

**REQUEST FOR PROPOSALS  
DISTRIBUTED ANTENNA SYSTEM (DAS) AND WI-FI SYSTEM  
AND STADIUM INFRASTRUCTURE  
FOR THE NEW MINNESOTA MULTIPURPOSE STADIUM  
IN MINNEAPOLIS, MINNESOTA**

JUNE 13, 2014

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**I. PROJECT INFORMATION**

A. Introduction

In 2012, the State of Minnesota enacted 2012 Minnesota Laws, Chapter 299 (the “Act”), to establish the Minnesota Sports Facilities Authority (the “Authority”) and to provide for the construction, financing, and long term use of a new stadium and related stadium infrastructure as a venue for professional football and a broad range of other civic, community, athletic, educational, cultural and commercial activities.

As set forth in the Act, the design, development and construction of the Stadium and the Stadium Infrastructure is a collaborative process between the Authority and Minnesota Vikings Football, LLC (the “Team”). To that end, the Authority and the Team have prepared this Request for Proposals (“RFP”) for the design, construction and implementation of a DAS and Wi-Fi System and infrastructure.

B. The Minnesota Multi-Purpose Stadium

The MMPS will be used as a venue for Minnesota Vikings football games and a broad range of other civic, community, athletic, educational, cultural, and commercial activities. The MMPS will be located on a site partially including the site of the former Hubert H. Humphrey Metrodome and also including additional adjacent land acquired in Minneapolis, Minnesota. The Preliminary Site Plan for the MMPS is incorporated in the RFPs. The Stadium will be designed to meet the standards required for a National Football League (“NFL”) franchise as well as other programmatic uses consistent with other multipurpose facilities. Construction of the Stadium began in the fourth quarter of 2013 with substantial completion to be achieved not later than July 15, 2016 so as to be ready for occupancy in advance of the Minnesota Vikings’ 2016 NFL season.

The 64,500 Minnesota Vikings fans, which will be welcomed in 2016, and 70,000 NFL fans which will attend the 2018 Super Bowl at the Minnesota Multi-Purpose Stadium (MMPS), will surpass the population of the 8th largest city in Minnesota. The visually stunning 1.75 million square foot

MMPS will provide an amazing array of state of the art architectural, operational and technical features.

With the stadium's openness, fans will experience an outdoor feel in a climate-controlled environment. Super Bowl fans will also be as close to the action as any NFL stadium, with seats just 41 feet from the sideline. The largest transparent ethylene-tetrafluoroethylene (ETFE) roof in the nation will enable light to flow from the roof through glass walls, clerestory windows wrapping the perimeter of the stadium, and five 95-foot high pivoting glass doors that will open unto a nearly three-acre plaza, two block City Park and the iconic Minneapolis downtown skyline.

Seven levels in the stadium, including two general admission concourses with 360-degree circulation and clear expansive views into the bowl, will be seamlessly connected via easily accessible escalators, elevators, stairs and an expansive continuous ramp. Inside, the stadium's seven levels will feature a world-class portfolio of clubs, restaurants, and individualized luxury suites, including one-of-a kind field level locations. Elevators, escalators and ramps will also smoothly transport a capacity crowd of energized fans directly from the Plaza and skyway connected parking ramps to seating selections on each stadium deck.

MSFA and the Minnesota Vikings are designing a dynamic and cohesive technology vision for the MMPS that will exceed the expectation for the presentation of superior Game Day and event experiences. Together with our design, construction and integration teams, we will reset the bar for stadium experiences with a world class content distribution system designed to be extensible to all in-venue networks, future activation platforms and monitors, capable of supporting high capacity connection rates to the multitude of multi-format personal devices, to create a remarkable and memorable experience.

The ability to master the logistics of moving and managing crowds in an unprecedented way is a critical success factor in creating the MMPS world-class stadium experience.

The MMPS Plaza and adjacent City Park will feature live performances, large format video displays, high end audio, and immediate access to MMPS Distributed Antenna System (DAS), Wi-Fi and Public Safety video and radio coverage to provide integrated and robust, high density, reliable wireless access to content that will enhance the fan experience and contribute to an animated, more comfortable, and safer zone where people can celebrate, connect and communicate.

Connectivity to the MMPS DAS, Wi-Fi and non-public Public Safety infrastructure will remain persistent on end user devices as fans transition through the Super Bowl Experience and into the MMPS where instant activation will commence the in-venue experience.

Being in a crowded stadium environment can be overwhelming. Beyond entrances, exits, life safety and security issues, circulation within the MMPS must flow smoothly, promoting ease of access, especially at this high capacity event. Large format flat screens and video walls will present content to fans as they enter and navigate the venue. Pre game content will focus on way finding, facility orientation, Game Day or event highlights, entertainment, and promotions.

Two of the largest and highest-quality HD video boards in the NFL will be prominently located in both the east and west end zones, and viewable from nearly all concourse positions. Multiple\_HD

flat digital screens and video walls will be integrated into the fabric of the stadium. The MMPS will be provisioned with a ubiquitous high-density wireless broadband infrastructure to support both cellular and Wi-Fi device access from anywhere in the venue; including bowl seating, concourses, suites, clubs, restaurant and the Plaza.

The DAS and Wi-Fi systems will be powered by massive bandwidth delivered through a converged Local Area Network supporting all MMPS systems including redundant fiber optic MMPS connections that will enable fans to share pictures, video and text across carrier and social media networks.

MMPS will feature some of the largest ribbon boards in an NFL venue with high-resolution clarity, and an audio system with concert-level sound quality. The main scoreboard will be the single most viewed source for presentation of live video and replays, Sponsorship, Advertising and other game day information. Whether it's to fuel the crowd or celebrate the outcome, the MMPS AV infrastructure will create an electric, energetic environment.

The stadium will be pre-wired for broadcast network, cable channel, local and social media, and in-house broadcast. Network and stadium camera positions will utilize a combination of fiber and copper from each camera position through redundant interconnect rooms to mobile broadcast trucks. Local TV stations and ancillary content providers will have cabling to support their sports programs and live remote broadcasts.

Suites will offer a secure, living room environment accessible from a separate, dedicated concourse. The suites offer unprecedented high-definition television monitors, multi media (voice, data, text and video) communications systems with wireless Internet access, as well as convenient tablet computing devices for intuitive content access and systems control, all integrated into each suite. The MMPS will feature the closest seating options among NFL venues and a dynamic in-house channel line up with multiple audio and video source options that will allow suite guests to access customized Game Day and event programming.

The MMPS is designed from the ground up to enable heightened security and energy efficiency. The architectural design and facility systems will be integrated to provide a smarter, safer, and more efficient venue. Much of this technology will be invisible to the general public. The MMPS will include two fully equipped on-site, one off-site Operations and Public Safety Command Centers linked to MMPS local and state Public Safety systems and rooftop antennas (and fiber network connectivity from City of Minneapolis Emergency Operations facilities directly to MMPS in-venue, Plaza and perimeter security cameras) to provide real time monitoring, and immediate access to security and operations personnel as well as life safety, fire alarm, public address and building automation systems, security screening points and cameras, elevators and areas of refuge.

Efficient facility operations are critical to the success of the stadium. MMPS operations portals will provide MSFA and Minnesota Vikings operations personnel with access to, staff, security and concessionaires; building automation systems, technology systems, security and camera systems; integrated emergency communications with Public Safety personnel, and venue control systems to transition to and from the Game Day configuration.

The Video and Audio Production Control Rooms will be the epicenters for control and distribution of the video and audio content on the large video displays and speaker arrays in the bowl, as well as the multi level LED ribbon displays and the numerous speakers, video monitors and video wall channels being viewed and heard simultaneously before, during and after a game or event.

Concurrent with the construction of the MMPS, the new adjacent Minneapolis Downtown East development project will add:

- 1.2 Million SF, two 17-story Wells Fargo Operations Center for 5,000-6,000 employees
- 28,000 SF of retail space, street level
- Stadium connected skyway
- Approximately 620 residential units
- 1,610 stall parking structure
- 150-room Radisson Red Hotel
- 4.2 Acre City Park

In addition, Hennepin County Medical Center, a 3.9 million square foot 9 building, primary 455 bed Level I trauma center, located on five city blocks across the street from the new MMPS will break ground on a \$191 million, 322,000-square-foot clinic and specialty center at its downtown Minneapolis campus in 2016.

### C. Intent and Process of the Requests for Proposal

The preliminary programs for these wireless systems are incorporated within the RFPs. The 100% Construction Documents identifying DAS and Wi-Fi System components based on preliminary design for the wireless environments are also incorporated within the RFPs. The successful Proposer to the RFPs will be engaged to perform DAS and/or Wi-Fi System final design, construction and implementation services for the MMPS as further described in the RFPs and any future addendums that will be issued.

The RFPs are focused on the selection of one or more DAS and Wi-Fi firms (with a preference toward a unified proposer team); with significant experience in the construction and optimization of wireless environments for at least three similar public assembly facilities, to act as the DAS and or Wi-Fi System Design and Implementation Service Provider(s) for the MMPS.

The purpose of the RFPs is to provide Proposer(s) sufficient information to provide financial models and technical solutions for evaluation by the Authority and Team. Following receipt of proposals, the Authority and Team will schedule informational work sessions and interviews with selected proposers based upon submittals. This document and supporting attachments are considered confidential and proprietary until final contract awards.

#### D. Scope of DAS and or Wi-Fi System Design and Implementation Services

The DAS and or Wi-Fi System Design and Implementation Service Provider(s) is required to perform services in accordance with the terms and conditions of the RFPs and any future Addendums.

The Authority and Team have deemed consistent, pervasive high bandwidth full coverage wireless connectivity to be an essential part of the stadium experience. To that end, the MMPS and surrounding plaza area will be provisioned with a “state-of-the-art” Distributed Antenna System and High Density Wi-Fi System.

The intent of the RFPs is to select the Provider(s) who will design, construct and implement a complete and fully functioning Wireless Network System designed to support robust Cellular and Wi-Fi access that will accommodate all wireless users including business, team, operations, event, tenants, food service, ticketing, press, broadcast, and public users with the greatest overall financial benefit to the Authority and the Team.

The DAS System must:

- Meet and exceed cellular customer capacity demands for data bandwidth, voice calls, texting, video and simultaneous connections in effect in 2016 and for ten years beyond.
- Provide 100% DAS coverage uniformly in all areas of the MMPS, attached Parking Ramp and stadium property and ticket queue areas as shown on the enclosed construction documents.
- DAS system must be LTE, MIMO and AWS Ready including any and all formats, frequencies and standards available in the public and commercial cellular transmission and reception space.
- DAS will cover frequencies from 620-2700 MHz and shall include provisioning for Emergency Responder radio repeaters and Public Safety communications in collaboration with City of Minneapolis, as well as MMPS 2 way radio requirements.
- System will be designed to a minimum of 30 sectors within the bowl and circulation areas and 13 sectors in the surround areas.
- Meet and exceed NFL guidelines for Distributed Antenna Systems in NFL Stadiums that will be in effect in 2016. Current NFL guidelines are incorporated in the RFPs for your review and should be considered as baseline, minimum technical standards which are subject to change.
- Support a minimum of four major regional wireless carriers attached and operating on the neutral-host DAS no later than the first new stadium event in 2016, and provide a superior mobile experience to fans, regardless of carrier.

- Ensure DAS components; pathways and antennas within view of the public are implemented in as esthetically pleasing manner as possible and subject to the approval of the MMPS prior to the installation.
- Provide skilled, on-site DAS technical assistance and carrier liaison services during large events as requested by Authority and Team.
- Provide real time and unfiltered access to the user data and use patterns for Authority and Team, including all mobile user and DAS performance statistics to monitor user experience and utilize data for marketing purposes.
- Implement the highest quality DAS installation and components used in similar NFL Stadiums.
- Limit radio frequency interference between carriers and other systems within the stadium to the greatest extent possible.
- Satisfy wireless carrier technical requirements.
- The DAS Cellular System must be a neutral host design, supporting a minimum of four (4) carrier distributed antenna system that must support all major and local Cellular Carrier signals. The DAS coverage will be ubiquitous throughout the MMPS in all public and non-public areas and must be fully compliant with NFL Wireless Standards for 3G/4G DAS and Wireless Local Area Networks.
- The DAS system must deliver the bandwidth (upload, download, throughput) required for sharing pictures, multi-cast video, streaming video, and text across carrier and social media networks.

The Wi-Fi System must:

- Meet and exceed auto authenticated Wi-Fi customer capacity demands for mobile data bandwidth, video and simultaneous connections in effect in 2016 and for ten years beyond.
- Provide pervasive High Density 802.11xx compliant 100% Wi-Fi coverage in all areas of the MMPS facility and property as shown on the attached construction documents including all exterior ticketed areas.
- Ensure Wi-Fi components, pathways and antennas within view of the public are implemented in as esthetically pleasing manner as possible and approved by the MMPS prior to installation.
- Provide skilled, on-site Wi-Fi technical assistance during large events as requested by Authority and Team.
- Provide real time and unfiltered access to the user data and use patterns, to the Authority and Team, including mobile user and Wi-Fi performance statistics to monitor user experience and utilize data for marketing purposes.
- Implement the highest quality Wi-Fi installation and components as possible as demonstrated by proven usage in other NFL Stadia.
- Limit radio frequency interference between City of Minneapolis USIW Wi-Fi Backhaul and other systems within the stadium to the greatest extent possible.

- Recommend and optimize provided applications and tools for Authority and Team to monetize the Wi-Fi to the fullest extent possible, while maintaining the integrity of technical objectives.
- Wi-Fi shall fully integrate with all MMPS provided systems with no additional elements and distribute content created and provided by the MMPS or Team.
- The Wi-Fi system must deliver the bandwidth (upload, download, throughput) required for sharing pictures, multi-cast video, streaming video, and text across carrier and social media networks.

Our design intent is to work with Metropolitan Transit and other Regional Transit Authorities and Operators to equip mass transit (Heavy Rail, Light Rail and Bus and Private Coach) vehicles with robust broadband (cellular, multi-cast and Wi-Fi) coverage. We believe this technology can be effectively leveraged to promote use of Mass Transit options; thereby greatly improving the smooth flow of traffic and crowds as they enter and exit the MMPS.

Additional turn-key services to be provided as a part of a fully designed and operating system by the selected DAS and/or Wi-Fi System Design and Implementation Service Provider(s) and sub contractors must include, but are not limited to:

- Advising on infrastructure and systems design and construction, project phasing, selection of components and equipment including, without limitation, delivery of a detailed site logistics plan for DAS and Wi-Fi systems construction and implementation, project phasing plan, and a risk assessment and value added plan.
- Providing recommendations on design, materials and labor, time requirements for installation and construction, and factors related to costs including costs of alternative designs or materials.
- Assisting the Authority and Team in developing, and participate in, a value engineering process (“Value Engineering”) that analyzes the feasibility of alternative systems, equipment and materials and to identify such alternative systems, equipment and materials of equivalent quality, and having equivalent characteristics, to those specified in the Design Documents that can be fully specified, obtained, and installed at a lower price or, in the sole judgment of the Authority and Team, more-desirable operating characteristics or greater functionality or any combination of these.
- Assisting the Authority and Team to design the best possible overall financial benefit to the MMPS.
- Developing a schedule in a critical path method format that tracks activities, resources, and durations to achieve substantial completion of the Project, including realistic activity sequences, and durations, allocation of labor and materials, processing of shop drawings and samples, and delivery of products requiring long lead time procurement by the schedule.



E. Requested Qualifications

The Authority and Team reserve the right and discretion to determine the qualifications and responsibility of the Proposers to perform the services that are the subject of the RFPs. It is the request and intent of the Authority and Team that Proposers responding to the RFPs have the following qualifications.

- Progressive experience in the design, construction, implementation and optimization of wireless environments for at least three similar public assembly facilities with a seating capacity in excess of 50,000 seats.
- In-house capacity to produce necessary design, construction and schedule documentation, which does not preclude any firm from also identifying potential sub-consultants that could assist in producing such estimates and schedules.
- Bonding and capital capacity or ability to obtain bonding capacity to the full amount of the DAS and or Wi-Fi System Design, Construction and Implementation Budget as required by the MMPS and the National Carriers.

The Authority and Team will consider a wide range of proposals that offer a DAS and/or Wi-Fi technical and financial solution in a manner that serves the requirements of the Authority and Team.

The selected Respondent will be required to comply with the Minnesota Multi-Purpose Stadium Construction Services Agreement Equity Plan (“Stadium Equity Plan”). MBEs and WBEs that are interested in acting as the DAS and or Wi-Fi System Design and Implementation Service Provider(s) for the Project are encouraged to respond to the RFPs.

The selected Respondent will also be required to comply with Minnesota prevailing wage laws, as provided in Minn. Stat. §§ 177.41-43, and each of those provisions of the Act or Minnesota law that apply to the Project. Finally, the Authority and Team will require the selected Respondent to negotiate and enter into a project labor agreement (“Project Labor Agreement”) for the Project as part of its services. The Project Labor Agreement shall be subject to the approval of the Authority and Team.

F. Tentative Schedule of Selection Process

<b>ACTIVITY</b>	<b>DATE</b>
Issue Requests for Proposals	June 13, 2014
Publication in Minnesota State Register	June 13, 2014

Indication of Interest and Qualifications	June 20, 2014; 4:00 pm
Pre-proposal Meeting (1010 S 6 <sup>th</sup> St. LL)	June 24, 2014; 1:00 pm
Written Questions Due	June 27, 2014; 4:00 pm
Written Responses Issued	July 1, 2014
Proposals Due	July 3, 2014; 4:00 pm
Interviews of Shortlisted Proposers	July 22 – 23, 2014
Selection of DAS and Wi-Fi Solution Finalist(s)	August 1, 2014
Final Contract Negotiations	September 1 – 5, 2014
Substantial Completion	July 15, 2016

By submitting a proposal, the Proposer affirms that this timeline must be met to avoid the potential for significant harm to the progress of the Project. The DAS and Wi-Fi Systems and Stadium Infrastructure must be completed and ready by July 2016 for Vikings game-day operations well in advance of the 2016 NFL Season.

## II. PROPOSAL REQUIREMENTS AND EVALUATION CRITERIA

Interested Proposers must submit an Indication of Interest and Qualifications by June 20, 2014; 4:00 pm. The Indication of Interest and Qualifications must be delivered via mail or e-mail to:

Steven C. Maki, P.E.  
Metropolitan Sports Facilities Commission  
511 South Eleventh Avenue  
Minneapolis MN 55415  
Email: [steve.maki@msfa.com](mailto:steve.maki@msfa.com)

and to:

Don Becker, Project Executive  
Minnesota Vikings Football, LLC  
Minnesota Vikings – Winter Park  
9520 Viking Drive  
Eden Prairie, MN 55344

Email: [beckerd@vikings.nfl.net](mailto:beckerd@vikings.nfl.net)

A. Submittal Requirements – Indication of Interest and Qualifications

The following items shall be included:

- Proposer's name and address of the office that would have central responsibility for the work. If the Respondent is a joint venture, please identify each venturer and their respective percentages of participation.
- Description of how Proposer(s) is/are qualified to provide the DAS and/or Wi-Fi design, construction and implementation services requested in the RFPs and proposed by Respondent. Include descriptions of any similar projects.
- Provide representative list of similar projects managed by Proposer during that last 5 years or that are currently under construction or management. Include:
  - Project name and location.
  - Contracting or ownership entity and key contact or reference from project Owner including name, title, email, and telephone number.
  - Project description; listing dates of construction, seating capacity, project gross square footage and wireless environment cost. Proposers shall be specific about which projects have been worked on by current employees while employed by your firm vs. those that were worked on while employees of another employer. List key principal of Proposer who was responsible for the project.
- Provide copies of Proposer's certificates of insurance showing Proposer's current total limits of liability for commercial general liability, worker's compensation, employer's liability, business automobile liability, and professional liability.
- Provide evidence of Proposer's capacity to provide or obtain bonding in a letter from Proposer's bonding company listing Proposer's single project bonding capacity or limit. If Proposer is a joint venture, describe the joint venture's plan to provide bonding capacity.

B. Submittal Requirements – Proposal

As described below, the Authority and Team will evaluate proposals on and between one and three proposals receiving the highest evaluations, as determined by the Authority and Team, will then be selected to enter into final discussions and negotiations. The Authority and Team will select the Proposer(s), if any, whose final proposal is most advantageous to the Authority and

Team as permitted by the Act and according to agreements between the Authority and Team as it relates to final selection of a DAS and Wi-Fi provider.

Please provide the following information

a. Financial

- i. Explain proposed DAS and Wi-Fi business plan(s);
- ii. Proposed Contract Terms;
- iii. Financial Statements and Capital Funding ability for the previous 5 years.
- iv. 10 year proposed financial pro-forma workbook including:
  1. Revenues to be provided to Authority and Team
    - a. Expected Net capital contributions
    - b. Expected Net monthly rent;
  2. Expenses, if any, to be borne by Authority and Team
    - a. Payments;
    - b. DAS and Wi-Fi maintenance and monitoring fees;
    - c. Misc. costs (electrical, utility, insurance costs, etc.);
  3. Profit/Loss Pro-forma
- v. Detail all assumptions made in preparing pro-forma.
- vi. Detail annual escalator for rents and operating costs;
- vii. Timing of revenues.
- viii. Assume year 1 to be 2015, when DAS and Wi-Fi construction would commence.
- ix. Provide financial alternatives such as;
  1. Pre-payments to Authority and Team;
  2. Alternate ownership models
- x. List of all previous or pending hearings or litigation or discovery relating to the providing of Das and/or Wi-Fi services as out lined in this RFP

b. Technical Design

- i. Overall DAS and Wi-Fi technical plan;
- ii. Completed design dimensioning tables and calculations as required by the NFL Wireless design Standards
- iii. Number of proposed sectors/zones;
- iv. Selected DAS and Wi-Fi manufacturers/models and reasons selected;
- v. Estimated number of antennas, remote DAS units and Wi-Fi access points;
- vi. Detail approx. space and power required in IDF closets including rack space and floor square footage;
- vii. Detail approx. space and electrical service needed for the DAS and Wi-Fi head ends and carrier spaces;
- viii. Explain proposed outdoor coverage;
- ix. Explain why conceptual design is technically superior;
- x. Confirm design includes emergency responder and 2 way radio capabilities.

- xi. Detail mobile data and usage statistics available from system;
- xii. Detail NOC capabilities and help desk standards;
- xiii. Explain what technological changes that are expected to occur by 2016 - 2018 that would alter your conceptual design or philosophy.

### C. Description of Proposal Evaluation Process

Submission of a proposal indicates the Proposer(s)' acceptance of the evaluation criteria.

#### **1. Proposal**

The Proposer(s) should provide a detailed description of the proposed solution to the RFP requirements and other benefits to the MMPS. Specifically, Proposer(s) should describe the following:

- Proposed Specifications and Performance of DAS and/or Wi-Fi Systems and Stadium Infrastructure
- Integration with other Stadium Systems and Downtown Wireless Environment
- Proposed operational terms, if any.

#### **2. Price and Terms**

The Proposer(s) must state any cost or financial obligations of the Authority or the Team for the provision of the Facilities described in its proposal. The Proposer(s) should further state the price and terms for the operation, if any, of some or all of the DAS and/or Wi-Fi wireless environment.

#### **3. Respondent Qualifications**

The Authority and Team reserve the right and discretion to determine the qualifications and responsibility of the Proposer(s) to perform the services that they propose pursuant to the RFPs. In order to be considered Responsive, the proposal must provide the following information:

##### **▪ Relevant Design Experience**

Provide up to three past projects of relevant design experience. Please include detailed information regarding Proposer(s)' role in the project, ability to meet the project timeline and photographs of the projects.

##### **▪ Relevant Construction Experience**

Provide up to three past projects of relevant construction experience similar in size and scope to Proposer(s)' offering. Please include detailed information regarding Proposer(s)' role in the project, ability to meet the project timeline and photographs of the projects.

- **Past Performance**

Demonstrate proven methods Proposer(s) has/have used to manage the design, construction and implementation processes to not exceed a specified budget without a loss of quality and still meeting the requirements of the client.

- **Method of Approach**

The Proposer(s)' submittal shall include a narrative of the planned approach (specific to the MMPS) to: delivering a functional design, high performance DAS and/or Wi-Fi end user experience, low maintenance and life cycle cost, maximum financial benefit to the Authority and Team, and managing the project schedule.

- **Risk Mitigation**

Describe any difficulties, challenges or risks Proposer(s) foresee in providing the required DAS and/or Wi-Fi Systems and Stadium Infrastructure, how Proposer(s) expect to manage those difficulties, challenges or risks, and what assistance will be required from the Authority and/or Team. In particular, address how Proposer would intend not to disrupt or interfere in any way with the schedule for the construction of the Stadium and other Stadium infrastructure.

- **Team Strength**

The Respondent will identify which of its proposed team members have worked on comparable projects. The Lead Project Manager shall have recent experience in the management of the DAS and Wi-Fi installation in a Sporting public assembly facility or the required capacity.

- **Workforce**

The Respondent will describe its practices and history of hiring women and minorities. Also describe Respondent's history of achieving goals for MBE and WBE construction participation as required on other projects, and Respondent's proposed strategies for employing women and members of minority communities when hiring to comply with the Stadium Equity Plan.

- **Financial Strength**

The Respondent must be able to provide performance and payment bonds for the construction of the DAS and/or Wi-Fi Systems and Stadium Infrastructure and financial capabilities to secure any proposed operational obligations, if any. Provide 5 years of Financial Statements including capital funding requirements and cash flow analysis to support the construction, installation and optimization of the DAS and Wi-Fi systems.

- **Interviews**

Proposer(s) may be required to participate in an interview. The Authority and Team may interview all critical team members, including (**but not limited to**):

Lead Project Manager

Lead DAS and Wi-Fi Construction Services Project Managers

The Lead DAS and Wi-Fi Site Superintendents

The Lead DAS and Wi-Fi Design Architects

The Authority and Team may also request to interview additional personnel. The Authority and Team may request additional information prior to interviews. All proposed team members must be available in person for interviews on the date specified in this RFP. At the Authority and Team's discretion, substitutes, proxies, phone interviews, or electronic interviews may be allowed.

The interview phase may include Proposer(s) presentation(s). The interview itself will follow a question and answer format.

### **III. Instructions for Submissions**

#### **A. Submission.**

Three copies and one electronic copy of the qualification statement are to be submitted by 4:00 p.m. Central Time, on July 3, 2014. Responses must be sent to:

Steven C. Maki, P.E.  
Metropolitan Sports Facilities Commission  
900 South Fifth Street  
Minneapolis MN 55415  
Email: [steve.maki@msfa.com](mailto:steve.maki@msfa.com)

With three copies and one electronic copy to:

Don Becker, Project executive  
Minnesota Vikings Football, LLC  
Minnesota Vikings – Winter Park  
9520 Viking Drive  
Eden Prairie, MN 55344  
Fax: 952.828.6513  
Email: [beckerd@vikings.nfl.net](mailto:beckerd@vikings.nfl.net)

B. Questions and Inquiries.

Questions regarding interpretation of the content of this RFP must be in writing and directed to Steven C. Maki, P.E. at the address above or via email to [steve.maki@msfa.com](mailto:steve.maki@msfa.com) with copies to Don Becker at the address above or via email to [beckerd@vikings.nfl.net](mailto:beckerd@vikings.nfl.net). Questions may be submitted up June 27, 2014; 4:00 pm. If the questions are deemed necessary to provide clarification, an addendum to this RFP will be issued no later than 3 days prior to the submission deadline.

C. Communications.

Firms considering responding to this RFP are strictly prohibited from communicating with any other member of the Authority's Board or staff or Team's Ownership or staff, as all questions concerning this RFP should only be directed to the persons identified in Section A above.

D. Amendments.

The RFPs shall be modified only by a written amendment issued by the Authority. It is the responsibility of the Proposer(s) to verify that they have received and incorporated into their responses, all changes due to Amendments issued to the RFPs.

E. Cancellation; Rejection.

The Authority and Team reserve the right to accept or reject any or all proposals, to amend or alter the selection process in any way, to postpone the selection process for convenience at any time, and to waive any defects in proposals submitted. Proposals are required to remain open and subject to acceptance for a minimum of ninety (90) days following the date of submission of proposals. The Authority and Team also reserve the right to accept or reject any individual subcontractors or subconsultants that the successful Respondent proposes to use.

F. Respondent Costs.

Each Respondent submitting a proposal in response to this request acknowledges and agrees that the preparation of all materials for submittal and all presentation, related costs, and travel expenses are that Respondent's sole expense and the Authority and Team shall under no circumstances be responsible for any cost or expense incurred by the Proposer(s). The Authority and Team shall be allowed to keep any and all materials supplied by the Proposer(s) in response to the RFPs.

G. Minnesota Government Data Practices Act.

All proposals are subject to the Minnesota Government Data Practices Act, Minn. Statutes, Chapter 13. The Act prohibits disclosure of any information derived from proposals submitted by



competing Proposers, and the content of all proposals is nonpublic data under Chapter 13 until such time as notice to award a contract is given by the Authority. Proposers shall note with their proposal any trade secret information or other private data in their submittal, along with a detailed description of the reasons why such data is trade secret or private. If no information is designated as trade secret or private data in the proposal, the information shall be conclusively deemed not to be trade secret or private data.

#### H. Compliance

The successful Proposer(s) shall comply with all Federal, State and local laws, together with all ordinances and regulations applicable to the work. The Proposer(s) shall procure all licenses, permits, or other rights necessary for the fulfillment of their obligation under this document at the Proposer(s) sole expense.

## **SUMMARY OF CONTENTS**

**1.0 RFP INTRODUCTION**

**2.0 WIRELESS COORDINATION**

**3.0 DISTRIBUTED ANTENNA SYSTEM (DAS) SPECIFICATION  
(275319)**

**4.0 WIRELESS NETWORK SYSTEM SPECIFICATION (272101)**

**5.0 NFL STADIUMS DAS/WI-FI GUIDELINES – RF DESIGN &  
MINIMUM PERFORMANCE STANDARDS FOR 3G/4G DAS AND  
WIRELESS LOCAL AREA NETWORK (“WLAN”) FOR NFL  
STADIUMS**

**6.0 DAS DRAWINGS**

**7.0 WI-FI DRAWINGS**

**8.0 SAMPLE HANDRAIL DETAILS**

## **1.0 RFP INTRODUCTION**

- Ensure DAS components; pathways and antennas within view of the public are implemented in as esthetically pleasing manner as possible and subject to the approval of the MMPS prior to the installation.
- Provide skilled, on-site DAS technical assistance and carrier liaison services during large events as requested by Authority and Team.
- Provide real time and unfiltered access to the user data and use patterns for Authority and Team, including all mobile user and DAS performance statistics to monitor user experience and utilize data for marketing purposes.
- Implement the highest quality DAS installation and components used in similar NFL Stadiums.
- Limit radio frequency interference between carriers and other systems within the stadium to the greatest extent possible.
- Satisfy wireless carrier technical requirements.
- The DAS Cellular System must be a neutral host design, supporting a minimum of four (4) carrier distributed antenna system that must support all major and local Cellular Carrier signals. The DAS coverage will be ubiquitous throughout the MMPS in all public and non-public areas and must be fully compliant with NFL Wireless Standards for 3G/4G DAS and Wireless Local Area Networks.
- The DAS system must deliver the bandwidth (upload, download, throughput) required for sharing pictures, multi-cast video, streaming video, and text across carrier and social media networks.

The Wi-Fi System must:

- Meet and exceed auto authenticated Wi-Fi customer capacity demands for mobile data bandwidth, video and simultaneous connections in effect in 2016 and for ten years beyond.
- Provide pervasive High Density 802.11xx compliant 100% Wi-Fi coverage in all areas of the MMPS facility and property as shown on the attached construction documents including all exterior ticketed areas.
- Ensure Wi-Fi components, pathways and antennas within view of the public are implemented in as esthetically pleasing manner as possible and approved by the MMPS prior to installation.
- Provide skilled, on-site Wi-Fi technical assistance during large events as requested by Authority and Team.
- Provide real time and unfiltered access to the user data and use patterns, to the Authority and Team, including mobile user and Wi-Fi performance statistics to monitor user experience and utilize data for marketing purposes.
- Implement the highest quality Wi-Fi installation and components as possible as demonstrated by proven usage in other NFL Stadia.
- Limit radio frequency interference between City of Minneapolis USIW Wi-Fi Backhaul and other systems within the stadium to the greatest extent possible.

- Recommend and optimize provided applications and tools for Authority and Team to monetize the Wi-Fi to the fullest extent possible, while maintaining the integrity of technical objectives.
- Wi-Fi shall fully integrate with all MMPS provided systems with no additional elements and distribute content created and provided by the MMPS or Team.
- The Wi-Fi system must deliver the bandwidth (upload, download, throughput) required for sharing pictures, multi-cast video, streaming video, and text across carrier and social media networks.

Our design intent is to work with Metropolitan Transit and other Regional Transit Authorities and Operators to equip mass transit (Heavy Rail, Light Rail and Bus and Private Coach) vehicles with robust broadband (cellular, multi-cast and Wi-Fi) coverage. We believe this technology can be effectively leveraged to promote use of Mass Transit options; thereby greatly improving the smooth flow of traffic and crowds as they enter and exit the MMPS.

Additional turn-key services to be provided as a part of a fully designed and operating system by the selected DAS and/or Wi-Fi System Design and Implementation Service Provider(s) and sub contractors must include, but are not limited to:

- Advising on infrastructure and systems design and construction, project phasing, selection of components and equipment including, without limitation, delivery of a detailed site logistics plan for DAS and Wi-Fi systems construction and implementation, project phasing plan, and a risk assessment and value added plan.
- Providing recommendations on design, materials and labor, time requirements for installation and construction, and factors related to costs including costs of alternative designs or materials.
- Assisting the Authority and Team in developing, and participate in, a value engineering process (“Value Engineering”) that analyzes the feasibility of alternative systems, equipment and materials and to identify such alternative systems, equipment and materials of equivalent quality, and having equivalent characteristics, to those specified in the Design Documents that can be fully specified, obtained, and installed at a lower price or, in the sole judgment of the Authority and Team, more-desirable operating characteristics or greater functionality or any combination of these.
- Assisting the Authority and Team to design the best possible overall financial benefit to the MMPS.
- Developing a schedule in a critical path method format that tracks activities, resources, and durations to achieve substantial completion of the Project, including realistic activity sequences, and durations, allocation of labor and materials, processing of shop drawings and samples, and delivery of products requiring long lead time procurement by the schedule.

E. Requested Qualifications

The Authority and Team reserve the right and discretion to determine the qualifications and responsibility of the Proposers to perform the services that are the subject of the RFPs. It is the request and intent of the Authority and Team that Proposers responding to the RFPs have the following qualifications.

- Progressive experience in the design, construction, implementation and optimization of wireless environments for at least three similar public assembly facilities with a seating capacity in excess of 50,000 seats.
- In-house capacity to produce necessary design, construction and schedule documentation, which does not preclude any firm from also identifying potential sub-consultants that could assist in producing such estimates and schedules.
- Bonding and capital capacity or ability to obtain bonding capacity to the full amount of the DAS and or Wi-Fi System Design, Construction and Implementation Budget as required by the MMPS and the National Carriers.

The Authority and Team will consider a wide range of proposals that offer a DAS and/or Wi-Fi technical and financial solution in a manner that serves the requirements of the Authority and Team.

The selected Respondent will be required to comply with the Minnesota Multi-Purpose Stadium Construction Services Agreement Equity Plan (“Stadium Equity Plan”). MBEs and WBEs that are interested in acting as the DAS and or Wi-Fi System Design and Implementation Service Provider(s) for the Project are encouraged to respond to the RFPs.

The selected Respondent will also be required to comply with Minnesota prevailing wage laws, as provided in Minn. Stat. §§ 177.41-43, and each of those provisions of the Act or Minnesota law that apply to the Project. Finally, the Authority and Team will require the selected Respondent to negotiate and enter into a project labor agreement (“Project Labor Agreement”) for the Project as part of its services. The Project Labor Agreement shall be subject to the approval of the Authority and Team.

F. Tentative Schedule of Selection Process

<b>ACTIVITY</b>	<b>DATE</b>
Issue Requests for Proposals	June 13, 2014
Publication in Minnesota State Register	June 13, 2014

Indication of Interest and Qualifications	June 16, 2014; 4:00 pm
Pre-proposal Meeting (1010 S 6 <sup>th</sup> St. LL)	June 20, 2014; 1:00 pm
Written Questions Due	June 25, 2014; 4:00 pm
Written Responses Issued	July 1, 2014
Proposals Due	July 11, 2014; 4:00 pm
Interviews of Shortlisted Proposers	July 22 – 23, 2014
Selection of DAS and Wi-Fi Solution Finalist(s)	August 1, 2014
Final Contract Negotiations	September 1 – 5, 2014
Substantial Completion	July 1, 2016

By submitting a proposal, the Proposer affirms that this timeline must be met to avoid the potential for significant harm to the progress of the Project. The DAS and Wi-Fi Systems and Stadium Infrastructure must be completed and ready by July 2016 for Vikings game-day operations well in advance of the 2016 NFL Season.

## II. PROPOSAL REQUIREMENTS AND EVALUATION CRITERIA

Interested Proposers must submit an Indication of Interest and Qualifications by May 23, 2014; 4:00 pm. The Indication of Interest and Qualifications must be delivered via mail or e-mail to:

Steven C. Maki, P.E.  
Metropolitan Sports Facilities Commission  
511 South Eleventh Avenue  
Minneapolis MN 55415  
Email: [steve.maki@msfa.com](mailto:steve.maki@msfa.com)

and to:

Don Becker, Project Executive  
Minnesota Vikings Football, LLC  
Minnesota Vikings – Winter Park  
9520 Viking Drive  
Eden Prairie, MN 55344

Email: [beckerd@vikings.nfl.net](mailto:beckerd@vikings.nfl.net)

#### A. Submittal Requirements – Indication of Interest and Qualifications

The following items shall be included:

- Proposer's name and address of the office that would have central responsibility for the work. If the Respondent is a joint venture, please identify each venturer and their respective percentages of participation.
- Description of how Proposer(s) is/are qualified to provide the DAS and/or Wi-Fi design, construction and implementation services requested in the RFPs and proposed by Respondent. Include descriptions of any similar projects.
- Provide representative list of similar projects managed by Proposer during that last 5 years or that are currently under construction or management. Include:
  - Project name and location.
  - Contracting or ownership entity and key contact or reference from project Owner including name, title, email, and telephone number.
  - Project description; listing dates of construction, seating capacity, project gross square footage and wireless environment cost. Proposers shall be specific about which projects have been worked on by current employees while employed by your firm vs. those that were worked on while employees of another employer. List key principal of Proposer who was responsible for the project.
- Provide copies of Proposer's certificates of insurance showing Proposer's current total limits of liability for commercial general liability, worker's compensation, employer's liability, business automobile liability, and professional liability.
- Provide evidence of Proposer's capacity to provide or obtain bonding in a letter from Proposer's bonding company listing Proposer's single project bonding capacity or limit. If Proposer is a joint venture, describe the joint venture's plan to provide bonding capacity.

#### B. Submittal Requirements – Proposal

As described below, the Authority and Team will evaluate proposals on and between one and three proposals receiving the highest evaluations, as determined by the Authority and Team, will then be selected to enter into final discussions and negotiations. The Authority and Team will select the Proposer(s), if any, whose final proposal is most advantageous to the Authority and



Team as permitted by the Act and according to agreements between the Authority and Team as it relates to final selection of a DAS and Wi-Fi provider.

Please provide the following information

a. Financial

- i. Explain proposed DAS and Wi-Fi business plan(s);
- ii. Proposed Contract Terms;
- iii. Financial Statements and Capital Funding ability for the previous 5 years.
- iv. 10 year proposed financial pro-forma workbook including:
  1. Revenues to be provided to Authority and Team
    - a. Expected Net capital contributions
    - b. Expected Net monthly rent;
  2. Expenses, if any, to be borne by Authority and Team
    - a. Payments;
    - b. DAS and Wi-Fi maintenance and monitoring fees;
    - c. Misc. costs (electrical, utility, insurance costs, etc.);
  3. Profit/Loss Pro-forma
- v. Detail all assumptions made in preparing pro-forma.
- vi. Detail annual escalator for rents and operating costs;
- vii. Timing of revenues.
- viii. Assume year 1 to be 2015, when DAS and Wi-Fi construction would commence.
- ix. Provide financial alternatives such as;
  1. Pre-payments to Authority and Team;
  2. Alternate ownership models
- x. List of all previous or pending hearings or litigation or discovery relating to the providing of Das and/or Wi-Fi services as out lined in this RFP

b. Technical Design

- i. Overall DAS and Wi-Fi technical plan;
- ii. Completed design dimensioning tables and calculations as required by the NFL Wireless design Standards
- iii. Number of proposed sectors/zones;
- iv. Selected DAS and Wi-Fi manufacturers/models and reasons selected;
- v. Estimated number of antennas, remote DAS units and Wi-Fi access points;
- vi. Detail approx. space and power required in IDF closets including rack space and floor square footage;
- vii. Detail approx. space and electrical service needed for the DAS and Wi-Fi head ends and carrier spaces;
- viii. Explain proposed outdoor coverage;
- ix. Explain why conceptual design is technically superior;
- x. Confirm design includes emergency responder and 2 way radio capabilities.

- xi. Detail mobile data and usage statistics available from system;
- xii. Detail NOC capabilities and help desk standards;
- xiii. Explain what technological changes that are expected to occur by 2016 - 2018 that would alter your conceptual design or philosophy.

### C. Description of Proposal Evaluation Process

Submission of a proposal indicates the Proposer(s)' acceptance of the evaluation criteria.

#### **1. Proposal**

The Proposer(s) should provide a detailed description of the proposed solution to the RFP requirements and other benefits to the MMPS. Specifically, Proposer(s) should describe the following:

- Proposed Specifications and Performance of DAS and/or Wi-Fi Systems and Stadium Infrastructure
- Integration with other Stadium Systems and Downtown Wireless Environment
- Proposed operational terms, if any.

#### **2. Price and Terms**

The Proposer(s) must state any cost or financial obligations of the Authority or the Team for the provision of the Facilities described in its proposal. The Proposer(s) should further state the price and terms for the operation, if any, of some or all of the DAS and/or Wi-Fi wireless environment.

#### **3. Respondent Qualifications**

The Authority and Team reserve the right and discretion to determine the qualifications and responsibility of the Proposer(s) to perform the services that they propose pursuant to the RFPs. In order to be considered Responsive, the proposal must provide the following information:

##### **▪ Relevant Design Experience**

Provide up to three past projects of relevant design experience. Please include detailed information regarding Proposer(s)' role in the project, ability to meet the project timeline and photographs of the projects.

##### **▪ Relevant Construction Experience**

Provide up to three past projects of relevant construction experience similar in size and scope to Proposer(s)' offering. Please include detailed information regarding Proposer(s)' role in the project, ability to meet the project timeline and photographs of the projects.

- **Past Performance**

Demonstrate proven methods Proposer(s) has/have used to manage the design, construction and implementation processes to not exceed a specified budget without a loss of quality and still meeting the requirements of the client.

- **Method of Approach**

The Proposer(s)' submittal shall include a narrative of the planned approach (specific to the MMPS) to: delivering a functional design, high performance DAS and/or Wi-Fi end user experience, low maintenance and life cycle cost, maximum financial benefit to the Authority and Team, and managing the project schedule.

- **Risk Mitigation**

Describe any difficulties, challenges or risks Proposer(s) foresee in providing the required DAS and/or Wi-Fi Systems and Stadium Infrastructure, how Proposer(s) expect to manage those difficulties, challenges or risks, and what assistance will be required from the Authority and/or Team. In particular, address how Proposer would intend not to disrupt or interfere in any way with the schedule for the construction of the Stadium and other Stadium infrastructure.

- **Team Strength**

The Respondent will identify which of its proposed team members have worked on comparable projects. The Lead Project Manager shall have recent experience in the management of the DAS and Wi-Fi installation in a Sporting public assembly facility or the required capacity.

- **Workforce**

The Respondent will describe its practices and history of hiring women and minorities. Also describe Respondent's history of achieving goals for MBE and WBE construction participation as required on other projects, and Respondent's proposed strategies for employing women and members of minority communities when hiring to comply with the Stadium Equity Plan.

- **Financial Strength**

The Respondent must be able to provide performance and payment bonds for the construction of the DAS and/or Wi-Fi Systems and Stadium Infrastructure and financial capabilities to secure any proposed operational obligations, if any. Provide 5 years of Financial Statements including capital funding requirements and cash flow analysis to support the construction, installation and optimization of the DAS and Wi-Fi systems.

- **Interviews**

Proposer(s) may be required to participate in an interview. The Authority and Team may interview all critical team members, including (**but not limited to**):

Lead Project Manager

Lead DAS and Wi-Fi Construction Services Project Managers

The Lead DAS and Wi-Fi Site Superintendents

The Lead DAS and Wi-Fi Design Architects

The Authority and Team may also request to interview additional personnel. The Authority and Team may request additional information prior to interviews. All proposed team members must be available in person for interviews on the date specified in this RFP. At the Authority and Team's discretion, substitutes, proxies, phone interviews, or electronic interviews may be allowed.

The interview phase may include Proposer(s) presentation(s). The interview itself will follow a question and answer format.

### **III. Instructions for Submissions**

#### **A. Submission.**

Three copies and one electronic copy of the qualification statement are to be submitted by 4:00 p.m. Central Time, on July 3, 2014. Responses must be sent to:

Steven C. Maki, P.E.  
Metropolitan Sports Facilities Commission  
900 South Fifth Street  
Minneapolis MN 55415  
Email: [steve.maki@msfa.com](mailto:steve.maki@msfa.com)

With three copies and one electronic copy to:

Don Becker, Project executive  
Minnesota Vikings Football, LLC  
Minnesota Vikings – Winter Park  
9520 Viking Drive  
Eden Prairie, MN 55344  
Fax: 952.828.6513  
Email: [beckerd@vikings.nfl.net](mailto:beckerd@vikings.nfl.net)

B. Questions and Inquiries.

Questions regarding interpretation of the content of this RFP must be in writing and directed to Steven C. Maki, P.E. at the address above or via email to [steve.maki@msfa.com](mailto:steve.maki@msfa.com) with copies to Don Becker at the address above or via email to [beckerd@vikings.nfl.net](mailto:beckerd@vikings.nfl.net). Questions may be submitted up June 6 2014; 4:00 pm. If the questions are deemed necessary to provide clarification, an addendum to this RFP will be issued no later than 3 days prior to the submission deadline.

C. Communications.

Firms considering responding to this RFP are strictly prohibited from communicating with any other member of the Authority's Board or staff or Team's Ownership or staff, as all questions concerning this RFP should only be directed to the persons identified in Section A above.

D. Amendments.

The RFPs shall be modified only by a written amendment issued by the Authority. It is the responsibility of the Proposer(s) to verify that they have received and incorporated into their responses, all changes due to Amendments issued to the RFPs.

E. Cancellation; Rejection.

The Authority and Team reserve the right to accept or reject any or all proposals, to amend or alter the selection process in any way, to postpone the selection process for convenience at any time, and to waive any defects in proposals submitted. Proposals are required to remain open and subject to acceptance for a minimum of ninety (90) days following the date of submission of proposals. The Authority and Team also reserve the right to accept or reject any individual subcontractors or subconsultants that the successful Respondent proposes to use.

F. Respondent Costs.

Each Respondent submitting a proposal in response to this request acknowledges and agrees that the preparation of all materials for submittal and all presentation, related costs, and travel expenses are that Respondent's sole expense and the Authority and Team shall under no circumstances be responsible for any cost or expense incurred by the Proposer(s). The Authority and Team shall be allowed to keep any and all materials supplied by the Proposer(s) in response to the RFPs.

G. Minnesota Government Data Practices Act.

All proposals are subject to the Minnesota Government Data Practices Act, Minn. Statutes, Chapter 13. The Act prohibits disclosure of any information derived from proposals submitted by

competing Proposers, and the content of all proposals is nonpublic data under Chapter 13 until such time as notice to award a contract is given by the Authority. Proposers shall note with their proposal any trade secret information or other private data in their submittal, along with a detailed description of the reasons why such data is trade secret or private. If no information is designated as trade secret or private data in the proposal, the information shall be conclusively deemed not to be trade secret or private data.

#### H. Compliance

The successful Proposer(s) shall comply with all Federal, State and local laws, together with all ordinances and regulations applicable to the work. The Proposer(s) shall procure all licenses, permits, or other rights necessary for the fulfillment of their obligation under this document at the Proposer(s) sole expense.

## **2.0 WIRELESS COORDINATION**

**WIRELESS COORDINATION  
FOR THE NEW MINNESOTA MULTIPURPOSE STADIUM  
IN MINNEAPOLIS, MINNESOTA**

1. Wireless Vendor shall include an allowance of \$7,500 for existing sleeves that are currently being installed at seating bowl for pathways to handrails Wi-Fi antenna locations as a change order by the base project. The vendor shall confirm requirement with MSFA, Vikings, and Mortenson of actual cost and the Wireless Vendor will be responsible for reimbursing the project back.
2. Pathways Provided by Others:  
Vertical and horizontal pathways interconnecting Demarc Rooms, Main Telecommunications Room, and all IDF Rooms are furnished and installed by others and available for cabling installations required by this Bid Package. Available horizontal pathways consist of all cable tray as indicated on the Documents. Available vertical pathways consist of a combination of conduit and floor-to-floor sleeves interconnecting the Event Level cable tray systems to the above grade IDF Rooms. Firestopping of horizontal and vertical sleeves or penetrations utilized for installation of cabling shall be the responsibility of this Bid Package.
3. Pathways & Back-Boxes by this Bid Package:  
Furnish and install all backboxes required for the installation of devices or equipment related to this scope of work. All backboxes in finished and/or public spaces shall be flush mounted (concealed) in the wall and/or ceiling construction. All cabling shall be concealed. Cabling shall be installed in conduit within all walls, across exposed ceilings or structure and above inaccessible ceilings. Conduits shall be routed to the nearest accessible ceiling space, cable tray or IDF Room. Cabling above accessible ceilings may be routed without conduit, but appropriate cable supports (J-hooks), and wall sleeves, shall be provided. Furnish and install firestopping of horizontal and vertical sleeves or penetrations installed.
4. Provide vertical pathways as required, utilizing sleeves or conduits as noted on the drawings. Vertical pathways shall be provided within the established technologies riser locations and coordinated with other building systems.
  - a. Existing sleeving may be utilized if not dedicated to another system. Coordinate with General Contractor regarding capacity in existing riser system. Provide addition sleeves and/or conduit as necessary.
5. Any penetration or rough-in requirements necessary in precast are to be coordinated with Hanson Pipe & Precast (9060 Zachary Ln N, Ste 101, Maple Grove, MN 55369, 763-425-5555).



**WIRELESS COORDINATION  
FOR THE NEW MINNESOTA MULTIPURPOSE STADIUM  
IN MINNEAPOLIS, MINNESOTA**

6. Provide horizontal pathways and rough-in as required, utilizing sleeves or conduits as noted on the drawings.
  - a. Existing cable tray may be utilized wherever possible. Coordinate with General Contractor regarding capacity in the existing cable tray system. Subcontractor to provide additional dividers as necessary for segregation of systems and/or additional cable tray or J-hooks as required to support cable installation.
7. Seal all sleeve and raceway penetrations and openings to maintain fire ratings after communications cables are installed.
8. Do not exceed 270 degrees of bends or exceed 100 ft. between pull boxes or access points
9. All cabling shall be installed in conduit or cable tray in areas with exposed or inaccessible ceilings. Exposed cabling is not acceptable unless above an accessible ceiling. When installed above accessible ceilings, Subcontractor to provide proper support (J-hooks) and cable shall be plenum rated as applicable.
10. Vertical and horizontal conduit and back boxes shall be concealed within the building construction wherever possible. Locations on exposed concrete ceilings, walls or columns shall have back-boxes and conduit embedded (concealed) in the concrete structure. Conduit shall be routed from the device location to the cable tray, accessible ceiling or IDF closet. When routed to cable tray the conduit shall terminate with an approved grounding bushing and be bonded to the cable tray.
11. Cable fill to be coordinated as needed with SC 2.4, 3.24a, c, and 8.7 Subcontractors.
12. Provide labels on all communications pull boxes and junction boxes.
13. All conduit over 1" trade size must be three-dimensionally modeled and coordinated with other trades in accordance with the project 3D/4D BIM requirements.
14. Subcontractor shall provide pull strings or ropes in all conduits.
15. Please contact on-site electrical contractor for actual on site conditions: Build 23, Jace Erickson 612-801-4477.

**3.0 DISTRIBUTED ANTENNA SYSTEM (DAS)  
SPECIFICATION (275319)**

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

SECTION 275319

DISTRIBUTED ANTENNA SYSTEM (DAS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. When included as a part of this specifications, the following specification divisions contain related requirements and information:
  - 1. Division 21 Fire Suppression
  - 2. Division 23 Heating, Ventilation, and Air-Conditioning
  - 3. Division 26 Electrical
  - 4. Division 27 Communications
  - 5. Division 28 Security System
  - 6. Division 28 Fire Alarm

1.2 SUMMARY

- A. The Owner is seeking a Contractor/Service Provider to provide a complete and fully functioning and supported neutral host distributed antenna system (DAS) including equipment, installation, support, and maintenance. The Contractor shall provide options for installation, funding, and procurement as well as disclosure revenue opportunities as part of the Vendor's proposal response. The Contractor shall be responsible for providing a neutral host DAS that will support all major and local Cellular Carrier signals. The Contractor shall be solely responsible for negotiating and coordinating all legal agreements, technical requirements, utility costs, and financial/revenue obligations of each Cellular Carriers.
- B. The Contractor shall be fully responsible for supporting and maintaining DAS.
- C. The Contractor shall include the following information in the bid response.
  - 1. Cellular Carrier Agreements, Coordination, and Requirements
  - 2. Procurement Options
  - 3. Financial Obligations and Shared Revenue Opportunities
  - 4. Cellular Carrier Agreements and Utility Service Agreements
  - 5. System Maintenance and Support Options
  - 6. User Support Options – Events, Regular Venue Operations, and Afterhours
  - 7. Public Safety/Emergency Responder Coordination and Requirements
  - 8. DAS Equipment Room
  - 9. DAS Head-End, Infrastructure, Equipment, Remote Units, Antennas
  - 10. DAS Support Systems – Mechanical, Electrical, Plumbing, and Fire Suppression
- D. The DAS shall meet the all coverage and capacity requirements for a professional football stadium based on the highest occupancy allowed by code. The coverage shall be ubiquitous throughout venue in public and non-public area. Coverage shall fully cover football, baseball, concerts, and other event types that may occupy the field area such as trade shows, concerts, conventions and large meetings.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

- E. Contractor shall provide all detailed coordination of antenna placement for approval by Owner and Architect. Work shall include all necessary concealment, facades, and painting to hide equipment including antennas, cables, raceway, remote units, and any other exposed equipment.
- F. The term “provide” used throughout this specification and drawings shall mean “furnish, install, test, certify, support, and maintain”.
- G. Coordinate project schedule, installation schedule, phasing and any other requirements deemed necessary with Construction Manager and all necessary Trades to ensure successful completion of work.
- H. Phasing, temporary distribution/equipment, cut-over and implementation shall be coordinated with Owner, Construction Manager and Architect.
- I. This specification is not intended to contain proprietary information or requirements based on any specific manufacturer or system. Any proprietary information included in this specification is unintentional.
- J. This specification is intended to establish the minimum performance criteria requirements for providing a neutral host distributed antenna system (DAS). The contractor shall coordinate all system and performance requirements and criteria with all DAS users to ensure signal strength, coverage, capacity, and other requirements are all maintained. This includes coordination with Cellular Carriers.
- K. This specification outlines general wireless requirements for implementing a neutral host DAS used for supporting applications such as cellular telephones, two-way public safety (police/fire/EMS radios), two-way building operations radios, and two-way security radios.
- L. The Contractor will coordinate all Public Safety frequencies, preferred manufacturer make/model, antennas, equipment, power conditions and locations with Rod Olson, City of Minneapolis Radio Shop, 612.673.5672 or [Rodney.olson@minneapolismn.gov](mailto:Rodney.olson@minneapolismn.gov).
- M. The DAS shall include an in-building and exterior system. The exact requirements for the exterior system requires coordination with wireless carriers to determine extent and coverage of system. The Contractor shall get written confirmation regarding verifiable DAS performance and cellular strength and capacity requirements from all Carriers for exterior DAS coverage and associate adjustment of macro cells.
- N. Design, furnish, install, and configure a turnkey DAS, wireless carrier interfaces, two-way radio head-end equipment, and system management and monitoring software. Work shall include all necessary radio frequency design, fiber optic backbone, distributed antenna system components and installation thereof required including raceway, cable, cable terminals, transceivers/media converters, amplifiers, equipment, fireproofing, fire suppression, etc. for a fully operational and functional DAS.
- O. The distributed antenna system (DAS) scope of work shall be for a complete and fully functioning DAS system including but not limited to wireless surveys, technical design, procurement, installation, cellular carrier coordination, and full support and maintenance of system. These elements of this scope shall include all necessary components and infrastructure such as DAS head-end, fiber optic backbone, remote units, antennas, antenna cables, horizontal raceway, and miscellaneous power distribution.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

- P. The system shall fully support multi-cast and unicast communications for application including but not limited to audio streaming, video streaming, IPTV, and multi-point video, etc. All necessary licensing and patent agreements shall be included to utilize this technology as part of this work.
- Q. The base project will construct a DAS Equipment Room (shell only). The complete fit-out of the DAS equipment shall be provided by Contractor including all necessary HVAC systems, power distribution, electrical meters, UPS, fire suppression system to cover the entirety of the DAS and main communications room, equipment racks/cabinets, cable trays, raceways, etc. The base stadium project has accommodated a certain amount of spare capacity in the backbone raceway system at comm rooms/risers and cable trays at major routings throughout the facility for the DAS provider to install backbone fiber cable. Any additional infrastructure and/or space required are the responsibility of the Contractor and shall coordinate these with the Owner for approval. Any space required for head-end equipment beyond what is provided in base building shall be provided by contractor in the form of a mezzanine above the DAS Equipment Room. The Contractor shall review and inspect current Construction Documents to determine where this raceway infrastructure exists and what additional infrastructure will be required for their installation. In some cases, backbone and antenna cables may be routed in shared riser conduits and/or cable trays but Contractor must verify Building Codes and Industry Standards for fill capacity requirements. Contractor shall be responsible for field coordinating use of any shared raceway with other trades.
- R. The DAS shall include a real time management and monitoring software control system.. This control system shall be set up and fully configured and monitored offsite in real-time 24-hours per day.
- S. The contractor shall provide all necessary power to DAS room from Electrical Disbriution Board including transformer, panel boards, UPS, receptacles/outlets, and equipment connections, etc.
- T. The Contractor shall provide meters all electrical power distribution to DAS equipment room including DAS head-end, Cellular Carrier base station equipment, air conditioning, lighting, and other support systems. Contractor shall pay the monthly utility costs to Owner.
- U. The DAS solution shall include options for technology that seamlessly offloads a user's cellular service to Wi-Fi. The Contractor shall present options for supporting this technology and information on maintaining quality of service. Additionally, Contractor shall provide options for amount of traffic that can be offloaded and associated requirements for ensuring performance and uptime of Wi-Fi system.
- V. This work shall include onsite wireless/RF surveys, virtual antenna placement, physical design of DAS, submittals, equipment, and installation.
- W. An onsite wireless/RF survey shall be provided to establish existing signal strengths and potential interfering sources. This study shall be completed on all levels and areas and as necessary to finalize locations of antennas as well as validate signal strength and coverage after installation and during commissioning. The Contractor shall coordinate project construction schedule with the Construction Manager to establish milestone dates for substantial completion, that affect occupancy certificates, system completion, commissioning, and turn-over.
- X. The DAS design shall be developed and optimized using wireless software such as iBwave for establishing antenna locations based on electronic architectural drawings and various wireless frequency bands. Construction materials shall be inputted into the software program for

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

structure, walls, floors, and ceilings. This software shall be used to predict antenna locations. Exact locations will need to be field verified using onsite wireless surveys as well as coordinating locations with Owner and Architect for approval.

- Y. The DAS wireless coverage and signal strength shall be field-tested and verified, certified, and guaranteed upon installation against design requirements.
- Z. The DAS shall support major national and local Cellular Carriers including AT&T, Sprint, T-Mobile/MetroPCS, and Verizon Wireless and any new formats the Carriers implement over time such as; 850Mhz LTE 2xMIMO and LTE850-MIMO and PCS LTE 2xMIMO dual streams.
- AA. Contractor shall provide all necessary coordination, requirements and contracts/lease agreements with Cellular Carriers. These shall include but not be limited to equipment room and all DAS technical requirements necessary to interface with base stations, transport the signal, and transmit the signal throughout building and exterior.
- BB. The Cellular Carriers shall be contacted only through the Contract in conjunction with Owner and/or their assigned representative.
- CC. The Contractor shall coordinate support systems requirements directly required by the DAS and Cellular Carrier equipment such as architectural, HVAC, electrical, and technology systems.
- DD. The Contractor shall provide, furnish, and install the required vertical and horizontal raceways and cabling required for the DAS.
- EE. Placement of all equipment including antennas, cable, and electronics shall be coordinated with Owner, Architect, Engineer, and other Construction Trades to ensure neat and functioning installation.
- FF. All antenna locations and cable routing shall be coordinated by the Contractor with the Owner and/or Owner's Representative, Construction Manager, and Architect prior to installation to maintain the highest level aesthetics sought on this project. The Contractor shall position antennas discreetly. Key contact for this activity is Scott Stenman, [stenmans@hammescosports.com](mailto:stenmans@hammescosports.com)
- GG. The installation of the distributed antenna system shall comply with all local building codes, and applicable rules and regulations of the authority having jurisdiction (AHJ), FCC, BICSI, EIA, IEEE, NEC, TIA, UL, and other industry standards, codes, and methods.
- HH. Provide a dedicated fiber optic backbone to support the DAS from the DAS Head-end to remote units and/or intermediate communications room. The Contractor is not permitted to use the building backbone planned to support telecommunications and IT systems.
- II. Extent of DAS work is indicated by Division 27 Specifications and Technology drawings and schedules and is hereby defined to include, but not by way of limitation, the provisions of:
  - 1. Raceway systems including but not limited to conduits, cable trays, sleeves, surface raceways, pull-boxes, junction boxes, back-boxes, etc., as required and specified in Division 27 sections and select Division 26 sections. The Contractor shall coordinate this with the Construction Manager and Sub-Contractor performing work and determine how the scope of work is assigned. The purpose of this specification is to establish design intent and general system scope.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

2. All infrastructure shall be provided as part of this work including but not limited to raceway, cable, cable terminals, room fit-out, etc. unless noted otherwise in this specification and drawings.
3. Horizontal cables between the Intermediate Communications (IC) Rooms and the antennas.
4. Dedicated fiber optic backbone cable between remote units and intermediate communications room and the DAS equipment room.
5. Cable terminations and terminals including but not limited to wiring panels/blocks, patch panels, fiber optic terminals and panels, and outlets/jacks.
6. Patch cords, jumper cables, and cross-connect cables to interconnect wiring terminals, antennas, and electronic equipment.
7. Connection from power supplies to electrical power receptacles located on walls, UPS, and/or vertical power strips. The Contractor shall be responsible for providing all necessary disconnects, transformers, and panel boards required to interface at distribution board located at electrical room serving DAS room.
8. Grounding and bonding of all metallic hardware components to the nearest telecommunications grounding bus (TGB) bar including but not limited to equipment chassis, metallic cable sheaths and shields, cable terminals, conduits, sleeves, etc. Grounding shall include insulated bonding conductors, lugs, and attachment hardware.
9. All physical cable management hardware including, but not limited to: "J-hooks" in accessible ceiling areas, "D-rings" on backboards, horizontal managers in racks and cabinets within all communication rooms, etc.
10. Fire stopping as required.
11. Testing of system, components, and infrastructure as noted by specification, drawings, and applicable industry standards.
12. Testing of all grounding systems as noted by specification, drawings, and applicable industry standards.
13. Labeling of all system equipment, components, hardware, cable, and terminations with mechanically printed labels.
14. Preparation and submission of product data, shop drawings, testing reports, as-built drawings, and cabling documentation as required in this specification.
15. Construction and Installation warranties.
16. Manufacturer components, channel and solutions warranties.
17. Installation and testing of all system and components.
18. Onsite administrative and user training (as applicable).
19. Manufacturer training of components (as applicable).
20. Preparation of maintenance plan recommended by system Manufacturer.
21. Spare parts for immediate onsite maintenance.

1.3 ACRONYMS AND ABBREVIATIONS

A. Provided below is a general list of typical acronyms and abbreviations:

1. 2G: Second Generation mobile telecommunications
2. 3G: Third Generation mobile telecommunications
3. 4G: Fourth Generation mobile telecommunications
4. AHJ: Authority Having Jurisdiction
5. AMPS: Advanced Mobile Phone Service
6. ARPU: Average Revenue Per User
7. BICSI: Building Industry Consulting Services International
8. BTS : Base Transceiver Station
9. CDMA: Code Division Multiple Access
10. DAS: Distributed Antenna System
11. FCC: Federal Communications Commission

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

12. GSM: Global System for Mobile Communications
13. iDEN: Integrated Digital Enhanced Network
14. IEEE: Institute of Electrical and Electronics Engineers
15. LMR/SMR: Land Mobile Radio/Specialized Mobile Radio
16. LTE: Long Term Evolution mobile broadband telecommunications
17. MIMO: Multiple Input / Multiple Output
18. NEC: National Electrical Code
19. PCS: Personal Communications Service
20. PoE: Power over Ethernet
21. POI: Point of interface
22. PSTN: Public Switched Telephone Network land based telecommunications providers i.e. Telephone Company.
23. RF: Radio Frequency
24. SHF: Super High Frequency (3-30 GHz)
25. TDMA: Time Division Multiple Access
26. UHF: Ultra High Frequency (300-3000 MHz)
27. VHF: Very High Frequency (30-300 MHz)
28. WCDMA: Wideband Code Division Multiple Access
29. WiMAX: Worldwide Interoperability for Microwave Access
30. WLL: Wireless Local Loop

1.4 SUBMITTALS

A. General Description and Requirements:

1. In addition to the requirements noted herein, refer to Division 1 Specification for additional requirements.
2. Within 15 days after award of contract or as dictated by the construction schedule (whichever period of time is shorter), the Contractor shall submit prefabrication submittals consisting of product data and shop drawings for approval. Partial submittals will not be accepted without prior written approval from the Architect. Coordinate all submittal dates with Construction Manager.
3. Review of the Prefabrication Submittals by the Architect is for purposes of tracking the work and contract administration and does not relieve the Contractor of responsibility for any deviation from the Contract Documents, or from providing equipment and/or services required by the Contract Documents which were omitted from the prefabrication submittals.
4. No portion of the project shall commence nor shall any equipment be procured until the prefabrication submittals have been approved in writing by the Owner and Architect. All installations shall be in accordance with the Contract Documents.
5. Prefabrication submittals shall be accompanied by a letter of transmittal identifying the name of the project, Contractor's name, date submitted for review, and a list of items transmitted.

B. Bid Documents: Refer to Section 1.14 Bid Information for requirements.

C. Compliance Matrix: Provide a specification compliance matrix indicating compliance or deviation for each item in the specification. Refer to Section 1.14 Bid Information section later in this specification for requirements.

D. Product Data: The DAS Product Data Submittal shall be submitted for review and approval by Owner, Architect, and Engineer prior to starting any work. Information shall include detailed manufacturer's specifications for each component to be installed. Submittal shall include a list every component with Manufacturer's part numbers referenced, and, if available, Manufacturer



MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

data sheets with features, options, ratings, and performance. Product numbers and options to be used shall be highlighted with color marker.

1. Component List: Provide complete submittal component list at the beginning of the submittal package. Component list shall identify each component name, manufacturer, and specific product/part number. All part numbers shall clearly indicate special options, color, accessories, etc.
  2. Cut-Sheets: Submit manufacturer's cut-sheets on all components listed within this specification and corresponding appendix. All components and parts being used shall be highlighted in color or clearly underlined on cut-sheets to distinguish specific product/part numbers, options, colors, accessories, etc.
  3. Product Substitutions: This specification is intended to be performance based, thus requirements and products noted are benchmarks. The Contractor may substitute manufacturers and models that may be more cost effective or readily available. All substitutions shall meet or exceed the minimum functional, physical, and technical specifications. Acceptance of such substitutions is at the discretion of the Owner, Architect, and Engineer. Additionally, the requirements of Division 1 Specifications shall apply and may supersede requirements noted herein.
  4. Schedule: A detailed completion schedule shall be submitted with the prefabrication submittals.
  5. Warranty Information: Provide all warranty information as described in this specification section for review and approval.
  6. Product Certificates: Signed by manufacturers of systems certifying that products furnished comply with requirements.
  7. Installer Certificates: Provide manufacturer certification signed by manufacturer certifying that installers have been trained to install all components of the system and comply with manufacturer's requirements.
- E. Equipment Coordination and Mock-Ups:
1. Contractor shall provide all detailed coordination of antenna placement for approval by Owner and Architect. Work shall include all necessary concealment, stealthing, facades, and painting to hide equipment including antennas, cables, raceway, remote units, and any other exposed equipment.
  2. Contractor shall provide full-scale mockups in stadium for all typical equipment placement including remote units, antennas, backbone/antenna/power cable routing, conduits, etc. Mockups shall include all painting and stealthing to match condition to be installed.
  3. Contractor shall present mock-ups for approval to Owner, Construction Manager, Architect, and Engineer prior to installation.
- F. NFL Standards Compliance: Complete DAS design documents and product data submittal shall be submitted to Qualcomm (the NFL's current reviewer) for approval to ensure design complies with NFL standards. Approved design compliance shall be received prior to completing any DAS construction work and procurement.
- G. Coordination Data: A detailed equipment and component schedule with supporting manufacturer cut-sheets shall be developed for all components and equipment for architectural, engineering, and construction coordination. These documents shall include electrical requirements (volts, phase, amps, power consumption, receptacle configuration, etc.), UPS requirements, heat dissipation, temperature operating range, target operating temperature, physical equipment sizes (LxWxH, rack units, racks, cabinets, panels, etc.).
- H. Shop Drawings: The DAS Shop Drawings shall be submitted for each "construction phase configuration" and "final configuration" prior to starting any work for review and approval by Owner, Architect, and Engineer. Additionally, Shop Drawings shall be used for coordination

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

with Construction Manager and Trades by this installer. Information shall include all drawings necessary to present installation intent including plans, enlarged plans, elevations, sections, details, and interface to other work or systems.

1. Legend Sheet: Provide drawings including descriptions of all abbreviations and symbols.
  2. One-Line Diagrams: Provide drawings that indicate backbone and horizontal cable infrastructure, antennas, and all equipment. Drawings shall include relevant information such as room numbers, panel numbers, cable and raceway requirements.
  3. Floor Plans: Provide scaled plan drawings based on architectural background indicating device and equipment locations including point of interface (POI) antennas, radiating cable antennas, backbone and horizontal cable distribution, panels, conduits, back-boxes, junction boxes, etc. Additionally, provide wiring diagrams for indicating cable origination and routing.
  4. Enlarged Plans: Provide enlarged scaled plan drawings for equipment layouts in communications rooms.
  5. Elevations: Provide scaled drawings for elevations of all equipment layouts in communications rooms, equipment racks, and panels.
  6. Details: Provide detail drawings as required to show components requiring greater detail. This should include various antenna types and mounting configurations.
  7. Labeling: Provided documentation of all labeling schemes for conduit, back-boxes, junction boxes, antennas, panels, cable, terminations, patch panels, cross-connects, patch panels, etc.
  8. Test Results: Provide all final RF test results in a table or matrix as well graphically on plan drawings. Test results shall indicate the signal strengths and interference levels (signal-to-noise, Eb/No, or equivalent).
- I. As-Built Drawings: The DAS As-Built Drawings shall be submitted to Owner after completing work. As-Built Drawings shall indicate final installation of system. Information shall include all drawings necessary to present final installation intent including plans, enlarged plans, elevations, sections, details, and interface to other work or systems.
1. Legend Sheet: Provide drawings including descriptions of all abbreviations and symbols.
  2. One-Line Diagrams: Provide drawings that indicate backbone and horizontal cable infrastructure, antennas, and all equipment. Drawings shall include relevant information such as room numbers, panel numbers, cable and raceway requirements.
  3. Floor Plans: Provide scaled plan drawings based on architectural background indicating device and equipment locations including point of interface (POI) antennas, radiating cable antennas, backbone and horizontal cable distribution, panels, conduits, back-boxes, junction boxes, etc. Additionally, provide wiring diagrams indicating cable origination and routing.
  4. Enlarged Plans: Provide enlarged scaled plan drawings for equipment layouts in communications rooms.
  5. Elevations: Provide scaled drawings for elevations of all equipment layouts in communications rooms, equipment racks, and panels.
  6. Details: Provide detail drawings as required to show components requiring greater detail. This should include various antenna types and mounting configurations.
  7. Labeling: Provided documentation of all labeling schemes for conduit, back-boxes, junction boxes, antennas, panels, cable, terminations, patch panels, cross-connects, patch panels, etc.
  8. Test Results: Provide all final RF test results in a table or matrix as well graphically on plan drawings. Test results shall indicate the signal strengths and interference levels (signal-to-noise, Db/No, or equivalent).

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

- J. Field Test Reports: Indicate and interpret test results for compliance with performance requirements of installed systems.
- K. Commissioning:
1. Check-List: Contractor shall create and submit a detailed checklist for commissioning system equipment and components. The list shall be submitted for Owner review. System commission shall include the following categories.
    - a. Procured Components Validation
    - b. Physical Installation and Location
    - c. Equipment Connectivity and Inter-Connectivity
    - d. Support Systems Functioning (HVAC, electrical, and UPS)
    - e. System Setup and Operation
    - f. Wireless Surveys
    - g. Testing
  2. Report: The Contractor shall complete commissioning of the system and issue a final report. Commissioning shall be performed upon completion of system, and after its testing and retuning. Report shall be completed and finalized by the Contractor prior to system acceptance by Owner. A formal report shall be generated that includes sign-off and notes of all checklist items.
- L. Maintenance Information: The Contractor shall provide Maintenance Manuals for the DAS equipment and components as specified in Division 1. Maintenance information shall include the following:
1. Detailed operating instructions under both normal and extraordinary conditions.
  2. Routine maintenance requirements for system components.
  3. Lists of spare parts and replacement components recommended for storage at the site for ready access.
- M. Warranties: The Contractor shall fully warranty and provide necessary maintenance on all parts, components, and labor for the entire duration of the DAS agreement with Owner. Warranty period shall start based on acceptance by Owner upon completion, testing and acceptance of the installation by the Wireless Carriers.
- N. Documentation: All documents submitted by Contractor including product data, submittals, as-built, test results, drawings, reports, etc. shall be provided in electronic (pdf) and paper format.
- O.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: The installation supervisor for both installation and maintenance of units required for this Project must be an experienced installer who is an authorized representative of the DAS manufacturer.
1. Contractors shall have at least five (5) years of successful installation experience with projects utilizing wireless systems including DAS.
  2. The Contractor shall have a fully staffed office with technical installations support personnel within 30 miles of the project.
  3. The company shall be a certified installer of the DAS manufacturer, and shall provide a 1-year warranty on installation/applications.
  4. The company shall be a certified installer of structured cabling systems, and shall provide a 25-year warranty on installation/applications.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

5. The Contractor shall have a professional engineer licensed to practice in jurisdiction where Project is located and who is experienced in providing engineering services of similar scope. The Contractor's design shall be reviewed, signed, stamped, and sealed by the engineer.

B. Manufacturer and Product Qualifications

1. Provided products shall come from manufacturers regularly engaged in the production of DAS and wireless systems.
2. Provide products from manufacturers whose products of similar types, capacities, and characteristics have been in satisfactory use in similar projects for not less than five (5) years.

C. Products and Substitutions: Other manufacturers' products complying with requirements may be considered. All manufacturer solutions, products components and/or substitutions shall be submitted at bid time for review and acceptance by Owner. Cost changes including additions or deductions, shall be submitted for all items.

D. Alternates: All alternates requested or proposed by the Contractor shall be submitted at bid time for review and acceptance by Owner. Cost changes including additions or deductions shall be submitted for all items.

E. Electrical Components, Devices, and Accessories: These shall be listed and labeled as defined in NFPA 70, NEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. All materials shall be Underwriters Laboratories (UL) Listed unless otherwise noted or required by AHJ.

1.6 CODES AND STANDARDS

A. All work including materials and installation shall conform to all applicable sections of currently adopted editions of the codes and standards listed below or the codes, standards and specifications published by the organizations listed below:

1. Uniform Building Code (UBC).
2. State and local codes.
3. ANSI: American National Standards Institute (ANSI).
4. ANSI/EIA/TIA-526: Standard Test Procedures for Fiber Optic Systems.
5. ANSI/EIA/TIA-568-C: Commercial Building Telecommunications Cabling Standard.
6. ANSI/EIA/TIA-569-A: Commercial Building Standard for Telecommunications Pathways and Spaces.
7. ANSI/EIA/TIA-606A: Administrative Standard for Commercial Telecommunications.
8. ANSI/EIA/TIA-607: Commercial Building Grounding and Bonding Requirements for Telecommunications.
9. ASTM: American Society for Testing and Materials
10. BICSI TDM Telecommunications Distribution Methods Manual (current edition).
11. BICSI Wireless Design Reference Manual (current).
12. EIA/TIA TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling.
13. Federal Specification Compliance: Comply with applicable requirements of FS W-C 586, "Electrical Cast Metal Conduit Outlet Boxes, Bodies, and Entrance Caps."
14. ICEA: Insulated Cable Engineers Association
15. IEEE: Applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141 and 142 pertaining to grounding and bonding of systems, circuits and equipment.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

16. IEEE-802.11 a, b, g, n: Wireless Local Area Networks
17. IEEE-802.3: 10Mb/s, 100Mb/s, 1Gb/s, and 10Gb/s Ethernet Standards as applicable based on media types (twisted pair copper, fiber optics, etc.)
18. IEEE-802.3ak: 10Gb/s Ethernet (evolving copper standard).
19. IEEE-802.3af: Power-over-Ethernet (PoE).
20. IEEE-1100-1999: Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.
21. IEEE-141: Comply with applicable requirements for installation of cable tray systems.
22. IEEE-241: Recommended Practice for Electric Power Systems in Commercial Buildings.
23. ISO/IEC 11801: International Standard on Information Technology – Generic Cabling of Customer Premises.
24. NEC: Applicable local electrical code requirements of the authority having jurisdiction, and the NEC as applicable to electrical boxes and fittings, cable tray systems, and grounding and bonding, pertaining to systems, circuits and equipment.
25. NESC: National Electrical Safety Code
26. NEMA: Applicable requirements of NEMA Stds/Pub No.'s OS1, OS2 and PUB 250 pertaining to raceways, outlet and device boxes, covers, and box supports.
27. NEMA: NEMA Stds/Pub No. VE 1 "Cable Tray Systems"
28. NFPA-70/NEC: National Electrical Code.
29. NFPA-70B: "Recommended Practice for Electrical Equipment Maintenance" pertaining to installation of cable tray systems.
30. UL Compliance.
31. UL Compliance: Applicable requirements of UL 50, UL 514-series, and UL 886 pertaining to electrical boxes and fittings.
32. UL Compliance: Applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment", and 869 "Electrical Service Equipment", pertaining to grounding and bonding of systems, circuits and equipment. In addition, comply with UL Std 486A, "Wire Connectors and soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL-listed and labeled for their intended usage.

- B. Where there is a conflict between the code and the contract documents, the code shall have precedence only when it is more stringent than the contract documents. Items that are allowed by the code but are less stringent than those specified on the contract shall not be substituted.

1.7 PROJECT CONDITIONS

- A. Prior to submitting a proposal, the Contractor shall inspect the Contract Documents, and shall become fully informed as to laws, ordinances, and regulations affecting the project. The Contractor shall immediately bring to the Owner, Architect, and Engineer's attention, in writing, any existing condition or statute that contradicts, is in conflict with, or negates the Contract Documents. Failure of the Contractor to become fully informed as to all above mentioned items shall in no way relieve the Contractor from any obligations with respect to its proposal.
- B. The Technology Drawings schematically depict locations of major equipment and components. Field conditions and coordination with related trades may warrant relocations of field devices. No additional compensation will be allowed due to these revisions.
- C. System components and equipment shall be rated for the environments where installed. Normal temperature range requirements for each area within the project will be identified per the following categories noted below.
1. Exterior Areas: -20 to +140°F (-29 to +60°C)
  2. Interior Areas-Seasonal: +32 to +104°F (0 to +40°C)

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

3. Interior Areas-Temp Controlled: Typ. 72°F (22.2°C) but range over +50 to +104°F (+10 to +40°C)
4. Riser Shafts: -20 to +140°F (-29 to +60°C)
5. Communication Rooms: Typ. 69°F (20.5°C) but range over +32 to +104°F (+0 to +60°C)

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Equipment and components shall be delivered in factory-fabricated containers or wrappings, which properly protect equipment from damage.
- B. Equipment and components shall be handled carefully to prevent damage including but not limited to breakage, denting or scoring of surfaces, etc. Do not install damaged units or components; replace with new. Replace damaged units or components following installation with new ones.
- C. Equipment and components shall be stored in original packaging in a dry, clean, well-ventilated space, and shall be protected from construction traffic, weather, moisture, soiling, humidity, and extreme temperatures.

1.9 SEQUENCING AND HANDLING

- A. All work shall be reviewed and coordinated with the Construction Manager and/or General Contractor prior to commencing.
- B. DAS, infrastructure, and equipment are sensitive to environmental conditions including but not limited to temperature, dirt, dust, and water. The contractor shall ensure the storage and installation of all system components are sequenced and scheduled accordingly to prevent any damage, loss of performance, and warranty voiding. All mis-installed components shall be replaced with new parts and re-installed at the contractors' expense.
- C. Installation shall be coordinated with Structural, Electrical, HVAC, Plumbing, Fire Protection, and other trades to eliminate disruption and/or conflict with other systems.
- D. Installation of DAS and infrastructure shall be sequenced with other work to minimize possible damage and soiling during the remainder of construction.

1.10 COORDINATION

- A. The Contractor shall:
- B. Coordinate Work of this Section with the requirements of each wireless service provider.
- C. Coordinate layout and installation of DAS equipment, antennas, and radiating cable with other construction that penetrates ceilings or is supported by them, including but not limited to light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- D. Coordinate location of cabling, antennas, and associated concealment with other trades.
- E. Coordinate location of equipment in the communications rooms and spaces with the Owner and Architect.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

1.11 SPARE COMPONENTS AND EQUIPMENT

- A. The Contractor shall maintaining all appropriate spare components and equipment as necessary to ensure operation of the system. The Contractor shall outline their specific plan.

1.12 WARRANTY

- A. The Contractor shall be responsible for coordinating warranty requirements and/or issues with their preferred DAS Manufacturer and sub-contractors. The Contractor shall ensure that a warranty is in place for replacement of components to ensure uptime of system. Typical warranty requirements are listed below but it's the Contractor's sole responsibility to obtain warranties of their system.
- B. The warranty requirements shall comply with Division 1 and as noted in this Section. Any conflicts shall meet the most stringent required unless approved otherwise by Owner.
- C. A one (1) year warranty on the Work shall be provided by the Contractor. If, within one (1) year after the date of final acceptance by Owner of the installation or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents or provided by a manufacturer, any of the work or equipment is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly including all parts and labor after receipt of notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This obligation shall survive termination of the contract. The Owner shall give such notice promptly after discovery of the condition. Such notice shall be provided by Owner representatives, to be identified, either verbally or in writing. Warranty period shall start based on acceptance by Owner upon completion, testing and acceptance of the installation by the Wireless Carriers.
- D. The manufacturer shall provide a warranty with a minimum term of 25 years for all structured cabling systems. This warranty shall cover all components including cable, terminations, patch panels, and wiring panels, etc. to maintain the specified performance and physical criteria. Any such components, link, or channel shall be replaced by the Manufacturer at no cost to Owner during this period. The Contractor and Manufacturer shall submit all information and documentation on Warranty.
- E. Nothing contained in the Contract Documents shall be construed to establish a shorter period of limitation with respect to any other obligation which the Contractor might have under the Contract Documents or any manufacturer's warranty. The establishment of the time period of one (1) year after the date of final acceptance or such longer period of time as may be prescribed by law or by the terms of any warranty required by the Contract Documents relates only to the specific obligation of the Contractor to correct the work or equipment, and has no relationship to the time within which his obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to his obligations other than specifically to correct the work or equipment. Warranty period shall start based on acceptance by Owner upon completion, testing and acceptance of the installation by the Wireless Carriers.
- F. Warranty response shall be as listed in Section 1.13 Response Time.
- G. If system operation is not fully restored during the warranty period within 24-hours, the Owner reserves the right to require the Contractor to provide on-site manufacturer's service technicians at no additional cost.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

- H. The Owner reserves the right to expand or add to the system during the warranty period using firm(s) other than the Contractor for such expansion without affecting the Contractor's responsibilities, provided that the expansion is done by a firm which is an authorized dealer or agent for the equipment of system being expanded.
- I. Special warranty specified in this Specification shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
  - 1. Special Warranty for DAS and Components: There shall be a written warranty, signed by the manufacturer and Installer agreeing to correct system deficiencies and replace components that fail in materials or workmanship within a specified warranty period when installed and used according to manufacturer's written instructions. This warranty shall be in addition to, and not limiting, other rights Owner may have under other provisions of the Contract Documents.
  - 2. Contractor shall guarantee coverage and fix any coverage gaps or incorrect signal strengths at no cost to the Owner. The Owner will not accept the system at turn-over until the system has been field tested, verified, certified, and guaranteed that coverage limits have been fulfilled.
  - 3. Contractor shall guarantee the Wireless Carriers and Service Providers will connect to the DAS provided as part of this work.
  - 4. Contractor shall guarantee the Two-Way Radio Systems supporting Building Operations, Security, and Public Safety will connect to the DAS as part of this work.

1.13 RESPONSE TIME (WARRANTY AND MAINTENANCE)

- A. Response time to failure of system, equipment, and/or component during warranty period and maintenance periods shall meet same requirements as Shared In-Building Wireless System License Agreement between Owner and Cellular Carriers.
- B. Refer to Appendix-C for response time requirements and definitions.

1.14 BID INFORMATION

- A. Instructions to Bidders
  - 1. The following is a partial list of instructions. Bidders shall provide a complete proposal including all information requested in the Contract Documents.
  - 2. Any questions or misunderstanding should be submitted in writing with the bid.
  - 3. Copies of the bid proposal shall be submitted to the Owner, Architect, and Engineer for review and approval.
  - 4. Bidders shall prepare equipment lists showing each item included in the bid. Equipment Lists must include the quantity, model number, manufacturer and price of each item listed under the generic description.
  - 5. Bidders shall provide a detailed description of any and all voluntary alternates and include cost changes in the Voluntary Alternate Bid forms. Bidders should submit voluntary alternates that will either provide for a better system or reduce costs without degrading the system. This includes alternate manufacturer and product substitution.
  - 6. If Drawings and Specifications do not directly coincide, or coincide individually, the item of better quality, greater quantity and/or higher cost shall be included in the base bid.
- B. Unit Pricing and Labor Rates



MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

1. Unit prices and labor rates submitted with the bid proposal shall be used for all additions, deductions, and alterations of the original contract and shall further be used for future purchases by the Owner from the Contractor for one (1) year from the date of final acceptance of the system.

C. Compliance

1. Bidders shall submit a Statement of Qualifications with their bid proposal that shall include the following information:
  - a. Company name, address, telephone number and contact person.
  - b. Brief company history.
    - 1) Years in business.
    - 2) Number of employees.
    - 3) Location of Headquarters and branch offices, including international locations.
  - c. Resumes of key personnel.
  - d. Local staffing description (job descriptions and numbers of persons in each position).
  - e. Local service capabilities (hours of operation and parts availability).
  - f. Technician factory certifications.
  - g. Description of local engineering and project management capabilities.
  - h. Line sheet listing major suppliers of security equipment.
  - i. Annual dollar value of sales, installation and service of each product line carried.
  - j. List of all projects and references for all projects completed in the last five years, including a brief project description, location, construction cost, and completion date.
  - k. List of references describing five (5) completed projects of similar size and complexity, including names and telephone numbers of the contact persons.
  - l. List of references describing similar projects completed in the area and in the last year including names and telephone number of the customer's contact person.
  - m. List of similar projects currently under construction in the area including names and telephone numbers of the customer's contact person.
  - n. Licensing information.
2. Bidders shall provide a specification compliance matrix indicating compliance or deviation for each item in the specification. The matrix shall be comprised of a list of all numbered paragraphs that appear in this Specification. Compliance of the proposed equipment and/or services shall be indicated by the word "Comply" following each paragraph number. Exceptions to the requirement shall be indicated by the word "Exception" following the applicable paragraph number. Should the proposed equipment and/or services not entirely comply with the requirements specified, but ultimately achieve the intent, the Bidder shall explain fully the extent, or lack thereof, of compliance for the applicable equipment and/or services proposed. Instances where there is no indication of compliance or exception shall be considered non-compliant. This matrix is critical for proposal evaluation. Failure to submit the matrix may result in the disqualification of the bid. Contractor shall submit Compliance Matrix with the Bid Proposal AND at the time of Product Data submittal (as indicated previously in this specification) so that a complete submittal review can be performed.
3. Additionally, and as described in this Specification, bidders shall submit the following information with their bid proposal:
  - a. Manufacturer's literature sheets for all standard manufactured items included in the equipment list and as proposed in the Voluntary Alternate Bid form, if applicable.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

- b. Workload and capability statements. The statements shall detail projects that will be active during the completion of this project, and the manpower that would be available for this project.
  - c. Confidentiality and return statements. The statements shall guarantee that the Contract Documents shall not be copied or distributed physically or verbally. The Contractor shall also assure the Owner that the Contract Documents shall be returned in their entirety upon request. The successful Contractor will be provided with as many copies as requested.
- 4. Certain paragraphs of the Specification require the Bidder to provide information (possibly not listed above) in the proposal to demonstrate compliance with a requirement. If the Bidder fails to provide detailed responses to these items, the proposal will be deemed to be non-compliant to the paragraphs stated.
  - 5. Bidders shall number all pages of the bid submittal.

D. Specification Response

- 1. The Bid Response Documents shall provide an overview and narrative description of the system architecture including but not limited to topology, application point of interfaces, backbone infrastructure, horizontal infrastructure, cables, terminals, amplifiers, repeaters, media converters, taps, splitters, and antennas.
- 2. The Bid Documents shall include a complete RF analysis of the project site as well as a complete design. The design shall include antenna layouts and cable routing. This information will be used to verify compliance with the DAS Specification, the extent of the Bidder's proposed solution, and the DAS Scope of Work.
- 3. The Bid Documents shall include a full design including Product Data Submittals and Shop Drawings Submittal per the requirements noted below. The Bid Response Documents shall include a complete and comprehensive discussion of the products, processes, techniques, and methods that will be used to accomplish the tasks and functional requirements.
- 4. The Bid Response Documents shall include unit pricing for all components, cable, software, hardware, licenses, and labor.
- 5. The Bid Response Documents shall include all Service Agreements, Warranties, and Guarantees.
- 6. The Bid Response Documents shall include an implementation schedule and project timelines starting from Contract Procurement to System Turn-Over.
- 7. The Bid Response Documents shall include expected annual maintenance costs, consisting of:
  - a. Annual maintenance cost beyond expiration of warranty.
  - b. Annual maintenance for any items required outside of warranty.
  - c. Annual maintenance for each year up to 5-years following the warranty period.
- 8. The Bid Response Documents shall include Customer Obligations.
- 9. The Bid Response Documents shall include a complete bill of materials indicating quantities, length, etc. of all components, cable, software, hardware, licenses, and labor required to complete the project.
- 10. The Bid Response Documents shall include any alternate or optional items that should be considered by Owner that has not been included in Base Bid. The Owner wants to ensure that they are aware of any items that should be evaluated that may enhance or allow support of future technologies.
- 11. The Bid Documents shall include completion of Appendix-A: Additional Bidder Questions
- 12. The Bid Document shall include completion of Appendix-B: Bidder's DAS Design Assumptions

PART 2 - PRODUCTS

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, products and solution shall be provided by one of the following DAS Manufacturers:

1. Andrew/Commscope
2. Solid
3. TE Connectivity
4. Corning/Mobile Access
5. Others based on Contractor's preference.

2.2 DISTRIBUTED ANTENNA SYSTEM

A. General Requirements:

1. The DAS shall be a single broadband radio frequency (RF) infrastructure that supports a wide range of current and future wireless technologies, protocols, and services. It shall be able to supply wireless services to multiple applications concurrently.
2. The system shall fully support multi-cast and unicast communications for application including but not limited to audio streaming, video streaming, IPTV, and multi-point video, etc. All necessary licensing and patent agreements shall be included to utilize this technology as part of this work.
3. The DAS shall include an in-building and exterior system. The exact requirements for the exterior system require coordination with wireless carriers.
4. The DAS shall be an in-building wireless system and exterior wireless system for supporting frequencies in the 450 to 2500 MHz range and expandable to support emerging technologies up to 6000 MHz.
5. The DAS shall support all frequencies currently used by national and local Cellular Carriers including the following current technologies:
  - a. AT&T: LTE-1900 (MIMO)
  - b. AT&T: LTE-700 (MIMO)
  - c. AT&T: LTE-2100 (MIMO)
  - d. AT&T: UMTS-850
  - e. AT&T: UMTS-1900
  - f. Verizon: CDMA-850
  - g. Verizon: EVDO-1900
  - h. Verizon: LTE-700 (MIMO)
  - i. Verizon: LTE-2100 (MIMO)
  - j. Sprint: CDMA-800
  - k. Sprint: CDMA-1900
  - l. Sprint: iDen-900
  - m. Sprint: LTE-1900
  - n. T-Mobile: GSM-1900
  - o. T-Mobile: LTE-2100
  - p. T-Mobile: UMTS-1900
  - q. T-Mobile: UMTS-2100
  - r. T-Mobile/MetroPCS: CDMA-1900
6. The system shall provide a dominant signal within each individual antenna's specific coverage area to overcome any existing signal by at least 10 dB and provide a minimum signal strength of -85 dBm within 95% of covered building areas.
7. Contractor shall ensure that ubiquitous coverage is provided throughout the facility, all levels, and seating bowl.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

8. All DAS components shall be the latest components available on the market. All components shall be new and have been manufactured within 6-months of installation.

- B. Equipment, Infrastructure, and Components: The system shall include a fiber optic backbone, horizontal cable, antennas, power supplies, transceivers, media converters, head-ends, and all other necessary components required to distribute wireless services throughout the building. The system shall utilize Point of Interface (POI) devices to interface with wireless telephone carrier networks, and two way radio systems including but not limited to Ops, Security, and Public Safety.
- C. Signal cables and connected components shall be protected against transient-voltage surges by suppressors and absorbers designed specifically for the purpose in required areas.

### 2.3 ANTENNAS

- A. The Contractor shall propose antennas for each condition for approval by Owner and Architect.
- B. Typical system antenna types shall conform to the following requirements:
  - 1. Broadband Log Periodic Antenna: Provides contiguous broadband directional RF signal power radiation.
    - a. Frequency Range: 420 to 2500 MHz.
    - b. Mounting: Pre-affixed bracket for bolting to any fixed structure.
    - c. Radome must be rated to UL 94V0 Plenum standards for installation above ceiling in plenum rated lay in ceilings.
  - 2. Low Profile Broadband Log Periodic Antenna: Provides contiguous broadband directional RF signal power radiation.
    - a. Frequency Range: 420 to 2500 MHz.
    - b. Mounting: Pre-affixed bracket for bolting onto flat and non-metallic ceiling and wall structure. Must be able to mount above lay-in ceiling.
    - c. Radome must be rated to UL 94V0 Plenum standards for installation above ceiling in plenum rated lay in ceilings.
  - 3. Broadband Omni Antenna: Provides contiguous broadband omni-directional RF signal power radiation.
    - a. Frequency Range: 420 to 2500 MHz.
    - b. Mounting: Pre-affixed bracket for bolting to any fixed structure.
    - c. Radome must be rated UL 94V0 plenum standards for installation above plenum lay in ceilings.

### 2.4 DISTRIBUTED ANTENNA SYSTEM COMPONENTS

- A. The system components shall meet the following requirements:
- B. Point of Interface (POI):
  - 1. Provide the neutral demark point-of-interface for RF services to be distributed over the DAS.
  - 2. Provide multiple connections among the primary RF services frequency bands (e.g. 450 to 512 MHz, 746 to 960 MHz, 1700 to 2170 MHz, 2.4 GHz WiMAX) to accommodate proposed wireless carriers, public safety services, in-house building operations, and any other service identified in this specification.
  - 3. Primary DAS head-end equipment shall include a data network interface for connecting to Management and Monitoring System. Interface shall be 10/100/1000 Mbps Ethernet (RJ45).

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

C. Remote Distribution Units:

1. Provide Remote Distribution Units or Expansion Units at Intermediate Communication Rooms and above ceilings as necessary to transition from single-mode fiber optic backbone to horizontal antenna cables (horizontal distribution).
2. Provide multiple connections among the primary RF services frequency bands (e.g. 450 to 512 MHz, 746 to 960 MHz, 1700 to 2170 MHz, 2.4 GHz WiMAX) to accommodate proposed wireless carriers, public safety services, in-house building operations, and any other service identified in this specification.
3. The remote units shall include a data network interface for connecting to Management and Monitoring System. Interface shall be 10/100/1000 Mbps Ethernet (RJ45).

2.5 SIGNAL TRANSMISSION COMPONENTS

A. The signal transmission components shall be of the following types and meet the following requirements

B. Cables:

1. Types:
  - a. Single-Mode Fiber Optic
  - b. Cat. 6A UTP
  - c. RG59 75-ohm Coaxial
  - d. RG6 75-ohm Coaxial
  - e. 1/2" 50-ohm Coaxial
  - f. 7/8" 50-ohm Coaxial
  - g. 7/8" Radiation Coaxial (Radiax or Leaky Coax)
2. Ratings: All cable shall be UL-Listed for use in plenums.

C. Terminals and Connectors: Equivalent to cable type and performance capabilities. Contractor shall provide connectors and terminals approved to work and comply with Manufacturer's system.

D. Cable Hangers: "Clic" Self Locking Hangar or approved equal.

E. Transmissions methods and components vary by manufacturer, so this information shall be submitted in detail at bid time for review and acceptances by Owner.

2.6 PUBLIC SAFETY SYSTEMS

A. Law Enforcement:

1. The DAS shall include all necessary head-end equipment to rebroadcast all Local Public Safety and any Federal Law Enforcement radio traffic. The Contractor shall coordinate Public Safety requirements including equipment and radio frequencies, etc. with each authority.
2. System requirements shall meet Police Department's current wireless communication standards.
3. Contractor shall provide equipment and components recommended by Manufacturer based on proposed solution.

B. Fire Department and EMS:

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

1. The DAS shall include all necessary head-end equipment to rebroadcast all Fire Department and EMS Two-Way Radio Communications System.
2. The Contractor shall coordinate Public Safety requirements including equipment and radio frequencies, etc. with each authority.
3. System requirements shall meet Fire Department and EMS's current wireless communication standards.
4. Contractor shall provide equipment and components recommended by Manufacturer based on proposed solution.

2.7 BUILDING OPERATIONS SYSTEM

A. General:

1. The DAS shall include all necessary head-end equipment rebroadcast the Owner's Building Operations Two-Way Radio and messaging Communications System.
2. Coordinate requirements including radio frequencies with Owner's RF Strategy and Frequency Allocation Schedule.
3. Contractor shall provide equipment and components recommended by Manufacturer based on proposed solution.

2.8 GPS SYSTEM

A. General:

1. The DAS shall include (2) GPS receivers and antennas located on the roof for location-based services.
2. Contractor shall provide GPS distribution panels at the DAS Room for the base station interfaces for each GPS receiver and antennas.
3. Contractor shall provide equipment and components recommended by Manufacturer based on proposed solution.

2.9 MANAGEMENT AND MONITORING SYSTEM

A. General:

1. The DAS shall be installed with Management and Monitoring System.
2. The DAS shall be remotely monitored by Contractor.
3. The Management and Monitoring System shall provide for interactive interfaces to all major DAS electronic components including base head-end, remote units, antenna points, and power supplies. The DAS components shall be interfaced to the facility's converged data network.
4. The Management and Monitoring System shall allow for real-time remote management and monitoring of the DAS.
5. The Management and Monitoring System shall have a customizable graphical user interface (GUI) for visual display and indication of system status. The GUI shall include the following minimum criteria:
  - a. Facility maps with interactive equipment icons of major system components and antenna locations.
  - b. Interactive equipment icons, color coded to indicate current status and clickable by mouse to show device information, status, log, configuration, etc.

B. System Features:

C. The Management and Monitoring System software shall incorporate the following features:

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

1. Remote Equipment Configuration and Troubleshooting
2. Graphical User Interface (GUI)
  - a. Facility Maps with Interactive Icons (equipment and antennas)
  - b. Color coded icons for quick visual reference.
  - c. Equipment Status (threshold, status, alarm, etc.)
3. Alarm Notification
  - a. Equipment and Antenna Status
4. Web Based Access
  - a. VPN credentials and User Login
  - b. Remote Diagnostics
5. Logs
  - a. Status
  - b. Alarm and Events
  - c. History
  - d. Performance
  - e. Maintenance
  - f. Users
  - g. System Inventory
  - h. Configurations
6. Maintenance Schedule, Alerts, Reminders, Notification, and Logs
7. System Administration
  - a. Administrator Login, Passwords, and Security Access Level
  - b. Users Login, Passwords, and Security Access Level

D. System Requirements

1. Operating System: Windows 7 or Windows 8.
2. Equipment Networking: Ethernet 10/100/1000 Mbps (RJ45 Jack).

2.10 UNINTERRUPTABLE POWER SUPPLY (UPS)

- A. All DAS equipment and components shall be connected to a UPS system to maintain uptime during failover of normal power to generator power. This includes head-end, remote equipment, and any other equipment/components requiring power, etc.
- B. All UPS equipment is being provided by Others as part of the Base Building Renovation Project. This includes DAS Room, Main Comm Room, and Intermediate Comm Rooms. Contractor shall coordinate all DAS power requirements with UPS installer to ensure requirements are included with equipment provided by others.
- C. Contractor shall interface DAS power to UPS, power strips, and/or other power receptacles provided as such.
- D. Any other UPS or battery backup equipment required to support the DAS shall be provided as part of this scope. Contractor shall identify any locations that require UPS that has not been included as part of Base Building Renovation Project.

2.11 ALTERNATES

- A. Wi-Fi Offload  
The DAS solution shall include options for technology that seamlessly offloads a user's cellular service to Wi-Fi. The Contractor shall present options for supporting this technology and information on maintaining quality of service. Additionally, Contractor shall provide options for

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

amount of traffic that can be offloaded and associated requirements for ensuring performance and uptime of Wi-Fi system.

1.

B. Contractor Proposed Alternatives

1. The Contractor may propose alternatives for Owner consideration.
2. All alternatives shall include procurement options, revenue sharing, pricing, description, equipment cut-sheets and any other technical documentation necessary.

C. Manufacturer Proposed Alternatives

1. The DAS Manufacturer may propose alternatives for Owner consideration.
2. All alternatives shall include pricing, description, equipment cut-sheets and any other technical documentation necessary.

PART 3 - EXECUTION

3.1 EXAMINATION

The following examination tasks shall be performed by Contractor:

- A. Examine pathway elements intended for cable. Check raceways, cables trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Examine rough-ins for antenna to verify actual locations of cable connections before antenna installation.
- C. Examine walls, floors, roofs, equipment bases, and roof supports for suitable conditions where equipment is to be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Provide detailed site survey to determine best cable routing and location of antennas.

3.2 SYSTEM DESIGN CRITERIA

A. General:

1. The system must be able to handle the facility's capacity requirements, growth and technology upgrades within the primary DAS equipment room(s), communications rooms, Owner, and service provider entrance facilities without being invasive to other areas. The system shall distribute and support the following:
  - a. All current technologies available to existing wireless providers authorized to provide service in the United States in all frequency bands.
  - b. All current public safety and emergency responders' two-way radio communications including First Responders, Police, Fire, Ambulance, and other emergency systems utilized by Public Authorities and Agencies.
  - c. All current building operations two-way radio systems and other in-house two-way radio communication systems.
  - d. All current and planned technologies as required and noted in this specification.



MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

2. The system must provide the ability to distribute additional protocols and frequencies in the 450 MHz to 2500 MHz range as well as other frequencies from 2500 MHz to 6 GHz. Contractor shall note the capability of the proposed solution.
3. The system must allow service providers to add capacity at any time, subject to space limitations in equipment rooms and telecommunications spaces. The system shall have spare capacity built-in and Contractor shall note spare capacity and expansion capability of the proposed solution.
4. The system must enable service providers to distribute signal uniformly inside locations in a manner that mitigates interference to their outside network.
5. The coverage inside the building (in all designated areas) shall provide dominant signal to overcome other signals from other zones or sectors within the building and from outside the building by at least 10dB at the coverage edge for 800 and 1900 MHz with a +28dBm input per RF channel into the POI.

B. Topology:

1. General: The topology will be a hierarchical star using a structured cabling system implemented for IT and telecommunications. The topology includes a backbone segment that connects comm room locations and a horizontal segment that connects antennas to comm rooms.
2. Main Equipment Room: A dedicated equipment room called a DAS Room has been provided on Level-01. This location will serve as the main distribution hub and main equipment room for DAS, Wireless Carrier, Public Safety, and Building Operations.
3. Communication Rooms:
  - a. All DAS equipment including remote units, transceivers, amplifiers, media converters, patch panels, etc. shall be installed in Intermediate Communications Rooms.
4. Backbone Distribution:
  - a. The backbone shall use Single-Mode Fiber Optic Cable provided as part of this work.
  - b. A fiber optic cable segment will be routed from the DAS Room to each Intermediate Comm Room and remote unit location.
  - c. The Contractor shall indicate immediate and future strand quantity required for the proposed solution.
  - d. All backbone cable shall be UL-Listed and meet environment conditions for where the cable is routed including plenum or risers.
  - e. All exterior cable with any metallic components including conductors and/or sheath shall have UL-Listed transient surge protection devices appropriately grounded per Building Codes installed on each end of the cable and as per manufacturer's requirements.
5. Horizontal Distribution:
  - a. Horizontal cable types shall be specified by the Contractor based on the proposed solution and Manufacturer's requirements.
  - b. Horizontal cable shall be routed from the Antennas to the Intermediate Communications Rooms and remote unit.
  - c. All horizontal cable and components shall be UL-Listed and plenum rated.
  - d. All exterior cable with any metallic components including conductors and/or sheath shall have UL-Listed transient surge protection devices appropriately grounded per Building Codes installed on each end of the cable and as per manufacturer's requirements.
6. Antenna:
  - a. Antennas will be connected to horizontal distribution.
7. Telecom Back-Haul:

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

- a. Telecommunications backhaul necessary to interface Service Providers to the PSTN will utilize backbone cable interconnecting the DAS Room to the Data Center.

C. System:

1. The DAS shall cover all interior and exterior building areas.
2. The interior system shall provide full coverage to all interior spaces. Refer to DAS coverage drawing in the Electrical Technology Set for additional requirements.
3. The requirements for the exterior system require additional coordination with all Service Providers including Wireless Carriers, Public Safety, and Building Operations. The Contractor shall propose a system for consideration by Owner and Service Providers.

D. Coverage and Capacity:

1. The DAS shall meet all coverage and capacity requirements for this facility type based on highest occupancy and facility use.
2. The system shall be designed with the appropriate sector/zone capacity and antenna points to ensure acceptable performance.
3. Refer to DAS Coverage Drawings included within the Electrical Technology Documents which indicate proposed coverage areas based on building area types.
4. The following General Areas of Coverage apply to the facility:
  - a. Entire building interior.
  - b. Exterior areas per coordination with Owner, Owner Representative, and Wireless Carriers.
  - c. Elevators, Escalators, Stairs, and Stair Towers.
  - d. Public Concourses, Restrooms, Building Entrances, and Restrooms.
  - e. Stadium Seating Area, Bowl, and Event Floors.
  - f. Suites and Club Areas.
  - g. Media and Print Press Areas.
  - h. Administrative Office Areas, Work Areas, and Lounges.
  - i. Back of House Corridors and Work Areas.
  - j. All indoor areas of the facility with emphasis on all levels including but limited to the following areas; expos, seating bowl, concourses, suites, clubs, bars, lounges, restaurants, kitchens, pantry's, office areas, entrance gates, writing press areas, TV broadcast booths and production areas, security command center, game day command center, and overflow writing press areas.
5. Other Wireless and Interference: Considerations shall be provided for minimizing interference from other susceptible systems including but not limited to the items noted below. Additionally, refer to Owner's RF Strategy and Frequency Assignment Schedule.
  - a. Assisted Listening Devices
  - b. Bluetooth Devices
  - c. Cordless Telephones
  - d. FM Radio Transmitter
  - e. Media TV Broadcast
  - f. Media TV Intercoms
  - g. Media Radio Broadcast
  - h. Microwave Ovens
  - i. Specialty Event Wireless
  - j. Sports Team Communications and Intercoms
  - k. Wireless Broadcast
  - l. Wireless Microphones
  - m. Wireless Telephone Headsets

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

- E. Sectors/Zones: The DAS shall accommodate multiple sectors (or zones) to ensure high capacity requirements that are acceptable to this facility type and worst case occupancy. Exact requirements shall be coordinated by the Contractor with Owner and all Service Providers including but not limited to Wireless Carrier, Public Safety, and Building Operations.
- F. Equipment Rooms and Communication Rooms
1. DAS Room:
    - a. The DAS Room will serve as the main distribution hub and main equipment room for DAS, Wireless Carrier, Public Safety, and Building Operations.
    - b. The DAS Room will be a co-location equipment room for all Cellular Carrier equipment provided by others.
    - c. All DAS head-end equipment, transceivers, media converters, amplifiers, and patch panels shall be installed in cabinets and racks provided by the others as part of base project.
    - d. All Public Safety head-end equipment, base station equipment, repeater equipment, transceivers, media converters, amplifiers, and patch panels shall be installed in cabinets and racks provided by the others as part of base project.
    - e. All Building Operations head-end equipment, base station equipment, repeater equipment, transceivers, media converters, amplifiers, and patch panels shall be installed in cabinets and racks provided by the others as part of base project.
    - f. Electrical power including receptacles and UPS power will be provided by others as part of base project.
    - g. Contractor to provide all HVAC including air-conditioning that is not included in base project. This includes but is not limited to duct work and CRAC units.
      - 1) Contractor shall identify and coordinate the individual requirements of components and systems and provide all required equipment.
    - h. Contractor to provide all fire suppression equipment for DAS room and attached Main Communications and Server rooms.
      - 1) Fire suppression system shall be pre-action, and comply with all requirements per division 21 specifications.
    - i. The base project has set aside a room of just over 1900 sqft. If the DAS head-end equipment requires more space than this, the contractor shall provide a mezzanine level and all associated systems.
      - 1) Associated systems include HVAC, power, lighting and fire suppression. All of this equipment must fulfill all requirements of equipment in room below.
      - 2) All head-end equipment in mezzanine level must conform to same standards as head-end equipment in room below.
      - 3) Structural design of mezzanine must be verified by architect, engineer and owner prior to installation.
  2. Intermediate Communication Rooms:
    - a. Intermediate Comm Rooms are shared rooms that co-locate technology systems and distribution in the facility.
    - b. Remote units, transceivers, media converters, amplifiers, and patch panels shall be installed in cabinets and racks provided by the others as part of base project.
    - c. Electrical power including receptacles and UPS power will be provided by others as part of base project.
    - d. HVAC including air-conditioning will be provided by others as part of base project.
      - 1) Contractor shall identify and coordinate the individual requirements of components and systems. Contractor shall provide any HVAC beyond that included in base project.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

G. Antennas:

1. The Contractor shall provide all antennas necessary for a complete and fully operation system.
2. Provided below is a general list of antennas required for this project.
  - a. Interior Wireless Antennas
  - b. Exterior Wireless System Antennas
  - c. GPS Antennas
3. Contractor shall propose antennas recommended by Manufacturer based on the proposed solution.
4. Antennas shall be located as necessary to provide the appropriate coverage and capacity requirements for all the wireless systems being supported and as listed in this specification.
5. All antennas and associated locations shall be discreet.
6. All antenna locations shall be coordinated with Architect prior to initiating any work.
7. Samples of each antenna type used on the project shall be submitted to the Owner and Architect for approval.

H. Public Safety System: Provide all necessary head-end equipment, radio equipment, system interfaces, hardware, and distribution components to accommodate public safety two-way radio communications systems for each of the agencies listed below. The Contractor shall obtain a copy of the appropriate current standards from each agency and ensure these requirements are fully provided for and supported in the DAS per those standards. All necessary equipment shall be included in the distributed antenna design. Separate meetings will be setup later with each agency by the Owner to review requirements for this project specifically.

1. Police Department
2. Fire Department

I. Building Operations Systems: Contractor shall provide all necessary head-end equipment, radio equipment, system interfaces, hardware, and distribution components to accommodate the Owner's building operation two-way radio communications system. The Contractor shall confirm the Owner's existing system and frequency assignment and ensure these requirements are fully provided for and supported in the DAS per those standards. All necessary equipment shall be included in the distributed antenna design. Separate meetings will be set up later with the Owner to review requirements for this project specifically.

J. Wireless Carrier Systems: Provide all necessary head-end equipment, system interfaces, hardware, and distribution components to accommodate all Wireless Carrier's equipment. The Contractor shall confirm current equipment and frequency assignment utilized by the Wireless Carriers and ensure these requirements are fully provided for and supported in the DAS. All necessary equipment shall be included in the DAS design other than the Wireless Carrier's equipment. Separate meetings will be set up later with the Owner and Wireless Carriers to review requirements for this project specifically.

3.3 INSTALLATION

A. General:

1. This Section describes the installation locations for the products and materials, as well as methods associated with the DAS and wireless installation portions of the Project. These Specifications, along with the drawings shall be followed during the course of the installation.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

2. The Contractor shall examine areas and conditions under which DAS infrastructure is to be installed. Notify Owner, Architect, and Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
3. The Contractor shall be knowledgeable of work to be performed by other trades and take necessary steps to integrate and coordinate their work with other trades.
4. The Contractor shall be responsible for furnishing all materials as specified herein and as indicated on the drawings for a complete DAS.
5. The Contractor shall verify space requirements and locations before starting cable installations and terminations. Inappropriate conditions shall be immediately reported to Construction Manager, Owner, Architect, and Engineer prior to initiating installation.
6. All DAS and communications infrastructure shall be installed in an aesthetically pleasing fashion. All surface raceway in new buildings must be approved by the Owner, Architect, and/or Engineer.
7. All communications infrastructure shall be installed for optimal performance.
8. All DAS and communications infrastructure shall be installed to allow for easy additions, moves, and other changes in the future.
9. The Contractor will create a mock up program including the installation of a complete kit of each public location of the AP, radio and enclosure, fully painted and secured for sign off. Refer to Submittal Requirements outlined in Section 1.14 for requirements.
10. Final labeling scheme for all DAS and communications components shall be coordinated with the Owner and Engineer during the shop drawings process, prior to initiating work. Labeling scheme shall include but not be limited to communications rooms, cabinets, racks, cable terminal blocks and patch panels, antennas, outlets, cables, etc.
11. Construction within communication rooms must be substantially complete before the installation of the DAS and communications cabling. This includes, but is not limited to, the installation of plywood backboard, cable tray or ladder rack, electrical outlets, light fixtures, sprinklers and ductwork. All walls shall also be painted before the installation.
12. All components noted in this section and drawings shall be provided and completely set up and installed. This includes but is not limited to Cable, Terminations, and Cable Managers.
13. The Contractor is required to coordinate their efforts with the other trades and sub-contractor who may be working within the same vicinity to avoid conflict and lost time.
14. The Contractor shall supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc., as customary for the craft and necessary for the installation.
15. Where applicable, the Contractor shall verify existing cable fill in riser conduits before installation of additional cables so as not to exceed 40% cable fill. Contractor will be responsible for installation of additional riser conduit, where additional cables to be added will exceed the 40% cable fill.
16. The contractor shall not install any component in a manner or condition that will void manufacturer and/or contractor warranty. Any such conditions that prevent an acceptable install shall be immediately reported to Construction Manager or General Contractor, Owner, Architect, and Engineer prior to initiating installation. All mis-installed components will be removed and replaced with new, appropriate components at the Contractor's expense. No additional cost will be submitted to Owner.
17. All equipment shall be installed in a neat and workmanlike manner, arranged for convenient operation, testing and future maintenance.
18. Communication rooms must be free from dust, dirt, and other foreign materials before the installation of any termination hardware or the termination of fiber optic cables. The door to the communication rooms must be installed and closed during termination.

B. Raceway Installation: The following procedures shall apply to raceway installation:

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

1. Provide floor to floor distribution with concrete floor sleeves or conduits as noted on the drawings, and as required by Architectural Design.
2. Provide protective cable bushings on all conduits immediately after installation.
3. Use only electrical 45° or 90° conduit elbows with long bend radii. Refer to manufacturer and industry standard requirements for minimum bend radii.
4. Do not place more than two 90° sweeps or exceed 100 ft. between pull boxes without providing a pull box.
5. Contractor shall provide horizontal conduits as necessary. Cable fill in conduits shall not exceed 40% cable fill.
6. Conduits shall be installed with pull strings. Do not exceed manufacturer's recommended pulling tensions.
7. Fire seal all raceway penetration and openings to maintain fire rating after communications cables are installed.
8. Provide labels on all communications pull-boxes and junction-boxes.
9. Identify conduits at cable tray end by architectural room number.

C. Cable Installation: The following procedures shall apply to cable installation:

1. All distribution cable, backbone cable, horizontal cable, radiating cable, and antenna cable must be plenum rated.
2. All DAS and communications cables routed within communications rooms shall be bundled and combed to provide a neat and organized appearance. This includes horizontal and vertical cables routed on cable tray, d-rings, vertical cable managers, equipment rack cable managers, etc. Cables shall be bundled using only manufacturer and industry approved wire ties with tensions that do not deform and damage cable resulting in loss of transmission or performance. Any bundles and combing methods used shall not exceed manufacturer or industry standard recommendations for that cable type.
3. Install cables concealed in accessible ceilings. Install cables according to manufacturer's recommended installation practices using approved hangers at a maximum spacing of every 48-inches (1.2m).
4. Do not lay cable on suspended tile ceiling, ductwork, piping, conduit, or other building equipment.
5. Do not route radiating coaxial cable through metallic conduit or sleeve through a wall or partition. Transition to a non-radiating coax or jumper to pass through metal conduit or concrete.
6. Mount radiating coaxial cable a continuous minimum distance of 2-inches (50mm) off any surface.
7. In order to minimize loss of RF signal due to shadowing, generally route radiating coaxial cable below the installed height of other infrastructure if within 2-feet (.7m) of HVAC ductwork, metal pipes, sprinklers, pull boxes, unistrut, cable tray, or other cabling.
8. Contractor shall train cables to the termination points with no excess where cable is installed within enclosures.
9. Cable bends shall not be less than that recommended by the manufacturer of the cable. Do not exceed manufacturer's minimum bending radii and other cable requirements. Provided below are some examples but all requirements shall be verified.
  - a. The minimum installed bend radius of ½-inch radiating coax is 5-inches (125mm).
  - b. The minimum routing bend radius of ½-inch radiating coax is 10-inches (250mm).
  - c. If cable (non-radiating coaxial cable) is to be installed in conduit, the bend radii of the conduits must be greater than 10-inches.
  - d. If conduit bend radius is less than 10-inches, the coaxial cable must be terminated (connectorized) prior to pulling through conduit and a jumper must be used for routing through conduit.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

10. The contractor shall not install any cable in conduits that does not have the appropriate protect bushings on conduit ends. All mis-installed cable will be removed, bushings installed, and new cable re-installed at the Contractor's expense. No additional cost will be submitted to Owner.
11. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
12. Do not splice cable between termination, tap, junction points, or between damaged cable segments.
13. Any exposed cables shall be installed parallel to building lines. Follow surface contours and support the cable according to manufacturer's written instructions. Do not run adjacent and parallel to power or data cables. All exposed cable routing shall be coordinated with the Owner and Architect prior to installation.
14. All cables shall be installed in conduit when routed exposed at public areas. Contractor shall verify identify certain cables types that may not be possible due to size and/or flexibility. Contractor shall coordinate these instances for approval with Owner, Construction Manager, Architect, and Engineer prior to installation.
15. Provide a minimum 8'-0" and maximum 10'-0" of slack at the Communications room. Loop shall be contained on the horizontal cable tray or ladder rack.
16. Care shall be taken so as not to damage cable during the installation process and that the manufacturer's and industry standard's pull tension specification is not exceeded.
17. Within communications rooms, cables shall be snugly wrapped using Velcro reusable cable ties, a minimum of every 3'-0" for cable organization. Velcro ties shall be tightened so as not to deform cable jackets and thus affect cable performance. Plastic cable tie wraps shall not be used.
18. Provide independent signal circuit grounding recommended by manufacturer.
19. Under no circumstances shall the cable be painted, treated, or covered with other material unless approved by manufacturer.

