



## CITY OF KIRKLAND

Department of Public Works

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### MEMORANDUM

**To:** Kurt Triplett, City Manager

**From:** Ray Steiger, P.E., Streets & Public Grounds Manager  
Erin Devoto, Public Works Superintendent  
Kathy Brown, Public Works Director

**Date:** November 26, 2014

**Subject:** SNOW AND ICE RESPONSE PLAN 2014 - 2015

### RECOMMENDATION:

The purpose of the study session is to brief the City Council on the updated Public Works Department Snow and Ice Response Plan. (Attachment A.) Staff is seeking feedback and input prior to the winter season; no formal Council action is required or requested.

### BACKGROUND AND DISCUSSION:

A key mission of the City of Kirkland Public Works Department is to provide snow and ice response services to mitigate hazardous driving conditions during freezing weather conditions. The Public Works Snow and Ice Response Plan seeks to maximize service and efficiency with the limited resources available to deal with winter weather conditions.

Snow and ice response work can be particularly challenging in our region for a number of reasons:

- **Weather forecasting is difficult in our area.** The significant variance in elevation from one neighborhood to another, proximity to the lake, tree canopies, and other factors make icy conditions extraordinarily difficult to forecast. Additionally, these factors can cause snow in some parts of the City, while other parts only experience rain. It is critical that our Snow and Ice Response Plan incorporate up-to-date, detailed weather data and forecasting. Even with the best possible forecasting, launching snow and ice control efforts is a judgment call based on the best available information.
- **Infrequency of events calls for minimal resourcing.** Compared to other parts of the country, snowfall is relatively rare in Western Washington. As a result, local governments need to balance the resources spent on snow and ice removal equipment with other, more pressing daily transportation and utility needs. It is not cost effective for most local agencies, including Kirkland, to have enough equipment on-hand to de-ice or plow/sand local streets. Such an investment would sit unused for the vast majority of the time and occupy valuable maintenance center and vehicle storage space needed for daily operations. Therefore efforts need to be focused on priority "lifeline" routes (such as routes leading to

hospitals), arterials, and major collectors.

- **Infrequency of events also results in less experienced drivers on City streets.** In spite of the best efforts to remove snow and ice, travelers of Kirkland roadways often find themselves unable to deal with snowy and/or icy roadway conditions. Abandoned vehicles and traffic accidents can create impassable roadways, or create even more hazardous conditions. Close coordination with the Kirkland Police and Fire departments, as well as other jurisdictions, is key to successful response efforts.
- **Freezing weather can cause "black ice" on roadways.** It is often the case that black ice conditions exist in higher elevations, even when there is no snow event, and even when there is no evidence of ice in downtown Kirkland. The Snow and Ice Response Plan needs to address these less visible conditions, as well as full blown snowstorms.

In spite of the complexities of weather forecasting, the National Weather Service produces long-range climate predictions to provide an indication of potential weather patterns. Predictions for the November 2014 – March 2015 winter season conclude that our area could potentially experience higher than normal temperatures and lower than normal snowfall. It is being classified as an "El Nino" winter. The coldest periods are likely to be in late December to late January.

Although the climate predictions do not indicate a likelihood of significant snowfall, the Public Works Department has taken necessary steps to be prepared in the event of snowy and/or icy conditions this winter. In preparation for the 2014 - 2015 inclement weather season, the Public Works Streets Division has held a series of internal planning and strategy meetings to review past practices and develop standard operating procedures. As a result, several updates and changes have been made to the plan and inclement weather route map. As in prior years, staff is committed to providing 24/7 service when needed to provide the safest possible transportation system for the motoring public.

Key elements of the updated Snow and Ice Response Plan include the following:

- Priority Routes
- Pre-assigned staffing (roles, shifts)
- Pre-assigned equipment
- Staff training
- Departmental Roles and Responsibilities
- Event sequencing (pre-event, response, post-event)
- Standardized reporting
- Planning level coordination

The entire draft Plan is included in this package as Attachment A. The final plan will incorporate any input from City Council members.

The 2014-2015 Plan contains some significant changes from past practice. Below is the summary of these changes:

1. **Updates to Resource Lists:** The Plan has been updated to reflect equipment lists, crew shift lists, and dispatching practices. The Public Works Department has established priority routes that can be plowed using existing resources. Moving forward, new equipment

purchases will include snow and ice removal attachments. Routes will be updated each year to ensure that equipment is maximized.

2. **Enhanced Weather Forecasting Service:** In November of this year, Public Works subscribed to a detailed, customized weather forecasting service, known as Weathernet. Weathernet creates customized daily forecasts for local jurisdictions to assist in making quick and informed decisions during critical maintenance operations. The system provides atmospheric and pavement forecasts. This service provides detailed information about specific locations in Kirkland and will assist staff in preparing for events. King County, WSDOT, and other local cities have used Weathernet services for many years to help make the best possible emergency response decisions.
3. **Priority Route Updates:** Priority 1 Routes have been expanded. (See Attachment 3 of the *Snow & Ice Response Plan*.) In the past, Priority 1 only included routes around Evergreen Hospital. The updated plan includes the following additions:
  - Routes leading from the Kirkland Maintenance Center to the prior Priority 1 Routes around the hospital (such as NE 85<sup>th</sup> Street).
  - Streets leading to the new Kirkland Justice Center.
  - Routes leading to possible shelters and "warming/charging centers."
  - Added Kirkland Avenue to the "Closed Roads" list.
  - 116<sup>th</sup> Ave NE has been removed from the "Potentially Closed Roads" list, and is designated to remain as an open route. This change is consistent with past services to the area when it was part of unincorporated King County, and maintains an important link between Finn Hill, Juanita, and I-405.
  - Priority 1 and 2 routes include improved links to Bellevue and Redmond.

It should be noted that any route may be closed as deemed necessary by the Police or Fire departments, or by Public Works, based on site-specific conditions.

4. **Emergency Response Activation:** Practice in prior years was for Public Works to wait for the Police Department to make the call to activate snow and ice response crews, based on existing roadway hazards. This practice did not allow Public Works crews to "get ahead" of the weather, which is particularly critical in anti-icing operations. This year, the Public Works Director will make the determination to activate crews. Public Works will, of course, continue to remain responsive to requests from the Police and Fire departments for site specific road closures or other actions.
5. **Anti-icing/De-icing:** This year, Public Works purchased and installed equipment (two 6,500 gallon tanks) to store a calcium chloride anti-icer/de-icing product. This product has been used for many years by King County and WSDOT, and is also used by the cities of Bellevue and Redmond, as well as many other jurisdictions in Washington State. Water mixed with calcium chloride has a lower freezing point than the simple salt (sodium chloride) brine solution used by the City of Kirkland in past years. The chemical product, known as **BOOST™** with Calcium Chloride, is an anti-icing/de-icing material additive produced from natural renewable resources with corrosion protection. "Anti-icing" is the pre-treatment of roadways prior to a freeze to prevent ice from forming. This type of pre-treatment can eliminate black ice, and can also prevent snow from binding to the pavement surface, making plowing operations far more effective. "De-icing" is the application of chemicals to melt ice after it has formed. Both de-icing and anti-icing are

weather dependent, and cannot be used in all situations.

6. **Staff Training:** During November, specific training sessions were held for operations staff on equipment use, de-icer application, chain installation and tracking application rates.
7. **Staff shifts:** Staff shifts have been changed from three eight-hour shifts to two twelve-hour shifts to maximize staffing resources, make the most efficient use of equipment, and to align service practices with neighboring jurisdictions. The new shifts may increase overtime costs during some events but will provide better coverage and faster response which staff believes outweighs the potential increases. However Public Works will monitor such costs closely and respond accordingly if changes are needed.
8. **Assignment of "Skeleton Crews" for Minor Events:** Far more frequent than full-blown snow events are periods of freezing such as the cold snap Kirkland recently experienced following the Thanksgiving holiday. Minor flooding was followed by very light snow and several days of freezing weather. During that time period, Public Works crews were also called upon to assist with one house fire, traffic accidents, and non-City utility issues. Rather than reactively attempting to respond to these types of smaller-scale emergencies with emergency call-outs, Public Works will proactively assign a small crew with a leadworker to perform de-icing, flood response, and/or windstorm cleanup based on weather forecasts. The "skeleton crews" will be assigned backup work (such as the backlog of sidewalk repair) to perform in the event emergency response services are not needed
9. **Improved Communication:** Communications need to be improved in a number of areas:
  - **Radios:** Seven radios were added to the Public Works inventory, for a total of seventeen radios that will be dispatched to each operating vehicle. Radios are particularly important during major weather events, as cell phone systems are frequently overburdened. Additionally, command staff can monitor radio communications to stay up to date on response activities, rather than waiting for individual phone calls from responders.
  - **IT:** Crew leads and other key responders will be supplied with cell phones that have texting and photo communication ability, which will greatly enhance the exchange of information, and eliminate delays due to multiple phone calls and lags in voicemail receipt. Public Works designated "stand-by" employees will also be issued tablets, so that field notes and dispatch records can be shared electronically with command staff and others.
  - **Direct Line Communication Between Key Staff:** Police, Fire, and Public Works will provide direct-line cell phone communication between responders. Responders can speak with one another directly as needed as events unfold, rather than relying solely on the initial dispatch from Norcom.
10. **Post Event Cleanup:** Street sweeping and vactoring will be a high priority following all snow and ice response events. It is critical that snow sand be removed from the roadway system as quickly as possible to prevent clogging of stormwater systems and subsequent hazardous flooding conditions on roadways. Additionally, quick cleanup of snow sand is an environmental best management practice, mitigating impacts to streams and lakes.

Cleanup operations might require the use of additional rental equipment.

- 11. Post Event Debriefs and Plan Updates:** As a standard practice, Public Works will debrief all emergency response events, both internally and with Public Safety, Fire, the City Manager's Office, Norcom, and other key stakeholders. Lessons learned will be applied, and the Snow and Ice Response Plan will be continually updated and improved.

