CALIFORNIA RESIDENTIAL SCENARIO

This scenario is intended to be used as a surrogate for all urban/suburban home and residential uses in the San Francisco Bay area of California (Figure 1). The area of interest (AOI) was selected based on the high degree of residential development (Figure 1) within the Red Legged frog habitat, and the generally wetter climate of the San Francisco Bay Area, relative to southern California. The intention is to couple the edge of field concentrations from this scenario with the edge of field concentrations from the impervious surface scenario for San Francisco to generate weighted concentrations for areas of varying impervious cover. Based an a 2002-2003 survey of northern California (Arcade Creek/Sacramento, Five Mile Creek Slough/Stockton, and San Francisco Bay areas), about 60% of residential pesticide uses were applied to hard surfaces such as sidewalk, walls, or foundations). Approximately 20% were applied to lawns and 20% to ornamental plantings. The remaining was applied to vegetable gardens, edible plants, or fruit trees (Flint, 2003). Approximately 83% of these were applied by the homeowners' themselves. Approximately 17% of homeowners hired an outside professional to apply the pesticides.

Crop parameters have been chosen to reflect residential turf areas, primarily lawns, within the AOI. The major species used for turfgrass in California include Bentgrass (Agrostis spp.), Kentucky bluegrass (Poa pratensis), ryegrass (Lolium spp.), tall fescue (Festuca arundinacea), fine fescues (Festuca spp.), common bermudagrass (Cynodon dactylon), kikuygrass (Pennisetum clandestinum), St. Augustinegrass (Stenotaphrum secundatum), zoysiagass (Zoysia japonica), and dichondra (Dichondra micrantha). The most common grass in residential areas includes tall fescue. Tall fescue is a cool-season grass, well adapted to sunny or partially shady areas. When densely sown, a pure stand forms a moderate to coarse-textured lawn that is uniform in appearance with good weed and disease resistance. Tall fescue tolerates warm summer temperatures and stays green during cool, but not severe winter conditions. New varieties that are finer in texture and shorter in stature are known as turf-type tall fescues and dwarf turf-type tall fescues. Tall fescue is a good species to plant for general lawn use and is the most common lawn grass in California (UCIPM, 2003). Residential Lawns are irrigated year round, even during the wet season. Northern/Central California however is implementing best management practices to reduce irrigation during the wet season (Darren Haver, personal communication).

Metfile W23234 was selected for this scenario since it is the closest metfile to San Francisco. Its data were collected in San Francisco, CA. The station is located approximately 2 meters above mean seal level (AMSL). San Francisco receives approximately 20 inches of rainfall annually with nearly 60% of the annual precipitation occurring in January, February, and March (NOAA, 2006). This station is the closest available weather station that includes data required for PRZM.

Soils were selected based on vulnerability and the extent of overlap within urban areas for central/coastal California based on land use data from the California Department of Forestry and Fire Protection (Figure 1). Urban areas are largely based on census blocks of over 500 people per sq. mile (CDF-FRAP, 2005a). The data developers indicate the coverage provides the statewide "urban footprint" from a consistent data source, useful for analyzing growth and associated impacts. The data are most useful for statewide or regional studies (CDF-FRAP, 2005a). According to data from the CDF-FRAP development footprint (CDF-FRAP, 2005b), this relates to about 1 or more housing units per 5 acres to greater than 1 housing unit per 1 acre. Based on a geospatial analysis of soils (USDA 2006a) and land use data (CDF-FRAP, 2005) for urban areas as well as conversations with local extension agents, Tierra soils were chosen to represent residential areas in the AOI (Table 5). The soils are of moderate extent and are generally located in areas within 30 miles of the coast in central and south-central California (USDA, 1997). Tierra soils are gently sloping to steep and are on dissected terraces and low hills at elevations of 100 to 1,200 feet. Slopes range from 2 to 50 percent (USDA, 1997). The geospatial analysis indicates that Tierra soils are the fourth most common D soil on which residential dwellings are located (Table 5), accounting for 2% of all soils in residential areas (USDA 2006a; CDF-FRAP, 2005a).

