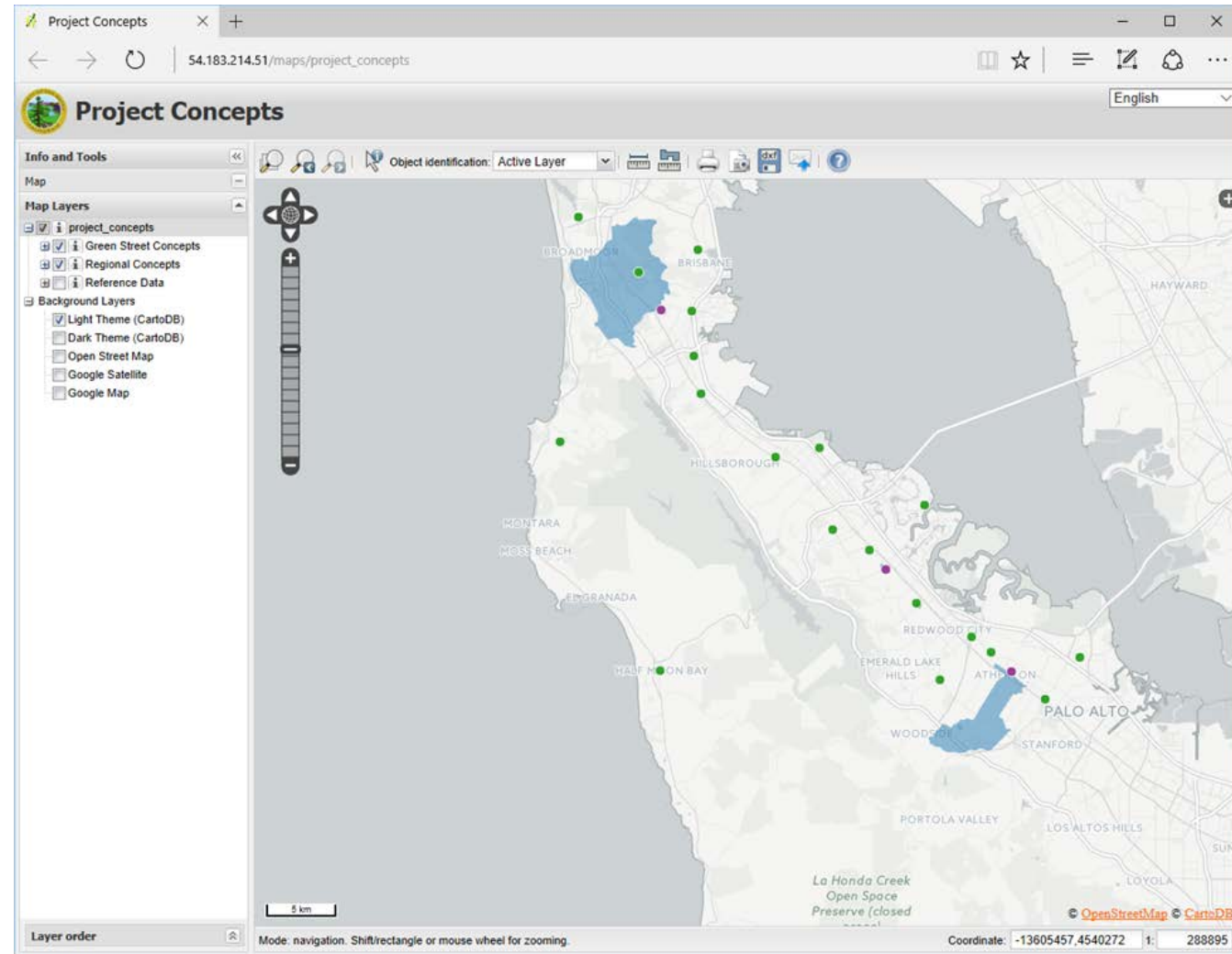
Site Information

Land Owner	City of South San Francisco
Street Address	Orange Ave, South San Francisco, CA 94080
Latitude/Longitude	37° 39' 13.1" N / 122° 25' 35.4" W
Watershed	Colma Creek



Implementation Strategy

- Discussion on resources to implement SRP
- Linkages to:
 - IRWMP
 - GI plan
 - TMDL implementation and RAA
- Timelines
- Institutional structure
- Adaptive management
- Performance measures





Storm Water Capture Model

Version 0.1
(updated 6/30/2016)

BMP Type

24-hour Rainfall Depth (in.)

Drainage Area (ac.)

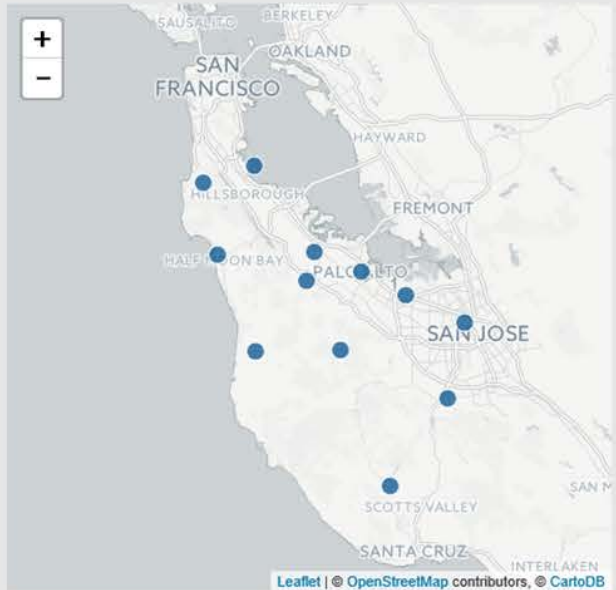
Percent Impervious (0-1.0)

BMP Footprint (sq. ft.)

Ponding Depth (ft.)

Constant Infiltration (in./hr.)

Summary	Value	Units
Runoff Volume	--	acre-feet
Volume Capture	--	acre-feet
Percent Capture	--	%



Use this map to reference rainfall gage statistics near your project site. The 85th %-tile, 24-hour rainfall depth estimates were developed using NCDC [Global Historical Climatology Network \(GHCN\)](#) data from Water Years 1981 through 2015.

Comments and Response Process

- Comments received from C/CAG:
 - City of Menlo Park
 - San Mateo County
- Comments generally editorial and provide additional information/suggestions for improving the narrative and historic facts.
- Paradigm will provide an updated draft next week:
 - Incorporating C/CAG comments
 - Responses to comments/questions

SRP Next Steps

- Dec 8 – to C/CAG Board for approval of public review draft
- First two weeks of Jan – three public workshops
- Jan 13 – Close public comment period
- Jan 19 – Summary of comments and proposed revisions to Stormwater Committee
- Feb 9 – to C/CAG Board for approval of final document
- (all pending State Board decision on grant awards)

Jan

May

Sep

2017

May

Sep

2018

May

Sep

2019

May

Storm Water Resource Plan (SWRP)



Hg and PCB TMDL Implementation Plan – Reasonable Assurance Analysis (RAA)



