LARSON ICE CENTER

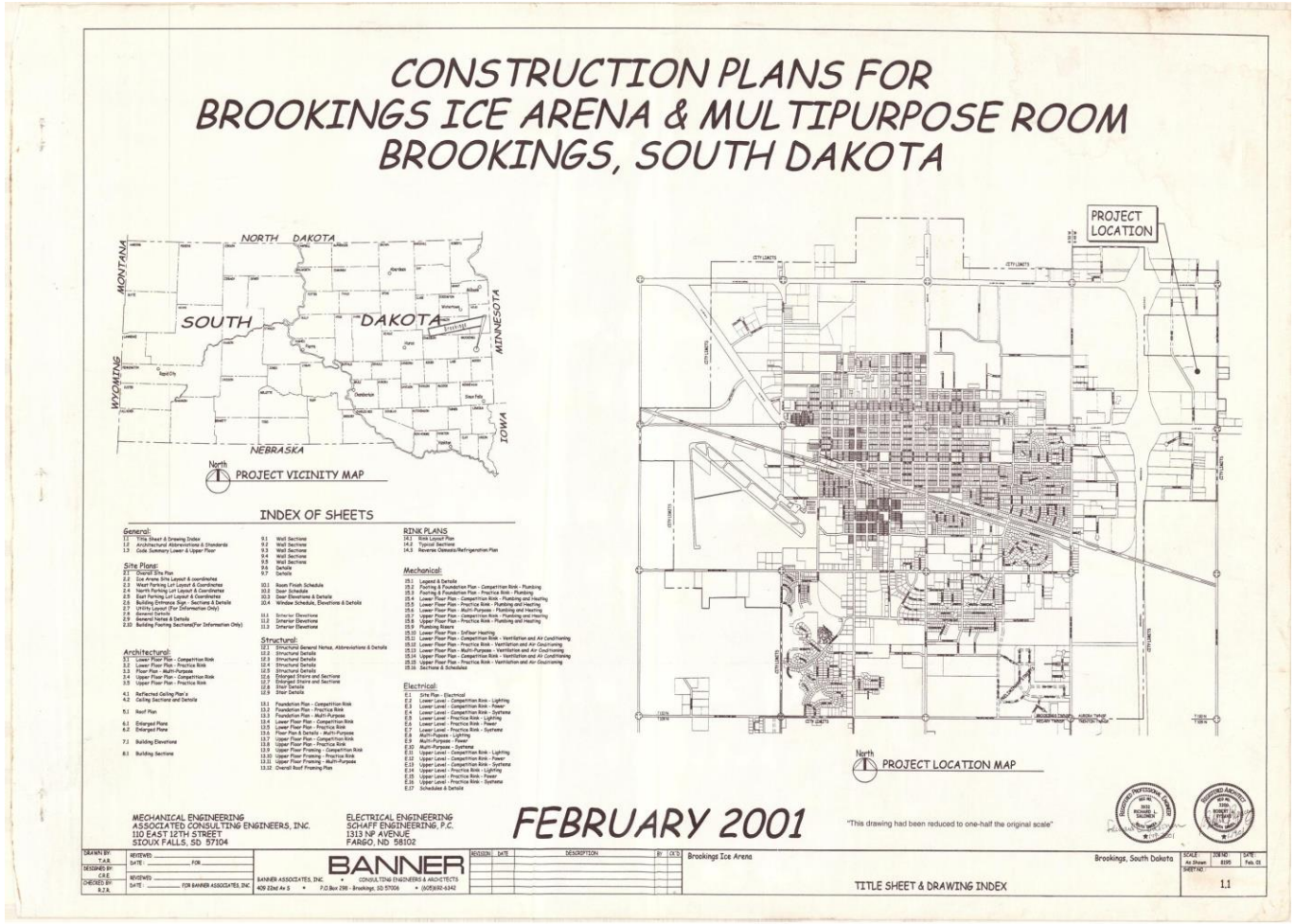
CITY OF BROOKINGS

CONTRIBUTORS

- Paul Briseno, City Manager
- Dan Brettschneider, Parks Recreation and Forestry Director
- Darren Hoff, Recreation Manager
- Allen Kruse, Parks and Forestry Superintendent
- Bill deBlonk, Parks Supervisor

CONTRIBUTING DOCUMENTS

- Evaluation Study and Site Audit Report
  CIMCO Refrigeration, August 2018
- Construction Plans for Brookings Ice Arena & Multipurpose Room
  Banner Associates, Inc., February 2001
- Brooking, SD CIMCO Refrigeration Shop Drawings,
  CIMCO Refrigeration, May 2003



CONSTRUCTION PLANS FOR
BROOKINGS ICE ARENA & MULTIPURPOSE ROOM
BROOKINGS, SOUTH DAKOTA

NORTH DAKOTA
MONTANA
SOUTH DAKOTA
MINNESOTA
WYOMING
IOWA
NEBRASKA
PROJECT VICINITY MAP

PROJECT LOCATION
PROJECT LOCATION MAP

INDEX OF SHEETS

FEBRUARY 2001

MECHANICAL ENGINEERING
ASSOCIATED CONSULTING ENGINEERS, INC.
110 EAST 12TH STREET
SIOUX FALLS, SD 57104

ELECTRICAL ENGINEERING
SCHAFF ENGINEERING, P.C.
1313 NP AVENUE
FARGO, ND 58102

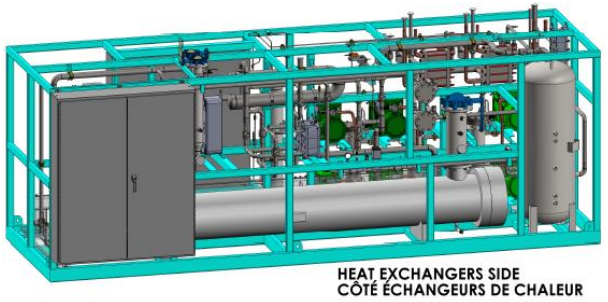
BANNER
BANNER ASSOCIATES, INC.
CONSULTING ENGINEERS & ARCHITECTS

Brookings Ice Arena
Brookings, South Dakota
TITLE SHEET & DRAWING INDEX
1.1

“BASIC” DEFINITIONS

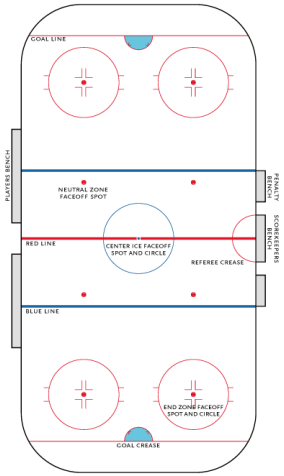
- Ice System:
  - A term used in totality describing the ice plant skid, ice floor system, header piping, header trench(s), heat recovery and HVAC&R energy saving components and dasher board systems. The ice system typically includes the concrete slab, sand, insulation and other materials encompassing the under-floor system.
- Ice Plant/Skid
  - The equipment located in the machine room connected to the rink floor systems that generates the heat transfer.
- Rink Floor
  - The concrete slab, cold floor piping, insulation, vapor retarder, sand and sub-floor heating system.

