State of Alaska

DEPARTMENT OF ENVIRONMENTAL CONSERVATION

DIVISION OF SPILL PREVENTION AND RESPONSE

CONTAMINATED SITES PROGRAM

USER'S GUIDE FOR SELECTION AND APPLICATION OF DEFAULT ASSESSMENT ENDPOINTS AND INDICATOR SPECIES IN ALASKAN ECOREGIONS

June 1999

* Note: This Guide was originally developed as Appendix A of the reference: Shannon & Wilson, Inc., 1999, *Ecoregions/Assessment Endpoint Project Technical Background Document for the Selection and Application of Default Assessment Endpoints and Indicator Species in Alaskan Ecoregions*. Prepared by Shannon & Wilson, Inc., Seattle, WA for the Alaska Department of Environmental Conservation (DEC), Juneau, AK. For a copy of that reference, please contact DEC.

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USER'S GUIDE FOR SELECTION AND APPLICATION OF DEFAULT ASSESSMENT ENDPOINTS AND INDICATOR SPECIES IN ALASKAN ECOREGIONS

1.0 INTRODUCTION AND OBJECTIVES

This section provides background information and an overview of the technical development process for selecting default assessment endpoints and indicator species for each ecoregion in Alaska. For technical details of the development process and site-specific use of the default assessment endpoints and indicator species, refer to the accompanying Technical Background Document (Shannon & Wilson, Inc., 1999).

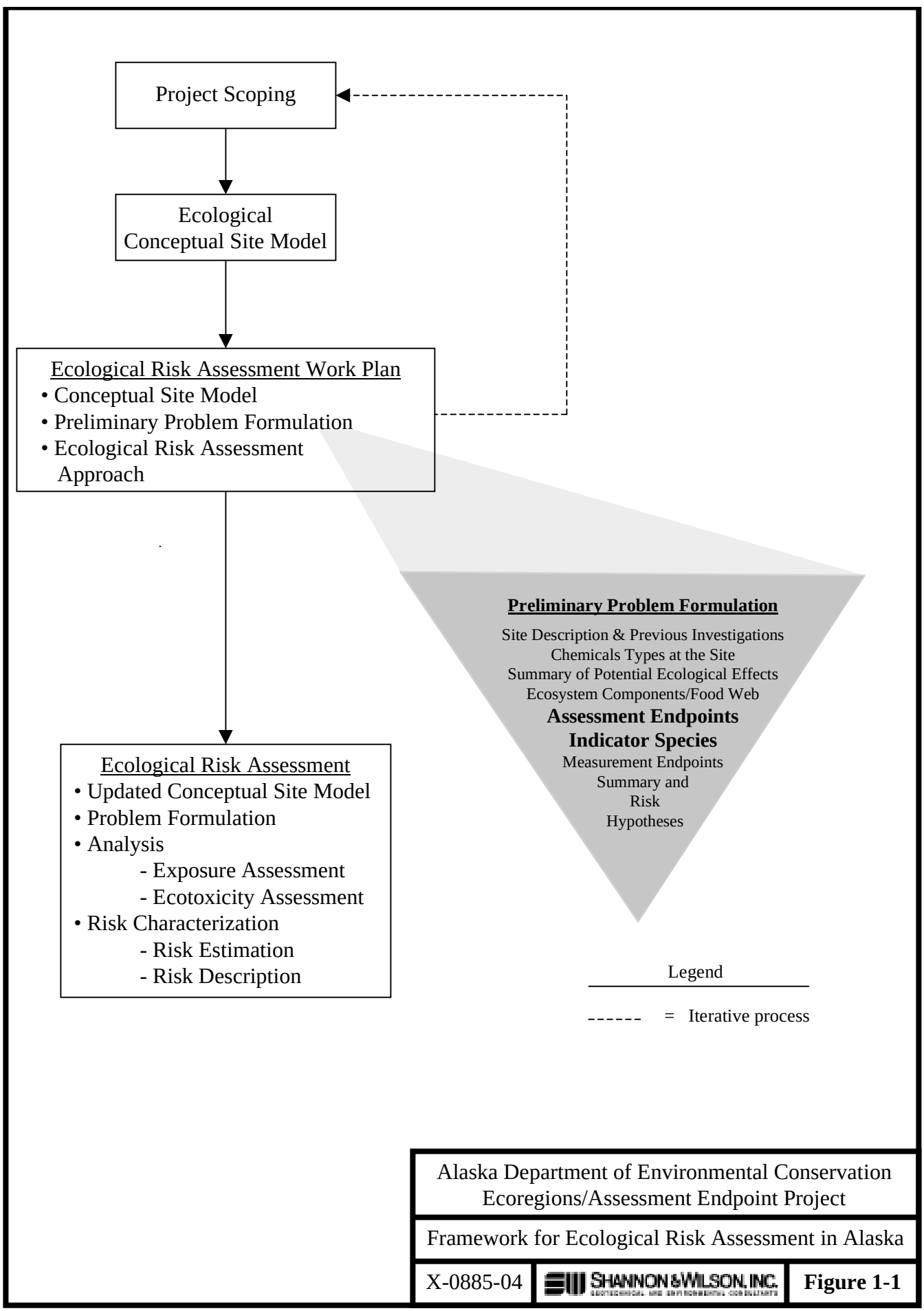
1.1 Overview of Ecological Risk Assessment Framework

Ecological risk assessment (ERA) is a process for estimating the potential for ecological effects, such as those that might be caused by chemicals at a contaminated site. ERAs are necessary at many, though not all, contaminated sites in Alaska. Concurrence with the Alaska Department of Environmental Conservation (ADEC) should be reached regarding whether an ERA is needed for a particular site.

The basic framework for ERAs in Alaska includes the following steps (see Figure 1-1):

- Project scoping.
- Conceptual site model (CSM) development.
- Ecological Risk Assessment Work Plan.
- Problem Formulation (including site-specific ecological description and selection of assessment endpoints [values to be protected] and indicator species).
- Analysis (assessment of exposure and ecotoxicity).
- Risk Characterization (the calculation of estimated risk and qualitative description of the risks, including uncertainties in the risk estimates).

According to the Risk Assessment Procedures Manual (ADEC, 1998), the proper procedure for a risk assessment for a contaminated site in Alaska is to prepare a CSM, followed by a Risk Assessment Work Plan (RAWP), including Preliminary Problem Formulation and method



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Framework for Ecological Risk Assessment in Alaska

X-0885-04 | SHANNON & WILSON, INC. | **Figure 1-1**

description for the Analyses and Risk Characterization. Once agency approval of the RAWP is obtained, then preparation of the risk assessment report can proceed.

