

REPORT NO. R.080010.001

WSP PROJECT NO. 151-13703-01

# **LIFE SAFETY UPGRADES SPRINKLER SYSTEM**

CANADA CENTRE FOR INLAND WATER

CCIW- NWRI BUILDING

BURLINGTON, ON

**100% SUBMITTAL**

JULY 26, 2016



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# 1 ASSET DESCRIPTION

The Canada Centre for Inland Waters, located at 867 Lakeshore Road in Burlington, Ontario, consists of five (5) buildings, most built in the early 1970s, with almost 55,000 square metres of floor space. The buildings are pre-eminently used as a freshwater research facility and as office space.

This report will consist of work required for the installation of sprinkler systems in the following buildings only:

- National Water Research Institute Building (NWRI) which is composed of the following:
  - Administration and Laboratory Building (A&L);
  - Research and Development Building (R&D);
  - Hydraulics Lab;
  - Warehouse; and
  - Boiler Plant.
- Wastewater Technology Centre Building (WTC).
- Annex Building.

Each of the buildings will be reviewed to determine the extent of existing sprinkler coverage and the work required to provide complete sprinkler coverage within these buildings.

# 2 ISSUE

This project seeks to investigate design and implementation methods for a fully integrated sprinkler system in the NWRI complex of the CCIW Facility in accordance with the latest codes and standards specific to life safety and property protection.

The buildings are provided with varying degrees of sprinkler coverage however only the Warehouse building is completely sprinklered. This report will aim to determine the extent of the work required to provide complete sprinkler coverage throughout the buildings while determining which existing systems should be reused and refurbished or replaced to ensure a compliant sprinkler system as per National Fire Protection Association (NFPA) 13 – *Installation of Sprinkler Systems* and with an adequate service life to meet PWGSC standards.

Areas where installation will be difficult will be identified as part of this report to ensure that these locations can be adequately addressed as part of the sprinkler design portion of the project.

# 3 APPLICABLE CODES, STANDARDS AND REGULATIONS

The Codes, Standards and Regulations deemed to be applicable to the building use and occupancy related to this report are:

- National Fire Code of Canada (NFCC)
- Treasury Board Fire Protection Standard (FPS)
- National Building Code of Canada (NBCC)

The documents listed above are provided in order of precedence for application in this case, with the NFCC being most applicable and the NBCC being least applicable. The purpose for the order is that fire codes are applicable at all times when a building is occupied, while building codes are applicable for new construction, renovation or change of use. Since DAOD and FPS documents contain certain maintenance requirements, they are listed ahead of the NBCC.

## 3.1 FEDERAL PROPERTIES

Federally-owned and/or occupied buildings are required to comply with Canada Labour Code – Part II (CLC), Canada Occupational Safety and Health Regulations (COSHR),

General application of these documents includes

1. The Labour Code, which deals generally with the safety of employers and employees in the workplace, of which fire safety is a part.
2. The COSHR, which includes very specific life safety provisions, as well as general references requiring compliance with the National Building Code of Canada (NBCC). Specifically under Part II, Division I Buildings, article 2.2 of COSHR it states the following.
  - 2.2(1). The design and construction of every building, the construction of which begins on or after the day of the coming into force of this subsection, shall meet the requirements of the National Building Code.
  - 2.2(2). Every building, the construction of which begins before the day of the coming into force of this subsection, shall, to the extent reasonably practicable, meet the requirements of the National Building Code.
  - 2.2(3). The renovation of any building or part of a building shall, to the extent reasonably practicable, meet the requirements of the National Building Code.
  - 2.2(4). When it is not reasonably practicable for an employer to comply with the requirements of the National Building Code the employer shall, before the proposed renovations start, notify the work place committee or the health and safety representative.



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The Treasury Board has established a Fire Protection Standard, effective April 1, 2010 which applies to all departments within the meaning of section 2 (schedule ii) of the Financial Administration Act (FAA). The FPS assigns responsibility for the delivery of the fire protection program to the Departmental Fire Protection Coordinator designated by the Deputy Head of the Department.

Although some familiar documents such as Fire Commissioner of Canada (FCC) and some chapter 3 Treasury Board Standards (TB) have been rescinded as of April 2010, they continue to be used as reference documents by some Departments. These documents provide additional measures to minimize fire risks to Government of Canada property and program activities. This risk management is accomplished through the application of standards of good fire protection engineering practice to the design, operation, and maintenance of all Government of Canada owned or occupied property.

In accordance with the Fire Protection Standards, the National Building Code of Canada (NBCC), and the National Fire Code of Canada (NFCC), are applicable to this property.

### 3.2 NATIONAL BUILDING AND FIRE CODES

The NBCC is not intended to be enforced retroactively to an existing building unless the building is undergoing renovations, there is a change of use, or a specific hazard is identified with the building or a portion thereof. As such, care and judgement is required when applying NBCC requirements to an existing building.

The NBCC is not intended to be a design guide, but rather a minimum set of requirements intended to provide for the safety of building occupants, emergency responders and surrounding properties. For the various fire protection systems, such as fire alarm, sprinkler and standpipe systems the NBCC references other standards which expand upon the basic requirements for design. Where necessary, we have verified compliance to referenced standards.

The NFCC applies to existing buildings owned and/or occupied by the Federal Government and may be enforced continuously by the AHJ. The NFCC includes requirements to maintain a minimum level of fire safety in the building and sets minimum maintenance and testing criteria for life safety measures and fire protection systems.

### 3.3 ONTARIO BUILDING AND FIRE CODES

The OBC is based on the NBCC; the national model Code. Similarly, the OFC is based on the NFCC. The province of Ontario has enacted the OBC and the OFC, rather than the NBCC and NFCC. However, the provincial and municipal authorities and fire officials have no jurisdiction over federal properties, such that the NBCC and NFCC remain the applicable Codes at these properties. That being said, there is a move within PWGSC to submit projects to municipalities for review; and in such case, the designs are required to comply with the OBC unless specific agreements are made.

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If the Client chooses to apply for a building permit with the city, design and construction will be expected to meet the minimum requirements set by the OBC.

The OBC is very similar to the NBCC, but in some specific areas there are significant differences, notably with requirements applicable to sprinklers, standpipe and hoses, electromagnetic locks and renovation projects. In case of conflicts between the NBCC and OBC requirements, the most stringent requirements should be applied unless it can be demonstrated that for practical reasons (significant construction challenges, firefighting approaches or consistency) an alternate approach should be used. In such case, it must be demonstrated on a case by case basis that similar levels of life safety and fire protection are provided.

### 3.4 REQUIREMENTS FOR SPRINKLER PROTECTION

The NBCC in force at the time of construction as well as the requirements for the current edition of the NBCC were reviewed to determine requirements for sprinkler protection. The classifications for the buildings were obtained from the LMDG Code Review completed in March of 2016. Where more than one major occupancy exists in the building, the most stringent requirements shall apply.

The requirement of the two editions of the NBCC are identified below:

Occupancy	NBCC Edition	Classification	Sprinkler requirements
<b>NWRI Building</b>			
Group A2	1970	3.2.2.16 – Group A, Division 2, Any Height, Any Area	Provided that the building construction meets the listed construction requirements, sprinklers are <b>not</b> required.
	2015	3.2.2.23 – Group A, Division 2, Any Height, Any Area, Sprinklered	Sprinkler protection is required.
Group D	1970	3.2.2.32 – Group D, Any Height, Any Area	Provided that the building construction meets the listed construction requirements, sprinklers are <b>not</b> required.
	2015	3.2.2.55 – Group D, Any Height, Any Area, Sprinklered	Sprinkler protection is required.
Group F2	1970	3.2.2.45 – Group F, Division 2, Any Height, Any Area, Sprinklered	Sprinkler protection is required.
	2015	3.2.2.74 – Group F, Division 2, Any Height, Any Area, Sprinklered	Sprinkler protection is required.
<b>WTC Building</b>			
Group D	1970	3.2.2.30 – Group D, Up to 3 storeys • 2,210 m <sup>2</sup> facing one street	Provided that the building construction meets the listed construction requirements, sprinklers are <b>not</b> required.
	2015	3.2.2.60 – Group D, Any Height, Any Area, Sprinklered • 2,210 m <sup>2</sup> facing one street	Provided that the building construction meets the listed construction requirements, sprinklers are <b>not</b> required.

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Occupancy	NBCC Edition	Classification	Sprinkler requirements
<b>WTC Building</b>			
Group F2	1970	3.2.2.16 – Group F, Division 2, Up to 4 Storeys • 2,210 m <sup>2</sup> facing one street	Provided that the building construction meets the listed construction requirements, sprinklers are <b>not</b> required.
	2015	3.2.2.79 – Group F, Division 2, Up to 2 Storeys, Sprinklered • 2,210 m <sup>2</sup> facing one street	Sprinkler protection is required; the building area exceeds allowance in the NBCC for non-sprinklered buildings of this occupancy.
<b>Annex Building</b>			
Group D	1970	3.2.2.29 – Group D, 1 and 2 Storeys • 598 m <sup>2</sup> facing three streets	Provided that the building construction meets the listed construction requirements, sprinklers are <b>not</b> required.
	2015	3.2.2.62 – Group D, Up to 2 Storeys • 598 m <sup>2</sup> facing three streets	Provided that the building construction meets the listed construction requirements, sprinklers are <b>not</b> required.
Group F3	1970	3.2.2.46 – Group F, Division 3, 1 and 2 Storeys • 598 m <sup>2</sup> facing three streets	Provided that the building construction meets the listed construction requirements, sprinklers are <b>not</b> required.
	2015	3.2.2.85 – Group F, Division 3, Up to 2 Storey • 598 m <sup>2</sup> facing three streets	Provided that the building construction meets the listed construction requirements, sprinklers are <b>not</b> required.

Based on the table above, sprinkler protection was not required in either the WTC or the Annex buildings at the time of construction however it is not known as to why the NWRI building was not sprinklered at the time of construction. Under the current edition of the NBCC, only the Annex Building could be constructed without sprinkler protection. The construction elements of the Annex Building would have to be reviewed against the requirements of Articles 3.2.2.62 and 3.2.2.85 to ensure that these Articles can be applied to the building.

For the purpose of the report, it will be assumed that sprinklers are to be installed in all buildings forming part of the review whether required or not they are required by the NBCC.

## 4 FINDINGS

Following the review of the drawings provided by PWGSC and compiling a list of all information which could be obtained from these drawings, WSP performed a detailed investigation of the buildings forming part of the report to determine the accuracy of the drawings, determine the extent of the sprinkler systems, identify areas where installation will be difficult and determine possible locations for the passage of primary sprinkler mains.

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Using these findings, WSP has determined the extent of the work required which will be reviewed against three different implementation strategies for the installation of sprinklers throughout the buildings including:

1. Installation of the sprinkler system while building is occupied after hours and during silent hours;
2. Installation of the sprinkler system while building is occupied during normal hours; and
3. Phased installation of the sprinkler system while building is unoccupied.

The findings for each building have been identified below:

### 4.1 NATIONAL WATER RESEARCH INSTITUTE BUILDING (NWRI)

The findings in the NWRI have been divided into the five separate buildings which form part of the facility. In addition to the partial sprinkler protection, the facility is provided with a Class III standpipe system which includes 65 mm hose valves for fire department use and 38 mm hose valves with hoses. Fire extinguishers are also located throughout.

#### 4.1.1 NWRI - ADMINISTRATION AND LABORATORY BUILDING (A&L)

The A&L building is a 7 storey building with a mechanical penthouse which is used to house a variety of occupancies including offices, laboratories, a cafeteria / kitchen, library area, data rooms and an auditorium. The third floor of the building is used for mechanical and electrical equipment only. This building is interconnected with the R&D building via the three storey “mall” area which is used as a division between the two buildings. The main entrance to the NWRI facility is located on the east side of the ground floor of the A&L building.

The building is currently provided with some sprinkler protection on the ground floor and second floor on the south side of the building which includes the library. A small preaction sprinkler system has been installed in room L230 on the second floor of the building to provide protection against accidental discharges or leaks for the materials stored within. The supply for the sprinkler systems is from the Hydraulic Lab located to the south of the A&L building. The remainder of the building is not provided with sprinkler protection.

A clean agent system (FM-200) is installed in the data room on the ground floor to protect the equipment therein however sprinklers are not installed in this area.

A number of locations will pose a significant challenge for the installation of sprinklers within the building.

1. The main lobby area, the auditorium and the areas below the bridges and air intakes in the mall are provided with a wood slat ceiling which can be removed however this will be an expensive undertaking. In several locations, very large sections of the ceiling would have to be removed to install the sprinklers. As is the case with all custom ceilings, the possibility of damage during removal and replacement or repair costs can be significant. In addition, as the wood ceilings result in concealed spaces created by combustible construction, sprinklers will be required above and below these wood slat ceilings.

