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March 31, 2004

Ms. Beatrice Egbejimba
Alaska Department of Environmental Conservation
555 Cordova Street
Anchorage, AK 99501

RE: **Conceptual Site Model**
Former Chevron Service Station 9-2609
Seward Highway, Mile 79
Portage, Alaska
SECOR Project No.: 77CH.92609.01.0010

Dear Ms. Egbejimba:

SECOR International Incorporated (SECOR), on behalf of Chevron Environmental Management Company (Chevron), is submitting this Conceptual Site Model (CSM) for the above referenced site. The CSM was prepared by SLR International Corporation (SLR) at the request of SECOR, for the review of the Alaska Department of Environmental Conservation (ADEC) as the first step in preparing a Risk Assessment Work Plan per ADEC's *Risk Assessment Procedures Manual*, 2000. This scope of work is being proposed based on agreements reached between Chevron, ADEC, and Robert Hall in December 2003.

Should you have any questions or concerns regarding these activities, please feel free to contact Brian Silva at (916) 861-0400, extension 240.

Sincerely,

SECOR International Incorporated

Brian A. Silva
Project Manager

Enclosures:

Attachment 1 Conceptual Site – Prepared by SLR International Corporation

cc: Robert J. Cochran, Chevron Environmental Management Company, San Ramon, CA
Robert Hall, Gorilla Fireworks, Wasilla, AK
Greg Anderson, Kailua-Kona, HI

ATTACHMENT 1
CONCEPTUAL SITE MODEL

Prepared by SLR International Corporation
Former Chevron Service Station 9-2609
Seward Highway, Mile 79
Portage, Alaska
SECOR Project No.: 77.CH.92609.01.0010
March 31, 2004

SLR

March 29, 2004

Ms. Beatrice Egbejimba
Alaska Department of Environmental Conservation
555 Cordova Street
Anchorage, Alaska 99501

Re: Conceptual Site Model for Former Chevron Service Station 9-2609, Seward Highway, Mile 79, Portage, Alaska.

Dear Ms. Egbejimba:

On behalf of SECOR International Corporation (SECOR), SLR International Corp (SLR) has prepared this letter to present a draft Conceptual Site Model (CSM) for the former Chevron Service Station 9-2609 (the site). This CSM and associated documents have been prepared for review by the Alaska Department of Environmental Conservation (ADEC) as the first step in preparing a Risk Assessment Work Plan for the site, in accordance with guidance provided by ADEC in the Risk Assessment Procedures Manual (2000). Accordingly, this letter provides: (1) a CSM for human receptors, and (2) a CSM for ecological receptors. The CSMs are described both in the text and graphically. They incorporate suggestions and requests you made in an electronic message to Brian Silva of SECOR (December 4, 2003). These draft CSMs describe "potential" exposure pathways. On the basis of ADEC comments, these draft CSMs will be revised to show "actual" exposure pathways, which will be provided in the Risk Assessment Work Plan to be prepared for the site. In addition to the CSMs, a brief description of the site is provided in the following text.

In view of the nature and extent of contaminants at the site, and results of a preliminary screening risk evaluation, SLR proposes to conduct a Method 4 risk assessment for both human and ecological receptors at the site. After careful consideration of the pertinent ADEC guidance and extant analytical data, a Method 4 approached is considered the most likely to satisfy requirements for regulatory site closure.

Site Background

The site is located in the southeast section of the Municipality of Anchorage in Portage Valley. The site is located on Mile 79 of the Seward Highway, which connects Anchorage and the Kenai Peninsula (Figure 1). Mile 79 is located opposite the turnoff to Portage Glacier. The site is approximately 200 feet east of a tidal mudflat that is associated with the easternmost edge of the Turnagain Arm. The Turnagain Arm is a glacial fjord infilled with intertidal sediments (Tidal Bore Research Society [TBRS], 2004).

Site Use. The approximately 0.8 acre site is a former Chevron service station that operated from 1971 to 1979. All site improvements were reportedly removed in 1980, but Chevron continued to lease the property until 1984. Prior to Chevron's occupation of the site, a retail service station was owned and operated on the property by another vendor until approximately 1963. Since Chevron left the site, a small retail ice cream stand has operated on the property during summer months (it is closed during the winter). During Chevron's service station operations, two 10,000-gallon gasoline underground storage tanks (USTs) and one 3,000-gallon diesel UST were stored and dispensed fuel. These were removed in 1980. No records of contamination, or records of discharges or other fuel loss have been located within site-related files. Details of the site are shown in Figure 2.

Land Uses. Currently the site is undeveloped, and is zoned as R-11 and PL1. Zone R-11 is the Turnagain Arm district. This zoning designation may allow institutional, residential, commercial, and/or industrial land use, based on certain criteria. Zone PL1 is public lands and institutions districts, and includes areas of significant public open space, and major public and quasi-public institutional uses (City of Anchorage, 2004). The site may be redeveloped as a service station, and construction of a home at the site for the business operator has not been ruled out (Personal communication with Brian Silva, SECOR, February 2004). Based on the isolated location of the site and the proximity to wilderness areas, residential and commercial development in the site vicinity is unlikely.

The land surrounding the site is characterized by undeveloped open space consisting of brushy areas, wetlands, ponds and streams, and mudflats adjacent to the inlet (USGS, 1984). Mile 80 is the turnoff to Portage Glacier. The nearest developed areas to the site are located at Mile 69 and Mile 90. Mile 69 is Turnagain Pass, a rest stop visited by skiers and snowmobilers. Mile 90 is Girdwood Exit where there is gas, food, and a hotel. The Turnagain Arm area has a variety outdoor activities including hiking, skiing, snowmobiling, fishing, surfing, and kayaking. These activities are not necessarily near the site, but occur along the 60-mile length of Turnagain Arm.