D. Antenna Installation: The following procedures shall apply to antenna installation:

1. All antennas and associated locations shall be discreet. Antennas shall be concealed wherever possible using stealth technology to ensure installation maintains high architectural form critical to the high-end finish of this project.
2. All antenna locations shall be coordinated with Architect prior to initiating any work.
3. Install antennas per manufacturer's requirements.
4. Contractor shall install antennas with all necessary supports to ensure safe installation and support to prevent falling.
5. Antennas shall be rated accordingly and as applicable for the installation type, location, condition, and application supported.

E. Equipment Installation: The following procedures shall apply to equipment installation:

1. Install surge suppressors where ac-power-operated devices are not protected against voltage transients by integral surge suppressors specified in UL1449. Install surge suppressors at the devices' power-line terminals. Comply with Division 26 Section "Transient Voltage Suppression."
2. Mount electronic equipment in the types of cabinets recommended by manufacturer. Group related items in methodical sequence.
3. Arrange equipment to facilitate access for maintenance and to preserve headroom and passage space.
4. Interface DAS equipment with all base station equipment as required during installation period of DAS.
5. Label all equipment and interfaces.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

- F. Long Term Wireless Carrier Interface
  - 1. Contractor shall coordinate and supervise the installation of Cellular Carrier Equipment and interfaces to the DAS.
- G. System Management and Monitoring Software Installation: The following procedures shall apply to system management and monitoring software installation:
  - 1. Install software on Owner provided computers.
  - 2. Coordinate computer and data network requirements with Owner's IT Group. This should include MAC and IP addressing, VLAN assignment, bandwidth requirements, class of service (CoS), VPN requirements, etc.
  - 3. The system management and monitoring software shall be fully set up, programmed, and configured including but not limited to the following:
    - a. Date and Time.
    - b. Networked DAS end points including but not limited to antenna points, remote units, base head-end equipment, etc.
    - c. Graphical user interface (GUI) including facility maps indicating interactive icons for all equipment locations and antenna points.
    - d. Web portals, user access, and VPN.
    - e. Administrator accounts, passwords, and security levels.
    - f. User accounts, passwords, and security levels.
    - g. Device thresholds, status, alarm points, alerts, and notification.
    - h. Remote diagnostics.
    - i. System Inventory.
    - j. Event reporting protocol.
    - k. System logs including status, performance, alarms, history, and others.
    - l. Maintenance log, schedules, and notification.

3.4 CONSTRUCTION PHASING

- A. The DAS and communications infrastructure installation shall be phased as necessary to meet the facility construction schedule.
- B. This project is implementing a phased construction schedule. The contractor shall meet with the Construction Manager to review the construction schedule and associated areas of work. All necessary labor, cable, terminations, components, and equipment shall be provided to accommodate temporary, phased, and final conditions and requirements.
- C. Contractor shall submit phasing documents including permanent and temporary conditions for associated timelines. Provide below are several key items that shall be included. Refer to Submittal section for additional requirements.
  - 1. General Narrative Description and Requirements
  - 2. Building Coverage Areas
  - 3. Cable Routing and Antenna Points
  - 4. Equipment Locations
- D. The contractor shall install the DAS based on the approved Shop Drawing phasing documents. Coordinate installation with Construction Manager and other trades as necessary.

3.5 COORDINATION



MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

- A. Wireless Carrier Coordination: Selected Bidders as determined by Owner shall participate in meetings prior to finalization and award to review system design and coordinate requirements with the Wireless Carriers to ensure proposed solution is acceptable and complete. The Bidder (Contractor) shall present system design, respond to questions, and submit final design with revisions and cost as part of final bid documents. This meeting will be set up by Construction Manager and Owner with selected Bidders.
  
- B. Design Coordination: All components proposed by the Contractor shall be coordinated with the Owner, Construction Manager, Architect, and Engineer. Provided below is a general list of major items that shall be documented in a table and coordinated. The list provided below is to be used as an example and is not intended to be all inclusive or to limit items required to be reviewed and coordinated.
  - 1. Equipment Type and Physical Size.
  - 2. Rack Units required per location.
  - 3. Electrical Power (voltage, amp, loads, and receptacle types)
  - 4. HVAC (heat dissipation and equipment operating temperature range)
  - 5. Antenna Types and Locations
  - 6. Backbone Distribution (fiber strand allocation)
  
- C. RF and Wireless Coordination:
  - 1. The Contractor shall perform an onsite RF and wireless study prior to starting work. This information shall be submitted in hard copy documents.
  - 2. The Contractor shall obtain a copy of the Owner's current RF strategy and frequency assignment. This information shall be reviewed in detail to identify any interfering and/or potentially interfering sources.
  - 3. The Contractor shall review and coordinate the onsite study, Owner's current RF strategy and frequency assignment, and proposed DAS design. The Contractor shall make recommendations to the Owner and adjust the proposed design accordingly to ensure no interfering sources or overlap of frequency assignment.
  - 4. The Contractor shall perform an on-site RF and wireless study after completing system installation. This information shall be submitted in hard copy documents. The results of this test shall be reviewed by the Contractor and Manufacturer to confirm system compliance with coverage, capacity, and performance requirements.
  - 5. All documents submitted by Contractor including product data, submittals, as-built, test results, drawings, reports, etc. shall be provided in electronic (pdf) and paper format.
  - 6. The Contractor will coordinate all Public Safety frequencies, preferred manufacturer make/model, antennas, equipment, power conditions and locations with Rod Olson, City of Minneapolis Radio Shop, 612.673.5672 or [Rodney.olson@minneapolismn.gov](mailto:Rodney.olson@minneapolismn.gov).
  - 7. Refer to submittal requirements as outlined in Section 1.4.
  
- D. Installation Coordination: The Contractor shall field coordinate all work with Construction Manager and other Sub-Contractors and Trades as necessary to minimize conflicts.
  
- E. Schedule: The Contractor shall coordinate the project schedule with the Construction Manager including but not limited to the following:
  - 1. RFP Response
  - 2. Submittals
  - 3. Construction and Phasing
  - 4. Installation
  - 5. Substantial Completion
  - 6. Final Completion

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

7. System Acceptance

3.6 IDENTIFICATION

A. The following procedures shall apply to system labeling:

B. General Label Requirements:

1. The labeling scheme shall be provided by the Contractor and coordinated with the Owner and Architect prior to initiating any work. A sample scheme shall be submitted for approval.
2. Mechanically print and install all labels.
3. Format: Select font size to be readable and to fit all information required without overlap of text.
4. Use all capital letters.
5. All labels shall be consistent font type, size, and color throughout project.
6. Labels shall be white with black text.
7. Clean all surfaces prior to attachment of any label. Follow manufacturer's recommendations for cleaning and affixing labels.
8. Method: Brady cable labels appropriately sized or approved equivalent.

C. Cable:

1. Label Location: Within 4 inches (100 mm) of each termination.
2. Near-End Label Information: "Cable No. XXX and Comm Room ZZZ - DAS Cable. Do not disturb," where XXX and ZZZ are actual room numbers assigned. Room numbers shall be coordinated with Owner and Architect.
3. Far-End Label Information: "Cable No. XXX and Room ZZZ - DAS Cable. Do not disturb," where XXX and ZZZ are actual room numbers assigned. Room numbers shall be coordinated with Owner and Architect.
4. Radiating Cable: In addition to end labels, any radiating coaxial cables shall be labeled "Radiating Coaxial Cable."

D. Equipment:

1. Label all equipment, components, cabinets, and enclosures.
2. Label Information: Equipment No. and Type (or Short Description).

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Contractor shall engage a factory-authorized service representative to inspect field-assembled components and equipment installation, and supervise pre-testing, testing, and adjusting of equipment.

B. Inspection: Contractor shall verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.

C. Pre-testing: Contractor shall align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Replace malfunctioning or damaged items. Retest until satisfactory performance and conditions are achieved.

D. Operational Tests: Contractor shall perform operational system tests to verify that system complies with Specifications. Operational tests shall include all modes of system operation. Equipment shall be tested for proper operation in all functional modes.

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

- E. Test Schedule: Contractor shall schedule tests after Operational testing has successfully been completed and system has been in normal functional operation for at least 14 days. Contractor shall provide a minimum of 10 days notice of the test schedule.
- F. Qualitative and Quantitative Performance Tests: Contractor shall verify for each major frequency band identified by Owner that signal coverage area, signal coverage levels, and signal coverage consistency are compliant with Specifications. Testing shall be conducted using calibrated "walk-test" receivers.
- G. Test Results: Contractor shall record test results and publish them in electronic and hard copies for distribution to Owner.
- H. Re-Test: Contractor shall correct all deficiencies identified by tests and observations, and re-test until specified requirements are met.
- I. Commissioning:

Contractor shall create and submit a detailed checklist for commissioning system equipment and components. The list shall be submitted for Owner review. System commissioning shall be completed by the Contractor prior to system acceptance by Owner. A formal report shall be generated that includes sign-off and notes of all items.

System commission shall include the following categories.

1. Validate Procured Components
2. Physical Installation and Location
3. Equipment Connectivity and Inter-Connectivity
4. Support Systems Functioning (HVAC, electrical, and UPS)
5. System Setup and Operation
6. Wireless Surveys
7. Testing

- J. Contractor shall provide onsite support for each major event for the first 120 days following the final installation. A major event shall be any event with an attendance exceeding 15,000 attendees.

### 3.8 CLEANING

- A. Contractor shall clean installed items using methods and materials recommended by manufacturer.
- B. Contractor shall clean system components, including antennas and supports, electronic equipment, and distribution components.

### 3.9 RECORD DOCUMENTATION

- A. Record documentation shall be submitted to the Owner by the Contractor at the completion of the DAS installation. The contractor shall submit all information necessary to operate and maintain the system including but not limited to the following:
  1. As-Built Documents
  2. Operations and Maintenance Manuals
  3. Maintenance Schedule

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

4. Maintenance Company Contact Information
  5. Troubleshooting Guide
  6. Product Data and Manufacturer Cut-Sheets
  7. Warranty Information and Contact
  8. Manufacturer's Product and Installation Certificate
  9. Log (troubleshooting, replacement, expansion, and replacements)
  10. Labeling Scheme
  11. Spare Parts Lists
- B. Contractor shall maintain current record documents at the construction site.
- C. All documents submitted by Contractor including product data, submittals, as-built, test results, drawings, reports, etc. shall be provided in electronic (pdf) and paper format.
- D. Refer to submittal requirements as outlined in Section 1.4.

END OF SECTION

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

**APPENDIX-A: ADDITIONAL BIDDER QUESTIONS**

The following Appendix shall be filled out by each bidder. This information will become contractually part of the prevailing Bidder's agreement.

1. Are you the manufacturer of your proposed solution? If not, who is the manufacturer? Please provide data sheets for all components used in the proposed solution.
2. Detail bands covered by your current offering.
3. Can each service (Cellular, Public Safety) be extended independently or are all services extended together?
4. Provide an overview of the monitoring and maintenance capabilities of the proposed system.
5. Detail the procedure to troubleshoot the following problems:
  - a. Disconnected antenna.
  - b. Failed remote distribution unit.
  - c. Cable break or cut (detail both fiber and coax).
  - d. Cable installed is 125% longer than design spec.
6. Provide an overview of the process used in the creation of your proposed design.
7. Detail maintenance and post sale support services, including duration, that are included in the price of the proposed system.
8. Detail maintenance and support services, including duration, that are available for additional cost, including extended warranty options.
9. Define requirements of standard warranty (and any extended warranty) being provided.
10. What extended warranty period is offered beyond standard warranty for the entire, installed system?
11. Do you have regional field service offices? If so, where are they located?
12. What field technical support response time is guaranteed?
13. All services on the proposed system have a guaranteed performance level. Please confirm the performance metrics of your proposed solution and your guarantee to deliver these performance levels as measured by field tests of the installed system or bring the installed system into compliance without cost to Owner.
14. What warranty period is offered for the entire installed system? For the active components? What response time is guaranteed?
15. Define the RF power per RF carrier, band and protocol.
16. Explain how RF output power is measured and where in the system the measurement is taken (i.e. at antenna point, at remote, etc.)
17. When providing system performance metrics, are these measured at the output of the remote unit? Do performance metrics factor in any cable loss?
18. List the system noise figure and how it is defined.
19. Describe cable distances and loss and how it affects your system, or attach a chart w/cable specs and max distances.
20. Please list the waveform accuracy specification for all supported protocols and provide performance test documentation.
21. How does/will your solution support 3G/4G services (HSPA/HSPA+, WiMAX, LTE)?
22. Does your solution support MIMO? If so, please describe how this is achieved in detail.
23. Does your solution support 64QAM data? Please provide test results.
24. Does your system support various power options—AC or DC?
25. Can the solution use UPS systems? If so, how are they alarmed? Describe the various options (duration of support, amount of equipment).
26. Does your solution support SNMP? If so, how is it supported (external box or integrated) and what are the connectivity options (LAN, wireless modem, POTS line)?
27. Do you offer a NOC/NMS capability for centralized monitoring/maintenance? If so, how many systems can be simultaneously monitored and managed?

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

28. If your system supports multiple frequency bands, can each band be managed independently? Can a frequency band be shut down on a system wide basis? Can a frequency band be shut down at a specific passive antenna point?
29. Can attenuation be applied via software to a single antenna point?
30. Can your solution support capacity and coverage changes post installation? If so, how is this managed?
31. Describe the system architecture flexibility of your solution(s).
32. Can your solution use the existing cable infrastructure in or between buildings? Please describe.
33. What is your MTBF for all products you're responding with?
34. Describe the physical space requirements for main equipment locations based on the system configuration proposed in this RFP.
35. List the potential RF interfaces your system can support (base station, BDA/repeater, CPRI/OBSAI base station interface, etc.).

MINNESOTA MULTI-PURPOSE STADIUM  
MINNEAPOLIS, MINNESOTA

**APPENDIX-B: BIDDER'S DAS DESIGN ASSUMPTIONS**

The following Appendix shall be filled out by each bidder. This information will become contractually part of the prevailing Bidders agreement.

1. Define number of sectors per frequency per service provider.
2. Define Design Goal. (example: -85 dBm for 90% of defined coverage area at 90% of time)
3. Define Coverage.
4. Define System Feed. (Will the system be fed remotely (off-air) or from a base station(s) on or off-site)?
5. State the assumed fade margin for the RF coverage prediction and what that accounts for.
6. State what the RF coverage prediction and system designs are based on.
7. State physical mounting locations for main equipment and if all necessary mounting gear is included in the proposal. This should include physical space and environmental requirements.
8. State AC Power and Grounding requirements in proposed equipment rooms.
9. State what types of antennas are permitted and confirm antenna location height from floor.
10. State whether existing cable pathways can be used. Confirm whether installation of additional cable racks or raceways is required.
11. State whether installation of new conduit is required.
12. State whether cable lengths are estimates or not-to-exceed amounts.
13. State whether existing cable infrastructure can be used. If so, state type and existing locations.
14. State whether penetration of fire-rated walls require approved fire-stopping methods.
15. State whether dust tents/partitions, water misting of surfaces, etc., will be required.
16. Confirm if quoted cabling is plenum rated; if required.
17. Confirm if Union labor is quoted.
18. Confirm if special high-lift equipment is quoted.
19. Describe close-out commissioning documentation package.
20. State whether spare products are quoted per Manufacturer's recommended quantities.

## **4.0 WIRELESS NETWORK SYSTEM SPECIFICATION (272101)**



MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

SECTION 272101

WIRELESS NETWORK SYSTEM TECHNICAL SPECIFICATIONS

PART 1 - GENERAL

1.1 PROJECT DESCRIPTION

- A. The project is a new multi-purpose stadium for the Minnesota Vikings. The stadium will seat approximately 65,000± spectators and will be designed to host football, baseball, and other events.
- B. Refer to the architectural plans for a detailed description of the facility.

1.2 BASIC SYSTEM REQUIREMENTS

- A. A complete and fully functioning Wireless Network System shall be provided for Wi-Fi access to accommodate all wireless users including business, team, operations, event, tenants, food service, ticketing, press, broadcast, and public users, etc.
- B. The Wireless Network System shall operate on a converged data network that provides a single data network backbone for connectivity to all building systems, applications, tenants, and users. This includes but is not limited to:
  - 1. Administrative Data (Computers, Printers, and Scanners)
  - 2. Advertising Panels
  - 3. Building Management Systems
  - 4. Building Systems Controllers (HVAC and Lighting)
  - 5. Point of Sale
  - 6. Security Management System
  - 7. IP Telephone
  - 8. IPTV
  - 9. IP Surveillance Cameras
  - 10. IP Security Controllers
  - 11. Ticketing System
  - 12. Wireless Ticket Scanners (Wi-Fi)
  - 13. Wireless POS (Wi-Fi)
  - 14. Wireless LAN (Wi-Fi)
  - 15. Wireless Public Internet (Wi-Fi)
  - 16. Other data communications to be determined (Wi-Fi)
- C. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. The Wireless Network System shall meet the NFL's 2018 standards for coverage and capacity.
- D. Coordination with City-wide Wi-Fi provider shall be required to eliminate potential interference and provide coverage for exterior areas.
- E. Up to (1500) wireless access points may be required for complete coverage and Wi-Fi system shall be complete with WAP controllers, WCS, bandwidth manager, and splash page.
- F. System shall be capable of 2 Mbps per user at a 50% simultaneous and concurrent active user take up rate. 100% of users shall be authenticated. Proposed per WAP user estimates shall be provided as part of the technical proposal.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- G. Authentications shall be provided by web portal or mobile application depending on event. A single sign on application shall be developed for stadium season ticket holders. Vendor shall provide a plan for development of mobile application as part of their submitted proposal. The wireless system shall support and be setup with roaming authentication from evolving technologies including Hotspot 2.0 and later revisions for user authentication as part of the base system.
- H. Selected provider shall provide development of an RFID, Bluetooth location solution. Coordinate with Owners Representative for requirements.
- I. The system shall fully support multi-cast and unicast communications for application including but not limited to audio streaming, video streaming, IPTV, and multi-point video, etc. All necessary licensing and patent agreements shall be included to utilize this technology as part of this work.

1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Section apply to work of this section.
- B. Division 26 Basic Electrical Materials and Methods sections apply to work specified in this section.
- C. When included as part of this specification, the following divisions contain related requirements and information that shall be adhered to.
  - 1. Division 11 AV and Broadcast
  - 2. Division 23 Heating, Ventilation, and Air-Conditioning
  - 3. Division 26 Electrical
  - 4. Division 27 Communications
  - 5. Division 28 Security
  - 6. Division 28 Fire Alarm

1.4 SUMMARY

- A. Equipment Installation
  - 1. The Contractor shall provide all required labor necessary to physically install the equipment and components specified in this specification and associated drawings. This includes connection to power systems, grounding, and tele/data patching of low voltage systems. The Contractor shall coordinate all Union Labor requirements associated with this project with the Owner and Construction Manager. The Contractor shall include all such cost in their scope of work and contract.
- B. System: Extent of the Wireless Network System work is indicated by drawings schedules, and specifications and is hereby defined to include, but not by way of limitation, the provisions of:
  - 1. All references herein to Wireless Network System shall hereby be referred to as Wireless Network from this point forward.
  - 2. The term “provide” used throughout this specification and drawings shall mean “furnish, install, implement, test, certify and warranty”.
  - 3. In general, the Wireless Network equipment required by this work will require dedicated, tested, and certified horizontal data cable (Cat. 6A) provided as part of this package from nearest Intermediate Communications Room to each wireless access point (WAP /

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

WLAN) location. This work is specified in other Division 27 Specification Sections. Wireless Data horizontal cable provided as part of this work will terminate with RJ45 patch panels and interface with patch cords to network switches provided by others and backbone cable infrastructure provided by others as part of the Base Building and/or unless noted otherwise. This includes the backbone topology including Cat.3 telecom and fiber optic backbone cable/terminations from each Intermediate Communications Rooms (IC) to the Main Communications Room (MC) or Data Center. Other horizontal tele/data/pos/iptv/etc cable infrastructure including all from all communication outlets to the nearest intermediate communications distribution room (IC) is provided in the Base Building. Refer to the following specification sections and associated drawings for additional requirements.

- a. 27 11 00 – Common Work for Communications
  - b. 27 13 01 – Fiber Optic Backbone Cabling
  - c. 27 13 02 – Telecommunications Backbone Cabling
  - d. 27 15 01 – Horizontal Cabling
  - e. 27 21 00 – Enterprise Network Switching and Routing System
  - f. 27 33 53 - Technology Uninterruptible Power Supply (UPS)
4. Coordinate project schedule, installation schedule, phasing and any other requirements deemed necessary with Construction Manager and/or General Contractor and all necessary trades to ensure successful completion of work.
  5. The Wireless Network shall converge the transport of all users, systems, and applications requiring IP Wireless Network connectivity. Contractor shall work and coordinate with Owner and all associated users, tenants and trades that will have systems converged to the Wireless Network. This shall include determining network traffic and bandwidth requirements. Additionally, the contractor shall set up, configure, and program all routing tables, security policies, class of service (CoS), quality of (QoS), VLANs, etc.
  6. Contractor shall coordinate all SSIDs with Owner. Quantity of SSIDs used shall be minimized wherever possible and utilize VPN, and VLANs to segment, secure, and control traffic.
  7. SSID broadcast should be limited only to APs where they are required.
  8. This specification is intended to establish the minimum performance criteria for providing a Wireless Network system. The contractor shall coordinate all system and performance, components and criteria with Owner to ensure project requirements and intent are maintained.
  9. This specification is not intended to contain proprietary information or requirements based on any specific manufacturer system. Any proprietary information included in this specification is unintentional.
  10. Design, furnish, install, setup, program, and configure a turnkey Wireless Network system. Work shall include all necessary components and installation thereof require.
  11. The Wireless Network System shall be complete, fully functioning, physically/electronically secure using LAN provided by others, and include but not be limited to the following:
    - a. Network Monitoring Equipment
    - b. Network Management Software
    - c. Patch Cords and Patching
    - d. Information and Pricing for Alternate Equipment (as noted in spec)
    - e. Servers supporting network functionality.
    - f. Wireless LAN Access Points
    - g. Wireless LAN Controllers
    - h. Enclosures
    - i. Antennas
    - j. Antenna Cables
  12. Access Point/Switch Programming/Configuration
    - a. Virtual LAN (VLAN) Determination, Assignment, Configuration, and Implementation

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- b. Class of Service (CoS) Determination, Assignment, Configuration, and Implementation
  - c. Quality of Service (QoS) Requirements and Implementation
  - d. Switch Software
  - e. Software Licenses
  - f. Client Licenses
  - g. Network Management Software
  - h. Hardware Licenses
  - i. Server Software Licenses
  - j. Applications Software Licenses; Power Supplies; Media Converters; etc. Interfaces and integration to existing systems and equipment shall be included and coordinated with the Owner.
13. Coordinate all support systems requirements such as architectural, HVAC, electrical, and technology systems.
  14. All phasing, temporary distribution/equipment, cutover and implementation shall be coordinated with Construction Manager and Owner.
  15. Physical installation of all equipment in cabinets and racks provided by others.
  16. Device placement. Coordination with owner for final placement of devices, including but not limited to device elevation, finish, mounting hardware, rack elevations and mounting details.
  17. All necessary electronic equipment setup, programming, and configurations. Coordinate with the Owner to establish system programming and configuration requirements.
  18. The contractor shall provide, furnish, and install all required patch cords. All patch cords to interconnect end devices to wall outlets, patch panels to Wireless Network equipment, intra-Wireless Network equipment, Wireless Network to servers, Wireless Network to service provider equipment or hand-off, etc.
  19. Connection from power supplies to electrical power receptacles located on walls, UPS, PDUs, and/or vertical power strips.
  20. Equipment within telecommunications spaces must be bonded and grounded to Telecommunications Grounding Busbar. All other equipment to be bonded and grounded per manufacturer and building code requirements.
  21. Seismic bracing of all equipment and components provided under this work as required by code and by local governing jurisdiction.
  22. The Wireless Network shall be field tested and verified, certified, and guaranteed upon installation. Testing shall include equipment, components, and infrastructure per industry standards, Manufacturer recommendations, and as per this specification.
  23. Labeling of all system equipment, components, hardware, cable, and terminations with mechanically printed labels.
  24. Preparation and submission of formal submittals required by project including but not limited to product data, shop drawings, testing reports, as-built drawings, manufacturer user manuals and cabling documentation as required in this specification.
  25. Contractor and Manufacturer installation and equipment warranties.
  26. Manufacturer equipment, components, and solutions warranties for all equipment, components, software, and infrastructure.
  27. Onsite administrative and user training.
  28. Manufacturer training of equipment and components.
  29. Preparation of maintenance plan recommended by system Manufacturer.
  30. Spare parts required for immediate onsite maintenance.

C. Standards and Codes

1. The installation of the Wireless Network shall comply with all local building codes, authority having jurisdiction (AHJ), FCC, BICSI, EIA, IEEE, NEC, TIA, UL, and other industry standards, codes, and methods.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

1.5 CODES AND STANDARDS

- A. All work including materials and installation shall conform to all applicable sections of currently adopted editions of the codes and standards listed below or the codes, standards and specifications published by the organizations listed below:
1. Uniform Building Code (UBC).
  2. State and local codes.
  3. ANSI: American National Standards Institute (ANSI).
  4. ANSI/EIA/TIA-526: Standard Test Procedures for Fiber Optic Systems.
  5. ANSI/EIA/TIA-568-C: Commercial Building Telecommunications Cabling Standard.
  6. ANSI/EIA/TIA-569-A: Commercial Building Standard for Telecommunications Pathways and Spaces.
  7. ANSI/EIA/TIA-606A: Administrative Standard for Commercial Telecommunications.
  8. ANSI/EIA/TIA-607: Commercial Building Grounding and Bonding Requirements for Telecommunications.
  9. ASTM: American Society for Testing and Materials
  10. BICSI TDM Telecommunications Distribution Methods Manual (current edition).
  11. BICSI Wireless Design Reference Manual (current).
  12. EIA/TIA TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling.
  13. Federal Specification Compliance: Comply with applicable requirements of FS W-C 586, "Electrical Cast Metal Conduit Outlet Boxes, Bodies, and Entrance Caps."
  14. ICEA: Insulated Cable Engineers Association
  15. IEEE: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141 and 142 pertaining to grounding and bonding of systems, circuits and equipment.
  16. IEEE-802.11 a, b, g, n, ac (or highest standard available at time of procurement): Wireless Local Area Networks
  17. IEEE-802.3: 10Mb/s, 100Mb/s, 1Gb/s, and 10Gb/s Ethernet Standards as applicable based on media types (twisted pair copper, fiber optics, etc.)
  18. IEEE-802.3ak: 10Gb/s Ethernet (evolving copper standard).
  19. IEEE-802.3af: Power-over-Ethernet (PoE).
  20. IEEE-1100-1999: Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.
  21. IEEE-141: Comply with applicable requirements for installation of cable tray systems.
  22. IEEE-241: Recommended Practice for Electric Power Systems in Commercial Buildings.
  23. ISO/IEC 11801: International Standard on Information Technology – Generic Cabling of Customer Premises.
  24. NEC: Comply with applicable local electrical code requirements of the authority having jurisdiction, and the NEC as applicable to electrical boxes and fittings, cable tray systems, and grounding and bonding, pertaining to systems, circuits and equipment.
  25. NESC: National Electrical Safety Code
  26. NEMA: Comply with applicable requirements of NEMA Stds/Pub No.'s OS1, OS2 and PUB 250 pertaining to raceways, outlet and device boxes, covers, and box supports.
  27. NEMA: Comply with NEMA Stds/Pub No. VE 1 "Cable Tray Systems"
  28. NFPA-70/NEC: National Electrical Code.
  29. NFPA-70B: "Recommended Practice for Electrical Equipment Maintenance" pertaining to installation of cable tray systems.
  30. UL Compliance: Provide components which are UL-listed and labeled.
  31. UL Compliance: Comply with applicable requirements of UL 50, UL 514-series, and UL 886 pertaining to electrical boxes and fittings.
  32. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment", and 869 "Electrical Service Equipment", pertaining to grounding and bonding of systems, circuits and equipment. In addition,

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- comply with UL Std 486A, “Wire Connectors and soldering Lugs for Use with Copper Conductors.” Provide grounding and bonding products which are UL-listed and labeled for their intended usage.
33. NFL Wireless Guidelines - RF Design & Minimum Performance Standards for 3G/4G DAS and Wireless Local Area Networks (“WLAN”) for NFL Stadiums (DAS / Wi-Fi Guidelines): Current Edition (This document attached but Bidder/Contractor shall obtain current edition from NFL)
  34. NFL 2018 Super Bowl Requirements
- B. Where there is a conflict between the code and the contract documents, the code shall have precedence only when it is more stringent than the contract documents. Items that are allowed by the code but are less stringent than those specified on the contract shall not be substituted.
- 1.6 SCOPE
- A. General
1. This work is to provide a complete and enterprise level Wireless Network system.
  2. Major system components and performance requirements have been listed in the specification but there are other components that are required and shall be included with this work. The Contractor shall provide all components necessary for a complete and fully functioning system.
  3. All hardware, firmware, operating systems, application software, and client licenses shall be included for a fully operational system meeting and/or exceeding the performance criteria herein.
  4. Requirements for add alternates are noted in this specification for Owner review and approval. This work shall be included with project schedule once approved by Owner.
- B. System
1. The Wireless Network shall be a complete, fully functioning, physically/electronically secure, and include but not be limited to the following: Network System Support and Management; Wireless LAN; Wireless Mobility Service Equipment (MSE); Wireless Service Control Engine (SCE); Wireless Intelligent Services Gateway (ISG); Wireless Intrusion Prevention System (WIPS)
  2. Refer to Part 2 – ‘**System Requirements**’ for additional requirements.
  3. Communications Infrastructure:
    - a. The system shall function utilizing the communications infrastructure and topology noted below. The network switches and backbone infrastructure are currently provided by others as a separate contract as part of Base Project. The Wireless Network shall be coordinated with this infrastructure. The Contractor shall obtain all necessary documentation to ensure Wireless Network design and installation complies with this requirement. The Contractor shall coordinate Wireless Network requirements with Base Project Contractor providing infrastructure to ensure all requirements are met.
    - b. Horizontal Distribution: Category 6A (Augmented) UTP cable shall be provided as part of this contract for all wireless access point locations (WLAN / WAP) locations communication devices to the nearest Intermediate Communications Room. Cables are terminated at each end with equivalently rated RJ45 jacks. Other specification sections note communications infrastructure requirements. Patch cords of equal or greater capacity shall be provided by the Wireless Network Contractor to connect with planned cable infrastructure, End-Point Equipment, and Wireless Network Equipment.
    - c. Backbone/Riser Distribution: Each Intermediate Communications Room has a single-mode fiber optic cables, provided by base project; originating from the Main

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

Communications Room for interfacing uplink connections between Core Switches and Access Switches. Other specification sections note communications infrastructure requirements. Patch cords of equal or greater capacity shall be Contractor by the system Provider to connect with planned cable infrastructure. Patch cords of equal or greater capacity shall be provided by the Wireless Network Contractor to connect with planned cable infrastructure and Wireless Network Equipment.

- d. Patch Cords: All patch cords shall be provided and installed as part of this work for connectivity to every network equipment port (fiber, copper, access switch, core switch, routers, firewalls, etc.).
- 4. Electrical Power and Uninterruptable Power Supply (UPS):
  - a. Electrical Power and UPS equipment are being provided by others as a separate contract as part of Base Project in the Main Communications Room.
  - b. The Contractor shall coordinate all power and UPS requirements with Base Project Contractor providing electrical systems and UPS equipment to ensure all requirements are met.
  - c. UPS shall maintain a minimum of 15-minute runtime or necessary to ensure cutover to emergency generator power. Additionally, UPS shall allow for appropriate runtime to shut down the Wireless Network equipment down during catastrophic power loss.
  - d. UPS system shall have management software that allows full control and monitoring of all UPS from a single point.
  - e. Contractor shall review requirements of the UPS specification for other UPS systems.

1.7 SUBMITTALS

A. General Description and Requirements:

- 1. In addition to the requirements noted herein, refer to Division 1 Specification for additional requirements.
- 2. Within 15 days after award of contract or as dictated by the construction schedule (whichever period of time is shorter), the Contractor shall submit prefabrication submittals consisting of product data, compliance matrix and shop drawings for approval. Partial submittals will not be accepted without prior written approval from the Architect. Coordinate all submittal dates with Construction Manager.
- 3. Review of the Prefabrication Submittals by the Architect is for purposes of tracking the work and contract administration and does not relieve the Contractor of responsibility for any deviation from the Contract Documents, or from providing equipment and/or services required by the Contract Documents which were omitted from the prefabrication submittals.
- 4. No portion of the project shall commence nor shall any equipment be procured until the prefabrication submittals have been approved in writing by the Owner and Architect. All installations shall be in accordance with the Contract Documents.
- 5. Prefabrication submittals shall be accompanied by a letter of transmittal identifying the name of the project, Contractor's name, date submitted for review, and a list of items transmitted.
- 6. Contractor shall refer to other parts of this section, for details on specific submittal requirements. A submittal shall not be considered complete until all requirements of this section are completed.
- 7. In addition to submitting as required by the Construction Manager and the Architect, the contractor shall provide all submittal documentation electronically for review.

B. Bid Documents: Refer to Section 1.13 Bid Information for additional requirements.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- C. Compliance Matrix: Provide a specification compliance matrix indicating compliance or deviation for each item in the specification. Any deviations shall be fully explained including proposed change. Refer to Section 1.13 Bid Information section later in this specification for additional requirements.
- D. Bill of Materials:
1. Provide a detailed Bill of Materials including all equipment, cables, components, firmware/software, and other options.
  2. Information shall be listed in specific categories according to equipment type and include a basic description, quantities, retail price, extended price, total price, labor hours, labor costs, etc.
  3. List all Equipment Alternates separately at end of report. This should include adds and deduct alternates.
  4. List all Equipment Maintenance and Support items separately at end of report.
  5. Provide Unit Cost for each piece of equipment, accessories, and labor so that the Owner may select that equipment during the project to meet expanding or declining requirements.
  6. Refer to Section 1.13 Bid Information section later in this specification for additional requirements.
- E. Product Data: The Wireless Network system Product Data Submittal shall be submitted prior to starting any work for review and approval by Owner, Architect, and Engineer. Information shall include detailed manufacturer's specifications for each component to be installed. Submittal shall include a list every component with Manufacturer's part numbers referenced. Manufacturer data sheets with features, options, ratings, and performance. Product numbers and options to be used shall be highlighted with color marker.
1. Component List: Provide complete submittal component list at the beginning of the submittal package. Component list shall identify each component name, manufacturer, and specific product/part number. All part numbers shall clearly indicate special options, color, accessories, etc.
  2. Cut-Sheets: Submit manufacturer's cut-sheets on all components listed within this specification and corresponding appendix. All components and parts being used shall be highlighted in color or clearly underlined on cut-sheets to distinguish specific product/part numbers, options, colors, accessories, etc. Cut sheets shall be submitted in the same order of the Component List.
  3. Product Substitutions: This specification is intended to be performance based, thus requirements and products noted are benchmarks. The Contractor may substitute manufacturers and models that may be more cost effective or readily available. All substitutions shall meet or exceed the minimum functional, physical, and technical specifications. Acceptance of such substitutions is at the discretion of the Owner, Architect, and Engineer. Additionally, the requirements of Division 1 Specifications shall apply and may supersede requirements noted herein.
  4. Schedule: A detailed schedule shall be submitted with the prefabrication submittals. The schedule shall include the expected timelines, for ordering, shipping, burn-in, configuration, installation, acceptance, and training. The schedule shall be coordinated with the Construction Manager.
  5. Warranty Information: Provide all warranty information as described in this specification section for review and approval.
  6. Product Certificates: Signed by manufacturers of systems certifying that products furnished comply with requirements.
  7. Installer Certificates: Provide manufacturer certification signed by manufacturer certifying that installers have been trained to install all components of the system and comply with manufacturer's requirements.



MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- F. Equipment Coordination and Mock-Ups:
1. Contractor shall provide all detailed coordination of antenna placement for approval by Owner and Architect. Work shall include all necessary concealment, stealthing, facades, and painting to hide equipment including antennas, cables, raceway, remote units, and any other exposed equipment.
  2. Contractor shall provide full-scale mockups in stadium for all typical equipment placement including remote units, antennas, backbone/antenna/power cable routing, conduits, etc. Mockups shall include all painting and stealthing to match condition to be installed.
  3. Contractor shall present mock-ups for approval to Owner, Construction Manager, Architect, and Engineer prior to installation.
- G. NFL Standards Compliance: Complete Wi-Fi design documents and product data submittal shall be submitted to Qualcomm (the NFL's current reviewer) for approval to ensure design complies with NFL standards. Approved design compliance shall be received prior to completing any construction work and procurement.
- H. Coordination Data: A detailed equipment and component schedule with supporting manufacturer cut-sheets shall be developed for all equipment, components and options for architectural, engineering, and construction coordination. These documents shall include electrical requirements (volts, phase, amps, power consumption, receptacle configuration, etc.), UPS requirements, heat dissipation, temperature operating range, target operating temperature, physical equipment sizes (LxWxH), equipment deployment weight, etc.).
- I. Shop Drawings: The Wireless Network Shop Drawings shall be submitted prior to ordering of any equipment and starting of any work. Shop drawings are submitted for review and approval by Owner, Architect, and Engineer. Additionally, Shop Drawings shall be used for coordination with Construction Manager and Trades by this installer. Information shall include all drawings necessary to present installation intent including diagrams, plans, enlarged plans, elevations, sections, details, and interface to other work or systems.
1. Legend Sheet: Provide drawings including descriptions of all abbreviations and symbols.
  2. Network Topology Diagram: Provided drawing of all major components located in main communications room, data center, and typical intermediate comm room. Drawings shall include relevant information such as room numbers, equipment number and references, uplinks, equipment links, bandwidth, panel numbers, and uplink bandwidths.
  3. One-Line Diagrams: Provide drawings that indicate all equipment, backbone uplinks between access layer switches, core switches, and existing core switches, all equipment and locations. Drawings shall include relevant information such as room numbers, equipment number and references, panel numbers, and uplink bandwidths.
  4. Floor Plans: Provide scaled plan drawings based on architectural background indicating equipment and locations. Drawings shall include all relevant information such as room numbers, equipment numbers and references, patch panel numbers, etc.
  5. Enlarged Plans: Provide enlarged scaled plan drawings for equipment layouts in communications rooms. Equipment shall be clearly labeled including numbers and references.
  6. Elevations: Provide scaled drawings for elevations of all equipment layouts in communications rooms, racks, and cabinets. Equipment shall be clearly labeled including numbers and references.
  7. Details: Provide detail drawings as required to show components requiring greater detail.
  8. Labeling: Provided documentation of all equipment and component labeling, etc.
  9. Schedule: A detailed schedule shall be submitted with the shop drawings. The schedule shall include the expected timelines, for ordering, shipping, burn-in, configuration, installation, acceptance, and training. The schedule shall be coordinated with the Construction Manager.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- J. As-Built Drawings: The Wireless Network system As-Built Drawings shall be submitted after completing work to Owner. As-Built Drawings shall indicate final installation of system. Information shall include all drawings necessary to present final installation intent including diagrams, plans, enlarged plans, elevations, sections, details, and interface to other work or systems.
1. Legend Sheet: Provide drawings including descriptions of all abbreviations and symbols.
  2. Network Topology Diagram: Provided drawing of all major components located in main communications room, data center, and typical intermediate comm room. Drawings shall include relevant information such as room numbers, equipment number and references, uplinks, equipment links, bandwidth, panel numbers, and uplink bandwidths.
  3. One-Line Diagrams: Provide drawings that indicate all equipment, backbone uplinks between access layer switches, core switches, and existing core switches, all equipment and locations. Drawings shall include relevant information such as room numbers, equipment number and references, panel numbers, and uplink bandwidths.
  4. Floor Plans: Provide scaled plan drawings based on architectural background indicating equipment and locations. Drawings shall include all relevant information such as room numbers, equipment numbers and references, patch panel numbers, etc.
  5. Enlarged Plans: Provide enlarged scaled plan drawings for equipment layouts in communications rooms. Equipment shall be clearly labeled including numbers and references.
  6. Elevations: Provide scaled drawings for elevations of all equipment layouts in communications rooms, racks, and cabinets. Equipment shall be clearly labeled including numbers and references.
  7. Details: Provide detail drawings as required to show components requiring greater detail.
  8. Labeling: Provided documentation of all equipment and component labeling, etc.
  9. Test Results: Provide all final test results in a table or matrix. Indicate Equipment Type, Number, and Room Number.
  10. Network Information: Contractor shall also include a detailed report on IP addressing, VLAN assignments, switch configurations, interface configurations, as well as documentation of any special configuration performed during final troubleshooting. Contractor shall abstract all configuration information to be free from passwords.
- K. Field Test Reports: Indicate and interpret test results for compliance with performance requirements of installed systems.
- L. Component Failure Tests: Contractor shall submit a schedule for testing after final completion of network and attached systems. Internet, Administrative Access, Point of Sale, Guest Wireless and other systems, must be up and running on network to verify actual network performance for failure under stress.
1. Power Cord (each, separately)
  2. Power Supply (each, separately)
  3. Uplinks (each, separately)
  4. Disconnect/Reconnect of an Access Point
- M. Maintenance Information: Provide Maintenance Manuals for the Wireless Network equipment and components as specified in Division 1. Maintenance information shall include the following:
1. Detailed operating instructions covering operation under both normal and abnormal conditions.
  2. Routine maintenance requirements and schedule for system components.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

3. Lists of spare parts and replacement components recommended being stored at the site for ready access.

N. Warranties: The Contractor shall fully warranty and provide necessary maintenance on all parts, components, and labor for the entire duration of the Wi-Fi agreement with Owner. Warranty period shall start based on acceptance by Owner upon completion, testing and acceptance of the installation by the Wireless Carriers.

O. Documentation: All documents submitted by Contractor including product data, submittals, as-built, test results, drawings, reports, etc. shall be provided in electronic (pdf) and paper format.

1.8 QUALITY ASSURANCE

A. Contractor Qualifications: An experienced Contractor who is a certified and authorized representative of the Manufacturer, for design, installation, warranty, support and maintenance of units required for this Project, to supervise installation of the system.

1. The Contractor shall have minimum of (5) years of experience on projects of similar size and complexity and provide evidence of successful completion of these projects, if requested. Indicate the following:
  - a. Names and locations of (3) previously installed systems of similar size and complexity.
  - b. Name and telephone number of a Contact at each installation.
  - c. Previous installation experience.
  - d. At least (2) personal references for similar Wireless Network System installations.
2. The Contractor shall have a fully staffed office with technical installations support personnel that can be at the project site within one (1) hour.
3. The Contractor shall be a currently certified installer of the Equipment and Components Manufacturer and shall provide a warranty on installation/applications. Refer to Warranty Periods for additional requirements.
4. The Contractor shall be currently licensed to install low-voltage cabling systems in the State of Minnesota.
5. The Contractor shall be a current certified installer of Infrastructure Systems, and shall provide warranty on installation/applications. Refer to Warranty Periods for additional requirements.
6. Must be supervised on-site by a BICSI RCDD. Must demonstrate knowledge and compliance with all BICSI, TIA/EIA, UL, and NEC standards and codes.
7. All members of the installation team must be certified by the manufacturer as having completed the necessary training to complete their part of the installation. Resumes of the entire team shall be provided along with documentation of completed training courses prior to the start of any work.
8. The Contractor shall have a Professional Engineer licensed to practice in jurisdiction where Project is located and who is experienced in providing engineering services of similar scope. The Contractors design shall be reviewed, signed, stamped, and sealed as appropriate.

B. Manufacturer and Product Qualifications

1. Provide products from manufacturers regularly engaged in the production of Wireless Network System.
2. Provide products from manufacturers whose products of similar types, capacities, and characteristics have been in satisfactory use in similar type projects for not less than five (5) years.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- C. Products and Substitutions: Other manufacturers' products complying with requirements may be considered. All manufacturer solutions, products, and components proposed and/or substitutions shall be submitted at bid time for review and approval by Owner and Engineer. Cost changes including additions, deduction, or no changes shall be submitted for all items.
- D. Alternates: All requested, manufacturer, and/or Contractor proposed alternates shall be submitted at bid time for review and acceptance by Owner and Engineer. Cost changes including additions, deduction, or no changes shall be submitted for all items.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, NEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. All materials shall be Underwriters Laboratories (UL) Listed unless otherwise noted or required by AHJ.

1.9 PROJECT CONDITIONS

- A. Prior to submitting a proposal, the Contractor shall inspect the Contract Documents, and shall become fully informed as to laws, ordinances, regulations and union jurisdictions affecting the project. The Contractor shall immediately bring to the Owner, Architect, and Engineer's attention, in writing, any existing condition or statute that contradicts, is in conflict with, or negates the Contract Documents. Failure of the Contractor to become fully informed as to all above mentioned items shall in no way relieve the Contractor from any obligations with respect to their proposal.
- B. The Technology and Wireless Network Drawings depict locations of major equipment and components, etc. in a schematic manner. Field conditions and coordination with related trades may warrant relocations of field devices and equipment. No additional compensation will be allowed due to these revisions.
- C. System components and equipment shall be rated for the environments where installed. Normal temperature range requirements for each area within the project will be identified per the following categories noted below.
  - 1. Exterior Areas: -20 to +140°F (-29 to +60°C)
  - 2. Interior Areas-Seasonal: +32 to +104°F (0 to +40°C)
  - 3. Interior Areas-Temp Controlled: Typ. 72°F (22.2°C) but range up to +50 to +104°F (+10 to +40°C)
  - 4. Riser Shafts: -20 to +140°F (-29 to +60°C)
  - 5. Communication Rooms: Typ. 69°F (20.5°C) but range +32 to +104°F (+0 to +60°C)

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall be responsible for acceptable delivery, storage, and handling of all equipment, components, and options.
- B. Deliver equipment and components in factory-fabricated containers or wrappings, which properly protect equipment from damage.
- C. Handle equipment and components carefully to prevent damage including but not limited to breakage, denting or scoring of surfaces, etc. Do not install damaged units or components; replace with new.
- D. Store equipment and components in original packaging in a dry clean space. Store inside in a well-ventilated space protected from construction traffic, weather, moisture, soiling, humidity,

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

and extreme temperatures. Equipment storage shall comply with Manufacturer specifications for each piece of equipment, component, and option.

- E. All equipment installation shall be coordinated and approved by the Owner and Construction Manager. Electronic communications equipment, such as Wireless Network switches, is highly sensitive to dirty environments. Examples, such as drywall compound sanding; is always a problem and can shorten the life of the equipment and void the warranty due to dust. HVAC systems shall also be fully functioning without interruption to ensure the specified temperature range. Equipment shall only be installed when stable power distribution is available with UPS equipment installed. Additionally, equipment shall only be installed in rooms that are physically secure to prevent theft and tampering.

1.11 SEQUENCING AND HANDLING

- A. All work shall be reviewed and coordinated with the Owner and Construction Manager prior to commencing.
- B. Wireless Network Equipment and infrastructure are sensitive to environmental conditions including but not limited to temperature, dirt, dust, and water. The contractor shall ensure the storage and installation of all system components are sequenced and scheduled accordingly to prevent any damage, loss of performance, and warranty void of such systems. All mis-handling of items including delivery, storage, handling, and installation of equipment and components shall be replaced with new and re-installed at the Contractors' expense.
- C. The contractor shall not deliver, store, handle, and/or install any equipment or component in a manner that will degrade system performance, reduce life span, and/or void Manufacturer's Warranty. All such items shall be brought to the attention of the Owner and Construction Manager.
- D. Coordinate installation with Tele/Data, Structural, Electrical, HVAC, Plumbing, Fire Protection, and other trades to eliminate disruption and/or conflict with other systems.
- E. Sequence installation of Wireless Network and infrastructure with other work to minimize or eliminate the possibility of damage and soiling during remainder of construction.

1.12 COORDINATION

- A. Coordinate Work of this Section with the requirements of Owner, Construction Manager, and General Contractor.
- B. Coordinate layout and installation of Wireless Network equipment with other construction trades that penetrates ceilings, communication equipment/distribution rooms or is supported by them, including but not limited to light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- C. Coordinate location of equipment in the communications rooms and spaces with the Owner and Architect.

1.13 SPARE COMPONENTS AND EQUIPMENT

- A. Due the strict timelines of this project Contractor shall have available appropriate spare components and equipment, such as power supplies, line cards, GBICs, 10GB Zenpaks, 10GB SFPs, 1GB SFPs, supervisory modules, etc., before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver spare components and equipment to Owner.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

1.14 WARRANTY

- A. The warranty requirements shall comply with Division 1 and as noted in this Section. Any conflicts shall meet the most stringent required unless approved otherwise by Owner.
- B. Warranty Periods: Provided below are the minimum warranty period requirements for this work.
  - 1. Contractor Installation and Labor: 1-year.
  - 2. Manufacturer's Electronic Equipment and Components: 1-year.
  - 3. Manufacturer's Communications Infrastructure: 25-year.
- C. The Warranty Period shall not start until Owner's written acceptance of system. Acceptance shall not be considered until system is fully operational, fully tested, problems corrected and system requirements and performance are verified by Owner.
- D. The Contractor shall provide Installation and Warranty against defects in material and workmanship from time of system Owner acceptance of the installed system. Warranty shall include all parts and labor required to honor the warranty.
- E. The Manufacturer shall provide Electronic Equipment and Components Warranty for all hardware, firmware, operating system, and application software proposed or equivalent maintenance coverage.
- F. A warranty on the Work shall be provided by the Contractor for the terms noted in the Warranty Periods section. If, within the warranty period after the date of final acceptance of the installation or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents or provided by a Manufacturer, any of the work or equipment is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly including all parts and labor after receipt of notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This obligation shall survive termination of the contract. The Owner shall give such notice promptly after discovery of the condition. Such notice shall be provided by Owner representatives, to be identified, either verbally or in writing.
- G. The Manufacturer shall provide an Infrastructure Warranty as noted in Warranty Periods section for all communications cable infrastructure components provided as part of this work. This warranty shall cover all components including cable, terminations, patch panels, and wiring panels, etc. to maintain the specified performance and physical criteria. Any such components, link, or channel shall be replaced by the Manufacturer at no cost to Owner during this period. The Contractor and Manufacturer shall submit all information and documentation on Warranty.
- H. Nothing contained in the Contract Documents shall be construed to establish a shorter period of limitation with respect to any other obligation which the Contractor might have under the Contract Documents or any manufacturer's warranty. The establishment of the time period of warranty after the date of final acceptance or such longer period of time as may be prescribed by law or by the terms of any warranty required by the Contract Documents relates only to the specific obligation of the Contractor to correct the work or equipment, and has no relationship to the time within which his obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to his obligations other than specifically to correct the work or equipment.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- I. If system operation is not fully restored during the warranty period within one (1) business day, the Owner reserves the right to require the Contractor to provide on-site Manufacturer's service technicians at no additional cost to the project or Owner.
- J. The Owner reserves the right to expand or add to the system during the warranty period using firm(s) other than the Contractor for such expansion without affecting the Contractor's responsibilities, provided that the expansion is done by a firm which is an authorized dealer or agent for the equipment of system being expanded.
- K. Special warranty specified in this Specification shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
  - 1. Special Warranty for Equipment and Components: Written warranty, signed by Manufacturer and Contractor agreeing to correct system deficiencies and replace components that fail in materials or workmanship within specified warranty period when installed and used according to manufacturer's written instructions. This warranty shall be in addition to, and not limiting, other rights Owner may have under other provisions of the Contract Documents.
  - 2. Contractor shall guarantee operation and functionality and fix any problems at no cost to the Owner. The Owner will not accept the system at turn-over until the system has been field tested, verified, certified, and guaranteed that requirements have been fulfilled.

PART 2 - SYSTEM REQUIREMENTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products and solution by one of the following Enterprise Wireless Network and Routing System Manufacturers:
  - 1. Cisco Systems, Inc.
  - 2. Aruba Networks, Inc.
  - 3. Ruckus Wireless, Inc.
  - 4. Approved Equal

2.2 TECHNICAL SPECIFICATIONS

- A. Architecture
  - 1. General:
    - a. The Wireless Network shall be a converged platform that provides a single but redundant backbone network for all building systems, applications, tenants, and user. This includes but not limited to the following:
      - 1) Wireless Administrative Data
      - 2) Wireless IP Telephone
      - 3) Wireless LAN
      - 4) Wireless Public Internet
      - 5) Other data communications to be determined and coordinated by Contractor with Owner.
    - b. The Wireless Network shall be modular and support an Integrated Services Architecture.
    - c. The system shall fully support multi-cast and unicast communications for application including but not limited to audio streaming, video streaming, IPTV,

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MINNEAPOLIS, MINNESOTA

- and multi-point video, etc. All necessary licensing and patent agreements shall be included to utilize this technology as part of this work.
- d. The Wireless Network shall be fully scalable to add future equipment, components, uplinks, users and interfaces with remote sites to provide seamless operation and continuity without major upgrade of changing current protocols, software, and hardware.
  - e. The Wireless Network shall be new and shall also be of the current standard production of the manufacturer at the time of the proposal and shall be expandable in design, and implementation.
  - f. The Contractor is required to supply the latest version of software, providing all the features enumerated in this specification, at the time of contract award.
  - g. The Wireless Network shall be an off-the-shelf type and meet all FCC and UL requirements. The Contractor shall also list the FCC and UL registration/listing numbers and guarantee the equipment is certified/registered.
  - h. The Contractor and Manufacturer shall propose system components including hardware and devices that meet or exceed the intent of this specification and associate performance.
2. Class of Service (CoS): The CoS shall ensure quality of service (QoS). QoS feature shall select network traffic (both uni-cast and multi-cast), prioritize it according to its relative importance, and provide priority-indexed treatment through congestion avoidance and queuing techniques.
  3. Internet Protocol (IP) Addressing and Dynamic Host Control Protocol (DHCP)
    - a. The Contractor shall coordinate IP addressing and DHCP requirements with Owner, Users, Building System Installers, etc.
    - b. The Contractor shall develop and provide an IP/DHCP Matrix that indicates the addressing scheme and methodology for all systems connected to the Wireless Network.
  4. Virtual Local Area Networks (VLANs):
    - a. VLANs shall be determined and configured by the Contractor based on coordination with the Owner and analysis of all converged systems to virtually segment, secure, establish class of service (CoS), traffic engineering, and bandwidth requirements for data systems converged on the Wireless Network.
    - b. The Contractor shall coordinate, evaluate, and determine network bandwidth requirements for all systems connected to the Converged Wireless Network.
    - c. The Contractor shall develop and provide a VLAN matrix based on the systems to be virtually segmented and secured.
    - d. The VLAN Matrix shall establish CoS requirements including bandwidth priority and allocation for each VLAN.
    - e. Provided below is a basic list of anticipated VLAN assignments that shall be confirmed and coordinated by the Contractor:
      - 1) Wireless (Administrative)
      - 2) Wireless (Media)
      - 3) Wireless (Multi-purpose/Event)
      - 4) Wireless (POS)
      - 5) Wireless (Ticketing)
      - 6) Wireless (Public Internet)

B. Base Network Equipment

1. Refer to 27 21 00 for base network requirements.
2. Wireless LAN
  - a. Wireless LAN Controllers
  - b. Access Points
  - c. Antennas
  - d. Firewall



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MINNEAPOLIS, MINNESOTA

- e. Gateways
- f. Map Software
- 3. Spare Parts
  - a. Manufacturer and Contractor to propose items.

C. Add Alternate Equipment

- 1. Others
  - a. Contractor Proposed Alternates
  - b. Manufacturer Proposed Alternates

D. Maintenance

- 1. 24-7 (4-hour response)
- 2. Next Business Day

E. Network System Support and Management

- 1. Onsite
- 2. Remote
- 3. Term Options
  - a. Year-1
  - b. Year-2
  - c. Year-3
  - d. Year-4
  - e. Year-5

2.3 EQUIPMENT SPECIFICATIONS

A. Wireless LAN Controller

- 1. Wireless LAN Controller shall be provided to manage all Access Points.
- 2. A primary and redundant Wireless LAN Controller shall be provided.
- 3. Wireless LAN Controller shall be installed with a minimum of (2) 10Gigabit Ethernet ports.
- 4. Each Wireless LAN Controller shall support up to (3000) Access Points.
- 5. Redundant power supplies and modules shall be provided.
- 6. WLAN configurations and management functions shall be automated to ease control, security, redundancy, and reliability to scale and manage wireless networks.
- 7. Wireless LAN Controllers shall support IEEE 802.11 a, b, g, IEEE 802.11 n draft 2.0, and 802.11 ac Wave 2 standards.
- 8. The Wireless LAN Controllers shall support minimum requirements with expansion capability.
- 9. The Wireless LAN Controllers shall support the following encryption types:
  - a. WEP and TKIP-MIC.
  - b. SSL and TLS.
  - c. AES.
  - d. IPsec.
- 10. System Requirements:
  - a. Description: Centralized High-Scale Wireless LAN Controller
- 11.
  - a. Quantity: (2) Wireless LAN Controllers. Refer to drawings for additional requirements.
  - b. Type: Rack Mount.
  - c. Equipment: Primary/Redundant Controller
  - d. Performance:

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- 1) Wireless Technology: 802.11a/b/g/n/ac (or highest available standard at time of procurement)
- 2) AP Supported: (3000) per controller
- 3) Clients: (64,000) per controller
- e. Power Supply:
  - 1) General: Integrated
  - 2) Quantity: (2) Primary/Redundant
  - 3) Voltage: Submit, Per Manufacturer
  - 4) Frequency: Submit, Per Manufacturer
  - 5) Phase: Submit, Per Manufacturer
  - 6) Load: Submit, Per Manufacturer
- f. Fans:
  - 1) General: Integrated
  - 2) Quantity: Submit, Per Manufacturer
- g. Interfaces
  - 1) Uplink: Minimum (8) 10/100/1000Mbps Ethernet (RJ45) 1000BASE-T
  - 2) Service Port: Submit, Per Manufacturer
  - 3) Utility Port: Submit, Per Manufacturer
  - 4) Console Port: Submit, Per Manufacturer
  - 5) Expansion: Submit, Per Manufacturer
- h. Physical
  - 1) Size (WxDxH): Submit, Per Manufacturer
  - 2) Rack Units: 19-inch EIA rack
  - 3) Weight: Submit, Per Manufacturer
- i. Environmental
  - 1) Operating Temperature: Submit, Per Manufacturer
  - 2) Storage Temperature: Submit, Per Manufacturer.
  - 3) Relative Humidity: Submit, Per Manufacturer
- j. Operating Altitude: Submit, Per Manufacturer
- 12. Product Specification:
  - a. Contractor shall submit products for approval, with all requested information above included.

B. Wireless Control System (WCS)

- 1. System Requirements:
  - a. Type: Enterprise Class
  - b. Performance
    - 1) Wireless Technology
      - a) Standard: IEEE 802.11ac
      - a) Compatibility: IEEE 802.11a/b/g/ac (or highest available standard at time of procurement)
  - c. Requirements
    - 1) Planning
      - a) Built-in planning and design tools.
      - b) Real-time assessment.
      - c) Support for on-demand coverage re-assessment and problems.
    - 2) Deployment
      - a) Integrated WLAN Controller and Access Point configurations.
      - b) Network Auditing.
      - c) Software based high-availability for failover primary (active) to secondary (standby).
      - d) Secure and controlled wired and wireless guest access.
      - e) Tools and processes support monitoring, upgrading, and migrating.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- f) Role based access control to segment wireless network into virtual domains.
- g) Power savings and adaptive power management.
- 3) Security and Network Protection
  - a) Intrusion prevention system (IPS) for detection, location, and containment of unauthorized (rogue) devices.
  - b) Customized signature files protect against unauthorized intrusion and RF attacks.
  - c) Automated alarms.
  - d) Robust service policy engine supporting multiple SSIDs with customizable security and enforceable parameters.
  - e) Management frame protection (MFP) monitors the authentication of 802.11 management frames.
  - f) Access point wired port authentication with 802.1X validates access point credentials.
  - g) Unified wired and wireless security.
- 4) Monitoring
  - a) Centralized monitoring of WLAN performance and optimization.
  - b) Graphical user interface (GUI) including plan drawings of building per level.
  - c) Interactive graphs, charts, and tables for quick visualization and status assessment.
  - d) Alarm summaries for security, event, and alarm management.
  - e) Integration with Google Earth to manage outdoor wireless mesh deployments.
- 5) Troubleshooting
  - a) Integrated workflow and tools to quickly assess service disruptions, receive notices for performance degradation, research resolutions, and action.
  - b) Search tools for cross-network access to real-time and historic data.
  - c) Client troubleshooting with step-by-step problem analyzing.
  - d) Specialized diagnostic tools for connection problems.
  - e) Find, classify, correlate, and display interference from Wi-Fi and non-Wi-Fi sources.
  - f) Radio resource management (RRM) tools for performance and RF statistics.
  - g) Voice tools to evaluate VoWLAN problems.
- 6) Reporting
  - a) Real-time and historic network activity, performance, usage, devices, inventory, compliance, and security.
  - b) Payment Card Industry (PCI) for potential non-compliant events.
  - c) Customizable data, timeframe, and format.
  - d) Display options for charts, graphs, and tables.
  - e) Output reports to CSV or PDF as a saved file or email.
  - f) Capacity planning.
- 2. System Capacity and Scalability (minimum)
  - a. Sites: Submit, Per Manufacturer
  - b. WLAN Controllers: Submit, Per Manufacturer
  - c. Total APs: Submit, Per Manufacturer
- 3. License Quantity
  - a. Access Point: Provide to support all APs installed (25-minimum)
- 4. Client Workstation: Submit, Per Manufacturer
- 5. Product Specification:

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- a. Contractor shall submit products for approval, with all requested information above included.

C. Wireless Access Points

1. Access Points shall be provided at every WLAN device location shown on the drawings.
2. Shall support IEEE 802.11 a, b, g, n, ac, (or highest available standard at time of procurement).
3. Upgrade path to IEEE 802.11 d shall be provided within the technical proposal.
4. Wireless LAN Access points shall allow for VLAN partitioning allowing multiple users to access specific networks.
5. Wireless LAN Access Point locations, placement and mounting shall be coordinated with the Owner, Architect, and Engineer during shop drawings.
6. Wireless LAN Access points shall be Power over Ethernet (PoE). PoE will be provided by switches in intermediate communications rooms; refer to Enterprise Network Switching and Routing System for details.
7. Wireless LAN Access Points shall have a RJ45 jack with 10/100/1000 Mbps Ethernet or Gigabit Ethernet Card Network Interface Card.
8. Wireless LAN Access Points shall be interfaced to a Wireless LAN Controller.
9. Wireless LAN Access Points shall include all necessary antennas, cables, and enclosures.
10. Wireless LAN Access Points installed outside and other wet or harsh environments shall be installed in weather proof enclosures. Contractor shall coordinate specific enclosures with the drawings, Owner, Architect and Engineer prior to ordering and installation.
11. Wireless LAN Access Points installed outside shall be able to operate in extreme temperature conditions including the minimum -4F to 114F.
12. Wireless LAN Access Points installed outside shall be able to operate in extreme humid environments including up to 90% relative humidity.
13. Wireless LAN Access Points and associated components installed above ceiling shall be UL-Listed for Plenum rated spaces.
14. Wireless access points at interior locations shall be installed above accessible ceilings where feasible. These locations shall have remote antennas extended below the ceiling. Provide all necessary extensions and remote antennas.
15. Wireless LAN Access Points shall have a XML or other application software developed and provided for Public Internet billing, login, and password. The software shall allow a specific web page to open upon launching the browser and should have a look consistent with Owner's logo. Customer information shall be encrypted.
16. Provide all necessary patch cords to interface Wireless LAN Access Point equipment to the network.
17. Contractor shall provide an onsite wireless field study to determine exact placement of wireless access points devices.
18. Wireless LAN Access Point types provided below are basis of design recommendations. Contractor shall provide any Wireless LAN Access Point types required to provide the coverage and level of service as outlined within this specification.
19. Wireless Access Point Type 1 System Requirements:
  - a. Description: High Gain Wireless Access Point w/ External 2.4GHz and 5GHz MIMO High Gain Stadium Antenna
  - b. Performance
    - 1) Wireless Technology
      - a) Standard: IEEE 802.11 ac
      - b) Compatibility: IEEE 802.11 a/g/n/ac (or highest available standard at time of procurement)
    - 2) Data Rates:
      - a) 802.11a: Up to 54-Mbps

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- b) 802.11g: Up to 54-Mbps
    - c) 802.11n: Up to 300-Mbps
    - d) 802.11ac: Up to 1.3-Gbps
  - 3) Frequency
    - a) Bands: 2.4 GHz and 5.0 GHz
    - b) Compliance: FCC
  - 4) Channels:
    - a) 2.4 GHz: (11) Channels
    - b) 5.0 GHz: (19) Channels
- c. Capabilities
  - 1) Radio resource management (RMM)
  - 2) 2x3 multiple input/multiple output (MIMO) with two spatial streams
  - 3) Maximal riation combining (MRC)
  - 4) Legacy beamforming
  - 5) 20-MHz and 40-MHz channels
  - 6) 3x3 MIMO
  - 7) 80-MHz and 160-MHz
  - 8) PHY data rates up to 300 Mbps
  - 9) Data rates up to 1.3 Gbps
  - 10) Packet Aggregation: A-MPDU (Tx/Rx), A-MSDU (Tx/Rx)
  - 11) 802.11 Dynamic frequency selection (DFS)
  - 12) Cyclic shift diversity (CSD) support
- d. Maximum Transmit Power
  - 1) 2.4 GHz
    - a) 802.11b: 23 dBm w/ (2) antennas
    - b) 802.11g: 20 dBm w/ (2) antennas
    - c) 802.11n (non-HT): 20 dBm w/ (2) antennas
    - d) 802.11n (HT20): 20 dBm w/ (2) antennas
    - e) 802.11ac: per final version of standard
  - 2) 5.0 GHz
    - a) 802.11a: 20 dBm w/ (2) antennas
    - b) 802.11n (non-HT): 20 dBm w/ (2) antennas
    - c) 802.11n (HT20): 20 dBm w/ (2) antennas
    - d) 802.11n (HT40): 20 dBm w/ (2) antennas
    - e) 802.11ac: per final version of standard
- e. Antennas
  - 1) 2.4 GHz, Type-1
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 13 dBi
    - e) Coverage: Dipole
  - 2) 2.4 GHz, Type-2
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 13 dBi
    - e) Coverage: Triple Omni-Directional
  - 3) 2.4 GHz, Type-3
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 13 dBi
    - e) Coverage: Diversity Patch
  - 4) 5.0 GHz, Type-1

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- a) Type: External w/Connectors
- b) Quantity: (3) Antennas each AP
- c) Connectors: RP-TNC
- d) Gain: 7 dBi
- e) Coverage: Dipole
- 5) 5.0 GHz, Type-2
  - a) Type: External w/Connectors
  - b) Quantity: (3) Antennas each AP
  - c) Connectors: RP-TNC
  - d) Gain: 7 dBi
  - e) Coverage: Triple Omni-Directional
- 6) 5.0 GHz, Type-3
  - a) Type: External w/Connectors
  - b) Quantity: (3) Antennas each AP
  - c) Connectors: RP-TNC
  - d) Gain: 7 dBi
  - e) Coverage: Diversity Patch
- f. Interface Ports:
  - 1) Wireless Network: Submit, Per Manufacturer
  - 2) Console Management: Submit, Per Manufacturer
- g. Memory:
  - 1) DRAM: Submit, Per Manufacturer
  - 2) Flash: Submit, Per Manufacturer
- h. Indicators
  - 1) Indication Lights: LED
  - 2) Status: Submit, Per Manufacturer
- i. Power Supply
  - 1) Power over Ethernet (PoE)
    - a) Source: PoE (802.11af, from Ethernet Switch)
    - b) Load: 15.4 W PoE (Class-3)
  - 2) Building Power
    - a) Voltage (Input): 44-57 VDC
    - b) Voltage(Receptacle): Submit, Per Manufacturer
    - c) Frequency: Submit, Per Manufacturer
    - d) Phase: Submit, Per Manufacturer
    - e) Load: Submit, Per Manufacturer
    - f) Power Cord: Submit, Per Manufacturer
- j. Physical
  - 1) Size (W x L x H): Submit, Per Manufacturer
  - 2) Weight: Submit, Per Manufacturer
  - 3) MTBF: Submit, Per Manufacturer
  - 4) Warranty: Submit, Per Manufacturer
- k. Environmental
  - 1) Operating Temperature: -4 to 131 °F (-4 to 55 °C);
  - 2) Storage Temperature: -40 to 185 °F (-40 to 85 °C);
  - 3) Relative Humidity: 10 to 90%, non-condensing
  - 4) Operating Altitude: Submit, Per Manufacturer
- l. Product Specification:
  - 1) Contractor shall submit products for approval, with all requested information above included.
  - 2) Other and Misc. Components: Manufacturer and Contractor shall include and recommend all necessary components for a complete and fully functioning system. Components above are for general reference and major parts only.

20. Wireless Access Point Type 2 System Requirements:

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- a. Description: Wireless Access Point w/ External Dual Band MIMO Omnidirectional Antenna
- b. Performance
  - 1) Wireless Technology
    - a) Standard: IEEE 802.11n
    - b) Compatibility: IEEE 802.11a/g/n/ac
  - 2) Data Rates:
    - a) 802.11a: Up to 54-Mbps
    - b) 802.11g: Up to 54-Mbps
    - c) 802.11n: Up to 450-Mbps
    - d) 802.11ac: Up to 1.3-Gbps
  - 3) Frequency
    - a) Bands: 2.4 GHz and 5.0 GHz
    - b) Compliance: FCC
  - 4) Channels:
    - a) 2.4 GHz: (11) Channels
    - b) 5.0 GHz: (21) Channels
- c. Capabilities
  - 1) Radio resource management (RMM)
  - 2) 2x3 multiple input/multiple output (MIMO) with two spatial streams
  - 3) Maximal ration combining (MRC)
  - 4) Legacy beam forming
  - 5) 20-MHz and 40-MHz channels
  - 6) 3x3 MIMO
  - 7) 80-MHz and 160-MHz
  - 8) PHY data rates up to 450 Mbps
  - 9) Data rates up to 1.3 Gbps
  - 10) Packet Aggregation: A-MPDU (Tx/Rx), A-MSDU (Tx/Rx)
  - 11) 802.11 Dynamic frequency selection (DFS)
  - 12) Cyclic shift diversity (CSD) support
- d. Maximum Transmit Power
  - 1) 2.4 GHz
    - a) 802.11b: 23 dBm w/ (4) antennas
    - b) 802.11g: 23 dBm w/ (4) antennas
    - c) 802.11n (HT20): 23 dBm w/ (4) antennas
    - d) 802.11ac: per final version of standard
    - e)
  - 2) 5.0 GHz
    - a) 802.11b: 23 dBm w/ (4) antennas
    - b) 802.11n (HT20): 23 dBm w/ (4) antennas
    - c) 802.11n (HT40): 23 dBm w/ (4) antennas
    - d) 802.11ac: per final version of standard
    - e)
- e. Antennas
  - 1) 2.4 GHz, Type-1
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 2.5 dBi
    - e) Coverage: Dipole
  - 2) 2.4 GHz, Type-2
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 2.5 dBi

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- e) Coverage: Triple Omni-Directional
  - 3) 2.4 GHz, Type-3
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 2.5 dBi
    - e) Coverage: Diversity Patch
  - 4) 5.0 GHz, Type-1
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 3.5 dBi
    - e) Coverage: Dipole
  - 5) 5.0 GHz, Type-2
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 3.5 dBi
    - e) Coverage: Triple Omni-Directional
  - 6) 5.0 GHz, Type-3
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 3.5 dBi
    - e) Coverage: Diversity Patch
- f. Interface Ports:
  - 1) Wireless Network: RJ45 10/100/1000-Mbps Ethernet 1000BASE-T
  - 2) Console Management: Submit, Per Manufacturer
- g. Memory:
  - 1) DRAM: Submit, Per Manufacturer
  - 2) Flash: Submit, Per Manufacturer
- h. Indicators
  - 1) Indication Lights: LED
  - 2) Status: Submit, Per Manufacturer
- i. Power Supply
  - 1) Power over Ethernet (PoE)
    - a) Source: PoE (802.11af from Ethernet Switch)
    - b) Load: Submit, Per Manufacturer
  - 2) Building Power
    - a) Voltage (Input): Submit, Per Manufacturer
    - b) Voltage(Receptacle): Submit, Per Manufacturer
    - c) Frequency: Submit, Per Manufacturer
    - d) Phase: Submit, Per Manufacturer
    - e) Load: Submit, Per Manufacturer
    - f) Power Cord: Submit, Per Manufacturer
- j. Physical
  - 1) Size (W x L x H): Submit, Per Manufacturer
  - 2) Weight: Submit, Per Manufacturer
  - 3) MTBF: Submit, Per Manufacturer
  - 4) Warranty: Submit, Per Manufacturer
- k. Environmental
  - 1) Operating Temperature: Submit, Per Manufacturer
  - 2) Storage Temperature: Submit, Per Manufacturer
  - 3) Relative Humidity: 10 to 95%, non-condensing



MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- 4) Operating Altitude: Submit, Per Manufacturer
- I. Product Specification:
  - 1) Contractor shall submit products for approval, with all requested information above included.
  - 2) Other and Misc. Components: Manufacturer and Contractor shall include and recommend all necessary components for a complete and fully functioning system. Components above are for general reference and major parts only.
21. Wireless Access Point Type 3 System Requirements:
  - a. Description: Wireless Access Point w/ Integrated Internal Antenna
  - b. Part #: Cisco 3602i WAP and Cisco 3700, or Approved Equal
  - c. Performance
    - 1) Wireless Technology
      - a) Standard: IEEE 802.11n
      - b) Compatibility: IEEE 802.11a/g/n
    - 2) Data Rates:
      - a) 802.11a: Up to 54-Mbps
      - b) 802.11g: Up to 54-Mbps
      - c) 802.11n: Up to 450-Mbps
      - d) 802.11ac: Up to 1.3-Gbps
    - 3) Frequency
      - a) Bands: 2.4 GHz and 5.0 GHz
      - b) Compliance: FCC
    - 4) Channels:
      - a) 2.4 GHz: (11) Channels
      - b) 5.0 GHz: (21) Channels
  - d. Capabilities
    - 1) Radio resource management (RMM)
    - 2) 2x3 multiple input/multiple output (MIMO) with two spatial streams
    - 3) Maximal ration combining (MRC)
    - 4) Legacy beam forming
    - 5) 20-MHz and 40-MHz channels
    - 6) 3x3 MIMO
    - 7) 80-MHz and 160-MHz
    - 8) PHY data rates up to 450 Mbps
    - 9) Data rates up to 1.3 Gbps
    - 10) Packet Aggregation: A-MPDU (Tx/Rx), A-MSDU (Tx/Rx)
    - 11) 802.11 Dynamic frequency selection (DFS)
    - 12) Cyclic shift diversity (CSD) support
  - e. Maximum Transmit Power
    - 1) 2.4 GHz
      - a) 802.11b: 23 dBm w/ (4) antennas
      - b) 802.11g: 23 dBm w/ (4) antennas
      - c) 802.11n (HT20): 23 dBm w/ (4) antennas
      - d) 802.11ac: per final version of standard
    - 2) 5.0 GHz
      - a) 802.11b: 23 dBm w/ (4) antennas
      - b) 802.11n (HT20): 23 dBm w/ (4) antennas
      - c) 802.11n (HT40): 23 dBm w/ (4) antennas
      - d) 802.11ac: per final version of standard
  - f. Antennas
    - 1) 2.4 GHz
      - a) Type: Integrated
      - b) Gain: 2.0 dBi
      - c) Coverage: 360°

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- 2) 5.0 GHz
  - a) Type: Integrated
  - b) Gain: 5.0 dBi
  - c) Coverage: 360°
- g. Interface Ports:
  - 1) Wireless Network: RJ45 10/100/1000-Mbps Ethernet 1000BASE-T
  - 2) Console Management: Submit, Per Manufacturer
- h. Memory:
  - 1) DRAM: Submit, Per Manufacturer
  - 2) Flash: Submit, Per Manufacturer
- i. Indicators
  - 1) Indication Lights: LED
  - 2) Status: Submit, Per Manufacturer
- j. Power Supply
  - 1) Power over Ethernet (PoE)
    - a) Source: PoE (802.11af from Ethernet Switch)
    - b) Load: Submit, Per Manufacturer
  - 2) Building Power
    - a) Voltage (Input): Submit, Per Manufacturer
    - b) Voltage(Receptacle): Submit, Per Manufacturer
    - c) Frequency: Submit, Per Manufacturer
    - d) Phase: Submit, Per Manufacturer
    - e) Load: Submit, Per Manufacturer
    - f) Power Cord: Submit, Per Manufacturer
- k. Physical
  - 1) Size (W x L x H): Submit, Per Manufacturer
  - 2) Weight: Submit, Per Manufacturer
  - 3) MTBF: Submit, Per Manufacturer
  - 4) Warranty: Submit, Per Manufacturer
- l. Environmental
  - 1) Operating Temperature: Submit, Per Manufacturer
  - 2) Storage Temperature: Submit, Per Manufacturer
  - 3) Relative Humidity: 10 to 95%, non-condensing
  - 4) Operating Altitude: Submit, Per Manufacturer
- m. Product Specification:
  - 1) Contractor shall submit products for approval, with all requested information above included.
  - 2) Other and Misc. Components: Manufacturer and Contractor shall include and recommend all necessary components for a complete and fully functioning system. Components above are for general reference and major parts only.
- 22. Wireless Access Point Type 4 System Requirements:
  - a. Description: Wireless Access Point w/ External 2.4GHz and 5 Ghz MIMO Directional Patch Antenna
  - b. Performance
    - 1) Wireless Technology
      - a) Standard: IEEE 802.11n
      - b) Compatibility: IEEE 802.11a/g/n
    - 2) Data Rates:
      - a) 802.11a: Up to 54-Mbps
      - b) 802.11g: Up to 54-Mbps
      - c) 802.11n: Up to 450-Mbps
      - d) 802.11ac: Up to 1.3-Gbps
    - 3) Frequency

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- a) Bands: 2.4 GHz and 5.0 GHz
    - b) Compliance: FCC
  - 4) Channels:
    - a) 2.4 GHz: (11) Channels
    - b) 5.0 GHz: (21) Channels
- c. Capabilities
  - 1) Radio resource management (RMM)
  - 2) 2x3 multiple input/multiple output (MIMO) with two spatial streams
  - 3) Maximal ration combining (MRC)
  - 4) Legacy beam forming
  - 5) 20-MHz and 40-MHz channels
  - 6) 3x3 MIMO
  - 7) 80-MHz and 160-MHz
  - 8) PHY data rates up to 450 Mbps
  - 9) Data rates up to 1.3 Gbps
  - 10) Packet Aggregation: A-MPDU (Tx/Rx), A-MSDU (Tx/Rx)
  - 11) 802.11 Dynamic frequency selection (DFS)
  - 12) Cyclic shift diversity (CSD) support
- d. Maximum Transmit Power
  - 1) 2.4 GHz
    - a) 802.11b: 23 dBm w/ (4) antennas
    - b) 802.11g: 23 dBm w/ (4) antennas
    - c) 802.11n (HT20): 23 dBm w/ (4) antennas
    - d) 802.11ac: per final version of standard
  - 2) 5.0 GHz
    - a) 802.11b: 23 dBm w/ (4) antennas
    - b) 802.11n (HT20): 23 dBm w/ (4) antennas
    - c) 802.11n (HT40): 23 dBm w/ (4) antennas
    - d) 802.11ac: per final version of standard
- e. Antennas
  - 1) 2.4 GHz, Type-1
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 2.5 dBi
    - e) Coverage: Dipole
  - 2) 2.4 GHz, Type-2
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 2.5 dBi
    - e) Coverage: Triple Omni-Directional
  - 3) 2.4 GHz, Type-3
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 2.5 dBi
    - e) Coverage: Diversity Patch
  - 4) 5.0 GHz, Type-1
    - a) Type: External w/Connectors
    - b) Quantity: (3) Antennas each AP
    - c) Connectors: RP-TNC
    - d) Gain: 3.5 dBi
    - e) Coverage: Dipole
  - 5) 5.0 GHz, Type-2

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- a) Type: External w/Connectors
- b) Quantity: (3) Antennas each AP
- c) Connectors: RP-TNC
- d) Gain: 3.5 dBi
- e) Coverage: Triple Omni-Directional
- 6) 5.0 GHz, Type-3
  - a) Type: External w/Connectors
  - b) Quantity: (3) Antennas each AP
  - c) Connectors: RP-TNC
  - d) Gain: 3.5 dBi
  - e) Coverage: Diversity Patch
- f. Interface Ports:
  - 1) Wireless Network: RJ45 10/100/1000-Mbps Ethernet 1000BASE-T
  - 2) Console Management: Submit, Per Manufacturer
- g. Memory:
  - 1) DRAM: Submit, Per Manufacturer
  - 2) Flash: Submit, Per Manufacturer
- h. Indicators
  - 1) Indication Lights: LED
  - 2) Status: Submit, Per Manufacturer
- i. Power Supply
  - 1) Power over Ethernet (PoE)
    - a) Source: PoE (802.11af from Ethernet Switch)
    - b) Load: Submit, Per Manufacturer
  - 2) Building Power
    - a) Voltage (Input): Submit, Per Manufacturer
    - b) Voltage(Receptacle): Submit, Per Manufacturer
    - c) Frequency: Submit, Per Manufacturer
    - d) Phase: Submit, Per Manufacturer
    - e) Load: Submit, Per Manufacturer
    - f) Power Cord: Submit, Per Manufacturer
- j. Physical
  - 1) Size (W x L x H): Submit, Per Manufacturer
  - 2) Weight: Submit, Per Manufacturer
  - 3) MTBF: Submit, Per Manufacturer
  - 4) Warranty: Submit, Per Manufacturer
- k. Environmental
  - 1) Operating Temperature: Submit, Per Manufacturer
  - 2) Storage Temperature: Submit, Per Manufacturer
  - 3) Relative Humidity: 10 to 95%, non-condensing
  - 4) Operating Altitude: Submit, Per Manufacturer
- l. Product Specification:
  - 1) Contractor shall submit products for approval, with all requested information above included.
  - 2) Other and Misc. Components: Manufacturer and Contractor shall include and recommend all necessary components for a complete and fully functioning system. Components above are for general reference and major parts only.

D. Electrical Power Overload Protection: Overload protection shall be provided by fuses, circuit breakers or other protective devices. Fusing and protective devices shall be easily accessible and shall be designed to provide automatic alarm capabilities.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

E. Patch Cords

1. Patch cords shall be provided and installed as part of this work for connectivity to every network equipment port (fiber, copper, stack cables, etc.). This includes ALL equipment and/or device that are connected to the Wireless Network as well as connecting the network equipment themselves. This is typical of Station Devices to Equipment (Wireless Access Point); and Interconnection of Network Components (Wireless Controllers), etc.)
2. Exact patch cord lengths shall be determined on field coordination and coordinated with Owner.
3. All patch cords shall be labeled on each end to match cable system scheme or as directed by Owner.
4. All patch cords shall be neatly grouped, organized, and wrapped to together.
5. Product Specification:

**Patch cords shall be from same manufacturer as awarded communications infrastructure. Contractor shall coordinate with Construction Manager to confirm type selected. Requirements shall meet Division 27 requirements.**

F. UPS Systems

1. Intermediate Communications Rooms:
  - a. UPS equipment is being provided as part of separate specification section.
  - b. Each intermediate communications room shall be installed with a UPS device capable of 15-minutes under full load as necessary. UPS devices shall be connected to emergency power provided in these rooms.
  - c. Contractor shall coordinate and calculate UPS requirements with equipment vendors providing UPS equipment.
  - d. Wireless Network Contractor shall interface Wireless Network equipment to electrical receptacles.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provided below are general requirements and milestones for executing work. Additional requirements may be necessary to complete work.
  1. Overall Execution Requirements
    - a. Provide a single project team that will install all systems and applications listed above. Any subcontractors must be detailed in the proposal.
    - b. Attend multiple client meetings to discuss specific applications and functionality and their applicability to the customer.
    - c. Provide a single project manager for duration of project.
    - d. Prepare, maintain and update the Project Timeline.
    - e. Attend weekly project meetings on-site.
    - f. Create meeting minutes for all meetings.
    - g. Site survey reviews and inspections. Notify Owner, Construction Manager, and General Contractor of any problems.
    - h. Coordinate work with other trades, 3<sup>rd</sup> party resources and/or subcontractors.
    - i. Contractor is responsible for all network equipment to be installed until system acceptance by Owner.
  2. Owner Coordination and Review
    - a. Provide submittals as outlined in this specification and additional information

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- b. Design, review, and coordinate system parameters such as DHCP, TFTP, DNS, IP addressing scheme and other parameters with Owner, Users, Tenants, and other building systems being interfaced. Contractor shall recommend changes (in writing) to insure QoS and a robust IP network.
  - c. Coordinate equipment availability and procurement dates with Manufacturer. Information shall be submitted in a schedule format for review with Owner.
  - d. Review room ready dates with Construction Manager and Owner.
  - e. Coordinate 3<sup>rd</sup> party applications and integrate into system.
  - f. Prepare implementation, phasing, cutover and testing plans.
  - g. Prepare design of all equipment, components, and options required.
  - h. Coordinate physical and support systems of the proposed and selected data network equipment and components.
  - i. Notify Owner of any potential PoE problems with the telephones proposed, including power consumption.
  - j. Prepare Visio network diagram of proposed connectivity.
  - k. Submit bill of materials for Owner approval.
  - l. Review construction schedule with Construction Manager and Owner.
  - m. Provide Manufacturer's recommended spare parts list in accordance with the delivery schedule set forth in the contract.
  - n. Coordinate 802.1Q VLAN Trunking scheme.
3. Implementation
- a. Order and procure all equipment authorized by Owner.
  - b. Receive and inventory equipment.
  - c. Record serial numbers and provide to Owner.
  - d. Setup, program, and test all equipment and components offsite at Contractor's labs.
  - e. Coordinate and develop security levels and access privileges.
  - f. Coordinate and develop routing plan.
  - g. Coordinate, develop and configure security settings and backup processes.
  - h. Configure IP address for management interface.
  - i. Configure SNMP community names.
  - j. Configure SSID's and Wireless Security requirements.
  - k. Establish, determine, and configure VLAN(s).
  - l. Configure and develop 802.1Q VLAN Trunks.
4. Installation
- a. Deliver equipment to secured location at job site.
  - b. Configure, Test and Integrate system with the Enterprise Network Switching and Routing System
  - c. Physically install all equipment and components in racks and cabinets.
  - d. Physically install all network access points.
  - e. Connect equipment and components to electrical power and UPS.
  - f. Patch all equipment and components to end-point (station) device patching to wall outlets.
  - g. Install the data network equipment and components as specified by Manufacturer and relevant to construction schedule and phasing plan.
  - h. Enable Quality of Service on all switches to support critical application and systems.
  - i. Implement, enable and configure QoS settings on LAN infrastructure.
  - j. Implement and tune wireless access points for optimal coverage areas.
5. Evaluation
- a. Perform a complete LAN network assessment as necessary to guarantee a robust environment of critical applications and systems including IP Telephony, IP surveillance and IPTV. This should be performed after the necessary network upgrades have been installed. Submit network assessment results to the customer.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- b. Perform a full Wi-Fi survey with wireless system up and fully functioning, provide results to owner. Results shall include heat maps overlaid on architectural backgrounds.
- c. Test fail-over and redundancy of network.
- d. Test power failure conditions to ensure both UPS systems and generator operate as planned; maintaining network functionality.
- e. Fail Test System.
- f. Cutover systems.
- g. Troubleshoot and Correct.
- 6. Go-Live and Testing
  - a. Test all systems and 3<sup>rd</sup> party applications.
  - b. First 7 days of in-service coverage.
  - c. Staff help desk for 7 days.
  - d. Technicians and engineers must attend first practice event and first full event.
  - e. Troubleshoot and Correct.
- 7. Finalization
  - a. Prepare Owner acceptance matrix for equipment.
  - b. Get sign off on each piece of equipment by Owner.
  - c. Turn over complete system documentation to customer.
  - d. Prepare a complete system ready checklist, compliance list, and commission system accordingly.
  - e. Receive final Network Acceptance Letter from Owner, prior to warranty start.
- 8. Training
  - a. Conduct Classroom training on system configuration and administration for all users.
  - b. Coordinate with client to design and prepare customized 1 page "Cheat Sheet" for network administration features.
  - c. Perform system administration training on all systems.

3.2 EXAMINATION

- A. Contractor shall coordinate with the Construction Manager to ensure that acceptable conditions exist for installation of all equipment and components.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Provide detailed site survey to ensure acceptable conditions exist.
- C. Examine all rooms and areas where equipment and components will be installed. Check all elements for compliance with space allocations, installation tolerances, hazards to equipment installation, and other conditions affecting installation.
- D. Examine walls, floors, roofs, and roof supports for suitable conditions where equipment is to be installed.
- E. Examine all support systems such as air-conditioning, electrical panels, receptacles, UPS, lighting, etc. are installed and functioning correctly.
- F. Examine all equipment racks and cabinets installations to ensure acceptable conditions exist for installation of all equipment and components.
- G. Ensure that all rooms and any areas where equipment and components are installed are physically secured at all times from theft, vandalism, etc.
- H. Report unacceptable installation or unsafe conditions to the Construction Manager.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- I. Under no condition shall the Contractor install any equipment or component that will void Manufacturer warranty or such conditions that will reduce equipment performance, longevity, and life.

3.3 MAINTENANCE

- A. Maintenance is to be provided on a complete service basis. Maintenance costs, other than those covered under warranty, shall be listed separately from the cost of equipment and shall include the costs of all parts and labor. The initial maintenance contract will be for a 1-year period starting at the conclusion of the warranty service period. The 1-year maintenance cost must be included as a separate cost in the basic offering. Maintenance cost shall be provided for 1-year, 2-years, 3-years, 4-years, and 5-years.
- B. The Contractor's response shall indicate if Contractor plans to provide total system maintenance or subcontract the system maintenance or any part thereof. In the event the use of subcontract maintenance is planned, the Contractor shall indicate what portion(s) of the system maintenance will be provided by the subcontractor and shall furnish proof of an agreement or that a tentative agreement has been negotiated with the subcontractor to provide maintenance on the proposed system. The Contractor shall also provide sufficient documentation that indicates the subcontractor is properly trained and has been certified by the equipment Manufacturer to provide maintenance on the proposed system or any part thereof.
- C. Maintenance will include coordination with Data Circuits procured from Telecommunication Service Providers network access trunks, WAN circuits, Internet circuits, and access devices. This coordination will include the resolution of problems involving the Telecom Service Provider's circuitry and will be a part of the Provider's warranty service and maintenance contract responsibilities as Owner's agent.
- D. Emergency maintenance response time shall be within 4-hours after receipt of an emergency maintenance call from Owner's designated representative. Emergency maintenance is defined as:
  - 1. System Failure
  - 2. Failure of a Common Control Unit
  - 3. Failure of 20% or More Network Ports and Uplinks
  - 4. Failure of a Power Supply
  - 5. Any System Failure that impacts events and/or business operations with no work-around
- E. Routine maintenance response time shall be within 12-hours after receipt of a routine maintenance call from Owner's designated representative. Routine maintenance is defined as any occurrence that does not meet the criteria of emergency maintenance
- F. For evaluation purposes only, unit prices will be multiplies by Service supplied factors based on equipment lines indicated in Part-2 System Requirements. Furnish the labor rate and escalation factor to be used to provide a 5-year price forecast of equipment changes and relocations.
- G. Emergency/critical requirements above may necessitate shorter time intervals. Manufacturer and Contractor shall submit options for Owner review and approval.
- H. Contractor shall propose spare parts list and training that the Owner's onsite staff can acquire that could benefit response time and reduce maintenance cost. Options shall be proposed for Owner review and approval.



MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

3.4 EVALUATION CRITERIA

- A. Maintenance Staffing: Contractor shall provide information on the number of certified technicians on its staff to service the type of the Data Network being proposed and the total number of that type of in the Contractor's local service area. Contractor must provide a letter of recommendation for the proposed product from manufacturer.
- B. Escalation Procedures: Contractor shall furnish a chart, which shows the escalation procedures to be followed to resolve problems or procedures.
- C. Preventative Maintenance: Contractor shall list the type and frequency of preventative maintenance procedures that will be provided under warranty and included in Contractor's maintenance contract.
- D. Remote Maintenance and Diagnostic Testing: Contractor shall list the type, capabilities and frequency of these procedures.
- E. Technical Support: Contractor shall provide information on the type of technical support, who will provide the technical support and the hours when technical support will be available.
- F. Service Area: Contractor shall supply the name, street address, city, state, zip code, and telephone number of Contractor's local service center. Indicate the distance from this local service center to Owner's Premise in road miles and driving time.
- G. Contact for Maintenance: Contractor shall indicate who the Owner's telephone coordinator will contact to obtain service for the Enterprise Data Network and Routing System.
- H. Maintenance Response Time: Contractor shall list the response time and the availability of emergency and routine maintenance.
- I. Dispatching of Technicians for Requests for Maintenance: Contractor shall provide the methods used to dispatch technical staff to respond to Owner's calls for service.
- J. Maintenance Records: Contractor shall indicate the type of maintenance records maintained and the location of these records.
- K. Spare Parts: Contractor shall supply information on the geographical location of replacement spare parts and indicate the distance from this parts depot to Owner's facility in road miles and driving time. In addition, list the emergency backup location for spare parts and indicate the distance from that location for spare parts and indicate the distance from that location to Owner's facility in road miles and driving time or the time required to get parts from that depot to Owner's facility.
- L. System Implementation Schedule: Contractor shall provide an Enterprise Data Network and Routing System implementation schedule for the project.

3.5 SOFTWARE AGREEMENT

Reasonable licensing terms and conditions will be presented to Owner for review and approval related to any proprietary system software and operating systems required to be delivered under the terms of any contract resulting from this RFP.

Bidders must provide cost of the next two versions of firmware and software upgrades.

3.6 INSTALLATION

TECHNOLOGY MANAGEMENT CORP/ALANNA CONSULTING GROUP/SECURITY EVOLUTIONS  
WIRELESS NETWORK SYSTEM  
2014-06-13

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

A. General:

1. This Section describes the installation locations for the products and materials, as well as methods associated with the Wireless Network System portions of the Project including all equipment, components, and cabling. These Specifications, along with the drawings shall be followed during the course of the installation.
2. Examine areas and conditions under which equipment, components, and cabling are to be installed. Notify Owner, Construction Manager, Architect, and Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.
3. The Contractor shall be knowledgeable of work to be performed by other trades and take necessary steps to integrate and coordinate their work with other trades.
4. The Contractor shall be responsible for furnishing all equipment, components, and cabling as specified herein and as indicated on the drawings.
5. The Contractor shall verify space requirements and locations before starting installation of equipment, components, and cabling. Inappropriate conditions shall be immediately reported to Construction Manager, Owner, Architect, and Engineer prior to initiating installation.
6. All equipment, components, and cabling shall be installed in a manner neatly and consistent with this type of work.
7. All equipment, components, and cabling shall be installed for optimal performance.
8. All equipment, components, and cabling shall be installed to allow for easy adds, moves, and other changes in the future.
9. Final labeling scheme shall be coordinated with the Owner and Engineer during the shop drawings process, prior to initiating work. Labeling scheme shall include all equipment, components, and cabling with all appropriate references such as communications rooms, cabinets, racks, cable terminal blocks, patch panels, antennas, outlets, cables, etc.
10. Construction within communication rooms must be substantially complete before the installation of equipment, components, and cabling. This includes, but is not limited to, the installation of plywood backboard, cable tray or ladder rack, electrical outlets, light fixtures, sprinklers and ductwork. All walls shall also be painted before the installation.
11. All equipment, components, and cable noted in this Specification and associated drawings shall be provided and completely setup and installed.
12. The Contractor is required to coordinate their efforts with the other trades and sub-contractor who may be working within the same vicinity to avoid conflict and lost time.
13. The Contractor shall supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc., as customary for the craft and necessary for the installation.
14. The contractor shall not install any component in a manner or condition that will void Manufacturer and/or Contractor warranties. Any such conditions that prevent an acceptable install shall be immediately reported to Construction Manager, Owner, Architect, and Engineer prior to initiating installation. All mis-installed components will be removed and replaced with new at the Contractors expense. No additional cost will be submitted to Owner.
15. All equipment shall be installed in a neat and workmanlike manner, arranged for convenient operation, testing and future maintenance.
16. Communication rooms must be free from dust, dirt, and other foreign materials before the installation of any equipment and components. The door to the communication rooms must be installed and closed during termination.

B. Cable and Patch Cord Installation:

1. All Data Network cable and patch cords shall be provided and installed per Division 27 specifications.

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

2. All Data Network and communications cables and patch cords routed within communications rooms shall be bundled and combed with Velcro to provide a neat and organized appearance. This includes horizontal and vertical cables routed on cable tray, d-rings, vertical cable managers, equipment rack cable managers, etc. Cables shall be bundled using only manufacturer and industry approved Velcro ties with tensions that do not deform and damage cable resulting in loss of transmission or performance. Any bundles and combing methods used shall not exceed manufacturer or industry standards recommendations for that cable type.
3. Within communications rooms, cables and patch cords shall be snugly wrapped using Velcro reusable cable ties, a minimum of every 3'-0" for cable organization. Velcro ties shall be tightened so as not to deform cable jackets and thus affect cable performance. Plastic cable tie wraps shall not be used and will prevent system acceptance.
4. Cable bends shall not be less than that recommended by the manufacturer of the cable. Do not exceed manufacturer's minimum bending radii and other cable requirements. Provided below are some examples but all requirements shall be verified.
5. Care shall be taken so as not to damage cable and patch cords during the installation process and that the manufacturer's and industry standard's pull tension specification is not exceeded.
6. Do not install bruised, kinked, scored, deformed, or abraded cable or patch cords. Remove and discard cable if damaged during installation and replace it with new cable.
7. All cables and patch cords shall be installed in vertical and horizontal cable management within cabinets and racks.
8. Cable and patch cords routed outside of racks and cabinets shall be in cable tray and ladder rack. Fiber optic patch cords shall be routed in fiber trough.
9. Provide independent circuit grounding recommended by manufacturer.
10. Under no circumstances shall the cable or patch cords be painted, treated, or covered with other material unless approved by manufacturer, Owner and Engineer.

C. Equipment Installation:

1. Contractor shall evaluate each space prior to equipment installation. Room shall be free from dust and debris; room shall be complete and sealed against further dust and debris. Contractor shall notify Owner, Engineer and Construction manager of any rooms that don't meet this requirement.
2. Install surge suppressors where ac-power-operated devices are not protected against voltage transients by integral surge suppressors specified in UL1449. Install surge suppressors at the devices' power-line terminals. Comply with Division 26 Section "Transient Voltage Suppression."
3. Point of Interface Equipment: Mount electronic equipment in the types of cabinets recommended by manufacturer. Group related items in methodical sequence.
4. Arrange equipment to facilitate access for maintenance and to preserve headroom and passage space.
5. All equipment and interfaces shall be labeled.
6. Install and patch wireless access points throughout the building.

D. Network Management and Monitoring Software Installation:

1. Install all system management software on Owner provided computers, if provided as part scope of work.
2. Coordinate computer and data network requirements with Owner's IT Group and Data Network contractor. This should include MAC and IP addressing, VLAN assignment, bandwidth requirements, class of service (CoS), quality of service (QoS), VPN requirements, etc.
3. The system management and monitoring software shall be fully setup, programmed, and configured including but not limited to the following:

MINNESOTA MULTI-PURPOSE STADIUM – WI-FI / DAS PRICING PACKAGE  
MINNEAPOLIS, MINNESOTA

- a. Date and Time.
- b. Network end points including but not limited to switches, routers, wireless access points, routers, firewalls, etc.
- c. Graphical user interface (GUI) including facility maps indicating interactive icons for all equipment locations, wireless antennae points, and uplinks.
- d. Web portals, user access, and VPN.
- e. Administrator accounts, passwords, and security levels.
- f. User accounts, passwords, and security levels.
- g. Device thresholds, status, alarm points, alerts, and notification.
- h. Remote diagnostics.
- i. System Inventory.
- j. Event reporting protocol.
- k. System logs including status, performance, alarms, history, and others.
- l. Maintenance log, schedules, and notification.

3.7 CONSTRUCTION PHASING

- A. The Wireless Network installation shall be provided, installed and phased as necessary to meet construction schedule.
- B. The contractor shall meet with the Construction Manager and Owner to review the construction schedule and associated areas of work.
- C. All necessary labor, cable, terminations, components, equipment, and components shall be provided to accommodate temporary, phased, and final conditions and requirement.
- D. Coordinate project schedule, installation schedule, phasing and any other requirements deemed necessary with Owner, Construction Manager and all necessary Trades to ensure successful completion of work.

3.8 COORDINATION

- A. Design Coordination: All components proposed by the Contractor shall be coordinated with the Owner and Architect. Provided below is a general list of major items that shall be documented in a table and coordinated. The list provided below is to be used as an example and not intended to be all inclusive or limit items required to be reviewed and coordinated.
  1. Equipment Type, Physical Size, and Weight.
  2. Rack Units required per location.
  3. Electrical Power (voltage, amp, loads, and receptacle types).
  4. UPS (connectivity and runtime).
  5. HVAC (heat dissipation and equipment operating temperature range).
  6. Wireless Access Point Types and Locations
- B. Installation Coordination: The Contractor shall field coordinate all work with Construction Manager and other Sub-Contractors and Trades as necessary to minimize conflicts. This shall include reviewing each Trade and Sub-Contractor's shop drawings and resolving conflicts.
- C. Schedule: The Contractor shall coordinate the project schedule with the Owner and Construction Manager including but not limited to the following:
  1. RFP Response
  2. Submittals
  3. Construction and Phasing
  4. Room Ready Dates

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MINNEAPOLIS, MINNESOTA

5. Installation
6. Substantial Completion
7. Final Completion
8. System Acceptance
9. Training

3.9 IDENTIFICATION

A. General Label Requirements:

1. The labeling scheme provided by the Contractor and coordinated with the Owner and Architect prior to finalizing and initiating any work. A sample scheme shall be submitted for approval.
2. Mechanically print and install all labels.
3. Format: Select font size to be readable and to fit all information required without overlap of text.
4. Use all capital letters.
5. All labels shall be consistent font type, size, and color throughout project.
6. Labels shall be white with black text.
7. Clean all surfaces prior to attachment of any label. Follow manufacturer's recommendations for cleaning and affixing labels.
8. Method: Brady cable labels appropriately sized or approved equal.
9. Cabling records must be provided in both PDF and paper formats, organized into multiple sets of a series of binders.

B. Cable:

1. Label Location: Within 0.5 inches (25 mm) of each termination.
2. Near-End Label Information: Cable No. XXX. Where XXX is the cable infrastructure number on the patch panel or inter-equipment port number.
3. Far-End Label Information: Cable No. XXX. Where XXX is the cable infrastructure number on the patch panel or inter-equipment port number.

C. Equipment:

1. Label all major equipment and components.
2. Label Information: Equipment No., Type (or Short Description), and Manufacturer part number or equipment series.

3.10 FIELD QUALITY CONTROL

- A. Test Plan: A comprehensive Test Plan shall be submitted as part of the technical proposal. Plan shall include all necessary steps to ensure complete functionality as per the specifications by Game 6 of the initial season.
- B. Manufacturer's Field Service: Contractor shall engage a Manufacturer-authorized service representative to inspect field-assembled components and equipment installation, and supervise pre-testing, testing, and adjusting of equipment.
- C. Inspection: Contractor shall verify that equipment and components are properly installed, connected, setup, configured, and programmed.
- D. Pre-testing: Contractor shall adjust system and pretest equipment, components, wiring, and functions to verify that they comply with specified requirements. Replace all malfunctioning or damaged items. Retest until satisfactory performance and conditions are achieved.

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MINNEAPOLIS, MINNESOTA

- E. Operational Tests: Contractor shall perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes. Hand-held diagnostic equipment shall be utilized during testing.
- F. Test Schedule: Contractor shall schedule tests after Operational testing has successfully been completed and system has been in normal functional operation for at least 7-days. Provide a minimum of 7-days' notice of test schedule. Contractor may have to compress testing schedule to meet project phasing deadlines and must accommodate all overtime and work after hours to meet schedule.
- G. 3<sup>rd</sup> Party Testing: Independent 3<sup>rd</sup> Party testing shall be required in cases of conflict. All costs for testing shall be the responsibility of the Contractor.
- H. Test Results: Contractor shall record test results and publish in electronic and hard copies for distribution to Owner. Wi-Fi signal heat maps shall be provided.
- I. Re-Test: Contractor shall correct all deficiencies identified by tests and observations, and re-test until specified requirements are met.
- J. Commissioning: Contractor shall create and submit a checklist for commissioning system equipment and components. The list shall include the following categories.
  - 1. Validate Procured Components
  - 2. Physical Installation and Location
  - 3. Equipment Connectivity and Inter-Connectivity
  - 4. Support Systems Functioning (HVAC, electrical, and UPS)
  - 5. System Setup and Operation
  - 6. VLAN Assignment and Quality of Service (QoS)
  - 7. SSID Configurations and Security Verification
  - 8. Testing
  - 9. Fail Testing

3.11 FAIL TESTING

- A. General:
  - 1. An Equipment Fail Test of all major equipment and components shall be performed by the Contractor and observed by the Owner. The system Manufacturer shall have appropriate personnel onsite to assist with testing.
  - 2. Real-time visual proof shall be provided using wireless computers, handhelds, POS systems and Ticketing systems.
  - 3. Intent of Equipment Fail Test is to confirm system availability, uptime, redundancy, and failover vital to system operation. All redundant Data Network equipment and equipment with redundant components shall be failed test to validate failover.
  - 4. Fail testing shall be completed on the fully functioning Wireless Network system after Contractor and Manufacturer has completed all system setup, programming, configuration, standard testing, troubleshooting, replaced all faulty components, and validated system performance and operation.
  - 5. The Contractor shall coordinate Equipment Fail Testing schedule with Owner.
- B. The installed Wireless Network must demonstrate its capability of providing the services enumerated in the contract. Test equipment required for demonstration will be Contractor provided. Contractor will also provide documented test results.

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C. Component Failure Tests: Contractor shall submit a schedule for testing after final completion of network and attached systems. Internet, Administrative Access, Point of Sale, Guest Wireless and other systems, must be up and running on network to verify actual network performance for failure under stress.

1. Power Cord (each, separately)
2. Power Supply (each, separately)
3. Uplinks (each, separately)
4. Disconnect/Reconnect of an Access Point

D. Equipment and Components: Fail testing shall be completed on each of the following components:

1. Wireless Controller
2. Wireless Access Point

### 3.12 CLEANING

- A. Contractor shall clean all equipment and components using methods and materials recommended by manufacturer.
- B. Equipment cleaning shall be completed prior to final site observation by Owner and final system acceptance.

### 3.13 DEMONSTRATION AND TRAINING

- A. Contractor shall submit a comprehensive Training Plan as part of their technical proposal. Plan shall include quantity and qualifications of available local training resources.
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment.
  1. Conduct training as specified in instructions to Owner's employees in Division 1 Section "Contract Closeout" or Division 26 Section "General Electrical Requirements." This shall include training with System Maintenance and Monitoring Software System.
  2. Review the system architecture, setup, configuration, connectivity, and location of all equipment and components.
  3. Provide general description of function for each individual equipment and component.
  4. Train Owner's maintenance personnel on procedures and schedules for system administration, routine use, troubleshooting, servicing, and maintaining equipment.
  5. Demonstrate methods of determining optimum setup, configuration, and adjustment of equipment and components for system controls and function.
  6. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data", Division 26 Section "General Electrical Requirements" and Division 27 Section "General Technology Requirements".
  7. Schedule training with Owner with at least 14-days advance notice.

### 3.14 RECORD DOCUMENTATION

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- A. Record documentation shall be submitted to the Owner by the Contractor at the completion of the wireless system installation. The contractor shall submit all information necessary to operate and maintain system including but not limited to the following:
1. As-Built Documents
  2. Operations and Maintenance Manuals
  3. Maintenance Schedule
  4. Maintenance Company Contact Information
  5. Trouble Shooting Guide
  6. Product Data and Manufacturer Cut-Sheets
  7. Warranty Information and Contact
  8. Manufacturer's Product and Installation Certificate
  9. Log (troubleshooting, replacement, expansion, and replacements)
  10. Labeling Scheme
  11. Spare Parts Lists
  12. Network Information: Contractor shall provide full network information document for submittal to Owner at the conclusion of the project. Each room shall be documented as a separate document amended to an overall architecture document. It shall be provided in Visio format and include, but not be limited to:
    - a. Detailed Installation Information:
      - 1) Settings
      - 2) VLANs
      - 3) SSIDs
      - 4) IP Addressing
      - 5) Routing Information
      - 6) QoS, CoS, settings
      - 7) Etc.
    - b. Equipment Information:
      - 1) Serial Number
      - 2) Part Number
      - 3) Warranty Expiration
    - c. Backup Configuration of all equipment at final acceptance
    - d. Backups of all Software installed as part of this work
    - e. Breakdown of Identification/Labeling Scheme
- B. Maintain current record documents at the construction site.
- C. Refer to Submittal Section of this Specification for additional requirements.

END OF SECTION



**5.0 NFL STADIUMS DAS/WI-FI GUIDELINES –  
RF DESIGN & MINIMUM PERFORMANCE  
STANDARDS FOR 3G/4G DAS AND WIRELESS  
LOCAL AREA NETWORK (“WLAN”) FOR NFL  
STADIUMS**

***RF Design & Minimum Performance Standards for 3G / 4G  
DAS and Wireless Local Area Networks (“WLAN”) for NFL  
Stadiums (DAS / Wi-Fi Guidelines)***

*October 9, 2013*

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# Contents

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<b>1 Introduction .....</b>	<b>7</b>
1.1 Purpose .....	7
1.2 Scope of Work .....	7
1.3 Document Organization .....	7
<b>2 PART A: Feature Sets and Minimum Capabilities .....</b>	<b>8</b>
2.1 Scope .....	8
2.2 Audience .....	8
2.3 DAS Features & Capabilities .....	8
2.3.1 Design Consideration: IDAS vs. ODAS.....	8
2.3.2 Typical DAS Solution Recommended for NFL Stadiums.....	9
2.3.3 DAS Product Features.....	9
2.3.4 Other DAS Accessories .....	11
2.4 Wi-Fi Features & Capabilities .....	12
2.4.1 Standard Features in Existing Wi-Fi Networks.....	12
2.4.2 Wi-Fi Accessories.....	15
2.5 DAS Cost Estimates .....	16
2.6 Wi-Fi Cost Estimates .....	18
<b>3 PART B: Distributed Antenna System and Wi-Fi Design Acceptance Criteria ...</b>	<b>20</b>
3.1 Scope .....	20
3.2 Audience .....	20
3.3 Acronyms .....	20
3.4 Definitions.....	22
3.5 Stadium Design & Dimensioning Acceptance .....	22
3.5.1 Objective .....	22
3.5.2 Acceptance Procedure & Exit Criteria.....	23
3.5.3 DAS Design & Dimensioning Acceptance – Report Template .....	23
3.5.4 RF Design Acceptance .....	24
3.5.5 DAS Design Acceptance .....	29
3.5.6 Wi-Fi Design & Dimensioning Acceptance – Report Template .....	30
3.5.7 Wi-Fi Design Acceptance .....	31
3.5.8 DAS Capacity Dimensioning Acceptance .....	36
3.5.9 Wi-Fi Capacity Dimensioning Acceptance .....	36
3.5.10 Wi-Fi Frequency Coordination Acceptance.....	36
<b>4 PART C: User Experience Assessment – Event-Based Performance Acceptance</b>	<b>38</b>
4.1 Objective .....	38
4.2 Assessment Procedure & Exit Criteria .....	38

4.3 Report Template.....	38
4.4 Review of DAS Deployment.....	39
4.4.1 DAS Deployment Inventory Assessment .....	39
4.5 Review of Wi-Fi Deployment.....	39
4.5.1 Wi-Fi Deployment Inventory Assessment .....	39
4.6 Off-Game RF Performance Assessment (Walk-Test Based) .....	39
4.6.1 UMTS / HSPA .....	40
4.6.2 CDMA / EVDO.....	40
4.6.3 LTE .....	41
4.6.4 Wi-Fi.....	41
4.6.5 GSM.....	42
4.6.6 RF Performance Acceptance Summary.....	43
4.7 Spot Test Assessment – Event-Based User Experience Analysis .....	44
4.7.1 Voice Service Experience.....	44
4.7.2 SMS and MMS Service Experience .....	45
4.7.3 GSM Data Service Experience .....	46
4.7.4 3G Data Service Experience .....	47
4.7.5 4G Data Service Experience .....	48
4.7.6 Wi-Fi Service Experience .....	49
<b>5 Part D: Design &amp; Deployment Checklists.....</b>	<b>51</b>
5.1 Performance Metrics to be collected.....	51
5.2 DAS Integration Checklist.....	51
5.3 Wi-Fi Checklist.....	54
<b>6 Part E: Input Requirements from Wireless Service Provider(s) / Third Party(ies)</b>	<b>56</b>
.....	
6.1 RF Design Acceptance Report .....	56
6.2 Wi-Fi Design Acceptance Report.....	58
6.3 Link Budget Calculations .....	60
6.4 Capacity Dimensioning Report .....	60
6.4.1 Air-Interface Capacity Dimensioning Results (DAS) .....	60
6.4.2 Backhaul Capacity Dimensioning Results.....	61
6.4.3 Channel Element Capacity Dimensioning Results .....	61
6.4.4 Wi-Fi Dimensioning Results.....	62
6.5 DAS Deployment Plan – Acceptance Report.....	64
6.6 Wi-Fi Deployment Plan – Acceptance Report.....	65
6.7 DAS Game Day Performance Statistics.....	66
6.7.1 Voice Game Day Performance Statistics .....	66
6.7.2 3G Data Game Day Performance Statistics.....	66
6.7.3 4G Data Game Day Performance Statistics.....	66
6.8 Wi-Fi Game Day Performance Statistics.....	67
<b>Appendix A Sample Link Budget.....</b>	<b>68</b>
7.1 UMTS CPICH Link Budgets.....	68
7.2 LTE RS Link Budgets .....	69
7.3 CDMA1x & EVDO Pilot Budgets .....	70
7.4 GSM BCCH Voice Link Budgets.....	71

---

7.5 Wi-Fi Link Budget .....72

## Figures

Figure 3-1: UMTS / HSPA Design Target.....	25
Figure 3-2: CDMA / EVDO Design Target.....	26
Figure 3-3: LTE Design Target.....	28
Figure 3-4: GSM Design Target.....	29
Figure 3-5: Generic DAS Design Target.....	29
Figure 3-6: ODAS Design Target.....	30
Figure 3-7: DAS Design Target for Neutral-Host Deployment.....	30
Figure 3-8: Wi-Fi Design Target.....	32
Figure 3-9: Wi-Fi Design Target - Bowl.....	33
Figure 3-10: Wi-Fi Design Target - Bowl + Suites / Clubs.....	33
Figure 3-11: Wi-Fi Design Target - Sidelines / Field.....	34
Figure 3-12: Wi-Fi Design Target - Locker Rooms.....	35
Figure 3-13: Wi-Fi Design Target - Entrance / Exit Perimeter, Ticketing, Point of Sale.....	35
Figure 3-14: Wi-Fi Design Target - Parking Lot.....	36
Figure 3-15: Flowchart for frequency planning and coordination.....	37
Figure 4-1: UMTS / HSPA RF Acceptance Target.....	40
Figure 4-2: CDMA / EVDO RF Acceptance Target.....	41
Figure 4-3: LTE RF Acceptance Target.....	41
Figure 4-4: Wi-Fi RF Acceptance Target.....	42
Figure 4-5: GSM RF Acceptance Target.....	42
Figure 4-6: RF Performance Acceptance Summary.....	43
Figure 4-7: RF Performance Acceptance Criteria.....	44
Figure 4-8: Voice Service Acceptance Summary.....	45
Figure 4-9: SMS / MMS Service Experience Summary.....	46
Figure 4-10: GSM Data Service Acceptance Summary.....	47
Figure 4-11: GSM Data Service Acceptance Criteria.....	47
Figure 4-12: 3G Data Service Acceptance Summary.....	48
Figure 4-13: 3G Data Service Acceptance Criteria.....	48
Figure 4-14: 4G Data Service Acceptance Summary.....	49
Figure 4-15: 4G Data Service Acceptance Criteria.....	49
Figure 4-16: Wi-Fi Data Service Acceptance Summary.....	50
Figure 4-17: Wi-Fi Data Service Acceptance Criteria.....	50
Figure 5-1: Checklist for Data Collection.....	51
Figure 5-2: Checklist for DAS Integration - Deployment Details.....	52
Figure 5-3: Checklist for DAS Integration - Installation Check.....	53
Figure 5-4: Checklist for DAS Integration - Call Verification.....	53
Figure 5-5: Checklist for Power & Gain Verification.....	53
Figure 5-6: Checklist for Wi-Fi Installation - Deployment Details.....	54
Figure 5-7: Checklist for Wi-Fi Installation - Installation Check.....	55
Figure 5-8: Checklist for Wi-Fi Installation – Call Verification Field Trial.....	55
Figure 6-1: Air-Interface Dimensioning Result Template.....	61
Figure 6-2: Backhaul Dimensioning Result Template.....	61

Figure 6-3: Channel Element Dimensioning Result Template .....62

Figure 6-4: Rough estimate of Wi-Fi capacity (for illustrative purpose only) .....63

Figure 6-5: Wi-Fi Dimensioning Result Template .....64

Figure 6-6: Sample DAS Line Diagram .....65

Figure 6-7: Sample UMTS Link Budget.....69

Figure 6-8: Sample LTE Link Budget .....70

Figure 6-9: Sample CDMA Pilot Link Budget.....71

Figure 6-10: Sample GSM BCCH Link Budget.....72

Figure 6-11: Sample Wi-Fi Link Budget.....73

# 1 Introduction

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## 1.1 Purpose

The purpose of this document is to provide common requirements, specifications, parameters & standards and also to articulate the program for providing wireless services in National Football League (“NFL”) stadiums. This document will capture the minimum requirements for the stadiums and deliver RF design and performance acceptance targets. The performance standards and specifications are designed to ensure that the customer experience at each NFL stadium is equal to or exceeds the customer expectations by ensuring standardized RF & Wi-Fi coverage throughout the stadium. The minimum requirements provided in this document will be the criteria each installation will be surveyed and tested against by NFL or applicable third parties (e.g., consultants).

