APPENDIX A – ATTACHMENT 3

Contaminant Category Scoring System

A numerical rating scheme for each susceptibility model was developed by the USGS, in consultation with DEP. When each model was applied to a well or intake, a rating score was generated. The Safe Drinking Water Maximum Contaminant Levels (MCLs) were used to guide the division between the three susceptibility ratings of high, medium, and low. A low susceptibility rating means a potential contaminant level was predicted to be less than 10 percent of the MCL for that contaminant. A medium rating was assigned where the contaminant level was predicted to be equal to or greater than 10 percent and less than 50 percent of the MCL. A high rating was assigned in cases where the potential contaminant level was predicted to be equal to or greater than 50 percent of the MCL. For the list of New Jersey primary and secondary drinking water standards, containing the MCLs, please refer to http://www.state.nj.us/dep/watersupply/standard.htm.

The tables below illustrate how the rating score was determined for a water-supply source. This document is divided into surface water and ground water sections and provides a table(s) for each of the contaminant categories. Using these rating score tables and the Individual Explanatory Variable Inventory, Appendix A–Attachment 1, the susceptibility rating score was determined for each water supply source. This rating score value, was then converted into a high, medium, or low susceptibility rating. The susceptibility rating score conversions are provided at the top of each table. For more information please refer to the Contaminant Group Reports, Appendix B-Attachments 5 and 6.

Surface Water

Surface Water Nutrients

Nitrate

Susceptibility rating scheme for nitrates in water from surface-water-quality sites. Nitrate Rating: 0-2 Low, 3-6 Medium, 7-15 High							
	Sensitivity Points						**Conceptual variable**
Variable	No sensitivity variables for nitrate for surface water.						
	Intensity Points						**Conceptual variable**
Variable	0	1	2	3	4	5	
Percent Urban Land, 1995	0	>0	≥10	≥30			No
Percent Agricultural Land, 1995	0	>0	≥10	≥20	≥30	≥50	No
Sewage Treatment Plant Density (per square mile)	0	>0	≥0.01	≥0.03	≥0.04	≥0.05	No

Surface Water Pesticides

Susceptibility rating scheme for pesticides in water from surface-water-quality sites. Pesticide Rating: 0-6.5 Low, 7-9.5 Medium, 10-12 High							
	Sensitivity Points						**Conceptual variable**
Variable	0	1	2	3	4	5	
Average Percent Soil Clay	0-5	>5-10	>10-14	>14-17	>17-20	>20	No
	Intensity Points						**Conceptual variable**
Variable	0	0.5	1	1.5	2	2.5	
Total Pesticide Application (lbs.)	0-20	>20-100	>100-200	>200-500	>500-1,500	>1,500	No
Percent Residential Land, 1995	0-2.5	>2.5-5	>5-10	>10-15	>15-20	>20	No
Distance to Agricultural Land, 1995 (ft)	>10,000		>1,000-10,000		0-1,000		No

Surface Water Volatile Organic Compounds

Susceptibility rating scheme for VOCs in water from surface-water-quality sites. VOC Rating: 0-4 Low, 5-6 Medium, 7-8 High				
	Sensitivity Points			**Conceptual Variable**
Variable	1	2	3	
Average Percent Soil Organic Matter	>8	>1.5 - ≤8	≤1.5	Yes[1]
	Intensity Points			**Conceptual Variable**
Variable	1	2	3	
Percent Urban Land, 1995	>0 - ≤10	>10 - ≤70	>70	No
Density of KCSL, SWL, NJPDES SW/Storm, and Class C [2]	≤5.5	>5.5		No

[1] This conceptual variable improves the model, shows a graphical relation, and is supported by previous scientific investigations.
[2] Known Contaminant Sites (KCSL), Solid Waste Landfills (SWL), New Jersey Pollutant Discharge Elimination System Sites Surface and Storm Water Permits (NJPDES SW/Storm), and Compost Facilities (Class C).

