Barton Springs Right-of-Way

This scenario is intended to represent right-of-way areas including roads, fence lines, power lines, and railroads in the Barton Springs Segment (BSS) of the Edwards Aquifer. Unlike most of EFED existing scenarios, the scenario is conceptually different in that it represents a linear surface that drains into an adjacent water body (drainage ditch). However, for this exercise, EFED assumes that while conceptually different, the scenario is for practicality purposes developed in a similar manner as a standard scenario that assumes a 10 hectare field draining into a 1 hectare static pond.

Crop cover parameters for this scenario were based on typical plants found adjacent to state maintained highway right-of ways. State-maintained highways include farm-to-market (FM) roads, state highways, interstates, and US highways. Bermuda grass is typically found in right-of-way areas in urban areas, while rural areas are dominated by native species such as little bluestem, side-oats grama, and hairy grama (John Mason, Vegetation Management Specialist, Texas DOT, Maintenance Div., personal communication).

Soils were chosen based on co-location with right-of-way areas based on land use coverage developed by the City of Austin (City of Austin 2003). The land use data set includes roads, utilities, and railroads, but does not include fence lines. Based on a geospatial analysis of right-of-way land uses (City of Austin 2003) and USDA soils data (USDA 2006), Brackett soils were chosen to represent right-of-way areas in the BSS (Table 5). Brackett soils are found in both the contributing and recharge zones of the Edwards Aquifer and are the most common soil on which right-of-way areas are located, accounting for 32% of soils in right-of-way areas (USDA 2006; City of Austin 2003). The Brackett series is loamy, carbonatic, thermic, shallow Typic Haplustepts. This soil consists of very shallow to shallow soils over bedrock. These well drained and moderately permeable soils formed in residuum over chalky limestone bedrock (Soil Survey Staff 2006).

The Brackett series was selected for this scenario because it is both highly representative of right-of-way areas in the BSS and because it represents the 90th percentile of vulnerability in drainage, erodibility, and slope. Brackett is a Hydrologic Group C soil with a USLE K factor of 0.37 which includes the 90th percentile of these soils in erodibility (Table 5). The relatively low organic matter content is also expected to result in lower microbial activity and thus reduced potential for pesticide degradation. Slopes range from 1 to 60 percent (Soil Survey Staff, 2006). Since the most typical range for the Brackett series in right-of-way areas is 1-12 %, comprising 17% of all soils in right-of-way areas in BSS (USDA 2006; City of Austin 2003), soil data available for "Brackett-Rock Outcrop Complex," slopes 1-12% were used to represent the soil profile of this scenario (Table 4).

The meteorological station selected for this scenario is located in Austin, Texas. This station is the closest available weather station that includes data required for PRZM.

Table 1. PRZM 3.12 Climate and Time Parameters for Barton Springs, TX.		
Parameter	**Value**	**Source/Comments**
Starting Date	Jan. 1, 1961	Meteorological File from Austin, TX (W13958)
Ending Date	Dec. 31, 1990	Meteorological File from Austin, TX (W13958)
Pan Evaporation Factor (PFAC)	0.69	PRZM Manual Figure 5.1 (EPA 1998).
Snowmelt Factor (SFAC)	0.36	PRZM Manual, Table 5.1 (EPA 1998).
Minimum Depth of Evaporation (ANETD)	25	Mid point of range (20-30), PRZM Manual, Figure 5.2 (EPA 1998).

Table 2. PRZM 3.12 Erosion and Landscape Parameters for Barton Springs – right-of-way.		
Parameter	**Value**	**Source/Comments**
Method to Calculate Erosion (ERFLAG)	4 (MUSS)	Default value.
USLE K Factor (USLEK)	0.37 tons EI^{-1}*	Brackett-Rock outcrop-complex, 1-12% slopes, Travis County, TX. NRCS Soil Data Mart Database (http://soildatamart.nrcs.usda.gov/).
USLE LS Factor (USLELS)	1.34	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, λ = 400 m (default value) and m = 0.5 (EPA 2004).
USLE P Factor (USLEP)	1	No contour plowing is expected (EPA 2004).
Field Area (AFIELD)	10 ha	Default drainage area for standard ecological pond (EPA, 2004)
NRCS Hyetograph (IREG)	4	PRZM Manual, Figure 5.12 (EPA, 1998).
Slope (SLP)	6 %	Brackett-Rock Outcrop-Complex slope range 1-60% (USDA 2006). Default value for field crops (e.g. hay, alfalfa) when the maximum of the slope range >12% (EPA 2004).
Hydraulic Length (HL)	356 m	Default value for standard ecological pond (EPA, 2004)
Irrigation Flag (IRFLAG)	0	Irrigation not applicable to right-of-way areas.
* EI = 100 ft-tons * in/ acre*hr		

