

# Snow Disposal Sites

## 2024 Ordinance and Design Criteria Evaluation Report

### **Introduction:**

The Municipality of Anchorage (MOA) and the State of Alaska Department of Transportation and Public Facilities (DOT&PF) are currently authorized to discharge stormwater from their combined Municipal Separate Storm Sewer System (MS4) to receiving waters as co-permittees (Permittees) under Alaska Pollutant Discharge Elimination System (APDES) Permit No. AKS-052558. During the fourth term of the Permit, the Permittees are required to “evaluate whether the current snow disposal ordinance and design criteria protect surface water quality by explicitly regulating the operation of private snow disposal sites within the MOA” and write a report based on that evaluation.

Throughout the fourth term of the Permit, the Permittees reviewed applications for new privately owned snow disposal sites through the MOA’s Conditional Use permitting process. The Permittees keep a mapping inventory of all privately owned snow disposal sites located in the Municipality of Anchorage and physically inspect all facilities to ensure that permanent controls required by MOA code and design criteria are in place and functional.

### **Objective of Snow Disposal Site Regulation:**

The objective of MOA snow disposal site code and design criteria requirements are to ensure that melt water from snow disposal sites is adequately treated to remove contaminants such as sediment and chlorides prior to discharging to a MS4 or receiving water, as well as ensuring that melt water infiltrating into the ground at the site will not adversely affect water wells, on-site systems, and aquifers. Previous evaluations of MOA owned and operated snow disposal sites in 2013, 2017, and 2018 found that chlorides in the melting snow piles were typically released to melt water very early in the melting process, while sediment concentration typically peaked much later in the melting process. The results of these evaluations concluded that site location, pad design, and structural controls, especially the use of extended detention of melt water, were important factors in limiting potential adverse effects of snow disposal sites.

### **Current MOA Snow Disposal Site Code and Design Criteria Requirements:**

The following is a summary of current MOA codes and design criteria that regulate snow disposal sites within the Municipality of Anchorage:

- AMC 21.05, 21.09, 21.10, 21.11– Use Regulations. These sections of the Anchorage Municipal Code define what specific land uses are allowed within certain zoning districts within the Municipality. Specific land uses may be allowed, prohibited, or conditionally allowed through the Conditional Use Approval process, Administrative Site Plan Review

process, Major Site Plan Review process, based on the zoning district of the property for which the specific land use is being considered. AMC 21.05 defines general use regulations for the Municipality. AMC 21.09 defines use regulations for the Girdwood area. AMC 21.10 defines use regulations for the Chugiak/Eagle River area. AMC 21.11 defines use regulations for the Downtown area.

- Land uses requiring conditional use approval are identified in Table 21.05-1, Table of Allowed Uses, Table 21.05-3, Table of Allowed Accessory Uses, Table 21.09-1, Table of Allowed Uses (Girdwood), Table 21.09-2, Table of Accessory Uses (Girdwood), Table 21.10-4, Table of Allowed Uses (Chugiak-Eagle River), Table 21.10-5, Table of Accessory Uses (Chugiak-Eagle River), Table 21.11-2, Table of Allowed Uses (Downtown), and Table 21.11-3, Table of Accessory Uses (Downtown).
  - Zoning districts that require Conditional Use Approval: R-1, R1-A, R2-A, R2-D, R2-M, R-5, R-6, R-7, B-3, PLI, gl1, gl2, GOS, CE-R-1, CE-R-1A, CE-R-2A, CE-R-2D, CE-R-2M, CE-R-3, CE-R-5, CE-R-5A, CE-R-6, CE-R-7, CE-R-8, CE-R-9, CE-R-10, CE-RC, CE-DR, CE-PR, and CE-PLI.
  - Zoning districts that require an Administrative Site Plan Review: I-1, I-2, MI, CE-I-1, CE-1-2, CE-I-3.
  - Zoning districts that require a Major Site Plan Review: gR3
  - Snow disposal sites are prohibited in all other Zoning districts not listed above within the MOA.
- AMC 21.05.060 – Industrial Uses: Definitions and use-specific standards. This section of the Anchorage Municipal Code contains definitions and standards for various industrial type land uses. The section defines a snow disposal site as “an area used for the concentrated storage of snow transported to that site from other locations” (AMC 21.05.060.E.8). Use-specific standards and regulations related to surface water quality contained in this section include:
  - Location standards: Snow disposal sites shall be located at least 25 feet from a class A or class B wetland, and at least 100 feet from a stream or water body.
  - Defining the minimum lot size allowed for a snow disposal site as 36,000 square feet.
  - Requiring that the snow storage area is well defined on-site and setback at least 25 feet from a public right-of-way in an industrial zoning district, or 50 feet in a non-industrial zoning district.
  - Requiring that the snow storage area be surrounded by an earthen berm or screening structure.
  - Requiring that on-site and off-site drainage will not impact neighboring properties and that melt water discharges comply with the requirements in the Anchorage Design Criteria Manual Volume 1: Management and Design Criteria (Design Criteria Manual Chapter 2 – Drainage). Specific requirements and design criteria prescribed in the manual will be further defined in the next section of this report.
- AMC 21.03.080 – Conditional Use Process. This section of Anchorage Municipal Code defines the application process and approval criteria required for specific land uses, including snow disposal sites. This process will be summarized and explained in a later section of this report.

