Table 3.3-6 Concentrations of VOCs and SVOCs in Soils
(Page 1 of 8)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
VOCs											
1,1,1,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,1-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,2,3-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,2,3-Trichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,2,4-Trimethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,2-Dibromoethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,3,5-Trimethylbenzene	0.0067	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002

ND = Not Detected (less than laboratory detection limits)

Table 3.3-6 Concentrations of VOCs and SVOCs in Soils
(Page 2 of 8)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
VOCs											
1,3-Dichlorobenzene	0.0082	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002
1,3-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
2,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
2-Chlorotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
4-Chlorotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Bromobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Bromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Bromoform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Bromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Chlorodibromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2

ND = Not Detected (less than laboratory detection limits)

Table 3.3-6 Concentrations of VOCs and SVOCs in Soils
(Page 3 of 8)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
VOCs											
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Dibromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Isopropylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
m+p-Xylenes	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Methyl ethyl ketone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
Methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
n-Butylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
n-Propylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
o-Xylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
p-Isopropyltoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
sec-Butylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2

ND = Not Detected (less than laboratory detection limits)

Table 3.3-6 Concentrations of VOCs and SVOCs in Soils
(Page 4 of 8)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
VOCs											
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
tert-Butylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Tertrachloroethene	0.0086	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
SVOCs											
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
1-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
2,4,5-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33

ND = Not Detected (less than laboratory detection limits)

Table 3.3-6 Concentrations of VOCs and SVOCs in Soils
(Page 5 of 8)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
SVOCs											
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
2-Chloronaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
3,3-Dichlorobenzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.67
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7
4-Bromophenylphenylether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
4-Chloro-3-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
4-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
4-Chlorophenylphenylether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33

ND = Not Detected (less than laboratory detection limits)

Table 3.3-6 Concentrations of VOCs and SVOCs in Soils
(Page 6 of 8)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
SVOCs											
Azobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Benzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.67
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Benzo(a)pyrene	ND	0.014	ND	0.035	ND	ND	ND	ND	0.059	0.014	0.0033
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
bis(-2-chloroethoxy)Methane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
bis(-2-chloroethyl)Ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
bis(2-chloroisopropyl)Ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
bis(2-ethylhexyl)Phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Butylbenzylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Dibenzo(a,h)anthracene	ND	0.012	ND	0.024	ND	ND	ND	ND	0.038	0.0099	0.0033
Diethyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Dimethyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Di-n-butyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33

ND = Not Detected (less than laboratory detection limits)

Table 3.3-6 Concentrations of VOCs and SVOCs in Soils
(Page 7 of 8)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
SVOCs											
Di-n-octyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Hexachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Hexacholorocyclopentadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.67
Hexachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Indeno(1,2,3-cd)pyrene	ND	0.025	ND	0.081	ND	ND	ND	ND	0.146	0.024	0.0033
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
m+p-Cresols	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
n-Nitrosodimethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
n-Nirtoso-di-n-propylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
n-Nitrosodiphenylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
o-Cresol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33

ND = Not Detected (less than laboratory detection limits)

Table 3.3-6 Concentrations of VOCs and SVOCs in Soils
(Page 8 of 8)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
SVOCs											
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33
Pyridine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.67

ND = Not Detected (less than laboratory detection limits)

Table 3.3-7 Concentrations of Pesticides and Herbicides in Soils (Page 1 of 7)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
Pesticides											
Alachlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Ametrym	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Atraton	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Atrazine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Benefin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Bromacil	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Butachlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Butylate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Carboxin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Chlorpropham	ND	ND	ND	0.0074	ND	0.0055	ND	0.0110	ND	ND	0.0033
Chlorpyrifos	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Cyanazine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Cycloate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Diazion	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Dichlorvos	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Diphenamid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033

ND = Not Detected (less than laboratory detection limits)

Table 3.3-7 Concentrations of Pesticides and Herbicides in Soils
(Page 2 of 7)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
Pesticides											
Disulfoton	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
EPTC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Ethalfluralin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Ethoprop	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Fenamiphos	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Fenarimol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Fluridone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Fonofos	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Hexazinone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Isopropalin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Kelthane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Malathion	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Merphos	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Methyl paraoxon	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Metolachlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Metribuzin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033

ND = Not Detected (less than laboratory detection limits)

Table 3.3-7 Concentrations of Pesticides and Herbicides in Soils
(Page 3 of 7)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
Pesticides											
Mevinphos	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
MGK-264	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Molinate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Napropamide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Norflurazon	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Oxadiazon	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Oxyfluorfen	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Pebulate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Pendimethalin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Phorate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Profluralin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Prometon	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Prometryn	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Pronamide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Propachlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Propazine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033

ND = Not Detected (less than laboratory detection limits)

Table 3.3-7 Concentrations of Pesticides and Herbicides in Soils
(Page 4 of 7)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
Pesticides											
Simazine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Simetryn	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Stirofos	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Terbacil	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Terbufos	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Terbutryn	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Triadimefon	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Triadimefon	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Triallate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Tricyclazole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Trifluralin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Vernolate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0033
Organochlorine Pesticides											
4,4'-DDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
4,4'-DDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017

ND = Not Detected (less than laboratory detection limits)

Table 3.3-7 Concentrations of Pesticides and Herbicides in Soils
(Page 5 of 7)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
Organochlorine Pesticides											
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
Aldrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
alpha-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
alpha-Chlordane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
beta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
Chlordane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.017
delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
Dieldrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
Endosulfan I	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
Endosulfan II	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
Endosulfan sulfate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
Endrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
Endrin aldehyde	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
Endrin ketone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
gamma-BHC (Lindane)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
gamma-Chlordane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017

ND = Not Detected (less than laboratory detection limits)

Table 3.3-7 Concentrations of Pesticides and Herbicides in Soils (Page 6 of 7)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
Organochlorine Pesticides											
Heptachlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
Methoxychlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017
Toxaphene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.167
Chlorinated Herbicides											
2.4.5-T	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.004
2.4.5-TP (Silvex)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.004
2.4-D	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02
2.4-DB	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05
3.5-Dichlorobenzoic Acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01
Acifluorfen	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01
Bentazon	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05
Chloramben	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01
Dacthal	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02
Dalapon	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05

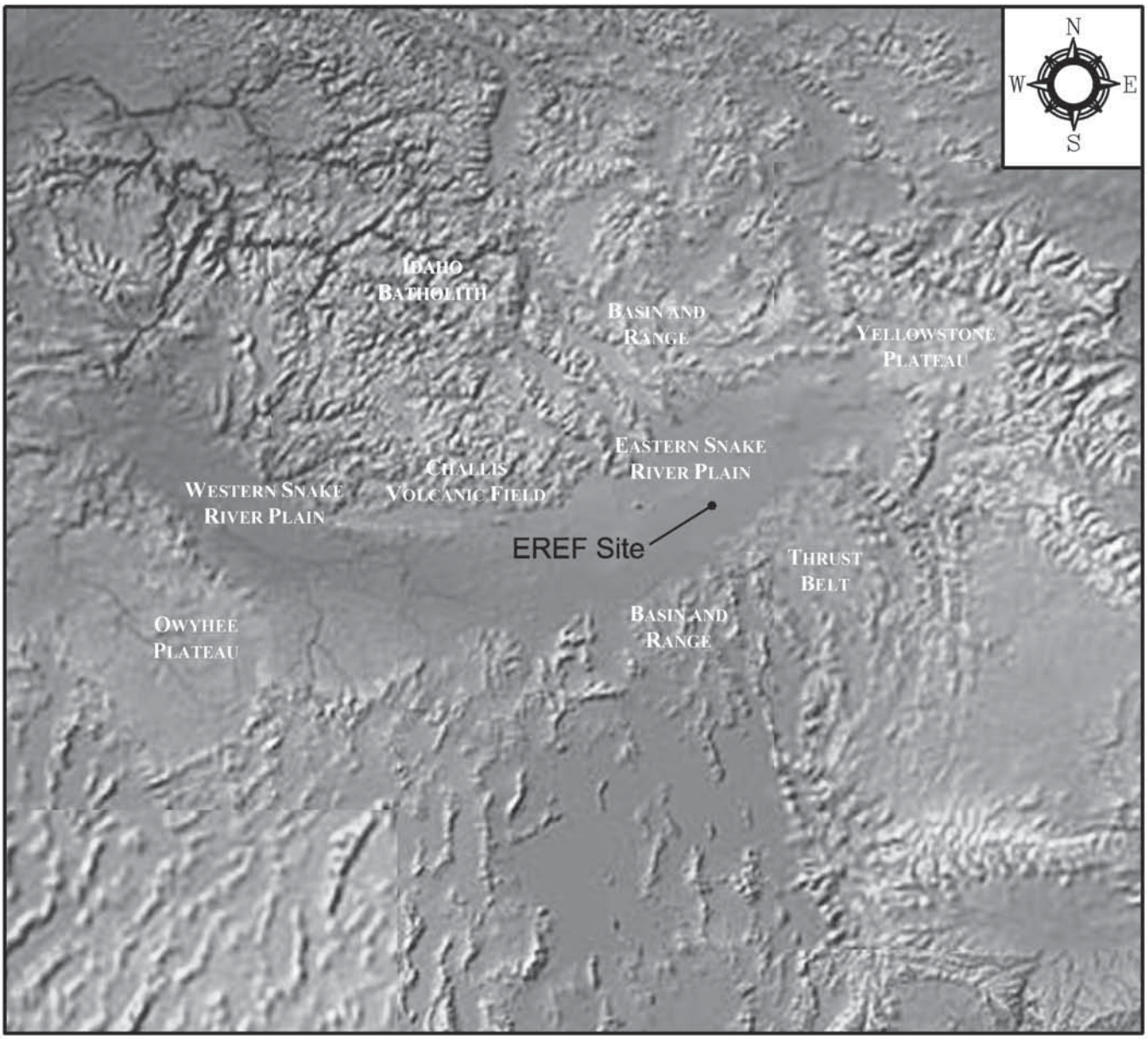
ND = Not Detected (less than laboratory detection limits)

Table 3.3-7 Concentrations of Pesticides and Herbicides in Soils (Page 7 of 7)

	Soil Sample Concentrations (mg/kg)										Detection Limits (mg/kg)
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	
Chlorinated Herbicides											
Dicamba	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Dichlorprop	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02
Dinoseb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02
MCPA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4
MCPP	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4
Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002
Picloram	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01

ND = Not Detected (less than laboratory detection limits)

FIGURES



SCALE

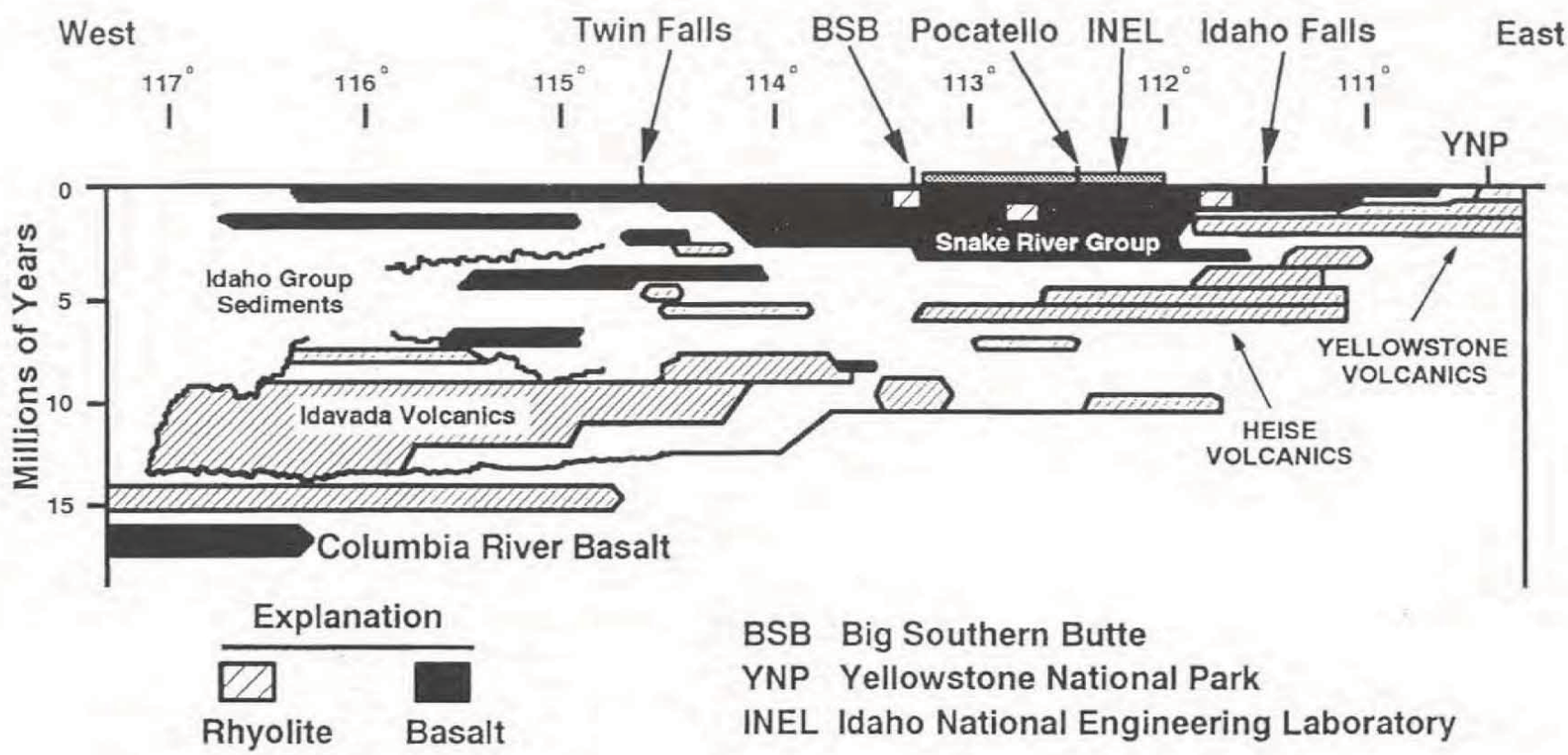
0 100 (km)

0 60 (mi)

Figure 3.3-1 **Rev. 2**

Regional Shaded-Relief Topographic Map of Snake River Plain and Surrounding Physiographic Regions

EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT



Source: Hackett, 2002.