Three hydrologic group D soils are more common than Tierra soils (Table 5), however they were not chosen for modeling for several reasons. San Joaquin soils are located in the Sacramento valley. Based on NOAA weather data, the Sacramento valley receives several inches less precipitation than the Bay area (e.g., San Francisco). Secondly, Clear Lake soils are often found in basins and drainage ways which are not generally expected to contain residential development (USDA, 2006b. Third, Jacktone soils are significantly less erodible (USLE K = 0.24) than Tierra soils (USLE K 0.32 – 0.42).

The Tierra series represents the 90th percentile of vulnerability in drainage, and erodibility. It is found on a range of slopes, including the maximum slope of this scenario. These soils are Fine, smectitic, thermic Mollic Palexeralfs which consists of deep soils formed in alluvial materials from sedimentary rocks (USDA 1997). Tierra is a Hydrologic Group D soil which account for approximately 40% of urban soils in drainage. Tierra soils located in urban areas within the AOI have a USLE K factor of 0.32-0.43 which includes the 90th percentile of these soils in erodibility (Table 5). Corresponding slopes range from 5 to 50 percent (Table 5).

Table 1. PRZM 3.12 Climate and Time Parameters for San Francisco, CA.

Parameter	Value	Source/Comments
Starting Date	Jan. 1, 1961	Meteorological File from San Francisco, CA (W23234)
Ending Date	Dec. 31, 1990	Meteorological File from San Francisco, CA (W23234)
Pan Evaporation Factor (PFAC)	0.77	PRZM Manual Figure 5.1 (EPA 1998). Value represents much of CA coastline.
Snowmelt Factor (SFAC)	0	Snow is not expected to occur in San Francisco.
Minimum Depth of Evaporation (ANETD)	17.5	Mid point of range (15-20), PRZM Manual, Figure 5.2 (EPA 1998).