- AMC 21.07 – Development and Design Standards. This section of Anchorage Municipal Code defines standards for natural resource protection (AMC 21.07.020), such as development setbacks for streams, drainageways, waterbodies, and wetlands, as well as defining standards for drainage, stormwater treatment, erosion control, and prohibited discharges (AMC 21.07.040).
- AMC 15.55 - Water Wells. This section of Anchorage Municipal Code defines standards for water wells including minimum separation distances from certain structures and other land uses.
- AMC 15.65 – Wastewater Disposal. This section of Anchorage Municipal Code defines standards for wastewater disposal systems including minimum separation distances from certain structures and other land uses.
- Anchorage Stormwater Manual Volume 1: Management and Design Criteria (Design Criteria Manual Chapter 2 – Drainage) – This is a document separate from Anchorage Municipal Code that provides specific design criteria for stormwater conveyances, Low Impact Development and Green Infrastructure practices and techniques, and snow disposal sites with references to relevant sections of Anchorage Municipal Code. This document will be explained in further detail in the next section of this report.

#### **Anchorage Stormwater Manual Volume 1: Management and Design Criteria (Design Criteria Manual Chapter 2 – Drainage):**

Section 8 of the Anchorage Stormwater Manual Volume 1: Management and Design Criteria, also known as the Design Criteria Manual Chapter 2 – Drainage (DCM Ch. 2) defines the storage requirements for snow disposal sites within the Municipality of Anchorage (see attached Appendix A for full text of DCM Ch. 2 Section 8). Section 8 covers topics such as site selection criteria, design information, specific design criteria, general design criteria, and snow disposal operational practices. The intent of the section is to manage the impacts of discharges of snow melt water on receiving waters and potable groundwater resources. It does this by employing three main principles: 1) maximize appropriate infiltration, 2) minimize sediment and other pollutants in melt water, and 3) provide for pollutant dilution. Design criteria for snow disposal sites are broken down by site selection criteria, design information, and specific and general design criteria. Specific criteria related to protecting surface water quality include:

- Section 8.2.2 – Site Selection Criteria:
  - Avoid areas with a high potential for contaminating closed lake or wetland systems. Melt water from snow disposal sites shall not be discharged to closed basin surface water features that have few or no surface water outlets.
  - Avoid sites that would discharge to streams with a base (winter) flow less than three cfs. Minimum receiving water discharge is based on probable adequacy for assimilation of chloride releases from snow melt to achieve compliance with the EPA and SOA water quality criteria. PM&E can provide maps of streams, site-specific channel geometry, baseline stream chemistry, and estimates of base flow throughout the MOA. On-site dilution of snow site melt water may be performed

prior to discharge to meet treatment goals listed in DCM Ch.2 Section 8.2.4 under the second subheading.

- Select sites that offer an optimum opportunity for infiltration to shallow, non-potable groundwater systems. This site selection criteria is secondary to criteria protecting potable aquifers, wetlands, lakes, and streams.
  - Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches. Snow combined with sand and debris may block a storm water drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow may also be quickly transported through the system into surface water.
  - Avoid sites that would negatively impact wetlands. Melt water from snow disposal sites shall not be discharged to wetlands such that discharge significantly reduces overall functionality (as cataloged in the Anchorage Wetlands Management Plan and its cited documents) to either the entire contiguous wetland feature or the impacted fraction alone.
- Section 8.2.3 – Design Information. This section defines what information and documentation is necessary to provide as part of an application for a snow disposal site:
    - Soil Investigation: A snow disposal site applicant must submit a detailed soil report based on the soil investigation performed at the site. The investigation and report should provide knowledge of the soil and potential problems with geotechnical concerns such as freeze/thaw effects, deep and shallow groundwater infiltration characteristics, and other constraints to site construction in order to determine possible marginal conditions for site stability and erosion concerns.
    - Surveying and Mapping: A snow disposal site applicant must provide a map to document watercourses, stormwater features, and other criteria that may be affected by the site. The map must include:
      - Site topography with two-foot or more detailed contour intervals.
      - Existing roads, culverts, ditches, storm drains, and other drainage features.
      - Location and depth of domestic wells and on-site sewage disposal systems within 500 feet of site boundaries.
      - Surface water features within 500 feet of the site, including wetlands, creeks, and lakes.
      - Ultimate receiving waters for melt water flows.
    - Groundwater Investigation: A snow disposal site applicant must provide a site-specific groundwater investigation to protect potable aquifer supplies and surface receiving waters. The investigation must include groundwater levels (seasonal high and low), gradient, direction, uses of the local aquifer, and probable hydraulic connections to potable groundwater aquifers within a 1,000-foot radius.
  - Section 8.2.4 – Specific Design Criteria. This section defines criteria specific to the design of the snow site. Specific design criteria related to surface water quality covered in this section include:
    - Snow Storage Pads – Snow storage pad design criteria include: pad orientation, pad design (including the use of v-swales), berm design (which helps detain melt water on-site), pad vegetation (which helps the pad resist erosion, traps fine sediment

mobilized in snow melt, and promotes the absorption of metals and other pollutants), channel and berm armoring, and pad outlet weirs (which allow for points at which melt water flows can be measured and samples).

