Department of Community Planning & Economic Development
250 South 4th Street, Room 300
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MEMORANDUM

TO: City Planning Commission, Committee of the Whole

FROM: Shanna Sether, Senior City Planner, (612) 673-2307

DATE: September 1, 2016

SUBJECT: Snow Storage Site Zoning Code Text Amendment

BACKGROUND

Council Member Reich has introduced subject matter on October 23, 2015, to amend ordinances related to *Snow Storage* to create zoning code standards for situations where snow is moved from an off-site location and stored on public or private property.

PEER CITY RESEARCH

Staff conducted peer city research to determine what types of ordinances exist for regulating on- and off-site impacts related to snow storage. Staff has found snow disposal site design criteria from Anchorage, Alaska, and best management practices from the Tahoe Regional Planning Agency, which are attached to this report. In addition, staff has completed a table with several United States and cities and Canadian providences and cities with regulations on characteristics for snow storage sites and best management practices.

APPLICABLE POLICIES

Staff has identified the following applicable policies that support an amendment to the Snow Storage Site land use in the zoning code:

Urban Design Policy 10.23 Promote climate-sensitive design principles to make the winter environment safe, comfortable and enjoyable.

10.23.1 Consider solar access, shelter from wind and snow storage and removal in site design.

10.23.4 Encourage snow removal and storage practices that promote pedestrian and bicycle activity and safety.

10.23.7 Consider topography and site grading so that snowmelt is directed away from roads and pedestrian areas to avoid icy conditions and from basements to avoid snowmelt infiltration.

10.23.8 Develop guidance that encourages climate-sensitive design for residential and commercial buildings, parking lots, and open spaces and parks.

Urban Design Policy 10.19: Landscaping is encouraged in order to complement the scale of the site and its surroundings, enhance the built environment, create and define

public and private spaces, buffer and screen, incorporate crime prevention principles, and provide shade, aesthetic appeal, and environmental benefits.

10.19.1 In general, larger, well-placed, contiguous planting areas that create and define public and private spaces shall be preferred to smaller, disconnected areas.

10.19.2 Plant and tree types should complement the surrounding area and should include a variety of species throughout the site that include seasonal interest. Species should be indigenous or proven adaptable to the local climate and should not be invasive on native species.

10.19.3 Landscaped areas should include plant and tree types that address ecological function, including the interception and filtration of stormwater, reduction of the urban heat island effect, and preservation and restoration of natural amenities.

10.19.4 Landscaped areas should be maintained in accordance with Crime Prevention Through Environmental Design (CPTED) principles, to allow views into and out of the site, to preserve view corridors and to maintain sight lines at vehicular and pedestrian intersections.

10.19.5 Landscaping plans should be designed to facilitate future maintenance including the consideration of irrigation systems, drought and salt-resistant species, ongoing performance of storm water treatment practices, snow storage, access to sun, proximity to buildings, paved surfaces and overhead utilities.

10.19.6 Green roofs, living walls, and porous pavement are encouraged but are not meant to be a substitute for ground-level landscaping of sites as landscaping provides both a natural amenity and aesthetic beauty to the urban landscape.

10.19.7 Boulevard landscaping and improvements, in accordance with applicable city polices, are encouraged.

Environment Policy 6.11: Take measures to reduce noise pollution at point and non-point sources.

6.11.1 Work with other governmental units, owners and developers to identify and implement ways to buffer and reduce noise originating from businesses, industries, railroads and rail corridors, freeways and highways, and airports.

6.11.3 Seek stricter enforcement of noise standards for businesses, vehicles (especially motorcycles, trucks and buses), small engines (leaf blowers, lawnmowers, snow blowers and chain saws) and sound systems.

PROPOSED TEXT AMENDMENT

Snow storage is presently addressed as a site plan review standard in Chapter 541 Off-Street Parking Loading, in the zoning code. Specifically, 541.380 states that required parking spaces, driveways, access aisles and landscaping shall not be used for the purpose of snow storage. However, there are no existing land uses that specifically identify or include snow storage as a *principal use* of a property. Staff is aware of existing properties that utilize snow storage as a principal use, which are otherwise vacant when not storing snow. Zoning Enforcement staff has observed off-site impacts including flooding and water collection in the public right of way, sediment carried off-site, trash and litter on- and off-site. Therefore, staff has proposed a definition of the use, identified appropriate zoning classifications where the use would be allowed permitted, as right, and several specific development standards to allow regulations that address the unique characteristics of the land use. CPED staff is seeking feedback on the draft proposal in advance of the public hearing that will take place for this amendment.

ATTACHMENTS

1. Proposed zoning code text changes
2. Tahoe Regional Planning Agency's Best Management Practices Toolkit
3. Anchorage, Alaska's site design criteria for snow disposal sites
4. Peer city research table

520.160 Definitions.

Unless otherwise expressly stated, or unless the context clearly indicates a different meaning, the words and phrases in the following list of definitions shall, for the purposes of this zoning ordinance, have the meanings indicated. Additional definitions may be found within specific chapters of this zoning ordinance. All words and phrases not defined shall have their common meaning.