1.2 Overview of Problem Formulation

Problem Formulation is a key part of an ERA during which the scope and objectives of the ERA are defined. Problem Formulation generally is initiated with the preparation of the CSM and expanded during preparation of the RAWP. Minor modifications to the Problem Formulation may also occur in the ERA report as new information becomes available. Any refinements made after approval of the RAWP must be submitted for review and acceptance by ADEC.

One aspect of Problem Formulation for a site, involves selection of assessment endpoints. Assessment endpoints are explicit statements of the ecological values to be protected. An example of an assessment endpoint is the potential for significant adverse effects on terrestrial mammalian herbivore (e.g., land mammals that primarily consume vegetation) abundance and diversity. Because it is not practical to estimate risks to every species potentially present at a site, one or more indicator species is generally selected in association with each assessment endpoint in order to allow quantitative evaluation of risks. For example, under conditions at a given site, a squirrel might be selected to represent land mammals that consume vegetation. Then, risks for a squirrel would be evaluated. If no unacceptable risk is predicted for the squirrel and if a squirrel is an appropriate indicator species, it can be assumed that no threat exists to populations of land mammals that consume vegetation.

1.3 Establishing Default Assessment Endpoints and Indicator Species

In the past, the process of selecting assessment endpoints and indicator species has been repeated at every contaminated site where an ERA is conducted. However, in future ERAs conducted for contaminated sites in Alaska, default assessment endpoints and indicator species may be used. Default assessment endpoints and indicator species were established for use in ERAs for contaminated sites in Alaska to accomplish the following objectives:

- Streamline the Problem Formulation and thus the ERA process.
- Increase comparability among ERAs conducted for sites in Alaska, especially within the same ecoregion.
- Increase consistency in ecological risk management decisions for sites in Alaska, especially within the same ecoregion.

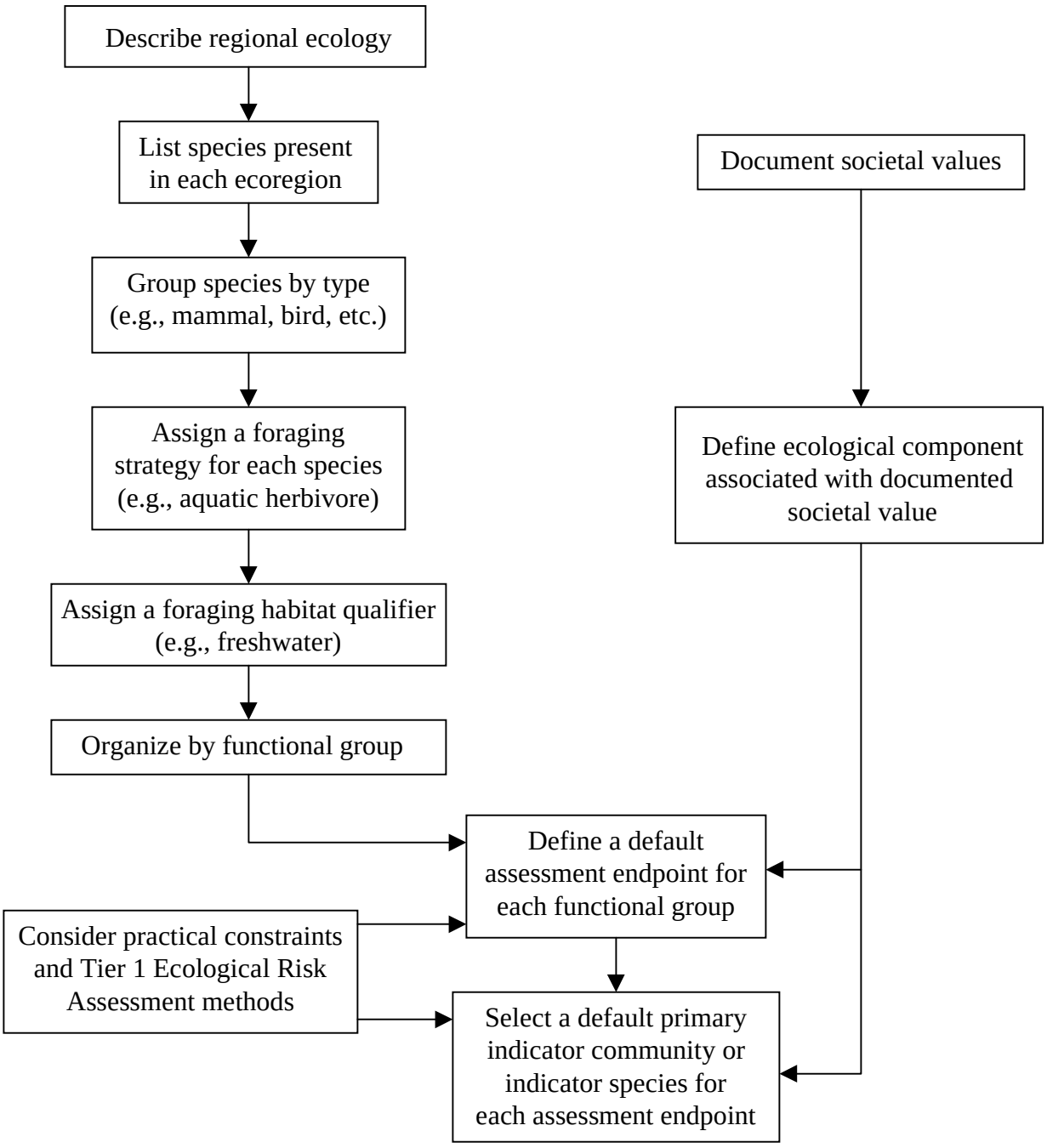
- < Ensure consideration of societal values, even at smaller sites where stakeholder participation is often minimal or nonexistent.

- < Streamline the RAWP and Risk Assessment review process.

This approach is not intended to circumvent the consideration of site-specific information during Problem Formulation, but rather to streamline the selection and regulatory approval of assessment endpoints and indicator species. This User's Guide provides an overview of the site-specific use of the established defaults, including methods for modifying defaults where appropriate. It is intended to provide an overview for risk managers, regulated parties, consultants, and interested stakeholders. A companion document, "Technical Background Document for Selection and Application of Default Assessment Endpoints and Indicator Species in Alaskan Ecoregions" (Technical Background Document; Shannon & Wilson, 1999), describes the criteria by which ecoregions, default assessment endpoints, and default indicator species were chosen. The Technical Background Document also describes the ecology of each ecoregion, provides detailed species lists by functional group (e.g., terrestrial mammalian herbivore) for each ecoregion, and discusses in greater detail the site-specific use of and modification to the defaults. Risk assessors conducting ERAs for contaminated sites in Alaska should not rely solely on this User's Guide, but should also consult the Technical Background Document to ensure that site-specific or other factors are not overlooked.