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2. The installation of sprinklers within the mall areas in area under the bridges, below the air intakes and at the top of mall will be difficult both due to the height of the space, which will require the use of a lift, and the finish of the ceiling. The use of sidewall sprinklers at the peak of the mall to protect the area below will be investigated during the design phase to minimize the visual impact of the sprinkler system in the mall. The sprinklers covering the mall area will be supplied from the ground floor of the A&L building.
3. The auditorium presents a challenge both due to the ceiling finish (wood slats), the construction configuration of the ceiling and the height of the space. The installation of fixed seats and the stepped slope of the floor make the use of a lift impossible. Access above the wood slat ceiling appears to be possible, likely accessible via catwalks, however it is not known just how many areas are accessible as the space above the ceiling was not investigated.
4. In the cafeteria, a decorative suspended ceiling has been installed. As is the case with all custom ceilings, the possibility of damage during removal and associated replacement or repair costs can be significant.

On the upper levels, the east and west corridors have been found to be quite congested with mechanical equipment. As such, the installation of the sprinkler mains will have to be done above the ceiling spaces of the offices or from the service core at the centre of the building.

Other more common complications for the installation of sprinkler systems, including gypsum ceilings and congested spaces due to building services such as ductwork, lighting, etc. are also present in the A&L building.

To avoid the installation of sprinklers within the concealed spaces above the wood slat ceilings, the replacement of these ceilings with a new “non-combustible” alternative could be reviewed.

As an alternative to installing new mains from the fire pump dedicated to sprinklers, the system could be supplied from the existing standpipe risers creating a combined sprinkler / standpipe system at one of the existing risers. This would eliminate the need to have a new supply main from the fire pump but could require modifications to the existing control configuration of the standpipe system.

### 4.1.2 NWRI - RESEARCH AND DEVELOPMENT BUILDING (R&D)

The R&D building is a 2 storey building with a mechanical penthouse which is used to house a variety of occupancies including offices and laboratories / workshops. This building is interconnected with the A&L building via the three storey “mall” area which is used as a division between the two buildings.

A small area on the north side of the ground floor, the hallway leading to the Warehouse building, is provided with sprinkler coverage which is supplied from the Warehouse building. Based on the review of the facility, the installation of the sprinkler systems in the R&D facility will be less complicated than that in the A&L portion of the building based on the ceiling types of the building.

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As is the case with the A&L building, the sprinkler system could be supplied from the existing standpipe risers creating a combined sprinkler / standpipe system at one of the existing risers. This would eliminate the need to have a new supply main from the fire pump but could require modifications to the existing control configuration of the standpipe system.

### 4.1.3 NWRI - HYDRAULICS LAB

The Hydraulics Lab is a partial 2 storey building used for laboratories and workshops. This building is also provided with a 2 storey office area at the south side of the building. The north wall of the building connects to the mall area between the A&L and R&D buildings.

A sprinkler room is located on the mezzanine area of the Hydraulics Lab accessible from the stairs at gridline C/33. The sprinkler room is supplied from an 8" pipe from the Boiler Plant located to the west of the Hydraulics Lab. Only a small section of the building, located near the centre section of the building, is provided with sprinkler protection. Another section to the east of the sprinklered portion of the building is provided with sprinklers and associated pipes however the piping is not yet connected to the water supply.

The ceiling of the Hydraulics Lab is mainly open steel deck which should make installation of the sprinkler system relatively simple. The areas below the mezzanine are also relatively open. The ceiling in the office section of the building is acoustic ceiling tiles however the level of congestion above the tiles is not known.

### 4.1.4 NWRI - WAREHOUSE

The Warehouse is a 2 storey building used for office, laboratories, workshops, storage and shipping and receiving. The building connects to the north of the R&D building on the ground and second floors.

The entire Warehouse building is provided with sprinkler systems however the installation dates back to building construction. A number of the sprinklers noted were Grinnell DuraSpeed, a sprinkler that while not on the recall list has proven to be problematic in the past with several unexplained activations. The large garage located to the northwest of the ground floor is protected by a glycol system. The control equipment for the glycol system is arranged with the "U" bend arrangement rather than a backflow preventer to separate the glycol and wet pipe systems.

While the building is provided with complete coverage, the sprinklers are close to reaching the age of 50 years at which a percentage have to be tested. In addition, the internal condition of the sprinkler system piping is unknown. This system should be refurbished with new sprinklers throughout and the internal condition of the sprinkler piping investigated to ensure that the system operates as required and continues to provide the required level of protection for the structure.

### 4.1.5 NWRI - BOILER PLANT

The Boiler Plant is a single storey building with some mezzanines used as the main heating plant for the entire NWRI facility; the fire pump and water entries are also located in the Boiler Plant. The fire pump is rated to provide a boost of 6.9 bar at a flow of 1892 lpm to the municipal water supply. Based on the test

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report provided for the fire pump (dated September 18<sup>th</sup>, 2014 by Fire Safety Solutions Inc.), as well as the hydrant flow tests (undated), the water supply appear to be sufficient to supply the sprinkler systems to be installed in the building.

The building is not provided with any sprinkler protection. The ceiling of the Boiler Plant is mainly open steel deck which should make installation of the sprinkler system relatively simple however access to the ceiling is significantly obstructed by equipment within the building.

There is an access hatch in the boiler plant which provides access to a low crawl space below the NWRI building. This crawl space is used to run some service piping and is constructed entirely of concrete. The space is not used for any other purpose than running pipes.

### **4.2 WASTEWATER TECHNOLOGY CENTRE BUILDING (WTC)**

The WTC building is a standalone 2 storey building used for storage, laboratories, workshops and offices.

The building is partially sprinklered with a project recently having been undertaken to sprinkler a portion of the ground and second floors on the north side of the building. The sprinkler valves are located on the ground floor on the north side of the building in a separate room accessible from the receiving area. The piping in the room appears to be sufficiently sized to extend the system into adjacent areas of the building which is not currently sprinklered.

The building is also provided with a Class II standpipe system (38 mm hose valves with hose only). Fire extinguishers are also located throughout.

The ceiling of the WTC is mainly open steel deck in the storage / warehouse area which should make installation of the sprinkler system relatively simple. The office section of the building is composed of acoustic ceiling tiles however the level of congestion above the tiles is not known.

Based on the test report provided for the hydrant flow tests (undated by Fire Safety Solutions Inc), the water supply appear to be sufficient to supply the sprinkler systems to be installed in the building without the need for a fire pump.

### **4.3 ANNEX BUILDING**

The Annex building is a standalone 2 storey building used for storage and offices.

The Annex is not provided with sprinkler protection. The ceiling of the building is mainly open steel deck in the warehouse area and the office section of the building is composed of acoustic ceiling tiles however the level of congestion above the tiles is not known.

Based on the test report provided for the hydrant flow tests (undated by Fire Safety Solutions Inc), the water supply appear to be sufficient to supply the sprinkler systems to be installed in the building without the need for a fire pump.



## 5 DESIGN REQUIREMENTS

The installation of sprinklers throughout the facility will be dependent on the use of the building, type of system required, extents on sprinkler modifications required to existing systems, congestion of ceiling spaces, types of ceilings in place and a number of different factors which have to be taken into account to ensure the buildings are adequately sprinklered. The work required, hazard classifications of the buildings and anticipated zoning for the sprinkler systems are identified in the paragraphs below for each building..

### 5.1 NATIONAL WATER RESEARCH INSTITUTE BUILDING (NWRI)

As with the findings section for the NWRI complex above, the work requirements for the installation of sprinklers has been divided into the five separate buildings forming part of the facility.

#### 5.1.1 NWRI - ADMINISTRATION AND LABORATORY BUILDING (A&L)

The building requires complete sprinkler protection as only a small section of the ground and second floors are currently sprinklered. The anticipated zoning of the sprinkler system would be as follows:

- Zone 1 – Ground floor: Include the reconnection of the small portion of the building currently sprinklered onto the ground floor zone to ensure that the entire floor plate is covered by a single zone. The ground floor zone would also include the mall area between the A&L and R&D buildings.
- Zone 2 – Second floor: Include the reconnection of the small portion of the building currently sprinklered onto the ground floor zone to ensure that the entire floor plate is covered by a single zone however the preaction system would remain a separate zone.
- Zone 3 – Third floor.
- Zone 4 – Fourth floor.
- Zone 5 – Fifth floor.
- Zone 6 – Sixth floor.
- Zone 7 – Seventh floor.
- Zone 8 – Penthouse.

Each of the zones would be provided with an indicating shutoff valves monitored by the building fire alarm system, a flow switch to sound an alarm upon water flow in the system and a test point to permit testing of the sprinkler devices.

In addition to the standard zoning, in areas where there exists special protection requirements (ex. computer room on ground floor), dedicated or sub-zones using systems such as pre-action sprinkler system can provide the required sprinkler protection with an added degree of protection against leaks or accidental activation.

In order to properly protect the mall area from the ground floor system without the piping being visible, sprinkler piping from the ground floor system will have to be installed up through the second and third floors



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in shafts or at other suitable locations. This piping will have to be well identified as serving the ground floor to ensure it is not used to supply sprinkler on either the second or third floors. Should this occur and one such sprinkler activates, it would announce as “ground floor” which could lead to confusion and delayed responses from emergency personnel.

Based on the use of the building, the hazard classifications are as follows:

- Offices, mall, auditorium, kitchen seating area, library and computer rooms – Light Hazard
- Kitchen cooking area, mechanical / electrical spaces – Ordinary Hazard Group 1
- Laboratories:
  - Class A (high hazard) or B (moderate hazard) – Ordinary Hazard Group 2
  - Class C (low hazard) or D (minimal hazard) – Ordinary Hazard Group 1

The classifications of hazards is based on the amount of combustible and flammable liquids stored and used within the laboratories as defined in NFPA 45 - *Fire Protection for Laboratories Using Chemicals*. Laboratories not using chemicals or other dangerous goods can be classified as Light Hazard occupancies.

In order to determine if the existing water supply could limit the type of laboratory which could be housed in the building, a preliminary hydraulic calculation was performed on level 7 at the most hydraulically demanding location of the building using the design criteria of Ordinary Hazard Group 2, the more demanding of the two alternatives. The water supply was capable of supplying water for a sprinkler system designed based on these criteria with a fair safety factor. As such, the laboratories can all be designed to the requirements of Ordinary Hazard Group 2 allowing for flexibility in the future.

There are two possible options for the installation of sprinklers in the A&L building:

1. Provide a dedicated sprinkler system from the fire pump in the Boiler Plant to a riser centrally located in the building such as in stair CC or the abandoned elevator shaft.
2. Utilize one of the existing 150 mm standpipe risers in the stairwells of the building to create a combined sprinkler and standpipe system.

Option 2 is a preferred option as it utilizes the existing infrastructure of the building to provide sprinkler protection throughout. The standpipe systems piping from the fire pump room and any of the existing risers are likely of sufficient size to supply the sprinkler systems however this will have to be proven hydraulically at design. A check valve would be required after the zone control valve for a combined sprinkler / standpipe system.

Work in areas of the building with wood slat ceilings will have to be designed in a manner to minimize the amount of ceiling to remove to keep the installation the least intrusive as possible. Unless the ceilings are replaced with a non-combustible alternative, sprinklers will be required in the concealed spaces above the wood slat ceilings as well as below.

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Elevators hoistways and machine rooms will also require sprinkler protection as required by 8.15.5 of NFPA 13. Sprinklers are required at the top and bottom of the shafts unless specific criteria are met such as shafts constructed of non-combustible materials, lack of hydraulic elevators and compliance with ASME A17.1, *Safety Code for Elevators and Escalators*. Sprinklers in elevator machine rooms can be omitted if the room is dedicated to elevator equipment, provided with smoke detection, the room and elevator shafts are separated by fire separations as required by code and the elevator is not hydraulic type. A review of the elevators as well as associated shaft and machine room will be required to determine if sprinklers can be omitted.

Sprinkler protection can also be omitted from electrical rooms provided that the rooms are dedicated to electrical equipment, that only dry type equipment is installed and that the rooms have fire resistance ratings of at least 2-hours.

### 5.1.2 NWRI - RESEARCH AND DEVELOPMENT BUILDING (R&D)

The building requires complete sprinkler protection as only a small section of the ground floor is currently sprinklered. The sprinkler protection is supplied from the Warehouse building to the north and the zoning will not be altered as part of the sprinkler installation. The anticipated zoning of the sprinkler system would be as follows:

- Zone 1 – Ground floor.
- Zone 2 – Second floor.
- Zone 3 – Penthouse.

