



How to Build and Maintain an Outdoor Rink

presented by:



How to Build and Maintain an Outdoor Ice Rink

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Surface Selection

Naturally, when looking for a site which is suitable for an outdoor rink, you will look for one which is fairly level. Of course, almost any terrain can be leveled by various construction methods; however, earth moving by any method is expensive and should be avoided where possible. You must also check the condition of the existing ground and find if the sub surface is made up of clay, loamy soil, etc. The type of sub surface can have a large effect on the spring drainage of the site and may dictate how much drainage you will have to artificially create. For example; if you build an outdoor rink on a slope with unstable earth above the ice surface you run the risk of having premature run-off or even worse some sliding of the hillside onto your surface.

Water Supply

Unless water is going to be trucked to the site you have selected then an ample supply of water should be readily available. It would be preferable to have a supply of water from a controlled water connection i.e. a valved source. Note: flooding from a fire hydrant without some sort of valved control can be costly, wasteful and ineffective when the water is merely poured out at an uncontrolled rate. If you do not have a controlled water connection site then the next best alternative is access to a stream, brook, pond, lake, slough etc. which does not completely freeze up during the coldest days of the year. A good gasoline pump and hose will serve your water needs well. Recommendations on types of equipment will be discussed later in this manual.

Power Supply and Lighting

The availability of electricity is another important consideration. To obtain maximum use of the facility it is recommended that some sort of lighting be considered, otherwise use will be drastically limited due to the shorter amounts of daylight available during the winter, especially in late December and early January. Outdoor lighting is recommended for the functional use of your rink. Without lighting, the amount of use is drastically reduced.

Surface Area of Site

In choosing a site, make sure that you have enough surface area to accommodate the facility. Care should be taken to ensure that the site can accommodate an ice surface of sufficient size. These decisions may be made already for you but give some thought to how the facility will be used and how best to meet the needs of those in the local area.

A 50 x 100 or 60 x 100 foot rink is adequate and can be used for 2 rinks sideways to accommodate more children. The two most common rink sizes are 120'X 60'and 100'x 60'. The rink you build can be smaller depending on the area available.

For a multi purpose pad (120' X 60') you will need 36 - 2' x 6'x 10' boards and for a pleasure rink (100'x 60') you will need 32 - 2'x 6' x 10' boards.

Ancillary Facilities

Facilities such as change rooms, washrooms, or maintenance sheds should be taken into account when you are selecting the site. You may not have these facilities when you open in the first year or two but you should make sure that the ice surface is located properly or in such a way as to accommodate these structures in the future. The provision of adequate space at this stage will cause you less headaches later on in the facilities life. Or a more cost effective alternative would be to construct this facility so that other facilities and portions of other facilities can be used for two purposes.

Parking

One item many communities forget about is parking. Parking can be a serious concern and cause other associated problems with the facilities operations. Try to pick a site where you can accommodate parking for at least 10 vehicles. At busy times you may have even more vehicles at the facility so the larger the parking area the better.

Rink Orientation

Where practical, the long axis of a rink should run a north south direction. This orientation will minimize the number of south facing rink boards, which reflect the sun's rays onto the ice surface and will cause soft ice conditions during warm weather. If located in the shade of trees or of a building, the ice will be less prone to melting on mild days. But, the more shade the cooler it is for the users!

Other Points to Consider:

- Where do you put the snow - is it easy to get a machine in to clean
- Prior to bringing any snow clearing equipment (ie: Bobcat) to the rink ensure there is adequate clearance. Many tennis court users push it to the middle. Leave room to get a hired machine or volunteer plow in.

Surface Preparation

Dirt, sand, gravel, grass, asphalt, and concrete are all usable surfaces for natural ice, if flooding is done properly. However, for indoor surfaces, sand, a clay sand mixture or concrete are the most commonly used. For porous surfaces, ensure that the area to be flooded is as level as possible, eliminating any humps, low spots, or rocks. Dirt and sand bases are the easiest to level annually before the frost sets into the ground. A sloping or uneven surface will take much more time and water to make ice than would a relatively level surface. All porous surfaces should be loose to a depth of approximately 1 - 2 cm (1/2" - 1") to ensure a good bond between the surface and the ice.