Figure 3.3-2 **Rev. 2**
Age-Distance Plot of Lake Cenozoic, Bimodal Volcanism in Snake River Plain-Yellowstone Province

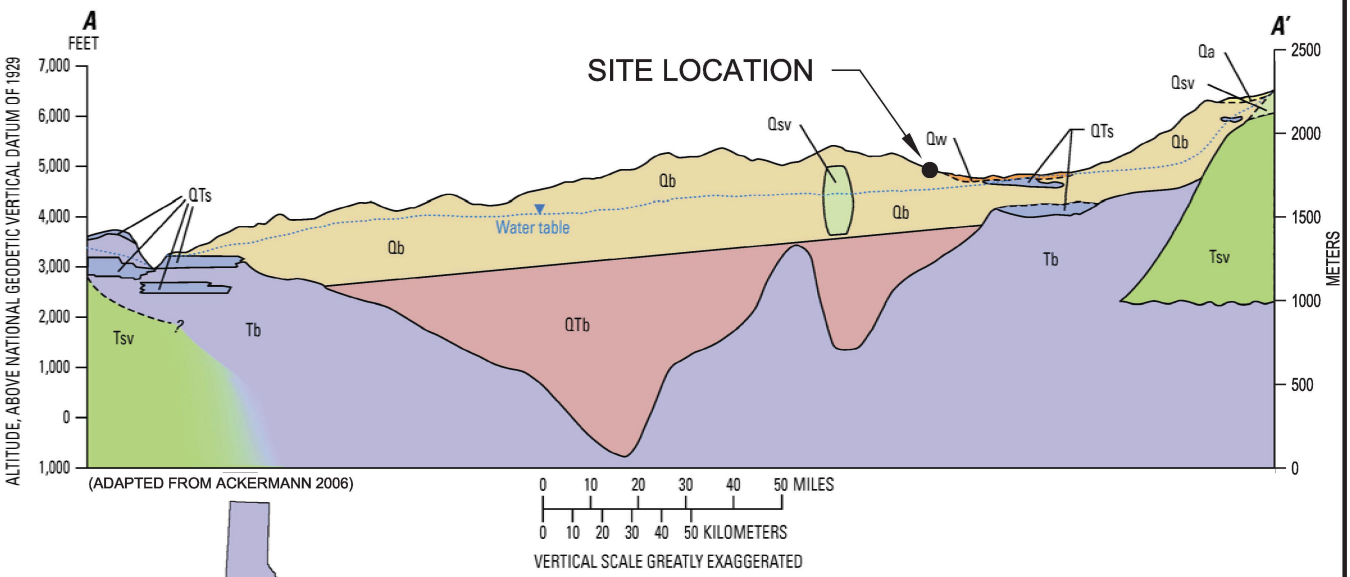
EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT

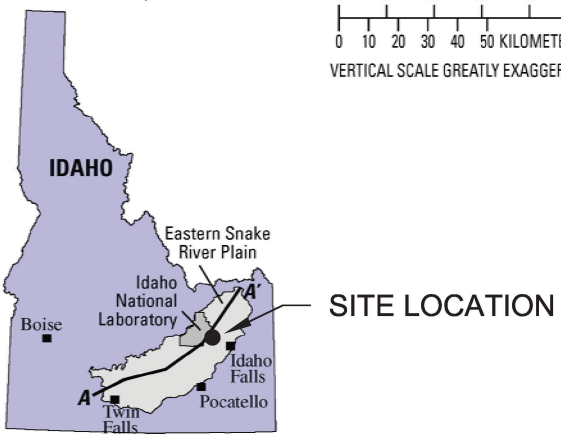
Eon		Era	Period		Epoch	Ma
Phanerozoic		Cenozoic	Quarternary		Holocene	0.01
					Pleistocene	1.8
			Tertiary	Neogene	Pliocene	5.3
					Milocene	23.7
				Paleogene	Oligocene	33.7
					Eocene	54.8
					Paleocene	65.0
		Mesozoic	Cretaceous			144
			Jurassic			206
			Triassic			248
		Paleozoic	Permian			290
			Pennsylvanian			323
			Mississippian			354
			Devonian			417
			Silurian			443
			Ordovician			490
			Cambrian			543
Precambrian	Proterozoic					2500
	Archean					4500

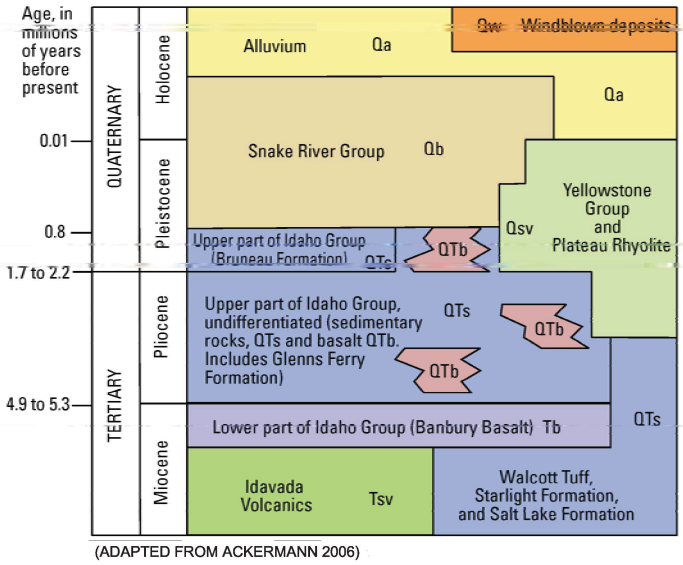
Figure 3.3-3 **Rev. 2**

Geologic Time Scale

EAGLE ROCK ENRICHMENT FACILITY
ENVIRONMENTAL REPORT







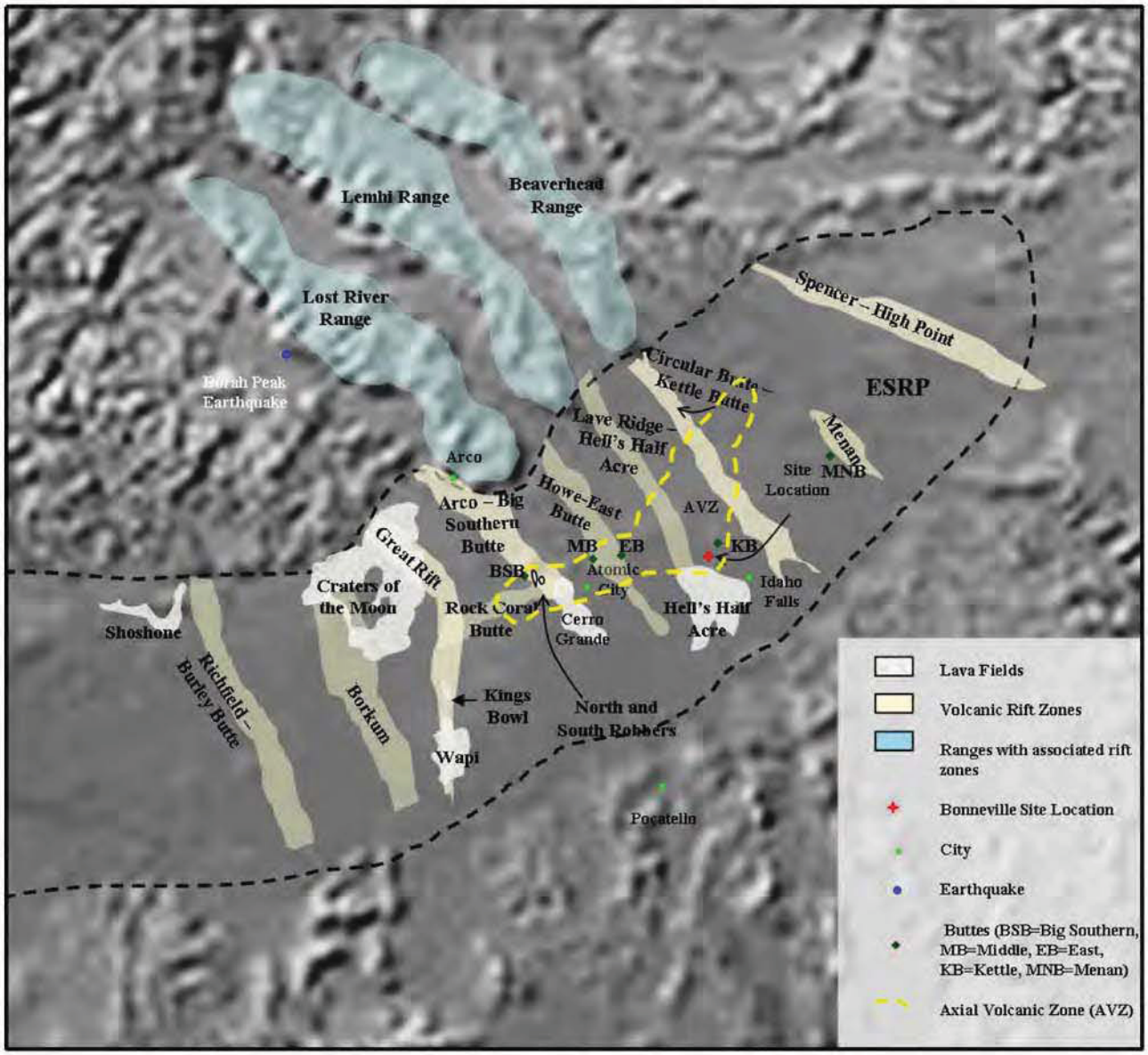
EXPLANATION AND DESCRIPTION OF MAP UNITS

Qa	Chiefly flood-plain deposits. May contain some glacial deposits and colluvium in the uplands. Clay, silt, sand, gravel, and boulders.
Qw	Chiefly windblown deposits. Includes some lake and glacial-flood deposits.
Qb	Olivine basalt, dense to vesicular; irregular to columnar jointing; thickness of individual flows averages about 20-25 feet (Mundorff and others, 1964, p.143). Includes beds of basalt cinders, rubbly basalt, and interflow sedimentary rocks.
Qsv	Rhyolitic ash-flow tuff, occurs as thick flows and blankets of welded tuff with associated fine- to coarse-grained ash and pumice beds.
QTb	Olivine basalt similar to Qb above.
QTs	Subaerial and lake deposits of clay, silt, sand, and gravel. Compacted to poorly consolidated.
Tb	Flood-type basalt, dense; columnar jointing in many places. May include some rhyolitic and andesitic rocks. Queried where uncertain.
Tsv	Rhyolitic, latitic, and andesitic rocks, massive and dense.

Figure 3.3-4 **Rev. 2**

General ESRP Geology and Stratigraphy

EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT



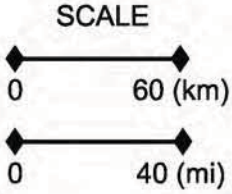
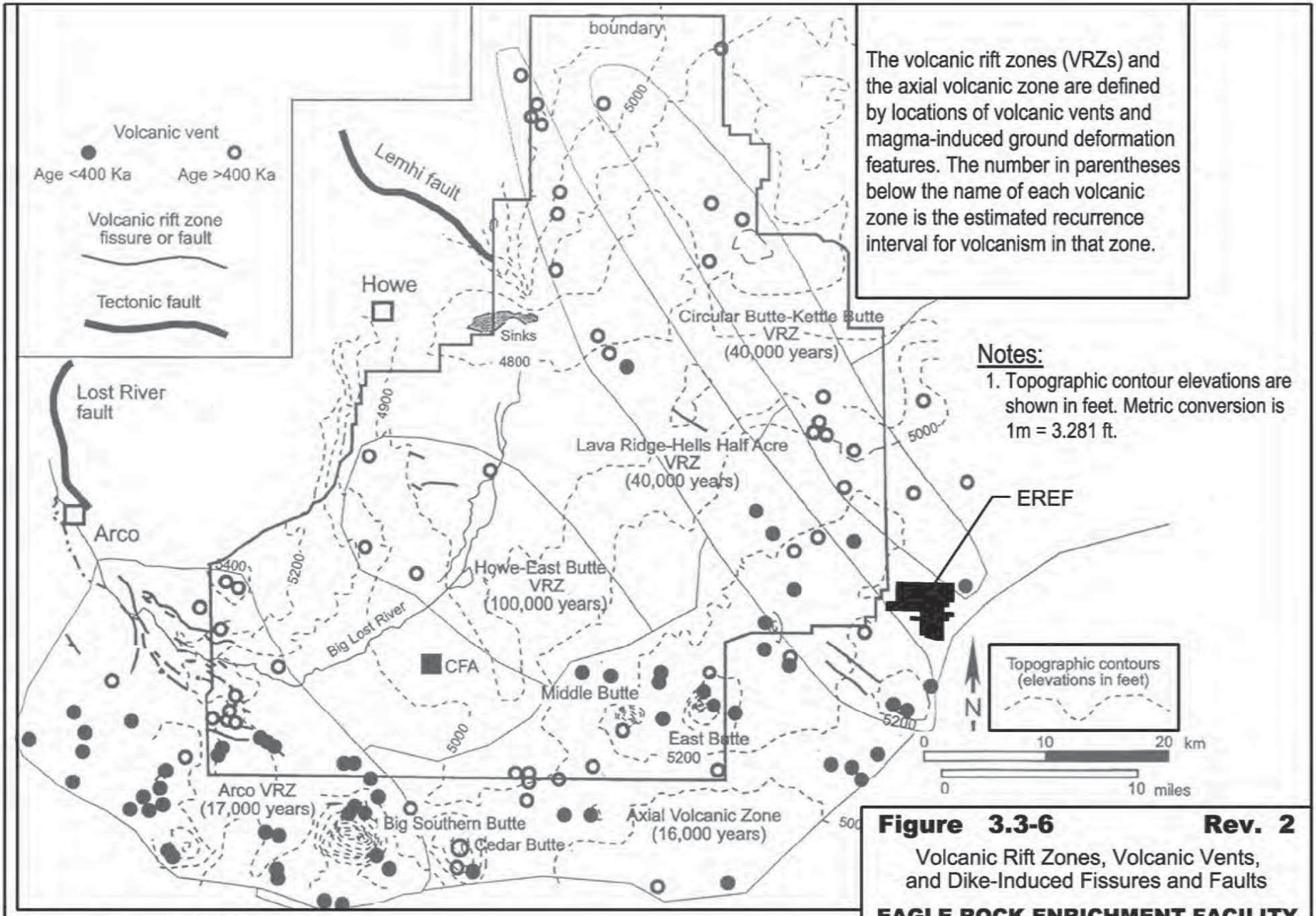


Figure 3.3-5 **Rev. 2**

Regional Shaded-Relief Topographic Map of Eastern Snake River Plain (ESRP) and Local Geology

EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT

Source: Map features from Kuntz, 2002.



The volcanic rift zones (VRZs) and the axial volcanic zone are defined by locations of volcanic vents and magma-induced ground deformation features. The number in parentheses below the name of each volcanic zone is the estimated recurrence interval for volcanism in that zone.