Each of the zones would be provided with an indicating shutoff valves monitored by the building fire alarm system, a flow switch to sound an alarm upon water flow in the system and a test point to permit testing of the sprinkler devices. In addition to the standard zoning, in areas where there exists special protection requirements, dedicated or sub-zones using preaction sprinkler systems such can provide the required sprinkler protection with an added degree of protection against leaks or accidental activation.

Based on the use of the building, the hazard classifications are as follows:

- Offices – Light Hazard
- Mechanical / electrical spaces – Ordinary Hazard Group 1
- Laboratories:
  - Class A (high hazard) or B (moderate hazard) – Ordinary Hazard Group 2
  - Class C (low hazard) or D (minimal hazard) – Ordinary Hazard Group 1

Laboratories not using chemicals or other dangerous goods can be classified as Light Hazard occupancies.

As with the A&L building, there are two possible options for the installation of sprinklers in the R&D building:

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1. Provide a dedicated sprinkler system from the fire pump in the Boiler Plant to a riser centrally located in the building such as in stair RC.
2. Utilize one of the existing 150 mm standpipe risers in the stairwells of the building to create a combined sprinkler and standpipe system.

Option 2 is a preferred option as it utilizes the existing infrastructure of the building to provide sprinkler protection throughout. The standpipe systems piping from the fire pump room and any of the existing risers are likely of sufficient size to supply the sprinkler systems however this will have to be proven hydraulically at design. A check valve would be required after the zone control valve for a combined sprinkler / standpipe system.

### 5.1.3 NWRI - HYDRAULICS LAB

The building currently has sporadic sprinkler protection at random locations while others are provided with piping and sprinklers but are not connected to a water supply. The sprinkler water supply comes from a 200 mm pipe from the adjacent Boiler Plant to a sprinkler room on a mezzanine. The anticipated zoning of the sprinkler system would be as follows:

- Zone 1 – Ground floor of large laboratory area including areas above and below mezzanines.
- Zone 2 – Ground floor office area.
- Zone 3 – Second floor office area.

Each of the zones would be provided with an indicating shutoff valves monitored by the building fire alarm system, a flow switch to sound an alarm upon water flow in the system and a test point to permit testing of the sprinkler devices. In addition to the standard zoning, in areas where there exists special protection requirements, dedicated or sub-zones using preaction sprinkler systems can provide the required sprinkler protection with an added degree of protection against leaks or accidental activation.

Based on the use of the building, the hazard classifications are as follows:

- Offices – Light Hazard
- Mechanical / electrical spaces – Ordinary Hazard Group 1
- Laboratories:
  - Class A (high hazard) or B (moderate hazard) – Ordinary Hazard Group 2
  - Class C (low hazard) or D (minimal hazard) – Ordinary Hazard Group 1

Laboratories not using chemicals or other dangerous goods can be classified as Light Hazard occupancies.

- Storage area:
 

Hazard classifications for storage areas range from Ordinary Hazard Group 1 to high densities and design area requirements based on the storage method, materials stored height of storage and the building height. Based on a review of the building, a large number of different kinds of

## 100% SUBMITTAL

storage applications exist in the building, the most demanding of which appeared to be rack storage at 6.1 m. As the stored material is not currently known, the design criteria could range from:

- Class 1 commodity: 23.6 lpm / m<sup>2</sup> over a design area of 232 m<sup>2</sup>; to
- Class 4 commodity 24.5 lpm / m<sup>2</sup> over a design area of 279 m<sup>2</sup>

The sprinkler system will have to be hydraulically calculated to ensure the density requirements for storage can be met. The areas used for storage are relatively small however, as they are not isolated or in dedicated areas, an area which extends beyond the limits of the storage will have to be calculated to ensure the system can operate as intended.

Elevators hoistways and machine rooms will also require sprinkler protection as required NFPA 13. Sprinklers are required at the top and bottom of the shafts unless specific criteria are met such as shafts constructed of non-combustible materials, lack of hydraulic elevators and compliance with ASME A17.1. Sprinklers in elevator machine rooms can be omitted if the room is dedicated to elevator equipment, provided with smoke detection, the room and elevator shafts are separated by fire separations as required by code and the elevator is not hydraulic type. A review of the elevators as well as associated shaft and machine room will be required to determine if sprinklers can be omitted.

Sprinkler protection can also be omitted from electrical rooms provided that the rooms are dedicated to electrical equipment, that only dry type equipment is installed and that the rooms have fire resistance ratings of at least 2-hours.

### 5.1.4 NWRI - WAREHOUSE

The building is current fully sprinklered however the installation dates back to original construction. The installation is therefore approaching the end of its service life of 50 years based on PWGSC standards.

As a means of extending the life of the system, it is recommended that all sprinklers on the system be replaced with new improve system reliability. An internal investigation of the condition of the piping should also be undertaken to sure that the piping has not corroded or deteriorated to a point where leaks may develop. In addition, the internal investigation should focus not only on the mains of the sprinkler system but also on branch lines, particularly at low sections, where debris and build-ups of foreign materials can occur. Where piping is found to be in poor condition, sections of the piping could be replaced or the system replaced in whole if the results of the investigation warrant it.

The zoning of the sprinkler system would not be altered as part of this project.

Although a compliant system, it is recommended that the glycol system in the garage area be replaced with a small dry pipe sprinkler system supplied from the adjacent wet sprinkler system. Glycol sprinkler systems have maintenance requirements which are significantly more demanding than wet or dry pipe sprinkler systems and are less environmentally friendly than the alternatives.

## 100% SUBMITTAL

Elevators hoistways and machine rooms will also require sprinkler protection as required NFPA 13. Sprinklers are required at the top and bottom of the shafts unless specific criteria are met such as shafts constructed of non-combustible materials, lack of hydraulic elevators and compliance with ASME A17.1. Sprinklers in elevator machine rooms can be omitted if the room is dedicated to elevator equipment, provided with smoke detection, the room and elevator shafts are separated by fire separations as required by code and the elevator is not hydraulic type. A review of the elevators as well as associated shaft and machine room will be required to determine if sprinklers can be omitted.

Sprinkler protection can also be omitted from electrical rooms provided that the rooms are dedicated to electrical equipment, that only dry type equipment is installed and that the rooms have fire resistance ratings of at least 2-hours.

### 5.1.5 NWRI – BOILER PLANT

The building requires complete sprinkler protection as there are presently no sprinklers installed in this section of the facility. As the building houses both the water entry and fire pump for the facility, the water supply should be sufficient to supply the sprinkler system in the building. Due to the relatively small size of the building and the hazard classification, it would be recommended to make the connection to the water supply upstream of the fire pump to avoid any over-pressurization issues in the sprinkler system.

The entire building would be protected by a single sprinkler zone. The zone would be provided with an indicating shutoff valve monitored by the building fire alarm system, a flow switch to sound an alarm upon water flow in the system and a test point to permit testing of the sprinkler device.

Based on the use of the building, the hazard classification of the building would be Ordinary Hazard Group 1 for mechanical / electrical spaces.

As the crawl space is constructed entirely of concrete and is not used for anything other than running piping, 8.12.1.2.2 of NFPA 13 can be applied to the crawl space. This permits concealed spaces with limited access to not require sprinkler protection provided they are non-combustible construction and do not permit occupancy or storage.

## 5.2 WASTEWATER TECHNOLOGY CENTRE BUILDING (WTC)

The building is partially sprinklered with a project recently having been undertaken to sprinkler portions of the ground and second floors on the north side of the building. The sprinkler configuration currently has four zones to protect the small sprinklered portions of the building each with a 100 mm riser supplied from a 200 mm water entry. There is no fire pump supplementing the water supply to the building.

The zones are divided as follows:

- Zone 1 – Ground floor offices.
- Zone 2 – Ground floor receiving area near sprinkler room.

## 100% SUBMITTAL

- Zone 3 – Second floor offices.
- Zone 4 – Second floor area above sprinkler room.

Each of the zones is provided with an indicating shutoff valves monitored by the building fire alarm system, a flow switch to sound an alarm upon water flow in the system and a test point to permit testing of the sprinkler devices. In order to minimize the number of sprinkler zones in the building, Zone 1 would be extended to cover all office areas on the ground floor, Zone 2 would be extended to cover all of the storage areas and Zone 3 would be extended to cover all office areas on the ground floor.

Based on the use of the building, the hazard classifications are as follows:

- Offices – Light Hazard
- Storage area:  
Hazard classifications for storage areas range from Ordinary Hazard Group 1 to high densities and design area requirements based on the storage method, materials stored height of storage and the building height. Based on a review of the building, a large number of different kinds of storage applications exist in the building, the most demanding of which appeared to be rack storage at 6.1 m. As the stored material is not currently known, the design criteria could range from:
  - Class 1 commodity: 23.6 lpm / m<sup>2</sup> over a design area of 232 m<sup>2</sup>; to
  - Class 4 commodity 24.5 lpm / m<sup>2</sup> over a design area of 279 m<sup>2</sup>

The sprinkler system will have to be hydraulically calculated to ensure the density requirements for storage can be met. The areas used for storage are relatively small however, as they are not isolated or in dedicated areas, an area which extends beyond the limits of the storage will have to be calculated to ensure the system can operated as intended.

While the intent is to extend Zone 2 to cover the storage area, the existing pipe sizing (100 mm) of Zone 2 may not allow for this due to the high water demands of the sprinkler system protecting the storage. If the need for larger pipe sizes is calculated during design, a separate zone will have to be created. The sprinkler demand could also result in the need for a fire pump or, alternatively, a change in storage practices in the building to permit the installation of a sprinkler system which does not require a fire pump.

Elevators hoistways and machine rooms will also require sprinkler protection as required NFPA 13. Sprinklers are required at the top and bottom of the shafts unless specific criteria are met such as shafts constructed of non-combustible materials, lack of hydraulic elevators and compliance with ASME A17.1. Sprinklers in elevator machine rooms can be omitted if the room is dedicated to elevator equipment, provided with smoke detection, the room and elevator shafts are separated by fire separations as required by code and the elevator is not hydraulic type. A review of the elevators as well as associated shaft and machine room will be required to determine if sprinklers can be omitted.

## 100% SUBMITTAL

Sprinkler protection can also be omitted from electrical rooms provided that the rooms are dedicated to electrical equipment, that only dry type equipment is installed and that the rooms have fire resistance ratings of at least 2-hours.

### 5.3 ANNEX BUILDING

The building is not currently provided with any sprinkler protection. The anticipated zoning of the sprinkler system to be installed in the building would be as follows:

- Zone 1 – Ground floor office area.
- Zone 2 – Second floor office area.
- Zone 3 – Warehouse storage.

Each of the zones would be provided with an indicating shutoff valves monitored by the building fire alarm system, a flow switch to sound an alarm upon water flow in the system and a test point to permit testing of the sprinkler devices.

Based on the use of the building, the hazard classifications are as follows:

- Offices – Light Hazard
- Storage area:

Hazard classifications for storage areas range from Ordinary Hazard Group 1 to high densities and design area requirements based on the storage method, materials stored height of storage and the building height. Based on a review of the building, a large number of different kinds of storage applications exist in the building, the most demanding of which appeared to be rack storage at 6.1 m. As the stored material is not currently known, the design criteria could range from:

- Class 1 commodity: 23.6 lpm / m<sup>2</sup> over a design area of 232 m<sup>2</sup>; to
- Class 4 commodity 24.5 lpm / m<sup>2</sup> over a design area of 279 m<sup>2</sup>

The sprinkler system will have to be hydraulically calculated to ensure the density requirements for storage can be met. The high water demands of the sprinkler system protecting the storage may result in the need to upsize the water entry or for the installation of a fire pump. Alternatively, a change in storage practices in the warehouse area may permit the installation of a sprinkler system which does not require a fire pump

Elevators hoistways and machine rooms will also require sprinkler protection as required NFPA 13. Sprinklers are required at the top and bottom of the shafts unless specific criteria are met such as shafts constructed of non-combustible materials, lack of hydraulic elevators and compliance with ASME A17.1. Sprinklers in elevator machine rooms can be omitted if the room is dedicated to elevator equipment, provided with smoke detection, the room and elevator shafts are separated by fire separations as required

## 100% SUBMITTAL

by code and the elevator is not hydraulic type. A review of the elevators as well as associated shaft and machine room will be required to determine if sprinklers can be omitted.

Sprinkler protection can also be omitted from electrical rooms provided that the rooms are dedicated to electrical equipment, that only dry type equipment is installed and that the rooms have fire resistance ratings of at least 2-hours.

# 6 IMPLEMENTATION STRATEGY

In order to implement the installation of complete sprinkler protection in the NWRI, WTC and Annex buildings, four implementation strategies have been reviewed based on feasibility, cost and impact to building operations. The four implementation strategies include:

1. Installation of the sprinkler system while building is occupied after hours and during silent hours;
2. Installation of the sprinkler system while building is occupied during normal hours; and
3. Phased installation of the sprinkler system while building is unoccupied.
4. Installation of the sprinkler system while building is occupied after normal hours with however service rooms during normal hours.