## 1.2 Scope of Work

- This document provides common requirements, guidelines, and recommendations for design, deployment, and performance assessment of wireless technologies such as Wi-Fi and high-capacity solutions such as DAS (for LTE, UMTS / HSPA, CDMA / EVDO, and GSM).
- As technology evolves, this document may be subject to change.
- This document is generic in nature and the actual implementation will be unique for every stadium.
- This document will be an additional component of or reference for any existing or new DAS or Wi-Fi agreement at each NFL stadium.

## 1.3 Document Organization

This document includes the following sections:

- Section 1: Introduction
- Section 2: Feature Sets and Minimum Capabilities
- Section 3: Distributed Antenna System and Wi-Fi Design Acceptance Criteria
- Section 4: User Experience Assessment – Event-Based Performance Acceptance
- Section 5: Design and Deployment Checklists
- Section 6: Input Requirements From Wireless Service Provider(s) / Third Party(ies)
- Appendix A: Sample Link Budget



# 2 PART A: Feature Sets and Minimum Capabilities

---

## 2.1 Scope

The scope of Part A includes the following:

- Definition of minimum features and capabilities to be present in DAS and Wi-Fi equipment.
- Recommended features aimed at enhancing performance and future technology support.
- Other recommendations and benefits pertaining to neutral-host DAS deployment.
- Shall be applicable for all NFL stadiums.

## 2.2 Audience

Part A is prepared for the NFL and NFL Clubs to facilitate the understanding of basic features and capabilities that should be included in all DAS and Wi-Fi equipment deployed in any NFL stadium.

## 2.3 DAS Features & Capabilities

### 2.3.1 Design Consideration: IDAS vs. ODAS

There could be several considerations to decide between IDAS (indoor DAS) and ODAS (outdoor DAS) deployment.

#### 2.3.1.1 Typical Deployment Considerations for IDAS

- Indoor Coverage Target: Objective is to cover indoor areas that could be served by indoor type of DAS deployment.
- High-Capacity Needs Within Stadium: That cannot be supported by the surrounding macro network.
- Inadequate Coverage from Macro: Despite best efforts, existing macro solution may not provide reliable coverage within 100% of the stadium area.
- Flexibility for Future Capacity Expansion: IDAS can easily be re-sectorized for capacity increase.

#### 2.3.1.2 Typical Deployment Considerations for ODAS

- Outdoor Coverage Target: Objective is to cover outdoor areas that could be served by outdoor type of DAS deployment.
- High-Capacity Needs: High sectorization possible.
- Flexibility for Future Capacity Expansion: ODAS can easily be re-sectorized for capacity increase.
- Time-to-Market: Often faster to deploy than regular macro sites.

- Cost Savings with Neutral-Host ODAS: Deploying an ODAS that is shared with other operators could lead to cost savings compared to regular macro deployment.
- Zoning: May be useful where no permits are possible for macro sites (e.g., historical districts).
- Terrain: Hilly terrain difficult to cover with single macro sector / antenna.
- Site Acquisition / Space Constraints: If there is no room for conventional macro equipment at each antenna location, nodeB-hosts and ODAS can provide a solution.

### 2.3.2 Typical DAS Solution Recommended for NFL Stadiums

In NFL stadiums, where there are a number of entrance / exit areas as well as multiple parking lots generally present surrounding the stadium, a combination of IDAS (Indoor DAS) and ODAS (Outdoor DAS) might need to be deployed at transition regions between the macro and indoor networks.

Considering the existence of strong macro signals in the surrounding areas, it is very likely that these transition areas (e.g., multi-layered parking lots, multiple entrance points or other similar areas that cannot be very clearly defined as part of either macro or the stadium but are located between the two and very often cater to high-traffic demand) will experience very strong signal strength from the existing macro network due to line-of-sight communication. In such cases, for these transition areas, it may not be possible to ensure strong IDAS dominance due to transmit power limitation. In order to achieve DAS dominance, these transition areas may therefore need deployment of ODAS solutions.

From the RF design perspective, it is necessary to define a transition zone between the macro and the indoor stadium. These areas are generally likely to have a strong macro signal and require deployment of ODAS to ensure its dominance. Hence, ODAS deployment is recommended in certain locations (e.g., entrance / exit areas, parking lots). Other indoor zones, such as the seating bowl, concourse, field, and locker rooms, can still be served by IDAS.

### 2.3.3 DAS Product Features

#### 2.3.3.1 MIMO Support

The current deployments should be planned in such a way that it would make DAS equipment 2x2 MIMO capable with the ability to support 4x4 MIMO deployment in the future. The following will be key considerations in respect of network element deployment to ensure MIMO readiness:

- The DAS head-end should offer independent connectivity to the eNodeB for 2x2 MIMO with the provision to extend connectivity to 4x4 MIMO in the future.
- The DAS remote equipment offered by the vendors should be 2x2 ready and facilitate easy upgrade to 4x4 MIMO.
- The fiber / cable connectivity between head-end and remote unit should have flexibility to be upgraded to 4x4 MIMO in the future.

#### 2.3.3.2 AGC / ALC Features

The DAS equipment should have AGC (Automatic Gain Control) / ALC (Automatic Level Control) feature on both uplink and downlink. Availability of AGC / ALC will ensure DAS amplifier operation in the linear region. This is especially important in cases where minimum separation between the DAS

antenna and user equipment (UE) is not always adequate. In such cases, additional attenuation may need to be incorporated in terms of uplink AGC offered by the remote IDAS equipment.

### **2.3.3.3 Centralized Network Management Unit in DAS**

The entire DAS system, IDAS and ODAS together, should have a remote centralized network management system. In case of a neutral-host deployment, the management system should be capable of monitoring status and performance of all technologies of all carriers. Otherwise, for carrier-specific design, each DAS system should have an independent centralized management unit. Some features expected in the management unit are as follows:

- Remote control and network monitoring
- Tracking and calculation performance during peak operation
- Efficient troubleshooting in case of failures or breakdown
- Real-time DAS equipment maintenance reports, status, and alarms
- Usage and performance reports

### **2.3.3.4 Neutral-Host Deployment Requirements**

The DAS equipment must be capable of supporting all bands and technologies. Although neutral-host DAS deployment is not a requirement specified by this document, it is recommended over carrier-specific deployment for reasons stated in the following sub-section:

#### **2.3.3.4.1 Benefits of Neutral-Host Deployment**

- Neutral-host deployment is cost-effective as all carriers can use the same equipment for all technologies.
- Management of the DAS and upgrades are also easier in case of neutral host.
- Carrier-specific deployment creates aesthetic issues due to overcrowding of DAS antennas and accessories within the stadium.
- In case of a bad RF environment, troubleshooting and RF optimization becomes a challenge with carrier-specific deployment.

#### **2.3.3.4.2 Neutral-Host Deployment Challenges**

- In a multi-carrier deployment scenario, leadership and coordination may become a challenge.
- Power assignment to each carrier can be a challenge. Ideally, equal PA power should be provided to all carriers but the actual power assignment could vary due to techno-commercial constraints.
- Neutral-host deployment can potentially lead to intermodulation which may not occur in carrier-specific deployment.
- DAS head-end may not always facilitate carrier-specific optimization-related changes.

### 2.3.3.5 Emerging Trends – LTE Broadcast

LTE Broadcast is an emerging technology solution, which can enable wireless operators to transmit content to all users in a cell or a group of cells in broadcast mode. LTE Broadcast uses standard, non-proprietary technology as stipulated within the purview of 3GPP. This technology may be a useful feature for wireless operators in NFL stadiums for transmitting content such as live updates, video streams, and other feeds to users in a stadium over broadcast channel(s).

## 2.3.4 Other DAS Accessories

### 2.3.4.1 Antenna Selection

The following section highlights some key antenna parameters to be considered for DAS antenna selection:

- Physical Size: Antennas should be easy to install and relatively smaller than macro antennas for aesthetic reasons.
- Frequency Range: The antennas should support multiple bands for both neutral-host and carrier-specific deployment.
- Horizontal Beamwidth (HBW): The horizontal beamwidth should be decided based on the target coverage area and the size of deployable antenna.
- Vertical Beamwidth (VBW): The vertical beamwidth is higher for small-panel antennas compared to regular larger macro antennas.
- Gain: It is customary to use small-sized antenna with typical gain varying in the range of 0 – 5dBi.
- Electrical Tilt: Due to low antenna heights, electrical tilt is typically not used in DAS deployments.
- Intermodulation: Potentially becomes a problem in multi-carrier deployments. Therefore, a high-quality antenna with a low intermodulation product specification should be used.
- Front-to-Back Ratio: A high value for front-to-back ratio is deemed to be healthy as it reduces the possibility of unwanted coverage and interference for APs in the surrounding area. It is important to achieve good sector isolation, especially when the antenna is not mounted on a large wall.
- Max Power Capability: A typical antenna specification is 200W, but some antennas are limited to 50W which is approaching the DAS TX power.
- MIMO Capability: Cross-pole antenna is preferable due to ease of deployment.

### 2.3.4.2 Splitters, Attenuators, and Feeder / Jumper Cables

For splitters and attenuators, the power rating of the equipment should be adequate for all carriers with a provision for additional carriers in the future. Splitters and attenuators should also exhibit linear RF characteristics.

There is a tradeoff between loss and bending radius for jumpers and feeders. Hence, the selection of these RF cables should be done considering the cable losses incurred and the area available for the installation of these cables.

Weather-proofing is important, especially for ODAS equipment and exterior IDAS equipment, which could be affected by certain weather conditions (e.g., rain, snow).

### **2.3.4.3 Optical Fiber Cables**

Optical fiber cables could be used for backhaul connections and for connections between the remote unit and the head end. Multi-mode fiber cables are often used for short-distance connections within the stadium to decrease cost without the loss of quality. Single-mode fiber cables, which have better characteristics, can be used for short- and long-distance backhaul connections, but are generally more expensive.

## **2.4 Wi-Fi Features & Capabilities**

### **2.4.1 Standard Features in Existing Wi-Fi Networks**

#### **2.4.1.1 IEEE Standard**

All the APs must be at least 802.11n compliant with a provision to upgrade to newer standards in the future (e.g., 802.11ac). The APs should also be backward-compatible to provide service to legacy devices (supporting standards before 802.11n such as 802.11a and 802.11g). However, 802.11b traffic must be blocked as transmissions over 802.11b decrease the overall efficiency and throughput significantly. 802.11b can be enabled only if the NFL's or a particular NFL Club's services mandatorily require it to be enabled. In such a case, 802.11b must be enabled only in zones where the service will be required. These zones, where 802.11b traffic will be selectively enabled, cannot be located in a high user density area, as it will lead to significant degradation of the user experience in that area and it should preferably have a separate SSID with dedicated channels. Also, it is recommended that the service should be upgraded to be compliant with a newer 802.11 standard, when appropriate (e.g., 802.11ac).

#### **2.4.1.2 MIMO Support**

MIMO is supported by all standards from 802.11n onwards. Deploying a network that is 2x2 MIMO capable is of prime importance. MIMO contributes to an enhanced user experience. Apart from being 2x2 capable, the infrastructure should be capable of supporting 4x4 MIMO in the future.

#### **2.4.1.3 Dual Radio APs**

Dual band APs are capable of supporting 2.4GHz and 5GHz simultaneously. Given that the network planning for every NFL stadium will be capacity driven, installing dual radio APs is preferred over single radio APs since it doubles the number of users that one AP can support and eases deployment. Installation of dual band radios will allow the APs to perform advanced operations like band steering, which is discussed in the following sub-section.

#### **2.4.1.4 Load Balancing / Band Steering**

Loading Balancing or Band Steering is a very important feature for densely deployed Wi-Fi networks. Band steering involves redirecting clients from a heavily loaded channel to a channel with relatively lower usage. Currently most of the traffic is driven over the 2.4GHz band. Hence, by steering clients capable of operating in both bands to a 5GHz channel, the load on 2.4GHz channels can be reduced. This should contribute to delivering higher user throughput for all users.

### 2.4.1.5 Channel Bonding

Channel aggregation or channel bonding is supported by standard 802.11n and onwards. Channel bonding involves clubbing two or more 20MHz channels together to form a bonded channel with greater bandwidth, which guarantees improved throughput. Since there are only a limited number of channels available in 2.4GHz, channel bonding is typically used in 5GHz.

IEEE Standard 802.11n supports bonded channels with a maximum channel bandwidth of 40MHz. 802.11ac supports the following channel bandwidths: 40MHz, 80MHz, and 160MHz. For the NFL Wi-Fi network deployment, the equipment must be capable of supporting channel bonding of at least 40MHz. The actual implementation will be a function of the design and dimensioning results.

### 2.4.1.6 Frame Aggregation

Frame aggregation will be a preferred feature in the Wi-Fi network installed in NFL stadiums. Frame aggregation is a feature introduced in IEEE 802.11e and onwards. There are two types of frame aggregation schemes: Aggregated MAC-Level Protocol Data Unit (A MPDU) and Aggregated MAC-Level Service Data Unit (A MSDU). The basic concept in these schemes is to aggregate several data frames into one large data frame and transport in one contention period. This reduces the overhead associated with repeated contention by all users and increases user throughput.

The maximum limit on aggregation level can be controlled depending on the peak number of users and type of traffic experienced.

### 2.4.1.7 Access Layer Network Controllers

In a typical deployment scenario in any NFL stadium, there will be multiple APs installed in each zone. Managing, maintaining, and troubleshooting all of these APs individually can be a significant challenge. Hence, it is mandatory to configure network controllers individually for all APs within a zone. Apart from the zone level APs, there must be a hierarchical model of controllers with a final centralized network controller module for the entire stadium. This hierarchical model is employed in most current high-density deployments.

These network controllers should be capable of monitoring and identifying issues with the network, providing smooth troubleshooting, and generating periodic reports. The controllers should also provide:

- Remote control, network monitoring, and configuration to dynamically re-assign channels and manage RF parameter settings
- Tracking and calculation performance during peak operation
- Efficient troubleshooting in case of failures or breakdown
- Real-time Wi-Fi maintenance reports, status, and alarms
- Usage and performance reports

### 2.4.1.8 Modules in Distribution and Core Layer

Apart from the access layer network controllers, the Wi-Fi network must be equipped with suitable IDF switches, MDF LAN switches and routers, and core layer WLAN controllers.

### **2.4.1.9 Security**

Security is an important feature for the private SSIDs that will be available exclusively for NFL internal services. The current recommended security standard is WPA2-Enterprise. WPA2 employs stronger encryption methods than the previous standards (WEP and WPA). Also, it is strongly recommended that WEP standard is not used for any private SSIDs. The public SSIDs will be unsecured.

### **2.4.1.10 Authentication**

Network should be capable of implementing authentication features which could be optionally turned on to admit only specific user groups in the stadium (e.g., fans, ticket scanners, media).

### **2.4.1.11 Carrier Mobile Data Offload**

Network shall be capable of implementing mobile carrier data offload.

### **2.4.1.12 Tracking User Usage Patterns**

Network should be capable of tracking the usage patterns and gathering analytics related to consumer behavior and application usage to aid the marketing team of the applicable NFL Club.

### **2.4.1.13 Emerging Trends – Wi-Fi Multicast**

Wi-Fi multicast is an emerging trend similar to LTE Broadcast. Multicast is an excellent option to conserve bandwidth, because it involves transmission through a single stream as opposed to many streams individually addressed to different clients. This could be of particular importance in an NFL stadium where streaming live video, score updates, and other information can be multicast to many users simultaneously.

Hence, it is recommended that the infrastructure be capable of upgrading the system with Wi-Fi multicast, as this technology will be used in the near future.

### **2.4.1.14 Emerging Trends – Hotspot 2.0**

Hotspot 2.0 is an interoperable Wi-Fi authentication and handoff technology that allows users to seamlessly transfer connections from one Wi-Fi hotspot to another without manually selecting SSIDs and entering passwords to mimic a handover scenario in cellular networks. Hotspot 2.0 can be used in public arenas like colleges, office environments, and stadiums. Hotspot 2.0 can be made possible with WPA2 and EAP authentication protocols. It supports EAP-SIM by means of which a SIM card on a smart phone can be used by the Wi-Fi network. The 3GPP standards group is looking into creating a seamless transition between cellular and Wi-Fi networks. This interoperability between cellular and Wi-Fi technologies is not yet ready for commercial deployment, but will be important in the future.

Hotspot 2.0 is currently in a developmental phase and not ready for commercial deployment. However, given the network requirements in an NFL stadium, it can prove to be of great use in the future.

### **2.4.1.15 Emerging Trends – Location-Based Services**

The Wi-Fi network should be capable of upgrading to location-based services to estimate the location of a client in the stadium.

## 2.4.2 Wi-Fi Accessories

### 2.4.2.1 Wi-Fi Antennas

- Internal vs. External Antennas: Internal antennas are the built-in omnidirectional antennas. Due to the ease of installation, internal antennas are deployed in most standard scenarios. External antennas are used for aesthetic reasons (e.g., to hide the AP) or when a directional antenna is a necessity from a coverage / capacity perspective.
- Omnidirectional and Directional Antennas: Omnidirectional antennas are generally used when the AP is located on the ceiling (located 15-20 feet or lower) and there is no frequency reuse planned in the vicinity. Most standard APs are equipped with omnidirectional antennas. The gain of an omnidirectional antenna is generally lower to avoid overshooting of coverage. Directional antennas are used to provide coverage and higher capacity to a particular zone, and in case of hard-to-reach areas, to provide isolation in order to facilitate frequency reuse. Directional antennas can be mounted on any wall or ceiling to provide adequate coverage to the target area. Directional antennas typically have more gain than omnidirectional antennas.
- Antenna Gain: The gain of the antenna is typically about 0-5dBi. An antenna with higher gain increases the footprint of the antenna, thus increasing the number of users that the AP would need to serve. Given the high-density nature of NFL stadiums, a large coverage would not be desirable.
- Horizontal and Vertical Beamwidth: The horizontal and vertical beamwidth should be decided based on the target coverage area and the size of the deployable antenna.
- Mechanical / Electrical Downtilt: Downtilt can be coupled with a directional antenna in areas where isolation is important or in a bad RF environment (zones which are hard to reach with conventional omnidirectional antennas). Downtilt is used to control the coverage span and to provide better throughput to clients in a particular zone.
- Front-to-Back Ratio: A high value for front-to-back ratio is deemed to be healthy as it reduces the possibility of unwanted coverage and interference for APs in the surrounding area. This is applicable for externally deployed directional antennas. It is important to achieve good isolation, especially when the antenna is not mounted on a large wall.
- MIMO Capability: Many of the commercial APs available in the market have inbuilt MIMO capability (2 or more antennas). If external antennas are to be used, cross-pole antennas are generally preferred.

### 2.4.2.2 Optical Fiber Cables

Optical fiber cables could be used for backhaul connections as well as for connections between the switch and the controller. Multi-mode fiber cables are often used for short-distance connections within the stadium to decrease cost without the loss of quality. Single-mode fiber cables, which have better characteristics, can be used for short- and long-distance backhaul connections, but are generally more expensive.



## 2.5 DAS Cost Estimates

Following are the main building blocks of a neutral-host DAS that will influence the overall cost of the DAS.

Item Description	Purpose & Dependency	Comment
<p><b>Head End Equipment</b></p>	<p><b><u>Purpose</u></b></p> <p>Take the inputs from RAN / UTRAN / E-UTRAN equipment in the DL and feed into the DAS transmission chain towards the remote unit. In the UL direction, this conditions the signals received from the remote unit and feeds into the base station receive chain.</p> <p><b><u>Dependency</u></b></p> <p>The size and complexity of the head-end equipment will depend on i) number of service providers being accommodated; ii) number of technologies per service provider; iii) frequency bands of operation; iv) total number of frequency spots being used; and v) number of base stations being fed, etc.</p>	<p>The dimensioning exercise outlined in this document will help determine the size and capacity of the head-end equipment along with its accessories. Based on these and per unit pricing obtained from the vendor / service provider, total cost of head end should be derived.</p>
<p><b>Remote Units</b></p>	<p><b><u>Purpose</u></b></p> <p>Convert optical signal into RF followed by amplification for subsequent transmission through antenna in the DL direction. The remote units perform the reverse function to the signal in the UL direction.</p> <p><b><u>Dependency</u></b></p> <p>The number of remote units will depend on all factors mentioned above as well as any additional challenges associated with covering any specific areas of the stadium.</p>	<p>The preliminary number of remote units will be determined from the dimensioning exercise, and finalized based on actual RF design. Once the final count is determined, based on unit price, total cost of remote units can be determined.</p>
<p><b>Cabling (Coaxial and Fiber) and RF Accessories</b></p>	<p><b><u>Purpose</u></b></p> <p><b><u>Fiber:</u></b> Convert RF signals from head end / remote unit into optical and transport to the remote unit / head end.</p> <p><b><u>Coaxial and RF Accessories:</u></b> Ensure successful transmission and fan-out, wherever necessary, of RF signal within the stadium.</p> <p><b><u>Dependency</u></b></p> <p>Will depend on the size of the stadium, capacity requirement, deployment constraints, and RF design outcomes (e.g., number of remote units, number of antennas, whether MIMO is employed).</p> <p>The number of fibers required for the DAS will</p>	<p>Based on the outcomes of final RF design, the bill of materials for RF accessories (e.g., cables, jumpers, connectors, splitters, attenuators) will have to be developed. Then, based on unit price of individual components, total pricing estimate will have to be determined.</p> <p>Based on the number of technologies that will have to be served, the length of fiber, and number of fiber strands, total cost of fiber can be determined.</p>

	depend on the factors mentioned above, as well as whether MIMO is going to be supported. In addition, costs may vary depending on the size of the stadium and total fiber length.	
<b>Design &amp; Optimization</b>	<p><b><u>Purpose</u></b></p> <p>Arrange adequate coverage and capacity within the venue of interest to ensure quality of end user experience.</p> <p><b><u>Dependency</u></b></p> <p>Design &amp; optimization KPIs like minimum signal strength within the stadium (e.g., RSCP, RSRP), minimum signal quality (e.g., Ec / Io, RSRQ, RS CINR), accessibility, retainability, minimum uplink and downlink user throughput, etc.</p>	Size of the stadium, number of technologies to be supported, and target KPIs will determine the cost of design & optimization.
<b>Installation</b>	<p><b><u>Purpose</u></b></p> <p>Ensure successful operation of the DAS within the stadium.</p> <p><b><u>Dependency</u></b></p> <p>Location and size of the stadium, as well as other design &amp; dimensioning aspects.</p>	Based on the size of the stadium, market, location of stadium, cost of labor, etc., total installation cost will have to be derived.
<b>Backhaul</b>	<p><b><u>Purpose</u></b></p> <p>Connect RAN / UTRAN / E-UTRAN equipment to the RNC / core network.</p> <p><b><u>Dependency</u></b></p> <p>Network topology of the individual service provider, availability of accessible backhaul transmission network near stadium, and capacity requirements.</p>	Depending on technical and operational requirements, the cost of backhaul can be estimated.
<b>Upgrade to Emerging Technologies</b>	<p><b><u>Purpose</u></b></p> <p>Deploy a system intended to significantly increase throughput, coverage, and capacity, and is at least able to support or be easily upgraded with emerging technologies (e.g., eMBMS, LTE carrier aggregation, higher-order MIMO).</p> <p><b><u>Dependency</u></b></p> <p>DAS product features, software version, stadium constraints, etc.</p>	<p>Ensuring easy upgrade to emerging technologies is recommended and will help minimize the cost of deployment in the future.</p> <p>While these features have many benefits and may enhance network capabilities in the future, these upgrades are recommended but not mandatory according to this guidelines document.</p>

Once the cost estimates of each of the above items are determined, the estimates can then be combined to determine the total cost of deployment. The total cost can then be divided by the total seating capacity of the stadium to determine the cost per user.

## 2.6 Wi-Fi Cost Estimates

Following are the main building blocks of a Wi-Fi network that will influence the overall cost.

Item Description	Purpose & Dependency	Comment
Access Points	<p><b><u>Purpose</u></b></p> <p>Connect users (stations) to the network (internet).</p> <p><b><u>Dependency</u></b></p> <p>The number of APs will depend on i) number of SSIDs being accommodated; ii) number of users to be served; iii) frequency bands of operation and available number of channels; iv) technology type (e.g., 802.11n or lower); v) user experience requirement in terms of throughput per user and number of concurrent users, etc.</p>	<p>The dimensioning exercise outlined in this document will help determine the number of APs along with its accessories. Based on these and per unit pricing obtained from the vendor / service provider, total cost of APs should be derived.</p>
Controllers	<p><b><u>Purpose</u></b></p> <p>Act as interface between AP and the internet.</p> <p><b><u>Dependency</u></b></p> <p>The dimensioning of controller will primarily depend on i) capacity requirement; ii) factors mentioned above for APs; iii) reliability requirement (e.g., hot-standby configuration); and iv) future upgrade needs, etc.</p>	<p>Based on the factors mentioned here, total cost of controller shall be determined.</p>
Cabling (Fiber & Coaxial) and RF Accessories	<p><b><u>Purpose</u></b></p> <p>Ensure successful transmission of RF signal within the stadium.</p> <p><b><u>Fiber:</u></b> Convert RF signals into optical and transport to the AP.</p> <p><b><u>Coaxial and RF Accessories:</u></b> Ensure successful transmission of RF signal within the stadium.</p> <p><b><u>Dependency</u></b></p> <p>Will depend on the size of the stadium, capacity requirement, deployment constraints, RF design (includes antennas and RF cables / jumpers), and RF design outcomes (e.g., number of APs, location of APs, distance from controllers).</p> <p>The number of fibers will depend on the factors mentioned above. In addition, costs</p>	<p>Based on the outcomes of final RF design, the bill of materials for RF accessories will have to be developed. Then, based on unit price of individual components, the total pricing estimate will have to be determined.</p>

	may vary depending on the size of the stadium as well as total fiber length.	
<b>Design &amp; Optimization</b>	<p><b><u>Purpose</u></b>                  Arrange adequate coverage and capacity within the venue of interest to ensure quality of end user experience.</p> <p><b><u>Dependency</u></b>                  Design &amp; optimization KPIs like best server RSSI, best server SINR, average UL and DL user throughput, average back off duration, etc.</p>	Size of the stadium, number of APs to be supported, and target KPIs will determine the cost of design & optimization.
<b>Installation</b>	<p><b><u>Purpose</u></b>                  Ensure successful operation of Wi-Fi within the stadium.</p> <p><b><u>Dependency</u></b>                  Location and size of the stadium and other design and dimensioning aspects.</p>	Based on the size of the stadium, market, location of stadium, cost of labor, etc., total installation cost will have to be derived.
<b>Backhaul</b>	<p><b><u>Purpose</u></b>                  Connect controller to the internet.</p> <p><b><u>Dependency</u></b>                  Network topology, availability of accessible backhaul transmission network near stadium, and capacity requirement.</p>	Depending on technical and operational requirements, the cost of backhaul can be estimated.
<b>Upgrade to Emerging Technologies</b>	<p><b><u>Purpose</u></b>                  Deploy a system intended to significantly increase throughput, coverage, and capacity, and is at least able to support or be easily upgraded with emerging technologies (e.g., 802.11ac, Hotspot 2.0, Wi-Fi multicast, voice over Wi-Fi).</p> <p><b><u>Dependency</u></b>                  Wi-Fi product feature, software version, stadium constraints, etc.</p>	<p>Ensuring easy upgrade to emerging technologies is recommended and will help minimize the cost of deployment in the future.</p> <p>While these features have many benefits and may enhance network capabilities in the future, these upgrades are recommended but not mandatory according to this guidelines document.</p>

Once the cost estimates of each of the above items are determined, the estimates can then be combined to determine the total cost of deployment. The total cost can then be divided by the total seating capacity of the stadium to determine the cost per user.

It is recommended that public Wi-Fi service in NFL stadiums be provided free of charge to all media staff and fans (regardless of wireless service provider).

# 3 PART B: Distributed Antenna System and Wi-Fi Design Acceptance Criteria

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## 3.1 Scope

The scope of Part B includes the following:

- Stadium design, dimensioning, and minimum performance acceptance targets
- RF & DAS acceptance and system capacity assessment for all technologies
- 3G / 4G technologies (UMTS, HSPA, CDMA, EVDO, LTE) and Wi-Fi
- Infrastructure-vendor and service provider-independent in nature
- Shall be applicable for all NFL stadiums
- Includes service provider-specific and neutral-host DAS

## 3.2 Audience

Part B is prepared for the NFL and NFL Clubs to facilitate the standardization of design, dimensioning, and performance acceptance of any NFL stadium.

## 3.3 Acronyms

The following acronyms and terms are used in this document:

3GPP	3 <sup>rd</sup> Generation Partnership Project
AGC	Automatic Gain Control
ALC	Automatic Level Control
AP	Access Point
AWS	Advanced Wireless Service Channel (DL: 2110 to 2155MHz and UL: 1710 to 1755MHz)
BCCH	Broadcast Control Channel in GSM
BOM	Bill Of Materials
BSIC	Base Site Identity Code in GSM
BTS	Base Transceiver Station
C/I	Carrier over Interference
CDMA	Code Division Multiple Access
CE	Channel Element
CNR	Carrier to Noise Ratio
CPICH	Common Pilot Channel
CS	Circuit Switched

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DAS	Distributed Antenna System
Ec	Received Pilot Signal Strength
Ec / Io	Pilot Signal Quality for CDMA
Ec / No	Pilot Signal Quality for UMTS / HSPA
EIRP	Equivalent Isotropic Radiated Power
eMBMS	Evolved Multimedia Broadcast Multicast Service (LTE)
EVDO	Evolution-Data Optimized
FDD / TDD	Frequency Division Duplexing / Time Division Duplexing
GSM	Global System for Mobile Communication
HE	Head End
IM	Intermodulation Product
KPI	Key Performance Indicator
LTE	Long Term Evolution
MC	Monte-Carlo Simulation
mE / Erl	milli Erlangs / Erlangs
MIMO	Multi Input Multi Output
MSLR	Minimum Service Level Requirement
NOC	Network Operations Center
OOBE	Out of Band Emission
PA	Power Amplifier
PCI	Physical Cell ID
PDSCH	Physical Downlink Shared Channel
PIM	Passive Intermodulation
PN	Pseudo-Random Noise Sequence
PRACH	Physical Random Access Channel
PS	Packet Switched
PSC	Primary Scrambling Code
PUSCH	Physical Uplink Shared Channel
RAN	Radio Access Network
RE	Remote Equipment
RS EPRE	Received Signal Energy per Resource Element
RSCP	Received Signal Code Power
RSRP	Reference Signal Received Power
RSRQ	Reference Signal Quality
RSSI	Received Signal Strength Indicator
RxQual	Receiver Quality
SINR	Signal to Interference and Noise Ratio
SLA	Service Level Agreement

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SSID	Service Set Identification
TMA	Tower Mounted Amplifier
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
UTRAN	UMTS Terrestrial Radio Access Network
WLAN / WWAN	Wireless Local Area Network / Wireless Wide Area Network
WPA	Wi-Fi Protected Access
WEP	Wired Equivalent Privacy
$\lambda$	Wavelength of Operation

## 3.4 Definitions

1. “**Stadium Zones**” shall be separate and specific geographic areas of each applicable stadium (e.g., “northwest corner end zone 100 level”), rather than separate functional areas (e.g., “all concourses”), and shall be identified when establishing the testing methodology for each stadium. For the avoidance of doubt, the “Average” for a Stadium Zone shall represent the average for the spot tests at that particular location, not all spot tests across all locations in a stadium.
2. The “**Average**” value of any metric shall be determined as follows:
  - a. Collect individual values of the metric from a series of tests undertaken at different spots in the stadium.
  - b. Calculate the mean value of all such values across all spot test locations.
  - c. This number shall represent the “**Average**” value of the metric.
  - d. If the “**Average**” value calculated is below the “**Average**” set for the metric, the minimum service level requirement is not met.
3. “**Call Success**” shall be determined by conducting tests randomly throughout the public areas of a stadium during the Busy Hours of a Game. Each call attempt that is able to connect during the first attempt and retain the connection for 90 seconds shall be deemed a successful call.
4. “**Message Success**” shall be determined by conducting tests randomly throughout the public areas of a stadium during the Busy Hours of a Game. Each message attempt that is able to be sent or received, as applicable, within 180 seconds of initiation shall be deemed a successful message.
5. “**Busy Hours of a Game**” shall be one hour before a game starts until one hour after a game ends.

## 3.5 Stadium Design & Dimensioning Acceptance

### 3.5.1 Objective

The purpose of this section is to outline design targets for each service and service provider (in case of neutral-host) that will be used for design acceptance by the applicable stadium entity(ies) (e.g., NFL Club, stadium owner, stadium management company, state authority) and/or other third party(ies) (e.g., consultant(s)).

The objective of this section is to ensure availability of adequate coverage, capacity, and quality that will provide reliable and ubiquitous service at all potential areas of interest within the stadium.

### 3.5.2 Acceptance Procedure & Exit Criteria

The design acceptance procedure will commence upon formal receipt of the design & dimensioning report from the service provider / third-party vendor. The objective of this section is to standardize the results and deliverables such that these can be used uniformly across all NFL stadiums, for both service provider-specific and neutral-host solutions, as well as in a vendor-agnostic manner. In addition, one key output of this section is to submit the bill of materials (BOM) for final approval.

The exit criterion will comprise of formal acceptance of the design & dimensioning report by the applicable stadium entity(ies) or third-party(ies), as referenced in Section 3.5.1.

### 3.5.3 DAS Design & Dimensioning Acceptance – Report Template

The design report should be created using MS Word and Visio, with all elements (e.g., formats, fonts, headings) matching those prescribed in this document.

At a minimum, the design report package should consist of the following:

- Executive Summary
  - *Executive summary of assumptions and results*
- Design Assumptions
  - *Type of Implementation*
    - *FDD or TDD, Technology (e.g., LTE, UMTS)*
  - *Frequency Bands of Operation*
    - *Band of operation (e.g., 700MHz, AWS) and associated bandwidths per technology*
- Design Objectives & Targets
  - *Coverage Objective*
    - *As described in Section 3.5.4*
  - *Traffic Capacity Considerations*
    - *As described in Section 6.4*
  - *Other Technical Assumptions*
    - *Other assumptions, if any, specific to the NFL stadium*
- Baseline Coverage and Capacity Results
  - *Summary of coverage and capacity results*
- Link Budgets
  - *All details pertaining to link budget have been described in Section 6.3*
    - *For Individual Services and Service Providers*
    - *Determination of Limiting Link*
- Sector Configuration Plan
  - *As described in Section 6.1*
- DAS Connectivity Plan
  - *As described in Section 6.1*
- Coverage Design Results (plots and statistics)



- As described in Section 6.1
- Capacity Design Results (plots and statistics)
  - As described in Section 6.1 and 6.4
- Summary & Conclusion

### 3.5.4 RF Design Acceptance

Following is the summary of the design targets for the technologies under consideration.

#### 3.5.4.1 UMTS / HSPA

UMTS / HSPA	Target	Comment
Best Server RSCP	To be primarily governed by the dominance requirement <b>Average Across Each Stadium Zone</b> <b>-85dBm</b> over 100% of the area	6dB dominance over surrounding macro sector will have to be ensured in both open and closed roof scenarios if applicable.  For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
Best Server PSC	Entire stadium area is served by the DAS; outside area is served by the surrounding macros	This will ensure proper signal dominance as well as containment of the desired server
PSC Reuse	Not recommended; in unavoidable cases, Co-PSC signal strength difference > <b>25dB</b>	Co-PSC interference can cause significant harm to the system performance
Best Server Ec / No	<b>Average Across Each Stadium Zone</b> <b>-16dB</b> at 100% downlink load for 100% of the area <b>Average Across Each Stadium Zone</b> <b>-9dB</b> at unloaded condition for 100% of the area.	This corresponds to the worst case scenario when UE is located at the intersection of 3 cells (1 server and 2 interferers)  For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
Active Set Size (within 5dB of Best Server)	<b>&lt;=1.35</b> (averaged over 100% of the area) Maximum number of servers within 5dB of best server <b>&lt;=3</b>	These will help achieve planned air-interface capacity
Maximum Best Server RSCP	In compliance with RF exposure requirement	Should be aligned with FCC or other regulatory requirements
Connection Success Rate (MC simulation)	<b>Average Across Entire Stadium &gt;=95%</b>	For definition of “Average” refer to Section 3.4.
Downlink Application User Throughput	<b>Average Across Entire Stadium</b> <b>&gt;=500kbps</b> for 100% of the area for fully loaded conditions <b>Average Across Each Stadium Zone</b> <b>&gt;=300kbps</b> for 100% of the area for fully	For capacity-driven design, as the deployment could be constrained by a maximum number of sectors that can be deployed in the stadium, an average of 500kbps user throughput will ensure reasonable end user experience

	loaded conditions	For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
<b>Uplink Application User Throughput</b>	<p><b>Average Across Entire Stadium</b>  <math>\geq 300\text{kbps}</math> for 100% of the area for fully loaded conditions</p> <p><b>Average Across Each Stadium Zone</b>  <math>\geq 150\text{kbps}</math> for 100% of the area for fully loaded conditions</p>	<p>Aligned with user experience target</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>
<b>Maximum User Throughput Limitation</b>	A rate limit can be applied by the service operator to avoid bandwidth consumption by a single user	Rate limiting is not a necessary requirement according to these guidelines; it is a recommended configuration to improve fairness of usage

Figure 3-1: UMTS / HSPA Design Target

### 3.5.4.2 CDMA / EVDO

CDMA 1x	Target	Comment
<b>Best Server Ec</b>	<p>To be primarily governed by the dominance requirement</p> <p><b>Average Across Each Stadium Zone</b>  <math>-85\text{dBm}</math> over 100% of the area</p>	<p>6dB dominance over surrounding macro sector will have to be ensured in both open and closed roof scenarios if applicable</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>
<b>Best Server PN</b>	Entire stadium area is served by the DAS; outside area is served by the surrounding macros	This will ensure proper signal dominance as well as containment of the desired server
<b>PN Reuse</b>	Not recommended; in unavoidable cases, Co-PN signal strength difference $> 25\text{dB}$	Co-PN interference can cause significant harm to the system performance
<b>Best Server Ec/Io</b>	<p><b>Average Across Each Stadium Zone</b>  <math>-14\text{dB}</math> at 100% downlink load for 100% of the area</p> <p><b>Average Across Each Stadium Zone</b>  <math>-7\text{dB}</math> at unloaded condition for 100% of the area</p>	<p>This corresponds to T_Drop threshold that is generally used for CDMA1x network</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>
<b>Active Set Size (within 5dB of Best Server)</b>	<p><math>\leq 1.35</math> for 100% of the area</p> <p>Maximum number of servers within 5dB of best server <math>\leq 3</math></p>	Same overlap target as UMTS
<b>Maximum Best Server Ec</b>	In compliance with RF exposure requirement	Should be aligned with FCC or other regulatory requirements
<b>Connection Success Rate (MC simulation)</b>	<b>Average Across Entire Stadium</b> $\geq 95\%$	<p>Same success rate target as UMTS</p> <p>For definition of “Average” refer to</p>

		Section 3.4.
<b>Downlink Application User Throughput</b>	<p><b>Average Across Entire Stadium</b>                  &gt;=500kbps for 100% of the area for fully loaded conditions</p> <p><b>Average Across Each Stadium Zone</b>                  &gt;=300kbps for 100% of the area for fully loaded conditions</p>	<p>Aligned with user experience target</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>
<b>Uplink Application User Throughput</b>	<p><b>Average Across Entire Stadium</b>                  &gt;=300kbps for 100% of the area for fully loaded conditions</p> <p><b>Average Across Each Stadium Zone</b>                  &gt;=150kbps for 100% of the area for fully loaded conditions</p>	<p>Aligned with user experience target</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>
<b>Maximum User Throughput Limitation</b>	A rate limit can be applied by the service operator to avoid bandwidth consumption by a single user	Rate limiting is not a necessary requirement according to these guidelines; it is a recommended configuration to improve fairness of usage

Figure 3-2: CDMA / EVDO Design Target

3.5.4.3 LTE

LTE	Target	Comment
<b>Best Server RSRP</b>	<p>To be primarily governed by the dominance requirement</p> <p><b>Average Across Each Stadium Zone</b>                  -95dBm for 100% area</p>	<p>6dB dominance over surrounding macro sector will have to be ensured in both open and closed roof scenarios if applicable</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>
<b>Best Server PCI</b>	Entire stadium area is served by the IDAS; outside area is served by the surrounding macros	This will ensure proper signal dominance as well as containment of the desired server
<b>PCI Reuse</b>	Not recommended; in unavoidable cases, Co-PCI signal strength difference > 25dB	Co-PCI interference can cause significant harm to the system performance
<b>Best Server RSRQ</b>	<p><b>Average Across Each Stadium Zone</b>                  -19dB at 100% downlink load for 100% of the stadium area</p> <p><b>Average Across Each Stadium Zone</b>                  -13dB at unloaded condition for 100% of the area</p>	For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
<b>PDSCH SINR</b>	<b>Average Across Each Stadium Zone</b> >=-4dB for 95% area where traffic is located, including stairs and elevators	Simulation studies with 19-site hexagonal plan show >=-4dB could be achievable for 95% area under full

	(100% RB loading at surrounding cells) >=-6dB for remaining 5% area	loading condition For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
<b>PUSCH SINR</b>	<b>Average Across Each Stadium Zone</b> >=-6dB for 95% area where traffic is located, including stairs and elevators (100% RB loading at surrounding cells) >=-8dB for remaining 5% area	Simulation studies with 19-site hexagonal plan show >=-6dB could be achievable for 95% area under full loading condition For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
<b>Average number of servers (within 5dB of Best Server)</b>	<=1.35 for 100% of the area Maximum number of servers within 5dB of best server <=3	Same overlap target as UMTS
<b>Maximum Best Server RSRP</b>	In compliance with RF exposure requirement or -25dBm RSSI	Should be aligned with FCC or other regulatory requirements
<b>Connection success rate (MC simulation)</b>	<b>Average Across Entire Stadium</b> >=95%	For definition of “Average” refer to Section 3.4.
<b>Downlink Application User Throughput</b>	<b>Average Across Entire Stadium</b> >=700kbps for 100% of the area for fully loaded conditions <b>Average Across Each Stadium Zone</b> >=500kbps for 100% of the area for fully loaded conditions	Aligned with user experience target For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
<b>Uplink Application User Throughput</b>	<b>Average Across Entire Stadium</b> >=500kbps for 100% of the area for fully loaded conditions <b>Average Across Each Stadium Zone</b> >=300kbps for 100% of the area for fully loaded conditions	Aligned with user experience target For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
<b>Max. Fiber Distance</b>	<= 10km for PRACH Format 0 <= 50km for PRACH Format 1	This is unlikely to be a constraint in IDAS. Calculation provided in Section 6.
<b>Max. Differential Fiber Delay between Simulcast Antennas</b>	<=0.94km for Normal CP <=3.39km for Extended CP	This is unlikely to be a constraint in indoor DAS
<b>MIMO Antenna Deployment</b>	Cross-Polarized or Spatial Separation At least 4λ Distance for Spatially Separated Antennas	Currently only limited field results are available Study shows similar gain using cross-pole or spatially separated antennas Minimum 4λ separation will ensure uncorrelated signals

<b>Maximum User Throughput Limitation</b>	A rate limit can be applied by the service operator to avoid bandwidth consumption by a single user	Rate limiting is not a necessary requirement according to these guidelines; it is a recommended configuration to improve fairness of usage
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**Figure 3-3: LTE Design Target****3.5.4.4 GSM**

<b>GSM</b>	<b>Target</b>	<b>Comment</b>
<b>Minimum Best Server RSSI</b>	To be primarily governed by the dominance requirement <b>Average Across Each Stadium Zone</b> <b>-92dBm</b> over 100% of the area	6dB dominance over surrounding macro sector will have to be ensured in both open and closed roof scenarios if applicable  For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
<b>Best server BCCH/BSIC</b>	Entire stadium area is served by the IDAS; outside area (entrance / exit zone, parking lots) is served by the ODAS	This will ensure proper signal dominance as well as containment of the desired server
<b>Reuse of BCCH-BSIC Combination</b>	Not recommended; in unavoidable cases, signal strength difference > 25dB	Since BCCH-BSIC combination can cause significant harm to the system performance
<b>Serving Cell Quality</b>	<b>Average Across Each Stadium Zone</b> <b>BCCH C/I (Co-channel) &gt;= 12dB</b> for 100% of the area  <b>BCCH C/I (Adjacent channel) &gt;= -6dB</b> for 100% of the area	As per typical design guidelines  For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
<b>Active Set Size (within 5dB of Best Server)</b>	<b>&lt;=1.35</b> for 100% of the area  Maximum number of servers within 5dB of best server <b>&lt;=3</b>	As per typical design guidelines
<b>Maximum Best Server RSSI</b>	In compliance with RF exposure requirement	Should be aligned with FCC or other regulatory requirements
<b>Connection Success Rate (MC simulation)</b>	<b>Average Across Entire Stadium</b> <b>&gt;=95%</b>	As per typical design guidelines  For definition of “Average” refer to Section 3.4.
<b>Downlink Application User Throughput</b>	<b>Average Across Entire Stadium</b> <b>&gt;=200kbps</b> for 100% of the area for fully loaded conditions  <b>Average Across Each Stadium Zone</b> <b>&gt;=100kbps</b> for 100% of the area for fully loaded conditions	Aligned with user experience target  For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
<b>Uplink Application User</b>	<b>Average Across Entire Stadium</b>	Aligned with user experience target

<b>Throughput</b>	<p><b>&gt;=60kbps</b> for 100% of the area for fully loaded conditions</p> <p><b>Average Across Each Stadium Zone</b></p> <p><b>&gt;=40kbps</b> for 100% of the area for fully loaded conditions</p>	For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
<b>Maximum User Throughput Limitation</b>	A rate limit can be applied by the service operator to avoid bandwidth consumption by a single user	Rate limiting is not a necessary requirement according to these guidelines; it is a recommended configuration to improve fairness of usage

Figure 3-4: GSM Design Target

### 3.5.5 DAS Design Acceptance

#### 3.5.5.1 General DAS Design Acceptance Targets

Following are some of the DAS-specific design targets that shall be used for acceptance.

DAS Equipment	Target	Comment
<b>Uplink Dominance Target &amp; DAS Sensitivity</b>	<p>Ensure lowest possible system noise figure while maintaining same UL and DL best serving cell</p> $\Delta T_x + \Delta \text{SystemNF} = 0$	This will ensure minimum UE transmit power, trade-off between RoT at DAS and macro as well as avoid the issue of poor HSDPA performance. All measurements shall be referenced at the antenna port. Depending on technology, “Tx” refers to CPICH (UMTS), Pilot (CDMA), and RS (LTE).
<b>Uplink Gain / Loss Setting in UTRAN</b>	If uplink End-to-End System Gain >0dB, Set this as TMA gain	Defined as the net system gain between DAS remote node input and NodeB receiver input
<b>Minimum Distance between UE and Antenna</b>	In line with Targets associated with OOBE, intermodulation and receiver clipping	This will address issues due to OOBE, intermodulation and/or receiver clipping
<b>Intermodulation Product</b>	Maximum IM level is 3 dB below the RX sensitivity of the DAS for the Air Interface technology with the best RX sensitivity	Especially important for high power DAS supporting multiple technologies & bands; all measurements are referenced at the antenna
<b>MIMO Support</b>	The system should be able to support MIMO (2x2) upgradable to 4x4	This will ensure that higher data rates are delivered to users
<b>Power Distribution Per Operator</b>	Unless agreed otherwise for specific techno-commercial reasons, equal PA power should be assigned to each operator	The total remote unit power should be equally distributed among the service providers

Figure 3-5: Generic DAS Design Target

### 3.5.5.2 ODAS Specific DAS Design Acceptance Targets

Following are some of the design targets for ODAS that shall be used for acceptance. As specified in Section 2, ODAS deployment is applicable in areas near the entrance / exit areas and parking lots.

DAS Equipment	Target	Comment
Uplink Dominance Target & DAS Sensitivity	Ensure lowest possible system noise figure while maintaining same UL and DL best serving cell $\Delta T_x + \Delta \text{SystemNF} = 0$	This will ensure minimum UE transmit power, trade-off between RoT at DAS and macro as well as avoid the issue of poor HSDPA performance. All measurements shall be referenced at the antenna port. Depending on technology, "Tx" refers to CPICH (UMTS), Pilot (CDMA), RS (LTE).
Uplink Gain / Loss Setting in UTRAN	If uplink End-to-End System Gain >0dB, Set this as TMA gain	Defined as the net system gain between DAS remote node input and NodeB receiver input
Intermodulation Product	Maximum IM level is 3dB below the RX sensitivity of the DAS for the Air Interface technology with the best RX sensitivity	Especially important for high power DAS supporting multiple technologies & bands; all measurements are referenced at the antenna
MIMO Support	The system should be able to support MIMO (2x2) upgradable to 4x4	This will ensure that higher data rates are delivered to users
Power Distribution Per Operator	Unless agreed otherwise for specific techno-commercial reasons, equal PA power should be assigned to each operator	The total remote unit power should be equally distributed among the service providers

Figure 3-6: ODAS Design Target

### 3.5.5.3 Neutral Host Specific DAS Design Acceptance Targets

Following are some of the DAS-specific design targets for neutral hosts that shall be used for acceptance. Apart from the target specified below, other targets are the same as those specified earlier.

DAS Equipment	Target	Comment
Multi-Operator Support	Should be able to support more than one operator	A neutral-host DAS makes sure the system is designed to support multiple operators, which is very important in the stadiums

Figure 3-7: DAS Design Target for Neutral-Host Deployment

### 3.5.6 Wi-Fi Design & Dimensioning Acceptance – Report Template

The design report should be created using MS Word and Visio, with all elements (e.g., formats, fonts, headings) matching those prescribed in this document.

At a minimum, the design report package should consist of the following:

- Executive Summary

- *Executive summary of assumptions and results*
- Design Assumptions
  - *Type of Implementation*
    - *Wi-Fi Standard - 802.11 a/b/g/n/ac*
  - *Frequency Bands of Operation*
    - *Band of operation (2.4GHz or 5GHz) and channel bandwidth*
- Design Objectives & Targets
  - *Coverage Objective*
    - *As described in Section 3.5.7*
  - *Traffic Capacity Considerations*
    - *As described in Section 6.4.4*
  - *Other Technical Assumptions*
    - *Other assumptions, if any, specific to the NFL stadium*
- Baseline Coverage and Capacity Results
  - *Summary of coverage and capacity results*
- Link Budgets
  - *Wi-Fi Link Budget is included in Section 6.3*
  - *For Individual Services and Service Providers*
  - *Determination of Limiting Link*
- AP Configuration Plan
  - *As described in Section 6.2*
- Coverage Design Results (plots and statistics)
  - *As described in Section 6.2*
- Capacity Design Results (plots and statistics)
  - *As described in Section 6.2*
- Summary & Conclusion

### 3.5.7 Wi-Fi Design Acceptance

Following are some of the Wi-Fi-specific design targets that shall be used for acceptance. The best server RSSI values vary for certain zones. Such variations have been specified in the following sub-sections. In zones for which a particular value for a KPI has not been stipulated, the design acceptance criteria will be in accordance with Figure 3-8.

Wi-Fi	Target	Comment
Best Server RSSI	<b>Average Across Each Stadium Zone</b> <b>-67dBm</b> for 100% of the area <b>Average Across Entire Stadium</b> <b>-57dBm</b> over 100% of the area	Target set for 20MHz channel BW Target for 40MHz channel BW shall be higher by 3-5dB The target should be met in both open and closed roof scenarios if applicable



		For definitions of “Stadium Zone” and “Average” refer to Section 3.4.
<b>Best Server SINR</b>	<p><b>Average Across Each Stadium Zone &gt; 10dB</b> for 100% of the area</p> <p><b>Average Across Entire Stadium &gt; 20dB</b> for 100% of the area</p>	<p>At the minimum, target is to use MCS of QPSK 3/4</p> <p>On the average, 16QAM modulation with 1/2 coding scheme is targeted</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>
<b>Maximum Total RSSI</b>	In compliance with RF exposure requirement	Should be aligned with FCC or other regulatory requirements
<b>Downlink Application User Throughput</b>	<p><b>Average Across Entire Stadium &gt;=1Mbps</b> over 100% of the area for fully loaded conditions</p> <p><b>Average Across Each Stadium Zone &gt;=500kbps</b> over 100% of the area for fully loaded conditions</p>	<p>Aligned with user experience target</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>
<b>Uplink Application User Throughput</b>	<p><b>Average Across Entire Stadium &gt;=500Kbps</b> over 100% of the area for fully loaded conditions</p> <p><b>Average Across Each Stadium Zone &gt;=300kbps</b> over 100% of the area for fully loaded conditions</p>	<p>Aligned with user experience target</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>
<b>Maximum User Throughput Limitation</b>	A rate limit can be optionally applied by the service provider to avoid bandwidth consumption by a single user	Rate limiting is not a necessary requirement according to these guidelines; it is a recommended configuration to improve fairness of usage
<b>Percentage of Simultaneous Users</b>	>=25% of the users over 100% of the area	This is an important metric in capacity dimensioning as it determines the UL and DL throughput requirements
<b>Wi-Fi Backhaul Capacity</b>	>=1Gbps for the entire stadium is recommended	<p>This value is only recommended by this guidelines document as a rough estimate, and does not guarantee to satisfy the actual backhaul requirement of the stadium</p> <p>To get the actual backhaul requirement, a dimensioning process similar to the one described in Section 6.4.4 should be undertaken</p> <p>A burstable backhaul circuit that can provide expanded bandwidth for peak demand should be considered</p>

**Figure 3-8: Wi-Fi Design Target**

### 3.5.7.1 Wi-Fi Design Acceptance (Private SSIDs)

The targets stated in Figure 3-8 are for generic metrics applicable to public SSIDs. In addition, there will be private SSIDs reserved for NFL use. These SSIDs would provide coverage near specified areas (e.g., entrance / exit, sidelines, locker rooms). This sub-section will cover additional minimum acceptance guidelines for the private Wi-Fi network.

**Number of SSIDs to be created:** The number of SSIDs used in a stadium may directly impact the capacity and frequency planning exercise. If each SSID is given its own set of channels within the same frequency band and hence dedicated APs are used, this will complicate the frequency coordination challenge and also increase overall costs due to the higher count of APs required.

On the other hand, if a channel is used by more than one SSID the overall capacity of the SSIDs will be reduced and the number of contentions within the channel could increase. Hence, while deciding on the number of SSIDs, it is important to consider the frequency planning and reuse factor and also the capacity dimensioning aspects of the individual SSIDs.

Although each NFL stadium may have different needs, it is generally recommended to have no more than six (6) private SSIDs on the stadium's Wi-Fi network.

Wi-Fi	Target	Comment
Security Standard	At least WPA2-Enterprise version	Required to ensure adequate security It is strongly recommended that WEP standard is not used for any private SSIDs

Figure 3-9: Wi-Fi Design Target - Bowl

### 3.5.7.2 Wi-Fi Design Acceptance (Bowl + Suites / Clubs)

Wi-Fi	Target	Comment
Best Server RSSI	<p><b>Average Across Each Stadium Zone</b> -67dBm for 100% of the area</p> <p><b>Average Across Entire Stadium</b> -57dBm over 100% of the area</p>	<p>Target set for 20MHz channel BW Target for 40MHz channel BW shall be higher by 3-5dB</p> <p>The target should be met in both open and closed roof scenarios if applicable</p> <p>For definitions of "Stadium Zone" and "Average" refer to Section 3.4.</p>

Figure 3-10: Wi-Fi Design Target - Bowl + Suites / Clubs

### 3.5.7.3 Wi-Fi Design Acceptance (Sidelines / Field)

The Wi-Fi access on the sidelines will be deployed and managed by the NFL and shall be for private NFL use and NFL Club use. Hence, coverage of the private SSIDs throughout these areas will be necessary. Wi-Fi coverage on the sidelines is preferably over 5GHz band to avoid interference issues.

The same private SSID shall be used for the sidelines, coaches’ rooms, training rooms, and locker rooms (discussed in the next sub-section). The private SSID should be provided only to those with a need for access (e.g., designated NFL or NFL Club personnel).

The minimum bandwidth requirement is two (2) APs in total (one AP per sideline) to provide sideline coverage, with a throughput of 5Mbps from each AP to the network backbone.

Channels 100 (Home) and 140 (Visitor) shall be dedicated for these two sideline APs and Channel 161 reserved for backup APs to remediate interference. These channels shall not be used in other public or private SSIDs in the stadium to avoid contention issues arising from spillover of the sideline APs in other zones.

Bandwidth requirements for the sidelines are subject to change based off potential future needs (e.g., tablet usage for specific game-related activities by NFL or NFL Club personnel).

Monitoring and oversight of the Wi-Fi AP coverage for the sidelines will be handled by the NFL and should be consistent with NFL policies.

Field coverage should be considered but is not mandatory.

Wi-Fi	Target	Comment
Best Server RSSI	<p><b>Average Across Each Stadium Zone</b> -72dBm for 100% of the area</p> <p><b>Average Across Entire Stadium</b> -62dBm over 100% of the area</p>	<p>Target set for 20MHz channel BW</p> <p>Target for 40MHz channel BW shall be higher by 3-5dB</p> <p>The target should be met in both open and closed roof scenarios if applicable</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>
Best Server SINR	<p><b>Average Across Each Stadium Zone &gt; 10dB</b> for 100% of the area</p> <p><b>Average Across Entire Stadium &gt; 20dB</b> for 100% of the area</p>	<p>At the minimum, target is to use MCS of QPSK 3/4</p> <p>On the average, 16QAM modulation with 1/2 coding scheme is targeted</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>

**Figure 3-11: Wi-Fi Design Target - Sidelines / Field**

**3.5.7.4 Wi-Fi Design Acceptance (Locker Rooms, Coaches’ Rooms, and Back Office)**

The Wi-Fi access available in these zones will be predominantly for private NFL & NFL Club use. Hence, coverage of the private SSIDs throughout these areas will be necessary. The same private SSID shall be used for the sidelines, coaches’ rooms, training rooms, and locker rooms. The private SSID should be provided only to those with a need for access (e.g., designated NFL or NFL Club personnel). The minimum bandwidth requirement for these sections is 5Mbps from each AP to the network backbone. Bandwidth requirements for these sections are subject to change based off potential future needs (e.g., tablet usage for specific game-related activities by NFL / NFL Club coaches and trainers). Bandwidth should be provided on an equal basis for the home and away team locker rooms.

Wi-Fi	Target	Comment
Best Server RSSI	<p><b>Average Across Each Stadium Zone</b> -67dBm for 100% of the area</p> <p><b>Average Across Entire Stadium</b> -57dBm over 100% of the area</p>	<p>Target set for 20MHz channel BW</p> <p>Target for 40MHz channel BW shall be higher by 3-5dB</p> <p>The target should be met in both open and closed roof scenarios if applicable</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>
Throughput Capacity per AP	>= 5Mbps over 100% of the area	In accordance with NFL requirements for sidelines

**Figure 3-12: Wi-Fi Design Target - Locker Rooms**

### 3.5.7.5 Wi-Fi Design Acceptance (Entrance / Exit Perimeter, Ticketing, Point of Sale)

There will be public SSIDs in the ticketing zone for fans when they enter and exit the stadium. There will also be private SSIDs along the perimeter for ticket verification at the entry points and in the POS zone. The guidelines for these SSIDs would be in accordance with the applicable ticketing and POS vendors’ specifications. The throughput requirement for these private SSIDs may be much lower, as the traffic could mostly consist of ticket verification and POS service.


Wi-Fi	Target	Comment
Best Server RSSI	<p><b>Average Across Each Stadium Zone</b> -72dBm for 100% of the area</p> <p><b>Average Across Entire Stadium</b> -62dBm over 100% of the area</p>	<p>Target set for 20MHz channel BW</p> <p>Target for 40MHz channel BW shall be higher by 3-5dB</p> <p>The target should be met in both open and closed roof scenarios if applicable</p> <p>For definitions of “Stadium Zone” and “Average” refer to Section 3.4.</p>

**Figure 3-13: Wi-Fi Design Target - Entrance / Exit Perimeter, Ticketing, Point of Sale**

### 3.5.7.6 Wi-Fi Design Acceptance (Parking Lot)

Parking lot coverage is recommended but not a requirement.

Wi-Fi	Target	Comment
Best Server RSSI	<p><b>Average Across Each Stadium Zone</b> -77dBm for 100% of the area</p> <p><b>Average Across Entire Stadium</b> -67dBm over 100% of the area</p>	<p>Target set for 20MHz channel BW</p> <p>Target for 40MHz channel BW shall be higher by 3-5dB</p> <p>The target should be met in both open and closed roof scenarios if applicable</p>



For definitions of “Stadium Zone” and “Average” refer to Section 3.4.

**Figure 3-14: Wi-Fi Design Target - Parking Lot**

### 3.5.7.7 Media Zone and Press Box

For the media zone and press box, wired access must be used. Wireless interface must also be provided, but shall only be used for supplemental operations in the media zone and press box. A separate private SSID shall be provided for dedicated use in the media zone and press box. Requirements for the wireless interface shall be as per the requirements stipulated in Figure 3-8.

### 3.5.8 DAS Capacity Dimensioning Acceptance

It is very likely that designs of the NFL stadiums under consideration will be driven primarily by the capacity demand during peak hours of the event. It is therefore of utmost importance that capacity dimensioning outputs be checked and verified for each of the individual technologies and service providers so that a quality user experience can be ensured during game periods.

A document in accordance with the minimum requirements stipulated herein needs to be submitted by the design vendor, which shall include air interface, backhaul, and channel element dimensioning calculations for present and future traffic requirements of the stadium. The generic structure and details that need to be included in the document have been specified in Section 6.4.

### 3.5.9 Wi-Fi Capacity Dimensioning Acceptance

Apart from the cellular network, a large number of users in the stadium are expected to use the public Wi-Fi network. Therefore, dimensioning key items, such average data traffic volume (both downlink and uplink) and expected throughput demand per SSID, is very important. The main objective of this exercise is to calculate the number of APs required for the public Wi-Fi network to ensure a quality user experience even during peak hours of the game.

Apart from the public network, there will be a need to dimension the expected traffic and AP requirement for the private SSIDs (for NFL’s internal use).

A document in accordance with the minimum requirements stipulated herein needs to be submitted by the design vendor, which shall include dimensioning calculations for present and future traffic requirements of the stadium. The generic structure and details that need to be included in the document have been specified in Section 6.4.4.

### 3.5.10 Wi-Fi Frequency Coordination Acceptance

The objective of this exercise is to minimize the Wi-Fi interference due to dense deployment and due to external local Wi-Fi APs created by certain items (e.g., large-scale frequency-hopping equipment, wireless cameras, enhanced audio networks). Since there are a limited number of channels available in 2.4GHz and 5GHz, frequency reuse cannot be avoided in a high-density deployment scenario like NFL stadiums. The guidelines stated herein are in accordance with NFL policies and must be addressed by the NFL Club, wireless operator, or applicable third party responsible for Wi-Fi installation, maintenance, and/or monitoring.

Thus, appropriate frequency coordination and planning must be undertaken to avoid high interference from neighboring APs. The flowchart in Figure 3-15 provides a high-level approach to consider for frequency coordination. It is essential to use a Wi-Fi frequency planning tool to obtain an optimized AP

installation and configuration plan. Also, due to external interference from rogue hotspots from certain items (e.g., large-scale frequency-hopping equipment, wireless camera, enhanced audio networks), periodic adjustments to the frequency plan are necessary. Hence, it is important to deploy network controllers which are capable of dynamic frequency reselection and parameter optimization.

Wi-Fi frequency coordination in all NFL stadiums should be conducted consistent with NFL frequency coordination policies.

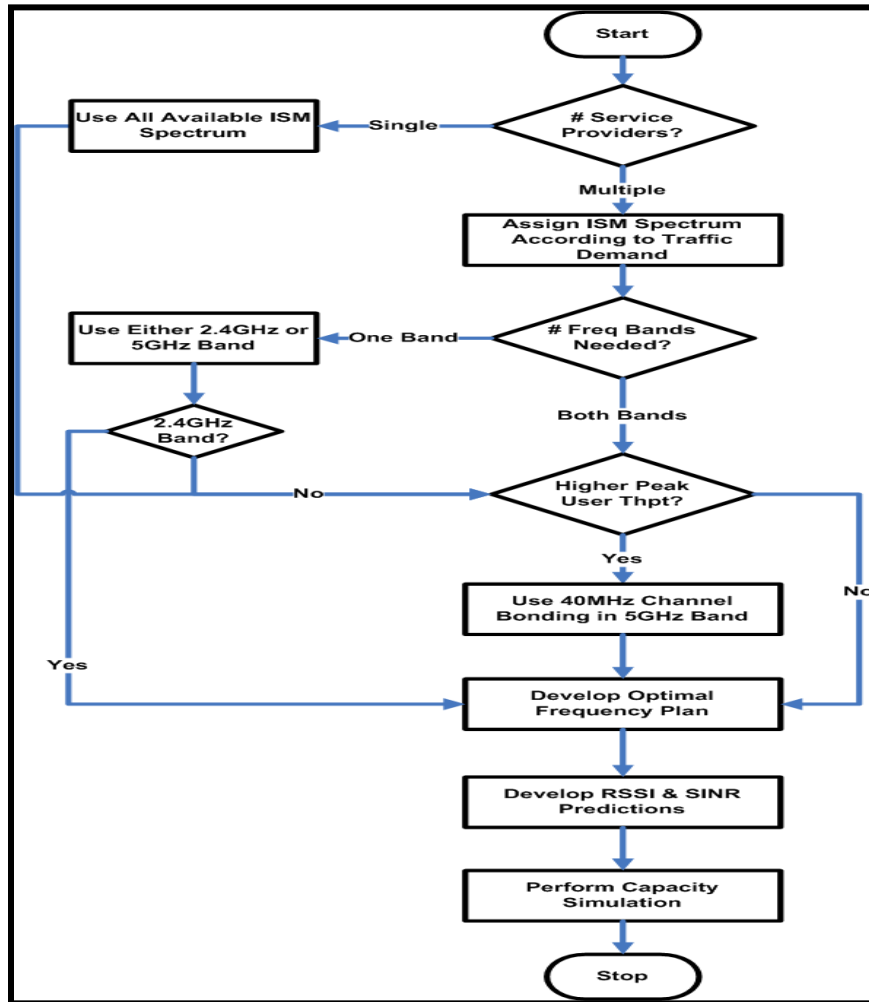


Figure 3-15: Flowchart for frequency planning and coordination

# 4 PART C: User Experience Assessment – Event-Based Performance Acceptance

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## 4.1 Objective

The purpose of this section is to outline the user experience assessment process and specify event-based performance acceptance targets for each service and service provider (in case of neutral host) that will be used for final acceptance.

The objective of this section is to ensure availability of adequate coverage, capacity, and quality during peak hours of the events to ensure reliable and ubiquitous service at all potential areas of interest within the stadium.

The user experience will be assessed for the following technologies:

- WWAN technologies: GSM, 1xCDMA, EVDO, UMTS, LTE
- WLAN technologies: Wi-Fi

## 4.2 Assessment Procedure & Exit Criteria

The performance acceptance procedure shall commence upon acceptance of design & dimensioning report and formal receipt of the event-based performance report from the service provider / third-party vendor. The objective of this section is to standardize the results, deliverables, and templates such that these can be used uniformly across all NFL stadiums, for both service provider-specific and neutral-host solutions, as well as in a vendor-agnostic manner.

The Event-Based Performance Acceptance process is performed as per the following steps:

1. **Off-Game RF Performance Acceptance:** Verification of network RF performance including RF coverage and quality for Unloaded System
2. **Game Acceptance:** Verification of service KPIs and capacity for Loaded System during the Event

The deliverables are a set of plots and reports, together with a checklist for marking off each requirement.

The exit criterion will comprise of formal acceptance of the Wireless Connectivity Services Assessment Report by the NFL.

## 4.3 Report Template

The performance acceptance report shall be created using MS Word / MS PowerPoint and Visio, with all elements (e.g., formats, fonts, headings) matching those prescribed in this document.

At a minimum, the report package should consist of the following:

- Executive Summary
- Spot Test Assessment – Event-Based User Experience Analysis
  - *UMTS / HSPA*
  - *LTE*
  - *CDMA / EVDO*

- *GSM*
- *Wi-Fi*
- RF Coverage Assessment – Off-Game Day
  - *UMTS / HSPA*
  - *LTE*
  - *CDMA / EVDO*
  - *GSM*
  - *Wi-Fi*
- Comparison of Performance Metrics between Loaded and Unloaded Scenarios
  - *UMTS / HSPA*
  - *LTE*
  - *CDMA / EVDO*
  - *GSM*
  - *Wi-Fi*
- Analysis of Performance Issues with Root Cause Assessment
- Summary & Conclusion

## **4.4 Review of DAS Deployment**

### **4.4.1 DAS Deployment Inventory Assessment**

A detailed inventory assessment of the DAS equipment and accessories and deployment verification may be performed as a part of this exercise. Based on the inventory list, a report would be submitted. A sample report is included in Section 5.2. The report covers all basic checklist items; however, additional comments specific to deployment in every NFL stadium will have to be enumerated.

## **4.5 Review of Wi-Fi Deployment**

### **4.5.1 Wi-Fi Deployment Inventory Assessment**

Similar to the DAS inventory assessment, a detailed inventory assessment and deployment verification may be performed for the Wi-Fi networks. Based on the inventory list, a report would be submitted. A sample report is included in Section 5.3. The report covers all basic checklist items; however, additional comments specific to deployment in every NFL stadium will have to be enumerated.

## **4.6 Off-Game RF Performance Assessment (Walk-Test Based)**

Walk-test shall be performed for RF coverage assessment on off-game day across all levels, concourses, and entrance / exit areas of the stadium. RF coverage plots shall be produced, separately for all service providers and all technologies. All main RF KPIs mentioned below shall be assessed as part of RF performance acceptance.



Target RF KPIs should comply with KPIs previously defined in Design Acceptance.

#### 4.6.1 UMTS / HSPA

The following plots shall be produced per carrier and separately for each service provider:

1. Signal Strength (RSCP)
2. Signal Quality (Ec / No) at unloaded condition
3. Signal Dominance (# of Servers within 5dB of Best Server)
4. Serving PCS Plot

SCANNER PLOTS FOR UMTS - INDIVIDUAL PLOTS FOR EACH FREQUENCY AND SERVICE PROVIDER	
Documentation / Plot	Purpose / Requirement
Best server PSC	Entire stadium area is served by IDAS Outside stadium (entrance, exit areas, and parking lots) served by ODAS
Best server RSCP	<b>Average Across Each Stadium Zone</b> RSCP $\geq -85\text{dBm}$ for 100% of the area
Best server Ec / No (unloaded)	<b>Average Across Each Stadium Zone</b> Ec / No $\geq -9\text{dB}$ for 100% of the area
Nr of pilots within 5dB of strongest server	$\leq 1.35$ (averaged over 100% of the area) Maximum number of servers within 5dB of best server $\leq 3$

**Figure 4-1: UMTS / HSPA RF Acceptance Target**

For definitions of “Stadium Zone” and “Average” refer to Section 3.4.

#### 4.6.2 CDMA / EVDO

The following plots shall be produced per carrier and separately for each service provider:

1. Signal Strength (Ec)
2. Signal Quality (Ec / Io) in unloaded condition
3. Signal Dominance (# of Servers within 5dB of Best Server)
4. Serving PN Plot

SCANNER PLOTS FOR CDMA - INDIVIDUAL PLOTS FOR EACH FREQUENCY AND SERVICE PROVIDER	
Documentation / Plot	Purpose / Requirement
Best server PN	Entire stadium area is served by DAS Outside stadium (entrance, exit areas, and parking lots) served by ODAS

Best server Ec	<b>Average Across Each Stadium Zone</b> Ec >= -85dBm for 100% of the area
Best server Ec / Io (unloaded)	<b>Average Across Each Stadium Zone</b> Ec/Io >= -7dB for 100% of the area
Nr of pilots within 5dB of strongest server	<=1.35 (averaged over 100% of the area) Maximum number of servers within 5dB of best <=3

**Figure 4-2: CDMA / EVDO RF Acceptance Target**

For definitions of “Stadium Zone” and “Average” refer to Section 3.4.

### 4.6.3 LTE

The following plots shall be produced per carrier and separately for each service provider:

1. Signal Strength (RSRP)
2. Signal Quality (RSRQ) in unloaded condition
3. Signal Dominance (# of Servers within 5dB of Best Server)
4. Serving PCI Plot

SCANNER PLOTS FOR LTE - INDIVIDUAL PLOTS FOR EACH CARRIER AND EACH OPERATOR	
Documentation / Plot	Purpose / Requirement
Best server PCI	Entire stadium area is served by DAS Outside stadium (entrance, exit areas, and parking lots) served by ODAS
Best server RSRP	<b>Average Across Each Stadium Zone</b> RSRP >= -95dBm for 100% of the area
Best server RSRQ (Unloaded)	<b>Average Across Each Stadium Zone</b> RSRQ >= -13dB for 100% of the stadium
Nr of servers within 5dB of strongest server	<=1.35 (averaged over 100% of the area) Maximum number of servers within 5dB of best server <=3

**Figure 4-3: LTE RF Acceptance Target**

For definitions of “Stadium Zone” and “Average” refer to Section 3.4.

### 4.6.4 Wi-Fi

STADIUM PASSIVE SURVEY FOR IMPORTANT SSIDs	
Documentation / Plot	Purpose / Requirement

<b>Individual SSID Signal Strength</b>	<b>Average Across Each Stadium Zone</b> <b>RSSI <math>\geq</math> -67dBm</b> for each SSID over 100% of the area
<b>Best Server SINR</b>	<b>Average Across Each Stadium Zone</b> <b><math>\geq</math> 10dB</b> for 100% of the area
<b>Noise Floor</b>	<b>Maximum Noise Floor <math>\leq</math> -77dBm</b> for 100% of the area
<b>Number of APs operating at adjacent channels and within 5dB of Best Serving AP (RSSI based)</b>	<b>Maximum <math>&lt;1.5</math></b> for 100% of the area

**Figure 4-4: Wi-Fi RF Acceptance Target**

For definitions of “Stadium Zone” and “Average” refer to Section 3.4.

#### 4.6.5 GSM

The following plots shall be produced per carrier and separately for each service provider:

1. BCCH Signal Strength (RSSI)
2. Signal Quality (Co-channel and adjacent channel C/I) in unloaded condition
3. Signal Dominance (# of Servers within 5dB of Best Server)
4. Best server plot

<b>SCANNER PLOTS FOR GSM - INDIVIDUAL PLOTS FOR EACH CARRIER AND EACH OPERATOR</b>	
<b>Documentation / Plot</b>	<b>Purpose / Requirement</b>
<b>Best server BCCH / BSIC</b>	Entire stadium area is served by the IDAS; outside area (entrance / exit zone, parking lots) is served by the ODAS
<b>Best server BCCH RSSI</b>	<b>Average Across Each Stadium Zone</b> <b>RSSI <math>\geq</math> -92dBm</b> for 100% of the area. In accordance with the RF exposure policy requirement.
<b>Reuse of BCCH-BSIC combination</b>	<b>Not recommended.</b> In unavoidable cases, <b>signal strength difference <math>&gt; 25</math>dB</b>
<b>Serving Cell Quality</b>	<b>Average Across Each Stadium Zone</b> <b>BCCH C/I (Co-channel) <math>\geq 12</math>dB</b> for 100% of the area <b>BCCH C/I (Adjacent channel) <math>\geq -6</math>dB</b> for 100% of the area
<b>Nr of servers within 5dB of strongest server</b>	<b><math>\leq 1.35</math></b> (averaged over 100% of the area) Maximum number of servers within 5dB of best server <b><math>\leq 3</math></b>

**Figure 4-5: GSM RF Acceptance Target**

For definitions of “Stadium Zone” and “Average” refer to Section 3.4.

#### 4.6.6 RF Performance Acceptance Summary

The following is a sample template of the summary of RF Performance Assessment Table based on assessed RF KPIs that will have to be submitted for NFL acceptance:

	Sub-Level	Service Provider 1		Service Provider 2		Service Provider 3	
		EVDO	LTE	UMTS	LTE	UMTS	LTE
Level	Seating Bowl	Good	Good	Good	Good	Improve	Good
	Clubs / Suites	Good	Good	OK	OK	Good	Improve
	Concourse	OK	OK	Good	OK	OK	OK
Other Zones	Locker Room	Good	Good	OK	OK	Good	Improve
	Field / Sidelines	OK	Good	Improve	OK	Good	Good
	Entrance / Exit Area	Improve	OK	Good	Good	OK	OK
	Parking Lot	OK	Good	Improve	OK	Good	Good

**Figure 4-6: RF Performance Acceptance Summary**

Technology	Criteria	Signal Strength (dBm)	Signal Quality (dB)	DL User Throughput (kbps)	UL User Throughput (kbps)
CDMA	Good	>-65	>-4	500	300
	OK	>-85	>-7	300	150
EVDO	Good	>-65	>-2	500	300
	OK	>-85	>-4	300	150
UMTS	Good	>-65	>-4	500	300
	OK	>-85	>-9	300	150
GSM	Good	>-65	>15	200	60
	OK	>-85	>12	100	40
LTE	Good	>-65	>-9	700	500
	OK	>-95	>-13	500	300
Wi-Fi	Good	>-57	> 20 (SINR)	1Mbps	500
	OK	>-67	> 10 (SINR)	500	300

\*For each technology, if performance is below the ‘OK’ threshold, the service will be noted as ‘Improve’

**Figure 4-7: RF Performance Acceptance Criteria**

## 4.7 Spot Test Assessment – Event-Based User Experience Analysis

Service acceptance tests are the set of voice and data calls that shall be originated during the period of event hours at predefined locations distributed evenly across the stadium. To ensure statistical significance, at least seven (7) locations shall be chosen throughout the stadium. Multiple sets of voice service experience and data service experience based statistics shall be collected per service provider and per technology, and comparative results between off-game and game-day shall be submitted to assess the impact of traffic on performance. The testing methodology included in this document is subject to change over time.

The tests in this section are performed after the DAS is made available to the general public and hence it is assumed that all regulatory procedures such as E911 testing have been complied with.

### 4.7.1 Voice Service Experience

#### 4.7.1.1 Voice Call Model

Following is an example voice call model that is anticipated to be used at every location and for each service provider:

- Mobile Originated: 90 second call hold time, 10 second idle time
- Minimum 5 calls per location

#### 4.7.1.2 Voice Service Experience per Service Provider per Technology

Based on the call model, the following template shall be submitted for each service provider and against each technology for NFL acceptance.

Level	Sub-Level	Call Setup Success Rate, %			# Call Drops			Average Call Setup Time, sec		
		Off-Game	Game	Change	Off-Game	Game	Change	Off-Game	Game	Change
Level 1	Field Club									
	Seating Area (Front)									
	Seating Area (Back)									
Level 2	Club Level									
	Concourse									
Level 3	Seating Bowl									
	View Level									

	Entrance / Ticketing									
	Parking Lot									
Cellular Voice Target (Average Call Success Rate)		95%			5%			5s		

\*Table above shows sample structure; the actual tables will vary as required per NFL stadium

**Figure 4-8: Voice Service Acceptance Summary**

Note 1: Call Success Rate shall be measured across those areas of the applicable stadium accessible by the general public during the Busy Hours of a Game.

Note 2: Cellular voice call success rate targets for LTE shall only be applicable once Voice over LTE services have been available in a stadium for six (6) months.

Note 3: For the definitions of “Average”, “Call Success”, and “Busy Hours of a Game”, refer to Section 3.4.

## 4.7.2 SMS and MMS Service Experience

### 4.7.2.1 Service Call Model

Following is an example call model that is anticipated to be used at every location and for each service provider:

- Send one SMS to a pre-defined cell phone number
- Send one MMS file to a pre-defined cell phone number
- Receive one SMS from a pre-defined cell phone number
- Receive one MMS file from a pre-defined cell phone number

### 4.7.2.2 Service Experience per Service Provider per Technology

Based on the call model, the following template shall be submitted for each service provider and against each technology for NFL acceptance.

The “time delay” refers to the length of the time between the SMS / MMS being sent by the sender and the SMS / MMS being received by the recipient.

Level	Sub-Level	Sent SMS Success Rate (+ Time Delay in sec)			Received SMS Success Rate (+ Time Delay in sec)			Sent MMS Success Rate (+ Time Delay in sec)			Received MMS Success Rate (+ Time Delay in sec)		
		Off Game	Game	Change	Off Game	Game	Change	Off Game	Game	Change	Off Game	Game	Change
Level 1	Field Club												
	Seating Area (Front)												

Level 2	Seating Area (Back)												
	Club Level												
	Concourse												
Level 3	Seating Bowl												
	View Level												
	Entrance / Ticketing												
	Parking Lot												

**Figure 4-9: SMS / MMS Service Experience Summary**

\*Table above shows sample structure; the actual tables will vary as required per NFL stadium

**Sent and Received SMS and MMS Average Message Success Rate: >= 90% \***

Note 1: Message Success Rate shall be measured across those areas of the applicable stadium accessible by the general public during the Busy Hours of a Game.

\* Note 2: For definitions of “Average”, “Message Success”, and “Busy Hours of a Game”, refer to Section 3.4. These definitions pertain to “Sent and Received SMS and MMS Average Message Success Rate” referenced above.

**4.7.3 GSM Data Service Experience**

**4.7.3.1 Data Call Model**

Following is an example data call model that is anticipated to be used at every location and for each service provider:

- Download: 5MB file from a pre-defined server location
- Upload: 2MB file to a pre-defined server location
- Minimum 2 uploads and downloads per location

**4.7.3.2 GSM Data Service Experience per Service Provider per Technology**

Based on the call model, the following template shall be submitted for each service provider and against each technology for NFL acceptance.

Level	Sub-Level	DL User Throughput (kbps)			UL User Throughput (kbps)			Ping Latency 1000 bytes (ms)		
		Off-Game	Game	Change	Off-Game	Game	Change	Off-Game	Game	Change
Level 1										

	Field Club									
	Seating Area (Front)									
	Seating Area (Back)									
Level 2	Club Level									
	Concourse									
Level 3	Seating Bowl									
	View Level									
	Entrance / Ticketing									
	Parking Lot									

\*Table above shows sample structure; the actual tables will vary as required per NFL stadium

**Figure 4-10: GSM Data Service Acceptance Summary**

Technology	Criteria	DL User Thpt (kbps)	UL User Thpt (kbps)	Ping Latency (ms)
GSM	Good	>=200	>=60	100
	OK	>=100	>=40	200

**Figure 4-11: GSM Data Service Acceptance Criteria**

### 4.7.4 3G Data Service Experience

#### 4.7.4.1 Data Call Model

Following is an example data call model that is anticipated to be used at every location and for each service provider:

- Download: 5MB file from a pre-defined server location
- Upload: 2MB file to a pre-defined server location
- Minimum 2 uploads and downloads per location

#### 4.7.4.2 3G Data Service Experience per Service Provider per Technology

Based on the call model, the following template shall be submitted for each service provider and against each technology for NFL acceptance.

Level	Sub-Level	DL User Throughput (kbps)	UL User Throughput (kbps)	Ping Latency 1000 bytes (ms)
-------	-----------	---------------------------	---------------------------	------------------------------



		Off-Game	Game	Change	Off-Game	Game	Change	Off-Game	Game	Change
		Level 1	Field Club							
Seating Area (Front)										
Seating Area (Back)										
Level 2	Club Level									
	Concourse									
Level 3	Seating Bowl									
	View Level									
	Entrance / Ticketing									
	Parking Lot									

\*Table above shows sample structure; the actual tables will vary as required per NFL stadium

**Figure 4-12: 3G Data Service Acceptance Summary**

Technology	Criteria	DL User Thpt (kbps)	UL User Thpt (kbps)	Ping Latency (ms)
EVDO	Good	>=500	>=300	100
	OK	>=300	>=150	200
UMTS	Good	>=500	>=300	100
	OK	>=300	>=150	200

**Figure 4-13: 3G Data Service Acceptance Criteria**

## 4.7.5 4G Data Service Experience

### 4.7.5.1 Data Call Model

Following is an example data call model that is anticipated to be used at every location and for each service provider:

- Download: 10MB file from a pre-defined server location
- Upload: 5MB file to a pre-defined server location
- Minimum 2 uploads and downloads per location
- Test video streaming functionality with NFL / Club Mobile App (e.g., YinzCam)

### 4.7.5.2 4G Data Service Experience per Service Provider per Technology

Based on the call model, the following template shall be submitted for each service provider and against each technology for NFL acceptance.

Level	Sub-Level	DL User Throughput (kbps)			UL User Throughput (kbps)			Ping Latency 1000 bytes (ms)		
		Off-Game	Game	Change	Off-Game	Game	Change	Off-Game	Game	Change
Level 1	Field Club									
	Seating Area (Front)									
	Seating Area (Back)									
Level 2	Club Level									
	Concourse									
Level 3	Seating Bowl									
	View Level									
	Entrance / Ticketing									
	Parking Lot									

\*Table above shows sample structure; the actual tables will vary as required per NFL stadium

**Figure 4-14: 4G Data Service Acceptance Summary**

Technology	Criteria	DL User Thpt (kbps)	UL User Thpt (kbps)	Ping Latency (ms)
LTE	Good	>=700	>=500	50
	OK	>=500	>=300	100

**Figure 4-15: 4G Data Service Acceptance Criteria**

## 4.7.6 Wi-Fi Service Experience

### 4.7.6.1 Data Call Model

Following is an example data call model that is anticipated to be used at every location and for the strongest SSID:

- Download: 10MB file from a pre-defined server location
- Upload: 5MB file to a pre-defined server location
- Minimum 2 uploads and downloads per location
- Test video streaming functionality with NFL / Club App (e.g., YinzCam)

### 4.7.6.2 Wi-Fi Data Service Experience per Service Provider per Technology

Based on the call model, the following template shall be submitted for each location for NFL acceptance.

Level	Sub-Level	DL User Throughput (kbps)			UL User Throughput (kbps)			Ping Latency 1000 bytes (ms)			RSSI (dBm)	SINR (dB)
		Off-Game	Game	Change	Off-Game	Game	Change	Off-Game	Game	Change	Game	Change
Level 1	Field Club											
	Seating Area (Front)											
	Seating Area (Back)											
Level 2	Club Level											
	Concourse											
Level 3	Seating Bowl											
	View Level											
	Entrance / Ticketing											
	Parking Lot											

\*Table above shows sample structure; the actual tables will vary as required per NFL stadium

**Figure 4-16: Wi-Fi Data Service Acceptance Summary**

Technology	Criteria	DL User Thpt	UL User Thpt (kbps)	Ping Latency (ms)
Wi-Fi	Good	>=1 Mbps	>=500	50
	OK	>=500 kbps	>=300	100

**Figure 4-17: Wi-Fi Data Service Acceptance Criteria**

# 5 Part D: Design & Deployment Checklists

## 5.1 Performance Metrics to be collected

Technology	Signal Level	Signal Quality	Performance Metric	Server
UMTS	RSSI, RSCP	Ec / No	User Throughput (HS) Dropped calls (voice) Access failure rate (voice) UE Tx Power DL BLER (R99), SPER (HS)	Minimum 8 PSC
LTE	RSSI, RSRP	RSRQ, PDSCH SNR, RS SNR	User throughput UE Tx Power DL SPER	Minimum 8 PCI
CDMA/DO	RSSI, Ec / No, Ec	Ec / No	User throughput (DO) Dropped calls (voice) Access failure rate (voice) Mobile Tx Power DL FER	Minimum 8 PN
GSM	RSSI	BCCH C/I (Adjacent channel and Co-channel)	Dropped calls (voice) Access failure Rate (voice) Mobile Tx Power	All BSIC / BCCH
Wi-Fi	RSSI (per individual SSID)	Noise Floor, DL SINR	User throughput for download User throughput for upload	All SSIDs (at points of interest)

Figure 5-1: Checklist for Data Collection

## 5.2 DAS Integration Checklist

Item Description	Surveyed Information	Comments
Names of the technologies being deployed		

Frequency band of operation		
Type of DAS deployment- exclusive IDAS / IDAS + ODAS		
Compare actual number of feeds into DAS with the dimensioning exercise output		
Verification of the number of sector / carriers deployed- compare with output of dimensioning exercise		
MIMO Installation Status per zone		

**Figure 5-2: Checklist for DAS Integration - Deployment Details**

Item Description	Surveyed Information	Comments
Identification of interface hardware terminals for each technology & operator		
Connection of RAN base stations (of individual technology and operators) with the designated terminals of the interface hardware		
Verification of the number of installed cables		
Verification of the number of installed antennas		
Verification of the number of installed attenuators		
Connection of two RAN ports per base station (Tx / Rx and Rx/D) with the interface hardware		
Measurement of RAN power per carrier, per technology and per frequency band at the output of the interface hardware terminal		
Verify that power at the interface hardware output is not exceeding the total maximum input power to the DAS head end		
Connection of interface hardware with the designated terminals at DAS head end		
Verify that Rx & Tx ports are not interchanged		
Deployment of optical fiber with proper connection between head-end and remote unit		
Configuration and satisfactory operation of RAN base stations in the NOC for all		

technologies		
Configuration and satisfactory operation of DAS supervision network in the NOC		
Verification of the PCIs and scrambling codes		
Conducting tests to verify gain settings with design acceptance report output		
Mapping and satisfactory operation of all alarms for DAS and RAN base stations		

**Figure 5-3: Checklist for DAS Integration - Installation Check**

Item Description	Surveyed Information	Comments
Origination CS call verification test		
Terminating CS call verification test		
MultiRAB call verification test		
PS call testing at designated locations		

**Figure 5-4: Checklist for DAS Integration - Call Verification**

DETAILED POWER AND GAIN VERIFICATION - ONE REMOTE						
Operator	Technology	Band	Channel Nr	Property	Design target Power [dBm]	Measured Power [dBm]
XX	GSM	850		RSSI		
XX	GSM	1900		RSSI		
XX	CDMA1x/DO	850		Ec		
XX	CDMA1x/DO	1900		Ec		
XX	UMTS	850		RSCP		
XX	UMTS	AWS		RSCP		
XX	LTE	700		RSCP		
XX	LTE	AWS		RSRP		

**Figure 5-5: Checklist for Power & Gain Verification**

### 5.3 Wi-Fi Checklist

Item Description	Surveyed Information	Comments
Name of the 802.11 standard being deployed (a/b/g/n/ac)		
Frequency band of operation / Channel Bandwidth		
Channels Used		
Comparing the actual frequency plan in the stadium with the proposed design		
MIMO Installation Status per zone		

**Figure 5-6: Checklist for Wi-Fi Installation - Deployment Details**

Item Description	Surveyed Information	Comments
Number of Access Points (APs) installed per zone		
Verification of the number of installed cables		
Verification of the number of installed antennas		
Verification of the number of installed attenuators		
Verifying if the number of APs installed per zone as matching the dimensioning exercise output		
Verification of actual AP antenna gain by measuring signal strength at 1m		
Conducting tests to verify gain settings with design acceptance report output		
Verifying frequency / channel deployment plan for 2.4GHz and 5GHz		
Verifying connectivity between network controller and all APs		
Verifying the actual installation of APs, routers, network controllers, etc. with the proposed design with appropriate hierarchy		
Mapping and satisfactory operation of all alarms for all Wi-Fi nodes		

**Figure 5-7: Checklist for Wi-Fi Installation - Installation Check**

Item Description	Surveyed Information	Comments
Conducting ping tests via all SSIDs in each zone		
Conducting data upload test (using server) for all public SSIDs		
Conducting data download test (using server) for all public SSIDs		
Conducting data download test with NFL / Club Mobile App (e.g., YinzCam) from Public SSIDs		
Conducting data upload test (using server) for private SSIDs		
Conducting data download test (using server) for private SSIDs		

**Figure 5-8: Checklist for Wi-Fi Installation – Call Verification Field Trial**



# 6 Part E: Input Requirements from Wireless Service Provider(s) / Third Party(ies)

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## 6.1 RF Design Acceptance Report

Following plots / reports should be included as part of the coverage results separately for all bands and technologies that are going to be deployed.

1. Sectorized plan view (in D-size with scale and arrow showing north) for individual sectors should be attached.
  - Sectorization plan overview (scaled map with arrow pointing to the north)
  - A plan view of individual sectors (scaled map with arrow pointing to the north)
  - Basic equipment (active and passive) configurations for the individual sectors
  - A plan view showing proposed indoor antenna locations in the individual sections of the stadium (scaled map with arrow pointing to the north)
  - A proposed equipment layout drawing
  - Trunking diagram indicating cable connections, system inputs, and power calculations
2. Line diagram (in D-size) for individual sectors showing DAS configuration along with DAS gains, remote unit output power per carrier, and schematic of all active and passive components should be attached.
3. Plan view (on D-size paper with scaled map and arrow pointing to the north) of the stadium showing existing coverage for different services and frequency bands. The plot should include the following metrics and color combination:
  - UMTS (Best server PSC, Best server RSCP, UE transmit power, number of overlapping cells, Best server  $E_c$  / No adjusted for 100% downlink load)
  - LTE (Best server PCI, Best Server RSRP, UE transmit power, PDSCH SINR)
  - CDMA 1x (Best server PN, Best server  $E_c$ , MS transmit power, number of overlapping cells, Best server  $E_c$  /  $I_o$  adjusted for 100% downlink load)
  - GSM (Best server BCCH ARFCN, Best server BCCH RSSI, Best server BCCH RxQual)
  - Color scheme (RSCP, RSRP,  $E_c$ , RSSI)
    - Dark Green (-65dBm and above)
    - Light Green (-75dBm to -65dBm)
    - Yellow (-85dBm to -75dBm)
    - Red (-95dBm to -85dBm)

- Light Blue (-105dBm to -95dBm)
  - Deep Blue (Less than -105dBm)
4. Plan view (on D-size paper with scaled map and arrow pointing to the north) of the stadium showing existing RF quality for different services and frequency bands. The following metrics and color schemes should be used for this purpose:
- UMTS (Best server  $E_c / N_o$ , downlink power loading during measurement from performance report)
  - LTE (downlink PDSCH SINR, uplink PUSCH SINR, downlink traffic loading, and uplink noise rise from performance reports)
  - CDMA 1x (Best Server  $E_c / I_o$ , downlink power loading during measurement from performance report)
  - GSM (Best server BCCH co-channel and adjacent channel C/I, Rx Qual)
  - Color scheme ( $E_c / N_o$ ,  $E_c / I_o$ )
    - Dark Green (-7dB and above)
    - Light Green (-7dB to -10dB)
    - Yellow (-10dB to -14dB)
    - Red (-14dB to -16dB)
    - Blue (less than -16dB)
  - Color scheme (GSM C/I)
    - Dark Green (15dB and above)
    - Light Green (15dB to 12dB)
    - Yellow (12dB to 9dB)
    - Red (9dB to 6dB)
    - Blue (less than 6dB)
5. Plan view (on D-size paper with scaled map and arrow pointing to the north) of the stadium showing handoff plot (for CDMA and UMTS only).
- UMTS (Number of servers within 3dB and 5dB of best server)
  - CDMA 1x (Number of servers within 3dB and 5dB of best server)
  - Color scheme
    - Dark Green (1 server)
    - Light Green (1 to 2 servers)
    - Yellow (2 to 3 servers)
    - Red (3 to 4 servers)
    - Blue (>4 servers)

6. Plan view (on D-size paper with scaled map and arrow pointing to the north) of the stadium showing DL APPLICATION data throughput for individual services. The following color scheme can be used for this purpose:
  - Color scheme
    - Dark Green (>.7Mbps)
    - Light Green (0.6Mbps to .7Mbps)
    - Yellow (0.5Mbps to 0.6Mbps)
    - Red (0.4Mbps to 0.5Mbps)
    - Blue (<0.4Mbps)
7. Plan view (on D-size paper with scaled map and arrow pointing to the north) of the stadium showing downlink PDSCH SINR as per the following color scheme:
  - Color scheme
    - Dark Green (>10dB)
    - Light Green (10dB to 5dB)
    - Yellow (5dB to 0dB)
    - Red (0dB to -4dB)
    - Blue (<-4dB)
8. Plan view (on D-size paper with scaled map and arrow pointing to the north) of the stadium showing downlink PUSCH SINR as per the following color scheme:
  - Color scheme
    - Dark Green (>10dB)
    - Light Green (10dB to 5dB)
    - Yellow (5dB to 0dB)
    - Red (0dB to -6dB)
    - Blue (<-6dB)
9. EM radiation compliance report.
10. Neighbor list highlighting the changes in the existing sectors.
11. List of recommended (and previously agreed upon) macro network RF configuration changes.

## 6.2 Wi-Fi Design Acceptance Report

1. Wi-Fi Network Plan view (in D-size with scale and arrow showing north) with all APs and the hierarchy of network controllers over different layers for individual SSIDs should be attached.
2. Wi-Fi Network Plan view (in D-size with scale and arrow showing north) depicting the frequency plan for each SSID should be attached.

3. Plan view (on D-size paper with scaled map and arrow pointing to the north) of the stadium showing existing coverage for each SSID. The plot should include the following metric and color combination:
    - Wi-Fi (Best Server AP, Best Server RSSI per SSID)
    - Color scheme (RSCP, RSRP, Ec, RSSI)
      - Dark Green (-65dBm and above)
      - Light Green (-75dBm to -65dBm)
      - Yellow (-85dBm to -75dBm)
      - Red (-95dBm to -85dBm)
      - Light Blue (-105dBm to -95dBm)
      - Deep Blue (Less than -105dBm)
  4. Plan view (on D-size paper with scaled map and arrow pointing to the north) of the stadium showing existing Wi-Fi signal quality for each SSIDs. The plot should include the following metrics and color combination:
    - Color Scheme (Wi-Fi Best Server SINR)
      - Dark Green (15dB and above)
      - Light Green (15dB to 10dB)
      - Yellow (10dB to 5dB)
      - Red (5dB to 0dB)
      - Blue (less than 0dB)
    - Color Scheme (Wi-Fi Noise Floor)
      - Dark Green (-85dB and above)
      - Light Green (-85dB to -95dB)
      - Yellow (-95dB to -105dB)
      - Red (-105dB to -115dB)
      - Blue (less than -115dB)
  5. Plan view (on D-size paper with scaled map and arrow pointing to the north) of the stadium showing DL application data throughput for Wi-Fi. The following color scheme can be used for this purpose:
    - Color scheme
      - Dark Green (>1.5Mbps)
      - Light Green (1Mbps to 1.5Mbps)
      - Yellow (800kbps to 1Mbps)
      - Red (500kbps to 800kbps)
      - Blue (<500kbps)
-

6. Plan view (on D-size paper with scaled map and arrow pointing to the north) of the stadium showing UL application data throughput for Wi-Fi. The following color scheme can be used for this purpose:
- Color scheme
    - Dark Green (>600kbps)
    - Light Green (500kbps to 600kbps)
    - Yellow (300kbps to 500kbps)
    - Red (200kbps to 300kbps)
    - Blue (<200kbps)

### 6.3 Link Budget Calculations

A document in accordance to "Appendix A Sample Link Budget" should be provided for all the bands, services, and technologies by all operators which shall be used to access the limiting link of all the services being deployed.

### 6.4 Capacity Dimensioning Report

Following reports should be included as part of the capacity dimensioning results separately for all bands and technologies that are going to be deployed.

#### 6.4.1 Air-Interface Capacity Dimensioning Results (DAS)

The air-interface dimensioning results shall be submitted in the following format, separately for each 3GPP and 3GPP2 technology and service provider.

Item Description	Formula	Year 1	Year 2	Year 3
a = Total Number of Attendees	Input			
b = % Share of Service Provider	Input			
c = % Share of Technology	Input			
d = Number of Subs per Technology	$a * b * c$			
e = Voice Usage (mE/Sub)	Input			
f = Data Usage (mE/Sub)	Input			
g = DL Data Activity Factor (%)	Input			
h = UL Data Activity Factor (%)	Input			
i = Min DL User Throughput Target (kbps)	Input			
j = Min UL User Throughput Target (kbps)	Input			

<b>k = Total Expected DL Throughput Volume in Mbps</b>	$d * f * g * i$			
<b>l = Total Expected UL Throughput Volume in Mbps</b>	$d * f * h * j$			
<b>m = Expected Voice Erlang</b>	$d * e$			
<b>n = Capacity per Sector-Carrier- Voice in Erlangs</b>	Input			
<b>o = Capacity per Sector-Carrier- Data in Mbps</b>	Input			
<b>p = Required Sector-Carrier</b>	$\max(k/o, l/o, m/n)$			
<b>q = Required Base Stations</b>	$\sim p/3$			

**Figure 6-1: Air-Interface Dimensioning Result Template**

### 6.4.2 Backhaul Capacity Dimensioning Results

The backhaul dimensioning report as per following format

Sector - Carrier per Base Station	Traffic (Erlang)						Total Mbps Requirement	T1 Required
	UMTS			CDMA		LTE		
	AMR	PS64	HSDPA	EVRC	Data	Data		

**Figure 6-2: Backhaul Dimensioning Result Template**

### 6.4.3 Channel Element Capacity Dimensioning Results

Finally, channel element dimensioning report shall be submitted as per following format.

Sector-Carrier per Base Station	Traffic (Erlang)			CE Required	# CE Boards @ 90% UL CE Utilization
	AMR	PS64	HSDPA		


**Figure 6-3: Channel Element Dimensioning Result Template**

In addition to the above, details of all calculations that resulted in above outcomes shall also be submitted as part of the dimensioning report so that these can be independently verified by the NFL and used as a reference for future capacity upgrades or to validate any other change requests.

### 6.4.4 Wi-Fi Dimensioning Results

The Wi-Fi dimensioning result shall be submitted in the following format, **separately for each private and public SSID** by the service provider. For the public SSIDs, the total number of users would be a function of the stadium capacity. For the private SSIDs, the estimated number of users, number of SSIDs, and share of each SSID (if more than one) would have to be provided by the NFL Club or NFL for appropriate dimensioning.

The minimum total backhaul capacity at the stadium shall be at least equal to the total average demand of all SSIDs together (private & public), as obtained from the dimensioning exercise. It is to be noted that this capacity may be able to satisfy minimum throughput requirements and it will not necessarily address the peak throughput demand. To satisfy the peak throughput criteria, additional dimensioning and simulations will have to be undertaken by the Wi-Fi operator / vendor.

Figure 6-5 provides a template to estimate the capacity requirement. To provide a rough estimate of a typical Wi-Fi capacity requirement, a generic calculation has been provided in Figure 6-4, considering one public SSID. It is to be noted that this calculation is only a rough estimate. The actual capacity numbers would be a function of the unique requirement of every stadium. The calculated capacity numbers are based on the average throughput demand. However, the dynamic and burstable nature of backhaul capacity requirement corresponding to peak demand would have to be considered.

Item Description	Formula	Year 1
a = Total Number of Attendees / Users	Input	65,000
b = % Share of Each SSID	Input	100
c = # Subs per SSID	a * b	65,000
d = Percentage of Simultaneous Users (according to design acceptance)	Input	25%
e = Expected Simultaneous Users per SSID	c * d	16,250
f = DL Data Activity Factor (%) (DL Data Activity Factor is the percentage of time a user associated with the SSID actively downloads data)	Input	10
g = UL Data Activity Factor (%) (UL Data Activity Factor is the percentage of time a user associated with	Input	10

the SSID actively uploads data)		
h = Target DL User Throughput (kbps) ("Good" Target according to design acceptance; it is the average data rate that the user should achieve on download)	Input	1,000
i = Target UL User Throughput (kbps) ("Good" Target according to design acceptance; it is the average data rate that the user should achieve on upload)	Input	500
j = Total DL Throughput Demand (Mbps) (It is the aggregated downlink data rate across all users connected to a SSID)	$e * f * h$	1,625
k = Total UL Throughput Demand (Mbps) (It is the aggregated uplink data rate across all users connected to a SSID)	$e * g * i$	813
l = Total (DL+UL) Throughput Demand (Mbps) (It is the summation of the uplink and downlink aggregated data rates)	$j + k$	2,438
m = Backhaul Overheads (It is the percentage of overheads due to control signaling, packet bundling, reliable packet delivery protocols that are necessary for data transmission on the backhaul)	Input	50%
n = Total Backhaul Requirement to meet average demand (Mbps) (This metric is a function of the backhaul overheads and the maximum of UL or DL aggregated data rate; this metric represents the actual backhaul bandwidth requirement)	$\max(j, k) * (1+p)$	2,437

**Figure 6-4: Rough estimate of Wi-Fi capacity (for illustrative purpose only)**

Item Description	Formula	Year 1	Year 2	Year 3
a = Total Number of Attendees/ Users	Input			
b = % Share of Each SSID	Input			
c = # Subs per SSID	$a * b$			
d = Percentage of Simultaneous Users (according to design acceptance)	Input			
e = Expected Simultaneous Users per SSID	$c * d$			
f = DL Data Activity Factor (%) (DL Data Activity Factor is the percentage of time a user associated with the SSID actively downloads data)	Input			
g = UL Data Activity Factor (%) (UL Data Activity Factor is the percentage of time a user associated with the SSID actively uploads data)	Input			
h = Target DL User Throughput (kbps) ("Good" Target according to design acceptance; it is the average data rate that the user should achieve on download)	Input			



<p><b>i = Target UL User Throughput (kbps)</b>                  (“Good” Target according to design acceptance; it is the average data rate that the user should achieve on upload)</p>	Input			
<p><b>j = Total DL Throughput Demand (Mbps)</b>                  (It is the aggregated downlink data rate across all users connected to a SSID)</p>	$e * f * h$			
<p><b>k = Total UL Throughput Demand (Mbps)</b>                  (It is the aggregated uplink data rate across all users connected to a SSID)</p>	$e * g * i$			
<p><b>l = Total (DL+UL) Throughput Demand (Mbps)</b>                  (It is the summation of the uplink and downlink aggregated data rates)</p>	$j + k$			
<p><b>m = Backhaul Overheads</b>                  (It is the percentage of overheads due to control signaling, packet bundling, reliable packet delivery protocols that are necessary for data transmission on the backhaul)</p>	Input			
<p><b>n = Total Backhaul Requirement to meet average demand (Mbps)</b>                  (This metric is a function of the backhaul overheads and the maximum of UL or DL aggregated data rate; this metric represents the actual backhaul bandwidth requirement)</p>	$\max$ $(j,k)*(1+p)$			

**Figure 6-5: Wi-Fi Dimensioning Result Template**

## 6.5 DAS Deployment Plan – Acceptance Report

The acceptance report will have to be submitted as part of the design & dimensioning report mentioned earlier. For stadiums with multiple operators, each operator should provide approval of the other operator’s design. At a minimum, this part of the report will consist of the following:

- Line diagram depicting DAS configuration plan
- Details of DAS settings including but not limited to the following:
  - *DL and UL gain settings of the main unit*
  - *DL & UL gain settings of each of the remote units*
  - *UL system nose figure calculation for each of the individual UL RF chain*
  - *UL AGC / ALC activation status/mechanism for each of the individual UL RF chain*
  - *Fiber loss for each of the individual fiber path*
- Interconnection details between RAN / UTRAN / eUTRAN and DAS
- Details of MIMO deployment plan and antenna configuration for LTE
- Details of sectorization plan along with proposed antenna locations including simulcasting mechanism per individual sector
- Details of downlink power distribution plan per service provider for each of the remote units

- Details of the downlink per distribution plan per technology
- Details of the power distribution plan per transmitted carrier for each of the technology
- Details of the total EIRP target per antenna to make sure FCC RF exposure limits are not exceeded
- Details of EIRP per carrier to make sure design targets are met
- PIM testing results for all operators per each sector
- Maximum number of operators supported on the DAS

Following is a sample line diagram for reference. It is recommended that the DAS configuration plan be submitted along this format.

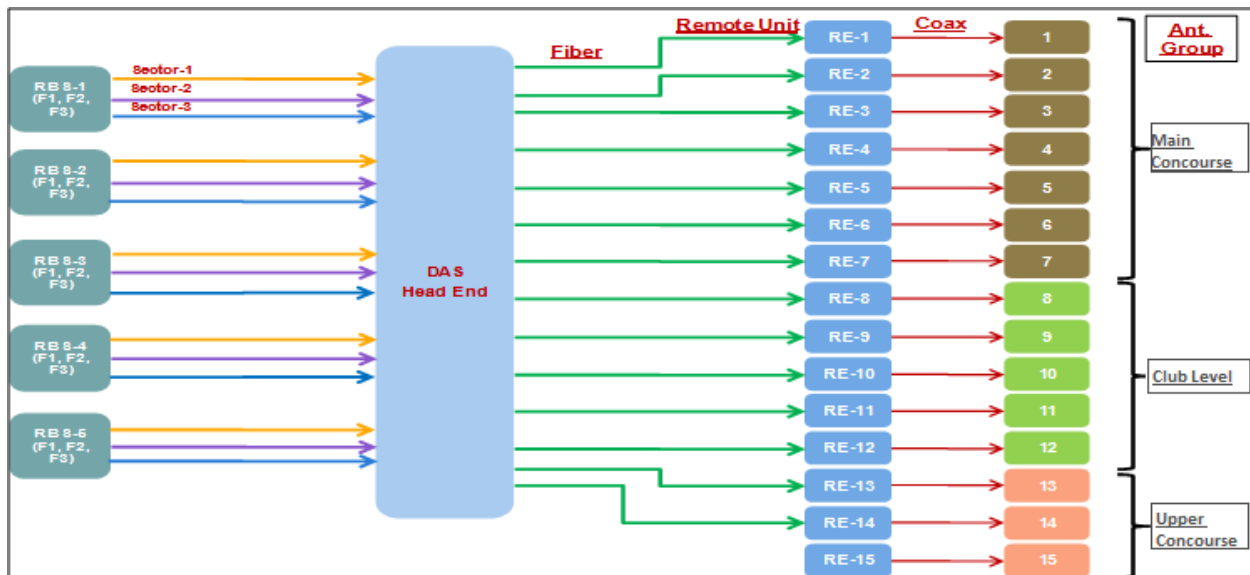


Figure 6-6: Sample DAS Line Diagram

## 6.6 Wi-Fi Deployment Plan – Acceptance Report

The acceptance report will have to be submitted as part of the design & dimensioning report mentioned earlier. This report will have to be submitted by the entity responsible for Wi-Fi deployment. At a minimum, this part of the report will consist of the following:

- Line diagram depicting Wi-Fi configuration plan
- Details of Wi-Fi settings including but not limited to the following:
  - *Connection of the network controllers to the APs*
  - *Connection of the zone-level network controllers to the centralized management unit*
  - *SSIDs served by each AP*
  - *Antenna configuration for each AP - internal / external; omnidirectional / directional*
  - *Cable loss for each of the individual cable path*
- Connection of the Wi-Fi network to backhaul

- Detailed connection plan (with requirements as mentioned in the bullets above) for the private SSIDs
- Details of MIMO deployment plan per AP
- Details of power distribution plan per AP
- Details of the total EIRP target per antenna to make sure FCC RF exposure limits are not exceeded
- Details of EIRP per SSID to make sure design targets are met

## 6.7 DAS Game Day Performance Statistics

The following network level statistics (aggregated over the cells / sectors / sites that offered coverage and capacity to the venue of interest) shall be produced by the service provider with hourly granularity for the Busy Hours of a Game. The service provider shall produce and send to the NFL (i.e., NFL League Office), the applicable NFL Club, and, if appropriate, any applicable third parties (e.g., stadium management company) (the “Parties”), during each of the six (6) months of every applicable NFL season (i.e., August through January) (or such more frequent basis as the Parties may reasonably request), the following network level statistics for each NFL game played at the stadium.

For definition of “Busy Hours of a Game” refer to Section 3.4.

### 6.7.1 Voice Game Day Performance Statistics

Statistics to be collected for Voice performance evaluation on game day are enumerated below:

- Total Calls
- Completion Rate (%)
- Dropped Rate (%)
- Blocked Rate (%)

### 6.7.2 3G Data Game Day Performance Statistics

Statistics to be collected for 3G Data performance evaluation on game day are enumerated below:

- Connection attempts
- Connection success (%)
- Connection drops (%)
- Aggregate traffic (GB)
- Concurrent connections

### 6.7.3 4G Data Game Day Performance Statistics

Statistics to be collected for 4G Data performance evaluation on game day are enumerated below:

- Connection attempts

- Connection success (%)
- Connection drops (%)
- Aggregate traffic (GB)
- Concurrent connections

## 6.8 Wi-Fi Game Day Performance Statistics

The following network level statistics (aggregated over the areas that offered coverage and capacity to the venue of interest) shall be produced by the service provider with hourly granularity for the Busy Hours of a Game. The service provider shall produce and send to the NFL (i.e., NFL League Office), the applicable NFL Club, and any applicable third parties (e.g., stadium management company) (the “Parties”), within one week of each NFL game played at the stadium (or such more frequent basis as the Parties may reasonably request), the following network level statistics.

For definition of “Busy Hours of a Game” refer to Section 3.4.

Statistics to be collected for Wi-Fi Data performance evaluation on game day are enumerated below:

- Unique associations
- Peak associations
- Downstream traffic (GB)
- Upstream traffic (GB)
- Aggregate traffic (GB)
- Peak throughput in (kbps)
- Peak throughput out (kbps)
- Average throughput (kbps)

In addition to the network level statistics mentioned above, it is desired that these statistics be presented on i) per UE category and ii) per application type basis during the period of interest. However, it is understood that actual data collection will depend on the methodology of data collection, capability of the infrastructure vendor, as well as the presence of network probes and other tools in the network.

Accordingly, the above information may be partially available for any specific stadium, so it should be offered by the service provider on a mutually agreed basis per stadium.

# Appendix A Sample Link Budget

## 7.1 UMTS CPICH Link Budgets

Following is a sample of CPICH link budget for the DAS equipment. It uses NodeB CPICH power setting as the input and designed CPICH target at the DAS (RE) as output. Then, based on various losses and gains, fiber length, number of splitters etc., that DAS-RE gain is set to meet the designed CPICH target.

Item Description	Unit	Value	Comment
<u>NodeB CPICH Power</u>	dBm	33	<b>Design input</b>
<u>Target DAS CPICH EIRP per Antenna</u>	dBm	0	<b>Design target</b>
<u>Loss between DAS (RE) and Antenna</u>			
a) <i>Feeder loss between RE &amp; antenna</i>	dB	-3	Depends on feeder type and length
b) <i>Splitter/coupler loss between RE &amp; antenna</i>	dB	-4	Needed to feed multiple antennas
<u>DAS Antenna Gain</u>	dB <sub>i</sub>	4	Assumption
<u>CPICH Power at DAS Output</u>	dBm	3	Calculated from above
<u>Net Downlink System Gain</u>	dB	-30	DAS output power – NodeB output power
<u>DAS Remote Gain Calculation</u>			
a) <i>RF Combining Loss at the Head End (HE)</i>	dB	-10	Will depend on the # carriers
b) <i>Fixed attenuator at the HE input</i>	dB	-30	Will depend on HE max. input power
c) <i>Adjustable attenuator at the HE</i>	dB	-13	Same as above
d) <i>Optical Splitter Loss at the Head End (HE)</i>	dB <sub>o</sub>	0	Optical splitter loss in dB
e) <i>Optical Loss between HE and Remote Equipment (RE)</i>	dB <sub>o</sub>	-4	This represents optical fiber loss in dB between HE & RE
f) <i>RF to Optical Conversion Loss (RF Equivalent)</i>	dB	-8	2 x total optical loss (analog optical; to be excluded for digital optical)
g) <i>Adjustable attenuator loss in the RE</i>	dB	0	Will depend on RE max input power
h) <i>Remote Equipment (RE) Gain</i>	dB	31	Calculated to achieve DL system gain of -30dB
<u>Fade margin (FM)</u>			
a) <i>Cell edge reliability</i>	%	90	Assumption
b) <i>Log normal fading standard deviation</i>	dB	10	Assumption
c) <i>Log normal fade margin</i>	dB	-12.8	Calculated as per NORMINV(90,0,10)

<u>Soft handover gain</u>	dB	0	No SHO gain for CPICH
<u>Body loss (BL)</u>	dB	-3	Assumption
<u>Cell edge outdoor RSCP target</u>	dBm	-95	Sample example; will depend on the stadium as well as dominance targets
<u>Maximum allowable path loss (MAPL)</u>	dB	79.2	EIRP+FM+BL- RSCP target

Figure 6-7: Sample UMTS Link Budget

## 7.2 LTE RS Link Budgets

Following is a sample RS link budget for the DAS equipment. It uses NodeB RS power setting as the input and designed RSRP target at the DAS (RE) as output. Then, based on various losses and gains, fiber length, number of splitters, etc., that DAS-RE gain is set to meet the designed RSRP target. For the sake of simplicity, the same DAS settings (as UMTS example) were used to check how those impact the downlink budgets.

Item Description	Unit	Value	Comment
<u>eNodeB PA Power</u>	dBm	44.8	Design input
<u>LTE channel bandwidth</u>	MHz	10	Design input
<u>Number of resource blocks</u>		50	For 10MHz bandwidth
<u>RS energy per resource element (EPRE)</u>	dBm	17.1	<b>eNodeB output</b>
<u>Target DAS RS EPRE EIRP per Antenna</u>	dBm	-6.1	<b>(6dB below UMTS CPICH to get same MAPL as UMTS CPICH)</b>
<u>Loss between DAS (RE) and Antenna</u>			
<i>c) Feeder loss between RE &amp; antenna</i>	dB	-3	Depends on feeder type and length
<i>d) Splitter/coupler loss between RE &amp; antenna</i>	dB	-4	Needed to feed multiple antennas
<u>DAS Antenna Gain</u>	dBi	4	Assumption
<u>RS EPRE Power at DAS Output</u>	dBm	-3.1	Calculated from above
<u>Net Downlink System Gain</u>	dB	-20	DAS output power – eNodeB output power
<u>DAS Remote Unit Gain</u>			
<i>a) RF Combining Loss at the Head End (HE)</i>	dB	-10	Will depend on the # carriers
<i>b) Fixed attenuator at the HE input</i>	dB	-20	Will depend on HE max. input power
<i>c) Adjustable attenuator at the HE</i>	dB	-13	Same as above
<i>d) Optical Splitter Loss at the Head End (HE)</i>	dBo	0	Optical splitter loss in dB
<i>e) Optical Loss between HE and Remote Equipment (RE)</i>	dBo	-4	This represents optical fiber loss in dB between HE & RE

<i>f) RF to Optical Conversion Loss (RF Equivalent)</i>	dB	-8	2 x total optical loss
<i>g) Adjustable attenuator loss in the RE</i>	dB	0	Will depend on RE max input power
<i>h) Remote Equipment (RE) Gain</i>	dB	31	Calculated to meet -20dB system gain
<b><u>Fade margin (FM)</u></b>			
<i>d) Cell edge reliability</i>	%	90	Assumption
<i>e) Log normal fading standard deviation</i>	dB	10	Assumption
<i>f) Log normal fade margin</i>	dB	-12.8	Calculated as per NORMINV(90,0,10)
<b><u>Body loss (BL)</u></b>			
<b><u>Minimum outdoor RSRP target at cell edge</u></b>	dBm	-101	Sample example; will depend on the stadium as well as dominance targets
<b><u>Maximum allowable path loss (MAPL)</u></b>			
	dB	79.1	RS EIRP+BL+FM-Min.RS target

Figure 6-8: Sample LTE Link Budget

### 7.3 CDMA1x & EVDO Pilot Budgets

The link budgets for  $E_c$  can be prepared in a similar fashion with UMTS CPICH link budget, although targets could be different.

