SAN MATEO COUNTYWIDE
Water Pollution Prevention Program
Clean Water. Healthy Community.

How to Determine LID Feasibility and Infeasibility

2011 New Development Workshop

Lisa Austin, Geosyntec Consultants

Thanks to Jill Bicknell, EOA

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Schedule/Agenda

- Introduction to LID BMPs
- Determining LID Feasibility
- Case Studies with Worksheet Exercise
  1. San Mateo Unincorporated County Single Family Development
  2. Oakland Multi-Family Redevelopment
  3. Dublin Commercial Redevelopment
  4. Fremont Commercial Redevelopment

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C3 Requirements

- LID Treatment Measures
  - Rainwater Harvesting
  - Infiltration
  - Evapotranspiration
  - Biotreatment
- Biotreatment may only be used if it is infeasible to implement the other LID Treatment Measures

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LID Treatment Measures

- Rainwater Harvesting

Potential uses:

- Landscape Irrigation
- Toilet flushing
- Industrial non-potable uses

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LID Treatment Measures

- Infiltration Measures are wider than deep
  - Bioinfiltration, infiltration basins, and shallow/wide infiltration trenches and dry wells

Bioinfiltration
Photo Credit: Geosyntec Consultants

Infiltration Basin
Photo Credit: WSUD.org

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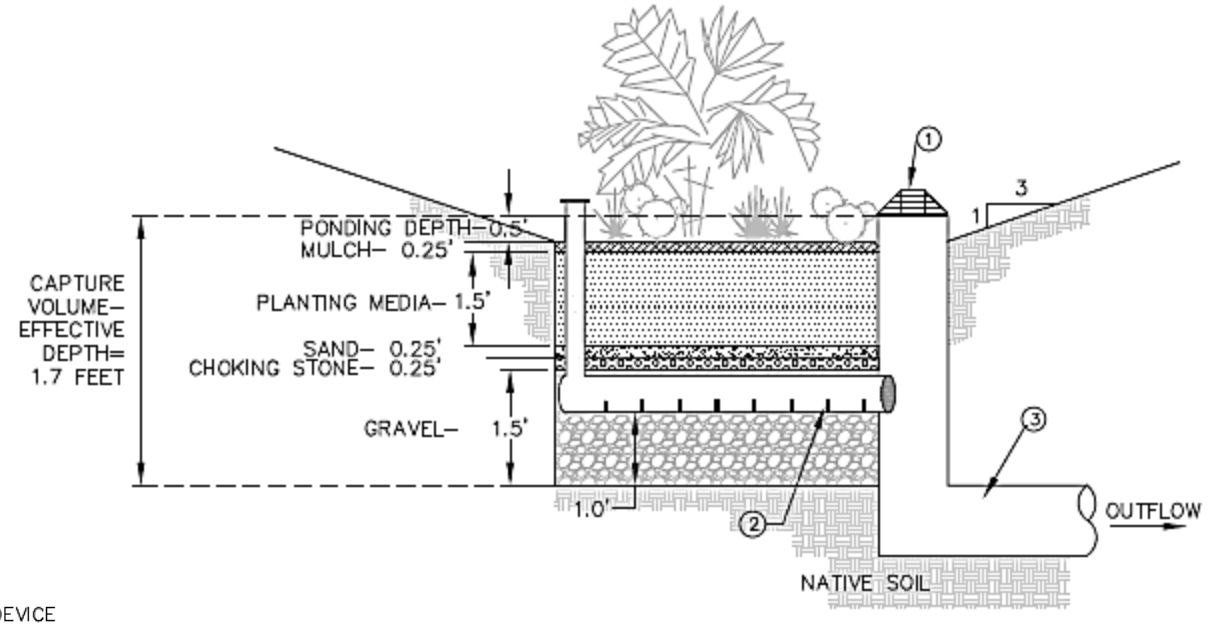
LID Treatment Measures

- Bioinfiltration



NOTES:

1. OVERFLOW DEVICE
2. SLOTTED 6" MIN PVC PIPE UNDERDRAIN
3. OUTLET PIPE
4. MEDIA POROSITIES: MULCH, PLANTING MEDIA, SAND = 0.25 FT/FT; CHOKING STONE, GRAVEL = 0.4 FT/FT

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LID Treatment Measures

- Infiltration Devices are deeper than wide
  - Dry wells, injection wells, and infiltration trenches

Dry Well Installation

Photo Credit: K&A Enterprises

Rural Highway Infiltration Trench

Photo Credit: stormwater.wordpress.com

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LID Treatment Measures

- Evapotranspiration
  - ET is loss of water to atmosphere by evaporation from soil and plants and plant transpiration
  - Occurs in bioinfiltration, biotreatment, irrigation, Self-Retaining Area, and Self-Treating Areas

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LID Treatment Measures

- Biotreatment

Bioretention

Photo Credit: Geosyntec Consultants

Planter Box

Photo Credit: Geosyntec Consultants

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Key Factors Affecting Feasibility

- Amount of Stormwater Runoff
  - LID Measures must treat 100% of C.3.d water quality design storm runoff
    - Volume based–80% of annual runoff
    - Flow based– Runoff from 2 x 85th percentile rainfall intensity or 0.2 in/hr
  - Bioinfiltration feasibility
    - Infiltrate 80% of avg. annual runoff volume
    - Within 4% of tributary area
    - Using standard design parameters