Because of the isolation of the site, visitors are generally restricted to people pulling off from the highway to rest or purchase ice cream on the way to visiting scenic attractions. There are no roads or hiking trails giving access to the wilderness near the site. The area's remoteness and the nature of the surrounding brushy wetlands make it relatively inaccessible for recreational use. Extensive mudflats at the tidal inlet, which is not visible from the site, make fishing from the shore difficult. In winter a high snow berm, deposited by snowplows at the side of the highway, makes the area inaccessible for winter sports such as cross country skiing. The existence of scenic areas in other places along the highway that have been developed for outdoor recreation makes use of the site and vicinity for recreation less likely. SECOR personnel visiting the site have not seen recreational visitors at or near the site, nor have large game animals such as moose or bear been seen. Only passerine (perching) birds have been seen at the site during site visits. Therefore, hunting and fishing near the site are unlikely for either recreational or subsistence purposes.

Subsurface Description and Groundwater Uses. The depth to groundwater at the site ranges from 3.5 to 11 feet below ground surface (bgs). Groundwater predominantly flows to the north with fluctuations to both west and east. The site is approximately 200 feet from a tidal mudflat associated with Turnagain Arm. A tidal study has been recently conducted by SECOR, and will be discussed in the upcoming risk assessment work plan. Soil underlying the site is primarily sandy gravel with lenses of silt.

Although the site is within the municipal Anchorage area, drinking water is not piped to the site and surrounding area; currently, bottled water must be brought in. Shallow groundwater at the site is not extracted for drinking water supplies, and is unlikely to be in the future because concentrations of iron and manganese exceeding secondary drinking water standards published in 18AAC80. The cost of filtration to achieve acceptable water taste, odor, and appearance make development of shallow groundwater as a drinking water source unlikely. However, as requested by ADEC (personal communication with Brian Silva, SECOR, December 4, 2003), shallow groundwater at the site should be considered a potential drinking water source for the purposes of the risk assessment.

A groundwater production well, well SW-1 (Figure 2), was installed near the western site boundary in 2001 as a replacement for the original production well. Drilling to approximately 100 feet bgs did not show any evidence of an aquitard. The boring was filled with bentonite to approximately 40 feet bgs and a 6 inch production well was installed. The well is now capped off. No pump was ever installed and the well has sat idle since installation. Water from the well is non-potable due to high metals content.

Site Characterization and Remediation. A summary of site investigation and remediation activities to date is provided below. Site characterization and analytical results for all sampled media will be thoroughly described in the Risk Assessment Work Plan for this site.

- Between 1993 and 2000, 16 soil borings were drilled onsite and 3 were drilled offsite. Boring depths ranged from 1 to 14 feet bgs. Samples were analyzed for diesel range organics (DRO), gasoline range organics (GRO), residual range organics (RRO), benzene, toluene, ethylbenzene, and xylenes (BTEX), and methyl tert butyl ether (MTBE). Selected samples were also analyzed for polynuclear aromatic hydrocarbons (PAHs) and soil properties.

- Between 1995 and 2000, 7 groundwater monitoring wells were installed onsite and 5 were installed offsite. Samples were analyzed for GRO, DRO, and BTEX. Selected samples were also analyzed for MTBE.

- Between August 21 and September 7, 2000, SECOR excavated three 2,000-gallon USTs and one 3,000-gallon UST with associated product piping. These tanks were not associated with Chevron's tenure of the service station but with operations that occurred prior to Chevron's lease of the site. The excavation pit varied from 4 to 16 feet bgs and a total of 3,500 cubic yards of excavated soil was removed from the site. Two monitoring wells were destroyed due to the proximity of the excavation pit. Soil samples were collected from the sidewall perimeter and bottom of the excavation pit. Soil samples were also collected from the native soil beneath each of the four USTs and the former dispensers.

The following analytes were detected in soil: GRO, DRO, RRO, and BTEX. PAHs and MTBE were not detected. In groundwater, DRO, GRO, BTEX, and MTBE were detected. MTBE was only detected in groundwater using USEPA Method 8020; it has not been detected using USEPA Method 8260, implying that MTBE is not a target analyte at the Site. Various inorganics, including lead and arsenic, were also detected in unfiltered groundwater samples collected from monitoring wells. Therefore, detected analytes consist of inorganics, volatile organic compounds (VOCs; e.g., BTEX), and semi-volatile organic compounds (SVOCs, e.g., DRO).

EDB?
~~Lead?~~
Lead in soil?

Conceptual Site Model

This text presents objectives of CSM development, summarizes land and groundwater use at the site and vicinity, presents key assumptions utilized to develop the CSM, and identifies receptors and potential exposure pathways for consideration at the site. The following guidance was consulted in preparation of this CSM:

- Risk Assessment Procedures Manual (ADEC, 2000)
- Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A) (USEPA, 1989)
- Standard Guide for Developing Conceptual Site Models for Contaminated Sites (American Society of Testing and Materials [ASTM], 1995).

Purpose of a CSM

A CSM is developed to facilitate the analysis of potentially complete exposure pathways at a contaminated site. As an important preliminary step in the exposure portion of a risk assessment, the CSM schematically represents the relationship between chemical sources and receptors (both human and ecological) at a site, and identifies potentially complete and significant pathways through which receptors may be exposed to chemicals of potential concern (COPCs). The CSM is constructed based upon careful consideration of current and future land and groundwater use at the site and vicinity, presence of biota and viable wildlife habitats, and fate and transport characteristics of the detected analytes in corresponding media. This allows the risk assessor to identify which pathways should be quantitatively evaluated and which can be adequately addressed through a qualitative approach.