Snow storage site. A use in which a principal activity is the storage of snow, transported from an off-site location.

536.20. - Specific development standards.

The uses listed below are subject to the following specific development standards, in addition to all other applicable regulations:

Snow storage site. Snow storage shall be located at least three hundred fifty (350) feet from any residence or office residence zoning district. All snow storage sites shall provide the following information:
(1) A vicinity plan that includes the following:
a. A description of natural features, including streams, rivers, lakes, wetlands and major topographical features located within three hundred fifty (350) feet of the site.
b. A description of any potential environmental hazard due to existing or proposed land uses, including soil and water contamination.
(2) Drainage and grading plans for stormwater management and runoff.
(3) A landscape plan showing compliance with the requirements of section 530.170 – Parking and loading landscaping and screening.
(4) A traffic plan describing the number of truck trips the proposal will generate and the principal access routes to the site, including a description of the use's traffic impact on the surrounding area.
(5) The premises, all adjacent streets, sidewalks and alleys, and all sidewalks and alleys within one hundred (100) feet shall be inspected regularly for purposes of removing any litter found thereon.

Table 541-1 Specific Off-Street Parking Requirements

Use	Minimum Parking Requirement	Maximum Parking Allowed	Notes (see 541.170)
INDUSTRIAL USES			
Specific Industrial Uses			
Snow storage site	None	None	1 The minimum requirement of 4 spaces shall not apply

Table 541-9 Specific Off-Street Loading Requirements

Use	**Minimum Loading Requirement**
INDUSTRIAL USES	
Specific Industrial Uses	
Snow storage site	None

Table 550-1 Principal Uses in the Industrial Districts

Use	I1	I2	I3	Specific Development Standards
INDUSTRIAL USES				
Specific Industrial Uses				
Snow storage site		C	C	✓

4.2-c SNOW STORAGE

BMP DESIGN APPROACH
■ Pollutant Source Control
■ Hydrologic Source Control
□ Stormwater Treatment
SCALE OF APPLICATION
■ All SFR and MFR < 1 acre
■ MFR 1-5 Acre and CICU < 5 acres
■ MFR and CICU > 5 acres and all WQIPs
BMP TYPE
□ Temporary
■ Permanent

DESCRIPTION

Snow is removed from streets, roadways, and parking areas to ensure public safety and to accommodate transportation. Plowed snow can contain pollutants such as salt, sand, oil, grease, heavy metals, and trash, which can accumulate in the area where the snow is stored and can be released when the snow melts.

In the Lake Tahoe Region snow storage practices vary dependent upon land use conditions: 1) in residential areas snow is plowed from roads onto road shoulders, and from driveways to pervious areas adjacent to driveways; 2) in commercial areas snow is commonly plowed to the corners of a parking lot; and 3) in the most densely developed areas (e.g., Lake Tahoe Boulevard in the City of South Lake Tahoe), snow is removed and stored at an off-site location. The guidance provided for this BMP primarily targets appropriate snow storage practices for commercial areas and densely developed areas.

This snow storage area is ideal because it is on a paved surface, upslope of drainage BMPs and the sign clearly indicates the area is dedicated for snow storage.

APPLICABILITY

- Appropriate snow storage practices are necessary for all properties and facilities where snow is plowed and stored.
- Snow should not be stored within a Stream Environment Zone (SEZ) or an SEZ setback.
- Snow should not be stored in stormwater treatment BMPs. Exceptions may be temporarily granted by the permitting authority on a case-by-case basis for dry basins or infiltration basins installed as part of a BMP Retrofit with severe space constraints. Refer to Design and Installation Considerations below for more details.

- Snow should not be stored within BMPs defined in this Handbook as a Wet Basin or a Media Filter.
- Snow may be stored above a vegetated Filter Strip as defined in this Handbook.

Advantages

- If properly sited and designed, snow storage practices can prevent the surface discharge of poor quality melt water.
- Regional snow storage facilities, where applicable, provide locations where pollutants in plowed/hauled snow can be directed through large scale stormwater treatment BMPs.

Disadvantages

- Requires designated locations for snow storage that may take up parking or other useful space.
- Can damage landscaping and vegetation.

DESIGN AND INSTALLATION CONSIDERATIONS

- Snow storage areas should be sited and designed to minimize pollutant and runoff impacts.
- Size the area designated for snow storage to accommodate the expected volume of snow. As a rule of thumb, size snow storage areas to be roughly 20 percent of the plowed area.
- Do not locate snow storage areas on top of drain inlets.
- Snow storage within dry basins and infiltration basins may be acceptable if the following conditions are met:
  - Drainage design standards for the responsible jurisdiction allow the practice.
  - The limits of snow storage within the basin are clearly designated and do not encroach on the inlet and outlet structures of the basin.
  - Basin capacity has been increased to accommodate expected snow storage amounts in addition to the design storm (typically the 20-yr/1-hr storm). The basin must retain the capacity to hold the design storm at all times during snow storage operations.
  - Stabilized access for snowplowing equipment is provided.
  - Maintenance is conducted annually after spring snowmelt to remove material and debris from the basin, rehabilitate the infiltration capacity of the basin, and to confirm conveyance facilities are functional.
- Clearly identify the boundaries of the snow storage area to be visible under winter conditions.
- Site pervious snow storage areas so that plowing and snowmelt will cause the least disturbance to soils and vegetation. Avoid siting snow storage on compacted or poorly draining soils.
- When storing snow in close proximity to an SEZ setback or other sensitive areas, construct a berm around the perimeter of the snow storage area to contain the

snowmelt. Alternatively, construct a vegetated filter strip between the SEZ setback and the snow storage area.

