

# **CATHEDRAL FIRE STATION**



LEED TM



# LEED CATEGORIES

> SUSTAINABLE SITES

> WATER EFFICIENCY

ENERGY & ATMOSPHERE

> MATERIALS & RESOURCES

> INDOOR ENVIRONMENTAL QUALITY

> INNOVATION & DESIGN



# SUSTAINABLE SITES 6

# > SITE SELECTION > PUBLIC TRANSPORTATION ACCESS > BIKE STORAGE & CHANGING ROOMS > STORM WATER RATE > HEAT ISLAND MITIGATION > LIGHT POLLUTION REDUCTION





# WATER EFFICIENCY 5

REDUCE IRRIGATION BY 50%
 NO POTABLE USE OR NO IRRIGATION
 20% WATER USE REDUCTION
 30% WATER USE REDUCTION
 INNOVATIVE WASTE WATER TECHNOLOGIES





# ENERGY & ATMOSPHERE 4-8

# > OPTIMIZE ENERGY PERFORMANCE (3 - 7) > OZONE PROTECTION





# ENERGY & ATMOSPHERE

### Mechanical System Comparison - 4 Options IES Virtual Environment 5.8.1 Energy Simulation Software

# Packaged Roof Top Units RTU'S / Energy-Recovery Ventilators Water-Source Multi-Split Variable Refrigerant Flow Geothermal



# ROOF TOP UNITS (HIGH EFFICIENCY)

- Forced Air Heating & Cooling
- Gas-fired Burners, Electric Cooling w/ Economizers
- Ducted to Diffusers / Exhaust Fans



# ROOF TOP UNITS (HIGHER EFFICIENCY)

- Forced air heating & cooling
- Gas-fired burners, electric cooling w/ economizers
- Energy-recovery ventilators
- Ducted distribution to diffusers / exhaust fans



# ➤ VRF

- Water-Source multi-split variable refrigerant flow
- Heating via gas-fired boilers
- Cooling via closed-loop cooling tower
- Delivered via ceiling-mounted fan coil units / diffusers



# ➢ GEOTHERMAL / DV

- In-floor radiant heating & cooling
- 100% fresh air displacement ventilation via ERV
- Supplemental cooling via fan coil units



# CAPITAL COST COMPARISON

≻ RTU	\$171,000	base case
≻ RTU/ERV	\$195,600	>14%
≻ VRF	\$284,000	<i>&gt;66%</i>
➢ GEOTHERMAL	\$351,000	>105%



# > ANNUAL ENERGY COST COMPARISON

### \$0.10 /kWh base electrical cost

\$13.72 /GJ base natural gas cost

RTU	\$12,131	\$1.21 /sf
RTU/ERV	\$9,850	\$0.98 /sf
VRF	\$10,071	\$1.00 /sf
GEOTHERMAL	\$4,946	\$0.49 /sf



# LIFE-CYCLE OPERATIONAL & MAINTENANCE COSTS ~ 50 YEARS ~

RTU	\$623,000	0
RTU/ERV	\$551,000	> \$7.20 sq.ft.
VRF	\$571,000	> \$5.20 sq.ft.
GEOTHERMAL	\$319,000	> \$30.40 sq.ft.

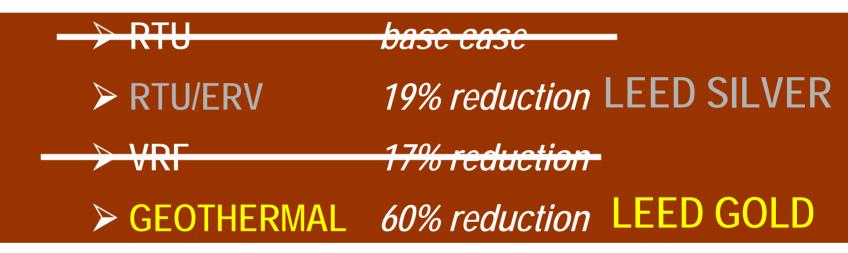


# ENERGY USE REDUCTION

RTU base case
RTU/ERV 19% reduction
VRF 17% reduction
GEOTHERMAL 60% reduction



# ENERGY USE REDUCTION





# MATERIALS & RESOURCES 7

DIVERT 50% FROM LANDFILL
 DIVERT 75% FROM LANDFILL
 7.5% RECYCLED CONTENT
 15% RECYCLED CONTENT
 20% REGIONAL MATERIALS
 RAPIDLY RENEWABLE MATERIALS
 CERTIFIED WOOD