INDIRECT VS. DIRECT ICE SYSTEM (CO2)

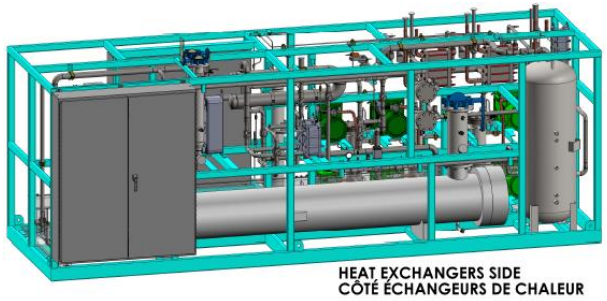


Indirect

Heat Exchanger and Pumps

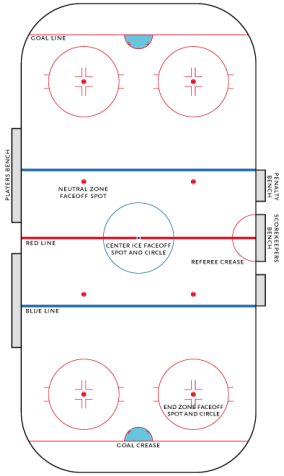


Secondary Fluid (Glycol/Brine) in HDPE Pipe



Direct

Pumps



Liquid/Gas Co2 in stainless steel Pipe

FEASIBILITY REPORT: PURPOSE

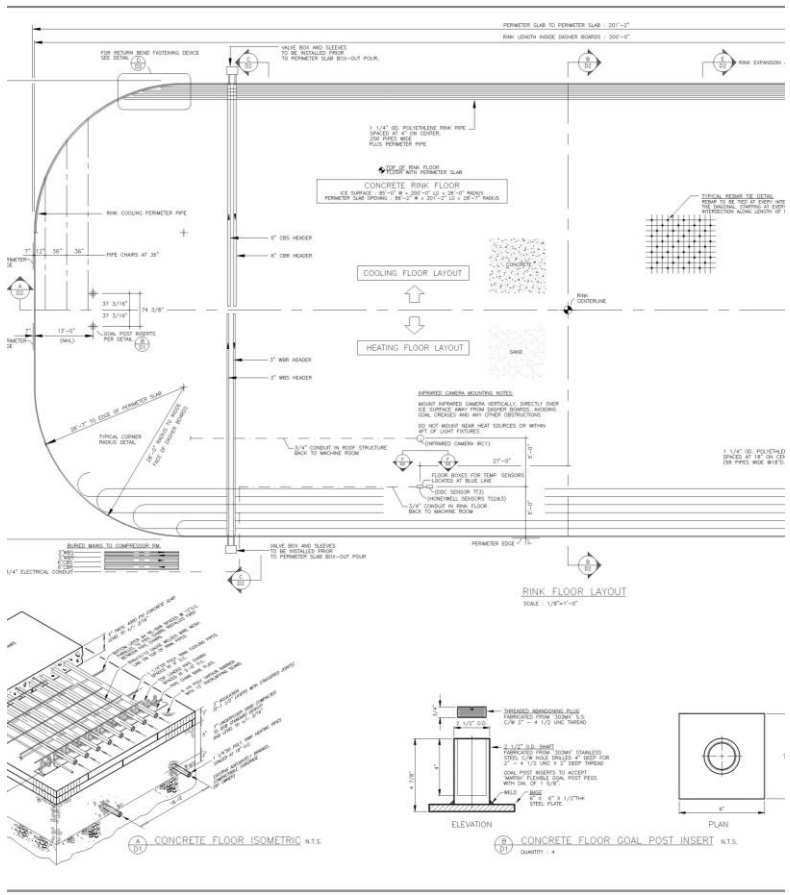
- To determine the feasibility of making improvements to the Larson Ice Center ice system
- Provide recommendations to the City of Brookings for improvements to the Larson Ice Center ice system

FEASIBILITY REPORT: PROCESS

- Analysis of original information, drawings specs, etc.
- Analysis of studies, reports and investigations
- On-site visit and building tour with staff
- Draft review with staff
- Final review with staff
- Council meeting

PROBLEM #1

- Sub-floor heating system mains and/or headers are leaking glycol under concrete slab. The result is the heat exchanger failed and the ground under the slab is freezing causing frost heave, which is damaging the concrete floors