- For snow that may contain elevated levels of pollutants (e.g., commercial parking lots or roads), site snow storage on an impervious surface that drains to a stormwater treatment BMP described in this Handbook.
- If an appropriate on-site snow storage area cannot be sited or designed, make arrangements for removal of snow and off-site storage.
- When storing snow in landscaped areas, plant with native and adapted species tolerant of snow storage (perennials that die back annually and shrubs/trees that can bend with weight, but not break).
- Employ concave landscaped areas rather than mounded landscapes for snow storage.
- Locate snow storage areas to maximize solar exposure and away from primary roadways to the greatest extent feasible.

Snow shall not be stored in the shorezone where polluted snowmelt can go directly into Lake Tahoe.

- For unpaved snow storage areas where snowplowing equipment will operate, the snow storage area should be covered with gravel or plowed to maintain 12 inches of packed snow to reduce soil disturbance and soil compaction.
- Site basins outside of the jurisdictional snow storage ROWs – usually 15-20 feet off of roadway.

INSPECTION AND MAINTENANCE

- Before and after winter, clean the designated snow storage area of accumulated sand, trash, and debris, and inspect any associated drainage outlets or conveyance facilities for damage or erosion.

- Before and after winter, repair any damage or erosion that may have occurred to the snow storage area from snow removal equipment or other snow storage activities.

EFFECTIVENESS CONSIDERATIONS

When properly sited, designed, and maintained, snow storage areas can significantly reduce the discharge of poor quality melt water to receiving waters and other sensitive areas.

Section 2.150 SNOW DISPOSAL SITE DESIGN CRITERIA

2.150 A. Introduction

Snow disposal sites provide storage areas for snowfall that exceeds the storage capacity of street rights-of-way and other public facilities. The criteria established in this section are for snow disposal sites managed by MOA, the State of Alaska and as well as large, private disposal sites operating under conditional use permits.

1. Objective

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

Besides storing snow, snow disposal sites are designed to discharge meltwater 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 by these three principals:

- maximize infiltration,
- minimize sediment and other pollutants in meltwater
- provide for pollutant dilution.

2. Codes and Review Process

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

For all sites:

- AMC Section 21.15.015 - Public facility site review requires a review by the planning and zoning commission of any snow disposal site.
- AMC Section 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 state sites:

- AMC Section 21.40.200.B.1. - I-1 Light Industrial District, lists snow disposal sites as a conditional use that requires an annual administrative permit.
- AMC Section 21.15.055 - Annual administrative permit establishes the annual administrative permit.
- AMC 21.15.030 - Approval of site plans and conditional uses outlines general requirements for site plan approval.

- 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.
- AMC 21.67 – Stormwater discharge establishes stormwater discharge restrictions and requires a system plan review.
- AMC 15.70.080 - Property line noise emission standards establishes noise standards.
- AMC 21.05.115 – Implementation – Anchorage Wetlands Management Plan establishes guidelines for managing wetlands.

2.150 B. 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.

1. Snow disposal sites are not permitted within 200 feet of a Class A or B well or within 100 feet of a Class C well [18 Alaska Administrative Code 80.020, Table A]. For disposal sites that are located more than 200 feet and less than 1,000 feet upgradient from a Class A or B well, or more than 100 feet and less than 1,000 feet upgradient from a Class C well, perform an engineering evaluation of the potential impact of dissolved solids on ground water.
2. Snow disposal sites are not permitted within 500 feet upgradient of an on-site sewage disposal system.
3. Avoid areas with high potential for contaminating potable water aquifers. The intent is to prevent meltwater having a high salt content from entering and contaminating these aquifers.

   Assess potential for such infiltration for both the site itself and for the complete flow path of the meltwater. Anchorage's surface geology is typically quite complex and locally highly variable over short distances. This siting criterion should be addressed by a hydrogeologist experienced in Anchorage area surficial geology, and in the hydrology and interaction of ground water and surface water.
4. Avoid areas with high potential for contaminating "closed" lake or wetland systems.