- Melt Water Detention and Discharge – This section includes specific design criteria and requirements for melt water detention ponds that allow for early season melt water detention and/or infiltration and for late season sedimentation. This is probably the most important aspect of Municipal design criteria for protecting surface water quality as detention and infiltration of melt water allows for the treatment and dilution of chlorides and other pollutants, as well as allowing sediment to settle and be removed during off-season maintenance. Design criteria and treatment goals for detention ponds include:
  - Minimum storage volumes.
  - Sediment treatment goal of 95% removal of all particle sizes greater than 100\_μm in diameter.
  - Chloride dilution and treatment goals of a seven-day average concentration less than 3000 ppm chlorides in one cfs of melt water, and a 30-day average concentration of less than 1000 ppm in 0.5 cfs of melt water. These chloride concentrations are below the acute exposure durations that would negatively affect fish, invertebrates, and vegetation.
- Waste Sediment Areas
- Section 8.2.6 – Snow Disposal Operational Practices. This section defines operational practices required for snow disposal sites, including managing litter, placing snow, and maintaining vegetation to limit pollutant release from the site. Practices related to protecting surface water quality include sequencing the placement of hauled snow from downhill to uphill to minimize erosion of sediment released from the snowpack during the later stages of melt, placing snow in a single fill layer over the entire storage space before stacking more snow help control chloride concentrations, placing snow in piles with steep sides to reduce the release of sediment from the sides of the piles, vegetation maintenance, and material storage and management.

### **Current MOA Snow Disposal Site Application and Review Process:**

Conditional Use Approval is required for snow disposal sites within the majority of zoning districts in the MOA where snow disposals sites are allowed (R-1, R1-A, R2-A, R2-D, R2-M, R-5, R-6, R-7, B-3, PLI, g11, g12, GOS, CE-R-1, CE-R-1A, CE-R-2A, CE-R-2D, CE-R-2M, CE-R-3, CE-R-5, CE-R-5A, CE-R-6, CE-R-7, CE-R-8, CE-R-9, CE-R-10, CE-RC, CE-DR, CE-PR, and CE-PLI), and is outlined below. The conditional use approval procedure is intended for situations where use may or may not be appropriate in a district, depending on the specific location, the use characteristics, and potential conditions to decrease the adverse impacts of the use on surrounding properties and/or the community-at-large. It also provides a discretionary review process for uses with unique or widely varying operating characteristics or unusual site development features. The procedure provides public review and evaluation of a use's operating characteristics and site development features through a public hearing process. The procedure for conditional use approval, taken from AMC 21.03.020, is as follows:

1. *Initiation.* An application for a conditional use approval shall be initiated by the owner(s) of the subject property.
2. *Pre-application conference.* Before filing an application, the applicant shall request a pre-application conference with the director, in accordance with subsection 21.03.020B.
3. *Community meeting.* A community meeting is required in accordance with subsection 21.03.020C.
4. *Application submittal.* Applications for a conditional use approval shall be submitted to the director on a form provided by the department and shall contain the information specified on the application form.
5. *Public notice.* Notice shall be provided in accordance with subsection 21.03.020H.
6. *Departmental review.* The department shall review each proposed conditional use approval application in light of the approval criteria of subsection D and distribute the application to other reviewers as deemed necessary. Based on the results of those reviews, the department shall provide a report to the Planning and Zoning Commission.
7. *Planning and Zoning Commission action.* The planning and zoning commission shall hold a public hearing on the proposed application and act to approve, approve with conditions, or deny the proposed conditional use, based on the approval criteria of subsection D.
8. *Appeal.* Decisions on conditional use approvals may be appealed to the board of adjustment in accordance with subsection 21.03.050A.



The Planning and Zoning Commission may approve a conditional use application if, in the judgment of the commission, all of the following criteria have been met:

1. The proposed use is consistent with the comprehensive plan and all applicable provisions of this title and applicable state and federal regulations;
2. The proposed use is consistent with the purpose and intent of the zoning district in which it is located, including any district-specific standards set forth in Chapter 21.04;
3. The proposed use is consistent with any applicable use-specific standards set forth in Chapter 21.05;
4. The site size, dimensions, shape, location, and topography are adequate for the needs of the proposed use and any mitigation needed to address potential impacts;
5. The proposed use will not alter the character of the surrounding area in a manner which substantially limits, impairs, or prevents the use of surrounding properties for the permitted uses listed in the underlying zoning district;

6. The proposed use is compatible with uses allowed on adjacent properties, in terms of its scale, site design, operating characteristics (hours of operation, traffic generation, lighting, noise, odor, dust, and other external impacts);
7. Any significant adverse impacts anticipated to result from the use will be mitigated or offset to the maximum extent feasible;
8. The proposed use is appropriately located with respect to the transportation system, including but not limited to existing and/or planned street designations and improvements, street capacity, access to collectors or arterials, connectivity, off-site parking impacts, transit availability, impacts on pedestrian, bicycle, and transit circulation, and safety for all modes; and
9. The proposed use is appropriately located with respect to existing and/or planned water supply, fire and police protection, wastewater disposal, storm water disposal, and similar facilities and services.

