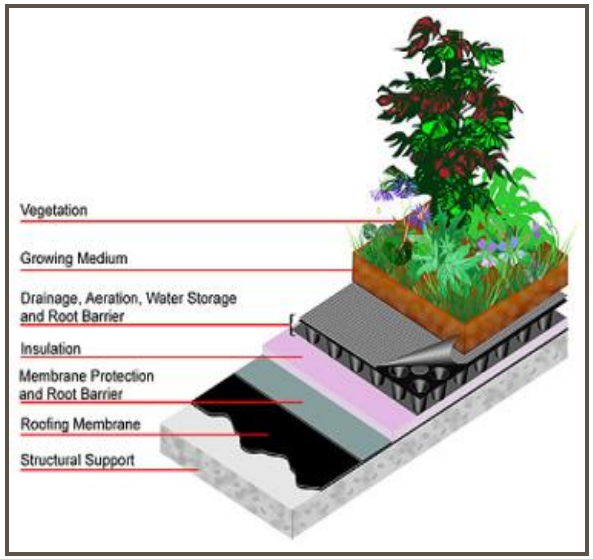

Determining the Feasibility/Infeasibility of Infiltration, Evapotranspiration and Rainwater Harvest and Use

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Assistant Program Manager
Santa Clara Valley Urban Runoff Pollution Prevention Program

Presentation Overview

- MRP Requirements for Feasibility/ Infeasibility Evaluation
- Technical Studies
- Infeasibility Factors and Criteria
- Evaluation Process
- Next Steps

MRP Provision C.3.c

- **100% LID Treatment required:**
  - **“LID Treatment” = harvesting/reuse, infiltration, evapotranspiration, or biotreatment**
  - **“A properly engineered and maintained biotreatment system” is only allowed if other options are infeasible**
  - **Permit provides list of potential infeasibility criteria**
  - **Report on criteria and procedures for determining feasibility/infeasibility submitted May 1, 2011**
  - **Report on experience applying the criteria and procedures due December 1, 2013.**

Technical Studies

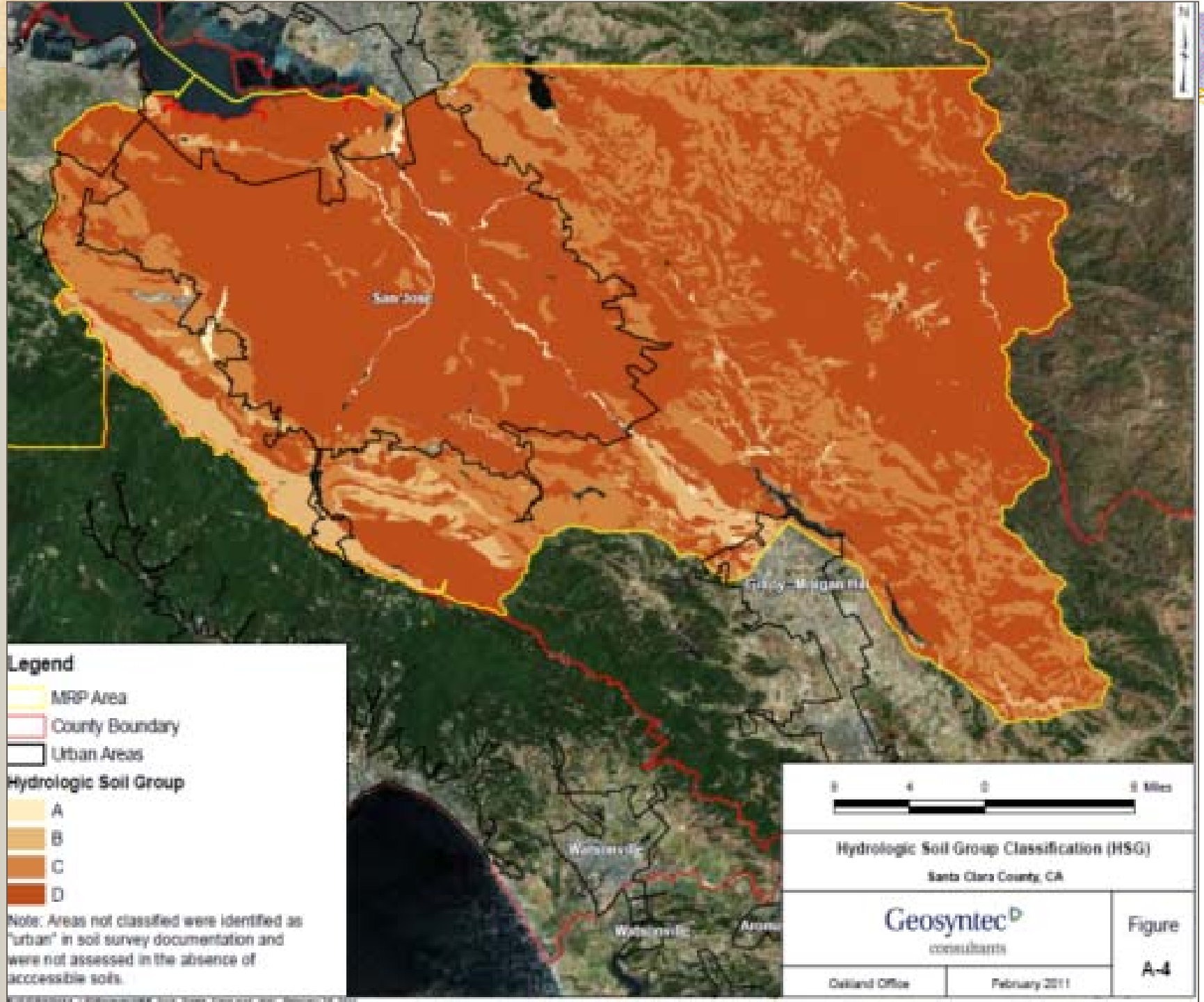
- **"Harvest and Use, Infiltration and Evapotranspiration Feasibility/Infeasibility Criteria Report" (Geosyntec, 2011)**
  - Literature Review
  - Mapping of Soil Types and Saturated Hydraulic Conductivity (Ksat)
  - Continuous Simulation Stormwater Modeling
    - Bioinfiltration system performance for various soil types
    - Cistern sizing for various drawdown times (i.e. demands)
    - Landscape dispersion simulation to develop effective impervious to pervious area ratios
  - Development of process flow chart
  - Development of reference tables for applying feasibility criteria