Item Description	Unit	Value	Comment
<b><u>BTS Pilot Power</u></b>	dBm	33	<b>Design input</b>
<b><u>Target Pilot EIRP per Antenna</u></b>	dBm	0	<b>Design Target</b>
<b><u>Loss between DAS (RE) and Antenna</u></b>			
<i>e) Feeder loss between RE &amp; antenna</i>	dB	-3	Depends on feeder type and length
<i>f) Splitter/coupler loss between RE &amp; antenna</i>	dB	-4	Needed to feed multiple antennas
<b><u>DAS Antenna Gain</u></b>			
	dB <sub>i</sub>	4	Assumption
<b><u>Pilot Power at DAS Output</u></b>			
	dBm	3	Calculated from above
<b><u>Net Downlink System Gain</u></b>			
	dB	-30	DAS output power – NodeB power
<b><u>DAS System Gain</u></b>			
<i>i) RF Combining Loss at the Head End (HE)</i>	dB	-10	Will depend on the # carriers
<i>j) Fixed attenuator at the HE input</i>	dB	-30	Will depend on HE max. input power
<i>k) Adjustable attenuator at the HE</i>	dB	-13	Same as above
<i>l) Optical Splitter Loss at the Head End (HE)</i>	dB <sub>o</sub>	0	Optical splitter loss in dB

<i>m) Optical Loss between HE and Remote Equipment (RE)</i>	dBo	-4	This represents optical fiber loss in dB between HE & RE
<i>n) RF to Optical Conversion Loss (RF Equivalent)</i>	dB	-8	2 x total optical loss (analog optical; to be excluded for digital optical)
<i>o) Adjustable attenuator loss in the RE</i>	dB	0	Will depend on RE max input power
<i>p) Remote Equipment (RE) Gain</i>	dB	31	Calculated to meet downlink system gain of -30dB
<b><u>Fade margin (FM)</u></b>			
<i>g) Cell edge reliability</i>	%	90	Assumption
<i>h) Log normal fading standard deviation</i>	dB	10	Assumption
<i>i) Log normal fade margin</i>	dB	-12.8	Calculated as per NORMINV(90,0,10)
<b><u>Soft handover gain</u></b>	dB	0	No SHO gain for pilot
<b><u>Body loss (BL)</u></b>	dB	-3	Assumption
<b><u>Cell edge outdoor Pilot Ec target</u></b>	dBm	-95	Sample example; will depend on the stadium as well as dominance targets
<b><u>Maximum allowable path loss (MAPL)</u></b>	dB	79.2	EIRP+FM+BL- Ec target

Figure 6-9: Sample CDMA Pilot Link Budget

## 7.4 GSM BCCH Voice Link Budgets

The link budgets for BCCH can be prepared in a similar fashion, although targets could be different.

Item Description	Unit	Value	Comment
<b><u>BTS BCCH Power</u></b>	dBm	43	<b>Design input</b>
<b><u>Target BCCH EIRP per Antenna</u></b>	dBm	3	<b>Design Target</b>
<b><u>Loss between DAS (RE) and Antenna</u></b>			
<i>g) Feeder loss between RE &amp; antenna</i>	dB	-3	Depends on feeder type and length
<i>h) Splitter/coupler loss between RE &amp; antenna</i>	dB	-4	Needed to feed multiple antennas
<b><u>DAS Antenna Gain</u></b>	dBi	4	Assumption
<b><u>BCCH Power at DAS Output</u></b>	dBm	6	Calculated from above
<b><u>Net Downlink System Gain</u></b>	dB	-37	DAS output power – BTS power
<b><u>DAS System Gain</u></b>			
<i>q) RF Combining Loss at the Head End (HE)</i>	dB	-10	Will depend on the # carriers



r) Fixed attenuator at the HE input	dB	-30	Will depend on HE max. input power
s) Adjustable attenuator at the HE	dB	-13	Same as above
t) Optical Splitter Loss at the Head End (HE)	dBo	0	Optical splitter loss in dB
u) Optical Loss between HE and Remote Equipment (RE)	dBo	-4	This represents optical fiber loss in dB between HE & RE
v) RF to Optical Conversion Loss (RF Equivalent)	dB	-8	2 x total optical loss (analog optical; to be excluded for digital optical)
w) Adjustable attenuator loss in the RE	dB	0	Will depend on RE max input power
x) Remote Equipment (RE) Gain	dB	24	Calculated to meet downlink system gain of -37dB
<b><u>Fade margin (FM)</u></b>			
j) Cell edge reliability	%	90	Assumption
k) Log normal fading standard deviation	dB	10	Assumption
l) Log normal fade margin	dB	-12.8	Calculated as per NORMINV(90,0,10)
<b><u>Soft handover gain</u></b>	dB	0	No SHO gain for pilot
<b><u>Body loss (BL)</u></b>	dB	-3	Assumption
<b><u>Cell edge outdoor BCCH RSSI target</u></b>	dBm	-92	Sample example; will depend on the stadium as well as dominance targets
<b><u>Maximum allowable path loss (MAPL)</u></b>	dB	79.2	EIRP+FM+BL- BCCH RSSI target

Figure 6-10: Sample GSM BCCH Link Budget

## 7.5 Wi-Fi Link Budget

Item Description	Unit	Value	Comment
<b><u>Maximum Transmit Power</u></b>	dBm	25	<b>Design Input</b>
<b><u>PA Back Off Factor</u></b>	dB	5	<b>Design Input</b>
<b><u>Transmission Side Losses</u></b>			
b) Feeder loss	dB	-0.5	Depends on feeder type and length
i) Splitter/coupler loss	dB	0	Needed to feed multiple antennas
<b><u>AP Antenna Gain</u></b>	dBi	3	Assumption
<b><u>EIRP</u></b>	dBm	23	Calculated from above
<b><u>Receiver Sensitivity</u></b>			

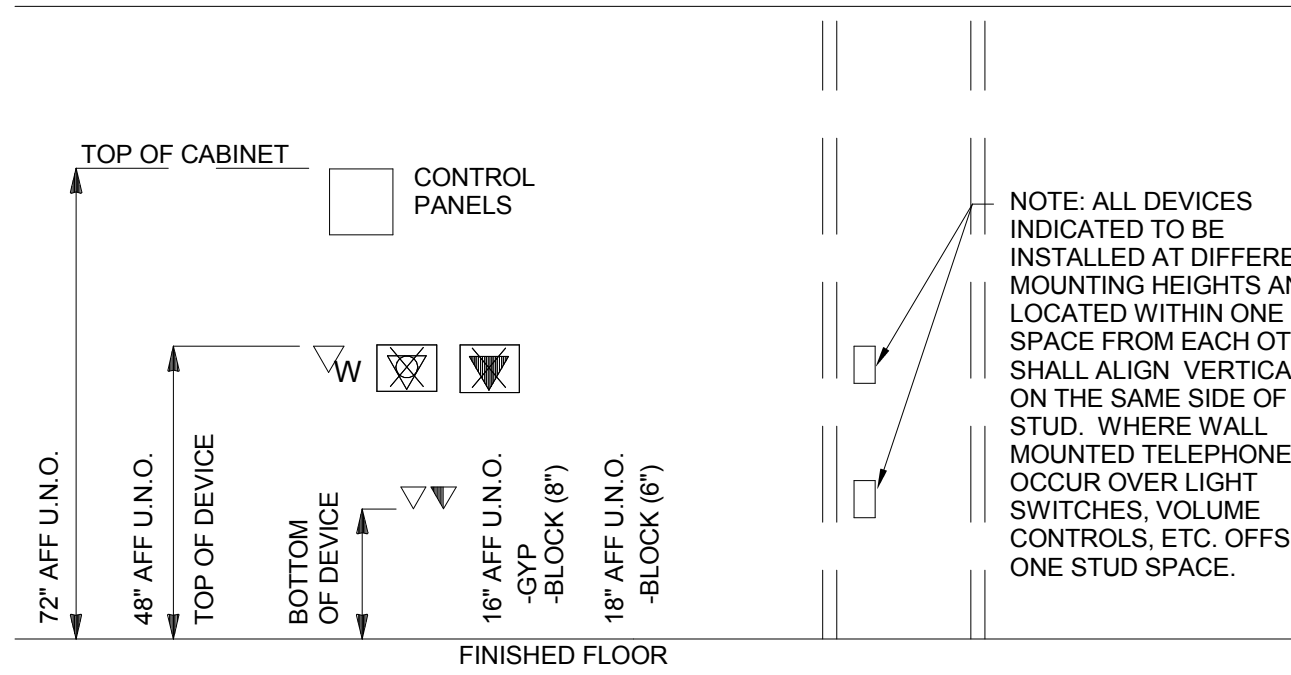
y) <i>Thermal Noise Density</i>	dBm/Hz	-174	Constant input
z) $10 \cdot \log(\text{Channel Bandwidth})$		73	Based on input channel bandwidth
aa) <i>Thermal Noise Floor</i>	dBm	-101	Calculated from above
bb) <i>Receiver Noise Figure</i>	dB	7	Assumption
cc) <i>SINR Threshold</i>	dB	10	Function of Target DL Data rate
dd) <i>Interference Margin</i>	dB	0	Assumption
ee) <i>Receiver Sensitivity</i>	dBm	-83	Calculated from above
<b><u>Receiver Attenuation and Gain</u></b>			
m) <i>Cell edge reliability</i>	%	99	Assumption
n) <i>Log normal fading standard deviation</i>	dB	8	Assumption
o) <i>Log normal fade margin</i>	dB	-18.6	Calculated as per NORMINV(90,0,10)
p) <i>Diversity Gain</i>	dB	0	Assumption
q) <i>Building Penetration Loss</i>	dB	20	Function of deployment scenario
r) <i>Body loss</i>	dB	0	Assumption
<b><u>Maximum allowable path loss (MAPL)</u></b>	dB	67.36	EIRP+FM+BL- Ec target

**Figure 6-11: Sample Wi-Fi Link Budget**

## **6.0 DAS DRAWINGS**

**GENERAL TECHNOLOGY SYSTEM REQUIREMENTS:**

- HEIGHTS SHOWN ARE TYPICAL TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE. ALL DEVICE OUTLETS SHALL BE MOUNTED VERTICALLY.
- MOUNTING HEIGHTS SHOWN ON ARCHITECTURAL ELEVATIONS SHALL GOVERN OVER THOSE SHOWN ABOVE.
- ALL DEVICES INDICATED TO BE INSTALLED AT DIFFERENT MOUNTING HEIGHTS AND LOCATED WITHIN ONE STUD SPACE FROM EACH OTHER SHALL ALIGN VERTICALLY ON THE SAME SIDE OF THE STUD, WHERE WALL MOUNTED TELEPHONES OCCUR OVER LIGHT SWITCHES, VOLUME CONTROLS, ETC. OFFSET ONE STUD SPACE.
- ALL EXPOSED RACEWAYS SHALL BE INSTALLED PARALLEL OR PERPENDICULAR TO WALLS OR STRUCTURAL MEMBERS SUCH THAT THEY FOLLOW STRUCTURAL SURFACE CONTOURS AND SHALL BE INSTALLED SUCH THAT THEY DO NOT OBSTRUCT PASSAGEWAYS. MULTIPLE RACEWAYS SHOULD BE INSTALLED GROUPED TOGETHER. THE LOCATION OF THESE RACEWAYS SHALL BE APPROVED BY THE ARCHITECT PRIOR TO INSTALLATION. (EXTRA TIME SHOULD BE ALLOWED FOR THIS REVIEW AND APPROVAL.)
- ALL BACK BOXES SHALL BE FLUSH MOUNTED UNLESS OTHERWISE NOTED. CONTRACTOR SHALL COORDINATE INSTALLATION OF CONDUIT AND BACK BOXES IN POURED CONCRETE, MASONRY, AND GYP WALLS.
- DATA GIVEN ON THE DRAWINGS IS AS EXACT AS COULD BE SECURED. ABSOLUTE ACCURACY IS NOT GUARANTEED AND THE CONTRACTOR SHALL OBTAIN AND VERIFY EXACT LOCATIONS, MEASUREMENTS, LEVELS, SPACE REQUIREMENTS, POTENTIAL CONFLICTS WITH OTHER TRADES, ETC. AT THE SITE AND SHALL SATISFACTORILY ADAPT HIS WORK TO ACTUAL CONDITIONS AT THE BUILDING. THE DRAWINGS ARE DIAGRAMMATICAL IN NATURE AND SHALL NOT BE SCALED. HOWEVER THIS DOES NOT RELIEVE ANY SUB-CONTRACTOR FROM COORDINATING HIS WORK WITH ALL OTHER TRADES AND FROM ADJUSTING HIS WORK AS REQUIRED BY THE ACTUAL CONDITIONS OF THE PROJECT. THE CONTRACTOR SHALL VISIT THE SITE BEFORE SUBMITTING A BID TO BECOME THOROUGHLY FAMILIAR WITH THE ACTUAL CONDITIONS OF THE PROJECT.
- COORDINATE AND ADJUST ALL WORK BETWEEN TRADES AND EXISTING CONDITIONS IN ORDER TO ACCOMPLISH A NEAT, INTEGRATED AND EFFICIENT INSTALLATION WHICH INCLUDE BUT IS NOT LIMITED TO:
  - EXAMINE THE CONTRACT DOCUMENTS OF ALL TRADES (IE: THE ARCHITECTURAL REFLECTED CEILING PLAN, MECHANICAL HVAC DRAWINGS, ELECTRICAL LIGHTING PLAN, TECHNOLOGY PLAN, FIRE PROTECTION PLAN, ETC.)
  - COORDINATE NECESSARY EQUIPMENT, FIXTURES, ETC. SO THAT THE FINAL INSTALLATION IS COMPATIBLE WITH THE MATERIALS AND EQUIPMENT OF THE OTHER TRADES.
  - THIS CONTRACTOR SHALL ASSIST THE DIVISION 21, 22, & 23 CONTRACTOR IN PREPARING SHOP DRAWINGS FOR COORDINATING INSTALLATION OF ALL WORK (IE: LOCATING ALL CEILING CLEARANCES, CABLE TRAY, CLEARANCES THROUGHOUT, ETC.)
- DEFINITIONS:
  - "FURNISH" MEANS TO "SUPPLY" AND USUALLY REFERS TO AN ITEM OF EQUIPMENT.
  - "INSTALL" MEANS TO "SET IN PLACE, CONNECT AND PLACE IN FULL OPERATIONAL ORDER"
  - "PROVIDE" MEANS TO "FURNISH AND INSTALL"
  - "EQUIVALENT" MEANS "MEETS THE SPECIFICATIONS OF THE REFERENCE PRODUCT OR ITEM IN ALL SIGNIFICANT ASPECTS." SIGNIFICANT ASPECTS SHALL BE DETERMINED BY THE ENGINEER.
  - "WORK BY OTHERS," "CONTRACTOR," "RE: DIVISION XX," AND SIMILAR EXPRESSIONS MEANS WORK TO BE PERFORMED UNDER THE CONTRACT DOCUMENTS, BUT NOT NECESSARILY UNDER THE DIVISION OR SECTION OF THE WORK ON WHICH THE NOTE APPEARS. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO COORDINATE THE WORK OF THE CONTRACT BETWEEN HIS SUPPLIERS, SUBCONTRACTORS, AND EMPLOYEES. IF CLARIFICATION IS REQUIRED, CONSULT ARCHITECT BEFORE SUBMITTING BID.
- FUTURE WORK:
  - THE DRAWINGS AND SPECIFICATIONS MAY INDICATE SOME WORK WHICH IS TO BE PROVIDED UNDER THIS SCOPE OF WORK BUT WHSE TIMING MAY BE DIFFERENT THAN THE REST OF THE WORK. THIS WORK GENERALLY FACILITATES THE INSTALLATION OF "TENANT FINISH" WORK OR FOOD SERVICE WORK. IT IS WITHIN THIS DIVISION'S SCOPE OF WORK TO COORDINATE THIS WORK WITH THE WORK OF THE CONTRACTOR PROVIDING THE FUTURE SCOPE OF WORK.
- "FIRE STOPPING" REQUIREMENT: ALL PENETRATIONS THROUGH RATED WALLS AND FLOORS AND CONDUITS/SLLEEVE OPENINGS SHALL BE SEALED WITH MATERIAL CAPABLE OF PREVENTING THE PASSAGE OF FLAMES, HOT GASSES AND SMOKE WHEN SUBJECTED TO THE REQUIREMENTS OF THE TEST STANDARD SPECIFIC FOR ALL APPLICABLE CODES.
- REFER TO ARCHITECTURAL DRAWINGS FOR MINIMUM CLEARANCE REQUIREMENTS TO DUCTWORK, CONDUIT, CABLE TRAY, LIGHTING, ETC.
- ALL COMMUNICATIONS RACEWAY AND PATHWAYS INCLUDING BUT NOT LIMITED TO CONDUIT, SLEEVES, CABLE TRAY, J-HOOKS SHALL BE INSTALLED TO MINIMIZE UNNECESSARY CABLE LENGTHS AND MAINTAIN INDUSTRY STANDARD LENGTH LIMITATIONS FOR HORIZONTAL CABLE DISTRIBUTION (IE: CAT 6E AND CAT 6/CAT 6A). NO HORIZONTAL CABLE LENGTH (BASIC LINK) SHALL EXCEED 90 METERS (295 FEET).
- CONDUIT SLEEVES SHALL BE INSTALLED THROUGH ALL WALLS WHERE CABLING IS ROUTED USING J-HOOKS TO PROVIDE CONTINUOUS UN-OBSTRUCTED PATHWAYS TO NEAREST COMMUNICATIONS ROOMS FROM STATIONS DEVICES.
- REFER TO AV CONSTRUCTION DOCUMENTS FOR AV CONDUIT REQUIREMENTS INCLUDING SIZES, QUANTITIES, AND LOCATIONS.
- ALL COMMUNICATIONS CONDUIT, CABLE TRAYS, LADDER RACKS, AND EQUIPMENT RACKS SHALL BE BONDED TO BUILDING GROUND SYSTEM PER NEC 250.
- ALL COMMUNICATION CONDUIT OR SLEEVES ROUTED THROUGH ELECTRICAL ROOMS SHALL BE PHYSICALLY CONTINUOUS AND BONDED TO GROUND SYSTEM.
- ANY CABLE TRAY ROUTED THROUGH ELECTRICAL ROOMS OR WITHIN PROXIMITY OF INTERFERING ELECTRICAL SOURCES SHALL BE ENCLOSED TYPE USING SOLID BOTTOM TROUGH WITH REMOVABLE COVERS. CABLE TRAY SHALL BE BONDED TO GROUND SYSTEM.
- J-HOOKS SHALL BE ONLY USED IN ACCESSIBLE FINISHED CEILING SPACES NOT SERVED BY CABLE TRAY OR CONDUIT.
- ALL TELEDATA CONDUIT AND OTHER RACEWAY INFRASTRUCTURE SHALL HAVE NO LESS THAN 25% SPARE CAPACITY ABOVE THE NEC MINIMUM FILL RATIOS.
- ALL COMMUNICATIONS CONDUIT LARGER THAN 2" SHALL HAVE A MINIMUM BEND RADIUS OF 10:1 OF THE INSIDE DIAMETER FOR ALL ELBOWS. ALL COMMUNICATIONS CONDUIT 2" AND SMALLER SHALL HAVE A MINIMUM BEND RADIUS OF 8:1 OF THE INSIDE DIAMETER FOR ALL ELBOWS.
- ALL COMMUNICATIONS CONDUIT ROUTING SHALL NOT EXCEED 180° FOR THE SUM OF ELBOWS FOR A PARTICULAR CONDUIT RUN WITHOUT AN APPROVED PULL-BOX OR MANHOLE. THE MAXIMUM BEND FOR ANY LOCATION SHALL NOT EXCEED 90°.
- PROVIDE PROTECTIVE BUSHINGS ON ALL COMMUNICATIONS CONDUITS INCLUDING RISER CONDUITS/SLEEVES, HORIZONTAL CONDUITS, DEVICE CONDUITS, AND SLEEVES.
- ALL RISER CONDUIT SHALL BE STUBBED A MINIMUM OF 2" AFF. PROVIDE A 2" CURB IF SLAB BLOCK-OUT IS USED RATHER THAN SLEEVES. SERVICE PROVIDER AND UNDERGROUND CONDUIT SHALL BE STUBBED A MINIMUM OF 4" AFF.
- ALL FIBER OPTIC CABLE SHALL BE INSTALLED WITHIN APPROVED/UL-LISTED INNER-DUCT COMPLETE WITH FITTINGS, COURTESIES, AND ADAPTERS (CARBON RISER GARD, FLENNIG GARD, OR APPROVED EQUAL). FIBER OPTIC CABLE CAN UTILIZE METALLIC ARMORED SHEATH RATHER THAN USING INNER-DUCT.
- UPON FINAL CABLE INSTALLATION, ALL UNDERGROUND COMMUNICATIONS CONDUIT SHALL BE SEALED TO PREVENT WATER, GAS AND RODENTS FROM ENTERING FACILITY.
- ALL COMMUNICATIONS CABLE INSTALLED BELOW GRADE SHALL BE GEL FILLED PIC/PIC-89 PER RUS/REA DESIGNATION.
- ALL UNDERGROUND COMMUNICATIONS CONDUIT SHALL HAVE METALLIC LOCATOR TAPE.
- ALL COMMUNICATIONS CABLE SHALL BE FLENNIG RATED (CMP), RISER RATED (CMR) AND UNDERGROUND RATED (WATERBLOCK) ACCORDING TO USE AND ENVIRONMENTAL CONDITIONS.
- ALL BACKBONE (RISER) COMMUNICATIONS CABLE SHALL BE INSTALLED BASED ON A PHYSICAL STAR TOPOLOGY. REFER TO ONE-LINE DIAGRAMS FOR LINE-SPECIFIC ROUTING REQUIREMENTS.
- ANY COMMUNICATIONS CABLES (FIBER AND COPPER) INSTALLED BELOW GRADE, UNDERGROUND, OR OTHER LOCATIONS SUBJECT TO WET CONDITIONS SHALL UTILIZE WATERBLOCK CONSTRUCTION.



**TYPICAL DEVICE MOUNTING HEIGHTS**  
NO SCALE

**NOTES:**

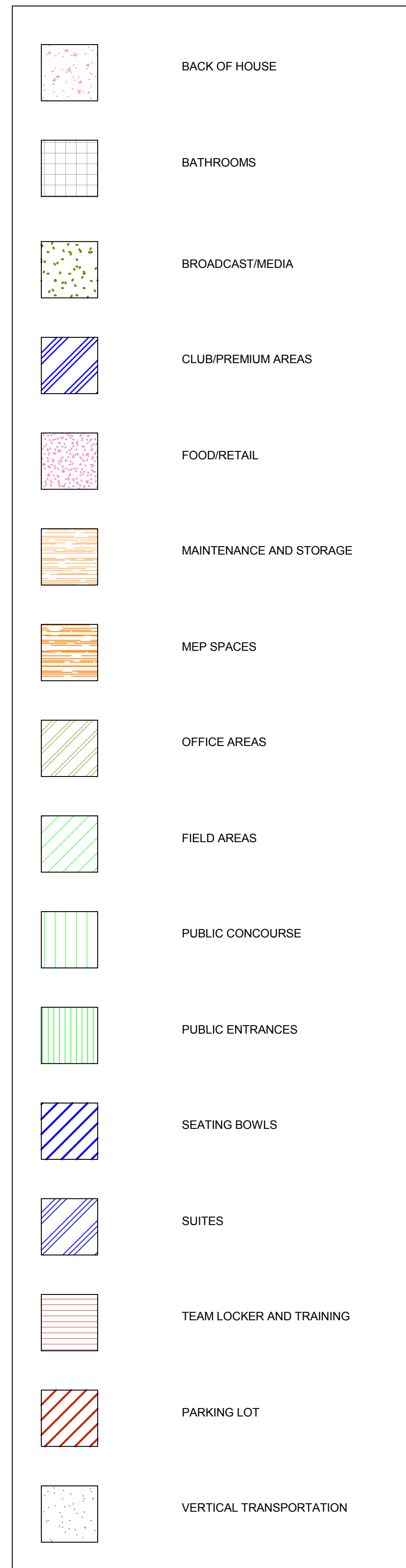
- MOUNTING HEIGHTS SHOWN ON ARCHITECTURAL ELEVATIONS SHALL GOVERN OVER THOSE SHOWN ABOVE.
- CONTRACTOR SHALL ENSURE THAT ALL MOUNTING HEIGHTS COMPLY WITH CURRENT ADA REQUIREMENTS.
- ALL ABOVE COUNTER DEVICES SHALL BE MOUNTED 8" ABOVE COUNTER OR A MAXIMUM OF 44" AFF (TO TOP OF DEVICE). VERIFY HEIGHTS WITH ARCHITECT.
- WHERE EVER DEVICES ARE INDICATED TO BE ABOVE DOORS, DEVICE SHALL BE CENTERED BETWEEN TOP OF DOOR TRIM AND CEILING LINE.

**ABBREVIATIONS**

AC	ALTERNATING CURRENT
ADA	AMERICANS WITH DISABILITIES ACT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHU	AIR HANDLING UNIT
ALD	ASSISTED LISTENING DEVICE
ALPETH	ALUMINUM POLYETHYLENE
ALS	ASSISTED LISTENING SYSTEM
ALT	ALTERNATE
AMP, A	AMPERE
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ANT	ANTENNA
ATSC	ADVANCED TELEVISION SYSTEMS COMMITTEE (DIGITAL TELEVISION SIGNAL)
AUX	AUXILIARY
AUDIO	MICROPHONE OR LINE LEVEL BALANCED SIGNAL
AV	AUDIO VIDEO
AWG	AMERICAN WIRE GAUGE
BAS	BUILDING AUTOMATION SYSTEM
BFC	BELOW FINISHED CEILING
BFG	BELOW FINISHED GRADE
BICSF	BUILDING INDUSTRY CONSULTING SERVICES INTERNATIONAL
BMS	BUILDING MANAGEMENT SYSTEM
BRI	BASIC RATE INTERFACE (ISDN)
C	CONDUIT
CATV	COMMUNITY ANTENNA TV (CABLE TV)
CC	CONTACT CLOSURE
COMP	COMMUNICATIONS PLENUM CABLE
CMR	COMMUNICATIONS RISER CABLE
CO	CENTRAL OFFICE
COAX	COAXIAL
CODEC	CODER / DECODER
CSI	CONSTRUCTION SPECIFICATIONS INSTITUTE
DAS	DISTRIBUTED ANTENNA SYSTEM
DB	DECIBEL
DC	DIRECT CURRENT
DEMARC	DEMARICATION
DISC	DISCONNECT
DM	DIGITAL MEDIA SIGNAL
DMP	DIGITAL MEDIA PLAYER
DSL	DISPLAYPORT
DP	DIGITAL SUBSCRIBER LINE
DSP	DIGITAL SIGNAL PROCESSOR
DSS	DIGITAL SATELLITE SIGNAL
DVI-D	DIGITAL VISUAL INTERFACE-DIGITAL
DVI-I	DIGITAL VISUAL INTERFACE-INTEGRATED
DWG	DRAWING
EBC	EQUIPMENT BONDING CONDUCTOR
EIA	ELECTRONICS INDUSTRY ALLIANCE
ELEC	ELECTRIC OR ELECTRICAL
ELEV	ELEVATOR
EMC	ELECTROMAGNETIC COMPATIBILITY
EMI	ELECTROMAGNETIC INTERFERENCE
EMT	ELECTRIC METALLIC TUBING
ENG	ELECTRONIC NEWS GATHERING
EX	EXISTING
FA	FIRE ALARM
FAA	FEDERAL AVIATION ADMINISTRATION
FACP	FIRE ALARM CONTROL PANEL
FLEX	FLEXIBLE
FM	FREQUENCY MODULATION
FO	FIBER OPTIC
FP	FLAT PANEL (VIDEO DISPLAY)
FTP	FILE TRANSFER PROTOCOL
GA	GAUGE
GALV	GALVANIZED
GB	GIGABYTE
GbPs	GIGABITS PER SECOND
GC	GENERAL CONTRACTOR
GEN	GENERATOR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GHz	GIGAHERTZ
GMP	GUARANTEED MAXIMUM PRICE
GUI	GRAPHICAL USER INTERFACE
HC	HORIZONTAL CROSS-CONNECT
HD	HIGH DEFINITION
HDMI	HIGH DEFINITION MULTIMEDIA INTERFACE
HVAC	HEATING, VENTILATING, AND AIR-CONDITIONING
Hz	HERTZ
IC	INTERMEDIATE CROSS-CONNECT
ID	INSIDE DIAMETER
IDF	INTERMEDIATE DISTRIBUTION FRAME
IEC	INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.
IF	INTERFACE
IG	ISOLATED GROUND
IMC	INTERMEDIATE GRADE METALLIC CONDUIT
IP	INTERNET PROTOCOL (ETHERNET)
IR	INFRARED SIGNAL
ISDN	INTEGRATED SERVICES DIGITAL NETWORK
ISO	INTERNATIONAL ORGANIZATION OF STANDARDS
J-BOX	JUNCTION BOX
kb	KILOBIT
kbps	KILOBIT PER SECOND
kmil	THOUSANDS OF CIRCULAR MILLS
kHz	KILOHERTZ
km	KILOMETER
kVA	KILOVOLT AMPERES
kw	KILOWATT
kWh	KILOWATT-HOURS
LAN	LOCAL AREA NETWORK
LED	LIGHT-EMITTING DIODE
LEC	LOCAL EXCHANGE CARRIER (OR SP)
LFC	LIQUID TIGHT FLEXIBLE CONDUIT
LUMEN	LUMINOUS FLUX (PROJECTOR BRIGHTNESS)

**ABBREVIATIONS**

LV	LOW VOLTAGE
LVC	LOW VOLTAGE CONTROL INTERFACE
M	METER
mA	MILLIAMPERE
MAG	MAGNETIC
MB	MEGABYTE
Mbps	MEGABITS PER SECOND
MC	MAIN CROSS-CONNECT
MDF	MAIN DISTRIBUTION FRAME
MECH	MECHANICAL
MFR	MANUFACTURER
Mhz	MEGAHERTZ
mm	MILLIMETER
MMFO	MULTI-MODE FIBER OPTIC
MNS	MASS NOTIFICATION SYSTEM
MPOE	MAIN POINT OF ENTRY
MPPO	MINIMUM POINT OF PRESENCE
NEC	NATIONAL ELECTRIC CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NETWORK INTERFACE CARD
NID	NETWORK INTERFACE DEVICE
NIT	1 CANDELA PER SQUARE METER (FLAT PANEL BRIGHTNESS)
nm	NANOMETER
NTS	NOT TO SCALE
CC	CONTACT CLOSURE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OEM	ORIGINAL EQUIPMENT MANUFACTURER
OS	OPERATING SYSTEM
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OSP	OUTSIDE PLANT
OTDR	OPTICAL TIME DOMAIN REFLECTOMETER
PA	PUBLIC ADDRESS
PABX	PRIVATE AUTOMATIC BRANCH EXCHANGE
PBX	PRIVATE BRANCH EXCHANGE
PCI	PAYMENT CARD INDUSTRY
PE	POLYETHYLENE
PH	PHASE
POTS	PLAIN OLD TELEPHONE SERVICE
PR	PAIRS
PRI	PRIMARY RATE INTERFACE (ISDN)
PSTN	PUBLIC SWITCHED TELEPHONE NETWORK
PROX	PROXIMITY
PTZ	PAN TILT ZOOM CAMERA
PVC	POLYVINYL CHLORIDE
PWR	POWER
RCDD	REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
RF	RADIO FREQUENCY SIGNAL
RGBHV	HIGH RESOLUTION ANALOG VIDEO
RGS	RIGID GALVANIZED STEEL
RH	RELATIVE HUMIDITY
RMC	RIGID METALLIC CONDUIT
RNC	RIGID NON-METALLIC CABLE
RS-232	BI-DIRECTIONAL CONTROL DATA STREAM (RS-232C/RS-422/RS485)
RX	RECEIVE
SMFO	SINGLE-MODE FIBER OPTIC
SMPOE	SECONDARY MAIN POINT OF ENTRY
SP	SERVICE PROVIDER
SPEAKER	SPEAKER LEVEL SIGNAL
SPL	SOUND PRESSURE LEVEL
STEREO	A BALANCED 2 CHANNEL AUDIO SIGNAL
STI-PA	SPEECH INTELLIGIBILITY INDEX - PUBLIC ADDRESS
STP	SHIELDED TWISTED PAIR
SW	SWITCH
TBB	TELECOMMUNICATIONS BONDING BACKBONE
TCP	TRANSMISSION CONTROL PROTOCOL
TCP/IP	TRANSMISSION CONTROL PROTOCOL WITH INTERNET PROTOCOL
TDD	TELECOMMUNICATIONS DEVICE FOR THE DEAF
TDR	TIME DOMAIN REFLECTOMETER
TEL	TELEPHONE
TELECO	TELEPHONE COMPANY (SP)
TGB	TELECOMMUNICATIONS GROUND BUS BAR
TIA	TELECOMMUNICATIONS INDUSTRY ASSOCIATION
TMGB	TELECOMMUNICATIONS MAIN GROUND BUS BAR
TP	TOUCH PANEL (CONTROL SYSTEM)
TP	TOUCH PANEL (CONTROL SYSTEM)
TR	TELECOMMUNICATIONS ROOM
TTB	TELEPHONE TERMINAL BOARD
TV	TELEVISION
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
UBS	UNIFORM BUILDING CODE
UC	UNDER COUNTER
UG	UNDERGROUND
UL	UNDERWRITER LABORATORIES
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUPTIBLE POWER SUPPLY
USB	UNIVERSAL SERIAL BUS
UTP	UNSHIELDED TWISTED PAIR
V	VOLTAGE
VC	VOLUME CONTROL
VGA	VIDEO GRAPHIC ARRAY (ANALOG COMPUTER SIGNAL. SEE ALSO RGBHV)
VM	VOLTMETER
VTC	VIDEO TELECONFERENCE SYSTEM
W	WATT
WAN	WIDE AREA NETWORK
WATS	WIDE AREA TELECOMMUNICATIONS SERVICE
WLAN	WIRELESS LOCAL AREA NETWORK (WIFI)
WM	WIRELESS MICROPHONE
WP	WEATHER PROOF
WT	WATERTIGHT
XFMR	TRANSFORMER
XP	EXPLOSION PROOF



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**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
300 N. WABASH AVE., SUITE 1500, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LEIGH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**MEP**  
WJHW  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**FOOD SERVICE**  
RICCA NEWMARK  
5325 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
ELEVATOR ADVISORY GROUP  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2995 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN WILLIAMS DAVIES AND IRWIN, INC.  
650 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8

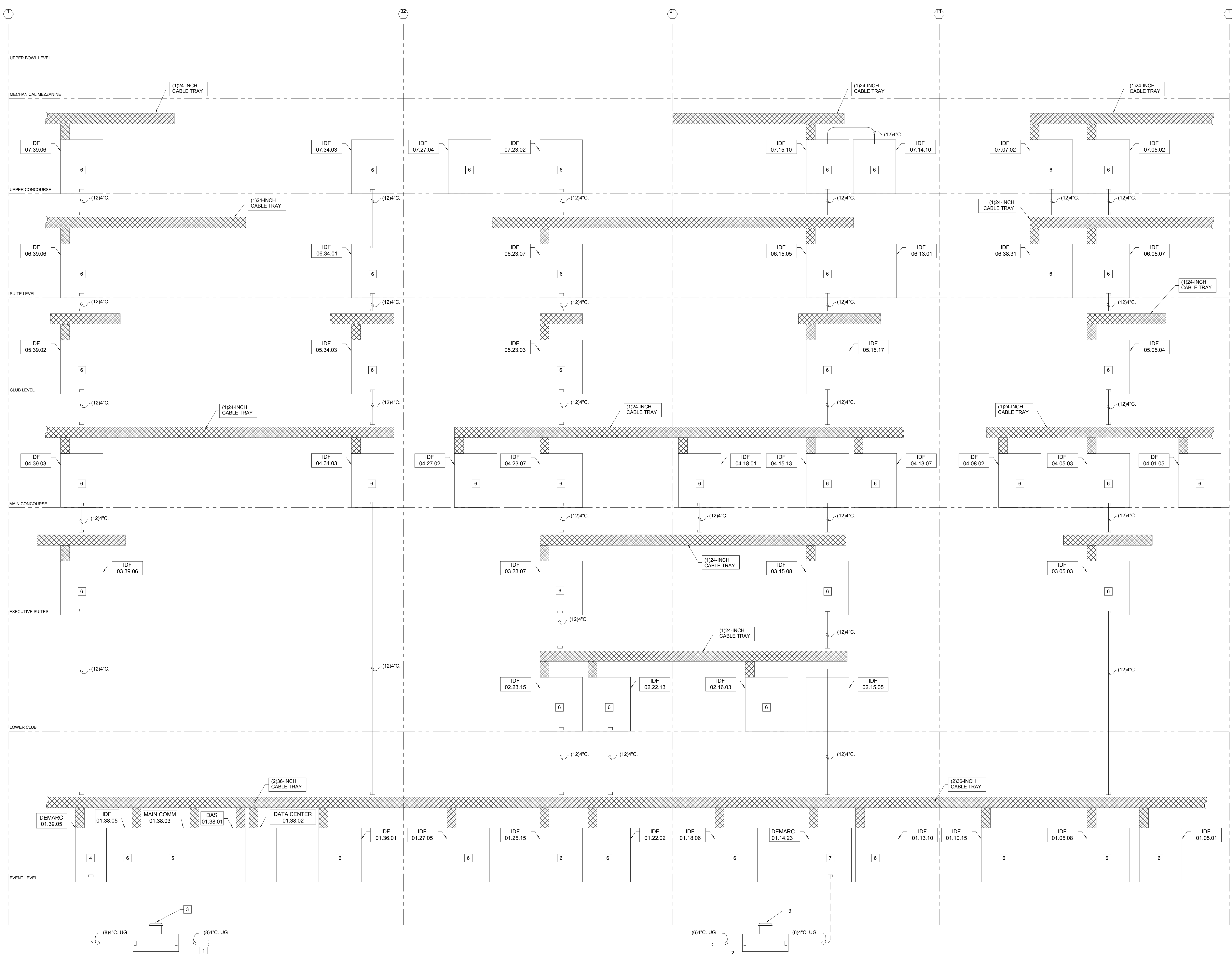
**GENERAL NOTES:**

- REFER TO SYMBOL LEGEND FOR ADDITIONAL REQUIREMENTS, INCLUDING BUT NOT LIMITED TO: INSTALLATION OF COMMUNICATIONS AND SECURITY RACEWAY, CABLING, AND DEVICES.
- CONTRACTOR SHALL COORDINATE ROUTING AND STUB UP LOCATIONS FOR ALL LOW VOLTAGE SYSTEMS RISERS/CONDUIT DURING SHOP DRAWING PROCESS. REFER TO ENLARGED COMMUNICATIONS ROOM PLANS FOR ADDITIONAL REQUIREMENTS.
- CABLE TRAY IS INDICATED ON THIS DRAWING FOR REFERENCE ONLY. REFER TO PLAN DRAWINGS FOR ADDITIONAL REQUIREMENTS.

**KEY NOTES:**  
(SOME KEY NOTES MAY NOT APPLY TO THIS SHEET.)

- PRIMARY TELECOM: PROVIDE (6) 4-INCH CONDUITS (WITH METALLIC LOCATOR TAPE) IN DUCT BANK BELOW GRADE FOR PRIMARY COMMUNICATIONS SERVICE. THREE CONDUITS SHALL EACH BE INSTALLED WITH THREE (3) 1-1/4" DIAMETER INNER-DUCTS. CONDUITS SHALL ORIGINATE FROM THE DEMARC LOCATION AND ROUTE TO A PROJECT PROVIDED VAULT. EXTEND CONDUIT FROM VAULT TO A LOCATION AT THE PROPERTY LINE COORDINATED WITH THE SERVICE PROVIDER. REFER TO TECHNOLOGY SITE PLAN FOR ADDITIONAL INFORMATION.
- REDUNDANT TELECOM: PROVIDE (6) 4-INCH CONDUITS ROUTED OUTSIDE OF BUILDING FOR DIVERSE SERVICE. TWO (2) CONDUITS SHALL EACH BE INSTALLED WITH THREE (3) 1-1/4" DIAMETER INNER-DUCTS. CONDUITS SHALL ORIGINATE FROM THE DEMARC LOCATION AND ROUTE TO A PROJECT PROVIDED VAULT.
- MANHOLE: PROVIDE COMMUNICATIONS VAULT. EXACT LOCATION SHALL BE COORDINATED WITH ARCHITECT, CONTRACTOR, CIVIL ENGINEER, AND SERVICE PROVIDER PRIOR TO INSTALLATION. REFER TO MANHOLE DETAIL FOR ADDITIONAL REQUIREMENTS.
- MPOE: PRIMARY COMMUNICATIONS SERVICE PROVIDER MAIN POINT OF ENTRY AND DEMARCATION.
- MC-ROOM: MAIN CROSS-CONNECT ROOM.
- IC-ROOM: INTERMEDIATE CROSS-CONNECT ROOM.
- POE: COMMUNICATIONS SERVICE PROVIDER DIVERSE POINT OF ENTRY AND DEMARCATION.

**NOT FOR CONSTRUCTION**



**A** TECHNOLOGY RACEWAY ONE-LINE DIAGRAM

NO SCALE

PLOT DATE: 4/20/14 8:58:17 AM TEMPLATE VERSION: 2/13/2012/2594

**GENERAL NOTES:**

1. REFER TO SYMBOL LEGEND FOR ADDITIONAL REQUIREMENTS, INCLUDING BUT NOT LIMITED TO, INSTALLATION OF COMMUNICATIONS AND SECURITY RACEWAY, CABLING, AND DEVICES.

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
350 N. ST. PAUL, ST., SUITE 100, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**ASSOCIATE ARCHITECT - INTERIORS**  
STUDIO HIVE  
901 NORTH 5th ST., SUITE 228, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10255 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N. MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**WJHW**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
5255 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELEBY PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

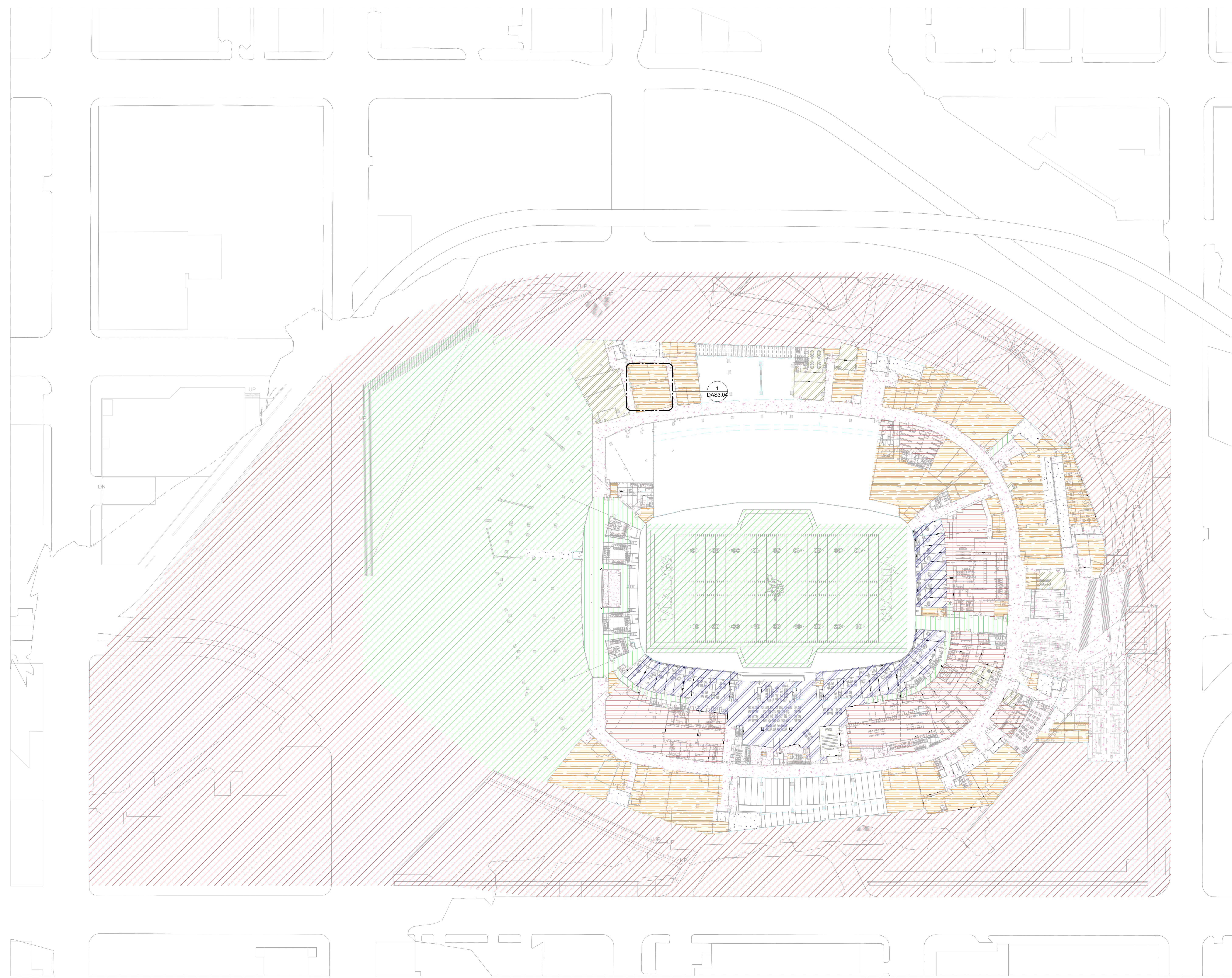
**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2990 MISSION BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
300 N. WABASH AVE., SUITE 1500, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LEITCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**KEYNOTES:**



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

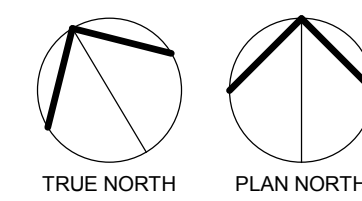
REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**MAY 2, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**SITE PLAN - DAS**

SHEET NO.  
**DAS1.00**

1 00 SITE PLAN - COMMUNICATIONS  
1" = 60'-0"



**GENERAL NOTES:**

1. REFER TO SYMBOL LEGEND FOR ADDITIONAL REQUIREMENTS, INCLUDING BUT NOT LIMITED TO, INSTALLATION OF COMMUNICATIONS AND SECURITY RACEWAY, CABLING, AND DEVICES.

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
350 N. ST. PAUL, ST., SUITE 100, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401

**ASSOCIATE ARCHITECT - INTERIORS**  
STUDIO HIVE  
901 NORTH 5th ST., SUITE 228, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10255 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15508 WRIGHT BROTHERS DR., ADDISON, TX 75001

**WJHW**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
6225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
5235 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELECT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

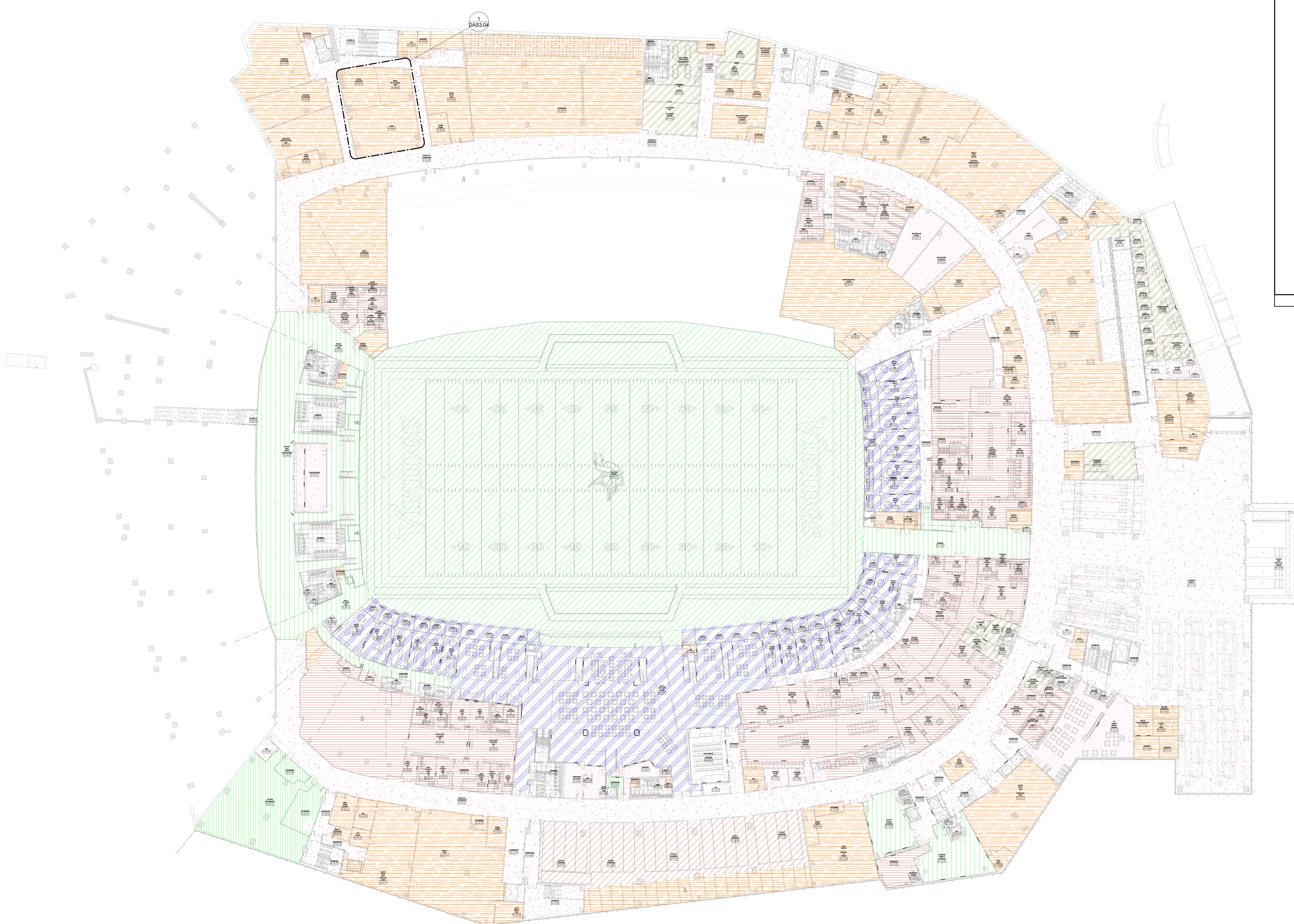
**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2990 MISSION BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8

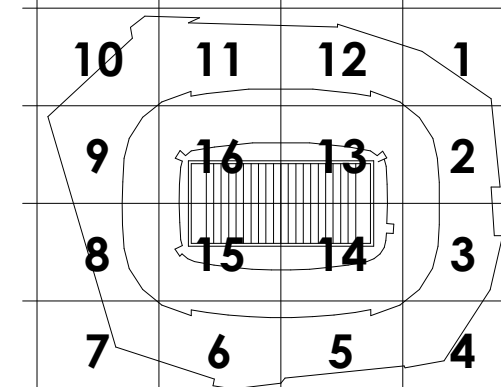
**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1500, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LEIGH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**KEYNOTES:**



**KEY PLAN**



REVISION NO. DESCRIPTION DATE

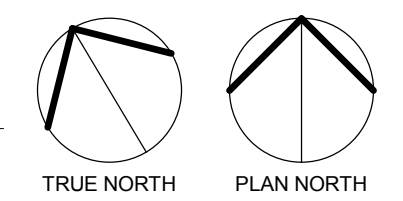
REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**MAY 2, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**EVENT LEVEL PLAN - DAS**

SHEET NO.  
**DAS2.01**

1 01 EVENT LEVEL PLAN - DAS COVERAGE  
1/32" = 1'-0"

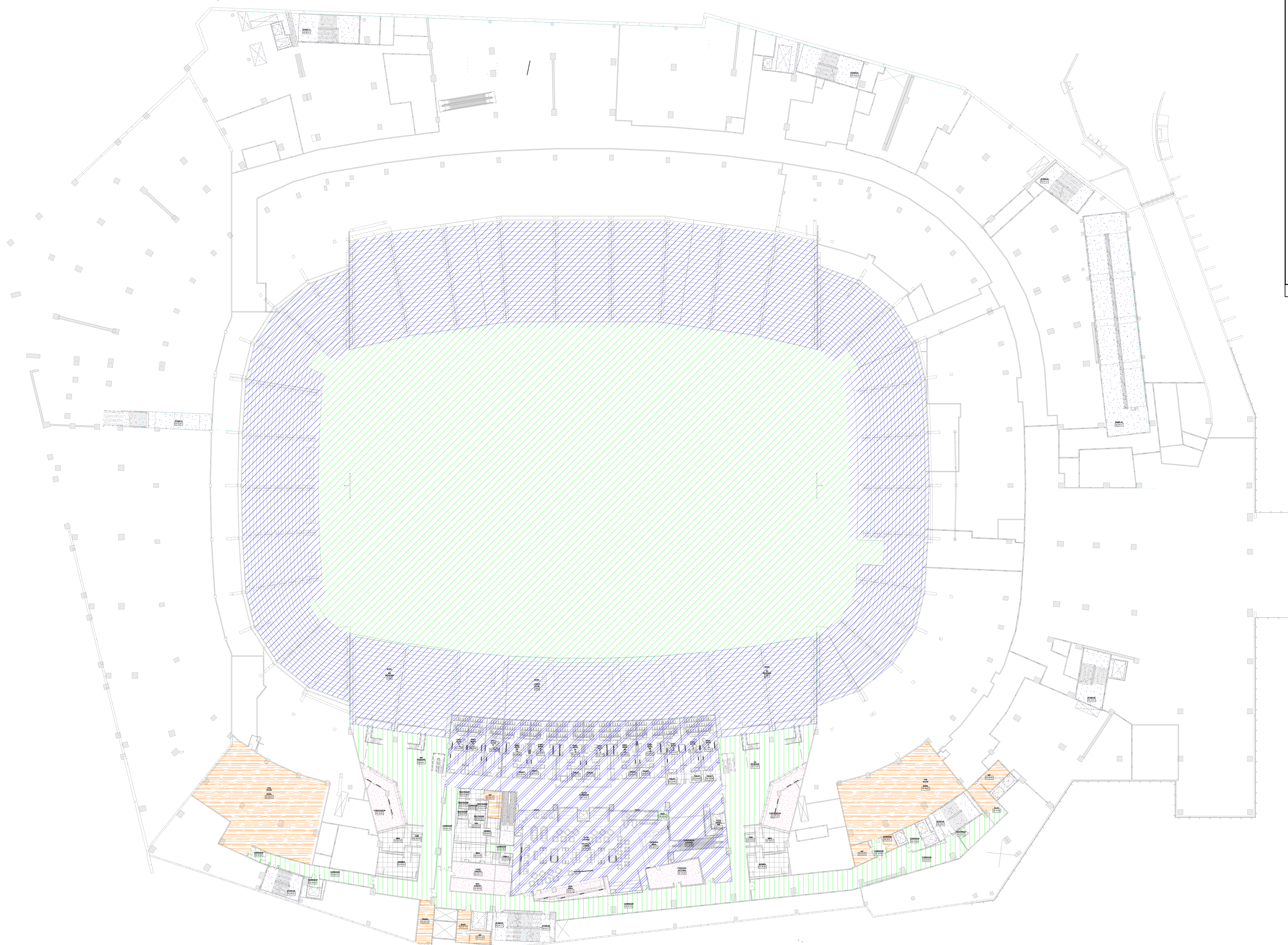


**GENERAL NOTES:**

1. REFER TO SYMBOL LEGEND FOR ADDITIONAL REQUIREMENTS, INCLUDING BUT NOT LIMITED TO, INSTALLATION OF COMMUNICATIONS AND SECURITY RACEWAY, CABLING, AND DEVICES.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
3501 N. ST. PAUL, SUITE 100, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- ASSOCIATE ARCHITECT - INTERIORS**  
STUDIO HIVE  
901 NORTH 5th ST., SUITE 228, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10255 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15508 WRIGHT BROTHERS DR., ADDISON, TX 75001
- WJHW**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9228 INDIAN CREEK, SUITE 300, OVERLAND PK., KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
5235 SOUTH VALENTIA, GREENWOOD VLG., CO 80111
- WAYFINDING**  
SELEST PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
22950 MISSION BELLVIEW, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
300 N. WABASH AVE., SUITE 1500, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LEITCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**KEYNOTES:**



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

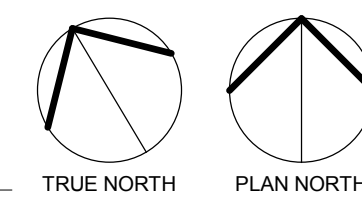
REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**MAY 2, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**EXECUTIVE SUITE LEVEL PLAN - DAS**

SHEET NO.  
**DAS2.02**

02 EXECUTIVE SUITE LEVEL PLAN - DAS COVERAGE  
1/32" = 1'-0"





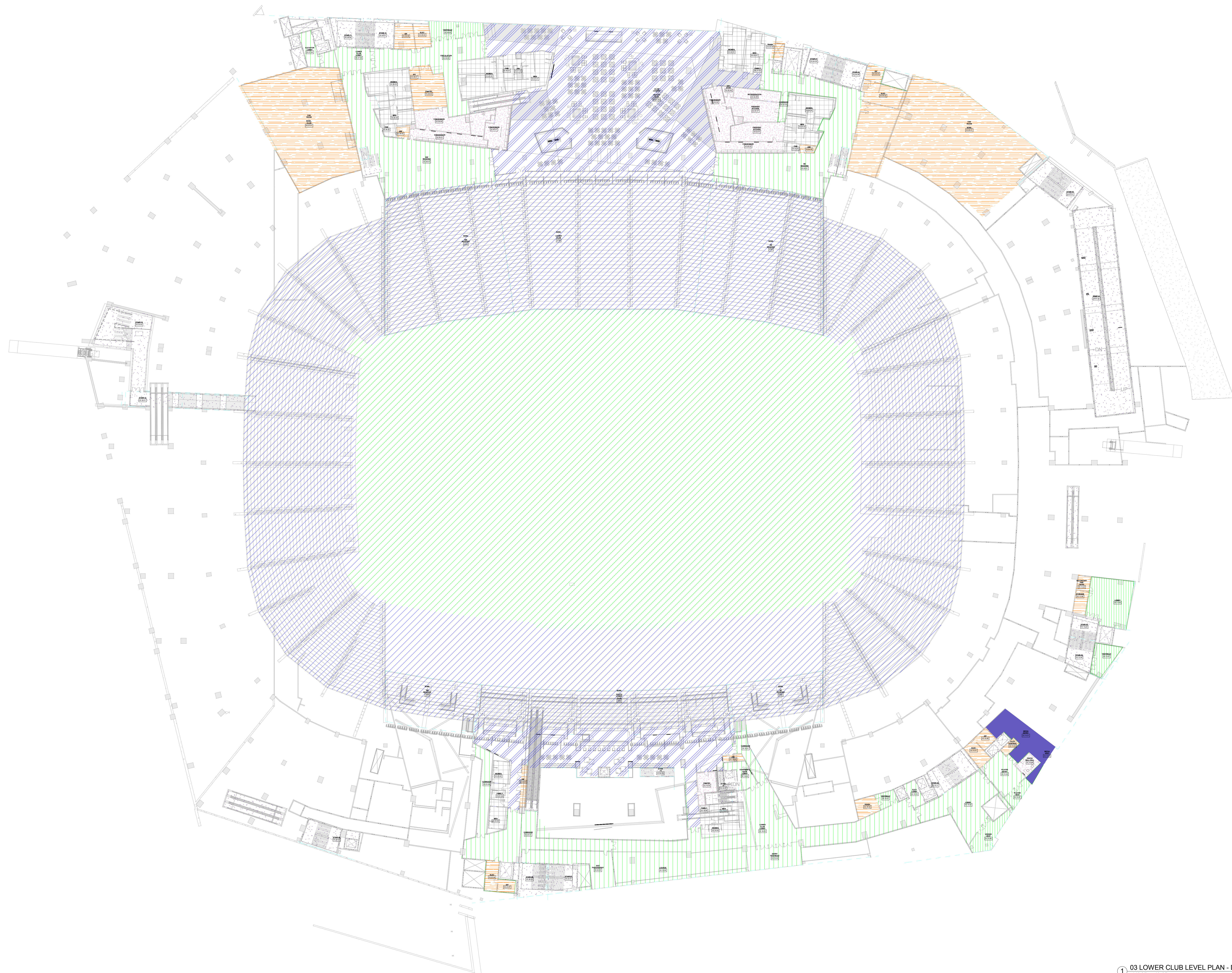
**GENERAL NOTES:**

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
350 N. ST. PAUL ST., SUITE 100, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- ASSOCIATE ARCHITECT - INTERIORS**  
STUDIO HIVE  
901 NORTH 5th ST., SUITE 228, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10255 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15508 WRIGHT BROTHERS DR., ADDISON, TX 75001
- WJHW**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
5235 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELEBY PERKINS DESIGN  
432 CULVER BLVD., PLATA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2595 MISSION BELLVIEW, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
300 N. WABASH AVE., SUITE 1500, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LEITCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**KEYNOTES:**



KEY PLAN

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9	16	13	2
8	15	14	3
7	6	5	4

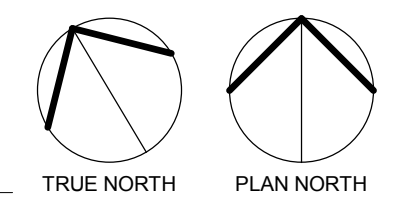
REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**MAY 2, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**LOWER CLUB LEVEL PLAN - DAS**

SHEET NO.  
**DAS2.03**

1 03 LOWER CLUB LEVEL PLAN - DAS COVERAGE  
1/32" = 1'-0"



**GENERAL NOTES:**

1. REFER TO SYMBOL LEGEND FOR ADDITIONAL REQUIREMENTS, INCLUDING BUT NOT LIMITED TO, INSTALLATION OF COMMUNICATIONS AND SECURITY RACEWAY, CABLING, AND DEVICES.

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
300 N. ST. PAUL ST., SUITE 100, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**ASSOCIATE ARCHITECT - INTERIORS**  
STUDIO HIVE  
401 NORTH 5th ST., SUITE 228, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10255 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15508 WRIGHT BROTHERS DR., ADDISON, TX 75001

**WJHW**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
5235 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAZA DEL REY, CA 90230

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCOCK AVE., SAINT PAUL, MN 55124

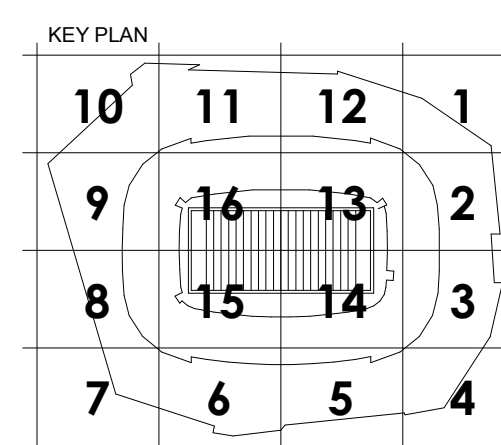
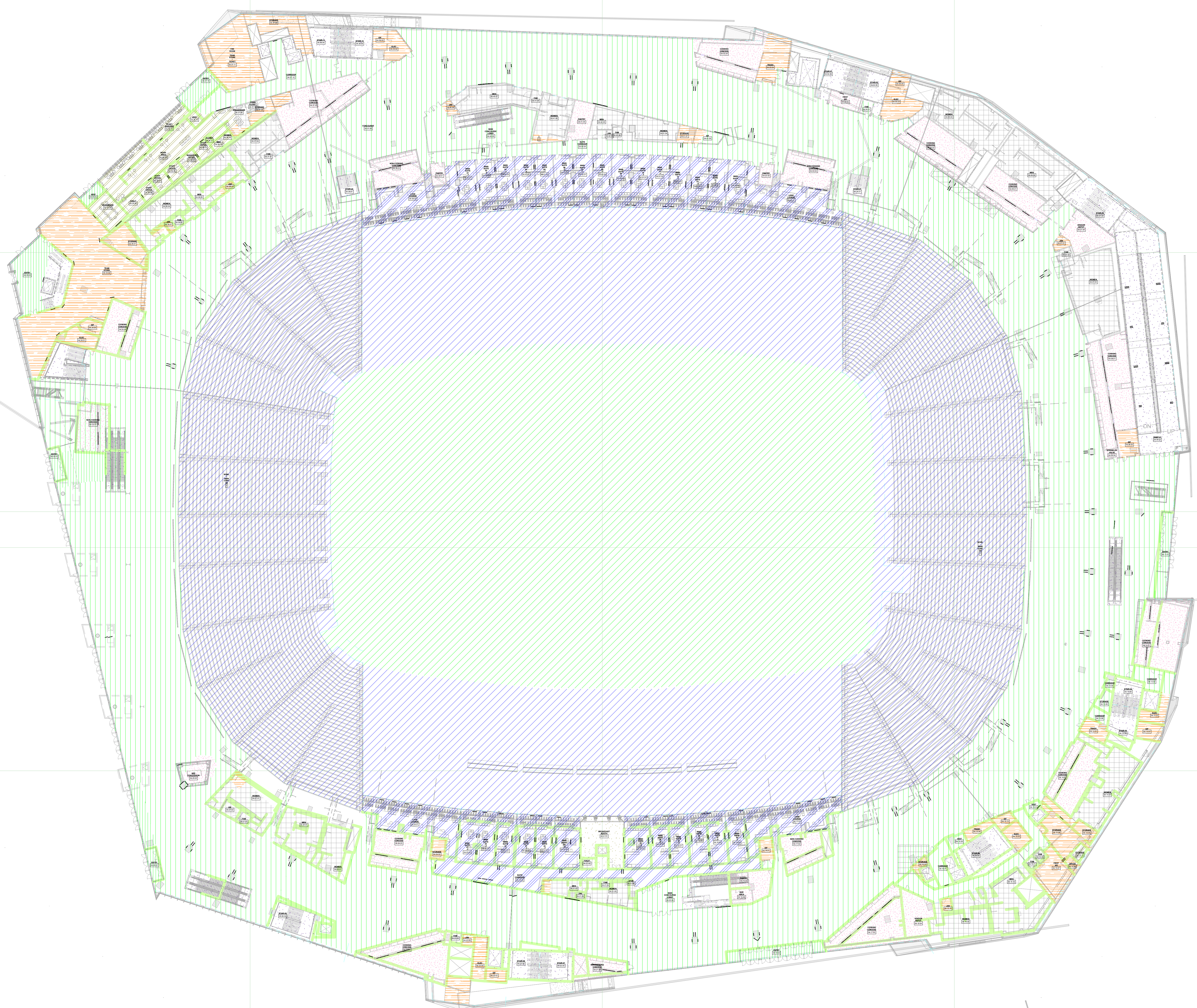
**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2290 MISSION BELLVIEW, LOUISBURG, KS 66663

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**FACADE ACCESS CONSULTANT**  
LEITCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**KEYNOTES:**



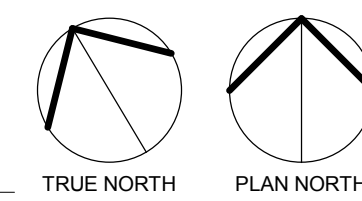
REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**MAY 2, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**MAIN CONCOURSE LEVEL PLAN - DAS**

SHEET NO.  
**DAS2.04**

04 MAIN CONCOURSE LEVEL PLAN - DAS COVERAGE  
1/32" = 1'-0"



**GENERAL NOTES:**

1. REFER TO SYMBOL LEGEND FOR ADDITIONAL REQUIREMENTS, INCLUDING BUT NOT LIMITED TO, INSTALLATION OF COMMUNICATIONS AND SECURITY RACEWAY, CABLING, AND DEVICES.

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
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**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**ASSOCIATE ARCHITECT - INTERIORS**  
STUDIO HIVE  
401 NORTH 5th ST., SUITE 228, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10255 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15508 WRIGHT BROTHERS DR., ADDISON, TX 75001

**WJHW**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
5235 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELECT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

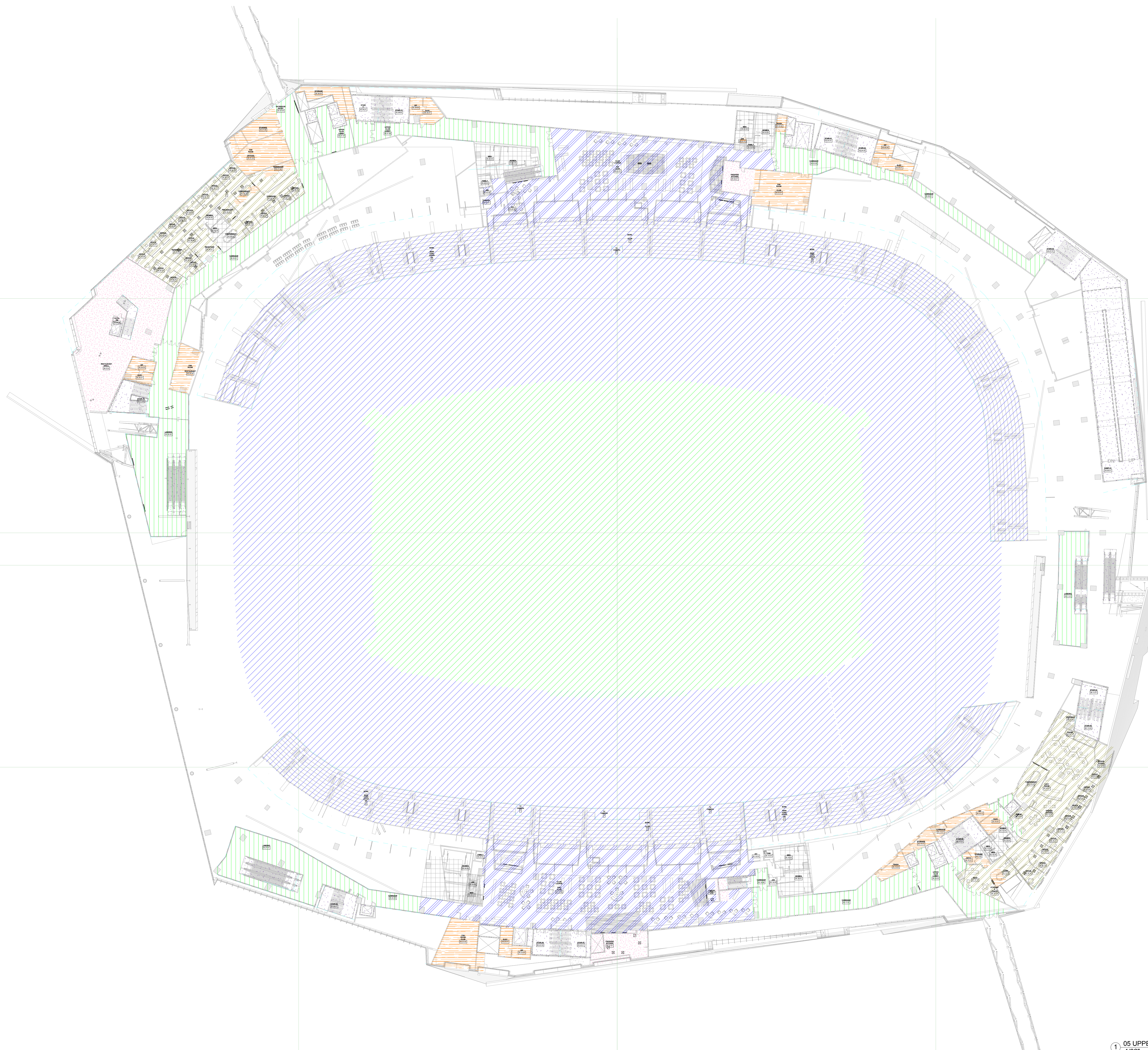
**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
22950 MISSION BELLVIEW, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
300 N. WABASH AVE., SUITE 1500, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LEITCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**KEYNOTES:**



KEY PLAN			
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9	16	13	2
8	15	14	3
7	6	5	4

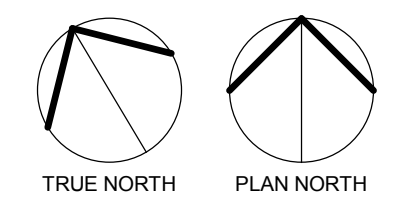
REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**MAY 2, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER CLUB LEVEL PLAN - DAS**

SHEET NO.  
**DAS2.05**

① 05 UPPER CLUB LEVEL PLAN - DAS COVERAGE  
1/32" = 1'-0"



**GENERAL NOTES:**

1. REFER TO SYMBOL LEGEND FOR ADDITIONAL REQUIREMENTS, INCLUDING BUT NOT LIMITED TO, INSTALLATION OF COMMUNICATIONS AND SECURITY RACEWAY, CABLING, AND DEVICES.

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
350 N. ST. PAUL ST., SUITE 100, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**ASSOCIATE ARCHITECT - INTERIORS**  
STUDIO HIVE  
901 NORTH 5th ST., SUITE 228, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10255 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
1508 WRIGHT BROTHERS DR., ADDISON, TX 75001

**WJHW**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
5235 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCOCK AVE., SAINT PAUL, MN 55124

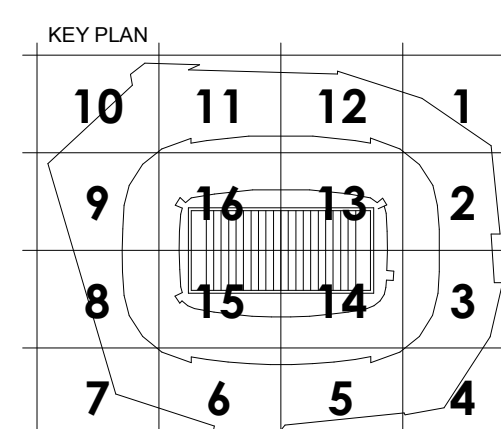
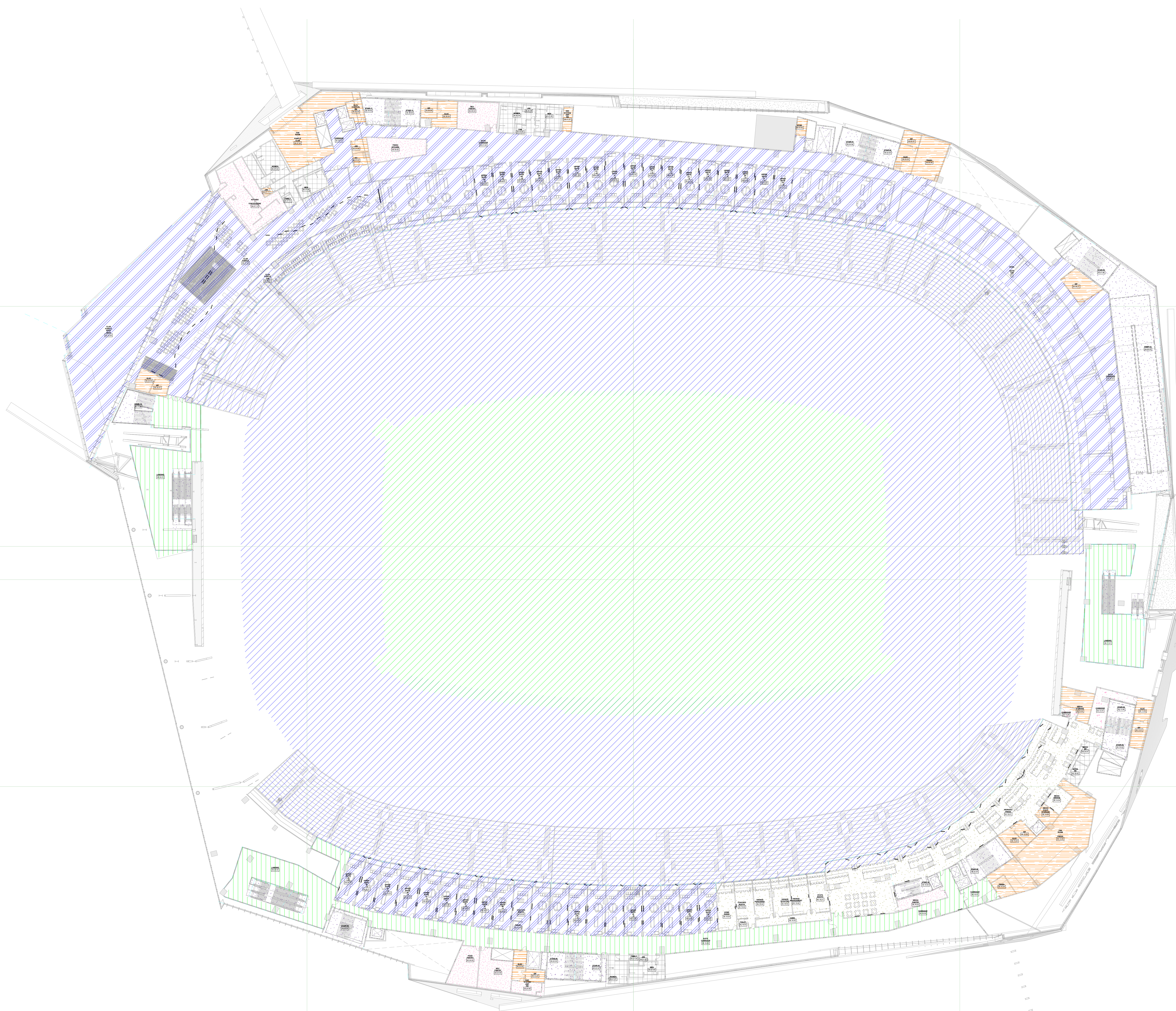
**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2590 MISSION BELLVIEW, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
300 N. WABASH AVE., SUITE 1500, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LEITCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**KEYNOTES:**



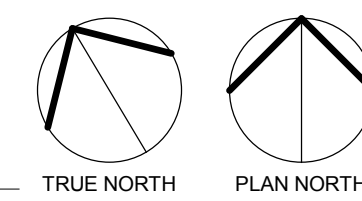
REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**MAY 2, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER SUITE LEVEL PLAN - DAS**

SHEET NO.  
**DAS2.06**

1 06 UPPER SUITE LEVEL PLAN - DAS COVERAGE  
1/32" = 1'-0"



**GENERAL NOTES:**

1. REFER TO SYMBOL LEGEND FOR ADDITIONAL REQUIREMENTS, INCLUDING BUT NOT LIMITED TO, INSTALLATION OF COMMUNICATIONS AND SECURITY RACEWAY, CABLING, AND DEVICES.

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
300 N. ST. PAUL, ST., SUITE 100, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**ASSOCIATE ARCHITECT - INTERIORS**  
STUDIO HIVE  
901 NORTH 5th ST., SUITE 228, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10255 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15508 WRIGHT BROTHERS DR., ADDISON, TX 75001

**WJHW**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
5235 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

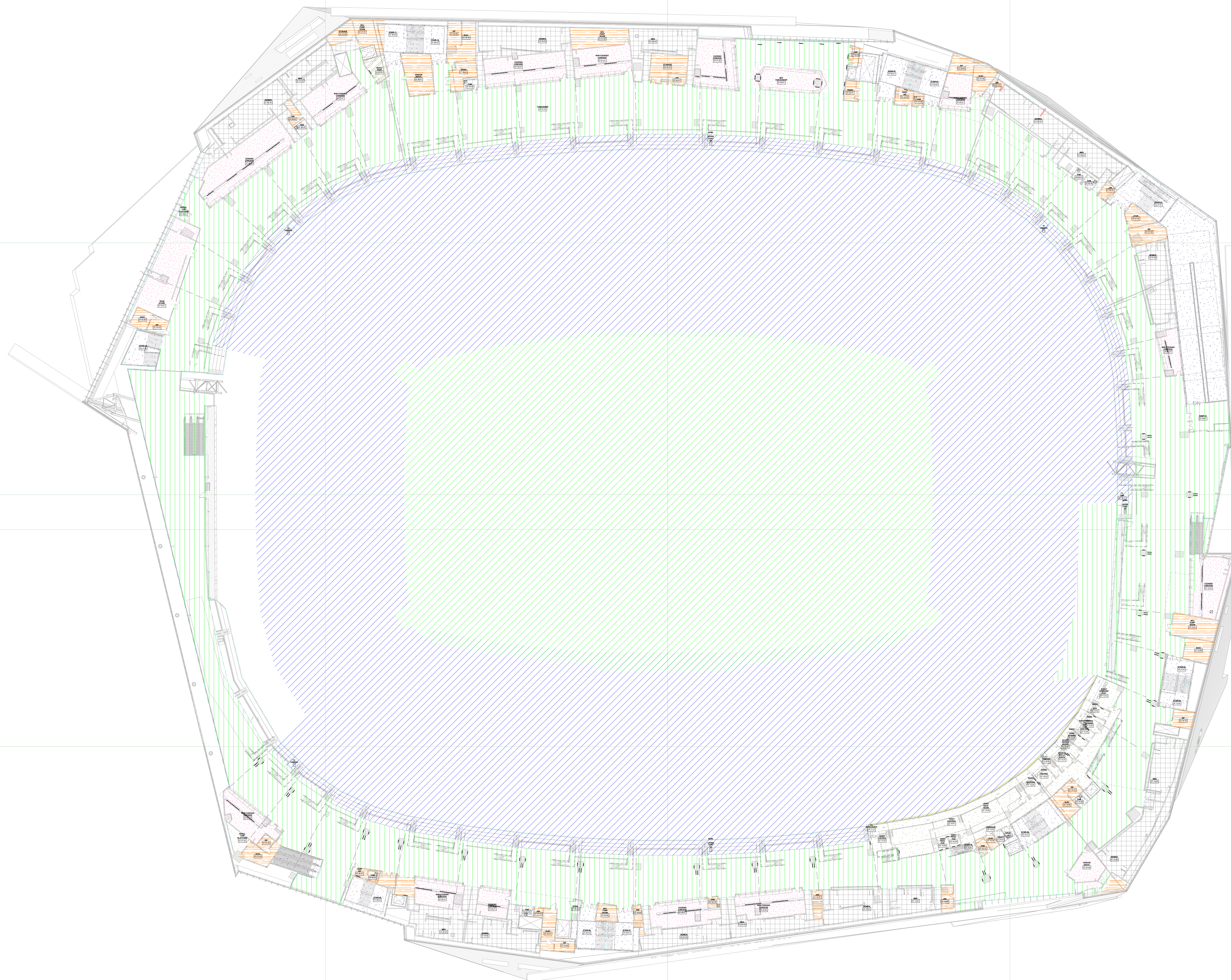
**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
22950 MISSION BELLVIEW, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8

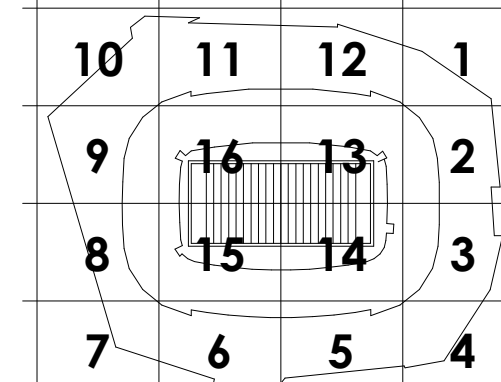
**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
300 N. WABASH AVE., SUITE 1500, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LEITCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**KEYNOTES:**



**KEY PLAN**



**REVISION**

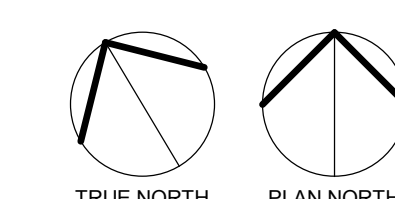
NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**MAY 2, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER CONCOURSE LEVEL PLAN - DAS**

SHEET NO.  
**DAS2.07**

① 07 UPPER CONCOURSE LEVEL PLAN - DAS COVERAGE  
1/32" = 1'-0"

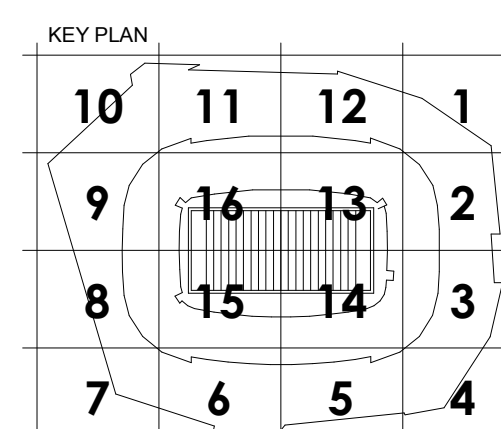
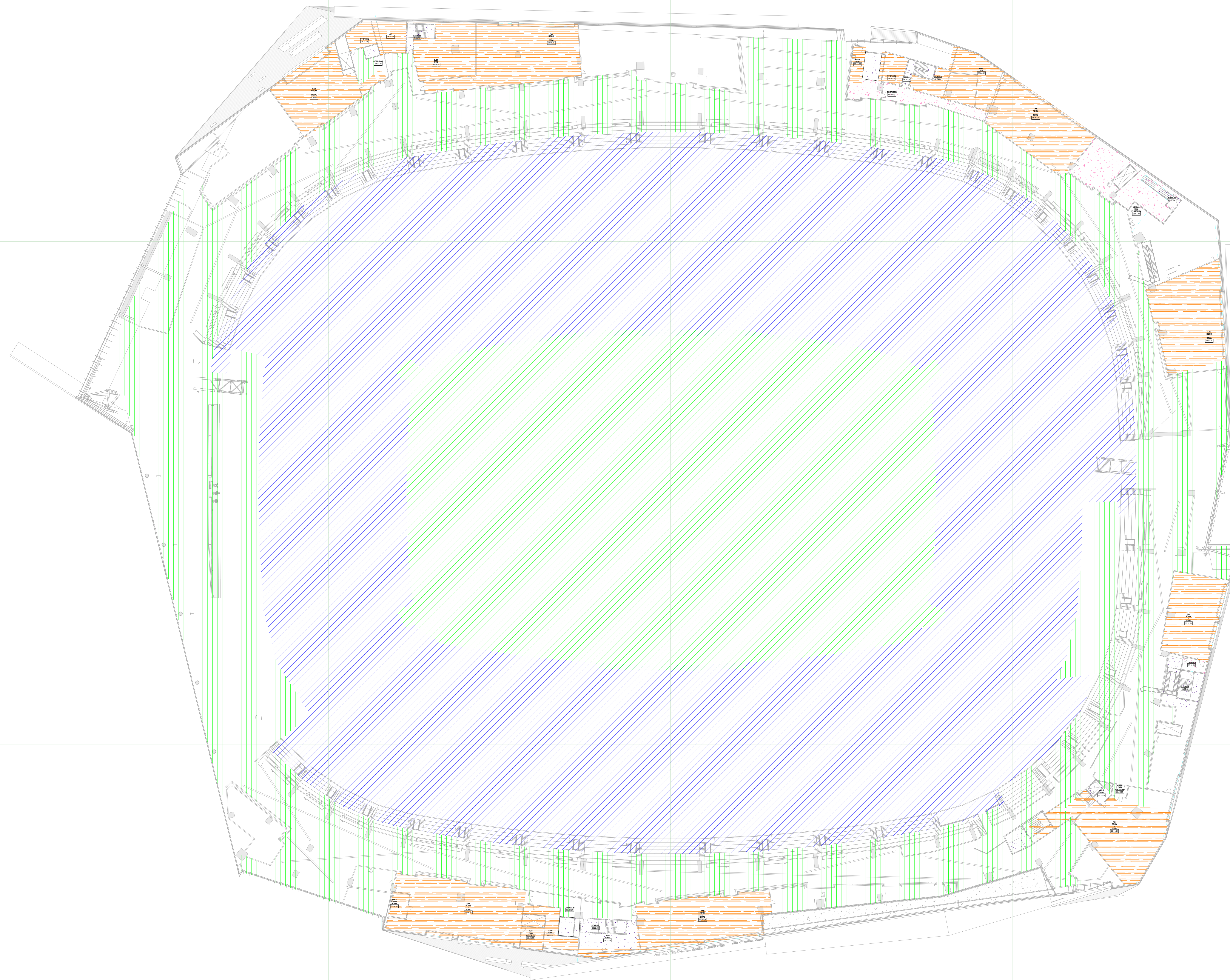


**GENERAL NOTES:**

1. REFER TO SYMBOL LEGEND FOR ADDITIONAL REQUIREMENTS, INCLUDING BUT NOT LIMITED TO, INSTALLATION OF COMMUNICATIONS AND SECURITY RACEWAY, CABLING, AND DEVICES.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
350 N. ST. PAUL, ST., SUITE 100, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401
- ASSOCIATE ARCHITECT - INTERIORS**  
STUDIO HIVE  
901 NORTH 5th ST., SUITE 228, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10255 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15508 WRIGHT BROTHERS DR., ADDISON, TX 75001
- WJHW**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
5235 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLATA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
25950 MISSION BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
300 N. WABASH AVE., SUITE 1500, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LEITCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**KEYNOTES:**



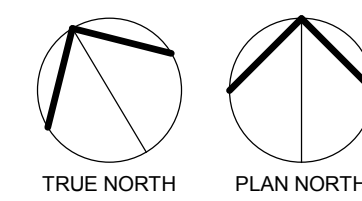
REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**MAY 2, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**MECHANICAL MEZZANINE PLAN - DAS**  
SHEET NO.

**DAS2.08**

1 08 MECHANICAL MEZZANINE PLAN - DAS COVERAGE  
1/32" = 1'-0"



**GENERAL NOTES:**

1. REFER TO SYMBOL LEGEND FOR ADDITIONAL REQUIREMENTS, INCLUDING BUT NOT LIMITED TO, INSTALLATION OF COMMUNICATIONS AND SECURITY RACEWAY, CABLING, AND DEVICES.

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
350 N. ST. PAUL, ST., SUITE 100, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**ASSOCIATE ARCHITECT - INTERIORS**  
STUDIO HVF  
901 NORTH 5th ST., SUITE 228, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10255 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
1508 WRIGHT BROTHERS DR., ADDISON, TX 75001

**WJHW**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
5235 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCOCK AVE., SAINT PAUL, MN 55124

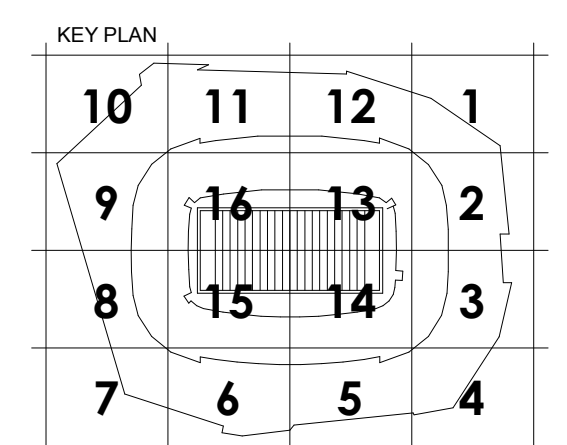
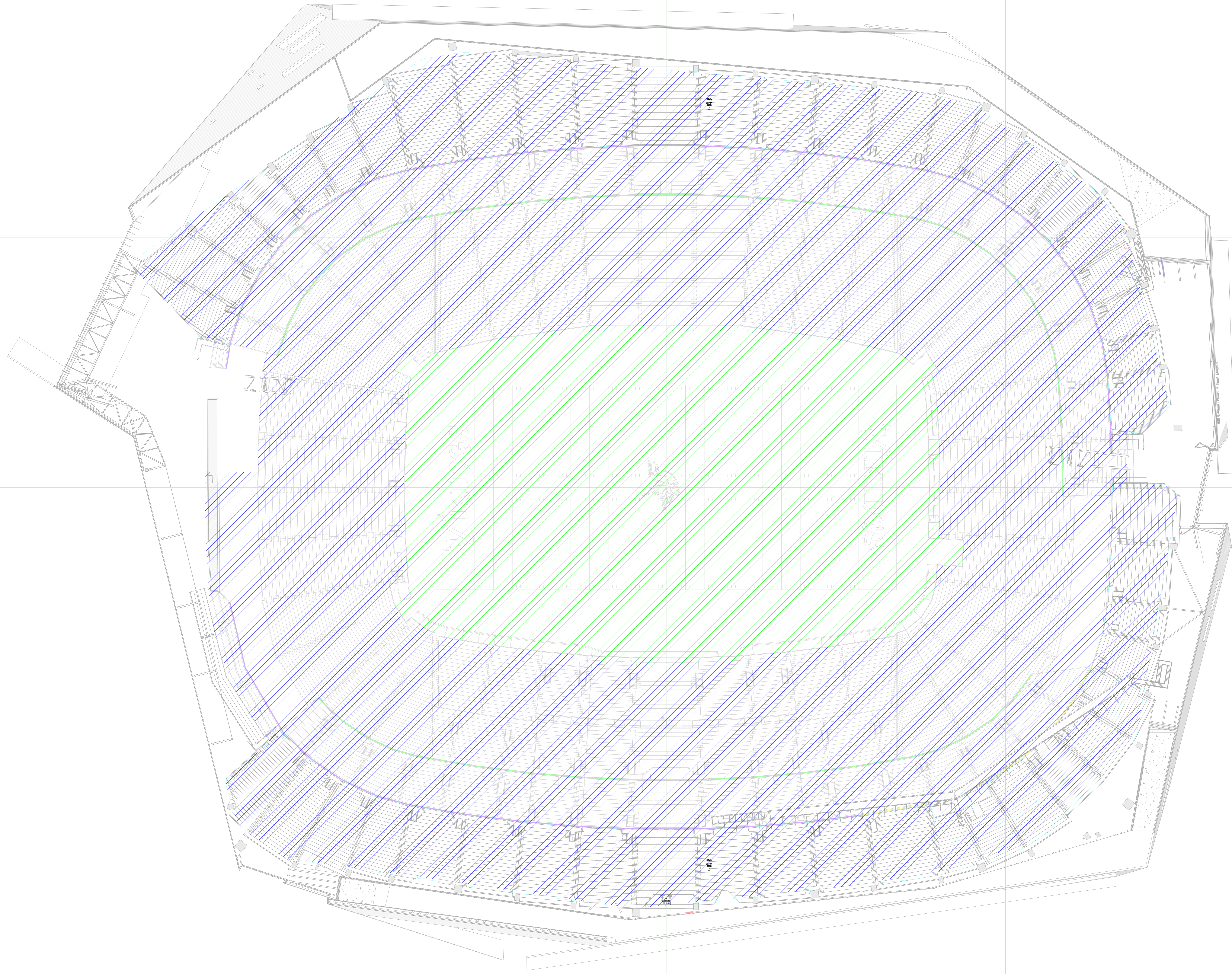
**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2590 MISSION BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
300 N. WABASH AVE., SUITE 1500, CHICAGO, IL 60611

**FACADE ACCESS CONSULTANT**  
LEITCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**KEYNOTES:**



REVISION NO.	DESCRIPTION	DATE

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**16246.000**

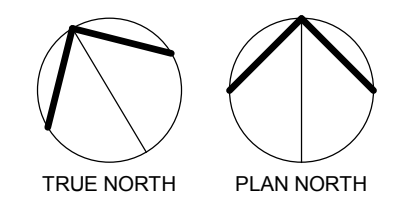
DATE  
**MAY 2, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER SEATING BOWL  
PLAN - DAS**

SHEET NO.  
**DAS2.09**

09 UPPER SEATING BOWL PLAN - DAS COVERAGE  
1/32" = 1'-0"



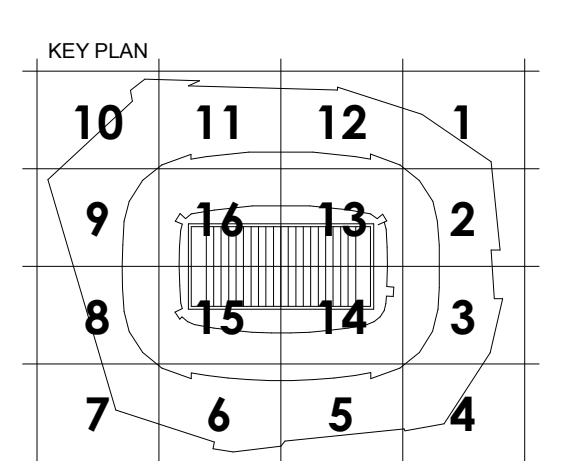
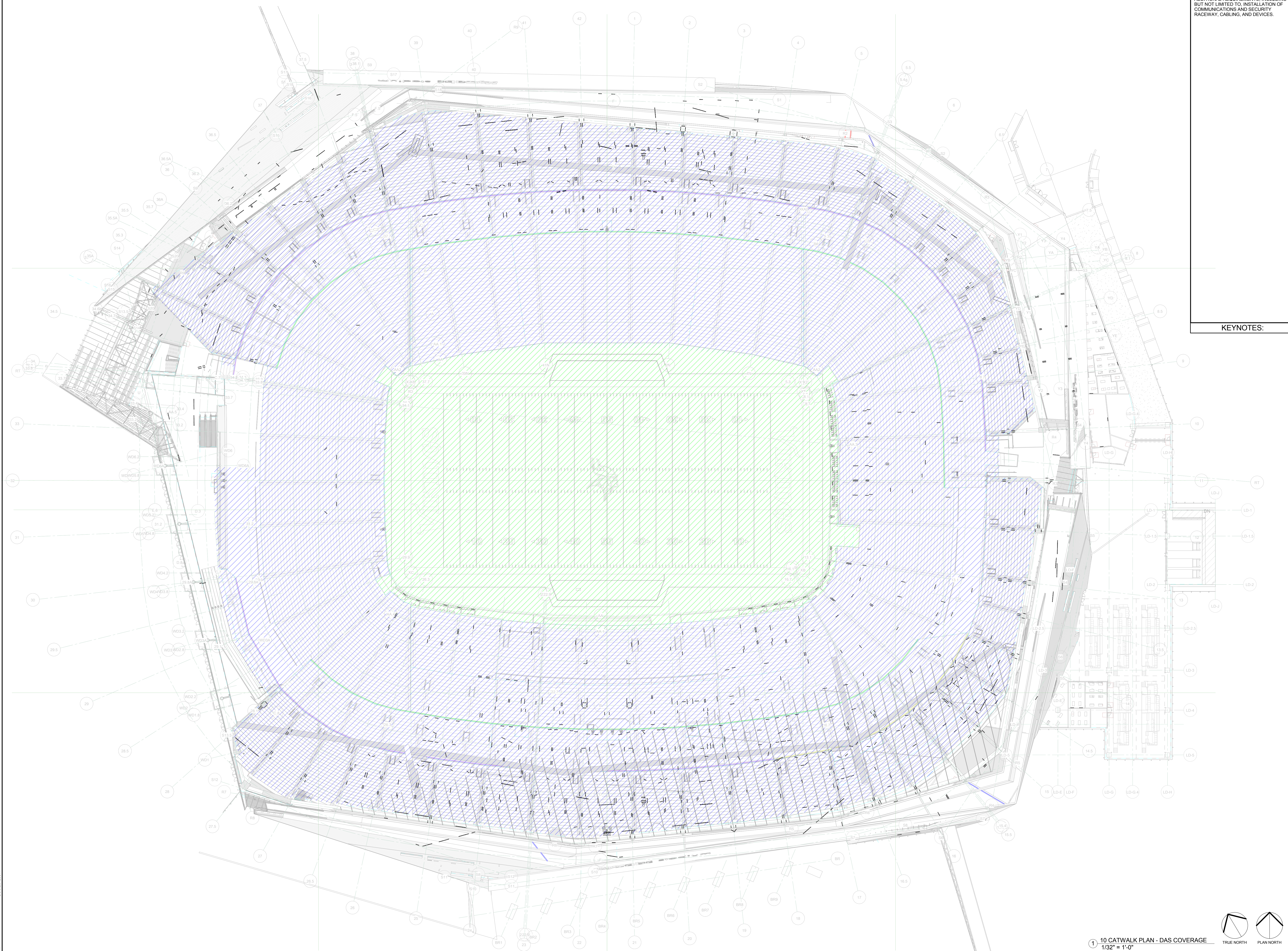
**GENERAL NOTES:**

1. REFER TO SYMBOL LEGEND FOR ADDITIONAL REQUIREMENTS, INCLUDING BUT NOT LIMITED TO, INSTALLATION OF COMMUNICATIONS AND SECURITY RACEWAY, CABLING, AND DEVICES.



- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
300 N. ST. PAUL ST., SUITE 100, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- ASSOCIATE ARCHITECT - INTERIORS**  
STUDIO HIVE  
901 NORTH 5th ST., SUITE 228, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10255 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
1508 WRIGHT BROTHERS DR., ADDISON, TX 75001
- WJHW**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
5235 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELECT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2595 MISSION BELLVIEW, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN WILLIAMS DAVIES AND IRWIN, INC.  
600 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
300 N. WABASH AVE., SUITE 1500, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
SERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**KEYNOTES:**



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

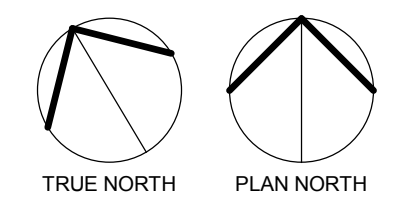
DATE  
**MAY 2, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**CATWALK PLAN - DAS**

SHEET NO.  
**DAS2.10**

1 10 CATWALK PLAN - DAS COVERAGE  
1/32" = 1'-0"





## **7.0 WI-FI DRAWINGS**



NOTE: ALL OF WIFI IS PART OF ALTERNATE 26.  
REFER TO ARCHITECTURE PLANS FOR MORE INFORMATION,

WIFI SHEET LIST	
Sheet Number	Sheet Name
TW-0.10	WIFI SYSTEM LOGIC DIAGRAM
TW-0.20	WIFI DETAILS
TW-0.21	WIFI DETAILS
TW-0.22	WIFI DETAILS
TW-1.00	00 SITE PLAN - WIFI
TW-2.0101	EVENT LEVEL WIFI - SECTOR 01
TW-2.0102	EVENT LEVEL WIFI - SECTOR 02
TW-2.0103	EVENT LEVEL WIFI - SECTOR 03
TW-2.0104	EVENT LEVEL WIFI - SECTOR 04
TW-2.0105	EVENT LEVEL WIFI - SECTOR 05
TW-2.0106	EVENT LEVEL WIFI - SECTOR 06
TW-2.0108	EVENT LEVEL WIFI - SECTOR 08
TW-2.0109	EVENT LEVEL WIFI - SECTOR 09
TW-2.0111	EVENT LEVEL WIFI - SECTOR 11
TW-2.0112	EVENT LEVEL WIFI - SECTOR 12
TW-2.0113	EVENT LEVEL WIFI - SECTOR 13
TW-2.0114	EVENT LEVEL WIFI - SECTOR 14
TW-2.0115	EVENT LEVEL WIFI - SECTOR 15
TW-2.0116	EVENT LEVEL WIFI - SECTOR 16
TW-2.0202	EXECUTIVE SUITES WIFI - SECTOR 02
TW-2.0203	EXECUTIVE SUITES WIFI - SECTOR 03
TW-2.0204	EXECUTIVE SUITES WIFI - SECTOR 04
TW-2.0205	EXECUTIVE SUITES WIFI - SECTOR 05
TW-2.0206	EXECUTIVE SUITES WIFI - SECTOR 06
TW-2.0208	EXECUTIVE SUITES WIFI - SECTOR 08
TW-2.0209	EXECUTIVE SUITES WIFI - SECTOR 09
TW-2.0213	EXECUTIVE SUITES WIFI - SECTOR 13
TW-2.0214	EXECUTIVE SUITES WIFI - SECTOR 14
TW-2.0215	EXECUTIVE SUITES WIFI - SECTOR 15
TW-2.0216	EXECUTIVE SUITES WIFI - SECTOR 16
TW-2.0302	LOWER CLUB WIFI - SECTOR 02
TW-2.0303	LOWER CLUB WIFI - SECTOR 03
TW-2.0304	LOWER CLUB WIFI - SECTOR 04
TW-2.0305	LOWER CLUB WIFI - SECTOR 05
TW-2.0306	LOWER CLUB WIFI - SECTOR 06
TW-2.0308	LOWER CLUB WIFI - SECTOR 08
TW-2.0309	LOWER CLUB WIFI - SECTOR 09
TW-2.0311	LOWER CLUB WIFI - SECTOR 11
TW-2.0312	LOWER CLUB WIFI - SECTOR 12
TW-2.0401	MAIN CONCOURSE WIFI - SECTOR 01
TW-2.0402	MAIN CONCOURSE WIFI - SECTOR 02
TW-2.0403	MAIN CONCOURSE WIFI - SECTOR 03
TW-2.0404	MAIN CONCOURSE WIFI - SECTOR 04
TW-2.0405	MAIN CONCOURSE WIFI - SECTOR 05
TW-2.0406	MAIN CONCOURSE WIFI - SECTOR 06
TW-2.0407	MAIN CONCOURSE WIFI - SECTOR 07
TW-2.0408	MAIN CONCOURSE WIFI - SECTOR 08
TW-2.0409	MAIN CONCOURSE WIFI - SECTOR 09
TW-2.0410	MAIN CONCOURSE WIFI - SECTOR 10
TW-2.0411	MAIN CONCOURSE WIFI - SECTOR 11
TW-2.0412	MAIN CONCOURSE WIFI - SECTOR 12
TW-2.0502	UPPER CLUB WIFI - SECTOR 02
TW-2.0503	UPPER CLUB WIFI - SECTOR 03

WIFI SHEET LIST	
Sheet Number	Sheet Name
TW-2.0504	UPPER CLUB WIFI - SECTOR 04
TW-2.0505	UPPER CLUB WIFI - SECTOR 05
TW-2.0506	UPPER CLUB WIFI - SECTOR 06
TW-2.0508	UPPER CLUB WIFI - SECTOR 08
TW-2.0509	UPPER CLUB WIFI - SECTOR 09
TW-2.0510	UPPER CLUB WIFI - SECTOR 10
TW-2.0511	UPPER CLUB WIFI - SECTOR 11
TW-2.0512	UPPER CLUB WIFI - SECTOR 12
TW-2.0601	UPPER SUITE WIFI - SECTOR 01
TW-2.0602	UPPER SUITE WIFI - SECTOR 02
TW-2.0603	UPPER SUITE WIFI - SECTOR 03
TW-2.0604	UPPER SUITE WIFI - SECTOR 04
TW-2.0605	UPPER SUITE WIFI - SECTOR 05
TW-2.0606	UPPER SUITE WIFI - SECTOR 06
TW-2.0607	UPPER SUITE WIFI - SECTOR 07
TW-2.0609	UPPER SUITE WIFI - SECTOR 09
TW-2.0610	UPPER SUITE WIFI - SECTOR 10
TW-2.0611	UPPER SUITE WIFI - SECTOR 11
TW-2.0612	UPPER SUITE WIFI - SECTOR 12
TW-2.0701	UPPER CONCOURSE WIFI - SECTOR 01
TW-2.0702	UPPER CONCOURSE WIFI - SECTOR 02
TW-2.0703	UPPER CONCOURSE WIFI - SECTOR 03
TW-2.0704	UPPER CONCOURSE WIFI - SECTOR 04
TW-2.0705	UPPER CONCOURSE WIFI - SECTOR 05
TW-2.0706	UPPER CONCOURSE WIFI - SECTOR 06
TW-2.0707	UPPER CONCOURSE WIFI - SECTOR 07
TW-2.0708	UPPER CONCOURSE WIFI - SECTOR 08
TW-2.0709	UPPER CONCOURSE WIFI - SECTOR 09
TW-2.0710	UPPER CONCOURSE WIFI - SECTOR 10
TW-2.0711	UPPER CONCOURSE WIFI - SECTOR 11
TW-2.0712	UPPER CONCOURSE WIFI - SECTOR 12
TW-2.0801	MECHANICAL MEZZANINE WIFI - SECTOR 01
TW-2.0802	MECHANICAL MEZZANINE WIFI - SECTOR 02
TW-2.0803	MECHANICAL MEZZANINE WIFI - SECTOR 03
TW-2.0804	MECHANICAL MEZZANINE WIFI - SECTOR 04
TW-2.0805	MECHANICAL MEZZANINE WIFI - SECTOR 05
TW-2.0806	MECHANICAL MEZZANINE WIFI - SECTOR 06
TW-2.0807	MECHANICAL MEZZANINE WIFI - SECTOR 07
TW-2.0809	MECHANICAL MEZZANINE WIFI - SECTOR 09
TW-2.0810	MECHANICAL MEZZANINE WIFI - SECTOR 10
TW-2.0811	MECHANICAL MEZZANINE WIFI - SECTOR 11
TW-2.0812	MECHANICAL MEZZANINE WIFI - SECTOR 12
TW-2.0901	UPPER BOWL WIFI - SECTOR 01
TW-2.0902	UPPER BOWL WIFI - SECTOR 02
TW-2.0903	UPPER BOWL WIFI - SECTOR 03
TW-2.0904	UPPER BOWL WIFI - SECTOR 04
TW-2.0905	UPPER BOWL WIFI - SECTOR 05
TW-2.0906	UPPER BOWL WIFI - SECTOR 06
TW-2.0907	UPPER BOWL WIFI - SECTOR 07
TW-2.0909	UPPER BOWL WIFI - SECTOR 09
TW-2.0910	UPPER BOWL WIFI - SECTOR 10
TW-2.0911	UPPER BOWL WIFI - SECTOR 11
TW-2.0912	UPPER BOWL WIFI - SECTOR 12

Grand total: 106

	Wi-Fi Access Point Mounting Type			
Level	Ceiling Mount	Wall Mount	Railing Mount	Pole Mount
Site	0	2	0	35
1	107	24	0	0
2	41	2	166	0
3	33	0	122	0
4	71	84	30	0
5	52	59	37	0
6	127	0	43	0
7	13	146	0	0
8	0	0	49	0
9	0	0	107	0

Note: Refer to Wi-Fi Drawing Set for Access Point locations and mounting details.

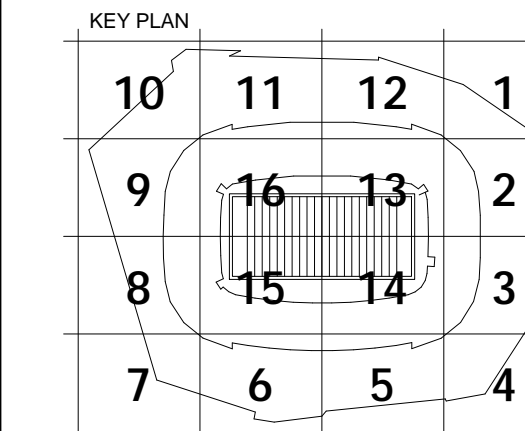
1 WIFI ACCESS POINT EQUIPMENT SCHEDULE  
3/4" = 1'-0"

WIFI SYMBOL LEGEND

◁ WAP	- WIRELESS ACCESS POINT (WALL MOUNTED) SEE DETAILS ON SHEET TW 0.20 AND TW 0.21
◁ WAP - HR	- WIRELESS ACCESS POINT (HAND RAIL MOUNTED) SEE HAND RAIL DETAILS ON SHEET TW 0.22.
◁ WAP - RS	- WIRELESS ACCESS POINT (RETRACTABLE SEATING AREA ) CONTRACTOR MUST MUST PROVIDE HANDRAIL MOUNTING SOLUTION FOR RETRACTABLE SEATING. SEE SIMILAR HAND RAIL DETAILS ON SHEET TW 0.22.
◁ WAP - EP	- WIRELESS ACCESS POINT (ELECTRICAL POLE MOUNTED)
◁ WAP - SB	- WIRELESS ACCESS POINT (SEATING BOWL MOUNTED) MOUNTED TO UNDERSIDE OF SEATING BOWL. SEE OVERHANG DETAIL 5/TW 0.21
◁ WAP	- WIRELESS ACCESS POINT (CEILING MOUNTED) SEE DETAILS ON SHEET TW 0.20 AND TW 0.21

SEE DETAIL SHEETS TW 0.20, TW 0.21, AND TW 0.22 FOR MORE INFORMATION.

- WIFI GENERAL NOTES:
- All Wireless Access Points shall be powered via Power-Over-Ethernet (POE) from the nearest communications room unless otherwise noted.
  - Coordinate all connectivity, conduit, cabling, and terminations with telecommunications contractor.
  - Coordinate the final exact mounting location and method for each device with owners representative prior to installation. Refer to structured cabling, wifi details, and written specifications for additional requirements.



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
WIFI LEGEND/  
ABBREVIATIONS/  
SCHEDULE

SHEET NO.

TW-0.00

4/29/2014 1:28:59 PM TEMPLATE VERSION: 210.250/2014

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43RD AVE., WHEAT RIDGE, CO 80033

TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295

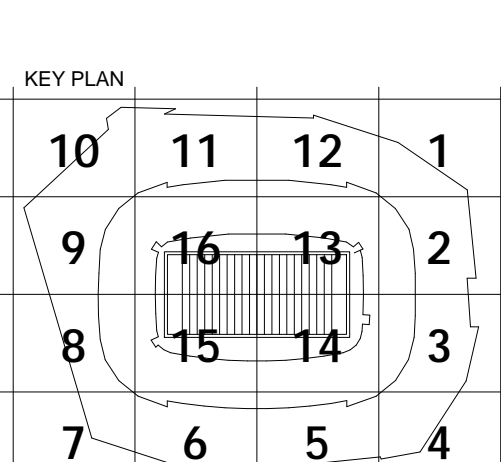
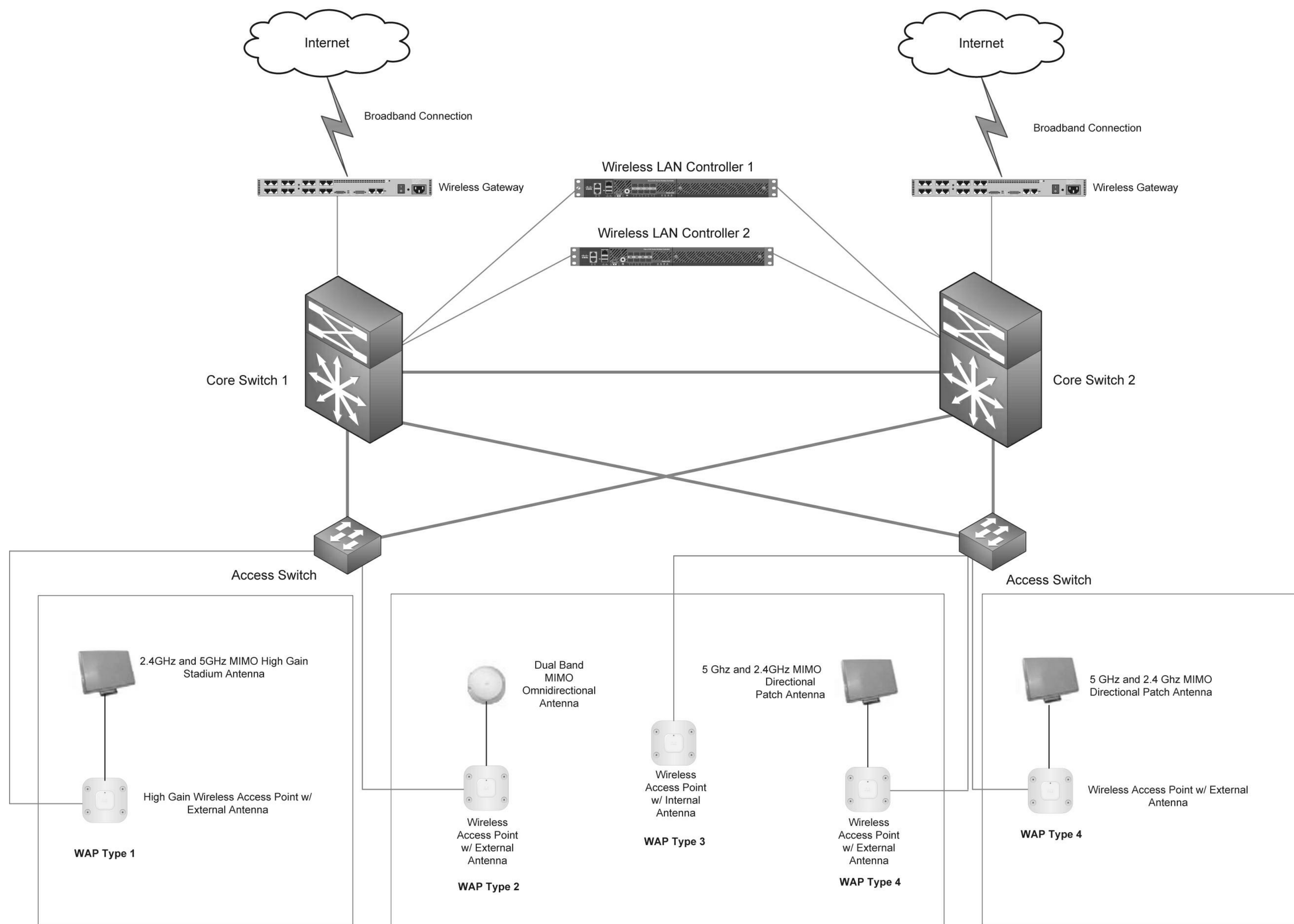
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B9

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



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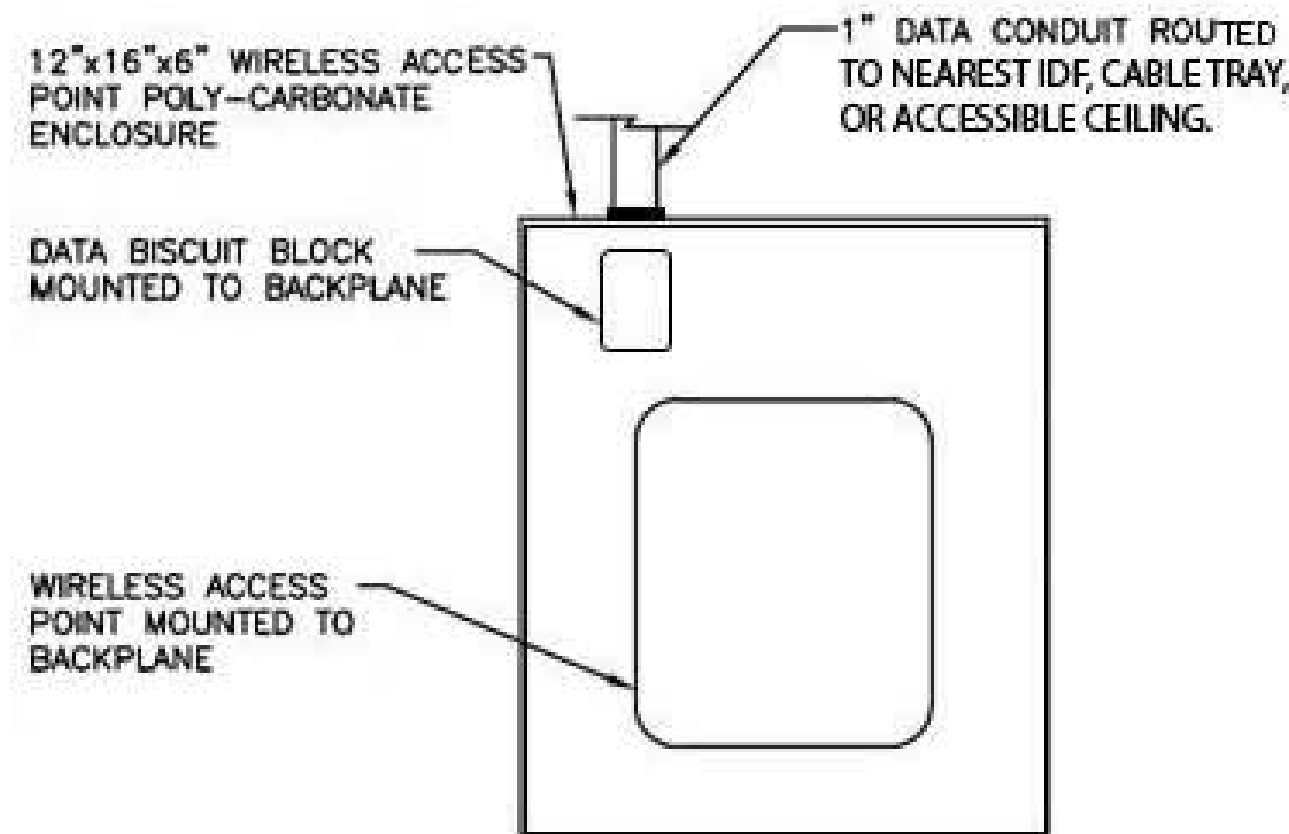
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May 02, 2014

ISSUE  
CCD-060

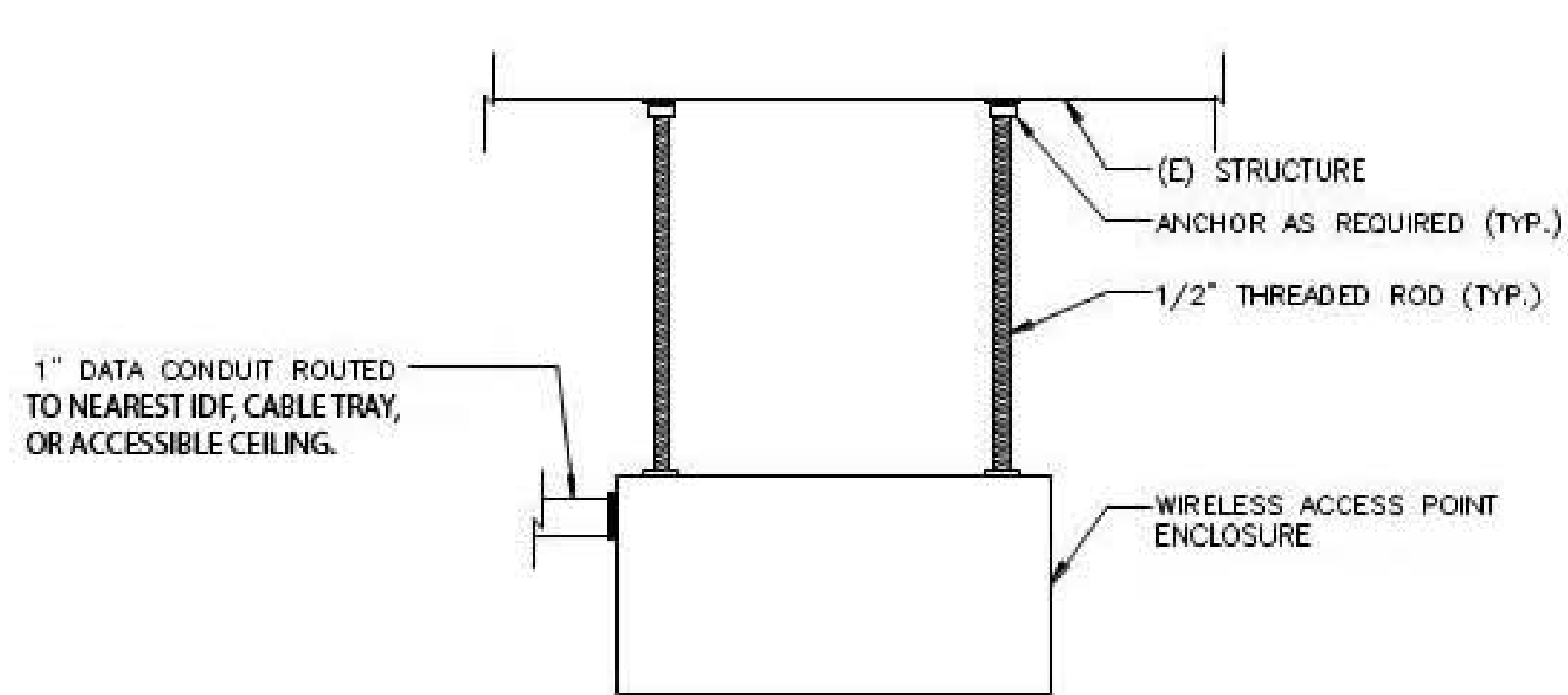
SHEET TITLE  
WIFI SYSTEM LOGIC DIAGRAM

SHEET NO.  
TW-0.10

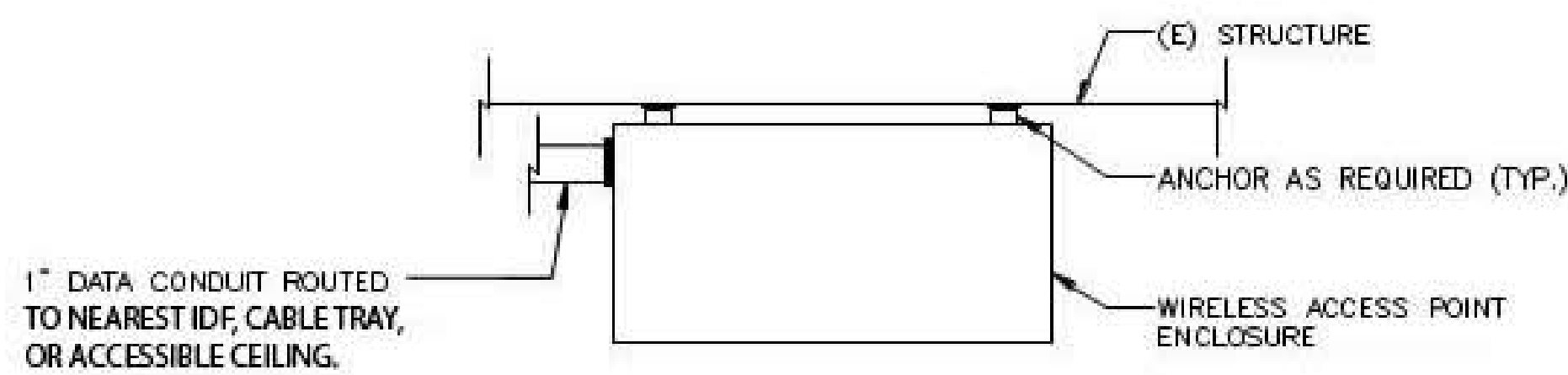
- ① WIFI SYSTEM LOGIC DIAGRAM  
NOT TO SCALE
- GENERAL NOTES FOR WIFI SYSTEM LOGIC DIAGRAM:**
- All network switches and connectivity shall be provided by telecommunications and network contractors. Coordinate with associated contractors and owners representative for all connectivity requirements.
  - Configuration of network switches and routing of wireless network traffic to the wireless LAN controllers shall be performed by network contractor.
  - All identified wireless access point and antenna types are for reference only. Contractor shall determine exact access point and antenna types required to meet the specifications.



