

# **Wireless “Full Roaming” Site Survey & Network Design Report**

**For**

**Bloom High School**

Chicago Heights, IL

*06/20/06*

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## **SITE SURVEY PROCESS**

### **Requirements**

Bloom High School requested a site survey for an indoor full roaming wireless network throughout the Bloom High School in Chicago Heights. The site survey took place on 06/01/2006 through 06/02/2006. John Wisnewski, who helped answer questions and provided a means of access to secure locations, was the main contact at Bloom High School during the site survey process.

Currently there are a few SOHO (Small Office Home Office) access points (AP's) providing limited wireless network connectivity within the High School. The existing AP's will be replaced with the AP's recommended from the site survey performed throughout the High School. The future indoor full roaming network will accommodate internet access in the areas specified by John Wisnewski. Bloom High School requested the use of Cisco 802.11 b/g AP's along with antenna recommendations from Wireless Information Networks (WIN).

### **Testing Procedures**

The Wireless Information Networks (WIN) site survey team, consisting of Dimitrios Rigas and Ken Pastore, began the site survey on 06/01/2006 at 9:00 AM. A pre-site survey meeting with John Wisnewski took place to answer any questions and prepare all parties for the ensuing site survey. A visual inspection of the school was conducted to establish potential obstructions, antenna mounting locations and to record all other pertinent information. After the initial inspection, the remaining time spent on site was used to perform extensive RF coverage testing of all desired coverage areas. This testing is meant to find the exact location of each wireless AP and corresponding antenna architecture recommended in this report. These tests are parts of WIN's 'on-site design' where the site survey team meticulously places and tests every location specified as a desired coverage area. The results from our tests are detailed in this report, primarily through our floor plan demarcation and recommended equipment list.

Upon completing the site survey, a post-site survey meeting with John Wisnewski was conducted to answer any remaining questions and to recap all findings. After the meeting was over, the WIN site survey team left the premises to begin organizing all data from the site survey. All data collected was used to determine the viability of a wireless full roaming network throughout the High School, which was then arranged into this comprehensive Site Survey Report for Bloom High School.

## Site Survey Test Equipment

Access Point Model	Cisco Aironet 1200 [802.11 B/G]
Access Point Transmit Power	100 mW
Antenna Model 1	2.2 dBi Omni-directional dipole
Antenna Model 2	90° 14 dBi 2.4-2.5GHz sector panel antenna
Client Testing Device	Compaq Ipaq/IBM Thinkpad
Client WLAN Card	Avaya Silver Card/Cisco PCI WLAN adapter
Client Card Tx Power	30 mW

## Documentation Overview

The remaining sections in this document details the information gathered from the site survey report. The next section of the report details the assumptions made based on years of wireless network experience and from the information gathered from the site survey.

Detailed findings of the High School will follow, which provides the following information: visual description of the floor, floor plans with equipment mounting locations.

A site survey summary and equipment list concludes the documentation for the site survey performed at Bloom High School.

## Site Survey Considerations and Assumptions

The following considerations and assumptions have been made throughout the site survey process and in the creation of this deliverable to provide wireless full-roaming coverage based on the data collected from the site survey. If any of the following information is not valid, or if questions arise, please contact your WIN representative.

1. The overall wireless indoor full roaming network is designed to aggregate bandwidth for seamless roaming to all mobile users in the desired coverage areas.
2. Electrical power is not required at each AP location; power to the AP's will be provisioned by single or multiple-port PoE (Power over Ethernet) injectors.
3. Since all AP's will utilize PoE, only one Cat 5e/Cat 6 data cable run will be required at each AP location. The data cable is to be terminated to a male RJ-45 connector in a straight through configuration, to accommodate proper AP/antenna placement.
4. The single run of Cat 5e/Cat 6 cabling is to be terminated at the location specified on the floor plan designs found in this report. A 10' service loop is requested to ensure that enough slack is present to match up the exact mounting location specified in this report and to accommodate for any future obstructions that may present themselves requiring the AP/antenna to move slightly.
5. All Cat 5e cabling will be the responsibility of Bloom High School. Cabling costs are not included in this report.
6. The procurement of all PoE (Power over Ethernet) equipment needed for installation will be the responsibility of Bloom High School. PoE equipment costs are not included in this report.
7. An MDF/IDF must be located within 300' of all equipment requiring Cat-5/cCat 6 cable, due to cable length restrictions specified by the ANSI/TIA/EIA-568-A standard, which states that "horizontal wiring" from a wiring closet to the device should be 90 meters or less, plus another 3 meters for a patch cord.
8. For classrooms where drop ceiling is available, APs will be placed above drop ceiling to conceal and protect the unit and associated wiring.
9. For classrooms where drop ceiling is not available, APs will be placed as high as possible to ceiling allowing enough area to have movement for the antennas attached above AP unit.
10. For all areas other than classrooms without drop ceiling please refer to the detailed mounting instruction in the findings sections of this report.
11. All AP's will utilize 100 mW of power to stay consistent with the propagation testing, unless otherwise stated.