Key Factors Influencing Feasibility

- **Amount of Stormwater Runoff**
  - LID measures must treat 100% of water quality design storm runoff specified in C.3.d
    - Volume based – 80% of annual runoff
    - Flow based – runoff from 2 X 85th percentile rainfall intensity or 0.2 in/hr (generally equivalent to volume)

Key Factors Influencing Feasibility

- **Feasibility of Infiltration**
  - **Site Condition and Location**
    - 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 in close proximity
  - **Soil Types and Infiltration Rates**
    - Hydrologic Soil Groups “C” and “D” have low to very low infiltration rates compared to “A” and “B” soils

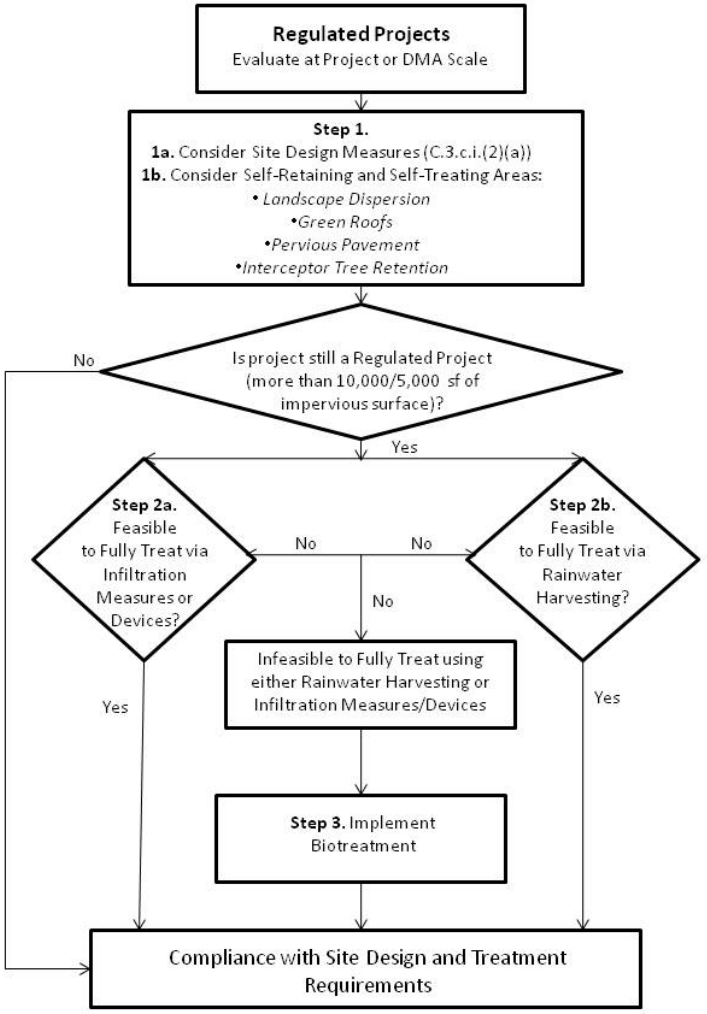

Legend
MRP Area
County Boundary
Urban Areas
Hydrologic Soil Group
A
B
C
D