Surface Water Inorganics

Arsenic

Susceptibility rating scheme for arsenic in water from surface-water-quality sites. Arsenic Rating: 0-4 Low, 5-11 Medium, 12-14 High						
	Sensitivity Points					**Conceptual Variable**
Variable	1	2	3	4	5	
pH of Water-Quality Sample	≤5		>5 - ≤7		>7	No
Physiographic Province	Coastal Plain	Valley & Ridge	Highlands	Piedmont		Yes[1]
New Jersey Water Region			Lower Delaware			No
	Intensity Points					**Conceptual Variable**
Variable	1	2	3	4	5	
Distance to Agricultural Land, 1995 (ft)	>20,000		>5,000 - ≤20,000		≤5,000	Yes[1]

[1] This conceptual variable improves the model, shows a graphical relation, and is supported by previous scientific investigations.

Lead

Susceptibility rating scheme for lead in water from surface-water-quality sites. Lead Rating; 0-6 Low, 7-13 Medium, 14-17 High						
	Sensitivity Points					**Conceptual Variable**
Variable	1	2	3	4	5	
Average Percent Soil Organic Matter	>5		>2 - ≤5		≤2	Yes[1]
Physiographic Province	Valley & Ridge	Piedmont	Coastal Plain	Highlands		Yes[1]
	Intensity Points					**Conceptual Variable**
Variable	1	2	3	4	5	
Percent Urban Land, 1995	>0 - ≤5		>5 - ≤75		>75	No
Density of KCSL, SWL, NJPDES GW, SWRRF, SWTF200011, Class B, DPCC, UST[2]	>0 - ≤2.5		>2.5 - ≤50		>50	No

[1] This conceptual variable improves the model, shows a graphical relation, and is supported by previous scientific investigations.

[2] Known Contaminated Sites (KCSL), Solid Waste Landfills (SWL), New Jersey Pollutant Discharge Elimination System Sites Ground Water Permits (NJPDES GW), Resource Recover Facilities (SWRRF), Transfer Facilities (SWTF200011), Class B Recycling Facilities (Class B), Discharge Prevention Containment and Countermeasures Facilities (DPCC), Underground Storage Tanks (UST)

Fluoride

Susceptibility rating scheme for fluoride in water from surface-water-quality sites. Fluoride Rating: 0-14 Low, 15-17 Medium						
	Sensitivity Points					**Conceptual Variables**
Variable	1	2	3	4	5	
Average Percent Soil Organic Matter	>8		>4 - ≤8		≤4	Yes[1]
	Intensity Points					**Conceptual Variables**
Variable	1	2	3	4	5	
Percent Developed Land, 1995	>0 - ≤20		>20 - ≤45		>45	Yes[1]
Percent Commercial-Industrial Land, 1995	>0 - ≤5		>5 - ≤30		>30	Yes[1]
Density of NJPDES SW/Storm and Class C[2]	>0 - ≤0.1	>0.1				No

[1] This conceptual variable improves the model, shows a graphical relation, and is supported by previous scientific investigations.

[2] New Jersey Pollutant Discharge Elimination System Sites Surface Water and Storm Water Permits (NJPDES SW/Storm) and Class C Compost Facilities (Class C)

Surface Water Disinfection Byproduct Precursors -Conceptual

Susceptibility rating scheme for DBP precursors in water from surface-water-quality sites. DBP Precursor Rating: 0 Low, 1-4 High			
	Sensitivity Points		**Conceptual Variable**
Variable	1	2	
Average Percent Soil Organic Matter	≤ 1	>1	Yes[1]
	Intensity Points		**Conceptual Variable**
Variable	1	2	
Distance to Wetlands, 1995	> 3,000	≤ 3,000	Yes[1]

[1] This conceptual variable improves the model, shows a graphical relation, and is supported by scientific investigations.