An Administrative or Major Site Plan Review is required for snow disposal sites within certain zoning districts within the MOA where snow disposal sites are allowed (I-1, I-2, MI, CE-I-1, CE-1-2, CE-I-3, and gR3). The purpose of the site plan review process is to ensure compliance with the development and design standards and provisions of this title, and to encourage quality development in the municipality reflective of the goals, policies, and objectives of the comprehensive plan. For land uses requiring a site plan review, such uses may be established in the municipality, and building or land use permits may be issued, only after a site plan showing the proposed development has been approved in accordance with the procedures and requirements Anchorage Municipal Code Title 21. Procedures for site plan reviews are as follows:

#### Administrative Site Plan Review:

1. *Application submittal.* Applications for an administrative site plan review shall be submitted to the director on a form provided by the department and shall contain the information specified on the application form.
2. *Public Notice.* Notice shall be provided in accordance with subsection 21.03.020H.
3. *Departmental review and director's action.* The department shall review each proposed administrative site plan application in light of the approval criteria of subsection F and distribute the application to other reviewers as deemed necessary. Based on the results of those reviews, the director shall take final action on the site plan application and approve, approve with conditions, or deny the application. The department's review and the director's action, including referral to other agencies and bodies, shall be completed within 60 days of verification of a complete application.
4. *Appeals.* Decisions on administrative site plans may be appealed to the urban design commission, in which case it shall be treated as a major site plan review application under subsection D.

Major Site Plan Review (For non-residential development with a gross floor area of 100,000 square feet or greater, and for residential development of 140 units or more, the decision-making body shall be the planning and zoning commission. For all other major site plan reviews, the decision-making body shall be the urban design commission):

1. *Pre-application conference.* Before filing an application, the applicant shall request a pre-application conference with the director, in accordance with subsection 21.03.020B.
2. *Community Meeting.* A community meeting is required in accordance with subsection 21.03.020C.
3. *Application submittal.* Applications for a major site plan review shall be submitted to the director on a form provided by the department and shall contain the information specified on the application form.
4. *Public Notice.* Notice shall be provided in accordance with subsection 21.03.020H.
5. *Departmental Review.* The department shall review each proposed major site plan application in light of the approval criteria of subsection F. below and distribute the application to other reviewers as deemed necessary. Based on the results of those reviews, the department shall provide a report to the applicable commission.
6. *Commission action.* The applicable commission shall hold a public hearing on the proposed application and, taking into account the recommendations of the department and public input, shall act to approve, approve with conditions, or deny the proposed major site plan, based on the approval criteria of subsection E.
7. *Appeals.* Decisions on major site plans may be appealed to the board of adjustment in accordance with subsection 21.03.050A.

The approval criteria for all site plan reviews are as follows:

1. The site plan is consistent with any previously approved subdivision plat, planned development master plan, or any other precedent plan or land use approval;
2. The site plan complies with all applicable development and design standards set forth in this title, including but not limited to the provisions in Chapter 21.04, Zoning Districts, Chapter 21.05, Use Regulations, Chapter 21.06, Dimensional Standards and Measurements, and Chapter 21.07, Development and Design Standards;
3. The site plan addresses any significant adverse impacts that can reasonably be anticipated to result from the use, by mitigating or offsetting those impacts to the maximum extent feasible; and
4. The development proposed in the site plan is consistent with the goals, objectives, and policies of the comprehensive plan.

### **Discussion and Conclusions:**

The Municipality of Anchorage has instituted a set of codes and design criteria to regulate the design and operation of snow disposal sites and protect surface water quality within the Municipality. These mechanisms cover the application and review process for snow disposal sites, site design criteria, operational practices, and set treatment standards for pollutants in snow melt water leaving the site. Specific design criteria such as those found in the DCM Ch. 2 were written with the intent of treating melt water on-site and protecting surface water quality of features into which snow disposal sites ultimately drain.

Snow disposal sites that were established prior to the institution of specific municipal codes and regulations for snow disposal sites are considered grandfathered and may be allowed to continue operating by-right. WMS has visited those sites and has made recommendations for site retrofits and stormwater controls to help protect surface water quality, but Municipal regulatory authority



over the grandfathered sites is limited and water quality concerns must be addressed on a case-by-case basis, often with the coordination of State and Federal agencies.

Urban space limitations are an important factor in snow disposal site success. Though MOA regulations and design criteria require each snow site to be designed for a site-specific storage capacity, storing snow volumes beyond the designed capacity can easily overwhelm site operational and treatment capabilities. Seasons where snow accumulation exceeds designed capacity of snow disposal sites, such as the winter of 2023-24, continue to create runoff issues beyond the capability of on-site treatment measures to control. This issue will continue to be an object of concern considering continuing climate change and seasonal precipitation variation.

#### References:

MOA, 2013, *Anchorage Snow Disposal Sites: 2013 Evaluation*

MOA, 2018, *Snow Disposal Site Monitoring: 2017 Data Report*

MOA, 2019, *Snow Disposal Site Monitoring: 2018 Data Report*

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**Appendix A: Anchorage Stormwater Manual Volume 1: Management and Design Criteria  
(Design Criteria Manual Chapter 2 – Drainage), Section 8 text**

## 8.0 SNOW STORAGE REQUIREMENTS

### 8.1 Snow Melt Guidelines

The impact of snow melt on runoff is important because it can cause flooding during spring breakup. Substantial runoff volumes can be produced because frozen ground is relatively impermeable and infiltration is minimal.

PM&E has conducted a study of snow melt in Anchorage using meteorological data collected at Anchorage International Airport over the period 1968 to 1977. The March 10, 1969 event was selected as representing the model or most frequently occurring snow melt event. The March 23, 1974 event was selected as representing an event with approximately a five-year recurrence interval. The equivalent snow melt hyetograph for the peak period of each of these two events is shown included in Appendix D.

Until better snow melt data are developed, design snow melt runoff shall be computed by using the five-year recurrence hyetograph in Appendix D. The snow melt hyetograph should be applied to all areas without orographic adjustment. However, the engineer should note that the 10-year design storm event rather than snow melt usually governs for pipe sizing.