For grass surfaces, the grass should be cut as short as possible and the cuttings removed.

For hard surfaces, all oil, gum, dirt should be removed and thoroughly cleaned off the surface. Water will have a great deal of difficulty bonding and freezing with any of these substances present.

For all surfaces, before water is applied, any spaces under the rink boards should be sealed to prevent water from creeping under the boards onto adjacent areas. This can be accomplished by using wet paper towels, rags, plastic sheeting, canvas strips, foam strips, fiberglass insulation pieces, or even wet packed snow if it is allowed to freeze before flooding. As the rink is flooded, a check should be made to ensure no water is escaping from the rink area.

Once cold weather is anticipated in the near future, some ice makers begin by soaking the ground with lawn sprinklers or with hoses and nozzles. This soaking procedure is repeated every two or three days until it is time to make ice. The reason for this soaking is to provide a maximum frost base which will help hold the ice through warm weather operating conditions.

However, many ice makers do not agree with this procedure. It is argued that wet soil conditions can create two problems. Firstly, as the frost level penetrates deeper into the soil, any water present will freeze and expand,

possibly causing frost boils and heaving of the ice. Secondly, this additional water may delay the use of the area in the Spring, after the ice has thawed.

Another optional procedure is the placement of a layer of snow over the surface before ice making is commenced. Usually, one can wait for the first snowfall and then pack it down before making ice. The purpose of such a procedure is to reduce the amount of heat absorbed from the sun and to provide a whiter playing surface. Other methods to achieve this effect will be discussed later in this manual.

A white covering is especially important over asphalt surfaces as this dark color will absorb much more sunlight/heat and melt the ice quicker.

Excess snow should be removed from the rink before ice making can begin. Only 3 - 5 cm. (1"2") of packed snow should be left covering the rink.

Tennis Courts:

- Install boards when warm, normally done before snow, seal with snow when it comes and wet snow lightly so it freezes and forms a seal. This seal on the outside of the boards should be a 6-8 inch triangle. Wet and foot stamp
- Put snow along inside of boards, but just a couple of inches. Remember it will disappear under ice as you flood and add water. Wet and foot stamp.
- Use of plastic or spray can foam has been suggested by others for use when there is little snow or for leaks
- Consider building a brim of snow around the outside of your boards to start, freeze it, and then start your flooding within the boards. All it can do is leak to the snow, but it is not lost. Also add some water to the court surface as a starter. If there is little frost it may not stay. If there is snow on the ground compact it to 2 or 3 inches.
- Sealcoat your rink. That is, spray a little water on and let it freeze. If really cold do 2 coats in one evening.
- Once sealed, it takes once or twice, flood, as per table below - this is a rule of thumb from experience. Try for minimum 8 inches.
- With lots of snow - DO NOT flood a foot of soft unpacked snow. It gets really crusty and seems to take forever to fill it in and get ice. If it snows a foot while you are starting to flood, get out the scoops and take the top off.

Ground Rinks:

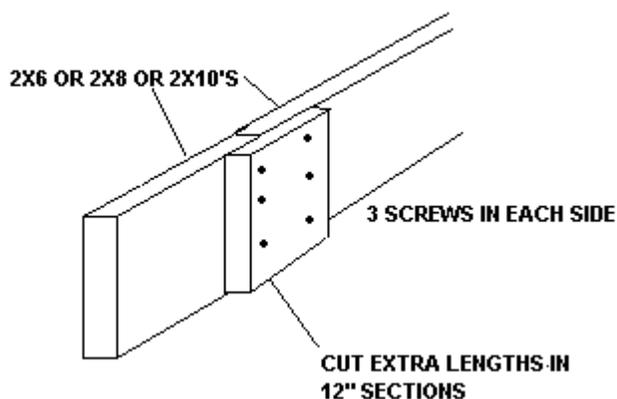
- The grass should be cut short
leaves should be raked up prior to ice making otherwise they melt through the ice and can create holes.
- Install perimeter boards or brim as in tennis court.