For the Warehouse section of the NWRI Building, the associated construction fees include for the internal assessment of the existing sprinkler piping and the replacement of all sprinklers. If the assessment determined the piping is in poor condition, the fees related to design and construction of the warehouse building will have to be revised.

## 6.1 OPTION 1: BUILDING OCCUPIED – AFTER HOURS & SILENT

The installation of the sprinkler system would be performed after normal working hours, on weekends and statutory holidays in all areas of the building. This option has the least amount of impact on building operations as work by building occupants and contractors would be performed at different times. Following each work shift by contractors, the work locations would be returned to normal operating conditions, when at all possible, to allow building occupants to resume their work in these areas. This will however result in a premium hourly cost for contractor to perform work after hours and the anticipated duration of construction would be longer due to the need to reinstate normal conditions at the end of each work shift to allow building occupants to use the areas. Alternatively to returning the areas to normal operating conditions after each work shift, small work areas could be vacated for short durations by building occupants to allow for the sprinkler system installation.

### 6.1.1 ADVANTAGES

- Least disruptive to building occupants. Some coordination for relocation of some equipment / storage / materials will be required during the construction phase.



## 100% SUBMITTAL

- Building can continue to operate without major disruptions.

### 6.1.2 DISADVANTAGES

- Hourly cost premium for contractor work after hours.
- Extended construction duration due to reinstatement of construction area to operating condition for building occupants after each shift.
- Possibility of complaints from occupants as a result of dust / debris resulting from construction.
- As construction is occurring in an occupied, operational area, the possibility of damage to building occupant equipment and operations is a possibility.

### 6.1.3 COST BREAKDOWN – CONSULTANT FEES

Description	Associated Cost
Consultant Design and construction services	\$271,500
Construction costs	\$2,575,250
<ul style="list-style-type: none"> <li>• NWRI - A&amp;L Building</li> <li>• NWRI - R&amp;D Building</li> <li>• NWRI - Hydraulics Lab</li> <li>• NWRI - Warehouse</li> <li>• NWRI - Boiler Building</li> <li>• Wastewater Technology Centre</li> <li>• Annex Building</li> </ul>	\$1,7071,850 \$391,875 \$700,550 \$195,500 \$37,500 \$141,025 \$37,400
Commissioning	\$24,875
<b>Total</b>	<b>\$2,871,625</b>

Where combustible wood slats ceilings have been installed in the NWRI - A&L Building, sprinklers will have to either be installed above the ceilings or the ceilings replaced with a non-combustible alternative to achieve compliance with the requirements of NFPA 13. Both options have been priced below and will have to be added to the construction costs for the A&L Building above based on the option selected. The ceilings priced were of a material which would maintain a similar look to those of the existing wood slat ceilings:

- Replacement of existing combustible ceiling with non-combustible ceiling: \$560,000
- Installation of sprinklers above the ceilings: \$58,500

100% SUBMITTAL

#### 6.1.4 SCHEDULE

Description	Number of Weeks
Design	16
Tender	4
Construction	96
Commissioning	3
<b>Total</b>	<b>119</b>

### 6.2 OPTION 2: BUILDING OCCUPIED – DURING NORMAL HOURS

The installation of the sprinkler system would be performed during normal working hours while the building is occupied. This option has the some impact on building operations as work by building occupants and contractors would be performed simultaneously. Areas where work is being performed by contractors will have to be vacated by building occupants for the period of time that the work is ongoing. While this option avoids a premium in hourly cost for contractor by having work performed during normal hours, a large number of “stop work” requests by building occupants could result in delays to construction. Locations which are not normally occupied, such as mechanical spaces, can be used as swing spaces for contractors to work in when such stoppages occur in order to try and maintain schedule.

#### 6.2.1 ADVANTAGES

- Relatively low disruption to building occupants. Some coordination for relocation of some equipment / storage / materials will be required during the construction phase.
- Building can continue to operate without major disruptions.
- No premium costs for after-hours work.
- Areas which are not normally occupied can be used if contractors are requested to stop work in certain locations.

#### 6.2.2 DISADVANTAGES

- A high number of work stoppages at the request of building tenants could result in extended construction duration.
- Possibility of complaints from occupants as a result of noise / dust / debris resulting from construction.
- As construction is occurring in an occupied, operational area, the possibility of damage to building occupant equipment and operations as well as injuries to occupants who may wander into a construction zones are possibilities.

100% SUBMITTAL

### 6.2.3 COST BREAKDOWN – CONSULTANT FEES

Description	Associated Cost
Consultant Design and construction services	\$271,500
Construction costs	\$2,261,865
<ul style="list-style-type: none"> <li>NWRI - A&amp;L Building</li> <li>NWRI - R&amp;D Building</li> <li>NWRI - Hydraulics Lab</li> <li>NWRI - Warehouse</li> <li>NWRI - Boiler Building</li> <li>Wastewater Technology Centre</li> <li>Annex Building</li> </ul>	\$950,785 \$348,562 \$612,630 \$171,350 \$32,955 \$121,390 \$24,193
Commissioning	\$24,875
<b>Total</b>	<b>\$2,558,240</b>

Where combustible wood slats ceilings have been installed in the NWRI - A&L Building, sprinklers will have to either be installed above the ceilings or the ceilings replaced with a non-combustible alternative to achieve compliance with the requirements of NFPA 13. Both options have been priced below and will have to be added to the construction costs for the A&L Building above based on the option selected. The ceilings priced were of a material which would maintain a similar look to those of the existing wood slat ceilings:

- Replacement of existing combustible ceiling with non-combustible ceiling: \$560,000
- Installation of sprinklers above the ceilings: \$58,500

### 6.2.4 SCHEDULE

Description	Number of Weeks
Design	16
Tender	4
Construction	72
Commissioning	3
<b>Total</b>	<b>95</b>

### **6.3 OPTION 3: BUILDING UNOCCUPIED – PHASED DURING NORMAL HOURS**

The installation of the sprinkler system would be performed during normal working hours while the building is unoccupied. This option would require planning with building occupants at the inception stages of the project to develop a phasing plan to allow for large sections of the building to be vacated while construction is occurring. This option has the greatest impact on building operations as work by building occupants will have to be interrupted or relocated for the duration of the work within the space. This option avoids a premium in hourly cost for contractor by having work performed during normal hours and allows for work to be performed in the least amount of time due to the low chances of interruptions as a result of tenant operations. This also minimizes the chances of complaints by building occupants resulting from construction in their work location as well as the chances of damage to equipment or injuries to occupants within the construction areas.

#### **6.3.1 ADVANTAGES**

- As work is being performed in unoccupied areas, the chances of work stoppages at the request of building tenants would be minimal.
- Reduced chances of complaints from occupants as a result of noise / dust / debris resulting from construction.
- The possibility of damage to building occupant equipment and operations as well as injuries to occupants who may wander into a construction zones are reduced due to work being performed in vacated areas.
- No premium costs for after-hours work.
- Shortest anticipated construction duration.

#### **6.3.2 DISADVANTAGES**

- Significantly disruptive to building occupants. Some processes and operations will have to be relocated or stopped for the duration of the construction phase.
- Opposition from building occupants can be expected where relocation is required.

100% SUBMITTAL

### 6.3.3 COST BREAKDOWN – CONSULTANT FEES

Description	Associated Cost
Consultant Design and construction services	\$271,500
Construction costs	\$2,131,500
<ul style="list-style-type: none"> <li>NWRI - A&amp;L Building</li> <li>NWRI - R&amp;D Building</li> <li>NWRI - Hydraulics Lab</li> <li>NWRI - Warehouse</li> <li>NWRI - Boiler Building</li> <li>Wastewater Technology Centre</li> <li>Annex Building</li> </ul>	\$898,900 \$330,000 \$574,950 \$161,000 \$31,200 \$112,975 \$22,475
Commissioning	\$24,875
<b>Total</b>	<b>\$2,427,875</b>

Where combustible wood slats ceilings have been installed in the NWRI - A&L Building, sprinklers will have to either be installed above the ceilings or the ceilings replaced with a non-combustible alternative to achieve compliance with the requirements of NFPA 13. Both options have been priced below and will have to be added to the construction costs for the A&L Building above based on the option selected. The ceilings priced were of a material which would maintain a similar look to those of the existing wood slat ceilings:

- Replacement of existing combustible ceiling with non-combustible ceiling: \$560,000
- Installation of sprinklers above the ceilings: \$58,500

### 6.3.4 SCHEDULE

Description	Number of Weeks
Design	16
Tender	4
Construction	65
Commissioning	3
<b>Total</b>	<b>88</b>

## **6.4 OPTION 4: BUILDING OCCUPIED – AFTER NORMAL HOURS WITH SERVICE ROOMS DURING NORMAL HOURS**

The installation of the sprinkler system would be performed during normal working hours in unoccupied spaces of the building such as service and mechanical rooms while the remainder of the installation would be performed afterhours while the building is vacant. This option has the some impact on building operations as work by building occupants and contractors would be performed simultaneously. Even when work is performed in unoccupied areas, the work being performed by contractors will generate a level of noise which could result in a number of “stop work” requests by building occupants. Pre-planning with building occupants at the inception stages of the project could help prevent these delays. This option minimizes chances of injuries to occupants within the construction areas.

### **6.4.1 ADVANTAGES**

- Relatively low disruption to building occupants. Some coordination for relocation of some equipment / storage / materials will be required during the construction phase.
- Building can continue to operate without major disruptions.
- As work is being performed in unoccupied areas during the day and occupied areas after hours, the possibility of injuries to building occupant and to occupant operations are reduced.

### **6.4.2 DISADVANTAGES**

- Cost premium for contractor due to irregular work schedule.
- Extended construction duration due to reinstatement of construction area to operating condition for building occupants after each shift.
- Possibility of complaints from occupants as a result of dust / debris resulting from construction.
- Possibility of complaints from occupants resulting from noise generated during construction in unoccupied area during normal working hours.
- Although performed after hours, as construction is occurring in an occupied, operational area, the possibility of damage to building occupant equipment and operations is a possibility.

100% SUBMITTAL

### 6.4.3 COST BREAKDOWN – CONSULTANT FEES

Description	Associated Cost
Consultant Design and construction services	\$271,500
Construction costs	\$2,500,150
<ul style="list-style-type: none"> <li>NWRI - A&amp;L Building</li> <li>NWRI - R&amp;D Building</li> <li>NWRI - Hydraulics Lab</li> <li>NWRI - Warehouse</li> <li>NWRI - Boiler Building</li> <li>Wastewater Technology Centre</li> <li>Annex Building</li> </ul>	\$1,039,975 \$379,500 \$689,150 \$192,200 \$31,200 \$140,275 \$27,850
Commissioning	\$24,875
<b>Total</b>	<b>\$2,796,525</b>

Where combustible wood slats ceilings have been installed in the NWRI - A&L Building, sprinklers will have to either be installed above the ceilings or the ceilings replaced with a non-combustible alternative to achieve compliance with the requirements of NFPA 13. Both options have been priced below and will have to be added to the construction costs for the A&L Building above based on the option selected. The ceilings priced were of a material which would maintain a similar look to those of the existing wood slat ceilings:

- Replacement of existing combustible ceiling with non-combustible ceiling: \$560,000
- Installation of sprinklers above the ceilings: \$58,500

### 6.4.4 SCHEDULE

Description	Number of Weeks
Design	16
Tender	4
Construction	80
Commissioning	3
<b>Total</b>	<b>103</b>

## 7 RECOMMENDATION

It is always preferable to perform construction work in areas which are not occupied, both for the safety of building occupants and to allow for the construction to proceed with the least amount of disruptions as possible. As such, we would recommend proceeding with the work using the implementation strategy detailed under Option 3 and performing the work with a detailed phasing plan to allow work to be completed in unoccupied areas. It is understood however that vacating a building, or parts thereof, currently in use is not always feasible. Therefore, if it is not possible to implement the work as detailed in Option 3, we would recommend that the implementation strategy under Options 1 or 4 be used to perform the work after normal working hours, on weekends and statutory holidays.

## 8 SIGNATURES

We trust that the report is straightforward and meets your current requirements. Please contact us if you have any questions.



