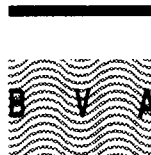
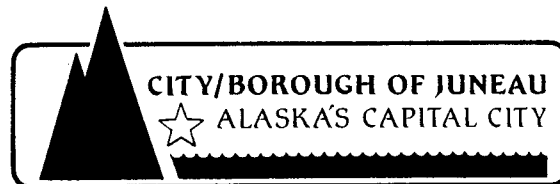


Technical Reconnaissance Study for New Landfill Site Selection

Final Report
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Brown, Vence & Associates

198 Cirby Way, Suite 170
Roseville, California 95678

R & M Engineering

6205 Glacier Highway
Juneau, Alaska 99803

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SECTION 1 INTRODUCTION

1.1 PURPOSE AND SCOPE OF THE PROJECT

The technical reconnaissance study for new landfill site selection for the City and Borough of Juneau (CBJ) was prepared in accordance with, and under the direction of, the CBJ Division of Lands and Resources. The purpose of this study was to conduct the first of a three-phase project to identify the most suitable location for a new municipal solid waste landfill to meet the long term disposal needs of the Juneau community.

This technical reconnaissance study is the first of three phases to analyze and ultimately select a new landfill site. Phase two of the landfill site selection process will be the public review and comment on the sites identified in this technical reconnaissance study. This will lead to the public's selection of a preferred site from the alternatives developed in the first phase. Phase three will be a detailed engineering study to determine the costs, design, permits, and timing for potential landfill development.

1.2 GOALS AND OBJECTIVES

The CBJ Division of Lands and Resources staff defined the following goals and objectives for development of the technical reconnaissance study. These goals and objectives were used to ensure that the search for new landfill sites emphasized environmental protection, public safety, and cost effective waste management for Juneau residents.

Goals

1. Ensure long-term disposal capacity for the community's solid wastes that cannot otherwise be reduced or recycled.

Objectives

A. Identify future landfill site capable of providing a minimum of 20 years of disposal capacity to the Juneau community.

Goals

2. Establish a systematic process for the objective, technical consideration of future landfill sites within the CBJ.

3. Create a database of current, accurate information on landfill siting issues for future reference and referral.

4. Ensure coordination of, and compliance and cooperation with, all federal, state, and local programs and regulations for siting of solid waste landfills.

5. Identify future landfill site(s) that meet(s) minimum technical/engineering standards.

Objectives

A. Design and carry out a fully documented and methodical site screening, evaluation, and selection process for scrutiny during the public review and engineering phases.

B. Develop and carry out a process that objectively considers all areas within the CBJ for their potential technical suitability for landfill development.

A. Identify and fully document reference data, information, maps and other resources used as part of the landfill siting effort. Provide copies of all documents, when possible.

A. Identify and incorporate federal, state, and local regulations and polices in the criteria development and application process.

B. Ensure that the selected landfill site is compatible with the CBJ Comprehensive Plan and zoning.

A. Develop and apply criteria that consider suitable soils, slope, surface water protection, seismic hazards, unstable terrain, airports, flooding, and hydrogeologic conditions in Juneau.

Goals

6. Identify future landfill site(s) that minimize(s) impacts to nearby residents.

7. Identify future landfill site(s) that maximize(s) public health and safety and minimize(s) impacts to the environment.

8. Identify future landfill site(s) that minimize(s) long-term solid waste management costs to Juneau residents.

9. Identify potential future disposal site(s) in a timely and informative manner for consideration in a public forum.

Objectives

A. Develop and apply siting criteria that consider the impacts to surrounding properties, properties along transportation routes, and local recreation areas in the evaluation of new landfill sites.

A. Develop and apply siting criteria that consider water and air quality impacts, traffic patterns and access, area land uses, visual aesthetics, sensitive habitats, wetlands, and cultural and recreational resources.

A. Develop and apply siting criteria that consider required landfill and access development costs and hauling costs for waste and cover material in the evaluation of new landfill sites.

A. Prepare a ranking of candidate landfill site(s) to initiate a public review process.

B. Provide CBJ staff sufficient information to make informed decisions regarding future landfill site selection.

C. Prepare maps identifying landfill sites appropriate for public review.

1.3 PROJECT SUMMARY

This technical reconnaissance study creates and applies an initial set of "severe limitations" criteria to rule out the most obviously unsuitable areas of the CBJ from further consideration for landfill development. The severe limitations criteria were drawn from topics required for consideration by federal, state, and local regulators and policy setters. They include surface and groundwater protection, structural and seismic risk minimization, airport safety, reasonable access, recreational resources protection, and residential neighborhoods protection.

The application of severe limitations criteria identified a landfill search area comprised primarily of river and creek valleys and some coastal areas distant from population centers. The application of the severe limitations criteria is illustrated in Appendix A, Severe Limitations Maps. The search area was subsequently reconnoitered by staff and consultants to identify potential candidate landfill sites. A total of nine potential sites or areas were identified: west side of Cowee Creek valley at Glacier Highway Mile 40; Herbert/Eagle River valley at Mile 28; vicinity of Peterson Creek along a wood cutting road leaving the Glacier Highway at Mile 26; upper Montana Creek in the vicinity of the confluence of McGinnis Creek; Auke Nu bench lands in the vicinity of Auke Nu Creek at Mile 13.5; upper Lemon Creek valley about 1.3 miles upstream of the Lemon Creek Correctional Center; lower Lemon Creek valley behind the correctional center; Fish Creek Quarry on north Douglas Island; and the north end of Douglas Island in the vicinity of the road terminus. After reconnaissance, three of the nine sites were selected as reasonable candidate sites for evaluation. Site 1, Peterson Creek, is located on a wood cutting road parallel to, and about 0.5 miles east of, Peterson Creek near the Amalga Harbor turnoff from Glacier Highway. Site 2, Upper Lemon Creek, is located about 1.3 miles northeast of the Lemon Creek Correctional Center on the west side of Lemon Creek. Site 3, Lower Lemon Creek, is located about 0.4 miles northeast of the correctional center on bench land above the correctional center and west of Lemon Creek.

A fourth site was originally identified as a reasonable site for evaluation. That site was the Fish Creek Quarry located on north Douglas Island, about 1 mile south of the intersection of North Douglas Road and Fish Creek Road. After completing evaluation of this site, a recalculation of distance to the Juneau Airport found that this site failed to meet the severe limitations criterion of a minimum 10,000 feet distance from airport runway ends. The evaluation of this site has therefore been removed from the body of this study and is included instead as Appendix D. The Fish Creek Quarry site could potentially become a viable option if it can be demonstrated that a landfill at this site would not pose a bird hazard to aircraft. The issue of airport safety and other federal landfill siting criteria are discussed further in Appendix C, Summary of RCRA Subtitle D Landfill Siting Requirements. For the purposes of this study, however, the site fails a severe limitations criterion and so is removed from consideration at this time. Further discussion of candidate sites in this study will refer to three candidate sites.

Appendix A, Site Maps, illustrates the locations of the three sites. Appendix D illustrates the location of the Fish Creek Quarry site.

Each of the three sites was then evaluated against a set of "Tier 1" criteria addressing concerns that are less readily mitigable through landfill planning, design, and/or engineering (e.g., distance to residences, sensitive habitats, cultural resources). Each of the three sites was then evaluated against a set of "Tier 2" criteria addressing concerns that may be readily mitigable through planning, design, and/or engineering (e.g., visibility, cover material, air quality). Finally, the three sites were ranked based on the summation of the Tier 1 and Tier 2 results to determine the best to least suited site for the Juneau community. The final results were as follows:

1. Site 2: Upper Lemon Creek
2. Site 3: Lower Lemon Creek
3. Site 1: Peterson Creek

1.4 STRUCTURE OF THE STUDY

The technical reconnaissance study for new landfill site selection was structured to succinctly document the results of the study and for easy reference by Juneau residents during the public review phase. The document structure is summarized below.

	<u>Section</u>	<u>Topics</u>
1.0	Introduction	Purpose and scope; goals and objectives; summary
2.0	Method and Criteria for Siting a New Landfill in Juneau	Role, development, and description of landfill siting criteria
3.0	Identification of Candidate Sites	Application of "Severe Limitations" criteria; field reconnaissance; description of candidate sites
4.0	Candidate Sites Evaluation	Application of Tier 1 criteria; application of Tier 2 criteria; final ranking of sites

<u>Section</u>	<u>Topics</u>
5.0 Conclusions	Summary of findings; special issues; cumulative impacts; next steps

SECTION 2

METHOD AND CRITERIA FOR SITING A NEW LANDFILL IN JUNEAU

This section describes the method and criteria used for identifying and evaluating potential new landfill sites for the Juneau community. In general terms, landfill siting criteria should mitigate potential public health and safety concerns, minimize environmental impacts, and provide an economical means of disposing of solid waste. This section addresses these issues for siting a new landfill in the CBJ.

2.1 ROLE OF CRITERIA IN THE SITING PROCESS

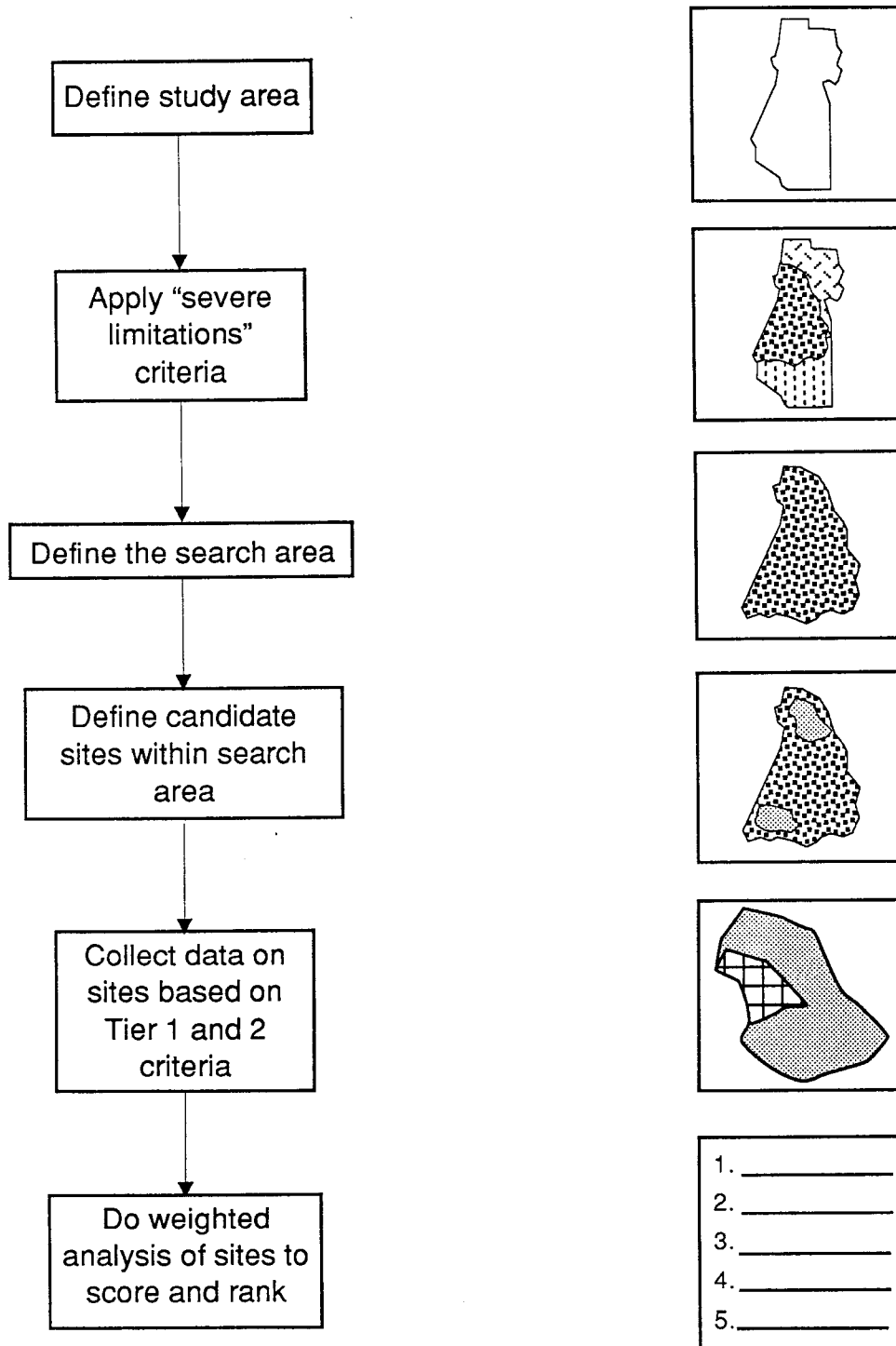
Criteria are standards on which a judgement or decision may be based. Landfill siting criteria are therefore standards which can be applied to areas or parcels of land to judge their suitability for landfill development. Siting criteria should have the following qualities:

- Quantifiable - the degree to which an area or parcel of land meets the criteria can be reasonably and clearly measured.
- Objective - the criteria should impartially measure the suitability of land areas or parcels without bias toward a particular area or site.
- Address community concerns - the criteria can meet the needs and concerns of both the regulatory community and local community members.

Siting criteria are typically divided into two types, those that exclude portions of the study area from further consideration (titled "severe limitations" criteria for the purposes of this study), and those that compare and evaluate the degree of conformity of various candidate sites to local preferences (often called "preferential" criteria). Figure 2-1 illustrates how these criteria are used to select a landfill site. The role of landfill siting criteria for the Juneau community is to: one, exclude those areas of the CBJ that do not meet minimum standards as set forth by regulators and policy setters; and two, compare various sites in an objective manner to determine which site maximizes the Juneau community's needs and desires for a new landfill.

Figure 2-1

Landfill Siting Process for Juneau



2.2 SITE SELECTION PROCESS

The site selection process for Juneau began with the entire CBJ under consideration. At the start, no portions of the CBJ were excluded or otherwise prejudiced as being a possibly "good" or "bad" area for new landfill development. In this approach, all lands were fairly and equally considered. The task of this study was, then, to "boil down" the 3,108 square miles of the CBJ to a set of reasonable, discrete landfill sites. This task was performed through three basic steps:

1. Remove the most obviously unsuited areas to identify a smaller, logical search area
2. Identify candidate sites within the remaining search area
3. Compare and evaluate the candidate sites based on a common set of criteria

These steps and the criteria used are discussed below.

2.2.1 Identifying the Search Area

The first step of the siting study was to remove from consideration those areas of the CBJ that were most obviously unsuited for new landfill development. To do this a set of "severe limitations" criteria was developed to screen out the most unsuited areas and leave a reduced search area within which landfill search efforts could be focused. A total of seven severe limitations criteria were selected for application. The severe limitations criteria are listed in Table 2-1. These criteria were drawn from two sources: the Resource Conservation and Recovery Act Subtitle D; and several CBJ-specific issues offered by CBJ staff.

Regarding RCRA Subtitle D, the U.S. EPA places certain landfill siting restrictions for new municipal solid waste landfills. These restrictions include certain unstable lands, earthquake faults, floodplains, airport zones, and wetlands. RCRA Subtitle D does allow for the possibility to waive some of these minimum criteria if the landfill owner/operator can conclusively demonstrate that the landfill has been designed and engineered to effectively mitigate the hazards addressed by the criteria, and if the Alaska state solid waste program is approved by the EPA. (Status of the EPA's approval of Alaska's solid waste program is discussed in Appendix C.) For the purposes of this study, CBJ staff and consultants determined that providing conclusive demonstration that the hazards have been effectively mitigated for most types of Subtitle D restrictions would be extremely difficult. Furthermore, considering the potential harm to human safety should the mitigation(s) fail, it was felt advisable to hold to most of these minimum standards to ensure maximum protection. In two cases, however, wetlands and seismic impact zones, it was found that removing such areas would exclude most or all of the CBJ from consideration. Specifically regarding seismic impact zones, it is likely that the entire CBJ lies within such a zone. (In fact, it has been documented (Repetto and Bray, 1992) that the vast majority of the western U.S. lies within a seismic impact zone.) Therefore, this study assumes that seismic impact zone risk would be mitigated through appropriate landfill design measures.

These measures consist primarily of constructing less steep slopes on the landfill and reducing the landfill's total height -- common mitigation practices in landfill engineering. In the case of wetlands, they were not excluded from consideration, but they were applied as a preferential criterion in the site evaluation phase. For the CBJ to site a landfill within a wetland or seismic impact zone, the State of Alaska must receive solid waste program approval from the EPA. Specific mitigations described in RCRA Subtitle D would then need to be followed. This issue is discussed further in Appendix C.

Regarding community-specific issues, CBJ staff identified three additional criteria to rule out certain areas from any further consideration. The three criteria address minimum distance from residential neighborhoods¹, exclusion of certain designated recreational lands, and exclusion of lands beyond five miles from existing or planned all-weather roads.

The application of these severe limitations criteria and the resulting search area are discussed in Section 3.

¹ For the purposes of this study, "neighborhood" was defined using best professional judgement on clusters of residential units (e.g., downtown Juneau, West Juneau, Douglas, lower Lemon Creek valley, East Mendenhall valley, Tee Harbor).

**Table 2-1
Severe Limitations Criteria for Juneau Landfill Siting**

Criteria Source	Criteria	Purpose
RCRA Subtitle D Subpart-B §258.10 through §258.15 (U.S.EPA)	Airport Safety: All areas located within 10,000 feet of any airport runway used by turbojet aircraft or within 5,000 feet of any airport runway used by only piston-type aircraft, will be removed from further consideration.	Minimize aviation risk caused by birds entering aircraft engines.
	Floodplain: All areas within a 100-year floodplain will be removed from further consideration.	Minimize risk of wash-out of waste into streams/ocean.
	Fault Areas: All areas within 60 meters (200 feet) of a Holocene fault (i.e., fault that has undergone displacement within the last approx. 10,000 years) will be removed from further consideration.	Minimize risk of ruptured landfill liners and slopes causing release of waste materials to the environment.
	Unstable Areas: All areas located in unstable areas (e.g., landslide, liquefaction prone areas, avalanche areas) will be removed from further consideration.	Minimize risk of ruptured landfill liners, other containment structures and slopes causing release of waste materials to the environment.
CBJ staff	Proximity to Residences: Exclude any area within 0.5 miles of a residential neighborhood.	Minimize odor, noise and visual impacts to nearby residences.
	Access: Exclude areas greater than 5 miles from existing or planned all weather roads.	Minimize cost of constructing new access roads to the selected site.
	Recreational Areas/Preserves: Exclude local and state parks and refuges, and the U.S. Forest Service Mendenhall Recreational Area.	Minimize odor, noise and visual impacts to nearby recreational areas.

RCRA Subtitle D criteria not applied as "severe limitations":

- **Seismic Impact Zone²:** Seismic Impact Zones will not be removed under the assumption that eventual landfill design will mitigate the seismic risk (e.g., construction of shallow side slopes and lower total landfill height).
- **Wetlands:** Wetlands will not be removed at this level. Wetlands are addressed as a Tier 2 criterion.

² "Seismic Impact Zone" is defined as an areas with a ten percent or greater probability that the maximum horizontal acceleration will exceed 0.1g in 250 years.

2.2.2 Identifying Candidate Landfill Sites

Application of the severe limitations criteria resulted in the exclusion of the most obviously unsuitable lands and creation of a reduced landfill search area. The next step was to identify potential landfill sites within the search area. This was done by first reviewing available soils, hydrology, topography and other map data to identify a set of potentially suitable landfill locations. These locations were then visited by CBJ Division of Lands and Resources staff and a consultant team of land use planners and engineers to determine whether, one, observed field conditions were potentially amenable to landfill development, and two, whether any "fatal flaws" existed at the potential site that would rule it out as a candidate. This field observation basically served to narrow the potentially suitable locations to a subset of reasonable, candidate landfill sites.