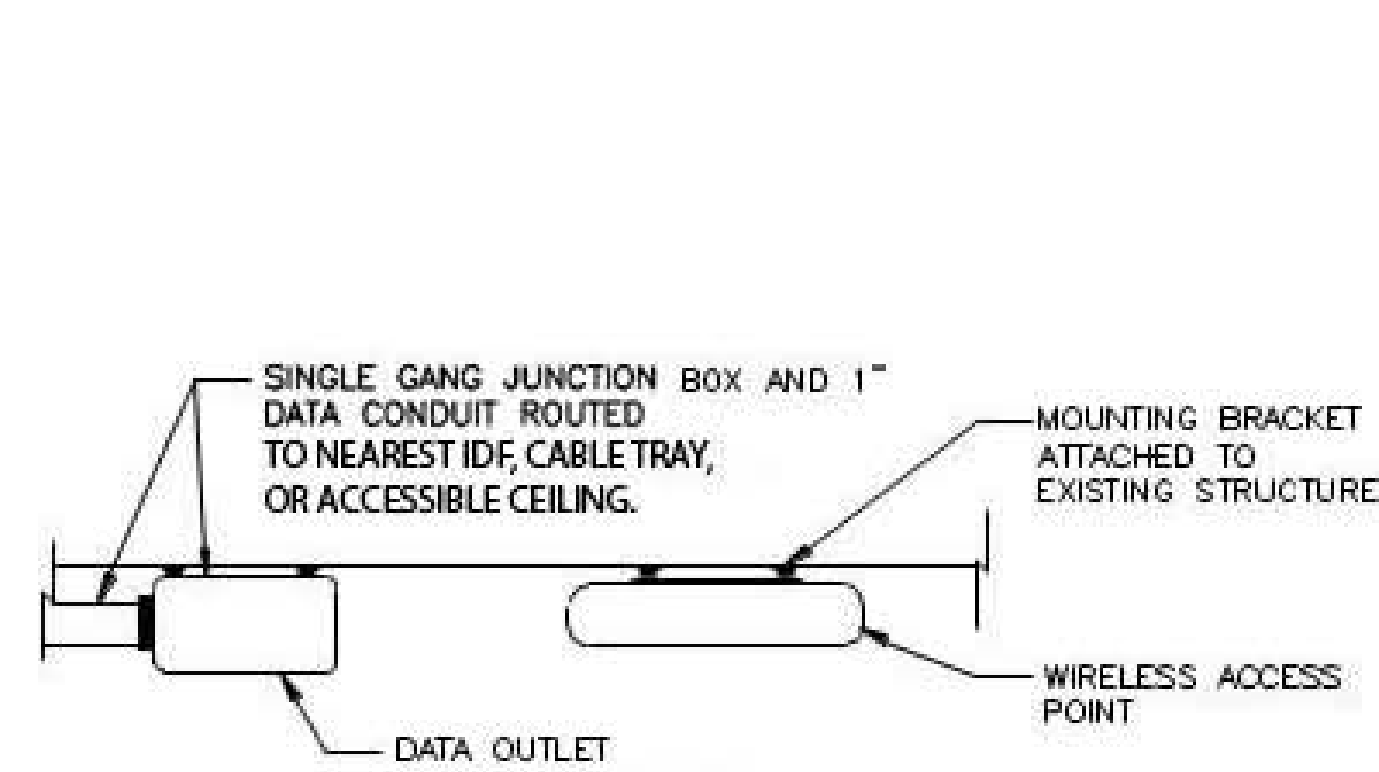
**1 ACCESS POINT ENCLOSURE DETAIL (COPPER)**  
NOT TO SCALE



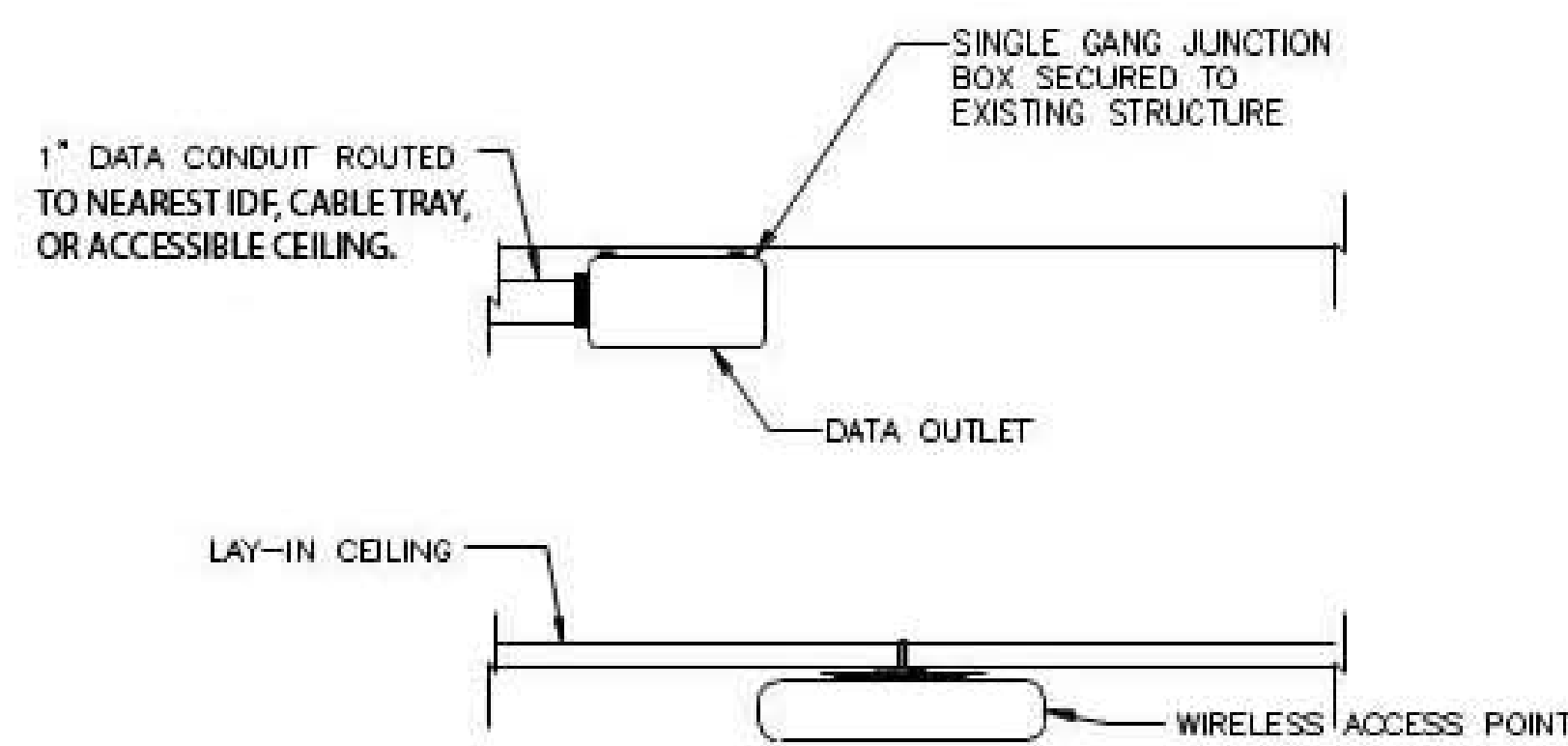
**2 ENCLOSURE SUSPENDED MOUNT DETAIL**  
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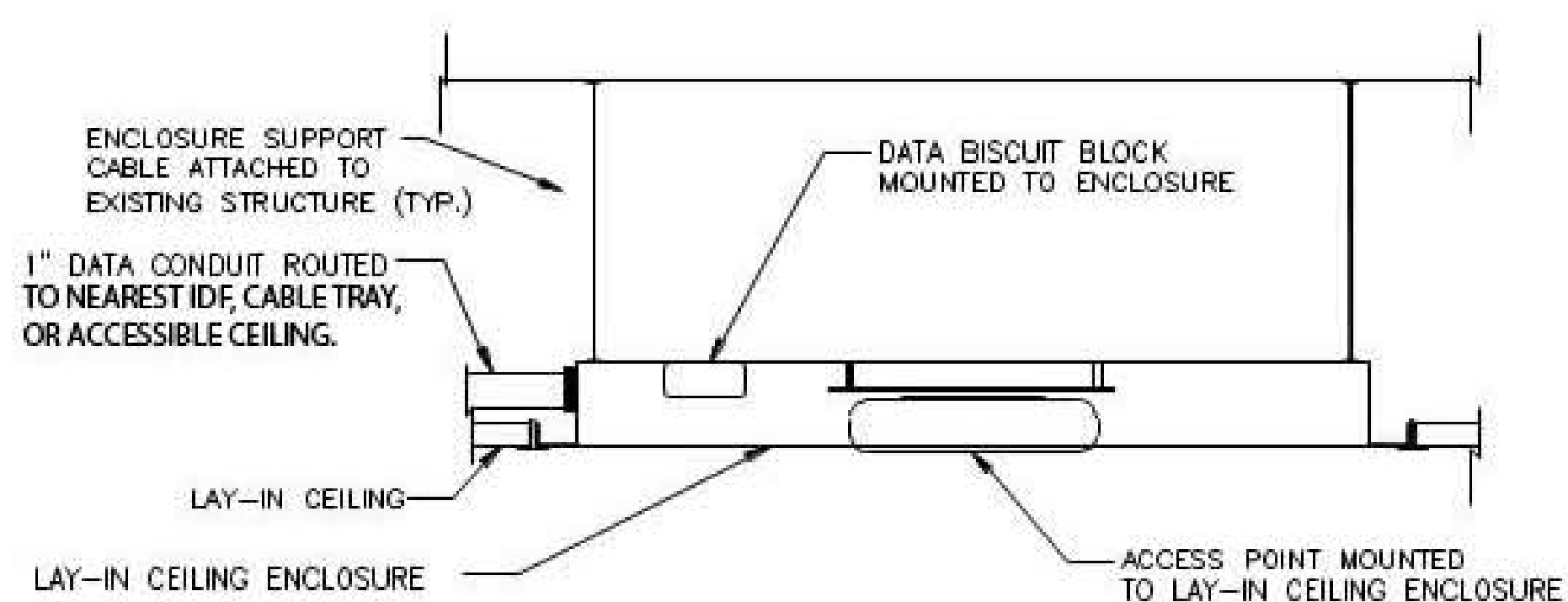
**3 ENCLOSURE SURFACE MOUNT DETAIL**  
NOT TO SCALE



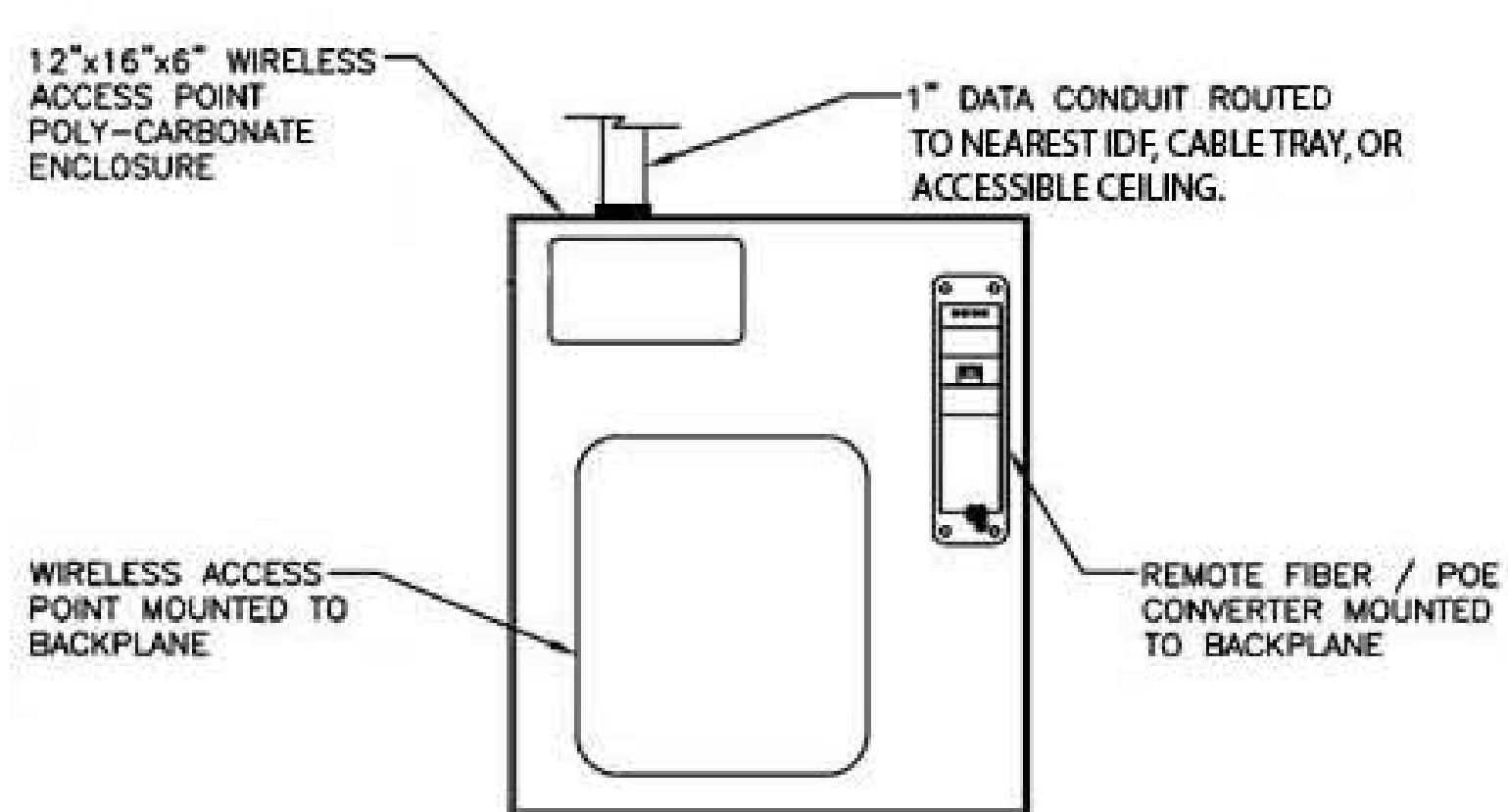
**4 AP SURFACE MOUNT DETAIL**  
NOT TO SCALE



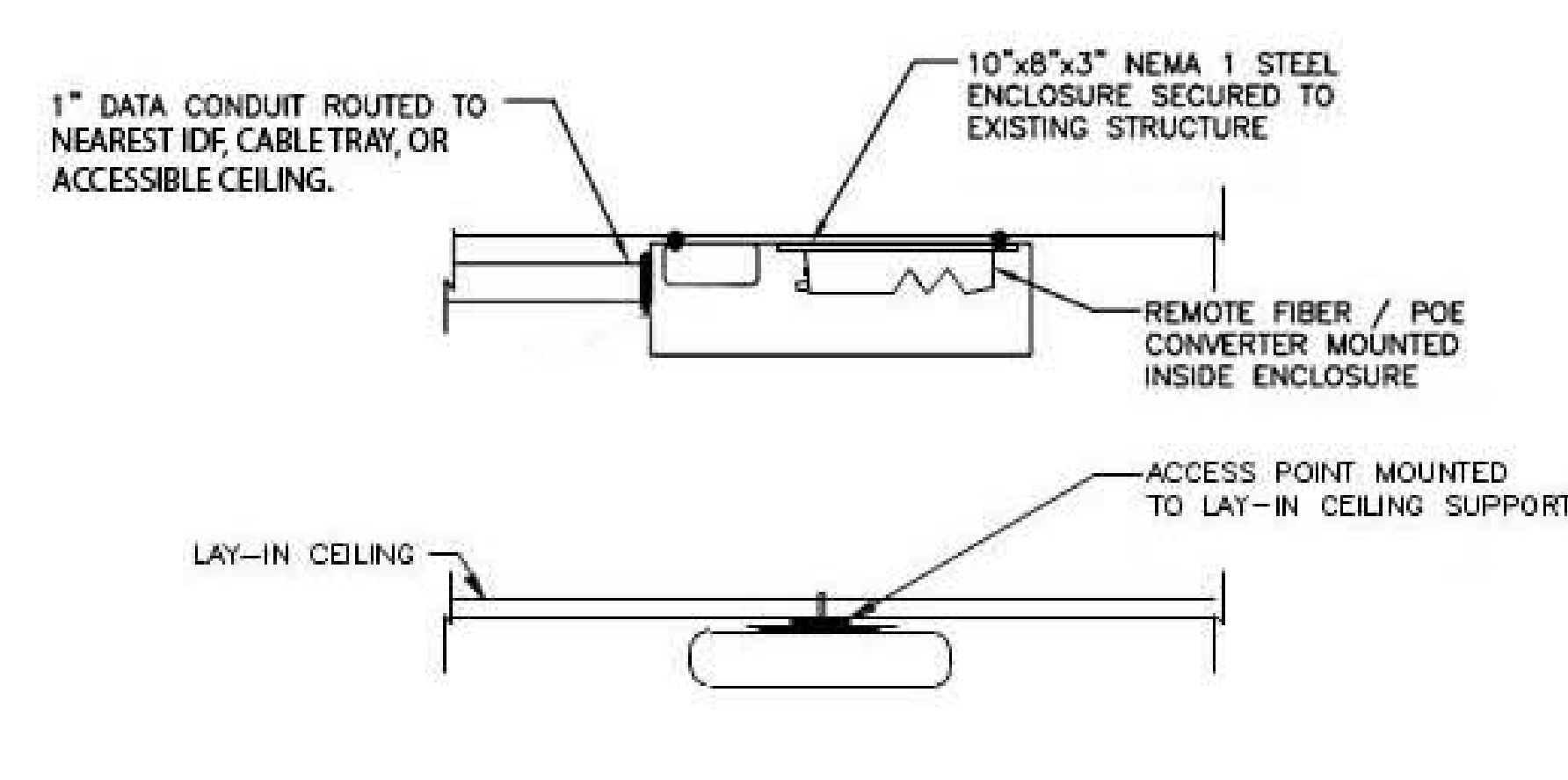
**5 AP LAY-IN CEILING CLAMP MOUNT DETAIL**  
NOT TO SCALE



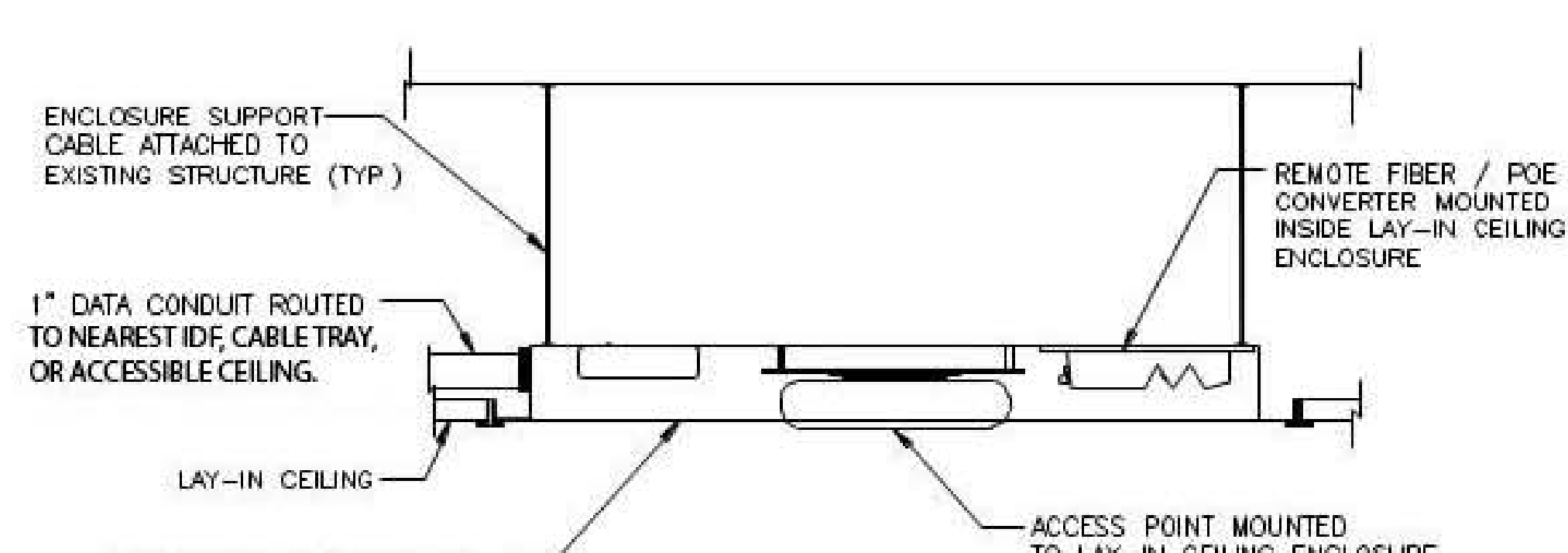
**6 AP LAY-IN CEILING ENCLOSURE MOUNT DETAIL**  
NOT TO SCALE



**7 ACCESS POINT ENCLOSURE DETAIL (FIBER)**  
NOT TO SCALE



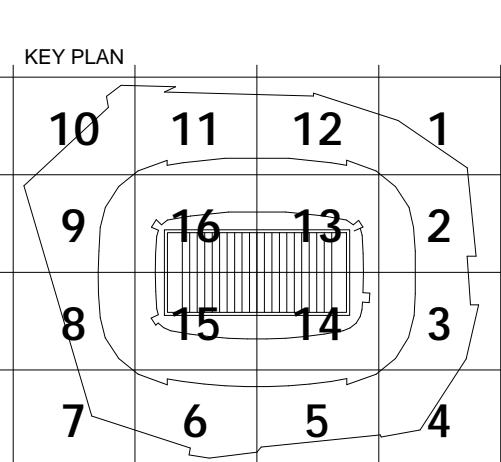
**8 AP LAY-IN CEILING CLAMP MOUNT DETAIL**  
NOT TO SCALE



**9 AP LAY-IN CEILING ENCLOSURE MOUNT DETAIL**  
NOT TO SCALE

**GENERAL NOTES FOR WIFI DETAIL SHEETS:**

1. Mount Access Points, Enclosures, and Antennas in accordance with Manufacturer's instructions, including proper grounding of components, installation of lightning arrestors, and weatherproofing of cable connectors.
2. All mounting hardware, anchorages, and associated structure shall be hot-dipped galvanized or stainless steel.
3. Coordinate routing of conduit and location of data outlets with Telecommunications Contractor.
4. Final design of all antenna and access point mounts to be provided by Contractor. Contractor shall submit product data for all mounting hardware for approval prior to installation.
5. Mounting conditions to be verified prior to installation.



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16246.000  
DATE  
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SHEET TITLE  
WIFI DETAILS

SHEET NO.  
TW-0.20

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WINGS FOOTBALL, LLC  
9500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

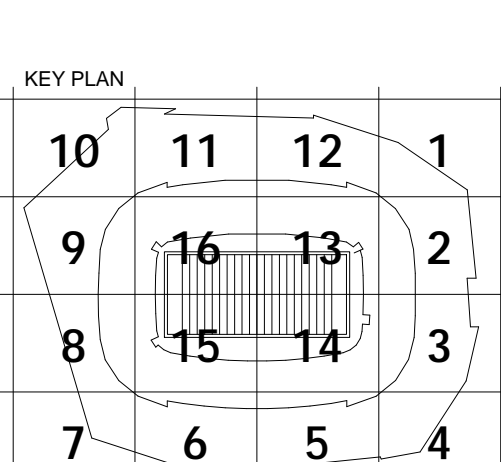
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROETHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

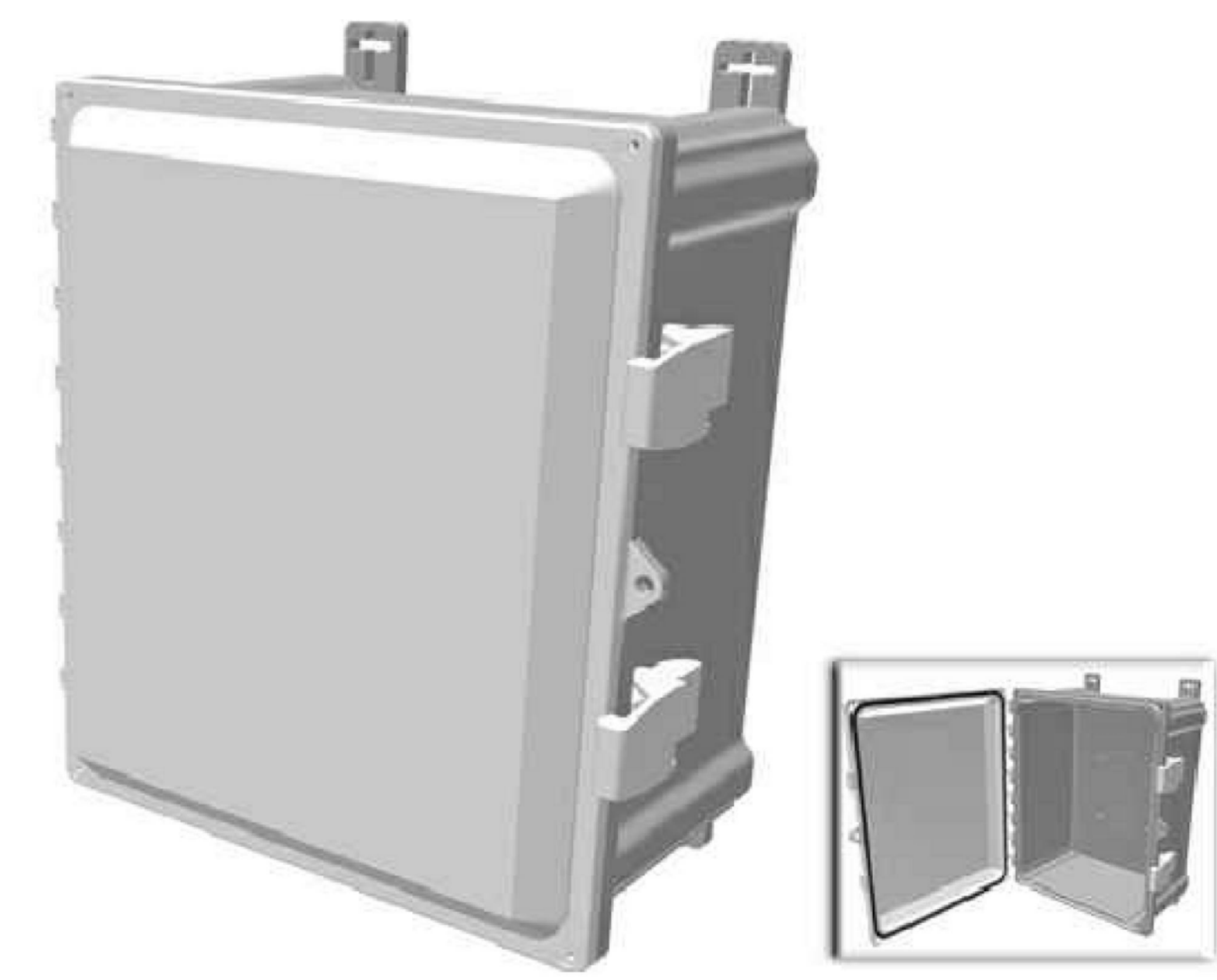
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

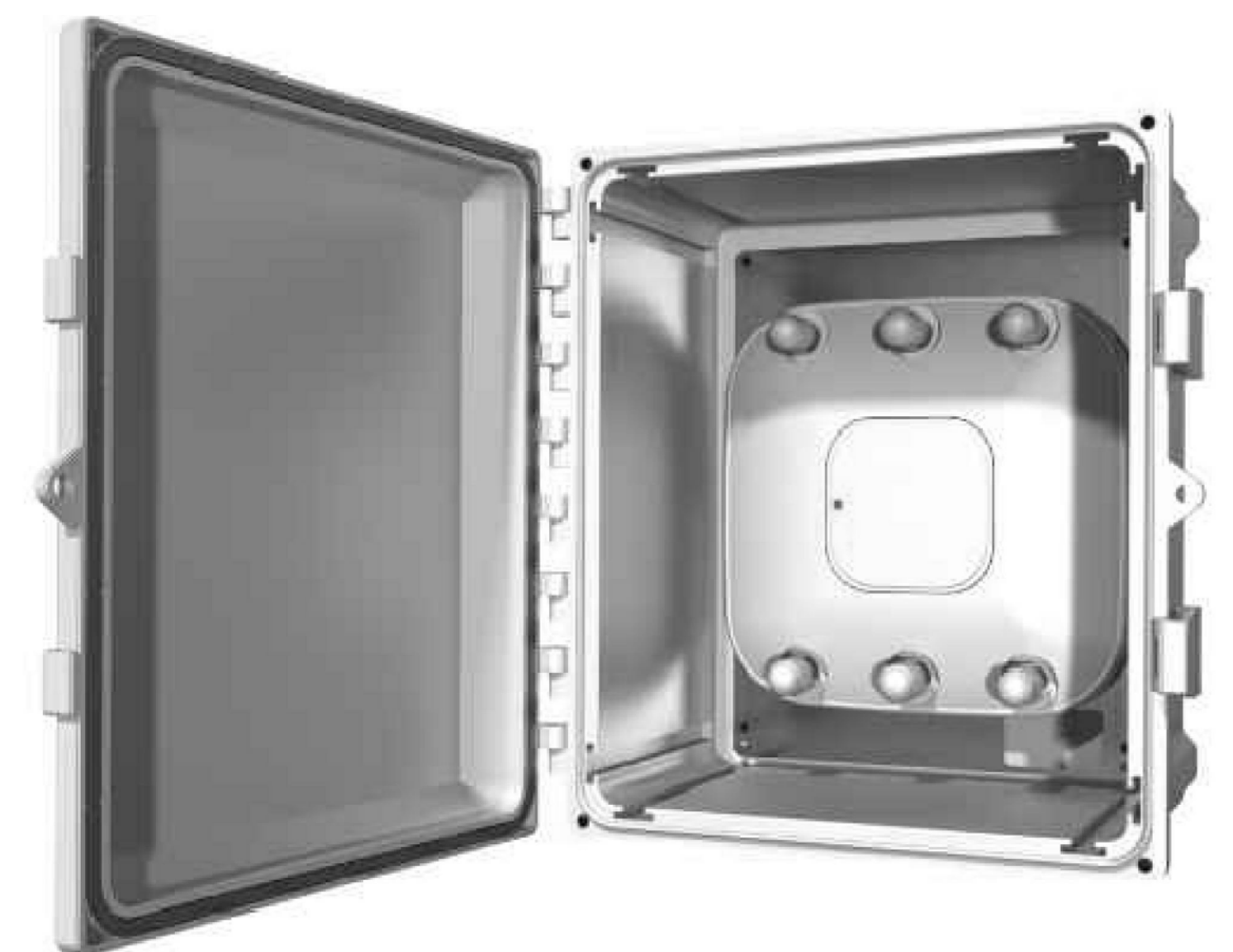
SHEET TITLE  
WIFI DETAILS

SHEET NO.  
TW-0.21



**WIRELESS ACCESS ENCLOSURE DETAIL**  
NOT TO SCALE

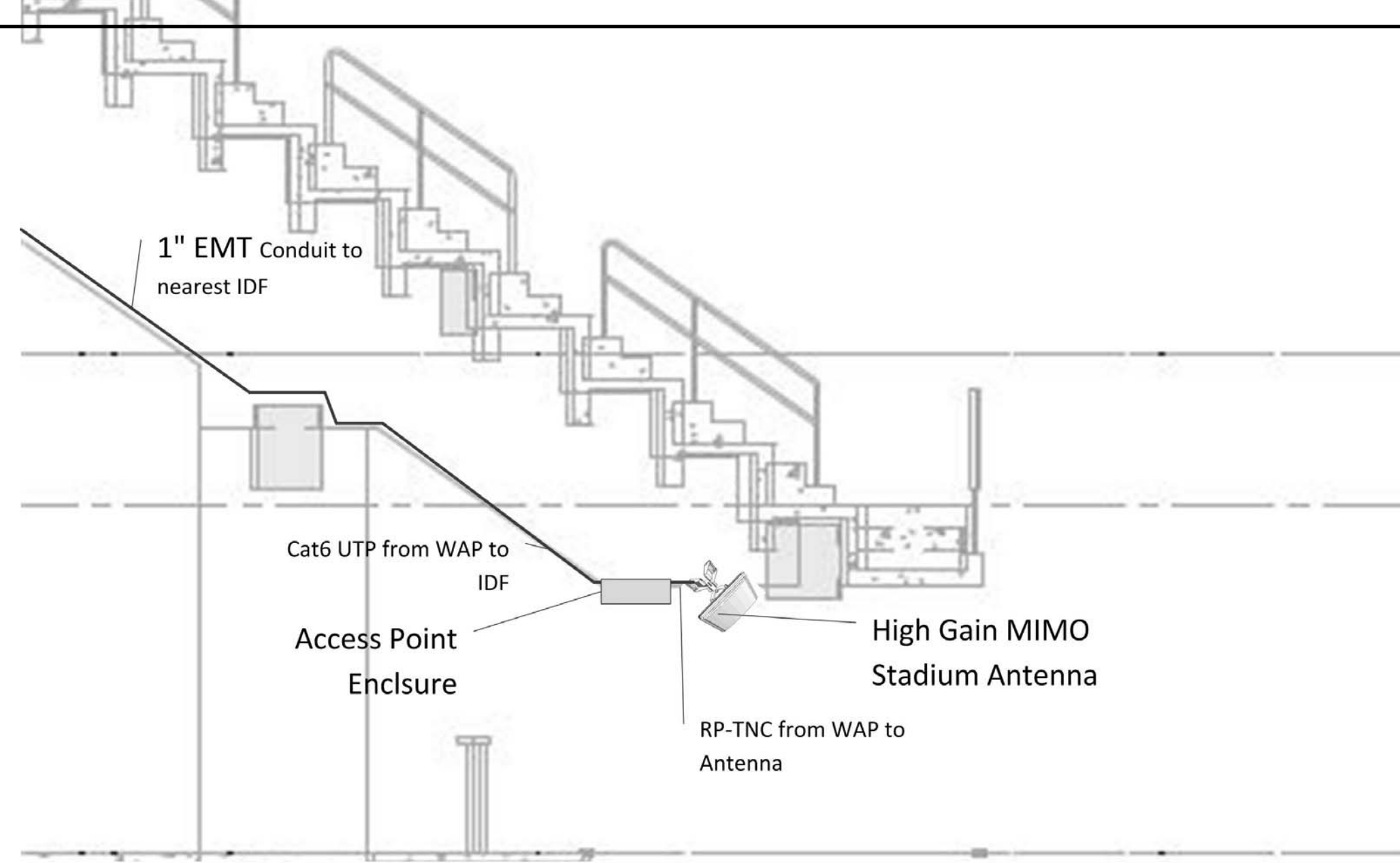
- NOTES:**
- THE TC SHALL PROVIDE NEMA 4 ENCLOSURE FOR UNDER-BOWL MOUNTING.
  - ENCLOSURE SHALL BE UL LISTED WEATHERTIGHT AND BE SIZED FOR WAP.
  - TC SHALL MOUNT WAP INSIDE ENCLOSURE.
  - TC SHALL PROVIDE ALL NECESSARY MOUNTING PLATES AND ACCESSORIES IN ACCORDANCE WITH LOCATIONS.
- WIRELESS ACCESS POINT DETAIL C**  
3/4" = 1'-0"



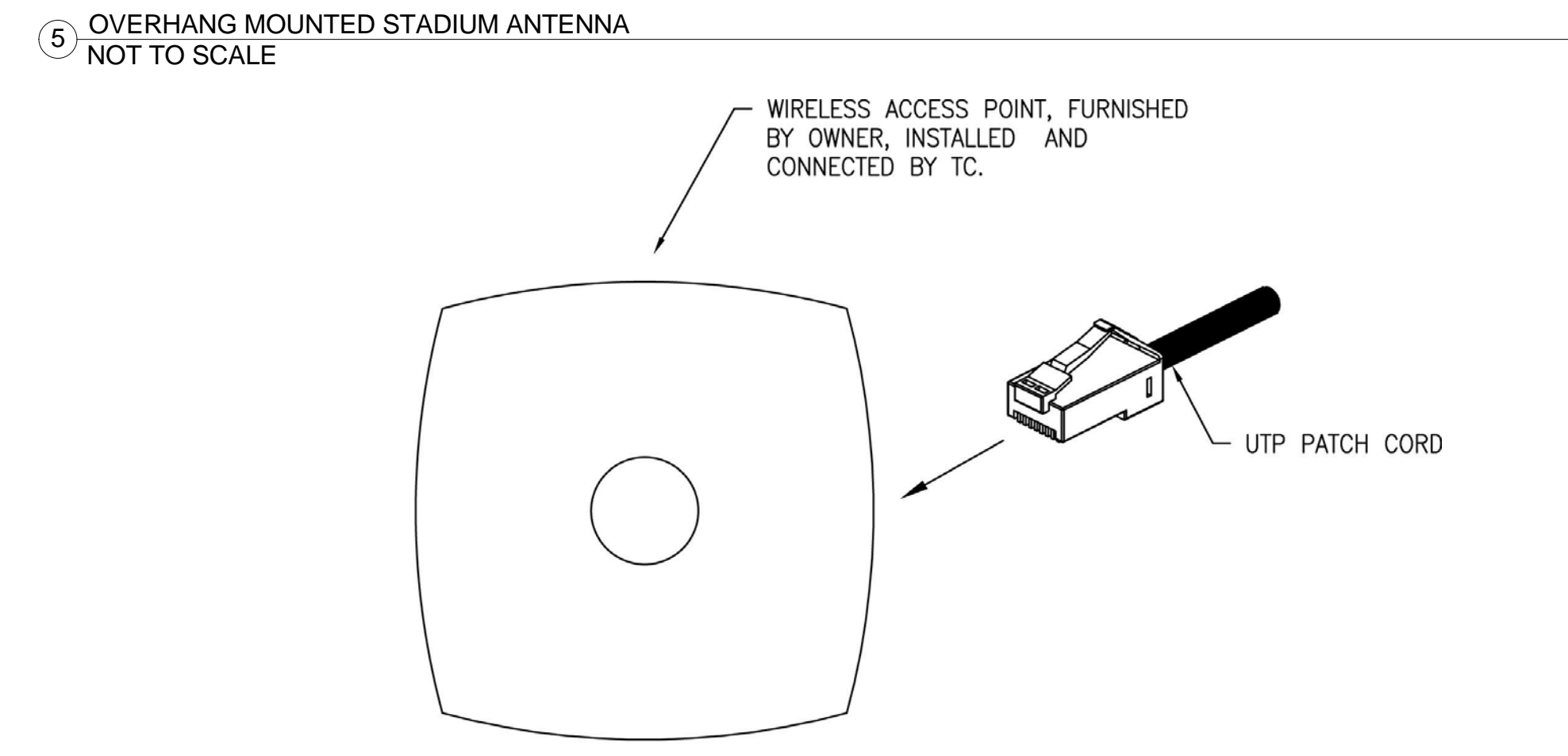
**WIRELESS ACCESS ENCLOSURE DETAIL**  
NOT TO SCALE

- NOTES:**
- THE TC SHALL PROVIDE NEMA 4 ENCLOSURE FOR UNDER-BOWL MOUNTING.
  - ENCLOSURE SHALL BE UL LISTED WEATHERTIGHT AND BE SIZED FOR WAP.
  - TC SHALL MOUNT WAP INSIDE ENCLOSURE.
  - TC SHALL PROVIDE ALL NECESSARY MOUNTING PLATES AND ACCESSORIES IN ACCORDANCE WITH LOCATIONS.
- WIRELESS ACCESS POINT DETAIL D**  
3/4" = 1'-0"

- GENERAL NOTES FOR WIFI DETAIL SHEETS:**
- Mount Access Points, Enclosures, and Antennas in accordance with Manufacturer's instructions, including proper grounding of components, installation of lightning arrestors, and weatherproofing of cable connectors.
  - All mounting hardware, anchorages, and associated structure shall be hot-dipped galvanized or stainless steel.
  - Coordinate routing of conduit and location of data outlets with Telecommunications Contractor.
  - Final design of all antenna and access point mounts to be provided by Contractor. Contractor shall submit product data for all mounting hardware for approval prior to installation.
  - Mounting conditions to be verified prior to installation.



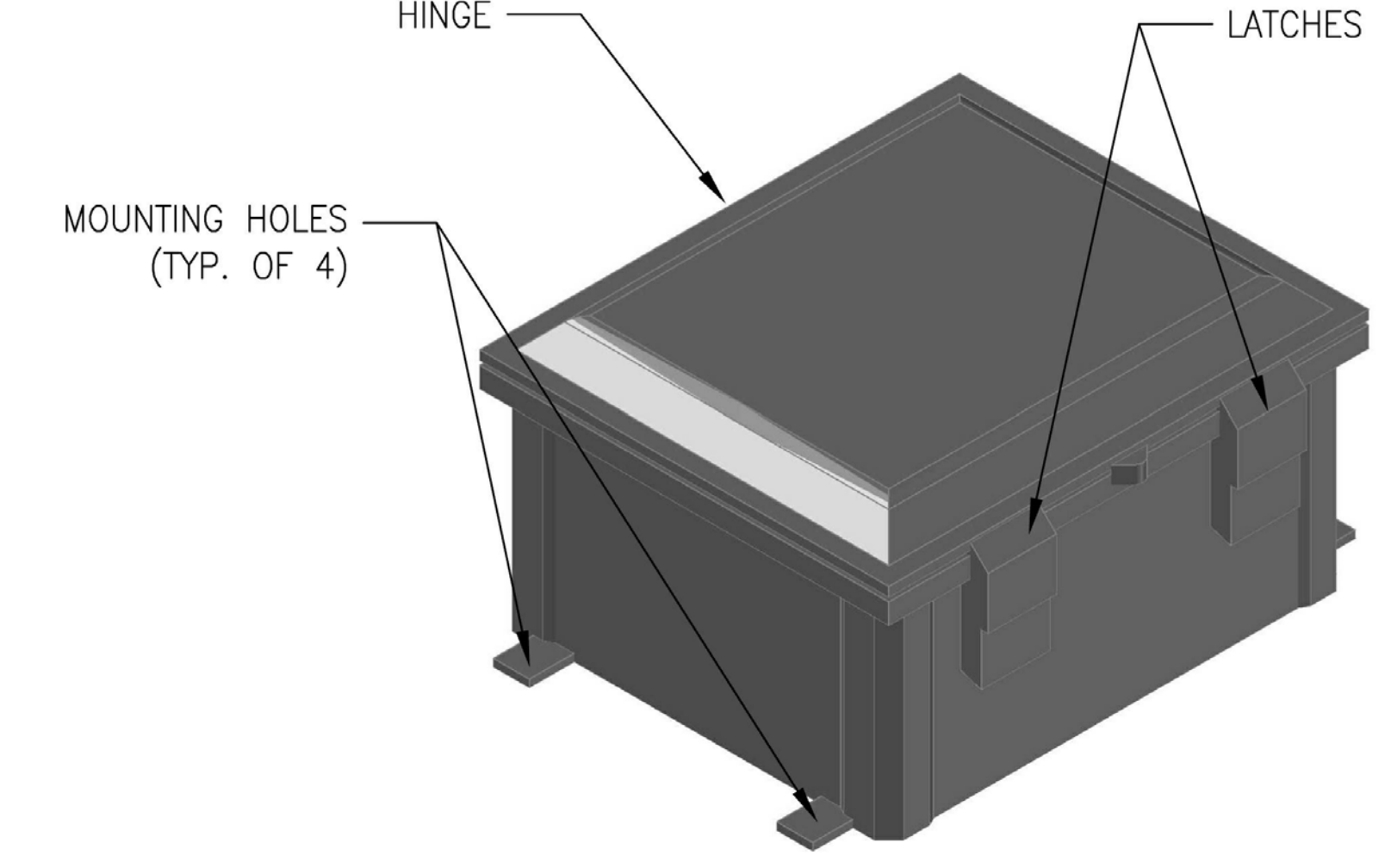
- Notes:**
- WiFi equipment shall be mounted as tightly as possible to the concrete structure on the underside of the designated seating bowl overhang.
  - Conduit pathway shown is for reference only. Refer to the Telecommunications Drawing Set for details.



**WIRELESS ACCESS POINT DETAIL**  
NOT TO SCALE

- NOTES:**
- 1 DATA CABLE AND JACK, TERMINATE ONTO PATCH PANEL IN THE FLOOR SERVING IT ROOM ON DATA PATCH PANEL AND LABEL.
  - TELECOMMUNICATIONS CONTRACTOR TO SECURE WAP TO INSIDE OF NEMA ENCLOSURE PER MANUFACTURERS' SPECIFICATIONS. REFER TO 'T' DRAWINGS FOR MOUNTING LOCATIONS.
  - TELECOMMUNICATIONS CONTRACTOR SHALL TERMINATE WAP END OF CABLE WITH AN RJ45 BISCUIT JACK, TEST, AND LABEL WHEN FINISHED.
  - TELECOMMUNICATIONS CONTRACTOR SHALL LEAVE 10-20 FEET OF SLACK, IF IT DOES NOT EXCEED CABLE DISTANCE SPECIFICATIONS, NEATLY COILED IN PLACE FOR FUTURE REVISION.

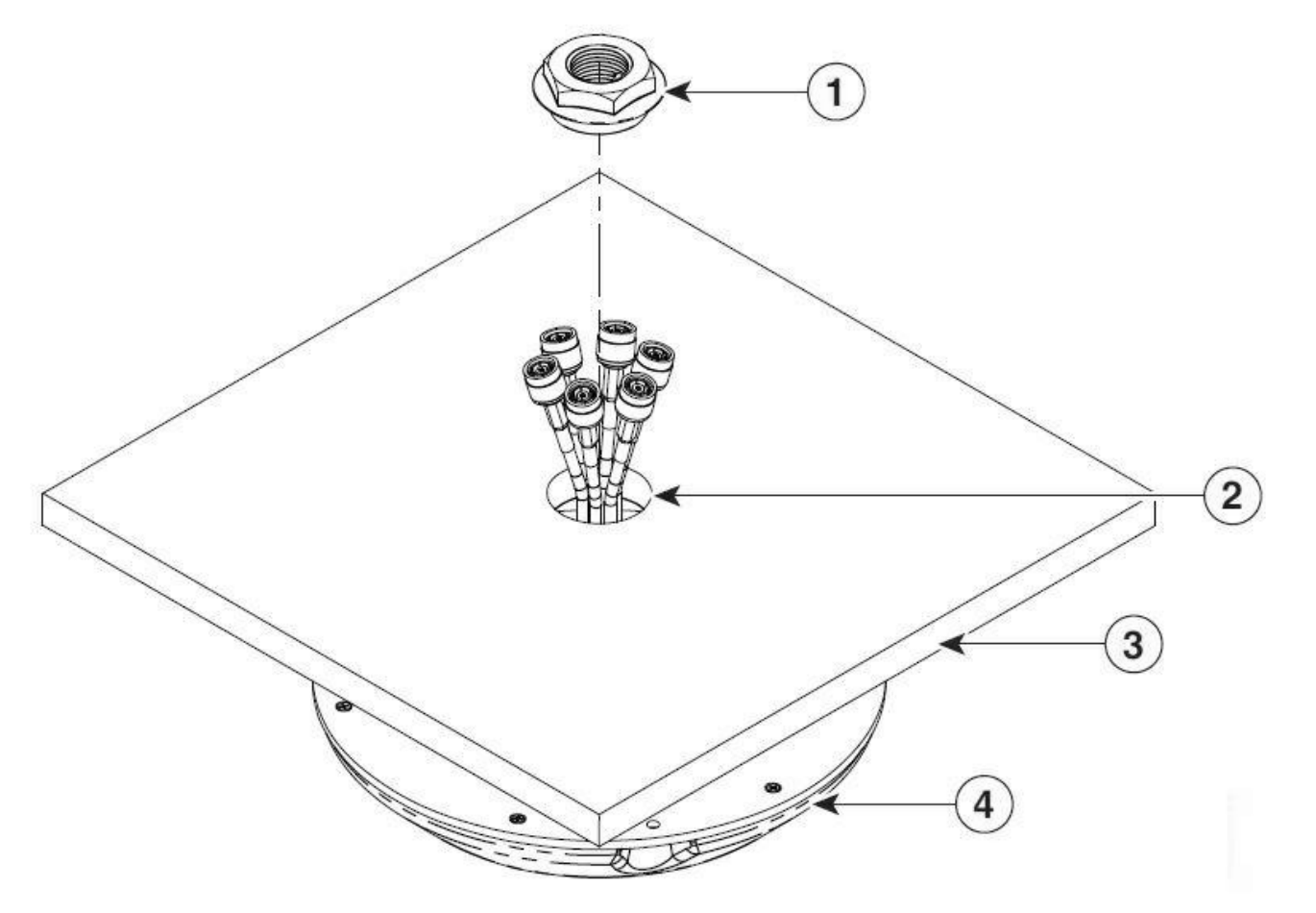
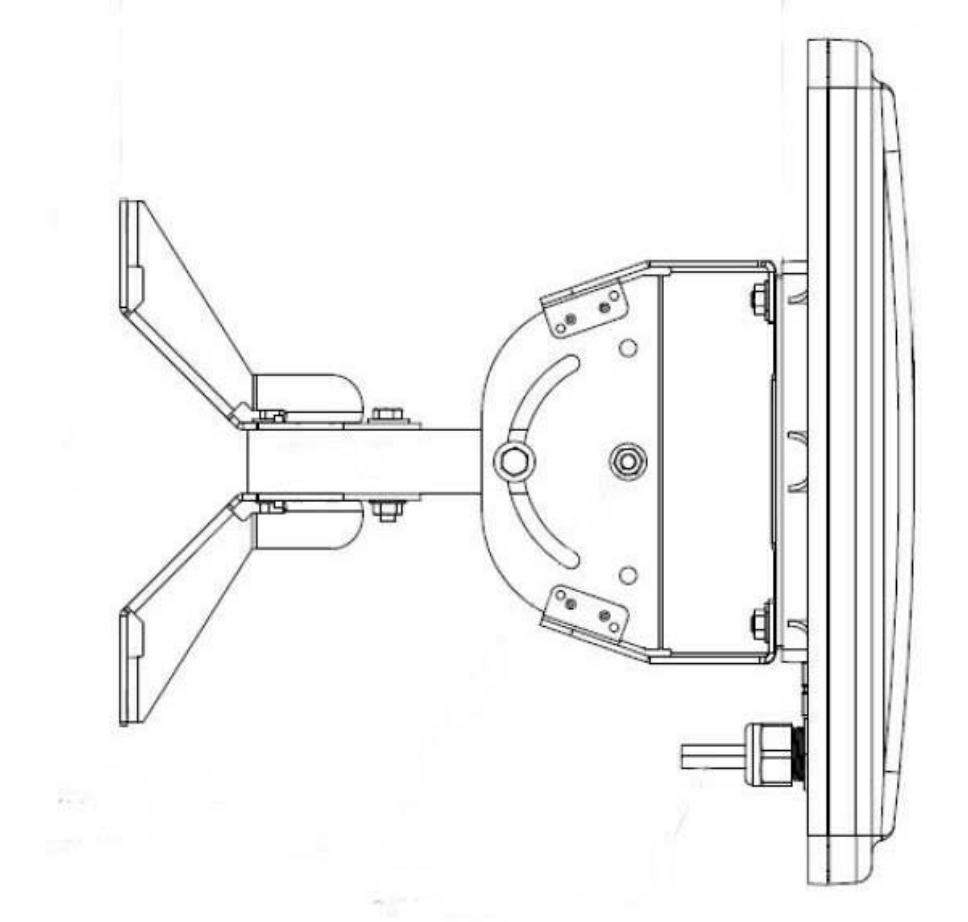
**WIRELESS ACCESS POINT DETAIL A**  
3/4" = 1'-0"



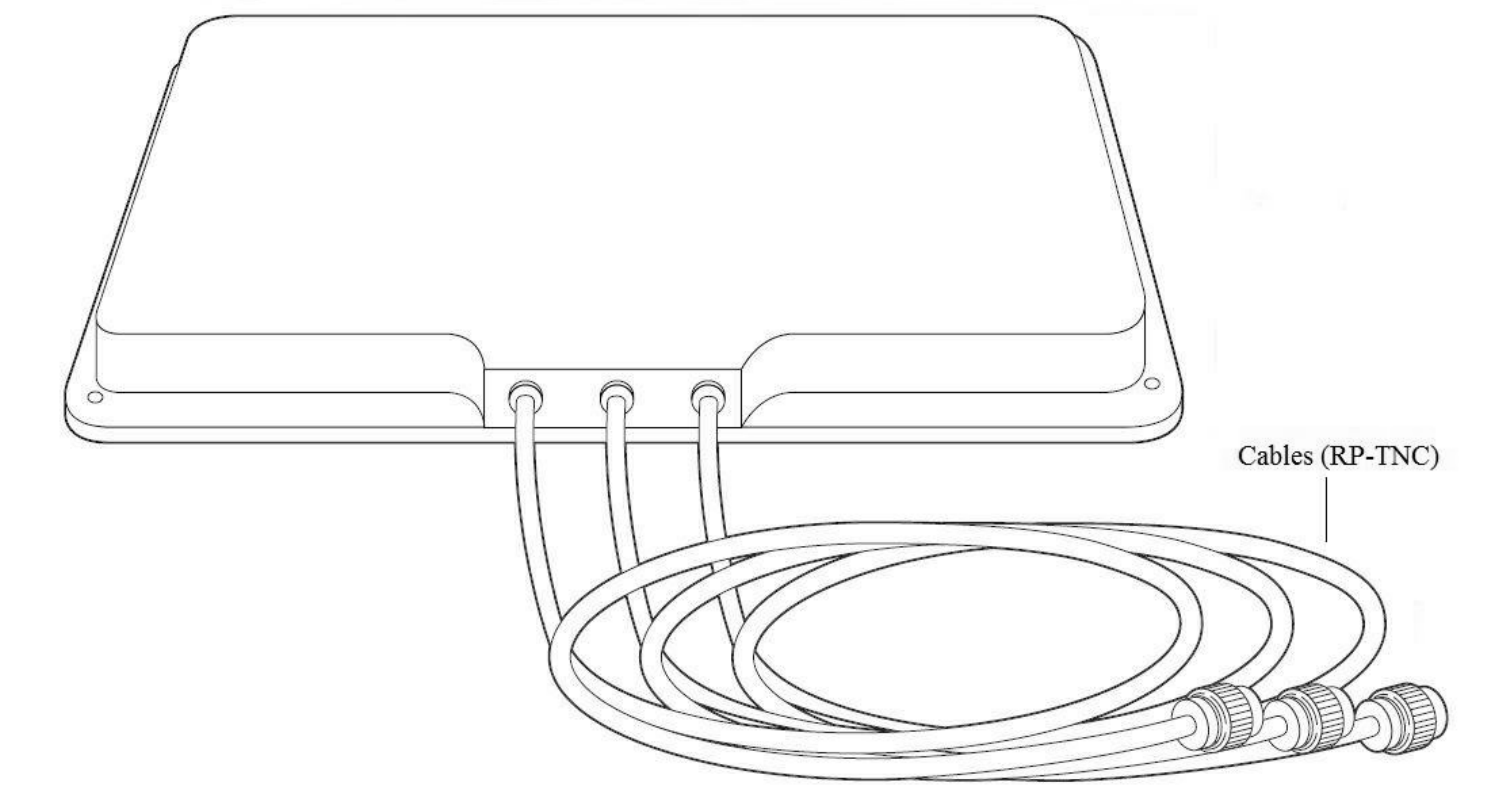
**WIRELESS ACCESS ENCLOSURE DETAIL**  
NOT TO SCALE

- NOTES:**
- THE TC SHALL PROVIDE NEMA 4 ENCLOSURE FOR UNDER-BOWL MOUNTING.
  - ENCLOSURE SHALL BE UL LISTED WEATHERTIGHT AND BE SIZED FOR WAP.
  - TC SHALL MOUNT WAP INSIDE ENCLOSURE.
  - TC SHALL PROVIDE ALL NECESSARY MOUNTING PLATES AND ACCESSORIES IN ACCORDANCE WITH LOCATIONS.
- WIRELESS ACCESS POINT DETAIL B**  
3/4" = 1'-0"

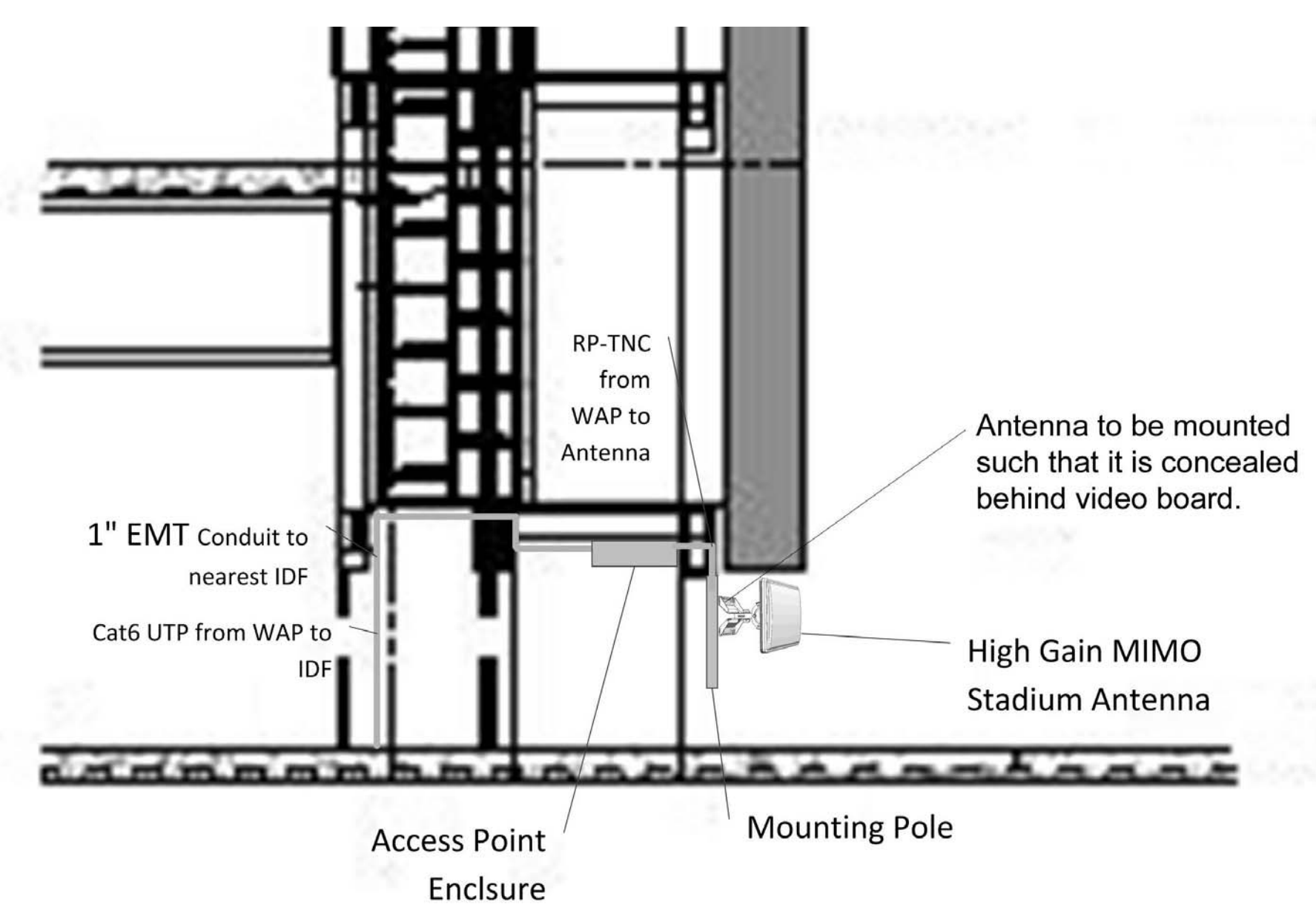
**HIGH GAIN STADIUM ANTENNA**  
12" = 1'-0"



**MIMO OMNIDIRECTIONAL ANTENNA**  
NOT TO SCALE



**MIMO PATCH ANTENNA**  
NOT TO SCALE



**VIDEO BOARD MOUNTED ANTENNA**  
NOT TO SCALE

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
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10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

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115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

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ACOUSTIC DIMENSIONS  
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**W/WHY**  
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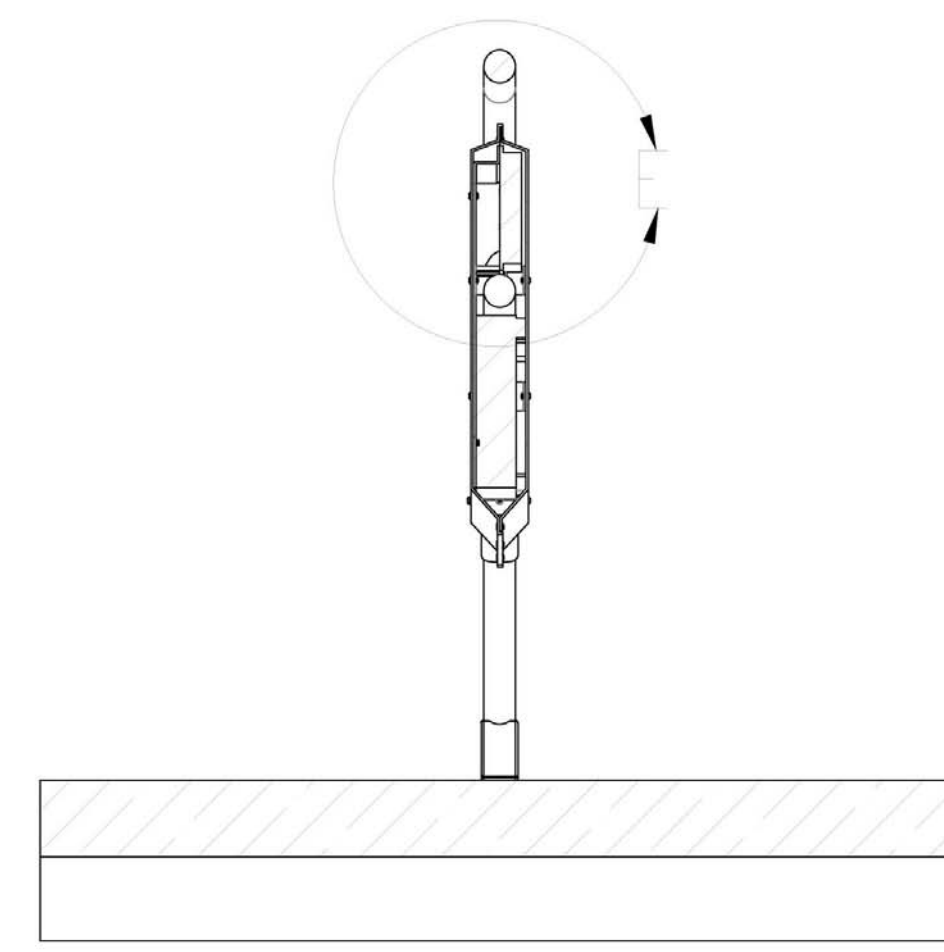
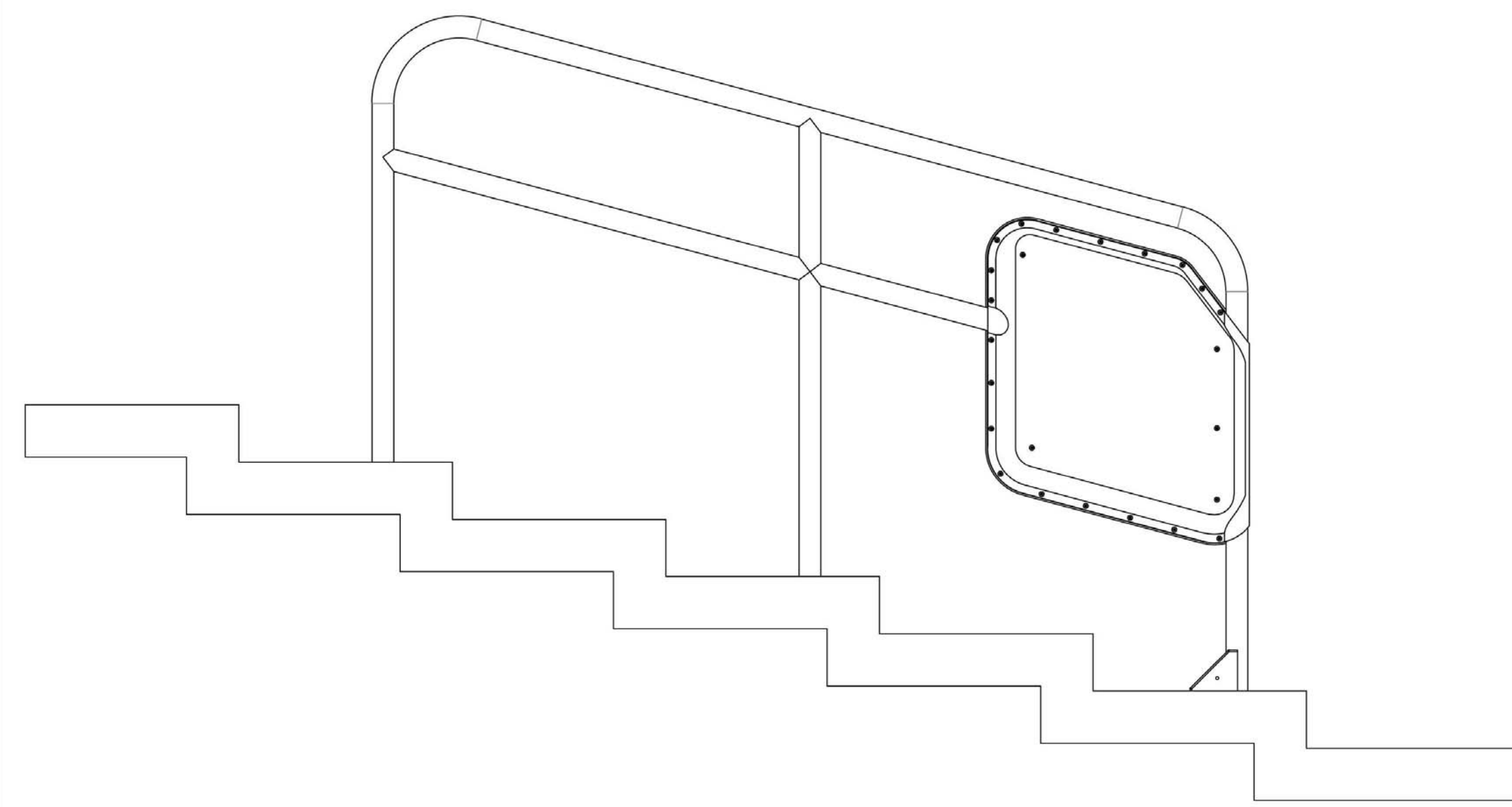
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2980 MISSOURI BELLEVUE, LOUISBURG, KS 66065

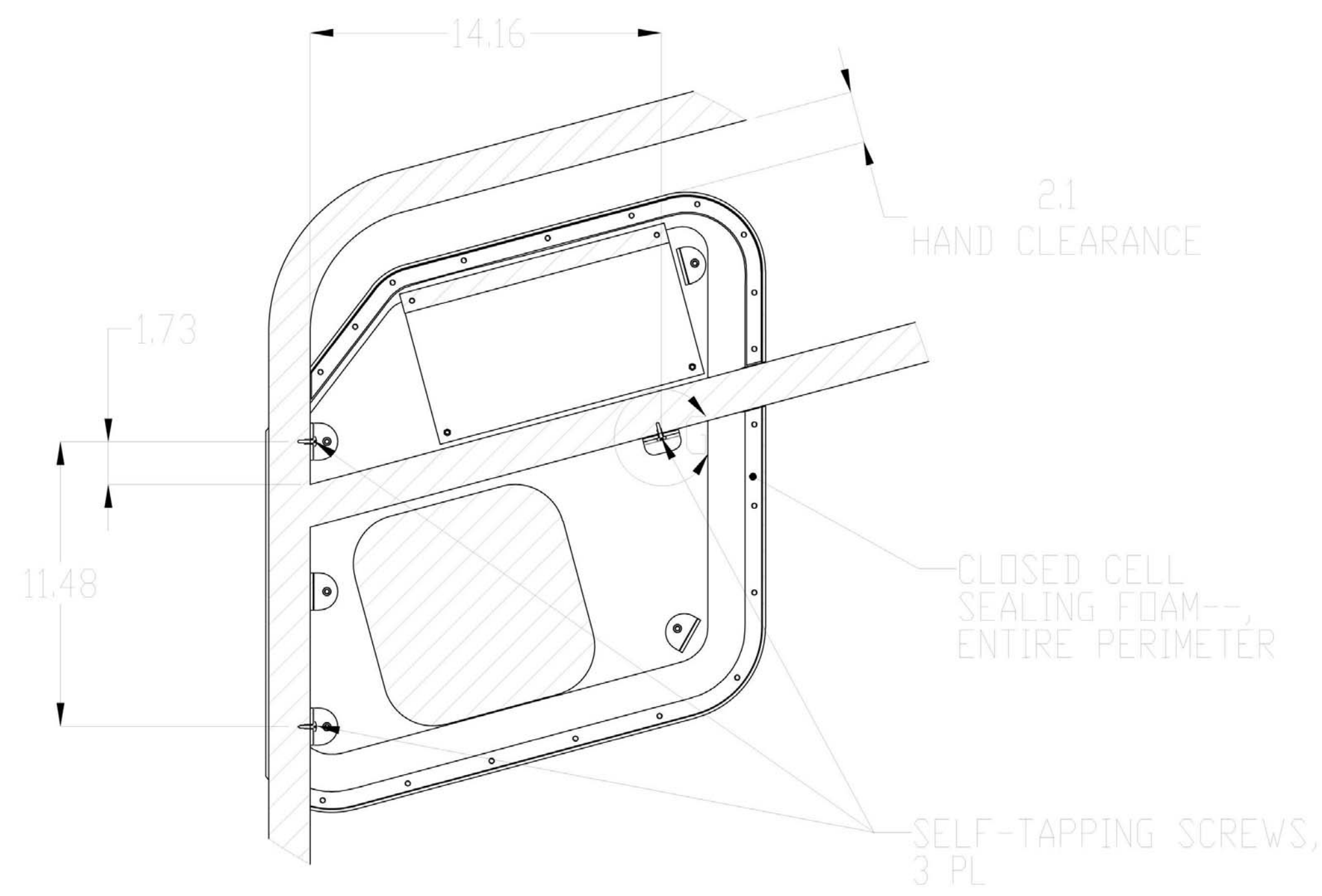
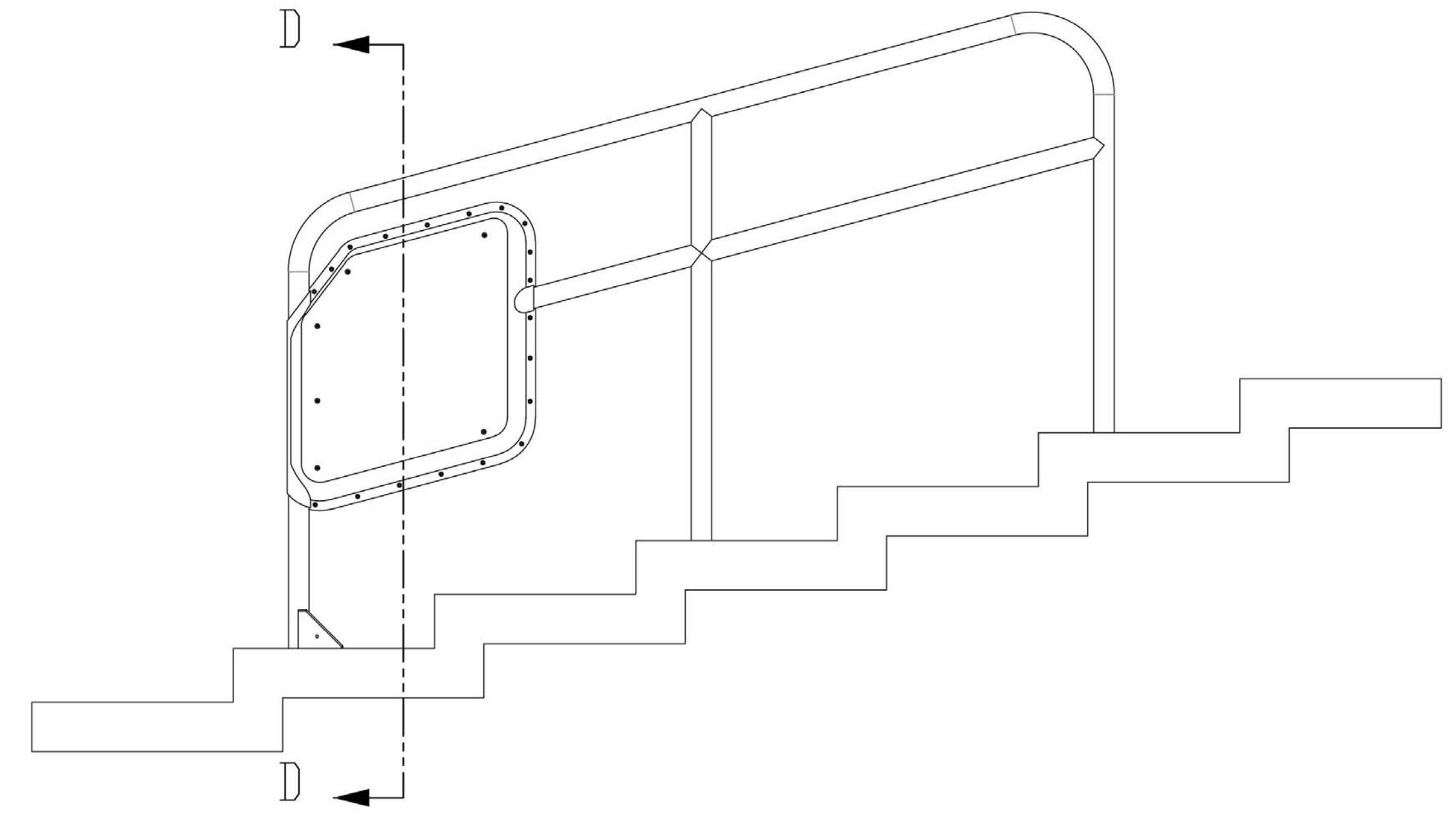
**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

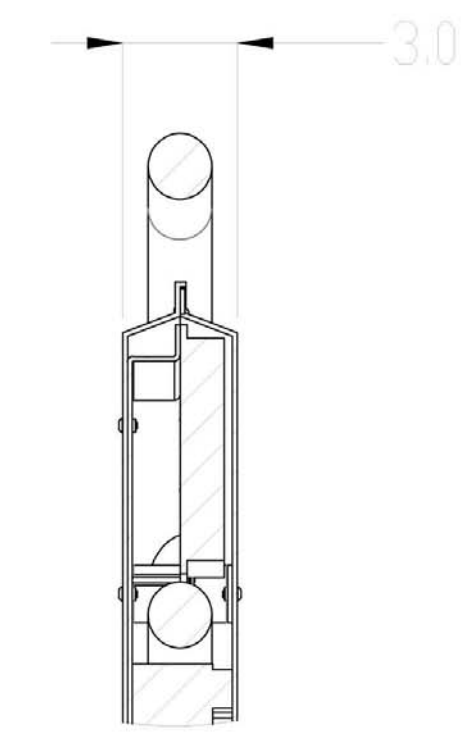
**FAÇADE ACCESS CONSULTANT**  
LEIGH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



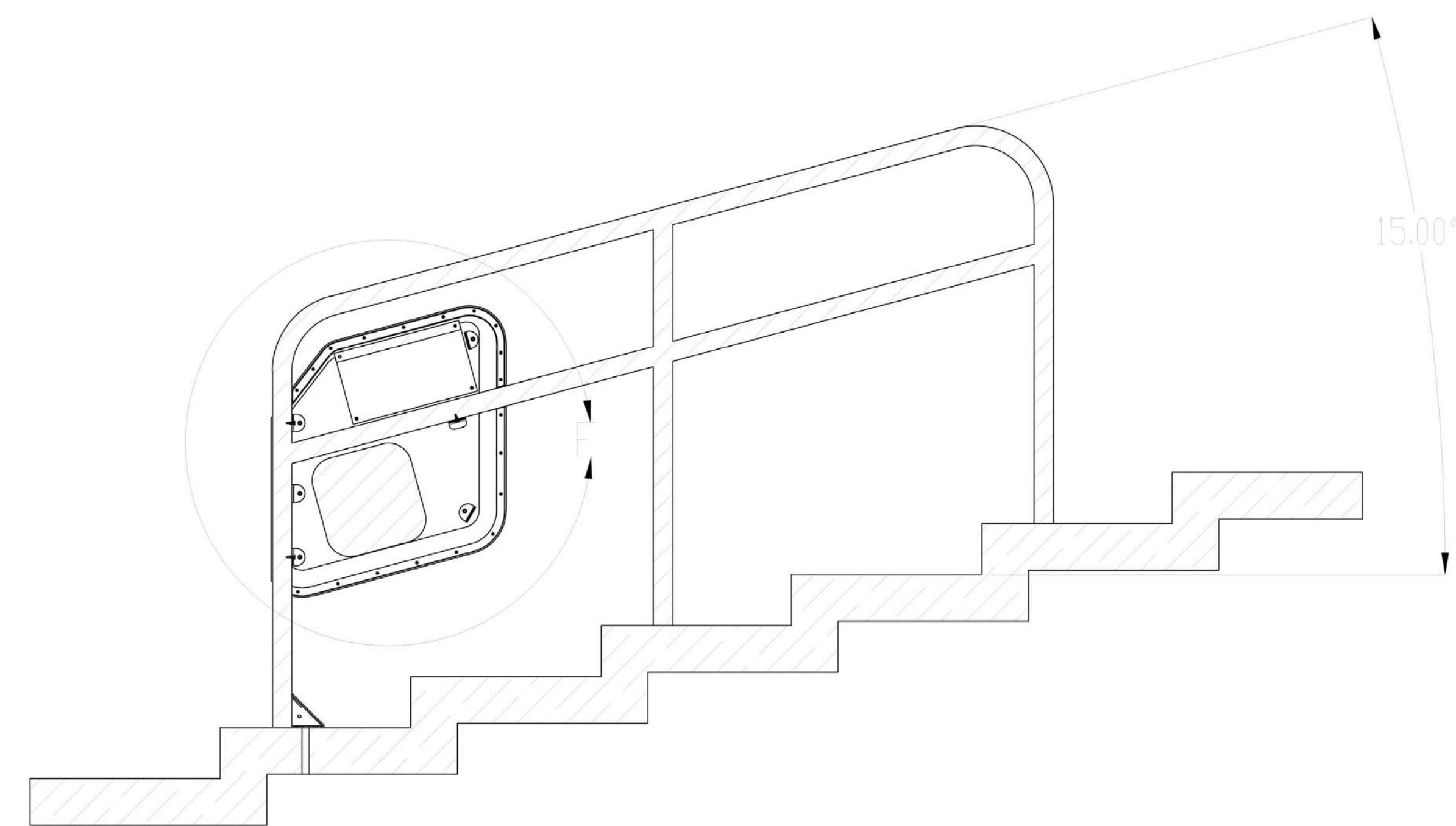
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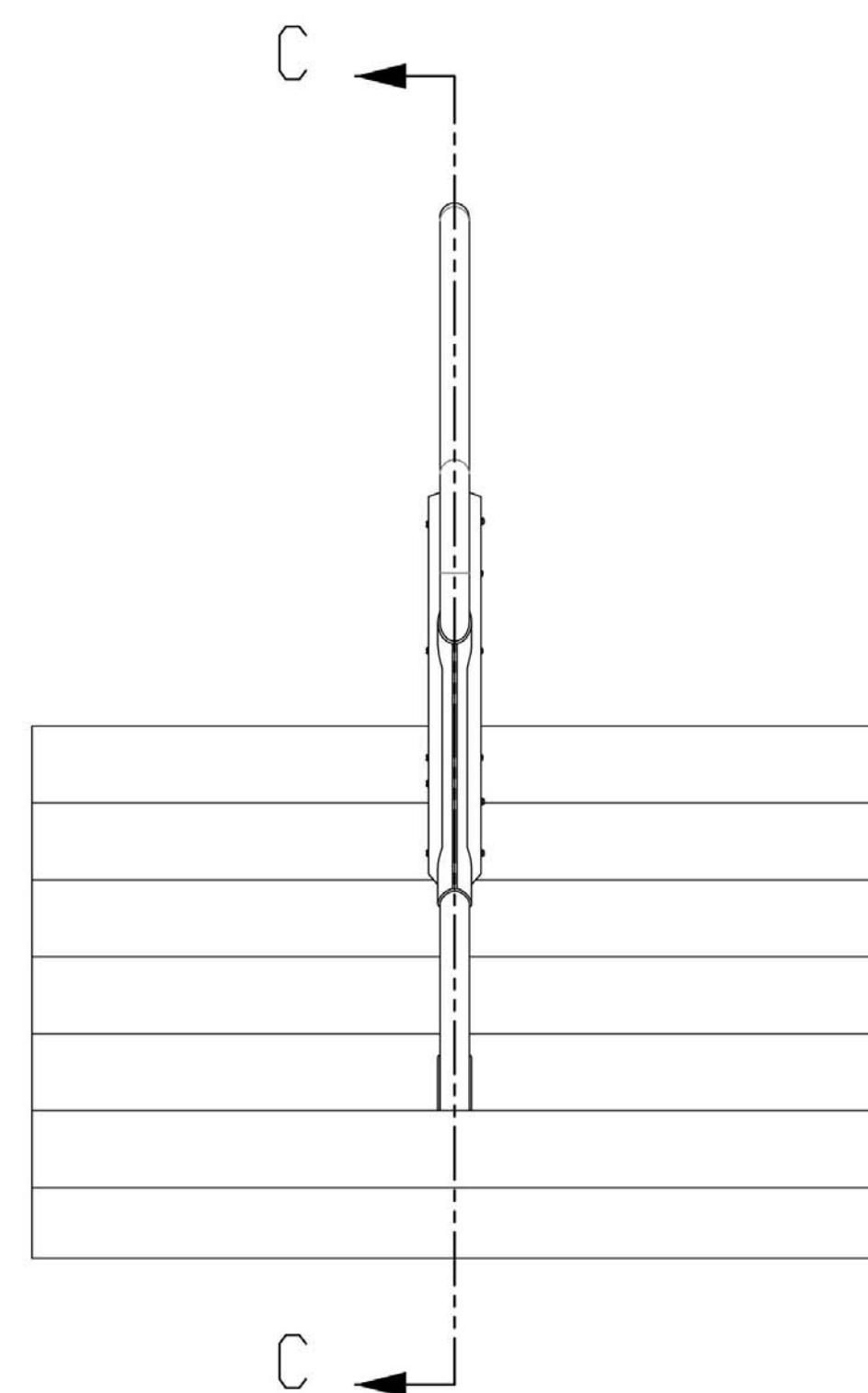
DETAIL F  
SCALE 1 : 6



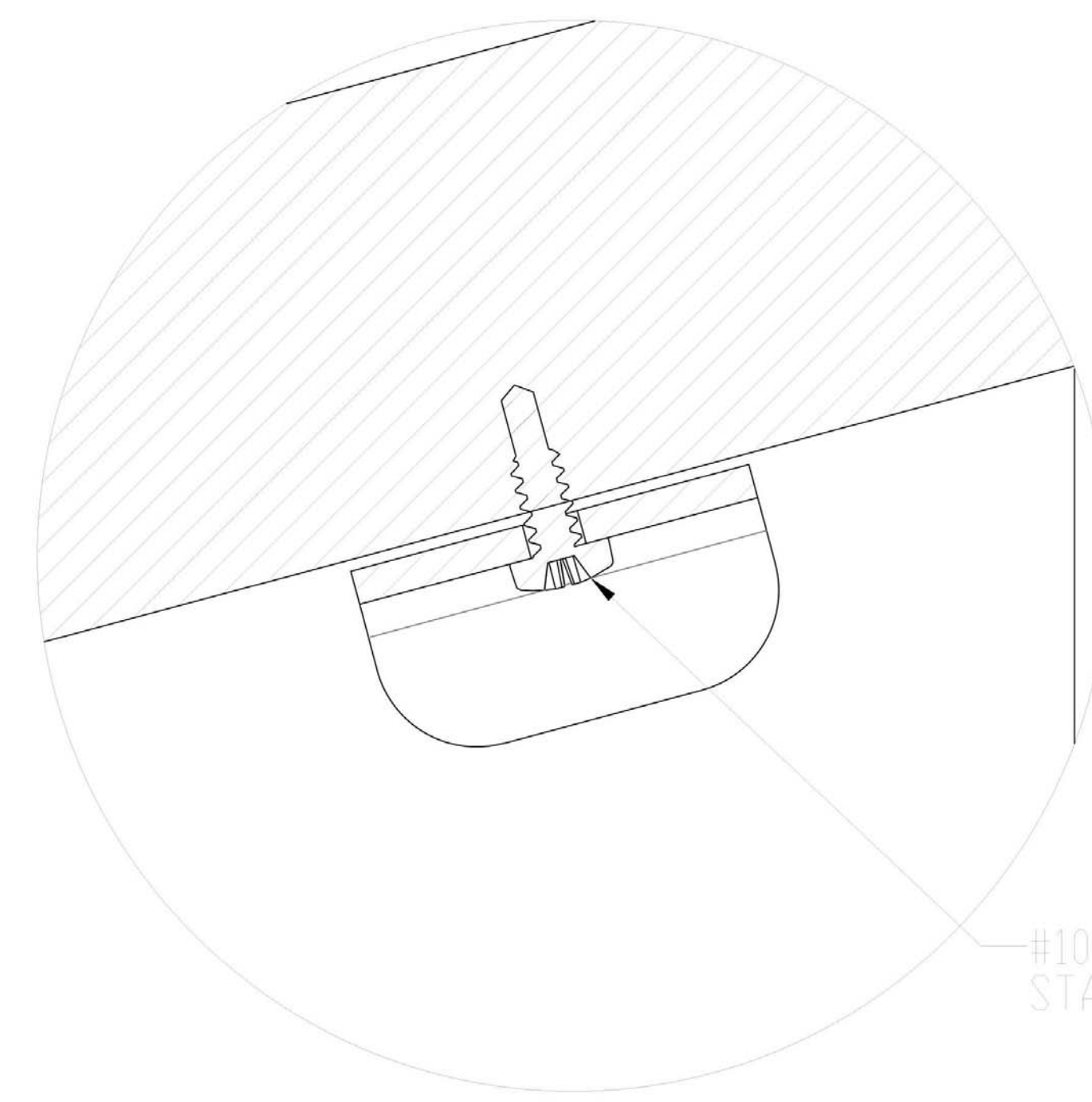
DETAIL E  
SCALE 1 : 6



SECTION C-C  
SCALE 1 : 12



C



DETAIL G  
SCALE 1.5 : 1

#10 SELF-TAPPING  
STAINLESS STEEL SCREW

1 WiFi RAILING DETAILS  
NOT TO SCALE

**GENERAL NOTES FOR WIFI DETAIL SHEETS:**

1. Mount Access Points, Enclosures, and Antennas in accordance with Manufacturer's instructions, including proper grounding of components, installation of lightning arrestors, and weatherproofing of cable connectors.
2. All mounting hardware, anchorages, and associated structure shall be hot-dipped galvanized or stainless steel.
3. Coordinate routing of conduit and location of data outlets with Telecommunications Contractor.
4. Final design of all antenna and access point mounts to be provided by Contractor. Contractor shall submit product data for all mounting hardware for approval prior to installation.
5. Mounting conditions to be verified prior to installation.

KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000  
DATE  
May 02, 2014  
ISSUE  
CCD-060

SHEET TITLE  
WIFI DETAILS

SHEET NO.  
TW-0.22

**WIFI PLANS  
GENERAL NOTES:**

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
2. Mount access points, enclosures, and antennas in accordance with manufacturer's instructions including proper grounding of components, installation of lightning arrestors, and weatherproofing of cable connectors.
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5. All wireless access points shall be powered via Power-Over-Ethernet (POE) from nearest communications room unless noted otherwise.
6. Contractor shall coordinate with the Construction Manager to ensure that acceptable conditions exist for installation of all equipment and components.
7. The Contractor is required to coordinate their efforts with the other trades and subcontractors who may be working within the same vicinity to avoid conflict and lost time.
8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55434

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**HWY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
6326 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14330 PENNCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2980 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROVAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD. W., QUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

REVISION  
NO. DESCRIPTION DATE

NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER

16246.000

DATE

May 02, 2014

ISSUE

CCD-060

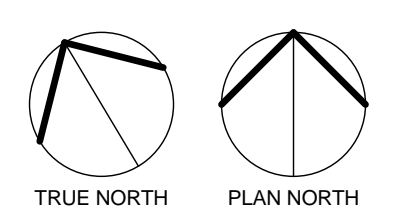
SHEET TITLE

00 SITE PLAN -

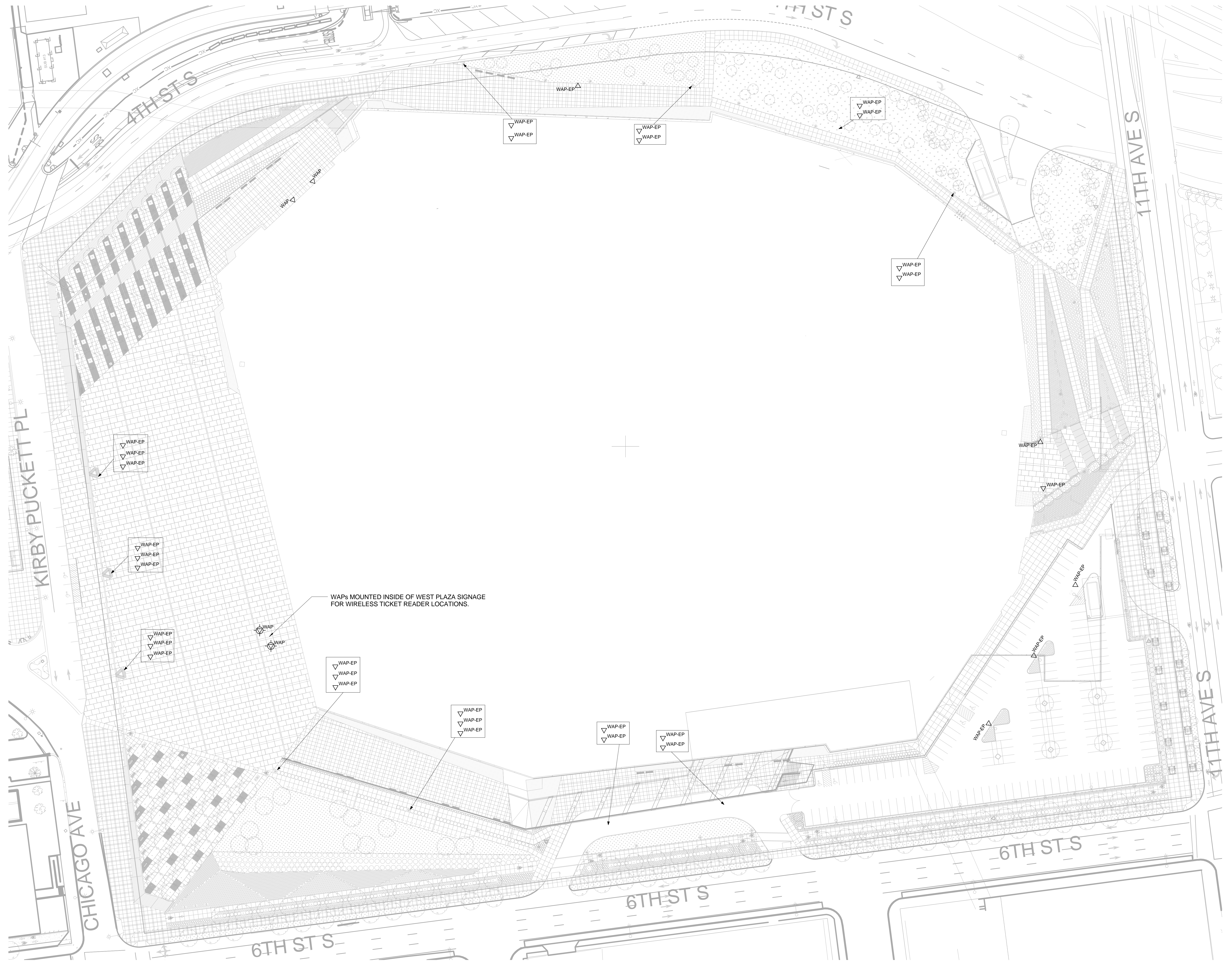
WIFI

SHEET NO.

TW-1.00



1 WIFI - 00 SITE PLAN  
1" = 40'-0"

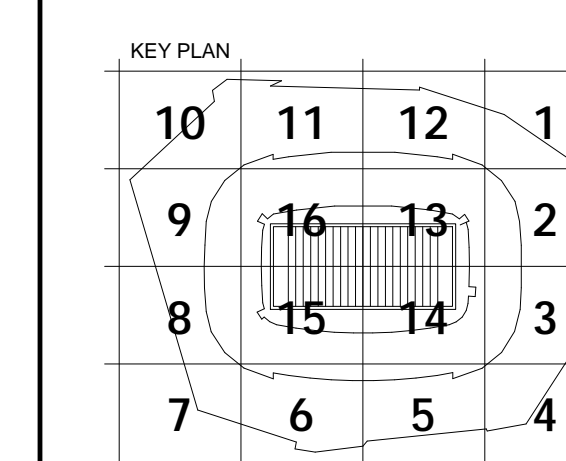
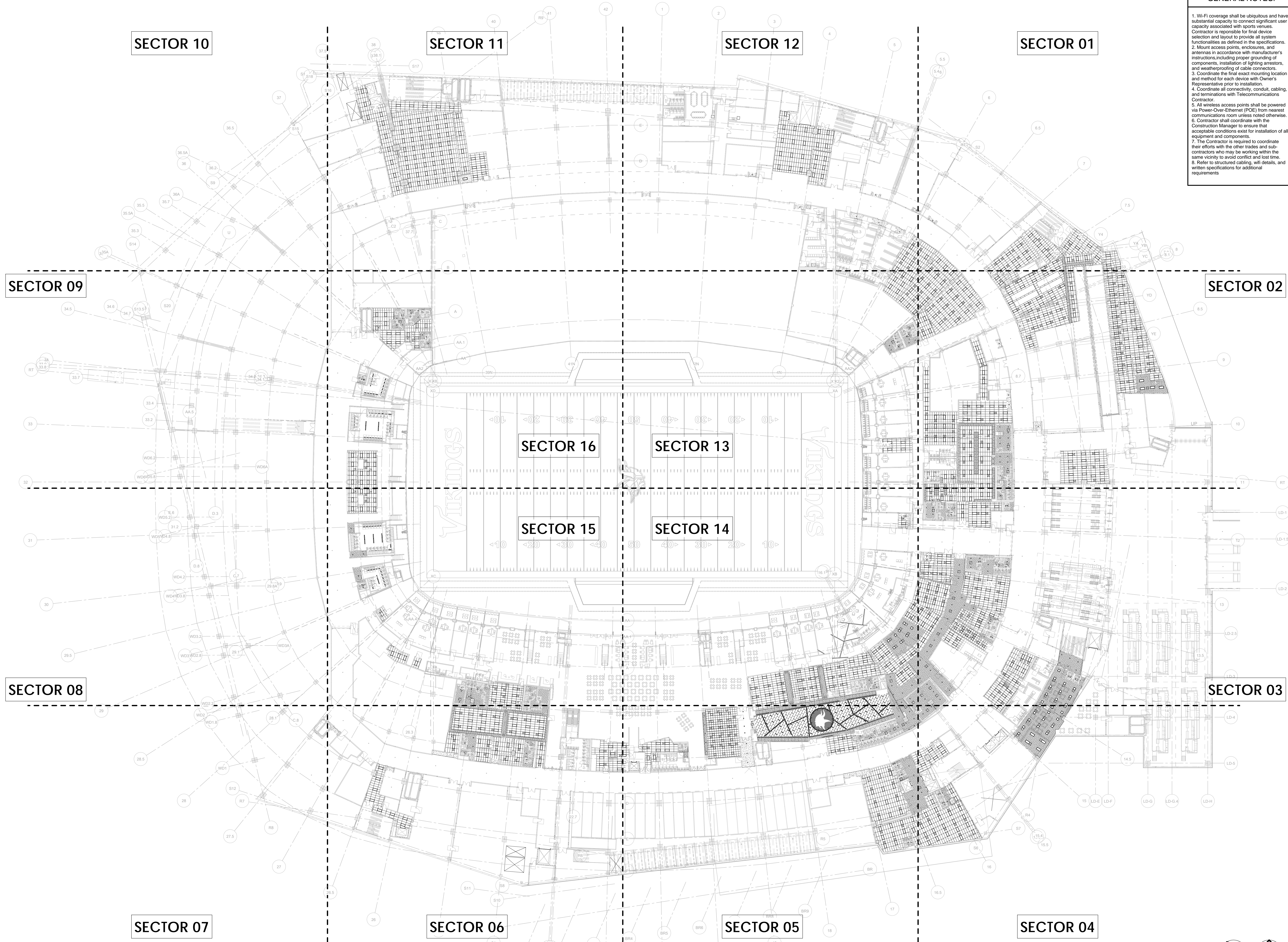


WAPs MOUNTED INSIDE OF WEST PLAZA SIGNAGE FOR WIRELESS TICKET READER LOCATIONS.

## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55416
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
8600 VIOMING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 WEST AVE. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80233
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HUNRY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
5320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

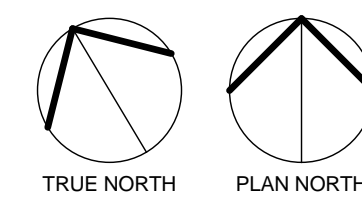
ISSUE  
CCD-060

SHEET TITLE  
01 EVENT LEVEL  
PLAN - WIFI

SHEET NO.  
TW-1.01

1 WIFI - 01 EVENT LEVEL PLAN  
1/32" = 1'-0"

NOTE: SEE SHEET TW 3.01 FOR ADDITIONAL INFORMATION.



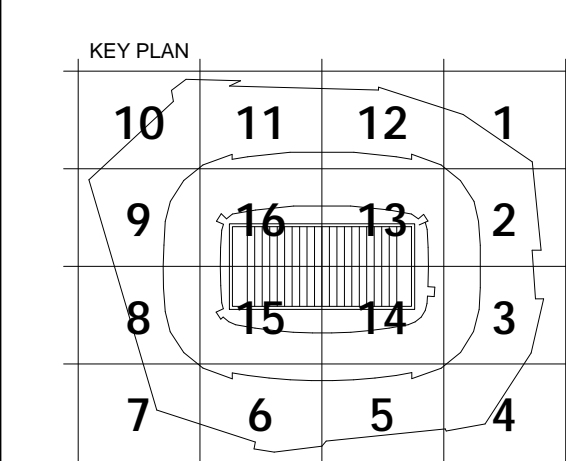
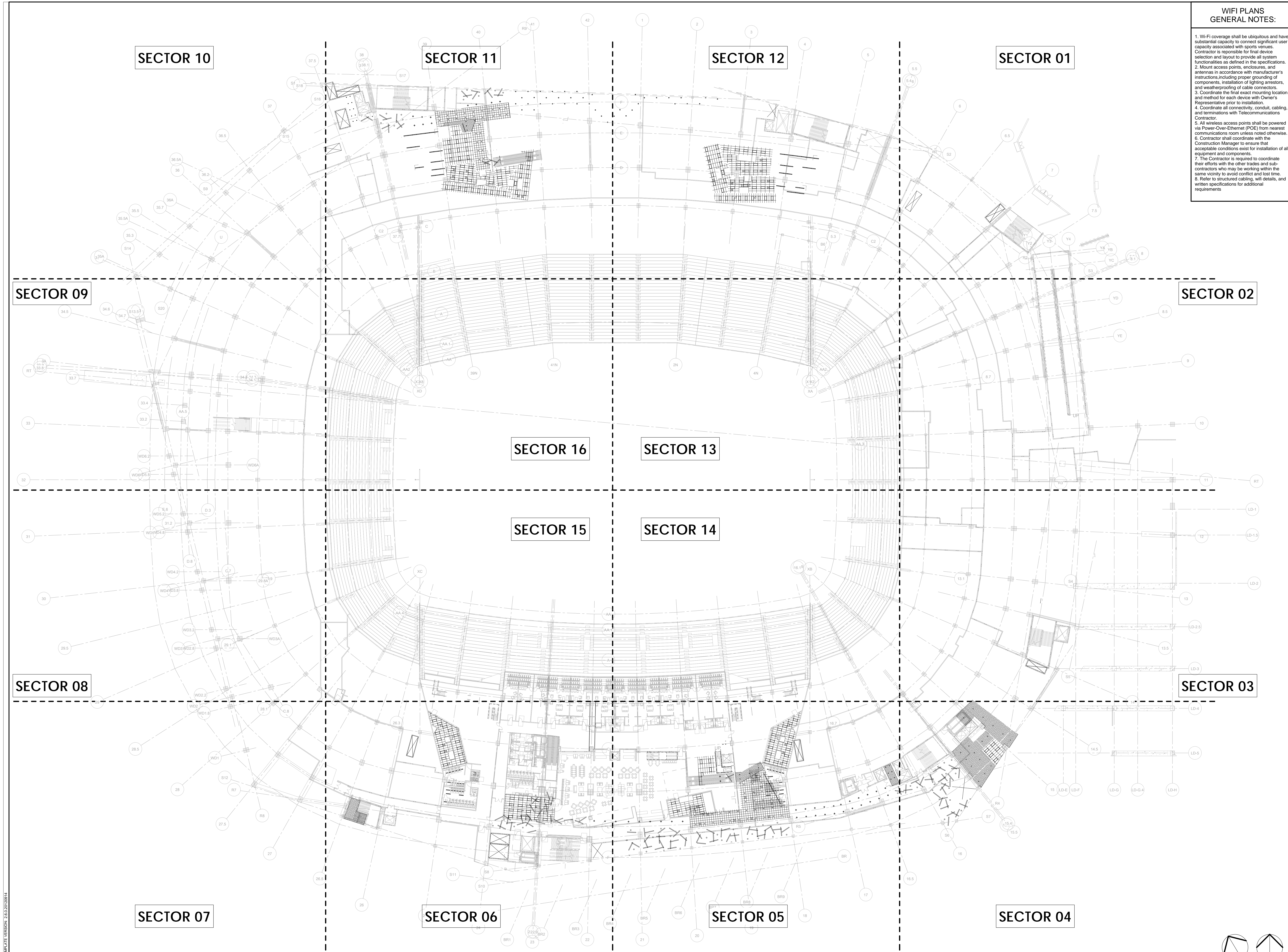
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## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
5600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR DIVISION GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHBERG CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

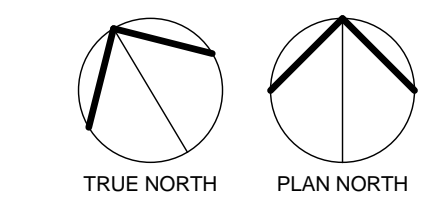
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
02 EXECUTIVE  
SUITE LEVEL PLAN  
- WIFI

SHEET NO.



① WIFI - 02 EXECUTIVE SUITE LEVEL PLAN  
1/32" = 1'-0"

## WIFI PLANS GENERAL NOTES:

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55434

**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55434

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIFTH AVE, SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**PLUMBING**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
6325 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAZA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNSYLVANIA AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2900 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROVANI, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B9

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1600, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

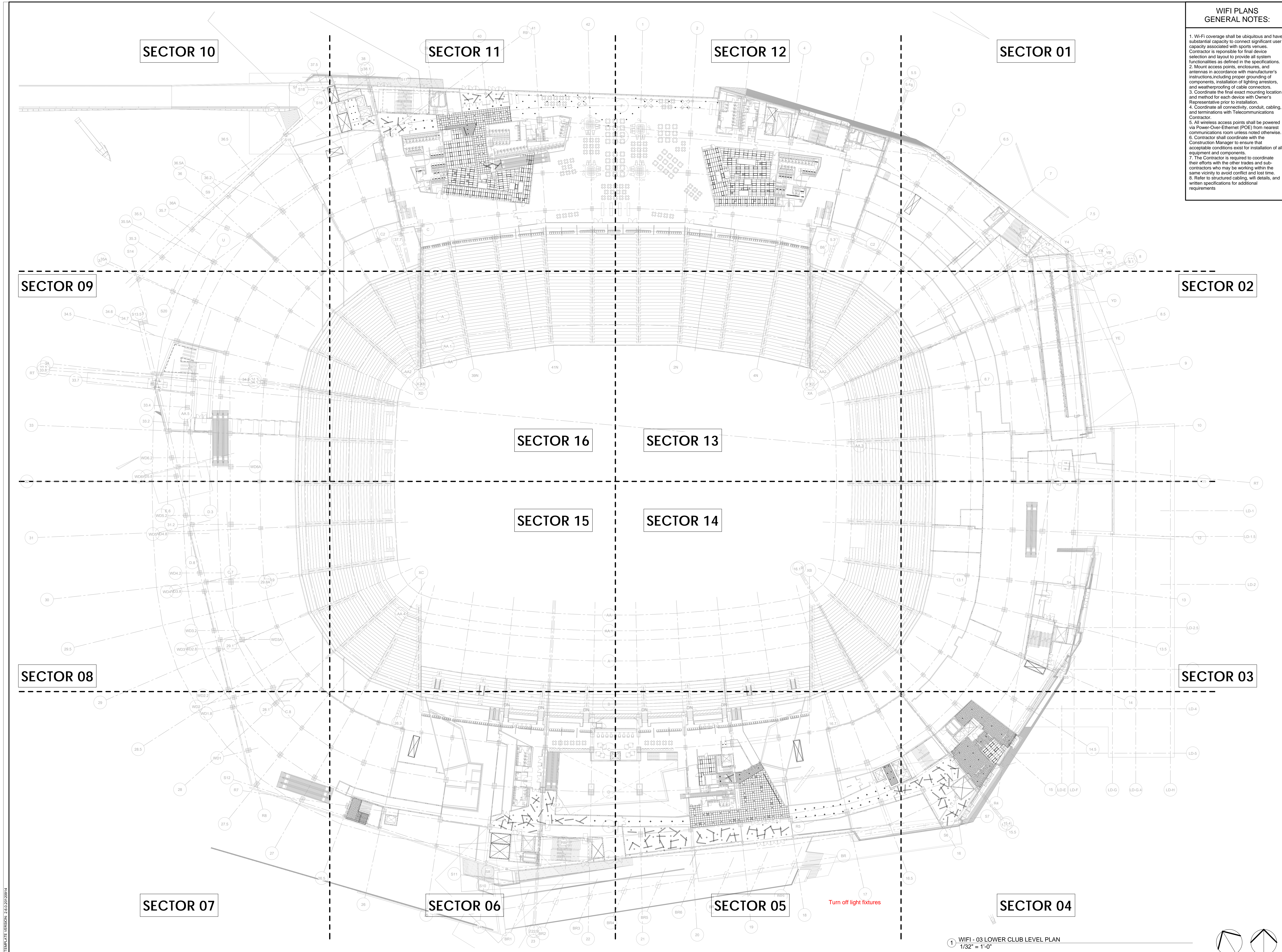
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

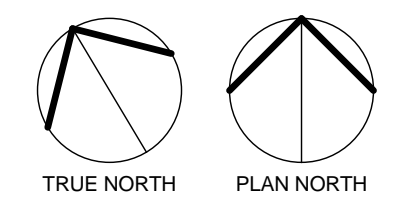
ISSUE  
CCD-060

SHEET TITLE  
03 LOWER CLUB LEVEL PLAN  
LEVEL PLAN - WIFI

SHEET NO.  
TW-1.03



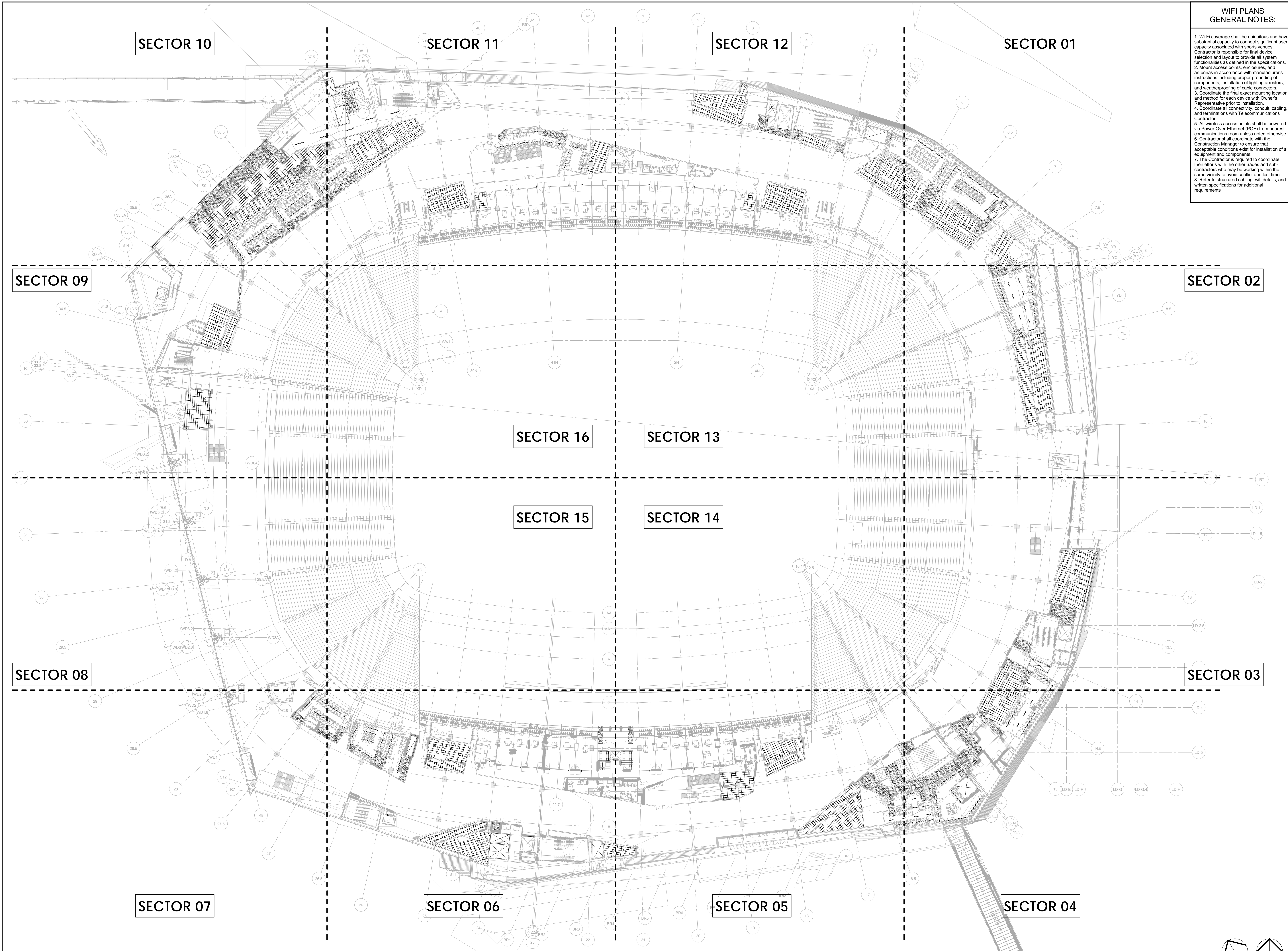
1 WIFI - 03 LOWER CLUB LEVEL PLAN  
1/32" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55434
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 WEST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
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- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
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ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
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6328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
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LERCH BATES, INC.  
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KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
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REVISION NO.	DESCRIPTION	DATE

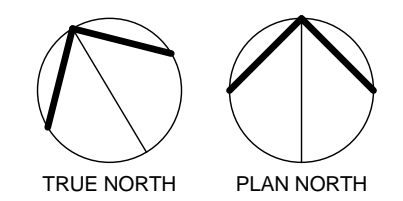
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SHEET TITLE  
04 MAIN  
CONCOURSE  
LEVEL PLAN - WIFI

SHEET NO.