Note: Areas not classified were identified as "urban" in soil survey documentation and were not assessed in the absence of accessible soils.
0 4 8 Miles
Hydrologic Soil Group Classification (HSG)
Santa Clara County, CA
Geosyntec consultants
Figure
A-4
Oakland Office
February 2011

Key Factors Influencing 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
  - **Other Factors**
    - Recycled water use conflicts
    - Municipal building & plumbing codes
    - Reliability of water quality & chemistry
    - Operational & treatment challenges
    - Site constraints, utility proximity
    - Geotechnical/structural stability

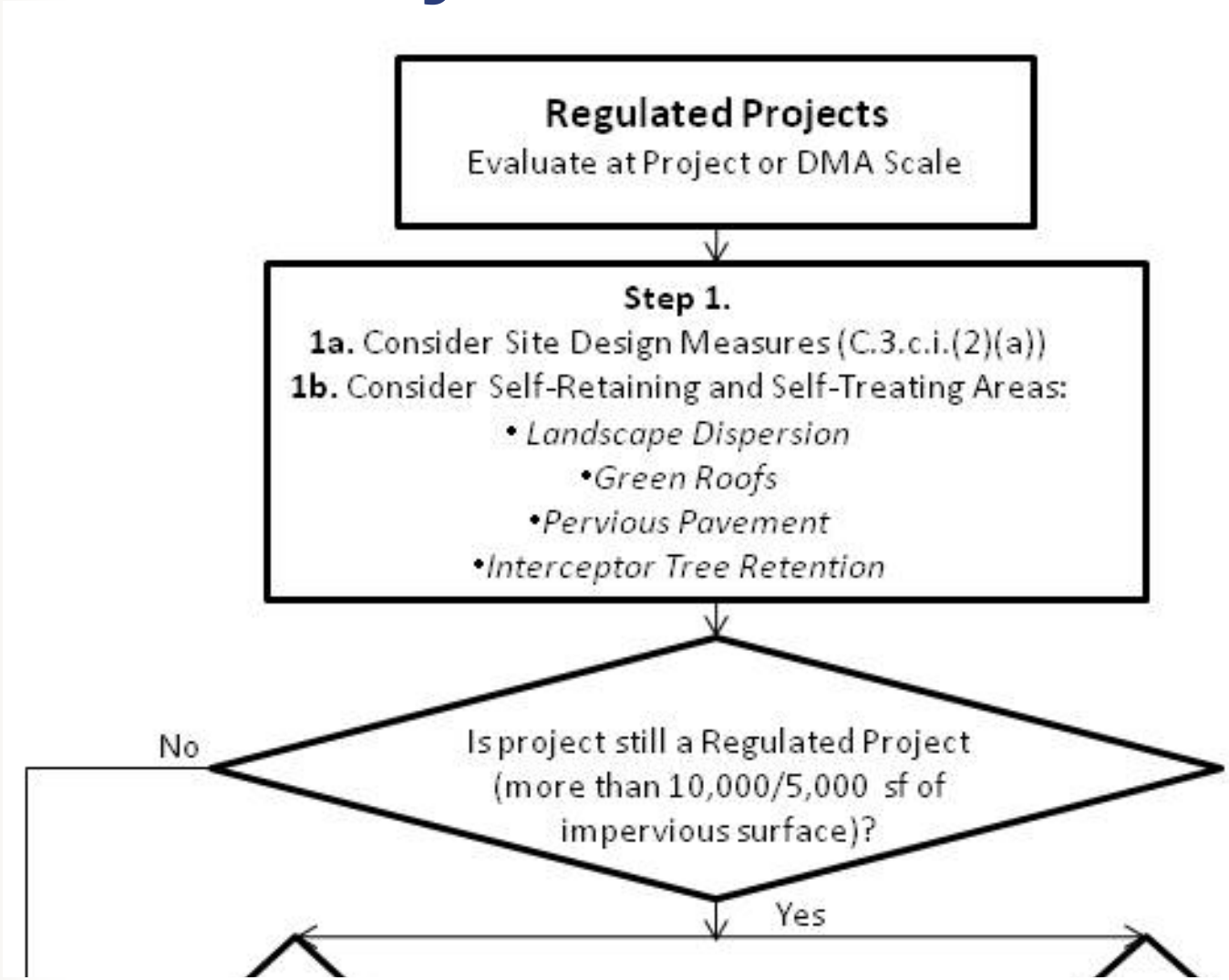
Feasibility Process Flow Chart

- **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?**
- **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**