Table 2. PRZM 3.12 Erosion and Landscape Parameters for California – residential.		
Parameter	**Value**	**Source/Comments**
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	Default value.
USLE K Factor (USLEK)	0.32 tons EI^{-1}*	NRCS Soil Data Mart Database for Tierra Loam, 2-9% slopes. Alameda County, CA. (http://soildatamart.nrcs.usda.gov/). Value is representative of Tierra Loam. In one case, USLEK is 0.43, however this is representative of Tierra-Watsonville complex which is a rare soil within the Tierra group and is located on severe slopes (up to 50%) where pesticide application is unlikely.
USLE LS Factor (USLELS)	0.37	Calculated according to Haan and Barfield (1978) equation: $LS = ((\lambda/72.6)^m)((430x^2 + 30x + 0.43)/6.613)$, where λ = slope length, $x = SLP/100$ and m = constant. In this case, $\lambda = 400$ m (default value) and $m = 0.3$ (EPA 2004).
USLE P Factor (USLEP)	1	No contour plowing is expected (EPA 2004).
Field Area (AFIELD)	172 ha	Area of Shipman Reservoir watershed (EPA, 1999)
NRCS Hyetograph (IREG)	2	PRZM Manual, Figure 5.12 (EPA, 1998).
Slope (SLP)	2.5%	Lawns are generally limited to slopes where it is safe to operate mowers (0-5%). Selected as midpoint of the range. Darren Haver (USDA 2006a).
Hydraulic Length (HL)	600 m	Shipman Reservoir (PRZM Guidance, EPA, 2004)
Irrigation Flag (IRFLAG)	1	Homeowners irrigate year round. (Darren Haver, Watershed Management Advisor, UC Cooperative Extension)
Irrigation Type (IRTYP)	3 (sprinkler)	Homeowners irrigate year round. (Darren Haver, Watershed Management Advisor, UC Cooperative Extension); and Irrigation Guidance for developing PRZM Scenarios, Table 3; (EPA 2005).
Leaching Factor (FLEACH)	0.1	Irrigation Guidance for developing PRZM Scenario, Table 3; (June 15, 2005).
Fraction of Water Capacity when Irrigation is Applied (PCDEPL)	0.5	Residential irrigation is highly variable in California. People usually irrigate even when not necessary (D. Haver, Watershed Management Advisor, UC Cooperative Extension). Set to default as per Irrigation Guidance for developing PRZM Scenario, Table 3; (EPA 2005).
Maximum Rate at which Irrigation is Applied (RATEAP)	0.1 cm hr^{-1}	Residential irrigation is highly variable in California. People usually irrigate even when not necessary (D. Haver, Watershed Management Advisor, UC Cooperative Extension). Set to default as per Irrigation Guidance for developing PRZM Scenario, Table 3; (EPA 2005).
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for California – residential.		
Parameter	**Value**	**Source/Comments**
Initial Crop (INICRP)	1	Default value
Initial Surface Condition (ISCOND)	2	2 = cover crop. Turf is overseeded (Cover crops) to keep turf green when grass goes dormant. (Darren Haver, Watershed Management Advisor, UC Cooperative Extension)
Number of Different Crops (NDC)	1	Set to number of crops in simulation. Default value.
Number of Cropping Periods (NCPDS)	30	Set to weather data in meteorological file: San Francisco, CA (W23234)
Maximum rainfall interception storage of crop (CINTCP)	0.15	Expected to be in the range of highly managed turf (0.10 as cited in PA turf and FL turf scenarios) and non-managed grasses (0.20 as cited in Dunne and Leopold, 1978).
Maximum Active Root Depth (AMXDR)	25 cm	Tall fescue (the most common grass) can root as deep as 8-10 inches. (Darren Haver, Watershed Management Advisor, UC Cooperative Extension)
Maximum Canopy Coverage (COVMAX)	100%	Assumes complete turf grass coverage for lawns. (Darren Haver, Watershed Management Advisor, UC Cooperative Extension)
Soil Surface Condition After Harvest (ICNAH)	2	2 = cover crop. Turf is overseeded (Cover crops) to keep turf green when grass goes dormant. (Darren Haver, Watershed Management Advisor, UC Cooperative Extension)
Date of Crop Emergence (EMD, EMM, IYREM)	1/1/1961	Grasses generally emerge in late fall, beginning in September. Grass generally stops growing in late July. (Darren Haver, Watershed Management Advisor, UC Cooperative Extension) This scenario was modeled as year round coverage.
Date of Crop Maturity (MAD, MAM, IYRMAT)	1/2/1961	
Date of Crop Harvest (HAD, HAM, IYRHAR)	31/12/1961	
Maximum Dry Weight (WFMAX)	0.0	Not used in scenario.
Maximum Canopy Height (HTMAX)	7.6 cm	(Darren Haver, Watershed Management Advisor, UC Cooperative Extension)
SCS Curve Number (CN)	83, 83, 83	TR-55 (Table 2-2a). Composite CN for ¼ acre residential lot assuming 38% average impervious area. Assumes year round turf (lawn) coverage with pervious curve number = 74. (USDA, 1986).
Manning's N Value (MNGN)	0.110	RUSLE Project; C21PCPCN for Sacramento Pasture, cool season with no till (USDA, 2000a). Data are from Sacramento, which is the closest RUSLE file with similar crop practices.
USLE C Factor (USLEC)	0.001	RUSLE Project; C21PCPCN for Sacramento Pasture, cool season with no till (USDA, 2000a). Data are from Sacramento, which is the closest RUSLE file with similar crop practices.

Table 4. PRZM 3.12 "Tierra-Watsonville Complex" Soil Parameters for California - residential.