Ground Water

Ground Water Pathogens

Coliform

Susceptibility rating scheme for coliform in water from ground water quality sites. Coliform Rating: 0-6.5 Low, 7-8.5 Medium, 9-14 High						
	Sensitivity Points – Unconfined					**Conceptual Variable**
Variable	0	1	2	3	4	
Average Soil Available Water Capacity	0-0.09	>0.09-0.11	>0.11-0.13	>0.13-0.15	>0.15	Yes[1]
Depth to Top of Open Interval (ft)	>60		>40-60		<=40	No
Sources Using Ground Water Under the Direct Influence of Surface Water	9 Points					Yes[2]
	Intensity Points –Unconfined					**Conceptual Variable**
Variable	0	.5	1	1.5	2	4	
Distance to Agricultural Land, 1995 (ft)	>50					<=50	No
Septic Tank Density per square mile	0-6	>6-12	>12-18	>18-24	>24		Yes[1]
Length of Streams in Tier 1 (greater than zero)	7 Points						Yes[2]
Confined - 0 Points							

[1] This conceptual variable shows a graphical relation, improves the model, and is supported by previous scientific investigation.
[2] Statistical test could not be used because variable was unavailable for the data set used to develop the model.

Ground Water Nutrients

Nitrate

Susceptibility rating scheme for nitrates in water from ground water-quality sites. Nitrate Rating: 5-12 Low, 13-15 Medium, 16-25 High							
	Sensitivity Points – Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Confined (Yes or No)	Yes					No	No
Depth to Top of Open Interval (ft)	≥400	<400	<300	<200	<100	<50	Yes[1]
Length of Open Interval (ft)	≥200	<200	<100	<50	<20	<10	Yes[1]
	Intensity Points – Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Percent Urban Land, 1995	0	>0-9	≥10-19	≥20-29	≥30-49	≥50	No
Percent Agricultural Land, 1986	0	>0-4	≥5-9	≥10-19	≥20-29	≥30	No
Confined - 0 Points							
[1] This conceptual variable shows a graphical relation and improves the model.							

Ground Water Pesticides

Susceptibility rating scheme for pesticides in water from ground water quality sites. Pesticide Rating: 5-19 Low, 20-35 Medium							
	Sensitivity Points – Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Confined (Yes or No)	Yes					No	No
Depth to Top of Open Interval (ft)	≥400	<400	<300	<200	<100	<50	Yes[1]
Length of Open Interval (ft)	≥200	<200	<100	<50	<20	<10	Yes[1]
	Intensity Points – Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Percent Urban Land, 1995	0	>0-9	≥10-19	≥20-29	≥30-49	≥50	Yes[1]
Percent Agricultural Land, 1986	0	>0-4	≥5-9	≥10-19	≥20-29	≥30	No
Minimum Distance to Agricultural Land, 1995	>5000	≥2500	≥1000	≥500	>0	0	No
Minimum Distance to a Golf Course	>5000	≥2500	≥1000	≥500	>0	0	Yes[1]
Confined - 0 Points							
[1] This conceptual variable shows a graphical relation and improves the model.							

Ground Water Volatile Organic Compounds

Susceptibility rating scheme for VOCs in water from ground water quality sites. VOC Rating: 0-17 Low, 18-25 High [1]							
	Sensitivity Points – Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Average Percent Soil Organic Matter	> 8.0			> 2.5 – 8.0		0 - 2.5	No
	Intensity Points - Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Area of Urban Land, 1995 (square miles)	0 – 0.2					> 0.2	No
Percent Impervious Surface, 1995	0 – 7.4			> 7.4 – 10.9		>10.9	No
Percent Commercial - Industrial Land, 1995	<7			7 - <9		≥9	No
Density of KCSL, SWL, and UST [2]	<1			1 - <3		≥3	No
Confined - 0 Points							

[1] No medium VOC susceptibility rating was assigned; the model predicted that concentrations of VOC would be either less than one-tenth the MCL of the respective VOC (low) or equal to or greater than one-half the MCL of the respective VOC (high).