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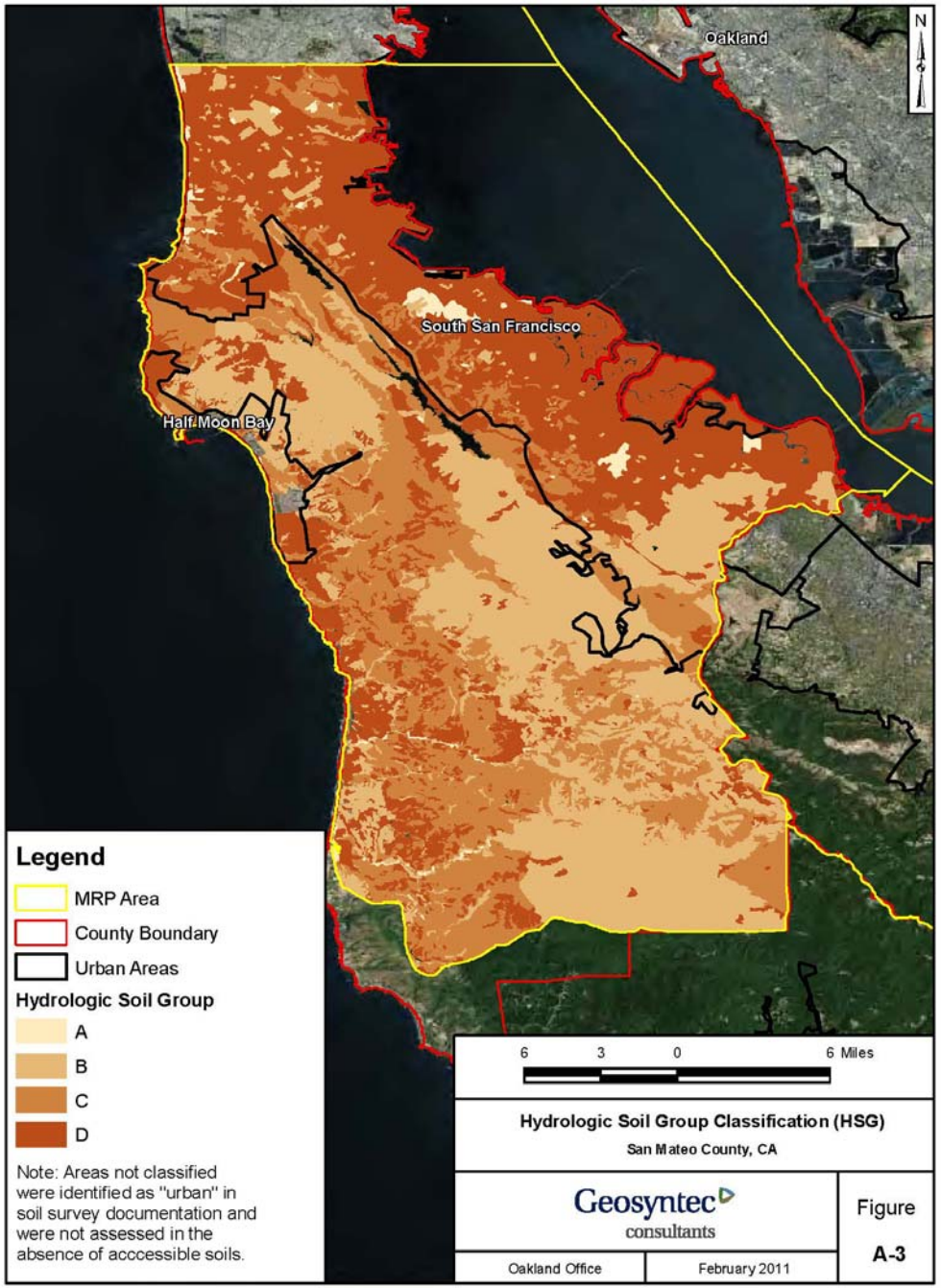
Key Factors Affecting Feasibility

- Feasibility of Infiltration
  - Soil Characteristics
    - "C" and "D" soils have low to very low infiltration rates compared to "A" and "B" soils



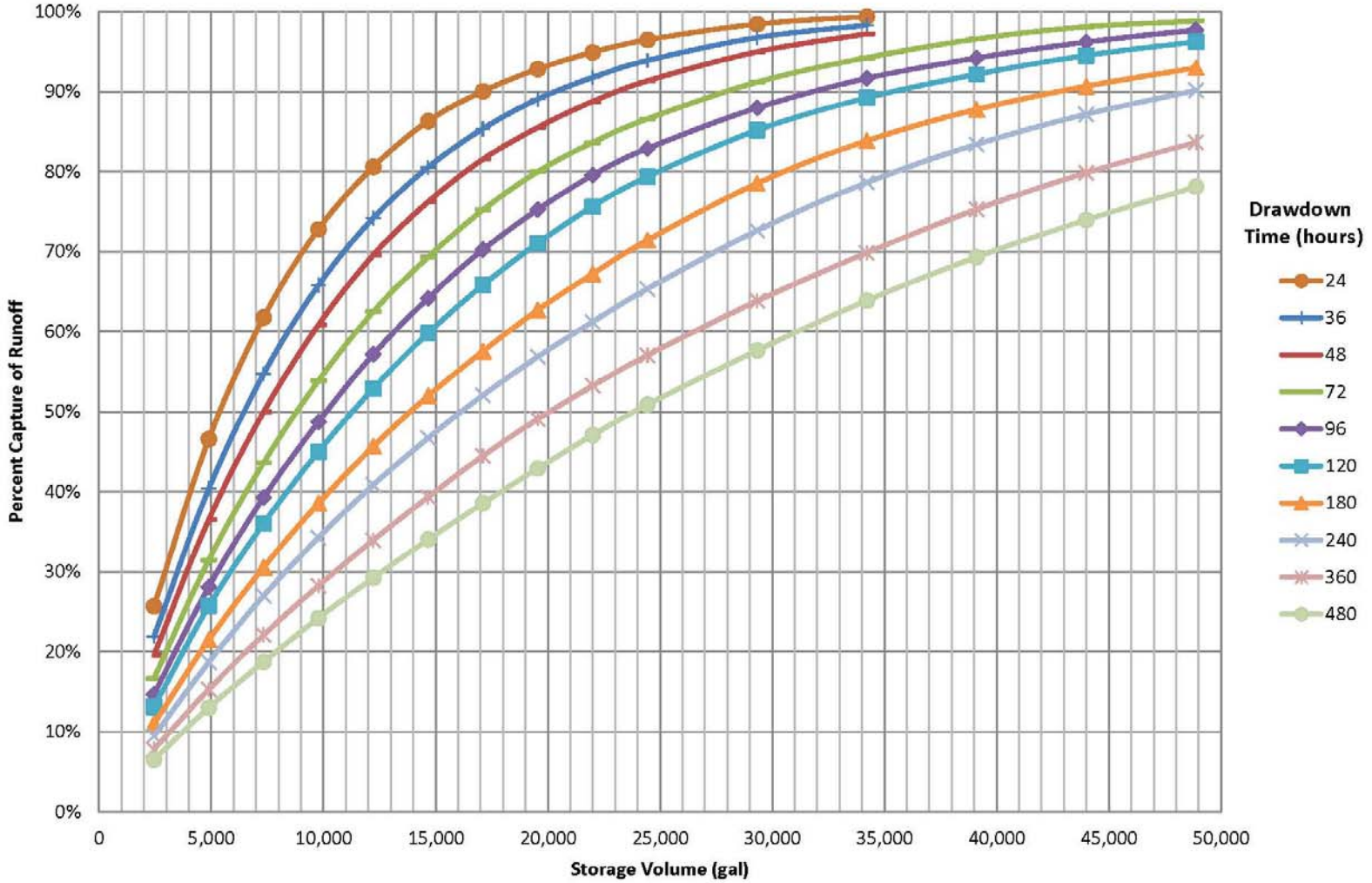
Key Factors Affecting Feasibility

- Feasibility of Infiltration
  - Site Characteristics
    - High groundwater table (<10' below base)
    - Groundwater production wells within 100'
    - Septic systems, underground tanks within 100'
    - Pollutants in soil or groundwater
    - Geotechnical hazards
    - Industrial or high traffic areas
    - Underground utilities/trenches

Key Factors Affecting Feasibility

- Feasibility of Rainwater Harvest/Use
  - Supply and Demand
    - Need reliable demand to draw down tank such that C.3.d volume requirement is met
    - Strongly affected by California rainfall pattern