## BLOOM HIGH SCHOOL FINDINGS

**Visual Inspection:** The school is considered a "Historic Site", built in the 1930's. This building is a public High School consisting of 5 stories of classrooms, offices and common areas. The campus also includes a cafeteria, library, indoor track & field complex, auditorium, and outdoor athletic field. The exterior of the building is brick and the interior is predominantly block construction. Many of the interior walls have metal lockers lining them. The RF obstructive nature of metal lockers was factored into all testing and recommendations in this report. A majority of the ceilings in the building are 2x4 drop ceilings, which will help to conceal the locations of the Access Points and data cabling. The soffit was not used in most instances for placement of the APs. In the event that a drop ceiling is not present, special considerations were taken.

Throughout most of the building, RF propagation flowed freely and signal strength was acceptable to above average; however there were a few zones within the building which prohibited the flow of RF signal. Therefore it was determined during the site survey that 50 access points, 98 2.2 dbi omni-directional dipole antenna, and 2 60° 17 dbi sector panel antenna will be required to provide a seamless full roaming wireless network within the facility in designated areas requested by the client. Please notice how the densities of the AP's are greater in some areas as opposed to others. This is a result of specific physical obstructions discovered throughout the site survey, which were noted and planned for during the on-site design and testing.

**Floor Plan Designs:** Diagrams of each floor of Bloom High School (Ground Floor through Fourth Floor) are provided to present an overview of the full roaming network providing AP locations for the entire building.

*Ground Floor:* The ground floor consisted of the Cafeteria, the Indoor Track and Field area (Field House) and the Outdoor Athletic Field as well as a small cluster of classrooms. With regards to the Field House and Cafeteria there was no drop ceiling available for the mounting of APs. Coverage for the outdoor area will be provided by the 2 sector panel antennas. The first two diagrams illustrate the AP/antennas required to provide full roaming wireless access in all desired coverage areas for the Ground Floor. The sections are broken down as follows:

- Section 1: the Cafeteria section
- Section 2: the Field House section

A total of 5 AP's were used in conjunction with 8 2.2 dbi omni-directional dipole antennas and 2 90° 14 dbi 2.4-2.5GHz sector panel antenna for the planned outdoor coverage(blue arrow). In addition, a splitter will be required for the AP affecting the outdoor area.

*Note: The placement of the AP for the cafeteria will be above drop ceiling directly centered according to the floor plan diagram provided by John Wisnewski. The placement of the APs for the Field House will be 15' above the ground level. It is also recommended that the APs be placed in a cage for protection from the elements and security purposes. The AP for the Outdoor Athletic Field will be mounted within the storage facility (we were unable to enter the storage facility at the time of the site survey) and holes will be drilled to accommodate the external antennas.*

*First Floor:* We have broken down the first floor into 3 separate diagrams for simple analysis of the layout. The first floor consisted of the Main Office, Gymnasium, AD offices, Auditorium, Small Theatre, and Chorus Rooms. Parsed among these larger rooms are the classrooms. Special consideration was taken for the placement of the AP in the Auditorium per the request of John Wisnewski. The three diagrams illustrate the AP/antennas required to provide full roaming wireless access in all desired coverage areas for the First Floor. The sections are broken down as follows:

- Section 1: the Auditorium section
- Section 2: the Main Office section
- Section 3: the Gymnasium section

A total of 23 AP's were used in conjunction with 46 2.2 dbi omni-directional dipole antennas.

