Appendix J

Characteristics of Herbicides Discussed for Chemical Treatment Options in this Environmental Impact Statement

TABLE J-1
Characteristics and Properties of Herbicides

Herbicide Properties				Behavior in Soils			Behavior in Water		Degradation Mechanism			Toxicity & EPA Toxicity Categories[e]					
Herbicide and Chemical Name	**Examples of Available Products**	**Target Weed Species**	**Mode of Action**	**Average Soil Half-life[a]**	**Soil Sorption (Koc)[b]**	**Mobility[c]**	**Water Solubility[d]**	**Average Half-life in Water**	**Microbial**	**Chemical**	**Solar**	**Oral LD50: Mammals[f]**	**LD50: Birds[g]**	**LC50: Fish[h]**	**Dermal LD50: Rabbit**	**Application Rate[i]**	**Notes**
2,4 D (2,4-dichlorophenoxy) acetic acid	Navigate®, Class®, Weed-Pro®, Justice® Weedar 64, Weed-B-Gon	broadleaf weeds	Auxin mimic	10 days	20 mL/g (acid/salt), 100 mL/g (ester)	moderate-high	900 mg/L (acid), 100 mg/L (ester), 796,000 mg/L (salt)	varies from hours to months	Primary mechanism	Minor mechanism	Low potential	764 mg/kg [low]	500 mg/kg (BW) [moderate]	263 mg/L [moderate]	>2,000 mg/kg	0.475 to 4.0 pounds per acre Typical S-CNF = 0.5 to 1.5 pounds per acre Maximum label = 4.0 pounds per acre	Inexpensive and common herbicide used for over 50 years.
Chlorsulfuron 2-chrloro-N-[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) aminocarbonyl)] benzenesulfonamide	Telar®	broadleaf weeds and some annual grass weeds	Stops production of an amino acid, which inhibits cell division in roots	1 to 3 months	no data available	high	no data available	no data available	no data available	no data available	no data available	<5,000 mg/kg [low]	<5,000 mg/kg (BW, M) [low]	<300 ppm [low]	>3,400 mg/kg	0.25 to 3.0 ounces per acre Typical S-CNF = 0.25 to 3.0 ounces per acre Maximum label = 3.0 ounces per acre	Practically nontoxic to fish, birds, and mammals
Clopyralid 3,6-dichloro-2-pyridinecarboxylic acid	Reclaim®, Curtail®, Transline®	annual and perennial broadleaf weeds	Auxin mimic	40 days	avg 6 mL/g but ranges to 60 mL/g	moderate-high	1,000 mg/L (acid), 300,000 mg/L (salt)	8-40 days	Primary mechanism	Minor mechanism	Low potential	4,300 mg/kg [low]	1,465 mg/kg (M) [low]	125 mg/L [moderate]	>2,000 mg/kg	0.0625 to 0.5 pound per acre Typical S-CNF = 0.1 to 0.375 pound per acre Maximum label = 0.5 pound per acre	Highly selective herbicide developed as an alternative to picloram.
Corn Gluten Meal	WOW!®, Bio-Weed®	broadleaf weeds and annual and perennial grasses	Inhibits the growth of a seed's feeder roots by breaking down the cell wall, so seedlings cannot hold moisture.	5 to 6 weeks	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	20 pounds per 1,000 square feet	Corn gluten is a by-product of wet milling process to make cornstarch. It is an animal feed for cattle, poultry, other livestock, fish and some dog foods.
Dicamba 3,6-dichloro-2-methoxybenzoic acid	Banvel®, Banex®, Trooper®	broadleaf weeds, vines, and brush	Growth regulator	1 to 6 weeks	no data available	high	6,500 mg/L	no data available	Primary mechanism	Very minor mechanism	Very low potential	566 to 3,000 mg/kg [low]	673 to 2,000 mg/kg [low]	>100 ppm [low]	2,000 mg/kg (note: rat, not rabbit)	0.25 to 2 pounds per acre. Maximum S-CNF = 2 pounds per acre per year on a treatment area.	Does not injure most grasses. It will kill broadleaf weeds before and after they sprout.
Fosamine ethyl hydrogen (aminocarbonyl) phosphonate	Krenite®	trees and bushes	Mitotic inhibitor	8 days	150 mL/g	moderate[b]	1,790,000 mg/L	stable in water	Primary mechanism	Very minor mechanism	Very low potential	24,000 mg/kg [slight]	10,000 mg/kg (BW/M) [slight]	670 mg/L [low]	>1,683 mg/kg	6 to 12 pounds per acre	Not registered for use in California or Arizona.