Yours truly,  
Daniel Viens, CET

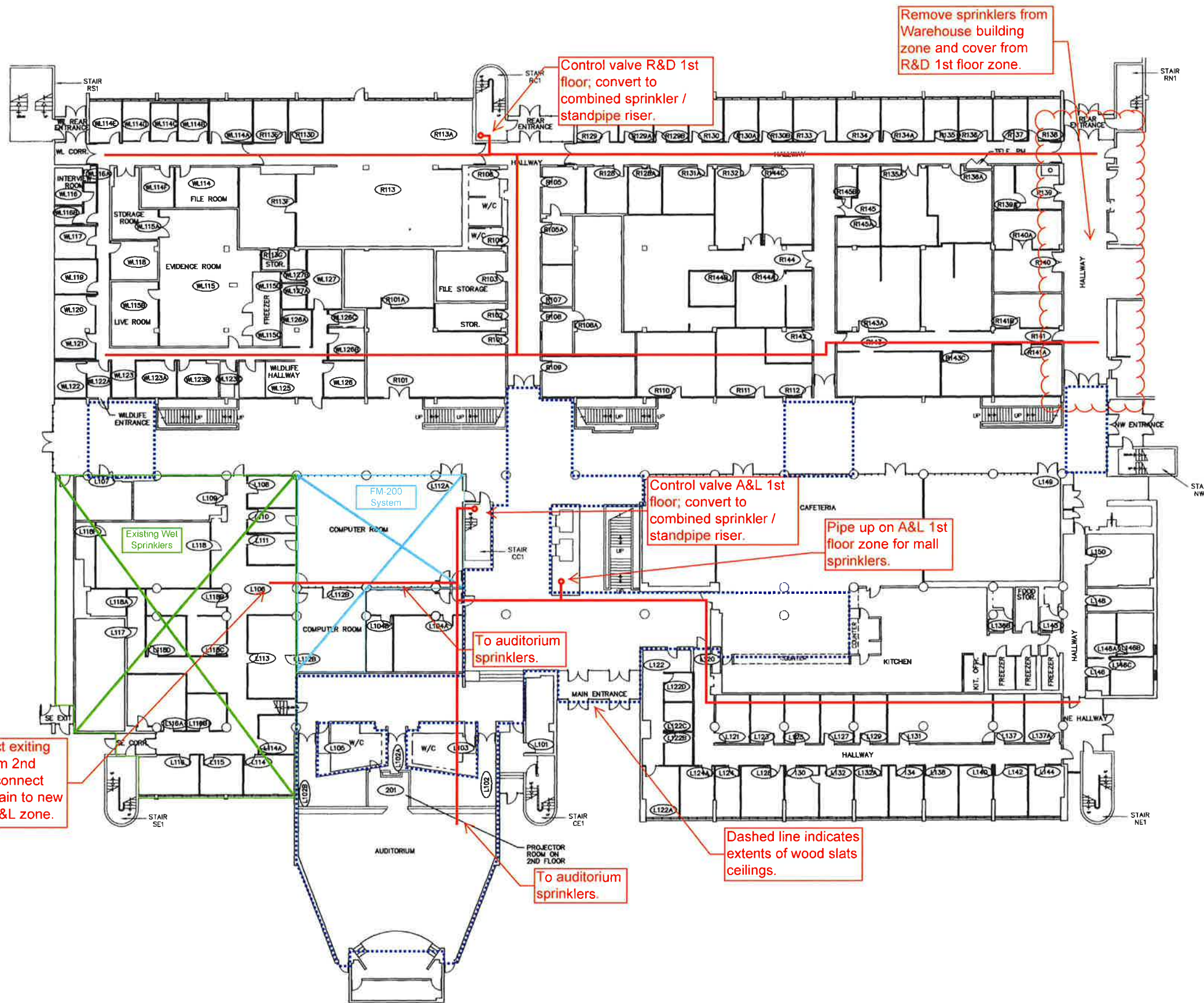
**WSP Canada Inc.**



# Appendix A

**PROPOSED MAIN LOCATIONS**



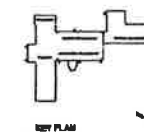


# General Notes

\* Pt Engineering originated these drawings during Phase 1 of MCRP's Fire System Upgrade Dated March 20, 2002.

CCIW-00013

b1	1G_AL_06	01/26/06
INIT.	Revision/Issue	Date



## Project Name and Address

CCIW 1st floor  
867 Lakeshore Road  
Burlington, ON L7R 4A6

## Project

CCIW Floor Plans

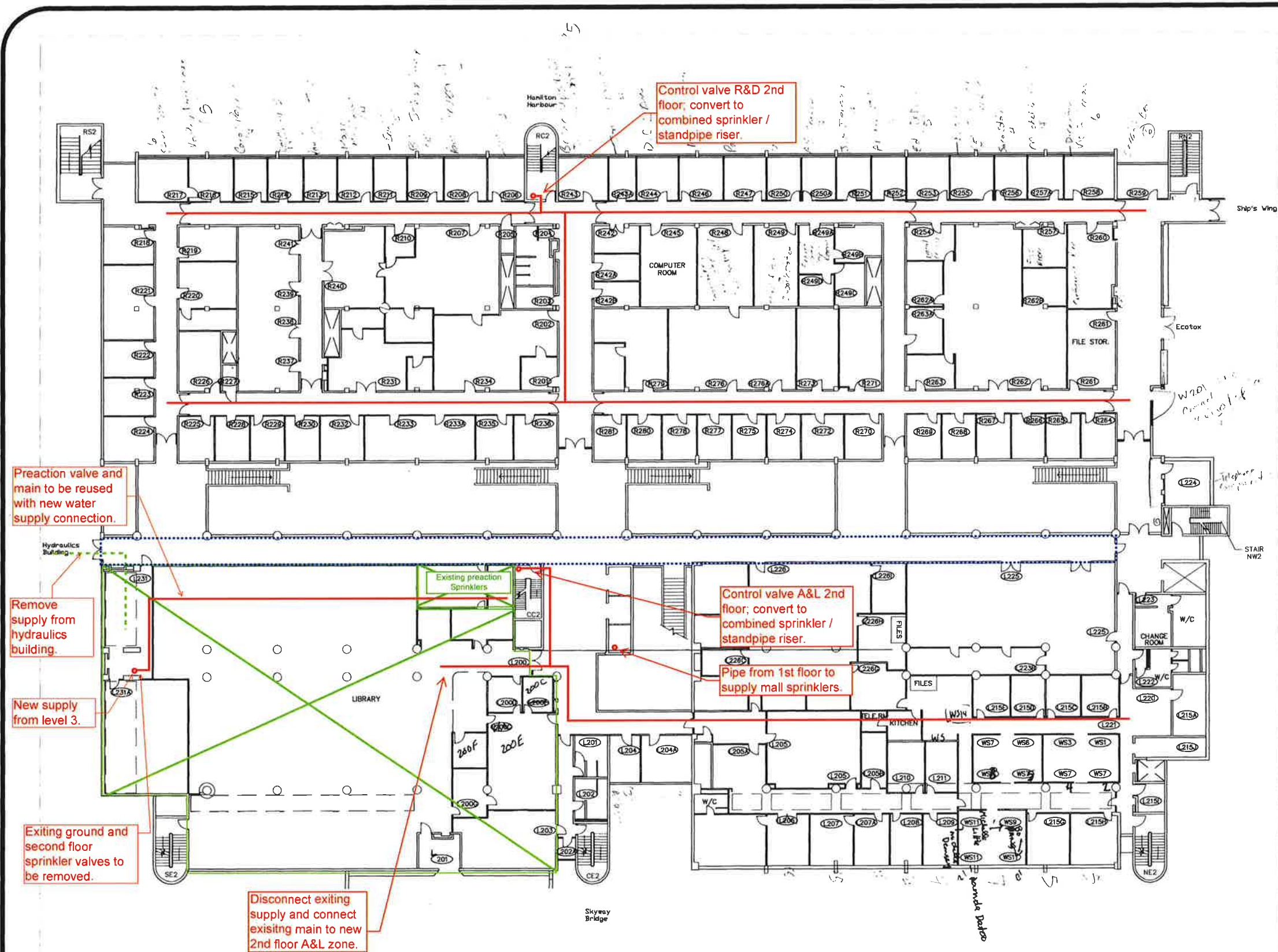
03/20/02

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## Sheet



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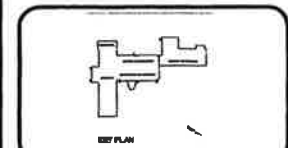


General Notes

\* Pt Engineering originated these drawings during Phase 1 of MCRP's Fire System Upgrade Dated March 20, 2002.

CCIW-00014

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Revision/Issue		Date

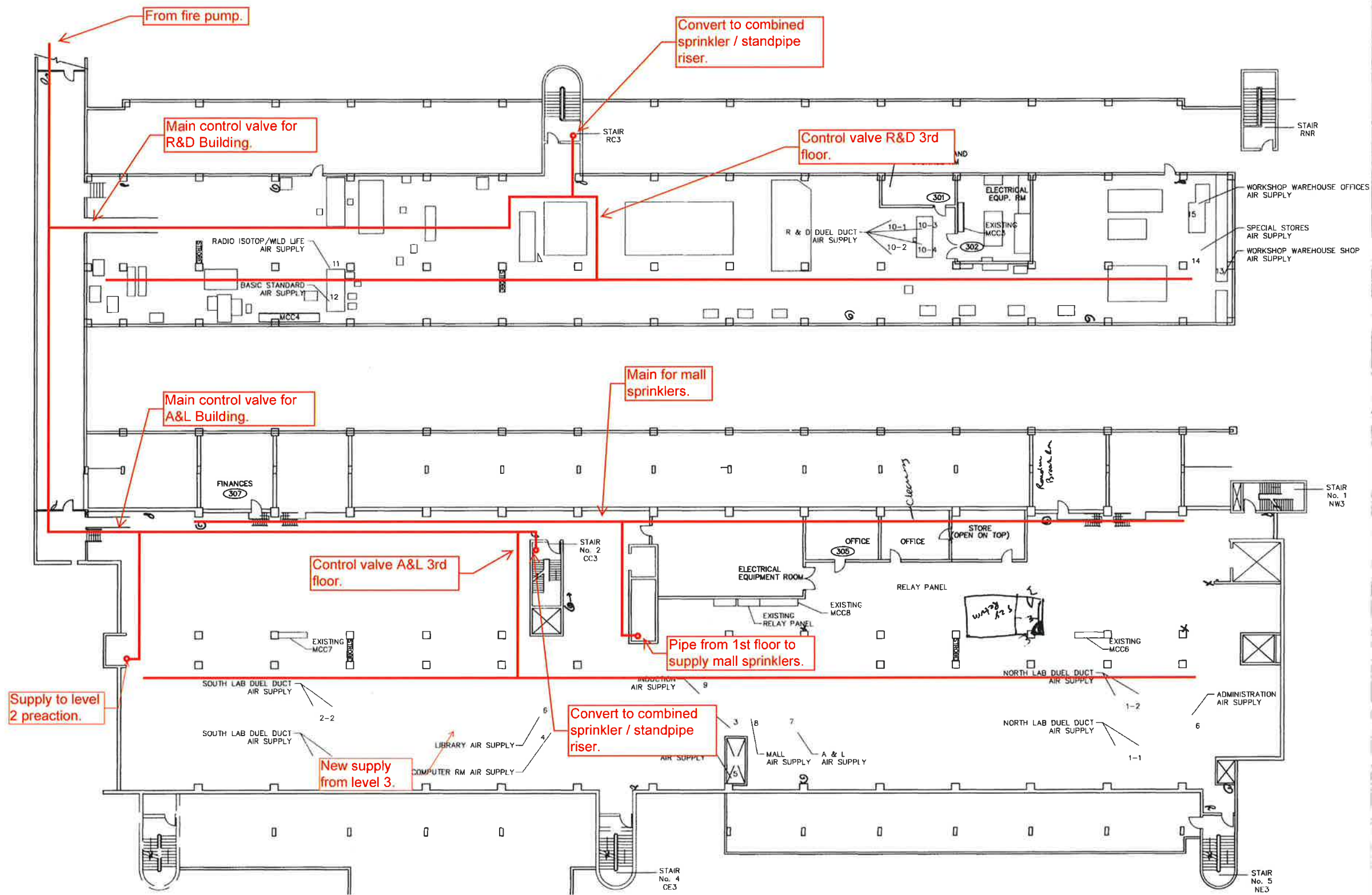


Project Name and Address  
CCIW 2nd floor  
867 Lakeshore Road  
Burlington, ON L7R 4A6

Project	CCIW Floor Plans	Sheet
Date	03/20/02	
Scale	NTS	

Brandon Elliott (AEC)



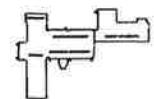


# General Notes

\* Pt Engineering originated these drawings during Phase 1 of MCRP's Fire System Upgrade Dated March 20, 2002.