- Flatten the snow, seal and flood right away.
- Seal coat - Apply a light coat to seal ground surface and perimeter to insure no leaks.
- Next day, apply water in 2 meter to 4 meter strips from side to side working from one end to the other.
- When weather is suitable to make ice, make every effort to do it as the weather may change.
- Once you seal coat and get first coat on, FLOOD LOW SPOTS AND DO NOT FLOOD HIGH SPOTS. BUILD YOUR ICE FROM THE LOW AREAS. REASON - If you add water to high spots, some does freeze on them and makes them higher, thus it takes you longer to get the whole area smooth.
- Do not let the hose stay in one spot when making ice, especially at the start, it melts ice very quickly - Direct pressure without a nozzle from 5 feet can cut 1 inch into ice in 2 minutes.
- Check ice by walking around on it before flooding again. Shell ice means you have a leak or water flowing into lower spots. Put a light coat on that area to seal the bottom under the shell ice. Check perimeter and pack down any wet areas. Refreeze leaks, add snow.
- Back flood - a technique where you flood low areas and let water come around you before you move back to next strip.

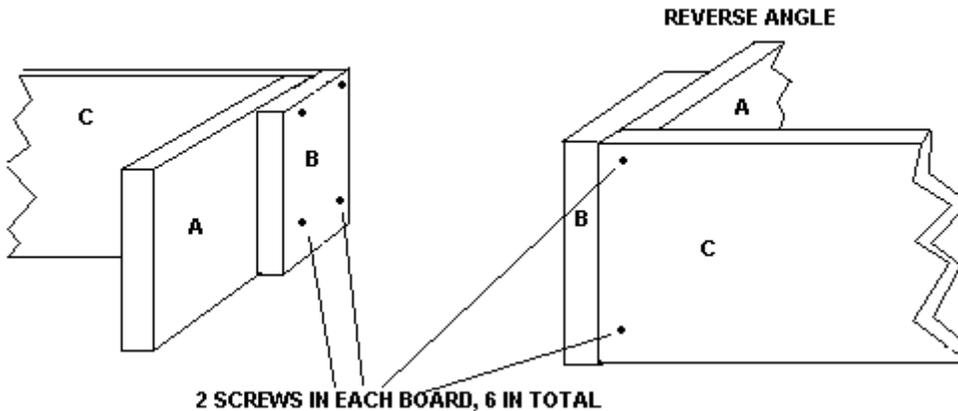
Decide on the size of rink you want to build.

Once you have decided where your rink is going on your lawn and the size of tarp you require, (remember the tarp will be approx. 2 ft. longer and 2 ft. wider than the rink). Go to your local lumber dealer and purchase the required 2x8's or 2x10's or 2x12's depending on how flat your backyard is. Always purchase an extra couple of lengths in order to fabricate the rink. Cut the extra lengths into one (1) foot pieces.