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Glyphosate N-(phosphonomethyl) glycine	RoundUp®, Rodeo®, Accord®	annual and perennial weeds	Inhibits the shikimac acid pathway, depleting aromatic amino acids	47 days	24,000 mL/g	low	15,700 mg/L (acid), 900,000 mg/L (IPA salt), 4,300,000 mg/L	12 days to 10 weeks	Primary mechanism	Minor mechanism	Low potential	5,600 mg/kg [slight]	> 4,640 mg/kg (BW/M) [low]	120 mg/L [moderate]	>5,000 mg/kg	0.3 to 3.75 pounds per acre Typical S-CNF = 0.5 to 2.0 pounds per acre Maximum label = 3.75 pounds per acre	Little to no soil activity. Some formulations are highly toxic to aquatic organisms.
Imazapic (±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-methyl-3-pyridinecarboxylic acid	Plateau®, Plateau Eco-Pak®, Cadre®	annual and perennial weeds	Inhibits AHAS synthesis, blocking amino acid synthesis	120-140 days	206 mL/g	low?	36,000 mg/L (pH 7)	< 8 hours	Primary mechanism	Very minor mechanism ?	Low?	> 5,000 mg/kg [slight]	> 2,150 mg/kg (BW) [low]	> 100 mg/L [moderate]	> 5,000 mg/kg	Typical S-CNF = 0.06 to 0.2 pound per acre Maximum label = 0.75 pound per acre	Degree of control depends on selectivity of individual plants.
Metsulfuron methyl Methyl-2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)-amino]carbonyl]amino] sulfonyl]benzoate	Escort®, Ally®	brush, woody plants, annual and perennial broadleaf and annual grassy weeds	Inhibits cell division and stops growth	120 to 180 days	no data available	no data available	109 mg/L	29 to >84 days	no data available	no data available	no data available	> 5,000 mg/kg [low]	<2,150 mg/kg [low]	<150 ppm [low]	>2,000 mg/kg [low]	0.33 to 2.0 ounces per acre Typical S-CNF = 0.25 to 0.75 ounce per acre Maximum label = 2.0 ounces per acre	Will leach in some soils, but is practically nontoxic to birds, fish, invertebrates, and honeybees.
Pelargonic acid C8H17COOH natural fatty acid	Scythe®	annual and perennial broadleaf and grass weeds, as well as most mosses and other cryptogams	Disrupts cell membrane permeability, which results in cell leakage and death of all contacted tissue	no data available	no data available	no data available	no data available	no data available	Primary mechanism	no data available	no data available	>5,000 mg/kg	no data available	no data available	>2,000 mg/kg	9.45 pounds to 84 pounds per acre	Pelargonic acid has been found to occur naturally in low concentrations in soil. It is considered safe for humans and non-toxic.

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Picloram 4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid	Tordon K®	annual and perennial broadleaf weeds, vines, and woody plants	Auxin mimic	90 days	16 mL/g (can range -17-160 mL/g)	moderate-high	430 mg/L (acid), 200,000 (salts)	2-3 days	Primary mechanism	Primary mechanism	Moderate potential	> 5,000 mg/kg [slight]	> 2,510 mg/kg (M) [low]	>14.4 mg/L [high]	>2,000 mg/kg	• As triisopro-panolamine salt: 0.27 to 2.16 pounds per acre • As isooctyl ester: used for basal bark treatment • As potassium salt: 1.0 to 8.5 pounds per acre Typical S-CNF = 0.125 to 0.50 pound per acre Maximum label = 1.0 pound per acre	Environmental persistence can endanger non-target plants and animals.
Sulfometuron methyl methyl 2-[[[[(4,6-dimethyl-2-pyrimidinyl) amino]carbonyl]amino] sulfonyl]benzoate	Oust Weed Killer®, DPX 5648®	annual and perennial grasses and broadleaf weeds	Inhibits cell division in tips, roots, and shoots	1 month	no data available	moderate-high	Insoluble	1 to 3 days	Primary mechanism	Primary mechanism	High potential	>5,000 mg/kg [slight]	<5,620 ppm (BW) and <5,000 ppm (M) [slight]	<12.5 ppm [slight]	>2,000 mg/kg	Up to 2.25 ounces per acre Typical S-CNF = 0.25 to 0.75 ounce per acre Maximum label = 2.25 ounces per acre	Readily absorbed through the gastrointestinal tract and rapidly broken down and removed.
Triclopyr [(3,5,6-trichloro-2-pyridinyl)oxy]acetic acid	Garlon®, Remedy®	woody and annual broadleaf weeds	Auxin mimic	30 days	20 mL/g (salt), 780 mL/g (ester)	moderate-high	430 mg/L (acid), 23 mg/L (ester), 2,100,000 mg/L (salt)	4 days	Primary mechanism	Minor mechanism	Moderate potential	713 mg/kg [low]	1,698 mg/kg (M) [low]	148 mg/L [moderate]	>2,000 mg/kg	0.25 to 9 pounds acid equivalent per acre	Commonly used herbicide. The ester formulation is highly toxic to aquatic organisms.