The City's typical snow response chain of events includes the following:

- Weather forecast and anti-icing pre-treatment (if conditions warrant pre-treatment)
- Anticipated equipment prepped and staged
- Event Activation:
  - Public Works Director: Activation of full-crew 12 hour shifts, based on forecasts or known conditions
  - Police or Fire: Notify Operations (standby, if off-hours) of site-specific conditions or if unforeseen snow/ice conditions are discovered
- Fleet prepares equipment/installs chains
- The focus for Public Works will be to clear the right of way.
- The focus for Parks will be on public facilities.
- Post-event cleanup.

In the case of minor emergency weather forecasts (such as freezing without snow accumulation or minor flooding), below is the typical sequence of events:

- Weather forecast and anti-icing pre-treatment (if conditions warrant pre-treatment)
- Anticipated equipment prepped and staged
- Public Works Superintendent or Director: Activation of skeleton crews based on forecasts or known conditions
- Focus for anti/de-icing will be on priority routes first, however crews will continue de-icing on lower priorities if time allows.
- Post-event cleanup.

Historically, the City's budget for snow and ice removal has averaged \$30K/annually. Winters during 2009 and 2012 had expenses of \$70K - \$95K. (Attachment B.) Public Works will monitor expenditures as events unfold.

The Public Works Department welcomes input from City Council members on the draft Snow and Ice Response Plan. Comments and questions will be addressed in the final Plan.

Attachment A: Snow and Ice Response Plan  
Attachment B: Historical snowfall and budget

**2014 – 2015  
City of Kirkland Snow and Ice  
Response Plan  
DRAFT**

**Public Works Department**

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3. Inclement Weather maps
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## **INTRODUCTION**

The mission of the City of Kirkland's Street Division is to operate and maintain the transportation network while ensuring that the network functions as safely and efficiently as possible. During wind, snow, and ice events, the Streets Division conducts snow removal operations, anti/de-icing, traction improvements and selected road closures to mitigate hazardous driving conditions; if events dictate and additional staff is needed, crews from Public Grounds, Water, Sanitary Sewer, Storm, Fleet, and Parks will supplement Street Division forces.

The purpose of this Snow and Ice Response Plan is to provide effective, clear, consistent and environmentally responsible guidelines and procedures, resulting in the best possible service to the citizens of Kirkland.

During inclement weather events, the administration and coordination of crews is especially critical to ensure that emergency situations will be responded to in an efficient, effective and timely manner. The primary goal is to provide passable routes for emergency vehicles, school buses, public transportation, commercial vehicles, travelers, and commuters during conditions of snow, ice or severe frost on the City's roads and streets. Public Works is responsible for approximately 240 center lane miles of roadway including approximately 40 lane miles of arterial lifeline routes that provide connectivity from residential areas to the State highway system and key service centers.

As the City of Kirkland's topography is extremely diverse and creates a variety of situations throughout the City during winter weather, Public Works annually re-evaluates equipment, crews and response scenarios to address a variety of scenarios. Public Works Department staff work closely with King County Metro Transit, the Lake Washington School District, adjoining jurisdictions such as Redmond and Bellevue, local universities, and hospitals to assist in maintaining mobility for our residents and businesses. Some winters bring heavy snowfall, and other years see no snow accumulation at all. In any city, snow removal is complicated by urban factors such as parked cars, pedestrians and narrow streets. Cities with regular heavy snowfall often have winter parking restrictions that make it easier to plow streets. Since Kirkland doesn't have regular significant snowfall, these sorts of parking restrictions are not practical.

The City of Kirkland commits to plowing snow from identified routes throughout the city within 24 hours of a significant lull in the storm. This level of service does not commit to reaching bare pavement; however, it will provide for passable roadways. Differing event patterns may alter this timeframe. The priority route map can help the public know what to expect and provides clear direction to operations staff.

Crews will plow snow to the right of the roadways so that melting snow will not pass back over the street surface and refreeze when the temperature drops at night. If a car is parked on snow route, the owner may have to dig it out.

Businesses and residents are responsible for shoveling and de-icing their sidewalks and steps.

Public Works staff begins preparing early for the snow season by getting snow equipment ready and stockpiling supplies. Crews may use the same trucks for paving streets one day and for winter weather response the next, balancing our investments in equipment that is exclusively dedicated to snow removal with investments for equipment used year around. Another important pre-event activity is staff training. Staff has been trained in the City's Snow and Ice Response Plan and operating procedures. Also, the snow response priority route map has been reviewed and updated to ensure that newly annexed areas have been considered and included, and to address any changed conditions. During a snow storm, city

crews work around the clock. Designated citywide and neighborhood priority routes are cleared first to accommodate fire, medical and police response, as well as transit, school buses and commuter traffic. If snowfall is continuous, those arterials may require repeated plowing and sanding before crews can work to clear neighborhood streets.

## **PLANNING/PREPAREDNESS SCHEDULE**

- |           |   |
|-----------|---|
| September | Chemical anti/de-icing materials are purchased and spray trucks are purged of chemicals used for vegetation control during summer months.   |
| October   | Weather and temperatures are more closely monitored; anti-ice treatment typically begins as colder conditions warrant. Staff begins priority route modification process based on changes in the community, and staff shift schedules are drafted.   |
| November  | King County Office of Emergency Management, Washington State Department of Transportation, and City of Kirkland annual kickoff meetings are held to discuss weather preparedness, nature of anticipated winter (such as, "El Nino," or "La Nina"). Training curriculum is finalized and training is conducted. Materials and equipment are stockpiled and prepared. |
| Dec – Mar | Most inclement weather occurs during this timeframe. Crews perform emergency response activities, such as anti-icing, plowing, sweeping, cleaning of enclosed drainage systems, and responses to wind and other events.   |
| April     | Typically, April is a transition month, winding down from winter weather response mode. Equipment is returned to non-winter month status. For example, anti-icing trucks are returned to vegetation control preparation; plows and sanders are cleaned and stored.  |

The Snow and Ice Response Plan reflects the following concepts:

### **Constant Vigilance:**

Public Works staff monitors conditions and follows weather reports 24 hours a day.

- Public Works uses a forecasting tool developed with the University of Washington called SNOWWATCH to learn how a storm will most likely affect different neighborhoods. This information helps determine where the crews will be needed first.
- Starting in the 2014/2015 winter, Kirkland will subscribe to the Weathernet service.

### **Being Proactive:**

In general, the City will shift from a past practice of reactively responding to snow and ice events, to proactively "getting in front" of emergencies to the greatest extent possible. Specific steps in moving toward a proactive approach include the following:

- **Enhanced Weather Forecasting Service:** In November of this year, Public Works subscribed to a detailed, customized weather forecasting service, known as Weathernet. Weathernet creates customized daily forecasts for local jurisdictions to assist in making quick and informed decisions during critical maintenance operations. The system provides atmospheric and pavement forecasts. This service provides detailed information about specific locations in Kirkland and will assist staff in preparing for events. King County, WSDOT, and other local cities also use Weathernet service to help make the best possible emergency response decisions.

**Emergency Response Activation:** Practice in prior years was for Public Works to wait for the Police Department to make the call to activate snow and ice response crews, based on existing roadway hazards. This practice did not allow Public Works crews to “get ahead” of the weather, which is particularly critical in anti-icing operations. This year, the Public Works Director will make the determination to activate crews. Public Works will, of course, continue to remain responsive to requests from the Police and Fire departments for site specific road closures or other actions.

- **Staff shifts:** Staff shifts have been changed from three eight-hour shifts to two twelve-hour shifts to maximize staffing resources, make the most efficient use of equipment, and to align service practices with neighboring jurisdictions. Staffing is pre-assigned to each shift, with specific task and equipment assignments.
- **Assignment of “Skeleton Crews” for Minor Events:** Far more frequent than full-blown snow events, are periods of freezing such as the cold snap Kirkland recently experienced following the Thanksgiving holiday. Minor flooding was followed by very light snow and several days for freezing weather. During that time period, Public Works crews were also called upon to assist with one house fire, traffic accidents, and non-City utility issues. Rather than re-actively attempting to respond to these types of smaller-scale emergencies with emergency call-outs, Public Works will pro-actively assign a small crew with a lead worker to perform de-icing, flood response, and/or windstorm cleanup based on weather forecasts. The “skeleton crews” will be assigned backup work (such as the backlog of sidewalk repair) to perform in the event emergency response services are not needed
- Starting in December 2014, the City of Kirkland will use newly purchased anti-ice equipment and chemical and will pre-treat key streets, bridges, and overpasses before the snow starts falling to help prevent ice from forming. Pre-treatment is weather dependent; anti-icing chemicals should not be applied in wet weather.
- As the snow begins to fall, the crews continue to drive their routes, treating the roadway with anti-icer where needed. When approximately one inch of snow has accumulated, staff begins plowing.

## **GENERAL INFORMATION**

Administration and coordination of crews during snow and ice conditions is conducted from the City of Kirkland Maintenance Center, 915 8<sup>th</sup> Street, Kirkland, WA. From this location, Public Works crews are capable of providing 24 hour, 7 day per week snow and ice control activities. Parks and Community Services crews operate out of 1129 8<sup>th</sup> Street (the “Park Maintenance Building”) near the Maintenance Center in order to carry out their responsibilities during snow and ice events. In a declared City emergency during which the Emergency Operations Center (EOC) is activated, the Maintenance Center will still function as the focal point for direct coordination of crew activities; however, priorities for snow and ice control efforts or other emergency conditions by all crews will be as directed by the EOC.

## **STAFF ORGANIZATION**

Effective management and accomplishment of snow and ice control objectives must be accomplished through an integrated and coordinated effort by Public Works and Parks and their respective Managers, Supervisors, Lead persons and crews. Generally the areas of responsibility for snow and ice control efforts between Public Works and Parks are as follows:

Public Works: Field crews will be responsible for snow and ice control activities within the public right-of-ways (streets) and within the yard component of the Maintenance Center (sand, anti/de-

icing, etc.). Field crews may be drawn from Streets & Public Grounds, Water, Sewer, and/or Storm Divisions.

Equipment Rental (aka Fleet): Will be responsible for setup, maintenance, and repair of vehicles and equipment including the emergency generator at the Maintenance Center during power outages.