JOINING SIDE BOARDS

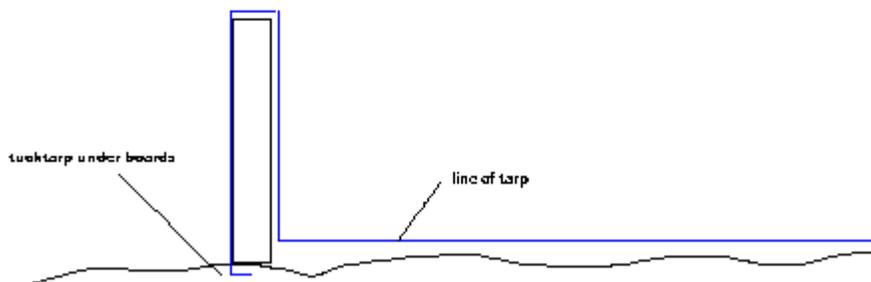


CONNECTING THE CORNERS



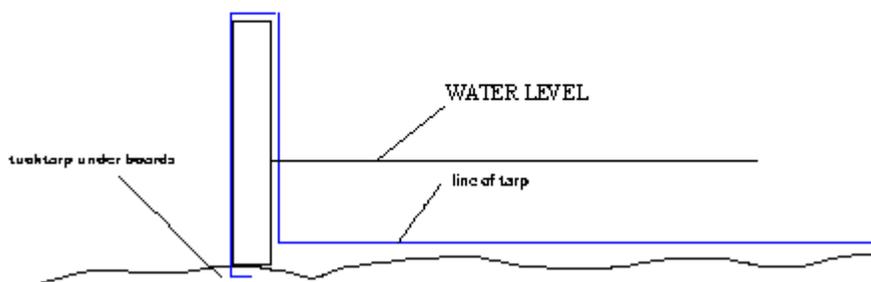
Connect the boards as shown in the dimensions of your rink. Your rink will stand up on its own.

INSTALLING TARP AROUND BOARDS



Spread the tarp over the entire rink and if you have built it properly, drape it over the top of the boards, down the back and tuck it under the board itself.

INSTALLING TARP AROUND BOARDS



Once this is complete, fill the rink area with water ensuring that there is enough tarp to go perpendicular with the bottom of the boards. Wait until the water freezes, shovel off any snow that has fallen, and flood ice.

Without a Liner/Tarp

Decide on the size of rink you want to build.

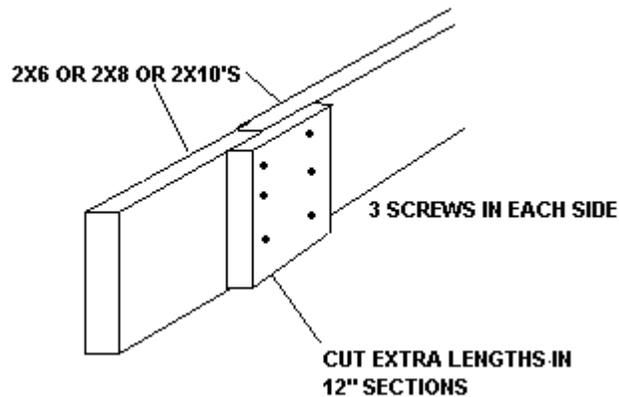
Go to your local lumber dealer and purchase the required 2x8's or 2x10's or

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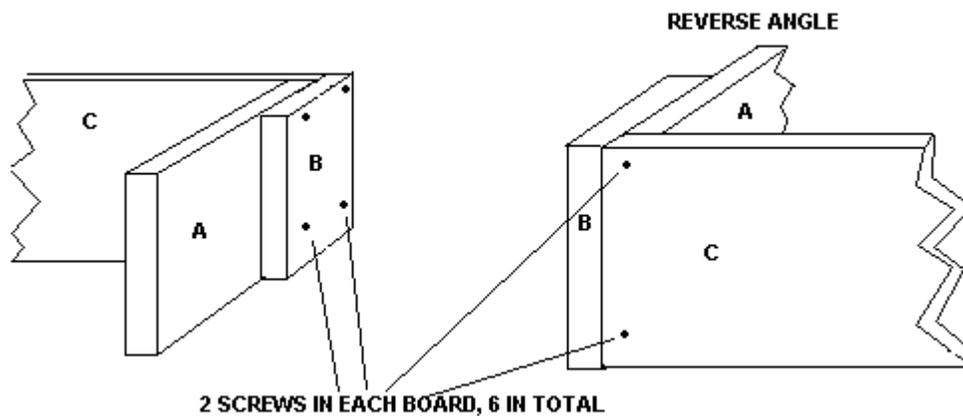
How To Build an Outdoor Rink

2x12's depending on how flat your backyard is. Always purchase an extra couple of lengths in order to fabricate the rink. Cut the extra lengths into one (1) foot pieces.