Parameter	Value	Source/Comments
Total Soil Depth (CORED)	182 cm	Tierra Loam, Alameda County, CA. NRCS Soil Data Mart Database (http://soildatamart.nrcs.usda.gov/). Includes 2 cm Thatch layer.
Number of Horizons (NHORIZ)	5	PRZM Scenario Guidance (2004).
Horizon Thickness (THKNS)	2 cm (HORIZN =1) 10 cm (HORIZN =2) 54 cm (HORIZN =3) 86 cm (HORIZN =4) 30 cm (HORIZN =5)	According to an extension agent (D. Haver), residential areas reside on a variety of soils.
Bulk Density (BD)	0.37 g/cm3 (HORIZN = 1) 1.5 g/cm3 (HORIZN =2) 1.5 g/cm3 (HORIZN =3) 1.45 g/cm3 (HORIZN =4) 1.43 g/cm3 (HORIZN =5)	Top horizon split in two and thatch layer added as HORIZN 1. Soil parameters of HORIZN 1 according to EPA guidance on development of turf scenario, which is appropriate for modeling residential lawns.
Initial Water Content (THETO)	0.47 cm3/cm3 (HORIZN =1) 0.309 cm3/cm3 (HORIZN =2) 0.309 cm3/cm3 (HORIZN =3) 0.372 cm3/cm3 (HORIZN =4) 0.309 cm3/cm3 (HORIZN =5)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN = 2) 3 cm (HORIZN = 3) 2 cm (HORIZN = 4) 4 cm (HORIZN = 5)	
Field Capacity (THEFC)	0.47 cm3/cm3 (HORIZN =1) 0.309 cm3/cm3 (HORIZN =2) 0.309 cm3/cm3 (HORIZN =3) 0.372 cm3/cm3 (HORIZN =4) 0.309 cm3/cm3 (HORIZN =5)	
Wilting Point (THEWP)	0.27 cm3/cm3 (HORIZN =1) 0.167 cm3/cm3 (HORIZN =2) 0.167 cm3/cm3 (HORIZN =3) 0.289 cm3/cm3 (HORIZN =4) 0.175 cm3/cm3 (HORIZN =5)	
Organic Carbon Content (OC)	35.6 % (HORIZN = 1) 1.74 % (HORIZN =2) 1.74 % (HORIZN =3) 0.15 % (HORIZN =4) 0.15 % (HORIZN =5)	OC% set according to EPA guidance on development of turf scenario, which is appropriate for modeling residential lawns.