Facilities: Will be responsible for ongoing City building maintenance.

Parks & Community Services: Will be responsible for snow and ice control activities around public buildings and facilities including driveways at Fire Stations and parking facilities and walkways and parking lots at City Hall, Kirkland Justice Center, Maintenance Center, Senior Center, N.K.C.C., and other City facilities as necessary.

The Public Works Operations and Maintenance Divisions (Streets, Public Grounds, Water, Sewer, Storm, and Fleet) have approximately 50 full time field crew and approximately 10 administrative/management staff situated at the Maintenance Center. Consultation between the Division Managers, the Superintendent, Director of Public Works, and/or the City Manager or an ECC, activates field crew employees which will be assigned to two pre-determined, around-the-clock, "12-hour" shifts as follows:

Shift #1 (day)	10:30 a.m. – 10:45 p.m.
Shift #2 (swing)	10:30 p.m. – 10:45 a.m.

This shift arrangement allows for complete 24 hour coverage, providing smooth transition of plowing, sanding, and de-icing activities. This coverage maximizes available equipment and crews (approximately 25 operational staff will be available for each shift). This approach also allows each employee two one-half hour meal periods during their shift. Generally, this shift will be followed for as long as needed to effectively satisfy the mission statement objectives. On each shift a Public Works Manager, Supervisor or Leadperson will be responsible for coordinating, planning, scheduling and dispatching crews during the snow and ice conditions. The supervisor or lead persons will operate under the general direction of the Division Superintendent and Public Works Director who will have oversight of the snow and ice control operations.

Because each shift includes two one-half hour lunches with an approximately 15 minute overlap with the adjacent shift for reporting out, the physical time worked is 11 hours. 8 hours of each shift will receive a 20% shift differential, and 4 hours will be at time and a half.

The Parks Maintenance Division has approximately 20 full time crew, two administrative employees, three lead persons, one supervisor and one division manager situated at the Park Maintenance Building. Parks Maintenance is responsible for planning, scheduling and coordination of Parks Department snow and ice control activities to meet their mission activities.

Preparation of emergency vehicles (Fire and Police) is usually done in coordination with the individual stations. The Fire Department maintains an inventory of chains for all apparatus at each station which includes cable chains and "lug" chains (used if snow reaches 6 inches). All firefighters receive training on how to install the chains, however Fleet personnel are utilized if issues arise. Fleet also maintains a complete set of cable chains and back-up chains for all Police vehicles, and Fleet staff install the chains during an event. Due to their new presence at the Kirkland Justice Center, Staff is studying the potential benefit of having Fleet staff utilize a small pick-up mounted plow performing minor clearing activities at the Kirkland Justice Center.

## **EQUIPMENT AND RESOURCES**

The City owned equipment identified in Figure A which follows is available for snow and ice control. All vehicles are radio equipped and city owned cellphones are made available.

The Fleet Division mechanics, facilities, equipment and parts are housed at the Maintenance Yard located across the street from the MOC. On duty mechanics will be available to make equipment maintenance and repairs during shifts and assessments of equipment during shift changes to prevent equipment failures.

The Maintenance Center maintains a stockpile of sand which is stored outdoors/uncovered at the Maintenance Center in a specially constructed storage bin.

- A limited supply of bagged salt is stored indoors on pallets if needed; this salt can be added to sand or mixed with water to create a brine mix for preventing ice.
- Beginning in the winter of 2014/2015, Calcium Chloride with Boost will be utilized by Kirkland. This product has been used successfully by surrounding communities including Bellevue, Redmond, Kenmore, Bothell, King County, and WSDOT. Two 6,500 gallon storage tanks are installed at the maintenance center and are able to provide anti-icing material to either of two Kirkland spray equipped vehicles.
- Salt brine is also available at the Maintenance Center which can be used to "pre-wet" sand if used.

Finally, The Public Works Department has limited access to additional sand and Calcium Chloride anti-icer from the Washington State Department of Transportation (WSDOT) yard facility located at the south end of the City near Northup Way and SR 520. This stockpile is available as a mutual aid and support basis and limited to \$5,000 annually. In addition, through agreement with the City of Redmond and Cadman Sand and Gravel located in Redmond, Kirkland has access to an articulated loader and Calcium Chloride anti-icer from the City of Redmond, and the sand stockpile at Cadman's yard. This access is normally unattended and on the honor system for payment to Cadman Sand and Gravel, which is presently the City's contracted sand and gravel supplier.

# Kirkland Snow Equipment - October 2014

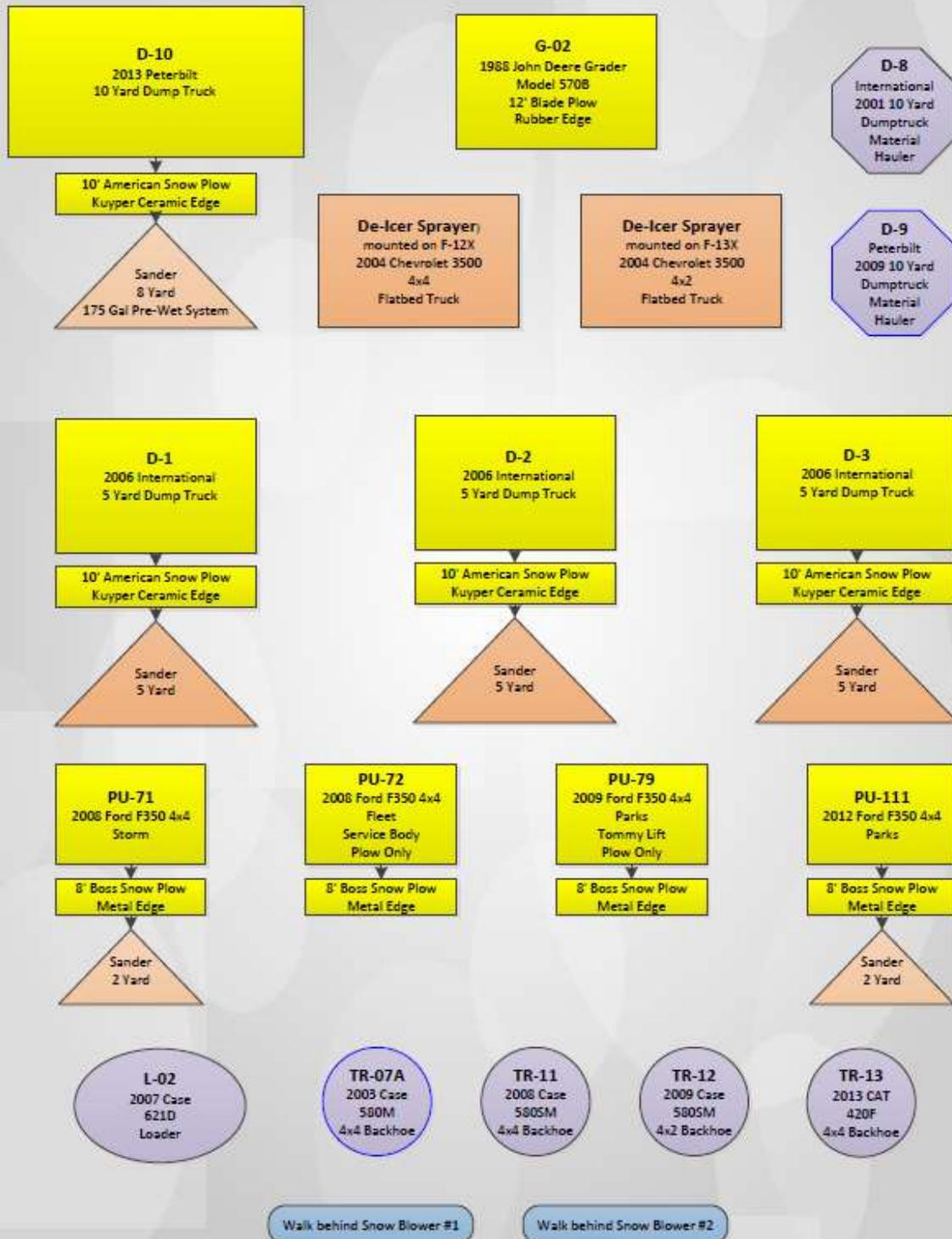


FIGURE A - EQUIPMENT

## **RESPONSE TO SNOW/ICE EVENTS**

During inclement weather events, response will be based on priority routes established annually before each winter season. Snow and Ice crews will mobilize based on the severity of the event. The roadway prioritization is based on access to "lifeline" facilities (such as Evergreen Hospital and the Kirkland Justice Center), roadway classification, and topographic considerations. Since each event will vary in its impact and duration, these pre-determined routes will be considered to be in effect unless the situation requires that resources be redirected.

The inventory of travelled roadway lanes in the City of Kirkland exceeds the available personnel, equipment, and resources in terms of snow and ice operations. Therefore a three level priority system has been developed through coordination with Police, Fire, adjacent Cities, King County Metro, Lake Washington Schools and Evergreen Hospital.

"Priority 1" Streets include major arterials, bus routes, access to and from the Kirkland Justice Center, some Fire Stations, Evergreen Hospital and freeway interchanges in the Totem Lake area.

"Priority 2" streets include remaining arterials throughout the City.

"Priority 3" routes are collectors serving key areas.

Pre-Treatment Priority Route: In addition to covering priority 1 and 2 routes, the pre-treatment (anti-ice) priority covers hilly, shady areas as well as bridges and overpasses.

### **Operations:**

City Staff will mobilize based upon the severity of a snow and ice event and as directed by the Public Works Director.

First Phase - Pre-treatment when measurable snow and/or severe black ice conditions are predicted.

- The supervisor may schedule applications of anti-icing agents if weather conditions are conducive to anti-icing treatment.
- Priority 1 and 2 routes are checked for snow or freezing conditions.
- Fleets and Streets Division prepares equipment for snow and ice operations.
- The supervisor adjusts the initial response schedules as the weather event unfolds.
- Citizen and emergency service requests are taken by Public Works staff and assigned based on crew availability according to pre-established priority routes.
- Crews remain on regular schedules unless the event occurs after hours at which the standby lead calls for additional personnel as conditions warrant.
- Depending on weather forecasts, "skeleton crews" may be assigned, or full-crew, 12-hour shifts may be assigned.