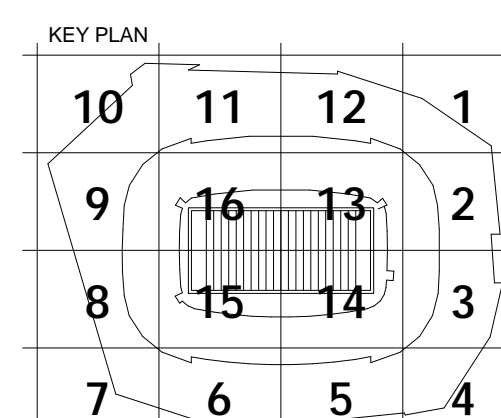
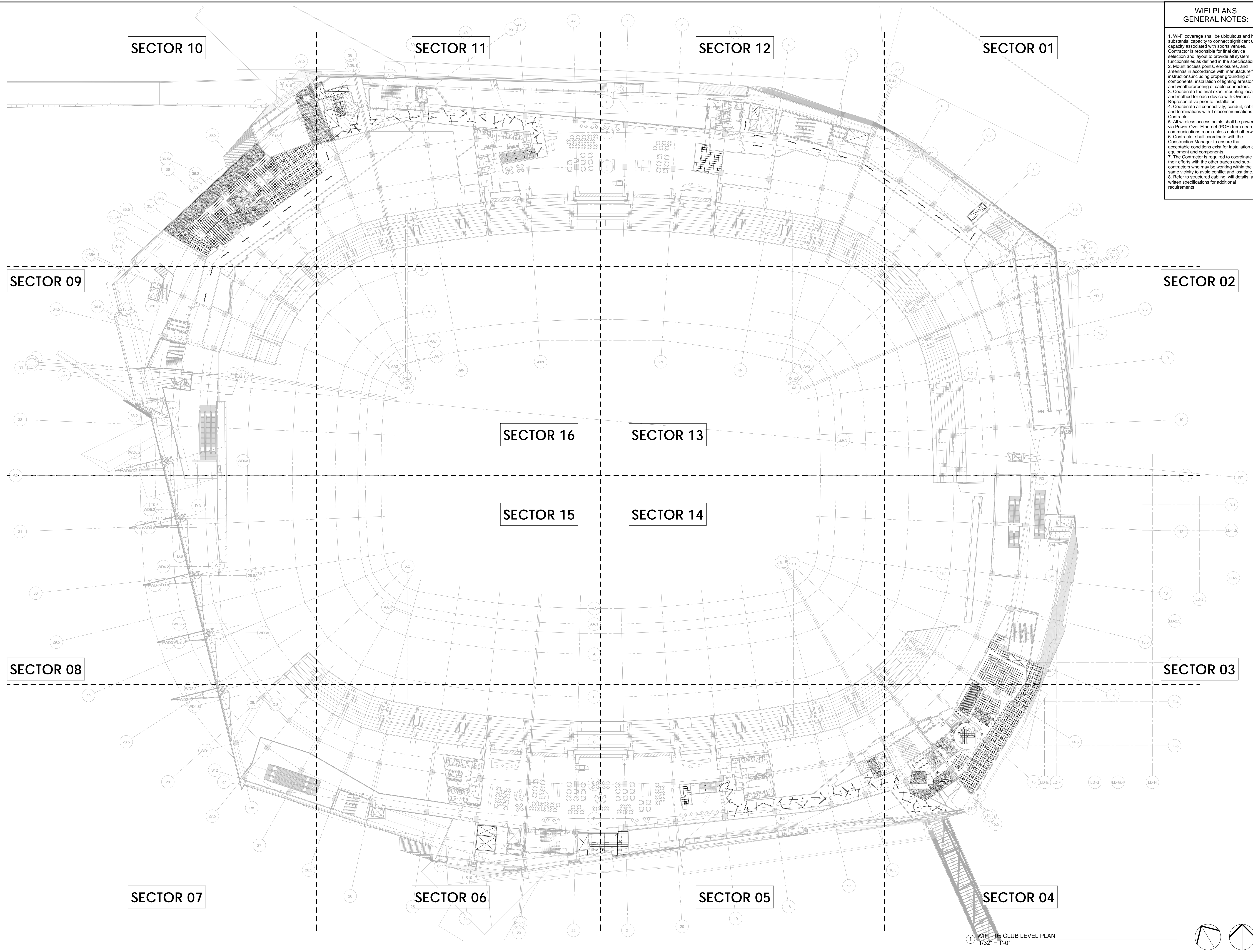


1 WIFI - 04 MAIN CONCOURSE LEVEL PLAN  
1/32" = 1'-0"

## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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7. The Contractor is required to coordinate their efforts with the other trades and sub-contractors who may be working within the same vicinity to avoid conflict and lost time.
8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVENUE, SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- PLUMBING**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAZA DEL REY, CA 90233
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

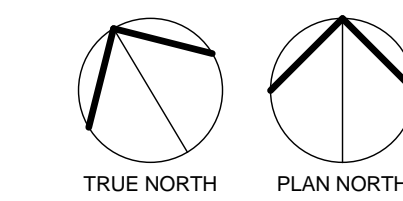
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
05 CLUB LEVEL  
PLAN - WIFI

SHEET NO.  
TW-1.05

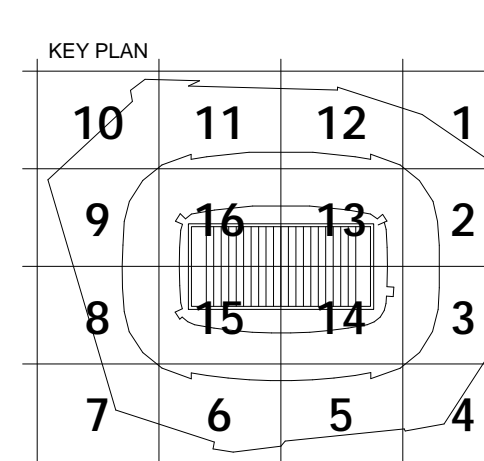
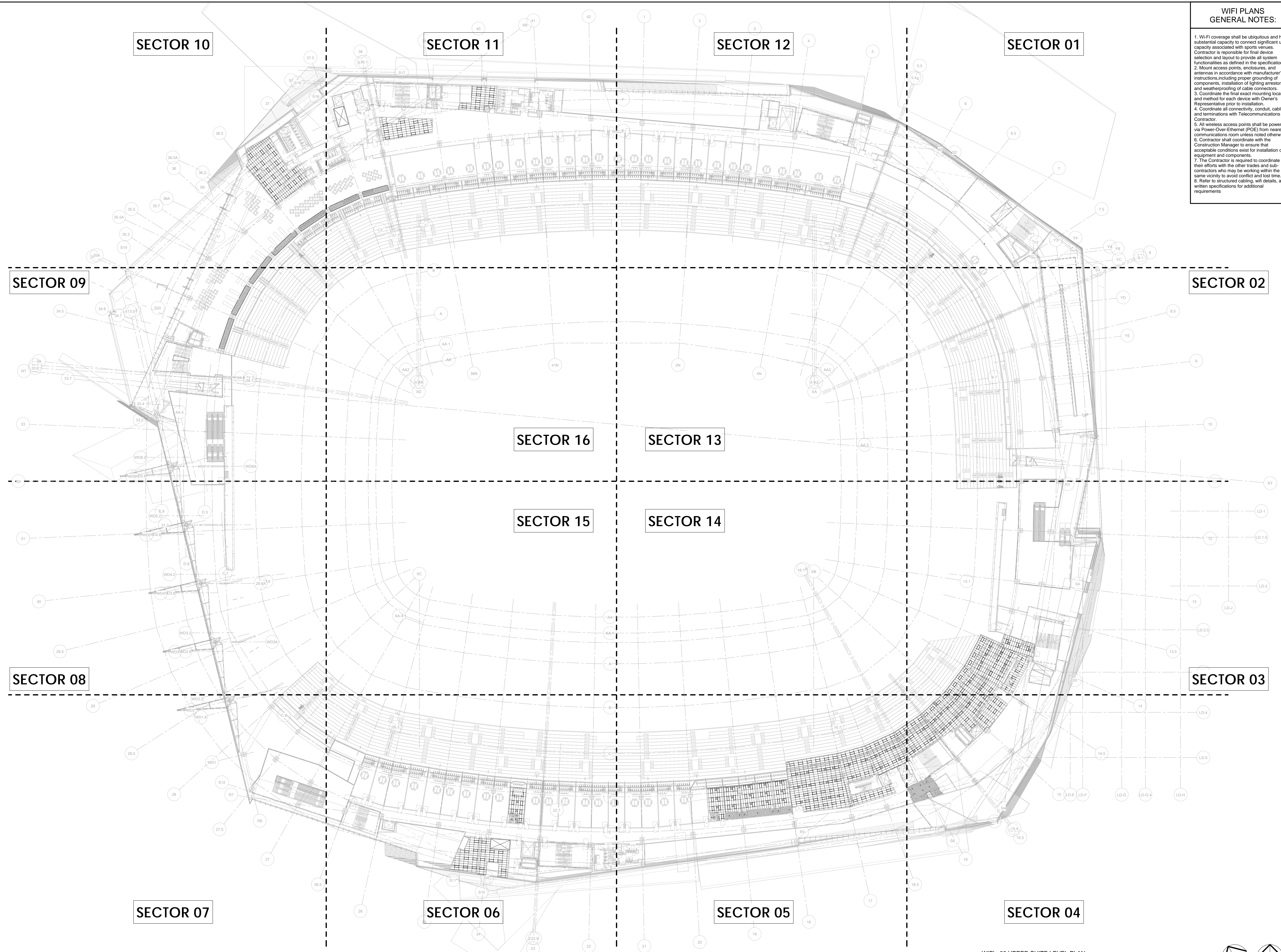
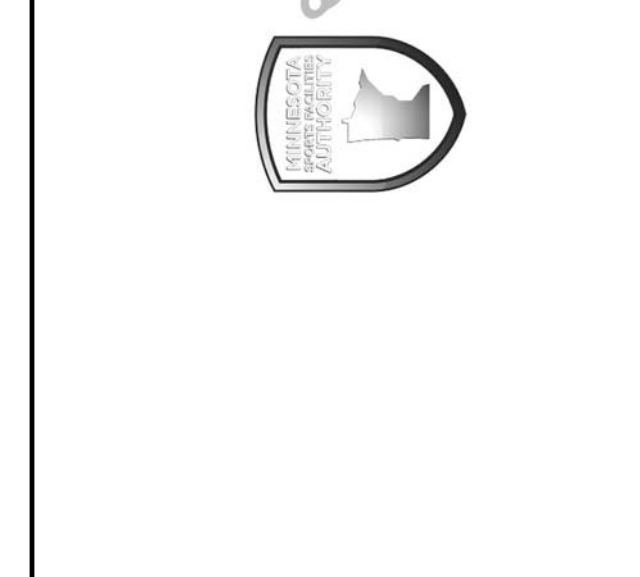


1. WIFI - 05 CLUB LEVEL PLAN  
1/32" = 1'-0"

## WIFI PLANS GENERAL NOTES:

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- OWNER**  
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- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIFTH AVE. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

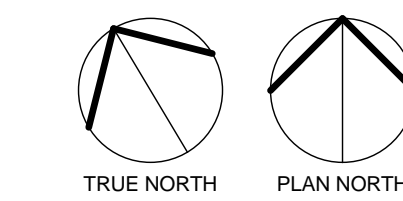
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
06 UPPER SUITE  
LEVEL PLAN - WIFI

SHEET NO.  
TW-1.06



1 WIFI - 06 UPPER SUITE LEVEL PLAN  
1/32" = 1'-0"

## WiFi PLANS GENERAL NOTES:

- Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues.
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**OWNER**  
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900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414

**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
5600 VIORG DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
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**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
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**MEP / TECHNOLOGY / LIGHTING**  
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10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**CIVIL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75281

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**HWY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
5328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAZA DEL REY, CA 90293

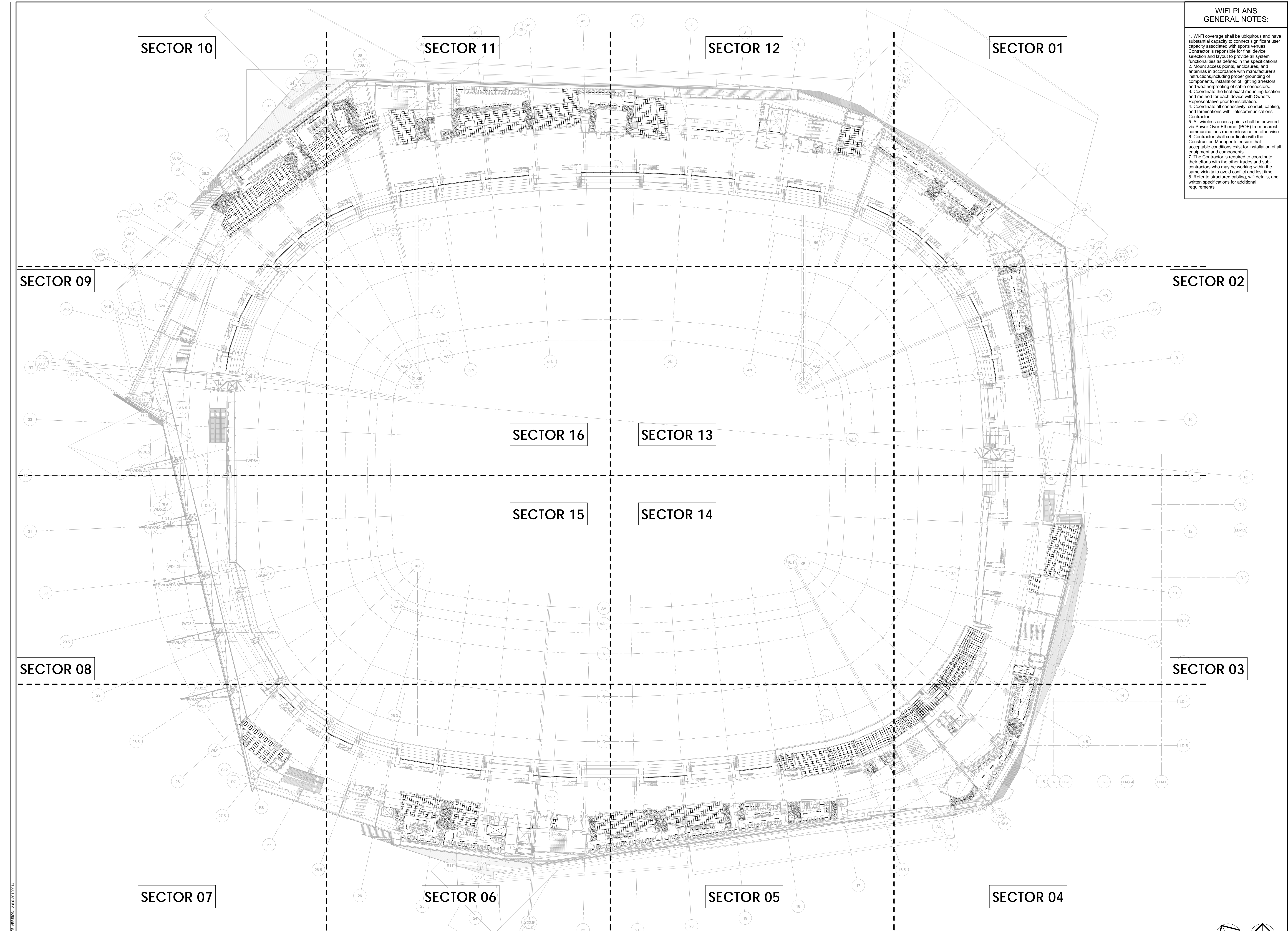
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHBERG CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND PERIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

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9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

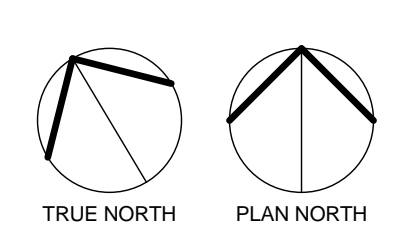
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
07 UPPER  
CONCOURSE  
LEVEL PLAN - WIFI

SHEET NO.

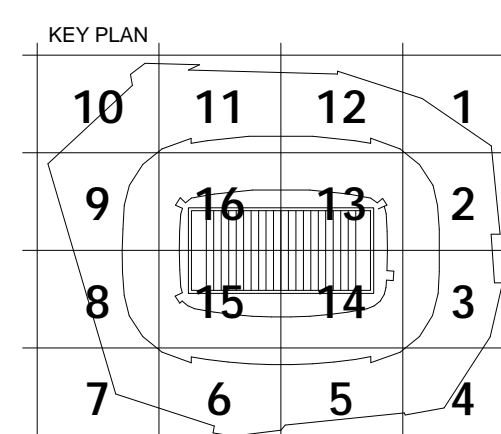
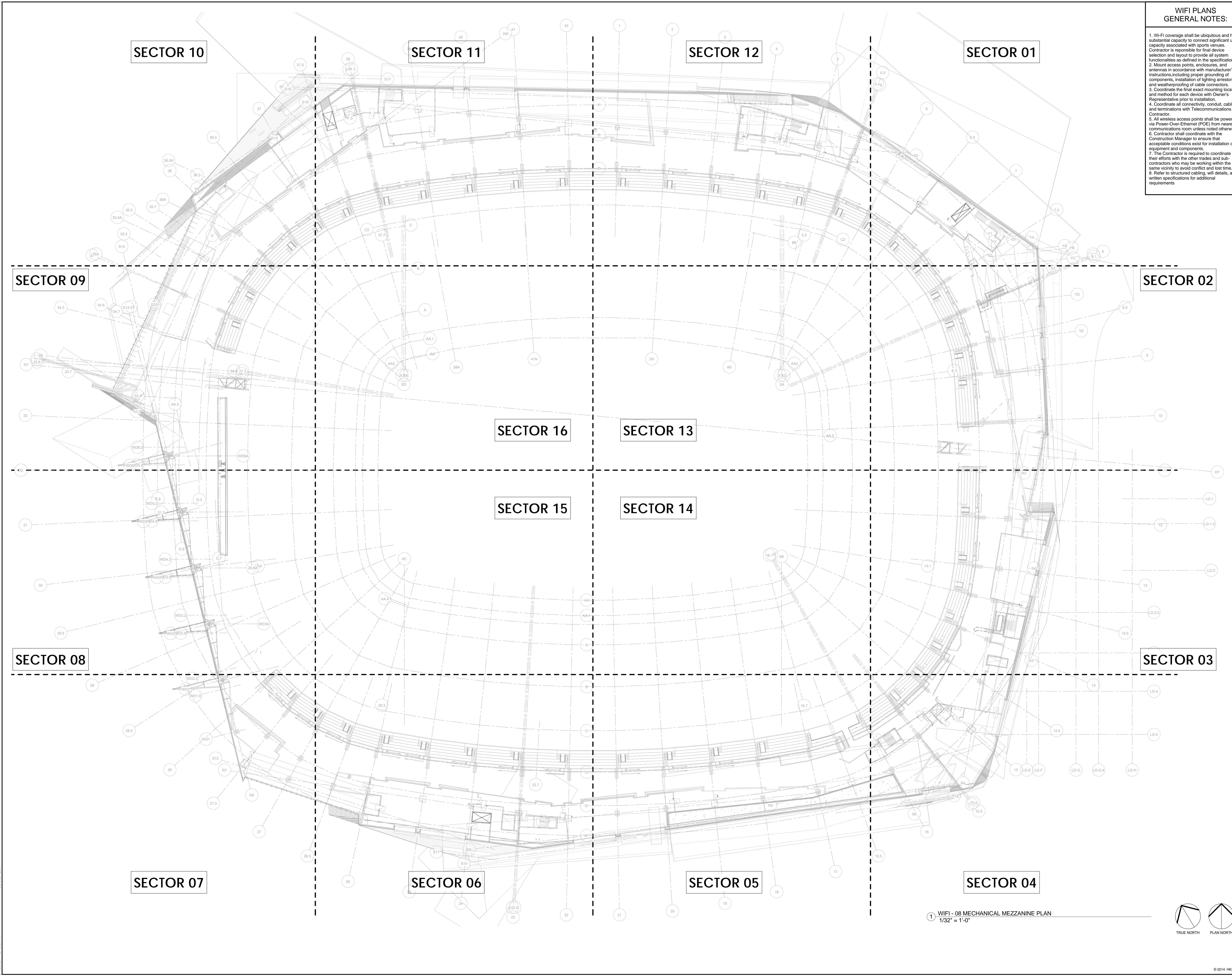


1 WIFI - 07 UPPER CONCOURSE LEVEL PLAN  
1/32" = 1'-0"

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- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 VIRONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIVE AVENUE, SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- PLUMBING**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14300 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
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ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

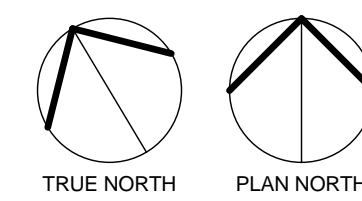
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
08 MECHANICAL  
MEZZANINE PLAN -  
WIFI

SHEET NO.

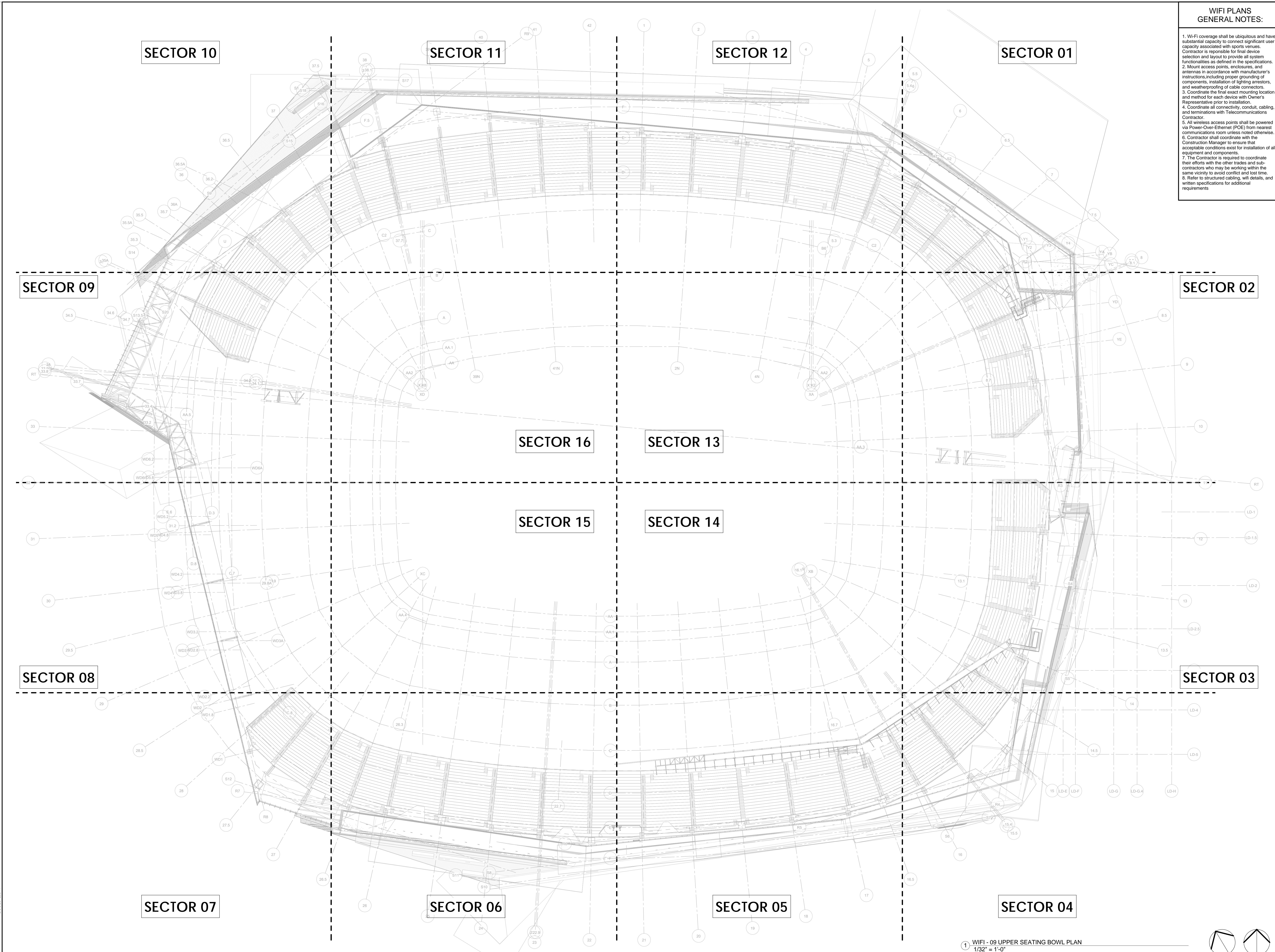


1 08 MECHANICAL MEZZANINE PLAN  
1/32" = 1'-0"

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- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIKING DR., EDEN PRAIRIE, MN 55344
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HKS, INC.  
1915 MARINEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIVE AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033
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- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
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- PLUMBING**  
HUNRY  
4801 SPRING VALLEY RD., DALLAS, TX 75244
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FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
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8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
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ED ROTHER CONSULTING, LLC  
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ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
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- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
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LORD & BATES, INC.  
8088 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

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9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

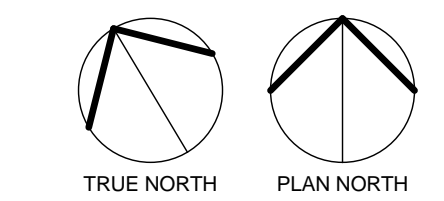
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
09 UPPER SEATING BOWL PLAN - WIFI

SHEET NO.



PLT DATE: 4/22/2014 12:45:36 AM TEMPLATE VERSION: 21032912914

1 WIFI - 09 UPPER SEATING BOWL PLAN  
1/32" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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5600 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
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**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
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**TECHNOLOGY MANAGEMENT CORPORATION**  
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**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
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**HUNY**  
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FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
6328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

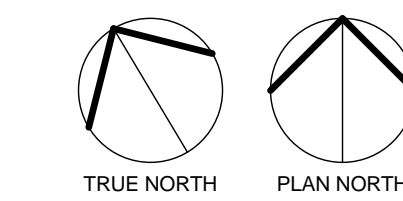
ISSUE  
**CCD-060**

SHEET TITLE  
**EVENT LEVEL WIFI  
- SECTOR 01**

SHEET NO.

**TW-2.0101**

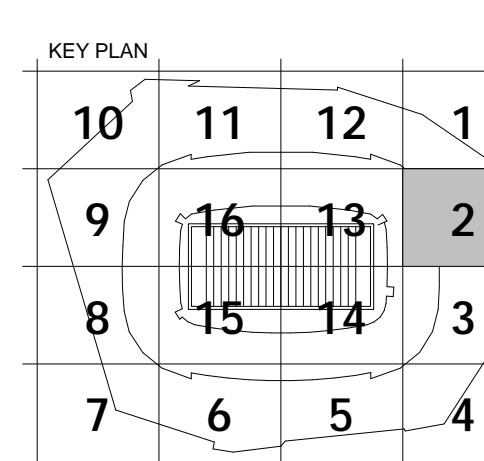
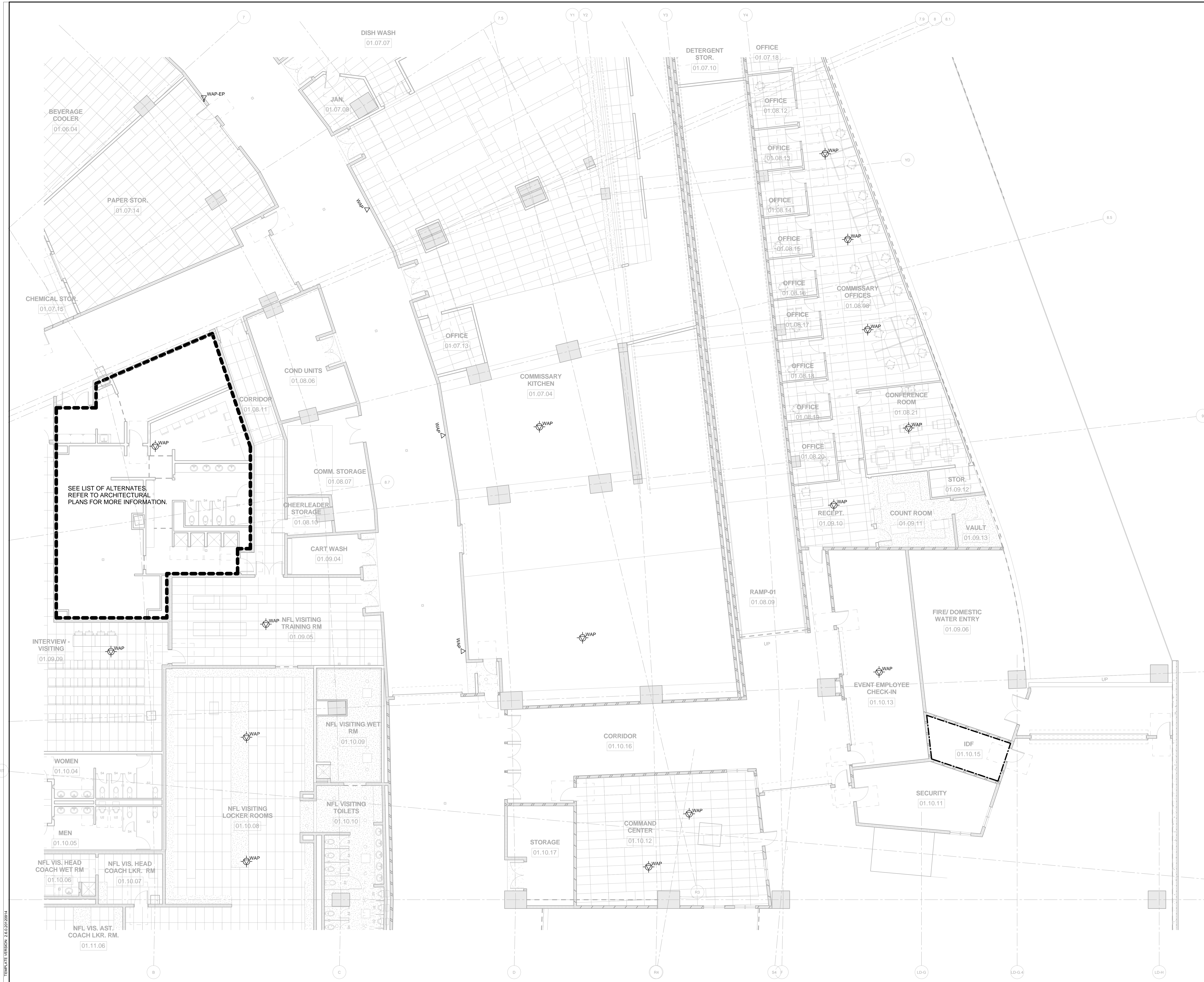
1 EVENT LEVEL PLAN WIFI - SECTOR 01  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROVAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

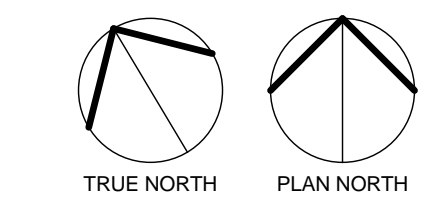
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
EVENT LEVEL WIFI  
- SECTOR 02

SHEET NO.  
TW-2.0102



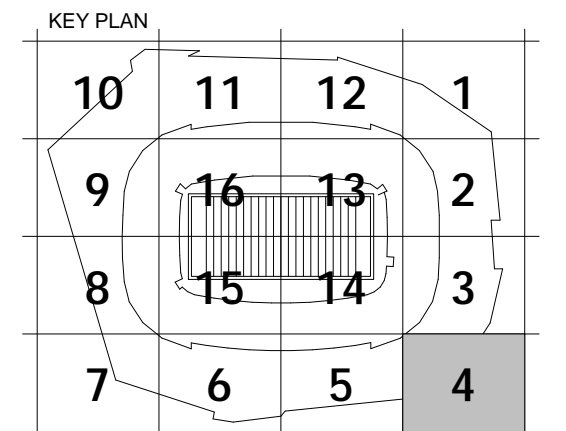
1 EVENT LEVEL PLAN WIFI - SECTOR 02  
1/8" = 1'-0"



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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIVE AVENUE, SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

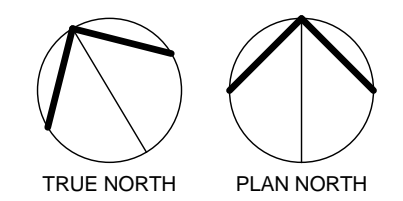
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
EVENT LEVEL WIFI  
- SECTOR 04

SHEET NO.  
TW-2.0104

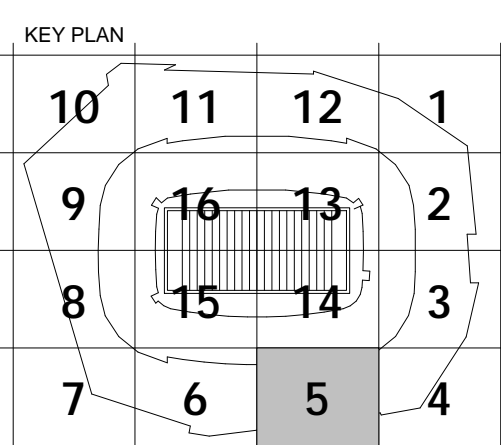
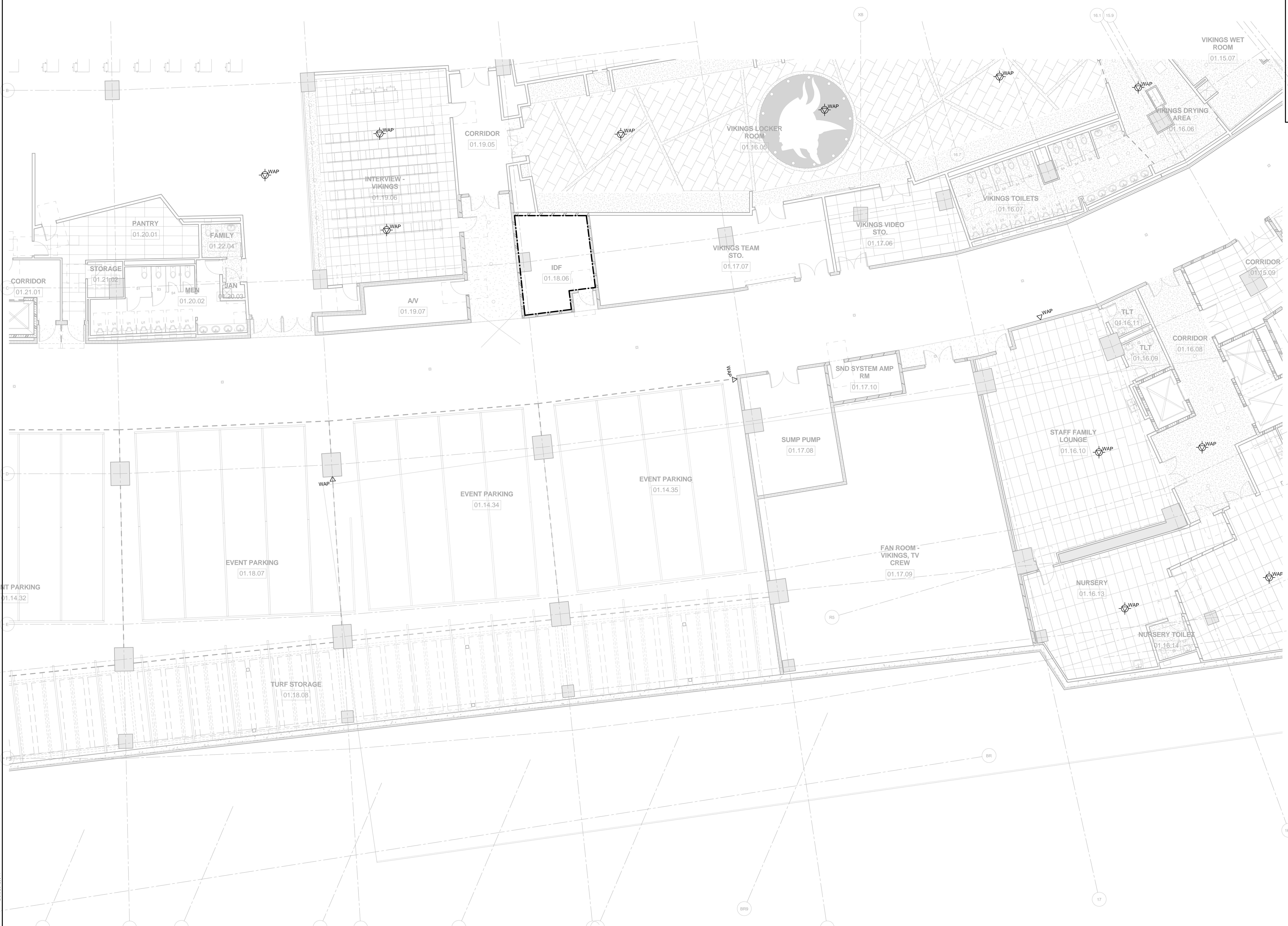
1 EVENT LEVEL PLAN WIFI - SECTOR 04  
1/8" = 1'-0"



### WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6000 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIVE AVE. N, SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- MECHANICAL**  
HUNAY  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROETHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND ROWE, INC.  
650 WOODLAWN RD., WY., QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

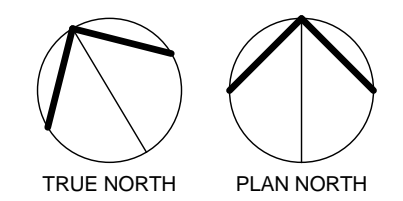
DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**EVENT LEVEL WIFI - SECTOR 05**

SHEET NO.  
**TW-2.0105**

**1 EVENT LEVEL PLAN WIFI - SECTOR 05**  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 WEST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- CIVIL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- PLUMBING**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLATA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., W. GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

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9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
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DATE  
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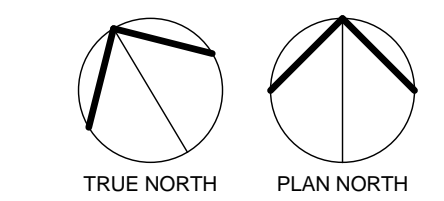
ISSUE  
CCD-060

SHEET TITLE  
EVENT LEVEL WIFI  
- SECTOR 06

SHEET NO.

TW-2.0106

1 EVENT LEVEL PLAN WIFI - SECTOR 06  
1/8" = 1'-0"





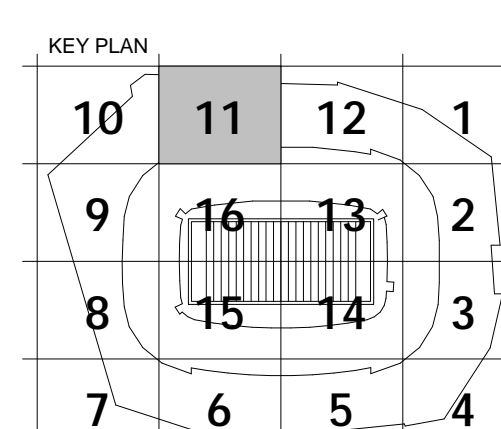




**WIFI PLANS  
GENERAL NOTES:**

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
5600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55424
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/H/W**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
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- ADA CONSULTANT**  
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2960 MISSOURI BELLEVEUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
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600 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 8B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



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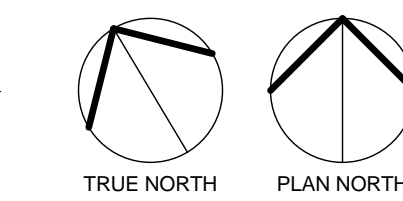
SHEET TITLE  
**EVENT LEVEL WIFI  
- SECTOR 11**

SHEET NO.

**TW-2.0111**



**1 EVENT LEVEL PLAN WIFI - SECTOR 11**  
1/8" = 1'-0"

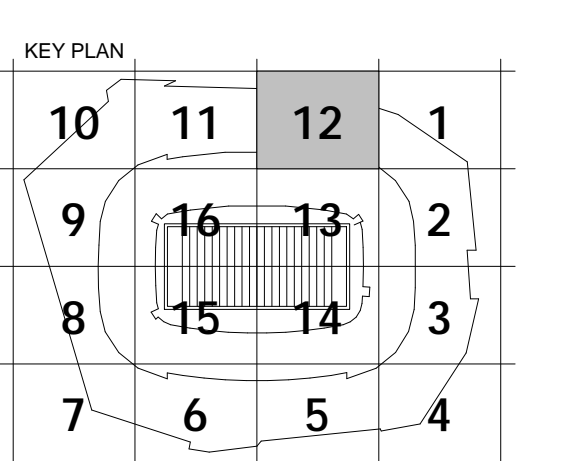


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WIFI PLANS  
GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OHLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10508 WRIGHT BROTHERS DR., ADDISON, TX 75001
- PLUMBING**  
H.W.H.W.  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHBERG CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND ROWE, INC.  
650 WOODLAWN RD., W. GLEN PH. ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

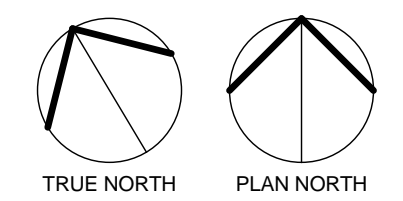
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
EVENT LEVEL WIFI  
- SECTOR 12

SHEET NO.  
TW-2.0112

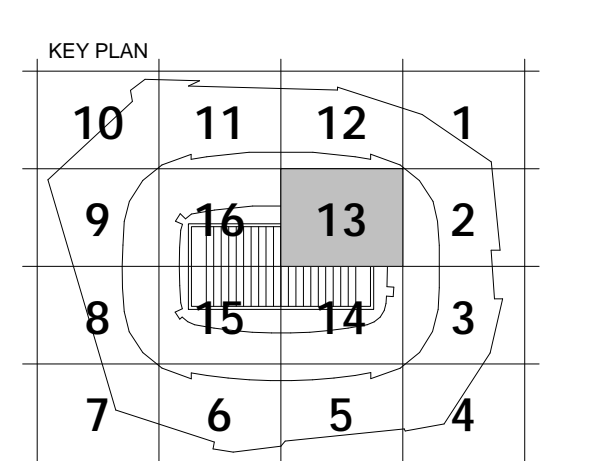
1 EVENT LEVEL PLAN WIFI - SECTOR 12  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80233
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55424
- LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

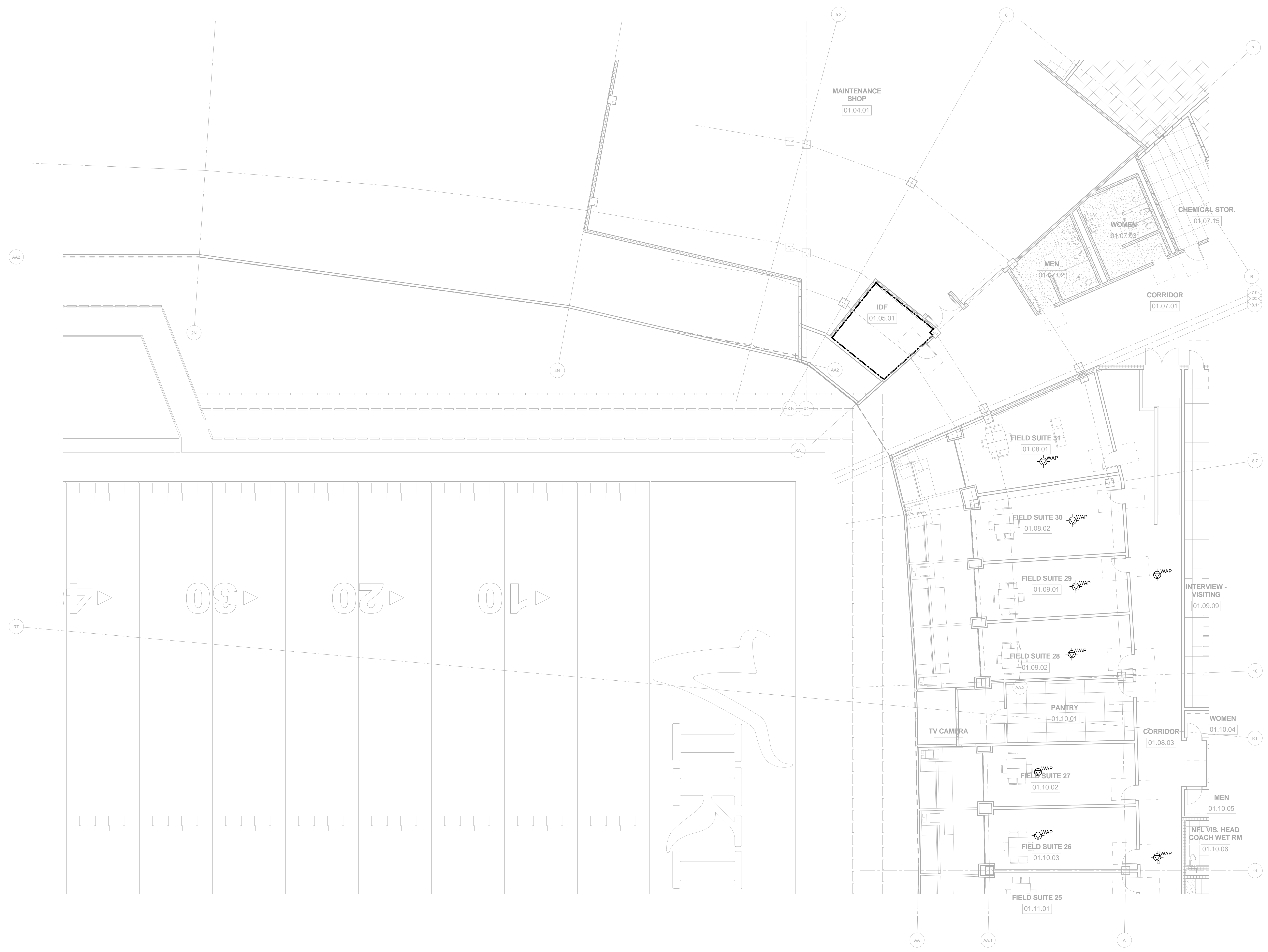
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

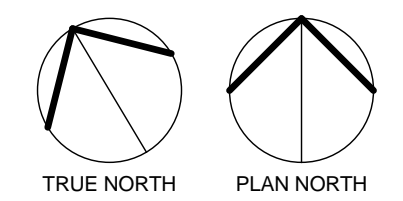
ISSUE  
CCD-060

SHEET TITLE  
EVENT LEVEL WIFI  
- SECTOR 13

SHEET NO.  
TW-2.0113



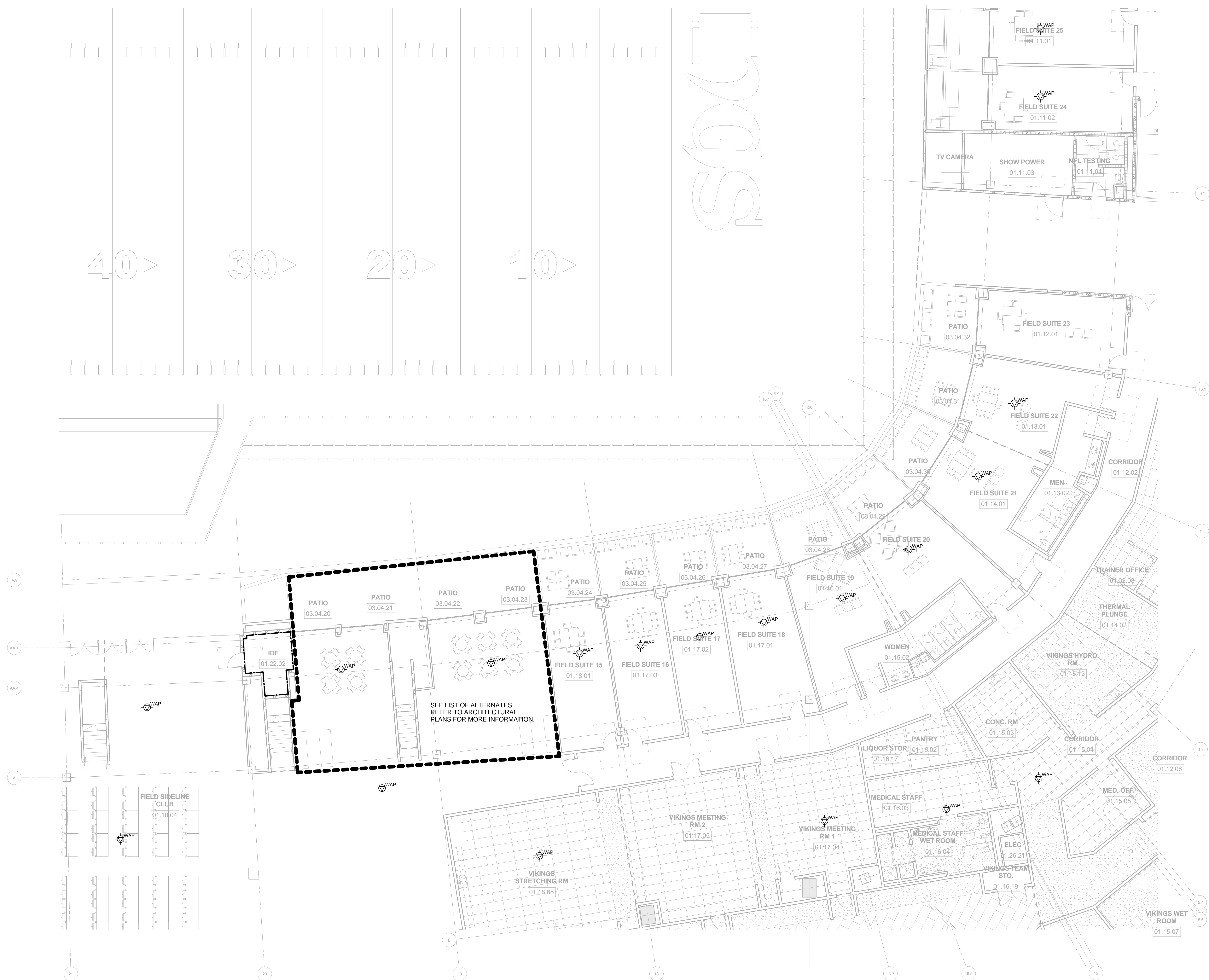
1 EVENT LEVEL PLAN WIFI - SECTOR 13  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
8500 VIKING DR., EDEN PRAIRIE, MN 55434
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- M/E/P / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434
- LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
1508 WRIGHT BROTHERS DR., ADDISON, TX 75001
- PLUMBING**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LORD & BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



SEE LIST OF ALTERNATES.  
REFER TO ARCHITECTURAL  
PLANS FOR MORE INFORMATION.

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

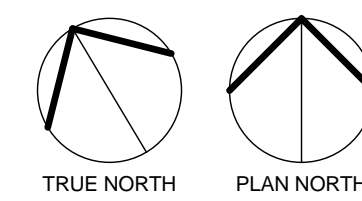
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
EVENT LEVEL WIFI  
- SECTOR 14

SHEET NO.  
TW-2.0114

1 EVENT LEVEL PLAN WIFI - SECTOR 14  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 WEST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- CIVIL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- LANDSCAPE ARCHITECT**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- AUDIO VISUAL CONSULTANTS**  
ACUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



SEE LIST OF ALTERNATES.  
REFER TO ARCHITECTURAL  
PLANS FOR MORE INFORMATION.

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KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

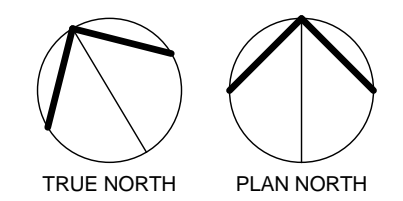
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
EVENT LEVEL WIFI  
- SECTOR 15

SHEET NO.  
TW-2.0115

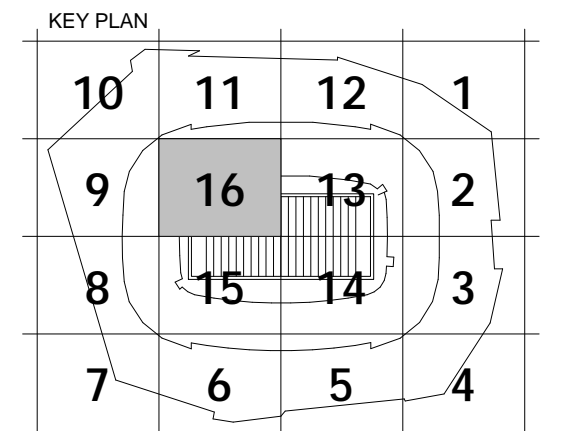
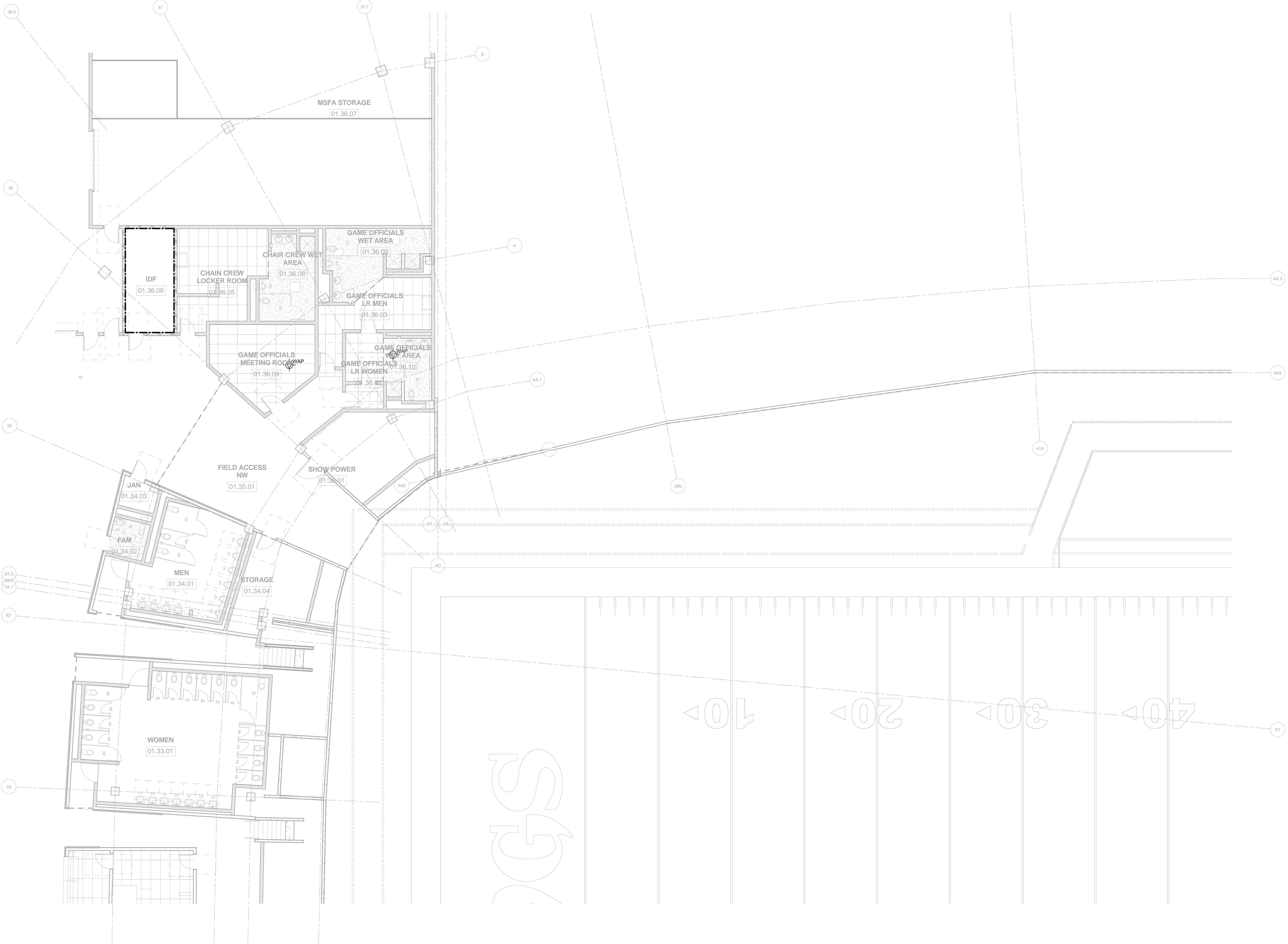
1 EVENT LEVEL PLAN WIFI - SECTOR 15  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5500 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- H/W/HV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHBERG CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND RYAN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

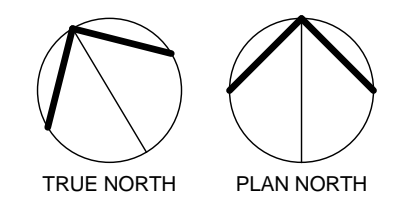
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
EVENT LEVEL WIFI  
- SECTOR 16

SHEET NO.  
TW-2.0116

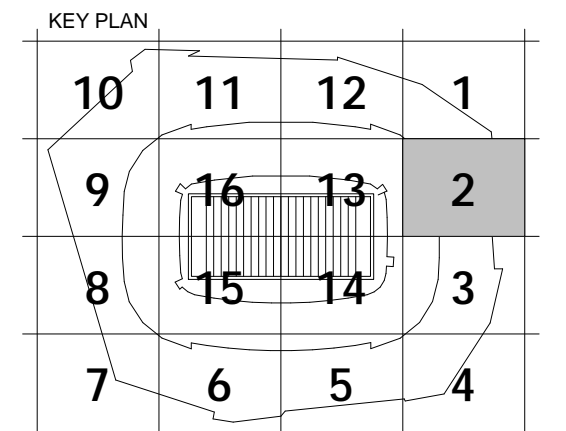
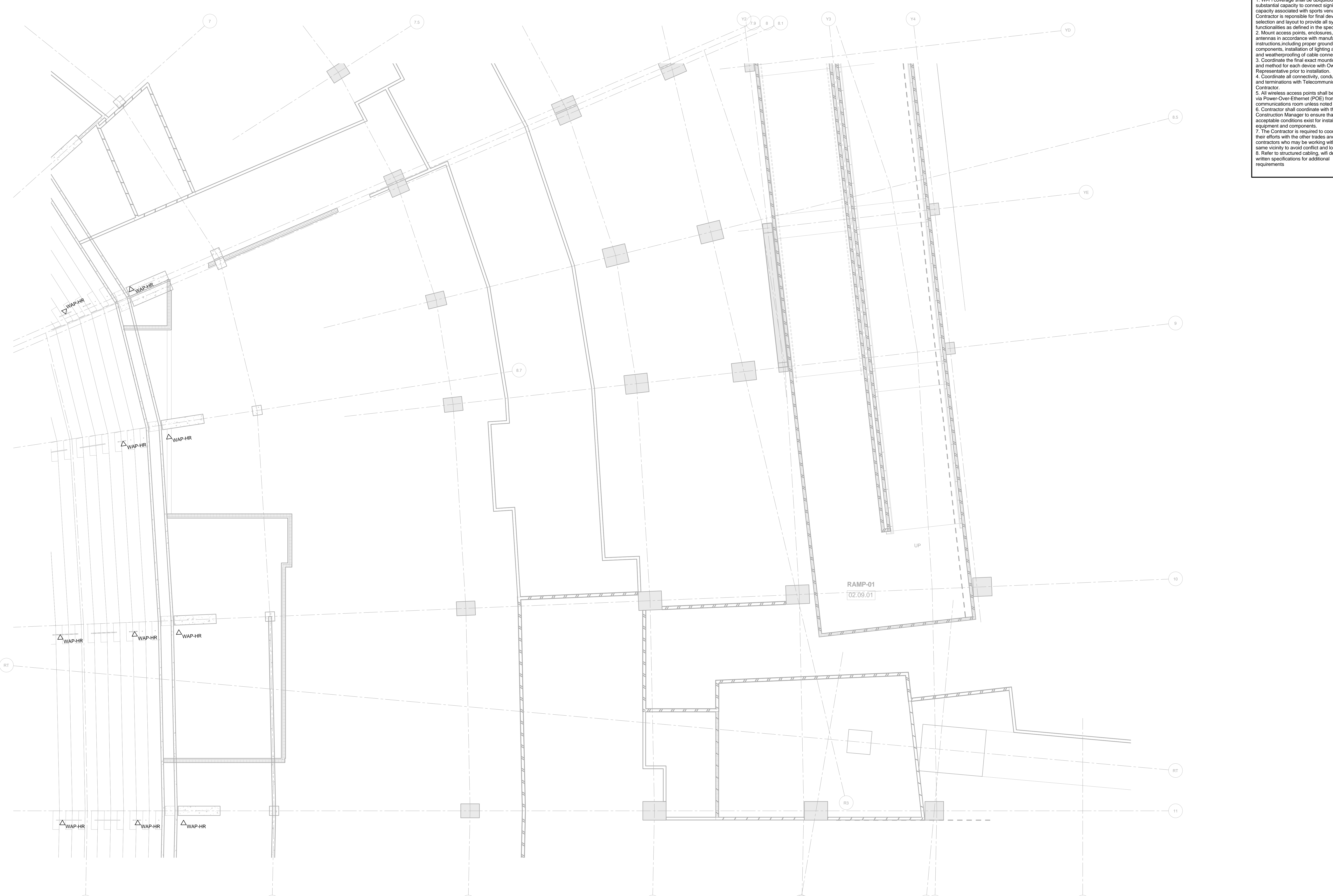
① EVENT LEVEL PLAN WIFI - SECTOR 16  
1/8" = 1'-0"



WIFI PLANS  
GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
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TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
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- LANDSCAPE ARCHITECT**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- AUDIO VISUAL CONSULTANTS**  
ACUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHBERG CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 8B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

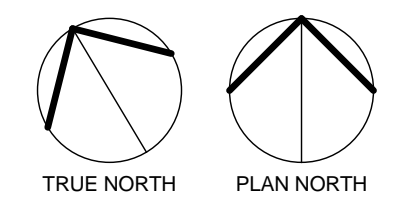
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
EXECUTIVE  
SUITES WIFI -  
SECTOR 02

SHEET NO.

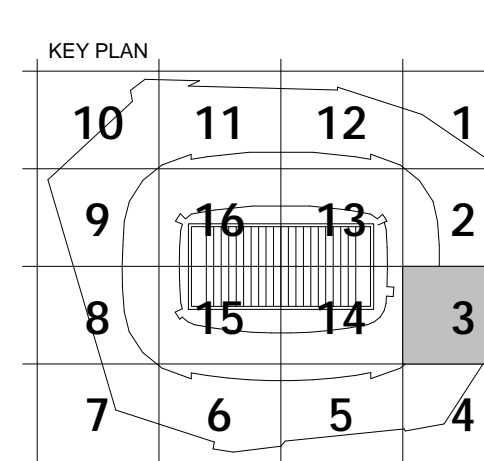
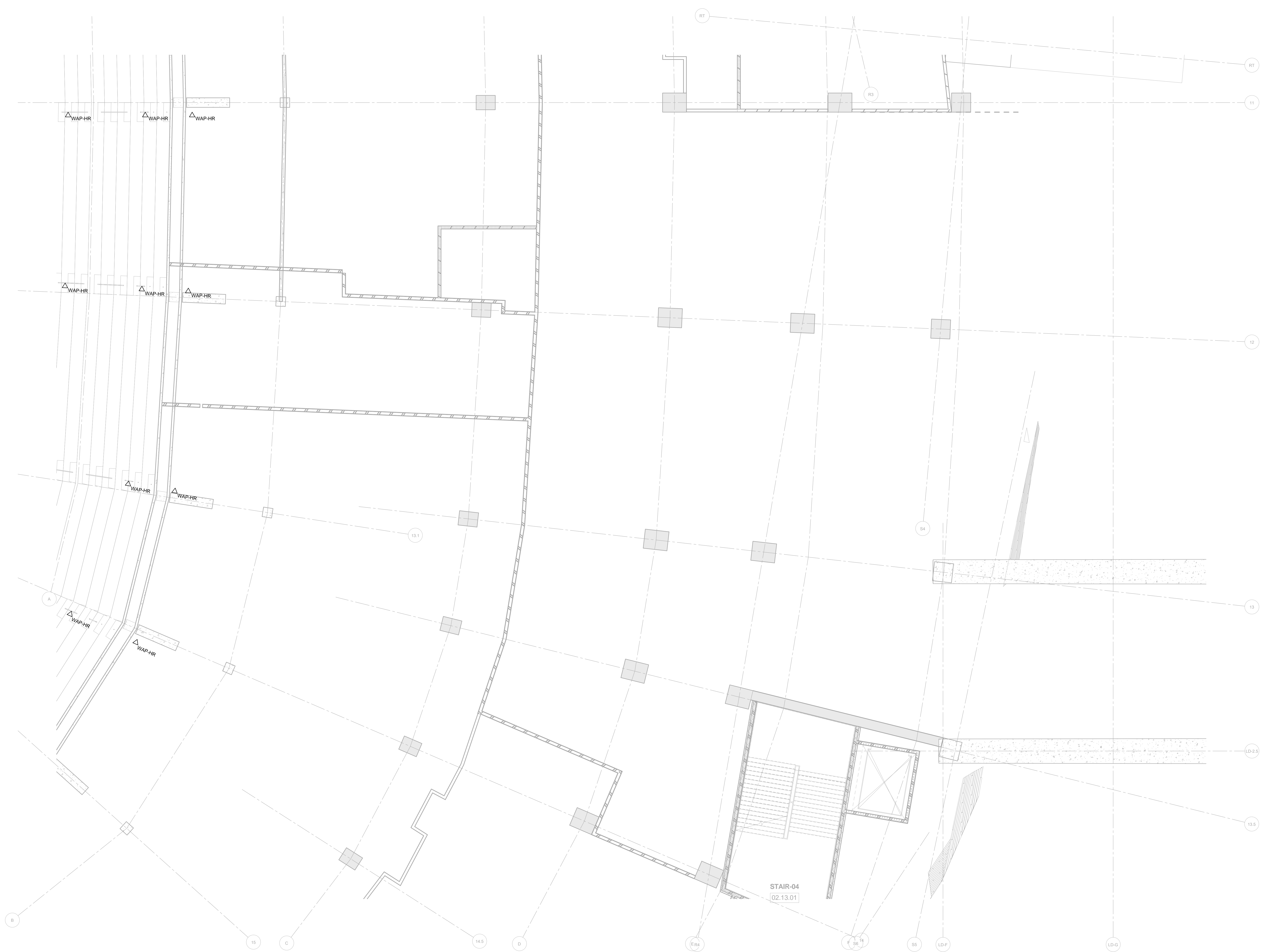


1 EXECUTIVE SUITES WIFI - SECTOR 02  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

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6. Contractor shall coordinate with the Construction Manager to ensure that acceptable conditions exist for installation of all equipment and components.
7. The Contractor is required to coordinate their efforts with the other trades and sub-contractors who may be working within the same vicinity to avoid conflict and lost time.
8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
8600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

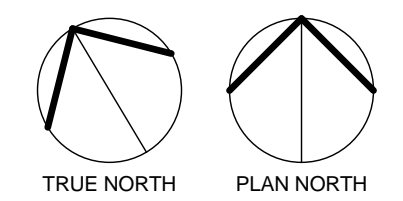
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
EXECUTIVE  
SUITES WIFI -  
SECTOR 03

SHEET NO.



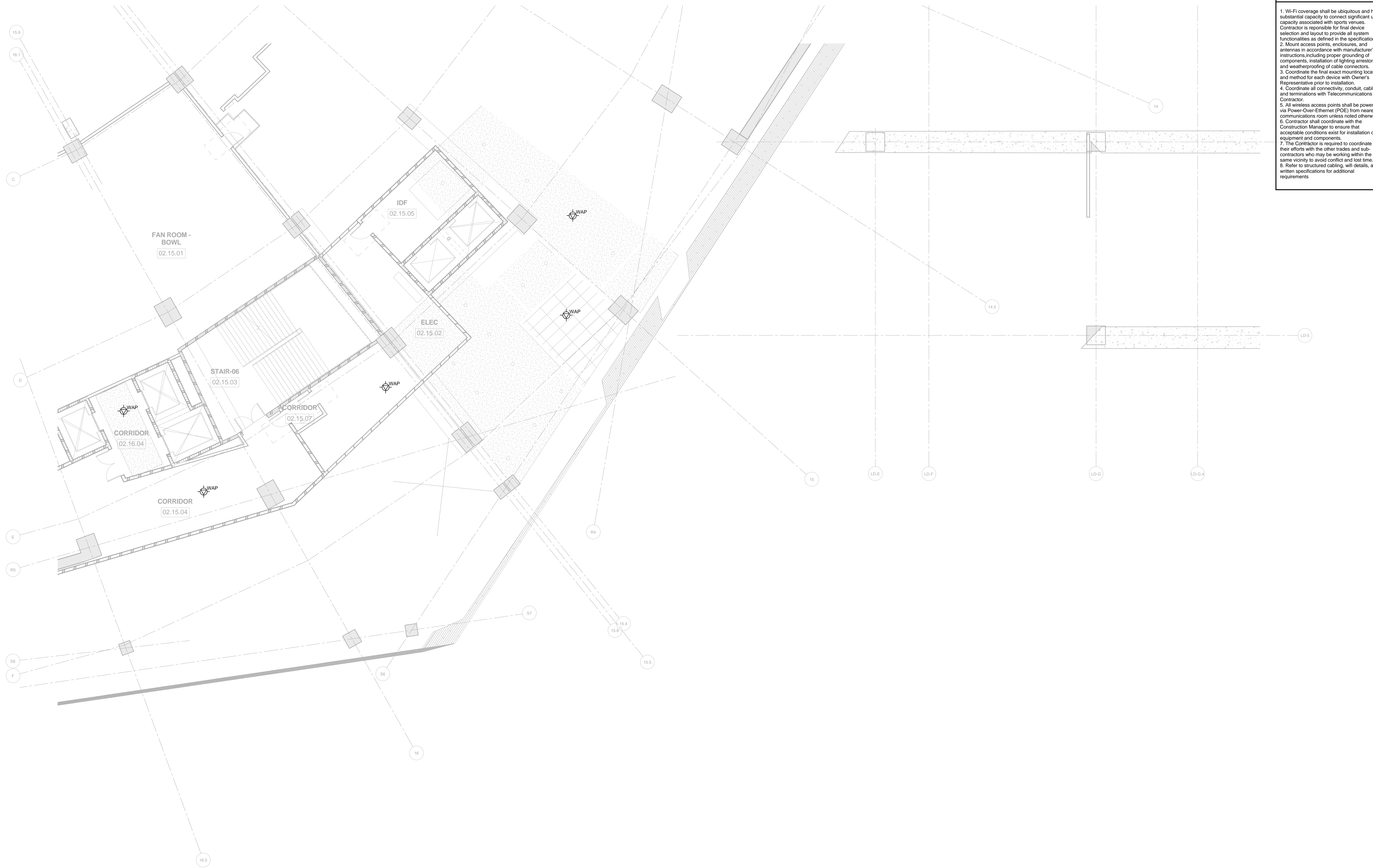
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1/8" = 1'-0"



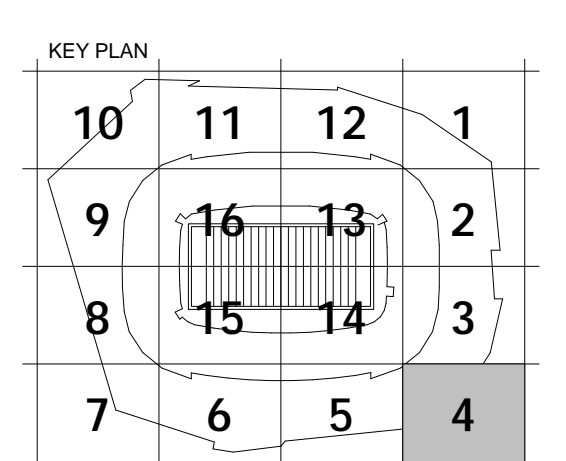
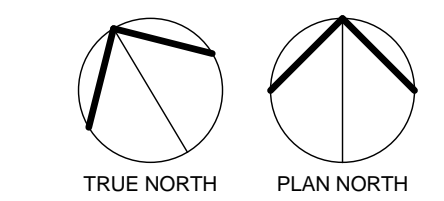
**WIFI PLANS  
GENERAL NOTES:**

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HUNY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9229 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



1 EXECUTIVE SUITES WIFI - SECTOR 04  
1/8" = 1'-0"



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
EXECUTIVE  
SUITES WIFI -  
SECTOR 04

SHEET NO.

## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55434
- OWNER**  
MINNESOTA WINGS FOOTBALL, LLC  
6500 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIVE AVENUE, SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



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8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

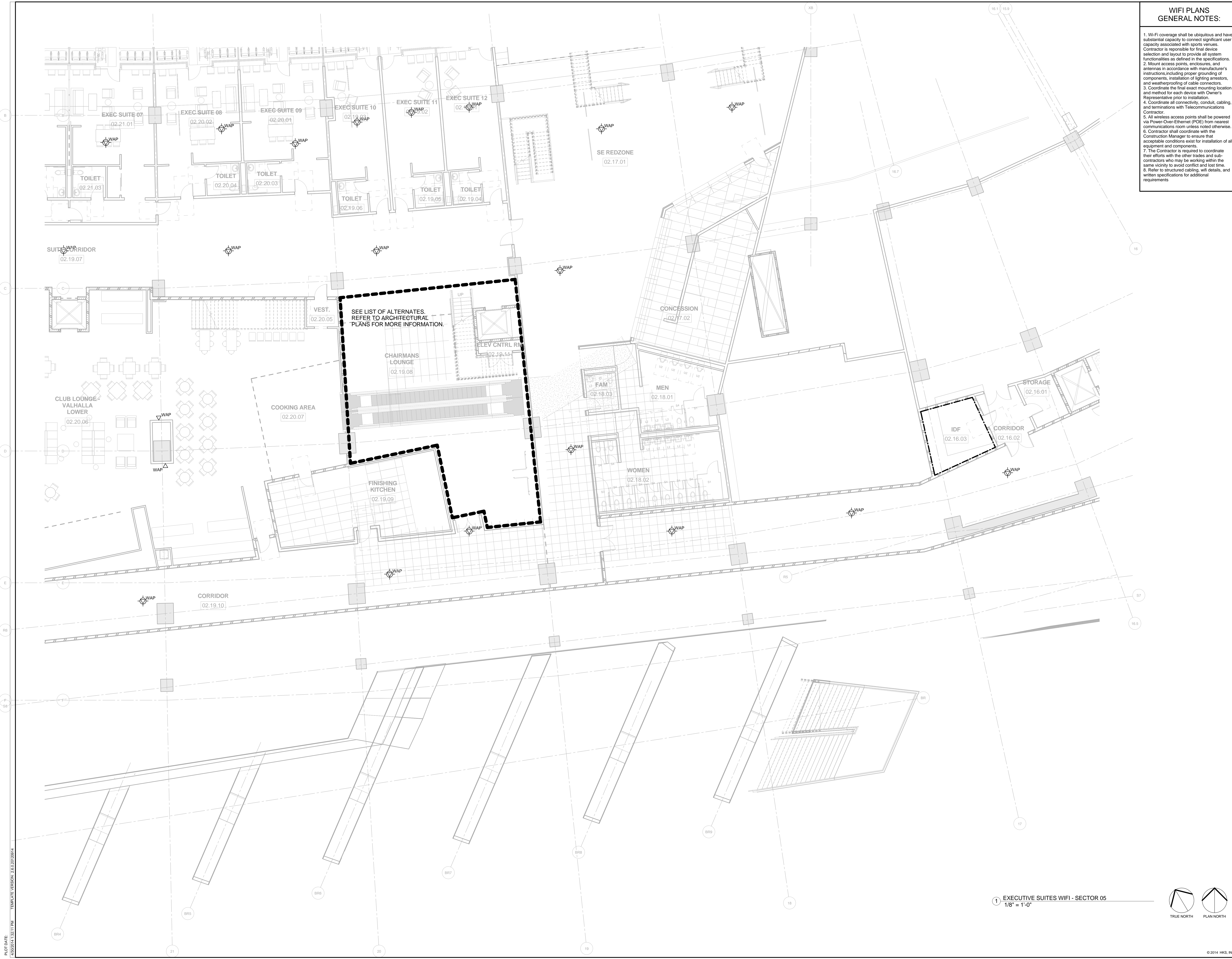
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
EXECUTIVE  
SUITES WIFI -  
SECTOR 05

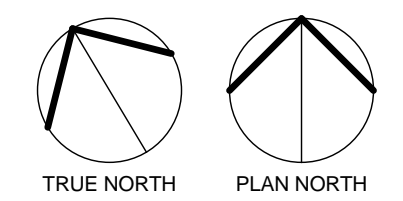
SHEET NO.

TW-2.0205



SEE LIST OF ALTERNATES.  
REFER TO ARCHITECTURAL  
PLANS FOR MORE INFORMATION.

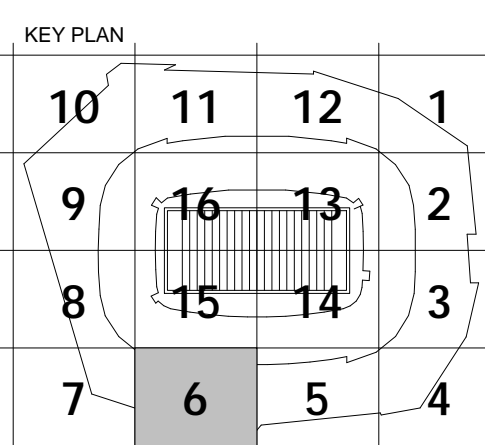
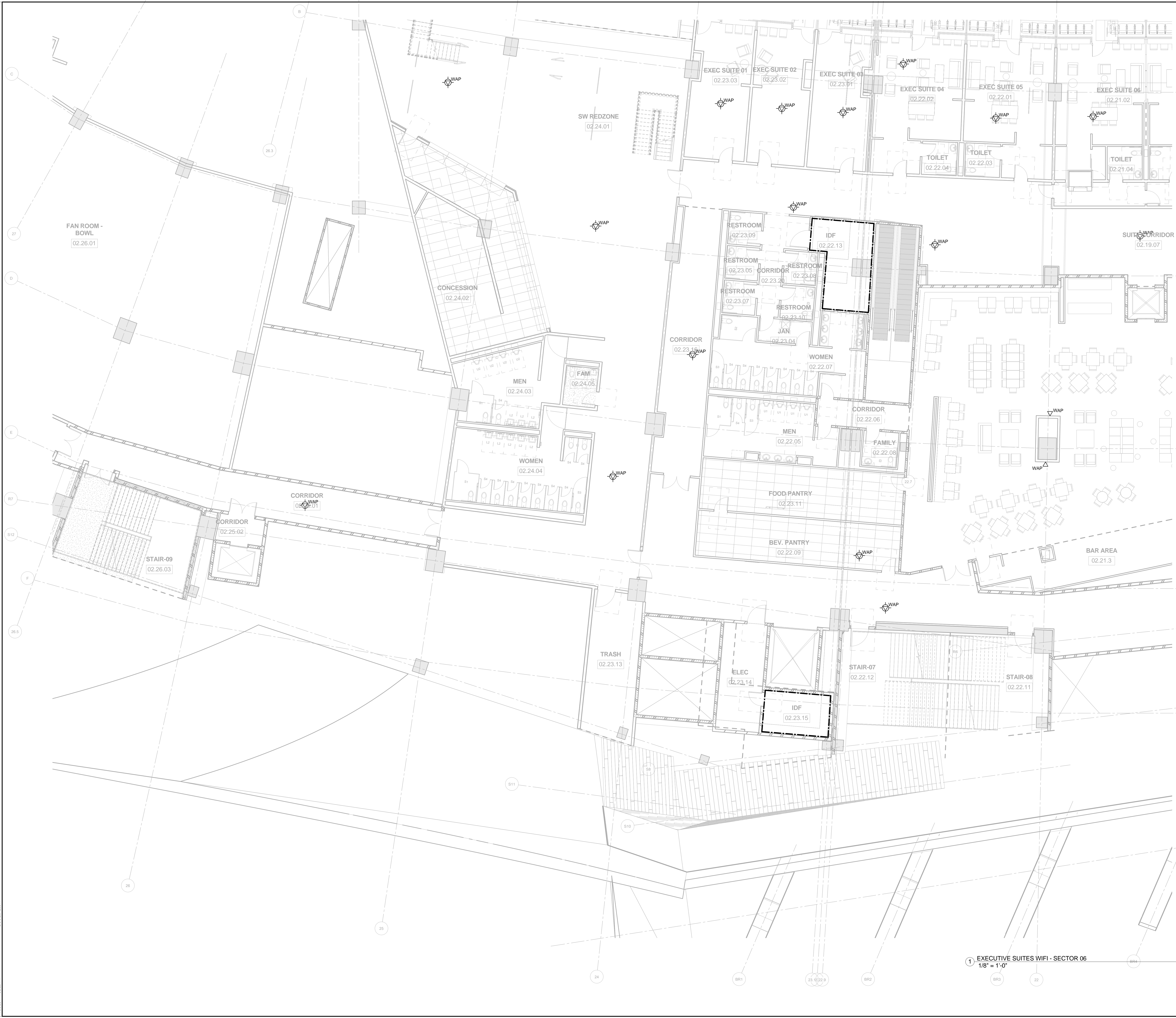
1 EXECUTIVE SUITES WIFI - SECTOR 05  
1/8" = 1'-0"



WIFI PLANS  
GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIKING DR., EDEN PRAIRIE, MN 55434
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE., SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HUNY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROETHER CONSULTING, LLC  
2960 MISSOURI BELLEVIEW, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1600, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

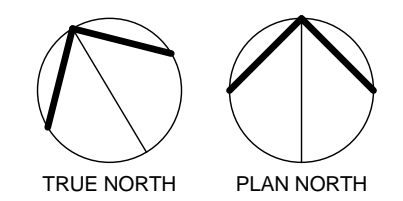


REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060



1 EXECUTIVE SUITES WIFI - SECTOR 06  
1/8" = 1'-0"

SHEET TITLE  
EXECUTIVE SUITES WIFI - SECTOR 06

SHEET NO.  
TW-2.0206

WIFI PLANS  
GENERAL NOTES:

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIONG DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295

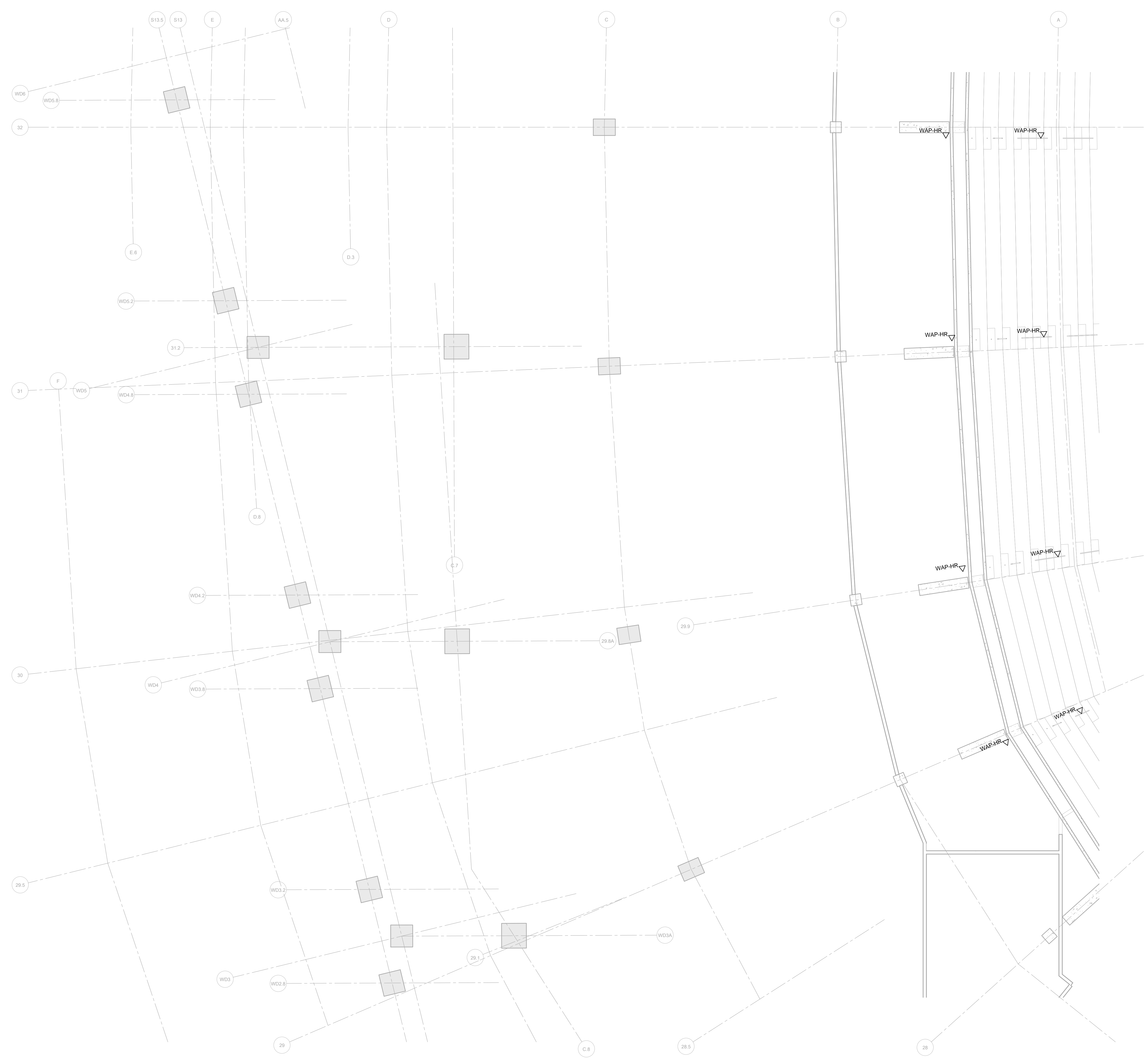
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROETHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66065

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

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9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

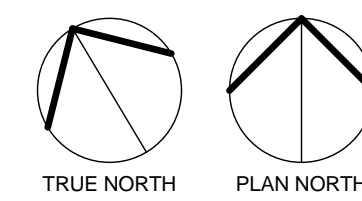
HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**EXECUTIVE SUITES WIFI - SECTOR 08**

SHEET NO.



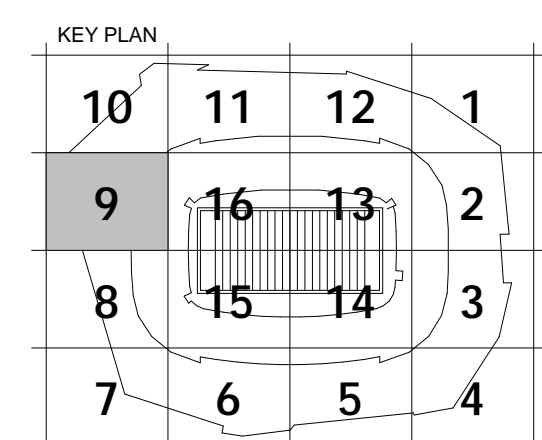
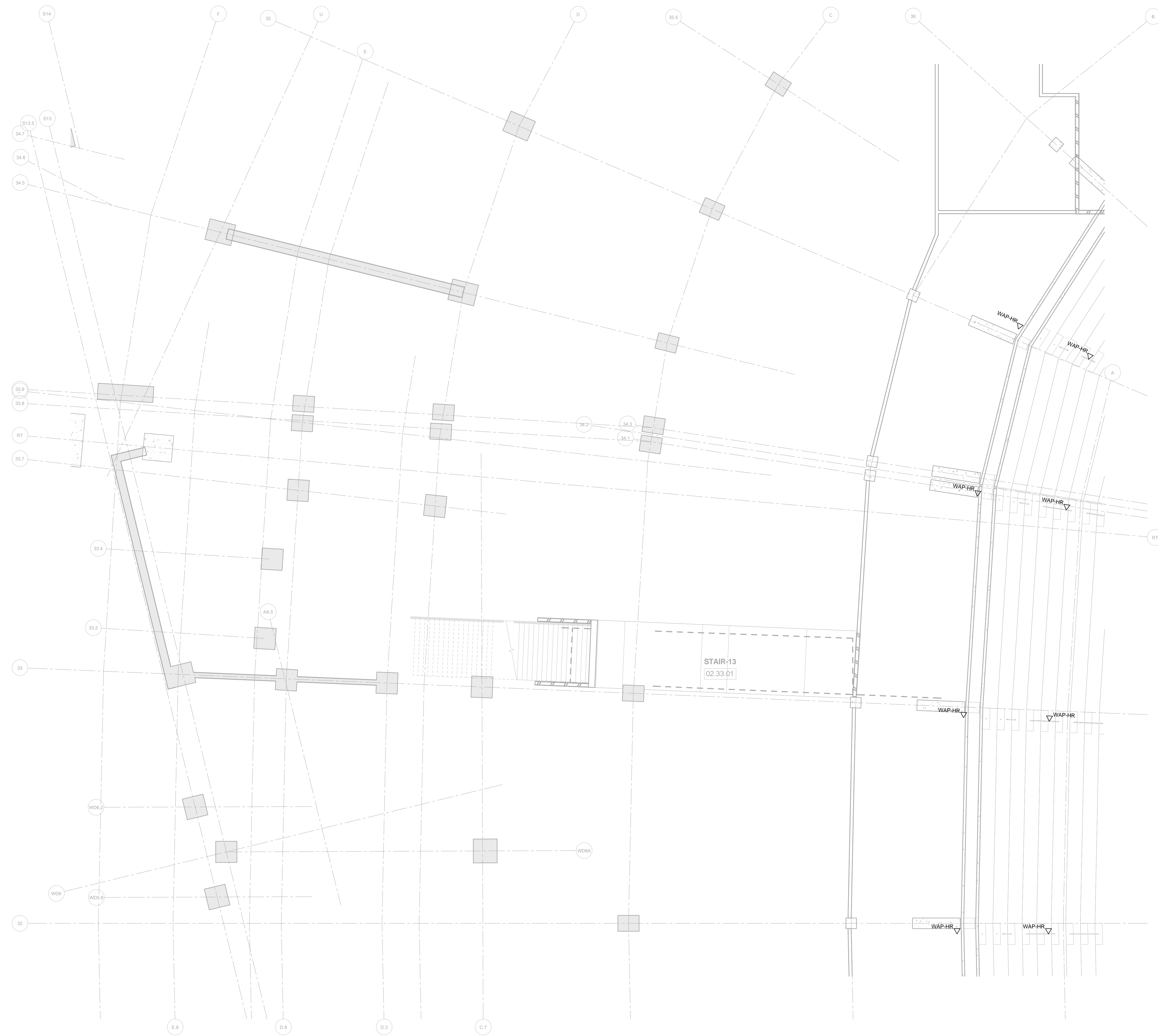
1 EXECUTIVE SUITES WIFI - SECTOR 08  
1/8" = 1'-0"

PLOT DATE: 4/29/2014 1:32:29 PM TEMPLATE VERSION: 2/12/2012/2014

WIFI PLANS  
GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6600 WIRONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10955 WEST 43rd AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434
- LANDSCAPE ARCHITECT**  
OSLAND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
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9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROETHER CONSULTING, LLC.  
2990 MISSOURI BELLEVUE, LOUISBURG, KS 66603
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LORD BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

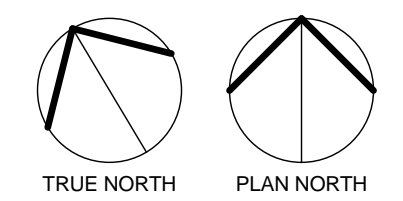
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
EXECUTIVE  
SUITES WIFI -  
SECTOR 09

SHEET NO.

1 EXECUTIVE SUITES WIFI - SECTOR 09  
1/8" = 1'-0"



PLOT DATE: 4/29/2014 1:32:29 PM TEMPLATE VERSION: 2/13/2012/2014

## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

**OWNER**  
MINNESOTA WINGS FOOTBALL, LLC  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

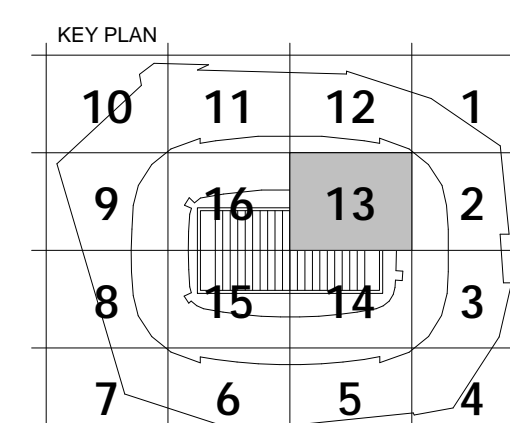
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66063

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611

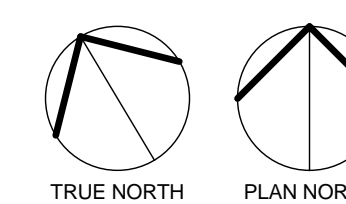
**FAÇADE ACCESS CONSULTANT**  
LEIGH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**May 02, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**EXECUTIVE SUITES WIFI - SECTOR 13**  
SHEET NO.



**1 EXECUTIVE SUITES WIFI - SECTOR 13**  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIONG DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIVE AVENUE, SUITE 600, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295

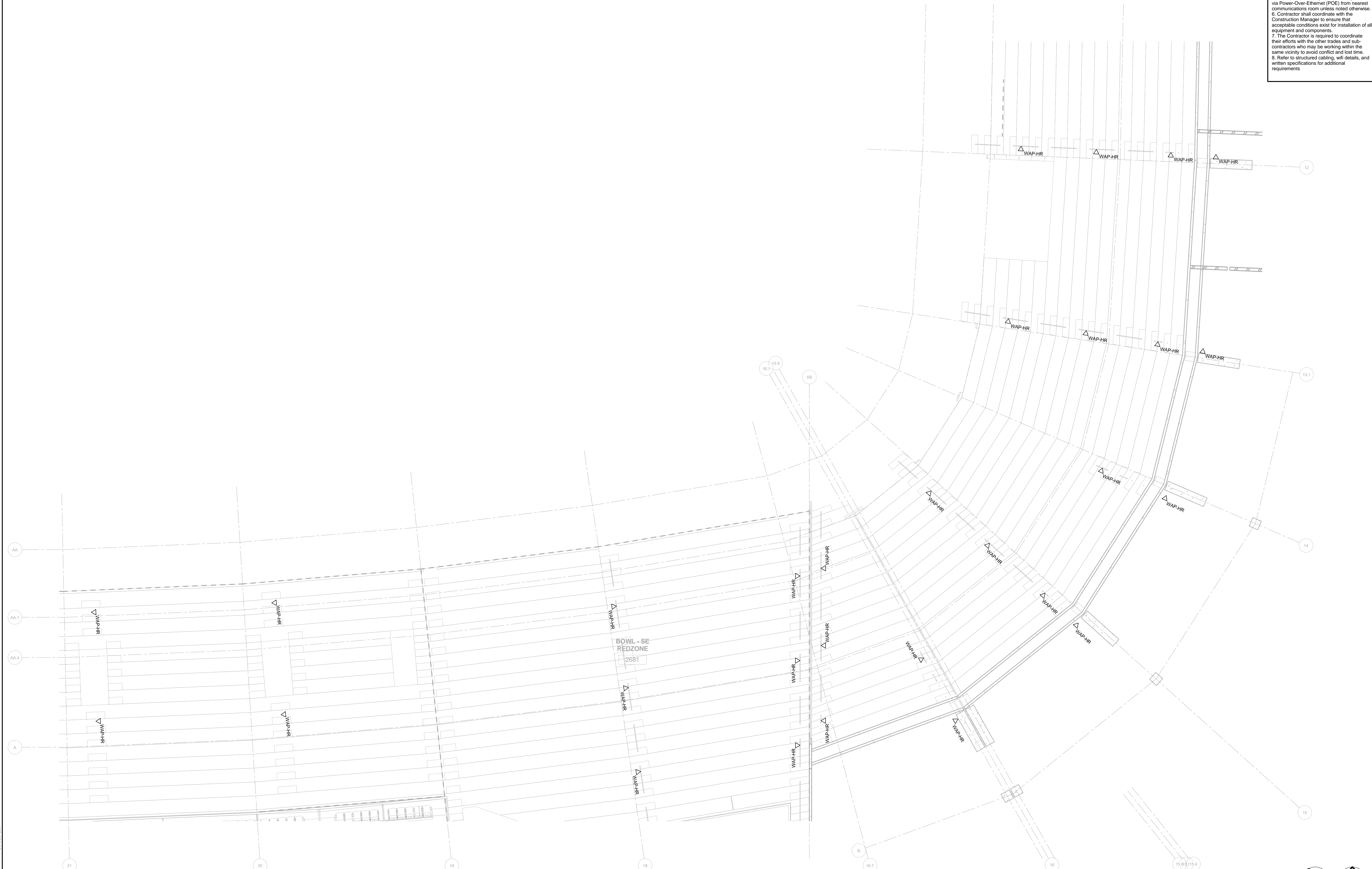
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2980 MISSOURI BELLEVIEW, LOUISBURG, KS 66065

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LORD BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

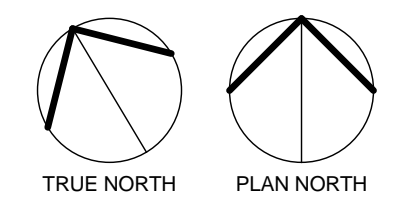
HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**EXECUTIVE SUITES WIFI - SECTOR 14**

SHEET NO.

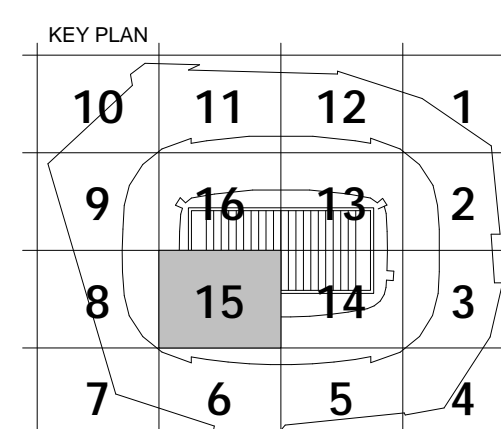
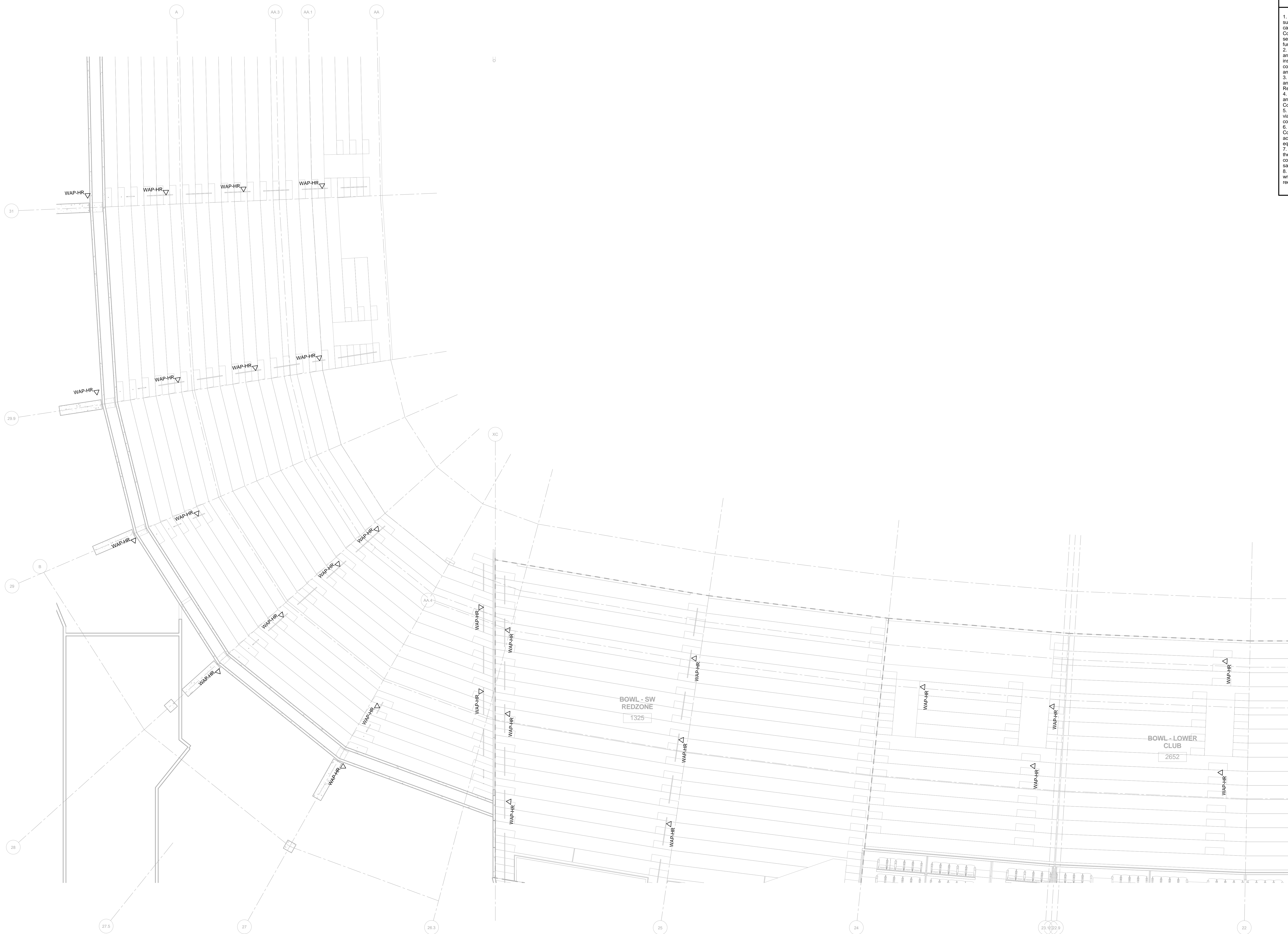


1 EXECUTIVE SUITES WIFI - SECTOR 14  
1/8" = 1'-0"

**WIFI PLANS  
GENERAL NOTES:**

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8500 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
1508 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HWAY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2980 MISSION BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROVAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LORD BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

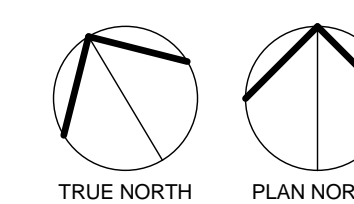
HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**EXECUTIVE SUITES WIFI - SECTOR 15**

SHEET NO.



**1 EXECUTIVE SUITES WIFI - SECTOR 15**  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIONG DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIVE AVENUE, SUITE 600, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE., N. MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

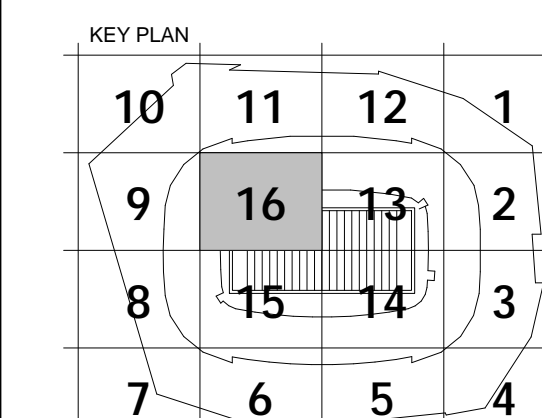
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66603

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611

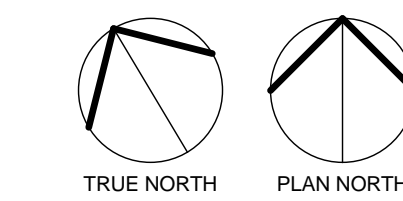
**FAÇADE ACCESS CONSULTANT**  
LORD BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



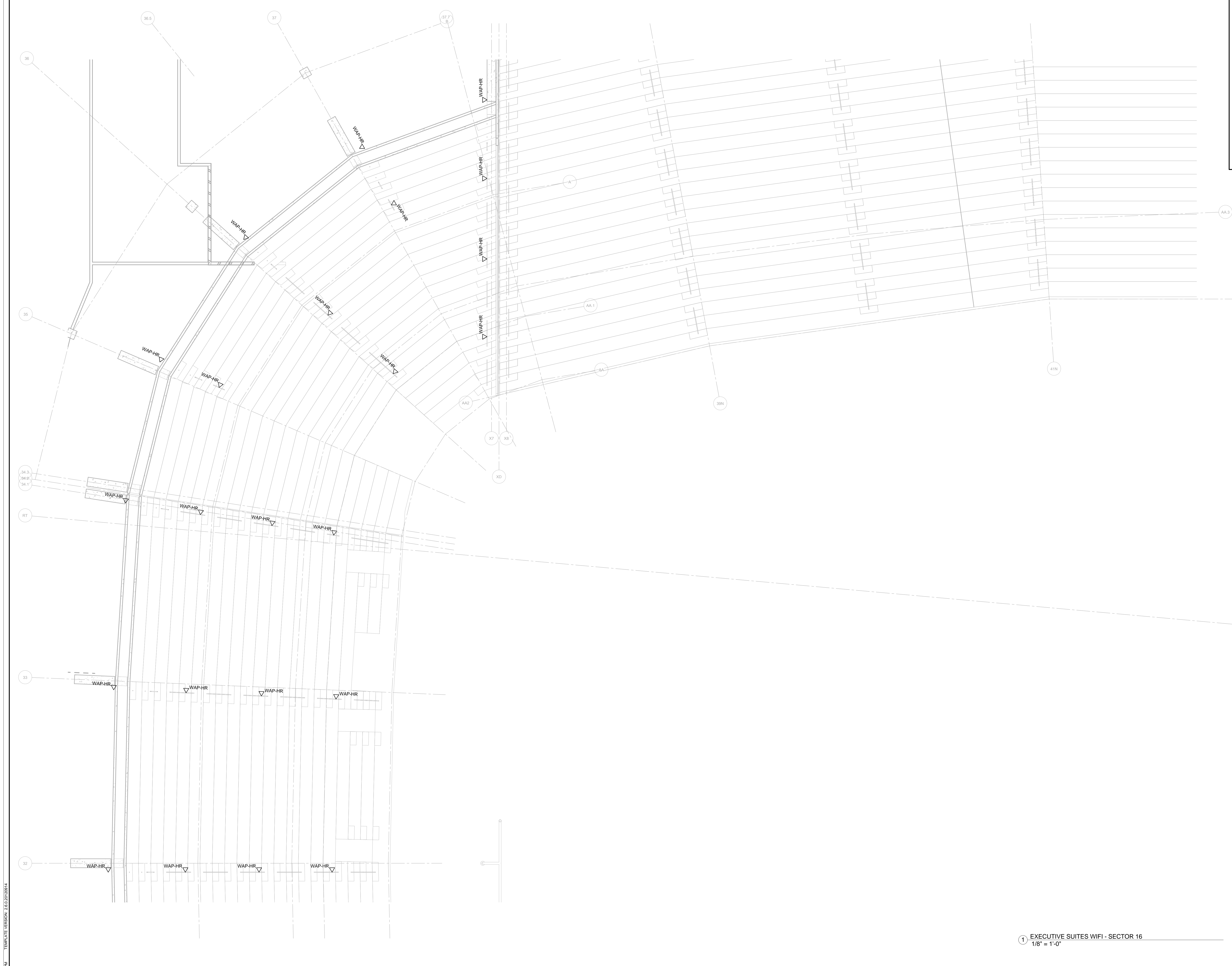
REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**May 02, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**EXECUTIVE SUITES WIFI - SECTOR 16**  
SHEET NO.



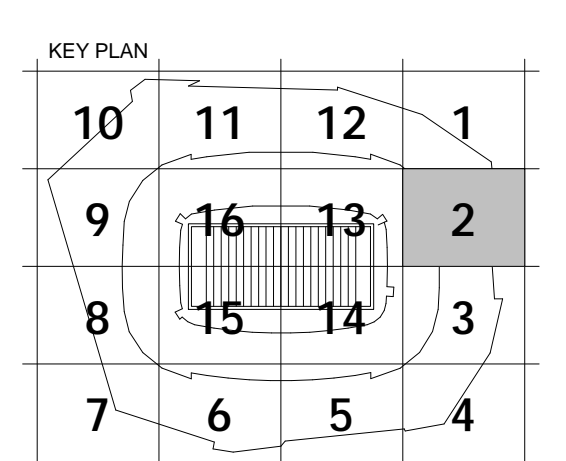
1 EXECUTIVE SUITES WIFI - SECTOR 16  
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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 VIONG DR., EDEN PRAIRIE, MN 55444
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55444
- LANDSCAPE ARCHITECT**  
OBLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
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- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
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- ADA CONSULTANT**  
ED ROETHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66505
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 8B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

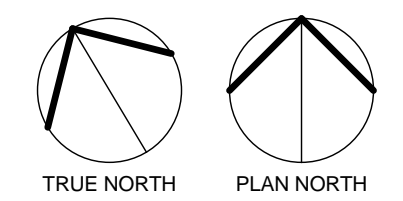
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
LOWER CLUB WIFI  
- SECTOR 02

SHEET NO.  
**TW-2.0302**

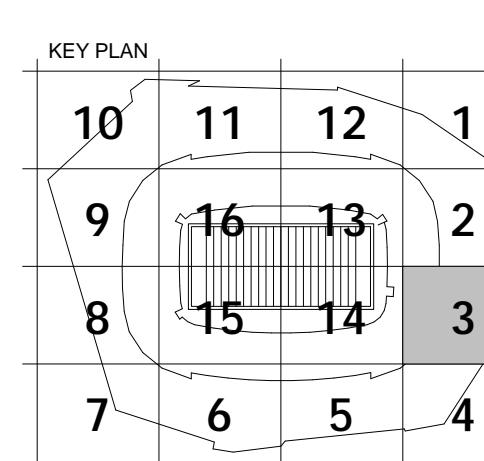
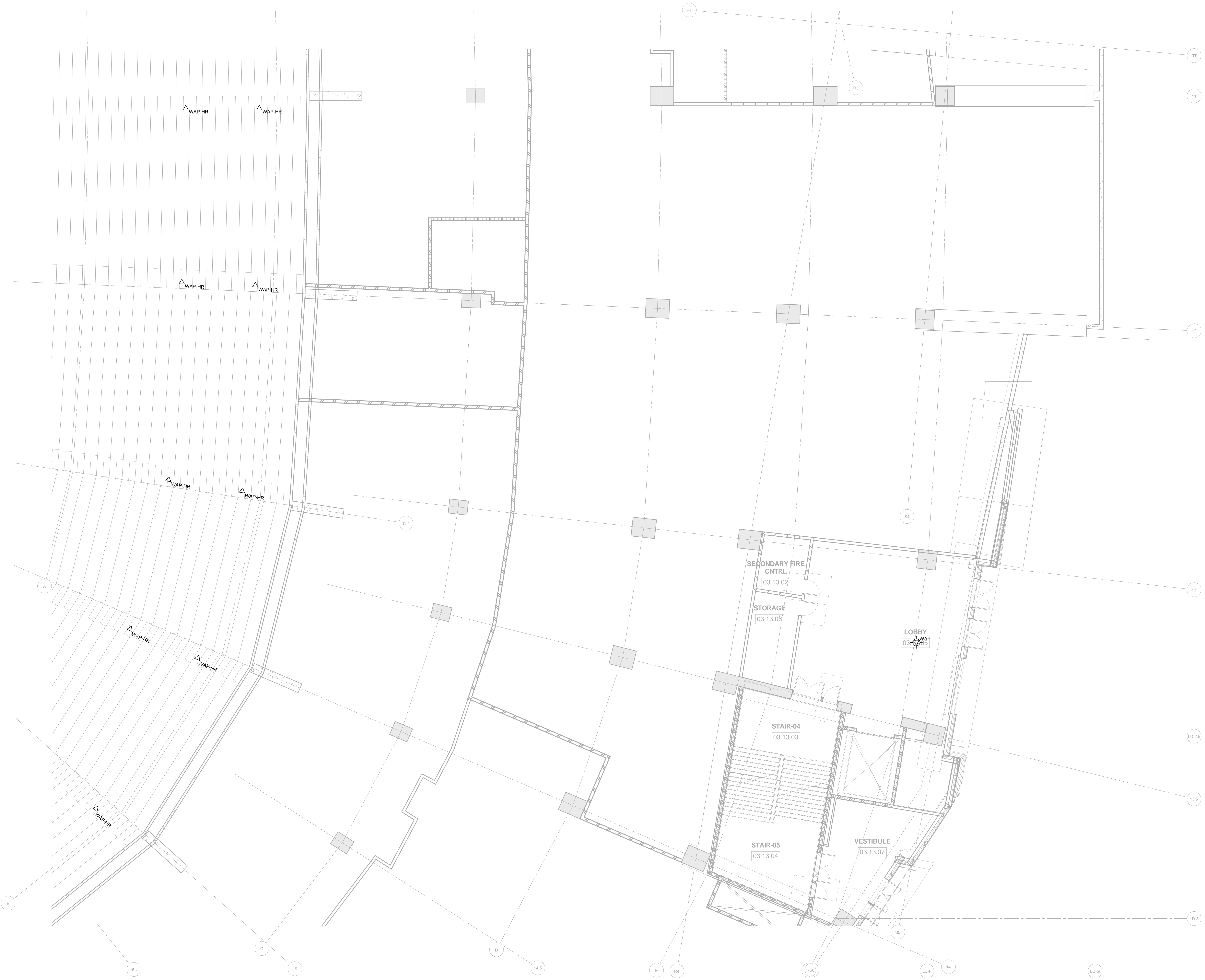
1 LOWER CLUB WIFI - SECTOR 02  
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- OWNER**  
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- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LORD BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

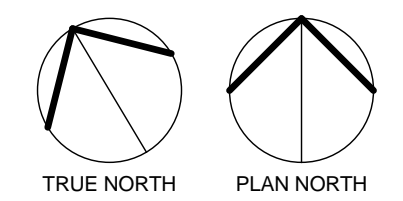
DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**LOWER CLUB WIFI  
- SECTOR 03**

SHEET NO.  
**TW-2.0303**

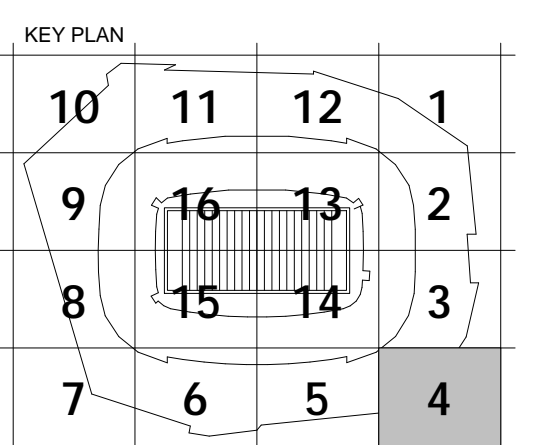
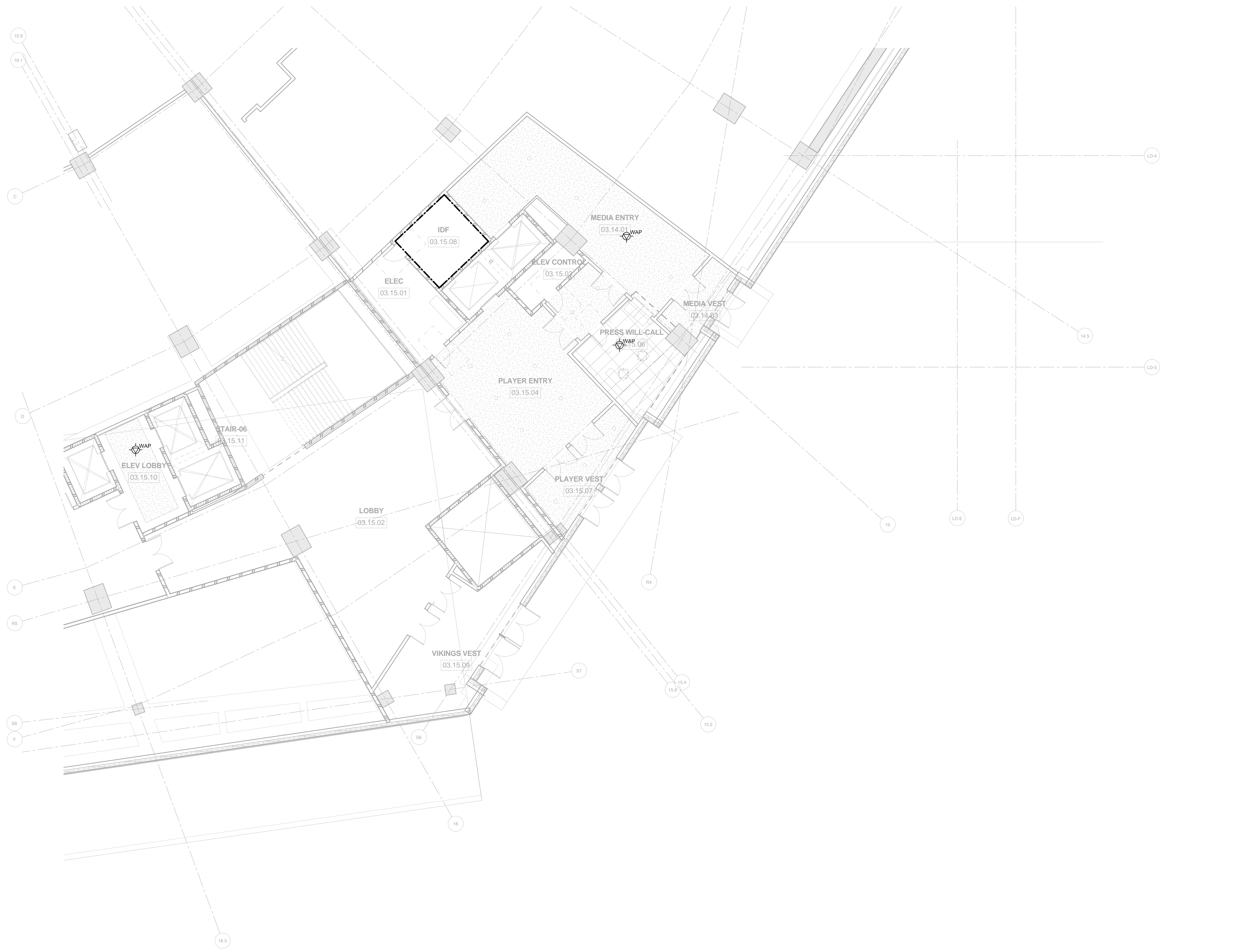
**1 LOWER CLUB WIFI - SECTOR 03**  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OBLIN AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HWY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LORD BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

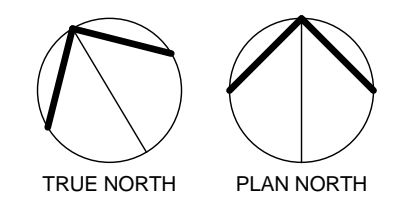
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
LOWER CLUB WIFI  
- SECTOR 04

SHEET NO.  
TW-2.0304

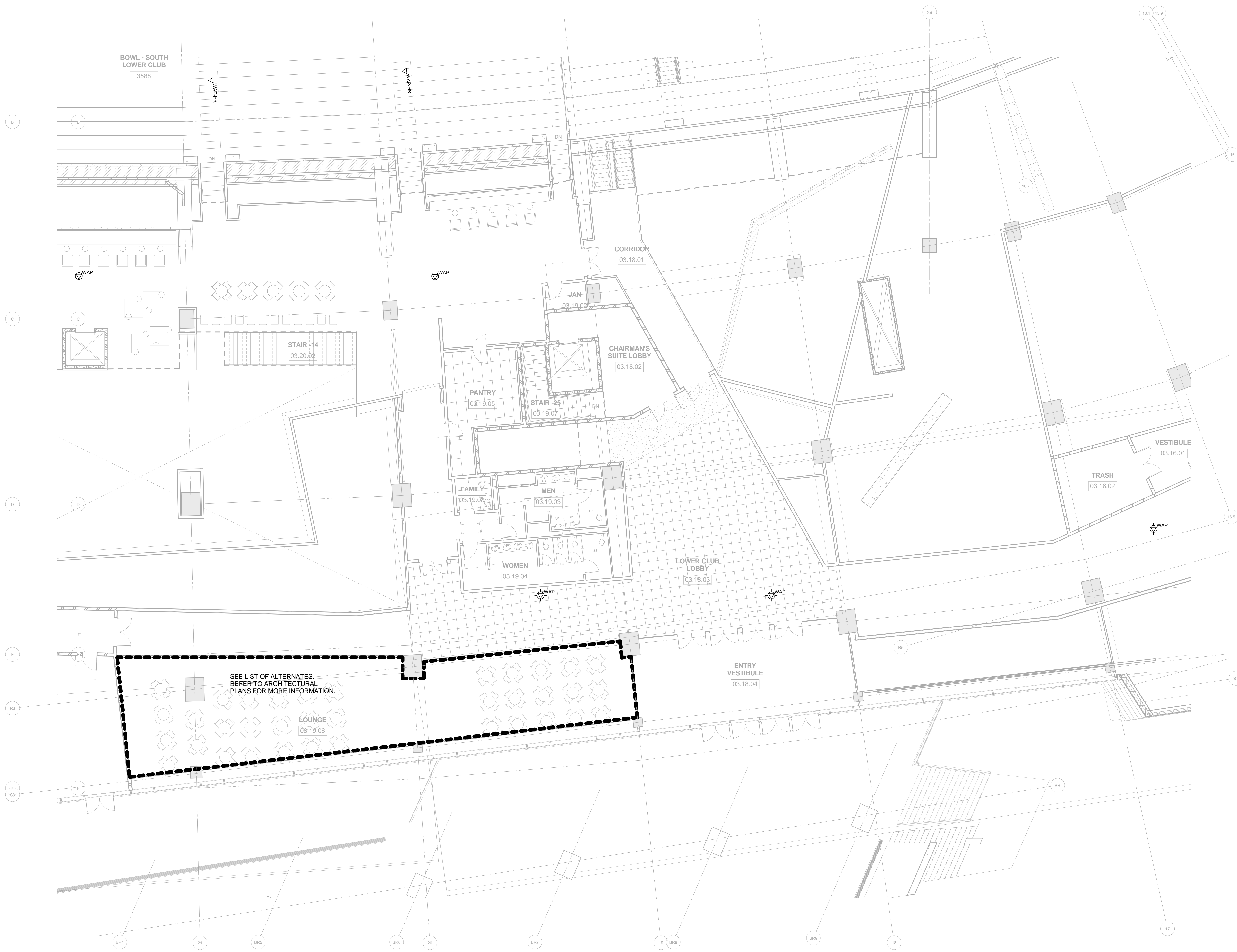
① LOWER CLUB WIFI - SECTOR 04  
1/8" = 1'-0"



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- OWNER**  
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900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6326 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

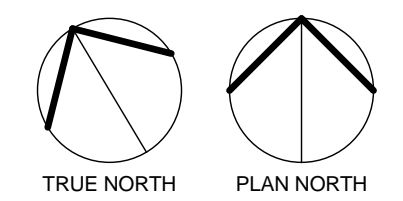
ISSUE  
CCD-060

SHEET TITLE  
LOWER CLUB WIFI  
- SECTOR 05

SHEET NO.

