Response to Daniel Peplow Comments (dated 8 July 2005) on the April 2005 Draft DMTS Fugitive Dust Risk Assessment

No.	Comment	Priority	Recommendation	Response	DEC Remarks
Peplow-1	The assertion that human health and environmental risks are not elevated does not consider the limitations of chemical assessment methods. The RA should more effectively utilize appropriate biological indicators in conjunction with chemical assessment.	Medium	Please update the uncertainty section.	The need for additional study of biological indicators will be evaluated during development of the risk management plan. The risk management plan will define what actions will be taken based on the findings of the DMTS risk assessment, thereby focusing priorities where potential risks were predicted.	Response is acceptable.
	Potential Pathways				
Peplow-2	There still exist potential pathways for people to come into contact with metals transported by fugitive dust, either directly or indirectly. These are pathways by which ecological receptors may be exposed to metals associated with the DMTS, including pathways of exposure for both terrestrial and aquatic communities in the vicinity of the DMTS road and port facility.	Medium	Please provide additional explanation for selection of pathways and designation of "secondary" pathways.	Comment noted. These pathways are evaluated in the risk assessment.	Response is acceptable.
Peplow-3	Evidence supporting the designation of exposure routes as secondary or incomplete were not included in the RA and therefore not available for review.			Discussion of the primary and secondary exposure route designations for the human health risk assessment (HHRA) is provided in Section 2.3.3 (and subsections). For the ecological risk assessment (ERA), the discussion is provided in Section 2.4.4.	Response is acceptable.
Peplow-4	In the ecological RA, (Section 6), an assessment was conducted to evaluate risk to ecological receptors inhabiting terrestrial, freshwater stream, pond, and coastal lagoon habitats. Since fish are an important food source for residents in the vicinity of the DMTS, and species that are harvested for subsistence use were selected as ecological receptors, the "Stream – Deposition – Sediment – Ingestion/Uptake – Fish" exposure pathway was selected for review. Like the secondary pathways in the human health risk assessment, this pathway was designated arbitrarily as secondary in that it was not considered to contribute significantly to risk estimates.			Figure 5-1 in the draft HHRA inadvertently presented a preliminary conceptual site model rather than the refined conceptual site model. The revised conceptual site model includes stream water and fish ingestion as primary pathways. The errors in Figure 5-1 have been corrected in the revised HHRA. In any case, both pathways were treated as primary exposure pathways in the draft risk assessment. The CoPC screening identified lead and thallium as freshwater CoPCs and potential risks from fish consumption and water ingestion were estimated. Figure 5-1 is attached for review. Also in response to this comment, Figure 6-1 was revised based on changes made to the text of Section 2.4.4 (Potential Exposure Pathways), so that the figure is consistent with the text. Figure 6-1 is attached for review with this comment response document. Also, for reference, Section 2.4.4 is provided below, and the changes that were made provided in red-line: *Potential pathways by which ecological receptors may be exposed to metals associated with the DMTS exist for both terrestrial and aquatic communities in the vicinity of the DMTS road and port facility, as illustrated in the preliminary CSM for the DMTS ecological risk assessment (Figure 2-2). The CSM identifies routes by which receptors are exposed to CoPCs, but does not make conclusions regarding the potential for risk associated with the exposure pathways.* *Primary exposure pathways are those expected to contribute most to total exposure, while secondary exposure pathways are not expected to increase exposure substantially. Primary exposure pathways for terrestrial receptors (such as herbivorous, invertivorous, and piscivorous birds and mammals) include the consumption of plant material or prey and the incidental ingestion of soil or sediment. Secondary exposure pathways for terrestrial receptors*	Response is acceptable.