CCIW-00015

1G_AL_06	01/26/06
INIT.	Revision/Issue
	Date



1st FLOOR

## Project Name and Address

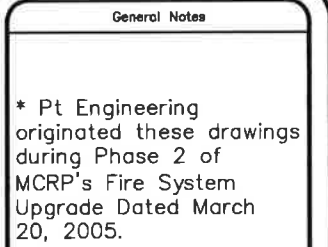
CCIW 3rd floor  
867 Lakeshore Road  
Burlington, ON L7R 4A6

## Project

CCIW Floor Plans

Date 03/20/02

Scale NTS

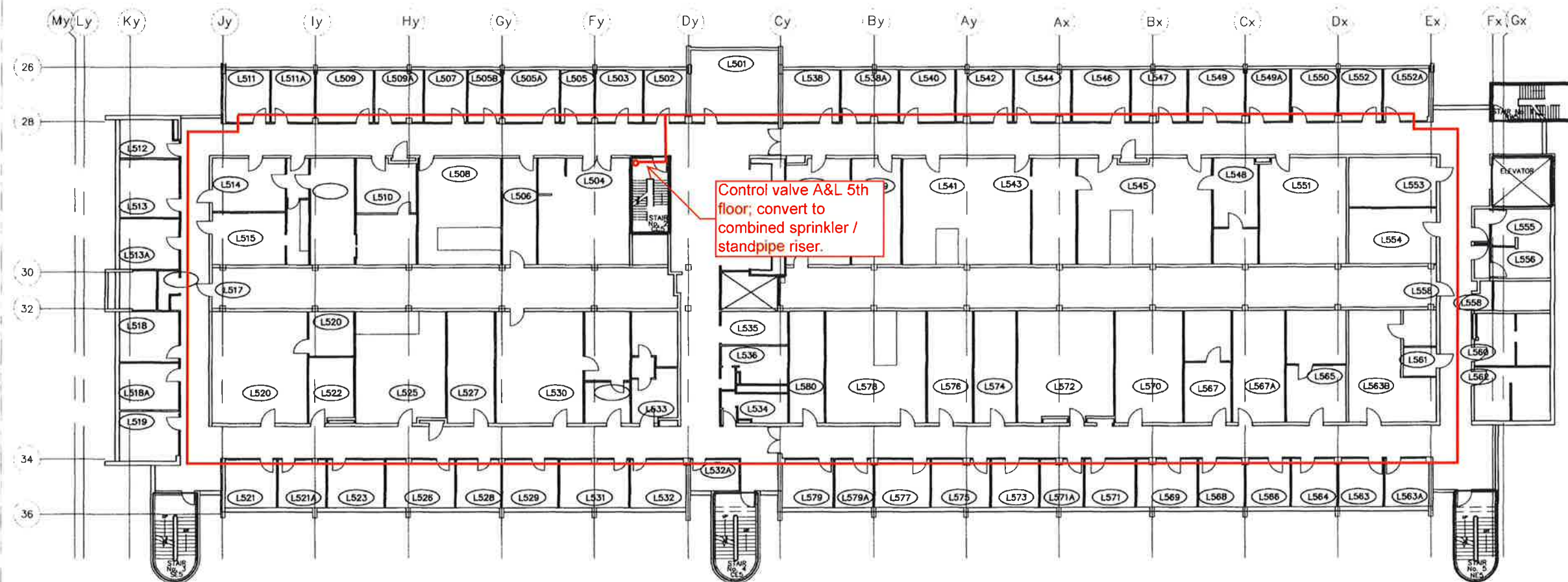


b	4G_AL_06	01/28/06
INIT.	Revision/Issue	Date



Project CCNY Floor Plans	Sheet
Date 03/20/02	
Scale 1:250	





General Notes

\* Pt Engineering originated these drawings during Phase 1 of MCRP's Fire System Upgrade Dated March 20, 2002.

CCIW-00017

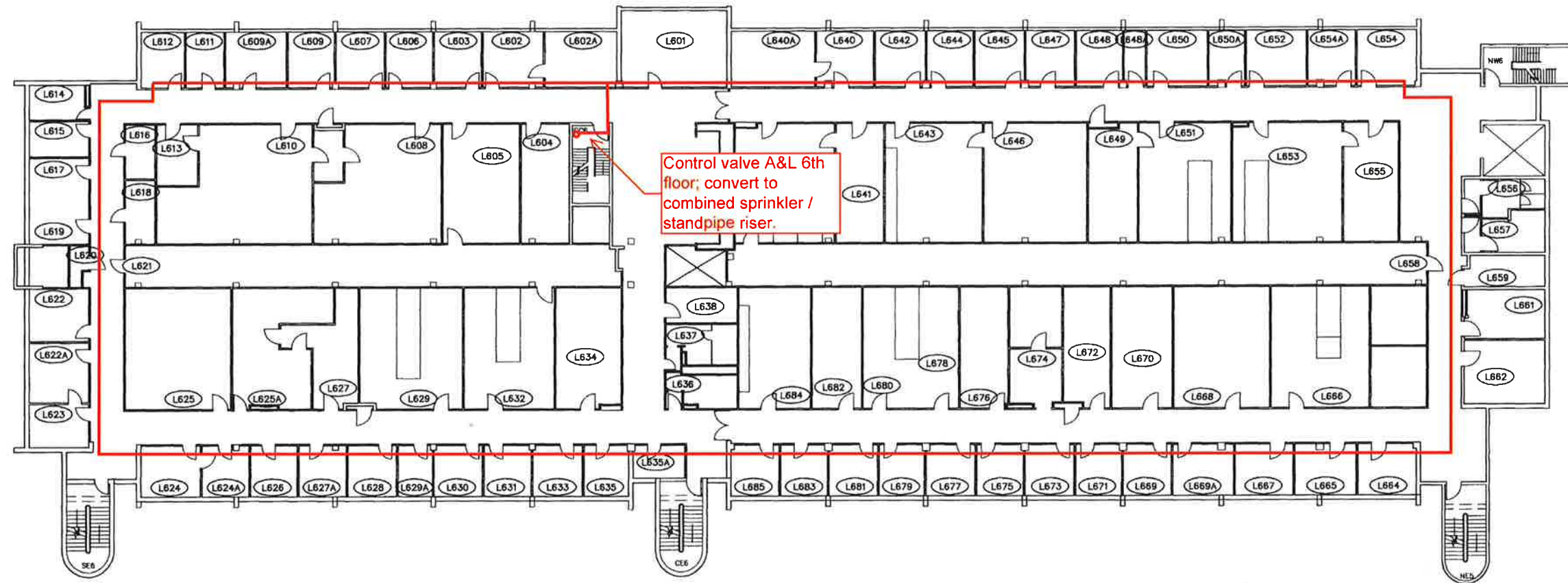
b1	5G_AL_06	01/26/06
INIT.	Revision/Issue	Date



KEY PLAN

Project Name and Address  
CCIW 5th floor  
867 Lakeshore Road  
Burlington, ON L7R 4A6

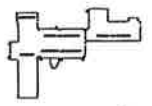
Project	CCIW Floor Plans	Sheet
Date	03/20/02	
Scale	1:250	



General Notes

CCIW-00018

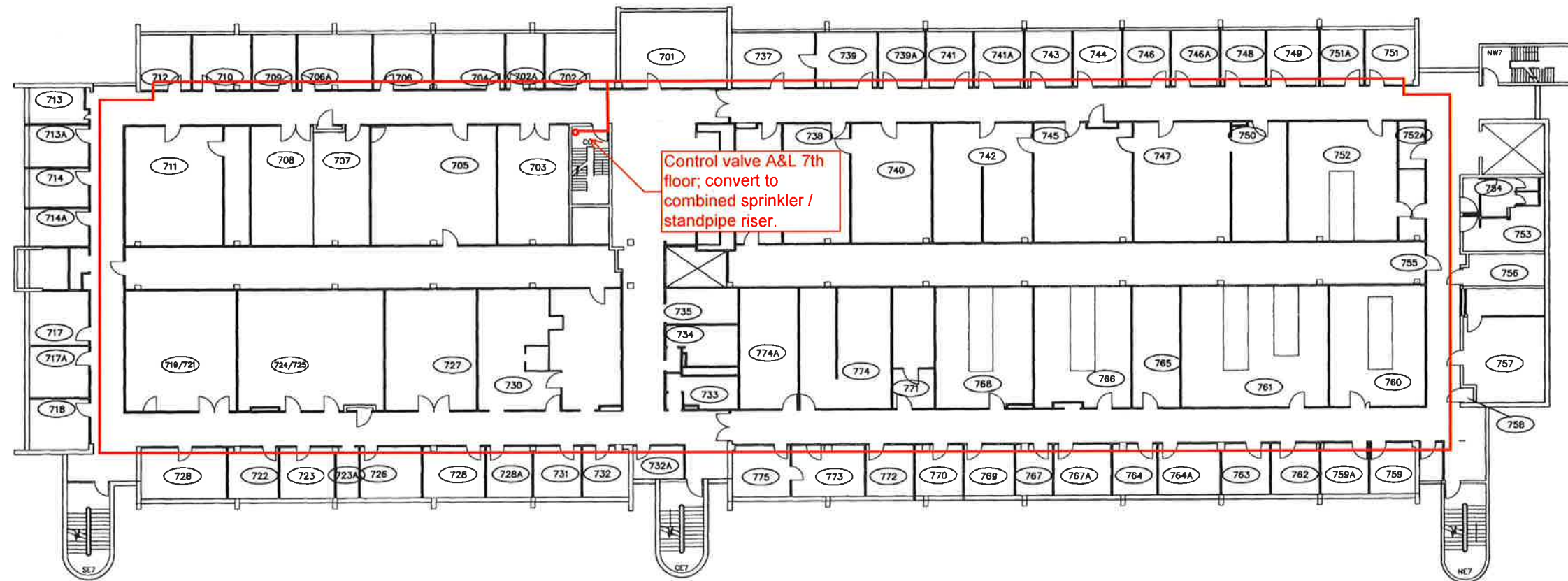
b	6G_AL_06	01/25/06
INIT.	Revision/Issue	Date



Project Name and Address  
CCIW 6th Floor  
867 Lakeshore Road  
Burlington, ON L7R 4A6

Project	CCIW Floor Plans	Sheet
Date	03/20/02	
Scale	1:250	



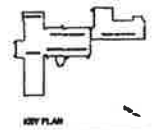


General Notes

\* Pt Engineering originated these drawings during Phase 1 of MCRP's Fire System Upgrade Dated March 20, 2002.

CCIW-00019

bl	7G_AL_06	01/25/06
INIT.	Revision/Issue	Date



Project Name and Address

CCIW 7th floor  
867 Lakeshore Road  
Burlington, ON L7R 4A6

Project

CCIW Floor Plans

Date

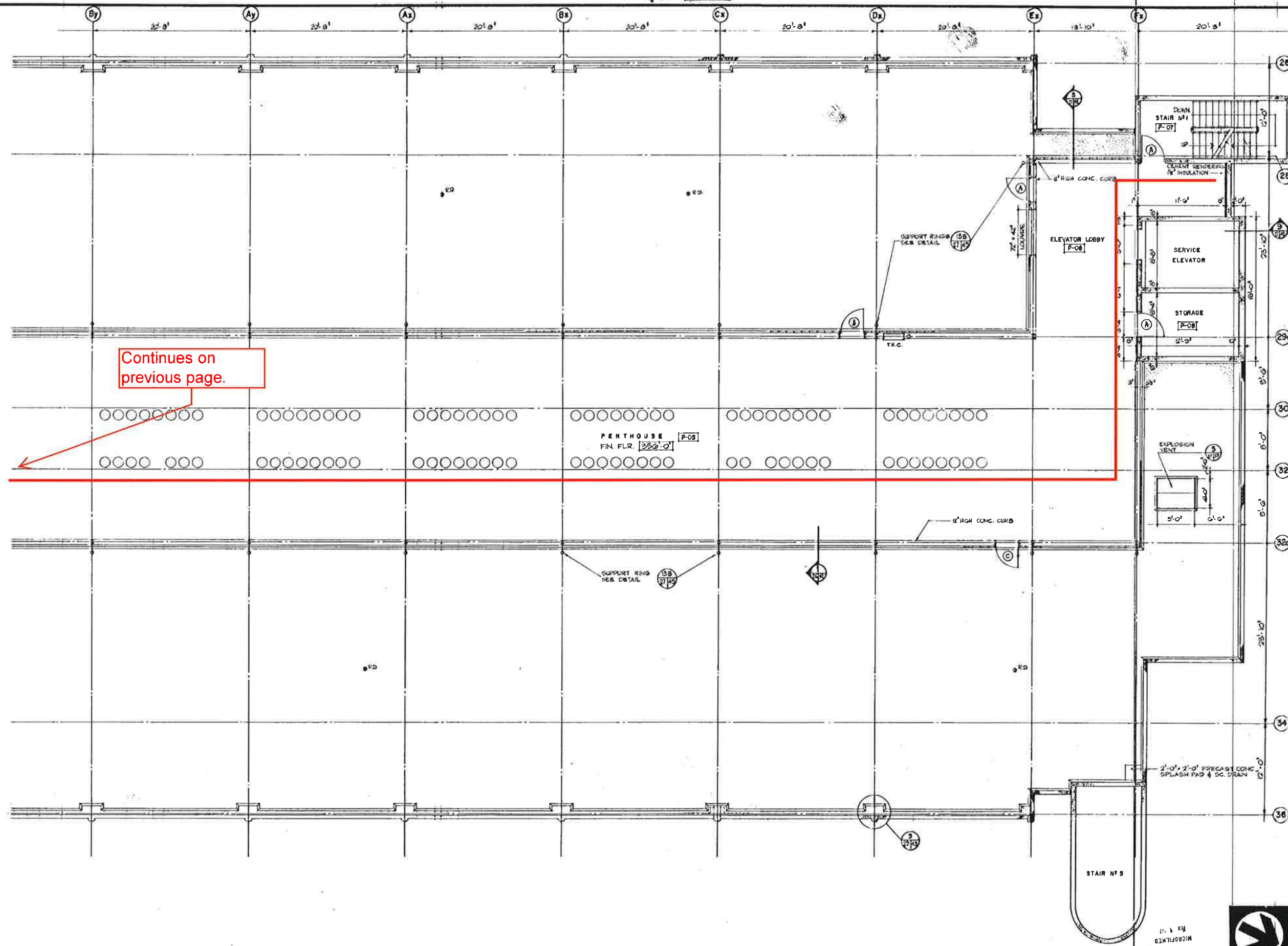
03/20/02

Scale

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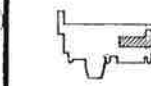
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previous page.