Table 3. PRZM 3.12 Crop Parameters for Barton Springs – right-of-way.		
Parameter	**Value**	**Source/Comments**
Initial Crop (INICRP)	1	Default value
Initial Surface Condition (ISCOND)	3	Set similar to rangeland conditions (Cris Perez, NRCS - District Conservationist, 3-16-06, Phone: 512-392-4050 x3)
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: Austin, TX (W13958).
Maximum rainfall interception storage of crop (CINTCP)	0.2	Representative of grasses that can intercept as much as 20% of gross precipitation during individual storms (Dunne and Leopold, 1978).
Maximum Active Root Depth (AMXDR)	43 cm	Cris Perez, NRCS - District Conservationist; Date: 3-16-06, Phone: 512-392-4050 x3 Root depth depends upon the soil depth. Can grow as deep as 3-4'. Therefore, this value set to CORED.
Maximum Canopy Coverage (COVMAX)	97%	Cris Perez, NRCS - District Conservationist Date: 3-16-06, Phone: 512-392-4050 x3
Soil Surface Condition After Harvest (ICNAH)	3	Set similar to rangeland conditions (Cris Perez, NRCS - District Conservationist, 3-16-06, Phone: 512-392-4050 x3)
Date of Crop Emergence (EMD, EMM, IYREM)	01/03/61	Cris Perez, NRCS - District Conservationist Date: 3-16-06, Phone: 512-392-4050 x3 Natural herbaceous plants emerge from late February-March. They mature mid June. Plants go dormant after the first frost, which occurs in November.
Date of Crop Maturity (MAD, MAM, IYRMAT)	15/06/61	
Date of Crop Harvest (HAD, HAM, IYRHAR)	15/11/61	
Maximum Dry Weight (WFMAX)	0.0	Not used in scenario.
Maximum Canopy Height (HTMAX)	122 cm	From BS rangeland/pasture scenario. Native grasses are expected to be present on right-of-way areas. Little bluestem is a typical grass for Brackett soils (USDA 2006).
SCS Curve Number (CN)	92, 92, 92	TR-55 (Table 2-2a). CN for paved; open ditches (including right-of-way).
Manning's N Value (MNGN)	0.110	San Antonio Pasture, warm season (I93PWPWN). This file incorporates no tillage and has a cover code representing first year grass, pasture or hay crops (2). Similar to TR-55 (Table 3-3) for short grass surface condition.
USLE C Factor (USLEC)	0.004	San Antonio Pasture, warm season (I93PWPWN).

Table 4. PRZM 3.12 "Brackett-Rock Outcrop-Complex" Soil Parameters for Barton Springs, TX – right-of-way.		
Parameter	**Value**	**Source/Comments**
Total Soil Depth (CORED)	46 cm	Brackett-Rock outcrop-complex, 1-12% slopes, Travis County, TX. NRCS Soil Data Mart Database (http://soildatamart.nrcs.usda.gov/).
Number of Horizons (NHORIZ)	3	Top horizon split in two and thatch layer added as HORIZN 1.
Horizon Thickness (THKNS)	10 cm (HORIZN =1) 5 cm (HORIZN =2) 31 cm (HORIZN =3)	Additional data were listed for a 4th HORIZN. However, these were not included in this soil profile since the 4th HORIZN is composed of bedrock.
Bulk Density (BD)	1.4 g/cm3 (HORIZN =1) 1.4 g/cm3 (HORIZN =2) 1.43 g/cm3 (HORIZN =3)	
Initial Water Content (THETO)	0.28 cm3/cm3 (HORIZN =1) 0.28 cm3/cm3 (HORIZN =2) 0.252 cm3/cm3 (HORIZN =3)	
Compartment Thickness (DPN)	0.1 cm (HORIZN = 1) 5 cm (HORIZN = 2) 1 cm (HORIZN = 3)	PRZM Scenario Guidance (2004).
Field Capacity (THEFC)	0.28 cm3/cm3 (HORIZN =1) 0.28 cm3/cm3 (HORIZN =2) 0.252 cm3/cm3 (HORIZN =3)	
Wilting Point (THEWP)	0.164 cm3/cm3 (HORIZN =1) 0.164 cm3/cm3 (HORIZN =2) 0.145 cm3/cm3 (HORIZN =3)	
Organic Carbon Content (OC)	1.16 % (HORIZN =1) 1.16 % (HORIZN =2) 0.73 % (HORIZN =3)	Adjusted using the relationship % OC = % Organic Matter/1.724 (Doucette 2000).