JOINING SIDE BOARDS



CONNECTING THE CORNERS



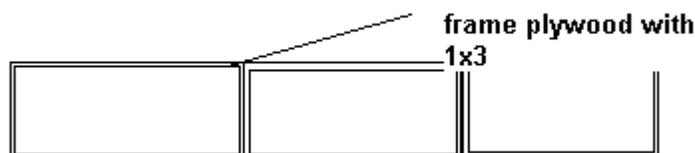
Connect the boards as shown in the dimensions of your rink. Your rink will stand up on its own. Once there is at least 4" of snow on the ground, pack it down. This can be accomplished by using your boots or any other method that packs the snow down tight. Hook up the [Rink Rake](#) and start with the holes up walking backwards over the entire size of your rink (much like a Zamboni would flood a rink). The [Rink Rake](#) will smooth the snow as you go. Continue this until the snow is soft and slushy (about 45 minutes) and let freeze. It will take about 5 to 10 minutes to do the first pass. Do not saturate the snow on the first pass.

Once frozen, continue until the ice becomes soft and slushy again. Continue until you see patches of ice forming on parts of your rink, once this happens, flip the [Rink Rake](#) over with the holes down and continue to flood until it is soft (at this point you are about an hour worth of work away from skating). Continue until your ice is smooth and ready for skating.

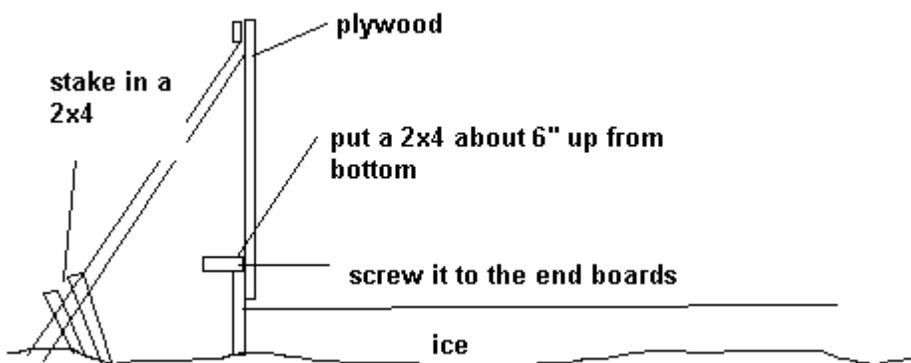
After you have skated on the ice and enjoyed your rink, use the [Rink Rake](#) every time to flood it and your rink will be smooth and maintained easily. Making a rink this way will take about 3 days and about 8 hours of work.

Nail the 1x3's to the outside perimeter on 3 sides of the plywood, the top and 2 sides.

This method stands up to anyones shot



About 6" up from the bottom of the plywood and screw a 2x4 along the same plain (Steps 2-7, see the diagram below). Put the end board up and have someone hold it until the 2 back supports can be installed. Where the supports hit the ground drive in 2 stakes and screw them to the back supports. Making sure the boards are vertical, once done screw the 2x4 into the rink bottom board. When you put the next end board up repeat this and screw the two end boards together. Make sure you have two back supports for each end board.



ICE RINK PREPARATION AND SET-UP

ICE MAKING SUGGESTIONS

The open hose method of flooding an ice surface is generally considered to be the wrong approach to making flood ice. While this method may free the worker to do other tasks, it inevitably results in problems. Firstly the

relatively warm water, i.e. +4 C (40 F) or warmer, will thaw the frozen surface and seep down into the soil where it may cause heaving and cracking problems later in the season. Secondly, the open-hose method will cause shell (shale) ice as the water on the surface freezes while the water underneath runs away, leaving an air space under the ice surface. This shell (shale) ice will usually break or crack under normal use, resulting in a difficult and time consuming repair job.

The correct way to flood an area is to apply water in small amounts through a hose or spray nozzle so that the water freezes on the surface and is built up slowly in thin layers. Once the surface of the ground is solidly frozen and the air temperature is regularly in the desired range, i.e. -18 C - -7 C (0 F - 20 F), the surface can be sealed by applying these fine sprays. It may be best to apply these sprays in the early morning or the evening when the air temperature is around - 12 C (10 F) or colder.

Start the flooding process at one end of the rink and work back to the center. Walk back and forth across the rink spraying the area with a fan like motion covering a strip 1.5 - 2 meters (5' 6') in width. Then go to the other end and work back to the center again. Spraying into the air rather than directly onto the ice will help to cool the water before it hits the ground.