Department of Public Works  
Ministère des Travaux publics  
Ontario Region  
Région d'Ontario  
RSID, CROWTHER and Partners Limited  
Engineers  
Toronto, Ontario  
WALL AND YAMAMOTO Architects  
Burlington Ontario



A. detail no. 1/6  
B. location  
C. design no.  
date 10/1/99

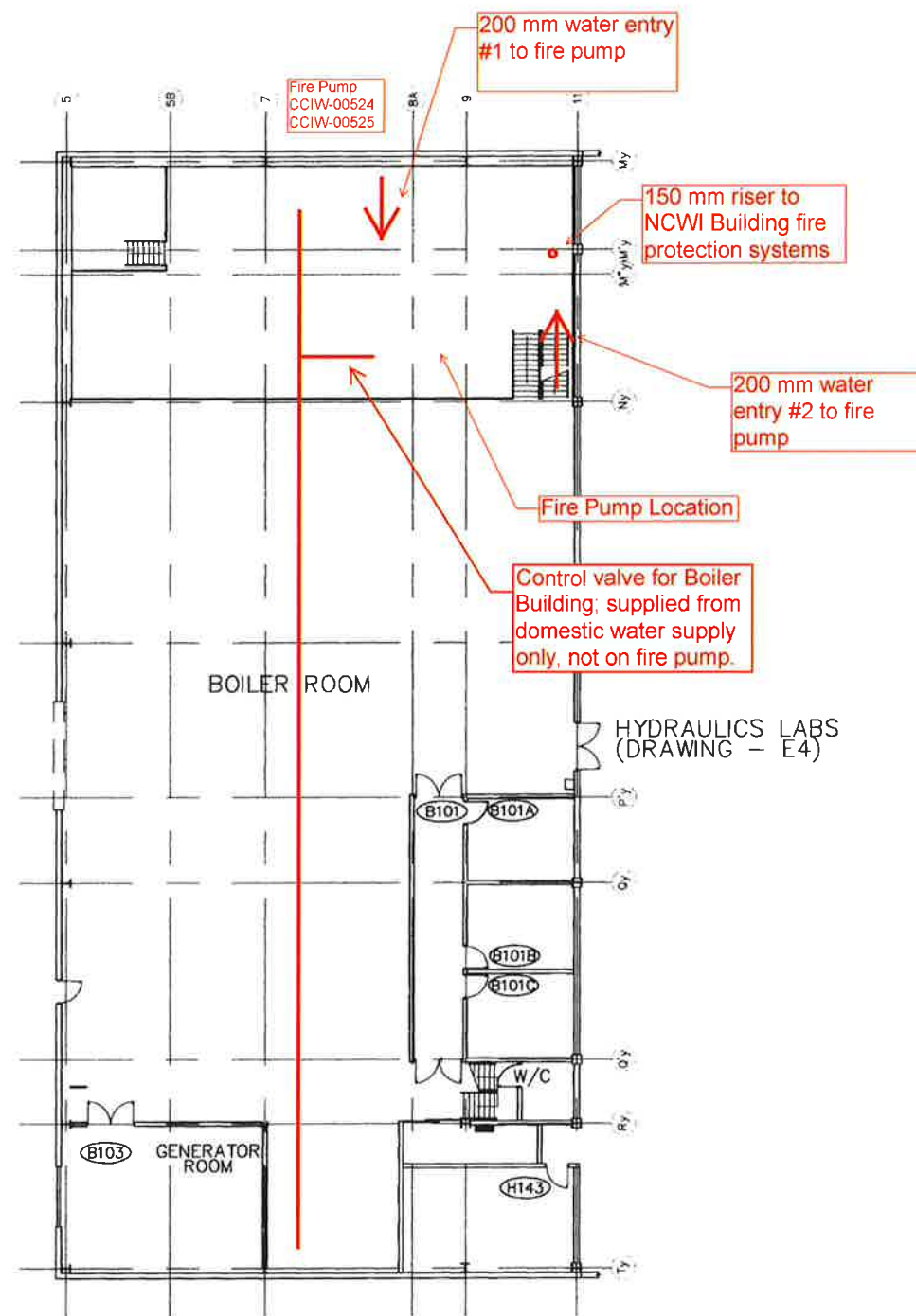
**AS-BUILT  
DRAWING**  
THIS DRAWING HAS BEEN  
REVISED TO SHOW THIS  
BUILDING AS-BUILT.



Key Plan  
BURLINGTON ONTARIO  
CANADA CENTRE  
FOR INLAND WATERS  
ADMINISTRATION AND  
LABORATORY BUILDING  
PENTHOUSE PLAN  
PART 'B'  
SCALE - 1/4" = 1'-0"  
PLS. OCT. 1999  
B.S.J. OCT. 1999  
W.B.T. OCT. 1999  
job number 88174  
d.w. no. A270134



CCIW-01922 **A**

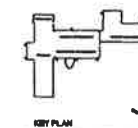


General Notes

\* Pt Engineering originated these drawings during MCRP's Fire System Upgrade Dated December, 2004.

CCIW-00020

bl	1G_BR_06	01/26/06
INIT.	Revision/Issue	Date



Project Name and Address

CCIW 1st floor boiler room  
867 Lakeshore Road  
Burlington, ON L7R 4A6

Project

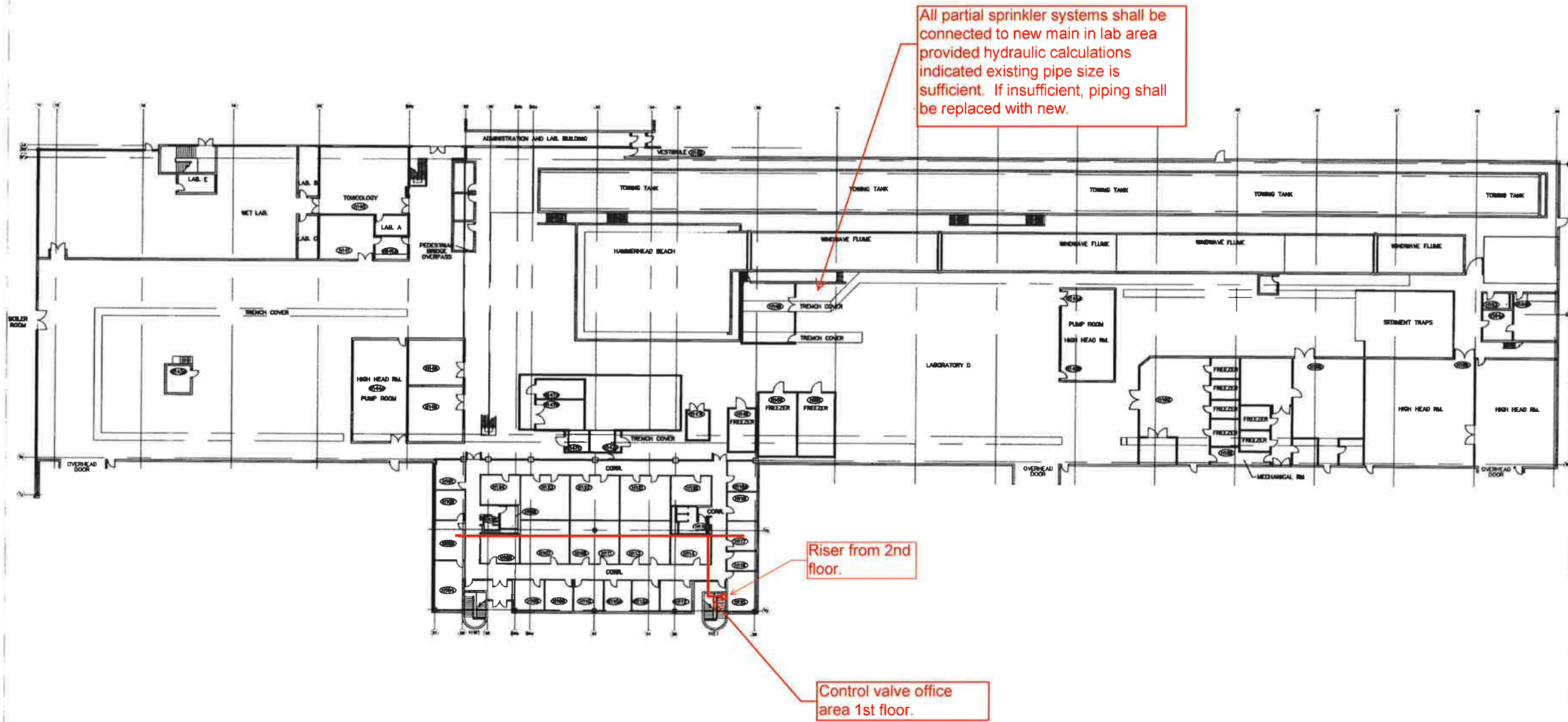
CCIW Floor Plans

Date

03/20/02

Scale

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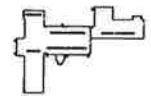


General Notes

\* Pt Engineering originated these drawings during Phase 2 of MCRP's Fire System Upgrade Dated March 20, 2002.