Current and Future Land and Groundwater Uses

The site is remote and located in an undeveloped wilderness area. Future use may involve development as a service station. Residential development at the site is unlikely but cannot be ruled out. Groundwater is not extracted for drinking water, and secondary water quality makes this unlikely; however such use is conservatively assumed for risk assessment purposes. The site is located in a marshy area adjacent to a tidal inlet.

Although recreational and subsistence hunting and fishing in the area are unlikely to occur to any significant degree, terrestrial and aquatic ecological receptors are likely present.

Key Assumptions for CSM Development

The generalized CSM was developed on the basis of key assumptions as described in the following text. This section is organized consistent with methods recommended by ASTM (1995).

Identification of Potential Contaminants. The chemicals that were detected in soil include VOCs and SVOCs. The chemicals that were detected in groundwater include VOCs, SVOCs, and inorganics.

Identification and Characterization of the Source(s) of Contamination. During Chevron's service station operations, two 10,000-gallon gasoline USTs and one 3,000-gallon diesel UST were stored and dispensed fuel (all were later removed).

Delineation of Potential Chemical Migration Pathways. VOCs that are present in the aqueous phase in soil (pore water) or groundwater may partition into the vapor phase and migrate vertically through the soil column, including via preferential conduits formed by plant roots and utility channels. Vapors may migrate from the soil surface into overlying buildings (vapor intrusion) or ambient air, where receptors may be exposed by inhalation.

SVOCs and metals present in the sorbed phase in shallow soil may migrate to ambient air when dust containing sorbed chemicals is generated by wind or mechanical erosion. The respirable portion of entrained dust particles (i.e., particles with a diameter of 10 microns or less) may then be inhaled into the lungs of receptors in outdoor air.

Chemicals in soil or shallow groundwater may translocate into plants and thence enter the food chain. VOCs and metals dissolved in groundwater may migrate offsite by advection, and thence recharge nearby surface water. Dissolved chemicals may migrate into sediment or the surface water column, with subsequent potential for exposure by aquatic and other ecological receptors.

Identification and Characterization of Potential Receptors

This section describes the realm of possible human and ecological receptors, then identifies those that may be significantly exposed to site-related chemicals.

Potentially Exposed Populations

Because the site is currently vacant, all onsite receptors are termed "future". Potential offsite receptors, however, are pertinent to both current and future land use. Receptors are not "real people" but members of general population groups who are assumed to be present at the site on the basis of land and water use, assumed human activity patterns and ADEC (2000) recommendations. To this extent, all receptors should be regarded as "potentially exposed populations". The following potentially exposed populations are considered likely present at the site in the future:

- Future onsite resident receptor (child and adult; assuming the possibility of future residential redevelopment of the site)

- Future onsite construction/utility worker receptor, assuming the possibility of future residential or commercial redevelopment of the site. This receptor is assumed to spend a short period redeveloping the site and engaging in soil invasive activities, or to visit sporadically to maintain underground utilities.

- Future commercial/industrial worker receptor. This receptor is assumed to spend the majority of their working day indoors in activities such as auto maintenance work, and does not engage in outdoor work such as maintenance and landscaping.

According to ADEC (2000) guidance, the presence of subsistence and recreational receptors (e.g., hunting, hiking, wading, fishing, and winter sports) at the site and vicinity should also be considered. These uses do not apply to the site itself, which, while undeveloped, contains no undisturbed habitat in which game animals could reside, and is too small for most of these activities. As previously discussed, people may visit the site en route to scenic attractions via the Seward Highway. Such visits are brief and infrequent. Associated onsite exposure to site-related chemicals, if any, will be much lower than that for the residential or worker receptors as described above and will not, therefore, be quantified. However, such uses are possible for the undeveloped site vicinity and nearby inlet. As previously discussed, such use is likely to be sporadic due to the isolation of the area, the relative inaccessibility of the nearby offsite area (which is not developed as a recreational area), and the presence of areas in the vicinity of high scenic value and that have been developed for recreational use. Moreover, although analytes have been detected in onsite groundwater located downgradient of the gravel pad, it is not known if migration to sediment in the nearby wetlands and saltwater inlet has occurred. Recreational receptors could potentially contact such sediment while hiking and fishing. If chemical migration has occurred, concentrations would be low, and even lower in surface water due to dispersion and tidal flushing. These factors, combined with the likely low frequency of offsite recreational use (and the low likelihood of subsistence use), suggest that offsite recreational and subsistence pathways may be complete but are insignificant. Therefore, offsite recreational and subsistence receptors should be qualitatively, not quantitatively, evaluated.

A residential exposure scenario is generally associated with the highest exposure and, therefore, the greatest potential risks, across all potential receptors. Quantifying potential onsite residential exposure is the most conservative approach for evaluating potential onsite exposure to chemicals in soil and groundwater, and risk management decisions are generally made on the basis of residential land use. Moreover, given the possible future development of the site as a service station, construction and commercial/industrial worker receptors will also be quantitatively assessed.

Potentially exposed human receptors are illustrated in the General CSM Diagram, Figure 3.

Potentially Exposed Ecological Receptors

Ecological receptors are either terrestrial or aquatic. The presence of terrestrial receptors depends on the availability of habitat of adequate size and quality at or near a site. Terrestrial receptors at the site are likely limited to common species that tolerate disturbed environments (e.g., small mammals and passerine birds).

Aquatic receptors are relevant for surface water and sediment impacts. Surface water near the site will be evaluated using a tiered approach (i.e., beginning with a qualitative evaluation followed by fate and transport modeling if necessary) to assess the possibility of recharge by groundwater impacted with site-related chemicals. Recharge could impact sediment or surface water, to which benthic organisms or fish could be exposed. Chemicals could thence enter the food chain and impact either aquatic receptors at higher trophic levels or terrestrial receptors that ingest aquatic biota.