Notes:

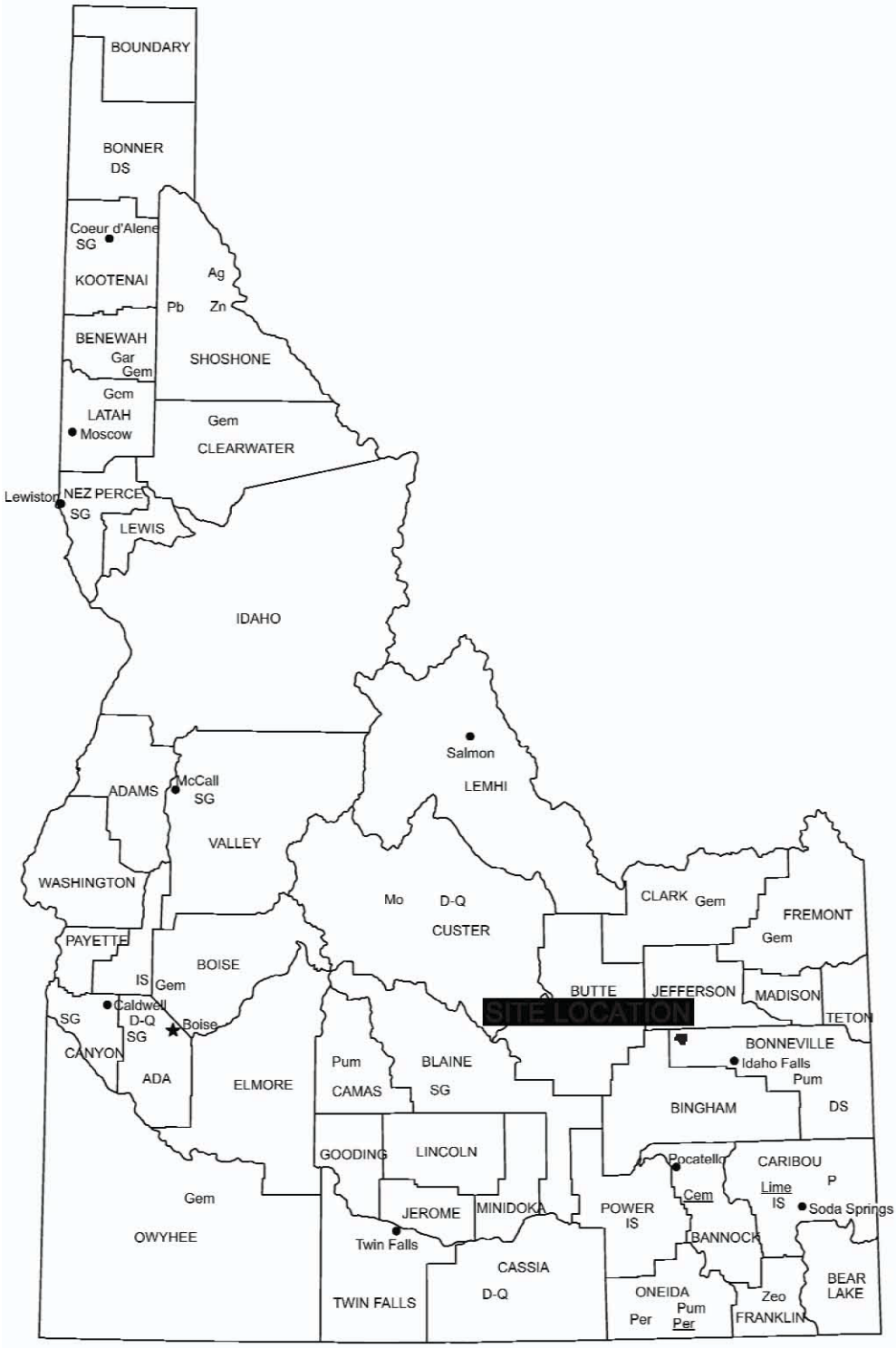
1. Topographic contour elevations are shown in feet. Metric conversion is 1m = 3.281 ft.

Source: Hackett, 2002.

Figure 3.3-6 **Rev. 2**

Volcanic Rift Zones, Volcanic Vents, and Dike-Induced Fissures and Faults

EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT



LEGEND

———	County boundary
★	Capital
●	City

MINERAL SYMBOLS
(Major producing areas)

Ag	Silver
Cem	Cement plant
D-Q	Dimension quartzite
DS	Dimension stone
Gar	Garnet
Gem	Gemstones
IS	Industrial sand
Lime	Lime plant
Mo	Molybdenum
P	Phosphate rock
Pb	Lead
Per	Perlite
Per	Perlite plant
Pum	Pumice and pumicite
SG	Construction sand and gravel
Zn	Zinc
Zeo	Zeolites

[redacted]

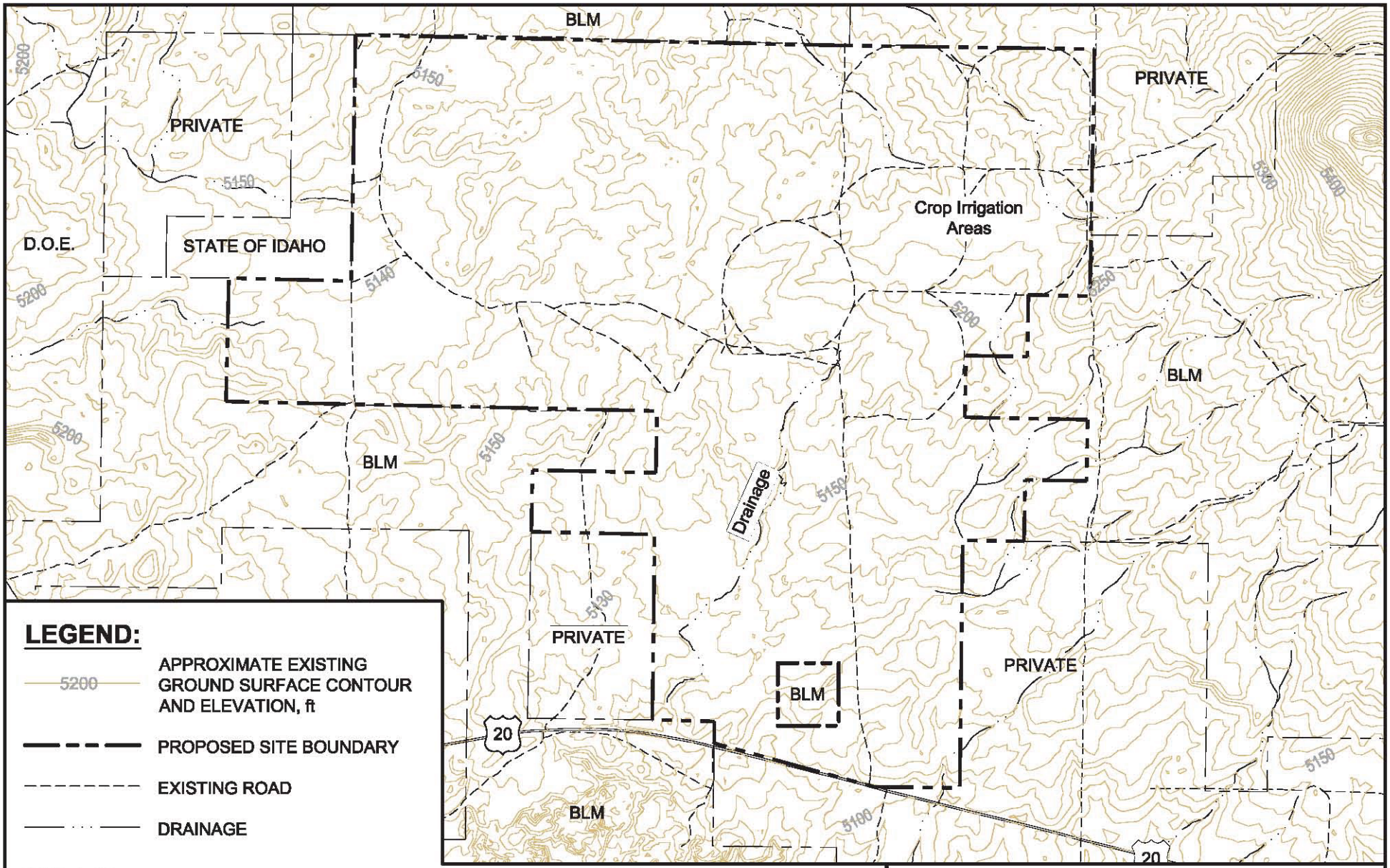
NOTE: ADAPTED FROM IGS, 2004.

SCALE
0 80 160 km
SCALE
0 50 100 miles

Figure 3.3-7 **Rev. 2**

Mineral Producing Areas of Idaho

EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT



LEGEND:

- 5200 — APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, ft
- PROPOSED SITE BOUNDARY
- EXISTING ROAD
- DRAINAGE

NOTES:

1. GROUND SURFACE CONTOUR ELEVATIONS ARE SHOWN IN FEET. METRIC CONVERSION IS 1 m = 3.281 ft.

SCALE
0 800 1600 m

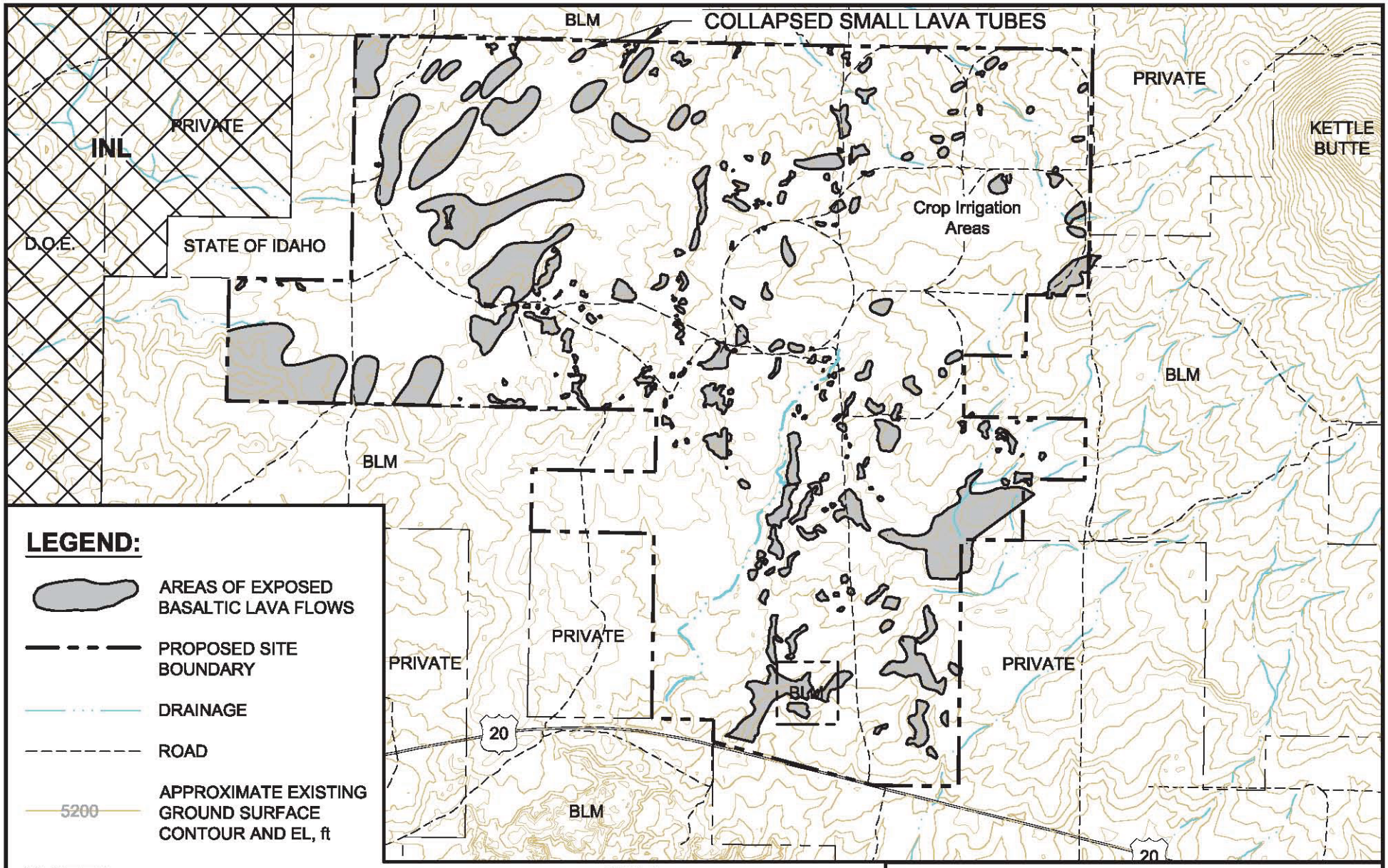
SCALE
0 2500 5000 ft

N

Figure 3.3-8 Rev. 2

Topography, Roads and Drainage

EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT



LEGEND:

- AREAS OF EXPOSED BASALTIC LAVA FLOWS
- PROPOSED SITE BOUNDARY
- DRAINAGE
- ROAD
- 5200 — APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND EL, ft

NOTES:

1. GROUND SURFACE CONTOUR ELEVATIONS ARE SHOWN IN FEET. METRIC CONVERSION IS 1 m = 3.281 ft.

SCALE
0 800 1600 m

SCALE
0 2500 5000 ft

N

Figure 3.3-9 **Rev. 2**

Areas of Exposed Basaltic Lava Flows

EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT

a) VESICULAR BASALT

b) COLUMNAR JOINT PATTERN

Figure 3.3-10 **Rev. 2**

Photos of Typical
Basalt Outcrops 1

EAGLE ROCK ENRICHMENT FACILITY
ENVIRONMENTAL REPORT

a) HORIZONTAL JOINTING AND CAVITIES

b) TOE RUBBLE AT END OF FLOW

Figure 3.3-11 **Rev. 2**

Photos of Typical
Basalt Outcrops 2

EAGLE ROCK ENRICHMENT FACILITY
ENVIRONMENTAL REPORT

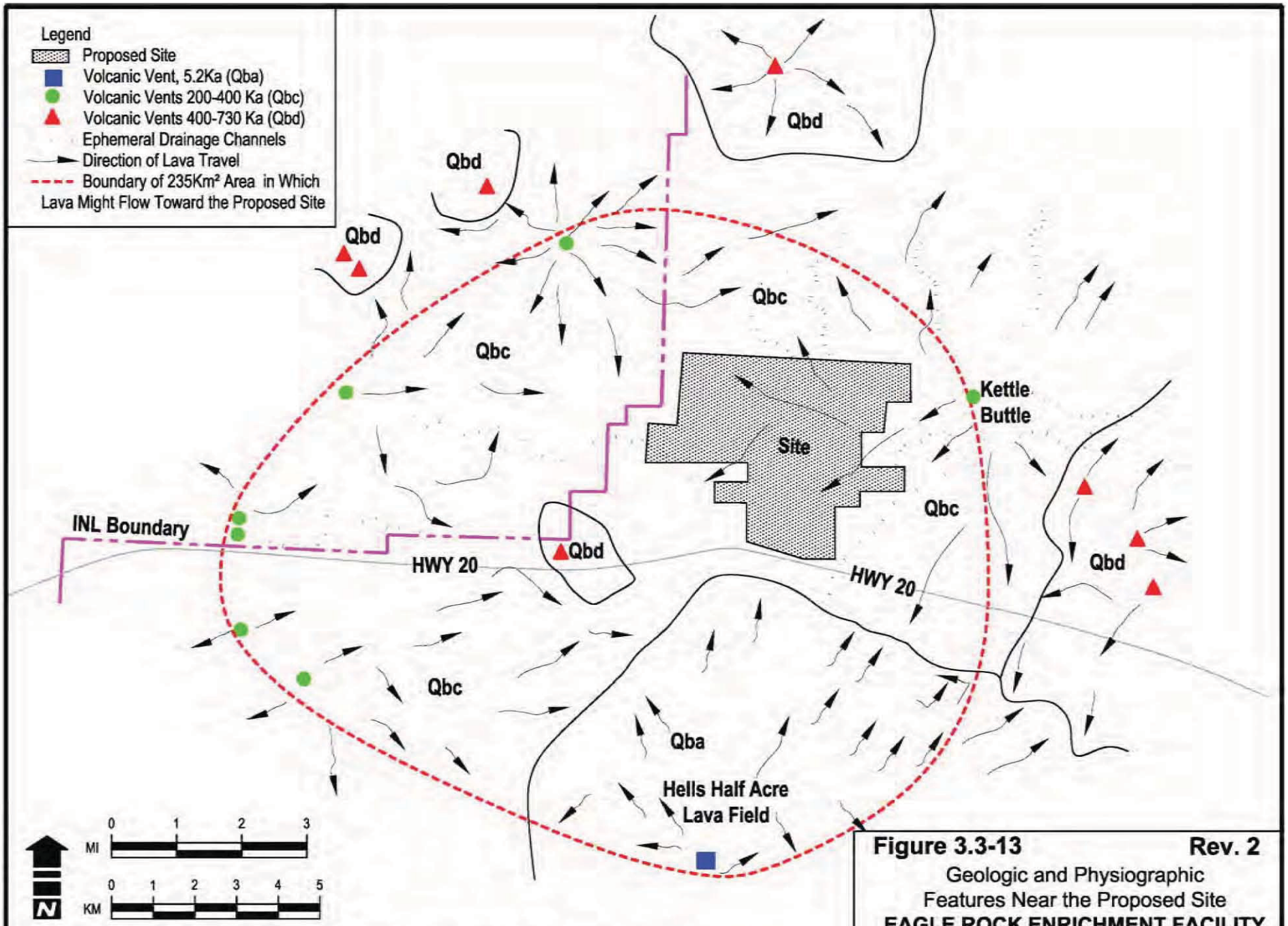
a) PRESSURE RIDGE

b) KETTLE BUTTE FROM NORTH BOUNDARY FENCE FACING EAST

Figure 3.3-12 **Rev. 2**

Photos of Significant Geological Features

EAGLE ROCK ENRICHMENT FACILITY
ENVIRONMENTAL REPORT

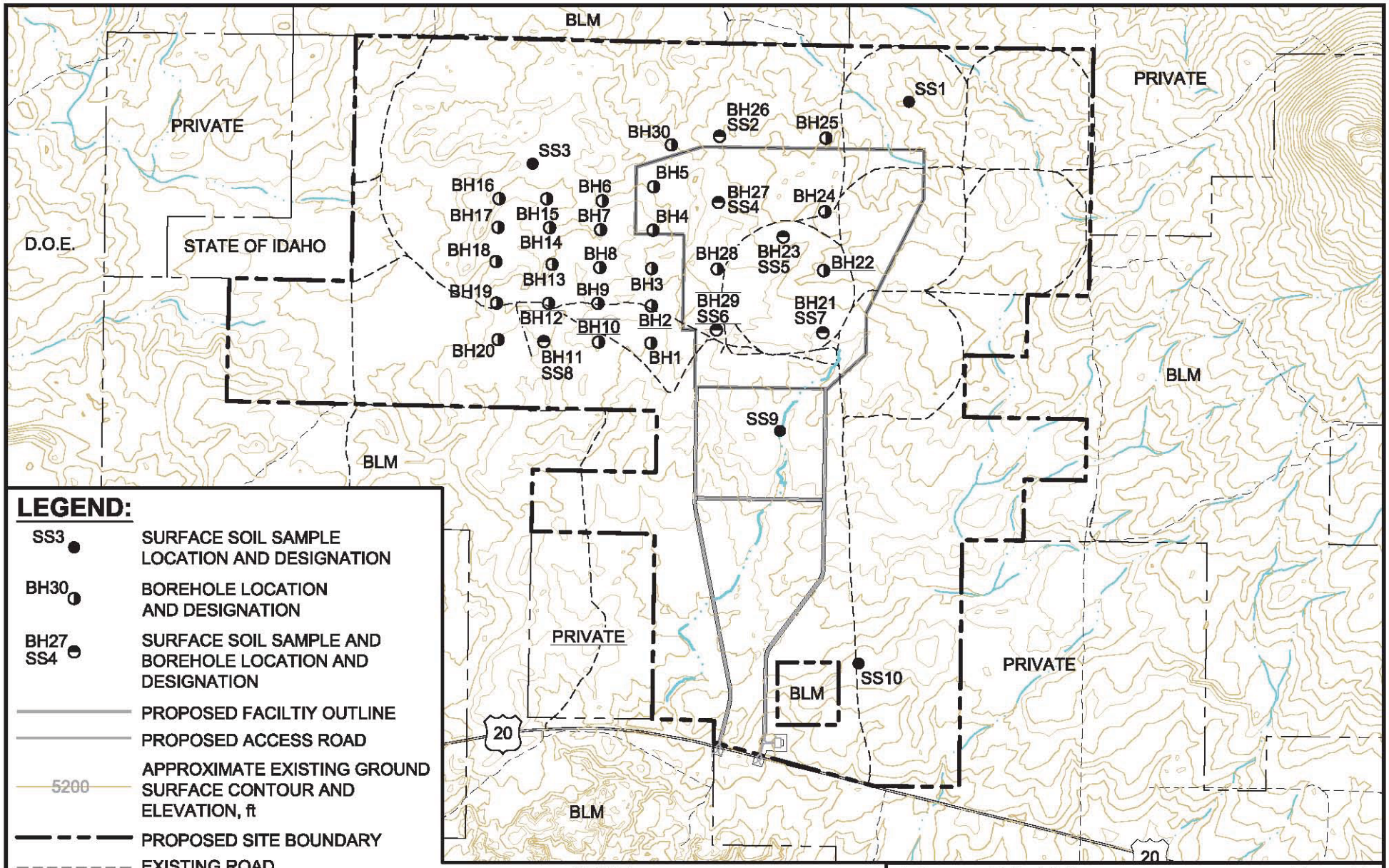


Source: Original drawing by W.R Hackett, based on Map from Kuntz, 1994.

Figure 3.3-13 **Rev. 2**

Geologic and Physiographic Features Near the Proposed Site

EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT



LEGEND:

- SS3 — SURFACE SOIL SAMPLE LOCATION AND DESIGNATION
- BH30 — BOREHOLE LOCATION AND DESIGNATION
- BH27 SS4 — SURFACE SOIL SAMPLE AND BOREHOLE LOCATION AND DESIGNATION
- PROPOSED FACILTIY OUTLINE
- PROPOSED ACCESS ROAD
- 5200 — APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, ft
- PROPOSED SITE BOUNDARY
- EXISTING ROAD

NOTES:

1. GROUND SURFACE CONTOUR ELEVATIONS ARE SHOWN IN FEET. METRIC CONVERSION IS 1 m = 3.281 ft.

SCALE
0 800 1600 m

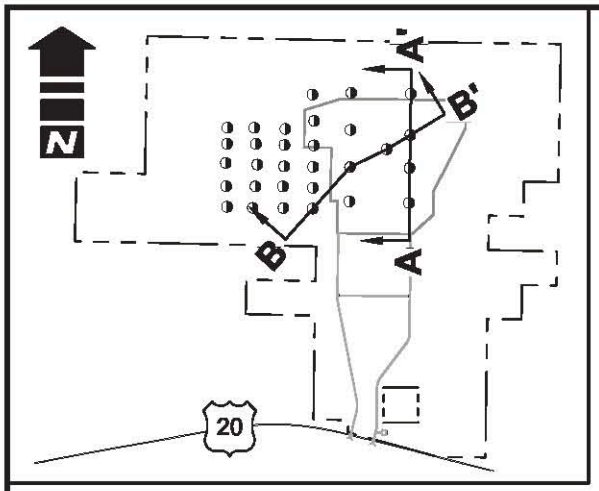
SCALE
0 2500 5000 ft

N

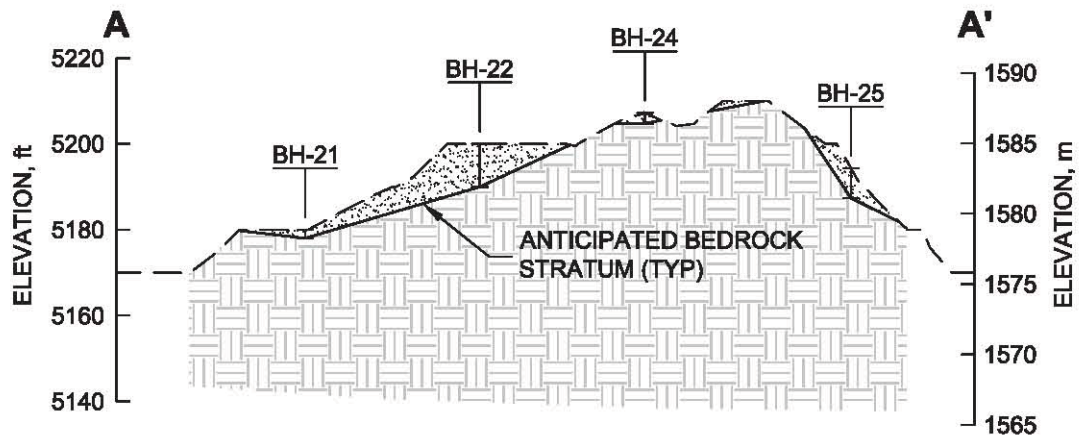
Figure 3.3-14A **Rev. 2**

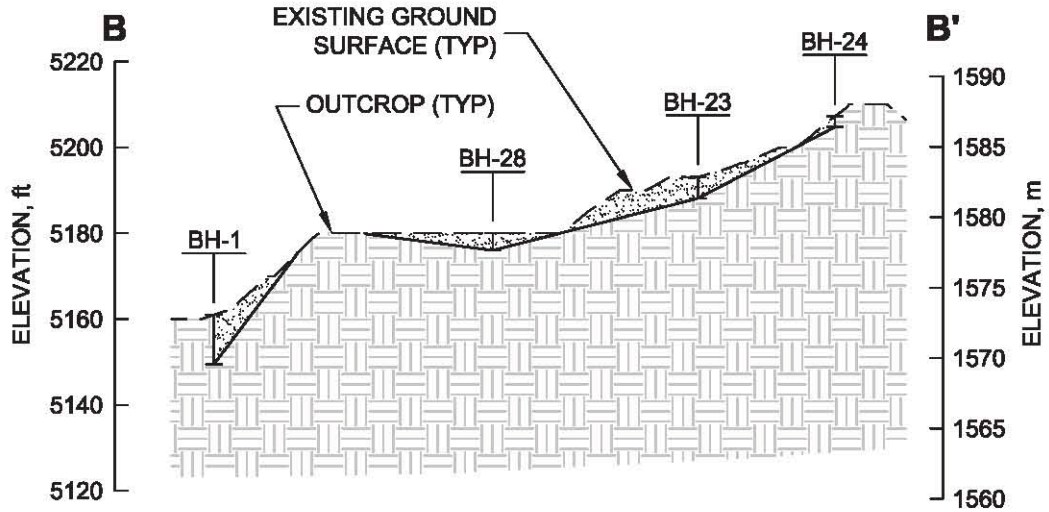
Borehole and Soil Sample Locations

EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT



SITE MAP
NTS





LEGEND:

- BOREHOLE LOCATION
- BH-1 — BOREHOLE IDENTIFICATION
- BOREHOLE COLLAR
- BOTTOM OF BOREHOLE

NOTE:

VERTICAL EXAGGERATION = 10X

SCALE
0 400 800 m
1250 2500 ft

Figure 3.3-14B **Rev. 2**
Cross Sections A-A' and B-B'
On the Proposed EREF Footprint
EAGLE ROCK ENRICHMENT FACILITY
ENVIRONMENTAL REPORT