Table 5. Soils co-located with right-of-way areas in the Barton Spring Segment based on USDA 2006 soils data and COA 2003 land use data.										
Soil	**Total Acreage**	**Area**	**Drainage Class**	**Slope (%)**	**KF**	**pH**	**OM (%)**	**Sand (%)**	**Silt (%)**	**Clay (%)**
Brackett	3,531	32%	C	1 - 60	0.37	8	2	34	37 - 38	28 - 30
Speck	1,444	13%	D	1 - 5	0.32	7	2	34	37	30
Tarrant	1,417	13%	D	0 - 50	0.32	8	5	22	28	50
Real	430	4%	D	1 - 8	0.28	8	6	36	34	31
Crawford	408	4%	D	0 - 2	0.32	7	2	22	28	50
Urban land	398	4%	D	0 - 8	0.00					
Comfort	388	4%	D	1 - 8	0.32	8	6	28	29	43
Rumple	355	3%	C	1 - 8	0.32	7	2	34	37	30
Volente	355	3%	C	1 - 8	0.32	8	3	7 - 30	32 - 54	39
Doss	243	2%	D	1 - 5	0.32	8	2	7	49	44
Eddy	231	2%	C	1 - 6	0.32	8	1	38	36	26
San Saba	225	2%	D	0 - 2	0.32	8	3	18	29	53
Denton	212	2%	D	1 - 5	0.32	8	3	6	48	46
Purves	160	1%	D	1 - 5	0.32	8	3	6 - 23	29 - 47	48
Austin	151	1%	C	1 - 6	0.32	8	3	7	48	45
Krum	133	1%	D	0 - 5	0.32	8	2	26	29	45
Heiden	124	1%	D	1 - 8	0.32	8	3	22	28	50
Houston Black	111	1%	D	0 - 8	0.32	8	3	17	28	55
Bolar	94	1%	C	1 - 3	0.32	8	2	34	37	30
Sunev	69	1%	B	0 - 3	0.32	8	2	18 - 34	37 - 52	30
Tarpley	61	1%	D	1 - 3	0.32	7	3	30	30	40
Castephen	60	1%	C	1 - 5	0.32	8	2	19 - 34	32 - 48	34
Gruene	57	1%	D	1 - 5	0.28	8	2	28	29	43
Alluvial land	51	0%	A	0 - 1	0.15	8	1	90	0	5
Medlin	48	0%	D	1 - 20	0.32	8	2	22	28	50
Lewisville	44	0%	B	0 - 3	0.32	8	2	8	51	41
Ferris	35	0%	D	8 - 20	0.32	8	1	18	29	53
Patrick	26	0%	B	1 - 10	0.32	8	2	28	29	43
Anhalt	25	0%	D	1 - 3	0.32	7	3	26	29	45
Branyon	25	0%	D	0 - 3	0.32	8	3	22	28	50
Orif	12	0%	A	0 - 1	0.28	8	2	82	9	9
Oakalla	10	0%	B	0 - 2	0.32	8	4	18 - 34	32 - 48	34
Eckrant	9	0%	D	8 - 40	0.32	8	7	22	28	50
Hardeman	9	0%	B	3 - 12	0.24	8	1	66	20	14
Pits	7	0%	D	5 - 40	0.00	7	0	0	0	0
Bergstrom	4	0%	B	0 - 2	0.32	8	2	7	62	31
Tinn	4	0%	D	0 - 1	0.32	8	3	22	28	50
Altoga	2	0%	C	1 - 8	0.32	8	1	7	48	45
Travis	2	0%	C	1 - 8	0.24	7	1	66	19	15
Whitewright	1	0%	C	1 - 5	0.32	8	1	31	33	37
Seawillow	1	0%	B	1 - 8	0.32	8	1	35	34	31
Gaddy	0	0%	A	0 - 1	0.17	8	0	84	7	10

Sensitive Parameter Uncertainties

Curve Number: The right-of-way use contains a wide range of uses including roads, railroads, utilities, and fencelines. As such, the fraction of impervious surfaces in each of the specific uses will vary widely. Curve numbers were set to TR-55 (Table 2-2a for paved; open ditches (including right-of-way) since a) data was obtained that indicate herbicides are applied to roads and b) impervious curve numbers will produce a high end runoff for this use (impervious areas in road right-of-ways are expected to dominate the runoff processes. This value may need to be refined depending on the particular use to be modeld (e.g. roads versus fencelines). An alternative approach for fencelines and more pervious type right-of-ways may be to use the rangelenad scenario.

Pesticide Application: According to Texas Department of Transportation (TX DOT), Vegetation Manager Dennis Markwardt, the TX DOT applies herbicides only (no insecticides) to all of its state roadways. They only apply herbicide to a one foot wide area along the roadway, not the entire right-of-way. They also limit the use of herbicides within the BSZ to mainly Round-Up, and to a more limited extent, Oust, OutRider and Escort. Occasionally they will need to apply spot treatment to noxious weeds.

According to Travis County Transportation and Natural Resources, Road and Bridge Division Maintenance Manager, Don Ward, Travis County applies herbicide only to their rural roads where there is no curbing gutter. They apply only Round-Up and apply it to a four foot wide area along the roadway approximately two times per year. Scott Lambert provided us with a GIS layer of the Travis County roads where herbicide may be applied.

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