Potentially exposed ecological receptors are illustrated in the General CSM Diagram, Figure 4.

Determination of Limits of the Study Area or System Boundaries

The application of this portion of the CSM lies in evaluating the potential for chemicals released at a site to impact offsite receptors. This question is generally restricted to impacted groundwater, which may migrate from the site to the nearby wetlands and tidal mudflats. With respect to soil pathways, onsite receptors, particularly residents, are likely to incur greater exposure to airborne chemicals, such as vapors and chemicals sorbed to particulates, than offsite receptors. There are no offsite residential or commercial receptors that could be exposed to either airborne chemicals or impacted groundwater, and such offsite development is unlikely in the future. Unless there are special circumstances due to land use or zoning restrictions, or the presence of offsite impacted surface water, it is more conservative to quantify risks for onsite than offsite receptors. Possible exposure of offsite recreational and ecological receptors was discussed in the preceding text. For the purposes of the risk assessment, evaluation of offsite ecological receptors is expected to better characterize potential offsite risks than a human offsite recreational scenario, which contains much greater uncertainty than the onsite human scenarios previously outlined.

Identification and Characterization of Potential Exposure Pathways

This section provides a discussion of potentially complete pathways that may be present at the site for human and ecological, receptors. For the purposes of this CSM, exposure pathways considered potentially complete and significant are also termed "potential pathways" (ADEC, 2000). These will be termed "actual pathways" subsequent to ADEC review, as indicated.

Potential Human Exposure Pathways

An exposure pathway is a mechanism by which receptors are assumed to contact COPCs. USEPA (1989) describes a complete exposure pathway in terms of four components:

- A source and mechanism of chemical release (e.g., a UST system leak releasing GRO to the subsurface)
- A retention or transport medium (e.g., vadose zone soil)
- A receptor at a point of potential exposure to a contaminated medium (e.g., commercial worker in an onsite building)
- An exposure route at the exposure point (e.g., inhalation of vapors).

If any of these four components are not present, then a potential exposure pathway is considered incomplete and is not evaluated further. If all four components are present, a pathway is considered complete. In addition to the distinction between complete and incomplete pathways, complete exposure pathways can be further delineated into those expected to be insignificant and those that may be significant. These two types of pathways are discussed below.

Complete but Insignificant Exposure Pathways. Exposure pathways in this category meet all four requirements to be considered complete. However, these pathways are not expected to contribute significantly to the overall exposure for a receptor, due to the nature of the particular fate and transport mechanisms that comprise the pathway. For this reason, the potential health impacts associated with these types of pathways are evaluated qualitatively but not usually quantified in risk assessments.

Complete and Potentially Significant Exposure Pathways. A complete and potentially significant exposure pathway is comprised of fate and transport mechanisms that tend to result in more substantial exposures than complete but insignificant pathways. These pathways comprise the majority of exposure, and as such potential health effects associated with these pathways are typically quantified in risk assessments.

Qualitative and screening evaluations are generally adequate to differentiate significant and insignificant pathways. For example, comparison of analytical data to pathway-specific Cleanup Levels in 18AAC75, as will be done in the risk assessment, may eliminate several exposure pathways from further consideration.

Soil Exposure Pathways. On the basis of the site characteristics previously discussed, direct exposure to chemicals in soil via ingestion and dermal contact will be quantitatively evaluated for future resident and construction worker receptors, and qualitatively evaluated for future commercial worker receptors. In addition, construction worker receptors will be quantitatively evaluated for dust and vapor inhalation in outdoor air during excavation activities (i.e., trench scenario). As previously stated, commercial worker receptors are assumed to work predominantly indoors and not to engage in outdoor activities such as landscaping; moreover, snow cover will prevent direct soil exposure during the winter months. Therefore, such soil exposure that occurs will likely be sporadic and associated with insignificant exposure. Generally speaking, direct soil exposure by worker receptors is evaluated under a construction worker scenario, which incurs brief but relatively high levels of direct soil exposure.

Vapor concentrations in indoor air are expected to be higher than outdoor air concentrations, despite the retarding effect of the foundation. Therefore, for the purposes of evaluating the vapor inhalation pathway, the resident and commercial worker receptors will be conservatively assumed to spend all their time indoors when present at the site. Outdoor vapor concentrations are expected to be substantially lower than indoor air concentrations because of the instantaneous dispersion that occurs when vapors migrate from the soil surface. In addition, inclement weather conditions for several months of the year decrease the exposure frequency and time receptors are likely to spend outdoors at the site. Indoor vapor inhalation will be quantified for future resident and commercial worker receptors, as discussed below.

At sites where VOCs are present in both vadose soil and shallow groundwater, vapor intrusion to indoor air is generally modeled using groundwater data (when soil gas data are unavailable). It has been shown that indoor air modeling using soil data contains more uncertainty than modeling using groundwater data. Therefore, vapor intrusion from vadose soil may not be separately quantified in the risk assessment. This will be further considered in the Risk Assessment Work Plan.

USEPA (2001) has stated in recently published guidance on dermal exposure to VOCs in soil that "volatile organic compounds would tend to be volatilized from the soil on skin and should be accounted for via inhalation routes in the combined exposure pathway analysis." Therefore, dermal exposure to VOCs such as BTEX in soil will not be quantified. However, dermal exposure to inorganics and SVOCs in soil will be quantified for construction and resident receptors.