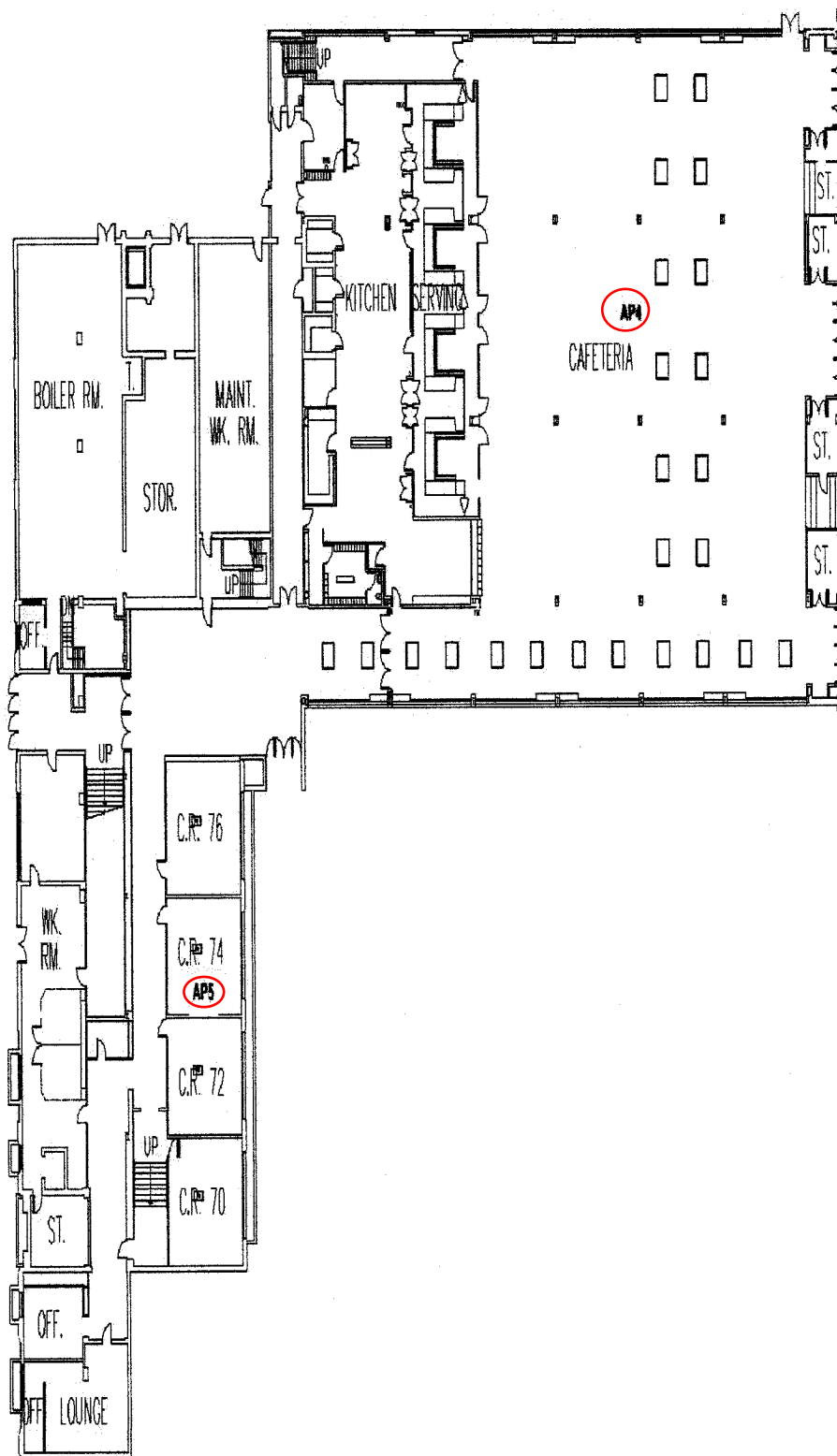
*Note: Per conversations with John Wisnewski it was determined the dressing room behind the auditorium will require a dedicated AP if coverage is needed. This is due to the building structure and current environment. The AP is not part of this design, and coverage will be incidental in these areas.*

*Second Floor:* The majority of the second floor consisted of a normal classroom structured environment with a Library facility. The Library facility was under renovation and consideration was taken for the rows of bookshelves that were not present at the time of testing. The diagrams illustrate the AP/antennas required to provide full roaming wireless access in all desired coverage areas for the Second Floor. A total of 9 AP's were used in conjunction with 18 2.2 dbi omni-directional dipole antennas.