Note: Evapotranspiration (ET) is a component of Self-Retaining and Self-Treating Areas, bioinfiltration and biotreatment facilities, and rainwater harvesting systems. For vegetated Self-Retaining, Self-Treating Areas and bioinfiltration and biotreatment measures, ET occurs through plant respiration; for rainwater harvesting, ET occurs when rainwater used for irrigation is taken up by irrigated plants.

Feasibility Process Flow Chart



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

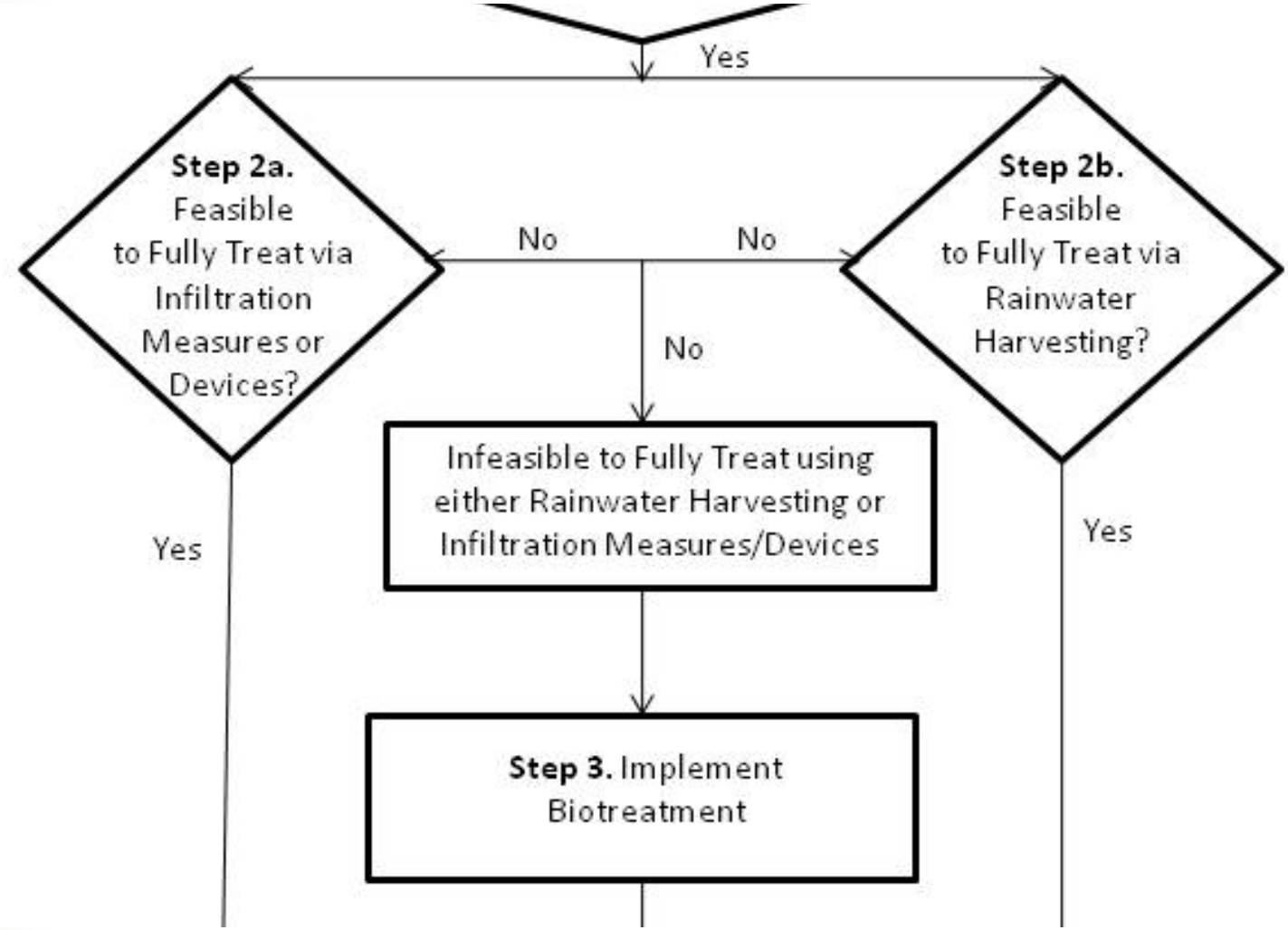
