

Fire Underwriters Survey
Barrie Fire Protection Services Review

Fire Underwriters Survey™
A SERVICE TO INSURERS AND MUNICIPALITIES

Agenda

- Brief History of FUS
- Fire Insurance Grading Index
- Overview of Fire Insurance grading
- Risk Assessment
- Fire Department Assessment
- Water Supply Assessment
- Questions and Answers

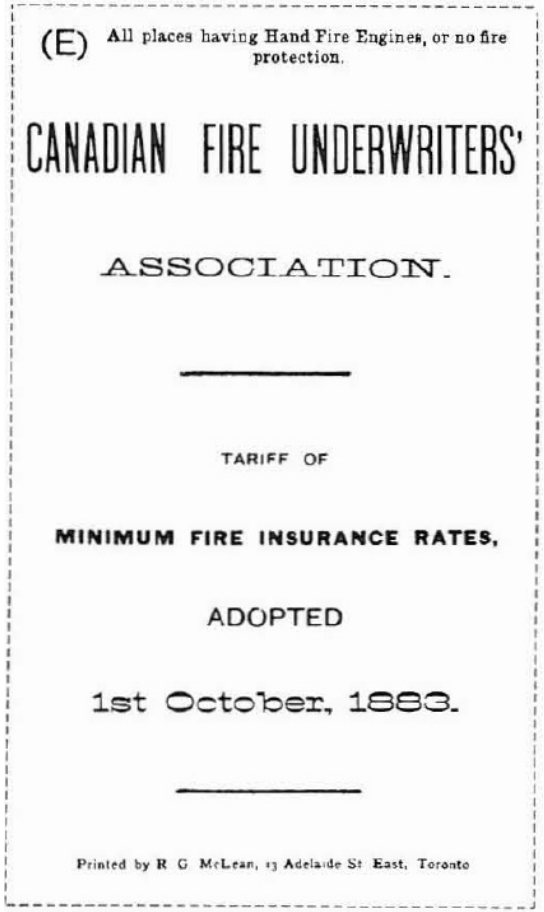
Historical Perspective

The Great Toronto Fire 1904

- Fire in major North American cities as Baltimore and Toronto destroyed entire blocks and sections of cities
- Financial stability of insurers threatened
- Team of engineers conducted insurer-sponsored study of fire conditions in major cities
- Standard schedule for grading cities and towns with reference to their fire defenses established

Fire Underwriters Survey

- Originally formed as the CFUA in 1883
- Large conflagration losses had significant impact on economics of insurance
- Insurers formed a group of engineers to develop a standardized index of fire insurance grades
- Insurers use grades in underwriting and determination of rates



(E) All places having Hand Fire Engines, or no fire protection.

CANADIAN FIRE UNDERWRITERS'

ASSOCIATION.

TARIFF OF

MINIMUM FIRE INSURANCE RATES,

ADOPTED

1st October, 1883.

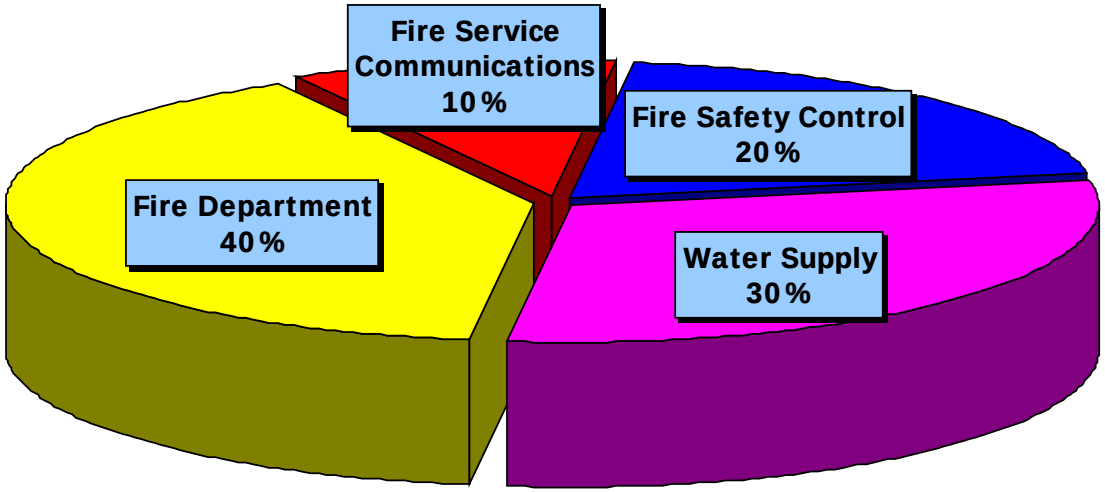
Printed by R. G. McLean, 13 Adelaide St. East, Toronto

2 Grade Systems

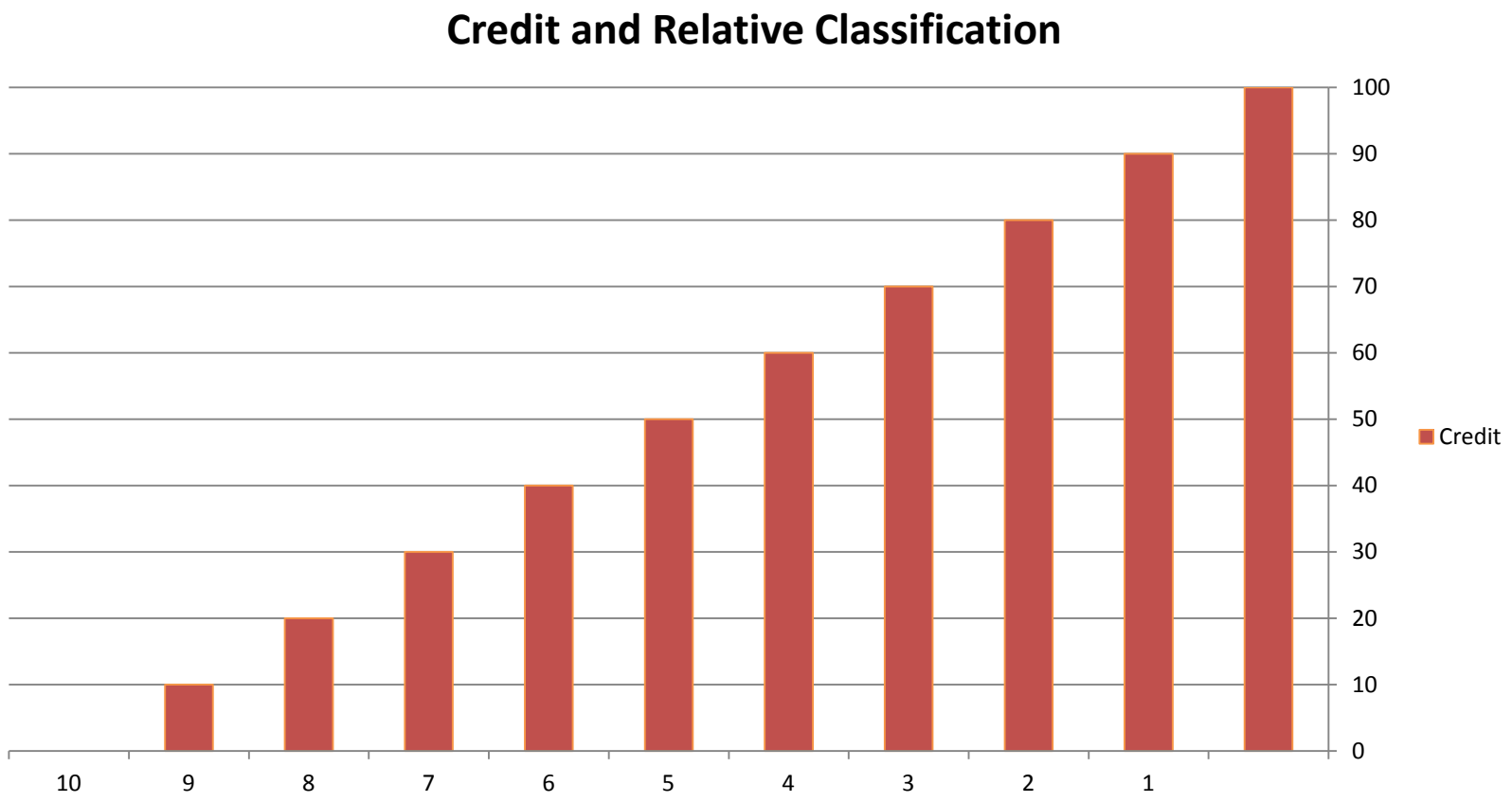
Commercial Lines:	Personal Lines:
Public Fire Protection Classification (PFPC)	***Dwelling Protection Grade (DPG)***
◆Complex and detailed analysis	◆Simple system of analysis
◆Grades between 1-10	◆Grades between 1-5
◆1 being the best and 10 meaning no organized fire protection	◆1 being the best and 5 meaning no organized fire protection
◆Total of 7,500 classifications published for communities and sub-districts	◆Total of 11,800 grades published for communities and sub-districts