Response to Daniel Peplow Comments (dated 8 July 2005) on the April 2005 Draft DMTS Fugitive Dust Risk Assessment

No.	Comment	Priority	Recommendation	Response	DEC Remarks
				include dermal contact with and ingestion of surface water and inhalation of soil particles. In most situations, dermal contact and inhalation are less important sources of metals exposure in wildlife than food and incidental soil ingestion (Newman et al. 2003). The external epithelium, an effective barrier to inorganic metals, minimizes the dermal uptake of metals in higher organisms (Paustenbach 2000). Therefore dermal contact is not considered a pathway for terrestrial receptors. In general, inhalation of particles is insignificant compared to other exposure routes for metals and is typically not addressed in ecological risk assessment (Newman et al. 2003). Thus, inhalation is considered a secondary pathway. *For terrestrial plants, the primary pathways of exposure are the contact with and uptake of metals incorporated into soil and the uptake of metals deposited onto plant surfaces as fugitive dust (Figure 2-2). Soil fauna are primarily exposed to metals through direct contact with and uptake of the soil and via ingestion of food in the soil.* *For aquatic plants, the primary pathways are direct uptake of sediment and surface water, and contact with surface water. Primary exposure pathways for aquatic receptors such as fish and aquatic invertebrates include the ingestion or uptake of surface water, consumption of plant material or prey, incidental ingestion of sediment during foraging, and direct contact with surface water (Figure 2-2). Secondary exposure pathways for aquatic receptors include contact with sediment. Some aquatic receptors may also be exposed through the uptake of metals from sediments.* Paustenbach, D.J. 2000. The practice of exposure assessment: a state-of-the-art review. J. Toxicol. Environ. Health B 3:179-291.	
Peplow-5	Potentially significant pathways and risks to receptors, human and environmental, could also be missed because the designation of exposure pathways as secondary or incomplete were not based on adequate evidence that was included in the RA and available for review.	Medium	Please provide additional explanation for selection of pathways and designation of “secondary” pathways.	With regard to the draft HHRA, as noted in the response to comment Peplow-4, both fish consumption and water ingestion were evaluated as primary exposure pathways. The errors in Figure 5-1 have been corrected. The rationale for designation of soil inhalation and dermal contact with soil is discussed in detail in Section 2.3.3. The marine environment was screened out because no CoPCs were identified during the screening process described in Sections 3.3.3 (particularly 3.3.3.2.2) and 4.3. Freshwater sediment exposure is considered a secondary pathway because of low water temperature and, in the case of lagoons, lack of subsistence foods in the sediment (described in Section 2.3.3 of the risk assessment). Dermal contact with freshwater is considered a secondary pathway because low water temperatures preclude prolonged human contact with the water and because it is not a significant means of exposure to metals relative to water ingestion.	Response is acceptable.
				With regard to the ERA, the discussion of exposure pathways is provided in Section 2.4.4. This discussion includes rationale for designation of pathways as primary or secondary exposure routes. As described in that section, the contact and inhalation pathways are considered secondary for ecological receptors. In most situations, dermal contact and inhalation are less important sources of metals exposure in wildlife than food and incidental soil ingestion (Newman et al. 2003). The external epithelium, an effective	Response is acceptable.

Response to Daniel Peplow Comments (dated 8 July 2005) on the April 2005 Draft DMTS Fugitive Dust Risk Assessment