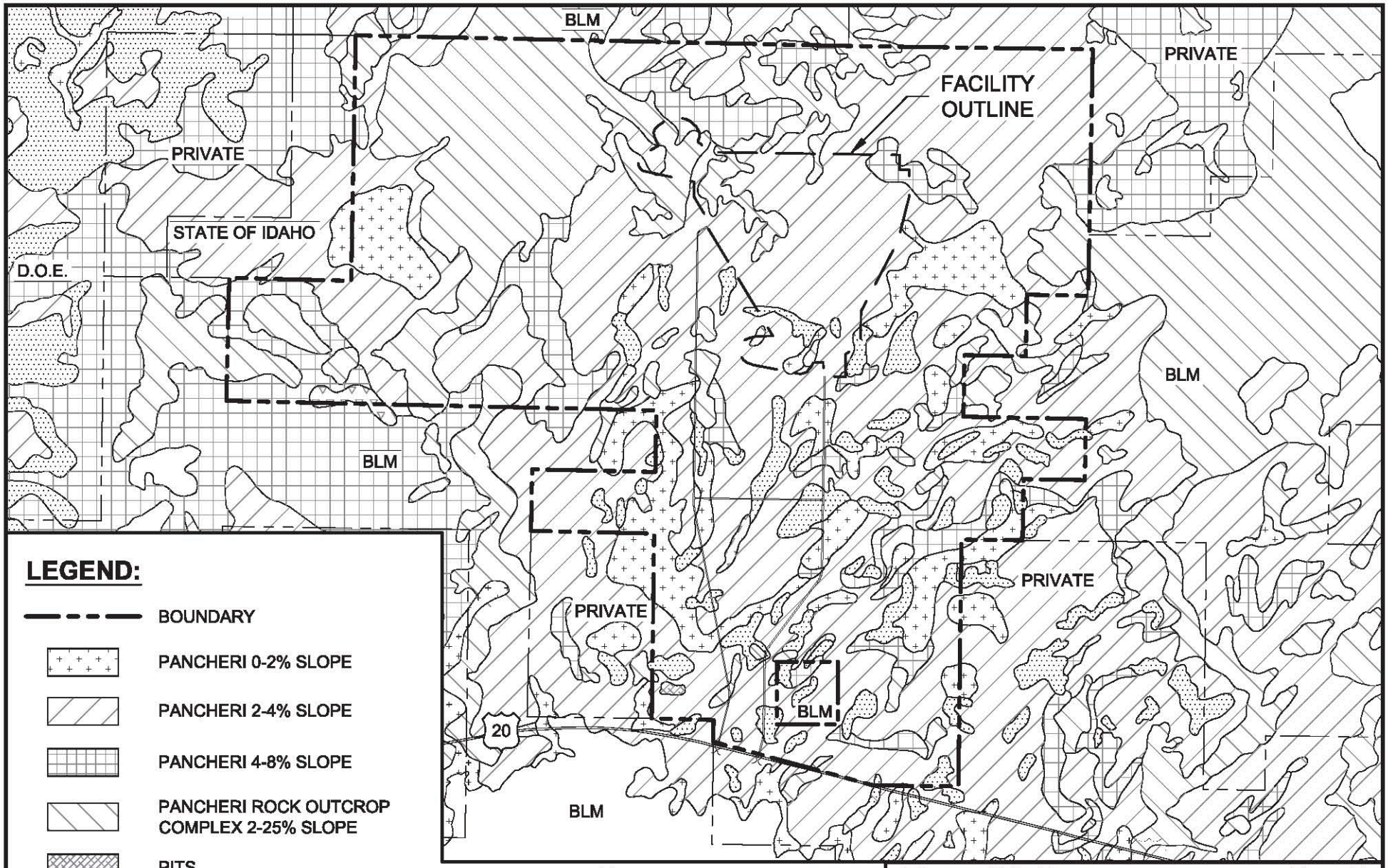
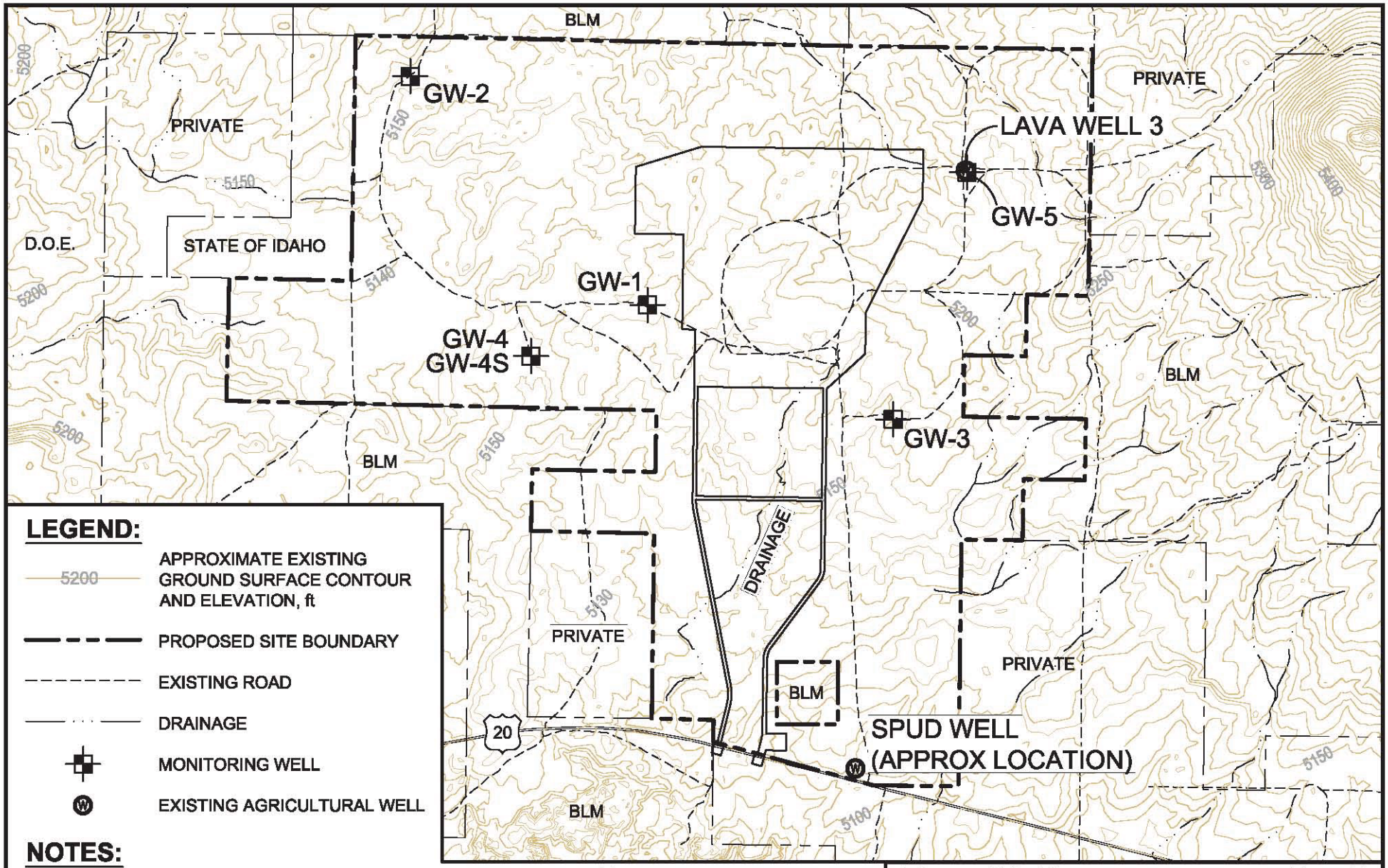


Figure 3.3-15 **Rev. 2**

Soil Map of the Proposed Site

EAGLE ROCK ENRICHMENT FACILITY
ENVIRONMENTAL REPORT



LEGEND:

- 5200 — APPROXIMATE EXISTING GROUND SURFACE CONTOUR AND ELEVATION, ft
- PROPOSED SITE BOUNDARY
- EXISTING ROAD
- DRAINAGE
- MONITORING WELL
- EXISTING AGRICULTURAL WELL

NOTES:

1. GROUND SURFACE CONTOUR ELEVATIONS ARE SHOWN IN FEET. METRIC CONVERSION IS 1 m = 3.281 ft.
2. MONITORING WELL GW-5 IS 14.7 m (48.2') SOUTHEAST OF LAVA WELL

SCALE
0 800 1600 m

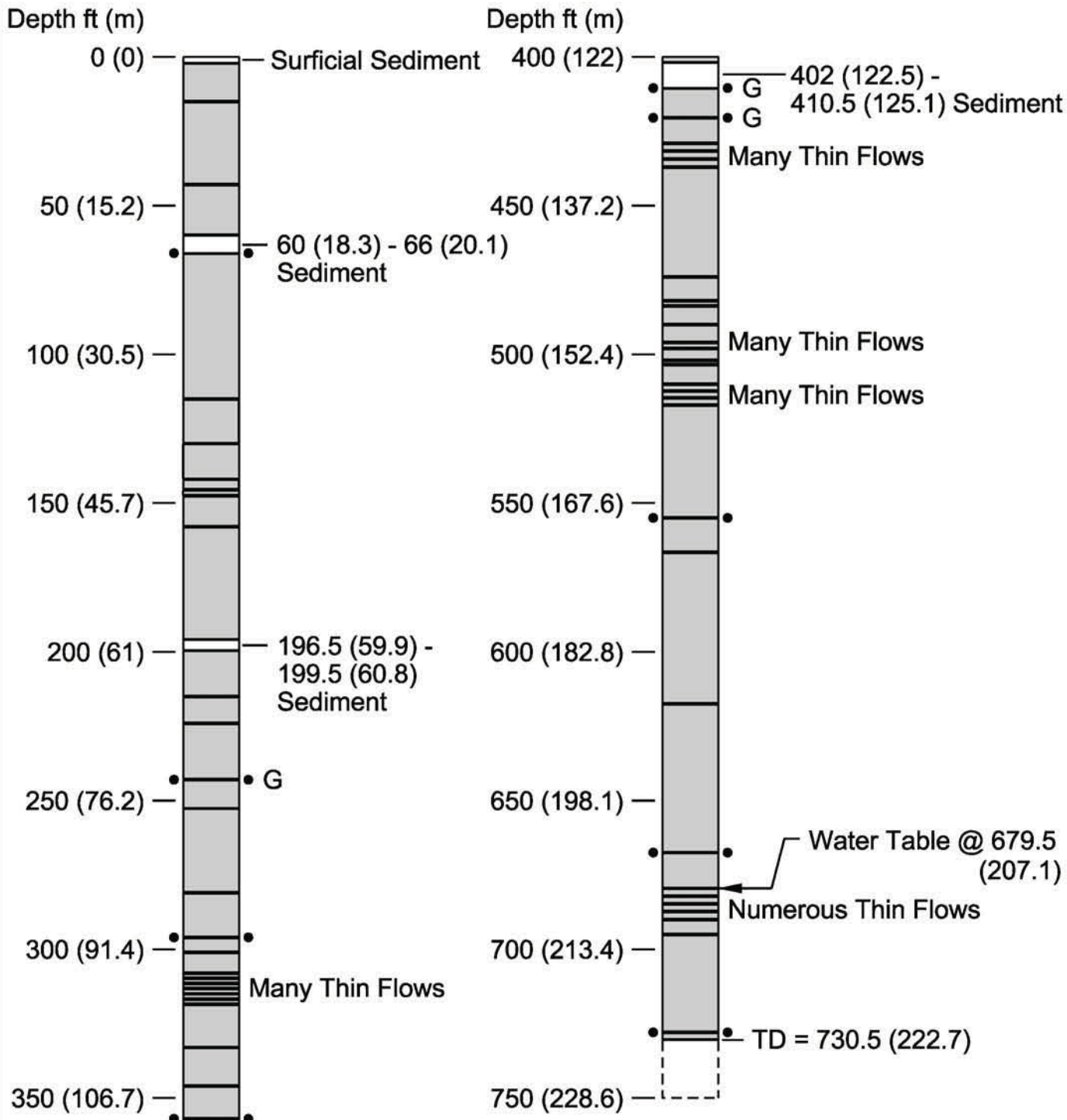
SCALE
0 2500 5000 ft

N

Figure 3.3-16 **Rev. 2**

Existing Agricultural and Newly Installed Monitoring Wells

EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT



Summary lithologic log of GW-1 rock core. Gray-shaded intervals are basalt lava flows, with flow contacts indicated as dark lines. Unshaded intervals are sediment interbeds of eolian origin. Filled dots at selected lava-flow contacts indicate a strong petrographic contrast between lavas across the contact. "G" symbol along side filled dots indicates a significant change in natural-gamma intensity across the lava-flow contact.

Figure 3.3-17 **Rev. 2**

GW-1 Lithologic Log - Summary

EAGLE ROCK ENRICHMENT FACILITY
ENVIRONMENTAL REPORT

3.4 WATER RESOURCES

This section describes the surface water and groundwater resources for the site of the proposed Eagle Rock Enrichment Facility (EREF). It provides data for the site and surrounding area and describes the regional setting of the natural water systems. This information establishes the basis for evaluation of potential facility impacts on surface water, groundwater, aquifers, water use, and water quality. Subsections address surface hydrology, water quality characteristics, pre-existing environmental conditions, water rights and resources, water use, contamination sources, and groundwater characteristics.

Much of the water resources information was obtained from prior studies, including extensive subsurface investigations for the Department of Energy's Idaho National Laboratory (INL), which is located immediately west of the proposed site, as well as regional studies conducted by the U.S. Geologic Survey and the State of Idaho. This information is supplemented by a site specific groundwater monitoring and sampling program initiated in March 2008.

The proposed facility will use groundwater for both process and potable water requirements. No surface water will be used. The collection and storage of runoff from specific site areas will be controlled. As described below, no significant adverse changes are expected for the hydrologic environment as a result of construction and operation of the facility. ER Section 4.4.7, Control of Impacts to Water Quality, addresses the potential impacts to water resources as a result of activities at the proposed facility, including runoff and infiltration changes due to plant construction and fill placement.

3.4.1 Surface Hydrology

The National Oceanic and Atmospheric Administration's (NOAA) Western Regional Climate Center maintains historical climate data for weather stations throughout the western United States. NOAA classifies the climate of the proposed site as semi-arid climate. A detailed description of the local climate is presented in ER Section 3.6, Meteorology, Climatology, and Air Quality. The combination of low annual precipitation, high evaporation and site topography has created a low potential for surface water run-on or run-off for this site.

The proposed EREF site contains no surface water bodies. There are a few small drainage features in the northeastern corner, and the southeastern and southwestern areas of the proposed site. However, the drainages in the northeastern corner are no longer evident in the field because they are within irrigated crop circles when the natural topography has been smoothed to accommodate crop production. The southeastern and southwestern drainage features likely originated from natural erosional processes during spring snowmelt or heavy rains but now primarily conduct minor amounts of water from irrigated agriculture areas. The southeastern drainages terminate as seepage loss into the ground or by evapotranspiration. In the southwestern area, a single natural drainage was identified during field reconnaissance and this ephemeral drainage can convey water off site during episodic melt water and precipitation events or agricultural flooding. The drainage is located in the southwestern corner of the proposed site and runs from the south-central area of the proposed site southward toward Highway 20. The source of the water within the site boundary is likely the westernmost center pivot agricultural irrigation system. The drainage also potentially conveys surface water during large rainfall events. Just to the north of Highway 20, a series of small ponds were used historically to collect and store water from this drainage for agricultural uses, but these ponds are no longer in use and are dry. Highway 20 has a culvert to convey water from this drainage to the south away from the roadway. Based on field observations, this drainage has an incised

channel into the soil exposing bedrock in some areas. Figure 3.4-1, Drainage Feature and Location, shows this drainage feature.

Regional and local hydrologic features are shown in Figure 3.4-2, Regional Hydrologic Features Within 80 km (50 mi), and Figure 3.4-3, Local Hydrologic Features Within 8 km (5 mi). An example of typical site drainage morphology is shown in Figure 3.4-4, Photo of Small Drainage Feature.

Most precipitation is contained on site due to infiltration and evapotranspiration. The vegetation on the site is primarily big sagebrush and perennial grasses or crops on approximately 389 ha (962 acres) of the proposed facility. The surface soils are predominantly of an eolian origin having low permeability and high storage, which tends to hold moisture rather than allow rapid infiltration. Water held in storage in the soil is subsequently subject to evapotranspiration by the well rooted xerophyte type and drought resistant plants of this locale.

Twenty subsurface borings were drilled at the site during November 2007. An additional 10 borings were drilled in May 2008. Moisture content by weight of the initial 20 samples ranged from 9.6% to 15.5%. Moisture content by weight of the May 2008 samples ranged from 10.6% to 19.0%. The winter and spring of 2008 were exceptionally moist in terms of snow and rainfall, explaining the higher moisture contents measured in May 2008 compared to those for November 2007.

The groundwater system underlying the Snake River Plain (SRP) in the vicinity of the proposed facility is referred to as the Eastern Snake River Plain (ESRP) Aquifer (Whitehead, 1992). Recharge rates from precipitation can vary significantly from one part of the ESRP to another due to variations in rainfall, timing, surface cover, evaporation rates, vegetation, etc. In the central part of the ESRP recharge rates are reported to range from 0.6 cm/yr (0.2 in/yr) near the EREF site to 9.1 cm/yr (3.6 in/yr) near Craters of the Moon to the west. The higher recharge rates at Craters of the Moon is attributed to higher precipitation, freshly exposed basaltic lava with high permeability, and because soils and vegetation are largely absent (Ackerman, 2006). At INL, recharge rates range from 0.30 cm/yr (0.12 in/yr) to 1.2 cm/yr (0.48 in/yr) or 2% to 5% of mean annual precipitation of 21.3 cm/yr (8.4 in/yr) (Ackerman, 2006). Given the proximity of INL and similarity in terrain, recharge rates to the ESRP Aquifer at the proposed site are also expected to be in the range of 2% to 5% of mean annual precipitation.

3.4.1.1 Facility Withdrawals and/or Discharges to Hydrologic Systems

A summary of annual liquid waste volumes anticipated to accumulate at the EREF is provided in Table 3.4-1, Summary of Potentially Contaminated Liquid Wastes for the Eagle Rock Enrichment Facility. EREF water consumption is provided in Table 3.4-2, Anticipated Normal Facility Water Consumption and Table 3.4-3, Anticipated Peak Facility Water Consumption. Domestic and process water will be withdrawn from one or more on-site wells. The EREF is expected to require approximately 24,900 m^3/yr (6,570,000 gal/yr) in support of plant operations. Of this approximately 2,100 m^3/yr (554,800 gal/yr) will be consumed by plant processes and 22,800 m^3/yr (6,023,000 gal/yr) will be used for potable water.