Grading Components

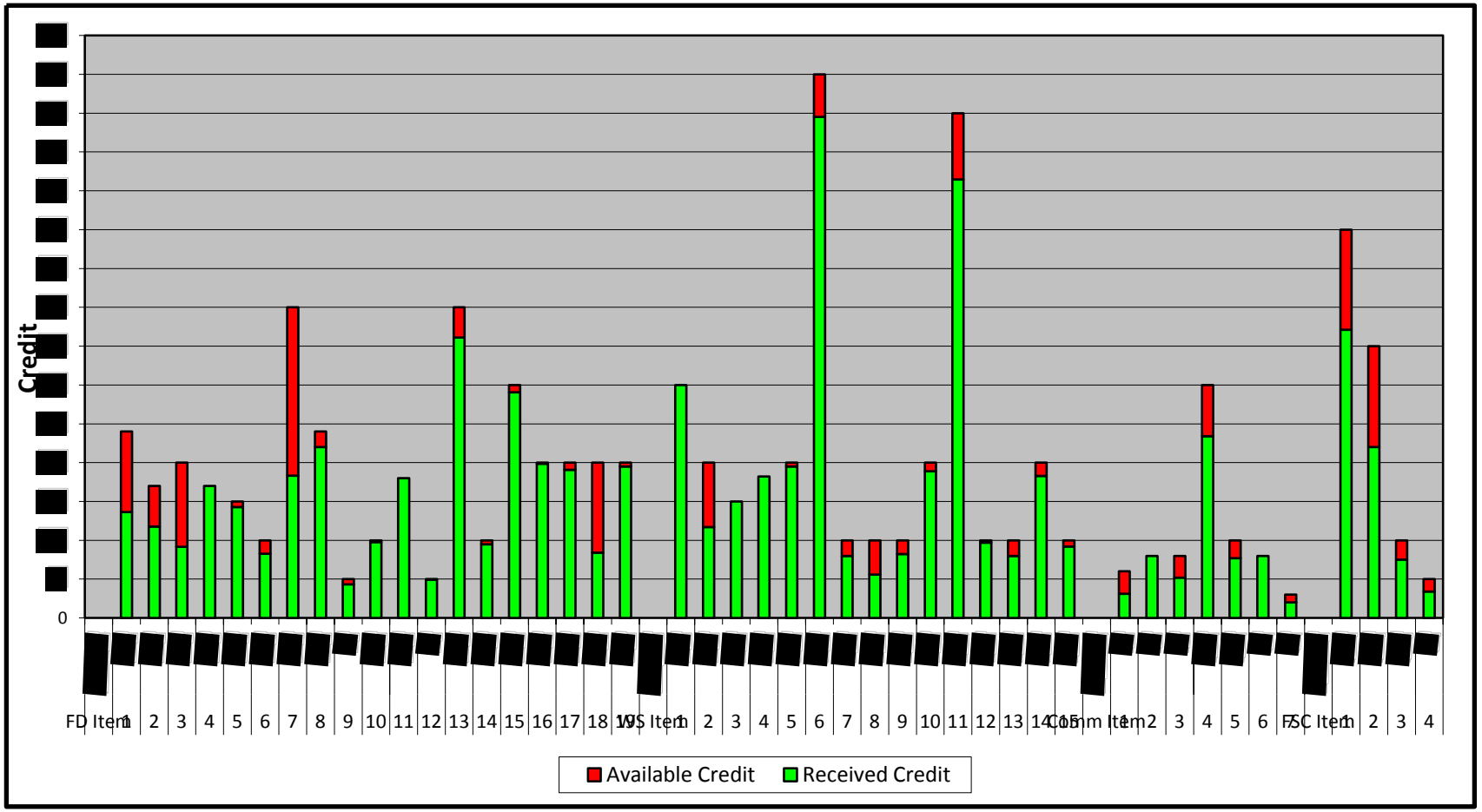
Fire insurance grades are based on more than 500 pieces of information



Each area is graded on a scale of 0-100%



Example PFPC Chart with weighted areas



Simplified Dwelling Protection Grade System

DWELLING PROTECTION GRADE	WATER WORKS SYSTEM	FIRE DEPARTMENT		CORRELATION WITH PUBLIC FIRE PROTECTION CLASSIFICATION (P.F.P.C.) See "Note" below
		EQUIPMENT	FIREFIGHTERS	
1	Water supply system designed in accordance with Fire Underwriters Survey standard "Water Supply for Public Fire Protection" with a relative classification of 5 or better	Response from within 8 km by road of a standard pumper.	Response of 3 on- duty career members plus fire chief or other officer not required on-duty.	Water supply and fire department must grade Class 5 or better.
2	Water supply system designed in accordance with Fire Underwriters Survey standard "Water Supply for Public Fire Protection" with a relative classification of 6 or better	Response from within 8 km by road of a standard pumper.	Response of 1 on-duty career member and 15 volunteers plus fire chief or other officer not required on-duty.	Water Supply and Fire Department must grade Class 6 or better.
3A	Water supply system designed in accordance with, and meeting the minimum requirements[1] of, Fire Underwriters Survey standard "Water Supply for Public Fire Protection"	Response from within 8 km by road of a standard pumper.	15 volunteers	Not correlated to Public Fire Protection Classification.

Simplified Dwelling Protection Grade System

DWELLING PROTECTION GRADE	WATER WORKS SYSTEM	FIRE DEPARTMENT		CORRELATION WITH PUBLIC FIRE PROTECTION CLASSIFICATION (P.F.P.C.) See "Note" below
		EQUIPMENT	FIREFIGHTERS	
3B	Not required	2 units required. Standard pumper plus a mobile water supply (tender) with a combined water carrying capacity of not less than 1500 Imp. Gallons	15 volunteers	Not correlated to Public Fire Protection Classification.
4	Not required	Standard pumper or 800 I.gal. tanker with booster pump of 200 I.gpm capacity.	10 volunteers	Not correlated to Public Fire Protection Classification.
5	Unprotected communities or communities not qualifying for Grades 1, 2, 3A, 3B, or 4 above.	Unprotected communities or communities not qualifying for Grades 1, 2, 3A, 3B, or 4 above.	Unprotected communities or communities not qualifying for Grades 1, 2, 3A, 3B, or 4 above.	Unprotected communities or communities not qualifying for Grades 1, 2, 3A, 3B, or 4 above.

City of Barrie
Fire Risk

Fire Risk Considerations

- Number of risks – increase
- Value of risks – increase
- Geographic distribution of risks – increase

Benchmark of Fire Risk: ***Required Fire Flows***

Required Fire Flow may be described as the amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure. This may include as much as a city block.

1. An estimate of the fire flow required for a given area may be determined by the formula:

$$F = 220C\sqrt{A}$$

where

F = the required fire flow in litres per minute.

C = coefficient related to the type of construction.

= 1.5 for wood frame construction (structure essentially all combustible).

= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).

= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).

= 0.6 for fire-resistive construction (fully protected frame, floors, roof).

Effective Fire Fighting Response for Basic Fire Flow

RISK RATING [2]	BUILDING DISTRICT EXAMPLES	FIRE FLOW		INITIAL RESPONSE TO ALARMS		1ST DUE	2ND DUE	1ST DUE	TOTAL AVAILABILITY NEEDED			
		L/min X1000	Approx. Igpm Range	Pumper Companies	Ladder Companies	Pumper Company, Minutes	Pumper Company, Minutes	Ladder Company, Minutes	Pumper Co's. No.	Pumper Co's. Min.	Ladder Co's. No.	Ladder Co's. Min.
1 (a)	Very small buildings, widely detached. Scattered	2	400	1	0	7.5	-	9 [3]	1	7.5	1 [3]	9
(b)	development (except where wood roof coverings).	3	600	1	0	6	-	7.5 [3]	1	6	1 [3]	7.5
2	Typical modern, 1 - 2 storey residential subdivision 3 - 6 m 10 - 20 ft. detached).	4-5	800-1000	2	0	4	6	6 [3]	2	6	1 [3]	6
3 (a)	Close 3 - 4 storey residential and row housing, small mercantile and industrial.	6-9 10-13	1200-2000 2200-2800	2 2	1 [5] 1 [5]	3.5 3.5	5 5	4 [3] 4 [3]	2 3	5 6	1 [3] 1 [3]	4 4
3 (b)	Seriously exposed tenements. Institutional. Shopping Centres Fairly large areas and fire loads, exposures.	14-16 17-19	3000-3600 3800-4200	2 2	1 1	3.5 3.5	5 5	4 4	4 5	7 7	1 1 [4]	4 4
4 (a)	Large combustible institutions, commercial buildings, multi-storey and with exposures.	20-23 24-27	4400-5000 5200-6000	2	1	2.5 2.5	4 4	3.5 3.5	6 7	7.5 7.5	2 2	5 5
4 (b)	High fire load warehouses and buildings like 4(a).	28-31 32-35	6200-6800 7000-7600	3	1	2.5 2.5	3.5 3.5	3.5 3.5	8 9	8 8	3 3	7 7
5	Severe hazards in large area buildings usually with major exposures. Large congested frame districts.	36-38 39-42 43-46	7800-8400 8600-9200 9400-10000	3	3	2.0 2.0 2.0	3.5 3.5 3.5	2.5 2.5 2.5	10 12 14	8 9 9	4 5 6	7.5 8 9