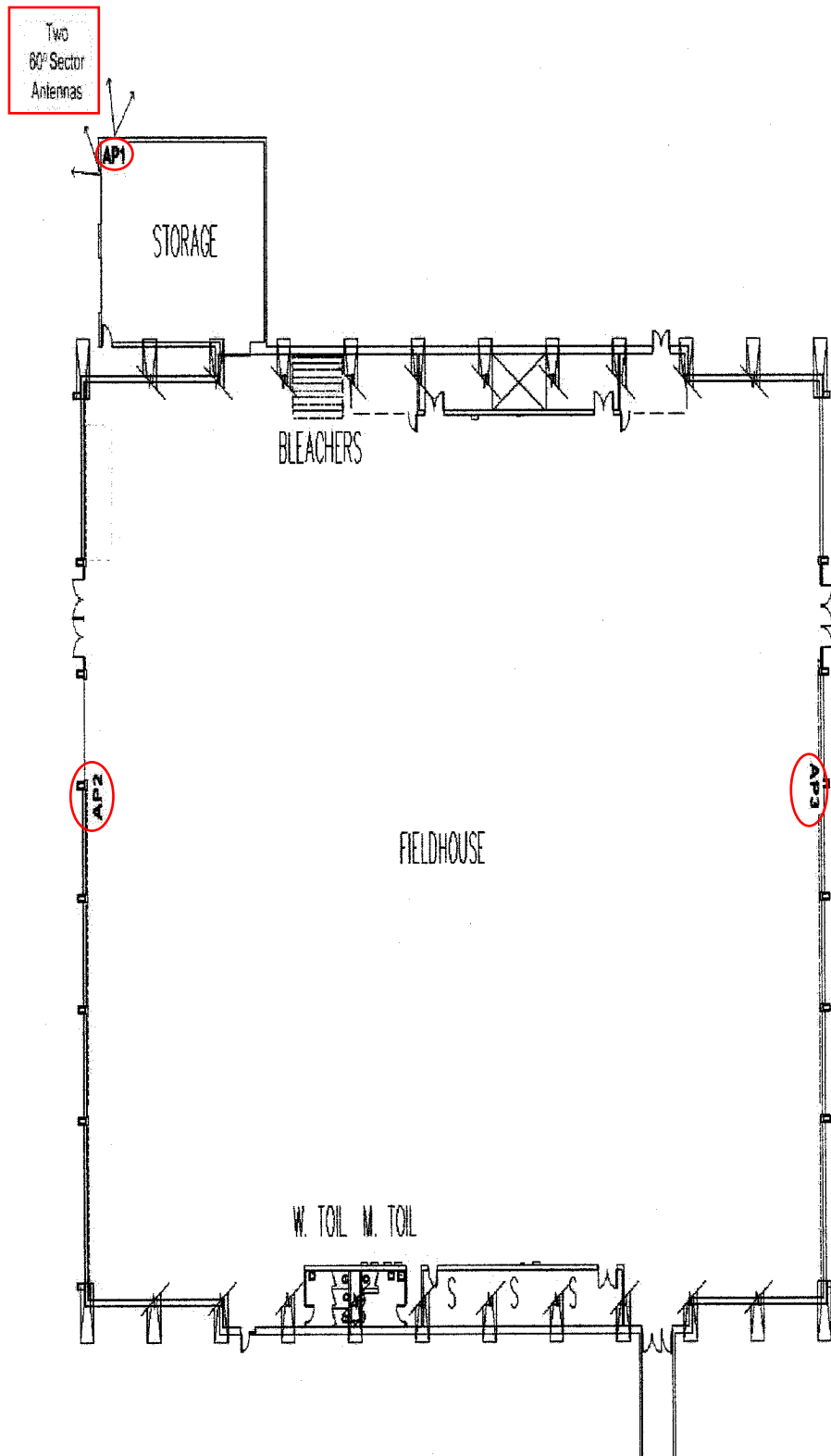
*Third Floor:* The greater part of the third floor consisted of classrooms. There was also an AV room and attached associated rooms that took special consideration due to the building structure. The diagram illustrates the AP/antennas required to provide full roaming wireless access in all desired coverage areas for the Third Floor. A total of 9 AP's were used in conjunction with 18 2.2 dbi omni-directional dipole antennas.

*Note: Per conversations with John Wisnewski we determined rooms 318 & 346 will require dedicated APs if coverage is needed. This is due to the building structure and current environment. The APs are not part of this design, and coverage will be incidental in these areas.*

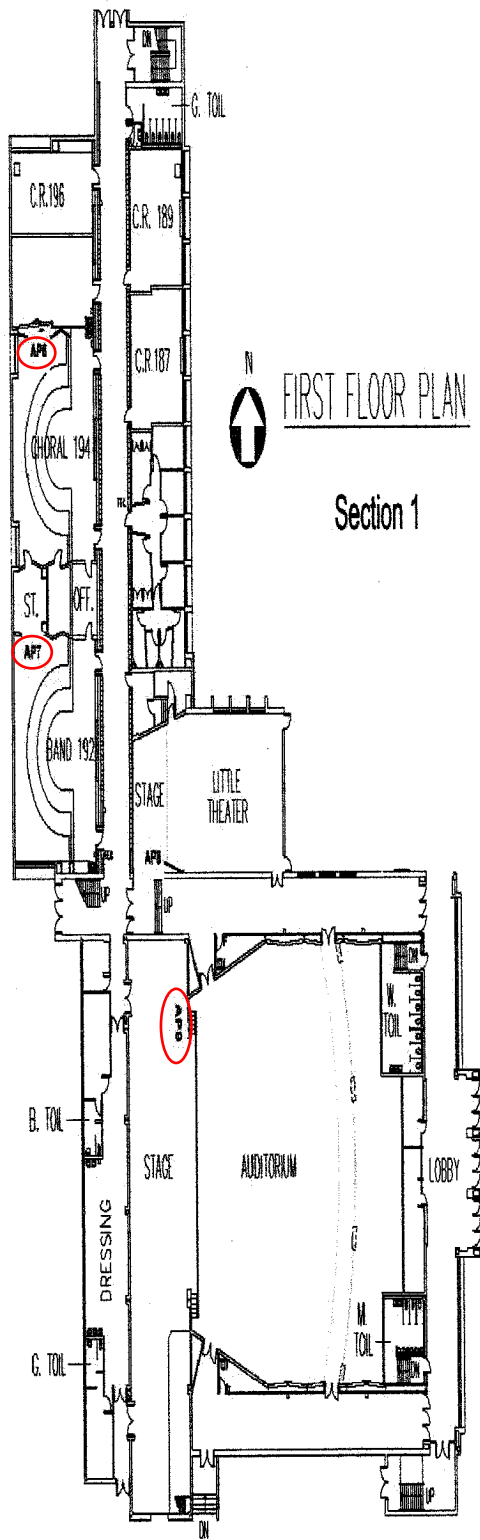
*Fourth Floor:* The fourth floor consisted of a medium stretch of hallway with classrooms on one side and an office space on the opposite side in the middle. There are also the IT offices at one end of the hallway. The diagram illustrates the AP/antennas required to provide full roaming wireless access in all desired coverage areas for the Second Floor. A total of 4 AP's were used in conjunction with 8 2.2 dbi omni-directional dipole antennas.