Figure F-8: Percent Capture Achieved by BMP Storage Volume with Various Drawdown Times for 1-Acre, 100% Impervious Tributary Area - Palo Alto

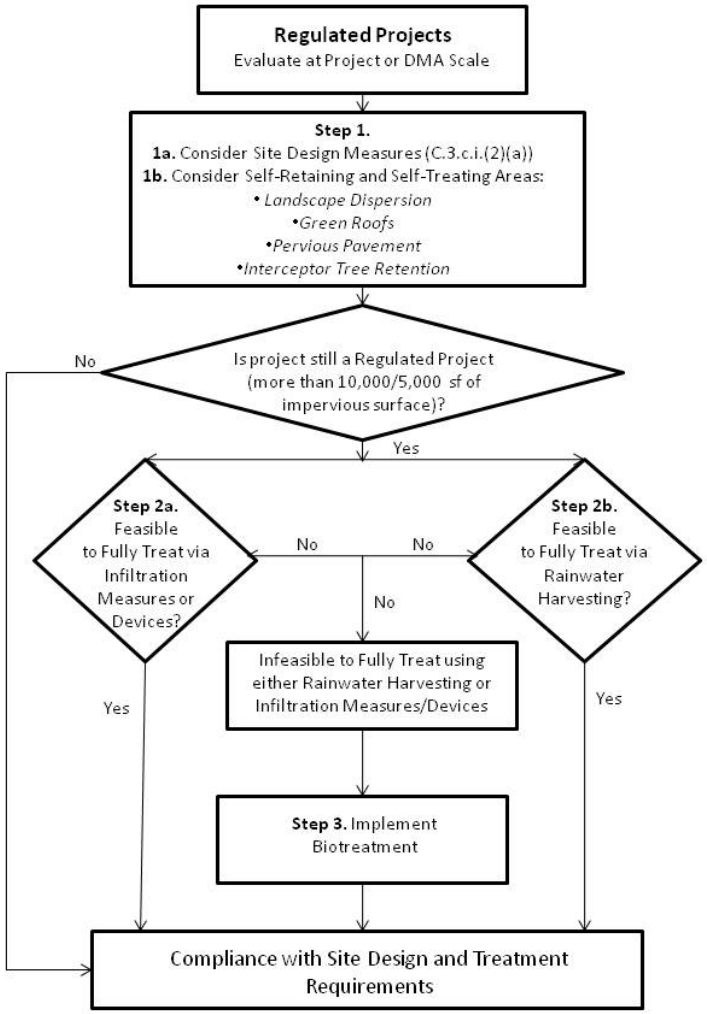


Key Factors Affecting Feasibility

- Feasibility of Rainwater Harvest/Use
  - Other Factors
    - Recycled water use conflicts
    - Municipal building & plumbing codes
    - Reliability of water quality
    - Operational & treatment challenges
    - Site constraints, utility proximity
    - Geotechnical/structural stability

Feasibility Process Flow Chart

- Regulated Projects: Evaluate Feasibility at Drainage Management Area (DMA) or Project Scale
- Step 1: Consider site design measures, Self-Treating, and Self-Retaining areas
- Decision: is project still a Regulated Project?



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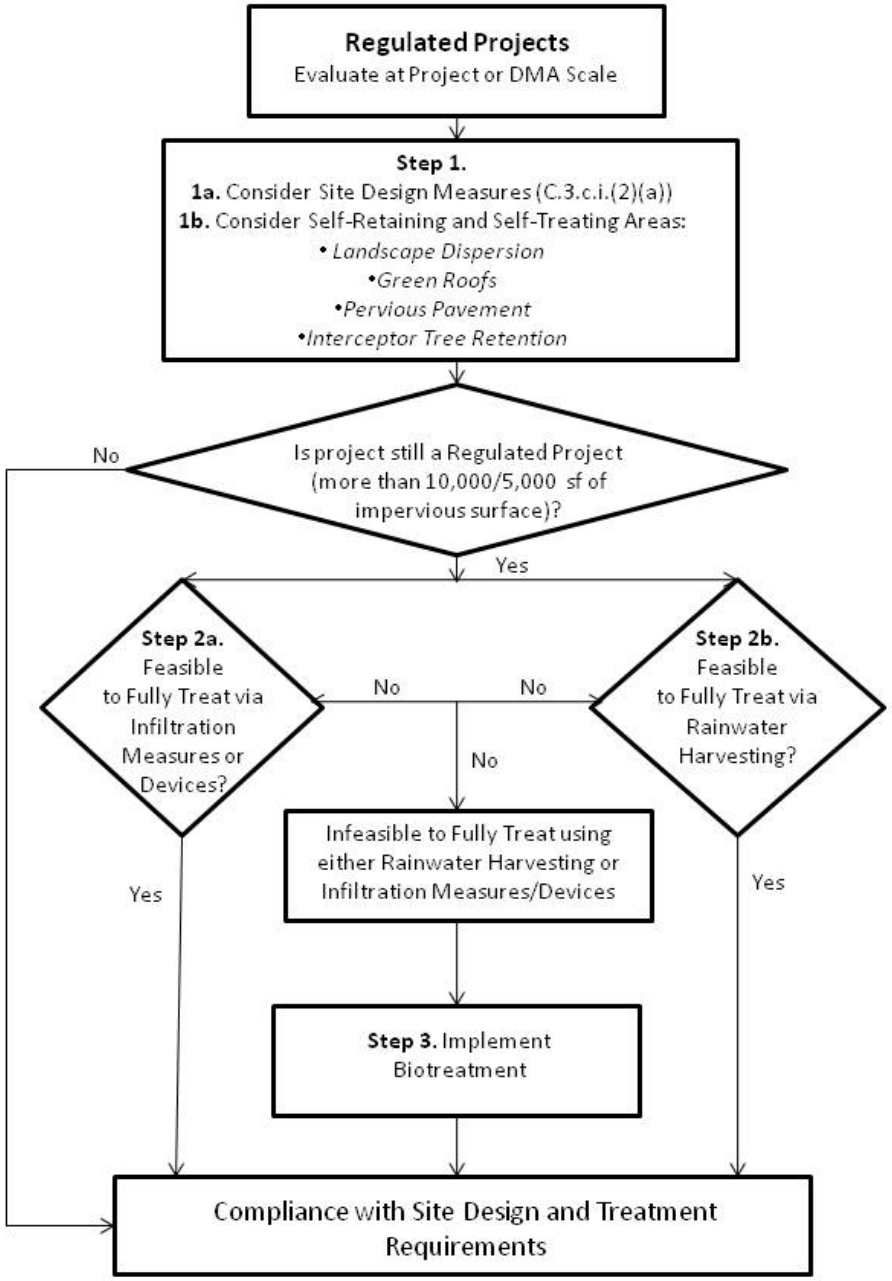
Feasibility Process Flow Chart

- Step 2: Evaluate Infiltration and Rainwater Harvesting
  - Infiltration and Rainwater Harvest Equal – must look at both
  - Evaluate soil type, infiltration rates, harvested rainwater use demand and other factors
- Step 3: Implement Biotreatment



Feasibility Process Flow Chart

Step 1.