[2] Known Contaminated Sites (KCSL), Solid-Waste Landfills (SWL), and Underground Storage Tanks (UST)

Ground Water Inorganics

Arsenic

Susceptibility rating scheme for arsenic in water from ground water quality sites. Arsenic Rating: 0-5 Low, 6-8 Medium, 9-11 High				
	Sensitivity Points-Unconfined			**Conceptual variable**
Variable	0	2	5	
Physiographic Province	Everything else		Piedmont	No
Dissolved Oxygen Concentration	>3	≤3		No
pH of Water Quality Sample	<7	≥7		No
	Intensity Points-Unconfined			**Conceptual variable**
Variable	0		2	
Density of KCSL, SWL, NJPDES GW/SW/Storm, Class C, SWRRF, SWTF200011, Class B, DPCC, and UST. [1]	≤9		>9	No
	Sensitivity Points-Confined			**Conceptual variable**
Variable	0		6	
Geologic Unit	Everything else		Magothy Formation, Raritan Formation, Potomac Formation, Shark River Formation - Toms River member, Englishtown Formation, Kirkwood Formation - lower member (sand facies), Vincentown Formation	No

[1]Known Contaminated Sites (KCSL), Solid Waste Landfills (SWL), New Jersey Pollutant Discharge Elimination System Sites Ground Water/Surface Water/Storm Water Permits (NJPDES GW/SW/Storm), Compost Facilities (Class C), Resource Recover Facilities (SWRRF), Transfer Facilities (SWTF200011), Class B Recycling Facilities (Class B), Discharge Prevention Containment and Countermeasures Facilities (DPCC), Underground Storage Tanks (UST)

Barium

Susceptibility rating scheme for barium in water from ground water quality sites. Barium Rating: 0-6 Low, 7-9 Medium					
	Sensitivity Points - Unconfined				**Conceptual variable**
Variable	0	1	2	5	
Physiographic Province	Everything else			Piedmont	No
	Intensity Points - Unconfined				**Conceptual variable**
Variable	0		1	2	
Distance to Agricultural Land, 1995 (ft)	>4,000		>1,000-4,000	0-1,000	No
Population Density-Tier 1	0-<1,500		≥1,500-<4,000	≥4,000	No
Confined - 0 Points					

Beryllium

Susceptibility rating scheme for beryllium in water from ground water quality sites. Beryllium Rating: 0-7 Low, 8-10 Medium, 11-17 High							
	Sensitivity Points - Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Physiographic Province	Everything else					Coastal Plain	No
Depth to Top of Open Interval (ft)	≥150	>75-<150	≤75				No
Average Percent Soil Clay	>15	>12.5-15	>10-12.5	>7.5-10	>5-7.5	≤5	No
	Intensity Points - Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Percent Barren Land, 1995[1]	≤2	>2-4	>4-8	>8-12	>12-16	>16	No
Confined - 0 Points							

[1]Barren land use category includes lands that are characterized by thin soil, or sand or rock; and that lack vegetation or have widely spaced vegetation. Barren land can be found in nature or result from human activities. Barren land includes surface and subsurface extractive mining operations; stone quarries; gravel, sand, and clay pits; solid waste disposal areas and landfills.

Fluoride

Susceptibility rating scheme for fluoride in water from ground water quality sites. Fluoride Rating: 0-16 Low, 17-19 Medium							
	Sensitivity Points-Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Physiographic Province	Coastal Plain		Everything else				No
Soil Average Saturated Hydraulic Conductivity (micrometers per second)	>50	>40-50	>30-40	>20-30	>10-20	≤10	No
Depth to Top of Open Interval (ft)	>150	>125-150	>100-125	>80-100	>60-80	≤60	Yes[1]
	Intensity Points-Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Percent Urban Land, 1970	0-<10	10-<20	20-<30	30-<40	40-<60	≥60	No
Distance to Sewage Treatment Plant (ft)	>1,000		≤1,000				No
Density of Sewage Treatment Plants (per square mile)	<1		≥1				No
	Sensitivity Points-Confined						**Conceptual variable**
Variable	0			17			
Geologic Unit	Everything else			Magothy Formation, Raritan Formation, Potomac Formation, Shark River Formation - Toms River member			No

[1]This conceptual variable shows a graphical relation and improves the model.