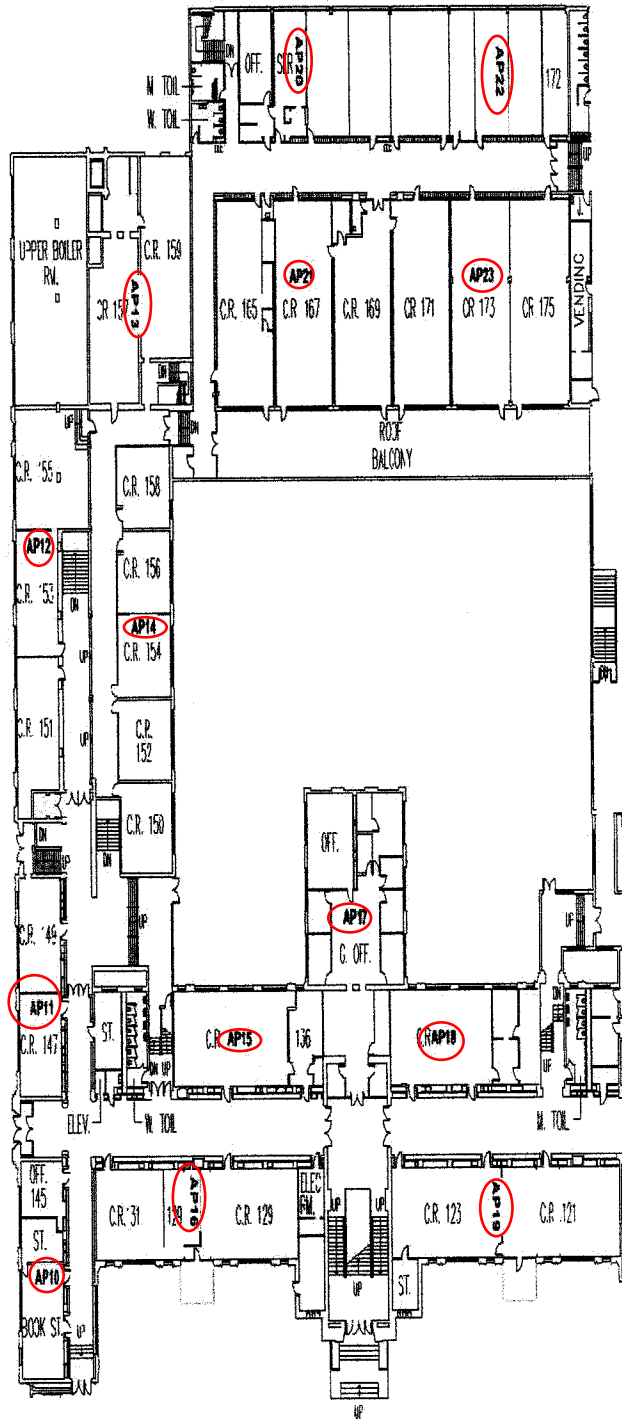
**FIGURE 1: Ground Floor Section 1 (Cafeteria)**