No.	Comment	Priority	Recommendation	Response	DEC Remarks
				barrier to inorganic metals, minimizes the dermal uptake of metals in higher organisms (Drexler et al. 2003), and in general, inhalation of particles is assumed to be insignificant compared to other exposure routes for metals and is not addressed in an ERA (Newman et al. 2003). To evaluate the relative importance of inhalation exposure and exposure from ingestion through diet and soil, the following text has been added to the uncertainty section (Section 6.6.5.1.1 – Body Masses and Intake Rate Parameters): *Although there is a minor, non-quantified exposure to wildlife via inhalation because receptors can be exposed to metals through incidental inhalation of fugitive dusts, this was considered to be a minor pathway for three reasons. First, the total exposure to metals in dust was considered to be small relative to the exposure received via ingestion of food and soil/sediment. Second, relatively little inhaled dust is likely to pass into the lower respiratory tract and lungs, where absorption could potentially occur. Instead, most inhaled dust will likely end up being ingested. Third, metals would be bound tightly on dust particles and not readily available for uptake, unlike other chemicals, such as volatiles, that could be readily absorbed into the circulatory system from the lungs.* *U.S. EPA (2003e) has provided example calculations for the meadow vole, which allows for a comparison of percent contribution of the various pathways of exposure. According to their example, the percent contribution of particulates from the inhalation pathway is very low at less than 0.001%, while in contrast, the combined diet and soil ingestion pathways contribute more than 99.9% to the relative dose.* *As noted in U.S. EPA (1993), calculation of dose deposited, retained, and absorbed in the respiratory tract is a function of many factors, including species anatomy, physiology, particle size distribution, and pharmacokinetic data. To accurately calculate the importance of the inhalation pathway would require use of PBPK models. However, these models only exist for a few common laboratory species and extrapolation to wildlife receptors would introduce considerable uncertainty to risk estimates that is disproportionate to the relative importance of this exposure pathway.* U.S. EPA. 2003e. Evaluation of dermal contact and inhalation exposure pathways for the purpose of setting Eco-SSLs. OSWER Directive 92857-55. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. November 2003.	
	Mercury				
Peplow-6	Hg background levels must be measured, and Hg in the study site must be removed from the CoPCs based on empirical data. In areas remote from anthropogenic impacts, atmospheric levels of Hg are 2-4 ng m-3. In urban areas, background mercury levels are about 10 ng m-3. According to the WHO	Low	Please provide an explanation of how mercury is addressed.	Excluding a specific source of elemental mercury, inorganic mercury is the predominant form of mercury found in soil. U.S. EPA (1997) states that soil conditions are typically favorable for the formation of inorganic Hg(II) compounds such as HgCl , Hg(OH) and inorganic Hg(II) compounds complexed with organic anions. U.S. EPA (1997) further notes that 97-99% of total soil mercury is in the form of inorganic Hg(II) complexes, with only a	Response is acceptable.

Response to Daniel Peplow Comments (dated 8 July 2005) on the April 2005 Draft DMTS Fugitive Dust Risk Assessment

No.	Comment	Priority	Recommendation	Response	DEC Remarks
	(2000) the LOAEL (lowest-observed-adverse-effect level) might be around 15-30 ng m-3. Sampling Hg in ambient air around the DMTS would provide data about Hg vapor exposure levels to the surrounding population and better indicate whether the "Terrestrial – Adsorption – Soil – Inhalation – Receptor" exposure route should be designated as primary or secondary. Sampling can be conducted using Hg vapor analyzers, also know as Hg sniffers (e.g., LUMEX).			small fraction present as elemental mercury in typical soil. Approximately 1-3% of the total mercury in typical surface soil is methylmercury, and as is the case for Hg(II) species, it will be bound largely to organic matter. In addition, as shown in Table 3-14 of the risk assessment, mercury concentrations in soil at the site were less than one-tenth of the DEC soil cleanup level (26 mg/kg), which is based on the inhalation pathway. Thus, mercury would not be considered a CoPC regardless of whether the mercury present is in the elemental or inorganic form. U.S. EPA. 1997c. Mercury study report to congress. Volume III: Fate and transport of mercury in the environment. Office of Air Quality Planning and Standards and Office of Research and Development, U.S. Environmental Protection Agency. EPA-452/R-97-005. December 1997.	
Peplow-7	The list of CoPCs, however, could be incomplete because some metals (e.g., Hg) were eliminated as CoPCs based on an incomplete consideration of current literature regarding pathways and toxicity.			See responses to comments Peplow-3 and Peplow-6.	Response is acceptable.
Peplow-8	Chemical assessment methods were used in the DMTS RA to measure the concentration of contaminants. These concentrations were evaluated in relation to fixed criteria in order to calculate risk and predict biological toxicity. Although criteria are used to describe the possible cause of environmental problems, results that meet criteria provide no assurance that toxicity is not occurring due to unexpected mixtures or interactions.	Low	Please discuss in uncertainty section.	Screening values are derived without any consideration for interactive effects, and if the measured value is below a screening value for a chemical, that chemical is considered not to pose a risk. With regard to the food web modeling, please see the uncertainty discussion in Section 6.6.5. In addition to using chemical-specific criteria, potential impacts to some assessment endpoints were evaluated using field survey methods and/or toxicity tests. These methods are designed to measure the cumulative impact of multiple stressors. Hence, for some assessment endpoints, chemical mixtures and interactions were evaluated. For example, plant communities were assessed through comparisons of site and reference stations, as well as other lines of evidence, such as trends with distance from the road and port facilities; these methods account for the cumulative effects of mixtures and interactions of multiple stressors present in tundra media. The fish assessment is based on two lines of evidence: site and reference comparison of stream sediment and invertebrate CoPC concentrations, and the results of ongoing biomonitoring in the vicinity of the DMTS road and mine area. Stream environments were evaluated through benthic macroinvertebrate drift assemblages, fish biomonitoring studies, comparison to reference conditions, and food web models. The lagoon environment assessment included sediment toxicity testing, which by the nature of the testing evaluates the cumulative effects of mixtures and interactions of multiple stressors present in sediment. These examples illustrate the use of multiple assessment tools to evaluate the simultaneous effects of the mixture of chemicals present at the site.	Response is acceptable.
Peplow-9	Drift sampling methods are not, however, quantitative and do not result in data that can be compared between sites. Instead, a fine-meshed Surber sampler, Hess sampler or even a D-Net Kick Sampler, should be used. Data analysis of quantitative benthic analyses would permit a more detailed analysis of community structure.	Low	Please provide the rationale for the sampling methods selected with respect to the use of sampling results. If possible, similar studies from the peer-reviewed literature should be cited. The pros and cons of drift net sampling versus other collection methods for benthos should be described to address this comment.	Aquatic invertebrates in the freshwater streams' riffle and pool habitats were collected using the rapid bioassessment techniques developed by the U.S. EPA (Barbour et al. 1997) as modified by Alaska Department of Fish and Game for aquatic monitoring for the National Pollutant Discharge Elimination System (NPDES) permit at Red Dog Mine (DFG 1998b). Results of the benthic surveys at site stream stations were compared with those at reference stream stations, as described in Section 6.3.1 of the document.	Response is acceptable.