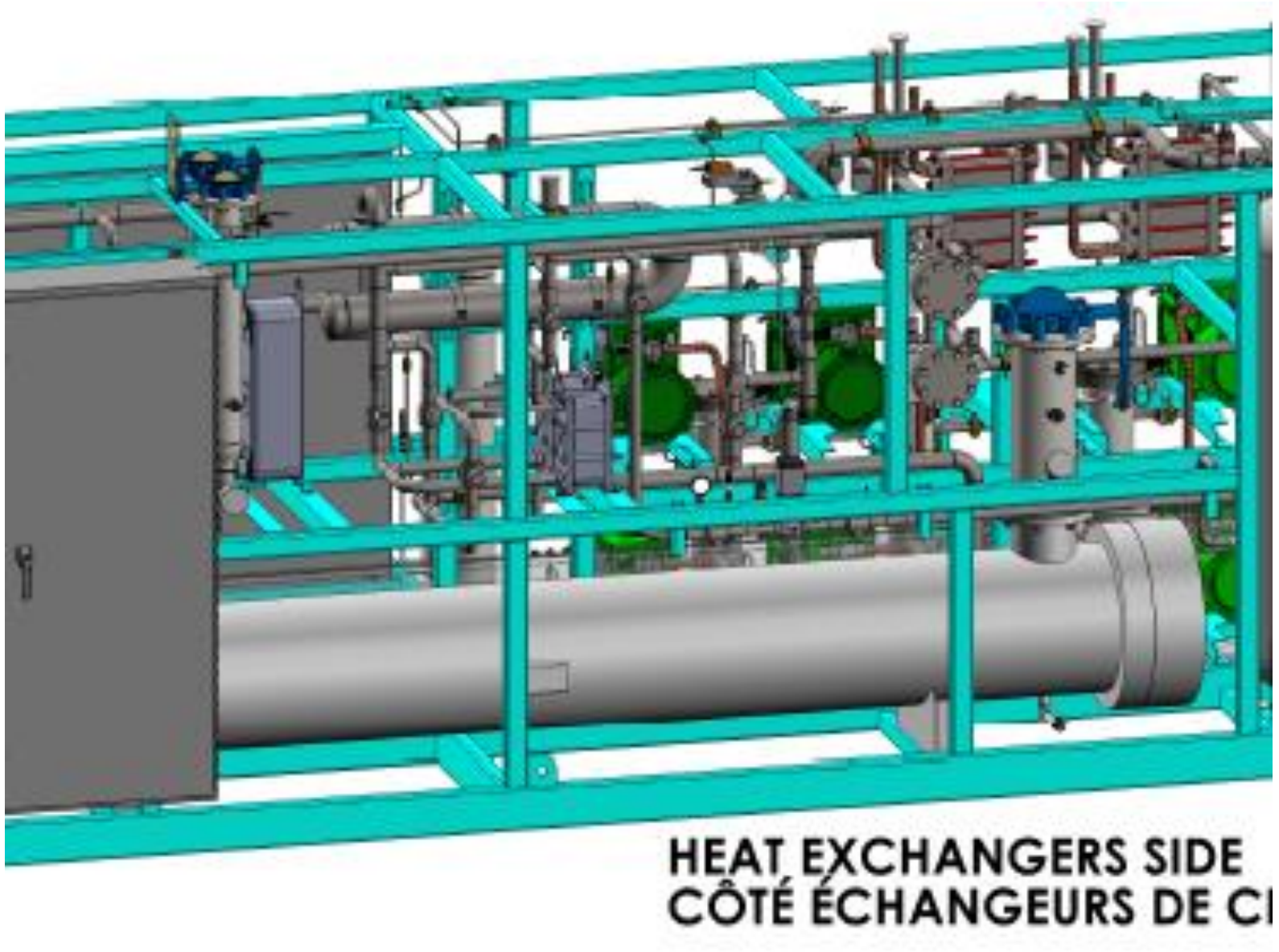


PROBLEM #2 – ICE PLANT

- The existing plant utilizes R-22 which is a synthetic refrigerant that will no longer be produced after January 1, 2020. In addition, the plant needs approximately $250,000 worth of improvements to aging components.

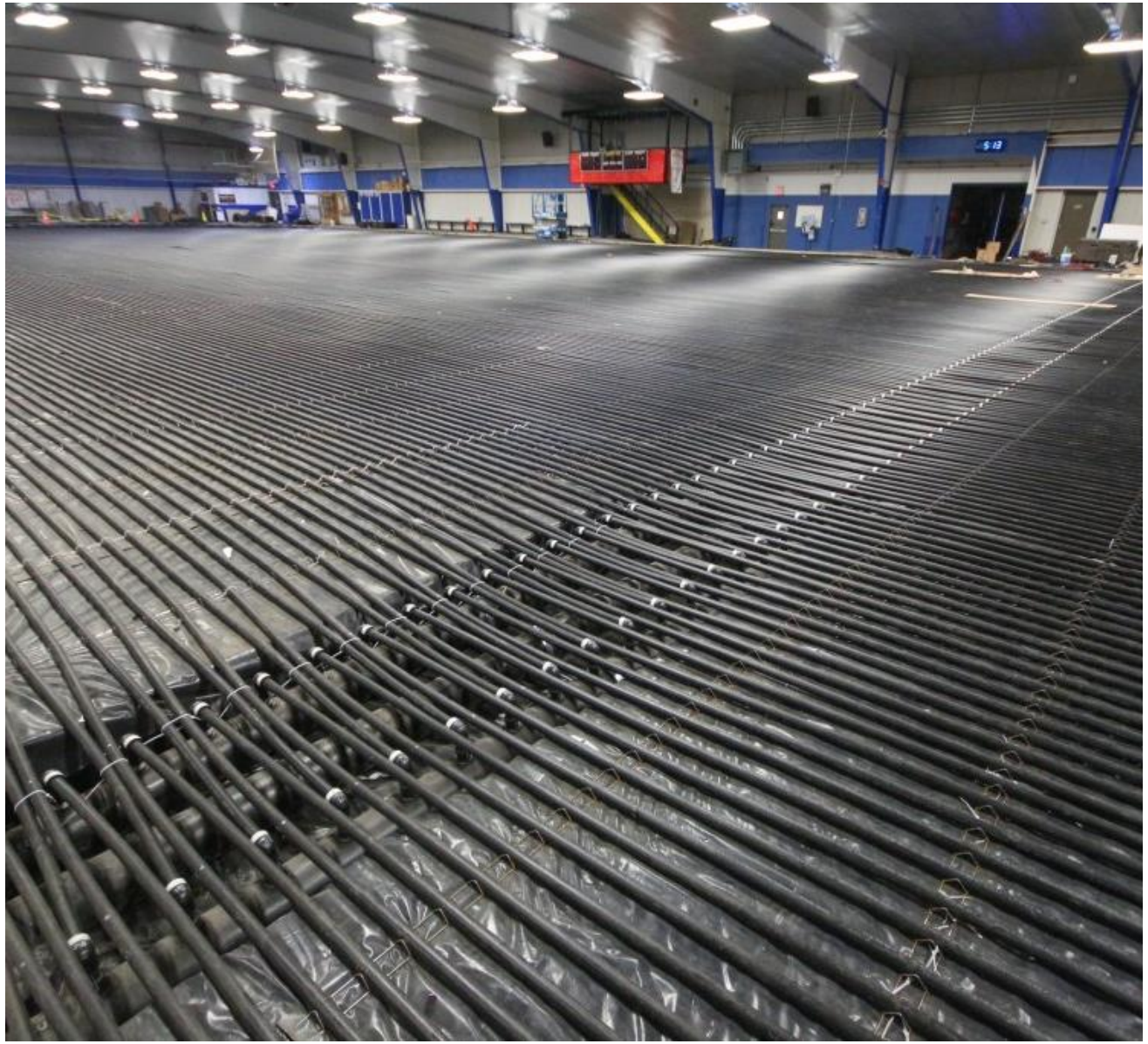
RECOMMENDATION 1 – SITE AND GROUNDWATER MITIGATION

- Make site improvements to minimize groundwater
- Install new sub-floor ground water mitigation system under new rink floors