Lead

Susceptibility rating scheme for lead in water from ground water quality sites. Lead Rating: 0-5.5 Low, 6-9.5 Medium, 10-14 High								
	Sensitivity Points-Unconfined							**Conceptual variable**
Variable	0	0.5	1	1.5	2	3	4	
pH of Water Quality Sample	>5.5		>5.0-5.5		>4.75-5.0	>4.5-4.75	≤4.5	No
Average Percent Soil Clay	>20	>15-20	>10-15	>5-10	≤5			Yes[1]
Depth to Top of Open Interval (ft)	≥150		>90-<150		≤90			Yes[2]
	Intensity Points-Unconfined							**Conceptual variable**
Variable	0		1		2	3	4	
Distance to DOT Road (ft)	>300				≤300			No
Length of Railroads (ft)	0-<2,000		2,000-<5,000		5,000-<10,000	10,000-<20,000	≥20,000	No
Confined – 0 Points								

[1] This conceptual variable shows a graphical relation, improves the model, and is supported by previous scientific investigations.

[2] This conceptual variable shows a graphical relation and improves the model.

Mercury

Susceptibility rating scheme for mercury in water from ground water quality sites. Mercury Rating: 0-7 Low, 8-9 Medium, 10-14 High							
	Sensitivity Points-Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Physiographic Province	Everything else		Coastal Plain				Yes[1]
Average Percent Soil Clay	>15	>10-15	0-10				Yes[2]
Average Percent Soil Organic Matter	>2	>1-2		>.5-1		≤0.5	Yes[2]
	Intensity Points-Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Population Density	0-<500	500-<1,000	1,000-<1,500	1,500-<2,500	2,500-<5,000	≥5,000	No
Confined – 0 Points							

[1] This conceptual variable shows a graphical relation and improves the model.

[2] This conceptual variable shows a graphical relation, improves the model, and is supported by previous scientific investigations.

Ground Water Radionuclides and Radon

Gross Alpha-Particle

Susceptibility rating scheme for gross alpha-particle in water from ground water quality sites. Alpha Rating: 0-3.5 Low, 4-7.5 Medium, 8-17.5 High									
	Sensitivity Points-Unconfined								**Conceptual variable**
Variable	0	0.5	1	1.5	2	2.5	3	4	
pH of Water Quality Sample	>6		>5.5-6		>5-5.5		>4.5-5	≤4.5	No
Soil Average Saturated Hydraulic Conductivity (micrometers per second)	0-15	>15-30	>30-45	>45-60	>60-75	>75			Yes[1]
Depth of Well (ft)	>200				≤200				Yes[1]
	Intensity Points-Unconfined								**Conceptual variable**
Variable	0	1	2	3	4	5			
Percent Urban Land, 1995 -Tier 1		≤20	>20-40	>40-60	>60-80	>80-100			No
Distance to Agricultural Land , 1995	>4000	>2000-4000	>1000-2000	>500-1000	≤500				Yes[2]
	Sensitivity Points-Confined								**Conceptual variable**
Variable	0			5					
Geologic Unit	Everything else			Magothy Formation; Magothy Formation - Old Bridge Sand member; Magothy, Raritan, and Potomac Formations; Potomac Formation; Shark River Formation					No

[1] This conceptual variable shows a graphical relation and improves the model.
[2] This conceptual variable shows a graphical relation, improves the model, and is supported by previous scientific investigations.