Response Distance and Time

- Fire Underwriters Survey utilizes a simplified equation for determination of Response time based on the RAND studies of response in Management Science

$$T(\text{min}) = 0.65(\text{min}) + 1.065(\text{min}/\,km)\,xD(km)$$

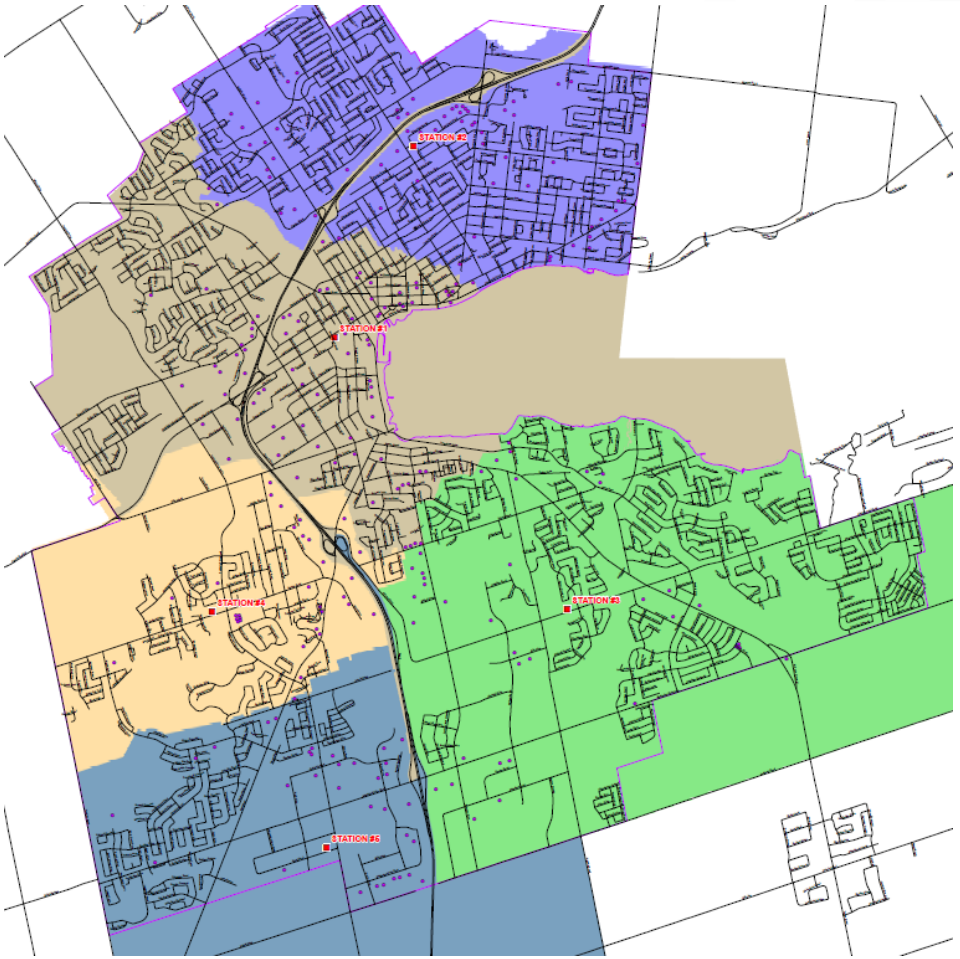
$$D(km) = \frac{\left[T(\text{min}) - 0.65(\text{min})\right]}{1.065(\text{min}/\,km)}$$