The EREF design precludes operational process discharges from the plant to surface or groundwater. Liquid wastes are treated and discharged to atmosphere by evaporation via the Liquid Effluent Collection and Treatment System Evaporator. Total effluent discharge to atmosphere by evaporation from the liquid effluent system evaporator are approximately 59,100 L (15,625 gal) annually. The slurry from the evaporator process is expected to be approximately 720 L (190 gal) annually. This waste will be collected and transferred offsite to a low-level waste facility. Two engineered basins, the Cylinder Storage Pads Stormwater

Retention Basins, will be utilized for the collection and containment of water from stormwater runoff from the Cylinder Storage Pads and daily treated domestic sanitary effluent discharges. The annual treated domestic sanitary effluent discharge to the basin will be approximately 18,700 m^3/yr (4,927,500 gal/yr). The annual stormwater runoff discharge from the Cylinder Storage Pads to the Cylinder Storage Pads Stormwater Retention Basins will be approximately 65,240 m^3/yr (17,234,700 gal/yr). Therefore, the total potential annual discharge to the two Cylinder Storage Pads Stormwater Retention Basins will be approximately 83,940 m^3 (22,162,300 gal). The locations of the Cylinder Storage Pads Stormwater Retention Basins are shown on Figure 4.4-1, Facility Layout with Stormwater Detention/Retention Basins. Evaporation will provide the only means of liquid disposal from the Cylinder Storage Pads Stormwater Retention Basins. The Cylinder Storage Pads Stormwater Retention Basins will include a single membrane liner, to eliminate infiltration into the ground. Residual dry solids, if any, after evaporation of water, will be impounded within the basin.

Each of the two Cylinder Storage Pads Stormwater Retention Basins is designed to contain a volume of approximately 83,019 m^3 (67.3 acre-ft) maintaining a freeboard of 0.9 m (3.0 ft). Under highly unlikely events, the volume of each basin will contain approximately 113,700 m^3 (92.2 acre-ft), maintaining a freeboard of 0.3 m (1.0 ft). The area served by the basin includes 25.6 ha (63.3 acres), the total area of the Cylinder Storage Pads. The retention basins are designed to contain runoff for a volume equal to twice that for the 24-hour, 100-year return frequency rain storm, a 5.70-cm (2.24-in) rainfall plus allowances for daily treated sanitary effluent discharges.

A packaged treatment plant is planned to dispose of domestic sanitary wastes at the site. The solid wastes generated by the Domestic Sanitary Sewage Treatment Plant will be temporarily stored in a holding tank for periodic disposal at an off-site location, as described in ER Section 4.1.2, Utilities Impacts. As indicated above, daily treated domestic sanitary effluent from the sewage system will be directed to two lined Cylinder Storage Pads Stormwater Retention Basins.

Residual solids, after evaporation of water from the Cylinder Storage Pads Stormwater Retention Basins, will be removed off site by a licensed contractor. The wastes will be disposed based on their characterization and in accordance with the U.S. EPA and State of Idaho regulatory requirements. The State of Idaho has adopted the U.S. EPA hazardous waste regulations governing the generation, handling, storage, transportation, and disposal of hazardous materials (IDAPA, 2008f). These regulations are found in ER Section 1.3, Applicable Regulatory Requirements, Permits and Required Consultations.

Stormwater runoff from the central, southern, and surrounding runoff diversions will be collected in the Site Stormwater Detention Basin. The Site Stormwater Detention Basin is located at the south side of the proposed site and will collect runoff from various developed parts of the site, including roads, parking areas, and building roofs (see Figure 4.4-1, Facility Layout with Stormwater Detention/Retention Basins). The detention basin will be unlined and will have an outlet structure to control discharges above the design level. Normal discharge will be through evaporation and infiltration into the ground. The detention basin will be designed to contain runoff for a volume equal to the 24-hour, 100-year return frequency rain storm of 5.70 cm (2.24 inch) rainfall. The storage capacity available for maintaining a freeboard of 0.6 m (2.0 ft) is approximately 32,835 m^3 (27 acre-ft). For a highly unlikely storm scenario maintaining a freeboard of 0.3 m (1.0 ft), the basin will have approximately 49,600 m^3 (40 acre-ft) of storage capacity. The area served by the detention basin is about 139.3 ha (344.2 acres). It will also be designed to detain post-construction peak flow runoff rates from the outfall that are equal to or less than the pre-construction runoff rates from the site area.

Water balances for the Cylinder Storage Pads Stormwater Retention Basins are presented in Tables 3.4-4 and 3.4-5, Water Balance for the Cylinder Storage Pads Stormwater Retention Basins (minimum and maximum scenarios, respectively). Similarly, water balances for the Site Stormwater Detention Basin are found in Tables 3.4-6 and 3.4-7, Water Balance for the Site Stormwater Detention Basin (minimum and maximum scenarios, respectively). The water balance tables consider the following components:

- Precipitation runoff
- Direct precipitation
- Treated domestic sanitary effluent to the retention basins
- Infiltration from the detention basin, and
- Evaporation.

The water balances include the following inputs and assumptions in addition to those cited in the table notes:

- The annual minimum and maximum precipitation amounts were distributed by month using the recorded direct and wettest distribution by month. Use of the minimum precipitation amounts provides a minimum discharge scenario. Use of the maximum precipitation amounts provides a maximum discharge scenario. The information conservatively represents what could possibly occur (although highly unlikely) over a very dry or very wet calendar year based on the 53 year period of record.
- No credit is taken for outflows from the Site Stormwater Detention Basin through the discharge outlet. Any such flows will eventually infiltrate, evaporate or evapotranspirate.
- Precipitation inflow to the retention basin is based on 100% impervious surface contribution from the Cylinder Storage Pads.
- Precipitation inflow to the detention basin is based on the proposed developed surface characteristics of impervious areas, gravel areas, lawn and natural areas contributing to the basin. Inflows were calculated using the HydroCAD Stormwater Modeling System computer software. Urban Hydrology for Small Watersheds, TR-55 was used to calculate runoff curve numbers, taking into account the frozen ground conditions during the winter season.

The tables provide the monthly balance (inflow minus outflow). A positive value indicates that the inflow components exceed the outflow components for the respective basin. A negative value indicates that outflow components will dispose of a portion of or the entire monthly inflow for the respective basin. The tables also provide the monthly net in the basin. A non-zero value indicates that the basin will contain standing water.

The results for the Cylinder Storage Pads Stormwater Retention Basins show that basin outflow due to evaporation will exceed inflows for the months of May through October under the minimum discharge scenario. Cumulative basin outflow due to evaporation does not exceed the monthly inflows for this unlikely chain of events during the maximum discharge scenario. However, the storage volume provided is never exceeded even under the cumulative effect of back to back record wettest months. Under this highly unlikely event, freeboard has been reduced to 0.3 m (1.0 ft) for calculating available basin volume. For the more likely scenario, if the monthly mean precipitation is used in this basin model, a freeboard of 2.15 m (7.05 ft) is provided.

The results for the Site Stormwater Detention Basin show that basin outflow due to evaporation and infiltration will exceed all inflows on a monthly basis under both discharge scenarios. Of the

amount that infiltrates into the ground, a portion is expected to eventually return to the atmosphere via evapotranspiration by vegetation growing within and in the vicinity of the basin. As shown in Tables 3.4-6 and 3.4-7, the combination of both potential infiltration and potential evaporation are more than sufficient to dispose of basin inflows on a monthly basis.

In summary, the results demonstrate that even under the maximum scenarios, the capacities of the basins are not exceeded. As stated above, the evaporation rates used in calculating the water balances for the retention and detention basins are based on historic ambient evaporation rates for the site area. Should ambient seasonal air temperatures increase due to global warming and climate change, the evaporation rates would be expected to increase, further reducing infiltration from the detention basin and/or the potential to exceed basin capacities. As a result, the water balance tables are considered conservative.

3.4.2 Water Quality Characteristics

As discussed in ER Section 3.4.1, Surface Hydrology, there are no surface water bodies at the proposed facility and no surface water was present in the drainages during the site field investigations and site visits between November 2007 and July 2008 and in October 2008. The vast majority of runoff from precipitation at the site is effectively contained on site by the natural topography where it infiltrates into the shallow soils. There are small linked drainages that likely convey limited seasonal drainage. The heads of these drainages are near the boundary of the facility footprint.

Two agricultural wells (Lava Well-3 and Spud Well) were previously installed at the proposed site. In addition, five deep aquifer monitoring wells (GW-1 through GW-5) and one shallow perched water well (GW-4S) were drilled and installed on the proposed site (see Figure 3.4-5). Standard protocols were followed during all phases of well drilling, installation, completion, development, and sample collection.

Groundwater samples were collected from all of the aquifer monitoring wells; however, a groundwater sample could not be obtained from the shallow perched water well (GW-4S) due to lack of water. GW-4S was installed to determine if a perched groundwater system existed at the site; however, this well has remained dry since completion. The existing agricultural wells were sampled in March 2008, June 2008, and September 2008. The deep monitoring wells GW-1 through GW-5 were sampled as they were completed between May 2008 and July 2008, and sampled a second time in September/October 2008. Additional groundwater sampling was performed in January, 2009 and April, 2009. The regional and local groundwater chemistry is described in detail in ER Section 3.4.15.

3.4.3 Pre-Existing Environmental Conditions

Historically, the site has been used for farming and grazing. There is no documentation of manufacturing, storage, or significant use of hazardous chemicals on the subject property. The closest area of large industrial operations is the INL. The eastern boundary of the INL is about 0.8 km (0.5 mi) west of the proposed site. The INL property near the proposed site is undeveloped rangeland. The closest facility on the INL property is the Materials and Fuels Complex located approximately 16 km (10 mi) west of the proposed property boundary. There are no other commercial or industrial facilities within 8 km (5 mi) of the site.

The primary anthropogenic effects on water quality reported for the ESRP Aquifer in the vicinity to the EREF are due to:

- Agricultural practices

- Industrial operations at INL

The major effects of agricultural practices on the ESRP water quality are elevated concentrations of nitrate and other anions and the occasional presence of pesticides. Wells near the eastern boundary of the INL show elevated nitrate and other anion concentrations probably due to agricultural impacts (DOE-ID, 2007a). The elevated nitrate concentrations are indicative of leaching of fertilizers in agricultural areas and transport into the aquifer. The transport to the aquifer reflects irrigation water migrating back to the aquifer with an increase in anions, chloride and sulfate due to evaporation. Agricultural areas upgradient of the EREF site could impact water quality beneath the EREF site.

INL is the closest area of large industrial operations to the proposed EREF site. However, regional groundwater flow directions indicate that INL is cross gradient to the proposed EREF (DOE-ID, 2007a; DOE-ID, 2007b; Ackerman, 2006). Groundwater flow paths determined by delineation of groundwater plumes at the INL indicate that these plumes will not impact the proposed EREF site (DOE-ID, 2007b).

3.4.4 Historical and Current Hydrological Data

The proposed facility is located in an area with no surface water bodies. The predominant regional direction of groundwater flow is from the northeast to southwest (Smith, 2004) (Whitehead, 1992). The closest surface water bodies are the Snake River and the Market Lake Wildlife Management Area (WMA). These two surface water bodies are located about 32 km (20 mi) to the east and northeast of the site, respectively. Each of these features is located within the Idaho Falls watershed (Hydrologic Unit Code [HUC] 17040201) (IDEQ, 2004). Due to the distance of these surface waters bodies from the proposed site, it is unlikely that they will be impacted by the facility from surface water flow. Flow data for the Snake River are presented in ER Section 3.4.13, Freshwater Streams for the Watershed Containing the Site.

3.4.5 Statistical Inferences

With the exception of the calculation and presentation of simple arithmetic means, no statistical parameters are used to provide or interpret surface hydrologic data for the proposed facility.

3.4.6 Water Rights and Resources

The proposed facility will obtain water for operational purposes from groundwater using wells within the property boundary. Water rights and transfers associated with the acquisition of this water are described in the following subsections.

3.4.6.1 Public Water Supply and Water Rights

The ESRP Aquifer has been a designated “sole source aquifer” since 1991. A sole source aquifer is defined by the EPA as an aquifer that supplies at least 50% of the drinking water in the area overlying the aquifer. The EPA definition also requires that the area dependent on the sole source aquifer must have no alternative drinking water sources that could satisfy all of the drinking water in an economical and legal manner (EPA, 2008a). At the current time, the ESRP Aquifer is the sole source of drinking water for the entire population residing in southeast and south-central Idaho.

The largest municipalities located in the ESRP include Idaho Falls in Bonneville County and Pocatello in Bannock County. The City of Idaho Falls operates a system of 19 groundwater

wells that produce an average daily usage of about 76,000 m^3/d (20,000,000 gal/d) and maximum usage of 220,000 m^3/d (58,000,000 gal/d). The City of Pocatello obtains drinking water from the ESRP and the tributary Portneuf Aquifer through a system of 21 water supply wells. These wells provide an average of 57,160 m^3/d (15,000,000 gal/d) (IDC, 2008a).

The use of groundwater by the EREF will be covered by a 1961 water right appropriation that will be transferred to the property for use as industrial water. The water transfer will occur concurrently with the purchase of the property by AES and will change the original water use from agriculture to industrial use. The primary point of diversion will be from the existing agricultural well, Lava Well 3, near the center of Section 13, or a replacement well. The water will be assigned to other points of diversion to allow for the use of water from another well if the primary well should happen to fail. The original 1961 appropriation will decrease to approximately 1,713 m^3/d (452,500 gal/d) for industrial use and 147 m^3/d (38,800 gal/d) for seasonal irrigation use.

The annual water usage during the construction years will increase to a maximum estimate of 98,458,000 L/yr (26,010,000 gal/yr) in the second year and decrease to 84,374,000 L/hr (22,289,000 gal/yr) during the seventh year of construction. The maximum annual water usage rate during construction is about 16% of the water appropriation value of 625,000,000 L/yr (165,000,000 gal/yr) for industrial use. It is assumed that construction water usage during construction years 8 through 11 will diminish markedly as most of the remaining construction activities are for assembly of systems and components and not concrete mixing, dust control or soil compaction. The heavy construction period includes the years when both construction and operation of cascades overlap. Section 3.4.7 provides the details of the water use values for construction and operation.

The predicted daily water consumption during operations of the EREF is anticipated to be approximately 68.2 m^3/d (18,000 gal/d) and the peak water consumption rate is anticipated to be 42 L/s (664 gpm). The normal annual water usage rate for the EREF will be 24,870,000 L/yr (6,570,000 gal/yr), which is a very small fraction (i.e., about 4%) of the water appropriation value of 625,000,000 L/yr (165,000,000 gal/yr) for industrial use. The peak water usage is developed based on the assumption that all water users are operating simultaneously. Furthermore, the peak water usage assumes that each water user is operating at maximum demand. This combination of assumptions is very unlikely to occur during the lifetime of the EREF. Nevertheless, the peak water usage is used to size the piping system and pumps. Given that the normal annual water usage rate for the EREF is a very small fraction of the appropriation value, momentary usages of water beyond the expected normal water usage rate are expected to be well within the water appropriation value for the EREF.