   The intent is to prevent salt buildup in these types of surface water features, where dilution can not mitigate this effect. Meltwater from snow disposal sites should not be discharged to "closed" basin surface water features that have little or no surface water outlet.
5. Avoid sites that would discharge to streams with a base (winter) flow of less than 3 cubic feet per second (cfs). The minimum receiving water discharge is based on probable adequacy for assimilation of chloride releases from snowmelt to achieve compliance with EPA water quality criteria. MOA PM&E can provide maps of streams, site-specific channel geometry, baseline stream chemistry, and estimates of stream baseflow throughout the municipality.

   On-site dilution of snow site meltwater may be performed prior to discharge to meet treatment goals (listed in 2.150 D.2).

6. Select sites that offer optimum opportunity for infiltration to shallow, non-potable ground water systems.

   The intent is to provide the maximum opportunity for diluting salt (chloride) in shallow ground waters, thus minimizing the scale of site detention and dilution facilities that might otherwise be required. This siting criterion is secondary to criteria protecting potable aquifers, wetlands, lakes, and streams.

7. Avoid sites that would negatively impact wetlands. Meltwater from snow disposal sites should 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.

   The intent is to ensure that meltwater quality and discharge volume is managed to support an acceptable long-term threshold functionality of the receiving wetland, while allowing some adjustment in species composition in a small fraction of the wetland. Research of storm water impacts to Anchorage wetlands is continuing. Planners and designers should view the criteria as preliminary guidance and contact MOA PM&E for site-specific and/or more current information.

8. Select sites that offer optimum opportunity for slope and aspect orientation. Sites should be selected that are generally suitable for constructing storage pads that are sloped down from south to north.

   The intent is to provide optimum opportunity for conformance with site design and operation criteria. Note that the aspect of the site need not be northerly, but the site should be amenable to constructing a pad sloping generally from south to north.

2.150 C. Design Information

The following information is required for snow disposal site design:

1. Soil Investigation

   A soil investigation is performed to provide knowledge of the soil and potential problems with geotechnical concerns such as freeze/thaw effects and other constraints to site construction. Soils analysis shall conform to information criteria in Chapter 1 of this Design Criteria Manual.

   A detailed soils report is required if the site is suspected of marginal conditions for site stability due to high ground water, high potential for saturation or erosion concerns.

2. Surveying and Mapping

   A map shall be formed to document watercourses, storm water features and other criteria that may be affected by the site. Mapping should include the following features:

   - Site topography with 2-foot 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

3. Groundwater Investigation

   A site-specific ground water investigation is conducted to protect potable aquifer supplies and receiving waters. Site-specific ground water level (seasonal high and low), gradient, direction, and the uses of the local aquifer should be compiled or determined.

2.150 D. Specific Design Criteria

In the snow disposal site design, include a constructed pad for snow storage, separate area(s) for wastes, and 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.

1. Snow Storage Pads – See Figure 2-26.

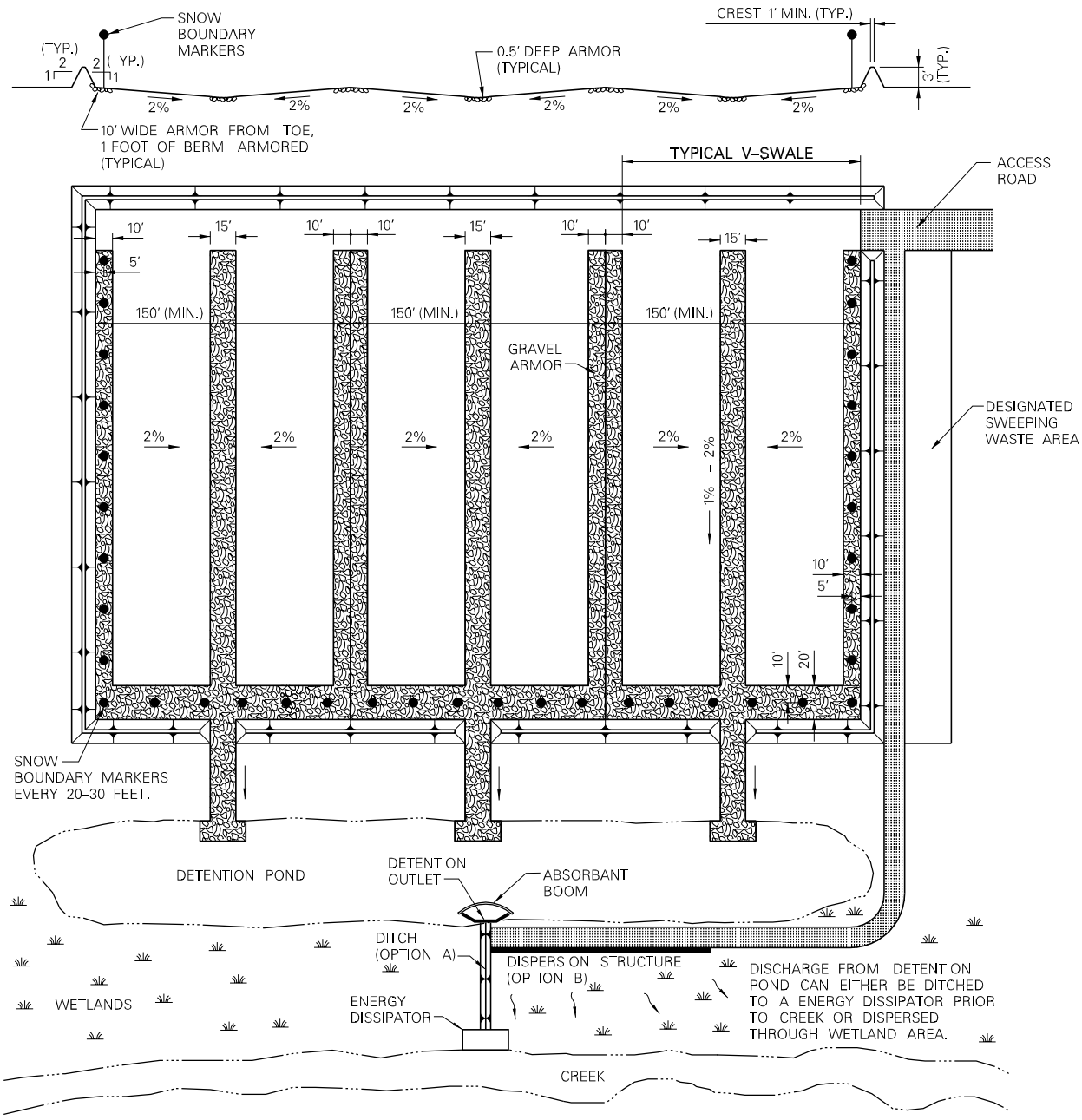
   a. Pad Design. Snow disposal should take place on an engineered working surface composed of competent native material or select imported fill. Construct snow disposal pads to have single or multiple "V"-swale cross-sections. A "V"-swale shall have a 2 percent side slope and a longitudinal slope of 1 to 2 percent. Each "V"-swale shall have a minimum width from crest to crest of 150 feet (45 meters). 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 slope, a series of minimum-sized "V"-swales may be generally preferable to one large swale.