Risks Considered in Barrie

- Over 200 Required Fire Flows Calculated throughout City

- Required Fire Flows Distributed throughout 5 Distinct Fire Response Zones

- Each Zone Slightly Different

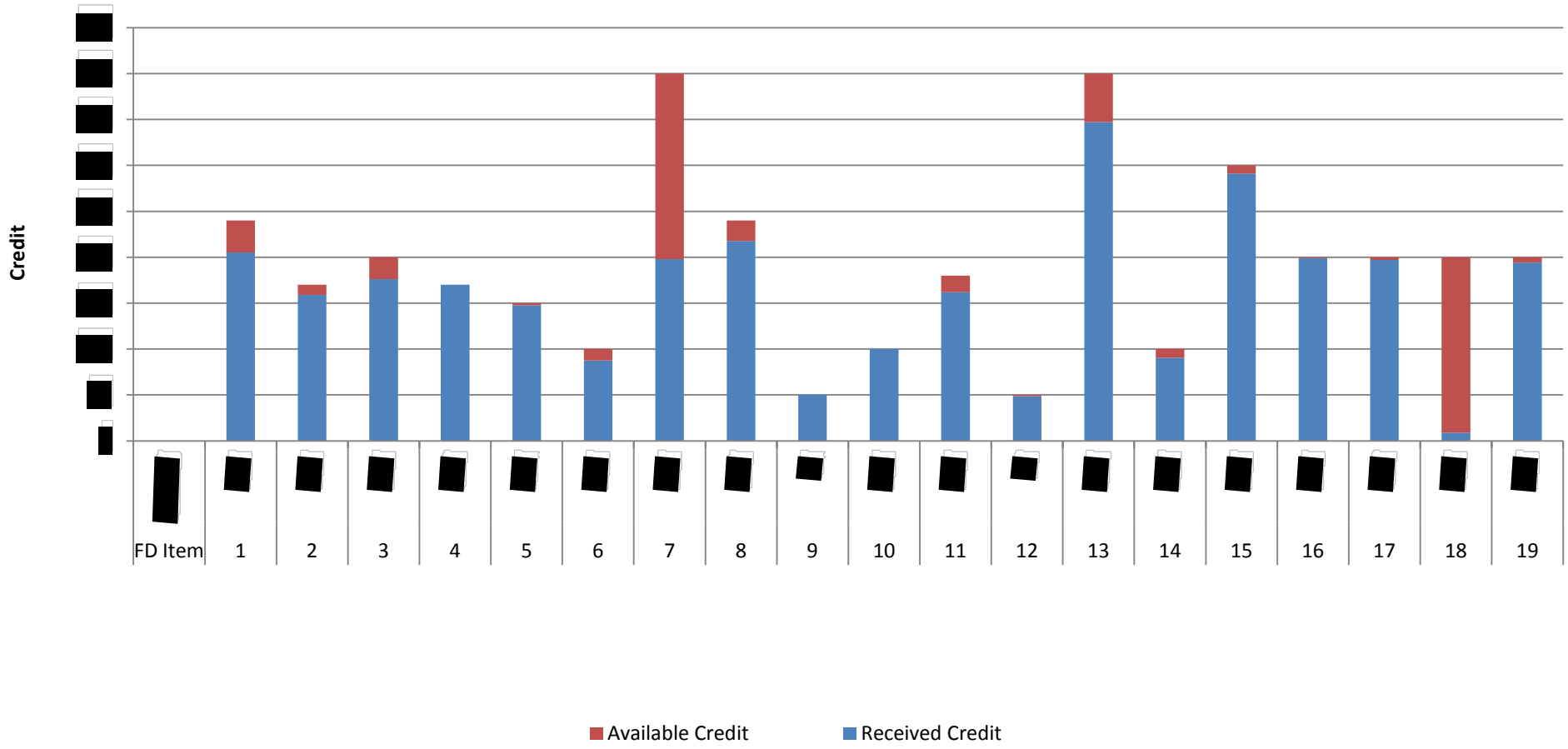


Barrie
Fire Response Capacity

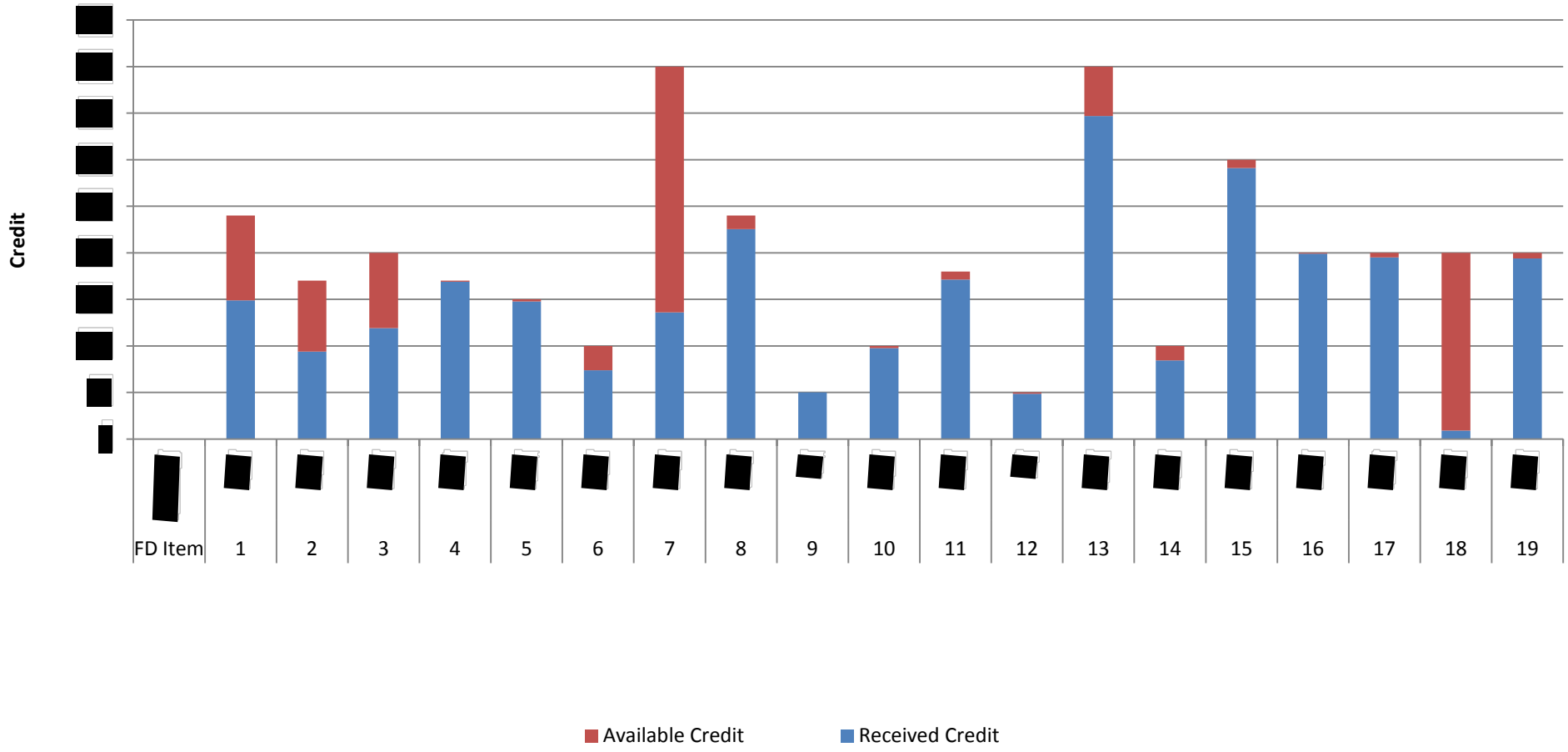
Fire Department – 40%

- Represents 40% of the Commercial Classification
- Measurement of City's capacity to provide structural fire fighting service
- Type and number of resources available
- Quality of service (training, record keeping, maintenance programs)

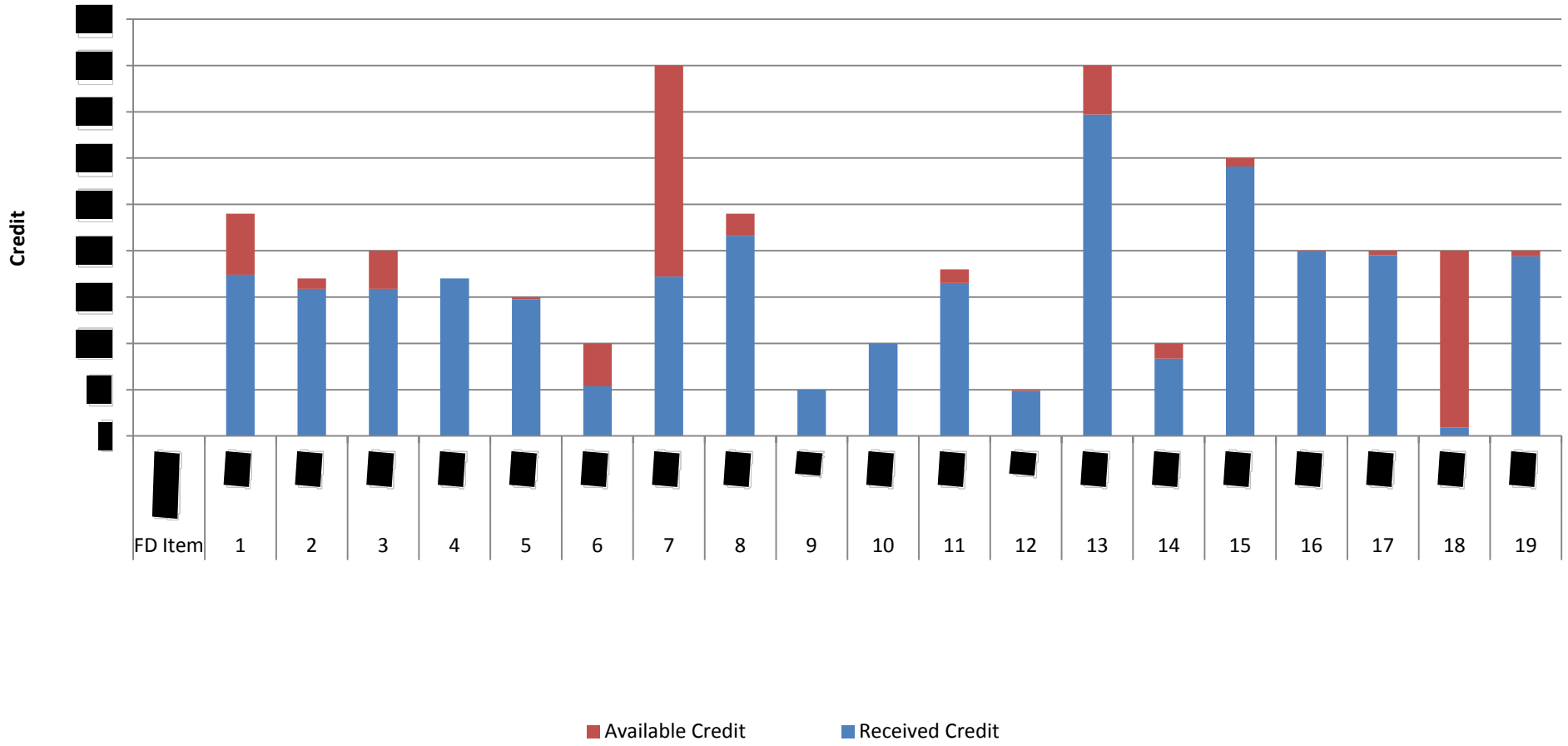
Fire Department Credit Score Summary (FS 1)



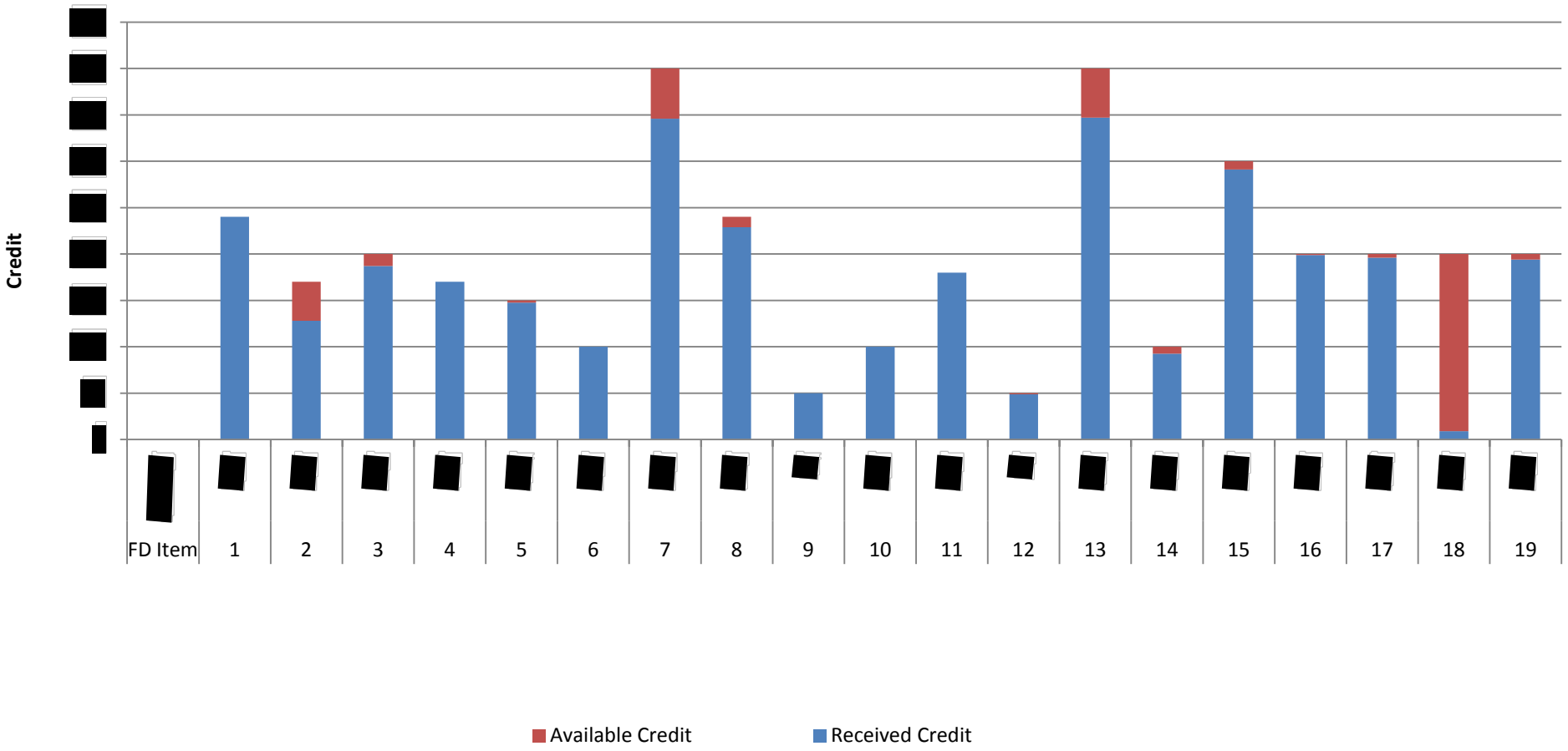
Fire Department Credit Score Summary (FS 2)