The ingestion of homegrown produce by future onsite resident receptors is possible but unlikely. Air temperatures are below freezing for four months of the year with three additional months of temperatures below 45 degrees Fahrenheit. In addition, there is snow or ice cover on the ground for seven months of the year (Alaska.com, 2004). Therefore, gardening activities are likely to take place for only a small portion of the year, indicating that ingestion of homegrown produce should be qualitatively and not quantitatively evaluated.

Groundwater Exposure Pathways. As previously discussed, the use of groundwater in the uppermost saturated zone at the site as drinking water is unlikely but cannot be ruled out at this stage. Therefore, direct groundwater exposure pathways (i.e., ingestion, dermal contact, and indoor inhalation of vapors during bathing use) for the onsite resident receptors are considered complete and potentially significant and will be quantitatively evaluated in the risk assessment. With regard to the passive vapor intrusion pathway, actively pumping and heating groundwater for domestic use such as showering is likely to generate greater indoor air concentrations, hence greater exposures, than passive vapor intrusion from the subsurface. Moreover, pumping will change groundwater dynamics in the aquifer near the future residence. Groundwater that is pulled towards the water production well by pumping will increase horizontal migration of dissolved VOCs in groundwater, compared to vertical migration in the vapor phase. This will likely decrease vapor intrusion. For these two reasons, the majority of domestic vapor exposure will likely be associated with a domestic use scenario. Therefore, this pathway may be complete but insignificant. However, to be conservative, the passive vapor intrusion pathway will also be quantified for future resident receptors. It is important to note that the Johnson & Ettinger model used to evaluate vapor intrusion from groundwater cannot be modified to account for the reduction in passive volatilization that may be associated with groundwater extraction. Vapor intrusion will also be quantified for commercial worker receptors, who will not be additionally evaluated for direct exposure to groundwater as drinking water.

A further consideration is the presence of chemicals in saturated soil at the site. This has fate and transport implications for modeling vapor intrusion, which will also be considered in the Risk Assessment Work Plan.

Construction and utility workers engage in invasive activities such as digging. The generally-accepted building site excavation depth in Alaska is approximately 15 feet (ADEC, 2000). Therefore, construction worker receptors could directly contact shallow groundwater at the site. Although water could be incidentally ingested during excavation, this is unlikely to substantially contribute to health risks and is considered a potentially complete but insignificant pathway. However, dermal exposure to COPCs in groundwater will be quantified for the future construction worker receptor.

Summary of Potentially Complete Human Exposure Pathways. Potentially exposed populations and potentially complete and significant exposure pathways are summarized below and in Figure 3:

- Future onsite construction/utility worker:
    - Incidental soil ingestion
    - Dermal exposure to metals and SVOCs in soil
    - Dermal exposure to shallow groundwater
    - Inhalation of outdoor particulates during soil disturbance activities
    - Inhalation of outdoor vapors during soil disturbance activities

- check VOC thing

- Future onsite resident receptor (adult and child):
    - Incidental soil ingestion
    - Dermal exposure to metals and SVOCs in soil
    - Ingestion of groundwater
    - Dermal contact with groundwater during domestic use
    - Inhalation of vapors from groundwater in indoor air (during showering and domestic water use)

- Inhalation of vapors from the subsurface (passive vapor intrusion from soil and groundwater)

- Future onsite commercial worker receptor:
  - Indoor vapor inhalation from the subsurface (soil and groundwater).

Potential Ecological Exposure Pathways

A site visit has not yet been conducted to complete the pertinent ecological checklists and problem formulation step of a Method 4 ecological risk assessment. As a result the following CSM is conceptual in nature and will be verified in the Risk Assessment Work Plan.

Onsite soil exposure pathways. Chemicals have not been detected at soil depths less than 3 feet bgs at the site. Chemicals present below 3 feet bgs are generally not available for plant root uptake and contact by burrowing animals. Therefore, there may be no complete ecological exposure pathways for soil at the site. The following pathways will be further considered for completeness in the Risk Assessment Work Plan, and are shown as potentially complete and significant in Figure 4:

- Terrestrial receptors (small mammals and birds):
  - Soil ingestion
  - Dietary ingestion.

For small mammals, soil ingestion represents a direct exposure pathway that can be significant relative to dietary exposure. Dietary ingestion of impacted plants and animals that have taken up chemicals from soil (e.g., invertebrates) represents the other primary exposure pathway for terrestrial wildlife. Small mammals may be exposed to chemicals in surface water during ingestion, but this represents a minor pathway relative to soil and dietary ingestion, particularly given the likely low concentrations of site-related chemicals in surface water, if any are detected. Although animals will receive some dermal-based exposure through preening and grooming, this is accounted for in soil ingestion values. Therefore, dermal exposure is not separately quantified. For birds, the same two exposure pathways are relevant and appropriate to evaluate. The vapor and dust inhalation pathways are generally not quantified for such receptors due to inherent uncertainties associated with quantifying exposure. For instance, vapor inhalation may be considered a potentially complete but insignificant pathway. Regarding the dietary ingestion pathway, exposure by plants is assumed to be from root uptake.

Offsite groundwater exposure pathways. A tidally influenced, brackish wetland is located south and east of the site across Seward Highway. This wetland is adjacent to Turnagain Arm. Therefore, State-defined sensitive environments are associated with the environment immediately adjacent to the site. Moreover, chemicals have been detected groundwater samples collected from offsite wells that are located between the site and the wetland (this will be fully described in the Risk Assessment Work Plan). This implies that complete exposure pathways for offsite ecological receptors might be present.