### 8.2 Snow Storage and Snow Disposal Site Design Criteria

#### 8.2.1 Introduction

Snow disposal sites provide storage areas for snowfall that exceeds the storage capacity of street ROW and other public facilities. The criteria established in this section are for snow disposal sites managed by the MOA, the DOT&PF, and private disposal sites.

Guidance for on-site private snow storage and ice control is included in a white paper in Appendix I. Contact PM&E for updated information.

**Objective:**

The objective of these design criteria is to provide project managers and site designers with information needed to site, design, and operate snow disposal sites that are safe, efficient, and protective of surface water and groundwater quality. Water quality concerns for melt water include chloride and other salts, suspended sediment, turbidity, and metals associated with sediment and turbidity.

Besides storing snow, snow disposal sites are designed to discharge melt water through a combination of infiltration and surface discharge. Siting criteria, design features, and operational procedures described in this section are all intended to manage the impacts of discharges on receiving waters and potable groundwater resources by using the three principles:

- A. Maximize appropriate infiltration,

- B. Minimize sediment and other pollutants in melt water, and
- C. Provide for pollutant dilution.

Codes and Review Process:

These siting, design, and operational criteria provide a framework for preparing plans for commission reviews or for approvals required under various portions of the AMC, as listed below. Note that the AMC is continually being revised; always refer to the most recent printed edition.

For all sites:

- A. AMC 21.15.015 - Public facility site plan review requires a review by the Planning and Zoning Commission of any snow disposal site.
- B. AMC 21.15.025 - Public facility project landscaping review by the Urban Design Commission is required for public facilities and land use permits.

In addition, for private and SOA sites:

- C. AMC 21.40.200.B.1 - Light industrial district lists snow disposal sites as a conditional use that requires an annual administrative permit.
- D. AMC 21.15.055 - Annual administrative permit establishes the annual administrative permit.
- E. AMC 21.15.030 - Approval of site plans and conditional uses outlines general requirements for site plan approval.
- F. AMC 21.50.270 - Conditional use standards - snow disposal sites outlines specific requirements for snow disposal sites. In particular, this section requires submitting a drainage and water quality plan and a dust and litter control plan.
- G. AMC 21.67 - Stormwater discharge establishes stormwater discharge restrictions and requires a system plan review.
- H. AMC 15.70.080 - Property line noise emission standards establishes noise standards.
- I. AMC 21.05.115 - Implementation - Anchorage Wetlands Management Plan establishes guidelines for managing wetlands.

## 8.2.2 Site Selection Criteria

Site selection criteria consider effects of on-site infiltration and effects of surface discharges on surface water including lakes, streams, and wetlands.

- A. Snow disposal sites are not permitted within 200 feet of a Class A or B well or within 150 feet of a Class C well (ADEC, Snow Disposal Area Siting Guidance 2007). For disposal sites that are located more than 200 feet and less than 1,000 feet up-gradient from a Class A or B well, or more than 150 feet and less than 1,000 feet up-gradient from a Class C well, perform an engineering evaluation of the potential impact of dissolved solids on groundwater.
- B. Snow disposal sites are not permitted within 500 feet up-gradient of an on-site sewage-disposal system.
- C. Avoid areas with high potential for contaminating potable water aquifers. The intent is to prevent

melt water with a high salt content from entering and contaminating these aquifers.

- D. Assess potential for such infiltration for both the site itself and for the complete flow path of the melt water. This site selection criterion shall be addressed by a Professional Engineer, hydrogeologist, or other professional experienced in Anchorage area surficial geology and in the hydrology and interaction of groundwater and surface water.
- E. Avoid areas with high potential for contaminating closed lake or wetland systems. Melt water from snow disposal sites shall not be discharged to closed basin surface water features that have few or no surface water outlets.
- F. Avoid sites that would discharge to streams with a base (winter) flow of less than three cfs. Minimum receiving water discharge is based on probable adequacy for assimilation of chloride releases from snow melt to achieve compliance with the EPA and SOA water quality criteria. PM&E can provide maps of streams, site-specific channel geometry, baseline stream chemistry, and estimates of stream base flow throughout the MOA.

On-site dilution of snow site melt water may be performed prior to discharge to meet treatment goals listed in Section 8.2.4 under the second subheading.

- G. Select sites that offer optimum opportunity for infiltration to shallow, non-potable groundwater systems. This site selection criterion is secondary to criteria protecting potable aquifers, wetlands, lakes, and streams.
- H. Avoid sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater. Additionally, in gravel pits there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.
- I. Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.
- J. Snow disposals sites should not be located in sections of parks or playgrounds that will be used for direct contact recreation after the snow season. Accidental ingestion of soils contaminated with metals can be detrimental to human health, especially in children. Areas in parks, such as parking lots, which are not used for public recreation, can serve as disposal sites.
- K. Avoid sites that would negatively impact wetlands. Melt water from snow disposal sites shall not be discharged to wetlands such that the discharge significantly reduces overall functionality (as catalogued in the Anchorage Wetlands Management Plan and its cited documents) of either the entire contiguous wetland feature or the impacted fraction alone.
- L. Research of stormwater impacts to Anchorage wetlands is continuing. Planners and designers should review the criteria and contact PM&E for site-specific and/or more current information.
- M. Select sites that offer optimum opportunity for slope and aspect orientation. Sites shall be selected that are generally suitable for constructing storage pads that are sloped down from south to north. Note that the aspect of sites need not be northerly, but sites should be amenable to constructing pads sloping generally from south to north.