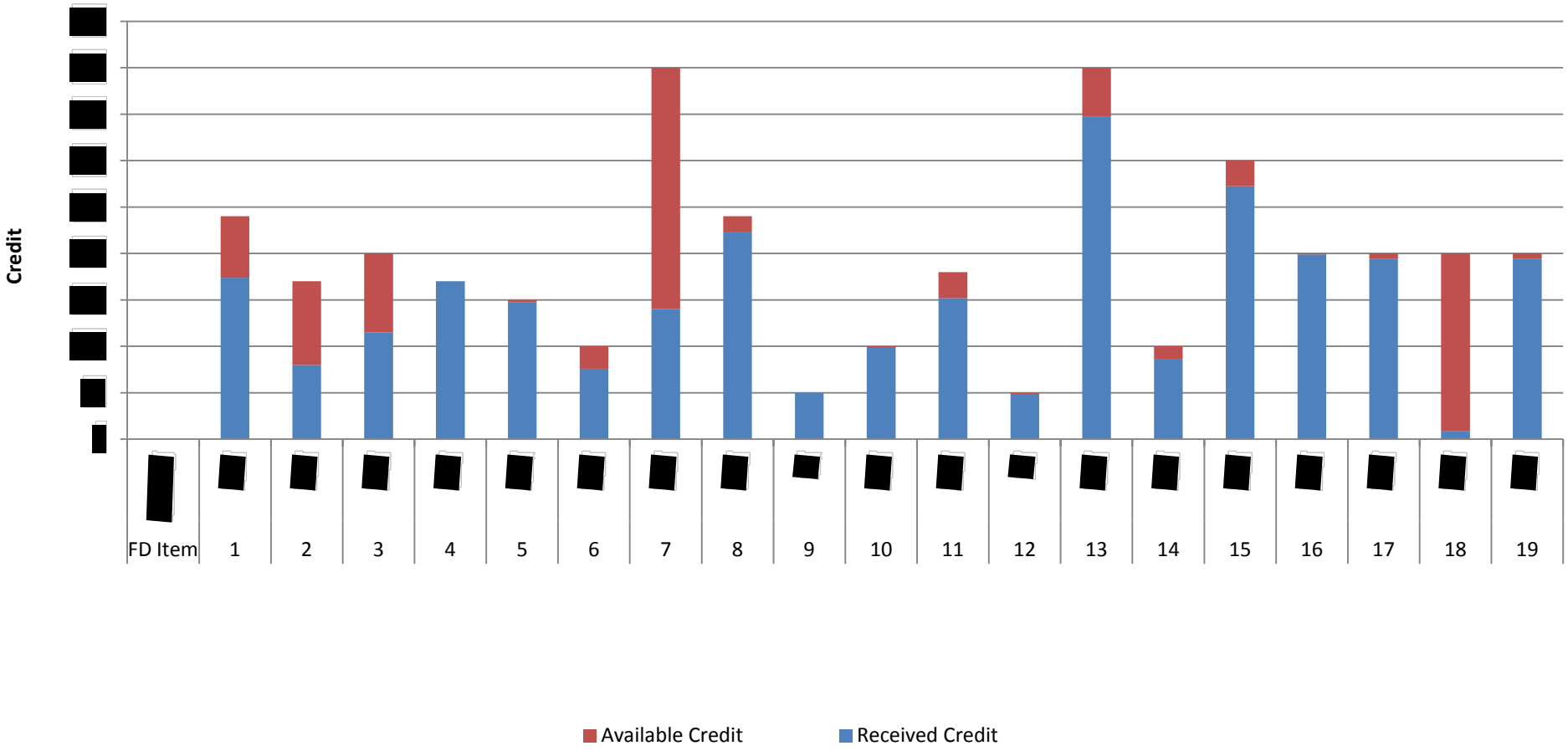
Fire Department Credit Score Summary (FS 3)



Fire Department Credit Score Summary (FS 4)



Fire Department Credit Score Summary (FS 5)



Barrie
Water Supplies for Public Fire Protection

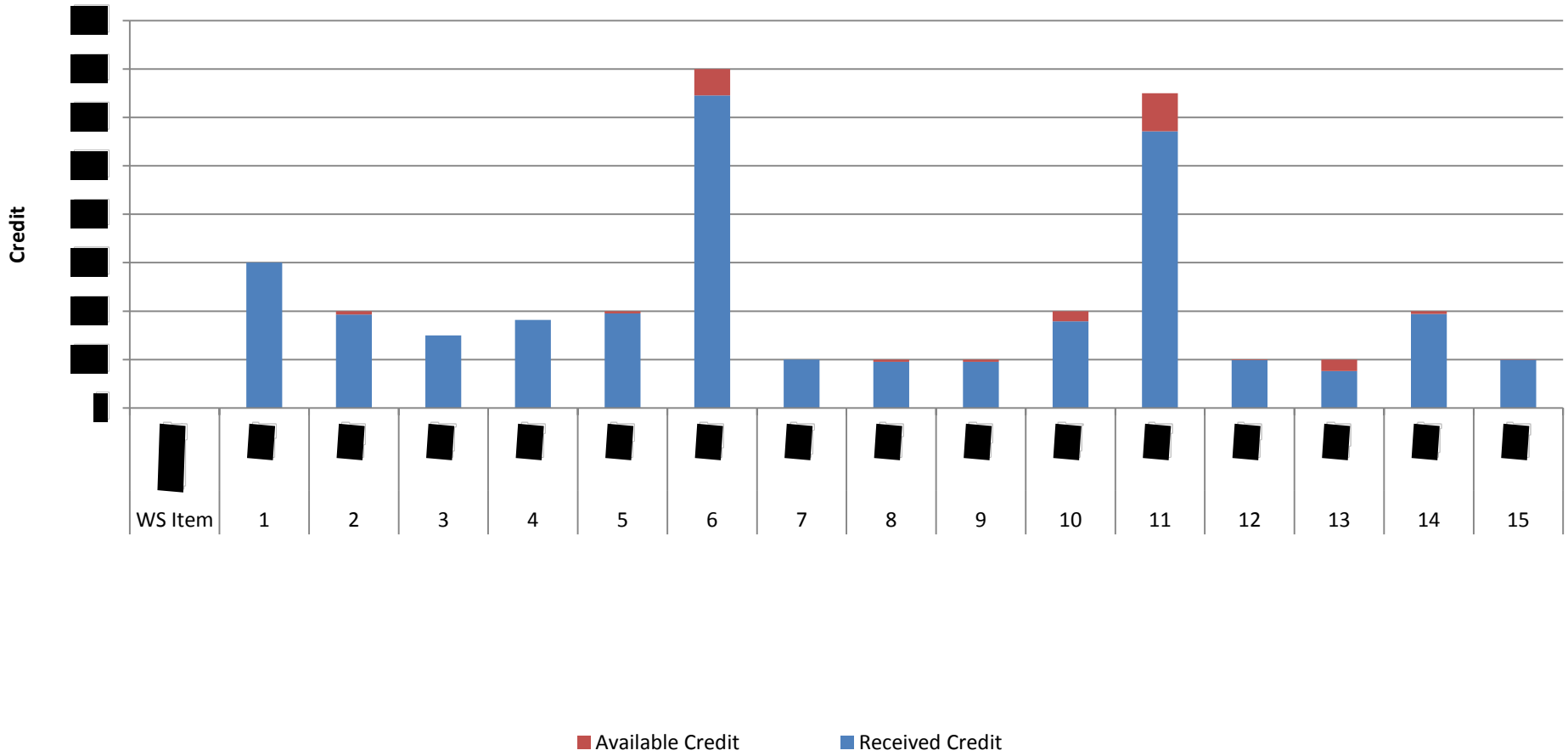
Water Supplies – 30%

- Represents 30% of the Commercial Classification
- Ability to provide water supplies for fire fighting for risks considered during regular and max day demand conditions
- Level of redundancy within the system
- Hydrant distribution

Barrie – Water Systems

- 5 distinct pressure zones
- Water Treatment Plant
- Uniform maintenance program
- Fire flows expected to vary throughout the City

Water Supply Credit Score Summary (Barrie)