Feasibility Evaluation Process

- **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**

Feasibility Evaluation Process

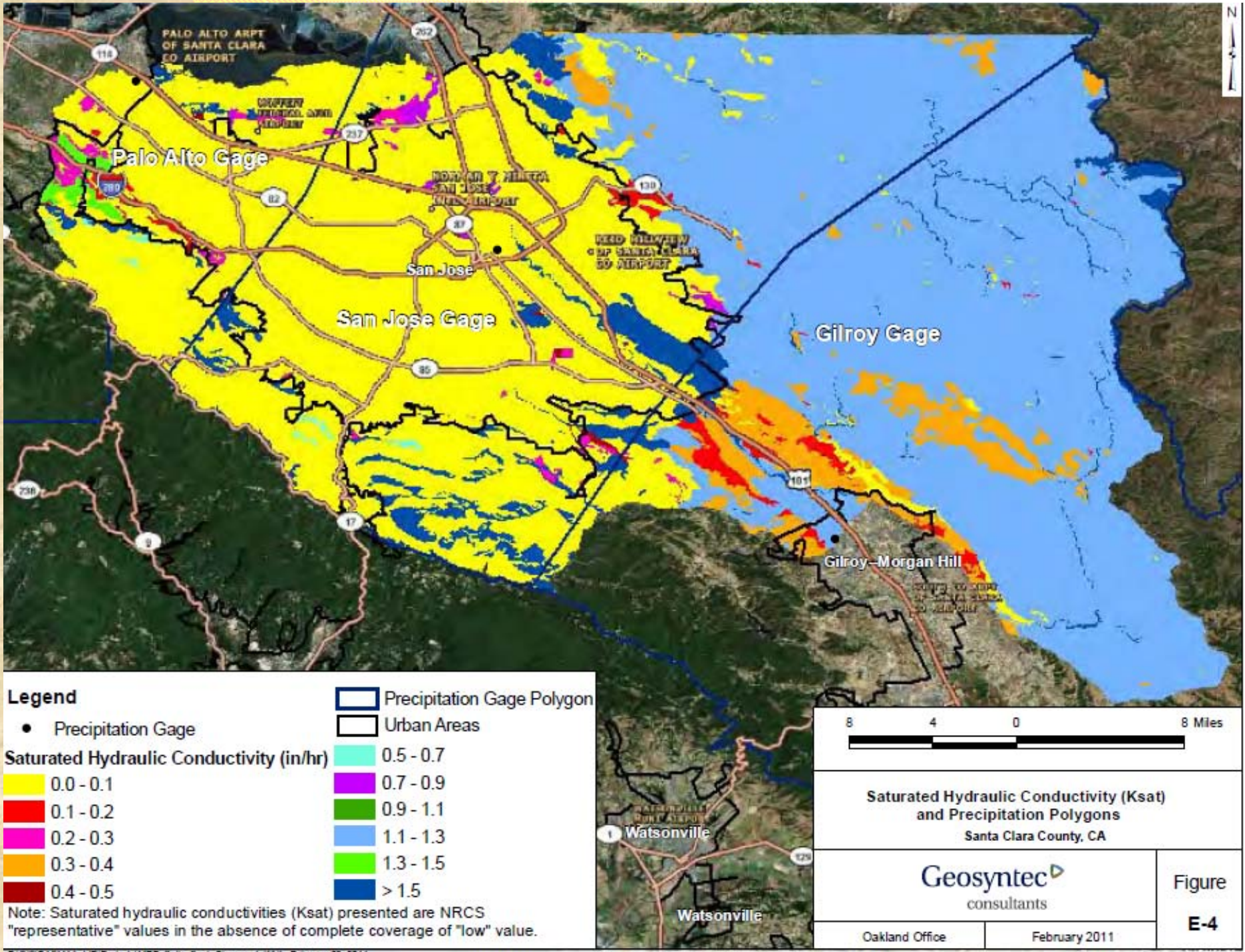
- **Step 1.b. – Consider Self-Treating or Self-Retaining Areas**
  - Self-Retaining Area = pervious area that retains first 1” of rainfall on itself and the contributing impervious area, up to a 2:1 ratio (impervious:pervious)
    - Roof runoff dispersion to landscaping
    - partial green roofs
   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