The results of this field investigation and the selected candidate sites are discussed in Section 3.

2.2.3 Evaluating and Ranking Candidate Sites

Once a set of reasonable candidate sites was identified, the last step was to evaluate and compare the sites based on a set of common preferential criteria. These preferential criteria evaluated the candidate sites by asking: to what degree do the sites conform with the preferential criteria developed? Specifically for this study, two sets (or tiers) of preferential criteria were created. The Tier 1 criteria addressed preferred soils, ground and surface water protection, habitats and archeological resources, and as well, a reapplication of selected severe limitations criteria. These were selected as Tier 1, or primary emphasis, because these concerns are generally less mitigable through planning, design, and/or engineering. The Tier 2 criteria addressed wetlands, appropriate land uses, human impacts, and economic considerations. These were selected as Tier 2, or secondary emphasis, because these concerns are generally more mitigable through planning, design, and/or engineering.

The Tier 1 and Tier 2 criteria used for the study, and the data sources for each criterion are described in Table 2-2 and Table 2-3, respectively.

Each candidate site was then quantitatively evaluated against each criterion. To determine a numerical score for each site, a scoring and ranking process was undertaken. Each Tier 1 and Tier 2 criterion was assigned a numerical weighting value by participating Citizen Advisory Committee members and selected CBJ staff according to the perceived importance of each criterion to the Juneau community. Participants had 100 points to "spend" among the Tier 1 criteria, and 50 points among the Tier 2 criteria. The lesser amount for Tier 2 reflects the secondary emphasis of these criteria. Each site was then evaluated against each criterion and assigned a score reflecting its level of conformity to each criterion. For example, the site that best conformed to particular criterion would receive all the points assigned to the criterion. The

site that least conformed to the criterion received none of the available points. Sites between best and worst received a direct proportion of the available points for that criterion. The individual scores per each criterion were then summed to determine a single total score for each candidate site. Higher scores indicated sites with total higher conformity with the criteria and thus, more preferred. The highest score possible was 150 points.

Section 4 presents the evaluation of the candidate sites against the Tier 1 and Tier 2 criteria, and the resulting scoring and ranking of these sites.

**Table 2-2
Tier 1 Criteria for the City and Borough of Juneau Landfill Siting Study**

Criteria		Purpose	Data Source(s)
Reapplication of Selected Severe Limitations Criteria	<p><u>Distance to Residences:</u> Maximize distance to existing residential neighborhoods.</p> <p>Study Goal #6</p>	Further minimize odor, noise, and visual impacts to nearby residences.	<p>Juneau B-2 SE quadrangle map (1:25000), USGS, 1986.</p> <p>City and Borough of Juneau Comprehensive Plan & Land Use Designation Maps, 1984</p> <p>City and Borough of Juneau Street and Property Atlas, 1982, revised 1/92.</p> <p>Aerial photos, May 1988</p>
	<p><u>Road Access:</u> Maximize proximity to existing or planned all-weather roads.</p> <p>Study Goal #8</p>	Further minimize cost of new access road construction to the landfill site.	<p>Juneau B-2 SE quadrangle map (1:25000), USGS, 1986.</p> <p>City and Borough of Juneau Street and Property Atlas, 1982, revised 1/92.</p>
Habitats & Archeological Resources	<p><u>Plant & Wildlife Habitat:</u> Maximize distance to designated rare, endangered, or threatened plant or animal habitats.</p> <p>Study Goal #7</p>	Minimize impacts to plant and wildlife habitats from new landfill construction.	John Palmes, Dept. of Fish & Game, Habitat & Restoration Division, June 1993.
	<p><u>Cultural Values:</u> Maximize distance to known historical or archaeological resource areas.</p> <p>Study Goal #7</p>	Minimize disturbance of cultural resources from new landfill construction.	As reported by Richard Dwyer--Goldbelt; Richard Harris--Sealaska; Albert Wallace--Auke Tribe; Dept. of Natural Resources, State Historic Preservation Office; June 1993.

**Table 2-2
Tier 1 Criteria for the City and Borough of Juneau Landfill Siting Study**

	Criteria	Purpose	Data Source(s)
Soils	<p><u>Suitable Soils</u>: Maximize suitable on-site soils.</p> <p>Study Goals #7 & #8</p>	<p>Maximize the suitability of on-site soils for construction of landfill liners and for daily covering of waste. Generally prefer deep, low permeability soils (e.g., silts, clays, other fine soils) to hold in waste and leachate.</p>	<p>Soils of the Juneau Area, Soil Conservation Service, 1974.</p> <p>Surficial Geologic Map of the Juneau Urban Area and Vicinity, USGS, 1975.</p> <p>Water Resources of the City and Borough of Juneau, 1971.</p> <p>Sludge Disposal Area Report, R&M Engineering, 1989.</p> <p>Lemon Creek Borrow Study, R&M Engineering, 1982.</p>
Hydro-geology	<p><u>Groundwater Quality</u>: Minimize siting over potable groundwater.</p> <p>Study Goal #7</p>	<p>Minimize risk of contaminating high quality ground water resources.</p>	<p>Water Resources of the City and Borough of Juneau, 1971.</p> <p>Hydrologic Map of the City and Borough of Juneau, 1971.</p> <p>Surficial Geologic Map of the Juneau Urban Area and Vicinity, USGS, 1975.</p>
	<p><u>Depth to Groundwater</u>: Maximize depth to groundwater level.</p> <p>Study Goals #7 & #8</p>	<p>Minimize risk of contaminating groundwater; maximize opportunity for soils to filter any leachate.</p>	<p>Soils of the Juneau Area, 1974.</p> <p>Surficial Geologic Map of the Juneau Urban Area and Vicinity, USGS, 1975.</p> <p>Sludge Disposal Area Report, R&M Engineering, 1989.</p>

Table 2-2
Tier 1 Criteria for the City and Borough of Juneau Landfill Siting Study

Criteria		Purpose	Data Source(s)
Surface Water	<p><u>Watersheds</u>: Minimize landfill siting in watershed used for drinking water supply.</p> <p>Study Goal #7</p>	Minimize risk of contaminating surface drinking water resources.	<p>City and Borough of Juneau Comprehensive Plan, Summary of Sensitive Areas, 1984 and 1988</p> <p>Bill Joiner, CBJ Public Works, Water Division.</p>
	<p><u>Water Volume</u>: Minimize mean annual rainfall on the site.</p> <p>Study Goals #7 & #8</p>	Minimize the potential for production of leachate; minimize cost for water run-on and run-off control measures at the site.	Jim Truitt, National Weather Service, June 1993.

**Table 2-3
Tier 2 Criteria for the City and Borough of Juneau Landfill Siting Study**

Criteria		Purpose	Data Source(s)
Regulatory Compliance	<p><u>Wetlands</u>: Minimize disturbance of wetlands.</p> <p>Study Goals #4 & #7</p>	Minimize degradation of wetland habitat resources.	<p>Juneau Wetlands Management Plan Atlas, February 1991.</p> <p>Juneau Wetlands Map Index, September 1987.</p> <p>Conversation with Ralph Thompson, Army Corps of Engineers, Juneau, June 1993.</p>
Land Use	<p><u>Recreation</u>: Minimize siting in a local recreational use area as described in the Comprehensive Plan and Juneau Trails Plan.</p> <p>Study Goal #6</p>	Minimize odor, noise, visual impacts to local CBJ recreational areas and trails.	<p>City and Borough of Juneau Comprehensive Plan, 1984.</p> <p>Juneau Trails Plan, January 1993.</p>
	<p><u>Land Use Compatibility</u>: Maximize compatibility with Comprehensive Plan designations and Table of Permissible Uses.</p> <p>Study Goal #7</p>	Identify sites compatibility with the Comprehensive Plan and Table of Permissible Uses.	<p>City and Borough of Juneau Comprehensive Plan-Land Use Designations, 1984 & updated 1988.</p> <p>Juneau Table of Permissible Uses, June 1991.</p>

**Table 2-3
Tier 2 Criteria for the City and Borough of Juneau Landfill Siting Study**

	Criteria	Purpose	Data Source(s)
Human Impacts	<p><u>Residences Along Access:</u> Minimize number of residences along access road. Measured from the point of convergence with state-maintained major collector roads to the landfill site.</p> <p>Study Goal #6</p>	<p>Minimize the number of residences that may be impacted by vehicle traffic, noise, and/or exhaust.</p>	<p>City and Borough of Juneau Street and Property Atlas, 1982, revised 1/92.</p> <p>Kathleen Bailey, CBJ Community Development Department, June 1993.</p>
	<p><u>Visibility:</u> Minimize site visibility in "critical" direction(s).</p> <p>Study Goal #6</p>	<p>Minimize visibility of the site from residences and recreational areas.</p>	<p>Visual observations, May 1993.</p>
	<p><u>Density:</u> Minimize number of residences within a 1 mile radius of the site center.</p> <p>Study Goals #6, #7 & #8</p>	<p>General indicator of potential property acquisition requirements; minimize number of residences impacted by landfill construction and operation.</p>	<p>City and Borough of Juneau Street and Property Atlas, 1982, revised 1/92.</p> <p>Kathleen Bailey, CBJ Community Development Department, June 1993.</p>
	<p><u>Air Quality:</u> Minimize landfill dust and odor migration to sensitive receptors.</p> <p>Study Goals #6 & #7</p>	<p>Minimize dust and odor effect from landfill construction and operation to nearby residences considering prevailing wind direction and speed.</p>	<p>Jim Truitt, National Weather Service, June 1993.</p>

**Table 2-3
Tier 2 Criteria for the City and Borough of Juneau Landfill Siting Study**

	Criteria	Purpose	Data Source(s)
Economics	<p><u>Haul Distance</u>: Minimize haul distance from waste centroid to landfill site.</p> <p>Study Goal #8</p>	<p>Minimize long-term waste disposal costs by minimizing haul distance for waste. Typical haul cost \$.50 per ton/mile.</p>	<p>Juneau B-2 and B-3 quadrangle maps (1:63360), USGS, 1974.</p>
	<p><u>Utilities</u>: Minimize length of new electric, water and sewer lines. Measured as the summation of the three distances from nearest hook up to edge of site.</p> <p>Study Goal #8</p>	<p>Minimize landfill development costs by minimizing length of new utility lines required. Typical installation comprises 2% to 4% of initial development cost.</p>	<p>Water and sewer: Terry Brenner, CBJ Engineering, June 1993.</p> <p>Bill Zentner, CBJ Community Development Department, September 1993.</p> <p>Electric: Tim MacLeod, AELP, June 1993.</p>
	<p><u>Grading & Site Preparation</u>: Minimize grading and site preparation requirements considering nature of on-site soils, vegetation and degree of existing disturbance.</p> <p>Study Goal #8</p>	<p>Minimize landfill development cost:</p> <ol style="list-style-type: none"> 1) maximize workable soils (e.g., silt/clay deposits, deep bedrock); 2) minimize land clearing costs (e.g., forests or wetlands); and 3) maximize the extent of existing disturbance (e.g., pre-existing pit) to reduce excavation cost. 	<p>Field observations, May 1993.</p> <p>Aerial photos, May 1988.</p> <p>Soils of the Juneau Area, 1974.</p> <p>Water Resources of the CBJ, 1971.</p>
	<p><u>Cover Material</u>: Minimize distance for transporting of cover material. Measured from nearest reasonable, appreciable borrow source.</p> <p>Study Goal #8</p>	<p>Minimize long-term landfill operating costs by minimizing haul distance required for obtaining suitable landfill cover material. Cost may be 10% of annual operating cost (depending on purchase price of material).</p>	<p>CBJ Natural Resources Inventory Report, undated.</p> <p>West Lemon Creek Material Resource Assessment, 1985.</p> <p>Lemon Creek Borrow Study--East Side of Lemon Creek, 1982.</p>

SECTION 3 IDENTIFICATION OF CANDIDATE SITES

This section identifies and describes the candidate landfill sites selected for detailed evaluation, scoring, and ranking.

3.1 APPLICATION OF SEVERE LIMITATIONS CRITERIA

The severe limitations criteria listed in Table 2-1 were used to exclude areas which did not meet minimum standards as set forth by regulators and local policy setters. The severe limitations criteria were applied to remove the most obviously unsuited areas to identify a smaller, logical search area.

All areas within 10,000 feet of the Juneau Airport, 5,000 feet of commonly used seaplane harbors, 100-year floodplains, fault areas¹, and unstable areas (e.g., landslide and avalanche prone areas) were identified and removed from consideration. The remaining area was then reduced further by removing any areas within 0.5 miles of a residential neighborhood; areas greater than 5 miles from existing or planned all weather roads; and recreational parks and refuges, including those designated in CBJ Ordinance Preserving Certain Municipal Land for the Juneau Open Space and Park System, Serial No. 85-76am.

After applying the severe limitations criteria, a greatly reduced search area remained. The application of the severe limitations criteria is illustrated in Appendix A, Severe Limitations Maps. The remaining search area was predominated by creek and river valleys and some coastal areas distant from population centers.

3.2 RECONNAISSANCE

The remaining search area was reviewed using available soils, hydrology, topography and other map data to identify potential sites. Also considered were minimum required landfill size (20 acres), the location of any anadromous fish streams, distance from residentially developed areas, ground cover, and occurrence of any existing ground disturbances that could facilitate landfill development. A total of nine potential sites or areas were identified through this process. The nine potential sites were then field checked. Between May 13 and May 15, 1993, potential sites were visited by CBJ Division of Lands and Resources staff and a consultant team to determine if field conditions were potentially amenable to landfill development, and whether any "fatal flaws" existed at the site that would exclude it as a candidate. Data were recorded on the existing level of disturbance, general soil availability and types, road access, nearest population,

¹ No Holocene faults were identified within the CBJ.

surface water conditions, and any development limitations. A brief discussion of the nine potential sites or areas is presented below.

- **Cowee Creek** -- The area is located on the west side of Cowee Creek valley at approximately Mile 40 on the Glacier Highway, approximately 0.5 miles south of the highway. The area is predominated by rocky cover material on the slopes; the valley floor is generally very marshy with extensive beaver ponding occurring around the creek in proximity to Glacier Highway. Some gravel deposits may exist along the break in slope, however access to these potential areas is poor. Topography is marginally conducive to landfill development. Cowee Creek is a significant anadromous fish stream. No suitable landfill site was identified in this area. It was recommended that this location be eliminated from further consideration.
- **Herbert/Eagle River Area** -- The area is located within the drainage of the Herbert and Eagle Rivers beginning approximately 0.5 miles northeast of the Glacier Highway at Mile 28. The area contains generally thick gravel deposits and deep groundwater. Surface conditions are generally wet. No direct access to suitable soil areas was observed. The area is a heavy recreational use area. No suitable landfill site was identified in this area. It was recommended that this location be eliminated from further consideration.
- **North Peterson Creek** -- The area is located on a fire wood cutting road leaving the east side of Glacier Highway just south of the Amalga Harbor turn-off at approximately Mile 26. The area begins about 0.5 miles south along this road. The area is characterized by thin soils with shallow bedrock and deep groundwater. No appreciable source of on-site soil was apparent. Highway access is good. The wood cutting road would need significant improvement and slope reduction. Topography is generally conducive to landfill development. The area is visually buffered from Peterson Creek and the highway. Peterson Creek is a significant anadromous fish stream. It was recommended that this location be considered for further evaluation.
- **Upper Montana Creek** -- The area is located in the vicinity of the confluence of Montana Creek and McGinnis Creek. The area generally contains rocky and peat soils, with some likely traces of gravel deposits. Extensive wetland areas were observed during reconnaissance. The existing access road is poor with some seasonal flooding. The road is not maintained year-round. The road would require a bridge across Montana Creek to access the area in question. It is a cold valley with a long winter; snow was still present during the May 1993 reconnaissance. The road along Montana Creek is popular for cross-country skiing. Montana Creek is a significant

anadromous fish stream. The general area is designated in the Comprehensive Plan as a potential municipal water supply watershed. There is currently no use of, nor plans for, Montana Creek as a municipal water supply. CBJ Public Works staff do indicate, however, that additional municipal water supplies for the general area are currently being sought and Montana Creek has been noted as an option. No suitable landfill site was identified in this area. It was recommended that this location be eliminated from further consideration.

- **Auke Nu Bench** -- The area is located on bench lands in the vicinity of Auke Nu Creek north of the Glacier Highway at approximately Mile 13.5. The area generally consists of peat and other shallow soil deposits. It is a highly visible area from many areas of Auke Bay and Fritz Cove Road. The area is heavily used for nordic skiing. No suitable landfill site was identified in this area. It was recommended that this location be eliminated from further consideration.
- **Upper Lemon Creek** -- The area is located in the upper Lemon Creek valley in the vicinity of a previously proposed sludge disposal area on the west side of Lemon Creek, about 1.3 miles upstream from the Lemon Creek Correctional Center. An expired borrow area at end of the road was not considered because of very shallow groundwater and immediate proximity to the creek. A scale house is already located along the road to previously proposed sludge disposal area. The site has some minimal disturbance. Much of the area along the road up to and beyond the previously proposed sludge disposal area has been mined for sands and gravels. Some "blue clay" material may be present in or near the previously proposed sludge disposal area. Topography is generally conducive to landfill development. CBJ Public Works staff indicate that additional municipal water supplies are currently being sought and Lemon Creek has been noted as an option. It was recommended that this location be considered for further evaluation.
- **Lower Lemon Creek** -- The area is located in the Lemon Creek valley approximately 0.4 miles northeast of, and behind the Lemon Creek Correctional Center. To access the site, a bridge would likely need to be constructed from the east side of the creek to the west side in the vicinity of the prison. Alternate access would be through a relatively high density residential neighborhood on the west side of the creek. The general area has some minimal disturbance. The topography is relatively flat bench lands above the creek and is generally conducive to landfill development. CBJ Public Works staff indicate that additional municipal water supplies are currently being sought and Lemon Creek has been noted as an option. It was recommended that this location be considered for further evaluation.

- **Fish Creek Quarry, North Douglas** -- The area is located at the Fish Creek Quarry off Fish Creek Road, approximately 0.5 miles south of North Douglas Road. The area has good access except icy conditions on North Douglas Road in the winter, and traffic congestion during peak hours at the Juneau-Douglas Bridge. There is a gravel road leading to the site from Fish Creek Road. The actual site is located in a rock quarry. Minimal cover material was observed in the area. A rocky knoll would need to be removed for the site to be usable. Topography is generally conducive to landfill development. The existing level of disturbance (rock quarry) contributes to the site's potential suitability for landfill development. The Comprehensive Plan includes Fish Creek as a potential municipal water supply watershed. The only known user at this time is the Eaglecrest Ski Area upstream of the Fish Creek Quarry. The actual site lies on a break between the Fish Creek watershed and the Ninemile Creek watershed. It was recommended that this location be considered for further evaluation. As discussed in Section 1.3 of this study, this site was later eliminated upon finding that the site lay within 10,000 feet of a Juneau Airport runway end (i.e., the site failed a severe limitations criterion). Analysis of this site has therefore been removed from the body of this report to Appendix D.
- **North End of North Douglas Road** -- The area is located at the northwest end of North Douglas Road. The area consists of flat benches with some perched water at the surface and generally shallow soil deposits. No suitable landfill site was identified in this area. It was recommended that this location be eliminated from further consideration.

Based on the results of data gathered during the field reconnaissance, the following three candidate landfill sites (excluding the Fish Creek Quarry site) were selected as reasonable sites for evaluation using the Tier 1 and Tier 2 criteria:

- Site 1: North Peterson Creek
- Site 2: Upper Lemon Creek (previously proposed sludge disposal site)
- Site 3: Lower Lemon Creek (bench land northeast of prison)

3.3 DESCRIPTIONS OF SELECTED CANDIDATE SITES

The three candidate landfill sites are described in more detail in this section. Appendix A, Site Maps, illustrates the location of the three candidate sites. The eliminated Fish Creek Quarry site is further described and illustrated in Appendix D. It should be noted that some existing wells and surface water supplies have been identified on the site maps. Only those supplies with a water rights application and current permit from the DNR are illustrated.