Response to Daniel Peplow Comments (dated 8 July 2005) on the April 2005 Draft DMTS Fugitive Dust Risk Assessment

No.	Comment	Priority	Recommendation	Response	DEC Remarks
	Furthermore, care must be taken to collect samples from riffles with similar hydrological and biogeophysical characteristics because the community structure of benthic macroinvertebrates varies widely with chemical, physical, and environmental such as streamflow, dissolved oxygen, alkalinity, mean substrate particle size, sediment and water pH, and water temperature. These potentially confounding factors were not controlled for in the RA report. Biotic indices depend on the collection of extensive physical and chemical data for each geographic location where they are to be applied. Karr's benthic index of biotic integrity and the Hilsenhoff Biotic Index are two examples. The index of Community Sensitivity addresses the impacts from metal pollution specifically but it requires that the dominant taxa within a region be ranked from most sensitive to least sensitive for one metal, and it then assumes that the ranking for another metal will be similar. In most benthic communities, there are typically a few genera represented by large numbers of individuals, smaller numbers of several genera, and many genera that are represented by a few individuals. In benthic communities impacted by metal contamination, metal-intolerant taxa are replaced by metal-tolerant taxa. The Montana Department of Environmental Quality has modified the Hilsenhoff Biotic Index to include tolerance values of benthic macroinvertebrates to metals. The Montana DEQ Biotic Index is the sum of the proportional abundance of a taxon in the sample times the tolerance values specified for all taxa in the sample. Values ranged from 0 (intolerant) to 10 (tolerant).		Please evaluate the usefulness of the biotic indices discussed in this comment; in particular the modified Hilsenhoff index for metals-contaminated systems from Montana DEQ. Can they add value to the benthic-community assessment for this site? If so, present the additional data analysis in the revised ERA.	Drift sampling methods were quantitative, as the results were standardized based on flow rates through the net to allow for a direct comparison between site and reference samples. The community data obtained by the drift net sampling allowed for a detailed analysis of community structure, including evaluation of six community metrics. The evaluation indicated that the overall characteristics of the communities found in the site streams crossing the road were similar to reference streams. As the commenter indicates, biotic indices, such as Karr's IBI or the Hilsenhoff Biotic Index require extensive site-specific physical and chemical data and a detailed understanding of inter-species differences in sensitivity of benthic taxa to metals. Such information is lacking for Red Dog, particular sensitivity of resident taxa to metals. For these reasons, it would be inappropriate to apply indices such as those developed for streams in Montana to this site in Alaska, as there is no means to determine whether index values developed for Montana species are relevant for Alaskan species.	
Peplow-10	Standard methods to predict mineral speciation, the solubility of oxidized metals, and solubility products using Eh-pH stability diagrams were not used. Similarly, sequential extraction techniques to characterize the relative concentrations of the different forms of the metal compounds and the potential bioavailability were not used.	Medium	Please further discuss metals speciation and bioavailability in the ERA. Indicate why the specific tools mentioned in this comment were not used.	To be conservative, the ERA calculations for each metal were made using the lowest of the biologically relevant toxicity reference values (TRVs) available for that metal, regardless of the form of the metal. In addition, the very conservative assumption of 100% bioavailability was used in the ERA. Also, it should be noted that the TRVs are often developed from animal studies that use more bioavailable forms of metals than those likely to be prevalent at the site. The following discussion was to added the uncertainty section (Section 6.6.5.4 – Toxicity Reference Values): *Efforts were made to select the best available TRVs, based on appropriate exposure studies and the most relevant endpoints. For example, if both drinking water and dietary exposure studies were available, the dietary*	Response is acceptable.