### 8.2.3 Design Information

The following information is required for snow disposal site design:

Soil Investigation:

A soil investigation is performed to provide knowledge of the soil and potential problems with geotechnical concerns such as freeze/thaw effects, deep and shallow groundwater infiltration characteristics, and other constraints to site construction. Soils analyses shall conform to criteria in Chapter 1 Section 1.7 of the DCM.

A detailed soils report is required for determination of marginal conditions for site stability due to high groundwater, high infiltration rate, high potential for saturation, or erosion concerns.

Surveying and Mapping:

A map shall be created to document watercourses, stormwater features, and other criteria that may be affected by the site. Mapping shall include the following features:

- A. Site topography with two-foot or more detailed contour intervals;
- B. Existing roads, culverts, ditches, storm drains, and other drainage features;
- C. Location and depth of domestic wells and on-site sewage disposal systems within 500 feet of site boundaries;
- D. Surface water features within 500 feet of the site, including wetlands, creeks, and lakes;
- E. Ultimate receiving waters for melt water flows.

Groundwater Investigation:

A site-specific groundwater investigation shall be conducted to protect potable aquifer supplies and receiving waters. Site-specific groundwater levels (seasonal high and low), gradient, direction, uses of the local aquifer, and probable hydraulic connections to potable groundwater aquifers within a 1,000-foot radius shall be compiled or determined. The investigation shall also specifically address shallow non-potable groundwater systems that may be suitable for receiving infiltrated snow melt water from the disposal site.

### 8.2.4 Specific Design Criteria

In snow disposal site design, include a constructed pad for snow storage with separate area(s) for any other wastes to be stored at the site as well as design features for water retention and discharge. Manage discharged water to meet stated water quality objectives. These site-specific design criteria serve as the basis of the drainage and water quality plan required under AMC 21.50.270.

Snow Storage Pads (see Figures 8.2-1 and 8.2-2):

- A. Pad Orientation - Orient v-swale snow storage pads preferentially with the downslope (discharge) ends of swale axes to the north.
- B. Pad Design - Snow disposal shall take place on a compacted working surface composed of competent native material or select imported fill. Construct snow disposal pads to have single or

multiple v-swale cross-sections. A v-swale shall have a two percent side slope and a longitudinal slope of one to two percent. Each v-swale shall have a minimum width from crest to crest of 150 feet. Pads may be constructed of a single v-swale spanning the width of an entire site, or of a continuous series of v-swales. However, given the operational requirements of v-swales and the required side slopes, a series of minimum-sized v-swales may be generally preferable to one large swale.

- C. **Berm Design** - Berms shall be a minimum of three feet in height and generally placed continuously along the outer perimeter of the snow disposal site pad. Berms are constructed with competent native material or select imported fill. Construct berms to have 2:1 side slopes and a one-foot minimum crest width. Place armor and seepage protection as specified under the section on channel and berm armoring. It is not intended for snow to be placed against the berms and berms are intended to be free from the erosional forces of melt water flows.
- D. **Pad Vegetation** - Vegetate all unarmored snow storage pad surfaces. A vegetated surface is essential to properly operate a snow disposal site. Vegetation resists pad erosion, traps fine sediments mobilized in snow melt, and promotes absorption of metals and other pollutants. Select and design a vegetative mix that is resistant to seasonal shallow burial (one to two inches of loose sand fill annually) and to elevated concentrations of salt and metals. Recommended seeding specifications are provided in Appendix J.

When constructing pads, cat-track all v-swale side slopes immediately prior to revegetation. Cat-tracking consists of imprinting the ground surface with crawler tractor tread marks along the fall line (i.e., trafficking directly upslope and downslope).

- E. **Channel and Berm Armoring** - Armor all critical pad surfaces and flow channels, provide permanent and temporary setback markers, and accommodate for icing storage in select armored channels. Maintain the elevation of all armored surfaces slightly depressed below and feathered to the vegetated pad surfaces to assure flow of melt water onto and across armored surfaces and not parallel to it. All armor shall be at least six inches thick with all finished armored surfaces feathered to the finish grade of the vegetated pad. Size armoring material according to expected flow velocities (peak discharge of snow melt from snow disposal sites can be up to one cfs). See Section 6.8 of this manual for riprap sizing guidance. In particular, perform the following:
  - 1. Construct armored surfaces along the centerline of each v-swale; along the crests of all multiple, interior v-swales; along the toe of all perimeter and interior berms; along all discharge channels; and at all discharge points (see Figure 8.2-1).
  - 2. Armor from an elevation of one foot up from the toe of each berm and extending down the side of the berm and across the pad surface for a distance of 15 feet from the toe of the berm.
  - 3. Armor a 20-foot wide band in front of the toe of the end perimeter berm for the full width of the lower end of each v-swale.
  - 4. Armor both sides of the crest of each interior v-swale for a distance of ten feet from the top of the crest.
  - 5. Armor the central (longitudinal) channel of each v-swale to a minimum width of 15 feet.
  - 6. Immediately beneath the surface armor along the centerline of each v swale install a french drain one foot by one foot in cross section comprised of washed rock wrapped in geotextile

cloth. End each french drain structure at an outlet drain structure six feet wide by 12 feet long and 1.5 feet thick with one end of the outlet drain placed against the upstream face of the v-swale's outlet weir. The outlet drain shall be comprised of washed rock contained on the sides and bottom with geotextile cloth, with the top of the washed rock placed flush with the surface of the surrounding perimeter pad armoring.