Second Phase - Snow and Ice conditions have occurred. Isolated to widespread accumulations have affected City roads.

- Public Works Director makes the call to initiate snow and ice response, if this has not already been done based on the weather forecast. Supervisor of snow event (Public Works Superintendent or Streets Manager or Standby Manager or Storm Manager activate MOC response center.)
- Snow and Ice Crews and associated Administrative staff start twelve hour shifts providing 24 hour coverage.
- The City of Kirkland EOC may be activated.
- Supervisor directs and assigns prioritization of snow and ice removal based on defined Priority routes.
- Shifts remain in place until Public Works Director terminates shifting.

Streets are normally first plowed to best facilitate the next morning or afternoon/evening rush hour traffic direction. All other streets are plowed based upon overall traffic volumes or public safety and are scheduled to coincide with the event patterns. Local streets, cul-de-sacs and dead ends have a lesser priority than heavier traveled streets, and depending on the inclement weather pattern and available resources, may not receive treatment. Typically, citizen requests are handled within the established priority system.

Depending on the severity of a snow and ice event, Parks crews are responsible to remove snow from parking lots, driveways, and pedestrian access paths to City facilities. These include all staffed City buildings, the Kirkland Justice Center, and Fire Stations as follows:

- Station 21 9816 Forbes Creek Dr. / Market Street
- Station 22 6602 108<sup>th</sup> Avenue NE
- Station 24 8411 NE 141<sup>st</sup> Street, Bothell
- Station 25 12033 76<sup>th</sup> Place NE
- Station 26 9930 124<sup>th</sup> Avenue NE
- Station 27 11210 NE 132<sup>nd</sup> Street, Kirkland
- City Hall 123 5<sup>th</sup> Avenue
- Kirkland Justice Center 11511 NE 118<sup>th</sup> Street
- N.K.C.C. 12421 103<sup>rd</sup> Avenue NE
- Senior Center 406 Kirkland Avenue
- Maintenance Center 915 8<sup>th</sup> Street
- Rose Hill Building 13013 NE 65<sup>th</sup> Street

Parks crews may not be able to reach every Fire Station due to traffic or street blockages. In those instances, Fire Station personnel will be responsible to assist to the extent possible by hand shoveling and clearing of driveways.

During inclement weather events, vehicles and equipment will be assigned in a manner which provides the best use and application for the particular event. Generally, the equipment having plowing capability will be assigned to plowing high priority streets which include major arterials, bus routes, access to and from schools, police and fire stations, freeway interchanges and Evergreen Hospital. The five-cubic yard dump trucks and one-ton pickups with snowplows/sanders will be assigned in an equitable or prioritized manner. The grader, if used, will focus primarily on Juanita Drive. Any extra available equipment will be used to assist plowing and respond to intersection and accident related requests. The deicing equipment will be assigned to areas on a priority basis. The articulated loader will remain in the Maintenance Center yard for use in stockpiling and loading sand and doing snow removal in the Maintenance Center yard and parking lot areas. 10 yard dump trucks will be available to haul sand materials to the Maintenance Center to replenish inventoried materials.

Truck mounted small plows and the backhoe/loaders will be operated by Parks along with snow blowers to assist them in maintaining designated public facilities.

Public Works and Parks Department crews may assist the equipment rental group in preparing vehicles and equipment for snow and ice tasks. This may include assisting with mounting the plows and sanding equipment and chaining vehicles based on equipment rental priorities (Fire, Police, Public Works and Parks).

## **DISPATCHING**

The initiation of snow and ice control procedures is by Public Works as determined by the Public Works Director. The Kirkland Police officer in charge will provide regular assessments of current conditions to the Public Works Director, Public Works Standby and/or the MOC Manager in charge if shifting has been activated. Crews will be activated by the Public Works Standby and Manager in charge during non-work hours.

NORCOM will provide site-specific emergency dispatching services to Public Works command staff. Public Works command staff will make specific crew assignments.

## **COMMUNICATIONS**

- All vehicles and equipment in use for snow and ice control are to be radio equipped with a hand held portable radio. The city maintains a 17 radio bank of hand-held portable radios. All dispatching of field crews will be by the Manager in charge, face to face, by radio or wireless device.
- Telephone lines are the primary communication link between the Police Dispatch and the Maintenance Center Manager on duty. These lines may fail or be damaged during heavy snow or ice events. As a backup to the telephone system, Police Dispatch may contact the Manager directly on the Public Works band on the 800 MHz radio.
- Members of the public who call the Maintenance Center or come to the Maintenance Center in person will deal directly with administration staff or the Manager on duty for service requests or other services. Requests outside of the pre-established priority routes will not receive high priority due to resource limitations.
- The City's Public Information Office and City Manager's office will be notified if shifting is activated and will be regularly updated on status and issues by phone. The City Manager also has a hand held radio device.

The Public Works Maintenance Division Managers, Supervisors and Lead persons will have access to portable weather alert radios during imminent inclement weather periods. Calls for snow and ice control should be made directly through the Maintenance Center at 425-587-3900. Telephones will be staffed during snow and ice events.

## **STREET CLOSURES**

During significant snow and ice events certain streets may be closed due to steep grades which create a hazard to motorists due to the inability to stop at the bottom or at intersections on the steep street (see Inclement Weather Route maps). Impacted streets are generally not high volume streets, although it may be necessary to close certain high volume streets as needed due to the inability to maintain the street sufficiently to protect public safety. Street closures will be coordinated with the Police and Fire Departments for their emergency response planning during snow and ice events.

Any given road within the City may at any given time be closed due to event specific situations; however, the following streets will be proactively closed (and mapped as such) during significant snow and ice events due to steep grade of the streets and the inability to provide sufficient traction for safety:

<u>CLOSED STREET</u>	<u>FROM</u>	<u>TO</u>
NE 52 <sup>nd</sup> Street	Lake Washington Blvd.	108 <sup>th</sup> Avenue NE
5 <sup>th</sup> Avenue S	Lake Street S.	State Street S.
Kirkland Ave	10 <sup>th</sup> Street S	I-405 pedestrian crossing
5 <sup>th</sup> Place	15 <sup>th</sup> Avenue	18 <sup>th</sup> Avenue
10 <sup>th</sup> Avenue	Market Street	1 <sup>st</sup> Street
11 <sup>th</sup> Avenue	Market Street	1 <sup>st</sup> Street
12 <sup>th</sup> Avenue	Market Street	1 <sup>st</sup> Street
13 <sup>th</sup> Avenue	Market Street	1 <sup>st</sup> Street
14 <sup>th</sup> Avenue	Market Street	1 <sup>st</sup> Street
15 <sup>th</sup> Avenue	Market Street	1 <sup>st</sup> Street
18 <sup>th</sup> Avenue	Market Street	1 <sup>st</sup> Street
19 <sup>th</sup> Avenue	Market Street	1 <sup>st</sup> Street
NE 112 <sup>th</sup> Street	100 <sup>th</sup> Avenue NE	104 <sup>th</sup> Avenue NE
120 <sup>th</sup> Avenue NE	NE 85 <sup>th</sup> Street	NE 90 <sup>th</sup> Street
NE 97 <sup>th</sup> Street	112 <sup>th</sup> Avenue NE	110 <sup>th</sup> Avenue NE
NE 104 <sup>th</sup> Street	111 <sup>th</sup> Avenue NE	112 <sup>th</sup> Pl NE
NE 116 <sup>th</sup> Place	Juanita Drive	NE 117 <sup>th</sup> Place
NE 117 <sup>th</sup> Place	NE 120 <sup>th</sup> Street	90 <sup>th</sup> Ave NE

<u>POSSIBLY CLOSED</u>	<u>FROM</u>	<u>TO</u>
108 <sup>TH</sup> Avenue NE	NE 38 <sup>th</sup> Street	NE 44 <sup>th</sup> street
NE 120 <sup>th</sup> Street	Slater Avenue NE	132 <sup>nd</sup> Avenue NE
120 <sup>th</sup> Ave NE	NE 85 <sup>th</sup> Street	NE 90 <sup>th</sup> Street
116 <sup>th</sup> Ave NE	NE 132 <sup>nd</sup> Street	NE 133 <sup>rd</sup> Street
NE 136 <sup>th</sup> Street	95 <sup>th</sup> Ave NE	98 <sup>th</sup> Ave NE
Willows Road	139 <sup>th</sup> Ave NE	Approx. NE 125 <sup>th</sup> St
NE 128 <sup>th</sup> Street	NE 126 <sup>th</sup> Place	136 <sup>th</sup> Ave NE

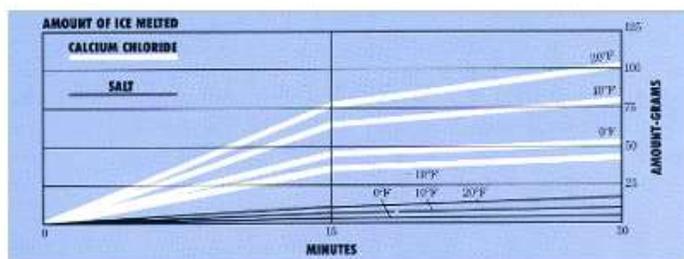
## **GUIDELINES FOR SNOW PLOWING AND CHEMICAL APPLICATION**

The objectives of these guidelines are to compliment the decision making and management of a systematic snow and ice removal program resulting in road systems that can be navigated by the public.

The procedures for the City of Kirkland are based on the Washington State Department of Transportation (WSDOT) application guidelines and the "Manual of Practice for an Effective Anti-Icing Program" (Appendix 1).

De-icer application of Calcium Chloride:

## Information About Calcium Chloride



Calcium chloride outdistances traditional deicing materials to achieve safer, bare pavement - faster than salt or abrasives alone. Calcium chloride melts up to eight times as much ice as does salt alone - within the first 30 minutes at 20F (-7C) following application. Pre-mixed with salt and abrasives, calcium chloride becomes a cost-effective edge for winter road safety.