Several fine sprays should be applied before proceeding to a heavier spray. If the weather is cold enough, i.e. - 18 C to - 12 C (0 F to 10 F) spraying can likely be continuous, as the first coat will be frozen almost immediately. However, in warmer weather, additional sprays should not be applied until the previous one is thoroughly frozen. Once the ground has been completely sealed and the water will not run away, the leveling of the ice can begin. Using a heavier spray, repeat the previous procedure, applying as many coats as may be necessary to build up a good level ice surface. Care must be taken during this leveling process to ensure the low spots are filled in gradually, as shell (shale) ice may result if too much water is applied at once. If some spots are particularly low, it may be best to apply water only to those spots until they are built up close to level.

During the flooding process, a number of precautions must be taken with the hose:

- Keep the hose on dry ice, if the hose is dragged over wet ice it will push ice and water with it and ridges will be formed,
- Keep the hose moving so that the warmer water running through the hose does not melt the hose into the ice;
- Ensure connections are tight and the hose does not leak;

- Do not leave a running hose unattended on the ice surface (a second person would be helpful to manage the excess hose).

When the greater percentage of the rink is leveled and covered with an adequate surface of ice, skating can be allowed. Skating will create snow that can be used for slush that will fill hard to freeze areas, cracks and low areas. The skating will also create a whitening effect on the ice surface, either in place of or in addition to, the actual painting of the ice.

Sugar cube

This approach is done by heavily watering the snow; imagine each section of snow is a large sugar cube. The darkening on the surface gives a good indication of the degree of saturation.

Slush method

- create slush working in small sections;
- Water the ground
- Work it into slush with a snow shovel to smooth it out
- Move along and do it again
- Work in lanes (walking backwards)
- The following night;
 - use an open ended hose - you want as much water on the ground as possible in a short amount of time
 - flood evenly
 - you may be able to flood 1-2 times in one night, depending on the size of the rink area and temperature

Ice Maintenance:

The first step in preparing the ice for re-flooding is to sweep the snow and chippings away from the boards, as the scraper will not get all the snow away from the boards. If this snow is left, it will build up and form a concave and rough edge which will cause pucks to bounce irregularly.

The rest of the ice surface should be scraped using a 90 - 100 cm (36" -40") steel scraper and all the scraping and debris removed.

At the end of the day, the ice surface should be inspected. If necessary, cracks and holes should be slushed in and a heavier flood should be completed with a hose to ensure that a proper covering of ice is retained over the lines.

In flooding with the hose, the same technique should be used as when making ice. Walk back and forth across the rink spraying the area with a fan-like motion, covering a strip 1.5 - 2 m (5' - 6') in width. Be sure to keep the nozzle moving and work quickly. Be sure to keep the edge of the ice coat

wet so that each strip will butt into its neighbor without forming laps, and ridges.

Generally speaking, the warmer the air temperature, the wider will be each strip of ice that can be flooded. The ice maker will quickly become experienced in judging the best width and work speed.

If weather is very cold, care should be taken to not get too much water on at one time as it will run and freeze in a ripple. Also, in severely cold weather, the ice will crack if flooded with too much water. A very light spraying should overcome this problem. A warm water application will prevent cracking, will melt the snow remaining on the ice and will spread over a greater distance.

Some ice makers suggest that when the temperature is less than -23 C (-10 F) the ice should not be flooded as too much cracking will result.

How often a rink should be flooded will depend upon the amount of ice usage. Some rinks will be flooded at the end of every day, while others may be flooded only once per week.

Always check the forecast.

REMEMBER - Snow and flooding do not mix.

Clean ice before flooding unless you plan to flood ice again the next morning. Snow and ice chips float to the surface and leave ridges of slush. The ridges sometimes are cut down by use if the temperature is not too cold. Flooding end to end from middle out to sides can minimize these ridges.

Flood in evening after participants have gone home.

Do not let participants skate or be on the ice while flooding.

Try what is called back flooding. Keep hose low and with slow back and forth motion push water away until it comes around even with you at your sides.