Response to Daniel Peplow Comments (dated 8 July 2005) on the April 2005 Draft DMTS Fugitive Dust Risk Assessment

No.	Comment	Priority	Recommendation	Response	DEC Remarks
				exposure study was selected preferentially. U.S. EPA (2005) recommended a mammalian lead NOAEL TRV of 4.7 mg/kg-day. The mammalian NOAEL for lead recommended by U.S. EPA (2005) was based on a drinking water study, and was therefore not an appropriate TRV based on the selection criteria. Additionally, deriving TRVs from exposure studies that are focused on chemicals dissolved in drinking water, which are highly available, is overly conservative and would overestimate exposure. For lead, a dietary exposure study was available, and therefore the mammalian NOAEL TRV used in this risk assessment was based on the more appropriate dietary study. Similarly, U.S. EPA (2005) recommended an avian lead NOAEL TRV of 1.63 mg/kg-day. The avian NOAEL for lead recommended by U.S. EPA (2005) was based on a paper that used Japanese quail as the receptor and the number of eggs produced as the relevant endpoint. Japanese quail have been bred specifically to have unnaturally high egg-laying rates, and therefore the relevance of "egg production" as the endpoint for wild birds is unclear. The meaning of extrapolating any apparent reproductive "effect threshold" in quail to wildlife receptors is unknown and highly questionable, because of differences in reproductive physiology. Instead, the NOAEL was derived from a study (Pattee 1984; see Section 6.5.2.9) that used wild species (American kestrels), dietary exposure, and the relevant endpoints included body weight, food consumption, clutch initiation, interval between eggs, clutch size, fertility, and eggshell thickness. Therefore, the avian lead NOAEL TRV was based on the Pattee (1984) study.	
Peplow-11	Specific baseline studies during the Baseline Study should reference the numerous studies conducted prior to implementation of the TeckCominco project, such as the one performed by Houghton and Hilgert (1983). These studies should be used as reference for the Environmental Assessment phase.	Low	Please evaluate the cited study and use it as appropriate when designing future monitoring studies at the site.	The Houghton and Hilgert (1983) study referred to is a chapter within the environmental baseline studies documents (Dames and Moore 1983a,b). These documents have been reviewed, considered, and referenced in the risk assessment, and will be considered in developing any future studies.	Response is acceptable.

Notes: Please note that RA text quoted herein may differ from that in other comment response documents, and in comparison with the final RA document, as a result of successive revisions made during the comment resolution process.
Comments submitted by Daniel Peplow, Ph.D. 841 42nd Ave. NE, Seattle, WA 98105 USA
See the original Peplow comment letter for complete citations of cited literature.