Development of the default assessment endpoints and indicator species was based on both technical considerations and societal values. An overview of this process is shown in Figure 1-2. Because of this, the active contributions of a diverse group of stakeholders and a multi-agency Ecoregions Working Group were essential to the development of the defaults. The active stakeholder group consisted of all respondents to an interest-level survey who indicated a willingness to actively participate. Approximately 60 organizations were surveyed. Twenty of these indicated an interest in receiving information about the project. Individuals associated with the following organizations indicated a willingness to participate more actively, either as a technical resource or peer reviewer:

- < Arctic Slope Native Association
- < Association of Village Council Presidents
- < Maniilaq Association
- < Tanana Chiefs Conference
- < Council of Athabascan Tribal Governments
- < Alaska Sea Otter Commission
- < Alaska Trappers Association



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Overview of the Development of Default Assessment Endpoints and Indicator Species

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- Alaska Community Action on Toxics
- Federal Aviation Administration
- U.S. Forest Service (USFS)
- U.S. Air Force
- U.S. Army Corps of Engineers

Stakeholders who wished to provide technical support were contacted prior to determining the default assessment endpoints and indicator species. Many of their ideas are reflected in the endpoint definition process.

The Ecoregions Working Group has had a key development role in the establishment of default assessment endpoints and indicator species. The multi-agency working group is comprised of representatives of the following organizations:

- ADEC
- Alaska Department of Fish and Game (ADFG)
- Alaska Division of Public Health (ADPH)
- National Oceanic and Atmospheric Administration (NOAA)
- United States Environmental Protection Agency (EPA),
- United States Fish and Wildlife Service (USFWS)
- United States Navy (Navy)

1.4 Use of Default Assessment Endpoints and Indicator Species

The steps involved in applying the established defaults follow:

- Step One: Determine the ecoregion in which your site is located.
- Step Two: Determine applicable default assessment endpoints and indicator species.
- Step Three: Determine relevance of defaults and/or modify them based on site-specific conditions.

These steps are briefly described in the remaining sections of this User's Guide and are depicted on Figure 1-3.

Step One

Determine which ecoregion your site is in

Decision #1

Straddles two ecoregions?

Within one ecoregion?

Use site-specific ecology to determine whether site fits into one or the other ecoregion or whether both ecoregions need to be considered

Other Problem Formulation Components

Conceptual site model and food web model (from problem formulation)

Review site-specific ecology, effects of contaminants of potential ecological concern (bioaccumulation potential), and practical constraints of assessment (from Problem Formulation)

Step Two

Select default assessment endpoint and indicator species table for your ecoregion(s)

Step Three (Part A)

Decision #2

Is each functional group exposed to site contaminants?

No → Remove non-exposed functional groups and associated assessment endpoints from further consideration

Yes

Decision #3

Is each remaining functional group affected and assessable?

Yes

No → **Remove non-affected or non-assessable functional groups and associated assessment endpoints**

Step Three (Part B)

Decision #4

Are additional assessment endpoints needed due to:
•Special conditions or unique species at the site?
•Stakeholder, trustee, or regulator concerns?

Yes → Add appropriate new assessment endpoints

No

Final list of site-specific functional groups and assessment endpoints

Step Three (Part C)

Retain the default primary indicator species associated with each site-specific assessment endpoint

Decision #5

Are each of these species potentially found at your site?

Yes

No → Remove from further consideration those primary default indicator species that are not potentially present at your site.

From the default functional grouping tables, select suitable alternate primary indicator species that are potentially present on-site for any unrepresented assessment endpoint(s).
Some considerations may include:

- Exposure potential
- Widespread occurrence/density
- Availability of exposure and toxicity data
- Societal value
- Regulatory status
- Simultaneous exposure to marine and fresh water
- Practical constraints

Step Three (Part D)

Add additional (secondary) indicator species from default or site-specific species list. Considerations for adding secondary indicator species may include:

- Cultural/Regulatory Value
- Risk management value
- Exposure Potential
- Toxicological sensitivity
- Sensitive Areas
- Secondary Foraging Strategy
- Secondary Habitats
- Low Density
- Ecological Niche

Decision #6

Do additional or secondary indicator species need to be added due to site-specific conditions, unique species at the site, or stakeholder, trustee, or regulator concerns?

Yes

No → **Final list of site-specific indicator species**

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Site-Specific Application
of
Default Assessment Endpoints and Indicator Species

X-0885-04 | SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS | Figure 1-3

2.0 STEP ONE: DETERMINE ECOREGION IN WHICH YOUR SITE IS LOCATED

The first step in selecting assessment endpoints and indicator species for your site is to determine the ecoregion in which your site is located. Several possible approaches to selecting ecoregions were considered, and a modification to the USFWS (unpublished) approach was selected (see Section 2.0 of the Technical Background Document). Based on this approach, the following eight ecoregions were defined:

- Aleutian Islands
- Arctic Slope
- Interior
- Northwest
- Southcentral
- Southeast
- Southwest
- Yukon-Kuskokwim Delta

Each of these ecoregions and the habitat types (i.e., ecological subregions) they encompass are described in detail in Section 3.0 and Appendix C of the Technical Background Document, respectively. Table 2-1 provides a list of the ecological subregions present within each Alaskan ecoregion. To determine the ecoregion in which your site is located, refer to Figure 2-1, which shows the extent of each ecoregion. Major highways, rivers, lakes, and large cities are depicted on the ecoregion map to help locate your site. If your site straddles multiple ecoregions (Decision No. 1), each ecoregion should be considered (see Technical Background Document, Section 2.0 for further details).