Candidate Landfill Site Number 1: Peterson Creek

Site No. 1 is located along a firewood cutting road running east of, and parallel to, Peterson Creek. It is situated on a bench between Peterson Creek and a ridge to the east. The western edge of the potential area is approximately 0.5 miles northeast of, and paralleling Peterson Creek. The center of the site lies at approximately 58° 29' latitude and 134° 46' longitude. Access to the site is the Glacier Highway at Mile 26 to the gravel firewood road just south of the turn-off for Amalga Harbor. The site is approximately 23 acres. Site soils are Tolstoi-McGilvery series generally consisting of bedrock overlain by a shallow peat layer. The firewood road would require improvement and regrading for access by refuse vehicles. The land use designation is Recreation Resource. The site is zoned Rural Reserve. Most vegetation on the site has been removed; the surrounding area is characterized by forested wetlands species. The site is owned by the U.S. Forest Service. The current policy of the U.S. Forest Service is to not authorize or permit new landfill activities on federal lands. Therefore, for this site to be a viable alternative, the lands will likely need to come under CBJ control. This could potentially be done through a land exchange. The U.S. Forest Service does have exchange authority for swapping of lands with CBJ.

The site was selected mainly due to its distance from residential populations, existing level of disturbance, conducive topography for landfill development, and natural visual screening.

Candidate Landfill Site Number 2: Upper Lemon Creek

Site No. 2 is located in the upper Lemon Creek valley, approximately 1.3 miles upstream from the Lemon Creek Correctional Center on the west side of Lemon Creek. It is situated on a bench above Lemon Creek, approximately 0.5 miles upstream from the confluence of Sawmill Creek and Lemon Creek. The center of the site lies at approximately 58° 23' latitude and 134° 28' longitude. The site is approximately 22 acres. It is located in a gravelly deposit between two ridges of shallow bedrock. Site soils are Kupreanof series (gravelly silt and sandy loams). The site was previously proposed as a sludge landfill site in a 1989 study by R&M Engineering. Site access is via a private, unimproved road starting approximately 0.4 miles northeast of the end of Anka Street on the east side of Lemon Creek. A scale house is located along the private access road to the proposed landfill site. The road crosses one small, wood bridge prior to the site; this bridge would likely require upgrade or replacement. A 500 to 1,000 foot road to the site itself would need to be constructed from the existing private road. It is also likely that portions of the existing private road would need to be improved and regraded for improved refuse vehicle access. The land use designation is Resource

Reserve. The site is zoned Rural Reserve. Area vegetation is generally undisturbed and is characterized by forested wetlands species.

The site was selected mainly due to the availability of soil deposits at the site, conducive topography, central location, and high level of existing disturbance in the general area. The site and environs are also generally unsuitable for other community land uses (e.g., residential or major recreational uses).

Candidate Landfill Site Number 3: Lower Lemon Creek

Site No. 3 is located on lower Lemon Creek, about 0.4 miles northeast of the Lemon Creek Correctional Center. It is situated on a bench above the prison and creek, at the point where the slope breaks and steepens. The site lies approximately 650 feet west of Lemon Creek at its southeast edge, 1,600 feet west of Lemon Creek at its northeast edge, and 2,300 feet north of the prison at its southeast edge. The center of the site lies at approximately 58° 22' latitude and 134° 29' longitude. The site is approximately 27 acres. Site soils are type Kupreanof series (KuC - very gravelly sandy loam) with KuA (potential fine grained borrow) located less than one-half mile from site. Access could be via a new road extending from the terminus of Mountain Avenue or via the new commercial development on the east side of Lemon Creek with a new bridge to the west side near the prison and a new road extending to the site. Designated land use is Urban/Low Density Residential, but use is not currently residential within 0.5 miles of the site. The area to the east of the site up to and across Lemon Creek is designated Resource Reserve. The site is currently zoned D-5 (Single family and duplex). Area vegetation is characterized by forested wetlands species.

The site was selected mainly due to its central location, availability of soil deposits including potential low permeability soils on or near the site, central location, and conducive topography.

Section 4 of this study evaluates and scores each of these three sites against a set of Tier 1 and Tier 2 criteria.

SECTION 4

CANDIDATE SITES EVALUATION

This section evaluates the three candidate landfill sites using a common set of criteria to determine which site best meets technical standards for the Juneau community.

4.1 APPLICATION OF THE TIER 1 CRITERIA

Each of the three candidate landfill sites identified in Section 3 was compared and evaluated against a set of "Tier 1" criteria and a set of "Tier 2" criteria. As discussed in Section 2, the purpose of the Tier 1 criteria was to evaluate the three sites against issues and concerns that are not readily mitigable through appropriate landfill planning, design, and/or engineering. Because the concerns are more difficult and/or expensive to mitigate, the Tier 1 criteria received primary emphasis in the site evaluations. Table 4-1 summarizes the findings of each site per each Tier 1 criterion in a matrix format. Section 4.2 then numerically scores and ranks the three sites based on the Tier 1 criteria.

**Table 4-1
Candidate Sites Evaluation Against Tier 1 Criteria**

Criteria ¹		Site 1: Peterson Creek	Site 2: Upper Lemon Creek	Site 3: Lower Lemon Creek
Selected Severe Limitations Criteria	<u>Distance to Residences:</u> Maximize distance to existing year-round residence. Distances measured in straight miles from nearest edge of site.	0.7 miles to nearest homes at Pearl Harbor.	1.2 miles to residences adjacent to the prison site.	0.5 miles to residences adjacent to the prison site.
	<u>Road Access:</u> Maximize proximity to existing or planned all-weather roads. Distances measured in road miles from nearest edge of site to existing or planned all-weather road.	0.9 miles to Glacier Highway measured along existing woodcutting road. Road not all-weather.	1.3 miles from industrial park construction area on east Lemon Creek. Measured along existing private road--not all-weather. Bridge across Lemon Creek required.	0.5 miles from terminus of Mountain Ave. on west side of Lemon Creek. (This value was used for scoring purposes.) 0.9 miles from east side of Lemon Creek at the industrial park construction area. This approach would require new bridge across Lemon Creek.

Table 4-1
Candidate Sites Evaluation Against Tier 1 Criteria

Criteria ¹		Site 1: Peterson Creek	Site 2: Upper Lemon Creek	Site 3: Lower Lemon Creek
Habitats & Archeological Resources	<p><u>Plant & Wildlife Habitat:</u> Minimize siting within designated endangered or threatened plant or animal habitats. No points - site contains designated endangered or threatened plant or animal habitats. Half points - no designated habitat, but site identified as a significant fishery resource. All points - no designated habitat, no significant fishery.</p>	<p>Peterson Creek identified as a significant fishery for pink, chum & coho salmon; Dolly Varden, cutthroat, & steelhead trout. Half points</p>	<p>Upper Lemon Creek not identified as a designated habitat or significant fishery resource. Fish & Game describes unnamed tributary adjacent to, and upgradient of, the site as impacted by past gravel removal operations. Tributary is a possible candidate for habitat enhancement. All points</p>	<p>Switzer Creek (tributary to lower Lemon Creek) identified as a significant fishery for pink, chum & coho salmon. It is likely that the site can be designed & engineered for drainage away from Switzer Creek. Lower Lemon Creek not identified as a designated habitat or significant fishery resource. Unnamed tributary adjacent to, and upgradient of, the site identified as having some chum and coho salmon, and Dolly Varden spawning. All points (assuming proper design & engineering)</p>
	<p><u>Cultural Values:</u> Maximize distance to known historical or archaeological resource areas. No points - known areas on or adjacent to site. Half points - N/A All points - no known areas on or adjacent to site.</p>	<p>None indicated in reviews by Sealaska, Goldbelt, and DNR representatives. All points</p>	<p>None indicated in reviews by Sealaska, Goldbelt, and DNR representatives. All points</p>	<p>None indicated in reviews by Sealaska, Goldbelt, and DNR representatives. All points</p>

**Table 4-1
Candidate Sites Evaluation Against Tier 1 Criteria**

Criteria ¹		Site 1: Peterson Creek	Site 2: Upper Lemon Creek	Site 3: Lower Lemon Creek
Soils	<p><u>Suitable Soils</u>: Maximize suitable on-site soils.</p> <p>No points - site predominated by stony soils and/or exposed or very shallow bedrock.</p> <p>Half points - site predominated by very gravelly or sandy loam soils. Moderate to deep bedrock.</p> <p>All points - site predominated by fine gravelly and/or sandy silt loam soils. Deep bedrock.</p>	<p>Site predominated by Tolstoi-McGilvery soils--very stony silt loam with appreciable amount of fines. Typical depth to bedrock 3 feet. Some exposed bedrock. Permeability 0.6"-2.0"/hr.</p> <p>No points</p>	<p>Site predominated by Kupreanof soils--very gravelly silt loam with appreciable amount of fines. Typical depth to bedrock 40 feet. Permeability 0.6"-2.0"/hr.</p> <p>Half points</p>	<p>Site predominated by Kupreanof (KuC) soils--very gravelly sandy loam; appreciable fines. Typical depth to bedrock 60 feet. Permeability 0.6"-2.0"/hr.</p> <p>The soils at this site are generally more silty than the Upper Lemon Creek site.</p> <p>Half points</p>
Hydro-geology	<p><u>Groundwater Quality</u>: Minimize siting over potable groundwater.</p> <p>No points - site over relatively high quality groundwater.</p> <p>Half points - site over relatively fair (iron-rich) quality groundwater.</p> <p>All points - site over relatively poor quality groundwater area.</p>	<p>Site predominated by undifferentiated bedrock suggesting relatively high groundwater quality.</p> <p>Some shallow permeable, drained material of high water storage capacity in the area.</p> <p>No points</p>	<p>Site predominated by permeable, drained material of high water storage capacity. Water typically iron-rich suggesting fair quality.</p> <p>Half points</p>	<p>Site predominated by impermeable, unconsolidated materials suggesting relatively poor groundwater quality. (Some permeable drained material also exists on site.)</p> <p>All points</p>
	<p><u>Depth to Groundwater</u>: Maximize depth to average groundwater level for potable aquifers. Measured in feet from surface.</p>	<p>Approximately 50 to 100 feet to groundwater. (75 feet average used for evaluation.) Perched water at 1 to 2 feet.</p>	<p>Approximately 15 feet to groundwater.</p>	<p>Approximately 10 feet to groundwater.</p>

**Table 4-1
Candidate Sites Evaluation Against Tier 1 Criteria**

Criteria ¹	Site 1: Peterson Creek	Site 2: Upper Lemon Creek	Site 3: Lower Lemon Creek
<p>Surface Water</p> <p><u>Watersheds:</u> Minimize landfill siting in watershed used for drinking water supply. No points - site within a designated watershed currently used for municipal supplies. Half points - site within a designated watershed for drinking water supply but not currently used for such. All points - watershed not within a designated watershed for drinking water supply.</p> <p><u>Water Volume:</u> Minimize mean annual rainfall on the site. Measured in average inches per year.</p>	<p>Site not within a designated watershed for drinking water supply (Peterson Creek watershed). All points</p>	<p>Site not within a designated watershed for drinking water supply (Lemon Creek watershed). All points</p>	<p>Site not within a designated watershed for drinking water supply (Lemon Creek watershed). All points</p> <p>Approximately 150" per year.</p>
	<p>Approximately 77" per year. (Precise measurement not available--NWS approximation for specific use in this study only)</p>	<p>Approximately 160" per year, based on extrapolated data.</p>	

Table Notes:

1. All distances were measured to the nearest edge of the landfill sites unless otherwise indicated.

4.2 RESULTS OF THE TIER 1 CRITERIA EVALUATION

Table 4-2 shows the averaged weighting value assigned by Citizen Advisory Committee representatives and selected CBJ staff to each Tier 1 criterion (total of 100 available points) and calculates a numerical score for each site based on the Tier 1 criteria. Scores were calculated by determining the level of compliance of each site to each criterion. The site that best conformed to a given criterion was assigned all of the weighting points available for that criterion. The site that least conformed to a given criterion was assigned zero points for that criterion. Sites between best and worst received a direct proportion of the available points for that criterion. In cases where the criteria were more qualitative (e.g., suitable soils criterion), the sites were awarded all, half, or none of the available points depending on which definition they best met in Table 4-1.

**Table 4-2
Candidate Sites Scores Based on Tier 1 Criteria**

Tier 1 Criteria	Assigned Weighting Factor	Site 1 Peterson Creek Score	Site 2 Upper Lemon Creek Score	Site 3 Lower Lemon Creek Score
Distance to Residences	13	3.7	13.0	0.0
Road Access	8	4.0	0.0	8.0
Plant & Wildlife Habitat	7	3.5	7.0	7.0
Cultural Values	6	6.0	6.0	6.0
Suitable Soils	14	0.0	7.0	7.0
Groundwater Quality	14	0.0	7.0	14.0
Depth to Groundwater	13	13.0	1.0	0.0
Watersheds	16	16.0	16.0	16.0
Water Volume	9	9.0	0.0	1.1
Total	100 points	55.2	57.0	59.1

The resulting ranking of sites based on Tier 1 criteria only is as follows:

1. Site 3: Lower Lemon Creek -- 59.1 points
2. Site 2: Upper Lemon Creek -- 57.0 points
3. Site 1: Peterson Creek -- 55.2 points

Site 3: Lower Lemon Creek came out as highest ranked on Tier 1 criteria due primarily to its location outside any designated municipal watershed, relatively poor underlying groundwater quality, good road access, and moderately suitable soils. Site 3 scored poorly on water volume (high average annual rainfall), shallow depth to groundwater (approximately 10 feet), and proximity to nearby residences (about 0.5 miles); however, the site scored sufficiently well on other criteria to offset these weaknesses. The second highest ranked site, Site 2: Upper Lemon Creek, scored significantly higher than the Lower Lemon Creek site on distance to residences (1.2 miles), but poorly on road access and groundwater quality criteria. Site 2 otherwise had similar weaknesses as the Lower Lemon Creek site. Site 1: Peterson Creek, scored highly on the watershed, water volume, and depth to groundwater criteria; however, it scored moderately to poorly on most other Tier 1 criteria.

4.3 APPLICATION OF THE TIER 2 CRITERIA

Each of the three candidate landfill sites identified in Section 3 was next compared and evaluated against a set of "Tier 2" criteria. As discussed in Section 2, the purpose of the Tier 2 criteria was to evaluate the three sites against issues and concerns that are more readily mitigable through appropriate landfill planning, design, and/or engineering. Because these concerns are generally less difficult and/or expensive to mitigate, the Tier 2 criteria received secondary emphasis in the site evaluations. This secondary emphasis was reflected in the study by assigning a total of 50 points to the Tier 2 criteria, rather than 100 points as were the Tier 1 criteria. Table 4-3 summarizes the findings of each site per each Tier 2 criterion in a matrix format. Section 4.4 then numerically scores and ranks the four sites based on Tier 2 criteria.

Table 4-3
Candidate Sites Evaluation Against Tier 2 Criteria

Criteria ¹	Site 1: Peterson Creek	Site 2: Upper Lemon Creek	Site 3: Lower Lemon Creek
<p>Regulatory Compliance</p> <p>Wetlands: Minimize disturbance of wetlands. No points - development would disturb traditional wetlands. Half points - development would disturb forested wetlands. All points - no wetlands involved.</p>	<p>Presence of hydric soils and hydrophytic vegetation (e.g., hemlock) in the general area suggesting potential forested wetlands.</p> <p>No wetlands mapping available for this area.</p> <p>Access road passes through wetland at intersection with Glacier Highway.</p> <p>Half points</p>	<p>Presence of hydric soils and hydrophytic vegetation (e.g., hemlock) in the general area suggesting potential forested wetlands.</p> <p>No wetlands mapping available for this area.</p> <p>Half points</p>	<p>Presence of hydric soils and hydrophytic vegetation (e.g., hemlock) in the general area suggesting potential forested wetlands.</p> <p>Juneau Wetlands Mgmt. Plan indicates no wetlands on or adjacent to site.</p> <p>Half points</p>

Table 4-3
Candidate Sites Evaluation Against Tier 2 Criteria

Criteria ¹	Site 1: Peterson Creek	Site 2: Upper Lemon Creek	Site 3: Lower Lemon Creek
<p>Land Use</p> <p><u>Recreation:</u> Minimize siting in a local recreational use area as described in the Comprehensive Plan and Juneau Trails Plan. No points - site in a local recreational use area Half points - N/A All points - site not in a local recreational use</p>	<p>Designated Recreational Resource Area.</p> <p>Peterson Creek trail passes on east side of creek on the opposite side of the creek from the site, approximately 0.5 miles from site.</p> <p>No points</p>	<p>No Recreational or Open Space designation.</p> <p>Lemon Creek trail passes east of the site and Lemon Creek.</p> <p>All points (assuming adequate visual/noise buffering in landfill design)</p>	<p>No Recreational or Open Space designation.</p> <p>Switzer Creek and Lemon Creek trails not impacted assuming adequate buffering</p> <p>All points</p>
<p><u>Land Use Compatibility:</u> Maximize compatibility with Comprehensive Plan designations² and Table of Permissible Uses (TPU). No points - site is not described as an appropriate land use in the Comp. Plan or TPU. Half points - site is compatible with TPU (RR or I designation); site designated Recreational Resource in the Comp. Plan. All points - site is within an appropriate land use designation for the Comp. Plan and TPU (RR or I designation).</p>	<p>National Forest</p> <p>Recreational Resource designation in Comp. Plan. Adjacent lands designated Open Space.</p> <p>RR (Rural Reserve) designation in TPU.</p> <p>Half points</p>	<p>CBJ lands</p> <p>Resource Reserve designation in Comp. Plan.</p> <p>RR (Rural Reserve) designation in TPU.</p> <p>All points</p>	<p>CBJ lands</p> <p>Urban/Low Density Residential (currently undeveloped). Adjacent lands designated Institutional/Public and Res. Reserve. D-5 (single family and duplex) designation in TPU.</p> <p>No points (Land use designation is currently incompatible, however, it should be noted that the site is currently undeveloped and 0.5 miles from the nearest residential development).</p>

Table 4-3
Candidate Sites Evaluation Against Tier 2 Criteria

Criteria ¹	Site 1: Peterson Creek	Site 2: Upper Lemon Creek	Site 3: Lower Lemon Creek
<p><u>Residences Along Access:</u> Minimize number of residences along access road. Measured from the point of convergence with state-maintained major collector roads to the landfill site. Residences counted using Assessor's maps.</p>	<p>0 residences--access by an unnamed wood cutting road near Amalga Harbor turn-off. State-maintained arterial is Glacier Highway.</p>	<p>8 residences--access by Anka Street. State-maintained arterial is Glacier Highway.</p>	<p>35 residences--access by Davis Street and Mountain Avenue. State-maintained arterial is Glacier Highway. (Option via Anka St.-- reduce count to 8 homes, but would require new bridge.)</p>
<p><u>Visibility:</u> Minimize site visibility in "critical"³ direction(s). No points - site not naturally screened. Half points -site partially naturally screened. All points - site completely naturally screened.</p>	<p>Site completely screened from Glacier Highway and coastal recreational areas by a natural ridge line. Site screened from Peterson Creek by slope and heavy vegetation. All points</p>	<p>Site completely screened from nearby residences. Site partially visible from Lemon Creek and trail due to hillside location above creek and previous disturbances in the area. It is likely impact could be mitigated during design phase. All points</p>	<p>Site completely naturally screened from prison, nearby residences, and Lemon Creek by bench flattening and surrounding vegetation. All points</p>
<p><u>Density:</u> Minimize number of residences within a 1 mile radius of the site center. Measured as the number of residences using Assessor's maps.</p>	<p>21 residences.</p>	<p>0 residences.</p>	<p>376 residences.</p>