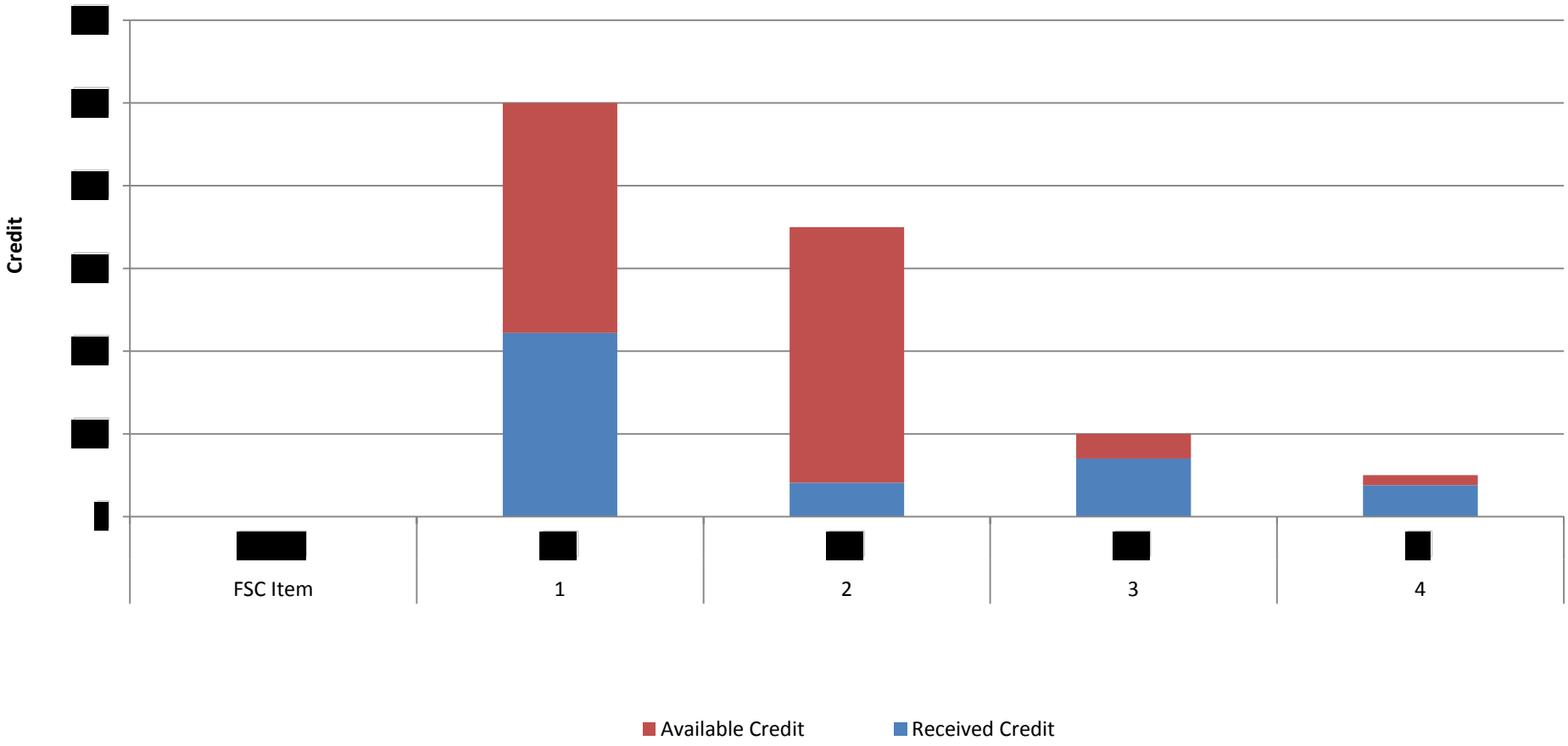


Barrie
Fire Prevention and Fire Safety Control

Fire Safety Control – 20%

- Elevated to 20% to reflect the need to shift from fire fighting to fire prevention
- Career staff assigned to fire prevention division
- Fire Prevention Program and Code Enforcement
- Building Code Inspections
- Fire Code Inspections (complaint & request or routine risk based)
- Plan Check Program
- Public Education Program

Barrie Fire Safety Control Credit

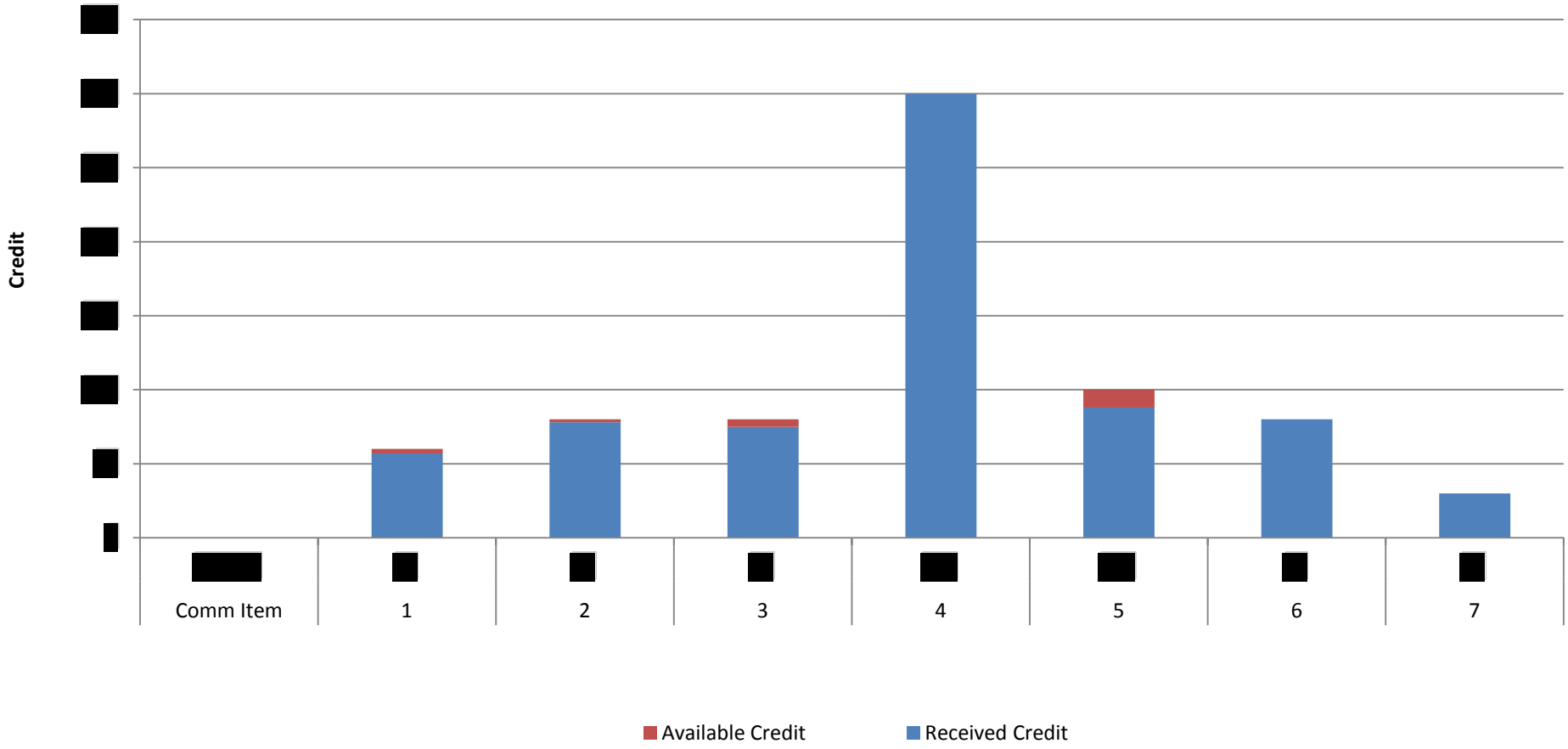


Barrie
Emergency 911 Communications

911 Service

- Represents 10% of final Commercial classification
- 911 Communications center review
- NFPA 1221 used as part of analysis
- Qualifications of operators
- Number of operators
- Means of dispatch in Barrie

Emergency Communications Credit Score Summary



Fire Insurance Grades for Barrie

Previous and Updated Grades

- Last assessment completed 2005
  - Single classification applied throughout entire City
  - Less accurate reflection of varying service levels throughout City
  - Less accurate reflection of varying risk levels throughout City

- Most recent update now completed in 2013
  - Multiple classifications throughout entire City (based on fire station response areas)
  - More accurate reflection of varying service levels throughout City
  - More accurate reflection of varying risk levels throughout City
  - More valuable information to assist with future planning, investments and development

City of Barrie – Fire Insurance Grades - PFPC

2005 PFPC

- City of Barrie PFPC = 4

2013 PFPC

- Fire Station 1 PFPC = 4
- Fire Station 2 PFPC = 5
- Fire Station 3 PFPC = 4
- Fire Station 4 PFPC = 3
- Fire Station 5 PFPC = 5