### PROPERTIES

- › Exothermic: calcium chloride releases heat to activate salt's melting ability.
- › Hygroscopic: calcium chloride attracts moisture required for rock salt's melting action.
- › Fast acting calcium chloride begins to dissolve immediately upon application to break the bond between pavement and ice.
- › Powerful calcium chloride brine remains active for prolonged periods of time to prevent ice from bonding to the highway.
- › Low eutectic point calcium chloride melts to much lower temperatures than salt.

### BENEFITS

- › Highway Safety: studies show that, in 85% of applications, calcium chloride/ salt mixtures achieve bare pavement faster than salt alone at temperatures near 30F (-1C), to ease traffic and reduce accidents.
- › Savings: calcium chloride increases salt's effectiveness, therefore reducing the number of applications necessary during storms - saving manpower, equipment and material costs. Plus, it freeze-proofs abrasives to help them embed in ice and snow, so you lose less material to spreader bounce and traffic scattering.

- 2014/2015 winter is the first season utilizing this treatment method for Kirkland. Standards call for application at a rate of 15#/lane mile, which is then refined based on a given agencies experience.
- The attached tables (Appendix 1) provide guidance for application of liquid chemicals and solid chemicals under six different winter weather conditions and include:
  1. Light Snow
  2. Light Snow with Periods of Moderate/Heavy Snow
  3. Moderate or Heavy Snow Storm
  4. Frost or Black Ice
  5. Freezing Rainstorm
  6. Sleet Storm

### Plowing:

Accumulation of snow: If snow has accumulated due to stalled or abandoned vehicles, it may not be possible to clear the streets. In these instances after prolonged snow conditions, accumulations may not be able to be removed with a snow plow blade. In these instances sufficient sand will be used only in the acceleration and deceleration lanes and on downslopes in order to allow traffic to start and stop at intersections and hills on high priority streets. De-icing brine will be distributed in the cleared travel lane(s), and salt is used only in sufficient quantities to mix with sand to keep the sand from freezing in the sander units.

### Sanding/Salting:

Extended full length sanding and salting of streets is not possible due to two primary reasons: there is not enough sand or salt available to sand more than the areas stated; and the use of pure rock salt is environmentally detrimental to the receiving waters in Lake Washington. In general, sanding is only

applied at key intersections, at steep grades, or in locations of historical ice accumulation due to water/drainage (i.e., from road sub-base) along the priority routes. Specific roadway conditions will be monitored, and sand will be applied as needed in the travelled roadway.

*Appendix 1: Treatment Scenarios*

*Appendix 2: Glossary of terms*

*Appendix 3 a, b, c: Route Maps (snow plowing, anti-icing, wind storm sweeping)*

*Appendix 4: 2014-2015 Crew Shift Schedule*

*Appendix 5: Calcium Chloride with Boost recommendations*

## MATERIAL APPLICATION GUIDELINES

### 1. INTRODUCTON

The following material application guidelines are intended to complement WSDOT region and area application guidelines which better represent practices unique to their own geographical location. These guidelines may serve as a basis for such local guidelines, or be used in kind to support decision-making and best management practices of a systematic anti-icing program. Local application guidelines which have regional management concurrence should always take precedence.

The department is also committed to reducing corrosion and maximizing the performance characteristics of solid material. Towards that end, the statewide standard application for solid material will be to pre-wet solid material with a minimum of 10 gallons of corrosion inhibited liquid anti-icer. A higher concentration of liquid anti-icer in combination with solid material is both allowed and recommended as such applications have been shown to be extremely effective in a variety of road and weather conditions.

This guide is based upon the Federal Highway Administration's (FHWA) "Manual of Practice for an Effective anti-icing Program" and the "National Cooperative Highway Research Program" (NCHRP) 6-13. The Manual of Practice for an Effective anti-icing Program provides the results of four years of anti-icing field-testing conducted by 15 State highway agencies and supported by the Strategic Highway Research Program (SHRP) and the Federal Highway Administration (FHWA). This guide also uses information obtained from the National Cooperative Highway Research Program (NCHRP) 6-13. Both manuals provide application rates for Sodium Chloride (NaCl). This Guide has been prepared to show equivalent material application rates for Calcium Chloride (CaCl<sub>2</sub>), Magnesium Chloride (MgCl<sub>2</sub>), and Calcium Magnesium Acetate (CMA)

### 2. GUIDANCE FOR ANTI-ICING OPERATIONS

Guidance for anti-icing operations is presented in Tables 1 to 6 for six distinctive winter weather events. The six events are:

1. Light Snow Storm
2. Light Snow Storm with Period(s) of Moderate or Heavy Snow
3. Moderate or Heavy Snow Storm
4. Frost or Black Ice
5. Freezing Rain Storm
6. Sleet Storm

The tables suggest appropriate maintenance actions to take during either an initial or subsequent (follow-up) anti-icing operation for a given weather event. Each action is defined for a range of pavement temperatures and an associated air temperature trend. For some events, the operation is dependent not only on the pavement temperature and trend, but also upon the pavement surface or traffic condition at the time of the anti-icing action. Most of the maintenance actions involve chemical applications in a solid, liquid, or pre-wetted solid form. Application rates or "spread rates" are given for each chemical option to be used appropriately. These are suggested values and should be adjusted, if necessary, to achieve increased effectiveness or efficiency, for local conditions. Application rates in volumetric units (gal/lane-mi) are calculated from dry chemical rates. Comments and notes are given in each table where appropriate to further guide the maintenance field personnel in their anti-icing operations.

**Table 1. Weather event: LIGHT SNOW  
Using a 32% concentration of Calcium Chloride**

PAVEMENT TEMPERATURE RANGE, AND TREND	INITIAL OPERATION		SUBSEQUENT OPERATIONS		COMMENTS	
	Pavement surface at time of Initial operation	Maintenance Action	Chemical spread rate (gal/ln-mi) Liquid <b>CaCl<sub>2</sub></b>	Maintenance Action		Chemical spread rate (gal/ln-mi) Liquid <b>CaCl<sub>2</sub></b>
Above 32°F, Steady or rising	Dry, wet, slush, or light snow cover	None, see comments	N/R	None, see comments	N/R	*Monitor pavement temperature closely *Treat icy patches if needed with chemical at 15-35 GPLM... plow if needed
32°F, or below is imminent;	Dry	Apply liquid	15-35	Plow as needed; reapply liquid Chemical when needed	15-35	*Application rates will depend on dilution potential
<i>ALSO</i> 20 to 32°F, Remaining in range	Wet, slush, or light snow cover		20-40		20-40	
15 to 20°F, Remaining in range	Dry, wet, slush, or light snow cover		30-65		30-65	
Below 15°F, Steady or falling	Dry or light snow cover	Plow as needed	N/R	Plow as needed	N/R	* It is not recommended that chemicals be applied in this temperature range * Abrasives can be applied to enhance traction

**CHEMICAL APPLICATIONS:** These application rates are starting points. Local experience should refine these recommendations. Time chemical applications to prevent deteriorating conditions or development of packed and bonded snow. Monitor temperature and humidity to determine application timing.

**PLOWING:** Before applying any ice control chemical, the surface should be cleared of as much snow and ice as possible

**CHEMICAL RATES:** The recommended snow and ice control material application rates depend on atmospheric and pavement conditions at the time of treatment and on how these conditions are expected to change over the time period (window) between the current treatment and the next anticipated treatment.

**SOLID DEICER:** See Sodium Chloride for application recommendations.

Table 2. Weather event: LIGHT SNOW STORM WITH PERIOD (S) OF MODERATE OR HEAVY SNOW

Using a 32% concentration of Calcium Chloride

PAVEMENT TEMPERATURE RANGE, AND TREND	INITIAL OPERATION			SUBSEQUENT OPERATIONS		COMMENTS
	Pavement surface at time of Initial operation	Maintenance Action	Chemical spread rate (gal/l <sub>n</sub> -mi) Liquid CaCl <sub>2</sub>	Maintenance Action	Chemical spread rate (gal/l <sub>n</sub> -mi) Liquid CaCl <sub>2</sub>	
Above 32°F, Steady or rising	Dry, wet, slush, or light snow cover	None, see comments	N/R	None, see comments	N/R	N/R=Not Recommended  *Monitor pavement temperature closely *Treat icy patches if needed with chemical at 15-35 GPLM... plow if needed
32°F, or below is imminent;	Dry	Apply liquid	15-35	Plow as needed; reapply liquid Chemical when needed	15-35	*Do not apply liquid chemical onto heavy snow accumulation or packed snow * Application rates will depend on dilution potential
ALSO 20 to 32°F, Remaining in range	Wet, slush, or light snow cover		20-40		20-40	
15 to 20°F, Remaining in range	Dry, wet, slush, or light snow cover		30-70		30-70	
Below 15°F, Steady or falling	Dry or light snow cover	Plow as needed	N/R	Plow as needed	N/R	* It is not recommended that chemicals be applied in this temperature range * Abrasives can be applied to enhance traction

**CHEMICAL APPLICATIONS:** These application rates are starting points. Local experience should refine these recommendations. Time chemical applications to prevent deteriorating conditions or development of packed and bonded snow. Monitor temperature and humidity to determine application timing.

**PLOWING:** Before applying any ice control chemical, the surface should be cleared of as much snow and ice as possible

**CHEMICAL RATES:** The recommended snow and ice control material application rates depend on atmospheric and pavement conditions at the time of treatment and on how these conditions are expected to change over the time period (window) between the current treatment and the next anticipated treatment.