Table 4-3
Candidate Sites Evaluation Against Tier 2 Criteria

Criteria ¹		Site 1: Peterson Creek	Site 2: Upper Lemon Creek	Site 3: Lower Lemon Creek
Human Impacts	<p><u>Air Quality</u>: Minimize landfill dust and odor migration to sensitive receptors. No points - prevailing wind direction toward residential or recreation areas. Half points - toward commercial or industrial areas. All points - prevailing wind direction primarily toward undeveloped or non-sensitive receptors.</p>	<p>Prevailing wind generally from north in cold season (up to 35 knots sustained in Lynn Canal area, probably less at site). Secondary wind from south up to 50 knots in Lynn Canal at least 10 days each winter. Orientation shelters site from south winds. North or south winds in warm season.</p> <p>Generally undeveloped areas exist immediately down-wind (north and south) of site.</p> <p>All points</p>	<p>Prevailing wind is generally light NE.</p> <p>Generally undeveloped area immediately down-wind of site. New commercial development approx. 2 miles down-wind. Light wind conditions suggest minimal potential impact to this development.</p> <p>All points</p>	<p>Prevailing wind is generally light NE.</p> <p>Residential neighborhood and prison site lie down-wind approx. 0.5 miles. Potential negative impact to sensitive receptors.</p> <p>No points</p>

Table 4-3
Candidate Sites Evaluation Against Tier 2 Criteria

Criteria ¹		Site 1: Peterson Creek	Site 2: Upper Lemon Creek	Site 3: Lower Lemon Creek
Economics	<u>Haul Distance</u> : Minimize haul distance from waste centroid ⁴ to landfill site. Measured in road miles.	18.1 miles.	4.0 miles (would require new bridge).	2.6 miles via Davis Ave. - Mountain Ave. route. (This value used for scoring purposes.) 3.5 miles via east Lemon Creek route (would require new bridge).
	<u>Utilities</u> : Minimize length of new electric, water and sewer lines. Measured as the summation of the three distances from nearest hook up to edge of site.	Electric--0.9 miles Water--8.2 miles Sewer--15.7 miles Total--24.8 miles (Electric from Glacier Hwy; water from Lena Cove; sewer from Brotherhood Bridge)	Electric--1.2 miles Water--1.2 miles Sewer--1.2 miles Total--3.6 miles (Assumes measure from the prison site)	Electric--0.5 miles Water--0.5 miles Sewer--0.5 miles Total--1.5 miles (Assumes measure from the prison site)
	<u>Grading & Site Preparation</u> : Minimize grading and site preparation requirements considering on-site soils, vegetation and degree of existing disturbance. No points - High cost anticipated due to very shallow bedrock; heavily vegetated; and/or no existing disturbance. Half points - Moderate cost anticipated due to moderate depth to bedrock; intermediate vegetative cover; and/or some existing disturbance. All points - Lower cost anticipated due to deep bedrock; sparse vegetative cover; and/or extensive disturbance.	Bedrock (\$10.50/cy for excavation and stockpile). Some vegetative disturbance on wood cutting road. Grading and preparation cost high given bedrock excavation requirements. No points	Sand and gravel, assume dense (\$4.25/cy for excavation and stockpile). Moderate vegetative cover. Minimal existing disturbance. Moderate grading and site preparation cost. Half points	Sand and gravel, assume dense (\$4.25/cy for excavation and stockpile). Moderate vegetative cover with minimal existing disturbance. Moderate grading and preparation cost. Half points

Table 4-3
Candidate Sites Evaluation Against Tier 2 Criteria

Criteria ¹		Site 1: Peterson Creek	Site 2: Upper Lemon Creek	Site 3: Lower Lemon Creek
Economics	<u>Cover Material</u> : Minimize distance for transporting cover material. Measured in road miles from nearest reasonable, appreciable borrow source.	Approximately 4 miles-- assuming use of Eagle River source, No. 3, CBJ Natural Resources Inventory Report. Adequate quantities appear available with sandy/gravelly nature, likely with fines.	Zero miles. Adequate material likely available at site or adjacent borrow area.	Zero to 2 miles. Likely material available at site through pit excavation w/supplemental material at nearby Lemon Creek borrow sites. (Zero miles assumed for evaluation purposes.)

Table Notes:

1. All distances were measured to the nearest edge of the landfill sites unless otherwise indicated.
2. For the purposes of this evaluation, "Resource Reserve" was considered an appropriate land use designation for landfill development. The term is defined in the Comprehensive Plan as lands to be managed primarily to identify and conserve natural resources until specific land uses are identified and developed.
3. Critical direction is defined as that direction or directions toward residential or recreational areas within the "view-shed".
4. The waste centroid, or geographic point of average waste generation, was determined to be at a point about 500 feet west of the intersection of Egan Drive and Branta Road (Sunny Point). This was determined using population comparison between East Mendenhall Valley and downtown Juneau.

4.4 RESULTS OF THE TIER 2 CRITERIA EVALUATION

Table 4-4 shows the averaged weighting value assigned by Citizen Advisory Committee representatives and selected CBJ staff to each Tier 2 criterion (total of 50 available points used to reflect secondary emphasis) and calculates a numerical score for each site based on the Tier 2 criteria. Scores were calculated in the same manner as the Tier 1 criteria by determining the level of compliance of each site to each criterion.

**Table 4-4
Candidate Sites Scores Based on Tier 2 Criteria**

Tier 2 Criteria	Assigned Weighting Factor	Site 1 Peterson Creek Score	Site 2 Upper Lemon Creek Score	Site 3 Lower Lemon Creek Score
Wetlands	6	3.0	3.0	3.0
Recreation	4	0.0	4.0	4.0
Land Use Compatibility	4	2.0	4.0	0.0
Residences Along Access	4	4.0	3.1	0.0
Visibility	4	4.0	4.0	4.0
Density	4	3.8	4.0	0.0
Air Quality	5	5.0	5.0	0.0
Haul Distance	6	0.0	5.5	6.0
Utilities	3	0.0	2.7	3.0
Grading & Site Preparation	5	0.0	2.5	2.5
Cover Material	5	0.0	5.0	5.0
Total	50 points	21.8	42.8	27.5

The resulting ranking of sites based on Tier 2 criteria only is as follows:

1. Site 2: Upper Lemon Creek -- 42.8 points
2. Site 3: Lower Lemon Creek -- 27.5 points
3. Site 1: Peterson Creek -- 21.8 points

Site 2: Upper Lemon Creek, was the highest ranked on Tier 2 criteria, scoring generally high on all of the criteria. Site 3: Lower Lemon Creek, was a distant second place, scoring significantly lower on all of the human impacts-related criteria (given its proximity to residences) except visibility. The Lower Lemon Creek site scored slightly better than Upper Lemon Creek site on the economic-related criteria of haul distance and utilities. Third place, Site 3: Peterson Creek, scored generally well on human impact criteria given its remoteness, but scored poorly on all economic criteria.

4.5 RESULTS OF COMBINED TIER 1 AND TIER 2 EVALUATION

The final ranking of the three sites based on Tier 1 and Tier 2 criteria combined is presented in Table 4-5. The Tier 1 and Tier 2 scores for each site were summed to obtain a total score based on 150 points. The last row of Table 4-5 normalizes the sites' total scores back to a 100 point basis.

**Table 4-5
Final Scoring of Candidate Landfill Sites**

Criteria	Total Weighting Factor	Site 1 Peterson Creek Score	Site 2 Upper Lemon Creek Score	Site 3 Lower Lemon Creek Score
Tier 1 Criteria	100 points	55.2	57.0	59.1
Tier 2 Criteria	50 points	21.8	42.8	27.5
Total Score	150 points	77.0	99.8	86.6
Normalized Total Score	100 points	51.3	66.5	57.7

The resulting final ranking of sites based on the combined Tier 1 and Tier 2 criteria is as follows:

1. Site 2: Upper Lemon Creek -- 66.5 points
2. Site 3: Lower Lemon Creek -- 57.7 points
3. Site 1: Peterson Creek -- 51.3 points

Based on these results, this study finds that Site 2: Upper Lemon Creek, best overall meets the combined Tier 1 and Tier 2 criteria for new municipal solid waste landfill siting.

SECTION 5 CONCLUSIONS

5.1 SUMMARY OF STUDY FINDINGS

This study finds that Site 2: Upper Lemon Creek (66.5 points out of a total 100 points), best conforms with the combined Tier 1 and Tier 2 criteria for new municipal solid waste landfill siting. In summary, Site 2 scored relatively strong on economic, land use, and human impact criteria, while scoring relatively weak on groundwater (i.e., shallow depth, moderate quality) and water volume (i.e., high annual rainfall suggesting extensive need for run-on/run-off and leachate controls) criteria.

Site 2 does not present any known, significant impact to designated plant or wildlife habitats, nor is Lemon Creek a significant fishery resource. The unnamed tributary east and upgradient of the site was reported by Fish & Game to already be disturbed by previous gravel removal operations. Site 2 is not located within a designated municipal water supply watershed.¹ The site is generally compatible with the Comprehensive Plan land use designation (Resource Reserve) and Table of Permissible Uses (zoned Rural Reserve). Recreational uses of Lemon Creek are relatively small. There are no residences within a one mile radius of the site. The area is generally unsuited to residential or commercial development; the area is not designated as a future growth area in the Comprehensive Plan.

Site 2 demonstrated generally usable soils (gravelly silt loam) for landfill development, though not ideal conditions (e.g., fine silty and/or clay soils). Bedrock is relatively deep (approximately 40 feet) suggesting potentially ample material on and/or adjacent to the site for landfill uses. Deep bedrock also lowers site excavation costs as compared to the Peterson Creek site.

Site 2 scored generally well on the economic criteria suggesting that, along with Site 3, it may be the least expensive site to develop and operate over the long-term. Site 2 lies relatively very close to the calculated waste centroid for Juneau thereby minimizing (along with Site 3) long-term waste hauling costs of the three sites. Site 2 will, however, likely require significant expenditure for water run-on and run-off controls, and leachate management given the very high annual precipitation on the site. Relatively shallow groundwater conditions at Site 2 would also require special engineering considerations such as sub-drains to collect groundwater during peak levels. Site 2 will also require access to, and improvement of (e.g., grading, slope reduction,

¹ CBJ Public Works Department staff indicate that additional water supplies for Juneau are being sought and Lemon Creek has been discussed as one option. There are currently no plans, however, for the development of Lemon Creek as a municipal water source.

and winter maintenance), the existing private road leading to the site. This would include upgrade or replacement of the existing wood bridge crossing Lemon Creek. Access to the site passes just eight residences on Anka Street.

5.2 SPECIAL ISSUES REGARDING THE CANDIDATE SITES

In the course of visiting and evaluating the three candidate landfill sites, some issues unique to each site were identified. These issues are related to the evaluation criteria and are presented in Table 5-1 as additional information for interested readers.

**Table 5-1
Special Issues Relating to the Tier 1 and Tier 2 Criteria^{1,2}**

Site 1: Peterson Creek	Site 2: Upper Lemon Creek	Site 3: Lower Lemon Creek
<p>Soil is very thin suggesting higher development and operating costs since soil cover will need to be imported and excavation may go into bedrock. This may be partially offset by the moderate level of existing ground disturbance at the site.</p> <p>Upper shallow muskeg layer may be usable as cover material if mixed with other soil or rock.</p> <p>Given the topography and soil conditions, sheet flow of water on to the site would need to be controlled as well as stream flow.</p> <p>Some additional perimeter run-on/seepage controls such as slurry walls or cut-off trenches may be required where the edges of developed areas meet perched water in muskeg layers.</p>	<p>Soil is thick, however, a semi-pervious layer creates a perched ground water condition at the 15 to 25 foot depth level. This semi-pervious layer may provide a good natural base for a landfill liner.</p>	<p>Soil is thick and of fairly low to moderate permeability. Some very large boulders at some locations.</p> <p>High volume of groundwater possible at scattered locations.</p>

**Table 5-1
Special Issues Relating to the Tier 1 and Tier 2 Criteria^{1,2}**

<p align="center">Site 1: Peterson Creek</p>	<p align="center">Site 2: Upper Lemon Creek</p>	<p align="center">Site 3: Lower Lemon Creek</p>
<p>National Weather Service describes Peterson Creek area as an area of potential for winter air mass inversions that can go unbroken for up to 20 days several times per cold season.</p>	<p>National Weather Service describes Lemon Creek area as of unusually poor ventilation much of the year with inversions that can go unbroken for one month at a time.</p> <p>A new bridge would probably need to be constructed along the access road. A bridge would significantly add to site development costs. Access is via private property. The CBJ is currently attempting to obtain permanent access.</p>	<p>National Weather Service describes Lemon Creek area as of unusually poor ventilation much of the year with inversions that can go unbroken for one month at a time.</p> <p>Access to this site is either via a highly populated access road (Davis Ave. and Mountain Ave.) then 0.5 miles new road construction, or Anka St. and the existing haul road with a new bridge constructed across Lemon Creek near the prison. A bridge would significantly add to site development costs. The Anka St. access would impact a smaller number of homes (8 on Anka St. rather than 35 on Davis Ave. and Mountain Ave.).</p>

**Table 5-1
Special Issues Relating to the Tier 1 and Tier 2 Criteria^{1,2}**

Site 1: Peterson Creek	Site 2: Upper Lemon Creek	Site 3: Lower Lemon Creek
<p>U.S. Forest Service policy is to not authorize or permit new landfill activity on federal lands. Therefore to become a viable option, the lands will likely need to come under CBJ control through a land exchange process.</p>	<p>Lemon Creek has been listed by Alaska DEC as an "impaired water body". DEC will impose more stringent standards on new developments (incl. landfills) impacting Lemon Creek to insure no further degradation of the water body occurs. Standards will be developed specific to the proposed project. Landfill would likely incur higher costs for run-off and leachate control, and monitoring/reporting.</p> <p>Department Fish & Game reports that the unnamed tributary east and upgradient of the site has likely been impacted by past gravel removal operations. Species potentially present include coho and chum salmon and Dolly Varden. The tributary is reported as a possible candidate for fish habitat enhancement and mitigation.</p>	<p>Lemon Creek has been listed by Alaska DEC as an "impaired water body". DEC will impose more stringent standards on new developments (incl. landfills) impacting Lemon Creek to insure no further degradation of the water body occurs. Standards will be developed specific to the proposed project. Landfill would likely incur higher costs for run-off and leachate control, and monitoring/reporting.</p> <p>Some chum and coho salmon and Dolly Varden spawning and rearing has been documented by the Department of Fish & Game in the unnamed tributary northeast and upgradient of the site. Cutthroat trout spawning and rearing is reported as a possibility.</p>
<p>The site lies approximately 16 miles from the nearest sewer hook-up. Extending the sewer line to the site for the sole use by a landfill would likely be economically unfeasible. Hauling of leachate to an existing treatment facility or construction of an on-site facility may be economically more reasonable.</p>	<p>CBJ Public Works Department staff indicate (September 1993) that Juneau is currently seeking additional municipal water supplies and Lemon Creek has been discussed as one option. There is, however, no formal plan or proposal for such use at this time.</p>	<p>CBJ Public Works Department staff indicate (September 1993) that Juneau is currently seeking additional municipal water supplies and Lemon Creek has been discussed as one option. There is, however, no formal plan or proposal for such use at this time.</p>

Table Notes:

1. For all sites there is a low potential for significant quantities of clay liner/cap soil in the area unless "blue clay" or fines from Gastineau Channel dredging are made available.
2. Unless Alaska becomes an "Approved State" according to RCRA Subtitle D, the regulations prohibit a landfill to be located in a wetland. All sites appear to lie within "forested wetland" conditions.

5.3 CUMULATIVE IMPACTS

A final point of discussion for this study is recognition of cumulative impacts that may be incurred by the development of a new landfill site in Juneau. This study examined, in turn, the impact of each criterion against each candidate landfill site. However, environmental planners and engineers are beginning to recognize that the total impact of a project upon the environment can be greater than the sum of each individual impact. This effect is referred to as "cumulative impacts" and is typically defined as two or more individual effects which, when considered together, compound to increase other environmental impacts. An example of potential cumulative impact from new landfill siting is potential human impacts. Some increased truck traffic on a given residential street may be a small negative impact. Potential landfill dust affecting that street may be a small negative impact. Visibility of the landfill from that street may also be a small negative impact. The sum, however, of these three impacts may be a very large human impact, i.e., unbearable living conditions for residents on that street. The purpose of cumulative impacts consideration then is to, one, identify where and to what level a cumulative impact may be created by a given project, and two, identify mitigation measures to reduce the risk of that cumulative impact forming. Such consideration typically takes place at the point of environmental review for the selected project (e.g., state and local agencies project consistency review). A suggested approach for identifying and mitigating cumulative impacts of landfill siting in Juneau is through preparation of an "environmental assessment" report for all the sites, or preferred subset of sites, after the public review phase. The environmental assessment concept is described in the following section.

5.4 NEXT STEPS

This study has identified three candidate sites (excluding the Fish Creek Quarry site) for potential landfill development, and scored and ranked those sites based on some broad economic, environmental, human impact, and geotechnical criteria. An important next step to determining the suitability/feasibility of landfill development is a more detailed engineering and environmental assessment for the sites, or selected subset of preferred sites, upon completion of the public review phase. The purpose of this next level of investigation is two-fold: one, to identify any "fatal flaws" that would eliminate a site from any further consideration; and two, provide decision makers a complete, detailed understanding of each site so that the most informed decisions can be made for a new landfill. The next steps are outlined below and summarized in Table 5-2.

1) Engineering assessment:

- geotechnical exploration -- exploratory drilling and/or trenching to determine precise soil depths and characteristics; type and characteristics of underlying bedrock (e.g., extent of fracture or shear planes, orientation of bedding plane); analysis of soils grain size, clay content, plasticity, moisture content, and dry

density of on-site soils (and any soils proposed to be imported to the site); amount of material available on-site for landfill liner and cover use.

- hydrological evaluation -- well borings to determine precise depth to groundwater and groundwater quality; groundwater flow direction; identification of shallow groundwater locations and potential remediations; and surface drainage mapping for potential water run-on and run-off quantities/directions.
 - geological exploration -- exploratory trenching to identify any landslide features; earthquake fault features; or geomorphic features indicative of potential ground failure.
- 2) Environmental assessments:
- detailed evaluation of each site relating to existing biology, noise, traffic, air quality, visual resources, and cultural resources.
 - potential environmental impact of developing a landfill at each of the sites for each of these topics.
 - potential cumulative impacts that may be created.
 - potential mitigations to alleviate individual and cumulative impacts.

The resulting environmental assessment document can also be used as a key component of the final site proposal and solid waste disposal application for agencies' review and information.

Upon selection of a preferred site, the following sequential basic steps can then be undertaken:

- 3) land procurement, rezoning, and financing plan (as appropriate).
- 4) preliminary site design and engineering.
- 5) solid waste disposal application and agencies' project consistency review.
- 6) final go/no go decisions and permits submittal.
- 7) final design and engineering incorporating permit conditions and mitigations identified during the agencies' review period.

8) construction.

Experience in other communities suggests the timeframe from preferred site selection to beginning new landfill operations ranges from approximately four to ten years.