Green Infrastructure (GI) Plan

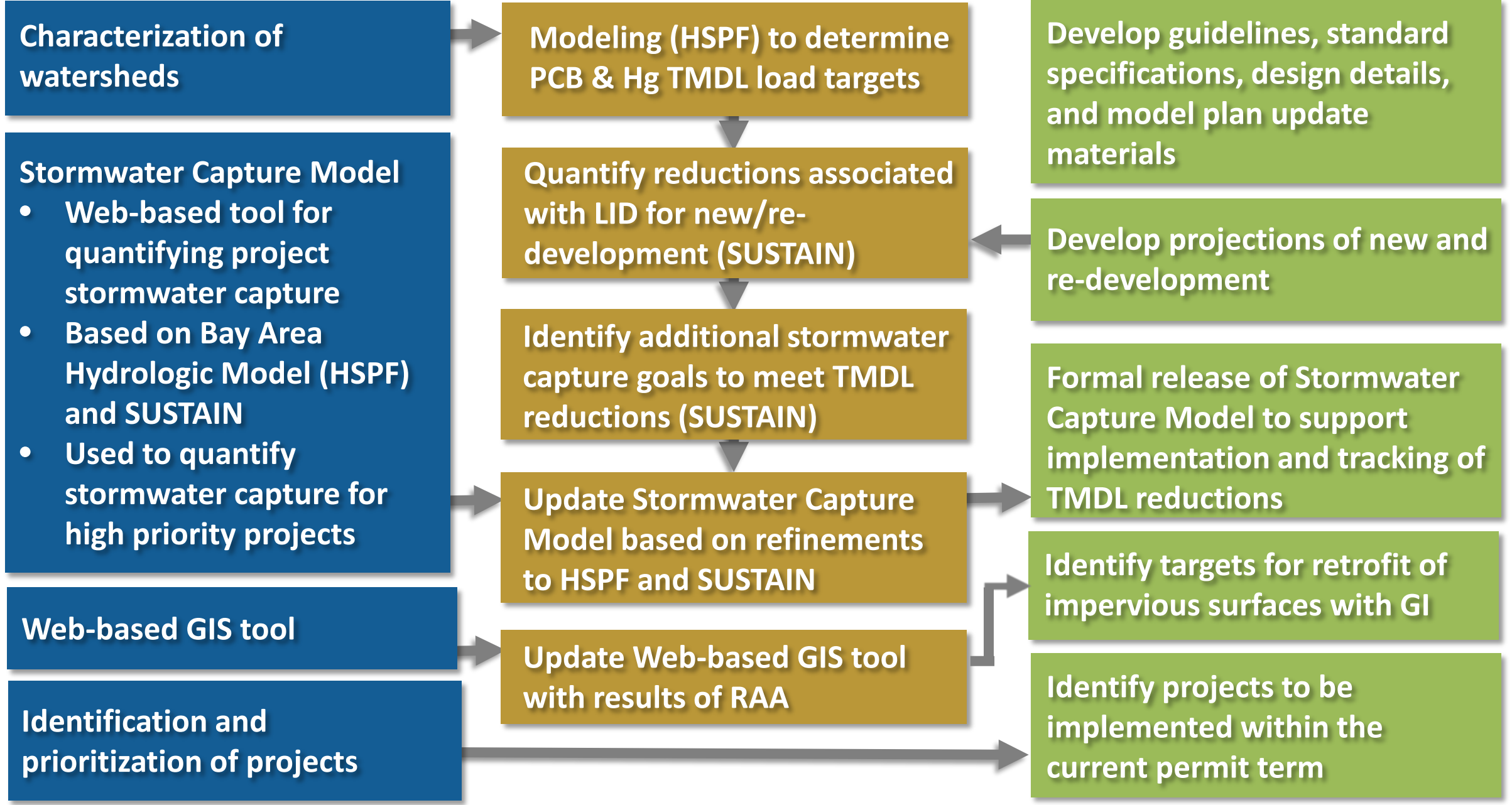


Parallel Planning Efforts

SWRP

RAA

GI Plan



Reasonable Assurance Analysis

HSPF

Data

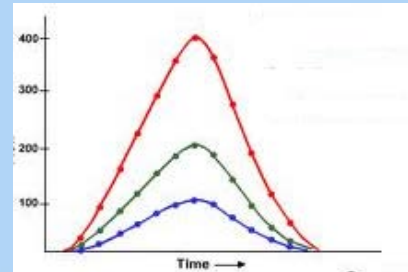
- Rainfall
- HRUs/Land Use
- Impervious
- Elevation
- Slopes
- Evaporation
- Infiltration