**SOLID DEICER:** See Sodium Chloride for application recommendations.

**Table 3. Weather event: MODERATE OR HEAVY SNOW STORM**

Using a 32% concentration of **Calcium Chloride**

PAVEMENT TEMPERATURE RANGE, AND TREND	INITIAL OPERATION			SUBSEQUENT OPERATIONS		COMMENTS
	Pavement surface at time of Initial operation	Maintenance Action	Chemical spread rate (gal/l <sub>n</sub> -mi) Liquid <b>CaCl<sub>2</sub></b>	Maintenance Action	Chemical spread rate (gal/l <sub>n</sub> -mi) Liquid <b>CaCl<sub>2</sub></b>	
Above 32°F, Steady or rising	Dry, wet, slush, or light snow cover	None, see comments	N/R	None, see comments	N/R	N/R=Not Recommended  *Monitor pavement temperature closely *Treat icy patches if needed with chemical at 15-35 GPLM plow if needed
32°F, or below is imminent; <i>ALSO</i> 20 to 32°F, Remaining in range	Dry	Apply pre-wet solid NaCl	N/R	Plow accumulation and reapply pre-wet solid chemical as needed	N/R	* If sufficient moisture is present, solid chemical without pre-wetting can be applied * Do not apply liquid chemical onto heavy snow accumulation or packed snow
15 to 20°F, Remaining in range	Wet, slush, or light snow cover		N/R		N/R	
	Dry, wet, slush, or light snow cover		N/R		N/R	
Below 15°F, Steady or falling	Dry or light snow cover	Plow accumulation as needed	N/R	Plow accumulation as needed	N/R	* It is not recommended that chemicals be applied in this temperature range * Abrasives can be applied to enhance traction

**CHEMICAL APPLICATIONS:** These application rates are starting points. Local experience should refine these recommendations. Time chemical applications to *prevent* deteriorating conditions or development of packed and bonded snow. Monitor temperature and humidity to determine application timing.

**PLOWING:** Before applying any ice control chemical, the surface should be cleared of as much snow and ice as possible

**CHEMICAL RATES:** The recommended snow and ice control material application rates depend on atmospheric and pavement conditions at the time of treatment and on how these conditions are expected to change over the time period (window) between the current treatment and the next anticipated treatment.

**SOLID DEICER:** See Sodium Chloride for application recommendations.

**Table 4. Weather event: FROST OR BLACK ICE**  
 Using a 32% concentration of Calcium Chloride

PAVEMENT TEMPERATURE RANGE, AND TREND	TRAFFIC CONDITION	INITIAL OPERATION		SUBSEQUENT OPERATIONS		COMMENTS
		Maintenance Action	Chemical spread rate (gal/l <sub>n</sub> -mi) Liquid CaCl <sub>2</sub>	Maintenance Action	Chemical spread rate (gal/l <sub>n</sub> -mi) Liquid CaCl <sub>2</sub>	
32°F, Steady or rising	Any level	None, see comments	N/R	None, see comments	N/R	*Monitor pavement temperature closely; begin treatment if temperature starts to fall to 32°F or below and is at or below dew point
28 to 32°F, Remaining in range or falling 32°F or below, and equal to or below dew point	Traffic rate less than 100 vehicles per hour	Apply liquid chemical	10-25	Reapply liquid chemical as needed	10-25	* Application rates will depend on dilution potential
	Traffic rate greater than 100 vehicles per hour		20-35		20-35	
15 to 28°F, Remaining in range, and equal to or below dew point	Any level		20-40		25-40	* Application rates will depend on dilution potential
Below 15°F, Steady or falling	Any level	Apply abrasives	N/R	Apply abrasives as needed	N/R	* It is not recommended that chemicals be applied in this temperature range * Abrasives can be applied to enhance traction

**CHEMICAL APPLICATIONS:** These application rates are starting points. Local experience should refine these recommendations. Time chemical applications to prevent deteriorating conditions or development of packed and bonded snow. Monitor temperature and humidity to determine application timing.

**PLOWING:** Before applying any ice control chemical, the surface should be cleared of as much snow and ice as possible

**CHEMICAL RATES:** The recommended snow and ice control material application rates depend on atmospheric and pavement conditions at the time of treatment and on how these conditions are expected to change over the time period (window) between the current treatment and the next anticipated treatment.

**Table 5. Weather event: FREEZING RAINSTORM**

Using a 30% concentration of Magnesium Chloride

Using a 32% Calcium Chloride

Using a 25% concentration of CMA

**CHEMICAL APPLICATIONS:** It is possible to use these chemicals during this event but is not recommended. However, these products can be used through a pre-wet system to increase solid / abrasive efficacy. The application rate for liquids alone would be cost prohibitive and the potential for dilution is high. It is recommended to use a solid chemical application or abrasives.

Using Solid Sodium Chloride

PAVEMENT TEMPERATURE RANGE, AND TREND	INITIAL OPERATION		SUBSEQUENT OPERATIONS		COMMENTS
	Maintenance Action	Chemical spread rate (lb/ln-mi) <b>NaCl</b>	Maintenance Action	Chemical spread rate (lb/ln-mi) <b>NaCl</b>	
Above 32°F, Steady or rising	None, see comments	N/R	None, see comments	N/R	N/R=Not Recommended * Monitor pavement temperature closely * Treat icy patches if needed with pre-wetted solid chemical at 100--150 lb/lane-mi
32°F, or below is imminent	Apply solid chemical	100-200	Reapply solid chemical as needed	100-200	* Monitor pavement temperature and precipitation closely * Application rates will depend on dilution potential
20 to 32°F, Remaining in range		200-300		200-300	
15 to 20°F, Remaining in range		250-400		250-400	
Below 15°F, Steady or falling	Apply abrasives	N/R	Apply abrasives as needed	N/R	* It is not recommended that chemicals be applied in this temperature range * Abrasives can be applied to enhance traction

**CHEMICAL APPLICATIONS:** These application rates are starting points. Local experience should refine these recommendations. Time chemical applications to prevent deteriorating conditions or development of packed and bonded snow. Monitor temperature and humidity to determine application timing.

**PLOWING:** Before applying any ice control chemical, the surface should be cleared of as much snow and ice as possible

**CHEMICAL RATES:** The recommended snow and ice control material application rates depend on atmospheric and pavement conditions at the time of treatment and on how these conditions are expected to change over the time period (window) between the current treatment and the next anticipated treatment.

**Table 6. Weather event: SLEET STORM**

Using a 32% concentration of Calcium Chloride

PAVEMENT TEMPERATURE RANGE, AND TREND	INITIAL OPERATION	SUBSEQUENT OPERATIONS	COMMENTS		
	Maintenance Action	Liquid CaCl <sub>2</sub>	Maintenance Action	Liquid CaCl <sub>2</sub>	N/R=Not Recommended
Above 32°F, Steady or rising	None, see comments	N/R	None, see comments	N/R	Go to Sodium Chloride Chart
32°F, or below is imminent	Apply solid NaCl	N/R	Plow accumulation and reapply pre-wet solid chemical as needed	N/R	
28 to 32°F, Remaining in range					
15 to 28°F, Remaining in range					
Below 15°F, Steady or falling	Plow as needed	N/R	Plow as needed	N/R	

**CHEMICAL APPLICATIONS:** These application rates are starting points. Local experience should refine these recommendations. Time chemical applications to prevent deteriorating conditions or development of packed and bonded snow. Monitor temperature and humidity to determine application timing.

**PLOWING:** Before applying any ice control chemical, the surface should be cleared of as much snow and ice as possible

**CHEMICAL RATES:** The recommended snow and ice control material application rates depend on atmospheric and pavement conditions at the time of treatment and on how these conditions are expected to change over the time period (window) between the current treatment and the next anticipated treatment.

### 3. GLOSSARY OF TERMS

**Black Ice:** Popular term for a very thin coating of clear, bubble-free, homogeneous ice which forms on a pavement with a temperature at or slightly above 32°F when the temperature of the air in contact with the ground is below the freezing-point of water and small slightly super cooled water droplets deposit on the surface and coalesce (flow together) before freezing.

**Freezing Rain:** Super cooled droplets of liquid precipitation falling on a surface whose temperature is below or slightly above freezing, resulting in a hard, slick, generally thick coating of ice commonly called glaze or clear ice. Non-super cooled raindrops falling on a surface whose temperature is well below freezing will also result in glaze.

**Frost:** Also called hoarfrost. Ice crystals in the form of scales, needles, feathers or fans deposited on surfaces cooled by radiation or by other processes. The deposit may be composed of drops of dew frozen after deposition and of ice formed directly from water vapor at a temperature below 32°F (sublimation).

**Light Snow:** Snow falling at the rate of less than 1/2 inch per hour; visibility is not affected adversely.

**Liquid Chemical:** A chemical solution; the volume of solution applied per lane mile is the chemical application rate used in this appendix.

**Moderate or Heavy Snow:** Snow falling at a rate of 1/2 inch per hour or greater; visibility is significantly reduced.

**Sleet:** A mixture of rain and snow, which has been partially melted by falling through an atmosphere with a temperature slightly above freezing.

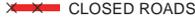
**Slush:** Accumulation of snow, which lies on an impervious base and is saturated with water in excess of its freely drained capacity. It will not support any weight when stepped or driven on but will "squish" until the base support is reached.

**Pre-wetting:** The practice of applying liquid chemical to dry material before it is placed on the pavement

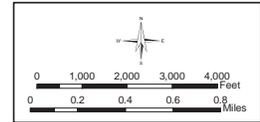
**Dry Chemical Spread Rate.** For solid chemical applications, it is simply the weight of the chemical applied per lane mile. For liquid applications it is the amount of liquid chemical applied per lane mile.