      The intent of "V"-swales is to maintain movement of meltwater inside the snow pack away from fine sediments generated on top of and adjacent to the pack. This minimizes contact of flowing water with easily eroded sediments and reduces turbidity released from the site. Properly operated and constructed "V"-swale snow disposal pads are anticipated to limit turbidity at pad discharge points to a seasonal average of about 50 nephelometric turbidity units (NTU).

   b. Pad Orientation. Orient V-swale snow storage pads preferentially with the downslope (discharge) end of the swale axis to the north.

      The intent is to promote melt of the snow pack (due to a more favorable aspect and proper site operation) to progress preferentially from the uphill side of the stored snow towards the downhill (discharge) side. Promoting this melt progression minimizes exposure of loose sediment to flowing meltwater.

   c. 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 snowmelt, and promote absorption of metals and other pollutants. Select and design a vegetative mix that is resistant to seasonal shallow burial [1 to 2 inches (2 to 5 cm) of loose sand fill annually] and to elevated salt and metals soil concentrations.



MULTIPLE V- SWALE SNOW SITE DESIGN CONCEPT

FIGURE 2-26

When constructing the pads, “trackwalk” all “V”-swale side slopes immediately prior to their vegetation. Trackwalking consists of imprinting the ground surface with crawler tractor tread marks along the fall line (i.e., trafficking directly up-slope and downslope).

d. 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. In particular: perform the following:

- 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 (Figure 2-26).
- Armor from an elevation of 1 foot (0.3 meters) up from the toe of each berm and extending down the side of the berm and across the pad surface for a distance of 10 feet (3 meters) from the toe of the berm. Armor the central (longitudinal) channel of each “V”-swale to a minimum width of 15 feet (4.5 meters).
- Armor both sides of the crest of each interior “V”-swale for a distance of 10 feet (3 meters) from the top of the crest.
- Armor a 20-foot (6-meter) wide band in front of the toe of the end perimeter berm for the full width of the lower end of each “V”-swale.
- Armor shall be at least four inches (10 centimeters) thick.