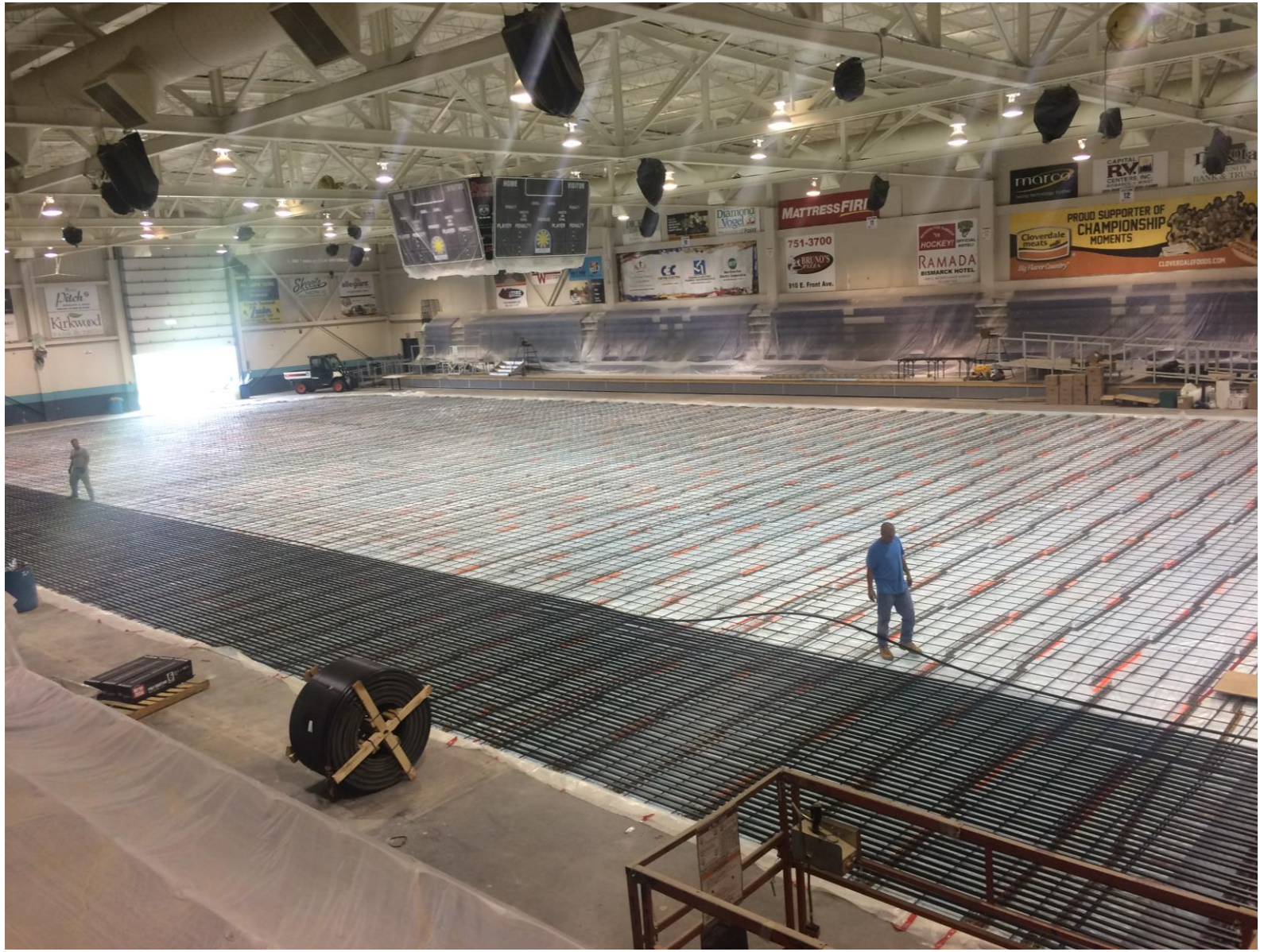
RECOMMENDATION 2: ICE PLANT

REPLACE EXISTING R-22 PLANT (SKID) WITH NEW CO2 INDIRECT OR DIRECT SKID.



RECOMMENDATION 3: RED RINK FLOOR

REPLACE ENTIRE RED RINK FLOOR AND INSTALL NEW GROUND WATER MITIGATION SYSTEM

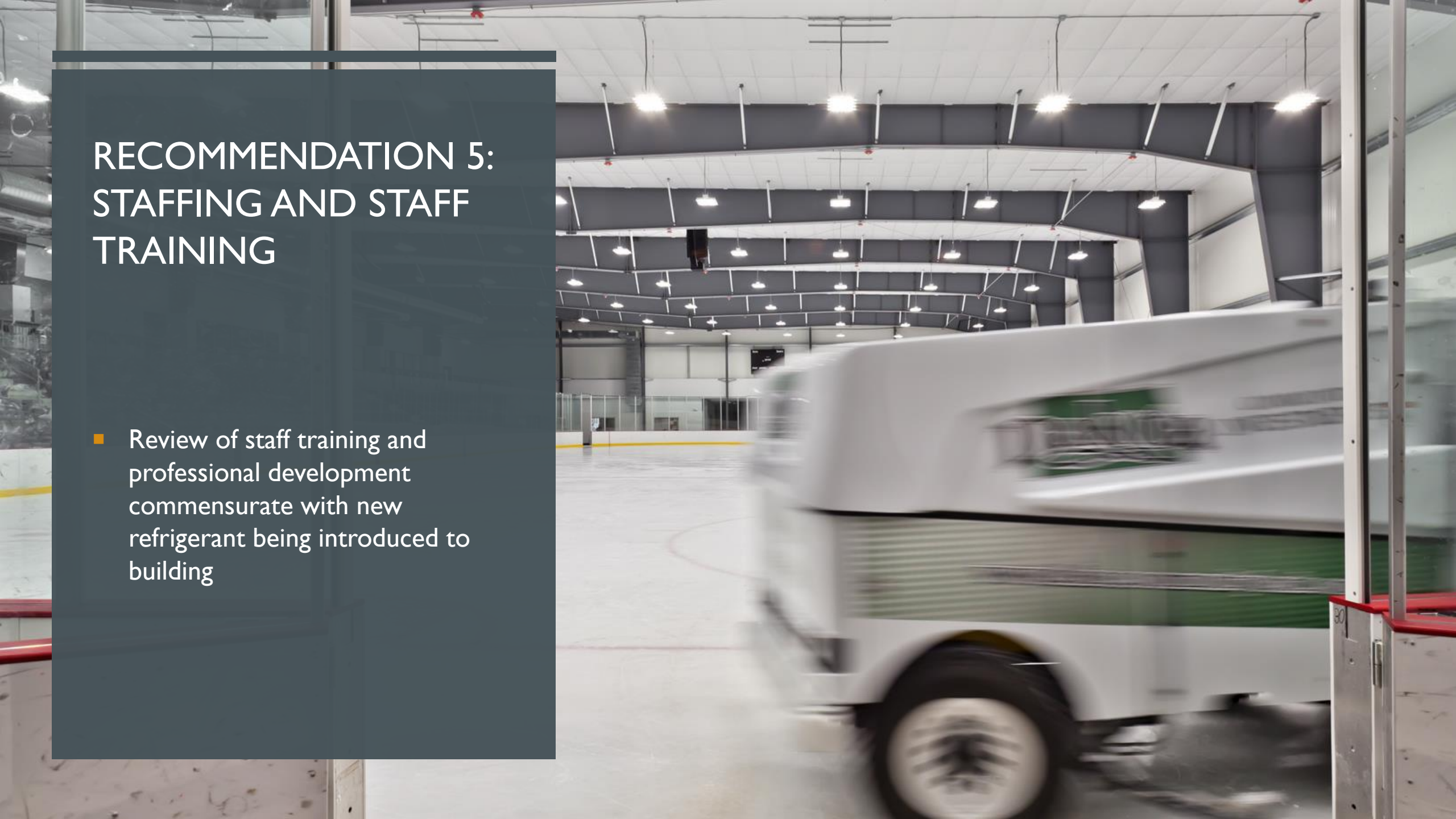


RECOMMENDATION 4: BLUE RINK FLOOR

REPLACE BLUE RINK FLOOR AND INSTALL GROUNDWATER MITIGATION SYSTEM

RECOMMENDATION 5: STAFFING AND STAFF TRAINING

- Review of staff training and professional development commensurate with new refrigerant being introduced to building