CCIW-00024

b1	1G_HY_06	01/25/06
INIT.	Revision/Issue	Date



KEY PLAN

Project Name and Address

CCIW 1st floor  
867 Lakeshore Road  
Burlington, ON L7R 4A6

Project

CCIW Floor Plans

Date

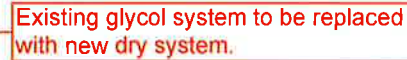
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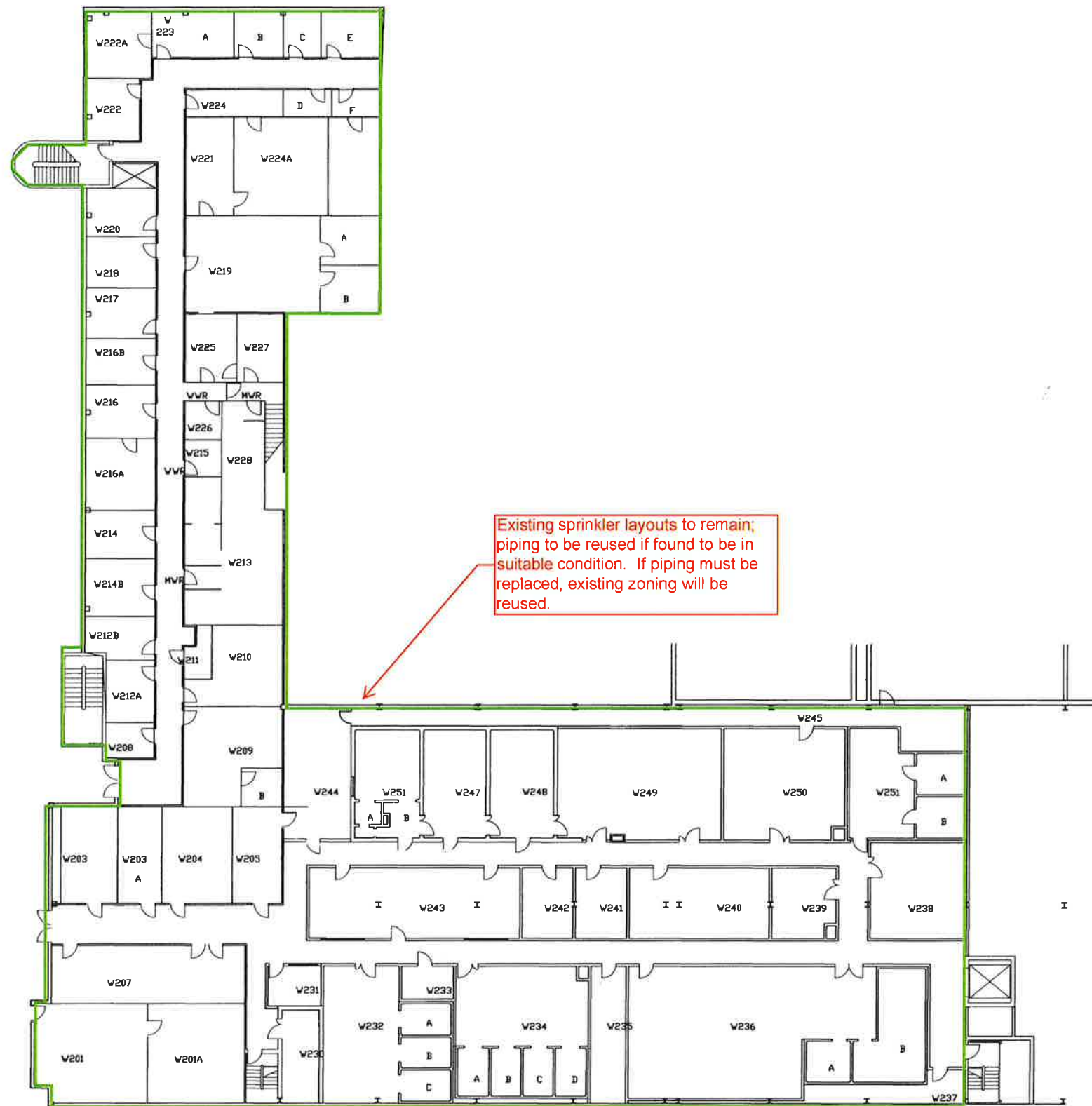
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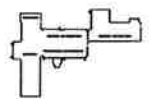
Scale 1:275



General Notes

CCIW-00023

bl	2G WH 06	01/25/05
INIT.	Revision/Issue	Date



KEY PLAN

Project Name and Address

CCIW 2nd floor  
867 Lakeshore Road  
Burlington, ON L7R 4A6

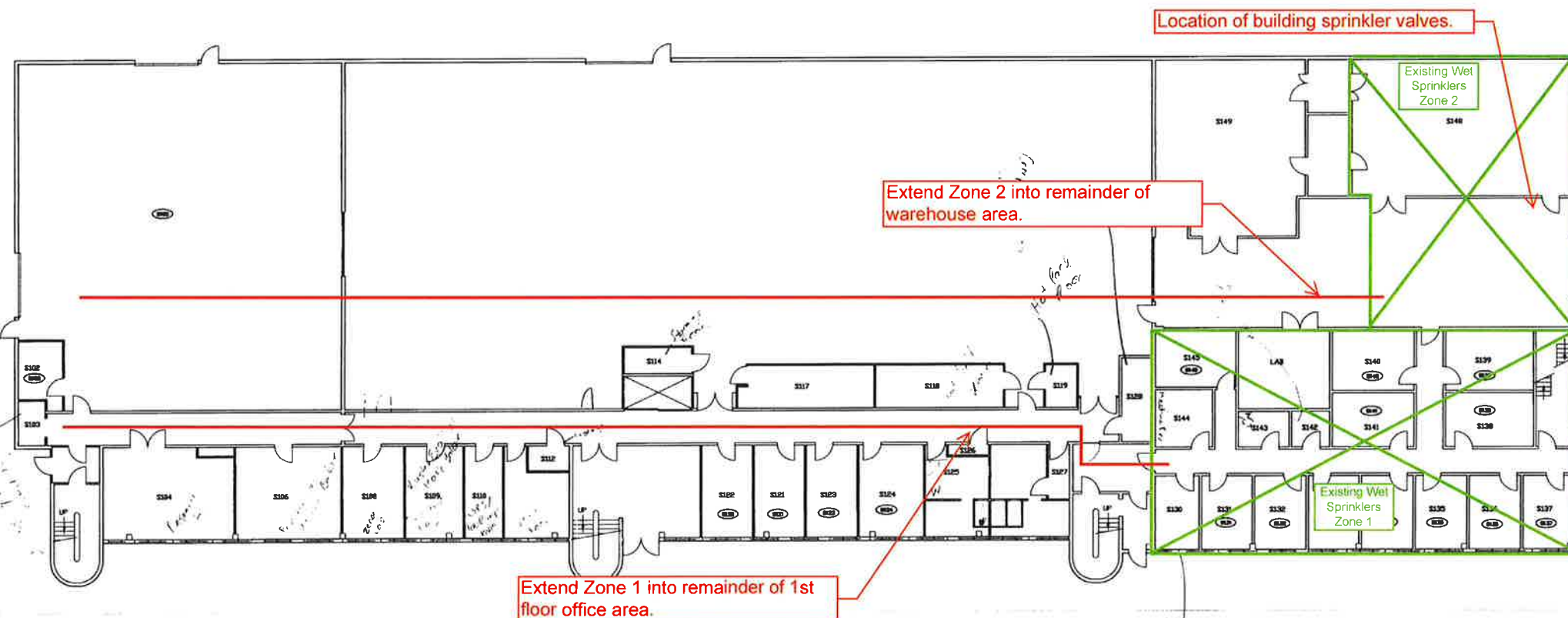
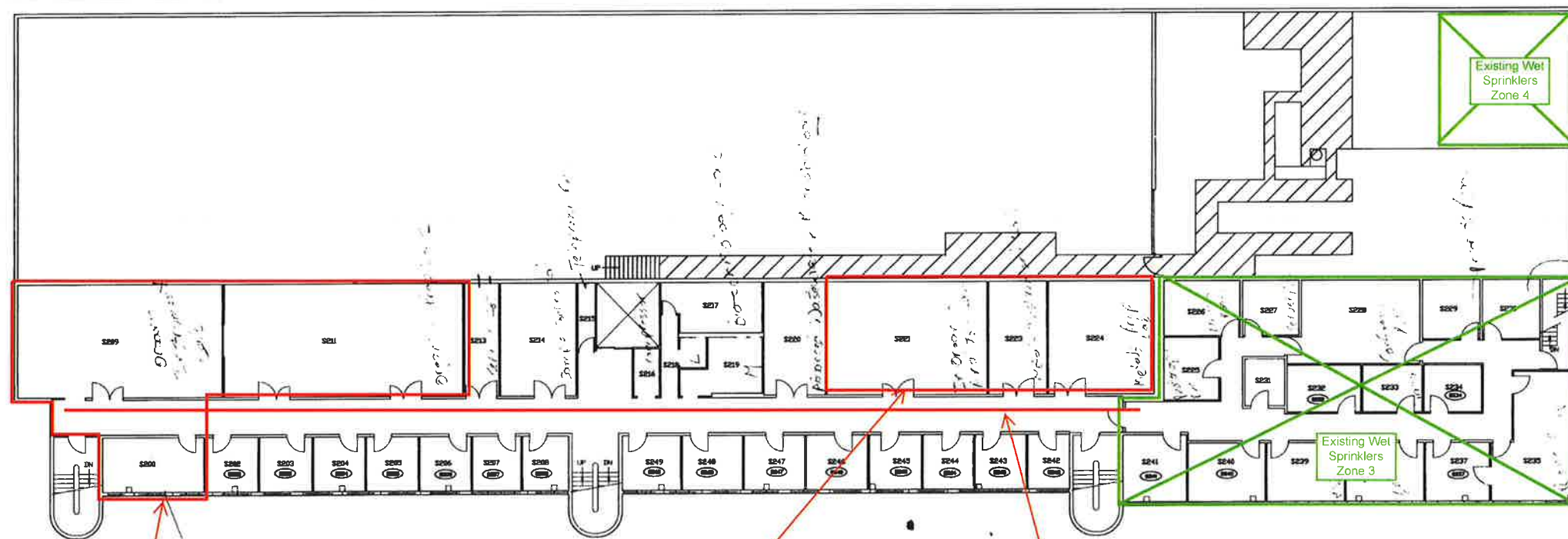
Project

CCIW Floor Plans

Date  
03/20/02

Scale  
1:250



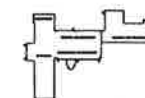


General Notes

\* Rondar originated these drawings Dated February, 2006.

CCIW-00012

b1	12G_WT_06	01/26/06
INIT.	Revision/Issue	Date



KEY PLAN

Project Name and Address

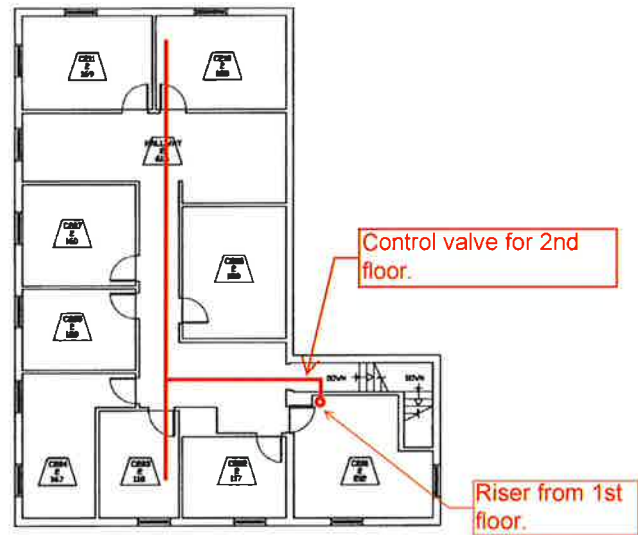
CCIW 1st and 2nd floors  
867 Lakeshore Road  
Burlington, ON L7R 4A6

Project

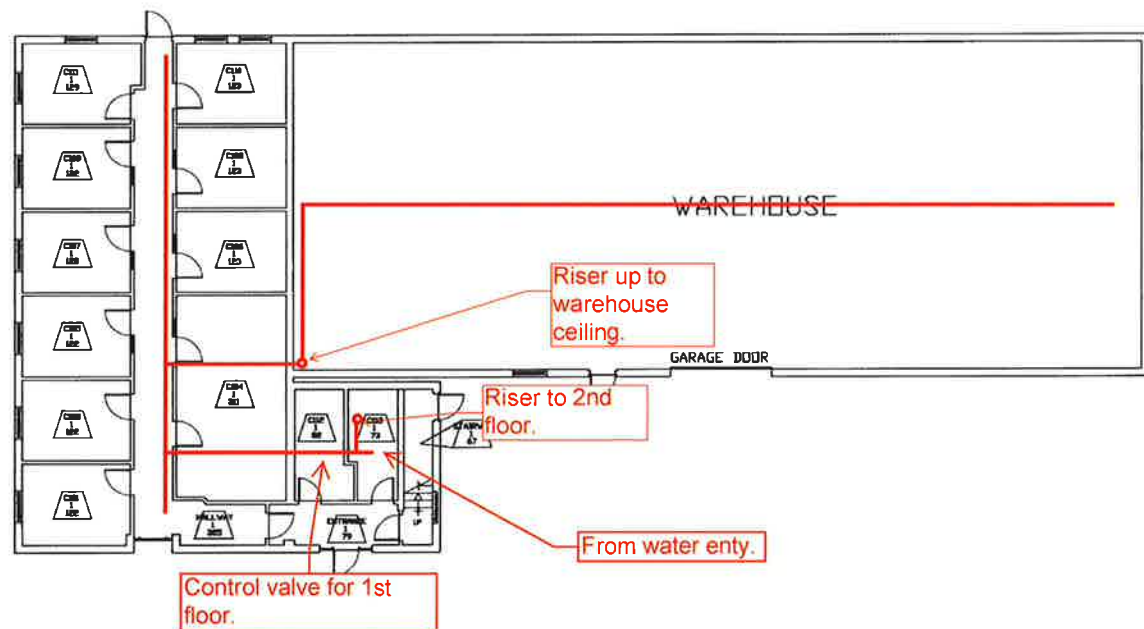
CCIW Floor Plans

Date 03/20/02

Scale NTS



SECOND FLOOR ROOM LAYOUT

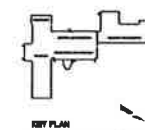


FIRST FLOOR ROOM LAYOUT

General Notes

CCIW-00021

bl	12G_AX_06	01/26/06
INIT.	Revision/Issue	Date



Project Name and Address

CCIW 1st and 2nd floors  
867 Lakeshore Road  
Burlington, ON L7R 4A6

Project

CCIW Floor Plans

Date

03/20/02

Scale

1:200