1a. Consider Site Design Measures (C.3.c.i.(2)(a))

1b. Consider Self-Retaining and Self-Treating Areas:

- *Landscape Dispersion*
- *Green Roofs*
- *Pervious Pavement*
- *Interceptor Tree Retention*

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Feasibility Evaluation Process

- **Step 1.a. – Consider Site Design Measures**
  - Limit disturbance of natural drainage systems
  - Conserve natural areas
  - Minimize impervious surface
  - Minimize disturbance to natural drainages
  - Direct runoff to landscaping or permeable paving

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Feasibility Evaluation Process

- **Step 1.b. – Consider Self-Treating or Self-Retaining Areas**
  - Self-Treating Area = pervious area that treats rain falling on itself only, via ponding, infiltration and ET
    - Interceptor trees
    - Green roofs
    - Pervious paving

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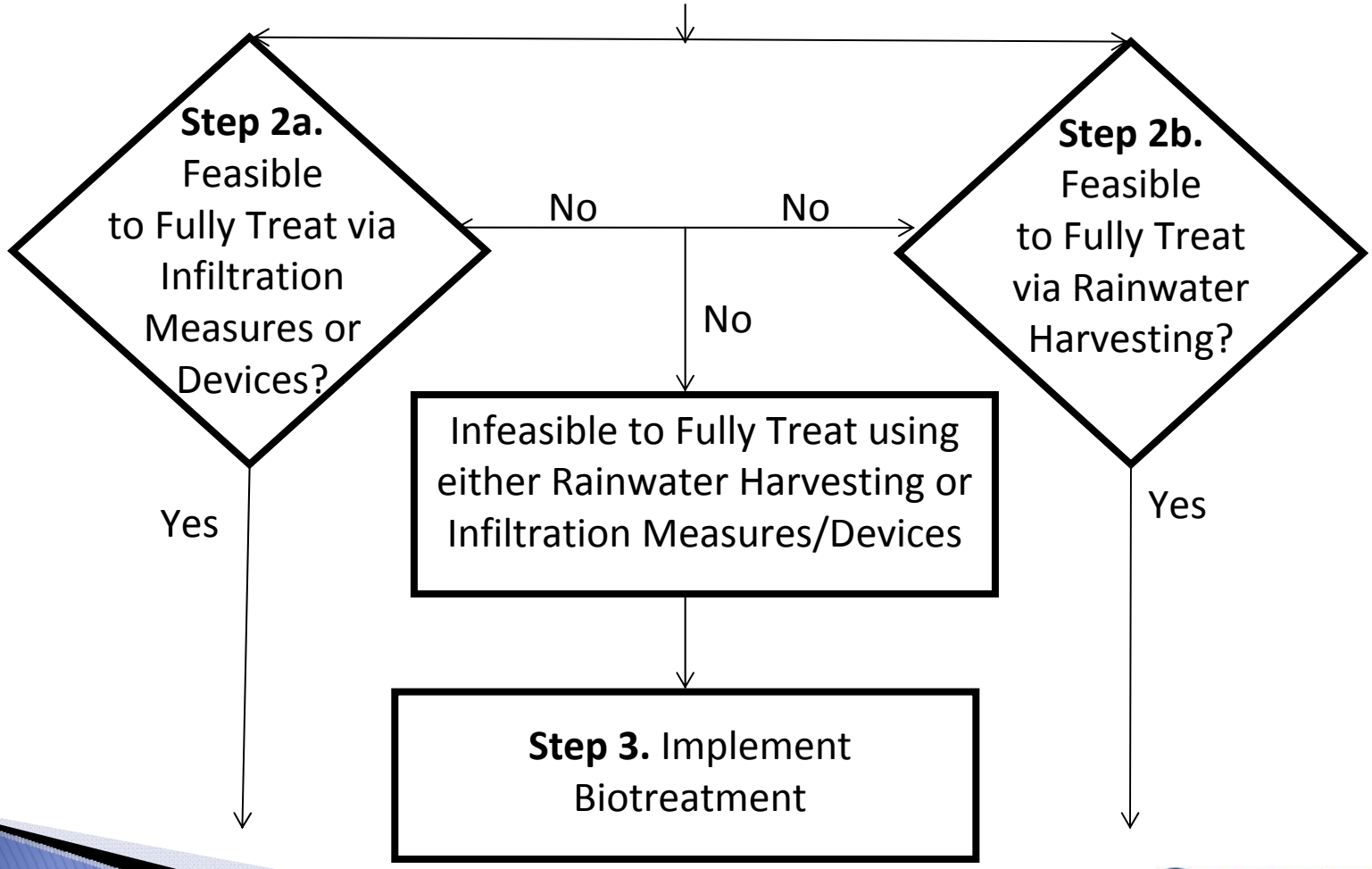
Feasibility Evaluation Process

- **Step 1.b. – Consider Self-Treating or Self-Retaining Areas**
  - Self-Retaining Area = pervious area that retains first 1" of rainfall on itself and the contributing impervious area, up to a 2:1 ratio (impervious:pervious)
    - Roof runoff dispersion to landscaping
    - Partial green roofs
    - Pervious paving

Feasibility Process Flow Chart



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Feasibility Evaluation Process

- **Step 2.a. – Infiltration Feasibility**
  - Soil Characteristics
    - Volume based sized criteria in C.3.d is 80% capture of the annual runoff
    - Modeling studies indicated that "bioinfiltration" areas in soils with Ksat < 0.4 in/hr (all "C" and "D" soils) cannot meet the 80% capture requirement
    - Increase in drain rock depth provided only marginal improvement, for Ksat = 0.4 –1.6 in/hr
  - Site Conditions
    - Evaluate other factors to see if infiltration allowed