RECOMMENDATION 6: CAPITAL IMPROVEMENT PLAN

PREPARE A COMPREHENSIVE BUILDING CONDITION SURVEY AND CAPITAL IMPROVEMENT PLAN

RECOMMENDATIONS – ICE PLANT/SKID

	507/134a	Ammonia/Glycol	Co2/Glycol	Co2 / Direct
Easily staged over two seasons with 2 floor phases	4	4	4	1
Delivery Lead Time	3	1	4	4
Demolition and rebuild of room required	2	1	2	2
Future Gas Phase-out	Y (1)	N (4)	N (4)	N (4)
Gas charge (lbs.)	1600 (2)	1000 (2)	500 (3)	3000+ (1)
Gas cost ($/lbs.)	$20-30 (1)	$ 1.50 (4)	$2.00 (2)	$2.00 (1)
Energy Efficiency	1	3	2	4
GWP (eq-Co2)	1	4	3	3
Ice Quality	2	3	2	4+
Government Regulations	2	1	4	3
Diffusion Tank Required	4	1	4	4
Highly Codified Room	2	1	4	4
Operator Experience	2	1	3	4
Cost of Maintenance	2	2	3	4
Initial First Cost	4	3	2	1
Total Cost (LCC) 30+yrs	1	2	3	4
Total	34 Points	37 Points	49 Points	48 Points

- Indirect Co2/Glycol preferred option if done as multiple phases
- Direct Co2 preferred option if done as one phase

SO WHY DIRECT CO2?

advantages

- Environmentally friendly
- Superior energy efficiency
- Lower maintenance costs
- Lowest life cycle costs
- In expensive gas
- Operator friendly

disadvantage

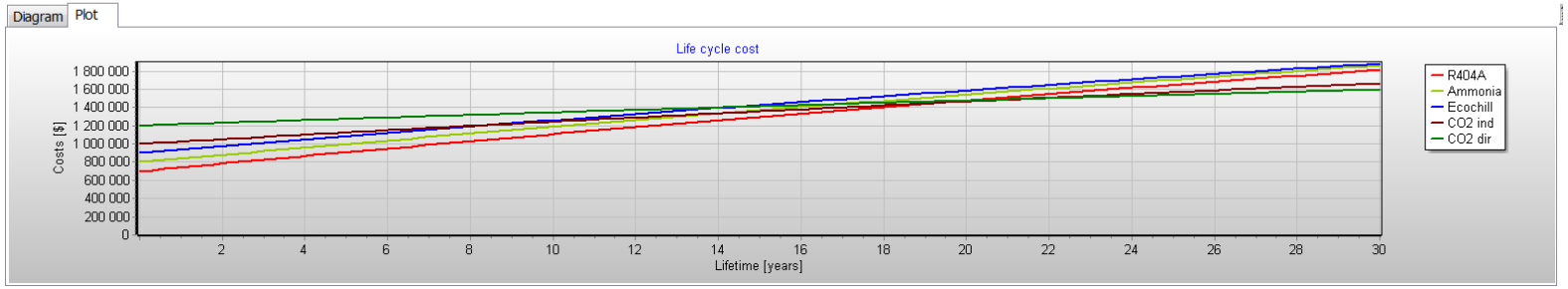
- First cost
- Rink floor must be replaced

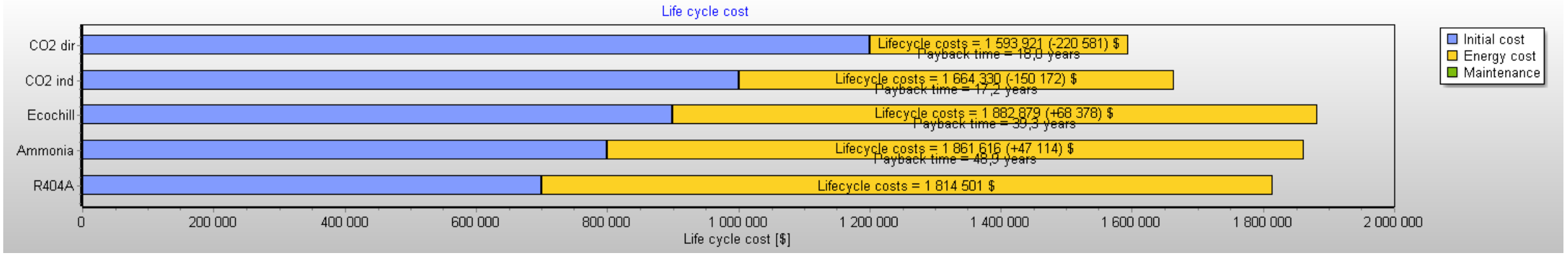
LIFE CYCLE ANALYSIS

Result:

	R404A	Ammonia	Ecochill	CO2 ind	CO2 dir
Effective interest rate [%]	0,98	0,98	0,98	0,98	0,98
Internal rate of return [%]	-	-2,91	-1,66	4,02	3,69
Total annual cost [$]	43 061	41 018 (-2 043)	37 976 (-5 086)	25 668 (-17 393)	15 220 (-27 841)
Payback time [years]	-	48,9	39,3	17,2	18,0
Total initial cost [$]	700 000 (39%)	800 000 (43%)	900 000 (48%)	1 000 000 (60%)	1 200 000 (75%)
Present value of maintenance cost [$]	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Present value of energy cost [$]	1 114 501 (61%)	1 061 616 (57%)	982 879 (52%)	664 330 (40%)	393 921 (25%)
Life cycle cost [$]	1 814 501	1 861 616 (+47 114)	1 882 879 (+68 378)	1 664 330 (-150 172)	1 593 921 (-220 581)