Watershed Model



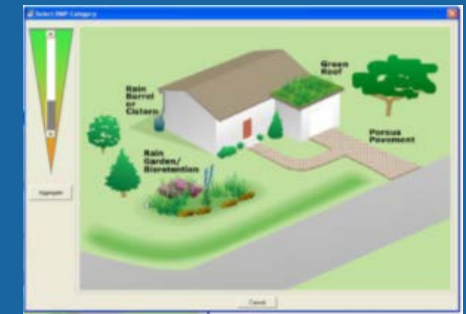
Results

Hourly runoff and sediment/pollutant loads



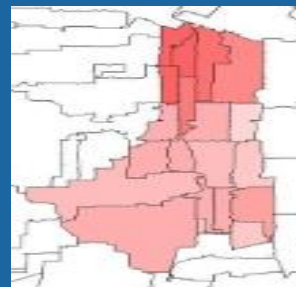
SUSTAIN

Stormwater Capture Model

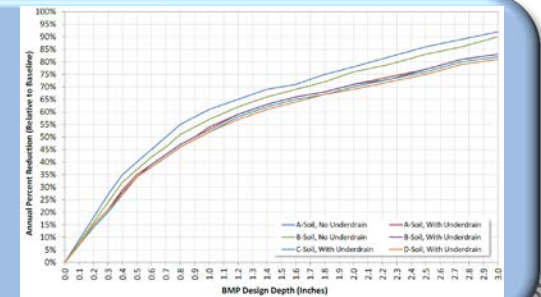


Calculation of project capture volumes

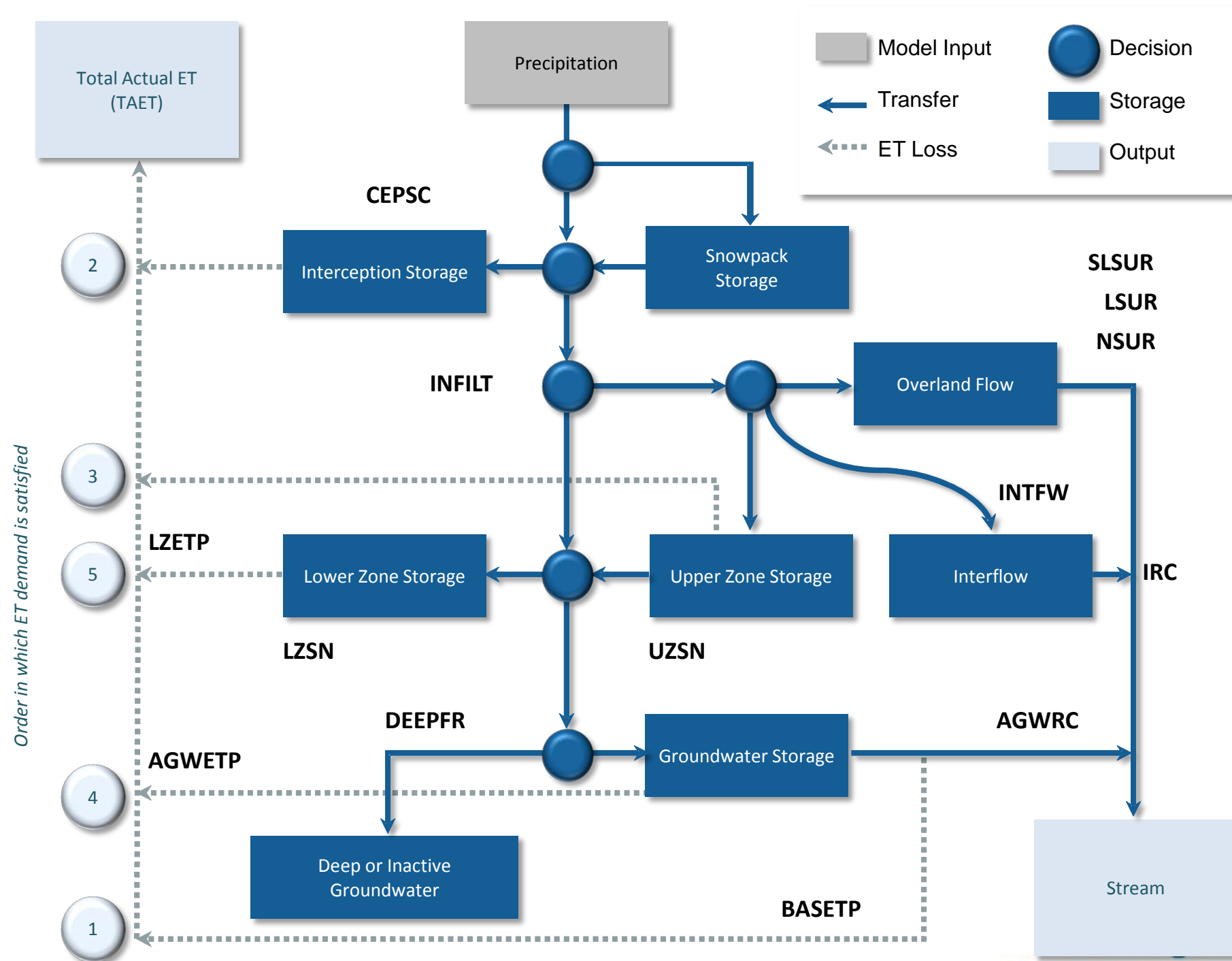
Stormwater Capture Model



GI Response

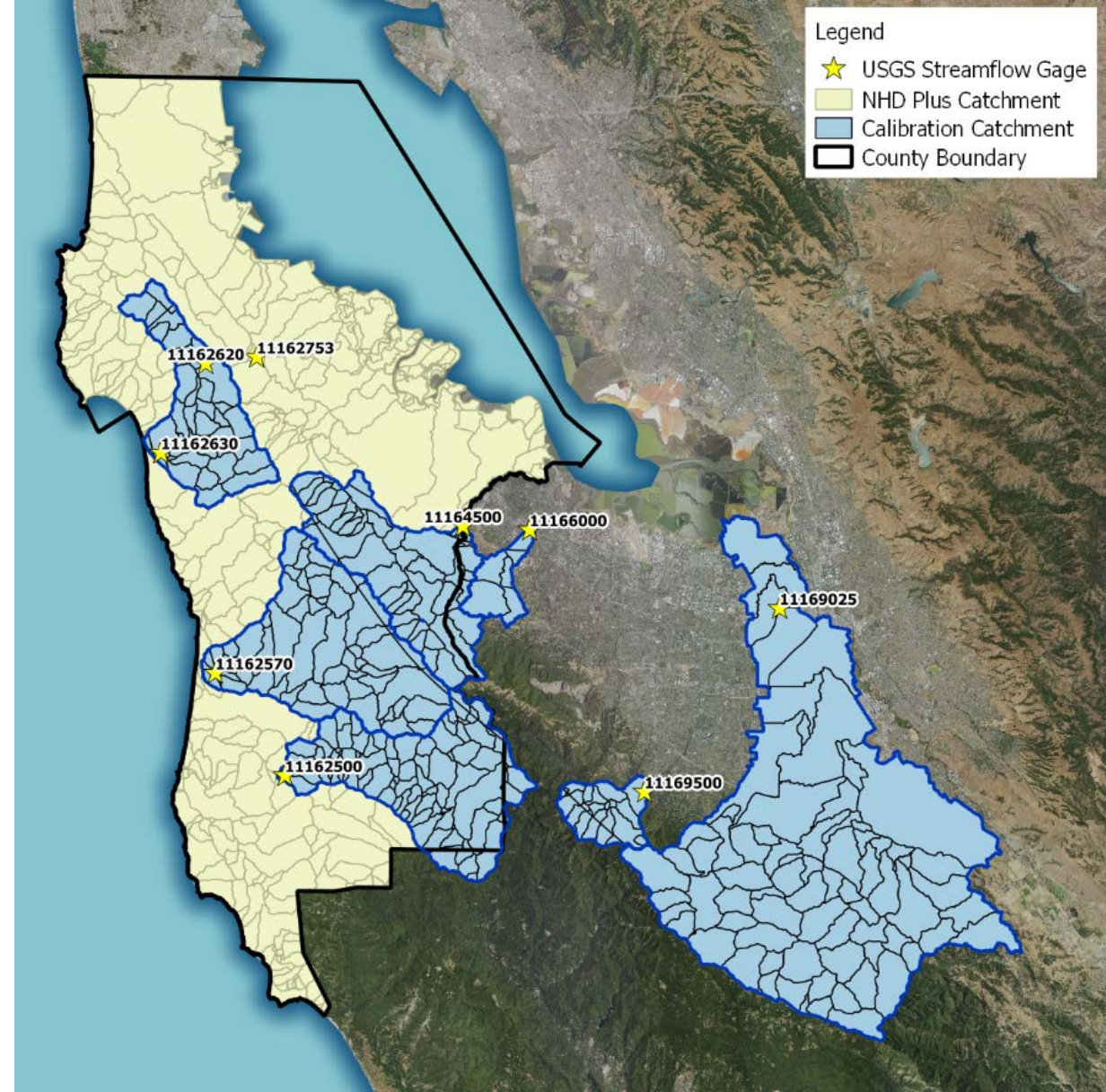


Hydrologic Simulation Program – FORTRAN (HSPF)



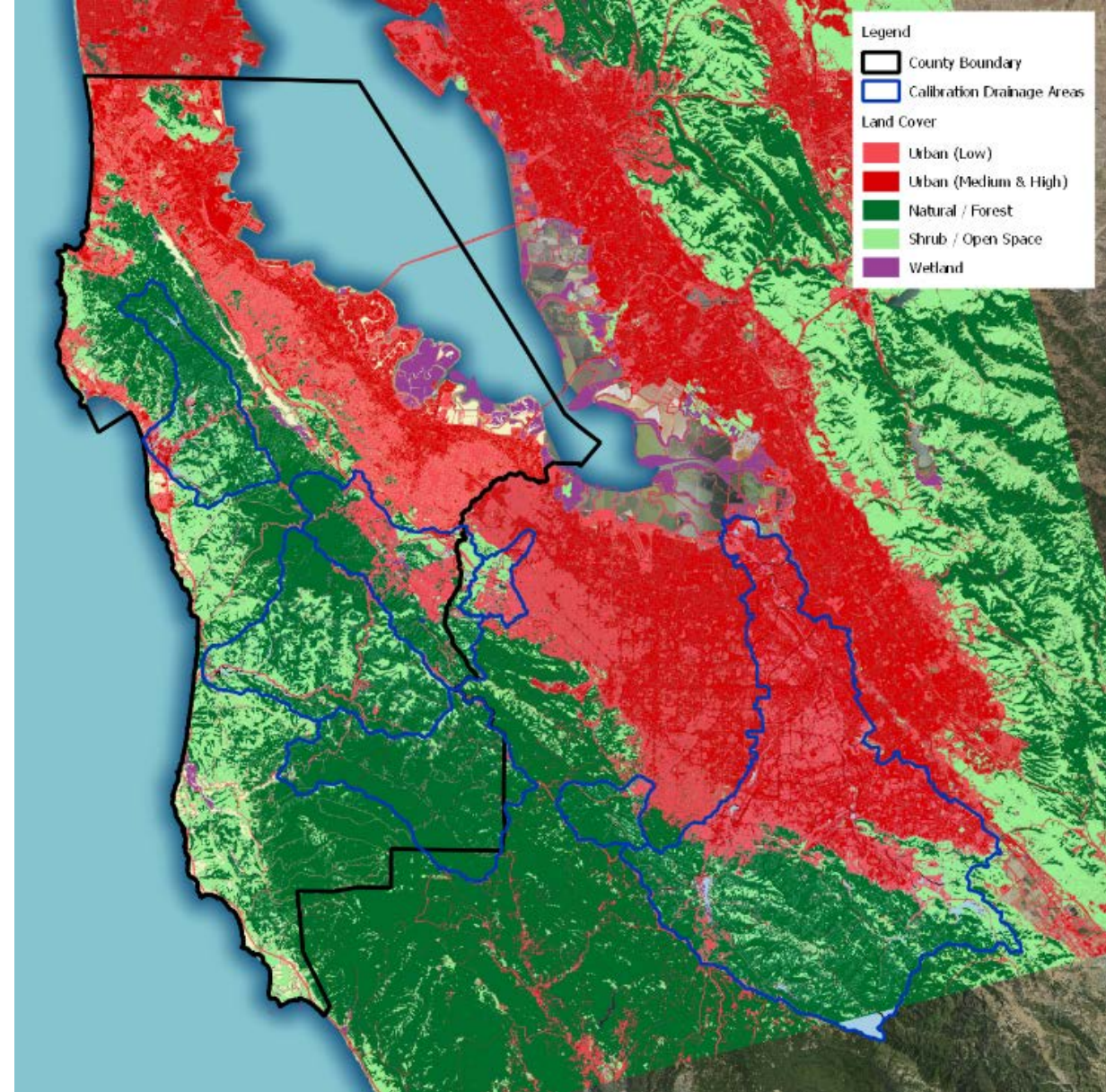
Subwatersheds

- Based primarily on NHD Plus v2 “catchments”
- Aggregated to lump small areas together
- Adjusted to reflect location of streamflow gages for calibration (when necessary)



Hydrologic Response Units

- Runoff & Pollutant load:
 - Slope
 - Hydrologic Soil Group (HSG)
 - Land use/cover
 - Impervious cover (DCIA)
- Urban HRU categories:
 - Rooftop, Sidewalk, Driveway, Roads based on analysis of typical parcels