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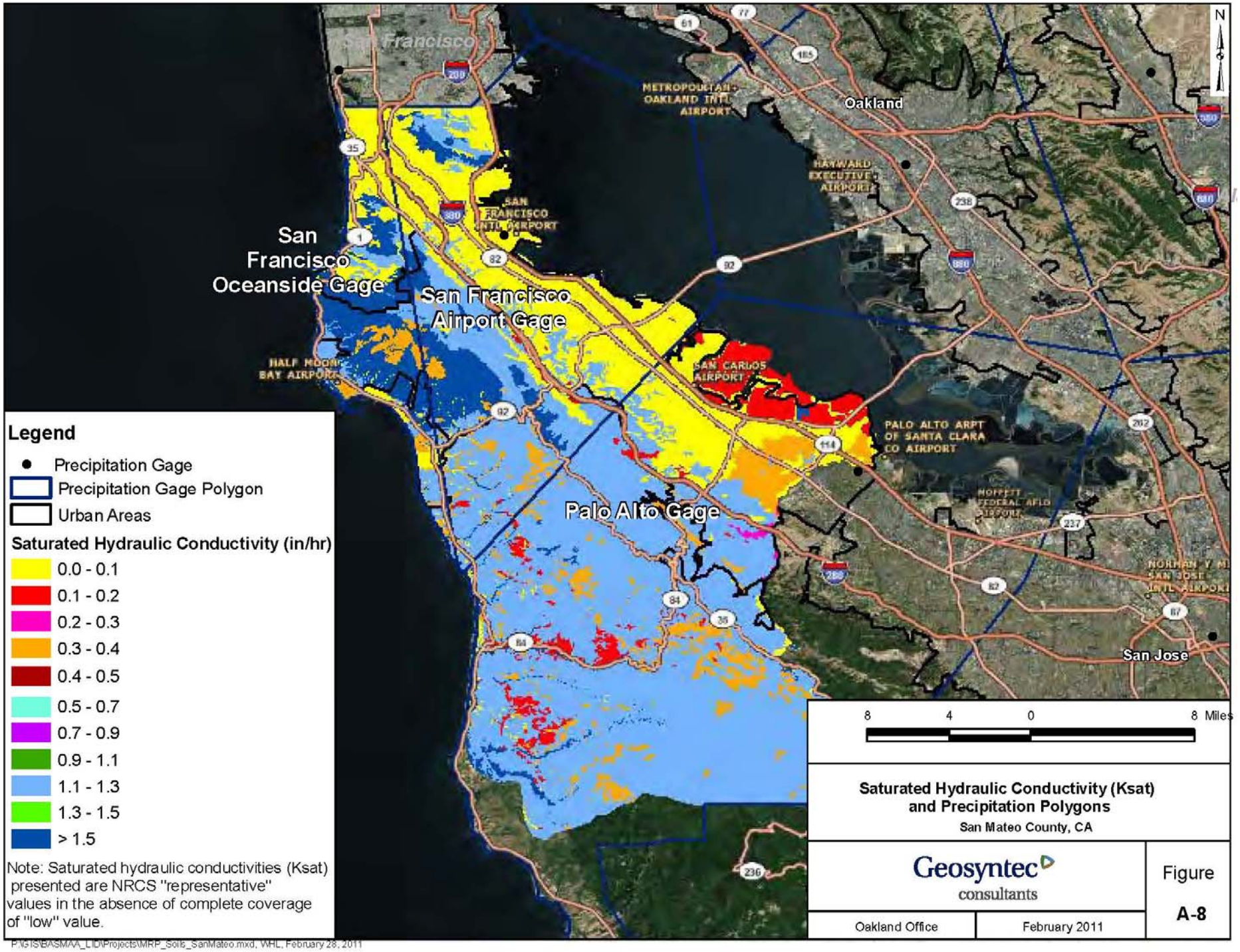

Saturated Hydraulic Conductivity (Ksat) and Precipitation Polygons

San Mateo County, CA

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Figure A-8

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Feasibility Evaluation Process

- **Step 2.b. – Rainwater Harvesting and Use**
  - Types of Demands
    - Irrigation
    - Toilet flushing
    - Other non-potable (e.g., commercial/industrial)
  - Applicable sizing criteria in C.3.d is 80% capture of the annual runoff volume
  - Key concept is drawdown time
  - Barriers: lack of plumbing codes, treatment, recycled water preference

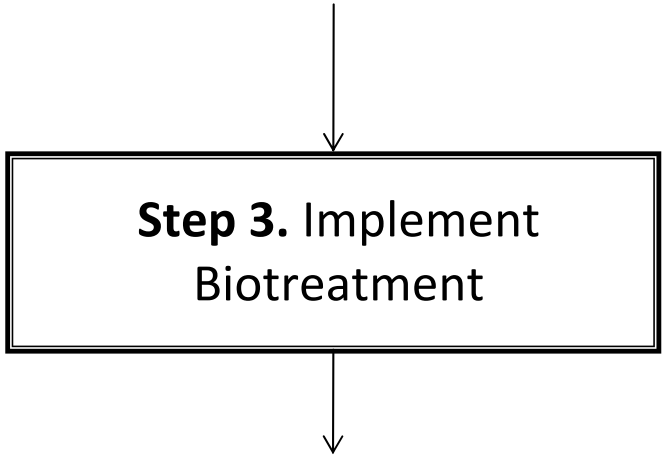
Feasibility Evaluation Process

- Rainwater Harvesting and Use
  - Modeling analyses for Palo Alto:
    - To meet 80% capture for non-potable (per acre of impervious area):
    - 16,000 gal. tank, 8,000 gpd (48 hr drawdown)
    - 50,000 gal. tank, 2,500 gpd (480 hr drawdown)
    - 2,500 gpd = 290 toilet users @ 8.6 gpd (under Green Building Code)
- To meet 80% capture for irrigation (per acre of impervious area):

  2,500 gpd = 2.5 to 5 acres of landscaping

Feasibility Process Flow Chart

- **Step 3: Implement Biotreatment**
  - Maximize infiltration
  - Low tech, low maintenance
  - Known standards and specs
  - Institutional experience
  - Excellent treatment!



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Case Studies

1. San Mateo Unincorporated County Single Family Development
2. Oakland Multi-Family Redevelopment
3. Dublin Commercial Redevelopment
4. Fremont Commercial Redevelopment

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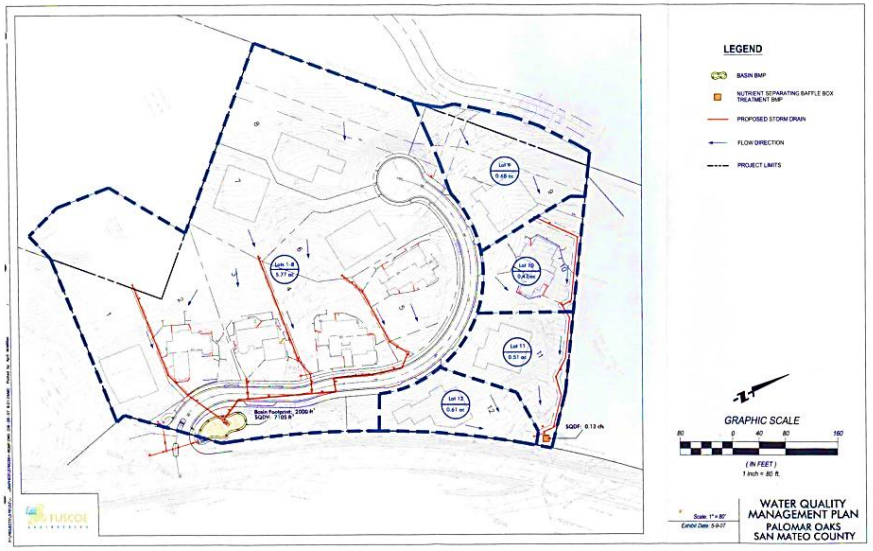
Case Study 1: San Mateo