**Table 5-2
Summary of Next Steps**

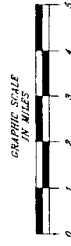
Task	Product	Timing	Cost
Public review of phase I reconnaissance report	Identification of preferred site from public acceptability standpoint	3 months	CBJ staff time
Engineering assessment	Detailed information on physical parameters of site; identification of preferred site from an engineering standpoint.	3 - 6 months Weather dependent	\$30,000 - \$60,000 Dependent on level of analysis desired and number of sites
Environmental assessments	Detailed information on environmental conditions at sites, potential environmental impacts and mitigations.	3 - 6 months Weather dependent; can occur simultaneous to engineering assessment	\$10,000 - \$30,000 Dependent on level of analysis desired and number of sites
Selection of preferred site	Identify preferred site for permitting and development based on public review and detailed engineering/environmental assessment	--	--
Land procurement, rezoning, and financing plan (as appropriate)	Obtain land; zoning consistency; financing plan for construction and development of site.	6 months	Cost of land dependent on ownership and existing land use.
Preliminary site design and engineering	Preliminary site specifications, construction drawings, and material needs	6 months	\$30,000 - \$80,000 Dependent on physical characteristics of site

**Table 5-2
Summary of Next Steps**

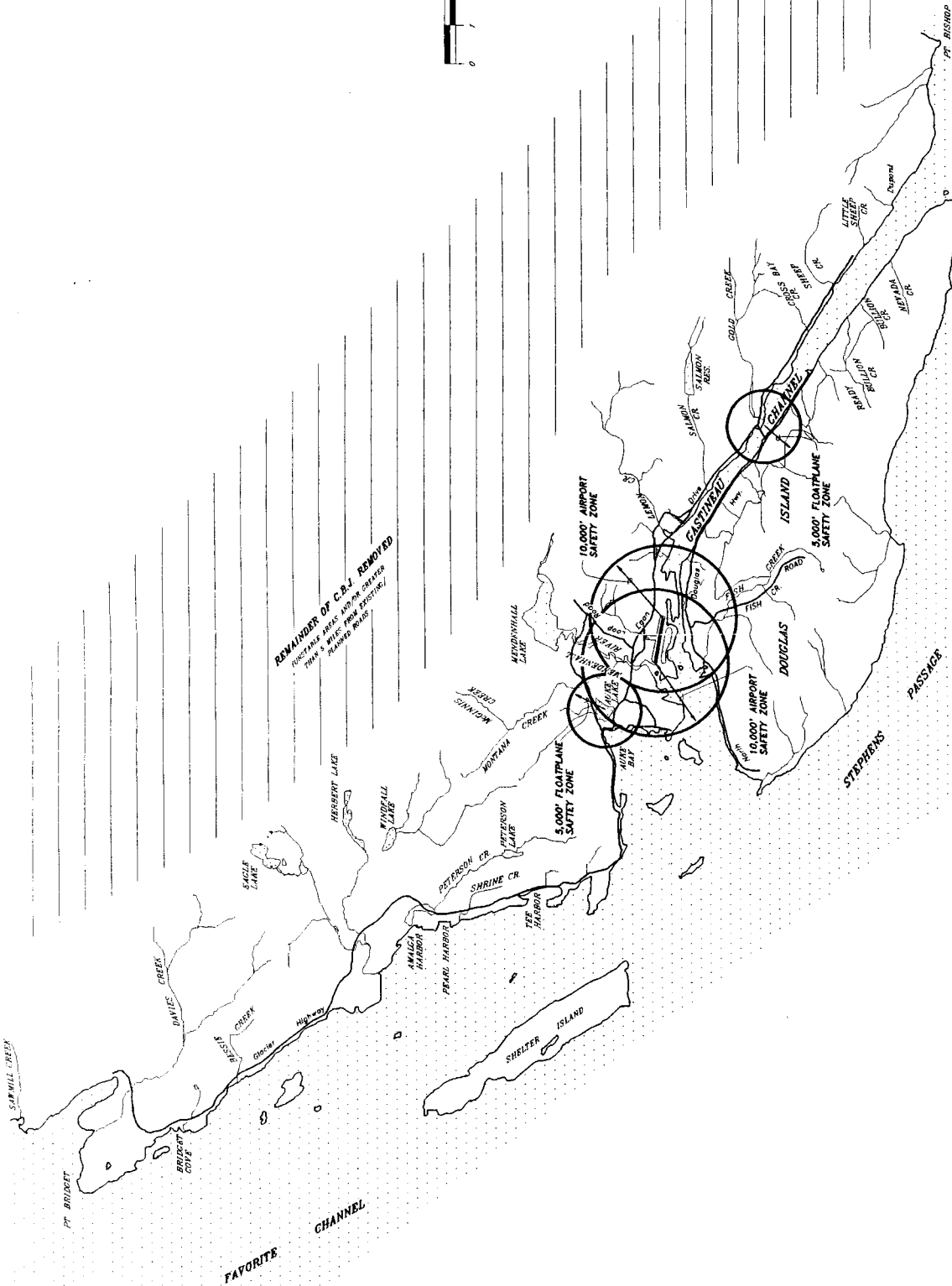
Task	Product	Timing	Cost
Solid waste disposal application and agencies' project consistency review	Determination of agencies' concerns and permitting requirements	2 - 3 months	CBJ staff time for application preparation
Final go/no go decisions and permits submittal	Completed permits for agencies' review and decisions	Dependent on number of permits and agencies' time requirements	CBJ staff time for permit(s) preparation
Final design and engineering	Detailed specifications and construction drawings for landfill construction and development	6 - 12 months	\$75,000 - \$150,000 Dependent of physical characteristics of site
Construction	Operational landfill site	12 - 24 months Weather dependent	\$4 million - \$6 million Primarily dependent on material types, length of construction, and materials shipping requirements

APPENDIX A:
SEVERE LIMITATIONS MAPS
AREA MAP
SITE MAPS

SEVERE LIMITATIONS MAPS



REMAINDER OF C.B.J. REMOVED
NORTHWAY & PEARL HARBOUR CHANNEL
FROM & ALONG ROADS



DIST. (SEE 1983)
P. & M. NO. 251242
SHEET 1 OF 1

AIRPORT SAFETY ZONE MAP
WITHIN
CITY & BOROUGH OF JUNEAU ALASKA

R & M ENGINEERING, INC.
ENGINEERS
GEOLOGISTS
SURVEYORS

BROWN, VENCE & ASSOCIATES
ENERGY AND WASTE MANAGEMENT ENGINEERING

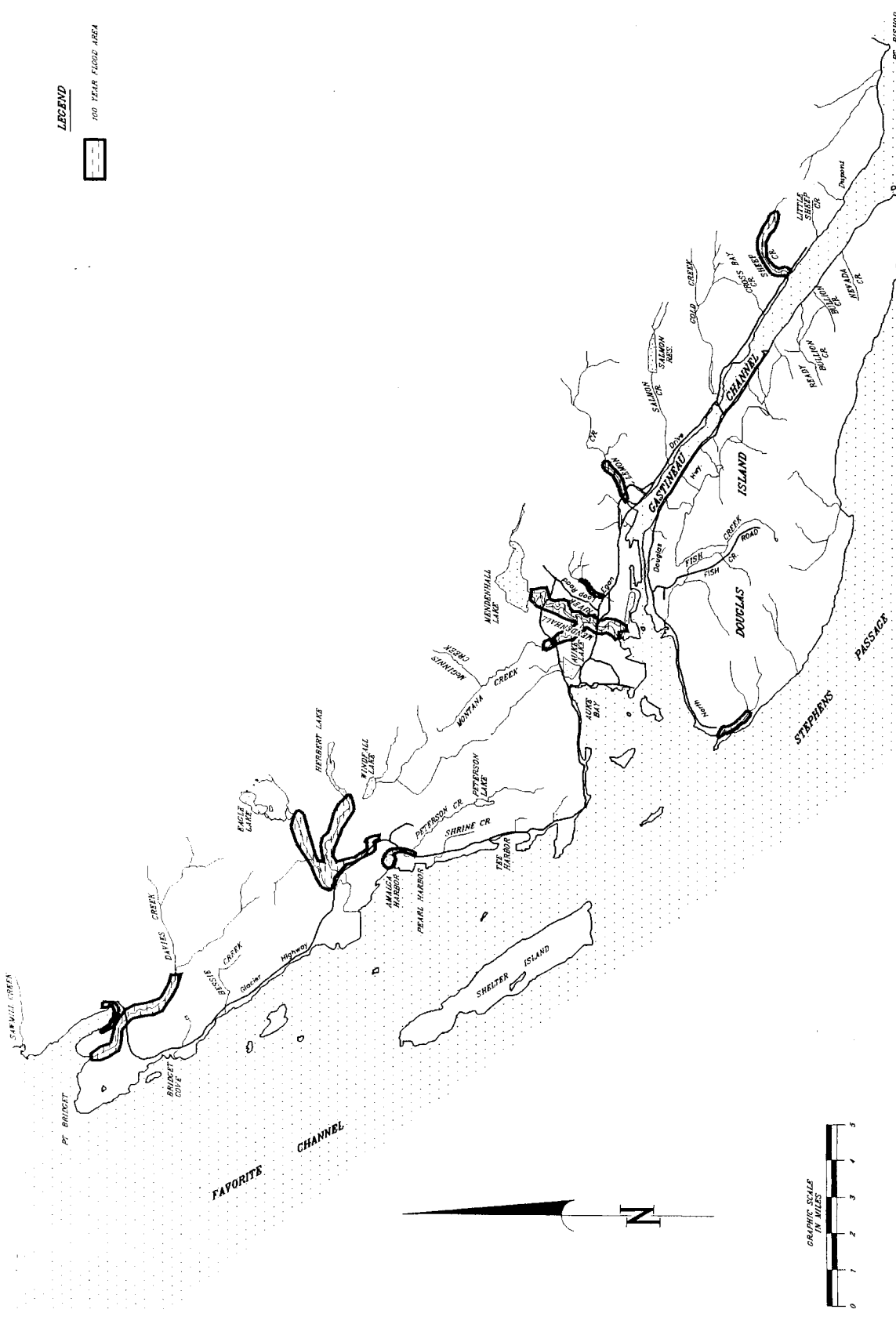
455 CAPITOL MALL, SUITE 205,
SACRAMENTO, CA 95814-0606
(916) 448-0900, (916) 448-1406 FAX

NO.	DATE	APPROVAL	BY

DESIGNED BY
CHECKED BY
APPROVED BY

LEGEND

100 YEAR FLOOD AREA



DATE: NOV. 28, 1981
 SHEET NO. 1 OF 1

100 YEAR FLOOD MAP
 WITHIN CITY & BOROUGH OF JUNEAU ALASKA

R & M ENGINEERING, INC.
 ENGINEERS
 GEOLOGISTS
 SURVEYORS

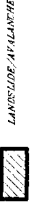


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 455 CAPITOL MALL, SUITE 205,
 SACRAMENTO, CA 95814
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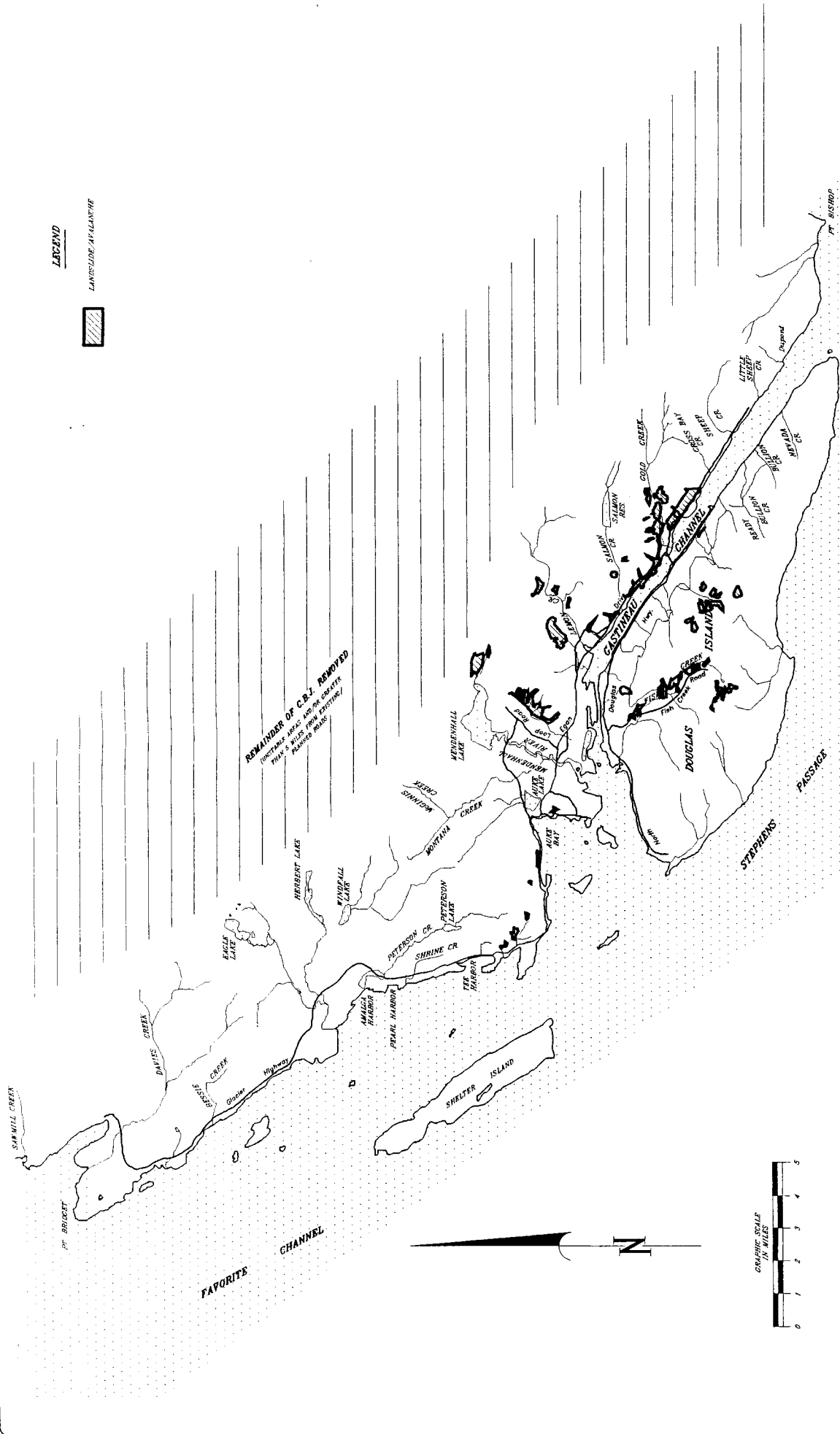
DATE	BY	REVISION

DESIGN: M.A.K.
 DRAWN: T.M.
 CHECKED: M.A.K.
 APPROVED: M.A.K.

LEGEND



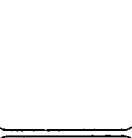
LANDSLIDE/AVALANCHE



DATE: APR. 1983
 P & M SIZE
 SHEET 1 OF 1

**LANDSLIDE/AVALANCHE
 MAP**
 WITHIN
 CITY & BOROUGH OF JUNEAU ALASKA

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 GEOLOGISTS
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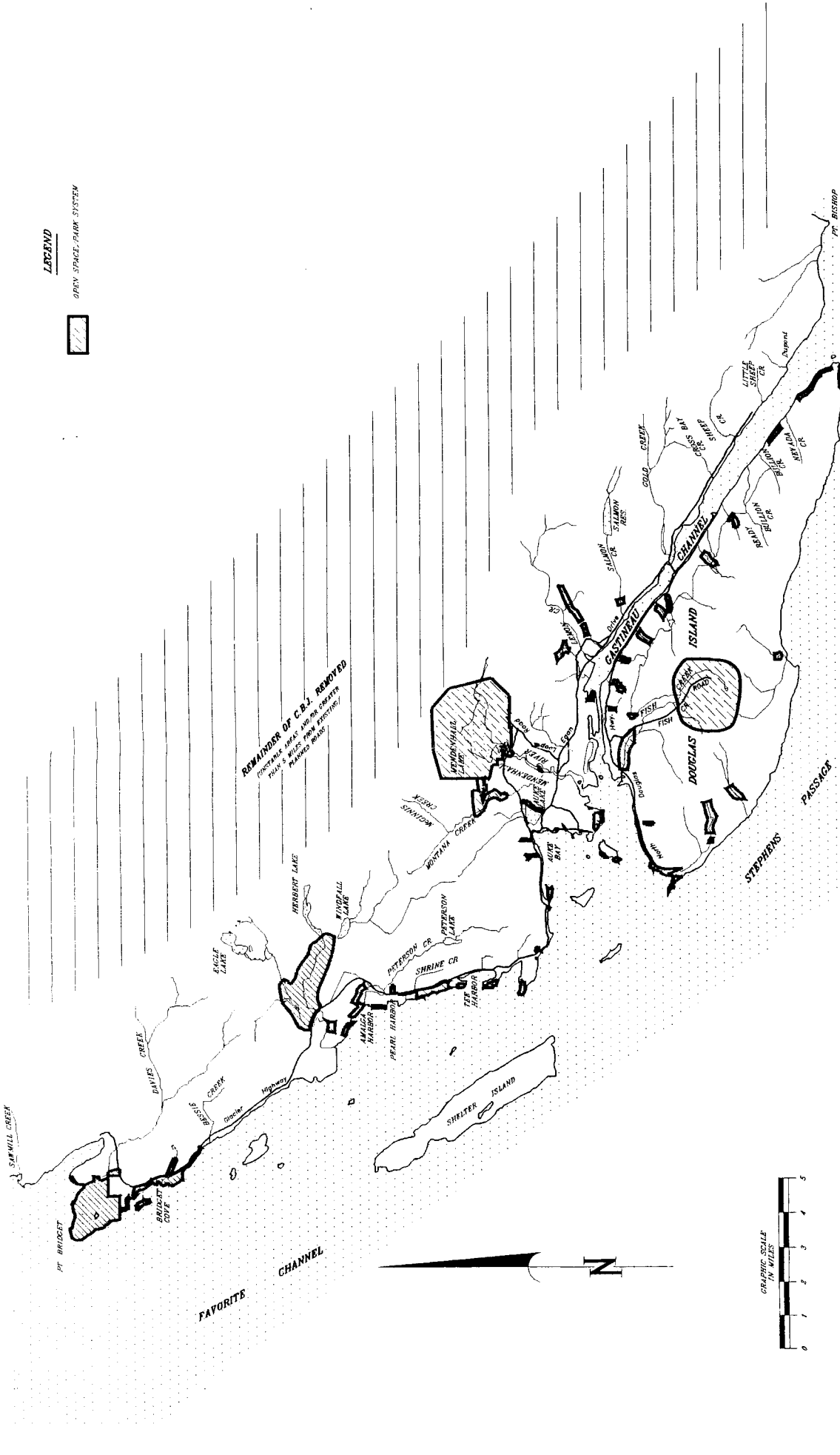
**BROWN, VENCE
 & ASSOCIATES**
 ENERGY AND WASTE MANAGEMENT ENGINEERING
 455 CAPITOL MALL, SUITE 205
 SACRAMENTO, CA. 95814
 (916) 448-0900. (916) 448-1406 FAX

DESIGN: M.M.	DATE:
DRAWN: F.M.	APPROVED:
CHECK: M.M.	DATE:
APPROVED: M.M.	DATE:

FILE NO.

LEGEND

OPEN SPACE/PARK SYSTEM



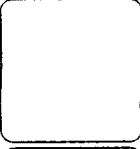
FAVORITE CHANNEL



DATE: 1971
 SHEET: 1 OF 1

**OPEN SPACE/PARK
 MAP**
 WITHIN
 CITY & BOROUGH OF JUNEAU ALASKA

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 SACRAMENTO, CA 95814
 (916) 448-0900, (916) 448-7408 FAX

NO.	DATE	BY	APP'D

DESIGN: J.A.M.
 DRAWN: F.K.
 CHECK: J.A.M.
 APPROVED: J.A.M.