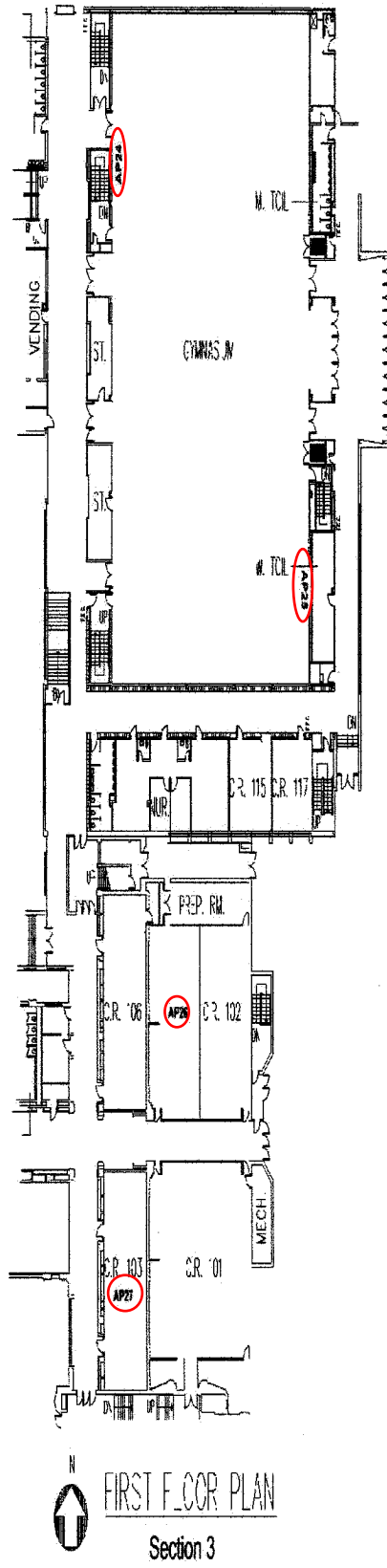
**FIGURE 2: Ground Floor Section 2 (Field House)**



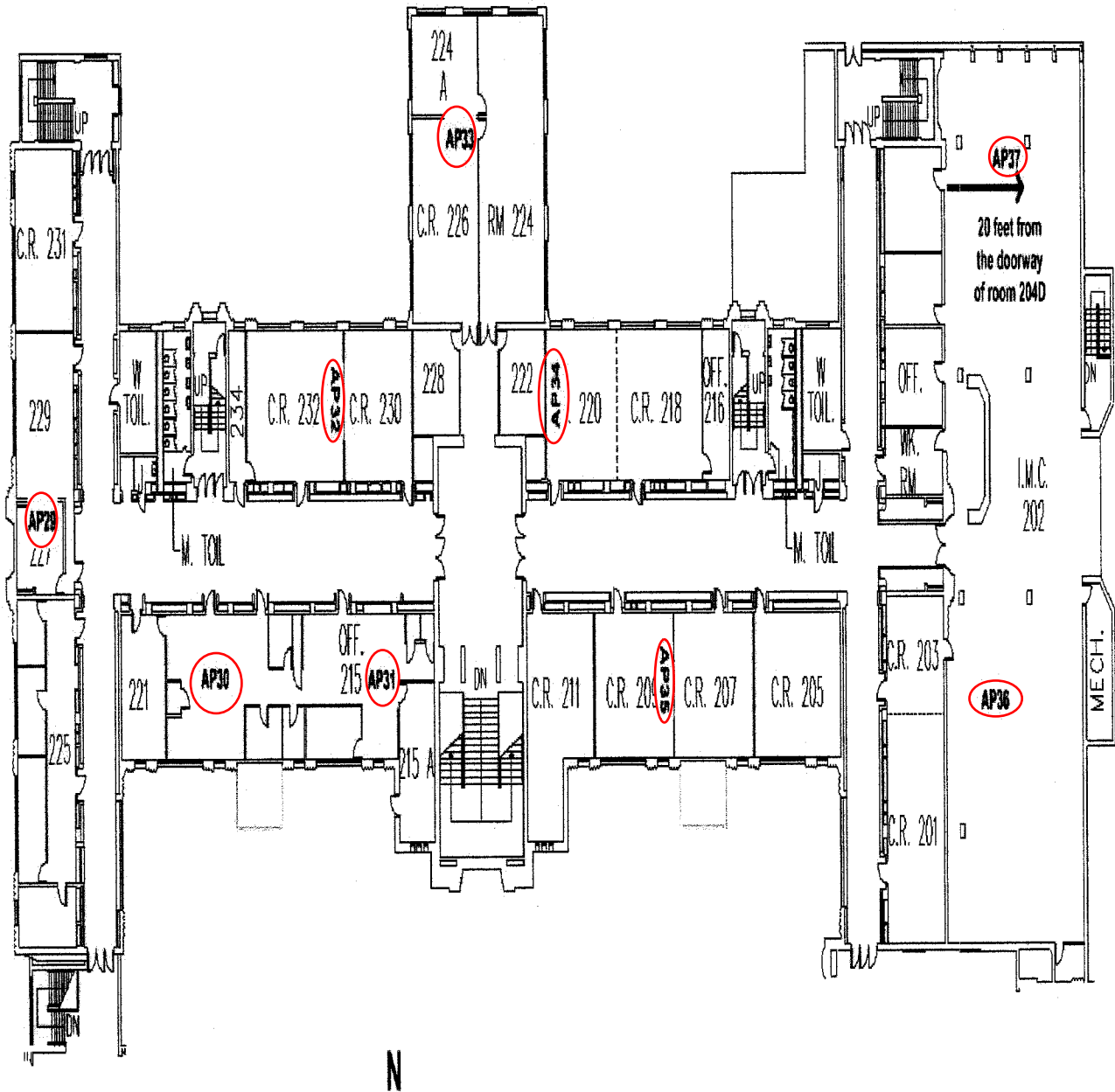
**FIGURE 3: First Floor Section 1 (Auditorium)**