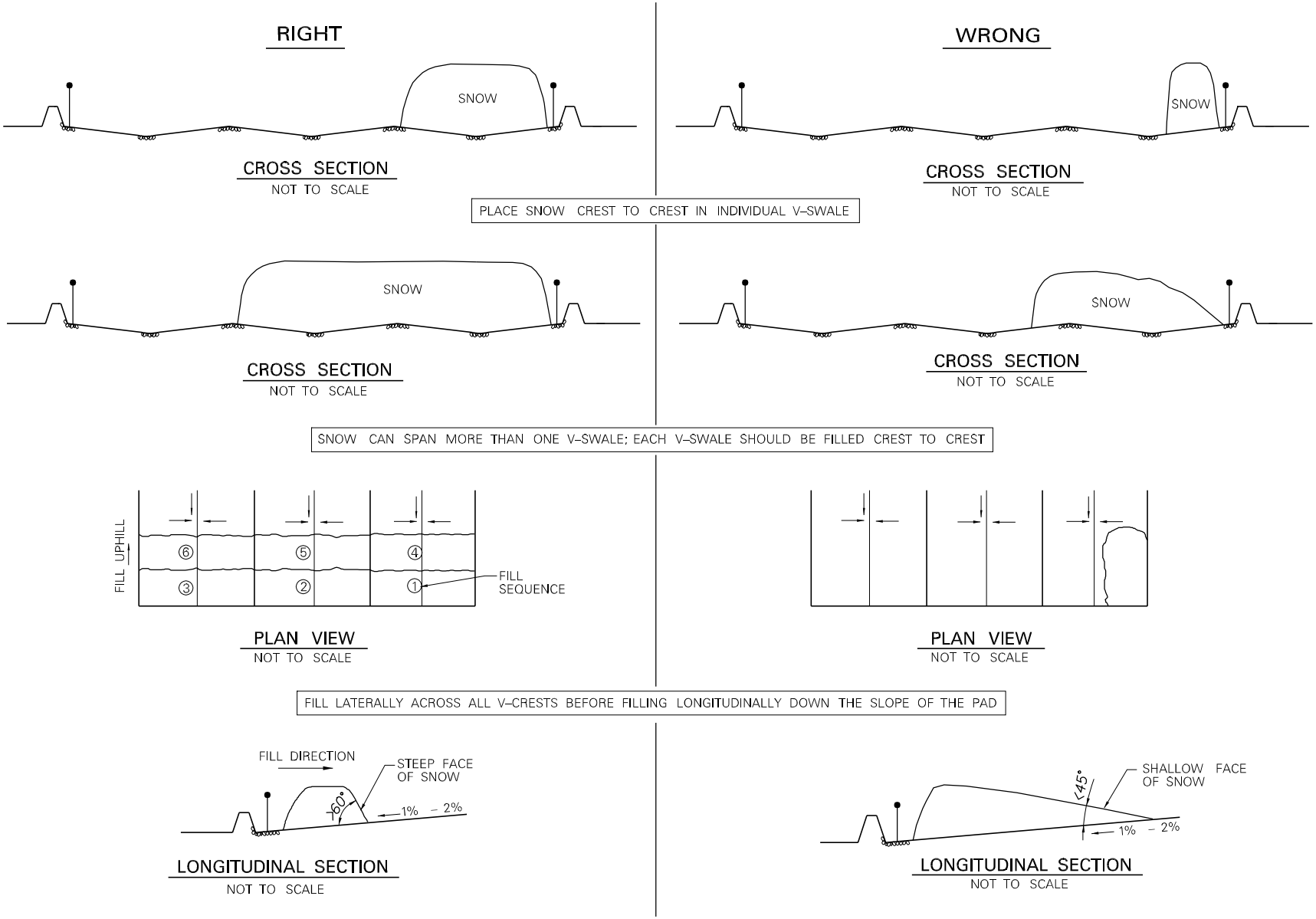
Maintain the elevation of all armored surfaces slightly depressed below the vegetated pad surfaces to assure flow of meltwater onto and through the armored surface and not parallel to it. Size armoring material according to expected flow velocities and Figure 2-17. Peak discharge of snowmelt from snow disposal sites can be up to 1 cfs.

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.

e. Mark limits of snow storage area. Provide permanent snow poles as snow storage setback guides at a distance of 10 feet (3 meters) from the toe of the end perimeter berm and 5 feet (1.5 meters) from the toe of all interior and lateral berms. Where multiple “V”-swales are constructed, provide supports for temporary setback poles along the interior crests of all “V”-swales.

2. Meltwater Detention and Discharge

Provide dry ponds for early season meltwater detention and/or infiltration and for late season sedimentation. Specific design criteria for detention basins are included in Section 2.100. Supplementary criteria and criteria deserving emphasis are described below.



SNOW SITE FILL PROCEDURE

FIGURE 2–27

a. Detention Pond Design. Detention pond design is primarily based on hydrologic characteristics of the meltwater from snow sites and secondarily sedimentary removal rates. Design for minimum storage volume at the beginning of the winter. Minimum storage volume in the pond above the allotted sediment and ice/snow storage shall include all runoff from the March 23, 1974, snowmelt hyetograph for a 40-hour duration (Figure 2-13).

   Storage volume goals for the pond above the allotted sediment and ice/snow storage shall provide for dilution of meltwater so that treatment goals for chloride are met.

   Meltwater properties for design purposes are:

   - 1-hour concentration of 8,000-ppm in 1 cfs of meltwater
   - 4-day average concentration of 6,000-ppm chloride in 1 cfs of meltwater
   - 30-day average concentration of 1,000-ppm in 0.5 cfs of meltwater

   Treatment goals for chloride (based on EPA recommendations), as measured at the end of any allowable stream mixing zones, include the following: (1) a 4-day average concentration of <230 parts per million (ppm) exceeded less than once in 3 years, and (2) a 1-hour average concentration of <860 ppm exceeded less than once in 3 years.