LEGEND
 0.5 WILDS FROM RESIDENTIAL
 NEIGHBORHOODS

DATE: NOV. 1991
 P.L.C. NO. 20028
 SHEET 1 OF 1

**RESIDENTIAL LIMITATION
 MAP**
 WITHIN
 CITY & BOROUGH OF JUNEAU ALASKA

R & M ENGINEERING, INC.
 ENGINEERS GEOLGISTS SURVEYORS



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 & ASSOCIATES**
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 455 CAPITOL MALL, SUITE 205,
 SACRAMENTO, CA. 95814
 (916) 448-0900. (916) 448-1406 FAX

NO.	DATE	BY	REVISED

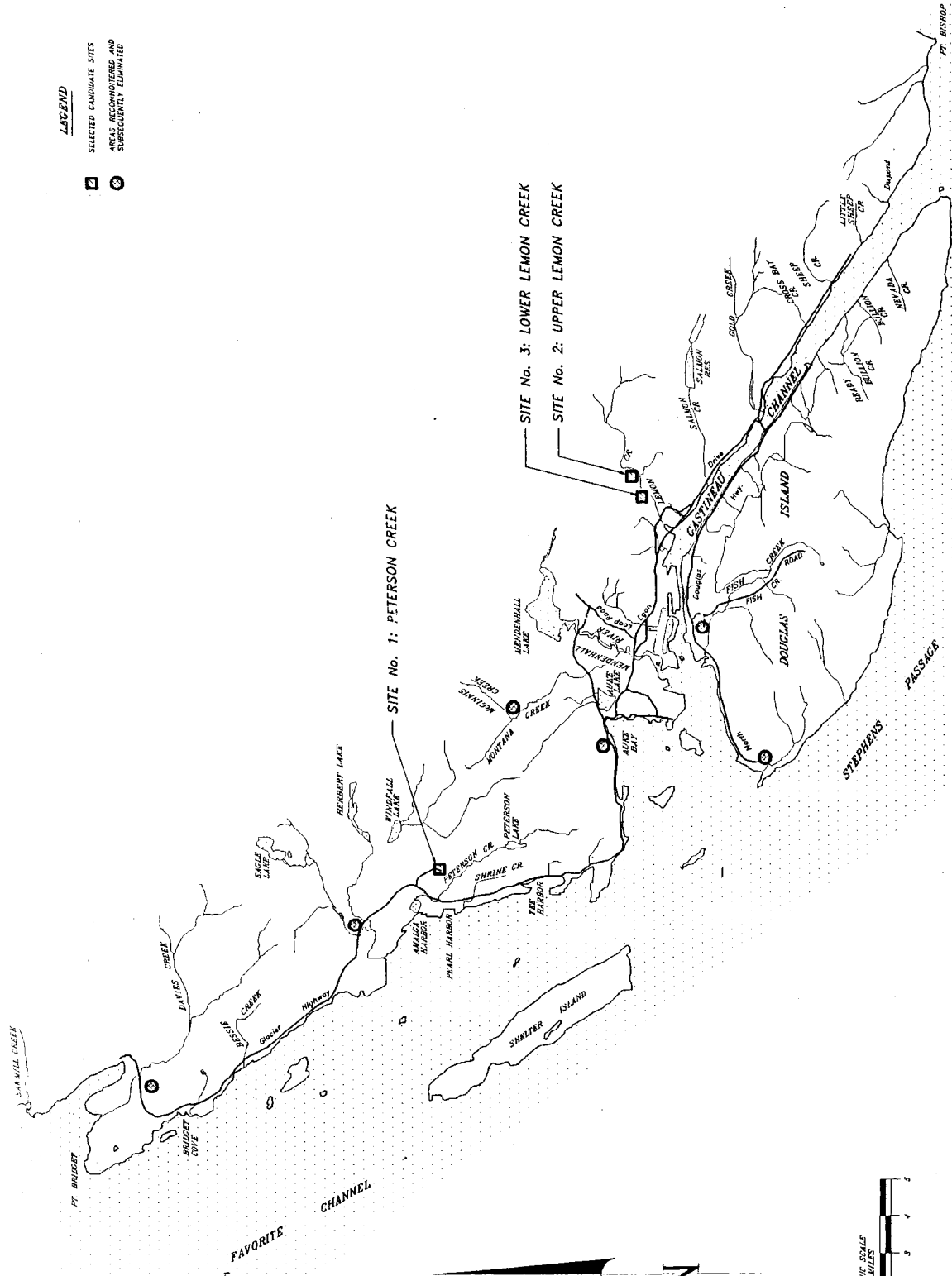
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 CHECK: M.S.E.
 APPROVED: E.L.M.



AREA MAP

LEGEND

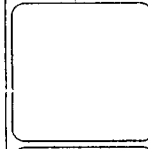
- SELECTED CANDIDATE SITES
- ⊗ AREAS RECOMMENDED AND SUBSEQUENTLY ELIMINATED



DATE	BY
11/11/80	J.M.K.
NO.	1
SHEET	1

**AREA MAP
OF LANDFILL SITES**
WITHIN
CITY & BOROUGH OF JUNEAU ALASKA

R & M ENGINEERING, INC.
ENGINEERS
GEOLOGISTS
SURVEYORS



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ENERGY AND WASTE MANAGEMENT ENGINEERING
455 CAPITOL MALL, SUITE 205,
SACRAMENTO, CA. 95814
(916) 448-0900, (916) 448-1106 FAX

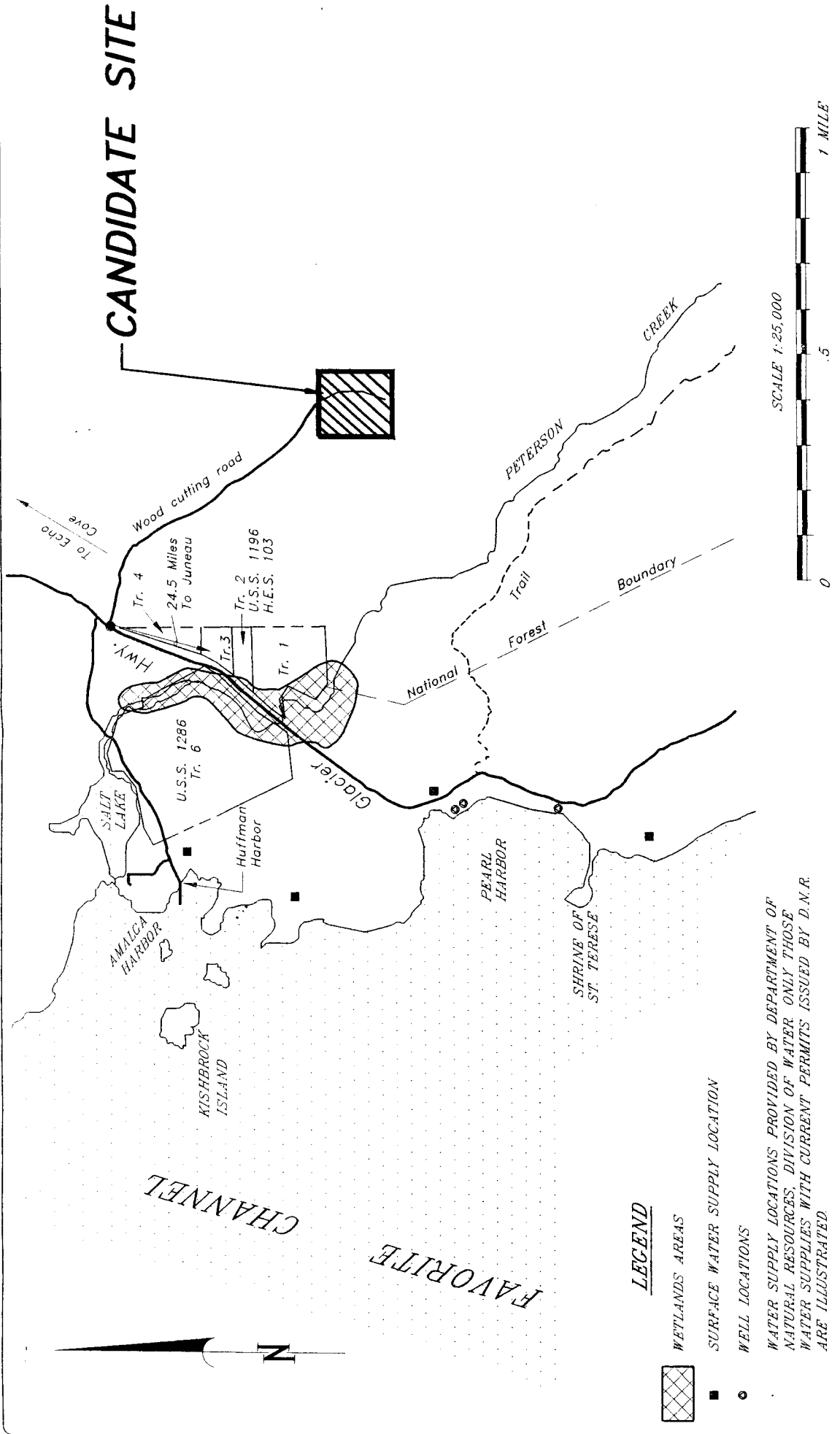
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APPROVED	M.L.K.






SITE MAPS

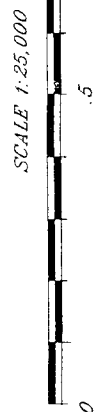
CANDIDATE SITE



LEGEND

-  WETLANDS AREAS
-  SURFACE WATER SUPPLY LOCATION
-  WELL LOCATIONS

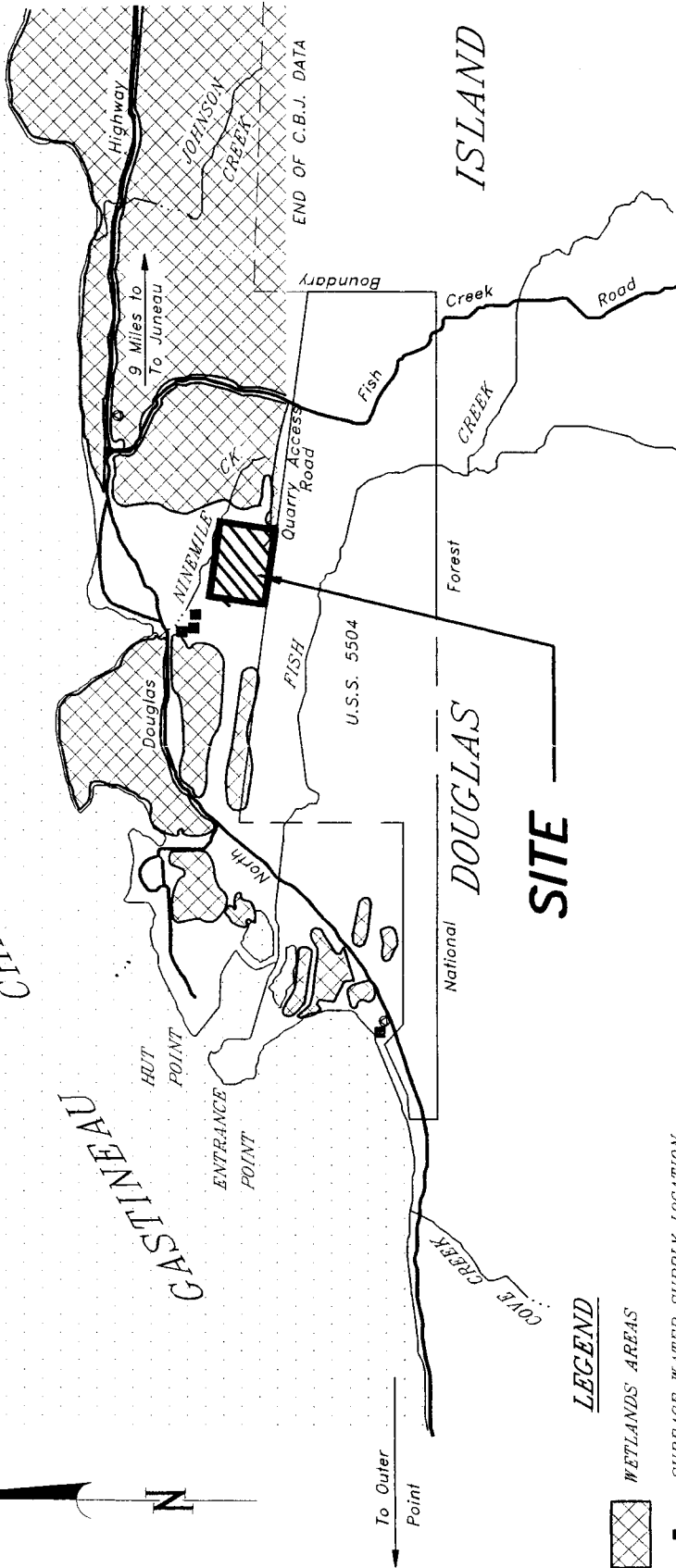
WATER SUPPLY LOCATIONS PROVIDED BY DEPARTMENT OF NATURAL RESOURCES, DIVISION OF WATER. ONLY THOSE WATER SUPPLIES WITH CURRENT PERMITS ISSUED BY D.N.R. ARE ILLUSTRATED.



DESIGNED BY DRAWN BY CHECKED BY APPROVED BY	DATE FILE NO.	DATE FILE NO.	SHEET 1 OF 3	SITE MAP # 1 PETERSON CREEK LANDFILL SITE WITHIN CITY & BOROUGH OF JUNEAU ALASKA
R & M ENGINEERING, INC. ENGINEERS GEODISTERS SURVEYORS				
BROWN VENCE & ASSOCIATES ENERGY AND WASTE MANAGEMENT ENGINEERING 455 CAPITOL MALL, SUITE 205, SACRAMENTO, CA. 95814 (916) 448-0900, (916) 448-1406 F.A.X.				
NO.	DATE	BY	REVISION	

GASTINEAU CHANNEL

ENTRANCE POINT
HUT POINT
North



LEGEND



WETLANDS AREAS

SURFACE WATER SUPPLY LOCATION

WELL LOCATIONS

C.B.J. WATER AVAILABLE TO ALL RESIDENTS

WATER SUPPLY LOCATIONS PROVIDED BY DEPARTMENT OF NATURAL RESOURCES, DIVISION OF WATER. ONLY THOSE WATER SUPPLIES WITH CURRENT PERMITS ISSUED BY D.N.R. ARE ILLUSTRATED.

DESIGN: B.A.M.
 DATA: P.M.
 CHECK: B.A.M.
 APPROVED: B.A.M.

DATE	BY	REVISION

BROWN, VENCE & ASSOCIATES
 ENERGY AND WASTE MANAGEMENT ENGINEERING
 455 CAPITOL HALL, SUITE 205,
 SACRAMENTO, CA. 95814
 (916) 418-0900, (916) 448-1406 FAX

R & M ENGINEERING, INC.
 ENGINEERS GEODRISTS SURVEYORS

SHEET MAP # 4
FISH CREEK QUARRY SITE
 WITHIN
 CITY & BOROUGH OF ANCHORAGE ALASKA

DATE: NOV. 1987
 P.P. 100 58122
 SHEET 1 OF 1

LEGEND

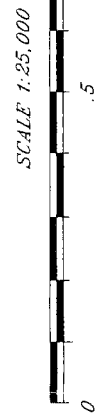
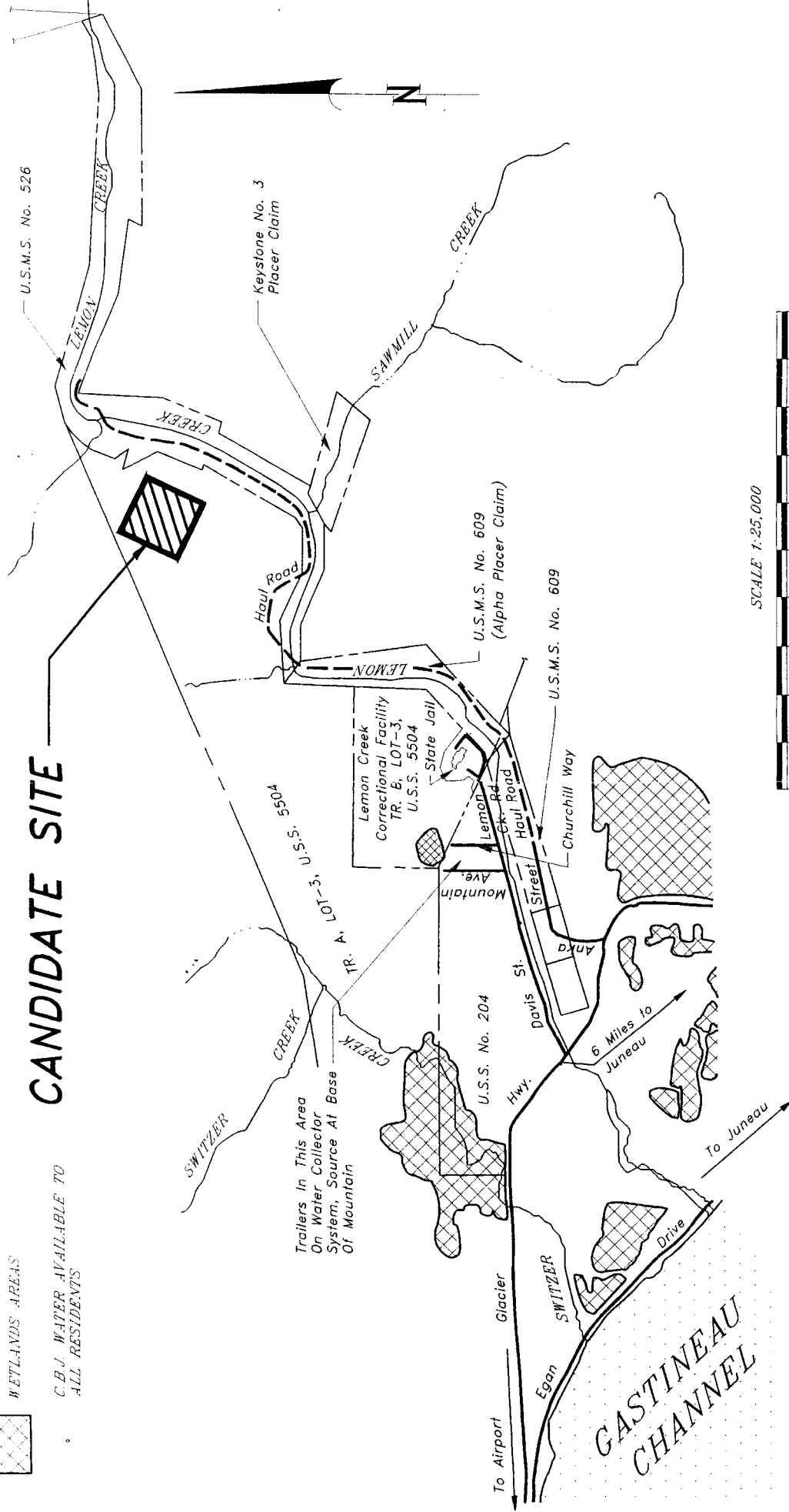
WETLANDS AREAS



C.B.J. WATER AVAILABLE TO ALL RESIDENTS

CANDIDATE SITE

U.S.M.S. No. 526



DESIGN: M.A.M. CHECK: P.M. DRAWN: M.A.M. APPROVED: M.A.M.	DATE: _____ TIME: _____ SHEET: 2 OF 3
CLAD: BVA-LEAD INC.	
FILE NO. _____	
BROWN, VENCE & ASSOCIATES ENERGY AND WASTE MANAGEMENT ENGINEERING 455 CAPITOL MALL, SUITE 205, SACRAMENTO, CA 95814 (916) 418-0900, (916) 418-1406 FAX	
R & M ENGINEERING, INC. ENGINEERS GEOLOGISTS SURVEYORS	
SITE MAP # 2 UPPER LEMON CREEK LANDFILL SITE WITHIN CITY & BOROUGH OF JUNEAU, ALASKA	