Table 5. Soils co-located with residential areas within the AOI* based on USDA 2006a soils data and CDF-FRAP, 2005 “urban areas” classification. Only soils occupying 0.5 percent or more are shown.								
SOIL	Acres	% Area	Slope	Drainage	Erodibility	% Sand	% Silt	% Clay
SAN JOAQUIN	55,651	5.6%	1 - 8	D	0.32 - 0.37	26.5 - 68.8	16.2 - 53.5	15 - 20
CLEAR LAKE	55,448	5.6%	1 - 9	D	0.17 - 0.32	10 - 63.1	19.4 - 40	17.5 - 50
HANFORD	30,657	3.1%	1 - 15	B	0.32	63.8 - 70.9	16.6 - 23.7	12.5
LOS OSOS	29,901	3.0%	15 - 75	C	0.28 - 0.49	20 - 39.2	33.6 - 52	23.5 - 31
TOCALOMA	25,212	2.5%	30 - 75	C	0.37	41.4	37.1	21.5
YOLO	22,256	2.2%	2 - 10	B	0.28 - 0.49	6.7 - 67.4	19.1 - 67.7	13 - 31
JACKTONE	21,439	2.2%	2 - 2	D	0.24	22.1	27.9	50
TIERRA	20,086	2.0%	5 - 50	D	0.32 - 0.43	41.6 - 65.9	19.1 - 37.4	15 - 21
DIABLO	19,948	2.0%	9 - 60	D	0.17 - 0.24	22.1 - 26.1	27.9 - 29.2	45 - 50
ORTHENTS	19,878	2.0%	2 - 75	B	-	-	-	-
DIBBLE	18,998	1.9%	9 - 50	C	0.28 - 0.37	18.1 - 39.2	37.3 - 50.9	23.5 - 31
CAPAY	18,913	1.9%	2 - 9	D	0.17 - 0.37	18.5 - 28.1	27.9 - 44	37.5 - 50
RINCON	17,363	1.8%	2 - 15	C	0.24 - 0.37	33.5 - 39.2	33.6 - 37.3	23.5 - 31
XERORTHENTS	17,197	1.7%	2 - 99	D	0.2 - 0.55	23.3 - 83	9 - 29.2	8 - 47.5
FIDDYMENT	16,908	1.7%	1 - 15	D	0.37 - 0.43	44.8 - 69.6	16.4 - 41.2	14
DANVILLE	16,627	1.7%	2 - 10	C	0.2 - 0.32	20 - 38.5	33.6 - 49	25 - 31
DELHI	15,457	1.6%	2 - 9	A	0.15 - 0.24	80.5 - 96.8	0.7 - 17	2.5
BOTELLA	15,383	1.6%	2 - 9	B	0.2 - 0.28	34.2 - 41.6	33.6 - 37.4	21 - 31
ZAMORA	13,262	1.3%	2 - 5	B	0.24 - 0.49	6 - 37.4	42.6 - 68.6	20 - 35
ANDREGG	13,005	1.3%	8 - 50	B	0.24 - 0.32	68.3	19.2	12.5
ALTAMONT	11,973	1.2%	9 - 75	D	0.2 - 0.24	22.1 - 23.3	27.9 - 29.2	47.5 - 50
PLEASANTON	11,355	1.1%	2 - 15	B	0.32 - 0.37	34.2 - 43	37.3 - 38.5	18.5 - 28.5
LODO	10,789	1.1%	30 - 75	D	0.24 - 0.37	35.4 - 39.8	33.6 - 37.7	22.5 - 31
COMETA	10,757	1.1%	5 - 5	D	0.37	65.9	19.1	15
MILLSHOLM	10,514	1.1%	30 - 75	D	0.28 - 0.55	24.5 - 39.2	37.3 - 52	23.5
SYCAMORE	10,513	1.1%	2 - 2	C/B	0.32 - 0.49	6.7 - 11.3	62.3 - 67.7	21 - 31
DINUBA	9,443	1.0%	1 - 1	C	0.37 - 0.43	66 - 67.7	21.3 - 23	11
XERARENTS	9,394	0.9%	1 - 15	-	-	-	-	-
WATSONVILLE	9,180	0.9%	2 - 30	D	0.37	43	38.5	18.5
TUJUNGA	8,667	0.9%	2 - 5	A	0.15 - 0.2	80.5 - 96.8	0.7 - 17	2.5
WRIGHT	8,653	0.9%	2 - 9	C/D	0.37	43	39.5	17.5
STOCKTON	8,629	0.9%	2 - 2	D	0.24 - 0.37	18.1 - 68.1	14.4 - 50.9	17.5 - 47.5
TOKAY	8,509	0.9%	2 - 2	B	0.32	70.9	16.6	12.5
AUBURN	8,333	0.8%	15 - 70	C/D	0.37	27.1 - 43	38.5 - 54.4	18.5
GALT	8,231	0.8%	1 - 5	D	0.24	22.1	27.9	50
ANTIOCH	7,769	0.8%	2 - 9	D	0.37	42.1	37.9	20
LOS GATOS	7,718	0.8%	30 - 75	C	0.24 - 0.37	39.2 - 39.8	37.3 - 37.7	22.5 - 23.5
HUICHICA	7,647	0.8%	2 - 9	C/D	0.37	42.1	37.9	20
CROPLEY	6,848	0.7%	2 - 9	D	0.2 - 0.28	5.3 - 22.1	27.9 - 44.7	50
POSITAS	6,617	0.7%	2 - 60	D	0.37	42.1	37.9	20
BRENTWOOD	6,548	0.7%	2 - 9	B	0.28	34.2	32.3	33.5
CONEJO	6,532	0.7%	2 - 9	C/B	0.2 - 0.28	35.4 - 39.2	33.6 - 37.3	23.5 - 31
GOLDRIDGE	6,403	0.6%	9 - 50	B	0.28	68.8	16.2	15
HAIRE	6,181	0.6%	2 - 30	C	0.32 - 0.43	34.2 - 68.8	16.2 - 37.3	15 - 33.5

MAYMEN	6,057	0.6%	50 - 75	D	0.24 - 0.32	43 - 65.9	19.1 - 39.5	15 - 17.5
BAYWOOD	6,025	0.6%	2 - 50	A	0.15 - 0.24	81.1	16.4	2.5
REYES	5,796	0.6%	1 - 2	D	0.17 - 0.28	5.3 - 23.3	27.9 - 47.7	35 - 50
BARNABE	5,698	0.6%	75 - 75	D	0.28	65.1	18.9	16
ALO	5,695	0.6%	30 - 75	D	0.2	23.3	29.2	47.5
ELKHORN	5,541	0.6%	2 - 50	B	0.2	65.9	19.1	15

* See text for Area of Interest description.