TABLE 2-1
CORRELATION OF ALASKAN ECOREGIONS AND ECOLOGICAL SUBREGIONS

Subregions	Ecoregions							
	Aleutian Islands	Arctic Slope	Interior	Northwest	Southcentral	Southeast	Southwest	Yukon-Kuskokwim Delta
Ahklun and Kilbuck Mountains			x				x	x
Alaska Peninsula Mountains							x	
Alaska Range			x		x			
Aleutian Islands	x							
Arctic Coastal Plain		x						
Arctic Coastline/Estuary		x						
Arctic Foothills		x		x				
Arctic Ocean (Beaufort and Chukchi Seas)		x		x				
Bering Sea	x			x				x
Bristol Bay - Nushagak Lowlands							x	
Brooks Range		x	x	x				
Coastal Western Hemlock - Sitka Spruce Forests					x	x	x	
Cook Inlet					x			
Copper Plateau					x			
Interior Bottomlands			x					x
Interior Forested Lowlands and Uplands			x	x			x	x
Interior Highlands			x	x				
Pacific Ocean	x				x	x	x	
Northwest Coastline/Estuary				x				
Ogilvie Mountains			x					
Pacific Coastal Mountains					x	x		
Seward Peninsula				x				
Southcentral Coastline/Estuary					x			
Southeast Coastline/Estuary						x		
Southwest Coastline/Estuary							x	
Subarctic Coastal Plain				x				x
Wrangell Mountains			x		x			
Yukon Flats			x					
Yukon-Kuskokwim Delta Coastline/Estuary								x

LEGEND

- ALEUTIAN ISLANDS
- ARCTIC SLOPE
- INTERIOR
- NORTHWEST
- SOUTHCENTRAL
- SOUTHEAST
- SOUTHWEST
- YUKON-KUSKOKWIM DELTA
- Major Lakes and Rivers
- HIGHWAY
- CITIES

NOTE: All Ecoregions with a coastline include the adjacent marine water body.

ARCTIC OCEAN

CHUKCHI SEA

BEAUFORT SEA

FORMER SOVIET UNION

CANADA

BERING SEA

GULF OF ALASKA

Barrow
Point Lay
Prudhoe Bay
Kaktovik
Umiat
Colville River
Anaktuvuk Pass
Noatak River
Kotzebue
Kobuk River
Koyukuk River
Fort Yukon
Porcupine River
Nome
Norton Sound
Galena
Yukon River
Fairbanks
Tanana River
Dawson
Lake Minchumina
Kuskokwim River
Emmonak
St. Mathews Island
Glennallen
Whitehorse
Sleetmute
Anchorage
Valdez
Bethel
Cordova
Juneau
Nunivak Island
Dillingham
Homer
Seward
Sitka
Ketchikan
Alexander Archipelago
Pribilof Islands
Bristol Bay
Kodiak Island
Aleutian Islands
Dutch Harbor
St. Lawrence Island

N

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ECOREGIONS OF ALASKA

X-0885-04 | SHANNON & WILSON, INC. | FIGURE 2-1

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3.0 STEP 2: DETERMINE POTENTIALLY APPLICABLE DEFAULT ASSESSMENT ENDPOINTS AND INDICATOR SPECIES

The second step in selecting assessment endpoints and indicator species for your site is to select the default assessment endpoints and primary indicator species that apply to the ecoregion in which your site is located. All default assessment endpoints in Table 3-1- apply to a given ecoregion unless "Not Applicable (NA)" is indicated.

Note that for certain assessment endpoints, a default primary indicator community (e.g., all terrestrial plants), rather than a default primary indicator species (e.g., squirrel), is provided. The most common Tier 1 ERA assessment methods (see Table 3-1) used for these particular assessment endpoints do not involve selection of indicator species because they do not involve dose modeling; rather, media concentrations are compared with criteria considered protective of a whole group or community of organisms. In fact, sometimes several such assessment endpoints can be assessed simultaneously in the quantitative Tier 1 ERA. For example, marine aquatic plants, marine aquatic invertebrates, and marine fish are often assessed simultaneously by comparing marine water concentrations with marine water quality criteria. The most common Tier 1 ERA assessment method indicated in Table 3-1 is provided only for informational purposes only; the specific methods to be used to quantify the risks associated with each applicable assessment endpoint should be proposed in the RAWP. Table 3-1 also identifies the primary (in bold) and other exposure media most commonly associated with a given assessment endpoint.