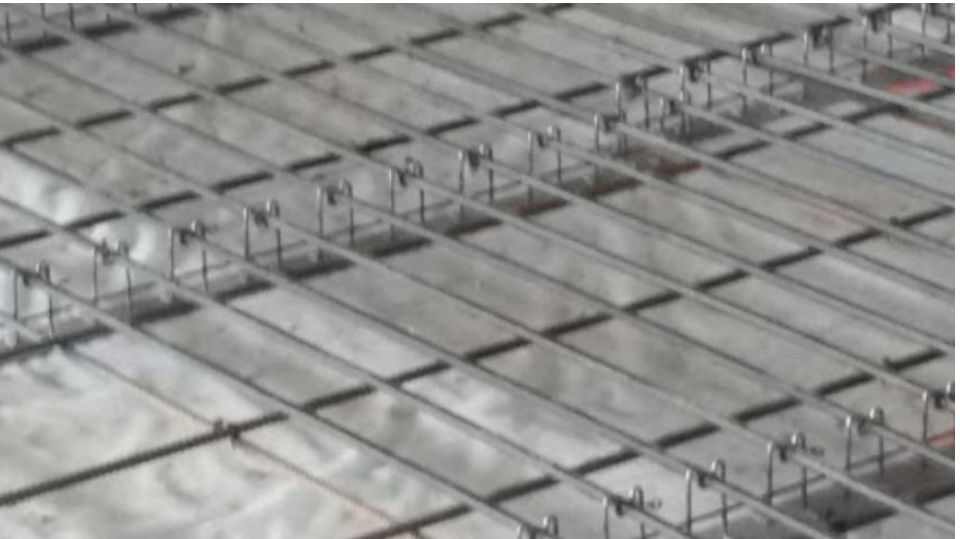
Diagram | Plot





CO2: ENERGY EFFICIENCY AND LIFE CYCLE (SAMPLE)

Existing R22	Co2 (Natural)	Ammonia	R404a
Longevity	+/- 30	+/- 40	+/-20
407,843 KW Reference	152 200 kWh (-62 %)	410 179 kWh (+ 0.5 %)	501 918 kWh (+ 23 %)
$40,784	15 220 $ (- $25,564)	41 017 $ (+ $233)	50 191 $ (+ $17,158)
After 30 years	(- $661,651)	+ $6 044	+ $243,481
Gas Saved annually	(- $18,397)	(- $21,301)	



DIRECT CO2

COST ESTIMATES: INDIRECT CO2

- ACTUAL: $3,248,361
- HIGH RANGE: $3,410,779
- LOW RANGE: $3,085,993

Cost estimates include cost of replacing both floors for comparison

Larsen Center - Ice System Replacement

Cost Analysis | Co2/Glycol and Red Rink Floor

11/5/2018

	Unit	Quantity	Cost	Total	Notes
DEMOLITION				$ 302,520.00	
Demolition - Site	Lump	0	0	$ -	
Demolition - Rink Floor (concrete cutting and removal)	SF	17000	6	$ 102,000.00	Concrete floor only
Demolition - Soil excavation, removal, stockpile	SF	17000	5	$ 85,000.00	Assumes frozen soils removed to 24" below sand
Demolition - Mains to headers	SF	752	35	$ 26,320.00	For both Rinks, hand removal
Demolition - Existing Ice Package	Lump	1	35000	$ 35,000.00	
Demolition - Machine Room	Lump	1	25000	$ 25,000.00	For install of new skid
Demolition - Concrete at Engine Room	SF	600	12	$ 7,200.00	House keeping pads
Demolition - HVAC	Lump	1	12000	$ 12,000.00	To allow for upgrade to meet code
Demolition - Electrical	Lump	1	10000	$ 10,000.00	Disconnect systems
NEW CONSTRUCTION				$ 1,671,676.00	
New Sitework	Lump	1	0	$ -	
Ground water mitigation system and subgrade prep	SF	17000	2	$ 34,000.00	Up to sand bed
Geotextile fabric	SF	17000	1	$ 17,000.00	Between new soil and sand
Sand and pipe chairs	ea.	1	11880	$ 11,880.00	
Underfloor heating loop pipe and headers	ea.	1	22500	$ 22,500.00	
Sand install, re-level and compact	ea.	1	14500	$ 14,500.00	
4" insulation and VB	ea.	1	53000	$ 53,000.00	
Concrete floor c/w pipe, mains, re-bar, headers	SF	17000	10	$ 170,000.00	
Transmission mains, trenching and backfill	SF	752	76	$ 57,152.00	
Glycol, test, top up and filtration	ea.	1	12500	$ 12,500.00	
Supply and install new HDPE mains and valves	SF	752	72	$ 54,144.00	
Glycol, oil refrigerant and supplies	Lump	1	15000	$ 15,000.00	
Supply and install Co2 skid, gas cooler and piping	ea.	1	635000	$ 635,000.00	
Code ventilation systems, leak detectors	ea.	1	45000	$ 45,000.00	
Labor and supervision	ea.	1	235000	$ 235,000.00	
Refrigerant, insulation and supplies	ea.	1	45000	$ 45,000.00	
Electrical and controls	ea.	1	45000	$ 45,000.00	
Engine Room Renovation	Lump	1	125,000	$ 125,000.00	
System Commissioning	Lump	1	10,000	$ 10,000.00	
Other - Hole cutting (Piping)	Lump	1	8,000	$ 8,000.00	
Other - Roof modifications (gas cooler)	Lump	1	6,000	$ 6,000.00	
Other - Fire rated sealants	Lump	0	3,000	$ -	
Other - Remove , store and Re-install Dasher Boards	Lump	1	25000	$ 25,000.00	
Other - Goal posts, pegs and install	Lump	1	8500	$ 8,500.00	
Other - Refrigeration isolation and service (Blue Rink)	Lump	1	12500	$ 12,500.00	
Other - Pump out, store glycol and recharge	Lump	1	10000	$ 10,000.00	
NET SUBTOTAL				$ 1,974,196.00	
SOFT COSTS				$ 562,645.86	
General Conditions	Lump			$ 177,677.64	9% of Net Subtotal
Contingency - Construction	Lump			$ 98,709.80	5% of Net Subtotal
Contingency - Design	Lump			$ 59,225.88	3% of Net Subtotal
A/E Fees	Lump			$ 167,806.66	8.5% of Net Subtotal
Permitting/Insurance	Lump			$ 19,741.96	1% of Net Subtotal
Testing	Lump			$ 39,483.92	2% of Net Subtotal (Geotech, concrete, soils)
PROJECT BUDGET				$ 2,536,841.86	

	Actual	Low Range	High Range
PROJECT BUDGET RANGE	$ 2,536,841.86	$ 2,409,999.77	$ 2,663,683.95
COST PER SF	$ 39.17	$ 37.21	$ 41.13