Adapted from Weed Control Methods Handbook, The Nature Conservancy, Tu et al. 2001. Other sources include Environmental Health Clearinghouse 2002, EXTOXNET 2002, PEMP 2002, and Wisconsin Master Gardener Program 2002.

[a] Half-life: The time required for half of something to undergo a process. As used in this document, it is the amount of time for half the herbicide to break down, becoming ineffective.

[b] Koc: The partitioning of a chemical between soil or sediment, usually expressed as K (the concentration of a chemical in soil (ug/g) to that in water (ug/ml)) or as Koc (which is K divided by the organic carbon content of the soil or sediment). The higher the number, the more binding the herbicide is to soil particles.

[c] Mobility: Relating to the capability of moving or being moved.

[d] Based on Helling's classification system - Helling & Turner 1968 (as cited in Tu et al. 2001). Solubility: The quality or state of being soluble. Expressed in this document as the quantity of a herbicide that can be dissolved in water.

[e] Based on EPA Toxicity Categories

[f] Rats

[g] BW—bobwhite quail; M—mallards

[h] bluegill sunfish

[i] Application rates for "Typical S-CNF" and "Maximum Label" are from the S-CNF 2002 Programmatic Biological Assessment for Fish (U.S. Forest Service 2002).

TABLE J-2
Worksheet for Assessing Risk Quotient Values and Levels of Concern for Aquatic Species Associated with Herbicide Applications

Methodology for Determining Level of Concern	Example using 2,4-D
Maximum application rate (known constant based on label rates)	3 lb ai/ac (pounds active ingredient per acre)
EEC—Estimated Environmental Concentration (from Urban and Cook [1986] table based on direct application to a pond 1 acre-foot in volume) measured in ppb (parts per billion), and converted to ppm (parts per million)	at 3 lb ai/ac, in 1 acre-foot water, the EEC = 1103 ppb or 1.103 ppm
Toxicity—The 96-hour LC50 (a standard test) for a specific aquatic species. The LC50 is the concentration of a toxicant that causes mortality in 50% of the test organisms under a specific set of conditions.	LC50 = 250 mg/L (milligrams per liter), or = 250 ppm (testing conducted with rainbow trout)
Safety Factor—A divisor applied to the toxicity value to establish a concentration below which risk is acceptable (as determined by EPA). For endangered aquatic species, EPA uses 1/20 of the LC50 value.	1/20 of the LC50 = 12.5 ppm (250 ppm x 1/20 = 12.5 ppm)
The EPA has determined that there is a presumption of unacceptable risk to endangered aquatic species if the EEC > 1/20 LC50. Conversely, if the EEC < 1/20 LC50, the application rate used to calculate the EEC should not result in an unacceptable risk to endangered aquatic species.	For 2,4-D amine, where: EEC = 1.103 ppm at 3 lb ai/ac maximum application rate 1/20 the LC50 = 12.5 ppm EEC is < 1/20 of the LC50
Because of some of the concerns associated with this level of concern (risk) analysis [(see Table 4 in Urban and Cook (1986)] and because the EPA does not define a magnitude of risk of endangered species, especially when the EEC < 1/20 LC50, a gradual "level of concern" scale was developed based on how close the EEC value is to the 1/20 LC50. The 1/20 LC50 value is divided by the EEC value and the quotient represents the level of concern for a given herbicide. The level of concern scale is as follows: If the 1/20 LC50 ÷ EEC is a quotient of >10, the level of concern is low. If the 1/20 LC50 ÷ EEC is a quotient of >1 but <10, the level of concern is moderate. If the 1/20 LC50 ÷ EEC is a quotient of <1, the level of concern is high.	For 2,4-D amine: 1/20 the LC50 = 12.5 ppm EEC = 12.5 ppm ÷1.103 ppm = 11 Since the quotient is >10, the level of concern is low.