TABLE 3-1
SUMMARY OF DEFAULT ASSESSMENT ENDPOINTS AND PRIMARY INDICATOR SPECIES FOR EACH ALASKAN ECOREGION

Default Assessment Endpoints	Ecoregions								Typical Tier I Assessment Method	Primary (bold) and Other Exposure Media
	Aleutian Islands	Arctic Slope	Interior	Northwest	Southcentral	Southeast	Southwest	Yukon-Kuskokwim Delta		
Primary Producers (Trophic Level 0)										
The potential for significant adverse effects on terrestrial soil plant species abundance, diversity, and primary production	**All plants that obtain nutrients primarily from soil** [a]	**All plants that obtain nutrients primarily from soil** [a]	**All plants that obtain nutrients primarily from soil** [a]	**All plants that obtain nutrients primarily from soil** [a]	**All plants that obtain nutrients primarily from soil** [a]	**All plants that obtain nutrients primarily from soil** [a]	**All plants that obtain nutrients primarily from soil** [a]	**All plants that obtain nutrients primarily from soil** [a]	Compare Media Concentrations with Lowest Available Phytotoxicity Benchmarks for Any Plant Species	**Surface Soil**
The potential for significant adverse effects on terrestrial air plant species abundance, diversity, and primary production	**All plants that obtain nutrients primarily from the air** [a]	**All plants that obtain nutrients primarily from the air** [a]	**All plants that obtain nutrients primarily from the air** [a]	**All plants that obtain nutrients primarily from the air** [a]	**All plants that obtain nutrients primarily from the air** [a]	**All plants that obtain nutrients primarily from the air** [a]	**All plants that obtain nutrients primarily from the air** [a]	**All plants that obtain nutrients primarily from the air** [a]	Not Evaluated under Normal Circumstances	**Air**
The potential for significant adverse effects on marine plant species abundance, diversity, and primary production	**All plants that obtain nutrients primarily from marine water** [a]	**All plants that obtain nutrients primarily from marine water** [a]	NA	**All plants that obtain nutrients primarily from marine water** [a]	**All plants that obtain nutrients primarily from marine water** [a]	**All plants that obtain nutrients primarily from marine water** [a]	**All plants that obtain nutrients primarily from marine water** [a]	**All plants that obtain nutrients primarily from marine water** [a]	Compare Media Concentrations with Available Adjusted Water Quality Criteria (Preference for Marine and Chronic Values)	**Marine Water**
The potential for significant adverse effects on marine semi-aquatic plant species abundance, diversity, and primary production	**All plants that obtain nutrients primarily from marine sediment** [a]	**All plants that obtain nutrients primarily from marine sediment** [a]	NA	**All plants that obtain nutrients primarily from marine sediment** [a]	**All plants that obtain nutrients primarily from marine sediment** [a]	**All plants that obtain nutrients primarily from marine sediment** [a]	**All plants that obtain nutrients primarily from marine sediment** [a]	**All plants that obtain nutrients primarily from marine sediment** [a]	Compare Media Concentrations with Available Adjusted Sediment Quality Criteria (Preference for Marine and Chronic Values); site-specific TOC adjustment when appropriate.	**Marine Sediment** Marine Water
The potential for significant adverse effects on freshwater plant species abundance, diversity, and primary production	**All plants that obtain nutrients primarily from fresh water** [a]	**All plants that obtain nutrients primarily from fresh water** [a]	**All plants that obtain nutrients primarily from fresh water** [a]	**All plants that obtain nutrients primarily from fresh water** [a]	**All plants that obtain nutrients primarily from fresh water** [a]	**All plants that obtain nutrients primarily from fresh water** [a]	**All plants that obtain nutrients primarily from fresh water** [a]	**All plants that obtain nutrients primarily from fresh water** [a]	Compare Media Concentrations with Available Adjusted Water Quality Criteria (Preference for Freshwater and Chronic Values)	**Fresh Water**
The potential for significant adverse effects on freshwater semi-aquatic plant species abundance, diversity, and primary production	**All plants that obtain nutrients primarily from freshwater sediment** [a]	**All plants that obtain nutrients primarily from freshwater sediment** [a]	**All plants that obtain nutrients primarily from freshwater sediment** [a]	**All plants that obtain nutrients primarily from freshwater sediment** [a]	**All plants that obtain nutrients primarily from freshwater sediment** [a]	**All plants that obtain nutrients primarily from freshwater sediment** [a]	**All plants that obtain nutrients primarily from freshwater sediment** [a]	**All plants that obtain nutrients primarily from freshwater sediment** [a]	Compare Media Concentrations with Available Adjusted Sediment Quality Criteria (Preference for Freshwater and Chronic Values); site-specific TOC adjustment when appropriate.	**Freshwater Sediment** Fresh Water
Herbivores and Detrivores (Primary Consumers - Trophic Levels 1 and 2)										
The potential for significant adverse effects on marine aquatic invertebrate community abundance and diversity	**All marine aquatic invertebrates** [a]	**All marine aquatic invertebrates** [a]	NA	**All marine aquatic invertebrates** [a]	**All marine aquatic invertebrates** [a]	**All marine aquatic invertebrates** [a]	**All marine aquatic invertebrates** [a]	**All marine aquatic invertebrates** [a]	Compare Media Concentrations with Available Adjusted Water Quality Criteria (Preference for Marine and Chronic Values)	**Marine Water**
The potential for significant adverse effects on marine benthic invertebrate community abundance and diversity	**All marine benthic invertebrates** [a]	**All marine benthic invertebrates** [a]	NA	**All marine benthic invertebrates** [a]	**All marine benthic invertebrates** [a]	**All marine benthic invertebrates** [a]	**All marine benthic invertebrates** [a]	**All marine benthic invertebrates** [a]	Compare Media Concentrations with Available Adjusted Sediment Quality Criteria (Preference for Marine and Chronic Values); site-specific TOC adjustment when appropriate.	**Marine Sediment** Marine Water
The potential for significant adverse effects on freshwater aquatic invertebrate community abundance and diversity	**All freshwater aquatic invertebrates** [a]	**All freshwater aquatic invertebrates** [a]	**All freshwater aquatic invertebrates** [a]	**All freshwater aquatic invertebrates** [a]	**All freshwater aquatic invertebrates** [a]	**All freshwater aquatic invertebrates** [a]	**All freshwater aquatic invertebrates** [a]	**All freshwater aquatic invertebrates** [a]	Compare Media Concentrations with Available Adjusted Water Quality Criteria (Preference for Freshwater and Chronic Values)	**Fresh Water**
The potential for significant adverse effects on freshwater benthic invertebrate community abundance and diversity	**All freshwater benthic invertebrates** [a]	**All freshwater benthic invertebrates** [a]	**All freshwater benthic invertebrates** [a]	**All freshwater benthic invertebrates** [a]	**All freshwater benthic invertebrates** [a]	**All freshwater benthic invertebrates** [a]	**All freshwater benthic invertebrates** [a]	**All freshwater benthic invertebrates** [a]	Compare Media Concentrations with Available Adjusted Sediment Quality Criteria (Preference for Freshwater and Chronic Values); site-specific TOC adjustment when appropriate.	**Freshwater Sediment** Fresh Water
The potential for significant adverse effects on soil invertebrate community abundance and diversity	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	Compare Media Concentrations with Lowest Available Toxicity Benchmarks for Earthworms or Other Soil Invertebrate Species	**Surface Soil**