- Values are for individual map unit areas intersecting the urban areas footprint. Table excludes STATSGO map units classified as water, generic urban land, pits, dumps, cut and fill, dams, dunes, beaches, and rock land.
- Erodibility, sand, silt, and clay values are “representative” values from STATSGO.

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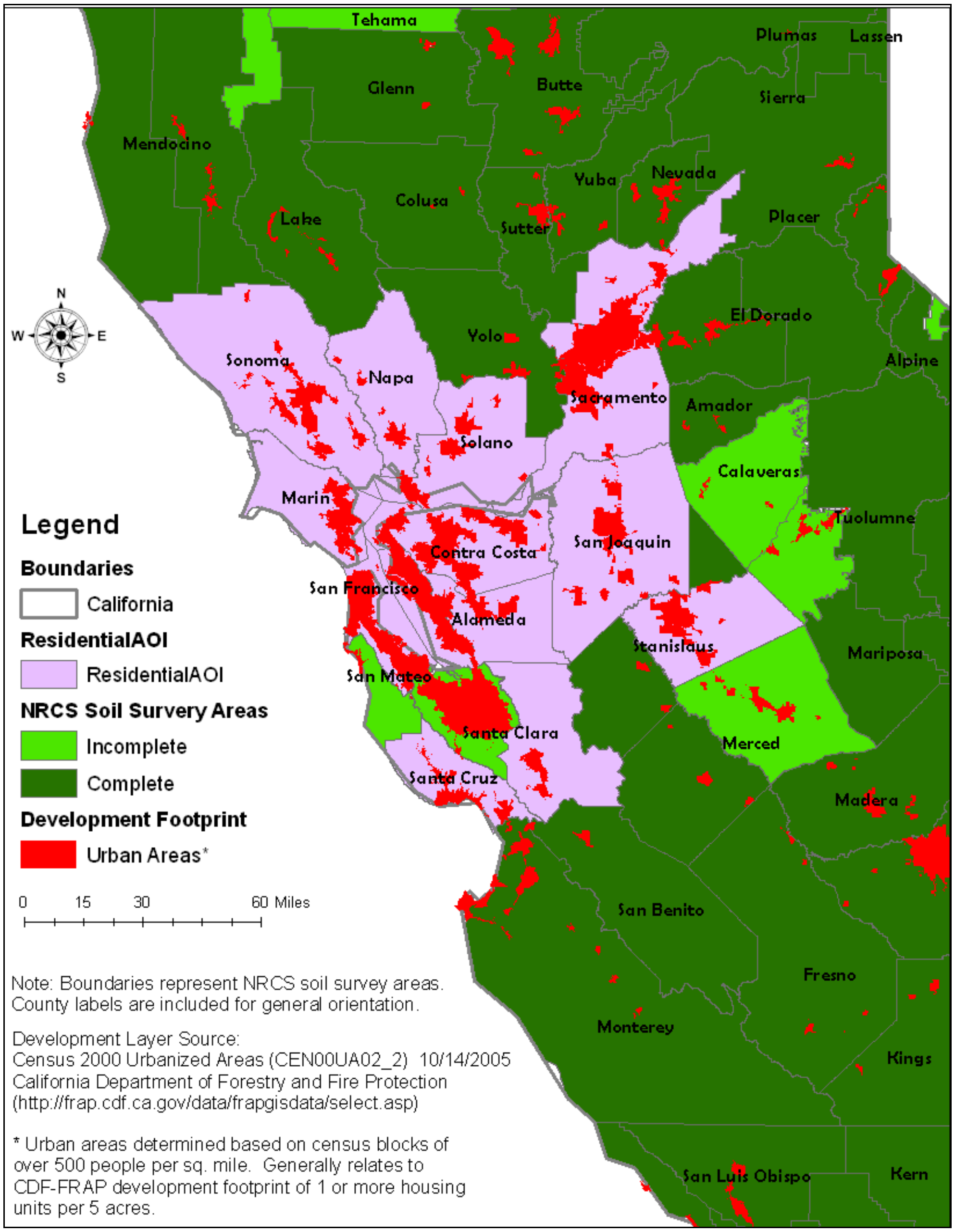

Figure 1. Residential scenario Area of Interest (AOI) including medium to high density development and NRCS soil spatial data availability as of December 2006.