3.4.6.2 Regional Groundwater Use

The SRP Aquifer is relied upon for drinking water and irrigation throughout southeastern Idaho (Garabedian, 1992)(Lindholm, 1996). A breakdown of the water withdrawals by use from the SRP Aquifer is provided in Table 3.4-8, Total Groundwater Withdrawals from the SRP Aquifer for Irrigation, Public-Supply, and Self-Supplied Industrial Water Uses in 2000. The data in this table indicate that irrigation is the primary use, accounting for 97% of the total withdrawals in 2000 (Maupin, 2005). Public water supply accounts for 3% of the total withdrawals, and industrial uses amount to a fraction of 1% (Maupin, 2005).

At the current time, about 1.2 million ha (3 million ac) of the SRP are irrigated farmlands. About one third of the irrigation water is pumped from the SRP Aquifer and two thirds from surface water diversions (DGI, 2008). Irrigation with groundwater is possible because of high rates of water yield from the basaltic units of the SRP Aquifer.

3.4.6.3 Idaho National Laboratory

The INL is a significant user of groundwater in the general area of the proposed site. The ESRP Aquifer is the source of all the water used at INL. In 2007, the INL pumped 3.97E+06 m^3 (1.05E+09 gal) from a total of 29 production wells at 8 facilities (INL, 2008). The water uses at the INL include drinking water for employees and water for use in chemical processing, facilities operations, wastewater treatment, and environmental remediation (ATSDR, 2004).

3.4.6.4 Site Groundwater Management

The proposed site location is within the Bonneville-Jefferson groundwater management district. According to the Idaho Department of Water Resources (IDWR, 2008a), groundwater districts were defined by the Idaho State Legislature in the "Ground Water District Act" of 1995. This Act allows groundwater users to organize their own Districts that have broader authorities than water measurement districts. The groundwater districts can perform the measurement and reporting functions required by law and levy assessments similar to water measurement districts. Additionally, groundwater districts may represent their members in various water use issues and related legal matters, develop and operate mitigation and recharge plans, and perform other duties. It is unlikely that stipulations of the Bonneville-Jefferson Groundwater Management District will have any impact on the proposed EREF use of ground water.

The proposed site location is not within the service areas of any irrigation companies. It also is not located in established groundwater critical groundwater areas, contamination areas, or groundwater vulnerability areas (IDWR, 2008a).

3.4.7 Quantitative Description of Water Use

The source of water for the proposed facility would come from on-site groundwater wells. Anticipated water use by the facility is shown in Table 3.4-2, Anticipated Normal Plant Water Consumption, and Table 3.4-3, Anticipated Peak Facility Water Consumption. Anticipated water use to construct the facility is shown in Table 3.4-15, Construction Water Use (2011-2022). The construction period includes the years when both construction and operation of cascades overlap. Anticipated water use to operate the facility during this period of construction and operations overlap is shown in Table 3.4-16, Operations Water Use (2011-2022). Irrigation water usage will start in the year 2013 and continue to increase until the completion of construction in 2022. The irrigation water usage will not exceed 24,669,000 L (6,517,020 gal) per growing season and will not be applied outside the period defined by the Idaho Department of Water Resources (IDWR) as the growing season – April 1 through October 31. Irrigation water usage is within the IDWR irrigation water use limitation specified in the IDWR Water Rights for the EREF site. The water supply will be adequate for construction, operation and maintenance of the proposed site.

3.4.8 Non-Consumptive Water Use

The EREF will have a water appropriation of approximately 1,713 m^3/d (452,500 gal/d) for industrial use and 147 m^3/day (38,800 gal/day) for seasonal irrigation use from an existing water right associated with the property. This water right will transfer to AES with the purchase of the property. Non-consumptive use of water is not planned.

3.4.9 Contaminant Sources

There will be no direct discharges to native groundwater or surface waters from the operations at the proposed facility, other than potential infiltration from the Site Stormwater Detention Basin. There is no history of industrial use at the site. With the exception of agricultural products (fertilizers, pesticides, etc.) used at or near the site, the closest source of known hazardous releases and contaminants to the groundwater system is the INL. However, the INL is hydrologically cross gradient to the proposed site based on predominant flow directions in the ESRP Aquifer (DOE-ID, 2007a; DOE-ID, 2007b; Ackerman, 2006). Agricultural influences are the only potential upgradient impacts. Additional industrial development could occur in the vicinity, but no plans for such operations are known at this time.

Stormwater runoff from the proposed site will be controlled during construction and operation. Appropriate stormwater construction runoff permits for construction activities will be obtained before construction begins. Designs for stormwater runoff controls for the operating plant are described in Section 4.4, Water Resources Impacts. Appropriate routine erosion control measures and best management practices (BMPs) will be implemented as is normally required by such permits.

During operation, stormwater will be collected from appropriate site areas and routed to detention/retention basins. The stormwater plan is described in ER Section 4.4.1, Receiving Waters and shown in Figure 4.4-1, Facility Layout with Stormwater Detention/Retention Basins.

3.4.10 Description of Wetlands

An evaluation of wetlands mapped by the Fish and Wildlife Service determined that the site does not contain jurisdictional wetlands (USFWS, 1980) (USFWS, 2008c).

3.4.11 Federal and State Regulations

ER Section 1.3, Applicable Regulatory Requirements, Permits, and Required Consultations, describes the applicable regulatory requirements and permits for this project. ER Section 4.4, Water Resources Impacts, describes potential site impacts as they relate to environmental permits regarding water use by the proposed EREF (refer to ER Section 1.3.1, Federal Agencies and ER Section 1.3.2, State Agencies).

Applicable regulations for water resources for this proposed site include:

- The Safe Drinking Water Act (SDWA) requirements on a state level: The Idaho Environmental Protection and Health Act (Idaho Code Chapter 1, Title 39) gives the Idaho Department of Environmental Quality (IDEQ) the authority to promulgate rules governing quality and safety of drinking water. The Water Quality Division (WQD) is delegated responsibility to implement the SDWA. Rules governing quality and safety of drinking water in Idaho have been promulgated in IDAPA 58.01.08. Although a permit is not required for a drinking water system serving fewer than 10,000 persons (IDAPA, 2008b), the IDEQ requires a comprehensive treatment plan and licensed plant operator. The drinking water plan for the proposed EREF will include sufficient detail to demonstrate that the proposed project meets applicable criteria. The facility plan generally addresses the overall system-wide plan.
- National Pollution Discharge Elimination System (NPDES): The NPDES permit program includes an industrial stormwater permitting component adopted under Section 402 of the CWA. The NPDES Stormwater Program regulates discharges of stormwater from industrial

and commercial facilities to waters of the United States. Since the construction of the proposed EREF would be greater than 0.4 ha (1.0 ac), AES will obtain a NPDES Construction General Permit to establish the provisions for meeting stormwater regulations at the EREF. For operations, AES will obtain a NPDES Multi-Sector General Permit for stormwater discharges. Design, construction, and operational details of facility groundwater systems and stormwater pollution prevention plans will be provided to EPA and IDEQ as part of the Notice of Intent to obtain each permit. Water Well Permit: A permit application to drill a well must be approved by staff of the IDWR. The information required on the application includes the well location, proposed use, and well construction methods. Wells must be drilled by persons holding a driller's license from the IDWR. Wells must also comply with Idaho's well construction standards found at IDAPA 37.03.09 (IDAPA, 2008h). A drilling permit must be obtained before the construction of any well greater than 5.5 m (18.0 ft) in depth. The drilling permit is valid for two months from the approval date for the start of construction.

3.4.12 Surface Water Characteristics for Relevant Water Bodies

No off-site surface water runoff will occur from the proposed facility. One minor, natural erosional drainage exists within the proposed site boundary (described in ER Section 3.4.1, Surface Hydrology). It is located in the southwestern corner of the proposed site and runs from the south-central area of the proposed site southward toward Highway 20. Highway 20 has a culvert to convey water from this drainage to the south, away from the roadway. Precipitation that will fall on the developed areas of the proposed site will be collected in stormwater retention and detention basins where it will be allowed to evaporate or infiltrate into the subsurface in the case of the detention basin.

3.4.12.1 Freshwater Streams, Lakes, Impoundments

The proposed site does not include any freshwater streams or lakes. Retention and detention basins designed to contain stormwater runoff and treated effluent from the Domestic Sanitary Sewage Treatment Plant from the EREF will be constructed as part of the facility. These components are described in ER Section 3.4.1.1, Facility Withdrawals and/or Discharges to Hydrologic Systems.

3.4.12.2 Flood Frequency Distributions, Including Levee Failures

The proposed facility elevation is above the 100-year and the 500-year flood elevation (FEMA, 1981).

3.4.12.3 Flood Control Measures (Reservoirs, Levees, Flood Forecasting)

The proposed facility is not located near any reservoirs, levees or surface waters that could cause flooding of the plant site. In addition, because the proposed facility elevation will be above the 100-year and the 500-year flood elevation - as designated by FEMA (FEMA, 1981), no flood control measures are proposed.

3.4.12.4 Location, Size and Elevation of Outfall

Operations at the proposed facility will not include an outfall to any surface water bodies.

3.4.12.5 Outfall Water Body

The operations at the proposed facility will not include a surface water body outfall.

3.4.12.6 Bathymetry Near Any Outfall

The operations at the proposed facility will not include an outfall to any surface water bodies and, as a result, bathymetry is not necessary.

3.4.12.7 Erosion Characteristics and Sediment Transport

The EREF is designed as a non-discharge facility; therefore erosion and sediment transport are not expected to occur. The operations at the proposed facility will not include an outfall or discharge to any surface water bodies.

3.4.12.8 Floodplain Description

The proposed EREF site elevation is above the 100-year and the 500-year flood elevation (FEMA, 1981). There are no detailed floodplain maps available for the site since it is not located near any floodplains.

3.4.12.9 Design-Basis Flood Elevation

Since the proposed site is not within the 100-year or 500-year floodplain (FEMA, 1981), flooding at the proposed facility is unlikely. The proposed site is contained within the Idaho Falls watershed, HUC 17040201, with gradual average slopes of about 1.4%. The Natural Resources Conservation Service soil survey data summary indicates that soils typically have no potential for ponding (NRCS, 2008a). Any on-site precipitation will be subject to evapotranspiration or infiltration. Minor intermittent drainages originating within the site boundary do not connect to off-site resources or larger drainages. The largest surface water body southwest of the proposed site (along the topographical grade) is Lake Wolcott, approximately 120 km (75 mi) from the proposed site and the Snake River about 32 km (20 mi) east of the site. No special design considerations for local intense precipitation are necessary to prevent flooding at the proposed site other than the stormwater runoff controls described in ER Sections 4.4.1, Receiving Waters, and 4.4.7.1, Mitigations.

3.4.13 Freshwater Streams for the Watershed Containing the Site

The Snake River and some minor tributaries are located in the Idaho Falls watershed, HUC 17040201, where the proposed facility will be located (IDEQ, 2004). No streams on the proposed site flow directly to any tributaries or the Snake River.

3.4.13.1 Drainage Areas

The proposed facility is located in the Idaho Falls watershed, HUC 17040201. The slopes and surface waters generally flow from northeast to southwest. The closest surface water bodies are the Snake River and the Market Lake Wildlife Management Area (WMA), about 32 km (20 mi) to the east and northeast of the site, respectively. Each of these features is located within the Idaho Falls watershed, HUC 17040201 (IDEQ, 2004). As described in ER Section 3.4.1, Surface Hydrology, there are a few small drainage areas within the proposed site boundary.

3.4.13.2 Historical Maximum and Minimum River Flows

There are three USGS streamflow gauging stations for the Snake River located within the Idaho Falls watershed that have historical daily records of streamflow (USGS, 2008b). These are the Snake River near Lewisville, Snake River above Eagle Rock near Idaho Falls, and Snake River near Idaho Falls. Table 3.4-9, Average Flows by Month for the Snake River, shows the average flows by month at these gauge locations along the Snake River. Table 3.4-10, Snake River Gauge Statistics, shows the average annual flow, average daily minimum and maximum flows, and daily minimum and maximum flows for each of these gauges.

A hydrograph depicting the mean daily streamflow over the period of record for the Snake River gauge with the longest historical record is shown in Figure 3.4-6, Snake River above Eagle Rock near Idaho Falls Hydrograph.

3.4.13.3 Historical Drought River Flows

The Palmer Drought Severity Index shows that south-central Idaho has been in a drought since water year 2000 (Skinner, 2007). Average annual flows recorded at USGS gauge 13057155, Snake River above Eagle Rock near Idaho Falls, have been reduced to about 200 m^3/s (7,060 ft^3/s) since this time. Refer to Figure 3.4-7, Annual Flows in the Snake River.

The State of Idaho has published a drought plan to respond to water supply issues during dry periods and has identified critical groundwater management areas, most located in southwestern Idaho, where groundwater has been “overdrafted” to supplement water needs (IDWR, 2001). However, the proposed EREF is located within the Idaho Falls watershed and has enough available water in times of drought to provide for regional needs.

3.4.13.4 Important Short Duration Flows

Annual peak flows for the Snake River above Eagle Rock near Idaho Falls tend to be between two and three times the average flows (Figure 3.4-7, Annual Flows in the Snake River). The greatest flow occurred during a storm in 1997 where the short duration flow reached 1,376 m^3/s (48,600 ft^3/s) (USGS, 2008b).

3.4.14 Water Impoundments

Impoundments to contain stormwater runoff and treated domestic sanitary effluent will be constructed as part of the facility. These features are described in ER Section 3.4.1.1, Facility Withdrawals and/or Discharges to Hydrologic Systems.

3.4.14.1 Elevation-Area-Capacity Curves

Impoundments to contain stormwater runoff and treated domestic sanitary effluent will be constructed as part of the proposed EREF. These features are described in ER Section 3.4.1.1, Facility Withdrawals and/or Discharges to Hydrologic Systems.

The Site Stormwater Detention Basin which will be located at the south side of the site will be designed to contain runoff for a volume equal to a 24-hour, 100-year return frequency rain storm of 5.70 cm (2.24 inch) rainfall. The storage capacity available for maintaining a freeboard of 0.6 m (2.0 ft) is approximately 32,835 m^3 (27 acre-ft). For a highly unlikely storm scenario maintaining a freeboard of 0.3 m (1.0 ft), the basin will have approximately 49,600 m^3 (40 acre-ft) of storage capacity. The area served by the detention basin is 139.3 ha (344.2 acres).

Each of the two Cylinder Storage Pads Stormwater Retention Basins which will be located northwest of the developed footprint will be designed to contain a volume of approximately 83,019 m^3 (67.3 acre-ft) maintaining a freeboard of 0.9 m (3.0 ft). Under highly unlikely events, the volume of each basin will contain approximately 113,700 m^3 (92.2 acre-ft), maintaining a freeboard of 0.3 m (1.0 ft). The area served by the retention basins will be 25.6 ha (63.3 acres). The retention basins are designed to contain runoff for a volume equal to twice that for the 24-hour, 100-year return frequency rain storm, a 5.70-cm (2.24-in) rainfall plus allowances for treated effluent from the Domestic Sanitary Sewage Treatment Plant.