- 12 Single-Family Residential Unit Development
  - Includes landscaping and private road
- 7.5 Acres
  - 1.8 Acres Residences
  - 5.7 Acres Landscaping
- 1.6 Dwelling Units/Acre Average



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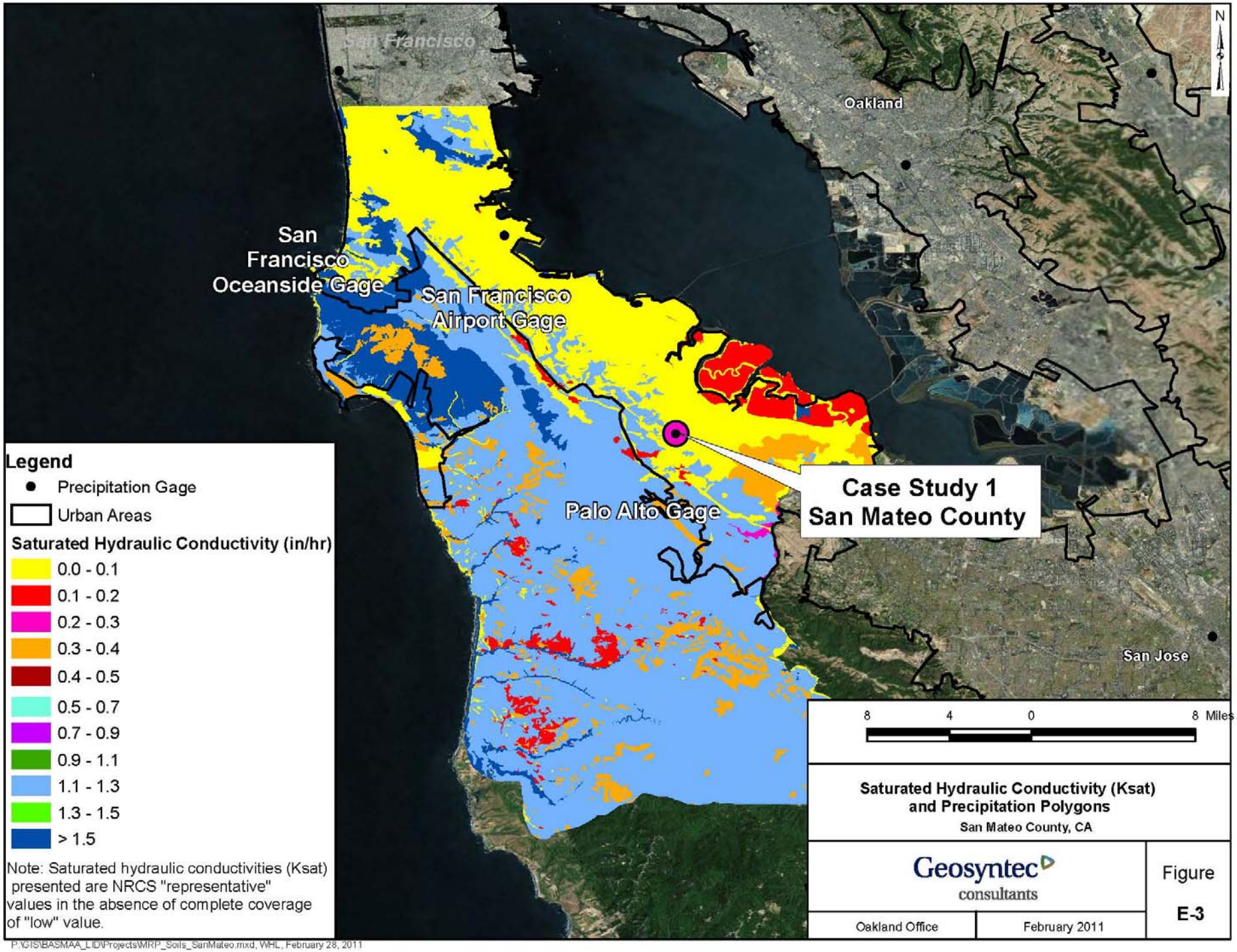
LID Feasibility Screening Worksheet

- 1. Applicant Info
  - Palomar Oaks
  - Unincorporated Area, San Mateo County
- 2.a. Do site soils either:
  - Have a Ksat < 1.6 inches/hour, or
  - Consist of Type C or D soils?
    - Yes


San Francisco
Oakland
San Francisco Oceanside Gage
San Francisco Airport Gage
Palo Alto Gage
Case Study 1
San Mateo County
San Jose
N
Legend
Precipitation Gage
Urban Areas
Saturated Hydraulic Conductivity (in/hr)
0.0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.7
0.7 - 0.9
0.9 - 1.1
1.1 - 1.3
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8 4 0 8 Miles
Saturated Hydraulic Conductivity (Ksat) and Precipitation Polygons
San Mateo County, CA
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Figure
E-3
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LID Feasibility Screening Worksheet

- 2.b. Check box if the project is installing and using a recycled water plumbing system for indoor non-potable use
  - [box not checked]

Case Study 1: San Mateo

New Impervious Surfaces (New IS):

•**Residences:**

1.8 [ac]*43560 [sq-ft/acre]=

78,000 sq-ft

- 75% residence impervious area is roof

•**Roads:**

0.5 [ac]*43560 [sq-ft/acre]=

21,000 sq-ft

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Table 1: Calculation of Impervious Surface Created and/or Replaced by the Project			
	1	2	3
Type of Impervious Surface	Pre-Project Condition (sq. ft.)	Proposed Impervious Surface (IS), in sq. ft.	
		Replaced IS	New IS
a. Footprint of building(s)	**N/A**	**--**	**58,500**
b. Impervious surface other than building footprint, including driveway(s), patio(s), impervious deck(s), unroofed porch(es), uncovered parking lot (including top deck of parking structure), impervious trails, miscellaneous paving or structures, and off-lot impervious surface (new, contiguous impervious surface created from road projects, including sidewalks and/or bike lanes built as part of new street)	**N/A**	**--**	**21,000**
e. **Total Impervious Surface in Square Feet for the Potential Rainwater Capture Area**	**0**	**0**	**79,500**

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LID Feasibility Screening Worksheet

- 3.1 Is the amount of impervious surface replaced or added by the project equal to 50% or more of the existing area of impervious surface?
  - **Not applicable (applies if there is existing impervious surface)**
- 3.2/ 3.3 Enter the square footage and acreage of the Potential Rainwater Capture Area:
  - 58,500 sq-ft + 21,000 sq-ft = 79,500 sq-ft
  - 1.8 acres

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LID Feasibility Screening Worksheet

- 3.4 Is landscaped area less than 2.5 times the acreage of Potential Rainwater Capture Area (Item 3.3)?
  - Landscaping and Open Space = 4.9 acres
  - 4.9 acres > 2.5*1.8=4.5 Acres
    - **No**
    - Direct runoff from impervious areas to Self-Retaining areas* OR refer to Table 11 and the curves in Appendix F of the LID Feasibility Report to evaluate feasibility of harvesting and using the C.3.d amount of runoff for irrigation.