DEC - Department of Environmental Conservation (Alaska)
DEQ - Department of Environmental Quality
DMTS - DeLong Mountain Regional Transportation System
ERA - ecological risk assessment
HHRA - human health risk assessment
NPDES - National Pollutant Discharge Elimination System
RA - risk assessment
TRV - toxicity reference values
WHO - World Health Organization

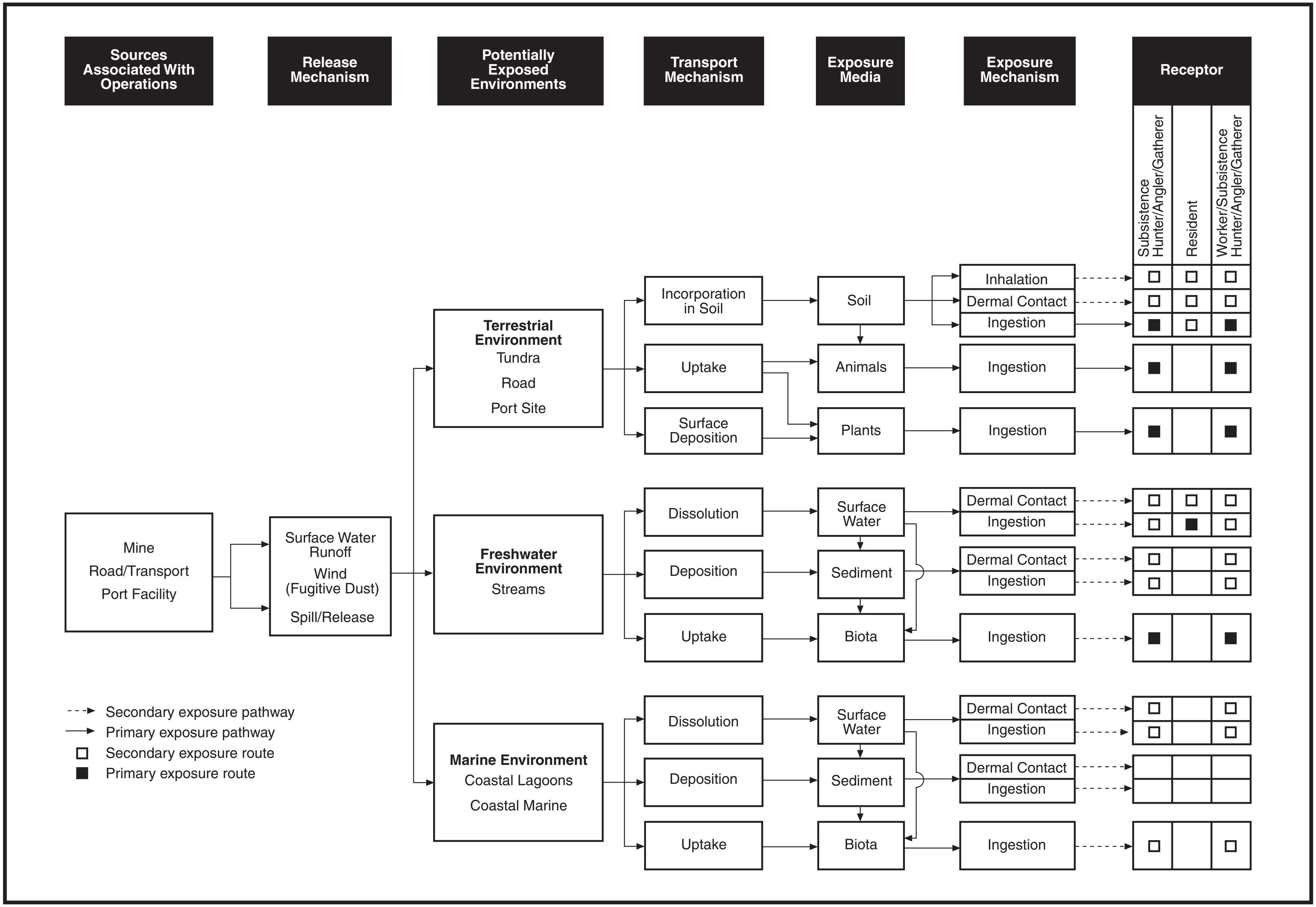
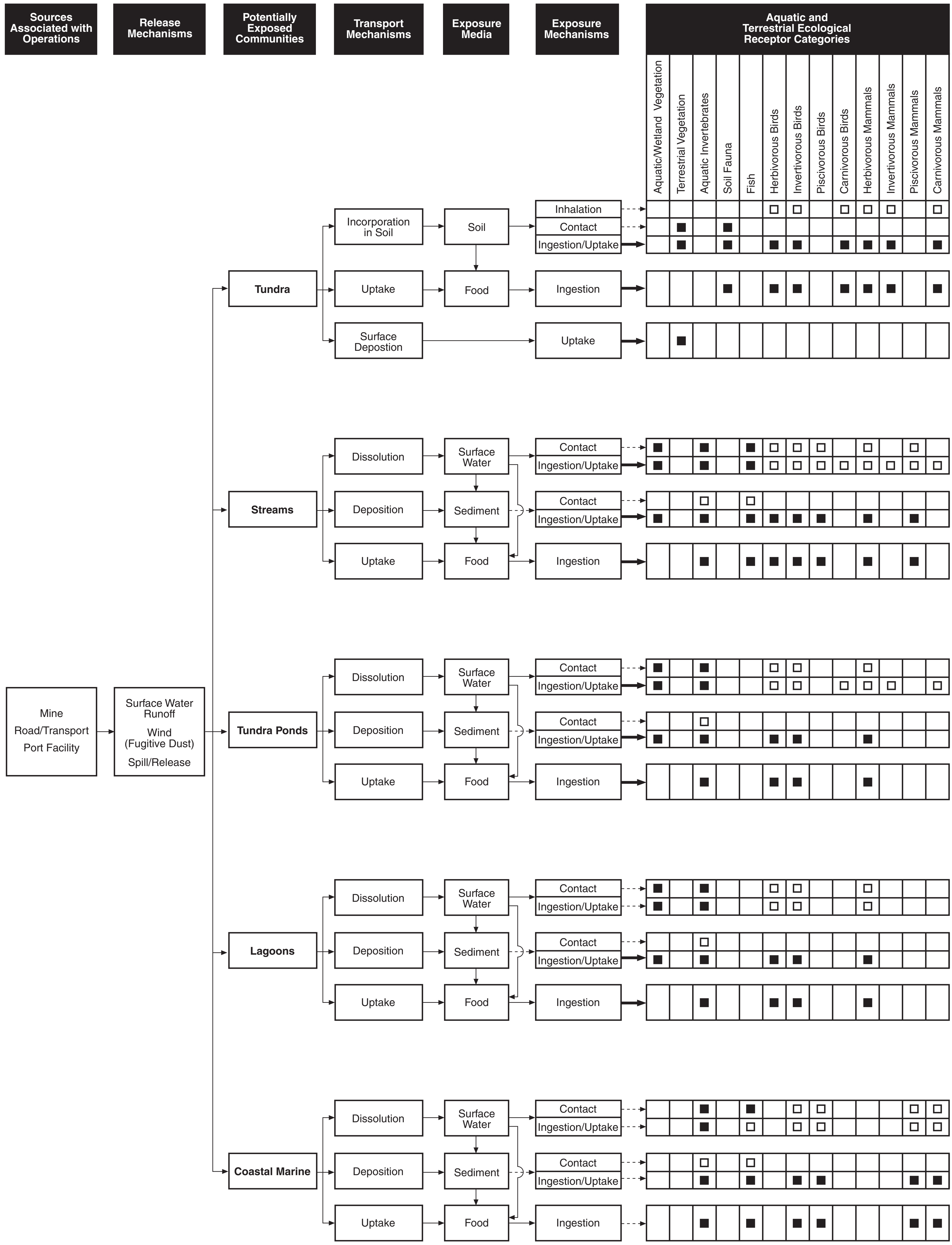


Figure 5-1. Refined conceptual site model for the DMTS human health risk assessment

8601997.001 4400 724/06 WA



Secondary exposure pathway
Primary exposure pathway
Secondary exposure route
Primary exposure route

Notes: Fish were not present in the tundra pond and lagoon communities, therefore no complete exposure pathway to fish or fish-eating wildlife is documented in the conceptual site model for these habitats. Aquatic vegetation was not present in the coastal marine offshore community, therefore no complete exposure pathway is documented in the conceptual site model for aquatic vegetation, or herbivorous wildlife in this habitat.

Figure 6-1. Refined conceptual site model for the DMTS ecological risk assessment

8601997.001 5400 10/18/06 WA