3.4.14.2 Reservoir Operating Rules

The proposed facility will not make use of any reservoir.

3.4.14.3 Annual Yield and Dependability

The proposed facility will not take or discharge process water to any local water body; thus, it will not affect water storage in any water body.

3.4.14.4 Inflow/Outflow/Storage Variations

The proposed facility will not take or discharge process water to any local water body; thus, it will not affect water storage in any water body.

3.4.14.5 Net Loss, Including Evaporation and Seepage

The proposed facility will not take or discharge process water to any local water body; thus, it will not affect water storage in any water body. Discharge of treated effluent from the Domestic Sanitary Sewage Treatment Plant will be to the Cylinder Storage Pads Stormwater Retention Basins, which will be lined. The retention basins will be designed so that evaporation is the sole discharge route. The annual evaporation potential is 117.73 cm (46.35 in).

3.4.14.6 Current Patterns

The proposed facility will not take or discharge process water to local water bodies or the ground surface; thus, there will be no change in current patterns.

3.4.14.7 Temperature Distribution

The proposed facility will not take or discharge process wastewater or non-contact cooling water to any local water body; thus, it will not affect water temperature in any water body.

3.4.15 Groundwater Characteristics

The groundwater characteristics for the area of the proposed EREF site are discussed in the following sections.

3.4.15.1 Regional Hydrology

The groundwater system underlying the SRP in the vicinity of the proposed facility is referred to as the Eastern Snake River Plain (ESRP) aquifer (Whitehead, 1992). The ESRP Aquifer consists predominantly of flood basalt lava flows with intermittent interbeds of unconsolidated

sediments (Whitehead, 1992) (Whitehead, 1994b) as discussed in ER Section 3.3, Geology and Soils. The geologic units comprising the aquifer are primarily lava flows of the Snake River Group basalts (Qb) and the upper part of the Idaho Group (Bruneau Formation) (Ackerman, 2006) (Smith, 2004). The basalt units are variable in thickness and generally discontinuous in lateral extent. Sedimentary interbeds exist between some of the basalts and are of variable thickness and lateral extent (Ackerman, 2006) (Smith, 2004). At the site, the groundwater surface is encountered at depths between 199.5 m (654.4 ft) and 219.4 m (719.9 ft) below ground surface (bgs). The saturated thickness of the ESRP Aquifer is shown on Figure 3.4-8, Saturated Thickness of Pliocene and Younger Basaltic Rocks in the ESRP Aquifer (Whitehead, 1994b).

The ESRP Aquifer covers about 26,000 km^2 (10,039 mi^2) with a thickness up to 400 m (1,312 ft) thick and the water volume in the aquifer is estimated at 100 billion m^3 (3.5E+12 ft^3) (Smith, 2004). The ESRP Aquifer is a major economic resource in southeastern Idaho that is relied upon for both drinking water and irrigation (Garabedian, 1992) (Lindholm, 1996). Wells completed in the top hundred meters or so (few hundred feet) of the Quaternary basaltic units are reported to have specific-capacity values that range from 0.103 m^3/s (3.6 ft^3/s) to 0.207 m^3/s (7.3 ft^3/s) per meter (3.3 ft) of drawdown (Whitehead, 1994b). Based on an analysis of 176 wells in the ESRP Aquifer, Garabedian (Garabedian, 1992) reported median specific yields that range from 0.0008 m^3/s (0.03 ft^3/s) to 0.197 m^3/s (7.0 ft^3/s) per meter (3.3 ft) of drawdown with higher values were the Quaternary basalts are thickest.

The ESRP Aquifer is unconfined over nearly all of its area through locally confined conditions may exist (Garabedian, 1992). The overlying unsaturated zone or vadose zone is spatially heterogeneous and ranges in thickness from 60 m (200 ft) to greater than 300 m (984 ft) (Smith, 2004) and consists of unconsolidated alluvium and Snake River Group basalts (Qb) (Ackerman, 2006). The saturated thickness of the aquifer is greatest in the central part of the ESRP and thins substantially to the west (Whitehead, 1994b). Within the basalts, permeable zones are located mainly in the tops and bottoms of lava flows, which are typically fractured and porous, leading to high horizontal hydraulic conductivity. Vertical joint densities and presence of lower permeability sediment interbeds act to control vertical hydraulic conductivity (Smith, 2004). The interbeds may also act to locally confine limited portions of the aquifer (Whitehead, 1992). Overall, the fractured, porous, and complexly interconnected nature of the basaltic lava flows has resulted in high but heterogeneous and anisotropic horizontal conductivity and much lower vertical conductivity (Nimmo, 2004).

Natural recharge to the aquifer occurs primarily in the Yellowstone Plateau in southeastern Idaho and in the Bitterroot, Lemhi, Lost River, White Knob, and Pioneer mountain ranges adjacent to the northern side of the aquifer (Smith, 2004). A water budget developed in 1980 for the ESRP Aquifer indicated that 60% of the recharge to the aquifer occurs from infiltration of irrigation water. Recharge from groundwater underflow derived from upland areas of the Yellowstone Plateau and mountainous areas on the north side of the ESRP accounts for another 18%. Infiltration of direct precipitation falling on the ESRP provides another 9% of the recharge budget. Contributions from losing stretches of Snake River tributaries and canals accounted for the remaining 13% of the recharge budget (Garabedian, 1992).

The primary discharge area for the aquifer is the Snake River (Ackerman, 2006) (Garabedian, 1992) (Smith, 2004) (Whitehead, 1992). Much of the discharge occurs in a series of springs known as the “Thousand Springs Area”, near the City of Twin Falls, Idaho and another area of springs near American Falls Reservoir located about 145 km (90 mi) upstream from Twin Falls, Idaho (Wood, 1988). The rate of discharge to the Snake River and the American Falls Reservoir is approximately 69.4 m^3/s (2,450.8 ft^3/s)(Whitehead, 1994b). Discharge rates at specific springs vary seasonally by up to 34% as a result of seasonal precipitation and irrigation

practices (Johnson, 2002). However the total discharge rates to the Snake River are relatively constant on a seasonal basis, although there have been long-term trends in discharge attributable to changes in irrigation practices and climatic fluctuations (Garabedian, 1992) (Lindholm, 1996) (Whitehead, 1994b).

3.4.15.1.1 Groundwater Elevations and Flow Direction

Groundwater elevations in the ESRP Aquifer vary from approximately 1,830 m (6,004 ft) at the northeastern edge to less than approximately 792 m (2,600 ft) at the southwestern edge. The elevation of groundwater drops about 610 m (2,001 ft) over a 320-km (200-mi) flowpath for an average gradient of 1.9 m/km (10.0 ft/mi) (Smith, 2004) (Wood, 1988). Groundwater flowpaths run in a southwestern direction, generally parallel to the Snake River for much of the central portion of ESRP. The Snake River turns northwestward and the groundwater flowpaths discharge to the Snake River (see Figure 3.4-9, Groundwater Elevations and General Direction of Groundwater Movement in the SRP Aquifer) (Ackerman, 2006) (Whitehead, 1994b).

3.4.15.1.2 Groundwater Aquifier Interactions

The ESRP Aquifer is located within a topographic basin formed by geological subsidence relative to surrounding mountain ranges and uplands (Garabedian, 1992). The ESRP Aquifer receives inflows of groundwater as underflow from tributary basins located along its margins, especially along the northern and northwestern boundaries where a series of northwest-trending mountain ranges and valleys terminate on their southern ends in the ESRP (Ackerman, 2006) (Garabedian, 1992) (Lindholm, 1996).

In the “Thousand Springs”, area, the Snake River has incised a deep west-northwest trending channel in the basalt matrix making up the aquifer. In addition, a significant amount of water is withdrawn from the aquifer for irrigation purposes.

Due to the aquifers physical configuration, and the nature of the inflows and outflows, the ESRP Aquifer does not interact with or convey water into other regional aquifer systems.

3.4.15.1.2 Groundwater Velocities

The transmissivities of the basalts comprising the ESRP are very high on average throughout much of the ESRP Aquifer (Ackerman, 2006) (Wood, 1988). As a result, groundwater velocities in the aquifer are relatively fast (Table 3.4-11, Ranges of Hydrologic Properties for the SRP). The average time for water to travel from the recharge areas in the northeast to discharge areas at the Snake River, which is a distance of approximately 320 km (199 mi), is estimated to be about 300 years, yielding an average velocity of 3 m/d (10 ft/d) (Smith, 2004). Determinations of groundwater velocities at the nearby INL, based on chloride-36 and tritium data, range from 0.6 m/d (2.0 ft/d) to 5.5 m/d (18.0 ft/d) (Figure 3.4-10, Groundwater Velocities in the ESRP) (Ackerman, 2006)). Reported velocities on the INL near the border of the proposed site are at the high end of this range at 4.6 m/d (15.1 ft/d) to 5.5 m/d (18.0 ft/d) with flow in a southwesterly direction (Figure 3.4-11, Water Elevations and Flow Directions in the ESRP Aquifer). These rapid flow rates are consistent with studies of stable isotope and tritium levels that have indicated that the water in the ESRP Aquifer is derived from modern meteorological sources in the basin and that recharge from these sources is rapid (Schramke, 1996) (Wood, 1988).

3.4.15.1.3 Regional Soil Properties

Soil cover across the ESRP is generally variable, ranging from non-existent in areas of recent volcanism to tens of meters (feet) to thickest in areas of wind-blown loess accumulation (Hughes, 1999) (Lindholm 1996) (Whitehead, 1994b). Thin soils and basalt outcrops are common in many areas along ridge lines and wind-swept areas. Natural soil development due to vegetation growth and degradation is minimal due to the cold, semi-arid climate.

Soil types in the ESRP fall into six orders of lightly weathered soils characteristic of arid conditions: alfisols, aridisols, entisols, inceptisols, mollisols, and vertisols (Cook, 2007). The textures of most of these soil types are described as falling in the silt-loam textural class with 0% to 27% clay, 55% to 80% silt, and 10% to 35% sand (Nimmo, 2004). The mineralogical composition of the soils reported for INL and likely representative of much of the ESRP include quartz, plagioclase feldspar, potassium feldspar, pyroxene, olivine, calcite, dolomite, and clay minerals (Nimmo, 2004).

Data summarized by Nimmo (Nimmo, 2004) for INL indicate that saturated hydraulic conductivities measured on soil cores range from about 5.0E-04 cm/s (1.6E-05 ft/s) to 1.0E-02 cm/s (3.3E-04 ft/s) although reported ranges in the literature span over six orders of magnitude from 1.1E-08 cm/s (3.6E-10 ft/s) to 1.2E-02 cm/s (3.9E-04 ft/s). The Nimmo (Nimmo, 2004) data show porosities from 0.42 to 0.55 and moisture contents from about 5% to 30%. Measurements of unsaturated properties for surficial soils are also summarized by Nimmo (Nimmo, 2004). These data show drying retention curves with air entry pressures near zero, an abrupt decrease in water content at -10 and -30 kPa (-1.4 and -4.3 psi) and then a nearly flat response in water content to higher pressures.

3.4.15.2 Regional Water Quality

The chemical composition of groundwater in the ESRP has been examined in detail (DOE-ID 2007a; DOE-ID 2007b; Wood, 1988). The geochemical and physical parameter data indicate that there are two major water types in the aquifer (Wood, 1988):

- An upper zone located in predominantly Quaternary basalts and sediment interbeds of the Snake River Group. This upper zone is also called the active portion of the aquifer because it is the fastest moving aquifer water and is the primary portion of the aquifer exploited for irrigation and public water supplies. The upper zone may be potentially impacted by EREF activities.
- A deeper zone of the aquifer often exhibits secondary mineralization and contains low temperature geothermal water located primarily in Tertiary basalts, rhyolites and tuffs. Geothermal water in the ESRP Aquifer is defined as water with a temperature greater than 26.0ºC (78.8ºF). The geothermal groundwater is not a major source for irrigation and public supply. This water would not be expected to be impacted by migration from a surface source located at the EREF.

The shallow part of the Snake River Plain Aquifer is characterized as a calcium-bicarbonate chemical type relatively enriched in silica (DOE-ID, 2007a; DOE-ID, 2007b; Wood, 1988). Solute mass balance calculations indicate that about 80% of the solute load leaving the ESRP is derived from subsurface inflows from surrounding drainage basins (Wood, 1988). The remaining 20% of the solute load is derived from mineral dissolution reactions occurring as groundwater flows through the ESRP and reacts with the bedrock. The major dissolving minerals are magnesium-iron-calcium silicates, pyrite, and anhydrite present in the basalt. Calcium, bicarbonate, and silica are removed from solution by the precipitation of calcite and amorphous silica (Wood, 1988). Detectable but low concentrations of minor elements and trace metals are found throughout the aquifer (Table 3.4-12, Mean Concentrations of Analytes in SRP

Shallow Zone Groundwater). The concentrations of minor elements and metals are generally low due to the neutral to slightly alkaline pH and moderately reducing conditions.

3.4.15.3 Site Hydrogeology

3.4.15.3.1 Site Groundwater Investigations

Site-specific hydrogeologic investigations occurred at the proposed EREF site between May and July 2008. Additional groundwater sampling was performed in September/October 2008, January 2009 and April 2009. The proposed site is located east of the INL site, which has had numerous subsurface investigations performed for the purpose of delineating and monitoring the subsurface hydrologic conditions. Much of this information is directly pertinent to the proposed site and provides the basis for the regional groundwater information summarized in this ER. In addition, the INL hydrogeologic information was used in planning the site-specific investigations.

The objective of the groundwater field studies was to collect data that can be used to describe the following characteristics for the site:

- Stratigraphy of the bedrock units
- Structure and hydrogeological properties of unsaturated and water saturated geological units
- Depth to saturated groundwater conditions within the site boundaries
- Groundwater elevation trends and flow directions
- Prevalence of perched groundwater systems
- Water quality for groundwater
- Potential for interaction between different aquifers

Field activities included:

- Collection of a continuous core between the ground surface and approximately 12.2 m (40.0 ft) below the static water table,
- Installation of five deep monitoring wells to intercept the regional groundwater,
- Installation of one shallow monitoring well to intercept potentially perched groundwater,
- Down hole geophysical testing in two locations,
- Hydrologic testing in both the saturated and unsaturated zones, and
- Groundwater collection and analyses.

Five deep monitoring wells installed at the proposed site were designated as GW-1, GW-2, GW-3, GW-4, and GW-5. One shallow well (GW-4S) was also completed. The locations of these monitoring wells on the proposed site are shown in Figure 3.4-5, Existing Agricultural and Newly Installed Monitoring Wells, and are distributed to allow monitoring of the ground water elevations, evaluation of regional groundwater flow direction, and water quality at the EREF site. The wells are located in areas that are hydrologically upgradient (GW-5), cross gradient (GW-2 and GW-3), downgradient of the plant footprint (GW-4), and within the downgradient edge of the facility footprint (GW-1). The five deep wells provide adequate site-specific data to define the