TABLE J-3
Toxicology Profile of Herbicides Used or Proposed for Use on the S-CNF

Toxicology	Transline[1] Clopyralid	Weedar 64[2] 2,4-D	Rodeo[3] Glyphosate	Escort[4] Metsulfuron Methyl	Tordon 22K[5] Picloram	Telar[6] Chlorsulfuron	Plateau[7] Imazapic	Oust[8] Sulfometuron Methyl	Banvel[9] Dicamba	Krenite[10] Fosamine	Garlon[11] Triclopyr
Rainbow Trout (96 hr LC50) (mg/L)	103	250	>1000	>150	5.5-19.3	250	>100	12.5	28	1,000	117
Daphnia (96 hr LC50) (mg/L)	232	184	930	>12.5 (48 hr)	68.3	>370	>100	125	100	—	1,140
Bio-accumulates	No	No	No	No	No	No	No	No	No	No	No
Persistence in soil[12]	40 Days (Moderate)	10 Days (Low)	47 Days (Moderate)	30 Days (1-4 Wks) (Low)	90 Days (20-300) (Mod-High)	40 Days (4-6 Wks) (Low-Mod)	7-150 Days Low-High	20-28 Days (Low)	7-42 days (Low-Mod)	8 days (Low)	30 days (Low)
Mobile in soil	No	Yes, but degrades quickly	No	No	Yes	No	No	No	Yes	Yes	Yes

[1]U.S. Forest Service 1999a. Clopyralid Risk Assessment—Final Report.

[2]U.S. Forest Service 1999b. 2,4-Dichlorophenoxyacetic Acid Formulations Risk Assessment—Final Report.

[3]U.S. Forest Service 1999d. Glysophate Risk Assessment.

[4]Ahrens 1994. Herbicide Handbook, Seventh Edition.

[5]U.S. Forest Service 1999e. Picloram Risk Assessment—Final Report.

[6]U.S. Forest Service 1995a. Chlorsulfuron Pesticide Fact Sheet.

[7]U.S. Forest Service 1999f. Imazapic Risk Assessment—Final Report.

[8]U.S. Forest Service 1999g. Sulfometuron Methyl Risk Assessment—Final Report

[9]U.S. Forest Service 1995b: Dicamba Pesticide Fact Sheet. U.S. Forest Service 2001c: Sandpoint Ranger District FEIS. Appendix Table J-1.

[10]http://pmep.cce.cornell.edu/profiles/herb (1985). Fosamine Herbicide Profile. Appendix Table J-1.

[11]U.S. Forest Service 1995c: Triclopyr Pesticide Fact Sheet. Appendix Table J-1.

[12]Soil half-life values for herbicides are from Herbicide Handbook (Ahrens 1994) Pesticides that are considered non-persistent are those with a half-life of less than 30 days; moderately persistent herbicides are those with a half-life of 30 to 100 days; pesticides with a half-life of more than 100 days are considered persistent.