7. Provide subdrain or other design elements along all discharge channels to accommodate decreased channel flow capacity lost to icing storage early in the melt season.
- F. Pad Outlet Weirs - To accommodate flow measurements and melt water sampling, construct rectangular outlet weirs or other device acceptable to PM&E at the end of each v-swale, or at each pad outlet point where multiple v-swales are served by a single discharge channel.
- G. Snow Poles - Set permanent snow poles as snow storage setback guides at a distance of ten feet from the toe of the end perimeter berm and five feet from the toe of all interior and lateral berms. Poles shall be at minimum 12 feet in height and marked with reflective tape along the top one foot. Where multiple v-swales are constructed, provide supports for temporary setback poles along the interior crests of all v-swales.

#### Melt Water Detention and Discharge:

Provide ponds for early season melt water detention and/or infiltration and for late season sedimentation. Specific design criteria for detention basins are included in Section 6.6. Supplementary criteria and criteria deserving emphasis are described below.

- A. Detention Pond Design - Detention pond design is based primarily on hydrologic characteristics of the melt water from snow sites and secondarily on sediment removal rates. Design the detention pond for minimum storage volume at the beginning of winter. Minimum storage volume in ponds above allotted sediment and ice/snow storage shall include all runoff from the March 23, 1974, snow melt hyetograph for a 40-hour duration (see Appendix D).

The pond treatment goal for sediment, as measured at the point of pond discharge, is 95 percent removal of all particle sizes greater than 100  $\mu\text{m}$  in diameter.

Storage volume goals for ponds above allotted sediment and ice/snow storage shall provide for dilution of melt water so that treatment goals for chloride are met.

Melt water properties for design purposes are:

1. Seven-day average concentration of 3,000 parts per million (ppm) chloride in one cfs of melt water.
2. 30-day average concentration of 1,000 ppm in 0.5 cfs of melt water.

Melt water properties are based on 1998-2001 winter street maintenance practices. Melt water properties could significantly change with changes to these Municipality-wide maintenance practices. Please contact PM&E for any changes to these design criteria.

Thresholds for chloride exposure recommended by the MOA are shown in Table 8.2-1. These values may change; check with PM&E for current chloride threshold values.



**Table 8.2-1: Recommended Thresholds for Chloride Exposure**

Exposure Duration	Fish and Invertebrates	Vegetation
Acute (less than 1 week)	3,600 mg/L	6,400 mg/L
Acute (up to 30 days)	1,200 mg/L	3,200 mg/L
Chronic (continuous)	300 mg/L	640 mg/L

- B. Outlets - Provide floating oil-absorptive booms guyed around all detention pond outlets. Provide cleanout access aprons at all inlets to detention ponds. Provide heavy maintenance vehicles access to all pond control structures. Provide for dispersion of all melt water discharge into wetlands and for flow energy dissipation at discharge points into lakes and streams. Design wetland dispersion structures to limit the size of wetland impact zones while assuring flows low enough to prevent erosion and extended, artificial ponding.

Waste Sediment Areas:

Provide separate storage areas with proper drainage and access for any waste sediment storage proposed for sites. Access to storage areas shall not require the traversing of any part of snow storage areas or their immediate access routes. Drainage from any sediment storage areas may be directed to snow site detention ponds but shall not be directed across any portion of snow storage pads.

## 8.2.5 General Design Criteria

General site design criteria, including lighting, noise control, parking, signage, landscaping, fencing, and traffic access, are specified in AMC 21.50.270 and in Chapters 3 and 5 of the DCM. Supplementary criteria are described below.

Traffic Access:

- A. Prohibit uncontrolled vehicular access to the site. A lockable gate shall be provided.
- B. Construct access driveway with a minimum width of 24 feet and a maximum width of 34 feet.

Lighting/Illumination:

- A. Consider installation of permanent lighting at all disposal sites anticipated to be operated while dark. Safety is the primary reason for lighting; lighting for disposal operations is a secondary concern.
- B. Strategically locate lighting at vehicular access points, retention basins, or other necessary areas. Provide a minimum of 0.3-foot candles at these locations. Pay particular attention to adjoining property users to meet glare requirements of AMC 21.45.080 Paragraph W.4.a. Additional information on lighting is provided in Chapter 5 of the DCM.

Landscaping:

The MOA Urban Design Commission must approve landscaping plans for snow disposal sites; Chapter 3 of the DCM provides guidelines. Supplementary criteria are described below.

- A. Ensure that landscaping on the outside of site berms and buffer areas provides year-round visual enhancement where possible. Plant woody vegetation away from equipment circulating and maneuvering areas.
- B. Provide vegetative ground cover for non-armored areas of snow disposal pads. Ground cover is necessary for proper functioning of pads. Select salt-tolerant plants and perform maintenance as necessary on an annual basis.
- C. Consider installation of an inexpensive irrigation system to be used at least during plant establishment periods.

Noise:

The facility design must address noise at adjacent and other affected properties per AMC 15.70.080.

## 8.2.6 Snow Disposal Operational Practices

Operations include managing litter, placing snow in winter, and maintaining vegetation in summer. Proper operation of snow disposal sites is essential to snow disposal site performance. Improper operations of snow disposal sites will result in increased pollutant release. In case of private sites, these considerations are incorporated into dust and litter control plan required under AMC 21.50.270.