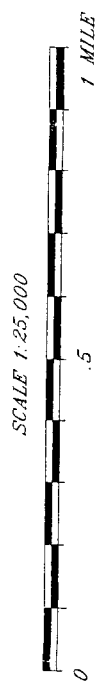
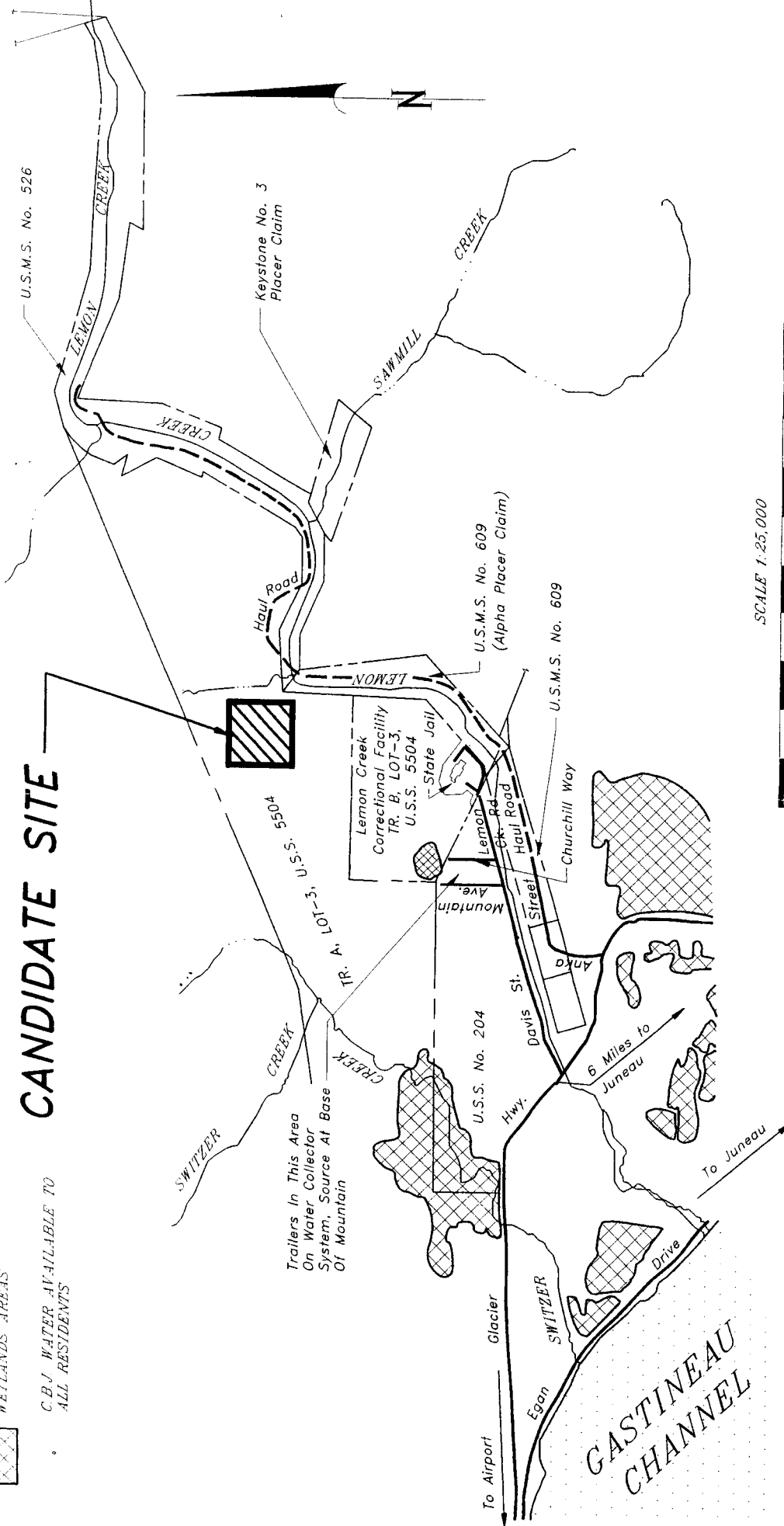
LEGEND

WETLANDS AREAS

C.B.J. WATER AVAILABLE TO ALL RESIDENTS



CANDIDATE SITE



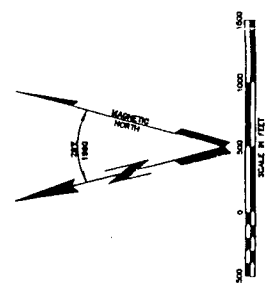
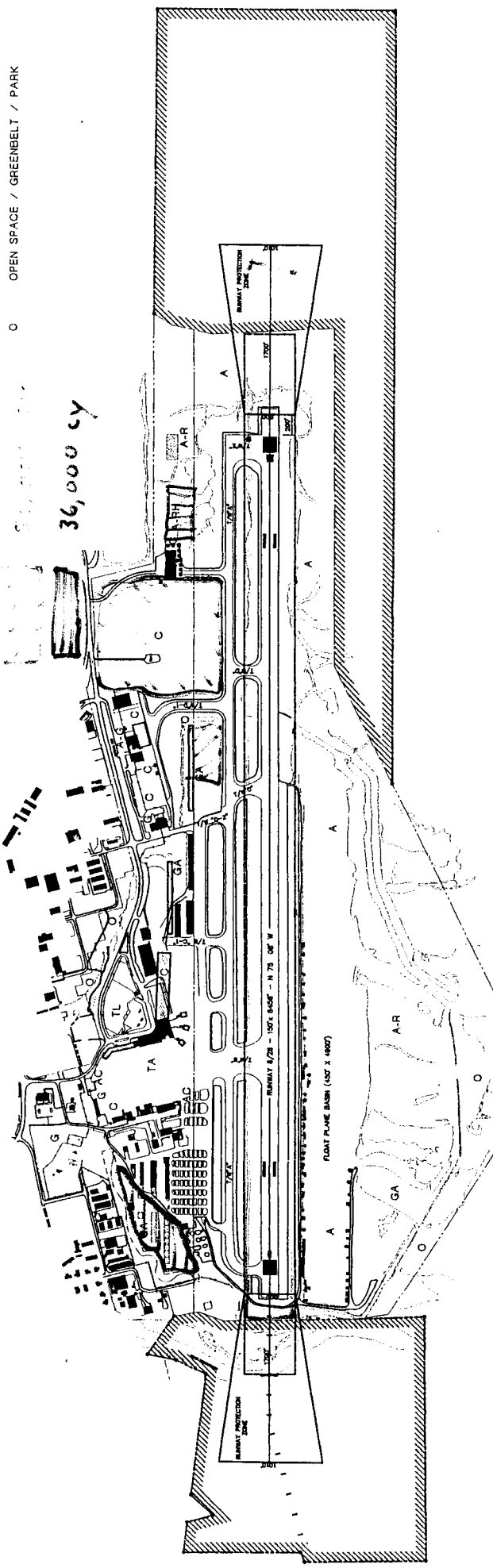
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<p>R & M ENGINEERING, INC. ENGINEERS GEOLGISTS SURVEYORS</p>			
<p>SITE MAP # 3 LOWER LEMON CREEK LANDFILL SITE WITHIN CITY & BOROUGH OF JUNEAU ALASKA</p>			
SHEET 3 OF 3			DATE: 10/18/92 BY: M.A.M.

APPENDIX B:
LIST OF REFERENCES USED

AIRPORT LAND USE LEGEND

- A AVIATION
- TA TERMINAL AREA (AIRSIDE)
- TL TERMINAL AREA (LANDSIDE)
- C COMMERCIAL (AVIATION)
- GA GENERAL AVIATION
- AC AIR CARGO
- A-R AIRPORT RESERVE
- A-RH AIRPORT RESERVE - HELICOPTER
- G GENERAL
- A-G GOVERNMENT - AVIATION
- O OPEN SPACE / GREENBELT / PARK

- EXISTING PAVEMENT
- FUTURE DEVELOPMENT
- WATER LINE
- EXISTING PROPERTY LINE
- LAND USE BOUNDARY
- EXISTING PROPERTY EASEMENT
- EXISTING BUILDINGS
- BUILDING RESTRICTION LINE
- FUTURE BUILDINGS



DATE _____

DATE _____



Architecture • Engineering
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JUNEAU INTERNATIONAL AIRPORT
JUNEAU, ALASKA

DES. D.L.M.
DR. C.M.B.
CH. D.L.M.
APP. X.X.X.

AIRPORT LAND USE PLAN

DATE FEBRUARY 1989

EXHIBIT E

SHEET 7 OF 13

REV. NO.	DATE	DESCRIPTION	APP.
WO# 500100		JA-LAND	

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Individuals Contacted:

Kathleen Bailey, CBJ Community Development Department 907-586-5230

Judith Bittner, Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation 907-762-2622

Terry Brenner, CBJ Engineering 907-586-5271

Joe Connelly, R&M Engineering, Juneau, AK 907-780-6060

John Dunker, Alaska Department of Natural Resources, Water Division 907-465-3400

Richard Dwyer, Goldbelt 907-463-4846

Ed Emswiler, Alaska Department of Environmental Conservation, Environmental Quality Division 907-465-5353

Steve Gilbertson, Lands and Resources Manager, CBJ Division of Lands and Resources 907-586-5266

Richard Harris, Sealaska Corporation, Resource Planning and Administration 907-586-1512

Richard Heffern, Alaska Department of Environmental Conservation, Air Quality Management 907-465-5100

Glen Jackson, U.S. Geologic Survey, Water Division, Anchorage 907-786-7100

Cynthia Johnson, Solid Waste Management Specialist, CBJ Division of Lands and Resources 907-586-5266

William Joiner, CBJ Public Works Department, Water Division 907-780-6888

Dee Koester, Alaska Department of Natural Resources, Division of Land 907-465-3400

Leif Lie, National Weather Service 907-586-7491

Mario Lim, Office of Water Quality Management, Groundwater Quality 907-465-5336

Timothy McLeod, Alaska Electric Light and Power Co. 907-586-2222

Tim Maguire, CBJ Community Development Department 907-586-5235

Gary Mendivil, CBJ Recreation Department, Eaglecrest Ski Area 907-586-5284

Malcolm Menzies, R&M Engineering, Juneau, AK 907-780-6060

Glenn Miller, Alaska Department of Environmental Conservation, Environmental Quality Division 907-565-5153

Ken Mitchell, US Forest Service, Juneau 907-586-8800

Roman Motyka, Alaska Department of Natural Resources, Geophysical Surveys Division 907-465-2520

Rick Noll, Alaska Department of Natural Resources, Water Division 907-465-3400

John Palmes, Alaska Department of Fish and Game, Habitats and Restoration Division 907-465-4290

Andrew Pekovich, Alaska Department of Natural Resources, Division of Land 907-465-3400

Steve Sharp, USEPA, Seattle 206-553-6517

Ursula Spannagel, Alaska Department of Environmental Conservation, Water Quality Management Division 907-465-5350

Jeanette St. George, CBJ Community Development Department 907-586-5235

Ralph Thompson, US Army Corps of Engineers 907-790-4490

Jim Truitt, National Weather Service 907-586-7491

Paula van Hagen, USEPA, Seattle 206-553-1847

Albert Wallace, Auke Tribe Representative 907-465-2316

Scott Williams, CBJ Community Development Department 907-586-5235

William Zentner, CBJ Engineering 907-586-5271

APPENDIX C:

SUMMARY OF SUBTITLE D LANDFILL SITING REQUIREMENTS

APPENDIX C

SUMMARY OF SUBTITLE D LANDFILL SITING REQUIREMENTS

C.1 BACKGROUND OF RCRA SUBTITLE D

On October 9, 1991, the U.S. Environmental Protection Agency (EPA) published new regulations aimed at improving the safety and environmental protection of solid waste disposal. These regulations were issued as Subtitle D of the Resource Conservation and Recovery Act (RCRA Subtitle D).

RCRA Subtitle D sets forth minimum federal criteria for municipal solid waste landfills. These criteria include location restrictions, facility design and operating criteria, groundwater monitoring requirements, corrective action requirements, financial assurance requirements, and closure and postclosure care requirements. RCRA Subtitle D also differentiates between the requirements for existing and new municipal solid waste landfills. Among other things, existing landfills are not required to remove existing waste and construct liners for active cells.

Under the provisions of RCRA Subtitle D, all facilities must comply with the prescriptive standards listed in the regulations unless they are located in a state that has a solid waste program approved by the EPA. An approved state can set forth performance requirements which landfill owners/operators must follow for the purpose of achieving the same results as the federal prescriptive standards. For a state program to become approved, the state must submit an application to the regional EPA solid waste program that demonstrates the program meets the requirements of RCRA Subtitle D.

Compliance dates for new and currently operating landfills are fully described in the regulations.

C.2 LOCATION RESTRICTIONS

The landfill location restrictions of RCRA Subtitle D are contained in Subpart B, §258.10 through 258.16 (§258.17 through 258.19 are reserved for future restrictions). These restrictions are summarized as follows:

- **Airport Safety** -- Demonstrate through design and operation that a landfill located within 10,000 feet of any airport runway end receiving turbojets or 5,000 feet of any airport receiving piston-type aircraft does not pose a bird hazard to aircraft. For new landfills, owners or operators must notify the FAA if a facility is sited within these distance limits.

- Floodplains -- Demonstrate that landfills located within a 100-year floodplain will not restrict flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste.
- Wetlands -- Do not locate a new landfill within a wetland unless the following are demonstrated to the director of an approved state:
 - There is not a practicable alternative which does not involve a wetland
 - Construction and operation of the landfill will not contribute to violations of any applicable state water quality standard; violate any applicable toxic effluent standard under §307 of the Clean Water Act; jeopardize the continued existence of endangered or threatened species or adverse modification of a critical habitat protected under the Endangered Species Act of 1973; or violate any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972.
 - The landfill will not cause or contribute to significant degradation of wetlands through erosion, instability of the landfill, soil migration, chemical constituents of waste, catastrophic releases, or any other factors to demonstrate sufficient protection of wetlands.
 - Steps are taken to attempt to achieve no net loss of wetlands under §404 of the Clean Water Act or applicable state wetland laws.
 - Sufficient information is available to make a reasonable determination with respect to the demonstrations described above.
- Fault areas -- Do not locate within 200 feet of a Holocene fault (known or unknown) unless the owner or operator demonstrates to the director of an approved state that a setback of less than 200 feet will prevent damage to the structural integrity of the landfill and protect human health and the environment.
- Seismic impact zones -- Do not locate in seismic impact zones unless the owner or operator demonstrates to the director of an approved state that all containment structures are designed to resist the maximum horizontal acceleration in lithified earth material for the site.
- Unstable areas -- Demonstrate that engineered measures to ensure structural integrity have been incorporated into the landfill's design if it is located in an unstable area.

In determining whether an area is unstable, an owner or operator must consider the following:

- On-site or local soil conditions related to differential settlement
 - On-site or local geologic or geomorphologic features
 - On-site or local human-made features or events (surface and subsurface)
- Closure of existing municipal solid waste landfill units -- existing landfills which cannot comply with the necessary siting restrictions must be closed according to the schedule specified in §258.16. Since this requirement does not apply to landfill siting, it was not considered in this study.

For a description of how the RCRA Subtitle D landfill location restrictions were developed into siting criteria as well as additional siting criteria used in this study, see Section 2 of this study.

C.3 IMPACT AND STATUS OF STATE APPROVAL

RCRA Subtitle D is set up such that individual state solid waste programs can be approved by the EPA so that solid waste disposal within that state will be regulated by state regulations and agencies. In order for a state to become approved, the state's lead agency must submit an application to their EPA regional office. This application must demonstrate how the state's program meets the requirements of Subtitle D. Current statutes dictate that states must be approved (either fully or partially) by October 9, 1993; this date is termed "the effective date." Initially states can apply for full approval of all solid waste disposal programs or partial approval of only the state programs which meet the Subtitle D standards. Alaska Department of Environmental Conservation staff have indicated that Alaska will initially be seeking partial approval. If Alaska applies for and receives partial approval by October 9, 1993, it must obtain full approval by October 9, 1995, or entirely lose its approved state status for all programs. The EPA has proposed measures which could extend the effective date from October 9, 1993, to April 9, 1994, in some cases. This provision may apply to Juneau's existing landfill. Because of the public comment and EPA review periods necessary, states should plan to submit their applications for approval at least three months prior to the effective date of the regulations. Assuming the October 9, 1993, effective date, applications should have been submitted by July 1, 1993. The significance for Juneau is that the strict Subtitle D performance standards will hold and deviations from those standards will be subject to potential citizen law suit until such time that the state gains EPA approval.

State approval offers potential flexibility to landfill owners/operators for the siting of a landfill, design, and other standards.¹ In an approved state, RCRA Subtitle D is based on performance standards that allow states to consider local conditions in setting appropriate controls for landfills. Use of performance standards will be beneficial to Juneau. For example, landfills may only be sited in wetlands where the director of an approved state approves numerous demonstrations (including "no net loss" demonstration) made by the landfill owner/operator. If a state is not approved, a landfill likely cannot be sited in a wetland area.² For Juneau, the location restrictions which will require approved state status for potential landfill siting flexibility are wetlands, fault areas, and seismic impact zones. In general, unless a state is approved, landfill owners/operators must follow the prescriptive standards listed in RCRA Subtitle D and cannot propose to follow any of the performance standards allowed in approved states. Data gathered in this landfill siting study suggest that all of the candidate landfill sites for Juneau lie within forested wetlands. In fact, vast areas of the CBJ appear to exhibit some type of wetland condition. All of the candidate sites (and all of the CBJ) likely lie within a seismic impact zone. Therefore, EPA approval of Alaska's solid waste program will be important if the City and Borough of Juneau wishes to pursue landfill siting at any of these locations.

In addition to these requirements, it should also be noted that the State of Alaska draft solid waste regulations currently include a requirement for landfill permit applicants to prepare a solid waste management plan as part of the application. The plan must demonstrate consideration of waste reduction, recycling, and treatment so as to reduce the amount of waste requiring disposal. This requirement is not included within RCRA Subtitle D.

As of September 1993, the State of Alaska solid waste program has not yet prepared and submitted their RCRA Subtitle D application to the EPA regional office. Staff of the Alaska Department of Environmental Conservation, Division of Environmental Quality, Office of Solid and Hazardous Waste Management, stated that they will be issuing revised regulations necessary for the state to submit an application which complies with Subtitle D standards. Draft regulations for public comment were issued September 8, 1993. The public comment period will run through November 30, 1993. Following public comment, summary, and revision, the

¹ It should be noted that the term "potential flexibility" is used here because RCRA Subtitle D is ultimately enforced through citizen law suits. Therefore, even with approved state status, a successful citizen law suit could potentially restrict the ability of a landfill owner/operator to deviate from the exact landfill siting, design, or operational standards set forth in Subtitle D.

² The State of Alaska current draft solid waste regulations have proposed additional wording to RCRA Subtitle D language addressing the goal of no net loss of wetlands. The proposed wording is: "The level of mitigation determined to be appropriate and practicable...may lead to individual permit decisions which do not fully meet this goal [*i.e., no net loss*] because the mitigation measures necessary to meet this goal are not feasible, not practicable or would accomplish only inconsequential reductions in impacts."

regulations will be re-issued. Department of Environmental Conservation staff are anticipating at least partial program approval by mid-1994.

APPENDIX D:

**EVALUATION OF THE FISH CREEK QUARRY (NORTH DOUGLAS
ISLAND) AS A CANDIDATE LANDFILL SITE**

APPENDIX D
EVALUATION OF THE FISH CREEK QUARRY (NORTH DOUGLAS ISLAND) AS A
CANDIDATE LANDFILL SITE

The purpose of this appendix is to illustrate the performance of the Fish Creek Quarry site against the Tier 1 and Tier 2 evaluation criteria had it remained a candidate landfill site for this study. As discussed in Section 1, the Fish Creek Quarry site was initially identified as a viable, candidate landfill site, however, upon rechecking the site against the severe limitations criterion of distance to airports (i.e., minimum 10,000 feet distance from the nearest airport runway end) it was found that the site did not meet this criterion. The east end of the Juneau Airport runway lies approximately 8,500 feet from the site. Given this result, the Fish Creek Quarry site was removed from analysis in the main body of this study. It is possible that this site could become a viable option if (as discussed in Appendix C, Section C.2, Location Restrictions) it can be adequately demonstrated that operation of a landfill at the Fish Creek Quarry site does not pose a bird hazard to aircraft. Given this possibility, the analysis and comparative ranking of this site is included in this appendix for reader information. Also included is a map illustrating the location and other information for this site.