TABLE J-4
Aquatic Level of Concern Assessment for Herbicides Used on the S-CNF

Active Ingredient	Product Name	Typical Application Rate lb ai/ac[1]	Max Label Application Rate lb ai/ac[2]	EEC (ppm)[3]	Toxicity 96-hour LC50 (mg/L)[4]	Safety Factor 1/20 LC50 (mg/L)	Species Tested	Risk Quotient and Level of Concern [5]
Clopyralid	Transline	0.1-0.375	0.5	0.184	103	5.2	Rainbow Trout	28 Low
2,4-D amine	Amine 4, Weedar 64	0.5-1.5	3.0	1.103	250	12.5	Rainbow Trout	11 Low
Glyphosate	Rodeo	0.5-2.0	3.75	1.379	1000	50	Rainbow Trout	36 Low
Metsulfuron-methyl	Escort	0.25-0.75	2.0 oz	0.046	150	7.5	Rainbow Trout	163 Low
Picloram [6]	Tordon 22K	0.125-0.5	1.0 [2]	0.368	19.3	0.965	Rainbow Trout	2 Moderate
Chlorsulfuron	Telar DF	0.25-3.0	3.0 oz	0.052	250	12.5	Rainbow Trout	240 Low
Imazapic	Plateau	0.06-0.2	0.75	0.276	100	5.0	Rainbow Trout	18 Low
Sulfometuron -methyl	Oust	0.25-0.75	2.0 oz	0.046	12.5	0.625	Rainbow Trout	161 Low
Dicamba [7]	Banvel	0.25-2.0	2.0	0.735	28	1.4	Rainbow Trout	1.9 Moderate
Fosamine [8]	Krenite	6.0-12.0	12.0	4.412	1,000	50	Rainbow Trout	11 Low
Triclopyr [9]	Garlon	0.25-9.0	9.0	3.309	117	5.85	Trout	1.7 Moderate

[1]Application rates are based upon typical and maximum label rates unless otherwise noted.

[2]Maximum application rate for picloram is 1 lb per acre; Rates may be higher for smaller portions of the acre, but the total use on the acre cannot exceed 1 lb ai/ac/yr.

[3]Hazard Evaluation Division, Standard Evaluation Procedure--Ecological Risk Assessment (Urban and Cook 1986). Concentrations derived from Table 2 (Page16) of Urban and Cook (1986) based upon application rate (lbs ai/ac) and 1 foot water depth.

[4]Rainbow Trout LC50 values from Herbicide Handbook, Seventh Edition (Ahrens1994) and individual U.S. Forest Service Pesticide Fact Sheets and Risk Assessments (see Table 12 footnotes above).

[5]The Risk Quotient and Level of Concern for a mixture of herbicides would reflect the values associated with the mixture's most toxic component. For example, the Level of Concern for a mixture of 2,4-D amine and picloram would be Moderate, reflecting calculations based upon the higher toxicity of picloram.

[6]Risk Quotient values for picloram reflect the range of LC50 toxicity value of 5.5 to 19.3 mg/L identified by various observers. Level of Concern would be Moderate for LC50 values above 7.3 mg/L, including the midpoint value of 12.4 mg/L. Level of Concern would be high based upon LC50 values from 5.5 to 7.3 mg/L.

[7]Dicamba application rates on the S-CNF are 1 lb per acre for broadcast applications and no more than 2 lb per acre per year on a treatment area, per label requirements for rangeland uses. LC50 value from Dicamba Pesticide Fact Sheet (U.S. Forest Service 1995b) and Sandpoint Ranger District FEIS (2001c).

[8]Fosamine application rates and LC50 value from http://pmep.cce.cornell.edu/profiles/herb (1985).

[9]Triclopyr application rates and LC50 value from Triclopyr Pesticide Fact Sheet (U.S. Forest Service 1995c).

TABLE J-5
Buffers, Maximum Wind Speed, Application Methods, and Herbicide Restriction Associated with Aquatic Habitats, Riparian Areas, and Wetland Resources on the S-CNF

Buffer	Maximum Wind Speed [1]	Herbicide Application Method	Herbicides Authorized (Aquatic Level of Concern-see Tables above)
>100 feet from open water	10 mph	All ground/broadcast spraying	Low[2], Moderate[3]
<100 feet from open water, but >50 feet from open water	10 mph 5 mph picloram	Spot spraying, wicking, dipping, painting, and injecting	Low[2], Moderate[3]
<50 feet from open water, but >15 feet from open water	5 mph	Spot spraying, wicking, dipping, painting, and injecting.	Low[2]
<15 feet from open water	5 mph	Spot spraying, wicking, dipping, painting, and injecting	Low, but aquatic approved herbicides only[4] No adjuvants

[1]Beufort Wind Scale Information Summaries will be distributed to field applicators to assist in assessing ambient wind conditions.

[2]Low Level of Concern for Aquatic Species: Transline, Weedar 64, Amine 4, Rodeo, Escort, Telar DF, Plateau, Oust, Krenite.

[3]Moderate Level of Concern for Aquatic Species: Tordon 22K, Banvel, Garlon.

[4]Aquatic approved herbicides: Rodeo, Weedar 64.