City of Barrie – Fire Insurance Grades - DPG

2005 DPG

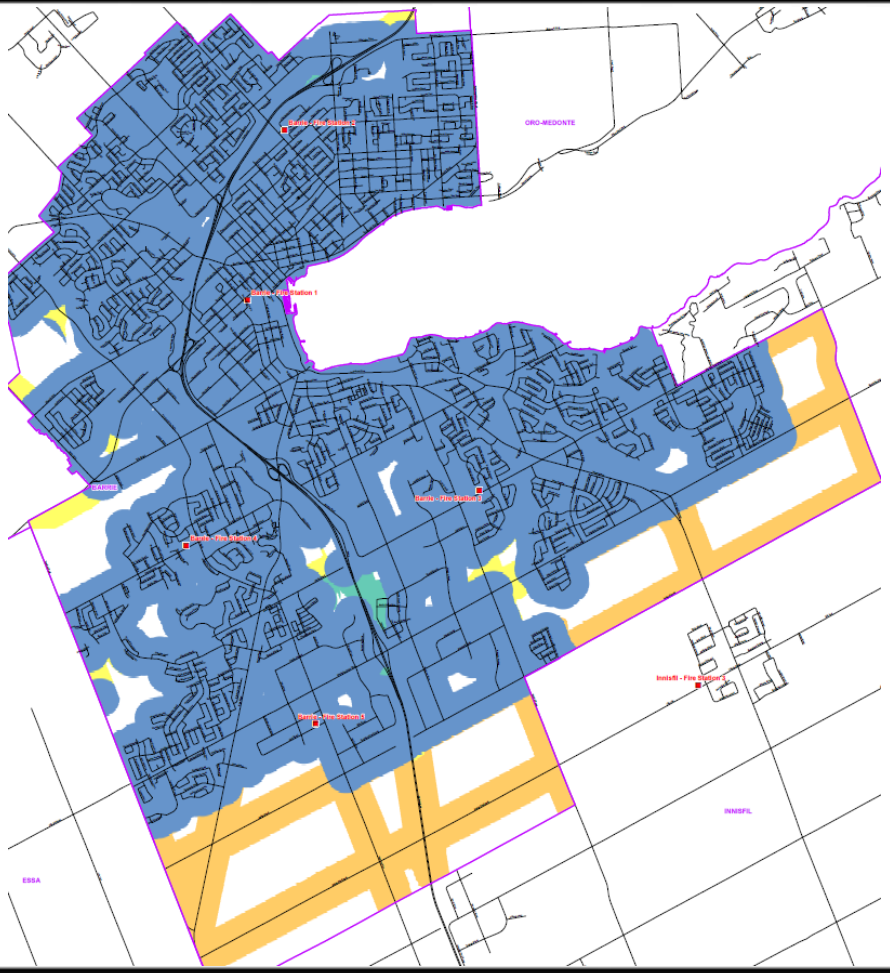
- City of Barrie DPG = 1

2013 DPG

- Fire Station 1 DPG = 1
- Fire Station 2 DPG = 1
- Fire Station 3 DPG = 1
- Fire Station 4 DPG = 1
- Fire Station 5 DPG = 1

Dwelling Protection Grade

- Hydrant Protected Areas = 1
  - Within 300 m of a recognized hydrant and 8 km of a fire station
- Non Hydrant Protected Areas = 3B
  - Within 8 km of Fire Station No 1 but not within 300 m of a hydrant
- Non Hydrant Protected Areas = 4
  - Within 8 km of Fire Station No 2, 3, 4, 5 but not within 300 m of a hydrant



Public Fire Protection Classification

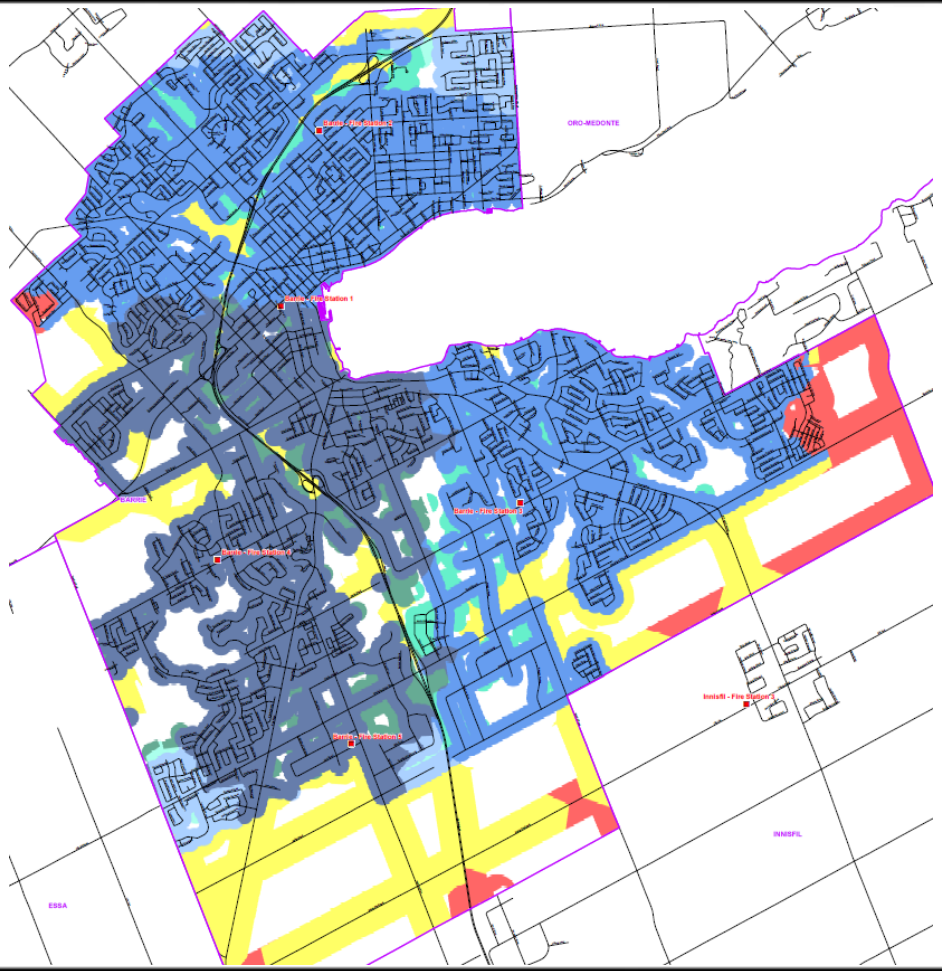
- Hydrant Protected Areas
  - Within 150 m of a recognized hydrant and 5 km of a fire station

  Dark Blue = 3 (FS 4)

  Blue = 4 (FS 1 and 3)

  Light Blue = 5 (FS 2 and FS 5)

- Non Hydrant Protected Areas = 9
  - Within 5 km of a fire station but not within 150 m of a hydrant
- Rest Unprotected = 10
  - Beyond 5 road km of a fire station



Recommendations

Barrie Options for Improvements

Various Options for Improvements

- Fire Safety Control Improvements – 4 Levels of Improvements
  - Increased Number of Inspections
  - Better Record Keeping Practices
  - Better Data Management
  - Additional Pre-Incident Plans
- Fire Department Improvements – Ladder Service and Distribution
  - New Ladder Company at Fire Station 2 or Fire Station 5
- Fire Department Improvements – Additional Pre-Incident Plans
  - 10% of total building stock considered in study with Pre-Incident Plan
  - 25% of total building stock considered in study with Pre-Incident Plan
  - 50% of total building stock considered in study with Pre-Incident Plan
  - 90% of total building stock considered in study with Pre-Incident Plan
- Combined Improvements
  - Implement first or initial phases of improvements discussed above to improve overall credit scores in each area reviewed within the City

Fire Safety Control – Impacts of Improvements

• Fire Safety Control improvements through a phased approach and their potential impact on the fire insurance grades

	Service Area	FSC Credit Points	Final Credit	PFPC	Impact from Original		
Level 1	Fire Station 1	8.88	68.49	4	1.46		
	Fire Station 2	8.88	60.97	**4**	1.46		
	Fire Station 3	8.88	64.72	4	1.46		
	Fire Station 4	8.88	74.91	3	1.46		
	Fire Station 5	8.88	60.25	5	1.46		
	Service Area	FSC Credit Points	Final Credit	PFPC	Impact from Original	Impact from Level 1	
Level 2	Fire Station 1	10.84	70.45	**3**	3.42	1.96	
	Fire Station 2	10.84	62.93	4	3.42	1.96	
	Fire Station 3	10.84	66.68	4	3.42	1.96	
	Fire Station 4	10.84	76.87	3	3.42	1.96	
	Fire Station 5	10.84	62.21	**4**	3.42	1.96	
	Service Area	FSC Credit Points	Final Credit	PFPC	Impact from Original	Impact from Level 1	Impact from Level 2
Level 3	Fire Station 1	12.7	72.31	3	5.28	3.82	1.86
	Fire Station 2	12.7	64.79	4	5.28	3.82	1.86
	Fire Station 3	12.7	68.54	4	5.28	3.82	1.86
	Fire Station 4	12.7	8.73	3	5.28	3.82	1.86
	Fire Station 5	12.7	64.07	**4**	5.28	3.82	1.86

Fire Department Improvements – Ladder Service from FS 2 or FS 5

Credit Improvements with New Ladder Company at Fire Station No.2				Impact from Original	
3 Fire Fighters	FD Credit Points	Credit Points	PFPC	FD Credit Increase	Final Credit Increase
Fire Station 4	32.33	74.59	3	0.84	1.14
Fire Station 5	23.80	62.88	4	2.97	4.09

Credit Improvements with New Ladder Company at Fire Station No.2				Impact from Original	
2 Fire Fighters	FD Credit Points	Credit Points	PFPC	FD Credit Increase	Final Credit Increase
Fire Station 4	32.05	74.21	3	0.56	0.76
Fire Station 5	23.42	62.36	4	2.59	3.57