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Water Pollution

Prevention Program

Mapped vs. Modeled HRUs

Land Use:
Urban Categories

Low, Medium, High-density Residential,
Commercial/Industrial/Institutional, Open Space

Mapped
Impervious Area

Percent Impervious for each
Land Use category

Land Cover:
Modeled HRUs

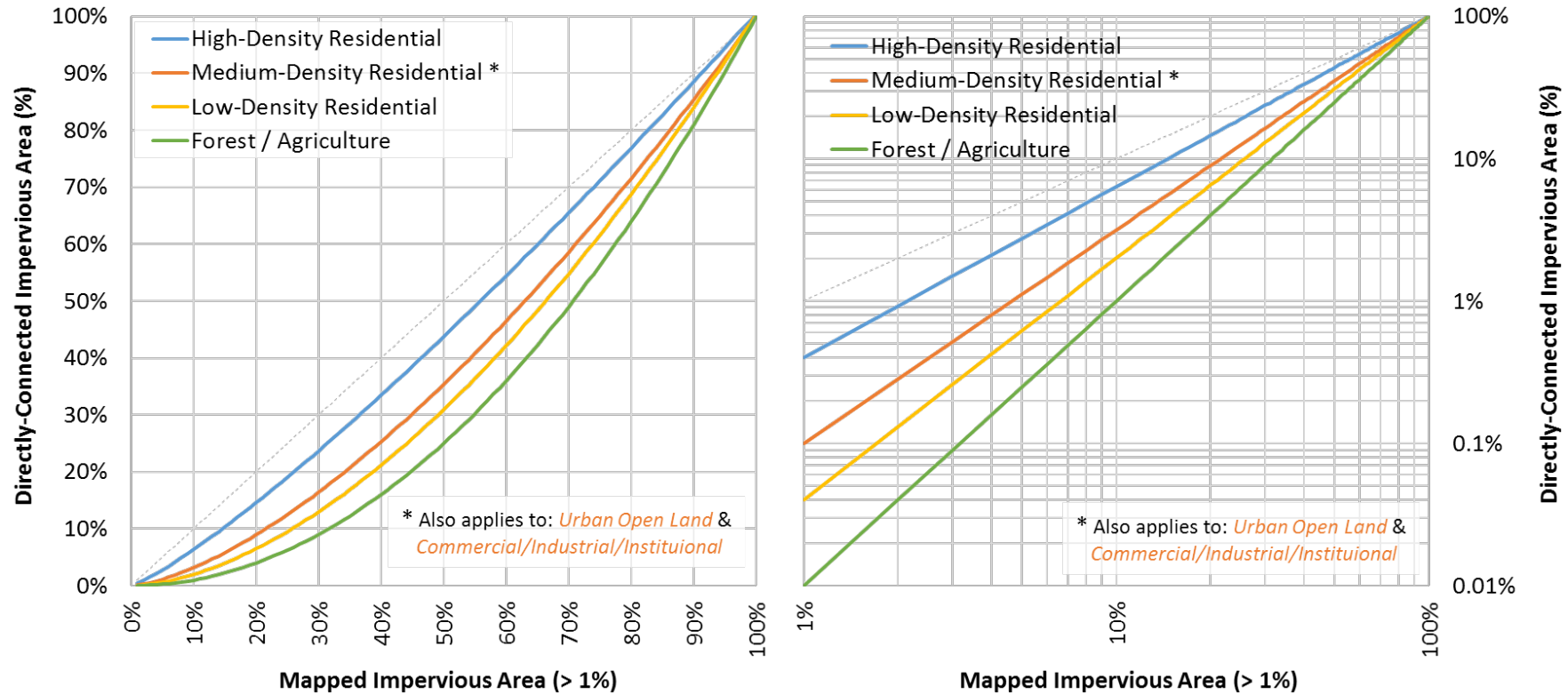
Rooftop, Driveway, Sidewalk,
Urban Pervious

Directly-Connected
Impervious Area (DCIA)

Only DCIA* portion is
modeled as impervious

* *Disconnected-impervious portion modeled as Urban Pervious*

Mapped vs. Modeled HRUs



- Sutherland Equations (*EPA Region 1 Methodology*)
Used to translate MIA to DCIA for each Land Use
- Rooftop, Sidewalk, Driveway, Roads, Pervious split
based on analysis of typical parcels

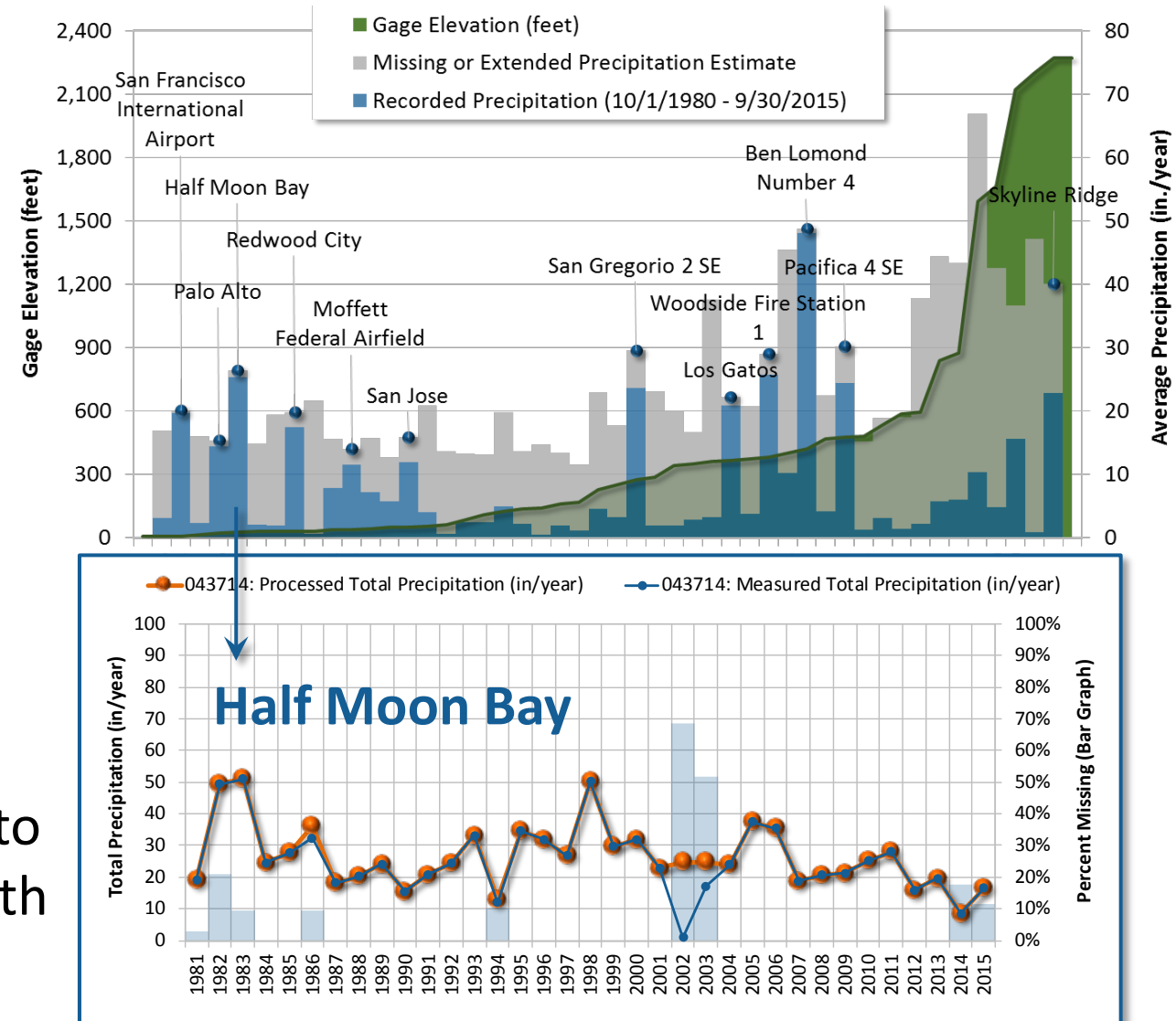
Precipitation

■ Rainfall Distribution

- Evaluated 48 regional NCDC rainfall gauges
- Selected 12 highest-quality gauges for distributions