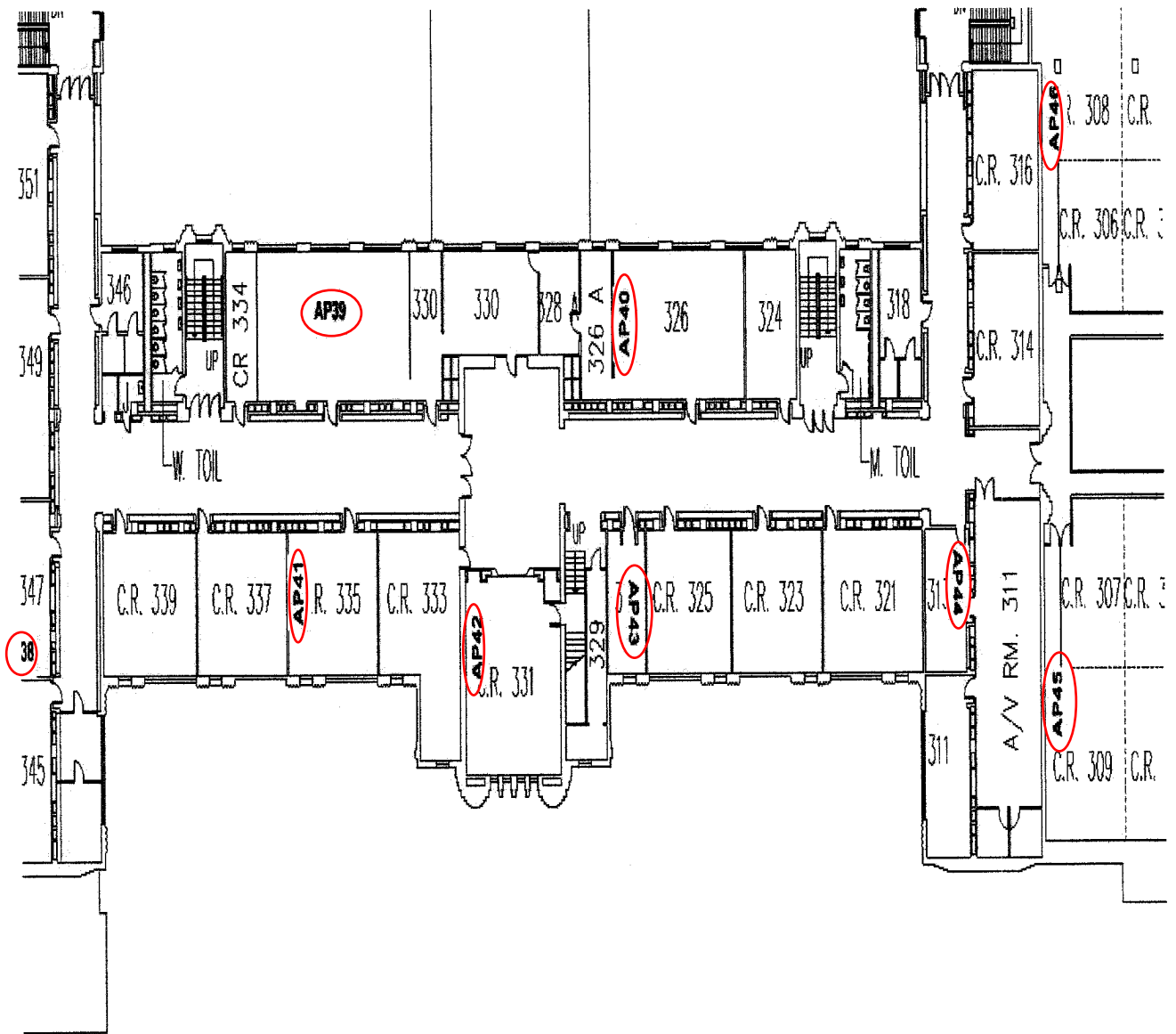
**FIGURE 4: First Floor Section 2 (Main Office)**