Credit Improvements with New Ladder Company at Fire Station No.5				Impact from Original	
3 Fire Fighters	FD Credit Points	Credit Points	PFPC	FD Credit Increase	Final Credit Increase
Fire Station 1	27.36	67.77	4	0.54	0.74
Fire Station 2	25.41	65.1	4	4.06	5.59

Credit Improvements with New Ladder Company at Fire Station No.5				Impact from Original	
2 Fire Fighters	FD Credit Points	Total Credit Points	PFPC	FD Credit Increase	Final Credit Increase
Fire Station 1	27.15	67.48	4	0.33	0.45
Fire Station 2	25.13	64.71	4	3.78	5.2

Pre-Incident Planning Improvement

10% Completed

Service Area	FD Credit Points	Final Credit Points	PFPC	Impact from Original: FD Credit Increase	Impact from Original: Final Credit Increase
Fire Station 1	27.02	67.31	4	0.2	0.28
Fire Station 2	21.55	59.79	5	0.2	0.28
Fire Station 3	24.28	63.53	4	0.2	0.27
Fire Station 4	31.69	73.72	3	0.2	0.27
Fire Station 5	21.03	59.06	5	0.2	0.27

25% Completed

Service Area	FD Credit Points	Final Credit Points	PFPC	Impact from Original: FD Credit Increase	Impact from Original: Final Credit Increase
Fire Station 1	27.6	68.1	4	0.78	1.07
Fire Station 2	22.13	60.58	5	0.78	1.07
Fire Station 3	24.86	64.33	4	0.78	1.07
Fire Station 4	32.27	74.52	3	0.78	1.07
Fire Station 5	21.60	59.86	5	0.77	1.07

50% Completed

Service Area	FD Credit Points	Final Credit Points	PFPC	Impact from Original: FD Credit Increase	Impact from Original: Final Credit Increase
Fire Station 1	28.58	69.45	4	1.76	2.42
Fire Station 2	23.11	61.93	4	1.76	2.42
Fire Station 3	25.84	65.67	4	1.76	2.41
Fire Station 4	33.25	75.86	3	1.76	2.41
Fire Station 5	22.58	61.20	4	1.75	2.41

90% Completed

Service Area	FD Credit Points	Final Credit Points	PFPC	Impact from Original: FD Credit Increase	Impact from Original: Final Credit Increase
Fire Station 1	30.16	71.62	3	3.34	4.59
Fire Station 2	24.69	64.1	4	3.34	4.59
Fire Station 3	27.42	67.84	4	3.34	4.58
Fire Station 4	34.83	78.03	3	3.34	3.77
Fire Station 5	24.16	63.37	4	3.33	4.58

City of Barrie – Improvements with Multiple Options Combined (initial phase)

Credit Improvement Summary (FS2 New Ladder Company, Pre-Incident Plans, FSC Level 1)					Impact from Original		
Service Area	FD Credit Points	FSC Credit Points	Final Credit Points	PFPC	FD Credit Increase	FSC Credit Increase	Final Credit Increase
Fire Station 1	27.38	8.88	69.51	4	0.92	1.46	2.72
Fire Station 2	25.39	8.88	66.83	4	4.48	1.46	7.62
Fire Station 3	24.28	8.88	64.99	4	0.2	1.46	1.73
Fire Station 4	31.42	8.88	75.18	3	0.47	1.46	2.1
Fire Station 5	20.81	8.88	60.52	4	0.42	1.46	2.04

Credit Improvement Summary (FS5 New Ladder Company, Pre-Incident Plans, FSC Level 1)					Impact from Original		
Service Area	FD Credit Points	FSC Credit Points	Final Credit Points	PFPC	FD Credit Increase	FSC Credit Increase	Final Credit Increase
Fire Station 1	26.84	8.88	68.77	4	0.38	1.46	1.98
Fire Station 2	21.33	8.88	61.25	4	0.42	1.46	2.04
Fire Station 3	24.28	8.88	64.99	4	0.2	1.46	1.73
Fire Station 4	32.26	8.88	76.33	3	1.31	1.46	3.25
Fire Station 5	23.78	8.88	64.61	4	3.39	1.46	6.13

Cost Of Recommendations

- Costs shown are approximate and can be expected to change depending on amount and type of investments

Recommendations	Capital	Operational	Comments
Recommendation 1 - Improve Ladder Service and Ladder Distribution	$1,200,000	$50,000	apparatus maintenance, fuels, repairs, etc
Recommendation 2 - Improve Total Available Fire Force	$380,000	$2,460,000	20 fire fighters and 4 captains
Recommendation 3 - Develop Facility for Training	$1,000,000	$60,000	
Recommendation 4 - Continue Development of Pre-Incident Plans	-	$115,000	staff salary
Recommendation 8 - Hire Additional Fire Prevention Inspectors	$15,000	$100,000	per inspector
Recommendation 9 - Improve Record Keeping Practices	$20,000	$15,000	data management software and licensing fee
Recommendation 9 - Improve Record Keeping Practices	$10,000	unknown	mobile tablets or laptops
Recommendation 9 - Improve Record Keeping Practices	-	unknown	archive existing files into data management software
Recommendation 9 - Improve Record Keeping Practices	-	unknown	develop building stock database
Total	**$2,625,000**	**$2,811,500**	-

Cost Benefit of Fire Insurance Grading

- Assessment considered total of 107 different property codes.
- Approximate annual insurance cost per year at PFPC Class 3 is $11.1 million.
- Approximate annual insurance cost per year at PFPC Class 4 is $12 million.
- Approximate annual insurance cost per year at PFPC Class 5 is $13.2 million.

- The total cost saving between Class 3 and Class 4 across the entire City is approximately $0.98 million or an average of 8% per property. The total cost savings between Class 4 and Class 5 across the entire City is approximately $1.2 million or an average of 9% per property

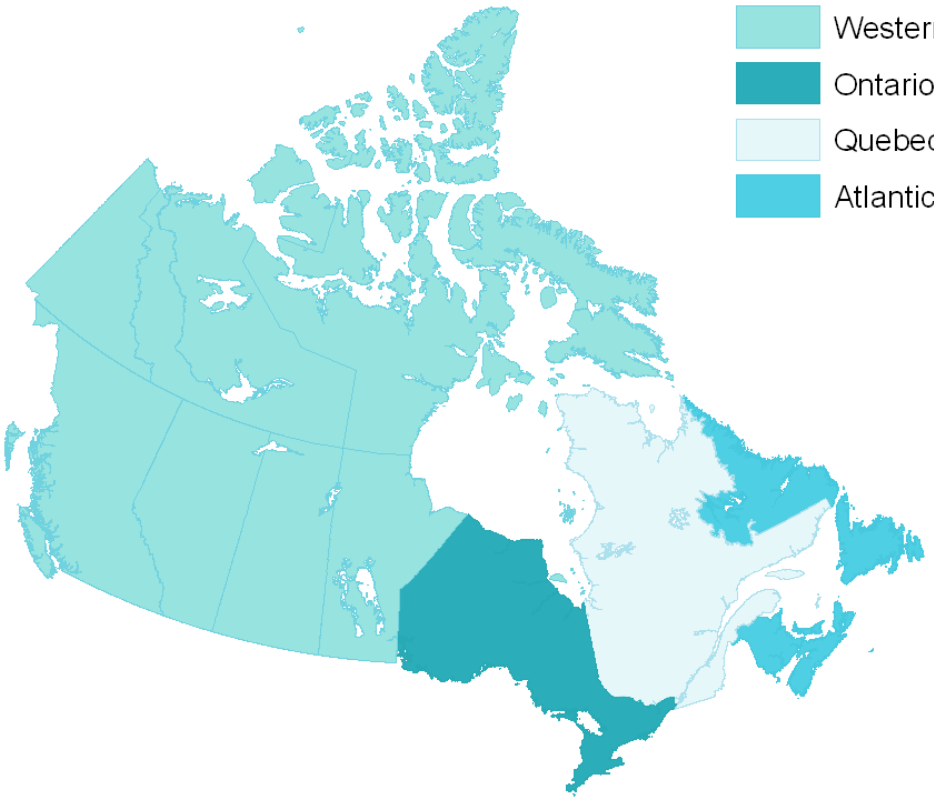
Property Code	Number of Properties	Assessment Total	Cost Per Year at PFPC 3	Cost Per Year at PFPC 4	Cost Per Year at PFPC 5	PFPC 3/4 Difference	PFPC 4/5 Difference	PFPC 3/5 Difference
Totals		$5,128,215,867	$11,065,567	$12,043,157	$13,250,830	$977,590	$1,207,673	$2,185,263

- Cities offer many different services with limited tax base
- Receive very few incentives for various services and investments
- Fire insurance grading recognition reduces property premium rates

Conclusions

- Continue to implement recommendations in Fire Master Plan
- Continue to update Fire Master Plan
- Invest in Fire Prevention to help reduce and mitigate risk and potential risk
- Continue to update and report back to Fire Underwriters Survey to ensure fire insurance grades are commensurate with service levels

Questions?



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THE END

Fire Underwriters Survey™
A SERVICE TO INSURERS AND MUNICIPALITIES