# INDOOR ENVIRONMENTAL QUALITY 7

VENTILATION EFFECTIVENESS
 CONSTRUCTION IAQ MANAGEMENT PLAN (CONSTRUCTION)
 0 VOC: ADHESIVES & SEALANTS
 0 VOC: PAINTS & COATINGS
 0 VOC: CARPET
 0 VOC: COMPOSITE WOOD & LAMINATE ADHESIVES
 INDOOR POLLUTANT SOURCE CONTROL





# INDOOR ENVIRONMENTAL QUALITY 5

CONTROLLABILITY OF PERIMETER SPACES
 CONTROLLABILITY OF NON-PERIMETER SPACES
 THERMAL COMFORT - COMPLIANCE
 DAYLIGHT 75% OF SPACES
 VIEWS 90% OF SPACES





# INNOVATION & DESIGN PROCESS 4

LEED EDUCATIONAL DISPLAY
 GREEN HOUSEKEEPING PROGRAM
 RAINWATER HARVESTING FOR TRUCK FILL
 LEED ACCREDITED PROFESSIONAL



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### LEED <sup>™</sup> PROJECT TOTALS

### Markham Cathedral Fire Station

LEED <sup>™</sup> Silver	37 Points	(33 - 38)
LEED <sup>TM</sup> Gold	42 points	(39-51)



### ➤ LEED <sup>TM</sup> Silver Construction Cost

Base Building\$ 2,700,000\$ 270.00 sq.ft.Green initiatives\$ 105,000\$ 10.50 sq.ft.

► LEED <sup>TM</sup> Silver Design Cost

\$ 17,500 \$ 1.75 sq.ft.

► LEED <sup>TM</sup> Silver CaGBC Reg. & Admin. Costs

\$ 36,000 \$ 3.60 sq.ft.



# ► LEED TM Silver Project Costs

Construction	\$ 2,805,000	\$ 280.50 sq.ft.
A&E Fees	\$ 197,500	\$ 19.75 sq.ft.
LEED <sup>™</sup> Reg.	\$ 4,000	\$.40 sq.ft.
Administration	\$ 32,000	\$ 3.20 sq.ft.
Total	\$ 3,038,500	\$ 303.85 sq.ft.



# ► LEED <sup>TM</sup> Gold Construction Cost

Base Building\$ 2,700,000\$ 270.00 sq.ft.Green initiatives\$ 225,000\$ 25.50 sq.ft.

# ► LEED <sup>TM</sup> Gold Design Cost

\$ 25,000 \$ 2.50 sq.ft.

# ► LEED <sup>TM</sup> Gold CaGBC Reg. & Admin. Costs

\$ 37,500 \$ 3.75 sq.ft.

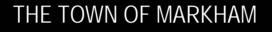


# ► LEED <sup>TM</sup> Gold Project Costs

Construction	\$ 2,955,000	\$ 295.50 sq.ft.
A & E Fees	\$ 205,000	\$ 20.50 sq.ft.
LEED <sup>™</sup> R/C	\$ 4,000	\$.40 sq.ft.
Administration	\$ 33,500	\$ 3.35 sq.ft.
Total	\$ 3,197,500	\$ 319.75 sq.ft.



LEED <sup>TM</sup> Silver	> 5.5%
Design Construction	> 1.6 % > 3.9 %
LEED <sup>TM</sup> Gold	> 11%
Design Construction	> 1.5 % > 9.4 %



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