Feasibility Process Flow Chart

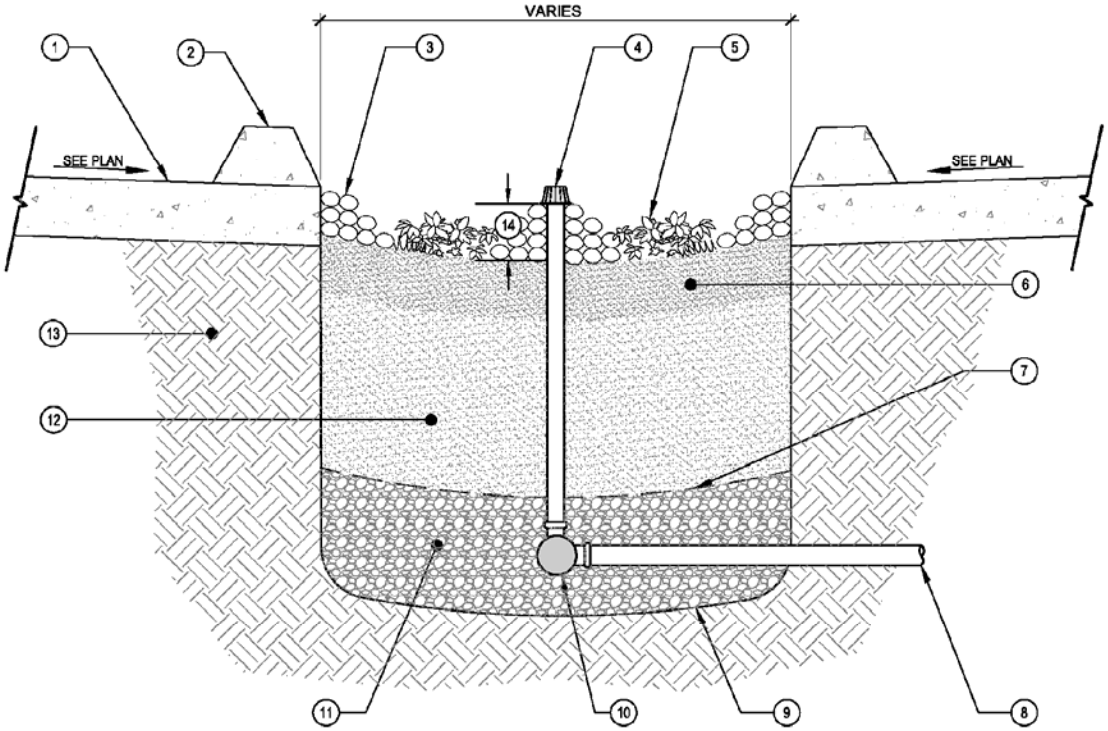


Feasibility Evaluation Process

- **Step 2.a. – Infiltration Feasibility**
  - **Soil Types and Infiltration Rates**
    - Volume based sized criteria in C.3.d is 80% capture of the annual runoff
    - Modeling studies indicated that “bioinfiltration” areas (bioretention with open bottom) 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
  - **Site Conditions**
    - Evaluate other factors to see if infiltration allowed


PALO ALTO ARPT OF SANTA CLARA CO AIRPORT
Palo Alto Gage
San Jose
San Jose Gage
Gilroy Gage
Gilroy--Morgan Hill
Watsonville
Watsonville
N
Legend
Precipitation Gage
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
1.3 - 1.5
> 1.5
Precipitation Gage Polygon
Urban Areas
Note: Saturated hydraulic conductivities (Ksat) presented are NRCS "representative" values in the absence of complete coverage of "low" value.
8 4 0 8 Miles
Saturated Hydraulic Conductivity (Ksat) and Precipitation Polygons
Santa Clara County, CA
Geosyntec consultants
Oakland Office
February 2011
Figure
E-4

Typical Bioretention Cross Section



NOTES:
SEE CALCULATIONS ON STORMWATER PLANS FOR DIMENSIONS.

1. PARKING LOT SURFACE (TYPICAL)
2. WHEEL STOP (TYPICAL)
3. COBBLE STONE DISSIPATOR ALONG EDGE OF BIORENTENTION CELL (TYPICAL)
4. OVERFLOW PIPE WITH ATRIUM GRATE WITH COBBLE STONE AROUND PIPE
5. VEGETATION (SEE LANDSCAPE PLANS)
6. PLANTING SOIL MIX (MIN. 6" DEPTH)
7. FILTER FABRIC (TYPICAL)
8. TO STORM DRAIN SYSTEM
9. IMPERMEABLE LINER (TYPICAL)
10. PERFORATED PVC SUBDRAIN PIPE
11. DRAIN ROCK (MIN. 12" DEPTH)
12. SANDY LOAM WITH PERCOLATION RATE OF 5" TO 10" PER HOUR (MIN. 18" DEPTH)
13. NATIVE GRADE OR CERTIFIED COMPACTED SUBGRADE
14. PONDING DEPTH FROM INLET OPENING TO GRADE (MIN. 6" DEPTH)