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LID Feasibility Screening Worksheet

- Table 11 EIATIA Ratio
  - EIATIA = 4.9/1.8 = 2.7, which is less than the required 6.4 ratio for conservation landscaping or 3.2 ratio for turf areas using the Palo Alto gage
  - Harvesting for irrigation is not feasible
- 3.5.a. Residential Projects: Proposed density (dwelling units/acre):
  - 1.6 DU/Acre
  - Less than 100 DU/Acre
    - Yes

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LID Feasibility Screening Worksheet

- 4. All questions in Section 3 Yes?
  - YES
- Applicant may use appropriately designed ***biotreatment*** facilities.

Case Study 2: Oakland

- Urban Infill Project in Downtown District
- Multi-Family Land Use
  - Total Project: 0.81 acres (35,300 sq-ft)
  - Replaced IS: 0.75 acres (33,500 sq-ft)
  - 475 DU/Acre
- Ksat range: 0.0-0.1 in/hr per map
- Redevelopment Project

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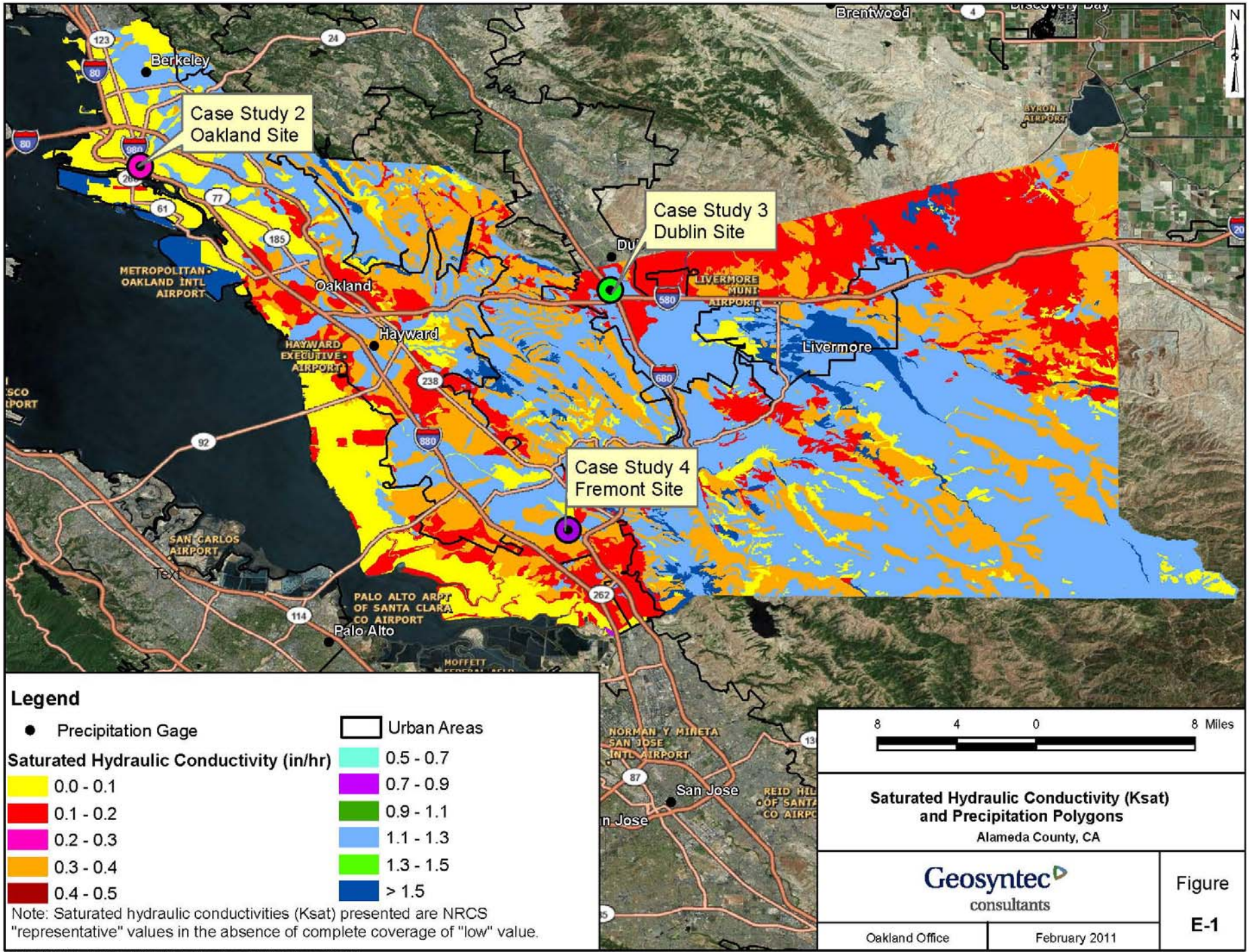
Case Study 2
Oakland Site
Case Study 3
Dublin Site
Case Study 4
Fremont Site
Berkeley
Oakland
Hayward
Livermore
Brentwood
San Jose
Palo Alto
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HAYWARD EXECUTIVE AIRPORT
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SAN CARLOS AIRPORT
PALO ALTO ARPT OF SANTA CLARA CO AIRPORT
NORMAN Y MINETA SAN JOSE INTL AIRPORT
BYRON AIRPORT
MOFFETT
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Alameda County, CA
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Figure
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Case Study 3: Dublin

- Neighborhood Commercial Project
- Commercial Land Use
  - Total Project : 1.9 acres (84,500 sq-ft)
  - Replaced IS: 1.70 acres (74,000 sq-ft)
  - 0.2 Acres (8,500 sq-ft) Landscaping
- Ksat range: 0.5-0.7 in/hr per map
- Assume FAR = 1:1