Chemicals in offsite groundwater can migrate and reside in pore-water and sediment in the wetland. Although chemicals might reach surface water, tidal flushing will eliminate any potential long-term exposures to chemicals in surface water. Therefore, the ecological risk assessment will focus on sediments and pore-water. Chemicals in sediments and pore-water also have the potential to be taken up by aquatic plants and macroinvertebrates. These plants and macroinvertebrates could then be eaten by fish and aquatic wildlife (e.g., eagles) in the wetland. These transport pathways and mechanisms are illustrated in the CSM (Figure 4).

Two primary exposure pathways are assumed to be potentially complete and significant at the offsite area:

- Direct contact with chemicals in sediment and/or pore water by benthic organisms and/or fish; and
- Ingestion of fish and/or benthic organisms by aquatic wildlife.

For aquatic receptors, exposure by fish or benthic invertebrates is assumed to be whole-body exposure via dermal contact, respiration, and ingestion of water. These receptors and pathways are illustrated in the CSM Diagram, Figure 4. Although other pathways may be complete, these are expected to represent the majority of potential exposure, and therefore will be the focus of the ecological risk assessment, if results of the site visit and ecological checklist indicate that ecological receptors may be present in potentially impacted areas.

Conclusion

Questions remaining about the completeness of the indicated exposure pathways will be resolved upon consideration of your review of this preliminary CSM, and "actual" complete and significant pathways will be presented in the Risk Assessment Work Plan, along with analytical and other pertinent site data. In addition, a site visit and work involved in preparation of the Risk Assessment Work Plan will resolve any remaining pathway analysis questions. We trust this letter and draft CSM provide the information you require at this time. If you have any questions, please call Brian Silva at SECOR (916) 861-0400 or Rosemary Wood at SLR (925) 681-0500.

Yours truly,

Marit L. Stefpi for:

Rosemary Wood, M.D.
Principal Risk Assessment Scientist
SLR International Corp.

Figures

Figure 1 Site Location Map

Literature Cited

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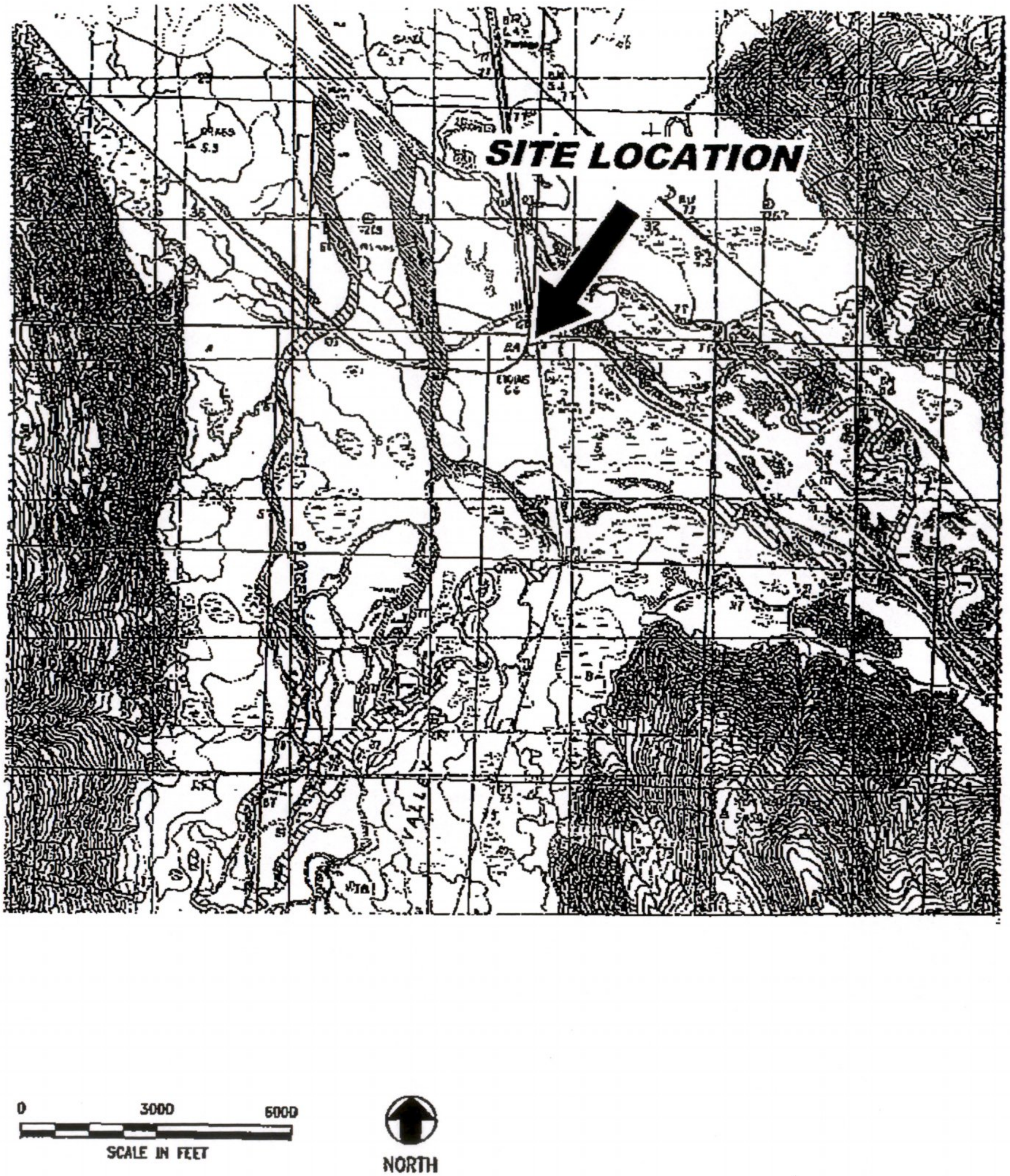
FIGURES