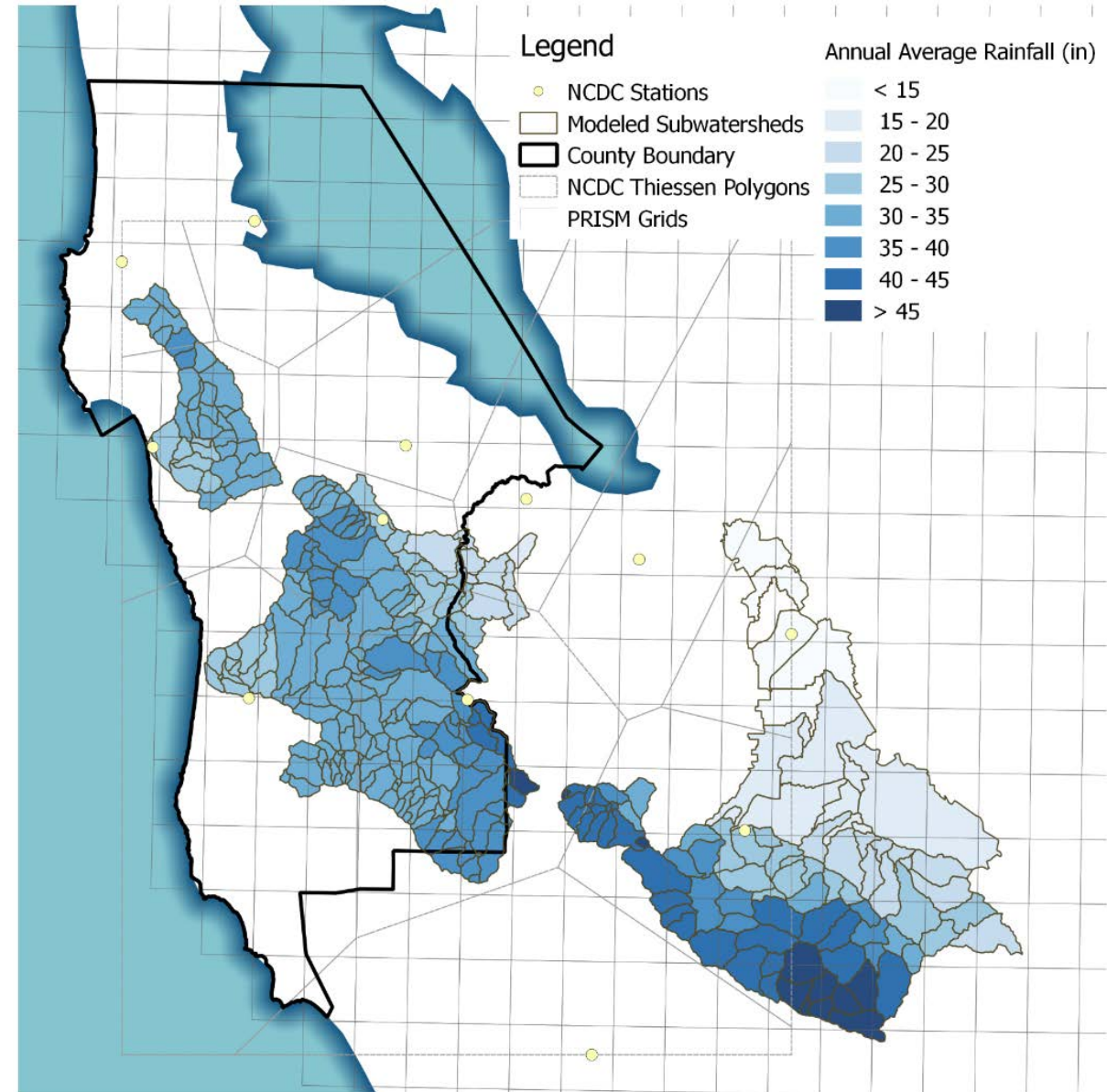
■ Quality Control

- Used Normal Ratio Method to Patched **missing** intervals with rain from nearby gauges
- Distributed **accumulated** intervals using hourly rainfall from nearby gauges



Precipitation

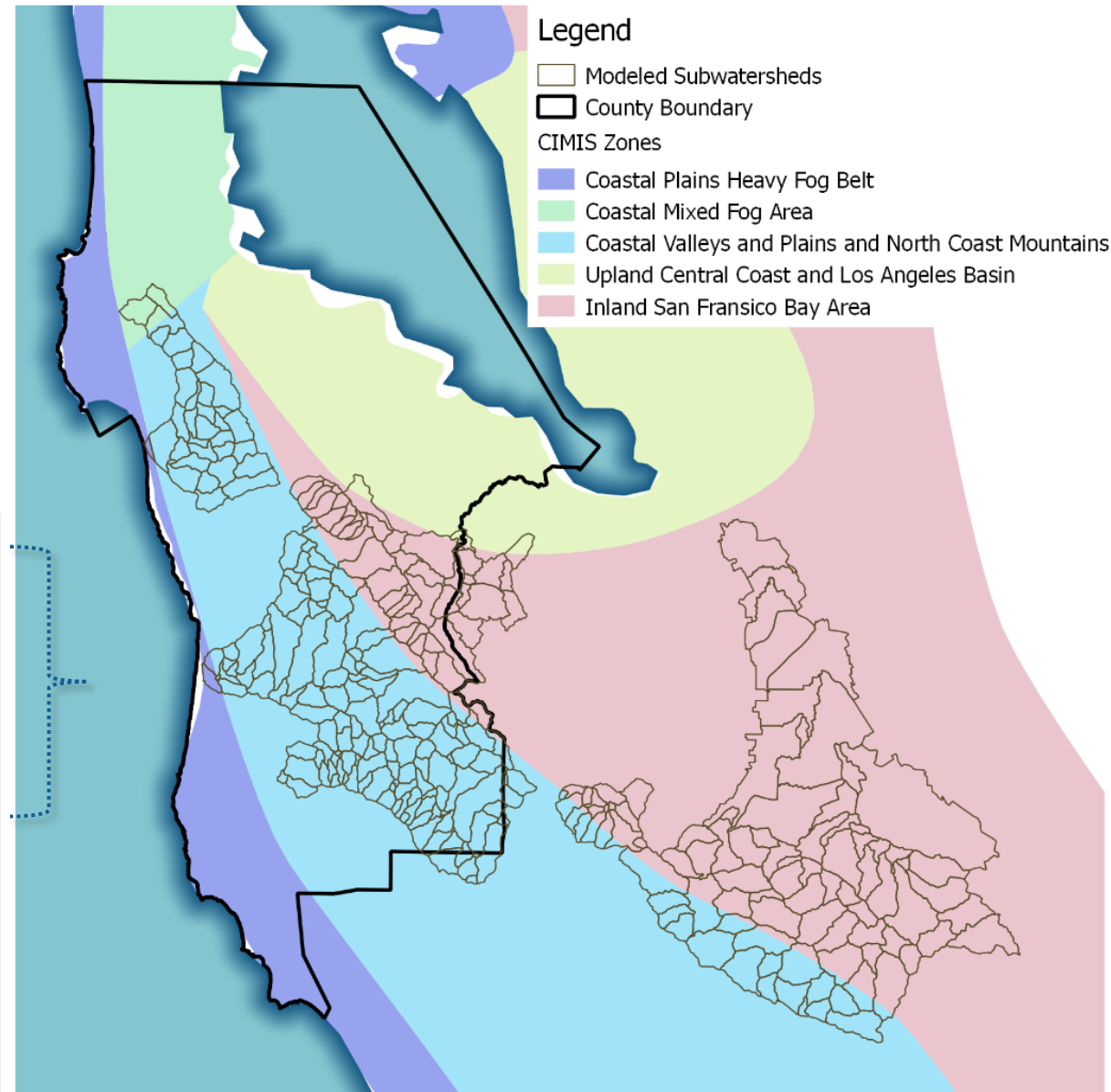
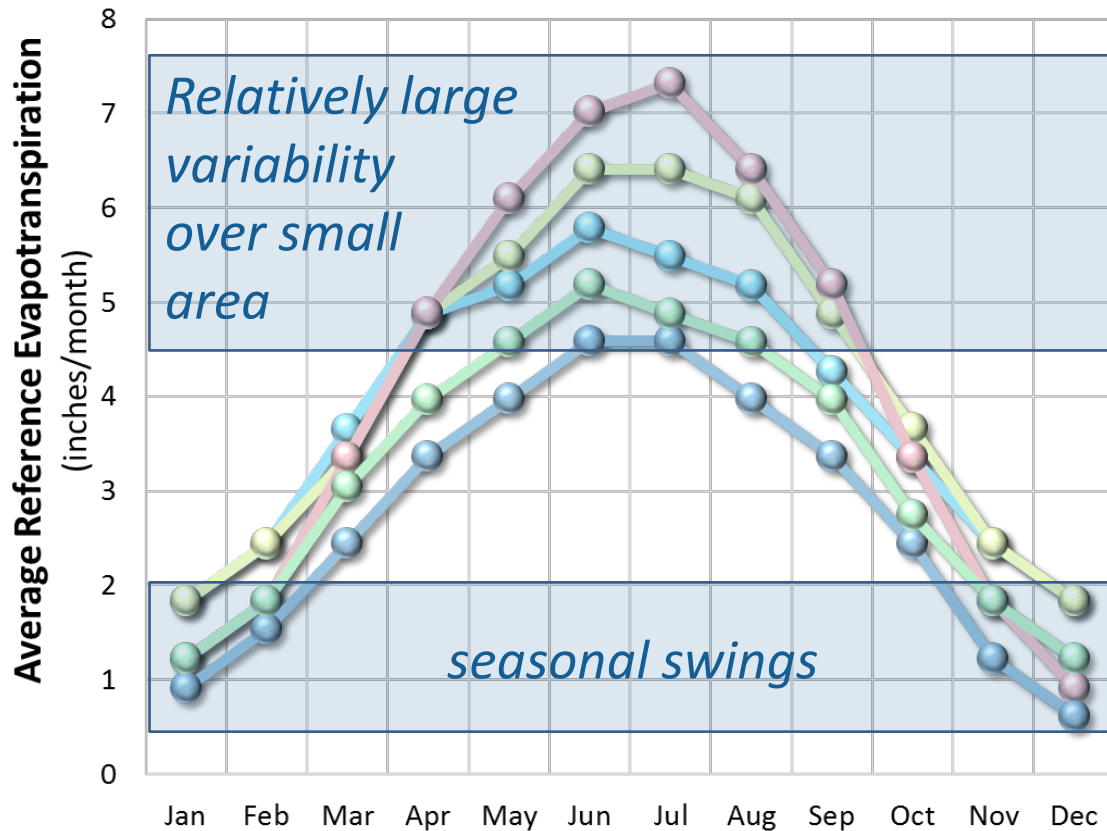
- NCDCC Distributions
- PRISM data provide more resolution for spatial variability (4 x 4 km grids)
- Area-weighted PRISM time series by subwatershed × NCDCC distributions