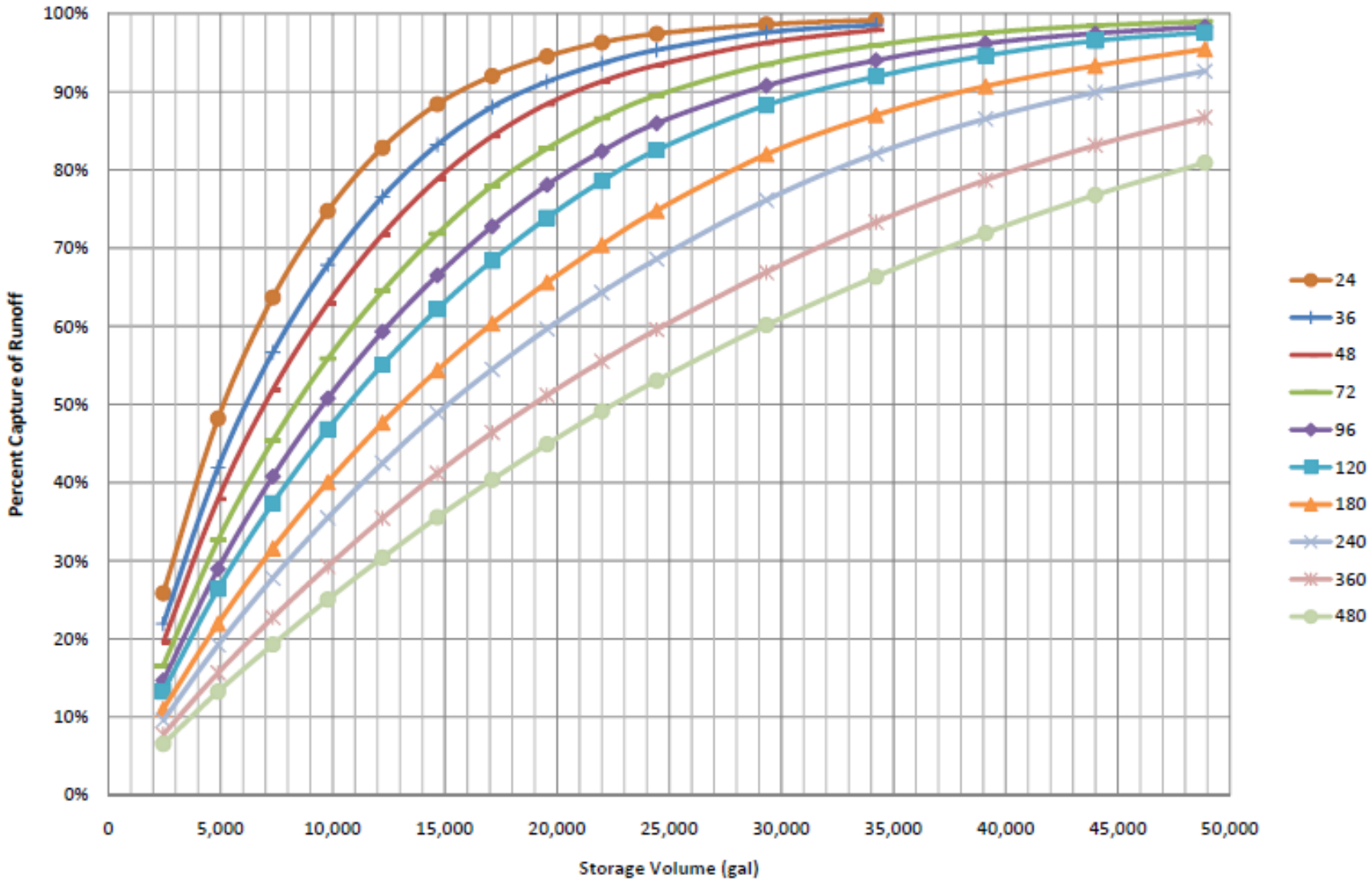
BIORETENTION CELL- WHEEL STOPS
SCALE: 1"=1'-0"

Feasibility Evaluation Process

- **Step 2.b. – Rainwater Harvesting and Use**
  - **Types of Demands**
    - Irrigation
    - Toilet flushing
    - Other non-potable (commercial/industrial)

  - **Volume based sized criteria in C.3.d is 80% capture of the annual runoff**
  - **Key concept is drawdown time**
  - **Barriers: lack of plumbing codes, treatment, recycled water preference**