SECOR International Incorporated	DRAWN BY: LG	APP. BY: RC	FIGURE 1
	DATE: 12-05-01		FORMER CHEVRON SERVICE STATION #9-2609 SEWARD HIGHWAY, MILE 79 PORTAGE, ALASKA
	JOB NO.: 006.03798.003		**SITE LOCATION MAP**
	DRAWING NO. 9-2609-1-A	REV. A	

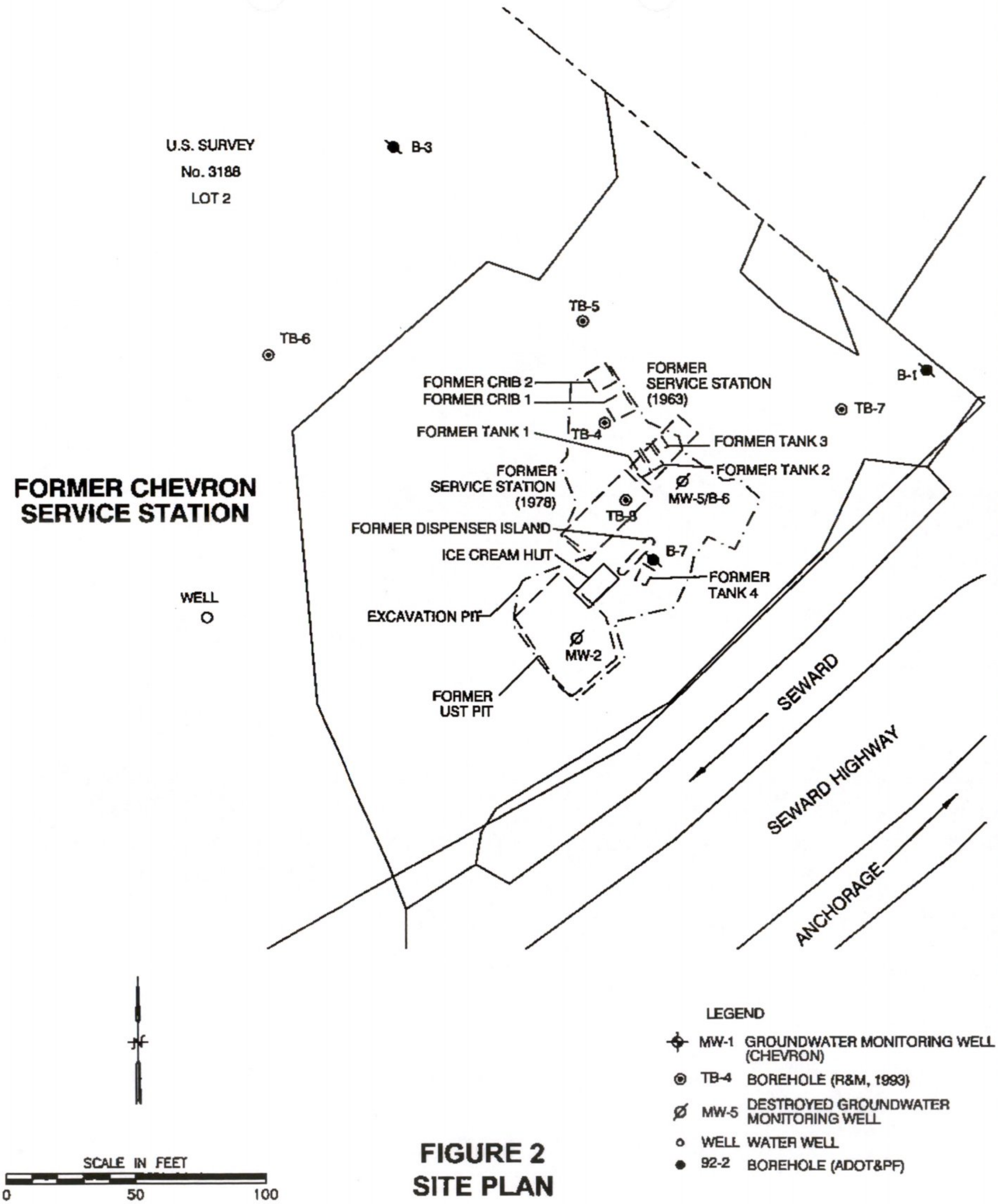
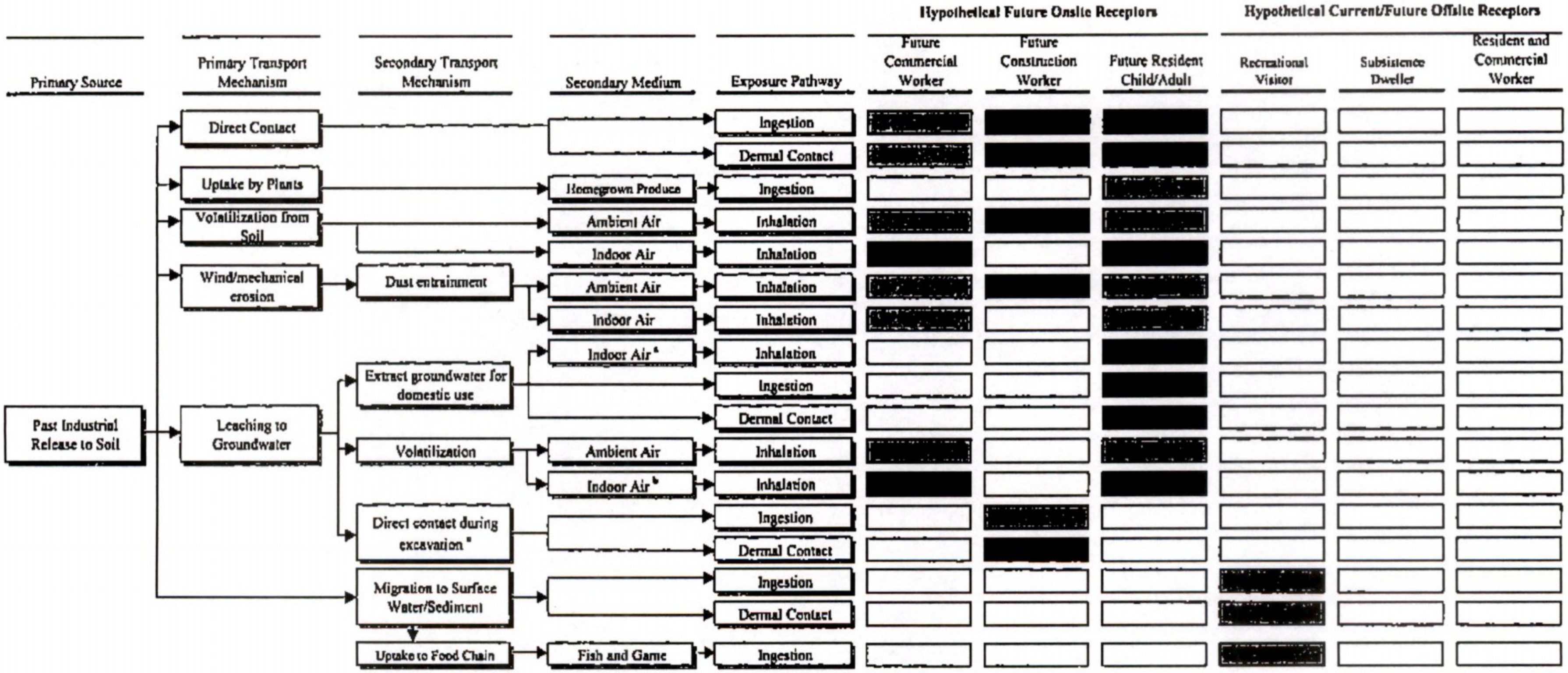