TABLE 3-1 (cont.)
SUMMARY OF DEFAULT ASSESSMENT ENDPOINTS AND PRIMARY INDICATOR SPECIES FOR EACH ALASKAN ECOREGION

Default Assessment Endpoints	Ecoregions								Typical Tier I Assessment Method	Primary (bold) and Other Exposure Media
	Aleutian Islands	Arctic Slope	Interior	Northwest	Southcentral	Southeast	Southwest	Yukon-Kuskokwim Delta		
The potential for significant adverse effects on marine fish detritivore abundance and diversity	**All marine fish** [a]	**All marine fish** [a]	NA	**All marine fish** [a]	**All marine fish** [a]	**All marine fish** [a]	**All marine fish** [a]	**All marine fish** [a]	Compare Media Concentrations with Available Adjusted Water Quality Criteria (Preference for Marine and Chronic Values)	**Marine Water**
The potential for significant adverse effects on freshwater fish detritivore abundance and diversity	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	Compare Media Concentrations with Available Adjusted Water Quality Criteria (Preference for Freshwater and Chronic Values)	**Fresh Water**
The potential for significant adverse effects on freshwater semi-aquatic avian herbivore abundance and diversity	**green-winged teal**	**northern pintail**	**mallard**	**green-winged teal**	**mallard**	**mallard**	**mallard**	**mallard**	Model dose from ingestion of water, sediment, and sediment-associated plants; compare with appropriate toxicity reference value.	**Freshwater Sediment** Fresh Water
The potential for significant adverse effects on marine semi-aquatic avian herbivore abundance and diversity	NA	NA	NA	**brant**	**brant**	NA	NA	**brant**	Model dose from ingestion of marine sediment and marine-sediment-associated plants and compare with appropriate toxicity reference value.	**Marine Sediment** Marine Water
The potential for significant adverse effects on terrestrial avian herbivore abundance and diversity	**willow ptarmigan**	**common redpoll**	**dark-eyed junco**	**dark-eyed junco**	**dark-eyed junco**	**dark-eyed junco**	**dark-eyed junco**	**dark-eyed junco**	Model dose associated with soil ingestion, surface water ingestion, and ingestion of soil-associated plants.	**Surface Soil** Fresh Water
The potential for significant adverse effects on freshwater semi-aquatic mammalian herbivore abundance and diversity	NA	**Moose**	**northern bog lemming**	**muskrat**	**northern bog lemming**	**northern bog lemming**	**muskrat**	**muskrat**	Model dose associated with sediment ingestion, surface water ingestion, and ingestion of sediment-associated plants and compare with applicable toxicity reference value.	**Freshwater Sediment** Fresh Water
The potential for significant adverse effects on terrestrial mammalian herbivore abundance and diversity	**Arctic ground squirrel**	**brown lemming**	**tundra vole**	**tundra vole**	**tundra vole**	**long-tailed vole**	**tundra vole**	**tundra vole**	Model dose associated with soil ingestion, surface water ingestion, and ingestion of soil-associated plants and compare with applicable toxicity reference value.	**Surface Soil** Fresh Water
Secondary Consumers (Trophic Level 3)										
The potential for significant adverse effects on marine avian invertevore abundance and diversity	**least auklet**	**least auklet**	NA	**least auklet**	**parakeet auklet**	**black oystercatcher**	**least auklet**	**least auklet**	Model dose associated with sediment ingestion and ingestion of marine aquatic invertebrates and compare with applicable toxicity reference value.	**Marine Water**
The potential for significant adverse effects on freshwater avian invertevore abundance and diversity	**American dipper**	**ruddy turnstone**	**American dipper**	**American dipper**	**American dipper**	**American dipper**	**American dipper**	**American dipper**	Model dose associated with sediment ingestion and ingestion of freshwater aquatic invertebrates and compare with applicable toxicity reference value.	**Fresh Water**
The potential for significant adverse effects on marine semi-aquatic avian invertevore abundance and diversity	**least sandpiper**	**lesser golden plover**	NA	**black-bellied plover**	**semipalmated plover**	**semipalmated plover**	**rock sandpiper**	**rock sandpiper**	Model dose associated with sediment ingestion and ingestion of marine benthic invertebrates and compare with applicable toxicity reference value.	**Marine Sediment**
The potential for significant adverse effects on freshwater semi-aquatic avian invertevore abundance and diversity	**common snipe**	**common snipe**	**common snipe**	**common snipe**	**common snipe**	**common snipe**	**common snipe**	**common snipe**	Model dose associated with sediment ingestion and ingestion of freshwater benthic invertebrates and compare with applicable toxicity reference value.	**Freshwater Sediment**

TABLE 3-1 (cont.)
SUMMARY OF DEFAULT ASSESSMENT ENDPOINTS AND PRIMARY INDICATOR SPECIES FOR EACH ALASKAN ECOREGION

Default Assessment Endpoints	Ecoregions								Typical Tier I Assessment Method	Primary (bold) and Other Exposure Media
	Aleutian Islands	Arctic Slope	Interior	Northwest	Southcentral	Southeast	Southwest	Yukon-Kuskokwim Delta		
The potential for significant adverse effects on terrestrial avian invertevore abundance and diversity	**Lapland longspur**	**Lapland longspur**	**American robin**	**Lapland longspur**	**American robin**	**American robin**	**American robin**	**Lapland longspur**	Model dose associated with soil ingestion and ingestion of soil invertebrates and compare with applicable toxicity reference value.	**Surface Soil**
The potential for significant adverse effects on freshwater fish invertevore abundance and diversity	NA	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	Compare media concentrations with available adjusted water quality criteria (preference for freshwater and chronic values)	**Fresh Water**
The potential for significant adverse effects on marine fish invertevore abundance and diversity	NA	NA	NA	NA	**All marine fish** [a]	**All marine fish** [a]	**All marine fish** [a]	NA	Compare media concentrations with available adjusted water quality criteria (preference for marine and chronic values)	**Marine Water**
All terrestrial invertebrates [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	**All terrestrial invertebrates** [a]	Compare Media Concentrations with Lowest Available Toxicity Benchmarks for Earthworms or Other Soil Invertebrate Species	**Surface Soil**
The potential for significant adverse effects on freshwater amphibian invertevore abundance and diversity	NA	**wood frog**	**wood frog**	**wood frog**	**wood frog**	**spotted frog**	**wood frog**	**wood frog**	Compare Media Concentrations with Available Adjusted Water Quality Criteria or Model dose associated with ingestion of freshwater aquatic invertebrates and sediment and compare with applicable toxicity reference value.	**Fresh Water** Sediment
Terrestrial amphibian invertevore abundance and physical health	NA	NA	NA	NA	**western toad**	**western toad**	NA	NA	Model dose associated with soil ingestion and ingestion of soil invertebrates and compare with applicable toxicity reference value.	**Surface Soil**
The potential for significant adverse effects on marine mammalian invertevore abundance and diversity	**sea otter**	**bearded seal**[f]	NA	**bearded seal**[f]	**sea otter**	**sea otter**	**sea otter**	**sea otter**	Model dose associated with sediment ingestion and ingestion of marine aquatic invertebrates and compare with applicable toxicity reference value.	**Marine Water** Sediment
The potential for significant adverse effects on terrestrial mammalian invertevore abundance and diversity	**shrews**	**tundra shrew**	**masked shrew**	**tundra shrew**	**masked shrew**	**masked shrew**	**masked shrew**	**tundra shrew**	Model dose associated with soil ingestion and ingestion of soil invertebrates and compare with applicable toxicity reference value.	**Surface Soil** Fresh Water
Tertiary Consumers (Trophic Level 4)										
The potential for significant adverse effects on marine avian piscivore abundance and diversity	**pigeon guillemot**	**pigeon guillemot**	NA	**pigeon guillemot**	**pigeon guillemot**	**pigeon guillemot**	**pigeon guillemot**	**pigeon guillemot**	Model dose associated with fish ingestion and compare with applicable toxicity reference value.	**Marine Water**
The potential for significant adverse effects on freshwater avian piscivore abundance and diversity	**Belted kingfisher**	**Arctic loon**	**belted kingfisher**	**belted kingfisher**	**belted kingfisher**	**belted kingfisher**	**belted kingfisher**	**belted kingfisher**	Model dose associated with fresh water and fish ingestion and compare with applicable toxicity reference value.	**Fresh Water**
The potential for significant adverse effects on terrestrial avian carnivore abundance and diversity	**northern shrike**	**northern shrike**	**northern shrike**	**northern shrike**	**northern shrike**	**northern shrike**	**northern shrike**	**northern shrike**	Model dose associated with soil ingestion and ingestion of prey and compare with applicable toxicity reference value.	**Surface Soil**
The potential for significant adverse effects on terrestrial mammalian carnivore abundance and diversity	NA	**least weasel**	**least weasel**	**least weasel**	**least weasel**	**shorttail weasel**	**least weasel**	**least weasel**	Model dose associated with soil ingestion and ingestion of prey and compare with applicable toxicity reference value.	**Surface Soil**
The potential for significant adverse effects on freshwater semi-aquatic mammalian carnivore abundance and diversity	NA	NA	**mink**	**mink**	**mink**	**mink**	**mink**	**mink**	Model dose associated with fresh water, freshwater sediment, and fish ingestion and compare with applicable toxicity reference value.	**Fresh Water** Sediment Surface Soil