   The treatment goal for chloride as measured at the point of site discharge into wetlands is a 30-day average concentration of <3,200 ppm to maintain wetland functionality and minimum impact zones.

   The intent is to ensure that meltwater quality and discharge is maintained to support an acceptable long-term threshold functionality of the entire receiving wetland while allowing some local species change and adjustment in a small fraction of the wetland. These values may change; check with MOA PM&E for current chloride threshold values.

   The pond treatment goal for sediment, as measured at the point of pond discharge, is 95 percent removal of all particle sizes $\geq$100μ (0.1mm) in diameter.

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 meltwater discharge into wetlands and for flow energy dissipation at discharge points into lakes and streams. Design wetland dispersion structures to limit the size of the wetland impact zone while assuring flows low enough to prevent erosion and extended, artificial ponding.

3. Waste Sediment Areas

   Provide a separate storage area with proper drainage and access for any waste sediment storage proposed for the site. Access to the storage area should not require traverse of any part of the snow storage area or its immediate access routes. Drainage from any sediment storage areas may be directed to the snow site detention pond but should not be directed across any portion of the snow storage pad.

2.150 E. 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 this Design Criteria Manual. Supplementary criteria are described below.

1. Traffic Access

   a. Prohibit uncontrolled vehicular access to the site. A lockable gate should be provided.
   b. Construct access driveway with a minimum width of 24 feet and a maximum width of 34 feet.
   c. If site access is from a paved road, pave the approach at least 450 feet into the site. The maximum grade is 8 percent. Approach centerline radii shall be 40 feet and match the off-site access road.

2. Lighting/Illumination

   a. Install 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 locutions. Give particular attention to adjoining property users to avoid stray lighting annoyances. Additional information on lighting is provided in Chapter 5 of this Design Criteria Manual.

3. Landscaping

The urban design commission must approve the landscaping plan for snow disposal sites; Chapter 3 of this Design Criteria Manual provides guidelines. Supplementary criteria are described below.

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

2.150 F Operational Considerations

Operations include managing litter, placing snow in winter, and maintaining vegetation in summer. While not part of design criteria, operational considerations are essential to the

objectives of snow disposal site performance. In the case of private sites, these considerations are incorporated into the dust and litter control plan required under AMC 21.50.270.

1. Snow placement (see Figure 2-27).

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

      Supports to allow use of temporary setback staking along interior swale crests can help operators prevent partial filling of adjacent swales when operations call for filling just one interior swale.

      Sequence 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 the dirt released from the snow pack during the latter stages of melt.

      Maintain the snow fill in as compact and thick a mass as possible. This will reduce the footprint of the residual dirt when it is finally released from the snowmass to the pad, and therefore substantially reduce the total mass of sediment mobilized by the final meltwater flows.

   b. Maintain a snow fill setback from all berms. Maintain a 10-foot setback from the end of a "V"-swale and a 5-foot setback from all side berms. Snow fill should overlap the armor placed along berms but should not extend past setback markers.

2. 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 the snow storage pad. Little or no mowing should be required. However, trafficking and regrading of the site should be absolutely minimized, particularly in the late melt season. Confine access to the pad or to control structures to trafficking along armored features.

3. Maintain all materials storage, including waste sediment, separate from the snow storage pad. No temporary storage of any sort should be allowed on the pad surface. No trafficking should be allowed during the melt season and access should be restricted throughout the year.

	Planning for Snow Management	Disposal Site Selection	Disposal Site Characteristics	Disposal Site Preperation and Maintenance
Alaska	Develop plowing and removal/redistribuatio n plans; determine snow capactiy; map surface water drainage systems and proximity to sensitive water bodies; identify structures (berms, settling basins or ponds, that are in place to control or handle snowmelt runoff;	Estimate how much snow disposal capacity is needed for the season --> number of sites to be selected and prepared; identify sites that could potentially be used (community or municipal open space) determining soils, slopes, flow patterns, receiving waters; prioritize the idenfied site with teh least envronmental impact, consider acquisition of sites to be dedicated to snow storage - preferable to have permanant sites solely for snow disposal. Permanant sites can be engineered to minimize environmental impacts and may be less csotly than a numver of temporary sites.	Locate on or adjacent to pervious surfaces, upland, away from water reousrces (filter soil, leave sand and debris for removal in spring); flat slope, outside of the floodplain and well above the groundwater table; choose sites with well-drained soil to allow filtration, adsorption and microbial activity; Avoid dumping of snow into any ice covered or open waterbody, if near water, use a vegetated buffer, avoiud areas near groundwater for drinking water; avoid sanitary landfills and gravel pits; avoid top of storm drain catch basins or storm water drainage swales or ditches - the combo of sand and debris can block these systems, causing flooding; avoid parks/playgrounds used for direct contact recreation after the snow season - high incidence of metals.	Maintenance measures to reduce water quality impacts of meltwater on surface and groundwaters and reduce the amount of meltwater leaving the site: silt fence, earthen berm or equivalent barrier, placed securley on the downgradient side of the snow disposal site, these types of structures can be used to direct meltwater and surface runoff to settling ponds or detention basins and minimize possible seepage of contaminents into groundwater, if earthen berms or channels are used to contain or direct the flow of meltwater they should be stabilized to prefent soil erosion during high flows; Use a vegetative buffer strip to filter pollutants out of the meltwaster, these should be maintained during the growth season, between the disposal siate and adjacent waterbodies or storm drains that discharge surface water. Debris/litter should be cleared from the site and properly disposed prior to and at the end of the snow season. Restore the soil, if needed; regrade if channelization from snowmelt or flowing water has occured; reseed with appropriate vegetation. Monitor the quality of snowmelt and the receiving water, especially if it is likely to infiltrate the groundwater.