FIGURE 2
SITE PLAN

FORMER CHEVRON 9-2609
SEWARD HIGHWAY, MILE 79
PORTAGE, ALASKA

FIGURE MODIFIED FROM:
SECOR FIGURE DATED 11/20/03

Figure 3
Human Conceptual Site Model (CSM) Diagram
Former Chevron Service Station 9-2609
Mile 79, Seward Highway, Portage, Alaska



Receptor likely to be exposed via this route, so exposure pathway considered potentially complete and significant and will be quantitatively evaluated.

Receptor may be exposed via this route; however, exposure likely insignificant. If further research shows pathway to be complete and significant, the pathway will be quantified. Otherwise, qualitative evaluation only.

Pathway is incomplete and not evaluated further.

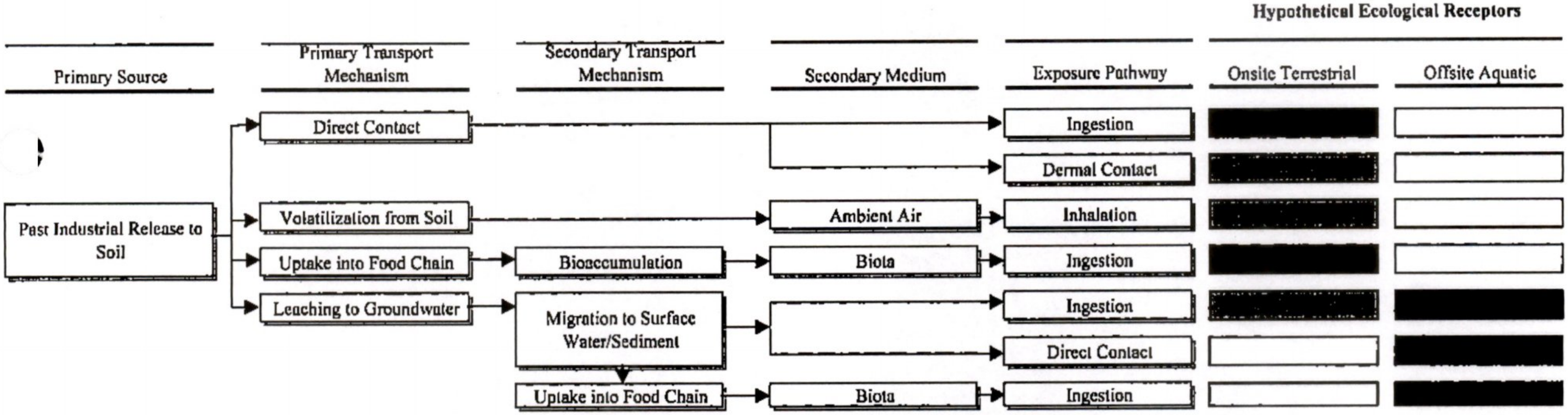
Footnotes:

[a] Inhalation of vapors from groundwater during bathing and domestic use.

[b] Passive intrusion of vapors from first encountered groundwater to indoor air.

[c] Groundwater ranges from 3.5 to 11 feet below ground surface.

Figure 4
Ecological Conceptual Site Model (CSM) Diagram
Former Chevron Service Station 9-2609
Mile 79, Seward Highway, Portage, Alaska



Receptor likely to be exposed via this route, so exposure pathway considered potentially complete and significant and will be quantitatively evaluated if verified by site-specific characteristics.

Receptor may be exposed via this route; however, exposure is likely insignificant. Pathway will be qualitatively evaluated.

Pathway is incomplete. No further evaluation.