TABLE 3-1 (cont.)
SUMMARY OF DEFAULT ASSESSMENT ENDPOINTS AND PRIMARY INDICATOR SPECIES FOR EACH ALASKAN ECOREGION

Default Assessment Endpoints	Ecoregions								Typical Tier I Assessment Method	Primary (bold) and Other Exposure Media
	Aleutian Islands	Arctic Slope	Interior	Northwest	Southcentral	Southeast	Southwest	Yukon-Kuskokwim Delta		
The potential for significant adverse effects on freshwater mammalian piscivore abundance and diversity	NA	**river otter**	**river otter**	**river otter**	**river otter**	**river otter**	**river otter**	**river otter**	Model dose associated with fresh water and fish ingestion and compare with applicable toxicity reference value.	**Fresh Water**
The potential for significant adverse effects on marine mammalian piscivore abundance and diversity	**harbor seal**	**ringed seal**	NA	**northern fur seal**	**spotted seal**	**harbor seal**	**spotted seal**	**ringed seal**	Model dose associated with fish ingestion and compare with applicable toxicity reference value.	**Marine Water**
The potential for significant adverse effects on marine mammalian carnivore abundance and diversity	**Arctic fox**	**polar bear**	NA	**polar bear**	**sperm whale**	**sperm whale**	**sperm whale**	**sperm whale**	Model dose associated with marine bird or marine mammal ingestion and compare with applicable toxicity reference value.	**Marine Water**
The potential for significant adverse effects on freshwater fish piscivore abundance and diversity	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	**All freshwater fish** [a]	Compare Media Concentrations with Available Adjusted Water Quality Criteria (Preference for Freshwater and Chronic Values)	**Fresh Water**
The potential for significant adverse effects on marine fish piscivore abundance and diversity	**All marine fish** [a]	**All marine fish** [a]	NA	**All marine fish** [a]	**All marine fish** [a]	**All marine fish** [a]	**All marine fish** [a]	**All marine fish** [a]	Compare Media Concentrations with Available Adjusted Water Quality Criteria (Preference for Marine and Chronic Values)	**Marine Water**

Notes:
a Toxicity data currently available for use in Tier I ecological risk assessments (e.g., ambient water quality criteria, sediment quality benchmarks, phytotoxicity data, and soil invertebrate toxicity benchmarks) do not allow consideration of individual species within each of these functional groups.
NA = Not applicable

4.0 STEP 3: DETERMINE THE RELEVANCE OF DEFAULTS OR MODIFY DEFAULTS BASED ON SITE CONDITIONS

This section outlines the approach to be used to determine the relevance of applicable default assessment endpoints (Step 3, Part A); to determine if additional assessment endpoints should be added (Step 3, Part B); to modify default indicator species identified under Step 2 to reflect site-specific conditions (Step 3, Part C); and to add secondary indicator species (Step 3, Part D). The process is to proceed from a generic, all-encompassing list of possibilities to a potentially smaller, site-specific subset of assessment endpoints and indicator species necessary for a comprehensive ERA at a site. The CSM and site-specific ecological information are the primary tools used for determining the relevance of assessment endpoints and for modifying indicator species.

The use of the descriptions of regional ecology, default functional groupings, and default assessment endpoint and indicator species tables provided in the Technical Background Document will reduce the amount of documentation required within a RAWP and ERA. However, each decision (and the associated rationale) made in site-specific application or modification of the defaults (including any deviations, additions, or eliminations) must be well-documented within the Problem Formulation; ADEC approval should be obtained before proceeding with the ERA.

4.1 Step 3, Part A: Determine the Relevance of Default Assessment Endpoints

Whether an assessment endpoint identified in Step 2 is relevant is to be determined based on the following factors:

- The CSM (Decision No. 2 on Figure 1-3).
- The chemicals of potential ecological concern (COPECs) (Decision No. 2 on Figure 1-3).
- Physical factors and/or known site ecology (Decision No. 3 on Figure 1-3).
- Available assessment methods (Decision No. 3 on Figure 1-3).

A default assessment endpoint is to be assumed relevant unless there is adequate evidence provided based on these factors to determine that it is not.

4.1.1 Conceptual Site Model

The CSM identifies complete and incomplete exposure pathways. If there is no complete exposure pathway, risk does not need to be quantified. Therefore, assessment endpoints pertaining to functional groups to which no complete and potentially significant exposure pathway exists are not relevant and may be eliminated. That is, if none of the primary associated media (indicated in bold in the last column of Table 3-1) are exposure media at a site, then that assessment endpoint would not be relevant and may be removed from the default list and from further consideration. For example, if surface soil is not contaminated and therefore no complete ecological exposure pathway to soil is identified, assessment endpoints focused on protection of terrestrial soil-associated organisms may be removed from further consideration. Another example would be if no freshwater bodies are potentially impacted by site contaminants. In this case, assessment endpoints focused on protection of freshwater semiaquatic, aquatic, or benthic organisms would not be relevant.

4.1.2 Contaminants of Potential Ecological Concern

COPECs may also influence assessment endpoints. For example, if no biomagnifying chemicals are suspected or detected, then assessment endpoints for protection of carnivorous receptors may not be relevant. Although formal COPEC selection generally will not have occurred at the Problem Formulation stage, if it has occurred, assessment endpoints for functional groups with primary associated media in which no COPECs are identified may also be eliminated.