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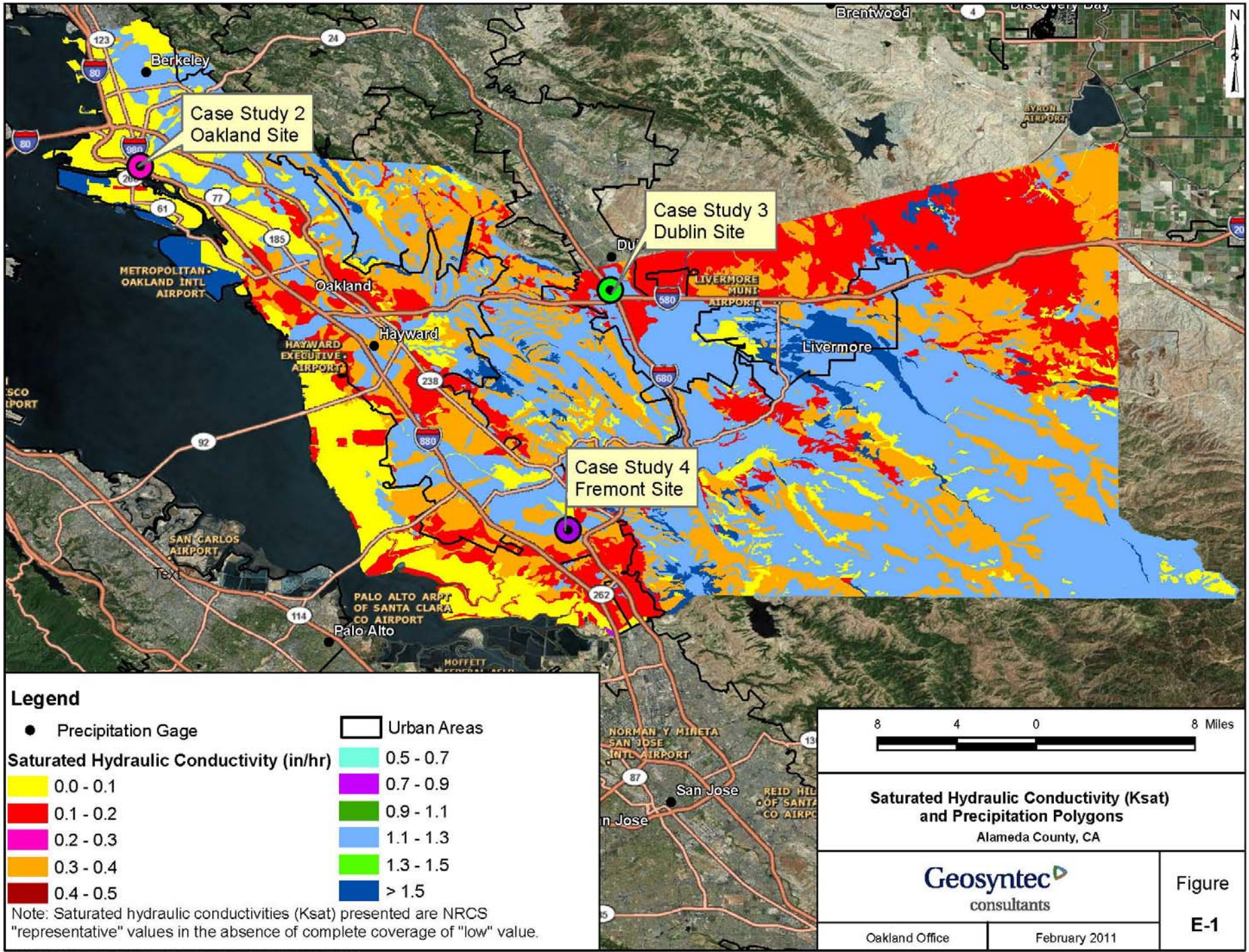
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Case Study 4: Fremont

- Commercial Redevelopment Project
- Not within Designated Development Area
- Surface-loaded Parking
- Commercial Land Use
  - Total Project: 0.36 acres (15,800 sq-ft)
  - Replaced IS: 0.32 acres (14,000 sq-ft)
  - Existing Condition: Assumed 50% Impervious
- Ksat within 0.3-0.4 range
- LUST Clean Up Site

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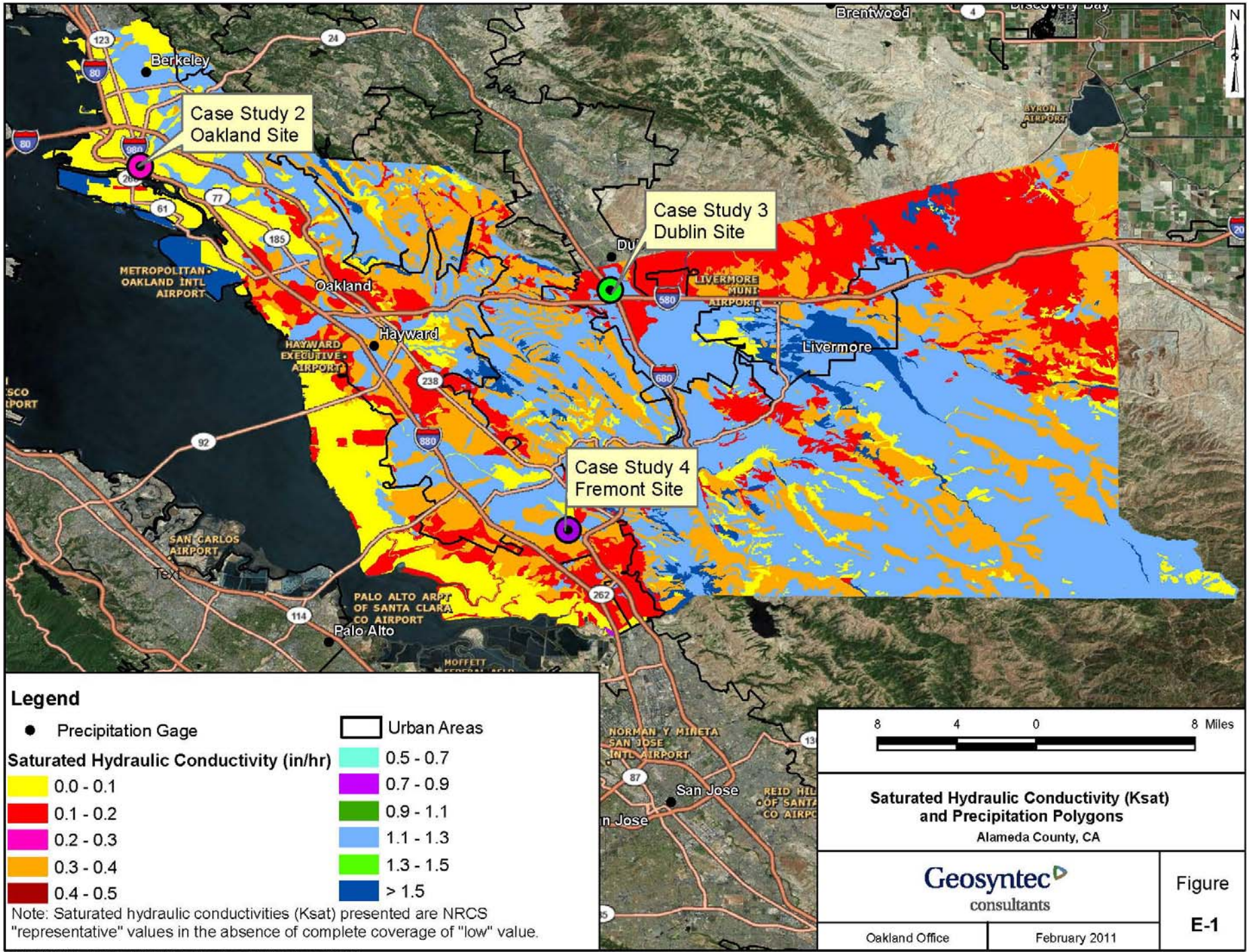
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