Radium

Susceptibility rating scheme for radium in water from ground water quality sites. Radium Rating: 1-2 Low, 3-6 Medium, 7-14 High							
	Sensitivity Points-Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Physiographic Province	Everything else		Piedmont		Coastal Plain		No
pH of Water Quality Sample	>6	>5.5-6	>5-5.5	>4.5-5	>4-4.5	≤4	No
	Intensity Points-Unconfined						**Conceptual variable**
Variable	0	1	2	3	4	5	
Percent Developed Land, 1995 -Tier 1	0-10	>10-30	>30-50	>50-70	>70-90	>90-100	No
Confined – 0 Points							

Uranium

Susceptibility rating scheme for uranium in water from ground water quality sites. Uranium Rating: 0-6 Low, 7-8 Medium, 9 High					
	Sensitivity Points-Unconfined				**Conceptual variable**
Variable	0	1	2	5	
Physiographic Province	Everything else		Highlands	Piedmont	No
	Intensity Points-Unconfined				**Conceptual variable**
Variable	0	1	2	5	
Percent Agricultural Land, 1970	0-25	>25-50	>50		No
Septic Tank Density per square mile in Piedmont	>50		≤50		No
Confined Wells – 0 Points					

Radon

Susceptibility rating scheme for radon in water from ground water quality sites. Radon Rating: 1-2.5 Low, 3-6.5 Medium, 7-11 High							
	Sensitivity Points-Unconfined						**Conceptual variable**
Variable	0	0.5	1	2	3	5	
Physiographic Province			Coastal Plain		Everything else	Piedmont	No
Average Percent Soil Clay	0-5		>5-10	>10			Yes[1]
Depth to Top of Open Interval (ft)	≥150		>75-<150	≤75			No
	Intensity Points-Unconfined						**Conceptual variable**
Variable	0	0.5	1	2	3	5	
Percent Agricultural Land, 1995	0-10	>10-25	>25				No
Distance to Wetlands, 1995 (ft)	>100		≤100				Yes[1]
	Sensitivity Points-Confined						**Conceptual variable**
Variable	0			5			
Geologic Unit	Everything else			Mount Laurel and Wenonah Formations, Shark River Formation - Toms River member			
[1] This conceptual variable shows a graphical relation and improves the model.							

Ground Water Disinfection Byproduct Precursors

Susceptibility rating scheme for DBPs in water from ground water quality sites. Disinfection Byproduct Precursor Rating : Unconfined wells: 0-13 Medium 14-16 High Disinfection Byproduct Precursor Rating : Confined wells: 0-3 Low, 4-7 Medium, 8-10 High						
	Sensitivity Points- Unconfined					**Conceptual variable**
Variable	1	2	3	4	5	
Average Percent Soil Organic Matter			>0 - 0.99		> 0.99	Yes [1]
Hydrologic Unit Group			All units			Yes [1]
	Intensity Points – Unconfined					**Conceptual variable**
Variable	1	2	3	4	5	
Number of NJPDES GW/SW/Storm, DPCC, SWTF200011, SWRRF, Class B, and Class C [2]	0		> 0			No
Area of Wetlands, 1995 (square miles)			0 – 0.17		> 0.17	Yes [3]
	Sensitivity Points – Confined					**Conceptual variable**
Variable	1	2	3	4	5	
Hydrologic Unit Group	Middle Potomac Raritan Magothy	Kirkwood Cohansey, Englishtown, Mount Laurel Wenonah, or Upper Potomac Raritan Magothy			Atlantic City 800 foot Sand	No
pH of Water-Quality Sample	< 6.1		< 6.7		≥ 6.7	No

[1] This conceptual variable shows a graphical relation, improves the model, and is supported by scientific investigations.
[2] New Jersey Pollutant Discharge Elimination System Sites (NJPDES), Discharge Prevention & Countermeasures Plans & Discharge Clean-up & Removal Plans sites (DPCC), Transfer Facilities (SWTF200011), Resource Recovery Facilities (SWRRF), Class B Recycling Facilities (Class B), and Class C Compost Facilities (Class C).
[3] This conceptual variable shows a graphical relation and improves the model.