PRISM Climate Group, Oregon State University,
<http://prism.oregonstate.edu>
Created November 2016

Evapotranspiration

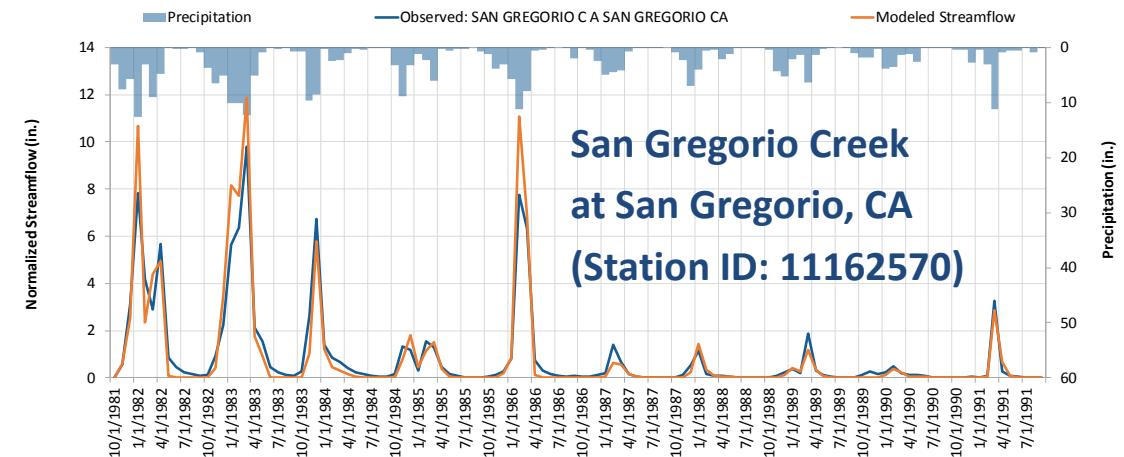
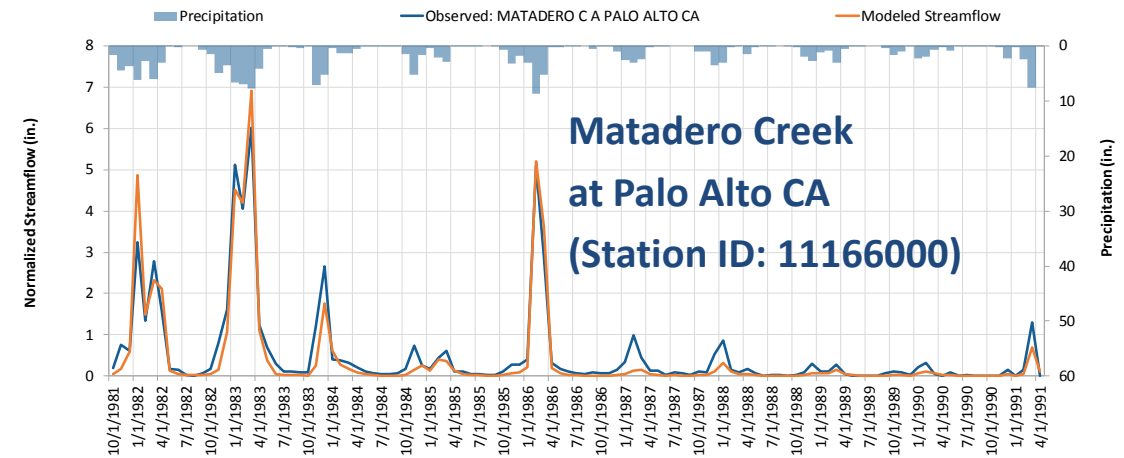
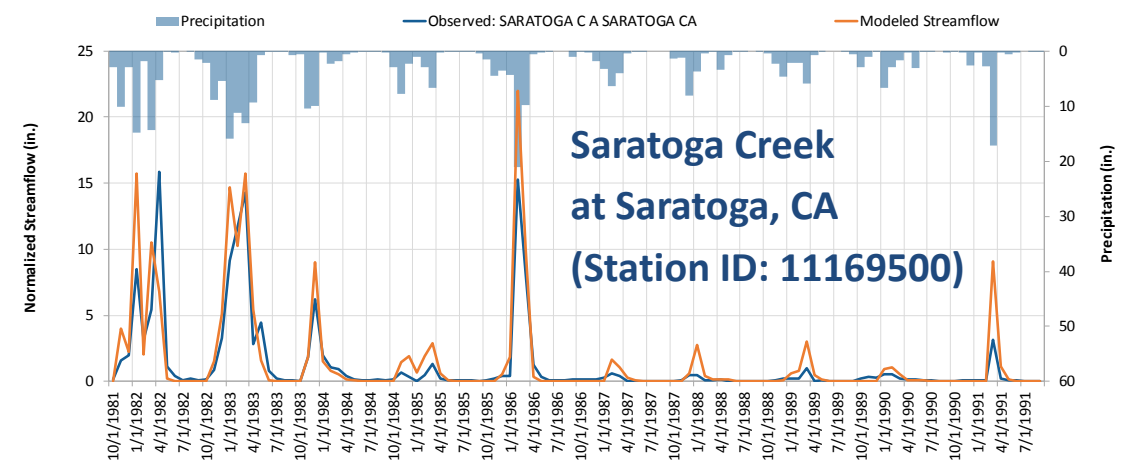
- COASTAL VALLEYS AND PLAINS AND NORTH COAST MOUNTAINS
- UPLAND CENTRAL COAST AND LOS ANGELES BASIN
- INLAND SAN FRANCISCO BAY AREA
- COASTAL PLAINS HEAVY FOG BELT
- COASTAL MIXED FOG AREA



Data Source:
California Irrigation Management
Information System (CIMIS)