4.1.3 Physical Factors and/or Known Site Ecology

An assessment endpoint can be eliminated if it is demonstrated that no species within a functional group is potentially present at a site. However, because substantial evidence will be required to demonstrate a lack of species, it is anticipated that assessment endpoints will seldom be eliminated based on this criterion. Physical factors and substantial knowledge of site ecology are the most common lines of evidence suitable for making this demonstration. Only if these types of factors affect an entire functional group can the assessment endpoint be eliminated; in most cases, these types of factors may simply affect the selection of indicator species.

Physical factors at a site may limit the types of receptors likely to use the site. For example, pavement, large areas of gravel/cobble/rock, structures, noise, routine human activity, fences, or other factors may minimize the likelihood that a given class of receptors will access the site on a routine basis, or may otherwise minimize the concern over a receptor group. Some examples of the influence of physical factors include the following:

- If the site habitat consists of mowed grass, protection of plant communities may not apply.

- If the soil consists of cobble and rock with little or no fines, it may not support soil invertebrate populations. Flying insects might be present in such areas, but are unlikely to have substantial exposure to soil-bound contaminants. Therefore, assessment endpoints for protection of soil invertebrates and terrestrial avian and mammalian invertevores may not apply under such conditions.

- If the site is fenced, large animals may not be able to routinely access the site.

- If human activity and noise levels are high, more reclusive animals such as wolverines and wolves are unlikely to be present.

Information on site ecology is rarely adequate for most hazardous waste and petroleum sites to determine whether an entire functional group is present or absent. However, where sufficient evidence exists from presence/absence surveys, trapping efforts, detailed habitat surveys, and/or other ecological field data, it may be possible to eliminate an entire functional group and the associated assessment endpoint.

4.1.4 Available Assessment Methods

In some cases, there may be no practical method to evaluate an assessment endpoint. One example is protection of epiphytic plants. Unless there is an unusual site-specific concern regarding potential impacts on epiphytic plants, this assessment endpoint will normally not need to be addressed, because suitable Tier 1 ERA techniques are not currently available.

4.2 Step 3, Part B: Determining the Need for Additional Assessment Endpoints

The addition of new assessment endpoints could be appropriate under site-specific conditions (Decision No. 4 on Figure 1-3). For example, if an endangered or threatened species is known to be present at the site, an assessment endpoint for protection of individual organisms, rather than populations, may need to be added. In some cases, assessment endpoints may also need to be added to meet specific goals and objectives of stakeholders and natural resource trustees (e.g., aesthetic considerations, for example). Similarly, there may be a need for an additional assessment endpoint based on the presence on site of an unusual species that is not represented by the default assessment endpoints. In some cases, adding an assessment endpoint may be technically unnecessary, but beneficial to site managers in order to address the concerns of site-specific stakeholders. For example, establishing a separate assessment endpoint because of an

intense, overriding societal concern even when evaluation of the default assessment endpoints would technically address the concern, but not in a way that is intuitive.

The result of Step 3, Parts A and B, will be a list of the site-specific assessment endpoints.

4.3 Step 3, Part C: Determine the Relevance of and Modify Default Primary Indicator Species

The default primary indicator species (or communities) associated with the list of site-specific assessment endpoints should be evaluated in light of site conditions to determine whether any modifications are needed (Decision No. 5 on Figure 1-3). The defaults were selected to be generally appropriate for most sites. However, it is essential to determine if site-specific modifications are needed. This may require selecting a different or alternate primary indicator species. This process is briefly described below; the Technical Background Document should be consulted for further details.

The third step in selecting site-specific assessment endpoints and indicator species is to verify that each of the default primary indicator species has some potential to be found at your site. Physical setting and available ecological information, as well as species habitat requirements within the region, should be reviewed by a biologist/ecologist familiar with the site and region. If information is sufficient to verify that any of the default primary indicator species are absent from the site for non-chemical-related reasons, those species should be removed from further consideration. Because this would leave one or more unrepresented assessment endpoints (i.e., assessment endpoint[s] without associated indicator species), it is necessary to select a replacement for the default primary indicator species. The replacement for the default primary indicator species, termed an alternate primary indicator species, generally should be the most highly exposed species (likely to be the smallest size) species within the functional group that has the potential to inhabit or use the site.

4.4 Step 3, Part D: Determine the Need for and Select Secondary Indicator Species

Depending on site conditions, it may be necessary to select more than one indicator species per assessment endpoint (Decision No. 6 on Figure 3-1). The additional indicator species are termed secondary indicator species. It is necessary to determine whether to evaluate any secondary indicator species and to select the secondary indicator species to be evaluated. Secondary indicator species generally need to be selected only when their evaluation is likely to provide information of use in risk management decisions. To determine whether to use secondary

indicator species, in addition to primary indicator species, the following factors should be considered in light of the needs of risk managers/decision makers and site-specific conditions:

- < Cultural values
- < Differential risk management values
- < Exposure potential
- < Toxicological sensitivity
- < Sensitive areas
- < Secondary foraging strategy
- < Secondary habitats
- < Marine and freshwater (dual habitat) exposure
- < Low-density population
- < Ecological niche

Because these factors do not necessarily apply at all sites, they must be evaluated separately for applicability to a specific site. These conditions were identified during the process of developing the default assessment endpoints and indicator species. If any of these considerations apply to your site and influence the use or selection of secondary indicator species, the rationale should be clearly documented in the ecological RAWP or ERA. Each of these factors, as they pertain to the decision to use secondary indicator species, is discussed in more detail in Section 5.4 of the Technical Background Document.

If secondary indicator species are determined to be necessary or desirable, the additional indicator species may be chosen from the species list provided in Appendix D of the Technical Background Document (Tables D.3-1 through D.3-8). Guidance on their selection is provided in Section 5.4 of the Technical Background Document; however, their selection will be largely site-specific.

The retained default or alternate primary indicator species, as well as any additional secondary indicator species, comprise the final list of site-specific indicator species to be carried into the ERA. The ecological RAWP should fully document the derivation of this site-specific list.

5.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 1998. Contaminated Sites Remediation Program: Risk Assessment Procedures Manual. November.

Shannon & Wilson, Inc. 1999. Technical Background Document for Selection and Application of Default Assessment Endpoints and Indicator Species in Alaskan Ecoregions. Prepared by Shannon & Wilson, Inc., for the Alaska Department of Environmental Conservation under contract no. 18-1019-97. June.