Note: When it is really cold you will develop ridges between the passes as water freezes faster than you can put it down. Solution - put on more warm water so it retains the heat for a few minutes

Tips

- Spray the area around your rink with a light spray of water after a snow. When the wind blows, this will keep the snow from blowing back on the rink and forming drifts.
- Tempera paint works great for centre face off dot, or goal creases. Mix a little red or blue and paint it on then pour a little clear water

over it to freeze it before you flood over it.

- Not good at freehand! Try a board e.g. a 2 x 4 with a 3 inch screw in one end about 2 inch through the board. Another screw 6 inches from the pivot will give you a 12 inch diameter scratch in the ice, which you can paint in between the lines.
- A goal crease! Try the same pivot but put 2 screws 2 inches apart about 3 feet to 33 inches feet from the pivot. Take point about 8 to 10 feet from the end (in the middle of the ice) or sideboards (for cross ice hockey).. Place pivot there and create 2 scratches. Paint between the lines and cover with a little water before flooding.
- Clean ice with scraper type shovel to remove chips and ice shavings.
- Get the water ready and flood from farthest point back to water source.
- Use side to side motion covering 2-4 meter strip with water either at once or in 2 or 3 passes. What works well is: with no spray nozzle hold hose pointing away from you, with a slow side to side motion, and push water away from you until it comes around you to the sides.
- To determine how much water you've laid down lay your fingers flat on ice, does water cover them? How thick are your fingers approx? Or how high does water come on your boot sole - how thick is the sole?
- When ice is cracked or pitted repair ice surface by grabbing a hand full of slush and filling in the damaged areas
- The thickness of the ice needs to be at least 4 - 6" to survive sudden thaws
- Snow should be removed as soon as possible, as a thick blanket of snow can result in an ice/snow combination that will ruin the surface.

Caution - Be careful when walking on wet ice – believe it or not it's very slippery.

FROZEN HOSES

To prevent hoses from freezing, be sure to drain the water from them after each use. Coil up the last few feet of the hose into a pail of warm water for 10- 15 minutes. Stretch out the hose and whip it up and down until the ice inside loosens up.

Freezing Rates

Temperature	Inches of Water	Comments:
-1 to -7	1/2	Use water sparingly as it may not freeze before the next morning.
-7 to -12	3/4 - 1	Experiment - scrape ice first as ridges will form from slush.
-12 to -20	1	Push shush to side with hose pressure
-20 to -30	1 to 4	Extra caution required-drain hoses

		immediately - allow extra time for hydrant to drain - use extra crewmember in case something does happen - e.g. a broken connection or hose - a fall on the ice.
* Do not flood more than 5 minutes in one spot at temperature above -20c.		

Snow and Flooding do not mix - check the forecast prior to flooding!

Common Ice Maintenance Problems

The following chart will attempt to describe some of the common problems with ice and suggest some remedies for consideration.

Ice Problem	Possible Cause	Possible Repair
Shell or Shale ice	Heavy flooding, leaving ponds of water which freeze on top and run away underneath	Scrape away, and fill with wet snow, or gradually build up with warm water.
Frost Boils	Excessive water in the soil freezes and expands, causing the ice to heave and crack. Excess water boils out through the cracks and freezes.	Cut out the boil, fill with wet snow, or gradually build up with warm water.
Cracked Ice	Cold temperatures	Fill with slush and flood.
Pebble or Rough Ice	Too much snow on ice, or flooding while snowing, or scrapers not flat or not sharp enough, or you could be using too little water, if it ripples you are using too much water	Make sure the ice is clean of all snow before flooding, or repair/sharpen scraper or blades or use warmer water. Make sure you are applying the correct amounts of water.
Ice Chipping	Brittle ice from severe cold weather	Flood with warm water.

Spring Deterioration	Warm weather or painted lines absorbing sun's rays or sun reflecting off the rink boards	Do not allow skating and place snow on melting areas as a thicker layer of ice will help prevent melting in warm weather. Some rinks may have as much as 30 cm (12") of ice by the end of the season. You can also try and bank snow up against the outside of the boards throughout the season will have an insulating effect in the warm weather.
Low Spots on the Ice	Excessive use, usually in goal crease, behind net, at players boxes, etc.	Flood with a pail of water in the evening after all the patrons have left.