For the purposes of this appendix, the Fish Creek Quarry site is labeled as Site #4.

D.1 DESCRIPTION OF THE FISH CREEK QUARRY SITE

The Fish Creek Quarry site is located on the north end of Douglas Island off of Fish Creek Road. The site is centered around the Fish Creek Quarry off of an unnamed gravel, graded access road approximately one mile south of the intersection of Fish Creek Road and North Douglas Road. The site is approximately 450 feet south of Ninemile Creek at its northeast edge and 600 feet southwest of Ninemile Creek at its southeast edge. The center of the site lies at approximately 58° 20' latitude and 134° 34' longitude. The site is approximately 22 acres of disturbed area with approximately 10 acres within the quarry boundary. Surrounding areas are typically muskeg with shallow bedrock formations. Designated land use at the site is Resource Reserve. A Comprehensive Plan designated "conceptual new growth area" lies immediately northeast of the site. Designated open space area lies to the east of the site along Fish Creek Road. The site is zoned Rural Reserve. Most vegetation on the site has been removed; surrounding areas are characterized by forested wetlands/muskeg species.

D.2 APPLICATION OF THE TIER 1 CRITERIA

The Fish Creek Quarry site was compared and evaluated against the set of Tier 1 criteria and Tier 2 criteria through the process described in Section 2. Table D-1 summarizes the findings for the site per each Tier 1 criterion in a matrix format. Section D.3 then numerically scores and ranks the site based on the Tier 1 criteria.

Table D-1
Fish Creek Quarry Site Evaluation Against Tier 1 Criteria

Criteria ¹		Site 4: Fish Creek Quarry
Selected Severe Limitations Criteria	<u>Distance to Residences</u> : Maximize distance to existing year-round residence. Distances measured in straight miles from nearest edge of site.	0.2 miles to nearest household on North Douglas Road immediately south of site.
	<u>Road Access</u> : Maximize proximity to existing or planned all-weather roads. Distances measured in road miles from nearest edge of site to existing or planned all-weather road.	0.4 miles to Fish Creek Road. Measured along quarry access road--not all-weather.
Habitats & Archeological Resources	<u>Plant & Wildlife Habitat</u> : Minimize siting within designated endangered or threatened plant or animal habitats. No points - site contains designated endangered or threatened plant or animal habitats. Half points - no designated habitat, but site identified as a significant fishery resource. All points - no designated habitat, no significant fishery.	Fish Creek identified as a significant fishery for pink, chum & coho salmon. Likely that site can be designed & engineered for drainage to Ninemile Creek (no designated habitat or significant fishery resource). All points (assuming proper design & engineering)
	<u>Cultural Values</u> : Maximize distance to known historical or archaeological resource areas. No points - known areas on or adjacent to site. Half points - N/A All points - no known areas on or adjacent to site.	None indicated in reviews by Sealaska, Goldbelt, and DNR representatives. All points

**Table D-1
Fish Creek Quarry Site Evaluation Against Tier 1 Criteria**

Criteria ¹		Site 4: Fish Creek Quarry
Soils	<p><u>Suitable Soils</u>: Maximize suitable on-site soils.</p> <p>No points - site predominated by stony soils and/or exposed or very shallow bedrock.</p> <p>Half points - site predominated by very gravelly or sandy loam soils. Moderate to deep bedrock.</p> <p>All points - site predominated by fine gravelly and/or sandy silt loam soils. Deep bedrock.</p>	<p>Site (existing quarry) predominated by Wadleigh (WaB) soils--very stony silt loam. Appreciable fines. Typical depth to bedrock 3 feet. Permeability 0.6"-2.0"/hr.</p> <p>Surrounding soils predominated by Maybeso (MaB) soils-- peat.</p> <p>No points</p>
Hydro-geology	<p><u>Groundwater Quality</u>: Minimize siting over potable groundwater.</p> <p>No points - site over relatively high quality groundwater.</p> <p>Half points - site over relatively fair (iron-rich) quality groundwater.</p> <p>All points - site over relatively poor quality groundwater area.</p>	<p>Undifferentiated bedrock within the existing disturbed area suggests some relatively high quality groundwater in the area. (Site surrounded by permeable, drained material of high water storage capacity. Water typically iron-rich suggesting fair quality for surrounding areas).</p> <p>No points</p>
	<p><u>Depth to Groundwater</u>: Maximize depth to average groundwater level for potable aquifers. Measured in feet from surface.</p>	<p>In excess of 100 feet to groundwater. Perched water in surrounding muskeg at 1 to 2 feet.</p>
Surface Water	<p><u>Watersheds</u>: Minimize landfill siting in watershed used for drinking water supply.</p> <p>No points - site within a designated watershed currently used for municipal supplies.</p> <p>Half points - site within a designated watershed for drinking water supply but not currently used for such.</p> <p>All points - watershed not within a designated watershed for drinking water supply.</p>	<p>Site lies on break between drainage to Fish Creek and Ninemile Creek. Fish Creek is a designated watershed for drinking water supply but not currently used for such (except Eaglecrest Ski Area, above the site), nor are there plans for such.</p> <p>It is likely site can be engineered for drainage to Ninemile Creek (non-designated watershed).</p> <p>All points</p>
	<p><u>Water Volume</u>: Minimize mean annual rainfall on the site. Measured in average inches per year.</p>	<p>Approximately 77" per year (at mouth of Fish Creek).</p>

Table Notes:

1. All distances were measured to the nearest edge of the landfill sites unless otherwise indicated.

D.3 RESULTS OF THE TIER 1 CRITERIA EVALUATION

Table D-2 shows the averaged weighting value assigned by Citizen Advisory Committee representatives and selected CBJ staff to each Tier 1 criterion (total of 100 available points), and calculates a numerical score for the Fish Creek Quarry site based on the Tier 1 criteria. The scores of the other three candidate sites are provided for comparison purposes. Scores were calculated through the process described in Section 4.

**Table D-2
Sites Scores Based on Tier 1 Criteria**

Tier 1 Criteria	Assigned Weighting Factor	Site 1 Peterson Creek Score	Site 2 Upper Lemon Creek Score	Site 3 Lower Lemon Creek Score	Site 4 Fish Creek Quarry Score
Distance to Residences	13	6.5	13.0	3.9	0.0
Road Access	8	3.6	0.0	7.1	8.0
Plant & Wildlife Habitat	7	3.5	7.0	7.0	7.0
Cultural Values	6	6.0	6.0	6.0	6.0
Suitable Soils	14	0.0	7.0	7.0	0.0
Groundwater Quality	14	0.0	7.0	14.0	0.0
Depth to Groundwater	13	9.4	0.7	0.0	13.0
Watersheds	16	16.0	16.0	16.0	16.0
Water Volume	9	9.0	0.0	1.1	9.0
Total	100 points	54.0	56.7	62.1	59.0

The resulting ranking of sites based on Tier 1 criteria and including the Fish Creek Quarry site is as follows:

1. Site 3: Lower Lemon Creek -- 62.1 points
2. Site 4: Fish Creek Quarry -- 59.0 points
3. Site 2: Upper Lemon Creek -- 56.7 points
4. Site 1: Peterson Creek -- 54.0 points

The Fish Creek Quarry site scored relatively high on the Tier 1 criteria primarily due to its location outside any designated municipal watershed¹, large depth to groundwater, and relatively low average annual rainfall amounts. The site scored poorly, however, on key criteria including: distance to residences (0.2 miles), suitable soils (shallow, peat and stony soils) and groundwater quality (likely relatively high groundwater quality at the site).

D.4 APPLICATION OF THE TIER 2 CRITERIA

The Fish Creek Quarry site was next compared and evaluated against a set of Tier 2 criteria through the process described in Section 4. The purpose of the Tier 2 criteria was to evaluate sites against issues and concerns that are more readily mitigable through appropriate landfill planning, design, and/or engineering. Table D-3 summarizes the findings of the Fish Creek Quarry site per each Tier 2 criterion in a matrix format. Section D.5 then numerically scores and ranks the site based on Tier 2 criteria.

¹ The Fish Creek Quarry lies at the break between the Fish Creek and Ninemile Creek watersheds. Fish Creek is a designated municipal watershed (but currently unused except for Eaglecrest Ski Area); Ninemile Creek is not a designated watershed.

**Table D-3
Fish Creek Quarry Site Evaluation Against Tier 2 Criteria**

Criteria ¹		Site 4: Fish Creek Quarry
Regulatory Compliance	<p><u>Wetlands</u>: Minimize disturbance of wetlands. No points - development would disturb traditional wetlands. Half points - development would disturb forested wetlands. All points - no wetlands involved.</p>	<p>Presence of hydric soils and hydrophytic vegetation (e.g., hemlock) in the general area suggesting potential forested wetlands.</p> <p>Juneau Wetlands Mgmt. Plan indicates wetlands adjacent to the site on the east, south and west sides.</p> <p>Access road passes through muskeg.</p> <p>Half points</p>
Land Use	<p><u>Recreation</u>: Minimize siting in a local recreational use area as described in the Comprehensive Plan and Juneau Trails Plan. No points - site in a local recreational use area Half points - N/A All points - site not in a local recreational use</p>	<p>No Recreational or Open Space designation on site, adjacent lands are designated Open Space.</p> <p>Fish Creek trail passes north and east sides of Fish Creek within approx. 0.25 miles south of landfill site.</p> <p>All points (assuming adequate visual/noise buffering in landfill design)</p>
	<p><u>Land Use Compatibility</u>: Maximize compatibility with Comprehensive Plan designations² and Table of Permissible Uses (TPU). No points - site is not described as an appropriate land use in the Comp. Plan or TPU. Half points - site is compatible with TPU (RR or I designation); site designated Recreational Resource in the Comp. Plan. All points - site is within an appropriate land use designation for the Comp. Plan and TPU (RR or I designation).</p>	<p>CBJ lands</p> <p>Resource Reserve designation. Adjacent lands designated Open Space and a conceptual growth area.</p> <p>RR (Rural Reserve) designation in TPU.</p> <p>All points</p>

**Table D-3
Fish Creek Quarry Site Evaluation Against Tier 2 Criteria**

	Criteria¹	Site 4: Fish Creek Quarry
Human Impacts	<p><u>Residences Along Access:</u> Minimize number of residences along access road. Measured from the point of convergence with state-maintained major collector roads to the landfill site. Residences counted using Assessor's maps.</p>	<p>0 residences--access by Fish Creek Road. State-maintained arterial is North Douglas Road.</p>
	<p><u>Visibility:</u> Minimize site visibility in "critical"³ direction(s). No points - site not naturally screened. Half points -site partially naturally screened. All points - site completely naturally screened.</p>	<p>Site partially naturally screened. Location on sparsely vegetated bench. May become partially visible from coastal and marine recreational areas depending on final height of landfill. Half points</p>
	<p><u>Density:</u> Minimize number of residences within a 1 mile radius of the site center. Measured as the number of residences using Assessor's maps.</p>	<p>84 residences.</p>
	<p><u>Air Quality:</u> Minimize landfill dust and odor migration to sensitive receptors. No points - prevailing wind direction toward residential or recreation areas. Half points - toward commercial or industrial areas. All points - prevailing wind direction primarily toward undeveloped or non-sensitive receptors.</p>	<p>Area generally sheltered from high winds. Sheltered from south and somewhat sheltered from north winds. Prevailing light wind conditions (5 -10 knots), winds from north up to 15-20 knots sustained. Generally undeveloped area down-wind from N winds. Residential neighborhood (Bayview and homes along Douglas Road) lies down-wind of S winds approx. 0.4 miles to road and 0.7 miles to Bayview. All points (for N winds, sheltered from S winds)</p>

**Table D-3
Fish Creek Quarry Site Evaluation Against Tier 2 Criteria**

	Criteria¹	Site 4: Fish Creek Quarry
Economics	<u>Haul Distance</u> : Minimize haul distance from waste centroid ⁴ to landfill site. Measured in road miles.	13.5 miles.
	<u>Utilities</u> : Minimize length of new electric, water and sewer lines. Measured as the summation of the three distances from nearest hook up to edge of site.	Electric--1.1 miles Water--1.1 miles Sewer--7.7 miles Total--9.9 miles (Electric and water from N. Douglas Road, sewer from the Juneau-Douglas Bridge)
	<u>Grading & Site Preparation</u> : Minimize grading and site preparation requirements considering nature of on-site soils, vegetation and degree of existing disturbance. No points - High cost anticipated due to very shallow bedrock; heavily vegetated; and/or no existing disturbance. Half points - Moderate cost anticipated due to moderate depth to bedrock; intermediate vegetative cover; and/or some existing disturbance. All points - Lower cost anticipated due to deep bedrock; sparse vegetative cover; and/or extensive disturbance.	Bedrock knob (\$10.50/cy for excavation and stockpile). Remaining area shallow bedrock at same cost for earthwork. Most vegetation cleared in proposed area. High disturbance. Grading and prep. cost high given bedrock excavation requirements. No points
	<u>Cover Material</u> : Minimize distance for transporting cover material. Measured in road miles from nearest reasonable, appreciable borrow source.	Approximately 6 miles--assuming use of Ludwig Pit, No. 39, CBJ Natural Resource Inventory Report. Adequate quantities appear available with some fine, silty material.

Table Notes:

1. All distances were measured to the nearest edge of the landfill sites unless otherwise indicated.
2. For the purposes of this evaluation, "Resource Reserve" was considered an appropriate land use designation for landfill development. The term is defined in the Comprehensive Plan as lands to be managed primarily to identify and conserve natural resources until specific land uses are identified and developed.
3. Critical direction is defined as that direction or directions toward residential or recreational areas within the "view-shed".
4. The waste centroid, or geographic point of average waste generation, was determined to be at a point about 500 feet west of the intersection of Egan Drive and Branta Road (Sunny Point). This was determined using population comparison between East Mendenhall Valley and downtown Juneau.

D.5 RESULTS OF THE TIER 2 CRITERIA EVALUATION

Table D-4 shows the averaged weighting value assigned by Citizen Advisory Committee representatives and selected CBJ staff to each Tier 2 criterion (total of 50 available points used to reflect secondary emphasis), and calculates a numerical score for the Fish Creek Quarry site. The scores of the other three candidate sites are provided for comparison purposes. Scores were calculated through the process described in Section 4.

Table D-4
Sites Scores Based on Tier 2 Criteria

Tier 2 Criteria	Assigned Weighting Factor	Site 1 Peterson Creek Score	Site 2 Upper Lemon Creek Score	Site 3 Lower Lemon Creek Score	Site 4 Fish Creek Quarry Score
Wetlands	6	3.0	3.0	3.0	3.0
Recreation	4	0.0	4.0	4.0	4.0
Land Use Compatibility	4	2.0	4.0	0.0	4.0
Residences Along Access	4	4.0	3.1	0.0	4.0
Visibility	4	4.0	4.0	4.0	2.0
Density	4	3.8	4.0	0.0	3.1
Air Quality	5	5.0	5.0	0.0	5.0
Haul Distance	6	0.0	5.5	6.0	1.8
Utilities	3	0.0	2.7	3.0	1.9
Grading & Site Preparation	5	0.0	2.5	2.5	0.0
Cover Material	5	1.7	5.0	5.0	0.0
Total	50 points	23.5	42.8	27.5	28.8

The resulting ranking of sites based on Tier 2 criteria and including the Fish Creek Quarry site is as follows:

1. Site 2: Upper Lemon Creek -- 42.8 points
2. **Site 4: Fish Creek Quarry -- 28.8 points**
3. Site 3: Lower Lemon Creek -- 27.5 points
4. Site 1: Peterson Creek -- 23.5 points

The Fish Creek Quarry site scored a distant second place to the number one ranked the Upper Lemon Creek site. The Fish Creek Quarry site scored generally well on the land use-related criteria and moderately well on human impacts-related criteria. The site scored relatively poorly, however, on the economic-related criteria due in part to shallow bedrock and surrounding muskeg conditions, and distance from the waste centroid.

D.6 RESULTS OF COMBINED TIER 1 AND TIER 2 EVALUATION

The final ranking of the Fish Creek Quarry site based on Tier 1 and Tier 2 criteria combined is presented in Table D-5. The scores of the other three candidate sites are provided for comparison purposes. The Tier 1 and Tier 2 scores for each site were summed to obtain a total score based on 150 points. The last row of Table D-5 normalizes the sites' total scores back to a 100 point basis.

**Table D-5
Final Scoring of Landfill Sites**

Criteria	Total Weighting Factor	Site 1 Peterson Creek Score	Site 2 Upper Lemon Creek Score	Site 3 Lower Lemon Creek Score	Site 4 Fish Creek Quarry Score
Tier 1 Criteria	100 points	54.0	56.7	62.1	58.0
Tier 2 Criteria	50 points	23.5	42.8	27.5	28.8
Total Score	150 points	77.5	99.5	89.6	86.8
Normalized Total Score	100 points	51.7	66.3	59.7	57.9

The resulting final ranking of sites based on the combined Tier 1 and Tier 2 criteria is as follows:

1. Site 2: Upper Lemon Creek -- 66.3 points
2. Site 3: Lower Lemon Creek -- 59.7 points
3. **Site 4: Fish Creek Quarry -- 57.9 points**
4. Site 1: Peterson Creek -- 51.7 points

Based on these results, this study finds that Site 2: Upper Lemon Creek, still best overall meets the combined Tier 1 and Tier 2 criteria for new municipal solid waste landfill siting. The Fish Creek Quarry site ranks third place just behind the Lower Lemon Creek site. Site 1: Peterson Creek, remains the least preferred site based on the combined Tier 1 and Tier 2 criteria.

D.7 SPECIAL ISSUES FOR THE FISH CREEK QUARRY SITE

In the course of visiting and evaluating the Fish Creek Quarry, some issues unique to the site were identified. These issues are related to the evaluation criteria and are presented below as additional information for interested readers.

- Soil is very thin suggesting higher development and operating costs since soil cover will need to be imported and excavation may go into bedrock. Costs may be partially offset by the moderate level of existing ground disturbance at the site. Upper shallow muskeg layer may be usable as cover material if mixed with other soil or rock.
- There is a low potential for significant quantities of clay liner/cap soil in the area unless "blue clay" or fines from Gastineau Channel dredging are made available.
- The site lies on a topographic high point with 270° drainage away from the site suggesting potential decreased costs for control of water running onto the site.
- Some additional perimeter run-on/seepage controls such as slurry walls or cut-off trenches may be required where the edges of developed areas meet perched water in muskeg layers. Grading of the site for drainage toward Ninemile Creek will be important to protecting the significant anadromous fishery of Fish Creek.
- Access along North Douglas Road could be icy in the winter due to the northern exposure. Travel from North Douglas Road across the Juneau-Douglas Bridge during peak traffic hours may be difficult. This may require scheduling of routes to avoid peak hours or modification of traffic patterns at the intersection of North Douglas Road and the bridge. Fish Creek Road experiences heavy traffic during the winter from people going to and from the Eaglecrest Ski Area. The road is used by bicyclers, runners and hunters in the summer.
- The site borders a conceptual new growth area to the south along North Douglas Road (Juneau Comprehensive Plan).
- Unless Alaska becomes an "Approved State" according to RCRA Subtitle D, the regulations prohibit a landfill to be located in a wetland. This site appears to lie within "forested wetland" conditions.
- Unless Alaska becomes an "Approved State" according to RCRA Subtitle D, the regulations prohibit a landfill to be located within 10,000 feet of a jet runway end. This site lies within approximately 8,500 feet of a jet runway end.