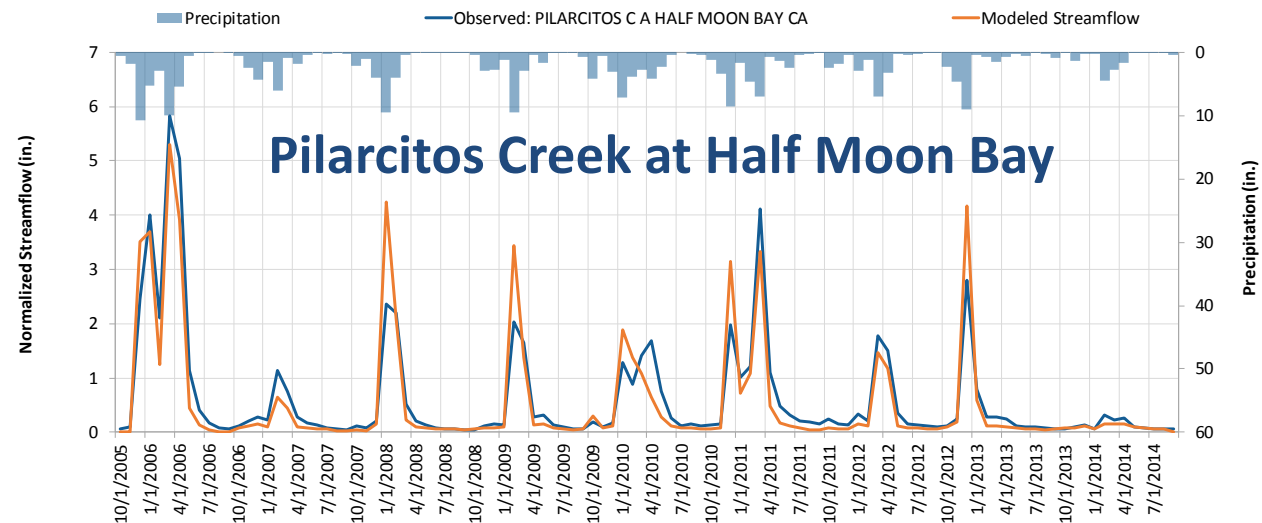
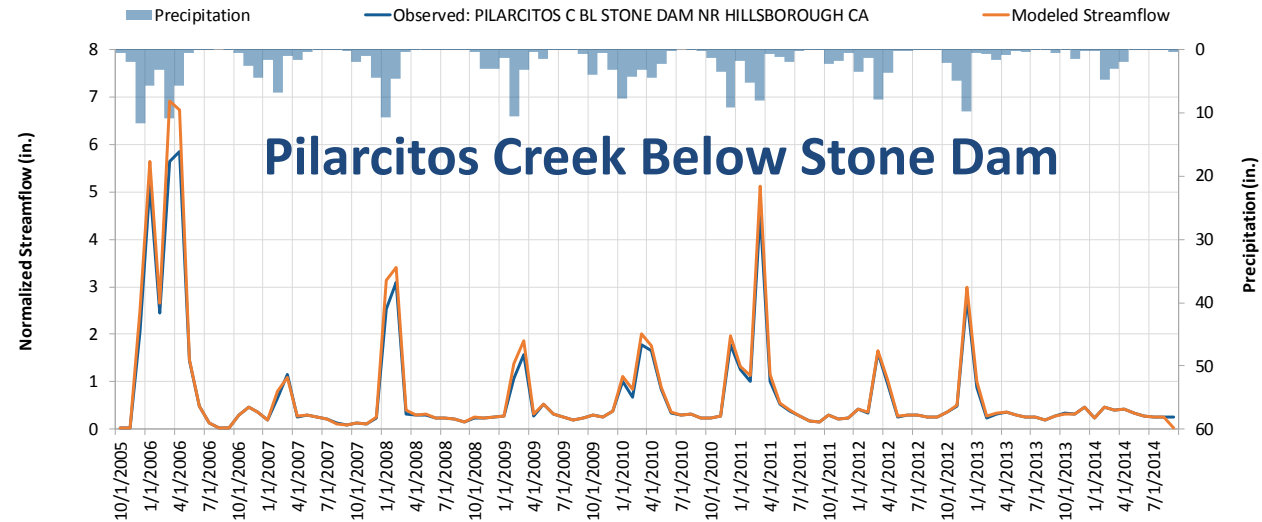
Hydrology Calibration

- Older, relatively natural watershed gauge data were used to establish hydrology for natural land areas
- Best available information used to refine physical representation of watershed features
- Selected reservoirs, diversions, and special features were included to validate significant water balance elements



Hydrology Calibration

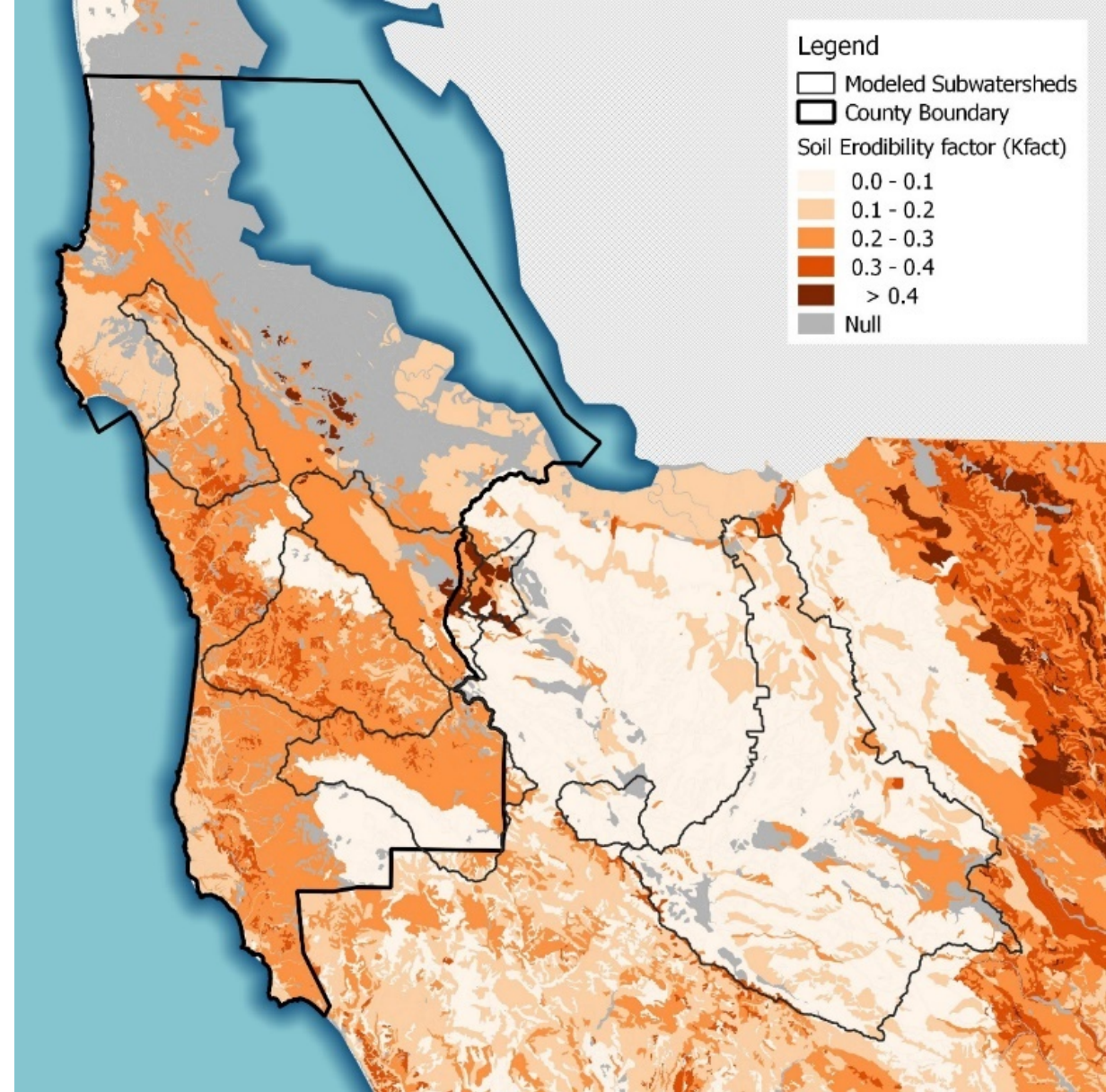
- Significant Influences
 - Reservoirs
 - Channel diversions
 - Irrigation withdrawals