# 2014/2015 City of Kirkland Snow Plowing Routes

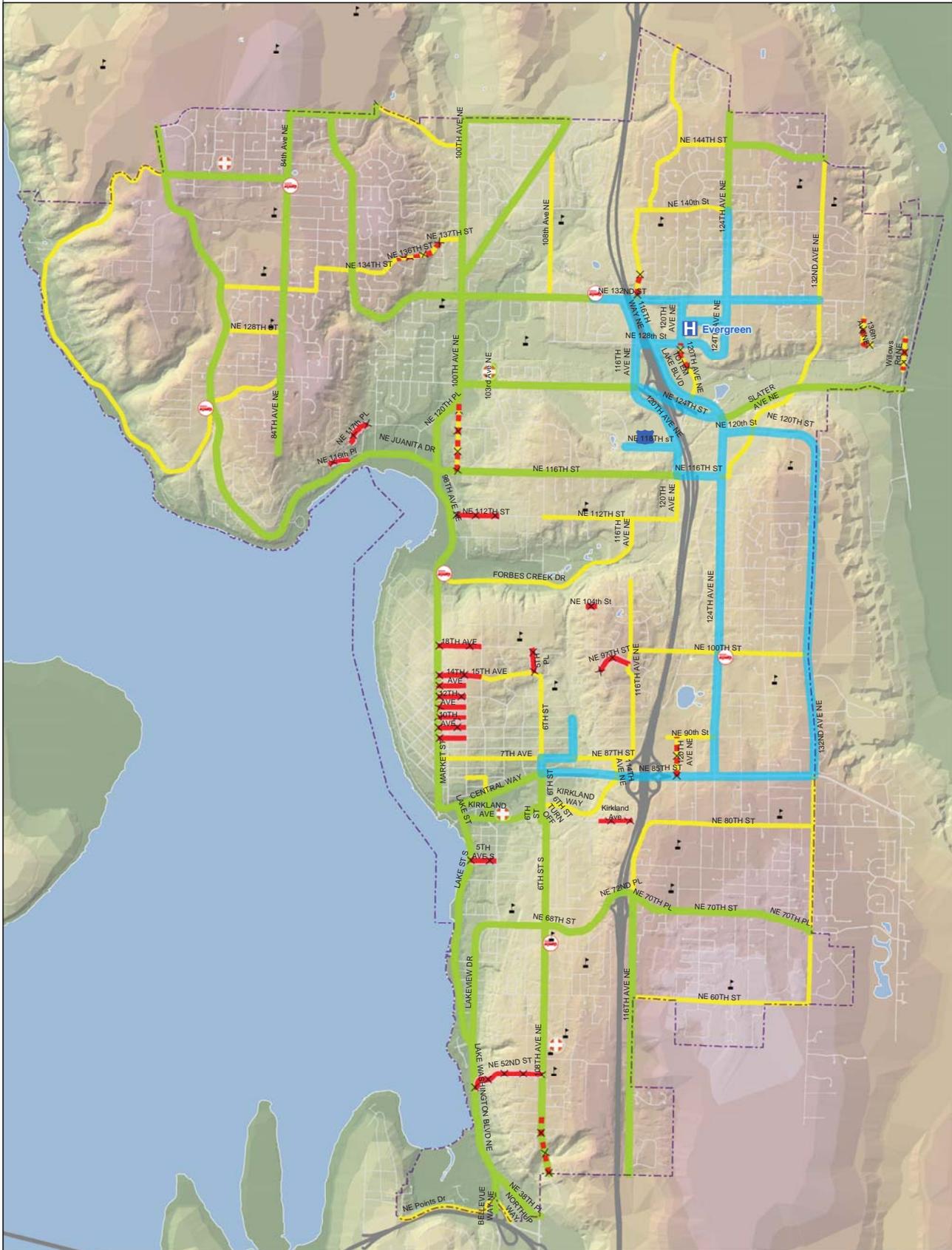
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-  Kirkland Justice Center
-  Fire Stations
-  CLOSED ROADS
-  POTENTIALLY CLOSED ROAD
-  PRIORITY 1
-  PRIORITY 2
-  PRIORITY 3
-  School Locations
-  Planned Shelter/Charging Locations

Elevation	Color
250 - 300	Lightest Yellow
200 - 250	Light Yellow
150 - 200	Yellow-Green
100 - 150	Light Green
50 - 100	Medium Green
0 - 50	Darkest Green
530 - 600	Lightest Pink
500 - 530	Light Pink
450 - 500	Medium Pink
400 - 450	Dark Pink
350 - 400	Light Brown
300 - 350	Dark Brown

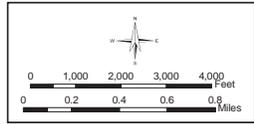
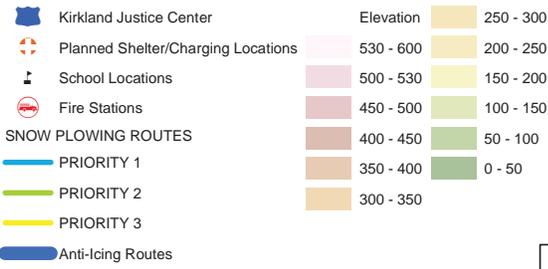


Author: Phil Larkin - IT GIS  
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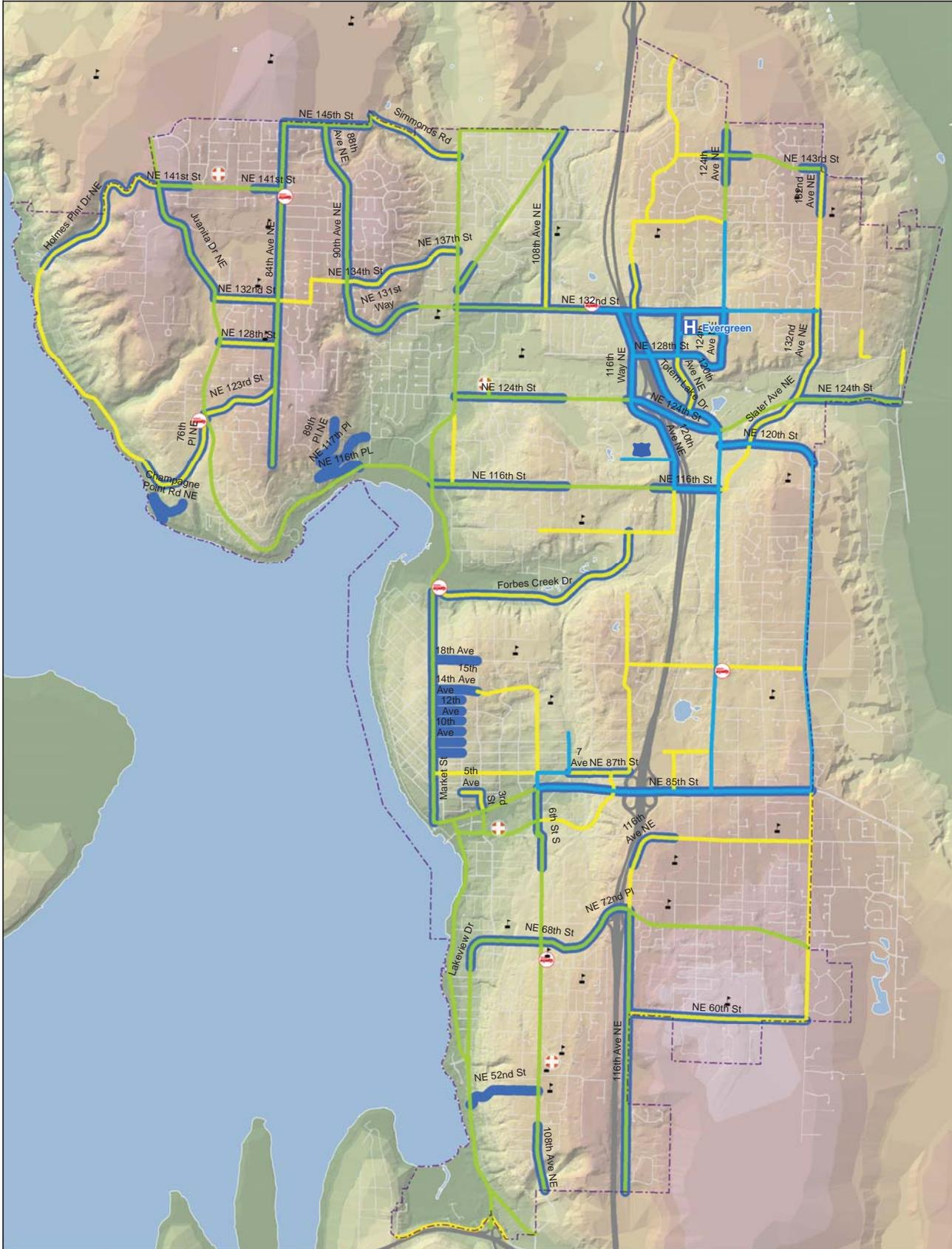


# 2014/2015 City of Kirkland Anti-Icing Routes

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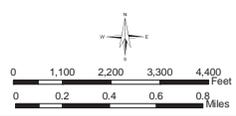
# 2014/2015 City of Kirkland Wind Storm Sweeping Routes

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limited to accuracy, fitness or merchantability,  
accompany this product.

-  Kirkland Justice Center
  -  Fire Stations
  -  PRIORITY 1
  -  PRIORITY 2
  -  School Locations
  -  Planned Shelter/Charging Locations
- |           |  |
|-----------|--|
| Elevation |  250 - 300  |
|           |  200 - 250 |
|           |  150 - 200 |
|           |  100 - 150 |
|           |  50 - 100  |
|           |  400 - 450 |
|           |  350 - 400 |
|           |  300 - 350 |
|           |  530 - 600  |
|           |  500 - 530  |