COST ESTIMATES: DIRECT CO2

- ACTUAL: $3,573,217
- HIGH RANGE: $3,751,878
- LOW RANGE: $3,394,556

Cost estimates include cost of replacing both floors for comparison

Larsen Center - Ice System Replacement

Cost Analysis | Co2 Direct and both rink floors

11/5/2018

	Unit	Quantity	Cost	Total	Notes
DEMOLITION				$ 489,520.00	
Demolition - Site	Lump	0	0	$ -	
Demolition - Rink Floor (concrete cutting and removal)	SF	34000	6	$ 204,000.00	Concrete floor only
Demolition - Soil excavation, removal, stockpile	SF	34000	5	$ 170,000.00	Assumes frozen soils removed to 24" below sand
Demolition - Mains to headers	SF	752	35	$ 26,320.00	For both Rinks, hand removal
Demolition - Existing Ice Package	Lump	1	35000	$ 35,000.00	
Demolition - Machine Room	Lump	1	25000	$ 25,000.00	For install of new skid
Demolition - Concrete at Engine Room	SF	600	12	$ 7,200.00	House keeping pads
Demolition - HVAC	Lump	1	12000	$ 12,000.00	To allow for upgrade to meet code
Demolition - Electrical	Lump	1	10000	$ 10,000.00	Disconnect systems
NEW CONSTRUCTION				$ 2,302,056.00	
New Sitework	Lump	1	0	$ -	
Ground water mitigation system and subgrade prep	SF	34000	2	$ 68,000.00	Up to sand bed
Geotextile fabric	SF	34000	1	$ 34,000.00	Between new soil and sand
Sand and pipe chairs	ea.	2	11880	$ 23,760.00	
Underfloor heating loop pipe and headers	ea.	2	0	$ -	Included with cold floor piping cost
Sand install, re-level and compact	ea.	2	14500	$ 29,000.00	
4" insulation and VB	ea.	2	53000	$ 106,000.00	
Concrete floor c/w pipe, mains, re-bar, headers	ea.	2	235000	$ 470,000.00	
Transmission mains, trenching and backfill	SF	752	76	$ 57,152.00	
Glycol, test, top up and filtration	ea.	0	12500	$ -	
Supply and install new HDPE mains and valves	SF	752	72	$ 54,144.00	
oil refrigerant and supplies	Lump	0	15000	$ -	
Supply and install Co2 skid, evap condensers and piping	ea.	2	375000	$ 750,000.00	
Code ventilation systems, leak detectors	ea.	1	45000	$ 45,000.00	
Labor and supervision	ea.	1	275000	$ 275,000.00	
Refrigerant, insulation and supplies	ea.	2	73000	$ 146,000.00	
Electrical and controls	ea.	1	78000	$ 78,000.00	
Engine Room Renovation	Lump	1	75,000	$ 75,000.00	
System Commissioning	Lump	1	10,000	$ 10,000.00	
Other - Hole cutting (Piping)	Lump	1	8,000	$ 8,000.00	
Other - Roof modifications (Gas Coolers)	Lump	1	6,000	$ 6,000.00	
Other - Fire rated sealants	Lump	0	3,000	$ -	
Other - Remove , store and Re-install Dasher Boards	Lump	2	25000	$ 50,000.00	
Other - Goal posts, pegs and install	Lump	2	8500	$ 17,000.00	
Other - Refrigeration isolation and service (Blue Rink)	Lump	0	12500	$ -	
Other - Pump out, store glycol and recharge	Lump	0	10000	$ -	
NET SUBTOTAL				$ 2,791,576.00	
SOFT COSTS				$ 781,641.28	
General Conditions	Lump			$ 251,241.84	9% of Net Subtotal
Contingency - Construction	Lump			$ 139,578.80	5% of Net Subtotal
Contingency - Design	Lump			$ 83,747.28	3% of Net Subtotal
A/E Fees	Lump			$ 223,326.08	8.0% of Net Subtotal
Permitting/Insurance	Lump			$ 27,915.76	1% of Net Subtotal
Testing	Lump			$ 55,831.52	2% of Net Subtotal (Geotech, concrete, soils)
PROJECT BUDGET				**$ 3,573,217.28**	

	Actual	Low Range	High Range
PROJECT BUDGET RANGE	$ 3,573,217.28	$ 3,394,556.42	$ 3,751,878.14
COST PER SF	$ 55.17	$ 52.41	$ 57.93

COST ESTIMATES: INDIRECT AMMONIA/BRINE

- ACTUAL: $3,098,016
- HIGH RANGE: $3,252,917
- LOW RANGE: $2,938,166

Cost estimates include cost of replacing both floors for comparison

Larsen Center - Ice System Replacement

Cost Analysis | Indirect Ammonia/Glycol and Red Rink Floor

11/5/2018

	Unit	Quantity	Cost	Total	Notes
DEMOLITION				$ 302,520.00	
Demolition - Site	Lump	0	0	$ -	
Demolition - Rink Floor (concrete cutting and removal)	SF	17000	6	$ 102,000.00	Concrete floor only
Demolition - Soil excavation, removal, stockpile	SF	17000	5	$ 85,000.00	Assumes frozen soils removed to 24" below sand
Demolition - Mains to headers	SF	752	35	$ 26,320.00	For both Rinks, hand removal
Demolition - Existing Ice Package	Lump	1	35000	$ 35,000.00	
Demolition - Machine Room	Lump	1	25000	$ 25,000.00	For install of new skid
Demolition - Concrete at Engine Room	SF	600	12	$ 7,200.00	House keeping pads
Demolition - HVAC	Lump	1	12000	$ 12,000.00	To allow for upgrade to meet code
Demolition - Electrical	Lump	1	10000	$ 10,000.00	Disconnect systems
NEW CONSTRUCTION				$ 1,554,676.00	
New Sitework	Lump	1	0	$ -	
Ground water mitigation system and subgrade prep	SF	17000	2	$ 34,000.00	Up to sand bed
Geotextile fabric	SF	17000	1	$ 17,000.00	Between new soil and sand
Sand and pipe chairs	ea.	1	11880	$ 11,880.00	
Underfloor heating loop pipe and headers	ea.	1	22500	$ 22,500.00	
Sand install, re-level and compact	ea.	1	14500	$ 14,500.00	
4" insulation and VB	ea.	1	53000	$ 53,000.00	
Concrete floor c/w pipe, mains, re-bar, headers	SF	17000	10	$ 170,000.00	
Transmission mains, trenching and backfill	SF	752	76	$ 57,152.00	
Glycol, test, top up and filtration	ea.	1	12500	$ 12,500.00	
Supply and install new HDPE mains and valves	SF	752	72	$ 54,144.00	
Glycol, oil refrigerant and supplies	Lump	1	15000	$ 15,000.00	
Supply and install Co2 skid, gas cooler and piping	ea.	1	515000	$ 515,000.00	
Code ventilation systems, leak detectors	ea.	1	45000	$ 45,000.00	
Labor and supervision	ea.	1	235000	$ 235,000.00	
Refrigerant, insulation and supplies	ea.	1	45000	$ 45,000.00	
Electrical and controls	ea.	1	45000	$ 45,000.00	
Engine Room Renovation	Lump	1	125,000	$ 125,000.00	
System Commissioning	Lump	1	10,000	$ 10,000.00	
Other - Hole cutting (Piping)	Lump	1	8,000	$ 8,000.00	
Other - Roof modifications (gas cooler)	Lump	1	6,000	$ 6,000.00	
Other - Fire rated sealants	Lump	1	3,000	$ 3,000.00	
Other - Remove , store and Re-install Dasher Boards	Lump	1	25000	$ 25,000.00	
Other - Goal posts, pegs and install	Lump	1	8500	$ 8,500.00	
Other - Refrigeration isolation and service (Blue Rink)	Lump	1	12500	$ 12,500.00	
Other - Pump out, store glycol and recharge	Lump	1	10000	$ 10,000.00	
NET SUBTOTAL				$ 1,857,196.00	
SOFT COSTS				$ 529,300.86	
General Conditions	Lump			$ 167,147.64	9% of Net Subtotal
Contingency - Construction	Lump			$ 92,859.80	5% of Net Subtotal
Contingency - Design	Lump			$ 55,715.88	3% of Net Subtotal
A/E Fees	Lump			$ 157,861.66	8.5% of Net Subtotal
Permitting/Insurance	Lump			$ 18,571.96	1% of Net Subtotal
Testing	Lump			$ 37,143.92	2% of Net Subtotal (Geotech, concrete, soils)
PROJECT BUDGET				$ 2,386,496.86	