Figure G-9: Percent Capture Achieved by BMP Storage Volume for Various Drawdown Times - San Jose

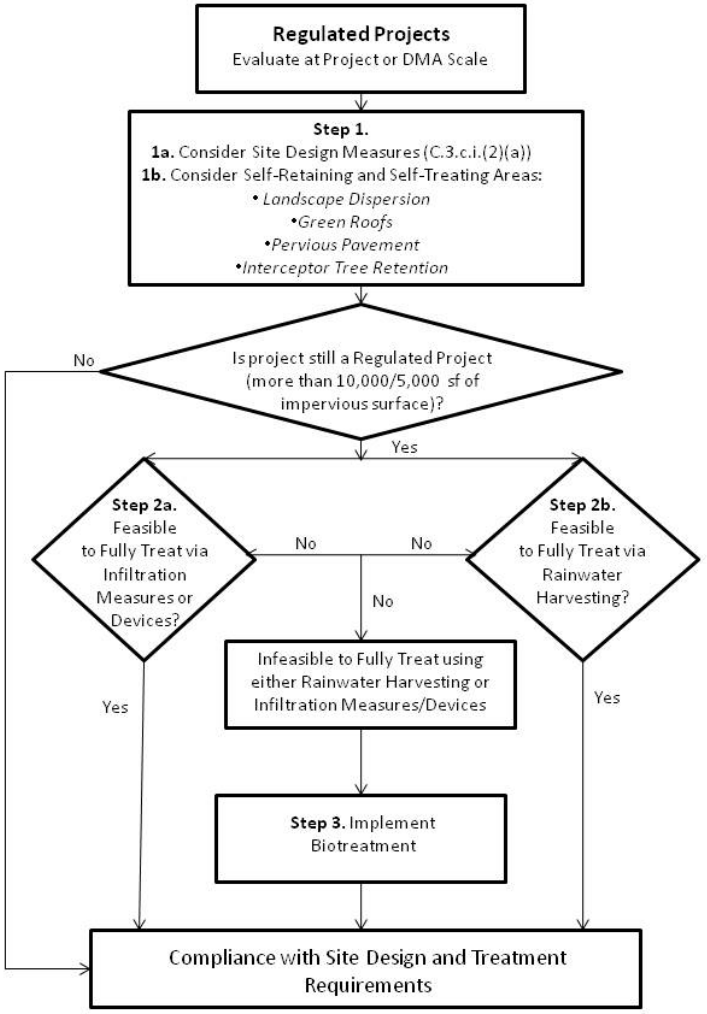


Feasibility Evaluation Process

- **Rainwater Harvesting and Use**
  - **Modeling analyses for San Jose:**
    - **To meet 80% capture for non-potable (per acre of impervious area):**
      - 15,000 gal. tank, 7,500 gpd (48 hr drawdown)
      - 48,000 gal. tank, 2,400 gpd (480 hr drawdown)
      - 2,400 gpd = 280 toilet users @ 8.6 gpd (under Green Building Code)
    - **To meet 80% capture for irrigation (per acre of impervious area):**
      - 2,400 gpd = 2.5 to 5 acres of landscaping

Feasibility Process Flow Chart

- Evaluate Feasibility at DMA or Project Scale
- Step 1: Consider site design, self-treating, self-retaining areas
- Step 2: Evaluate Infiltration and Rainwater Harvesting
- **Step 3: Implement Biotreatment**
  - Maximize Infiltration
  - Low tech, low maintenance
  - Known standards and specs
  - Institutional capacity and experience
  - Good Treatment



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Timeline

- Final Report submitted to Water Board – May 1
- Public Comment Period – until June 10
- Possible Report Revisions? – Summer
- Preparation for Implementation – Summer/Fall
- Begin Implementation – December 1, 2011

Next Steps

- **SCVURPPP will:**
  - Update C.3 Stormwater Handbook to include Feasibility Evaluation Process
  - Conduct additional workshops and outreach to municipal agencies & development community
- **Co-permittees will need to:**
  - Integrate feasibility evaluation process with development review
  - Prepare to allow/permit new approaches (e.g., green roofs, rainwater harvesting)

For More Information:

- **Municipal Regional Permit and Feasibility Criteria Report**
  www.scvurppp.org
  (Google "sf bay municipal regional permit")
- **CASQA California LID Portal**
  www.casqa.org
- **Developments Protecting Water Quality: A Guidebook of Site Design Examples**
  www.scvurppp.org
- **BASMAA Start at the Source: Design Guidance Manual for Stormwater Quality Protection**
  www.scvurppp.org