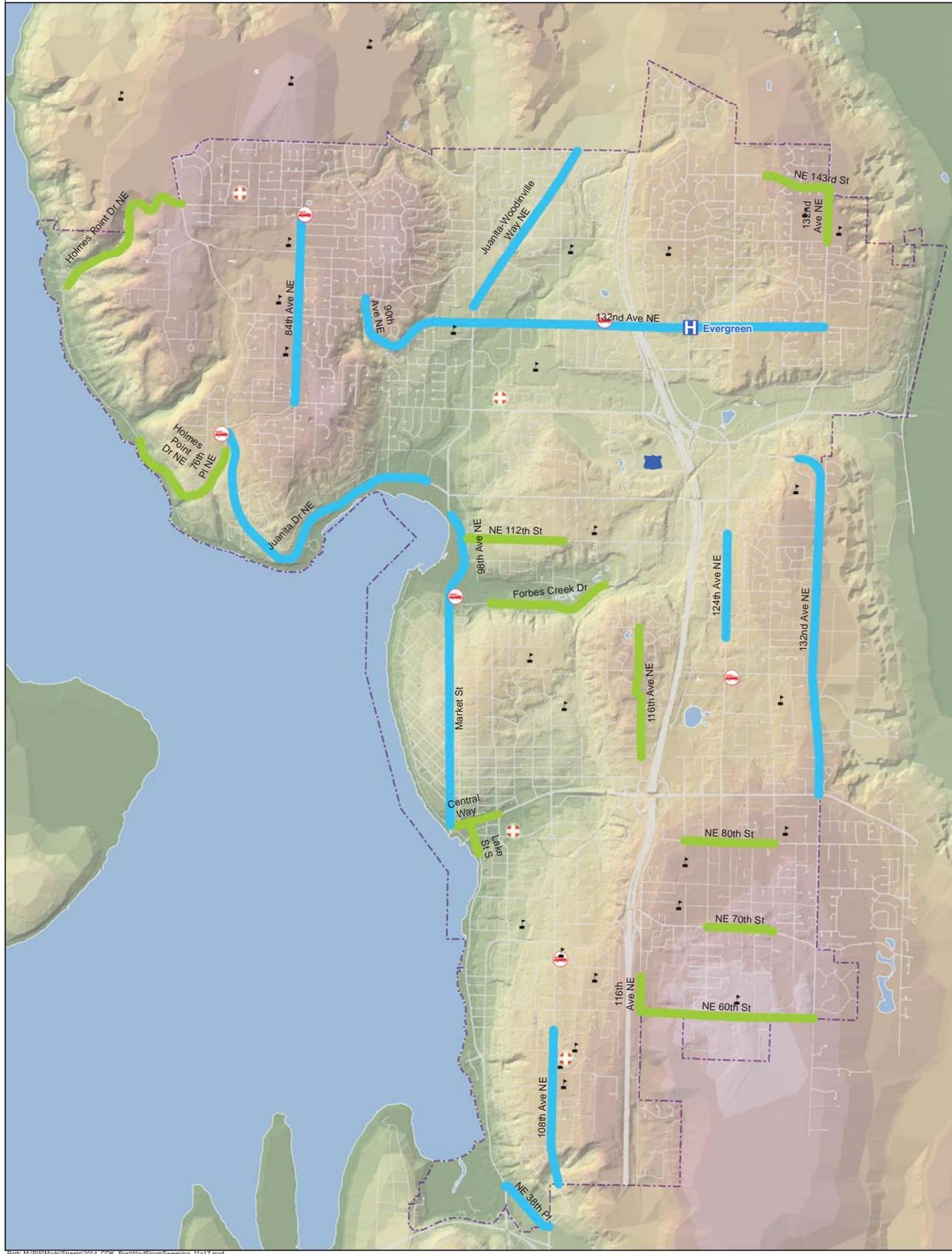


Appendix 3c



0 1,100 2,200 3,300 4,400 Feet  
0 0.2 0.4 0.6 0.8 Miles

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**PUBLIC WORKS MAINTENANCE CENTER  
2014-2015 SNOW / ICE SCHEDULE**

11/24/14

Appendix 4

EMPLOYEE NAME	NO.	POSITION	10:45 AM to 10:45P PM DAY	10:45 PM to 10:45 AM SWING
<b>MC SUPERINTENDENT</b>				
Erin Devoto		Superintendent		
<b>PW O&amp;M ADMIN 5am - 10pm</b>				
Sheth, Vandana	421	Management Analyst		
Ordos, Elizabeth	400	PWMC Office Specialist		
Fletcher, June	400	PWMC Office Specialist	9-3	
Hiatt, Heidi	400	Data Entry Clerk		
<b>FLEET DIVISION</b>				
Llewellyn, Tim		Fleet Supervisor		
Ultican, Tim		Fleet Leadperson	KJC	
Seeley, Scott		EVT		
Fink, Jim		EVT		
Gavigan, Kenny		EVT		KJC
Zoeger, Jason		EVT		
Campbell, Cindy		Fleet Maint/Inventory		
<b>STREET AND GROUNDS DIVISIONS</b>				
Steiger, Ray	407	Street Manager		
Berntsen, Mark	432	Leadperson		
Dalseg, Brian	448	Signal Tech		
Rogers, Dan	493	Signal Tech		
~vacant~		Signal Tech		
Helsel, Scott	430	Sign Shop		
Jammerman, Jenny	442	Sign Shop		
McVittie, Ben	427	Senior Maintenance		
Stansberry, Micah	437	Senior Maintenance		
Loken, David	460	Senior Maintenance		
Jarvi, Wain	445	Senior Maintenance		
Smith, Kyle	454	Senior Maintenance		
Young, Justin	481	Senior Maintenance		
Keele, Chris	457	Senior Maintenance		
Brown, Justin	428	Utility		
Plowman, Brenda	433	Utility		
~vacant~		Utility		
Malmquist, Blake	472	Utility		
<b>PUBLIC GROUNDS SECTION</b>				
Sedlacek, Shannon	466	Grounds Leadperson		
~vacant~		Field Arborist		
Hamilton, Zeb	439	Yard/Inventory		
Chase, Gary	436	Utility/yard		
Jabkiewicz, Leah	477	Utility		
Edwards, Jordan	458	GroundsTech		
Merkel, Jerry	492	GroundsTech		
Hedges, Teri	474	GroundsTech		
Dempsey, Mark	471	Laborer		
~vacant~		Laborer		
~vacant~		Laborer		
Hamlin, Kalvin	464	Laborer		
<b>WATER DIVISION</b>				
Neumann, Greg	440	Water Manager		
Ensminger, Steve	441	Leadperson		
Brown, Joe	438	Senior Maintenance		
Hoopes, Steve	485	Senior Maintenance		
Mallamo, Gianni	496	Meter Reader		
Holmes, Karla	498	Senior Utility		
Blacketter, Kim	487	Utility		
Thress, Duane	447	Utility		
~vacant~		Utility		
Kirschenmann, Trevor	452	Utility		
Nicholson, Shane	469	Utility		
<b>SURFACE &amp; WASTE WATER DIVISION</b>				
Wallace, Bobbi	480	Storm/Sewer Manager		
Van Iterson, Dan	495	Leadperson		
Osborn, Jason	482	Leadperson		
<b>SURFACE WATER SECTION</b>				
Winston, Lee	431	Senior Maintenance		
Seaton, Thomas	461	Senior Maintenance		
Gillie, Trebor	434	Senior Maintenance		
Maddalena, Jesse	497	Senior Maintenance		
Byrd, Jesse	443	Senior Maintenance		
Merrill, Craig	483	Utility		
Le, Ho	488	Utility		
Pickens, Brandi	478	Utility		
Milliken, Kevin	490	Utility		
Wells, Dave	435	Utility		
Danielson, Jonathan	489	Utility		
Olsson, Bennett	453	Utility		
<b>WASTE WATER SECTION</b>				
Gillespie, Nate	449	Senior Maintenance		
Reiser, Chris	467	Utility		
Murray, Gregor	451	Utility		
Jones, Mark	468	Utility		



# AMERICA WEST

**WHAT YOU WANT WHEN YOU WANT IT**

## ROADWAY SURFACE GOAL OPTIONS

	Surface Goal 1	Surface Goal 2	Surface Goal 3	Surface Goal 4	Surface Goal 5
<b>Primary Goal</b>	Bare roadway	Bare roadway	Bare roadway	Bare roadway	Passable roadway as safety considerations allow.
<b>Allowable Surface Condition</b>	Slush as necessary to allow solid chemical to work.	Snow accumulating up to 1 inch, bare within 2-4 hours from end of snow event.	Snow accumulation up to 2 inches, bare within 2-8 hours from end of snow event.	Snow accumulation up to 3 inches, bare within 4-12 hours from end of snow event.	Moderate snow accumulation greater than 3 inches.
<b>Treatment Strategies</b>					
<b>Frost</b>	Pre-treat with liquid 10-20 gal per lane mile.	Pre-treat with liquid 10-20 gal per lane mile.	Pre-treat with liquid 10-20 gal per lane mile.	Pre-treat with liquid 10-20 gal per lane mile.	Pre-treat with liquid 10-20 gal per lane mile.
<b>Snow</b>	Pre-treat with liquid 20-40 gal per lane mile.	Pre-treat with liquid 20-40 gal per lane mile.	Pre-treat with liquid 20-40 gal per lane mile.	Pre-treat with liquid 20-40 gal per lane mile.	Pre-treat with liquid 20-40 gal per lane mile.
<b>Accumulating Snow</b>	Plow and treat with solid chemical allowing chemical to work between passes.	Plow and use sand as needed.	Plow and use sand as needed.	Plow and use sand as needed, a rotary plow may be necessary to maintain width.	Plow and use sand as needed.
<b>Compact</b>	De-ice with solid chemical if necessary. Plow as needed. Apply sand only when too cold for chemicals.	At the end of the snow event, de-ice with solid chemical unless temperature is increasing. Plow as needed.	At the end of the snow event, may de-ice with solid chemical unless temperature is increasing. Use <i>Roadway Surface Goal 2 criteria</i> in high accident areas.	Remove compact as temperature allows. Use <i>Roadway Surface Goal 2 criteria</i> in high accident areas.	

### General Information

**Weather Information** The following weather information should be considered when making treatment decisions: Forecasted weather type (snow, rain, freezing rain) - Precipitation start and end times - Forecasted snow accumulation - Forecasted temperatures and rising or falling - Wind, fog, frost, or very cold temperatures - Road surface temperature and freezing point - RWIS information

**Chemicals** Solid chemical application rates should be determined by the expected snow accumulation. Always pre-wet solid chemical with liquid chemical during application.

**Abrasives** Abrasives should be used sparingly and only as needed for traction enhancement. Always pre-wet abrasives with liquid chemical during application.

Disclaimer: As America West Environment Supplies, Inc. will not be applying and since use conditions and treatment options are not within its control, America West Environmental Supplies, Inc. assumes no obligation or liability and does not guarantee results from selection and use of these treatment strategies.

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## Historic budgets (snow and ice removal costs)