	Actual	Low Range	High Range
PROJECT BUDGET RANGE	$ 2,386,496.86	$ 2,267,172.02	$ 2,505,821.70
COST PER SF	$ 36.85	$ 35.00	$ 38.69

COST ESTIMATES: BLUE RINK FLOOR

- ACTUAL: $711,520
- HIGH RANGE: $747,096
- LOW RANGE: $675,994

Larsen Center - Ice System Replacement

Cost Analysis | Blue Rink Floor

11/5/2018

	Unit	Quantity	Cost	Total	Notes
DEMOLITION				$ 187,000.00	
Demolition - Site	Lump	0	0	$ -	
Demolition - Rink Floor (concrete cutting and removal)	SF	17000	6	$ 102,000.00	Concrete floor only
Demolition - Soil excavation, removal, stockpile	SF	17000	5	$ 85,000.00	Assumes Frozen Soils
Demolition - Mains to headers	SF	0	35	$ -	
Demolition - Existing Ice Package	Lump	0	35000	$ -	
Demolition - Machine Room	Lump	0	25000	$ -	For install of new skid
Demolition - Concrete at Engine Room	SF	0	12	$ -	House keeping pads
Demolition - HVAC	Lump	0	12000	$ -	To allow for upgrade to meet code
Demolition - Electrical	Lump	0	10000	$ -	Disconnect systems
NEW CONSTRUCTION				$ 426,380.00	
New Sitework	Lump	1	0	$ -	
Ground water mitigation system and subgrade prep	SF	17000	2	$ 34,000.00	Up to sand bed
Geotextile fabric	SF	17000	1	$ 17,000.00	Between new soil and sand
Sand and pipe chairs	ea.	1	11880	$ 11,880.00	
Underfloor heating loop pipe and headers	ea.	1	22500	$ 22,500.00	
Sand install, re-level and compact	ea.	1	14500	$ 14,500.00	
4" insulation and VB	ea.	1	53000	$ 53,000.00	
Concrete floor c/w pipe, mains, re-bar, headers	SF	17000	10	$ 170,000.00	
Transmission mains, trenching and backfill	SF	0	76	$ -	
Glycol, test, top up and filtration	ea.	1	12500	$ 12,500.00	
Supply and install new HDPE mains and valves	SF	0	72	$ -	
Glycol, oil refrigerant and supplies	Lump	0	15000	$ -	
Supply and install Co2 skid, gas cooler and piping	ea.	0	515000	$ -	
Code ventilation systems, leak detectors	ea.	0	45000	$ -	
Labor and supervision	ea.	0	0	$ -	
Refrigerant, insulation and supplies	ea.	1	45000	$ 45,000.00	
Electrical and controls	ea.	0	45000	$ -	
Engine Room Renovation	Lump	0	105,000	$ -	
System Commissioning	Lump	0	10,000	$ -	
Other - Hole cutting (Piping)	Lump	0	8,000	$ -	
Other - Roof modifications (Condensers)	Lump	0	6,000	$ -	
Other - Fire rated sealants	Lump	0	3,000	$ -	
Other - Remove , store and Re-install Dasher Boards	Lump	1	25000	$ 25,000.00	
Other - Goal posts, pegs and install	Lump	1	8500	$ 8,500.00	
Other - Refrigeration isolation and service (Blue Rink)	Lump	1	12500	$ 12,500.00	
Other - Pump out, store glycol and recharge	Lump	0	10000	$ -	
NET SUBTOTAL				$ 613,380.00	
SOFT COSTS				$ 98,140.80	
General Conditions	Lump			$ 27,602.10	9% of Net Subtotal
Contingency - Construction	Lump			$ 12,267.60	2% of Net Subtotal
Contingency - Design	Lump			$ 12,267.60	2% of Net Subtotal
A/E Fees	Lump			$ 27,602.10	4.5% of Net Subtotal
Permitting/Insurance	Lump			$ 6,133.80	1% of Net Subtotal
Testing	Lump			$ 12,267.60	2% of Net Subtotal (Geotech, concrete, soils)
PROJECT BUDGET				$ 711,520.80	

	Actual	Low Range	High Range
PROJECT BUDGET RANGE	$ 711,520.80	$ 675,944.76	$ 747,096.84
COST PER SF	$ 10.99	$ 10.44	$ 11.53

PROPOSED SCHEDULE

Schedule

Proposed Design & Construction Schedule – Co2/Glycol Ice System Replacement and Red Rink Floor	
Übl submits Final Report to Council	November 27, 2018
Contract prepared and awarded for design	December 11, 2018
Design and Engineering	March 15, 2019
Bidding	April 5, 2019
Contract Award	April 9, 2019
Contracts Completed	April 16, 2019
Construction Begin	May 1, 2019
Substantial Completion	August 23, 2019
Commissioning and System Orientation	August 23, 2019
Cool floor down	August 26-30
First Ice Making	August 30, 2019
Final Completion	September 13, 2019
Refresh Training	January 2020
Pre-warranty walk-through	August 2020

Critical Path

- Select design team
- Project bidding
- Shop drawings and ordering of skid

DECISION POINTS

- Will project be phased or completed at one time?
- Which ice system is preferred?
- Project budget?

QUESTIONS