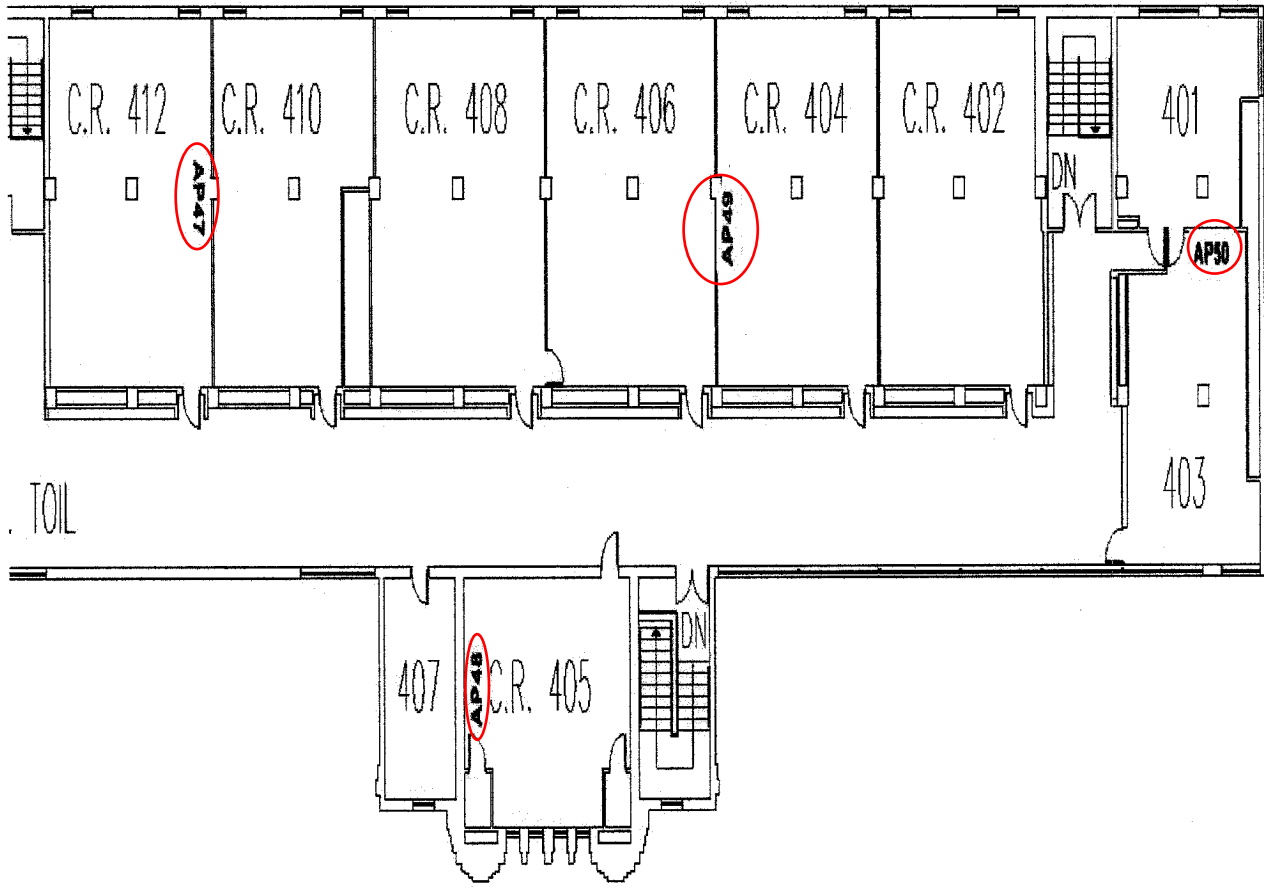
**FIGURE 5: Section 3 (Gymnasium)**



**FIGURE 6: Second Floor**



**FIGURE 7: Third Floor**



**FIGURE 8: Fourth Floor**

## **RECOMMENDATIONS**

### **Site Survey Summary**

Based on the site survey results, we conclude that full roaming coverage throughout the desired coverage areas of Bloom High School can be achieved with the design and equipment specified in this report. The placement of wireless equipment and the antenna architecture discussed in this report is designed to overcome the physical obstructions found throughout the facility, inherent within a High School environment (lockers, doors, walls, etc).

The subsequent equipment list represents the equipment necessary to achieve seamless wireless full-roaming throughout the areas specified by John Wisnewski from Bloom High School.

### **Equipment List**

The following equipment is recommended to provide wireless full roaming coverage throughout the Bloom High School. *Note: the procurement of the Cisco 1200 series 802.11g AP's will be handled by CDW. The labor cost for the programming and installation of the 50 provided AP's are included in the total price found below.*

#### **Hardware, Material and Services Description for Full Roaming Wireless Network**

- (50) Configuration of Cisco 1200 802.11g Access Point (Hardware price provided separately by CDW)
- (98) Cisco Aironet Dipole Antennas
- (2) Sector-Panel 2.4-2.5 GHz 14dbi 90° Antennas
- (50) Cisco SmartNet 8x5 Support 1 Year
- Misc. Equipment (Radio cables, connectors, mounts, etc.)
- Comprehensive Signal Attenuation & Link Testing
- Complete Network Integration & Implementation
- Comprehensive Project Management