Snow Placement (see Figure 8.2-1):

- A. Place snow across the full width of each v-swale. If multiple interior swales are used in a site design, fill must be placed across either the full width of all swales or across the complete width of one or more swales. Swales must not be filled across some fraction of their width or only on one side along their length. Non-conformance will increase turbidity in melt water.

As necessary, install and use temporary snow poles along interior swale crests. These poles help operators prevent partial filling of adjacent swales when operations call for filling just one interior swale.

Sequence the placement of hauled snow starting at the downhill side of the site and filling uphill (always across the full width of each swale cross section) to minimize erosion of dirt released from the snowpack during the latter stages of melt.

Place snow in a single fill layer over the entire available storage space before stacking snow on top of earlier fill. Thicker snow masses substantially increase initial leached chloride concentrations.

Maintain snow fill in as compact a mass as possible; never place snow as isolated and separate piles. Place snow such that sides are as steep and close to vertical as possible. Compact, steep-sided snow fills reduce release of sediment from the sides of the snow fill where mobilization of these sediments readily occurs.

- B. Maintain a snow fill setback from all berms. Maintain a ten-foot setback from the end of v-swales

and a five-foot setback from all side berms. Snow fill should be placed to overlap armor adjacent to the berms but not extend past setback markers.

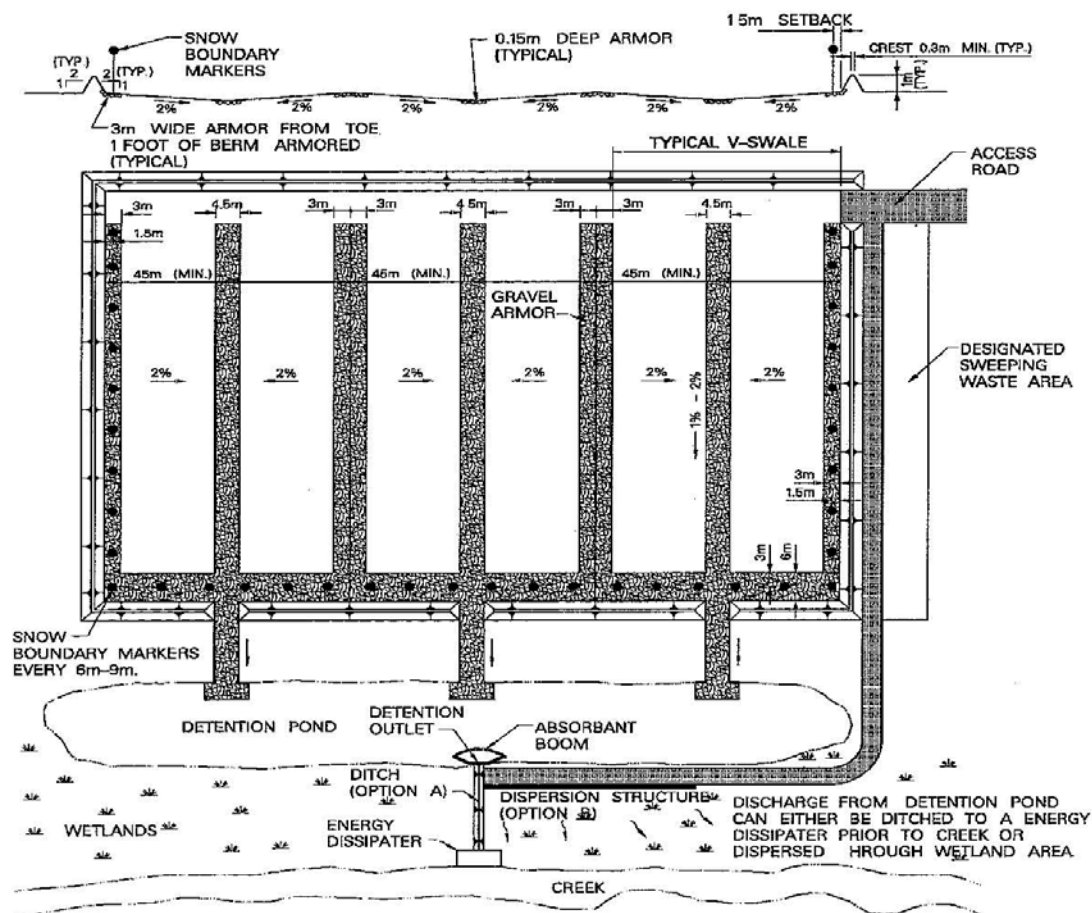
### Vegetation:

Maintain vegetation of all non-armored pad surfaces. With proper initial application of an appropriate seed mix, very little attention should be required to promote seasonal growth of vegetation across the surface of snow storage pads. Little or no mowing should be required. However, regrading of sites shall be absolutely prohibited or limited to maintaining the functionality of the site, particularly in the late melt season. Confine access to pads or to control structures to traffic along armored features.

### Materials Storage:

Materials storage practices must incorporate techniques to manage sediment transport from snow storage facilities for on-going pollutant control. Sediment management practices may incorporate techniques presented in Chapters 8 and 6 of this document or may utilize other generally accepted source control practices. At a minimum, management practices must ensure that 1) snow is not placed or stored over sediment that is left after snow piles have melted; and 2) snow is not placed or stored over other materials stored on the site or left behind from other uses. Use of the facility for activities other than snow storage shall not compromise the performance of snow storage controls.

**Figure 8.2-1: Multiple V-Swale Snow Site Design Concept**



**Figure 8.2-2: Snow Site Fill Procedure**