Managed by SFPUC, Pilarcitos Reservoir is a significant source of drinking water

Soil Group & Erodibility

- Hydrologic Soil Group: infiltration potential
- Erodibility: sediment mobilization potential
- Used as basis to stratify model parameters for erosion and sediment transport processes

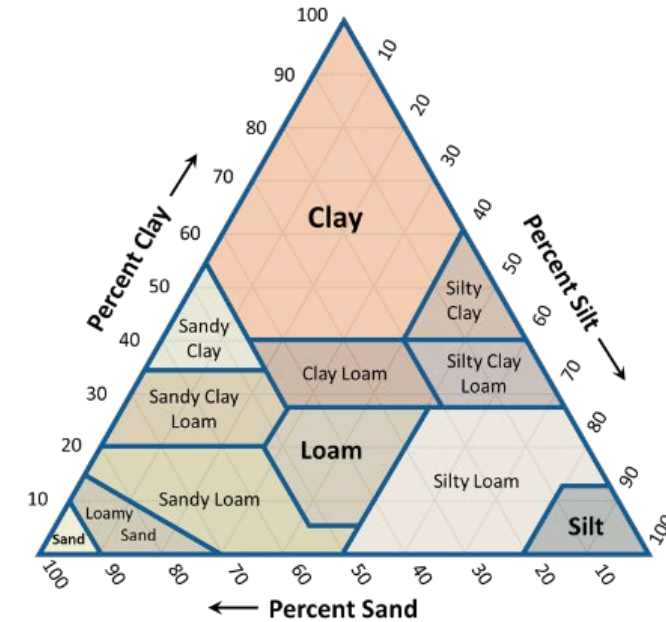


Data Source: USDA SSURGO
(Soil Survey Geographic Database)

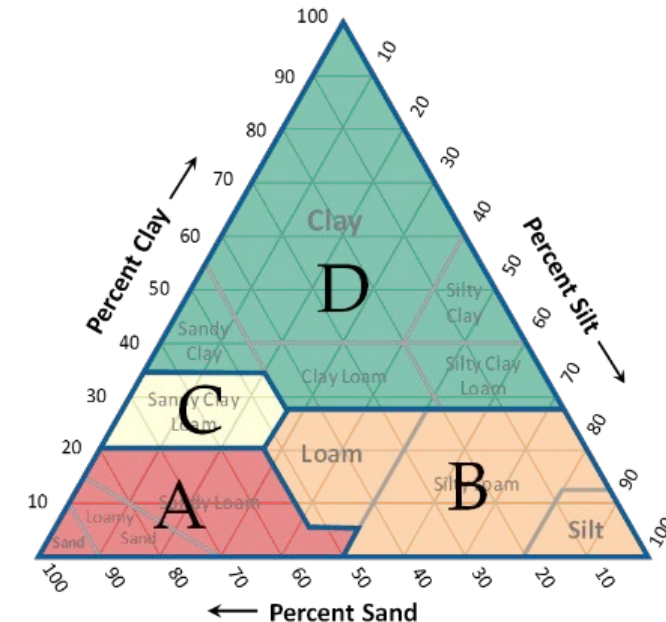
Soil Group & Erodibility

- Sandy soils (heavy particles) with high infiltration potential (Group A) are least erodible
- Soils with compacted clay content, though having low infiltration potential, are less easily mobilized
- Group C soils (Sandy Clay Loam) are generally the most erodible

USDA Soil Triangle



Hydrologic Soil Group

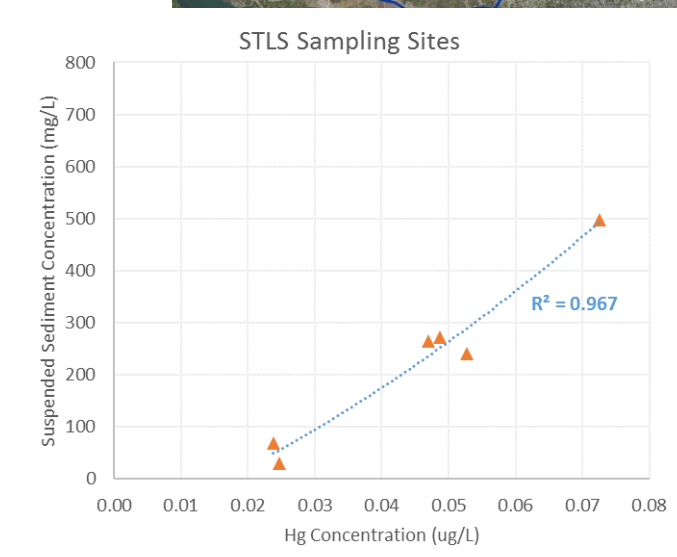
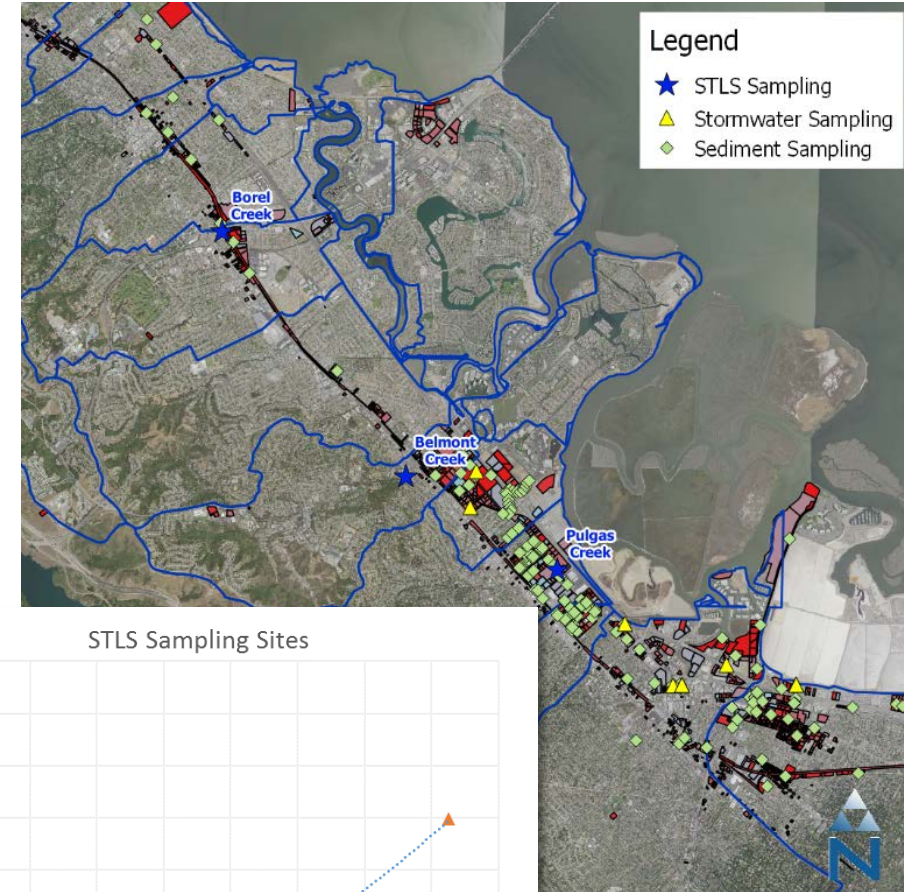


Sediment Calibration/Trends

- Best-available sediment monitoring data are available in Guadalupe watershed
- Soil Erodibility Analysis suggests that:
 - Soils in Guadalupe River watershed are not as representative of soils in San Mateo County
 - Matadero Creek has highly erodible soils
- San Gregorio Watershed Management Plan (2010)
 - Local estimates of County sediment sources & distribution
 - Soil erodibility correlates with mapped landslides

PCB & Hg Sources

- Data Sources
 - Small Tributary Loading Strategy (STLS)
 - Sediment Sampling
 - Stormwater Sampling
- Deriving relationship based on sediment by HRU; break out priority parcels



Next Steps

- Calibrate HSPF model for sediment, mercury, and PCBs
- Perform analysis of mercury/PCB reductions to meet TMDL wasteload allocations
- Development of modeling assumptions for green infrastructure (SUSTAIN)
 - Assumptions will be documented for C/CAG review prior to initiation of modeling