Alberta, CA	Find a permanent site large enough to accommodate the annual snow accumulation.	Avoid landfills, agricultural land, determine the locaiton, depth and nature of groundwater acquifers, locate below ground or above ground utilities; not in recreation areas due to high levels of metals and salts; waterbody setback of 200 meters (over 200 m with a gradient of 15% or more).	Consider noise impacts - 350 meters from existing or planned residential housing; sufficient storage capacity or adequate drainage from the site to prevent flooding of adjacent lands and where drainage systems are not obstructed; sites should maximize sun exposure during the midday;	Containment structures, settling ponds, grading, release of meltwater, site base, security
Anchorage	Soil investigation, surveying and mapping, groundwater investigation	200 feet from a Class A or B or within 100 feet of a Class C well; greater setbacks of sites with a slope towards a waterbody; avoid areas where aquifers could experience contamination; avoid closed lake or wetland systems; avoid areas where infitration is near shallow, non-potable ground water systems;	Traffic access; lighting and illumination; landscaping; operational (snow placement, maintain vegetation on non-armored pad surfaces, maintain all materials storage, separate from snow storage pad); maximize infiltration, minimize sediment and other pollutants in meltwater and provide for pollutant dilution	Pad design - engineered work surface, pad orientation, pad vegetation, channel and berm armoring, meltwater detention and discharge, detention pond design, outlets, waste sediment areas,
Connecticut	Follow procedures; when extradinary winter conditions present, the commissioner may relax provisions - with notification.	Upland areas only - away from freshwater or tidal wetlands, away from the top of storm drain catch basins, away from storm drainage swales, away from stream or river banks, away from drinking water supplies	Upland sotrage and dipsosal - athletic fields, parks and other flat, open-field sites; saltwater bodies, before freshwater bodies; no storage in or near wetlands or similar; avoid shoreline or steam bank damage or erosion	snow must not be visibly contaminated except from salt and sand from road clearing

Massachusetts	Use maps from MassGIS to show publicly owned open spaces, approximate locations of sensitive environmental resources.	Avoid dumping snow into any waterbody. Do not dump snow within a Zone II or Interim Wellhead Protection Area or within 75 feet of a well. Avoid dumping snow into sanitary landfills and gravel pits. Avoid snow on top of storm drain catch basins, stormwater drainage swales or ditches.	Things to consider: noise (tailgates, jake brakes, heavy equipment and backup alarms), sufficient lighting (lighting towers and heavy equipment lights), location (next to stream or pond, sufficient space for different types of trcusk and turning radius), accessibility (roads leading to site - arterials/collectors, haul routes - day and night) and environmental regulations (run-off, drainage, testing for heavy metals, oil, conductivity, temperature and pH, barriers for run-off on the down gradient edge of the snow dump site).	Clean up your site from trash, litter, etc. and check vegetation for damage
Quebec City, CA	Have 14 dump sites; 7.2M cubic yards with a capacity of 12.7M cubic yards. 49% of city is contracted, 51% is handled by the city, snow removal budget $59M,	Primary considerations: distance from operations, location (industrial zone, access to highways), capacity (volume of snow, number of truckloads/hour), noise in residential neighborhoods, surface water and groundwater protection. For emergency sites - used a paved surface, make sure the surface water from the site will slow to a sewage system for treatment.	Parcel should be rectangular, with site drainage to allow for a peripheral ditch and meltwater directed to a decantation basin with an oil and greese separator. The size of the decantation basin should be based on the volume of water generated on the site by a heavy rainfall combined with snow melt in one hour, may need waterproof basin depending on soils and groundwater, elongated basins are more efficient.	To prevent avalanches, make sure ya distance of at least 45 degrees from the ground to the top. To stabalize the snow bank, use an abutment made of snow from trucks. Clean the site and remove all debris, remove sediment from ditches and basins and repair all fences.

Wisconsin	Avoid landfills, wetlands, floodplains, strom sewers, surface waters, steep slope, playgrounds, ballparks and parking lots;	Land where contamineants and debris can be gradually released, contained or collected; protect groundwater, 1,000 feet from water supply, downhill of wells, avoid lakes, streams and wetalnds, find fine-textured soils, avoid areas with fractured bedrock or near surface	remove debris from snowplies after thaw or before flooding; fencing will prevent litter from blowing off-site or into waterways