TW-2.0305

1 LOWER CLUB WIFI - SECTOR 05  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WINGS FOOTBALL, LLC  
5600 VIONG DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIVE AVENUE, SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHERY CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. GLEN PH. ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

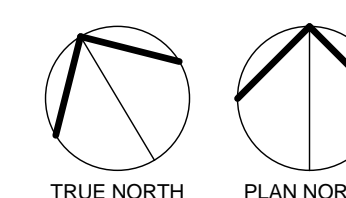
HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**LOWER CLUB WIFI  
- SECTOR 06**

SHEET NO.



**1 LOWER CLUB WIFI - SECTOR 06**  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

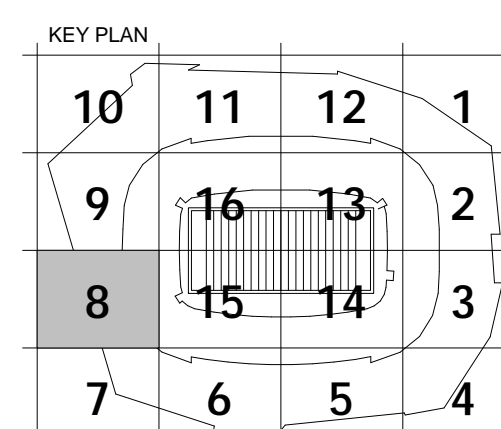
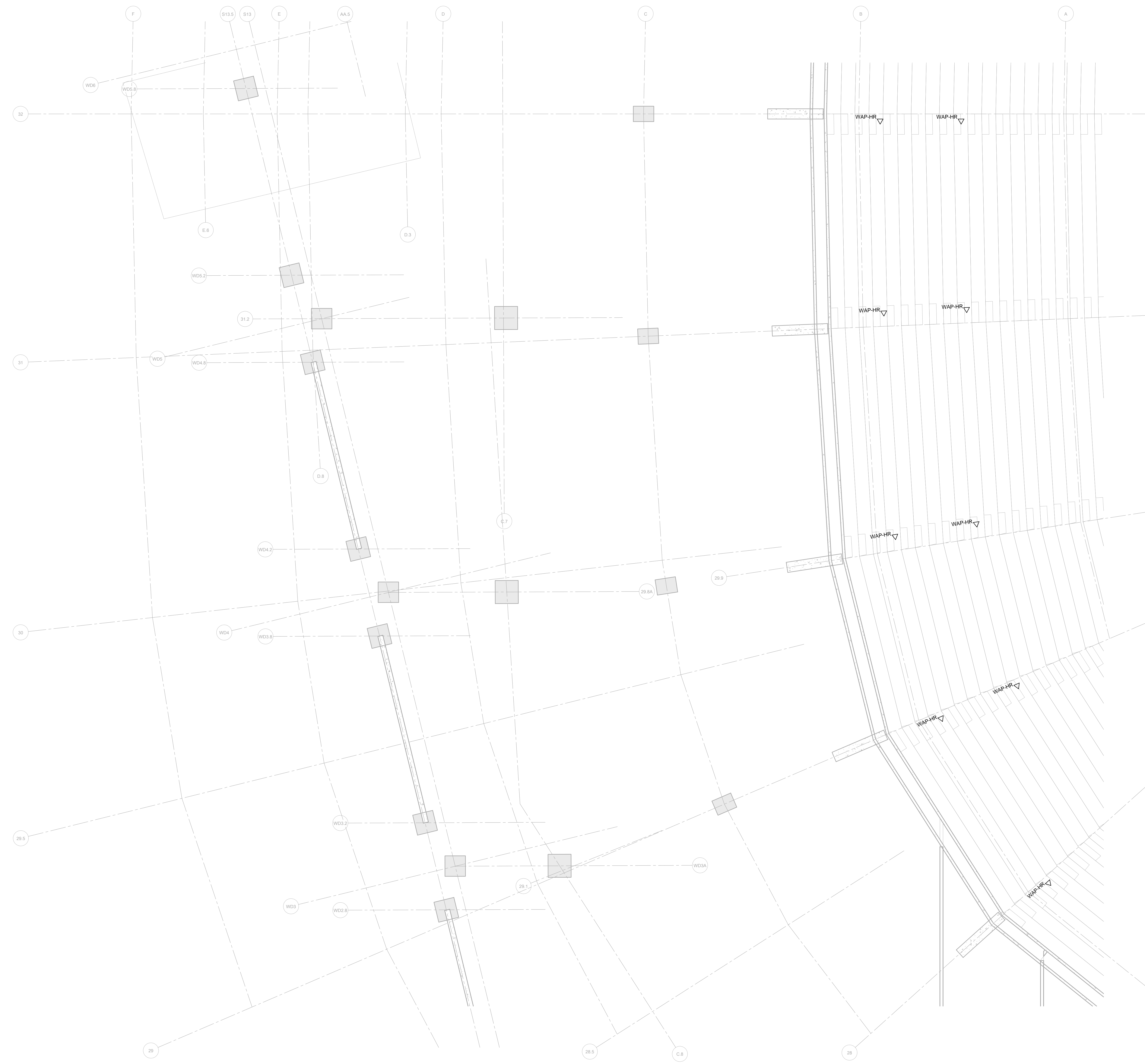
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



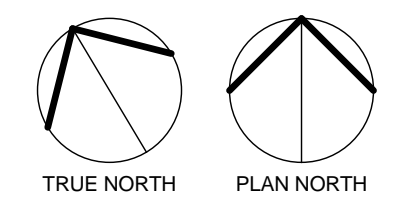
REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**May 02, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**LOWER CLUB WIFI - SECTOR 08**

SHEET NO.  
**TW-2.0308**

1 LOWER CLUB WIFI - SECTOR 08  
1/8" = 1'-0"

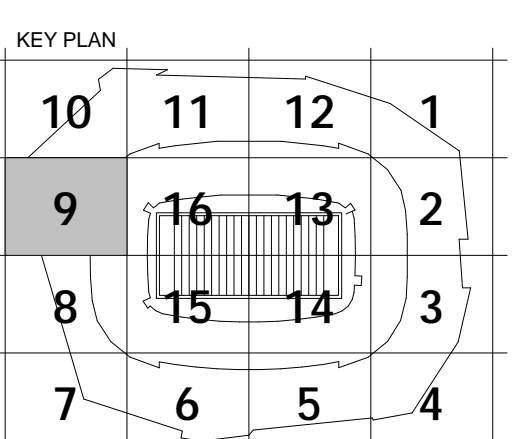
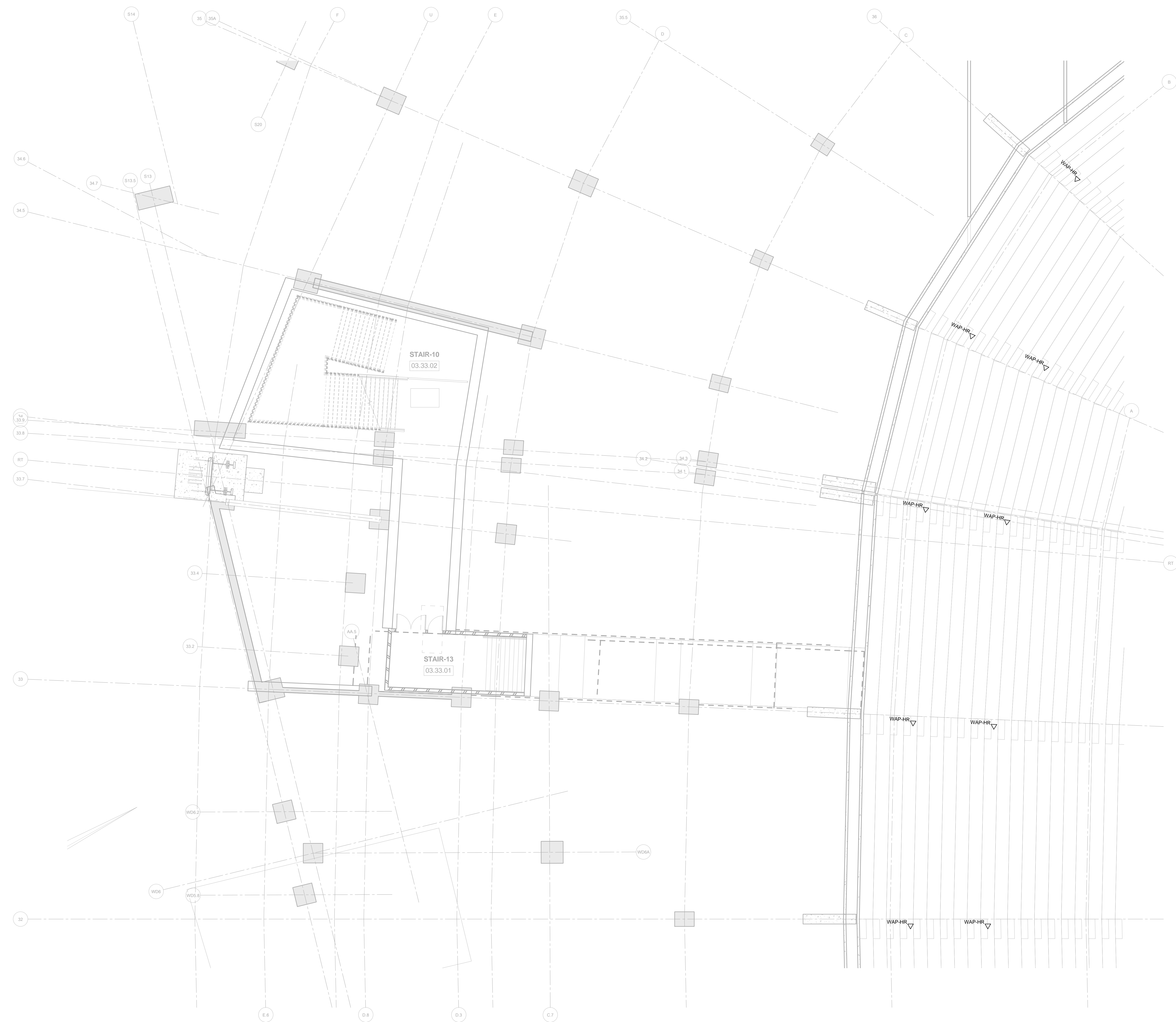


WIFI PLANS  
GENERAL NOTES:

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- OWNER**  
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OBLON AND ASSOCIATES  
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RICCIA NEWMARK  
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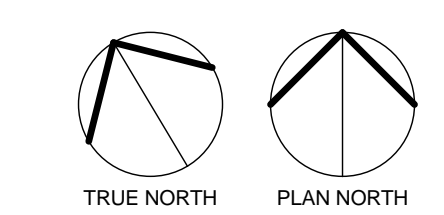
HKS PROJECT NUMBER  
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DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
LOWER CLUB WIFI  
- SECTOR 09

SHEET NO.  
TW-2.0309



1 LOWER CLUB WIFI - SECTOR 09  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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7. The Contractor is required to coordinate their efforts with the other trades and sub-contractors who may be working within the same vicinity to avoid conflict and lost time.
8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WINGS FOOTBALL, LLC  
6500 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVENUE N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15000 WRIGHT BROTHERS DR., ADDISON, TX 75001
- PLUMBING**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROVAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., W. GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH ST. SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION

NO.	DESCRIPTION	DATE

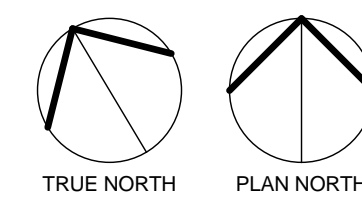
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
LOWER CLUB WIFI  
- SECTOR 11

SHEET NO.



① LOWER CLUB WIFI - SECTOR 11  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HWY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

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9	16	13	2
8	15	14	3
7	6	5	4

REVISION

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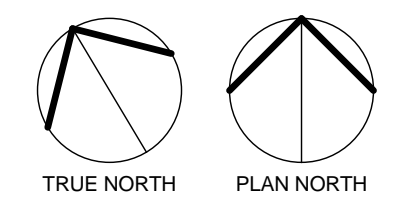
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
LOWER CLUB WIFI  
- SECTOR 12

SHEET NO.



1 LOWER CLUB WIFI - SECTOR 12  
1/8" = 1'-0"

WIFI PLANS  
GENERAL NOTES:

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6600 VIONG DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

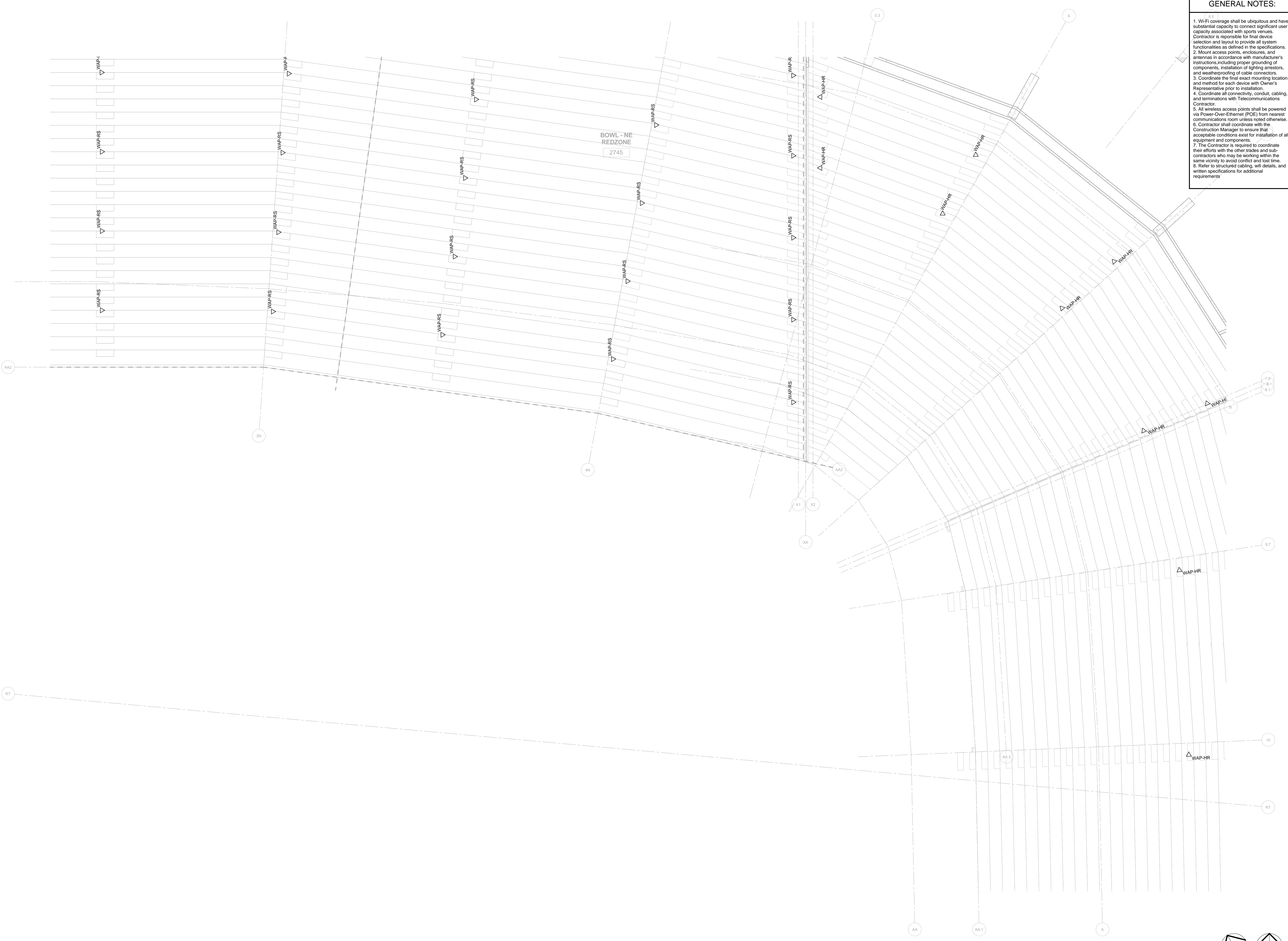
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

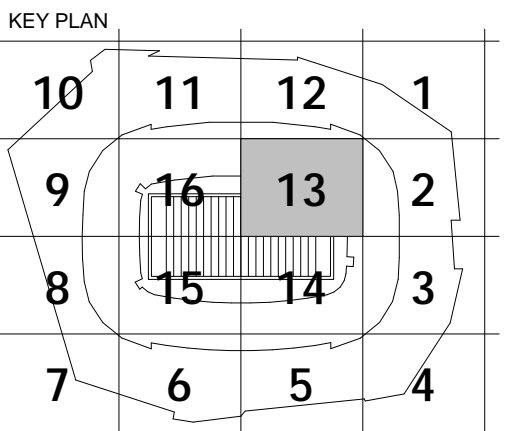
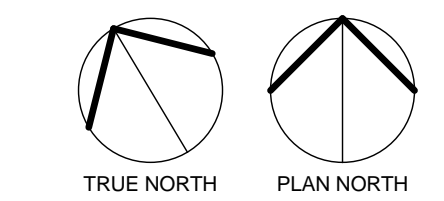
**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



1 LOWER CLUB WIFI - SECTOR 13  
1/8" = 1'-0"



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
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DATE  
May 02, 2014

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CCD-060

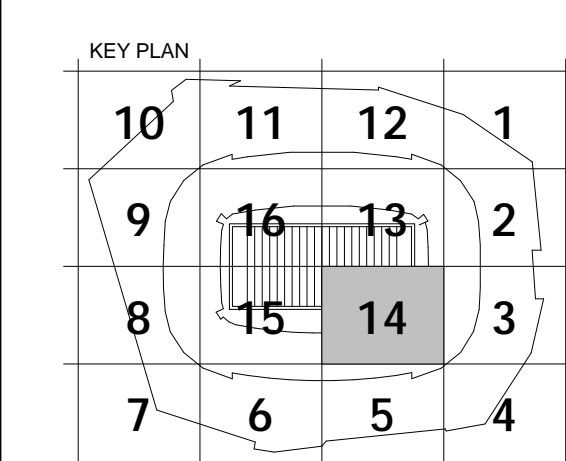
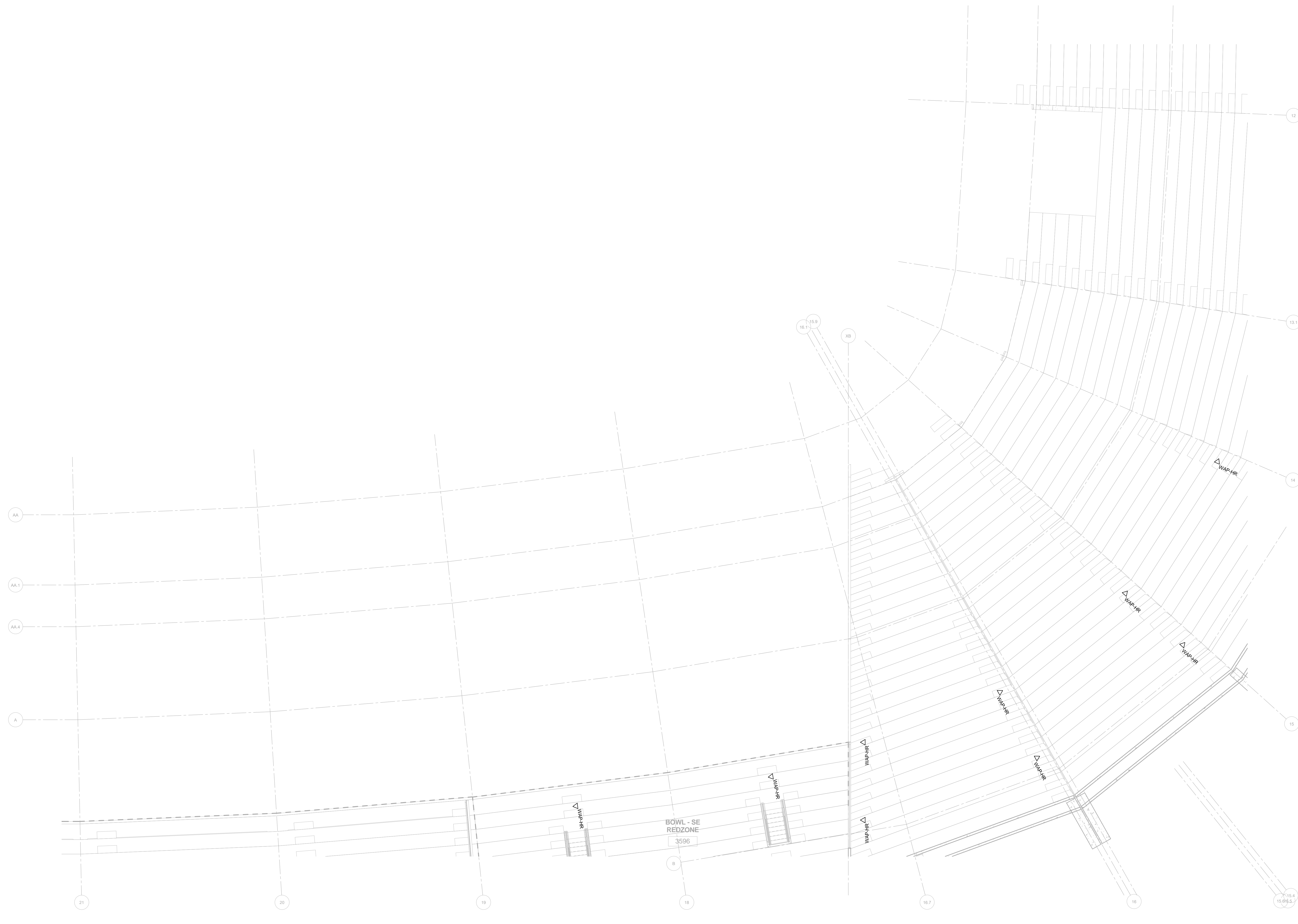
SHEET TITLE  
LOWER CLUB WIFI  
- SECTOR 13

SHEET NO.  
TW-2.0313

## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNGOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66063
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERDCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

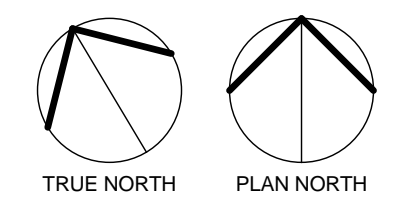


REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
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DATE  
May 02, 2014

ISSUE  
CCD-060



1 LOWER CLUB WIFI - SECTOR 14  
1/8" = 1'-0"

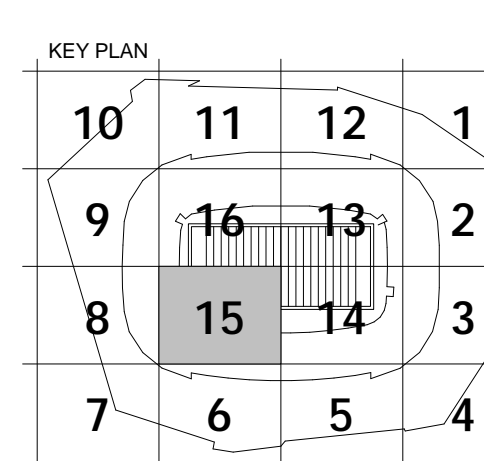
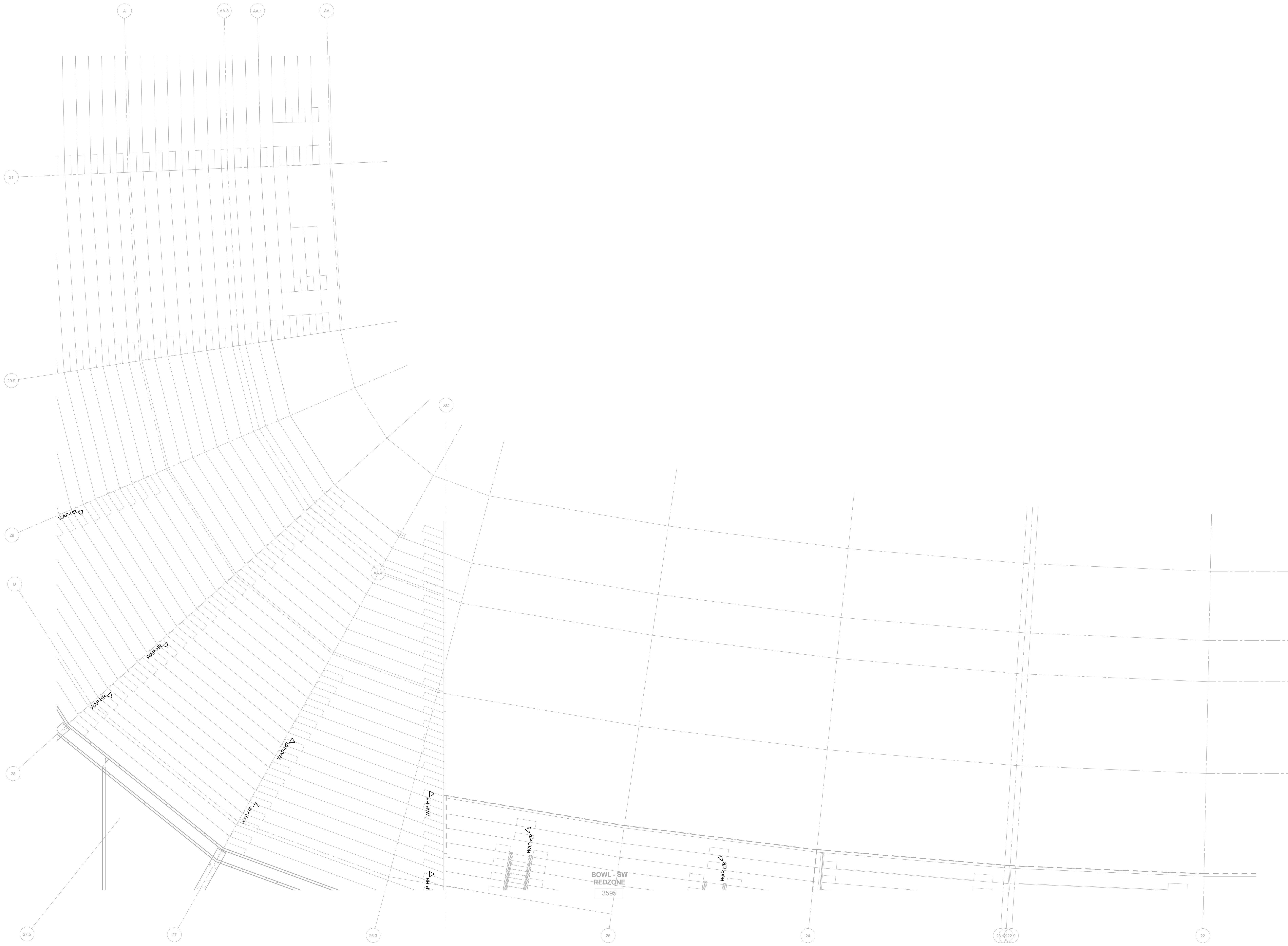
SHEET TITLE  
LOWER CLUB WIFI  
- SECTOR 14

SHEET NO.  
TW-2.0314

WIFI PLANS  
GENERAL NOTES:

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MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6000 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HVAC**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66063
- WIND / SNOW CONSULTANT**  
ROVAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION  
NO. DESCRIPTION DATE

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16246.000

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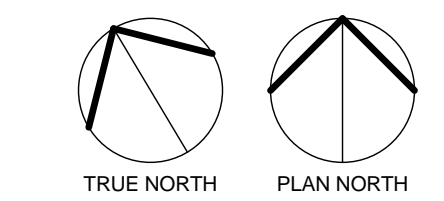
ISSUE  
CCD-060

SHEET TITLE  
LOWER CLUB WIFI  
- SECTOR 15

SHEET NO.

TW-2.0315

1 LOWER CLUB WIFI - SECTOR 15  
1/8" = 1'-0"

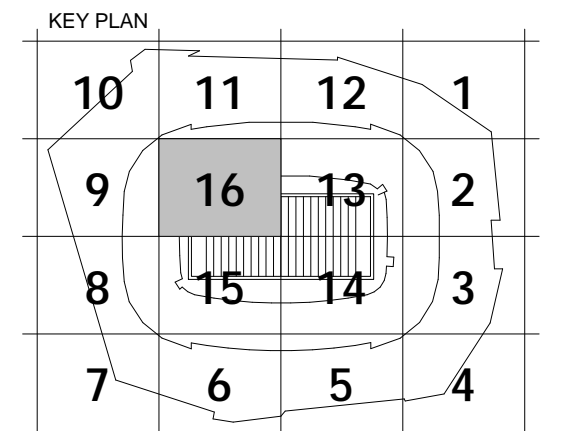
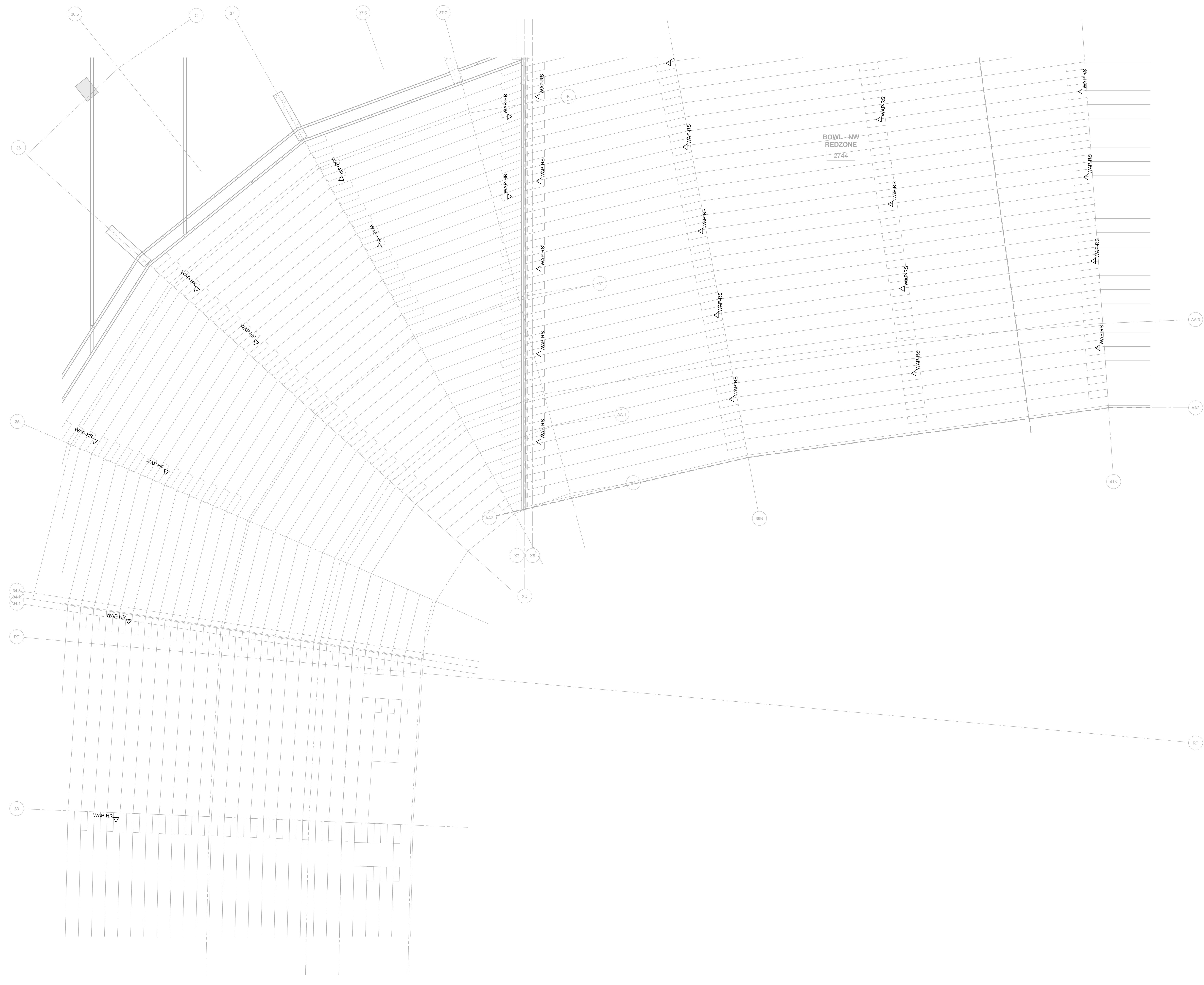




### WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIVE AVENUE, SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55424
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
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- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
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- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
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- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



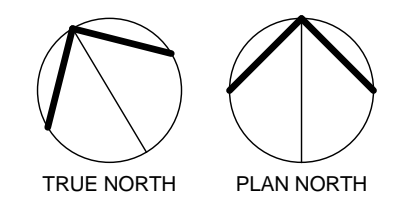
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ISSUE  
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SHEET TITLE  
LOWER CLUB WIFI  
- SECTOR 16

SHEET NO.  
TW-2.0316

1 LOWER CLUB WIFI - SECTOR 16  
1/8" = 1'-0"



PLOT DATE: 4/29/2014 1:35:24 PM  
TEMPLATE VERSION: 2/13/2012/2014

## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIVE AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 8B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

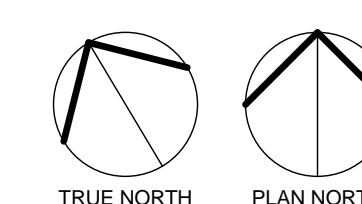
ISSUE  
CCD-060

SHEET TITLE  
MAIN CONCOURSE  
WIFI - SECTOR 01

SHEET NO.

TW-2.0401

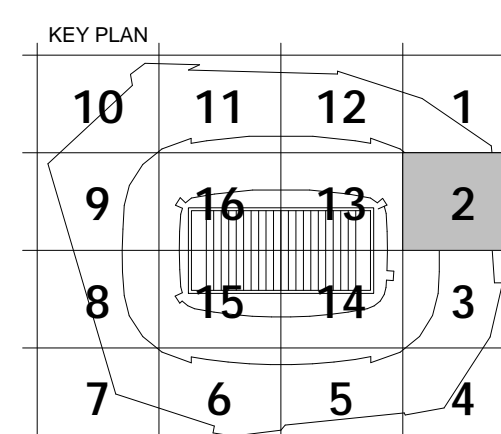
1 MAIN CONCOURSE WIFI - SECTOR 01  
1/8" = 1'-0"



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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
8600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 8B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH ST., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

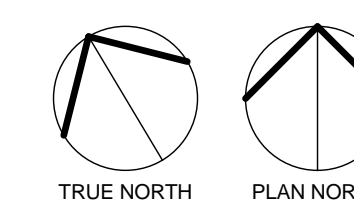
HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**MAIN CONCOURSE  
WIFI - SECTOR 02**

SHEET NO.  
**TW-2.0402**



1 MAIN CONCOURSE WIFI - SECTOR 02  
1/8" = 1'-0"

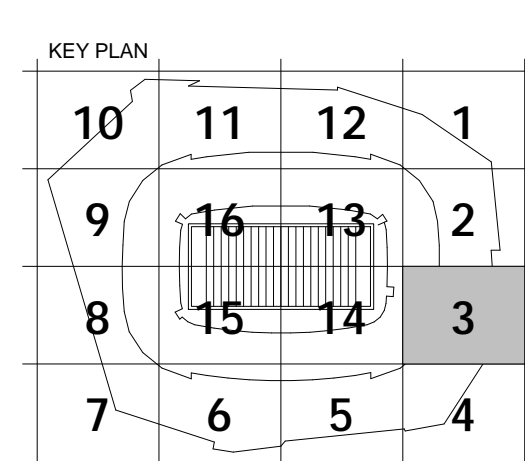




## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HUNY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2990 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

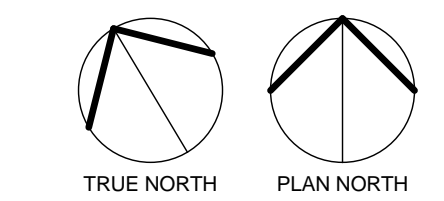
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
MAIN CONCOURSE  
WIFI - SECTOR 03

SHEET NO.  
TW-2.0403

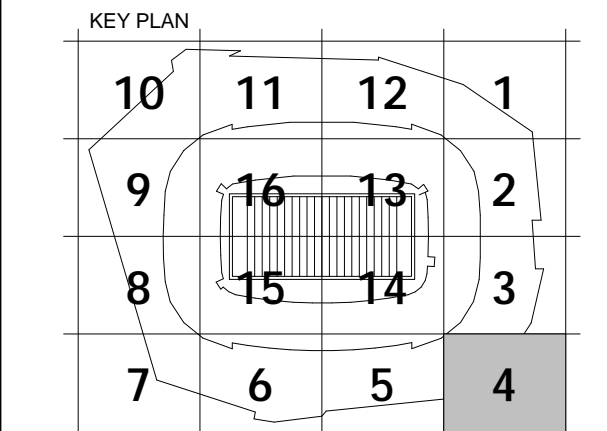
1 MAIN CONCOURSE WIFI - SECTOR 03  
1/8" = 1'-0"



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- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
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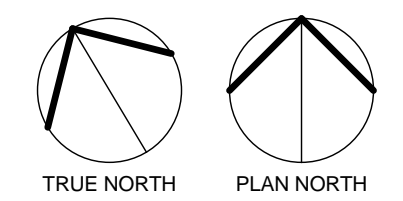
DATE  
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ISSUE  
CCD-060

SHEET TITLE  
MAIN CONCOURSE  
WIFI - SECTOR 04

SHEET NO.  
TW-2.0404

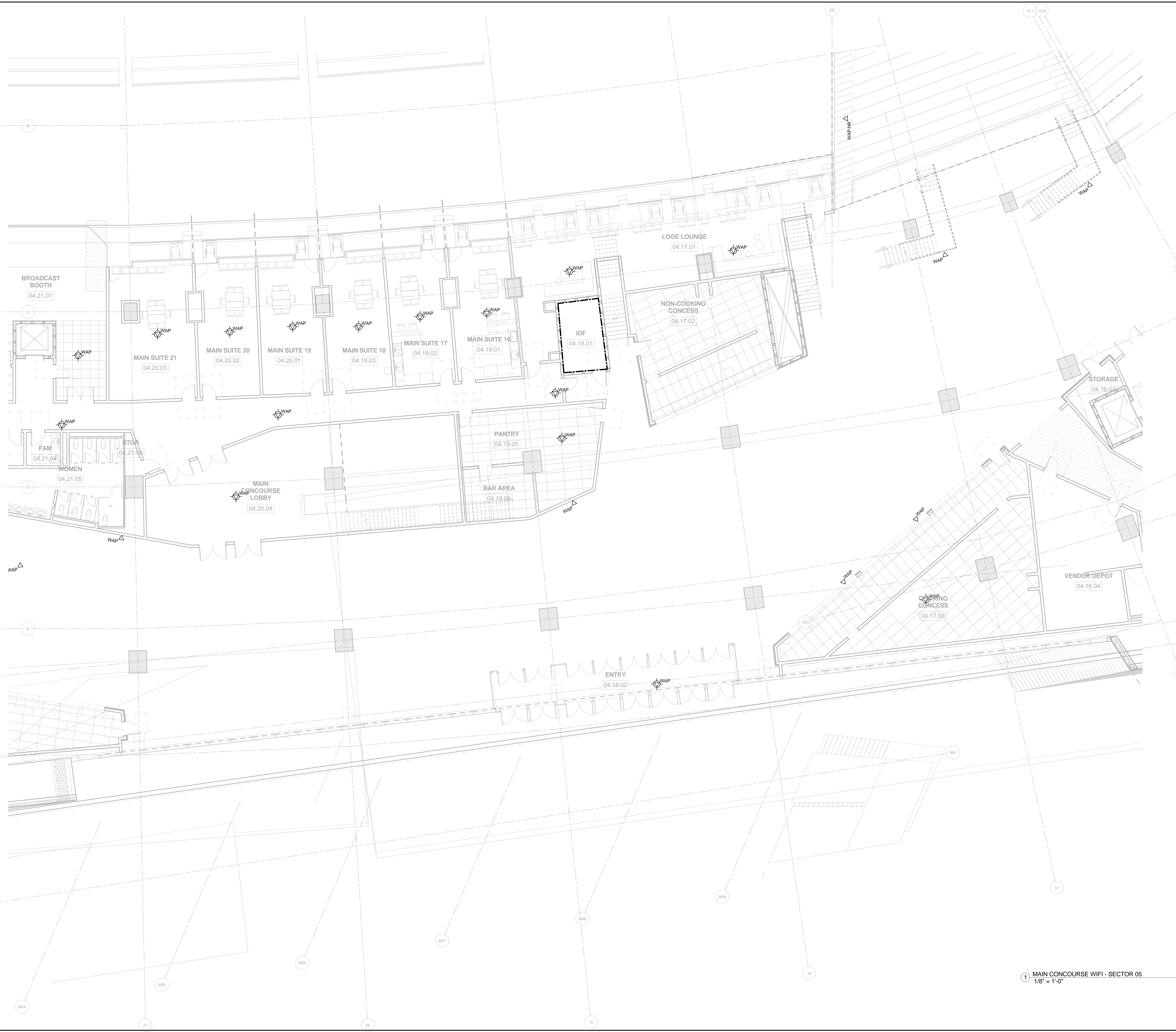
① MAIN CONCOURSE WIFI - SECTOR 04  
1/8" = 1'-0"



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- OWNER**  
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- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH ST., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION

NO.	DESCRIPTION	DATE

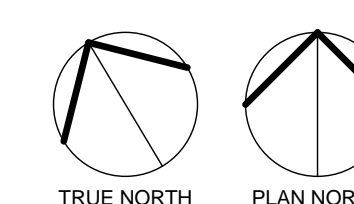
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
MAIN CONCOURSE  
WIFI - SECTOR 05

SHEET NO.



1 MAIN CONCOURSE WIFI - SECTOR 05  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

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**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6600 VIORING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10508 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210

**FOOD SERVICE**  
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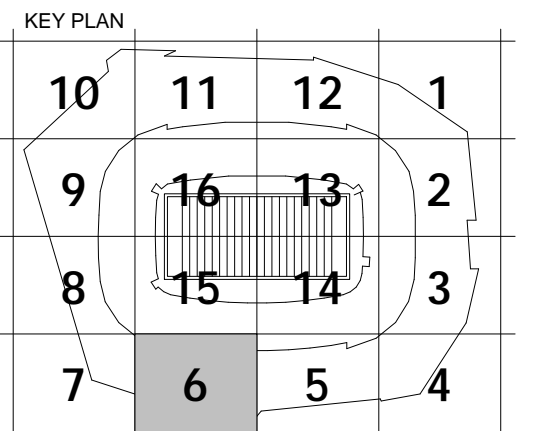
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
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650 WOODLAWN RD., GLEN PH, ON CANADA N1K 1B9

**BUILDING ENVELOPE CONSULTANT**  
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**FAÇADE ACCESS CONSULTANT**  
LERRH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



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HKS PROJECT NUMBER  
16246.000

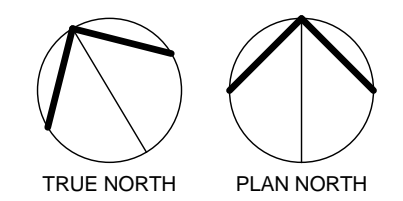
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
MAIN CONCOURSE  
WIFI - SECTOR 06

SHEET NO.  
TW-2.0406

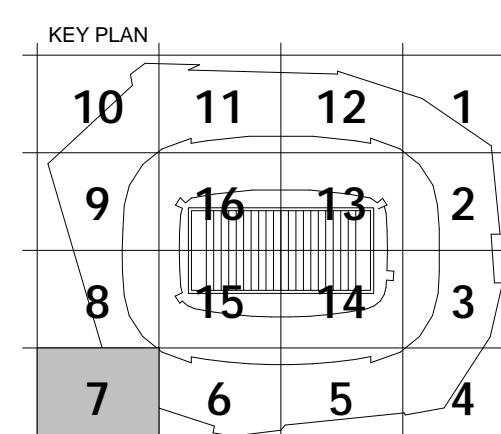
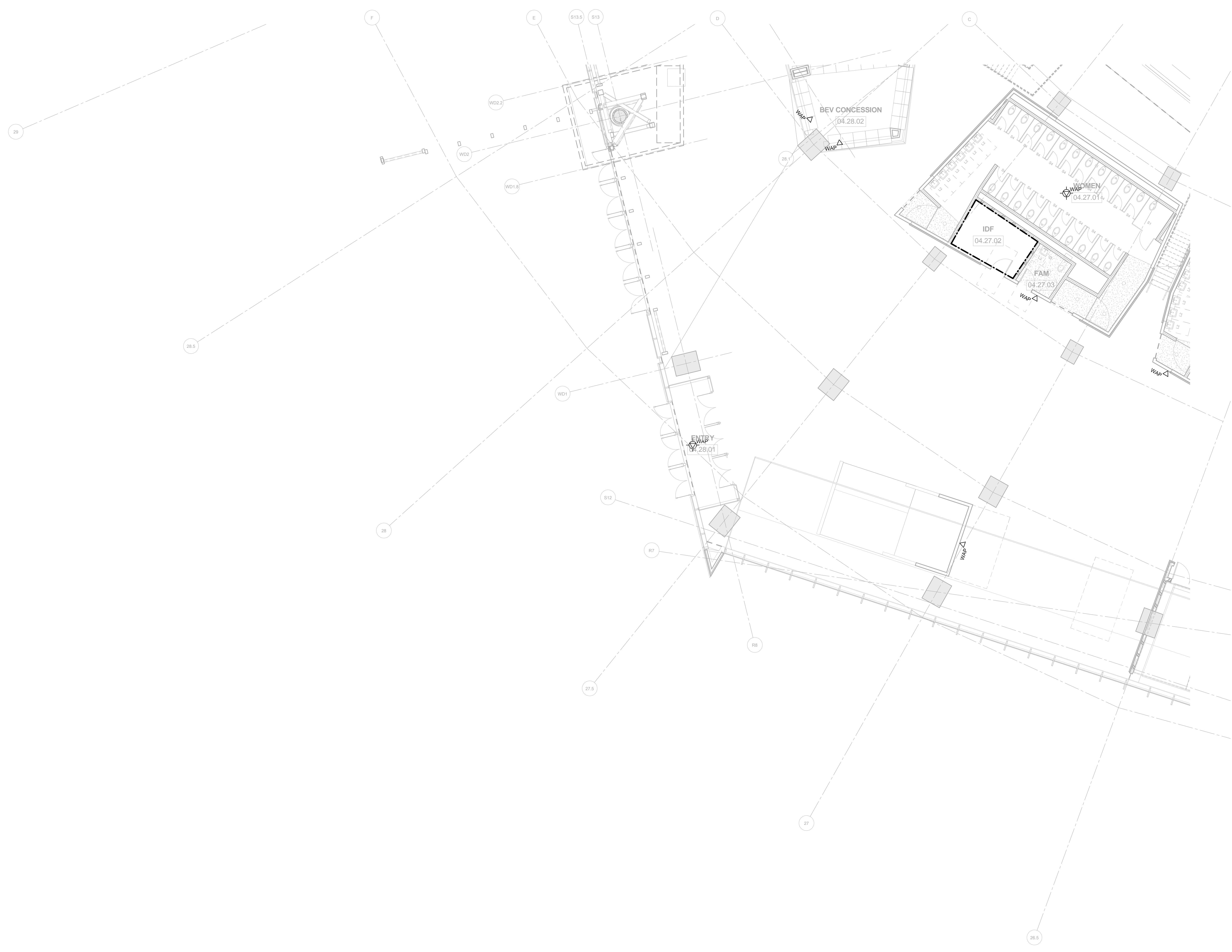
1 MAIN CONCOURSE WIFI - SECTOR 06  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55404
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
5600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
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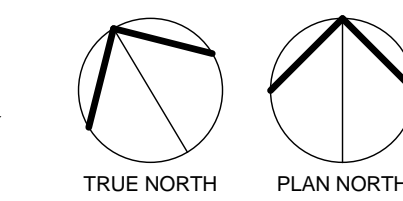
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
MAIN CONCOURSE  
WIFI - SECTOR 07

SHEET NO.  
TW-2.0407

1 MAIN CONCOURSE WIFI - SECTOR 07  
1/8" = 1'-0"



### WIFI PLANS GENERAL NOTES:

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIONG DR., EDEN PRAIRIE, MN 55434

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322 FIRST AVE., SUITE 600, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80233  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
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**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
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**W/AV**  
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**CODE / FIRE PROTECTION**  
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9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

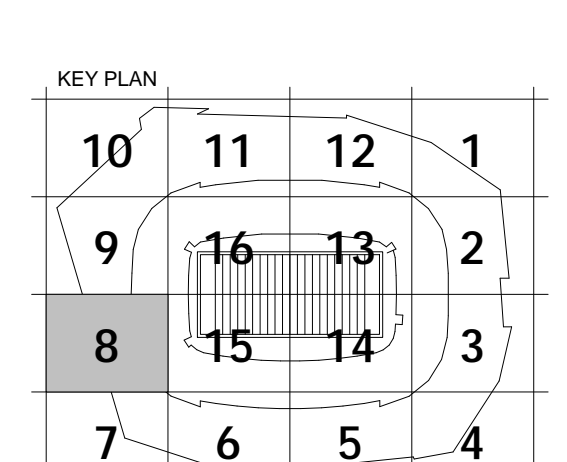
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
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**BUILDING ENVELOPE CONSULTANT**  
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**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

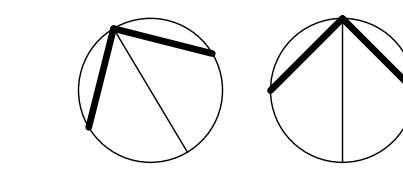


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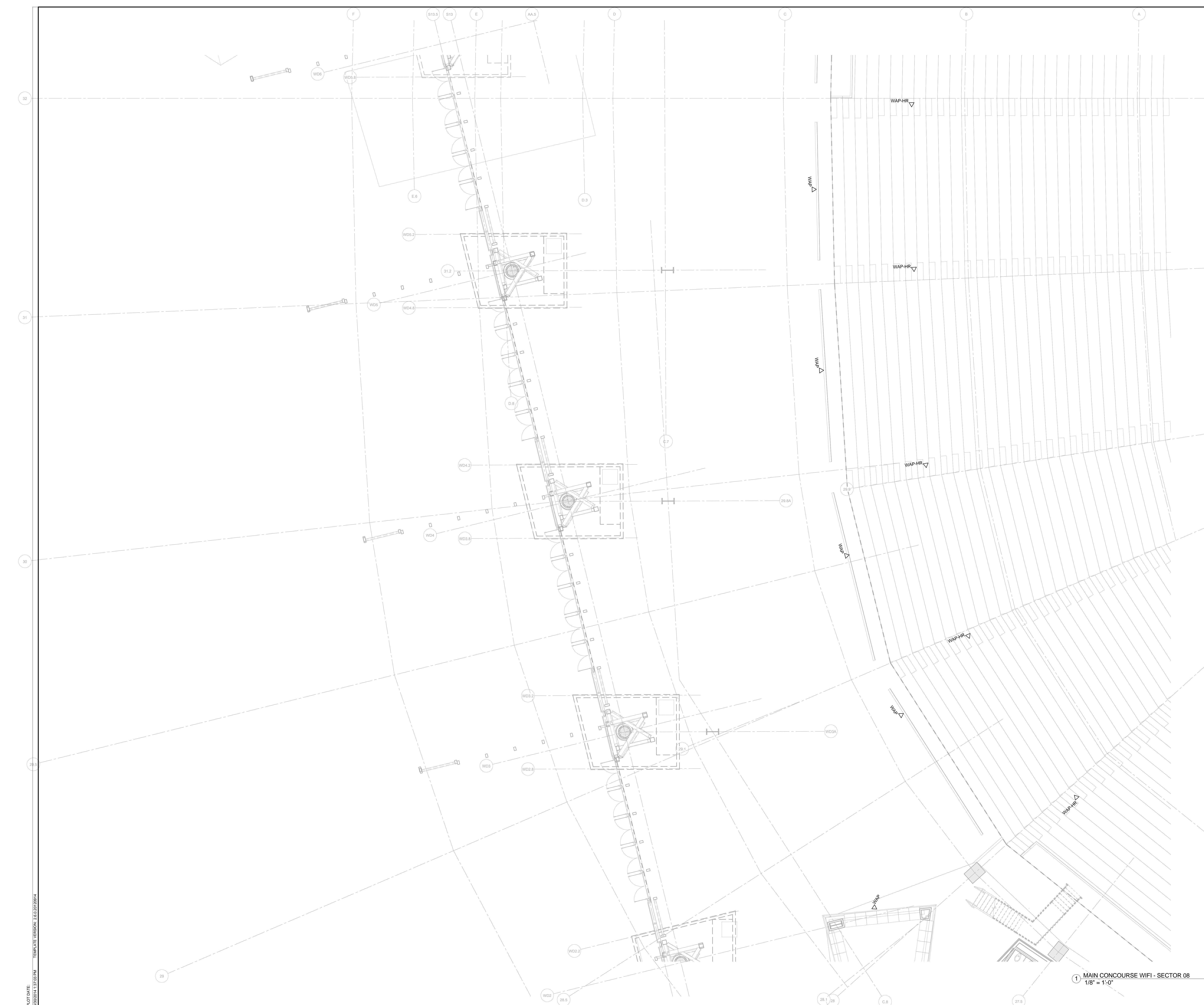
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**16246.000**  
DATE  
**May 02, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**MAIN CONCOURSE  
WIFI - SECTOR 08**

SHEET NO.  
**TW-2.0408**



① MAIN CONCOURSE WIFI - SECTOR 08  
1/8" = 1'-0"



WIFI PLANS  
GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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**OWNER**  
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900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414

**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6000 VIKING DR., EDEN PRAIRIE, MN 55344

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**ASSOCIATE ARCHITECT - SKIN**  
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**MEP / TECHNOLOGY / LIGHTING**  
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**STRUCTURAL ENGINEER**  
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**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OHLUND AND ASSOCIATES  
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**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAZA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROEHLER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66063

**WIND / SNOW CONSULTANT**  
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**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

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8	15	14	3
7	6	5	4

REVISION

NO.	DESCRIPTION	DATE

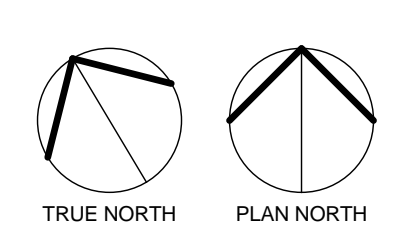
HKS PROJECT NUMBER  
16246.000

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ISSUE  
CCD-060

SHEET TITLE  
MAIN CONCOURSE  
WIFI - SECTOR 09

SHEET NO.  
TW-2.0409



① MAIN CONCOURSE WIFI - SECTOR 09  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
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- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



### KEY PLAN

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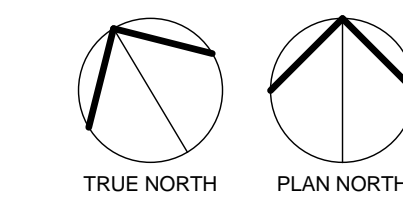
SHEET TITLE  
MAIN CONCOURSE  
WIFI - SECTOR 10

SHEET NO.

TW-2.0410



1 MAIN CONCOURSE WIFI - SECTOR 10  
1/8" = 1'-0"





## WIFI PLANS GENERAL NOTES:

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MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
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**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
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**CIVIL ENGINEER**  
E.V.S. INC.  
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**LANDSCAPE ARCHITECT**  
OBSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**HWY**  
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**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
6326 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
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ELEVATOR ADVISORY GROUP  
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**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVIEW, LOUISBURG, KS 66603

**WIND / SNOW CONSULTANT**  
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**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
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**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

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7	6	5	4

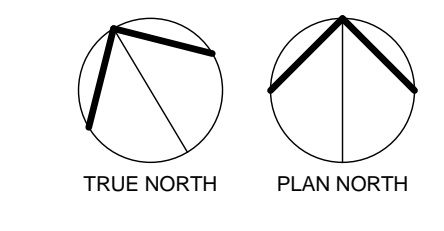
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SHEET TITLE  
MAIN CONCOURSE  
WIFI - SECTOR 11

SHEET NO.  
TW-2.0411

1 MAIN CONCOURSE WIFI - SECTOR 11  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
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FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
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SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
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- WIND / SNOW CONSULTANT**  
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THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
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- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

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9	16	13	2
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REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

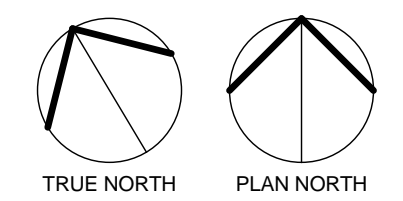
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
MAIN CONCOURSE  
WIFI - SECTOR 12

SHEET NO.  
TW-2.0412

1 MAIN CONCOURSE WIFI - SECTOR 12  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414

**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
8600 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

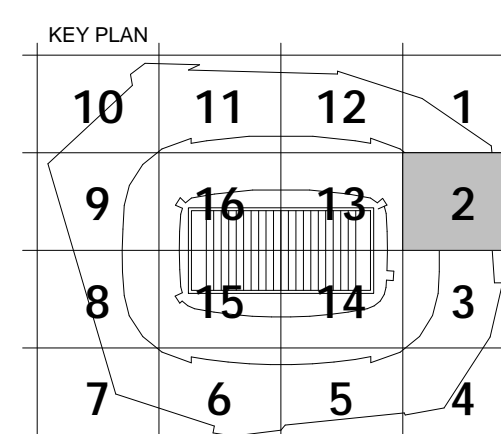
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

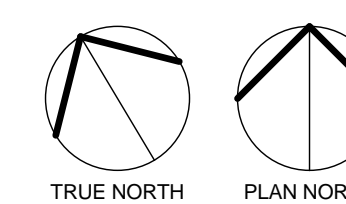


REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**May 02, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER CLUB WIFI - SECTOR 02**

SHEET NO.  
**TW-2.0502**

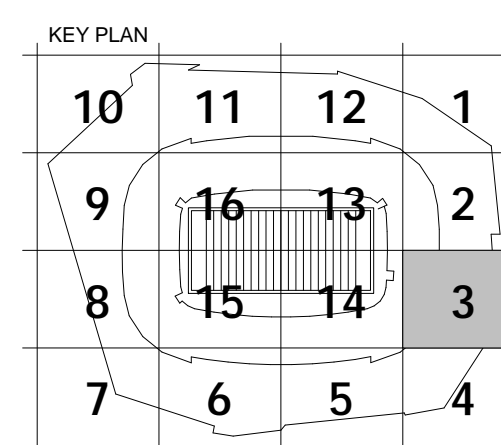
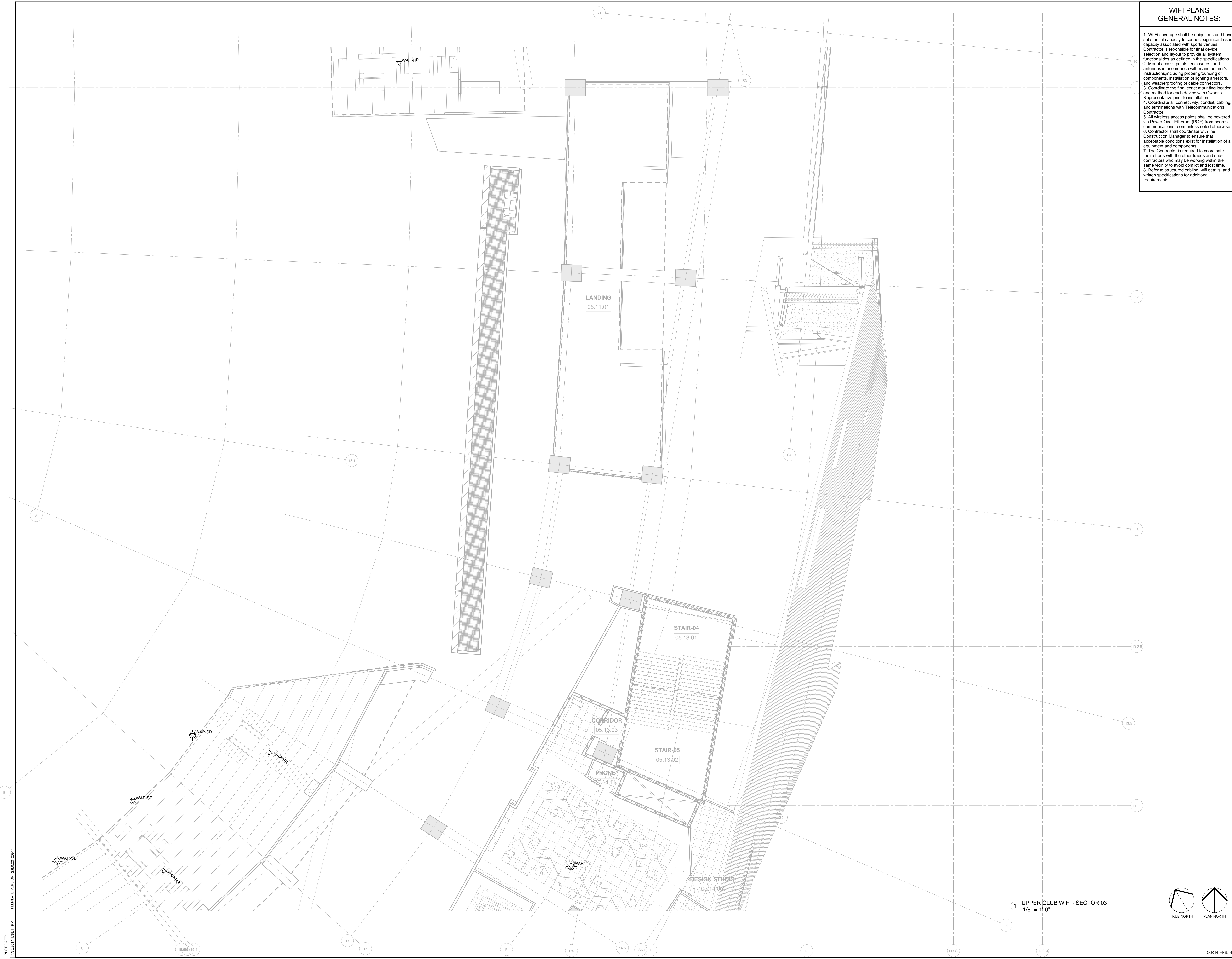


1 UPPER CLUB WIFI - SECTOR 02  
1/8" = 1'-0"

### WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
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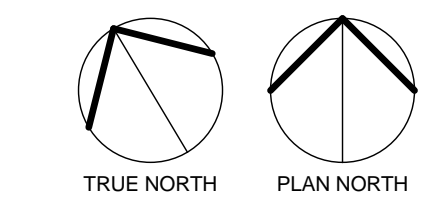
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
UPPER CLUB WIFI - SECTOR 03

SHEET NO.  
TW-2.0503

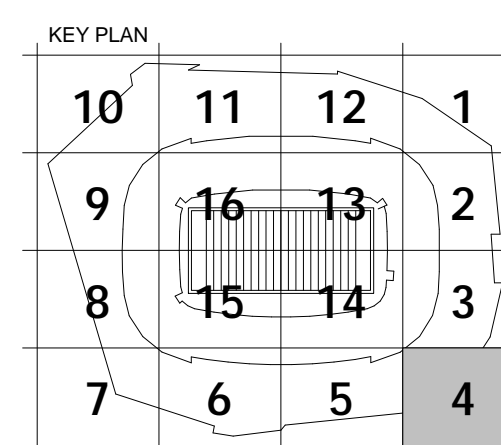
1 UPPER CLUB WIFI - SECTOR 03  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6000 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIFTH AVE., SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10508 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

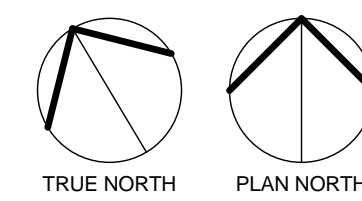


REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**



1 UPPER CLUB WIFI - SECTOR 04  
1/8" = 1'-0"

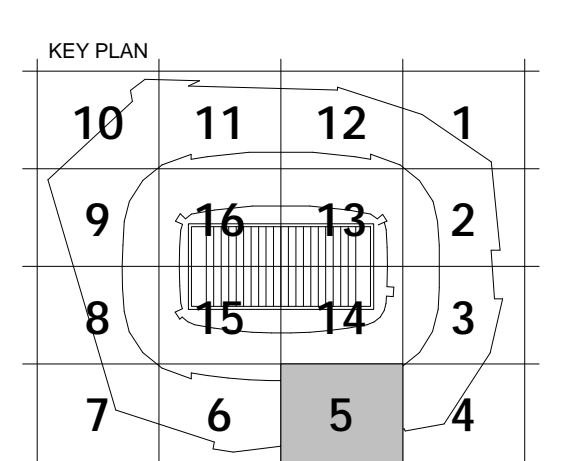
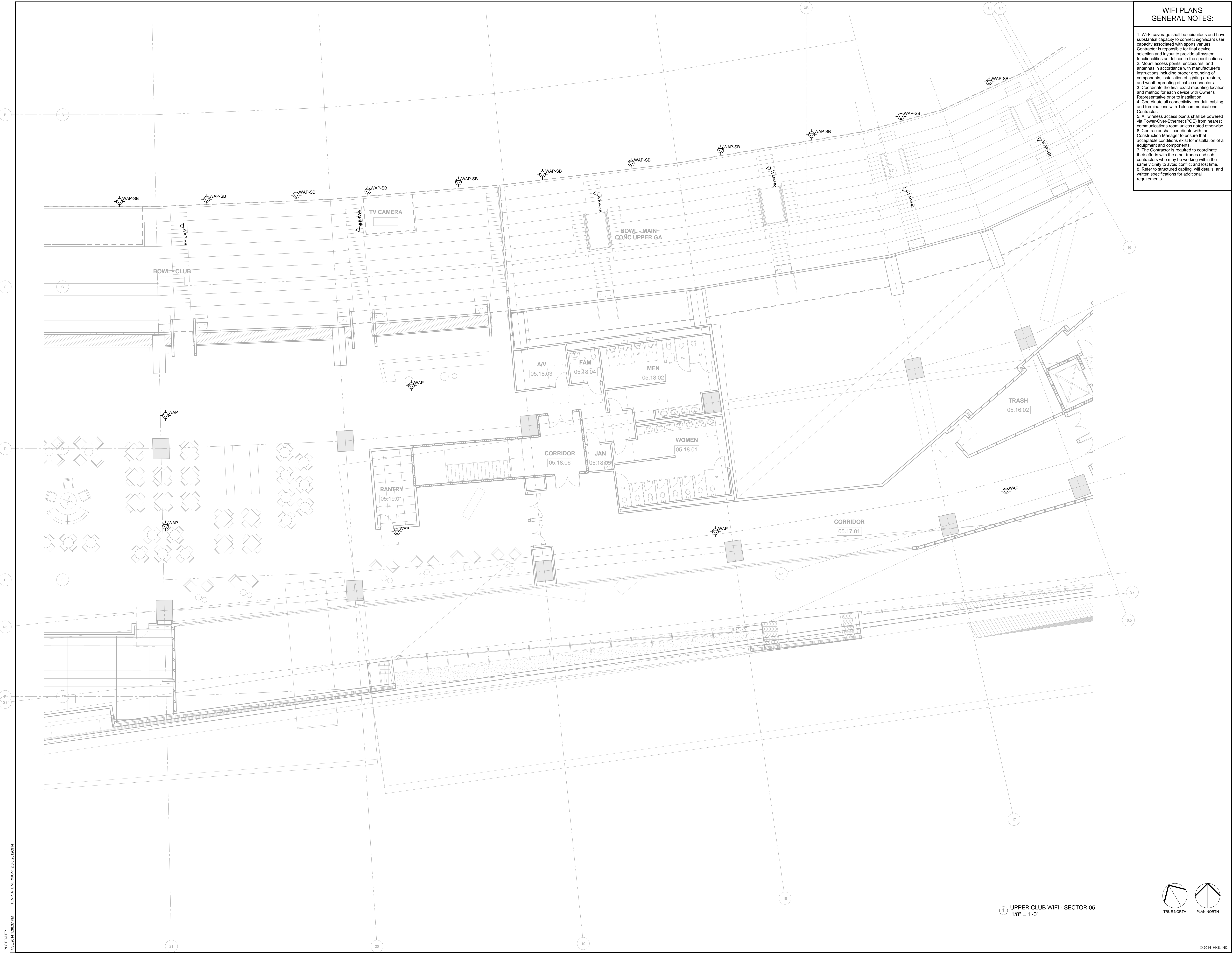
SHEET TITLE  
**UPPER CLUB WIFI - SECTOR 04**

SHEET NO.  
**TW-2.0504**

## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARSHWAY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OBLONG AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HWY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

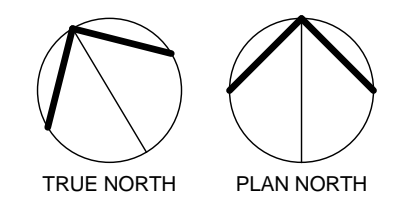
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
UPPER CLUB WIFI - SECTOR 05

SHEET NO.  
TW-2.0505

1 UPPER CLUB WIFI - SECTOR 05  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N. MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**MECHANICAL**  
HUNY  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210

**FOOD SERVICE**  
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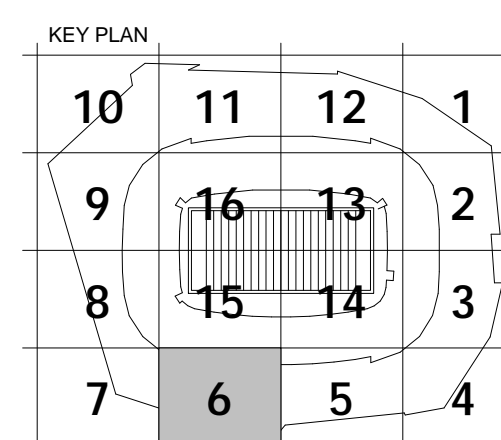
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2980 MISSOURI BELLEVUE, LOUISBURG, KS 66063

**WIND / SNOW CONSULTANT**  
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**BUILDING ENVELOPE CONSULTANT**  
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**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO. DESCRIPTION DATE

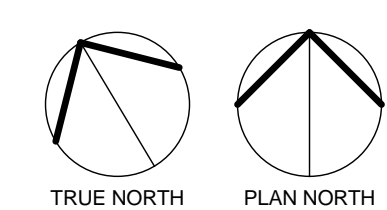
REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
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DATE  
May 02, 2014  
ISSUE  
CCD-060

SHEET TITLE  
UPPER CLUB WIFI - SECTOR 06

SHEET NO.  
TW-2.0506

1 UPPER CLUB WIFI - SECTOR 06  
1/8" = 1'-0"



**WIFI PLANS  
GENERAL NOTES:**

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MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6600 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
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6328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
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**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
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**ADA CONSULTANT**  
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ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAKE RD., WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LEROY BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO. DESCRIPTION DATE

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

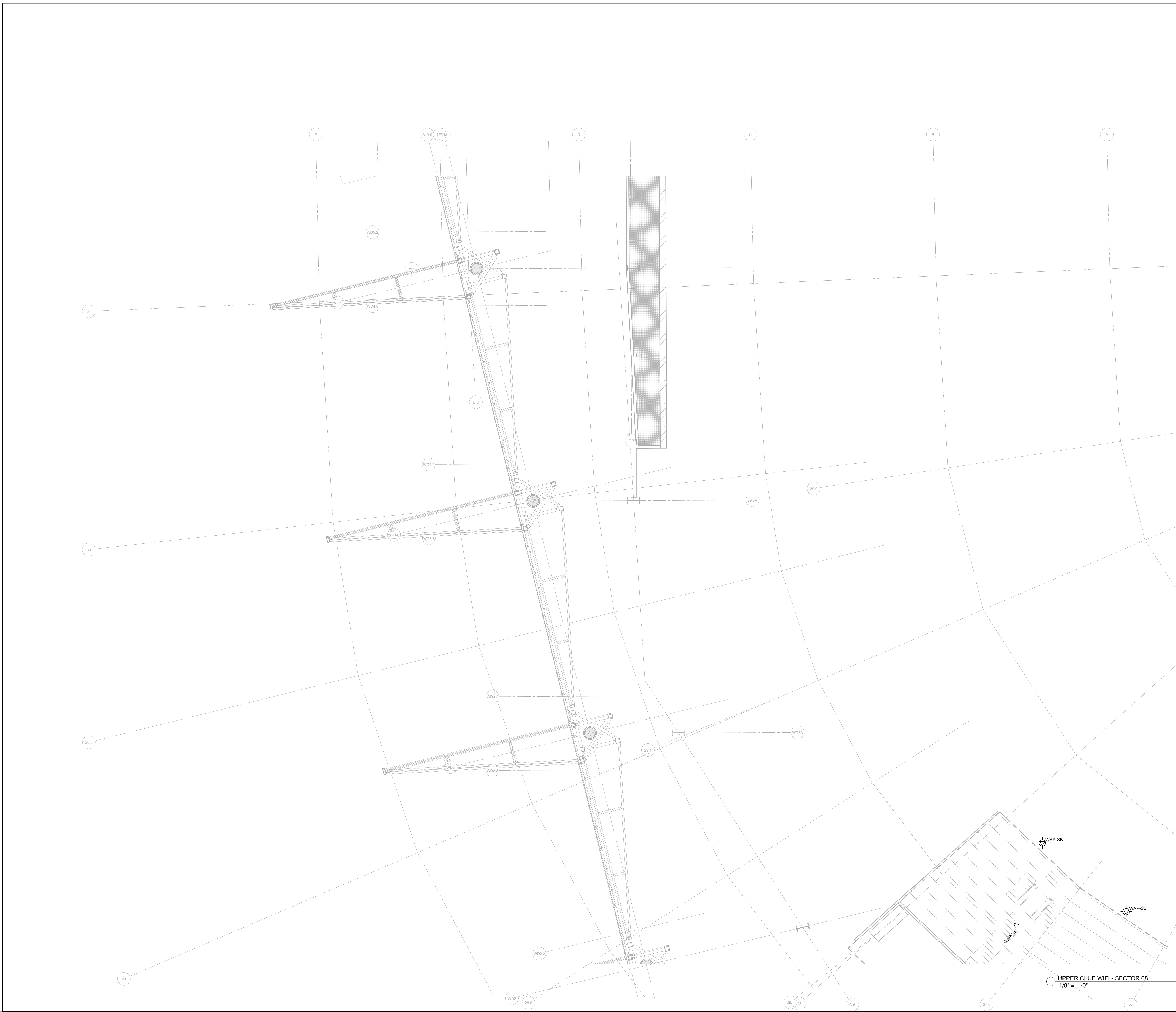
DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

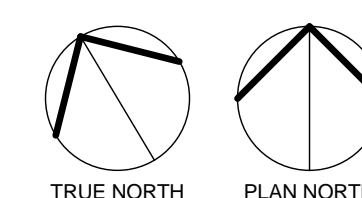
SHEET TITLE  
**UPPER CLUB WIFI - SECTOR 08**

SHEET NO.

**TW-2.0508**



**1 UPPER CLUB WIFI - SECTOR 08**  
1/8" = 1'-0"

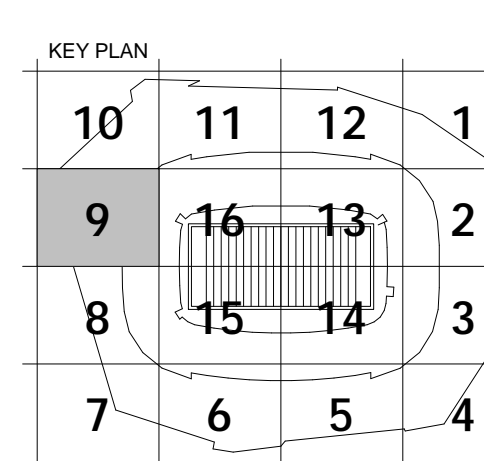




## WIFI PLANS GENERAL NOTES:

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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNSYLVANIA AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROETHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

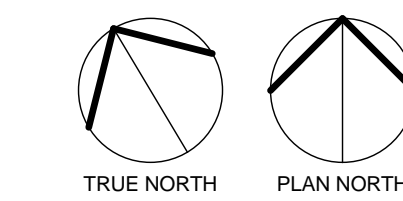
HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER CLUB WIFI - SECTOR 09**

SHEET NO.  
**TW-2.0509**



1 UPPER CLUB WIFI - SECTOR 09  
1/8" = 1'-0"

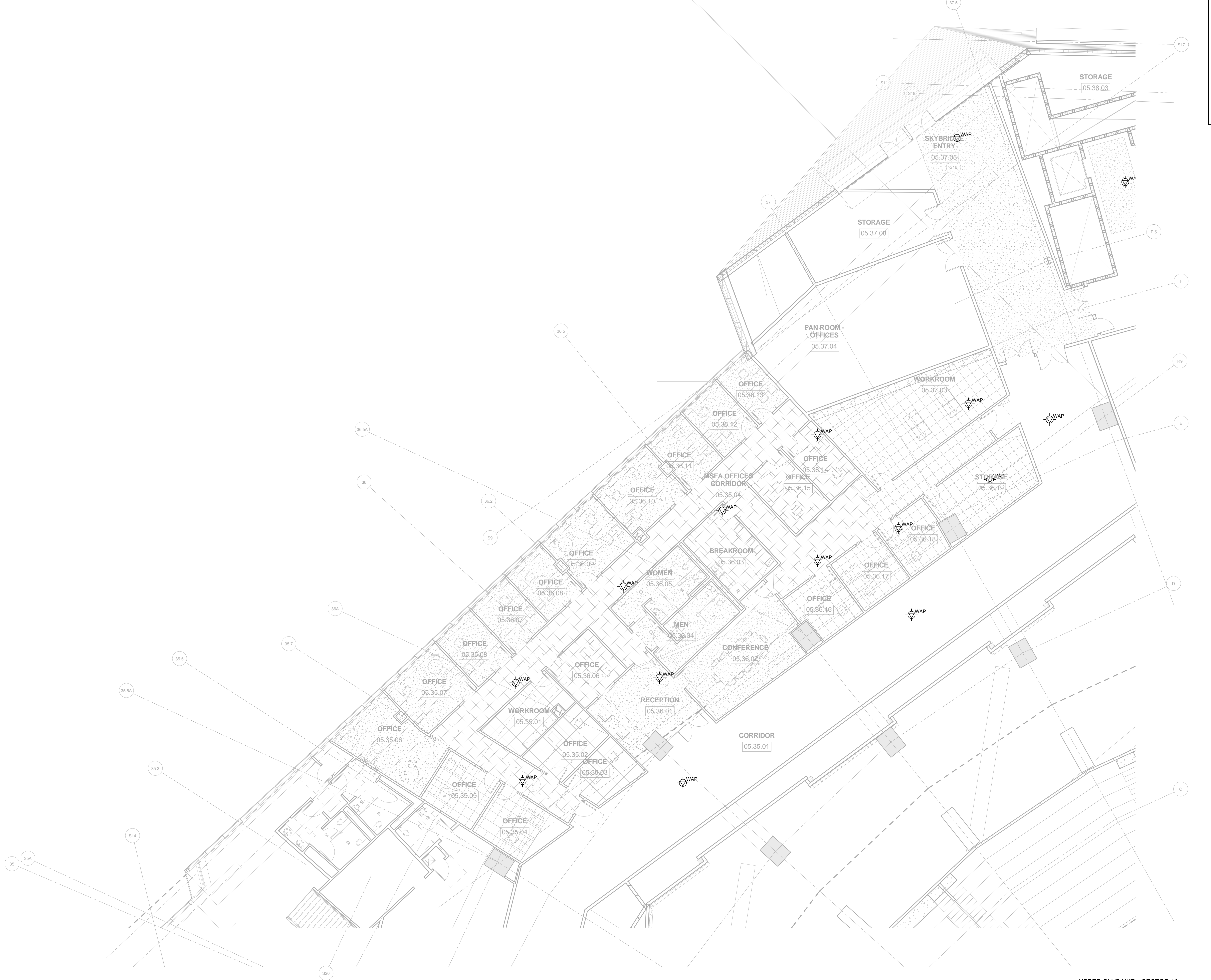


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## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80233
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



10	11	12	1
9	16	13	2
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REVISION NO.	DESCRIPTION	DATE

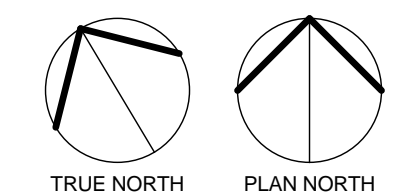
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
UPPER CLUB WIFI -  
SECTOR 10

SHEET NO.  
TW-2.0510

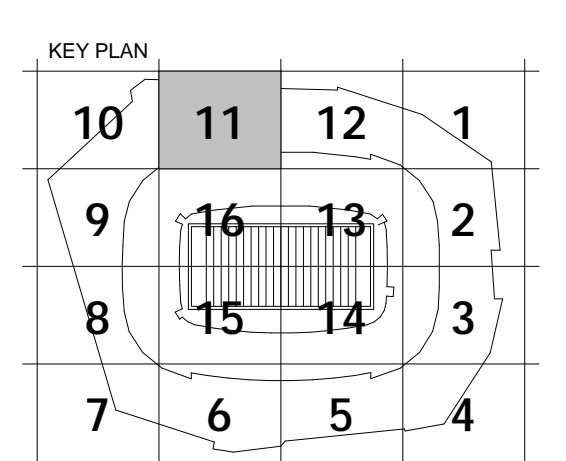
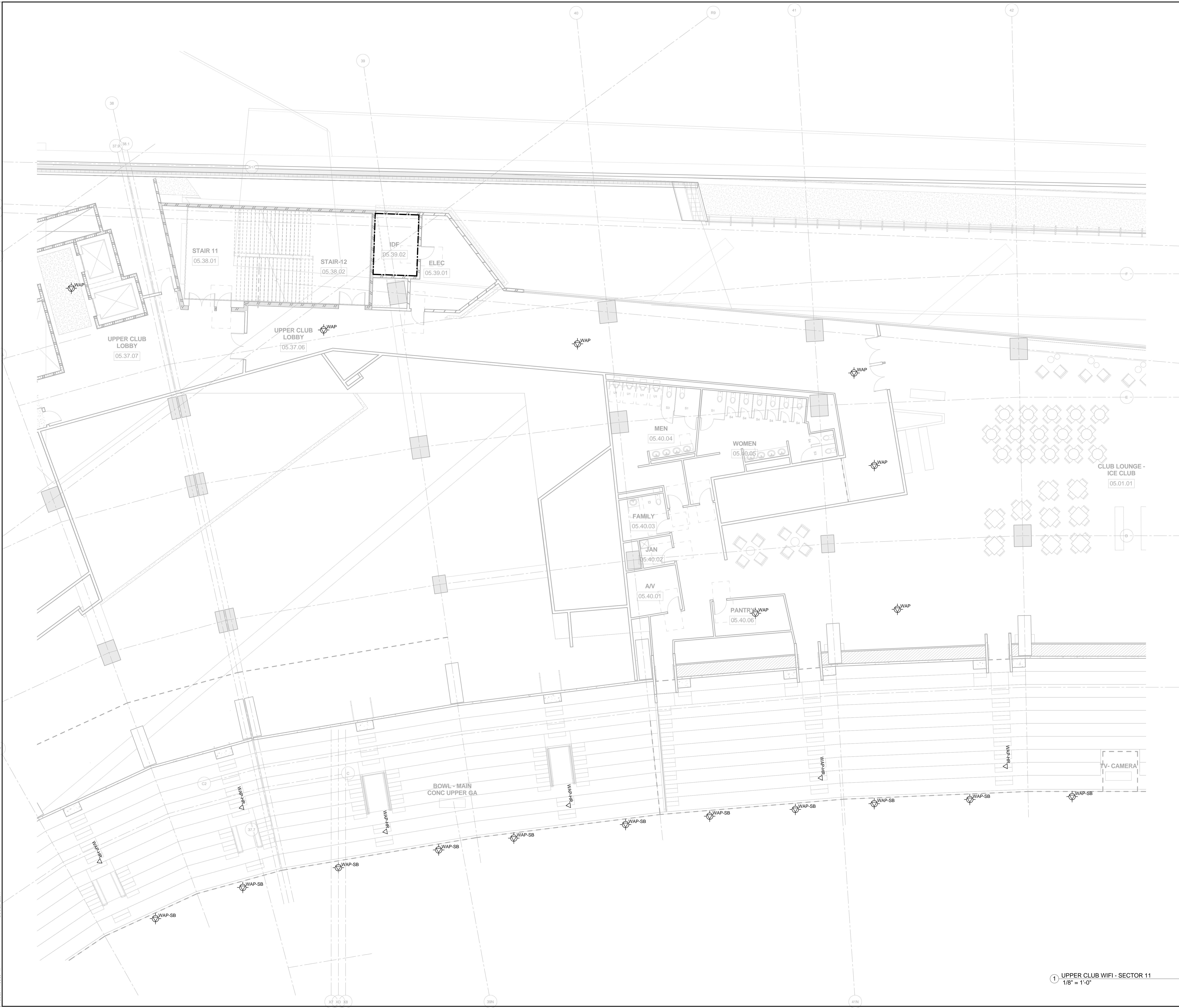


1 UPPER CLUB WIFI - SECTOR 10  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., SUITE 100, CHICAGO, IL 60611
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LORD BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

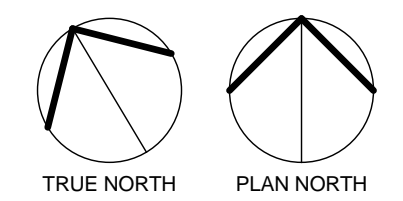
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
UPPER CLUB WIFI - SECTOR 11

SHEET NO.  
TW-2.0511

1 UPPER CLUB WIFI - SECTOR 11  
1/8" = 1'-0"





## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- H.W.H.V.**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
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- ADA CONSULTANT**  
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- WIND / SNOW CONSULTANT**  
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- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERDCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5TH STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
8600 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55424

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**H/W/HV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90239

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66065

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B9

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THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
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LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

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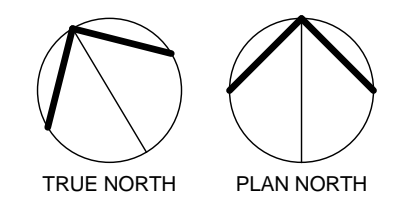
REVISION NO. DESCRIPTION DATE

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**



SHEET TITLE  
**UPPER SUITE WIFI  
- SECTOR 02**

SHEET NO.  
**TW-2.0602**



1 UPPER SUITE WIFI - SECTOR 02  
1/8" = 1'-0"



### WIFI PLANS GENERAL NOTES:

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10508 WRIGHT BROTHERS DR., ADDISON, TX 75001

**H/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

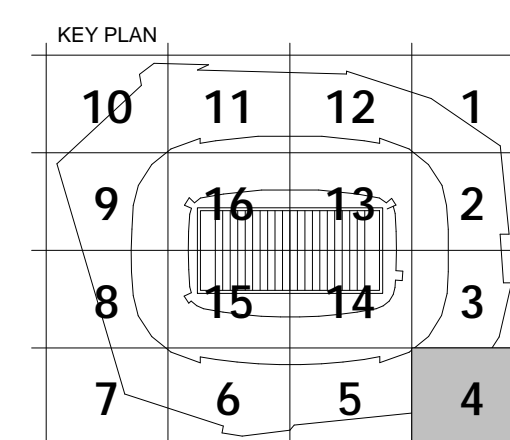
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66063

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 8B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

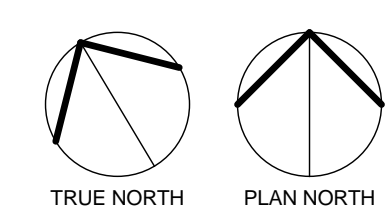


REVISION NO.	DESCRIPTION	DATE

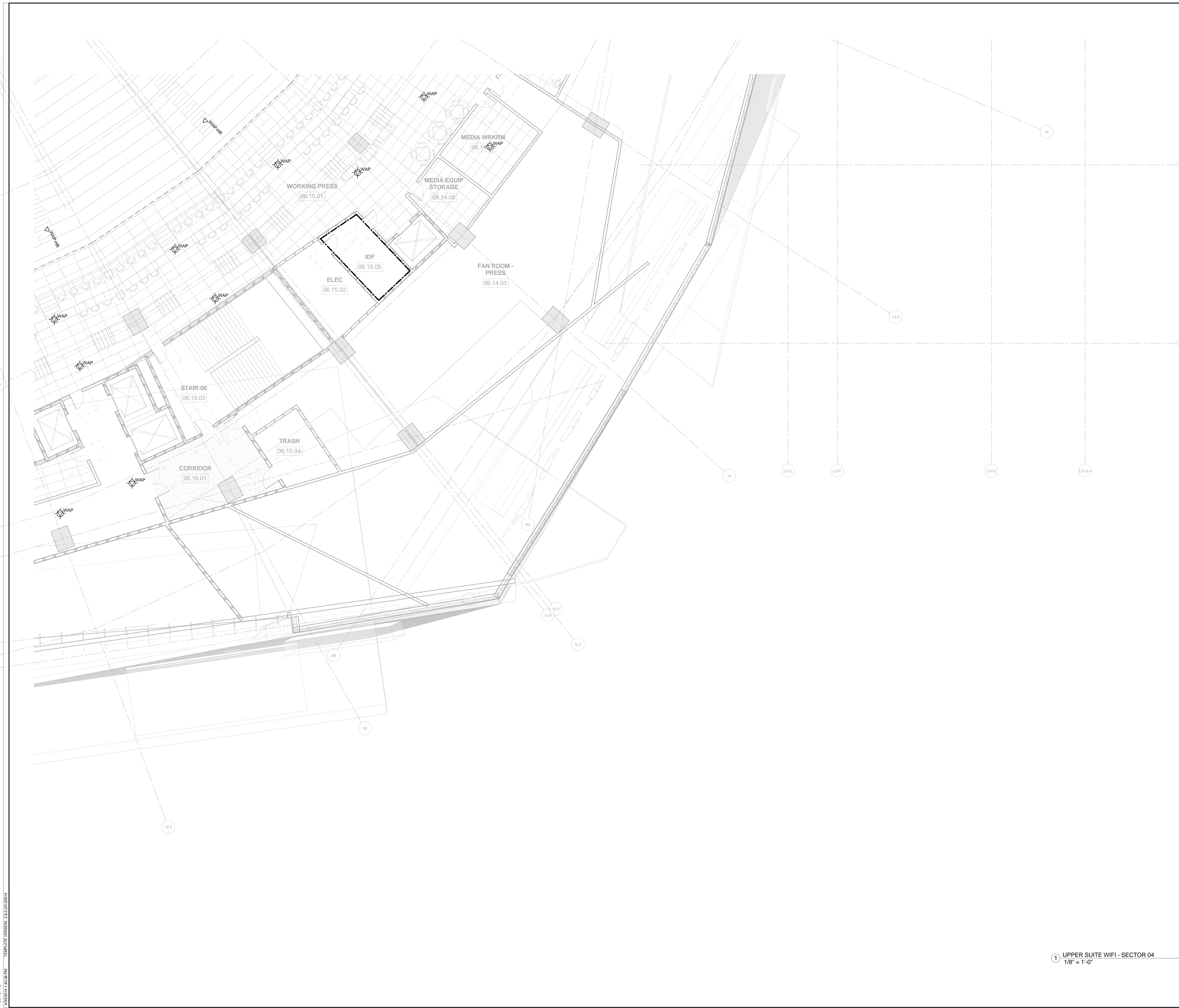
HKS PROJECT NUMBER  
**16246.000**  
DATE  
**May 02, 2014**  
ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER SUITE WIFI - SECTOR 04**

SHEET NO.  
**TW-2.0604**



1 UPPER SUITE WIFI - SECTOR 04  
1/8" = 1'-0"

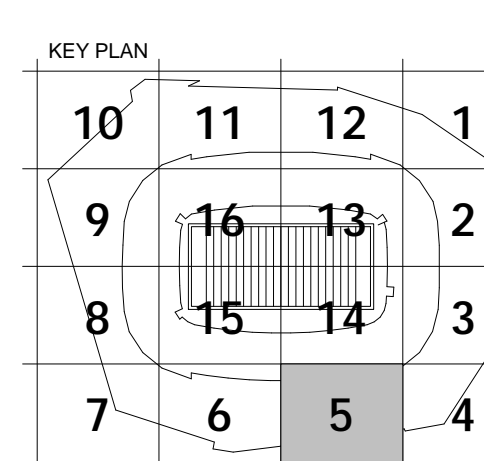




WIFI PLANS  
GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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7. The Contractor is required to coordinate their efforts with the other trades and sub-contractors who may be working within the same vicinity to avoid conflict and lost time.
8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIVE AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHBERG CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LORD BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

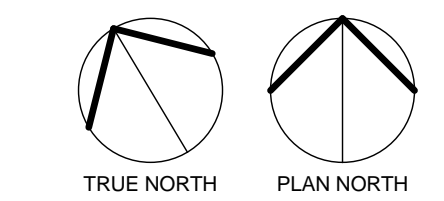
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
UPPER SUITE WIFI  
- SECTOR 05

SHEET NO.

TW-2.0605



1 UPPER SUITE WIFI - SECTOR 05  
1/8" = 1'-0"

PLOT DATE: 4/29/2014 1:40:58 PM  
TEMPLATE VERSION: 210320120914

### WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N. MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

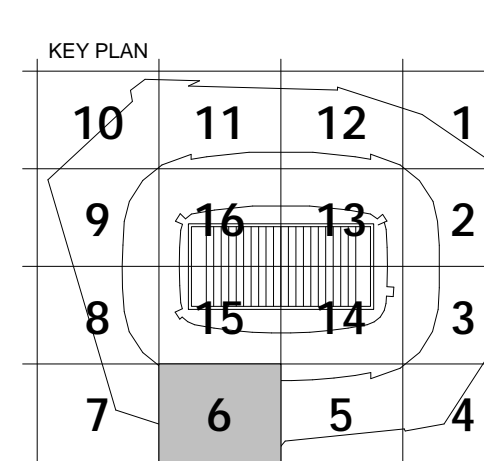
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHBERG CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

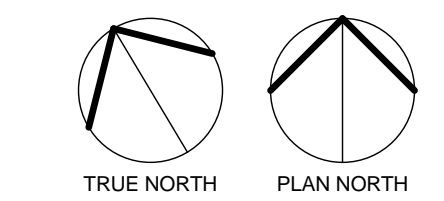
DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER SUITE WIFI - SECTOR 06**

SHEET NO.  
**TW-2.0606**

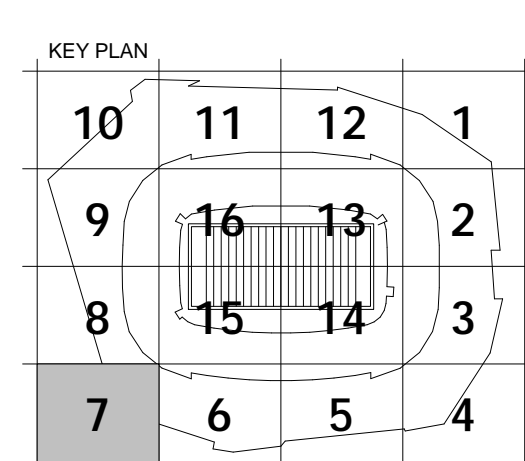
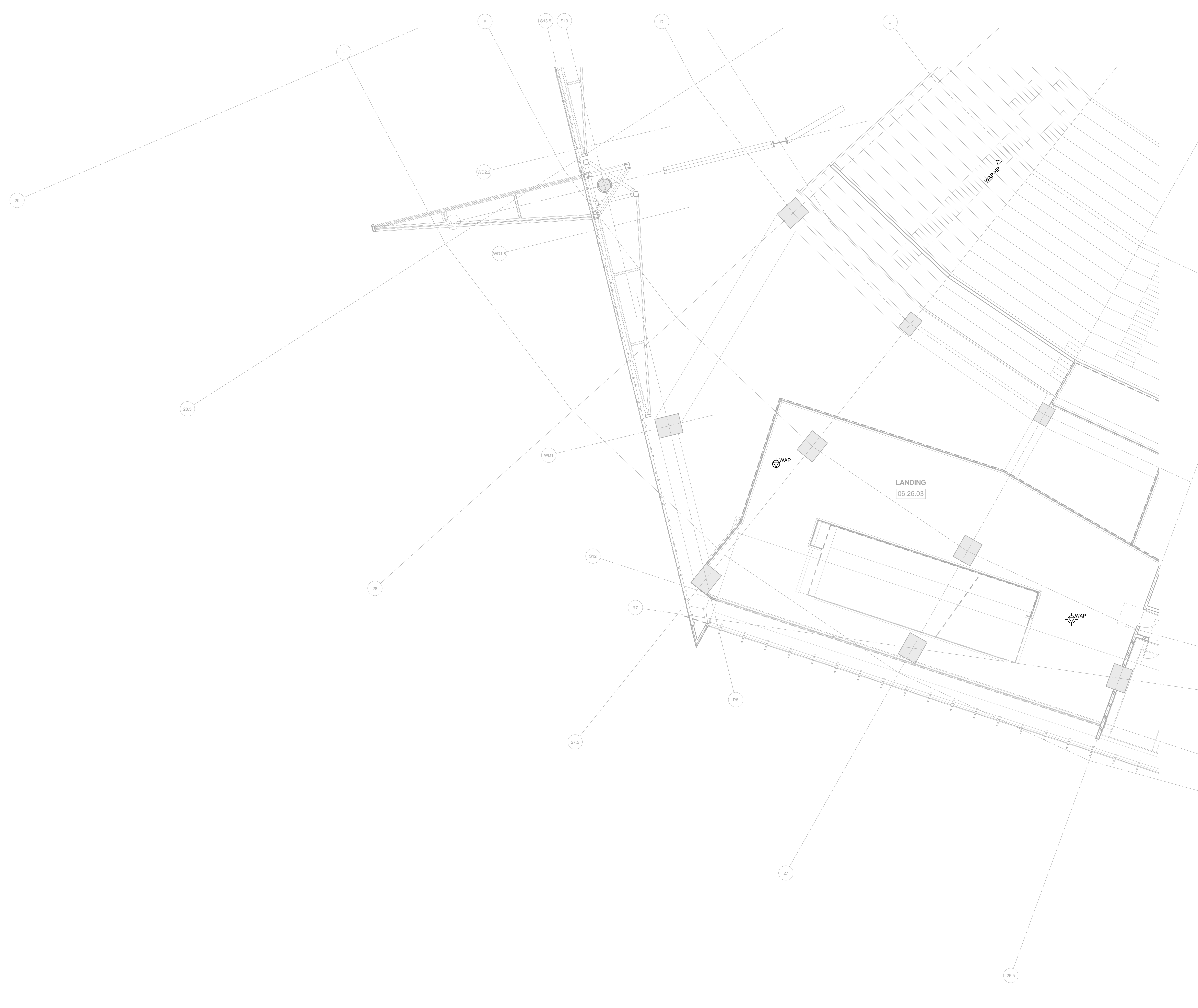
① UPPER SUITE WIFI - SECTOR 06  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- H/WAY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66065
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

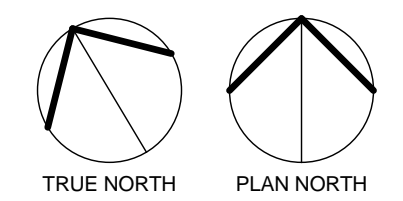
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
UPPER SUITE WIFI  
- SECTOR 07

SHEET NO.  
TW-2.0607

1 UPPER SUITE WIFI - SECTOR 07  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIKING DR., EDEN PRAIRIE, MN 55434

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 WEST AVE., SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**MECHANICAL**  
HUNBY  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION

NO.	DESCRIPTION	DATE

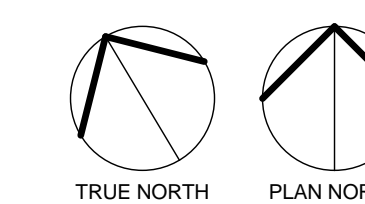
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

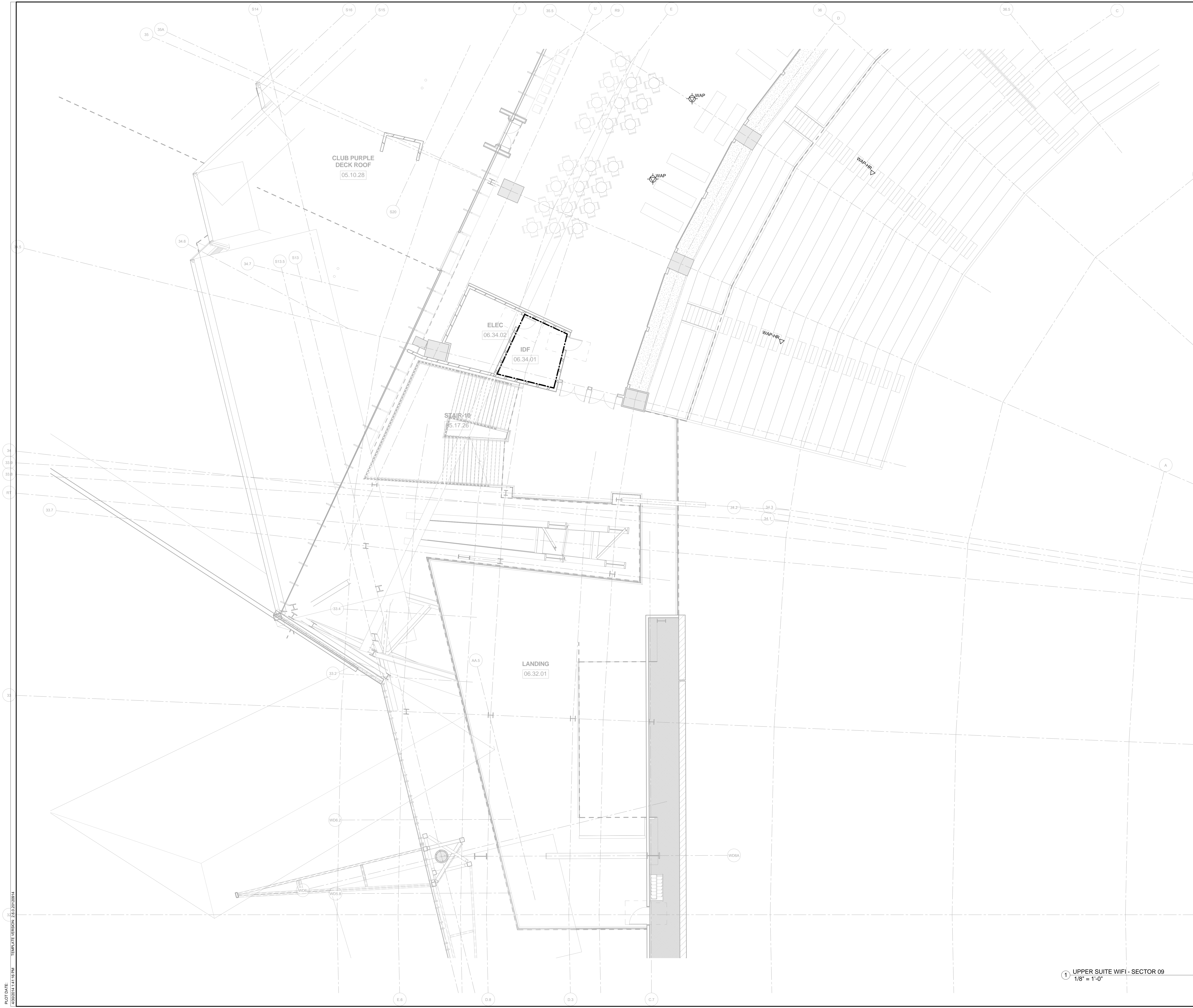
ISSUE  
CCD-060

SHEET TITLE  
UPPER SUITE WIFI  
- SECTOR 09

SHEET NO.  
TW-2.0609



1 UPPER SUITE WIFI - SECTOR 09  
1/8" = 1'-0"



PLT DATE: 4/20/2014 1:41:15 PM  
TEMPLATE VERSION: 2/13/2012/2014



**WIFI PLANS  
GENERAL NOTES:**

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
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6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

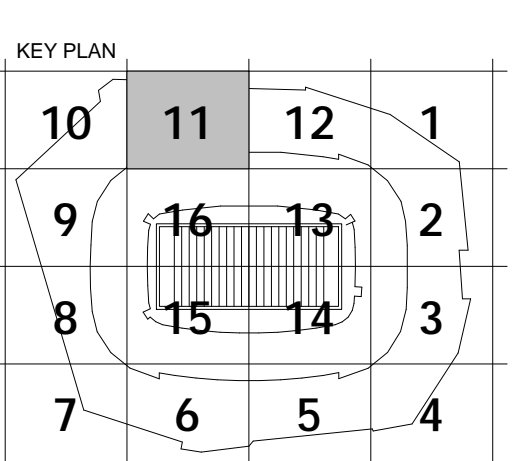
**ADA CONSULTANT**  
ED ROTHNER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., SUITE 200, CHICAGO, IL 60611

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
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**FAÇADE ACCESS CONSULTANT**  
LORD BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

**MINNESOTA**  
MULTI-PURPOSE STADIUM



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

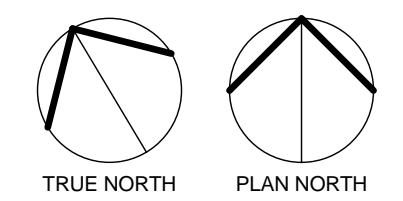
SHEET TITLE  
UPPER SUITE WIFI  
- SECTOR 11

SHEET NO.  
TW-2.0611



SEE LIST OF ALTERNATES.  
REFER TO ARCHITECTURAL  
PLANS FOR MORE INFORMATION.

1 UPPER SUITE WIFI - SECTOR 11  
1/8" = 1'-0"



**WIFI PLANS  
GENERAL NOTES:**

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 600, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OBLIN AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10508 WRIGHT BROTHERS DR., ADDISON, TX 75001

**PLUMBING**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
6326 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

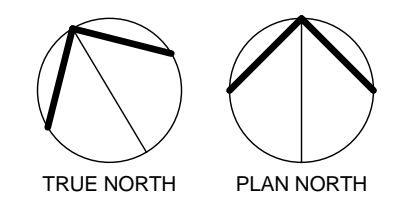
HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER SUITE WIFI  
- SECTOR 12**

SHEET NO.  
**TW-2.0612**



1 UPPER SUITE WIFI - SECTOR 12  
1/8" = 1'-0"

### WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
2. Mount access points, enclosures, and antennas in accordance with manufacturer's instructions including proper grounding of components, installation of lightning arrestors, and weatherproofing of cable connectors.
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7. The Contractor is required to coordinate their efforts with the other trades and sub-contractors who may be working within the same vicinity to avoid conflict and lost time.
8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 7TH AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N. MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**HUNY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

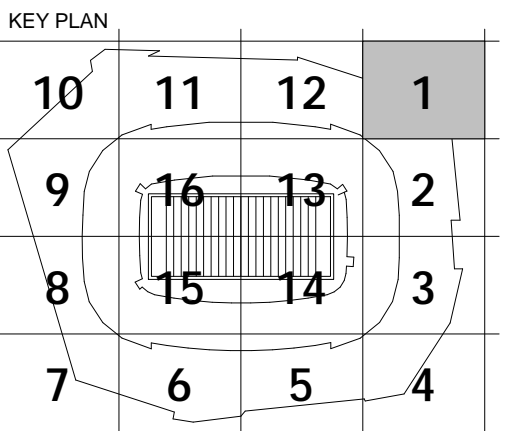
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROETHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66063

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

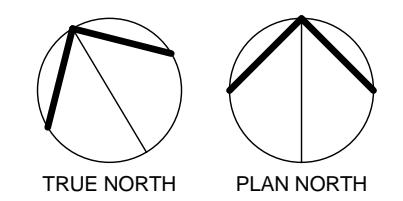
HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER CONOURSE WIFI - SECTOR 01**

SHEET NO.  
**TW-2.0701**



1 UPPER CONOURSE WIFI - SECTOR 01  
1/8" = 1'-0"



### WIFI PLANS GENERAL NOTES:

- 1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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- 7. The Contractor is required to coordinate their efforts with the other trades and sub-contractors who may be working within the same vicinity to avoid conflict and lost time.
- 8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55414

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 VIKING DR., EDEN PRAIRIE, MN 55434

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90239

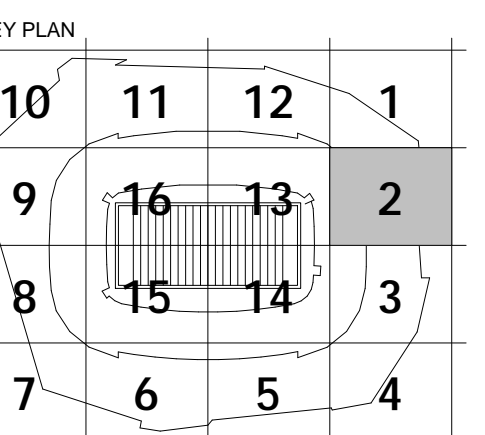
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66563

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., QUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
530 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

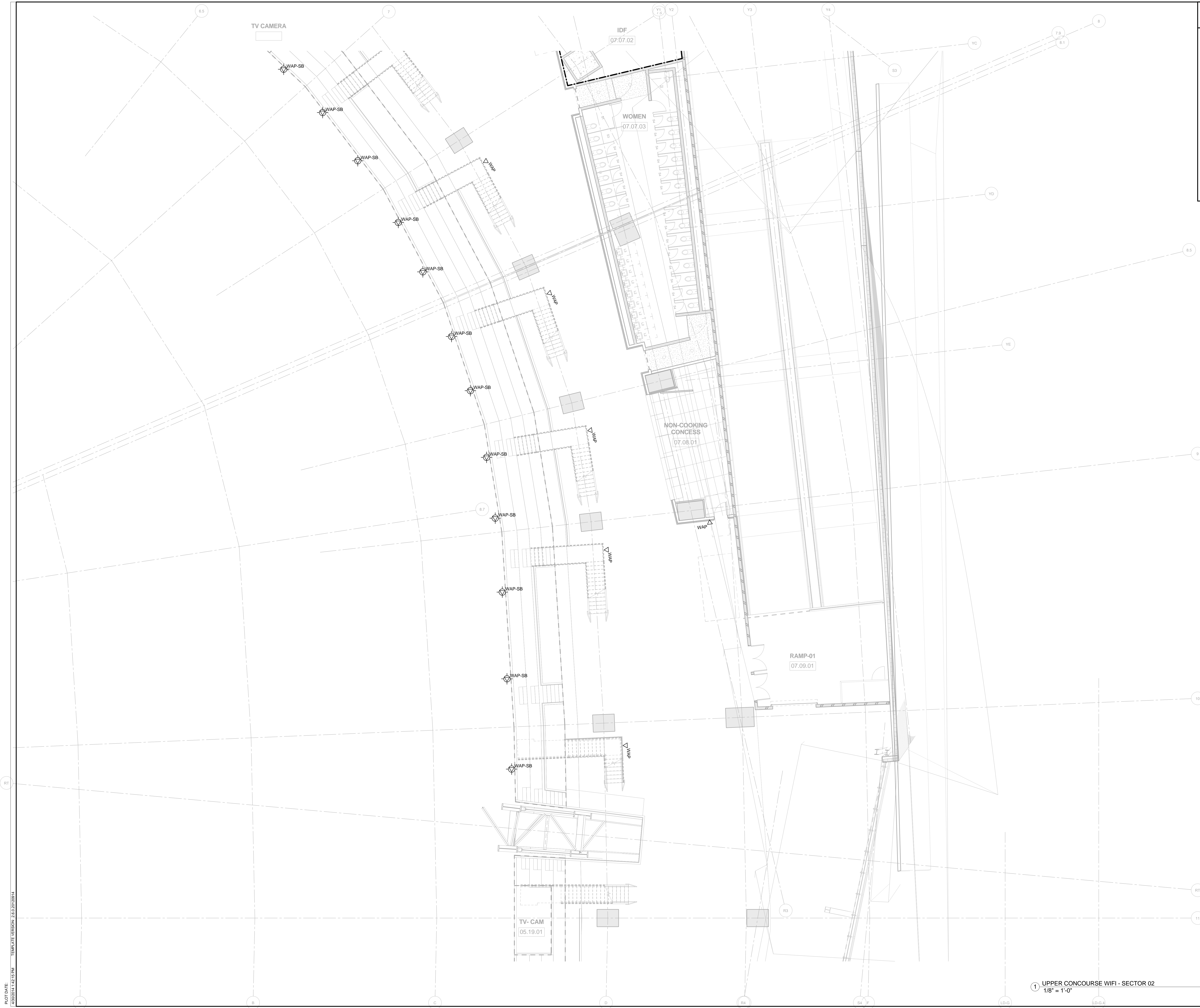
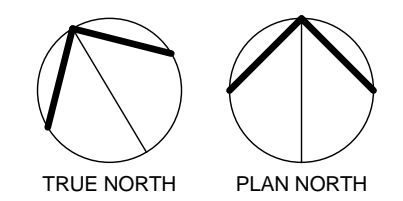
HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER  
CONOURSE WIFI -  
SECTOR 02**

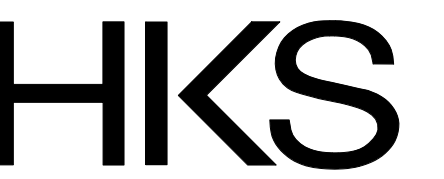
SHEET NO.  
**TW-2.0702**



1 UPPER CONOURSE WIFI - SECTOR 02  
1/8" = 1'-0"

**WIFI PLANS  
GENERAL NOTES:**

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.



**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 600, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295

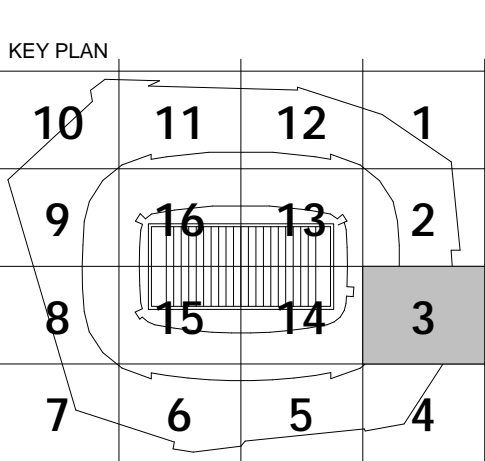
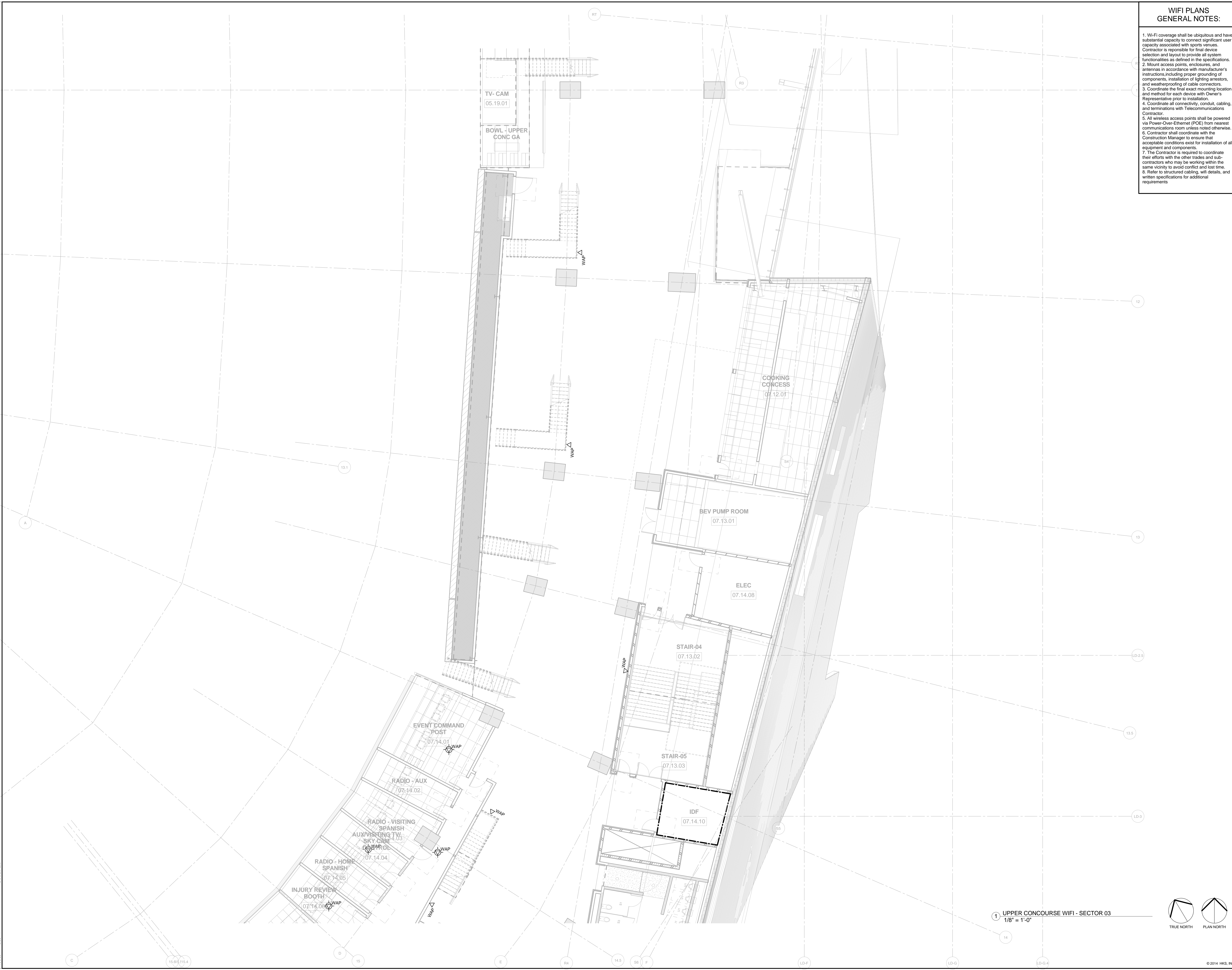
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD. WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

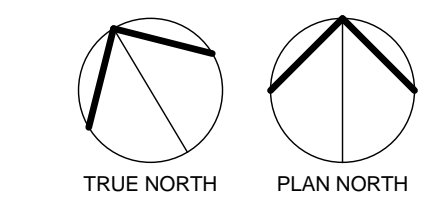


REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000  
DATE  
May 02, 2014  
ISSUE  
CCD-060

SHEET TITLE  
UPPER  
CONCOURSE WIFI -  
SECTOR 03  
SHEET NO.

TW-2.0703

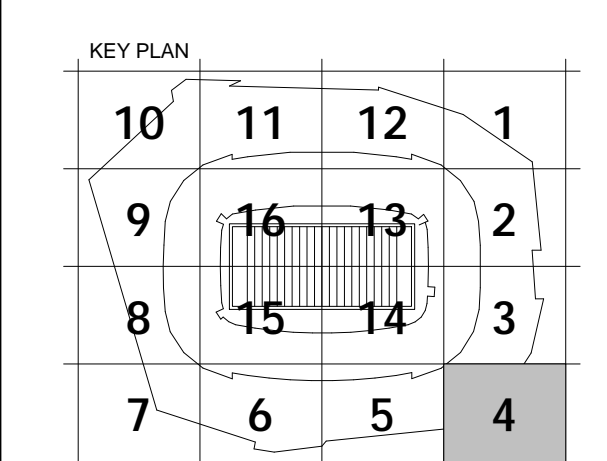
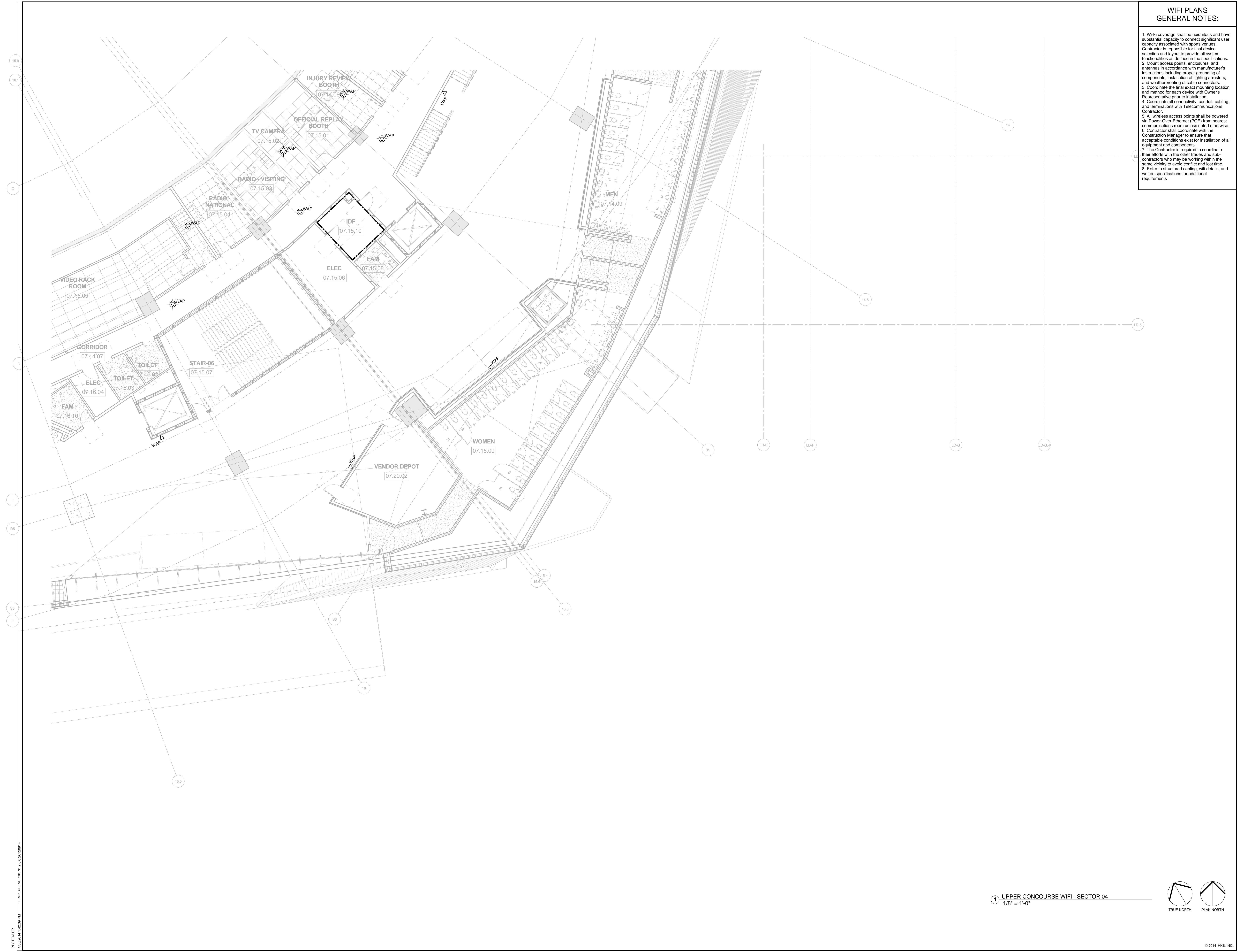


1 UPPER CONCOURSE WIFI - SECTOR 03  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIFTH AVE., SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR DIVISION GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., W. GUELPH, ON CANADA N1K 8B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH ST., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

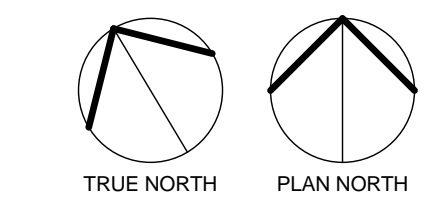
DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER  
CONCOURSE WIFI -  
SECTOR 04**

SHEET NO.  
**TW-2.0704**

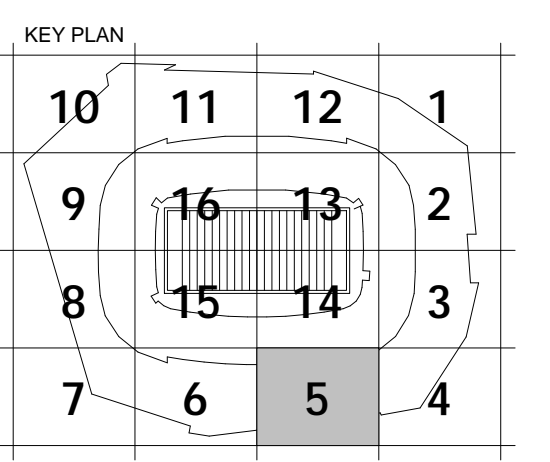
1 UPPER CONCOURSE WIFI - SECTOR 04  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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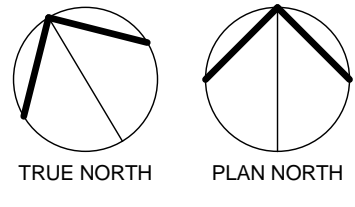
- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
9500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIVE AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLAND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
1508 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000  
DATE  
May 02, 2014  
ISSUE  
CCD-060

SHEET TITLE  
UPPER  
CONCOURSE WIFI -  
SECTOR 05  
SHEET NO.

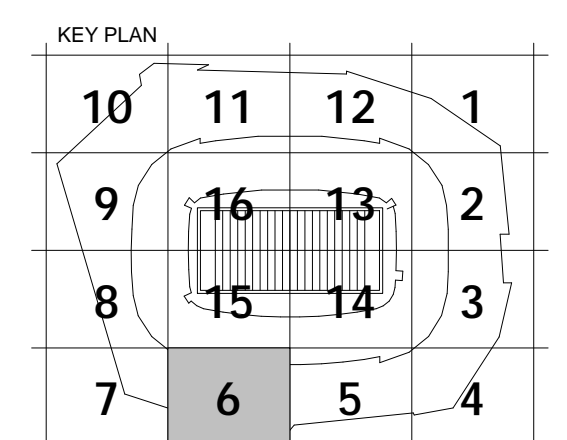


1 UPPER CONCOURSE WIFI - SECTOR 05  
1/8" = 1'-0"

### WIFI PLANS GENERAL NOTES:

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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- PLUMBING**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

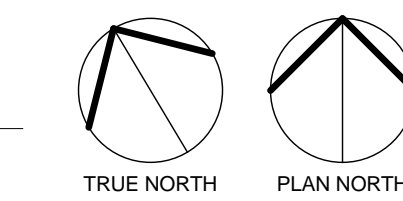


REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000  
DATE  
May 02, 2014  
ISSUE  
CCD-060

SHEET TITLE  
UPPER  
CONCOURSE WIFI -  
SECTOR 06  
SHEET NO.

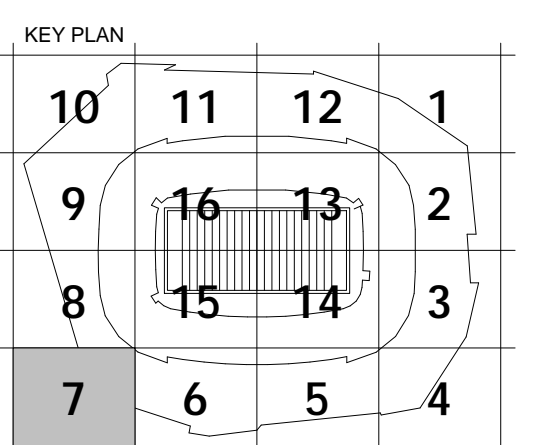
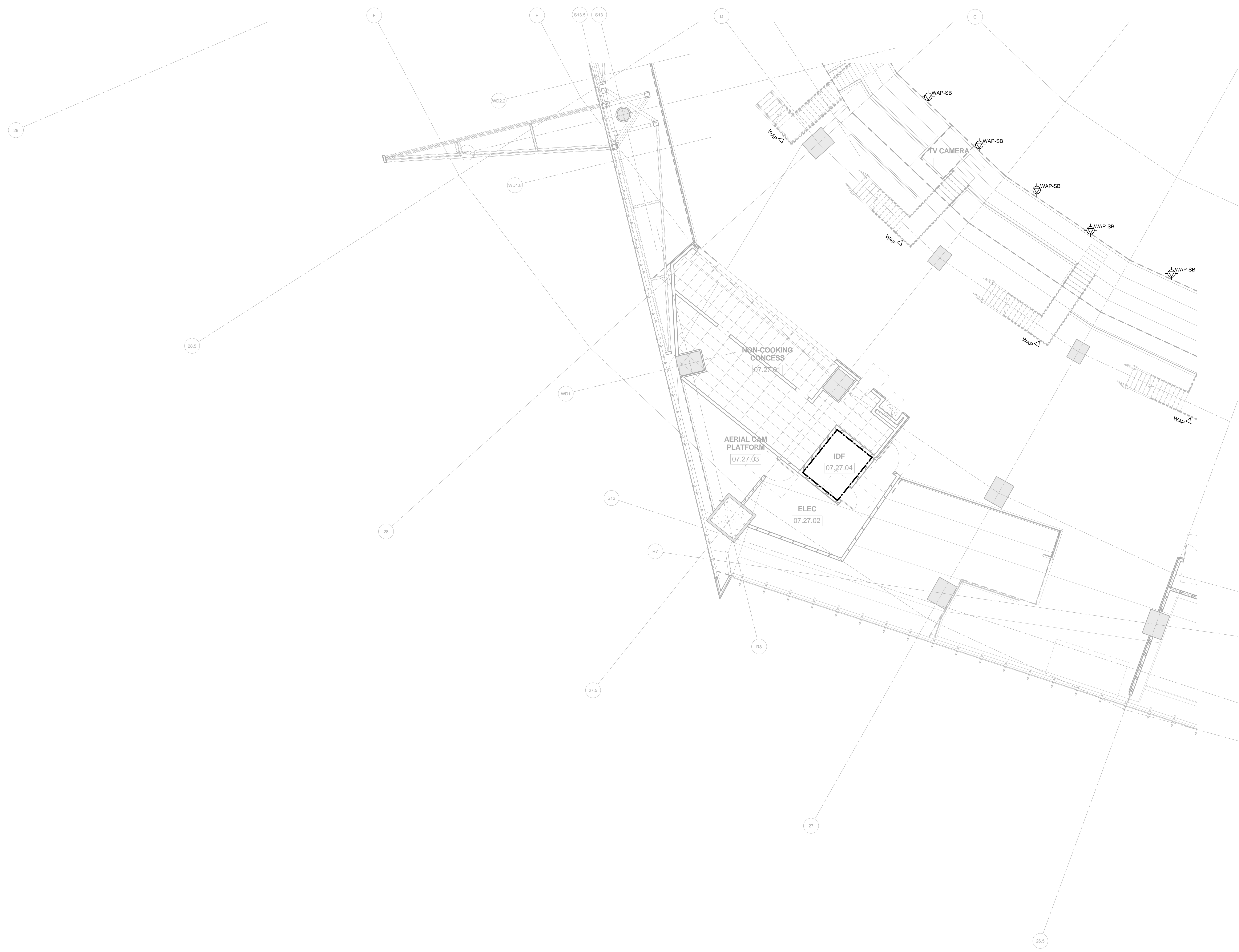
1 UPPER CONCOURSE WIFI - SECTOR 06  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNGOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

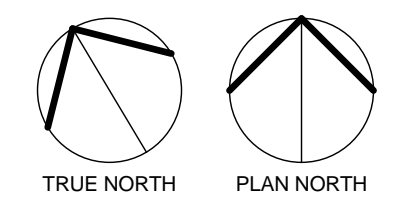
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
UPPER  
CONCOURSE WIFI -  
SECTOR 07

SHEET NO.

① UPPER CONCOURSE WIFI - SECTOR 07  
1/8" = 1'-0"

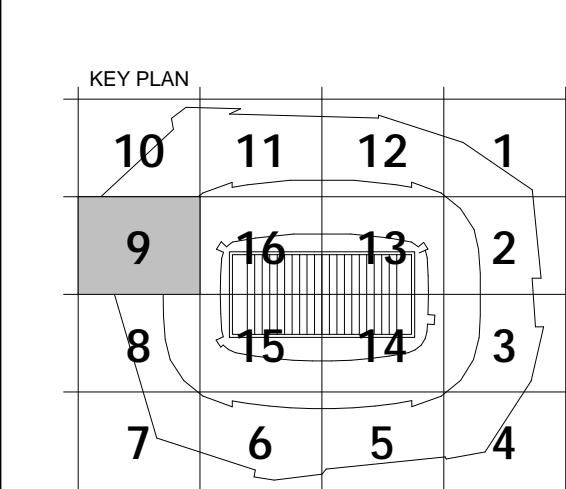
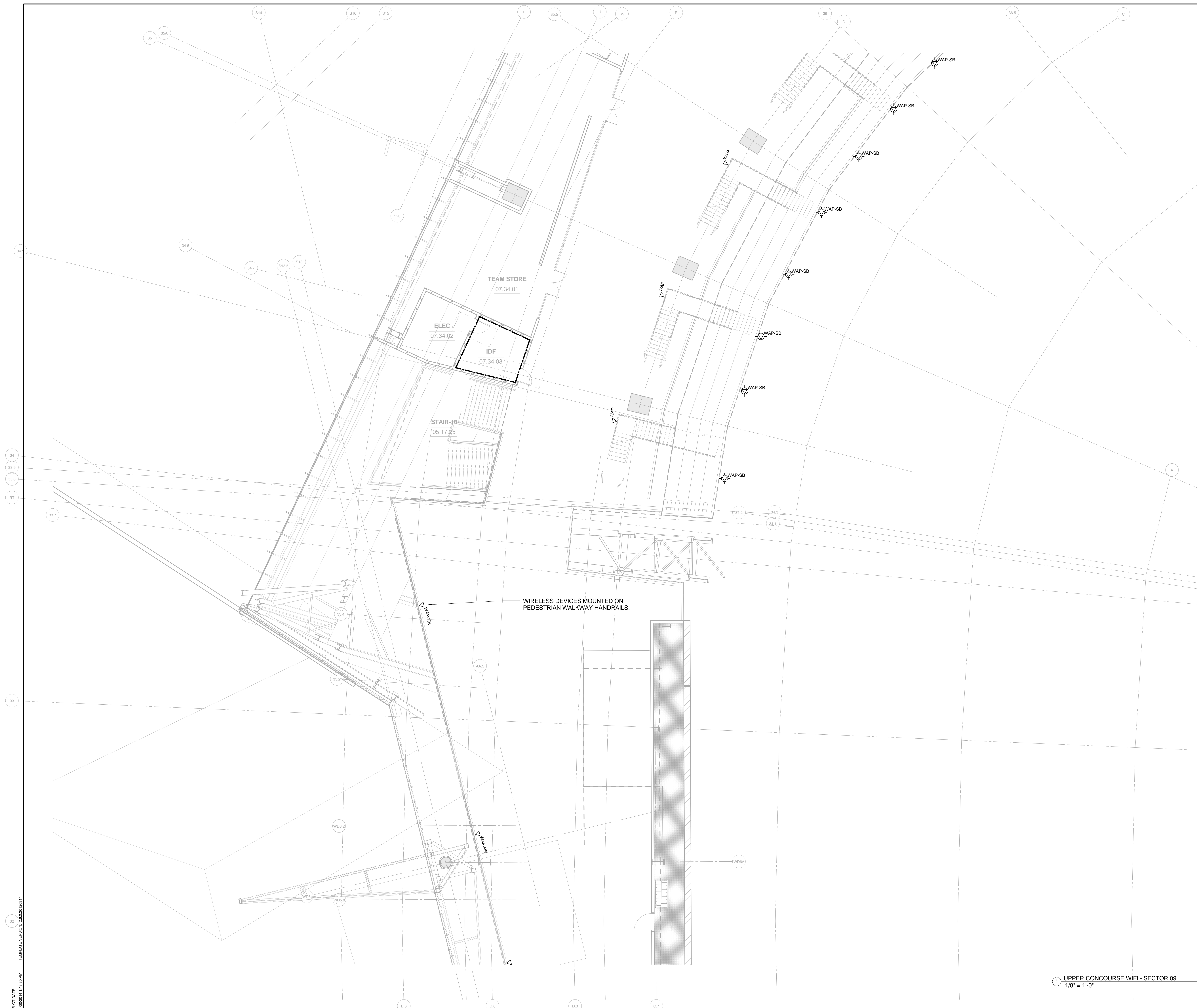




### WIFI PLANS GENERAL NOTES:

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- OWNER**  
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900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6600 VIOMING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- MECHANICAL**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2980 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERRCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

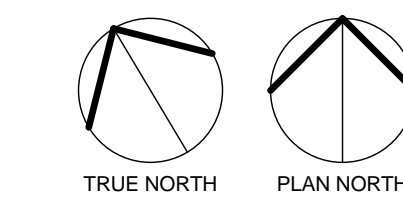


REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060



1 UPPER CONCOURSE WIFI - SECTOR 09  
1/8" = 1'-0"

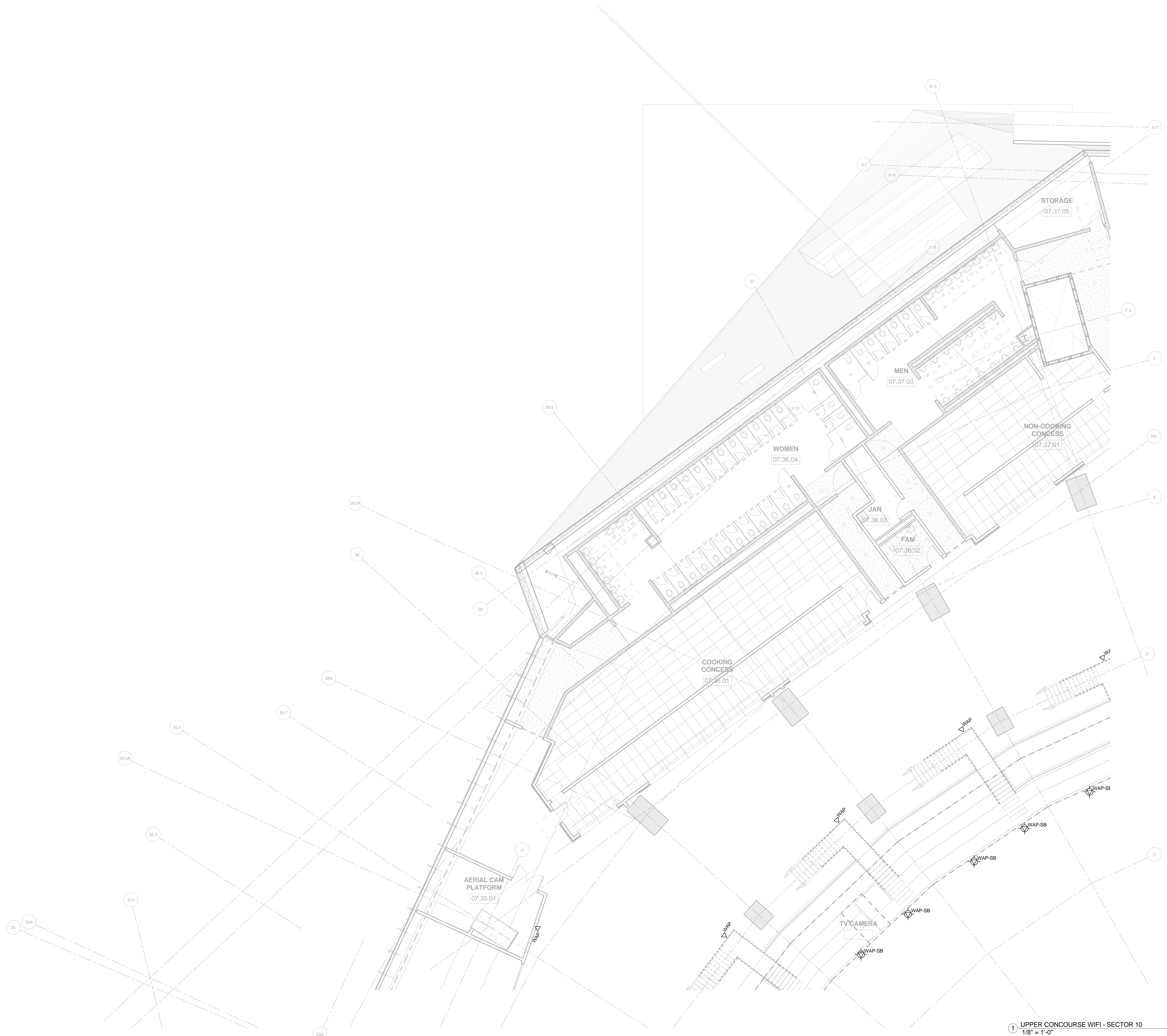
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SHEET NO.  
TW-2.0709



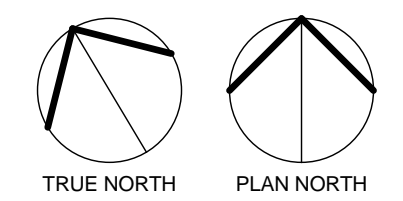
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900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55424
- LANDSCAPE ARCHITECT**  
OHLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROETHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B9
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



1 UPPER CONCOURSE WIFI - SECTOR 10  
1/8" = 1'-0"



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

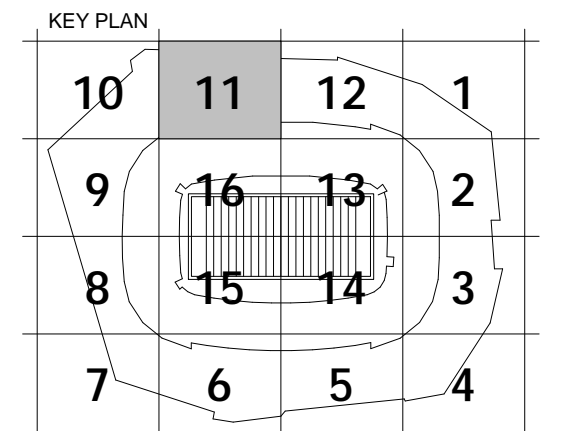
HKS PROJECT NUMBER  
16246.000  
DATE  
May 02, 2014  
ISSUE  
CCD-060

SHEET TITLE  
UPPER  
CONCOURSE WIFI -  
SECTOR 10  
SHEET NO.

## WIFI PLANS GENERAL NOTES:

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MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIONG DR., EDEN PRAIRIE, MN 55344
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HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
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THORNTON TOMASETTI  
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OSLUND AND ASSOCIATES  
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ACUSTIC DIMENSIONS  
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- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
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9225 INMAN CREEK, SUITE 300, OVERLAND PARK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
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SELBERT PERKINS DESIGN  
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- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WISCONSIN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH ST., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

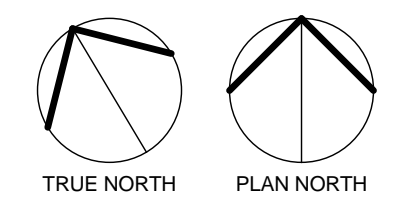


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HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**



① UPPER CONCOURSE WIFI - SECTOR 11  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

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900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
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- CIVIL ENGINEER**  
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10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- H/W/H**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
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- ADA CONSULTANT**  
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650 WOODLAWN RD., W. GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
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- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

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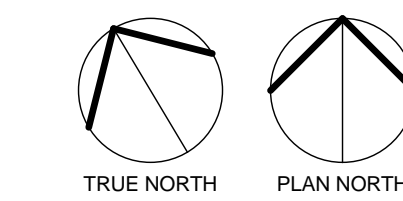
HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER  
CONOURSE WIFI -  
SECTOR 12**

SHEET NO.  
**TW-2.0712**



1 UPPER CONCOURSE WIFI - SECTOR 12  
1/8" = 1'-0"



WIFI PLANS  
GENERAL NOTES:

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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

OWNER  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

OWNER  
MINNESOTA WIKINGS FOOTBALL, LLC  
8500 VIONG DR., EDEN PRAIRIE, MN 55344

ARCHITECT / INTERIORS / BRANDING  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

ASSOCIATE ARCHITECT - SKIN  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 600, MINNEAPOLIS, MN 55401

MEP / TECHNOLOGY / LIGHTING  
M.E ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033

TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

STRUCTURAL ENGINEER  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

CIVIL ENGINEER  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

LANDSCAPE ARCHITECT  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401

AUDIO VISUAL CONSULTANTS  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

HUNY  
4801 SPRING VALLEY RD., DALLAS, TX 75244

CODE / FIRE PROTECTION  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

FOOD SERVICE  
RICCA NEWMARK  
8328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

WAYFINDING  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

VERTICAL TRANSPORTATION  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

ADA CONSULTANT  
ED ROTHER CONSULTING, LLC  
2980 MISSOURI BELLEVUE, LOUISBURG, KS 66663

WIND / SNOW CONSULTANT  
ROVAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD. WY, GUELPH, ON CANADA N1K 1B8

BUILDING ENVELOPE CONSULTANT  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

FAÇADE ACCESS CONSULTANT  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

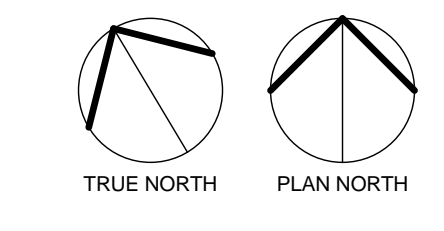
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REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**



1 MECHANICAL MEZZANINE PLAN WIFI - SECTOR 01  
1/8" = 1'-0"

WIFI PLANS  
GENERAL NOTES:

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900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
8600 VIONG DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OBLIN AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**H/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PARK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

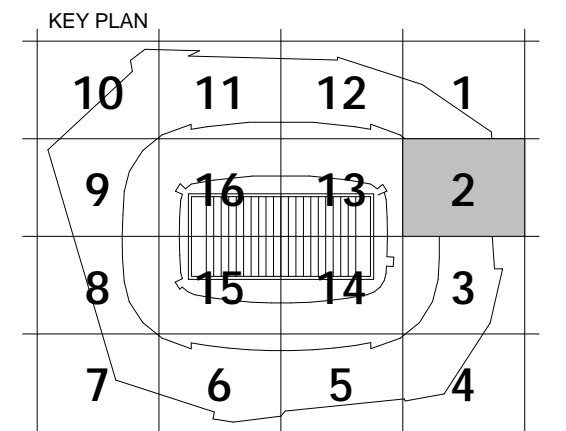
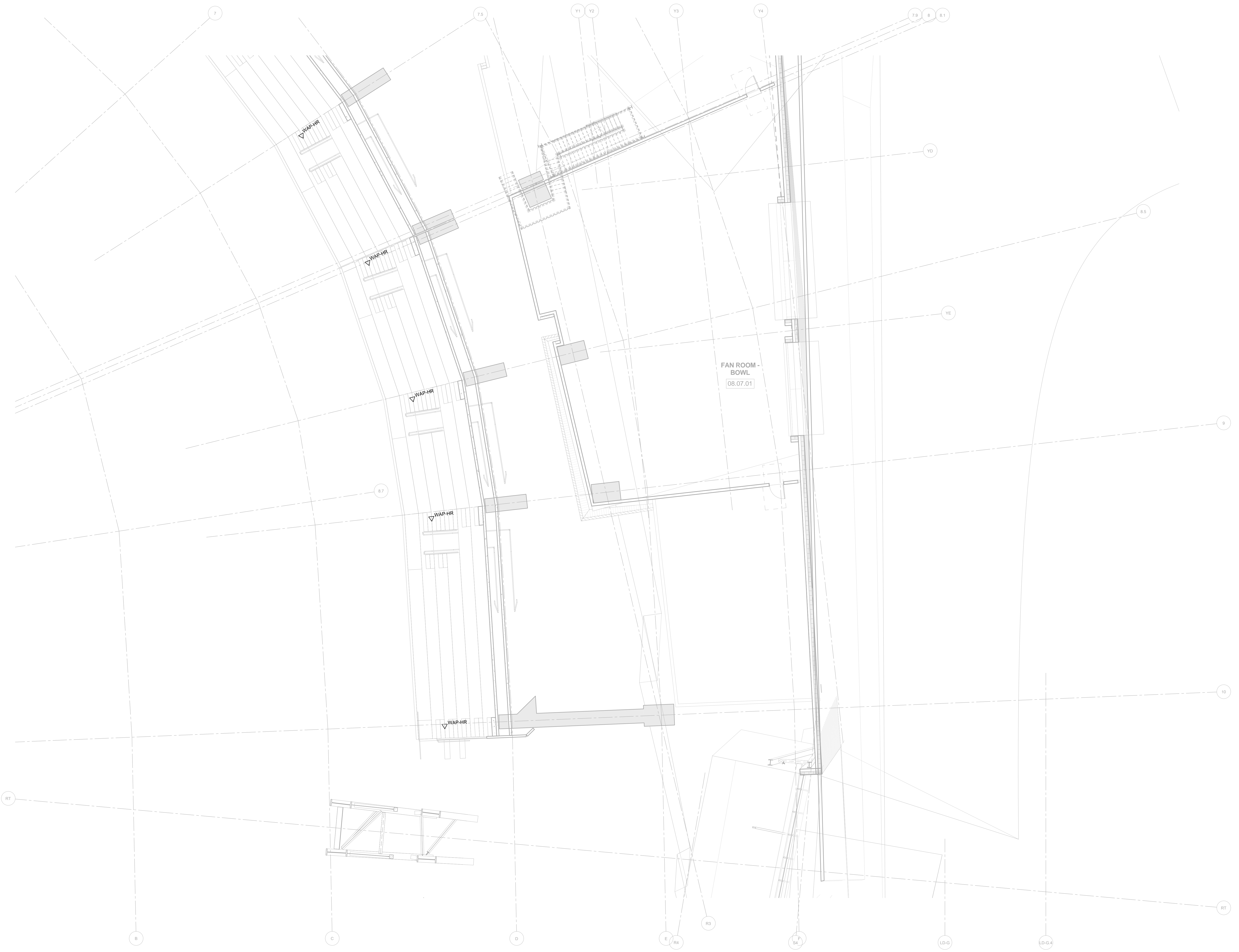
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

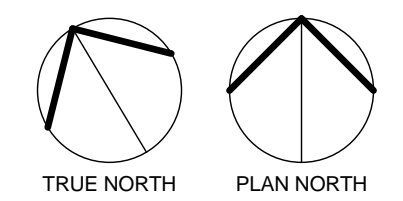
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
MECHANICAL  
MEZZANINE WIFI -  
SECTOR 02

SHEET NO.



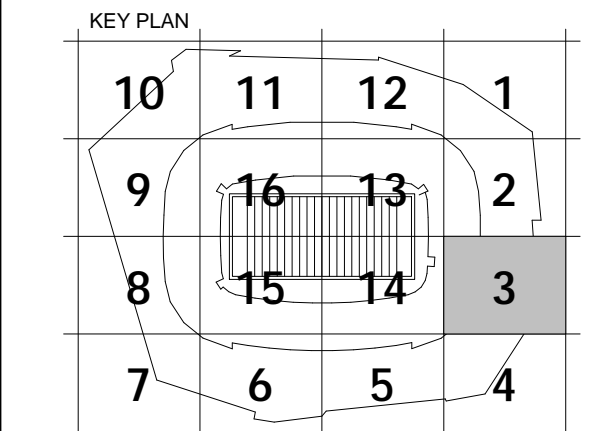
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1/8" = 1'-0"

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## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- H/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD. W., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

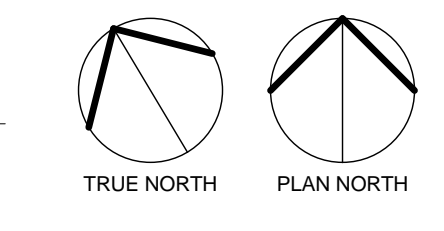
DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**MECHANICAL MEZZANINE WIFI - SECTOR 03**

SHEET NO.  
**TW-2.0803**

1 MECHANICAL MEZZANINE PLAN WIFI - SECTOR 03  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
8600 WIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10508 WRIGHT BROTHERS DR., ADDISON, TX 75001

**H/W/H**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
8225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

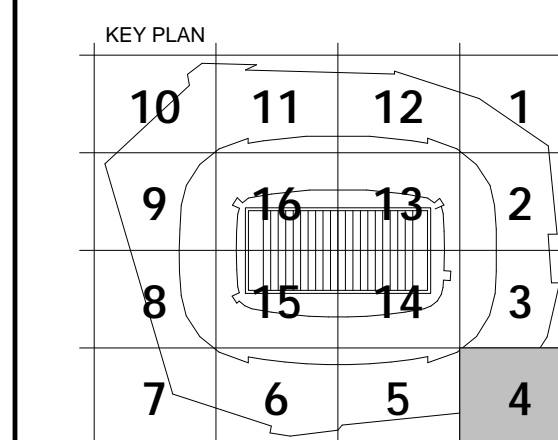
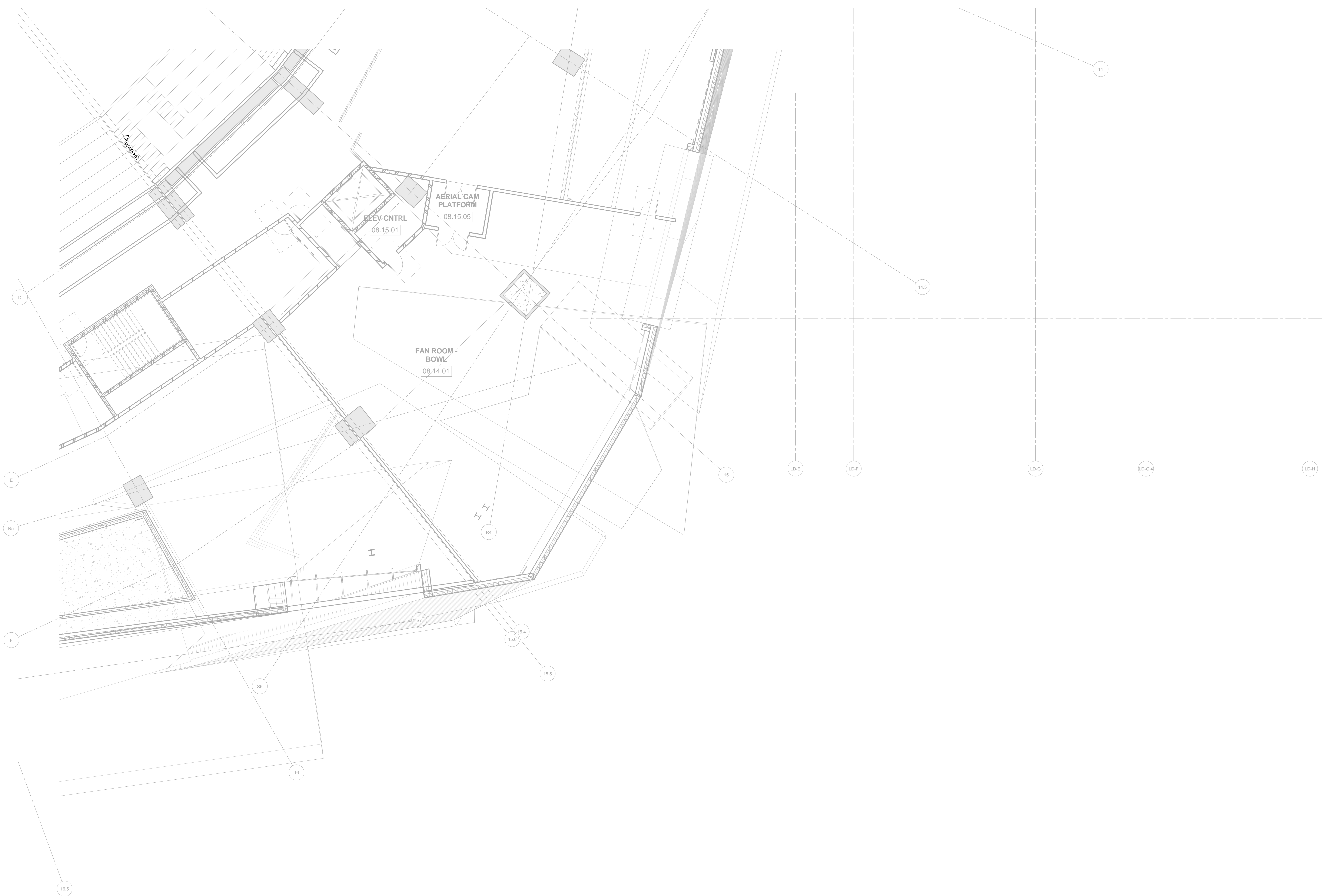
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2990 MISSOURI BELLEVUE, LOUISBURG, KS 66503

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WISCONSIN RD., SUITE PH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERRCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

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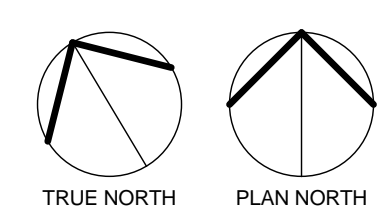
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
MECHANICAL  
MEZZANINE WIFI -  
SECTOR 04

SHEET NO.

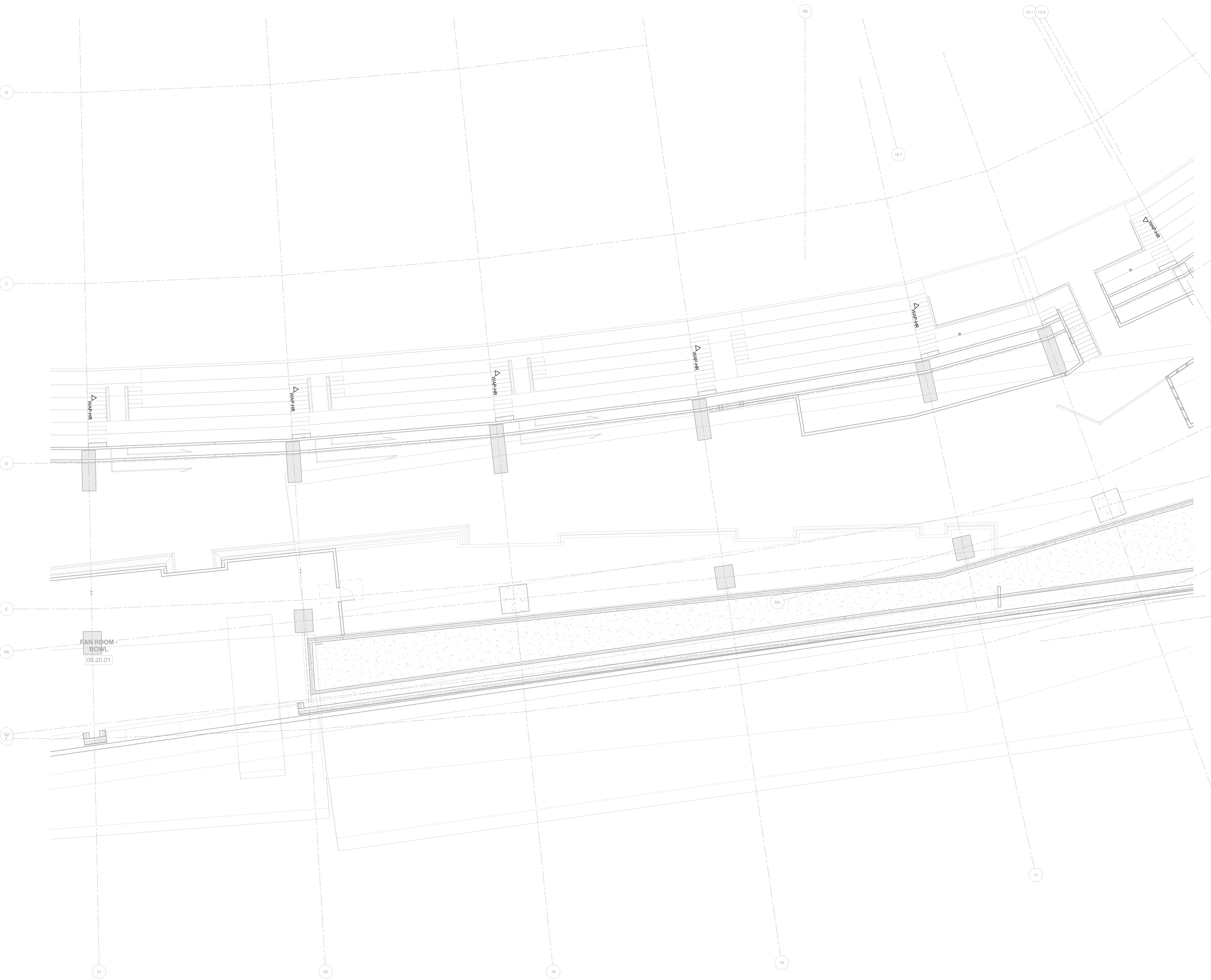
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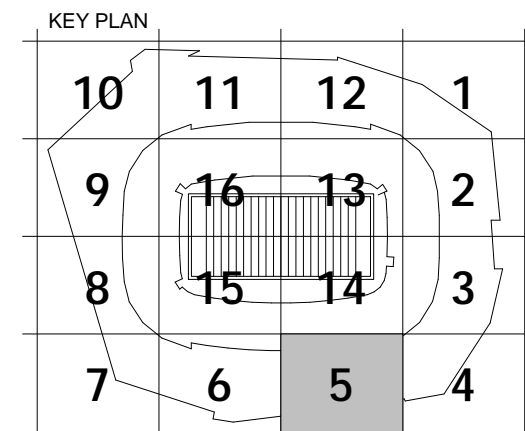
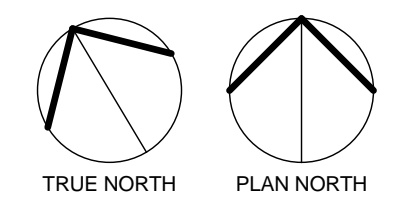
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MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6000 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75281
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AVM**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66063
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LORD BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



1 MECHANICAL MEZZANINE PLAN WIFI - SECTOR 05  
1/8" = 1'-0"



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**MECHANICAL MEZZANINE WIFI - SECTOR 05**

SHEET NO.  
**TW-2.0805**

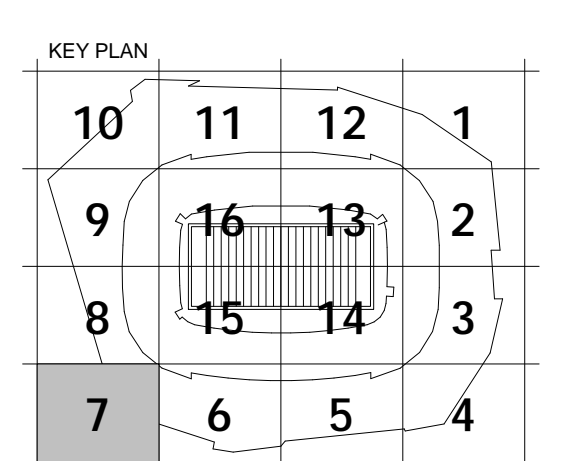
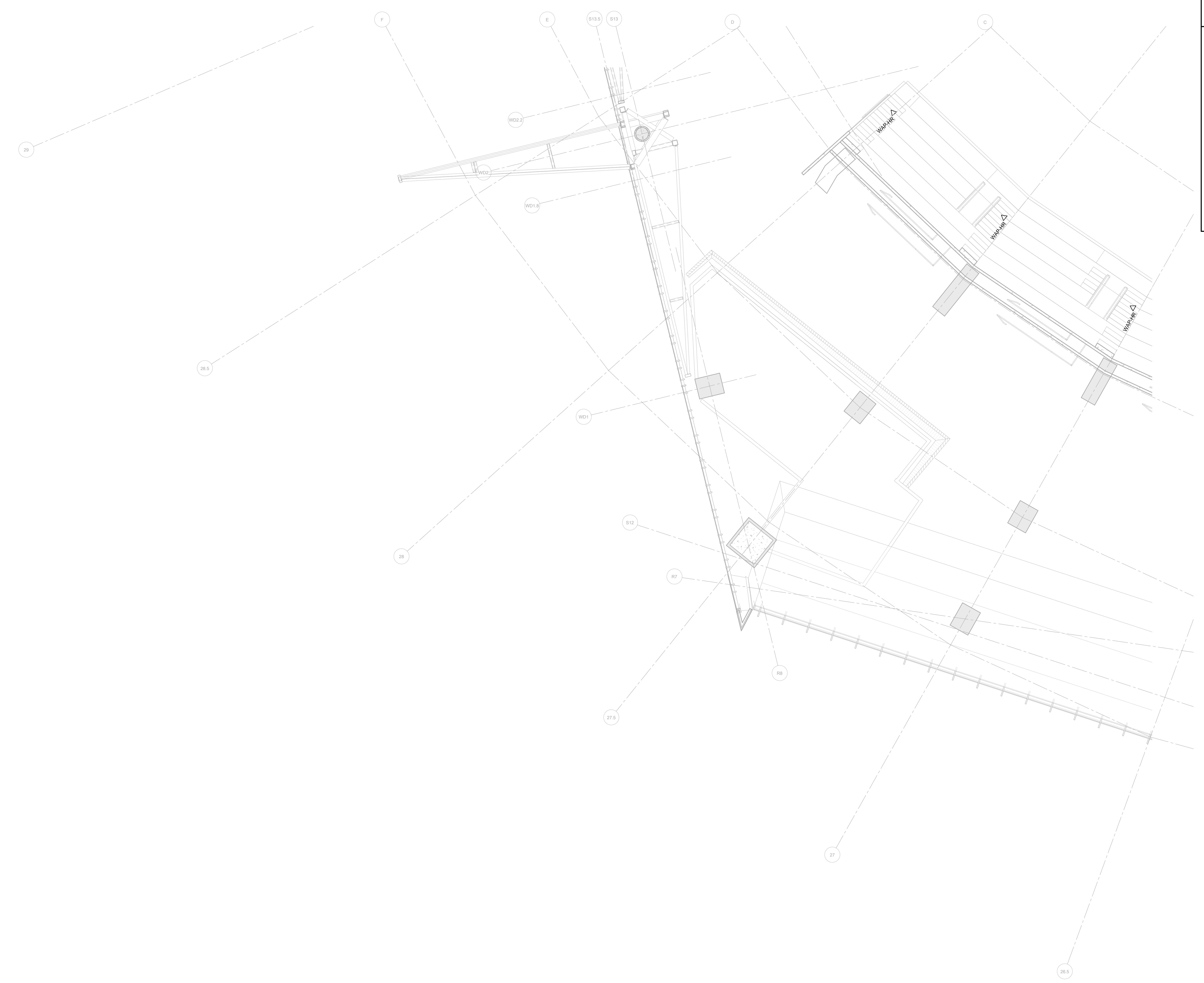




### WIFI PLANS GENERAL NOTES:

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- OWNER**  
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900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
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- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
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TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
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THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- LANDSCAPE ARCHITECT**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- AUDIO VISUAL CONSULTANTS**  
ACUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
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ELEVATOR ADVISORY GROUP  
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- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY., QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

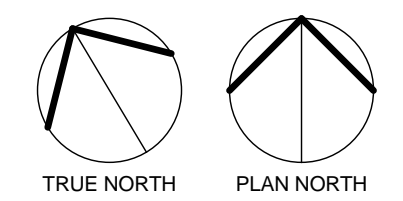
HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
MECHANICAL  
MEZZANINE WIFI -  
SECTOR 07

SHEET NO.



1 MECHANICAL MEZZANINE PLAN WIFI - SECTOR 07  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
2. Mount access points, enclosures, and antennas in accordance with manufacturer's instructions including proper grounding of components, installation of lightning arrestors, and weatherproofing of cable connectors.
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7. The Contractor is required to coordinate their efforts with the other trades and sub-contractors who may be working within the same vicinity to avoid conflict and lost time.
8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80233

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55434

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66603

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

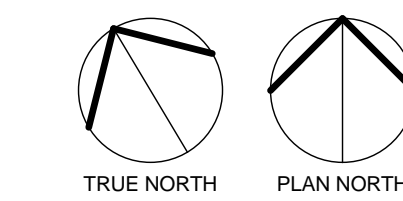
**FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



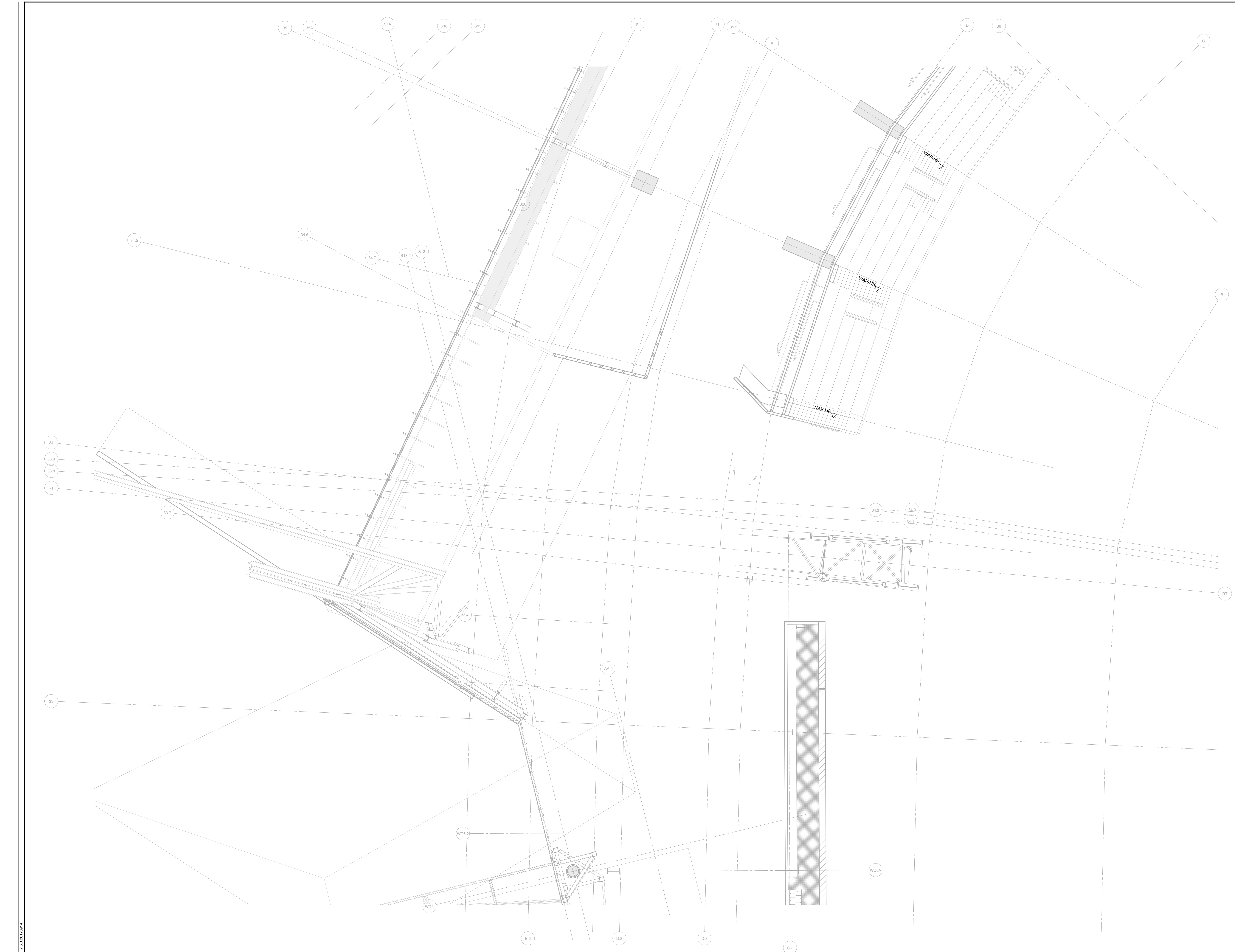
KEY PLAN			
10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**  
DATE  
**May 02, 2014**  
ISSUE  
**CCD-060**



SHEET TITLE  
**MECHANICAL MEZZANINE WIFI - SECTOR 09**  
SHEET NO.



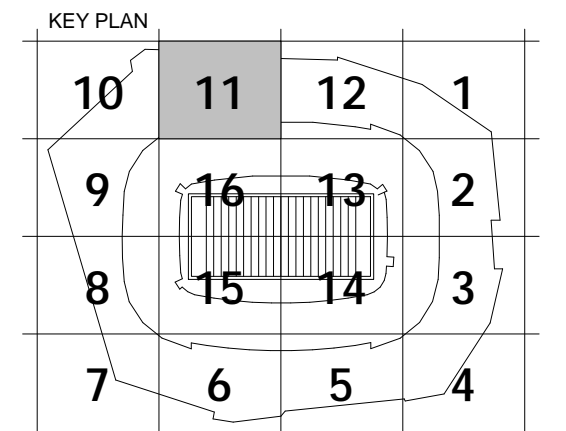
1 MECHANICAL MEZZANINE PLAN WIFI - SECTOR 09  
1/8" = 1'-0"



**WIFI PLANS  
GENERAL NOTES:**

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 AVE. N, SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

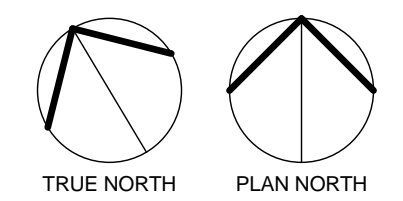
DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**MECHANICAL  
MEZZANINE WIFI -  
SECTOR 11**

SHEET NO.  
**TW-2.0811**

1 MECHANICAL MEZZANINE PLAN WIFI - SECTOR 11  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA VIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HAZARDOUS**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., W. GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

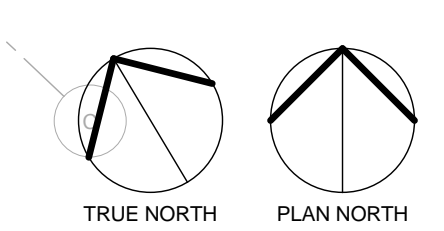
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
MECHANICAL  
MEZZANINE WIFI -  
SECTOR 12

SHEET NO.

1-MECHANICAL MEZZANINE PLAN WIFI - SECTOR 12  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE., SUITE 600, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10555 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**H/W/M**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9229 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
RICCA NEWMARK  
6328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHBERG CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66665

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LERDHI BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



KEY PLAN

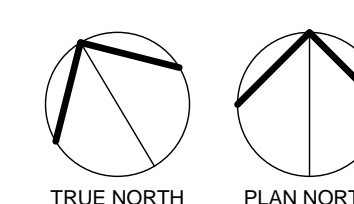
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9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000  
DATE  
May 02, 2014  
ISSUE  
CCD-060

SHEET TITLE  
UPPER BOWL WIFI  
- SECTOR 01

SHEET NO.  
TW-2.0901

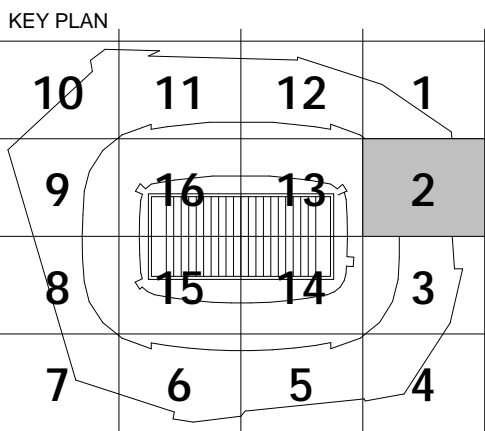
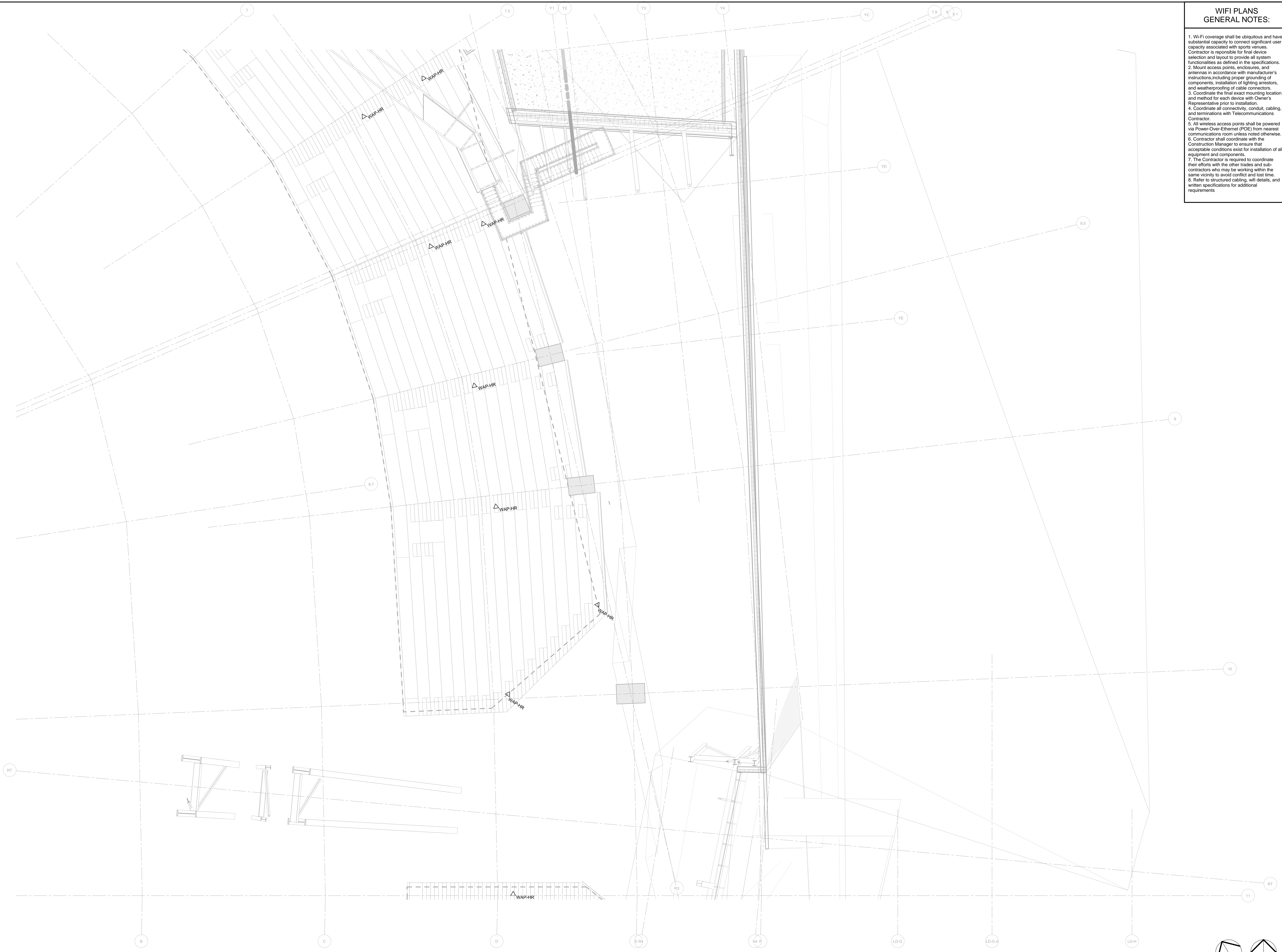


1 UPPER SEATING BOWL PLAN WIFI - SECTOR 01  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WINGS FOOTBALL, LLC  
9500 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/WHY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6328 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66503
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
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THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
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LERDCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

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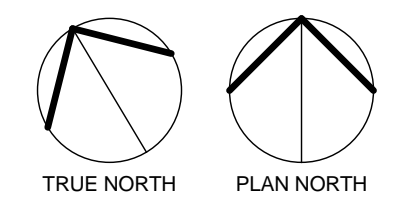
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
UPPER BOWL WIFI  
- SECTOR 02

SHEET NO.  
TW-2.0902

1 UPPER SEATING BOWL PLAN WIFI - SECTOR 02  
1/8" = 1'-0"





### WIFI PLANS GENERAL NOTES:

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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
5600 WING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE., SUITE 600, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033

**TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**HUNY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244

**CODE / FIRE PROTECTION**  
FSC, INC.  
9229 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210

**FOOD SERVICE**  
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432 CULVER BLVD., PLAYA DEL REY, CA 90293

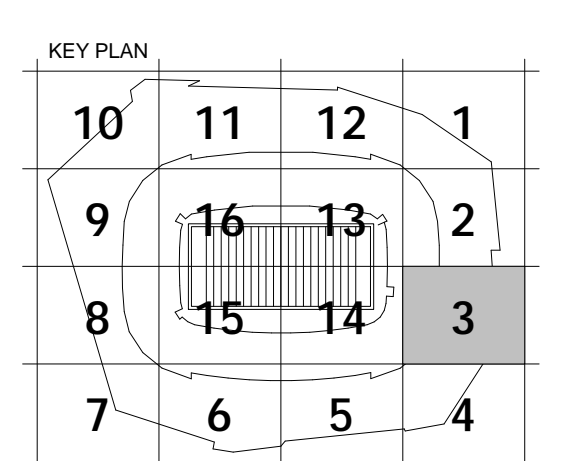
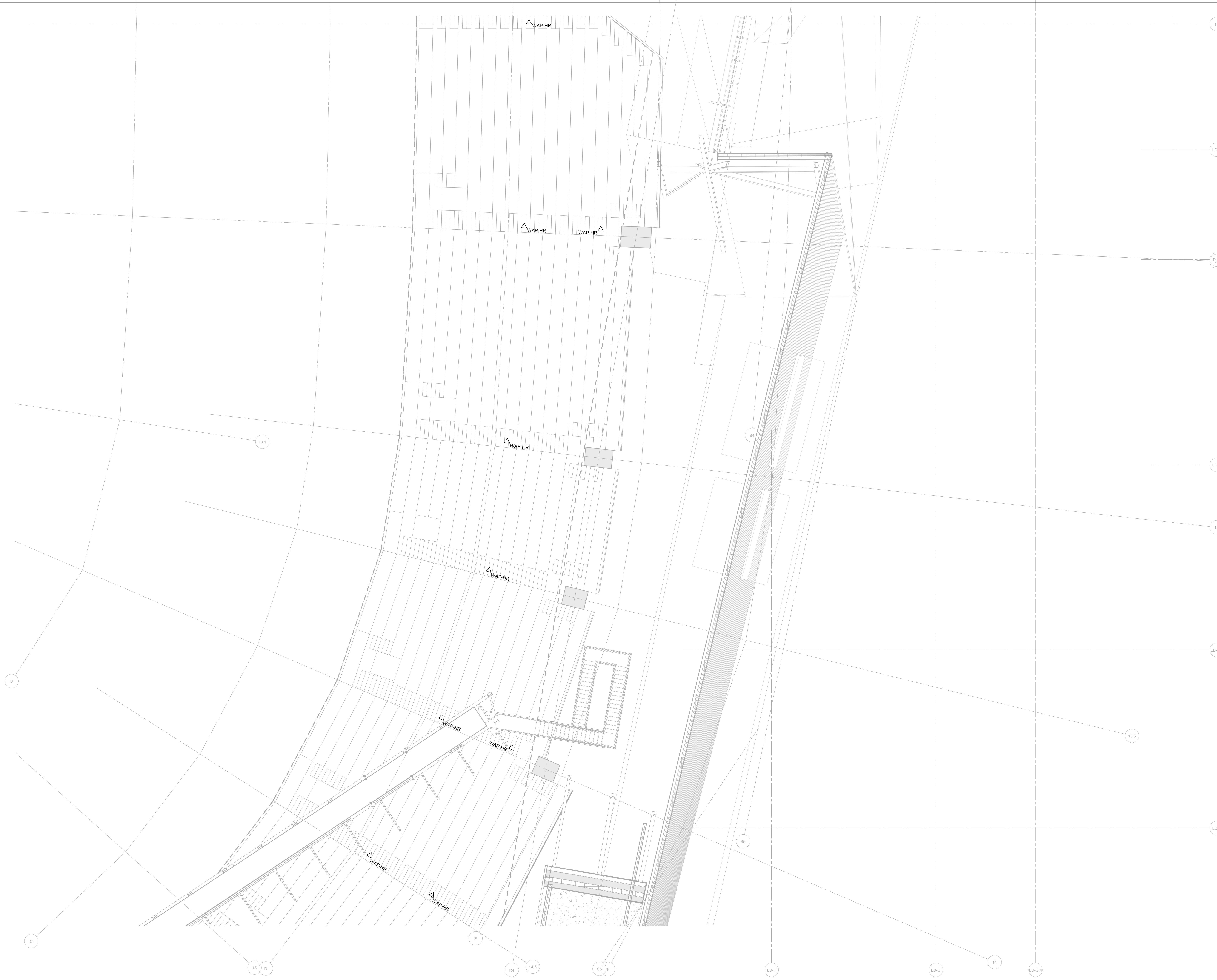
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNOCOCK AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66603

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LORD BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

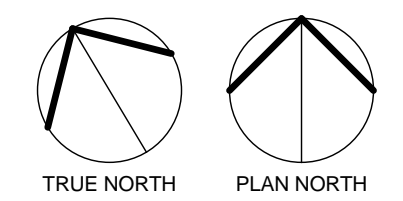


REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

DATE  
**May 02, 2014**

ISSUE  
**CCD-060**



① UPPER SEATING BOWL PLAN WIFI - SECTOR 03  
1/8" = 1'-0"

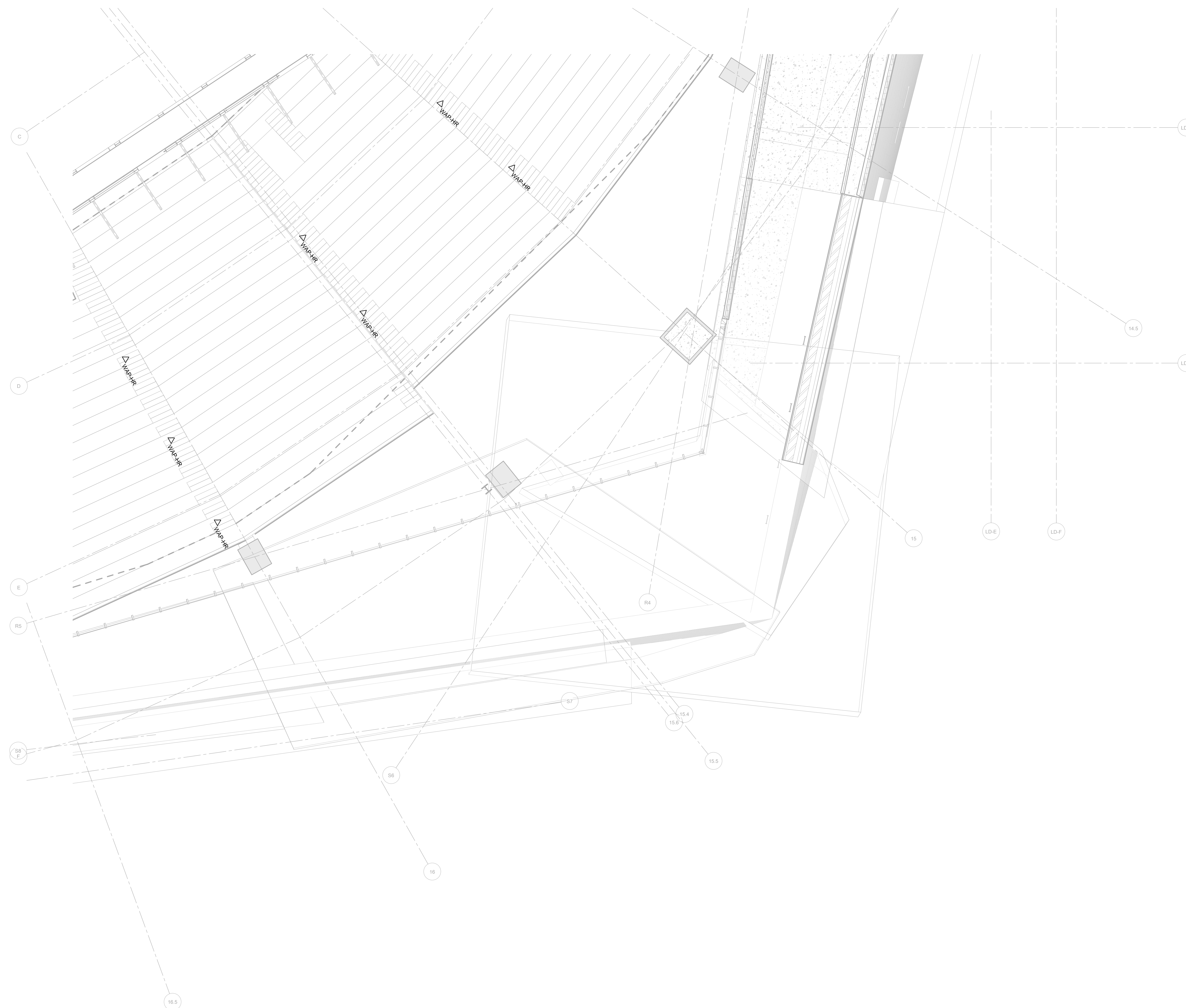
SHEET TITLE  
**UPPER BOWL WIFI  
- SECTOR 03**

SHEET NO.  
**TW-2.0903**

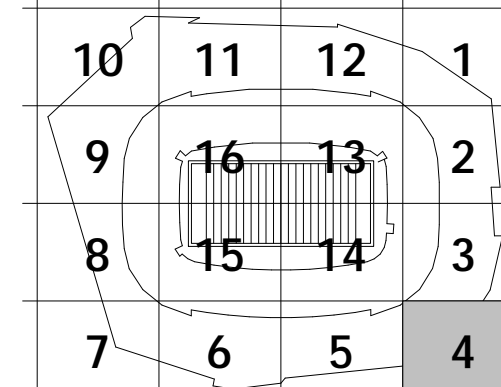
### WIFI PLANS GENERAL NOTES:

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8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLAND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HWY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66063
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1900, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



#### KEY PLAN



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

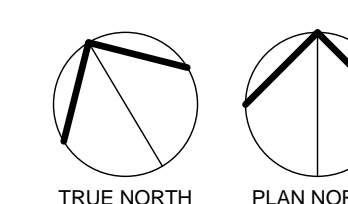
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
UPPER BOWL WIFI  
- SECTOR 04

SHEET NO.  
TW-2.0904

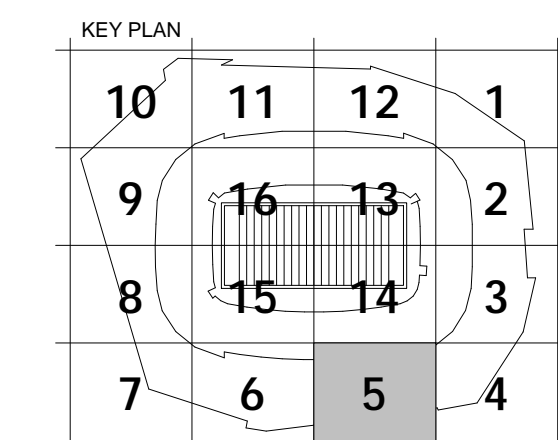
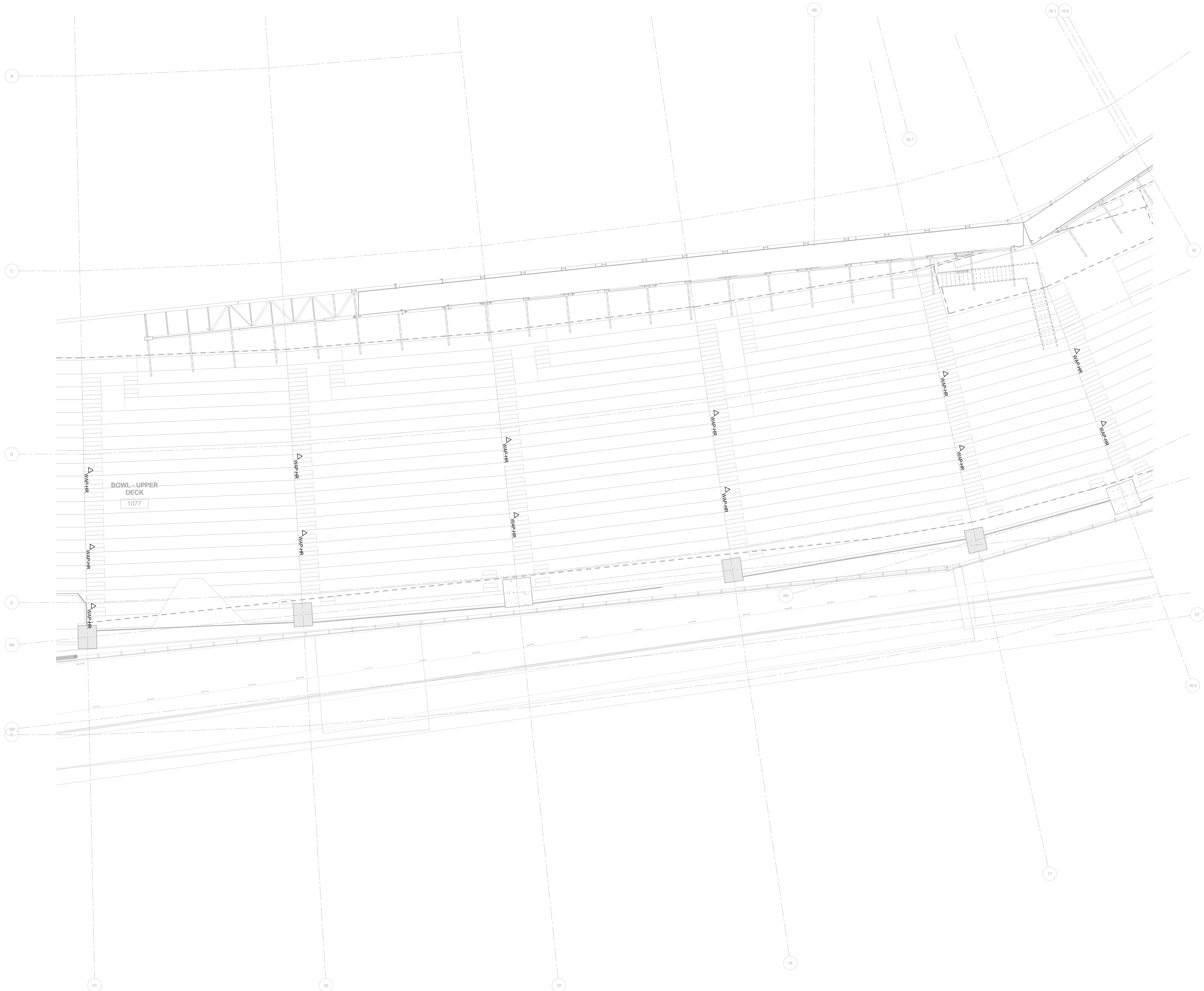
1 UPPER SEATING BOWL PLAN WIFI - SECTOR 04  
1/8" = 1'-0"



## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OBLIND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- PLUMBING**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
6326 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNSHOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHBERG CONSULTING, LLC.  
2960 MISSOURI BELLEVIEW, LOUISBURG, KS 66063
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122

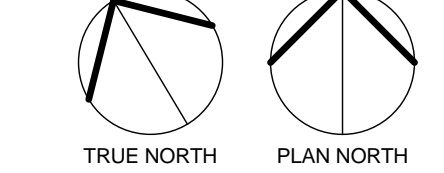


REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

DATE  
May 02, 2014

ISSUE  
CCD-060



SHEET TITLE  
UPPER BOWL WIFI  
- SECTOR 05

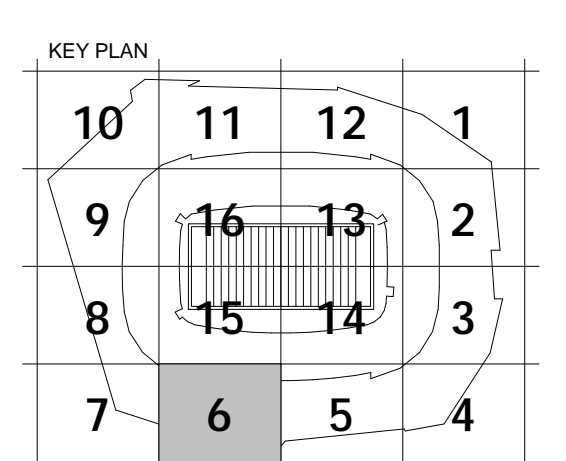
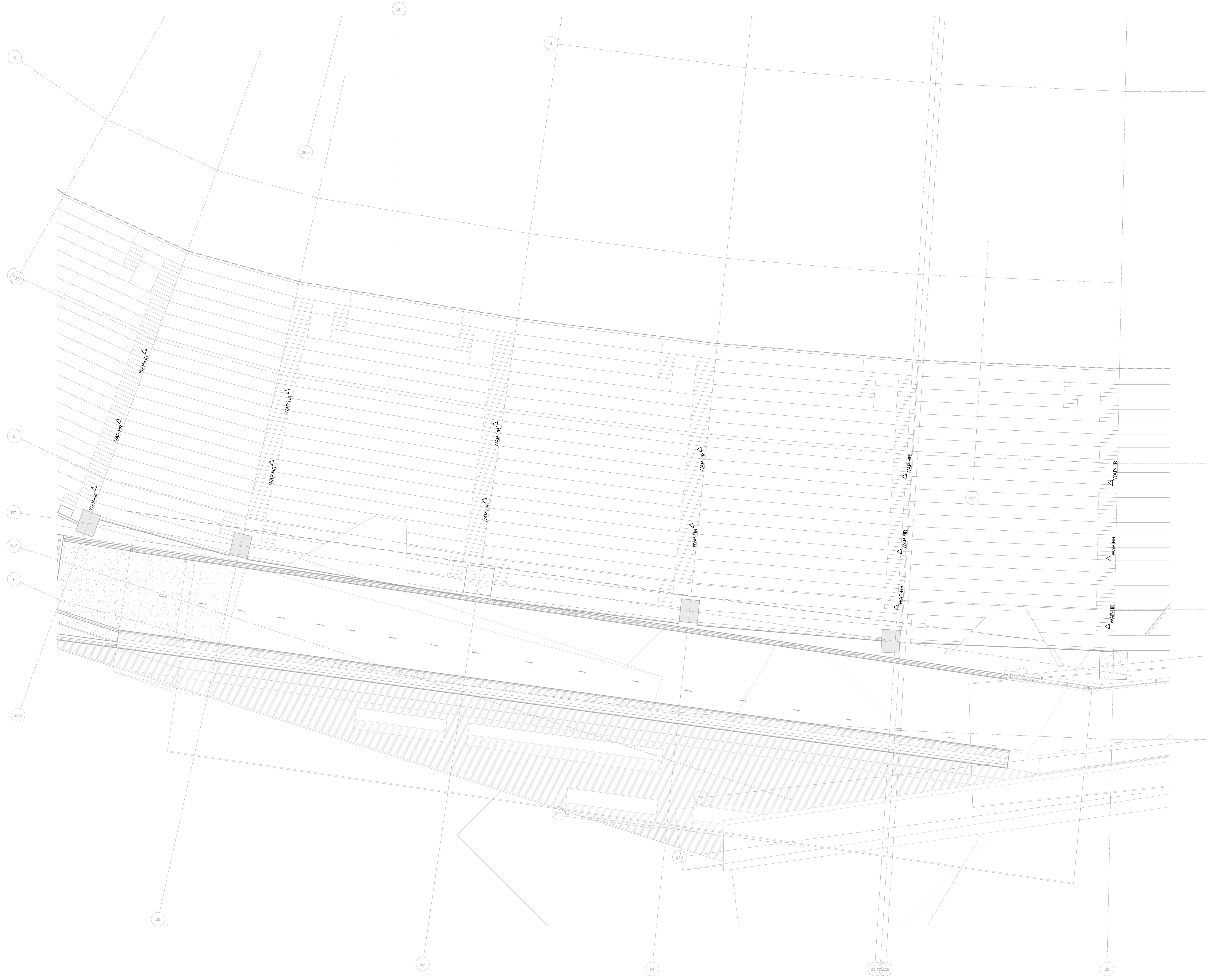
SHEET NO.  
TW-2.0905

1 UPPER SEATING BOWL PLAN WIFI - SECTOR 05  
1/8" = 1'-0"

## WIFI PLANS GENERAL NOTES:

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6000 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033  
TECHNOLOGY MANAGEMENT CORPORATION  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HAZARDOUS**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90295
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNCOCK AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSION BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH ST., SUITE 1600, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
**16246.000**

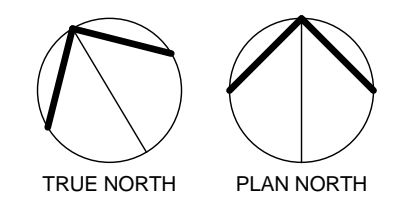
DATE  
**May 02, 2014**

ISSUE  
**CCD-060**

SHEET TITLE  
**UPPER BOWL WIFI  
- SECTOR 06**

SHEET NO.  
**TW-2.0906**

1 UPPER SEATING BOWL PLAN WIFI - SECTOR 06  
1/8" = 1'-0"



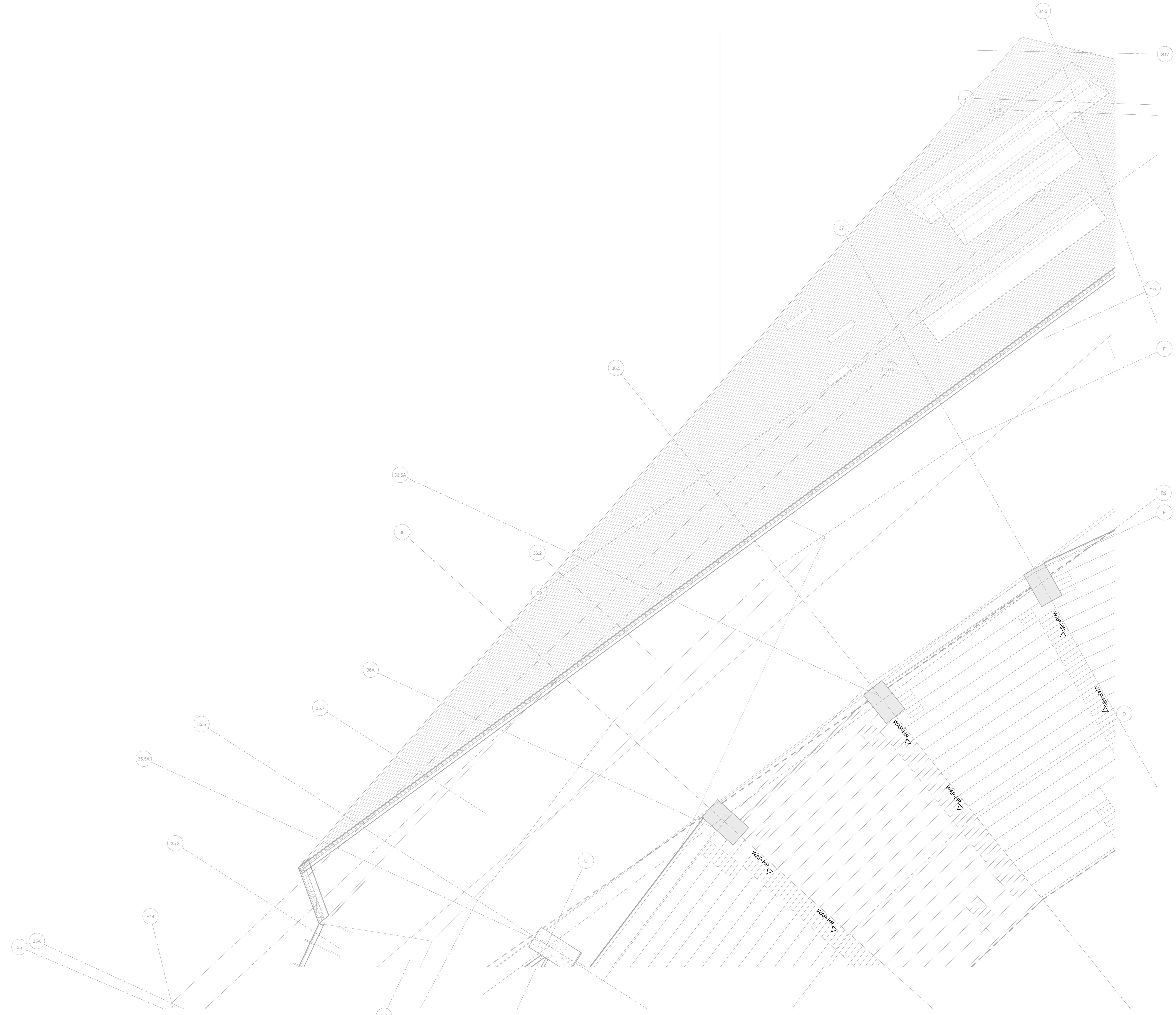




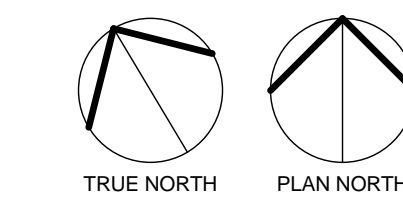
**WIFI PLANS  
GENERAL NOTES:**

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- OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N. SUITE 400, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033
- TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, LB-7, DALLAS, TX 75251
- CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N., MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
15008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- HUNY**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- ELEVATOR ADVISORY GROUP**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2980 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERDCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



**1** UPPER SEATING BOWL PLAN WIFI - SECTOR 10  
1/8" = 1'-0"



**KEY PLAN**

10	11	12	1
9	16	13	2
8	15	14	3
7	6	5	4

REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000  
DATE  
May 02, 2014  
ISSUE  
CCD-060

SHEET TITLE  
UPPER BOWL WIFI  
- SECTOR 10

SHEET NO.

TW-2.0910

WIFI PLANS  
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**OWNER**  
MINNESOTA SPORTS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415

**OWNER**  
MINNESOTA WIKINGS FOOTBALL, LLC  
6500 VIKING DR., EDEN PRAIRIE, MN 55344

**ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201

**ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 400, MINNEAPOLIS, MN 55401

**MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43RD AVE., WHEAT RIDGE, CO 80033

**TECHNOLOGY MANAGEMENT CORPORATION**  
4790 LAKEWAY TERRACE, SHOREWOOD, MN 55331

**STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251

**CIVIL ENGINEER**  
E.V.S. INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344

**LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401

**AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001

**WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293

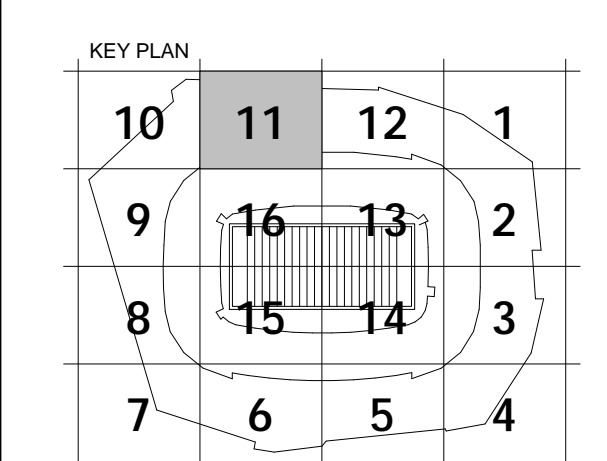
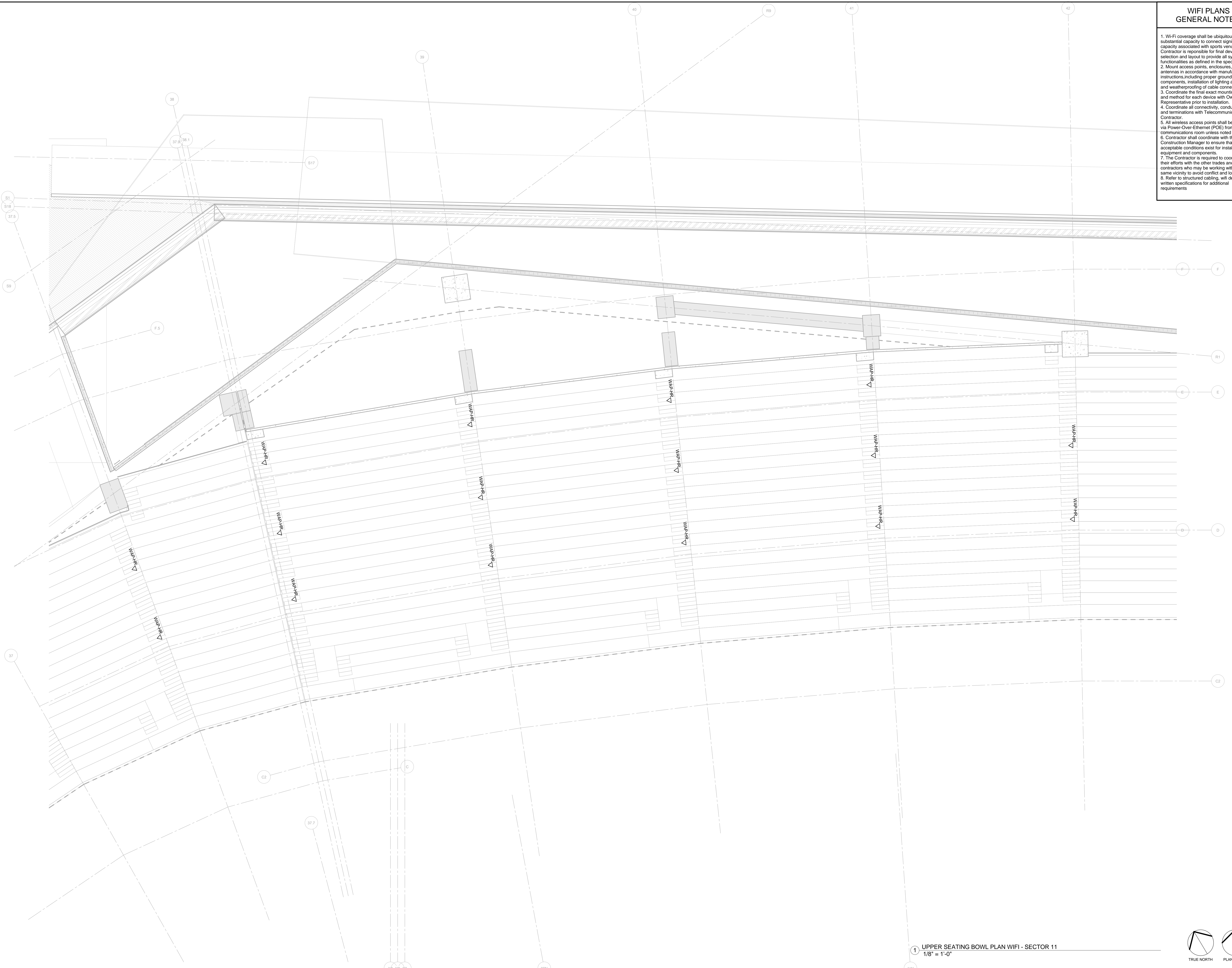
**VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124

**ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC.  
2960 MISSOURI BELLEVIEW, LOUISBURG, KS 66663

**WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
600 WOODLAWN RD., WY. QUELPH, ON CANADA N1K 1B8

**BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611

**FAÇADE ACCESS CONSULTANT**  
LEIGH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
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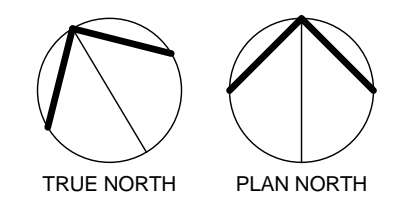
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
UPPER BOWL WIFI  
- SECTOR 11

SHEET NO.  
TW-2.0911

1 UPPER SEATING BOWL PLAN WIFI - SECTOR 11  
1/8" = 1'-0"

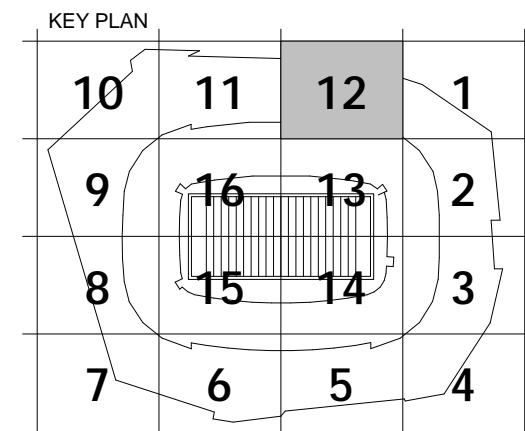
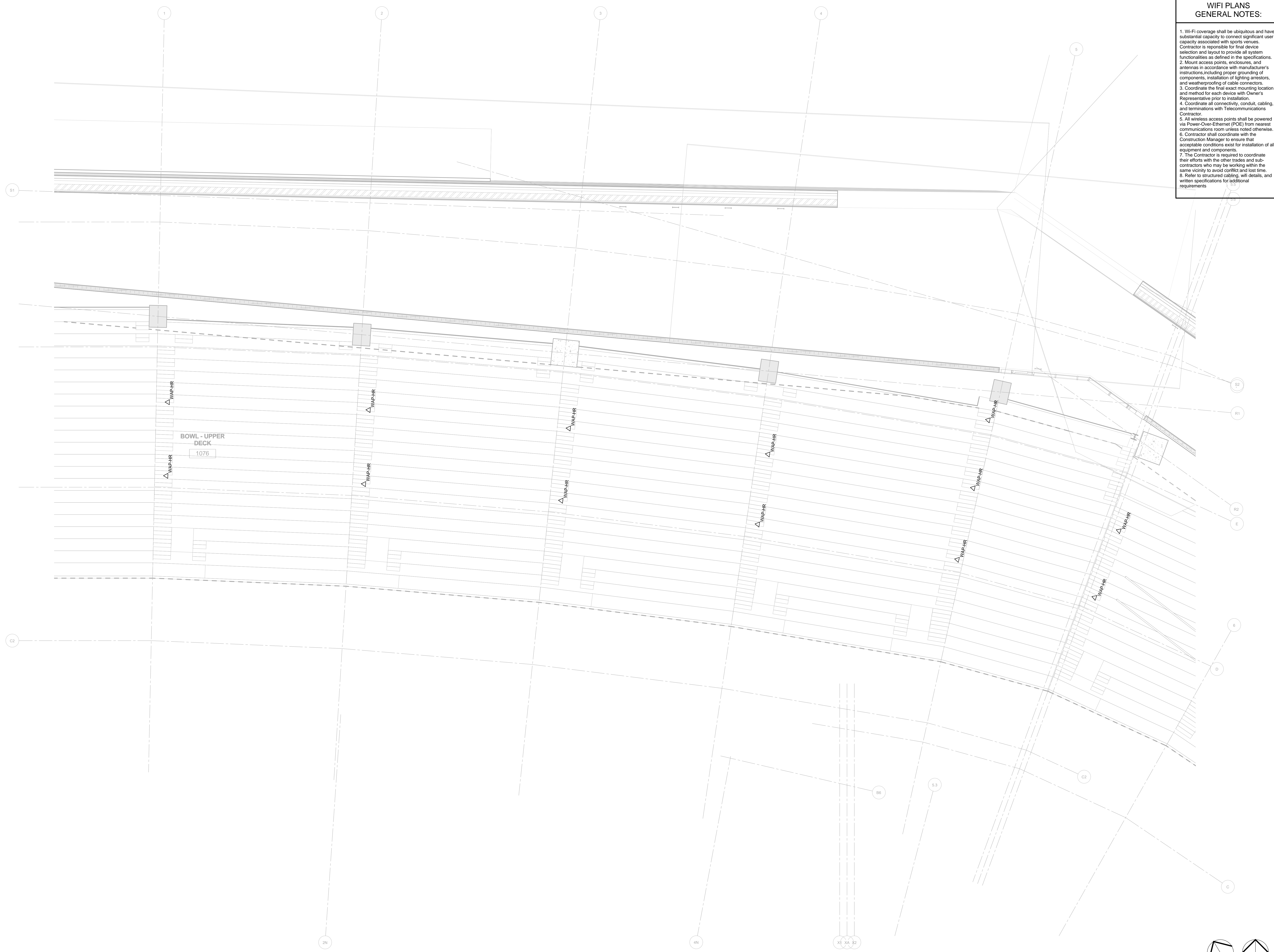




## WIFI PLANS GENERAL NOTES:

1. Wi-Fi coverage shall be ubiquitous and have substantial capacity to connect significant user capacity associated with sports venues. Contractor is responsible for final device selection and layout to provide all system functionalities as defined in the specifications.
2. Mount access points, enclosures, and antennas in accordance with manufacturer's instructions including proper grounding of components, installation of lightning arrestors, and weatherproofing of cable connectors.
3. Coordinate the final exact mounting location and method for each device with Owner's Representative prior to installation.
4. Coordinate all connectivity, conduit, cabling, and terminations with Telecommunications Contractor.
5. All wireless access points shall be powered via Power-Over-Ethernet (POE) from nearest communications room unless noted otherwise.
6. Contractor shall coordinate with the Construction Manager to ensure that acceptable conditions exist for installation of all equipment and components.
7. The Contractor is required to coordinate their efforts with the other trades and sub-contractors who may be working within the same vicinity to avoid conflict and lost time.
8. Refer to structured cabling, wifi details, and written specifications for additional requirements.

- OWNER**  
MINNESOTA WINGS FACILITIES AUTHORITY  
900 SOUTH 5th STREET, MINNEAPOLIS, MN 55415
- OWNER**  
MINNESOTA WINGS FOOTBALL, LLC  
6600 VIONG DR., EDEN PRAIRIE, MN 55344
- ARCHITECT / INTERIORS / BRANDING**  
HKS, INC.  
1915 MARINNEY AVENUE, DALLAS, TX 75201
- ASSOCIATE ARCHITECT - SKIN**  
STUDIO FIVE ARCHITECTS  
322 FIRST AVE. N, SUITE 600, MINNEAPOLIS, MN 55401
- MEP / TECHNOLOGY / LIGHTING**  
M.E. ENGINEERS, INC.  
10055 WEST 43rd AVE., WHEAT RIDGE, CO 80033
- STRUCTURAL ENGINEER**  
THORNTON TOMASETTI  
12750 MERIT DR., SUITE 750, DALLAS, TX 75251
- CIVIL ENGINEER**  
EVS, INC.  
10250 VALLEY VIEW, SUITE 123, EDEN PRAIRIE, MN 55344
- LANDSCAPE ARCHITECT**  
OSLUND AND ASSOCIATES  
115 WASHINGTON AVE. N, MINNEAPOLIS, MN 55401
- AUDIO VISUAL CONSULTANTS**  
ACOUSTIC DIMENSIONS  
10008 WRIGHT BROTHERS DR., ADDISON, TX 75001
- W/AV**  
4801 SPRING VALLEY RD., DALLAS, TX 75244
- CODE / FIRE PROTECTION**  
FSC, INC.  
9225 INDIAN CREEK, SUITE 300, OVERLAND PK, KS 66210
- FOOD SERVICE**  
RICCA NEWMARK  
8320 SOUTH VALENTIA, GREENWOOD VLG, CO 80111
- WAYFINDING**  
SELBERT PERKINS DESIGN  
432 CULVER BLVD., PLAYA DEL REY, CA 90293
- VERTICAL TRANSPORTATION**  
ELEVATOR ADVISORY GROUP  
14530 PENNINGTON AVE., SAINT PAUL, MN 55124
- ADA CONSULTANT**  
ED ROTHER CONSULTING, LLC  
2960 MISSOURI BELLEVUE, LOUISBURG, KS 66663
- WIND / SNOW CONSULTANT**  
ROWAN, WILLIAMS, DAVIES, AND IRWIN, INC.  
650 WOODLAWN RD., WY., GUELPH, ON CANADA N1K 1B8
- BUILDING ENVELOPE CONSULTANT**  
THORNTON TOMASETTI - BUILDING SKIN PRACTICE  
330 N. WABASH AVE., SUITE 1800, CHICAGO, IL 60611
- FAÇADE ACCESS CONSULTANT**  
LERCH BATES, INC.  
8089 LINCOLN ST., SUITE 105, LITTLETON, CO 80122



REVISION NO.	DESCRIPTION	DATE

HKS PROJECT NUMBER  
16246.000

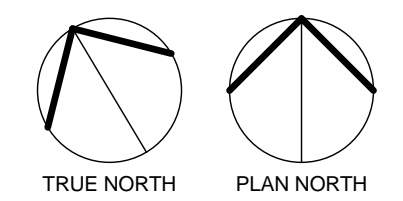
DATE  
May 02, 2014

ISSUE  
CCD-060

SHEET TITLE  
UPPER BOWL WIFI  
- SECTOR 12

SHEET NO.  
TW-2.0912

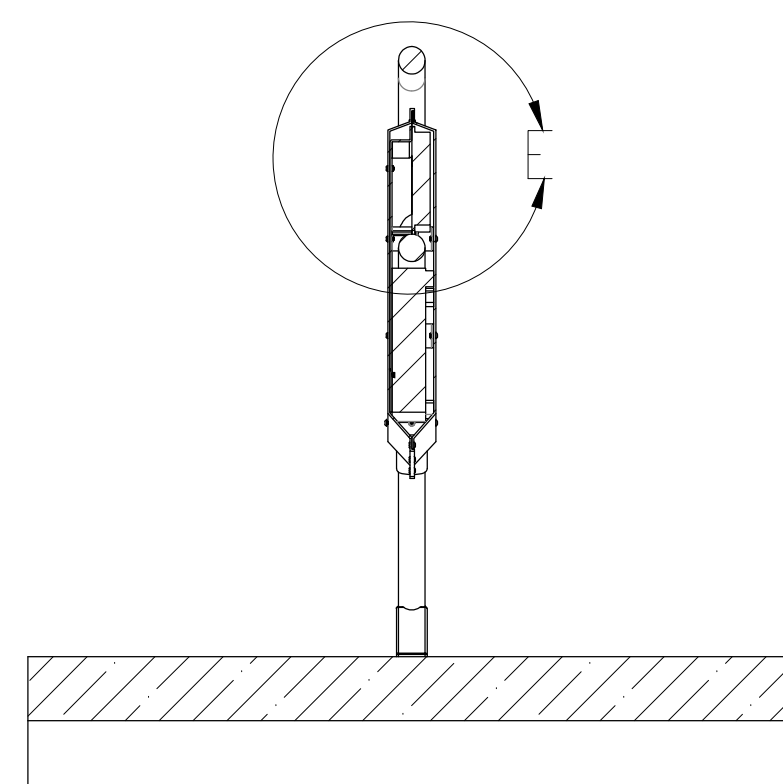
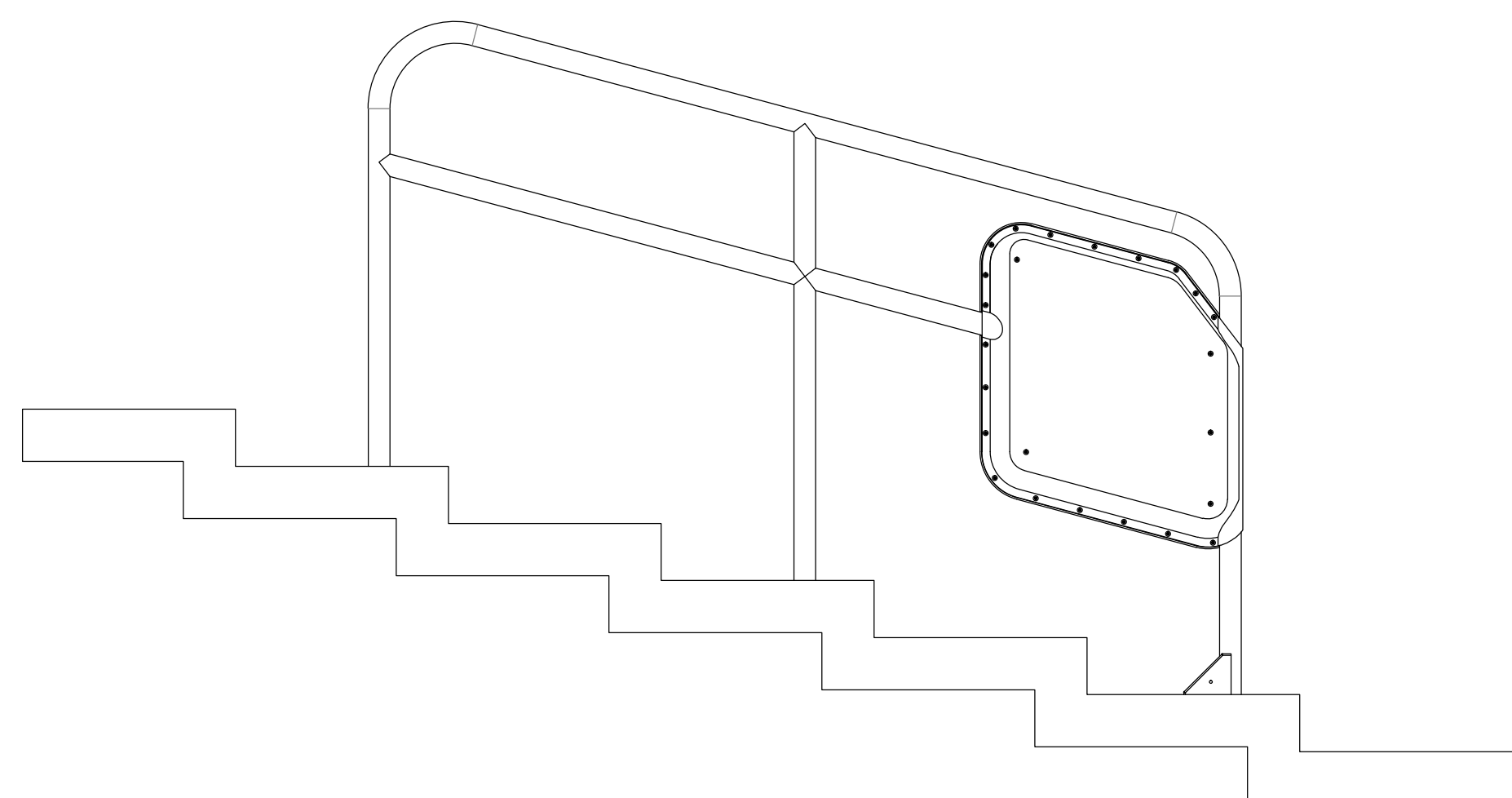
① UPPER SEATING BOWL PLAN WIFI - SECTOR 12  
1/8" = 1'-0"



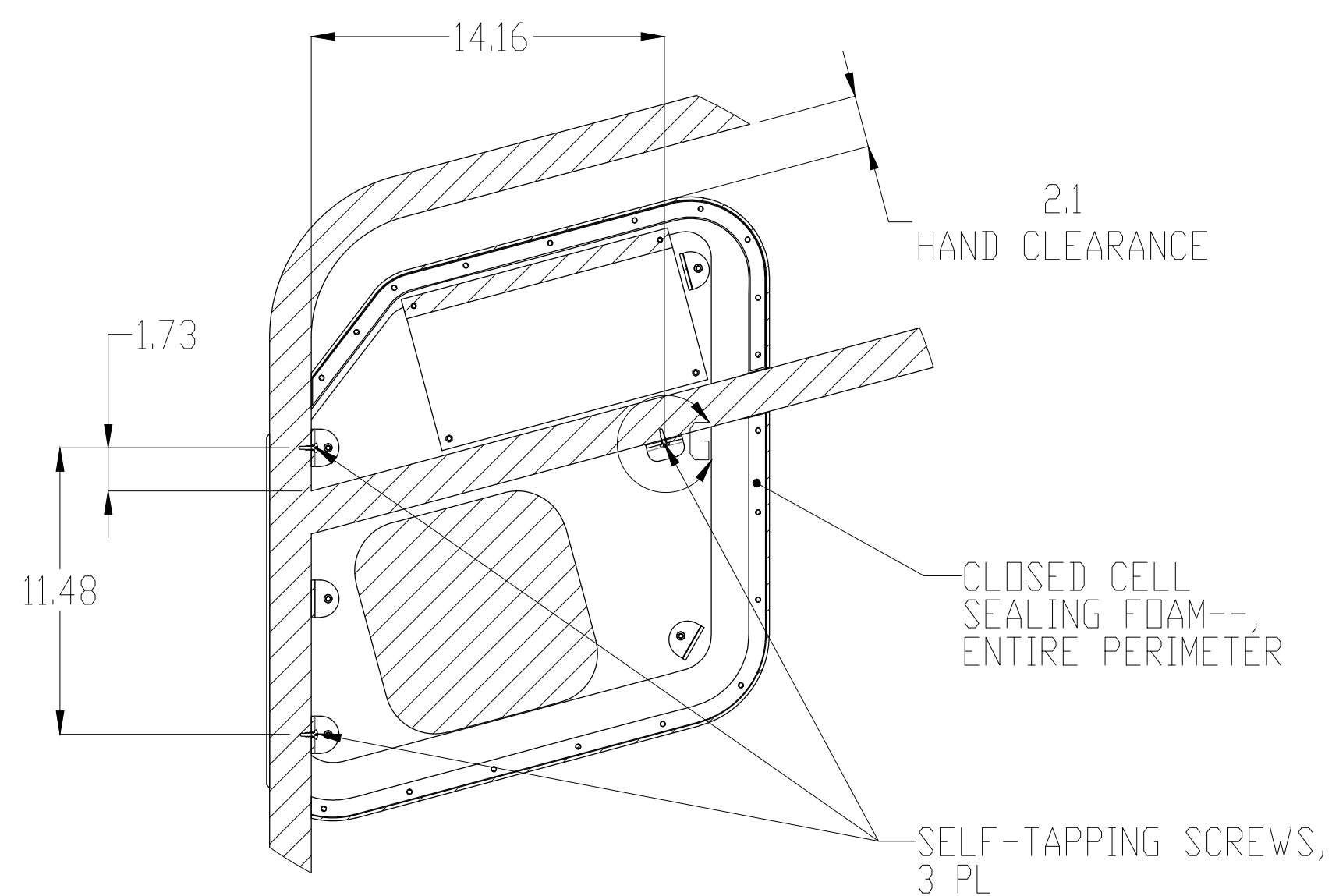
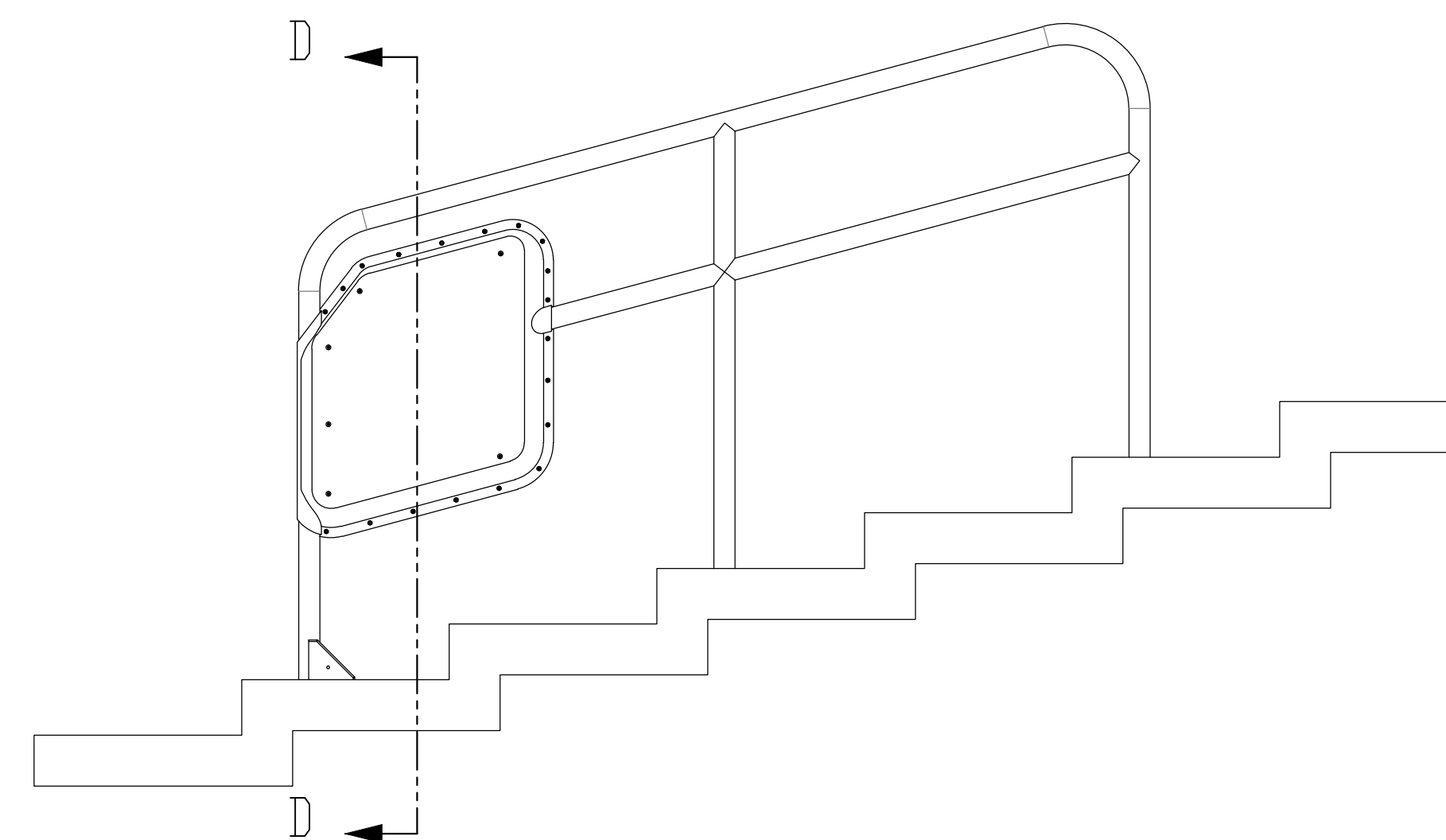
## **8.0 SAMPLE HANDRAIL DETAILS**

# AmpThink Mechanical Detail

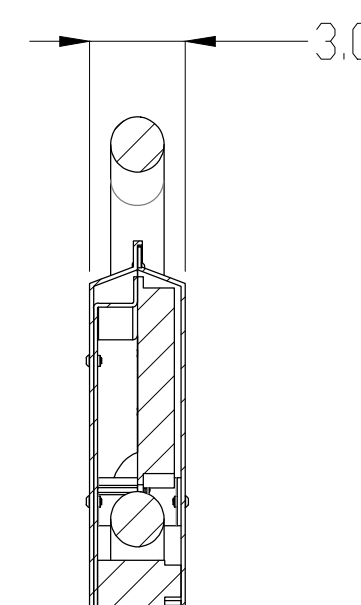
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APPROVED BY:		WCA		SCALE:		AS NOTED	
REVISIONS							
Issue No.	Issue No.	Drawn	Check	Issued			
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						F	



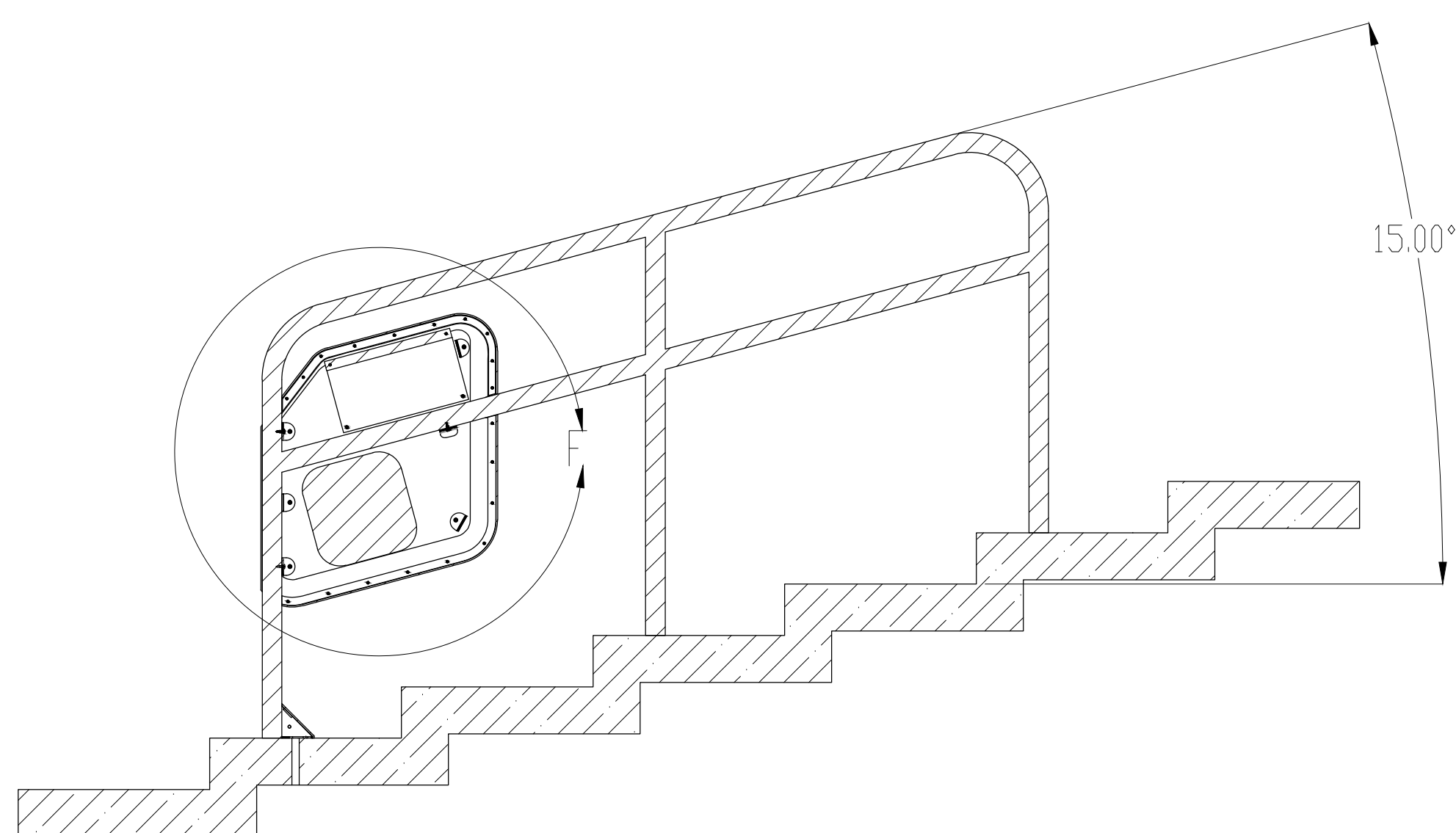
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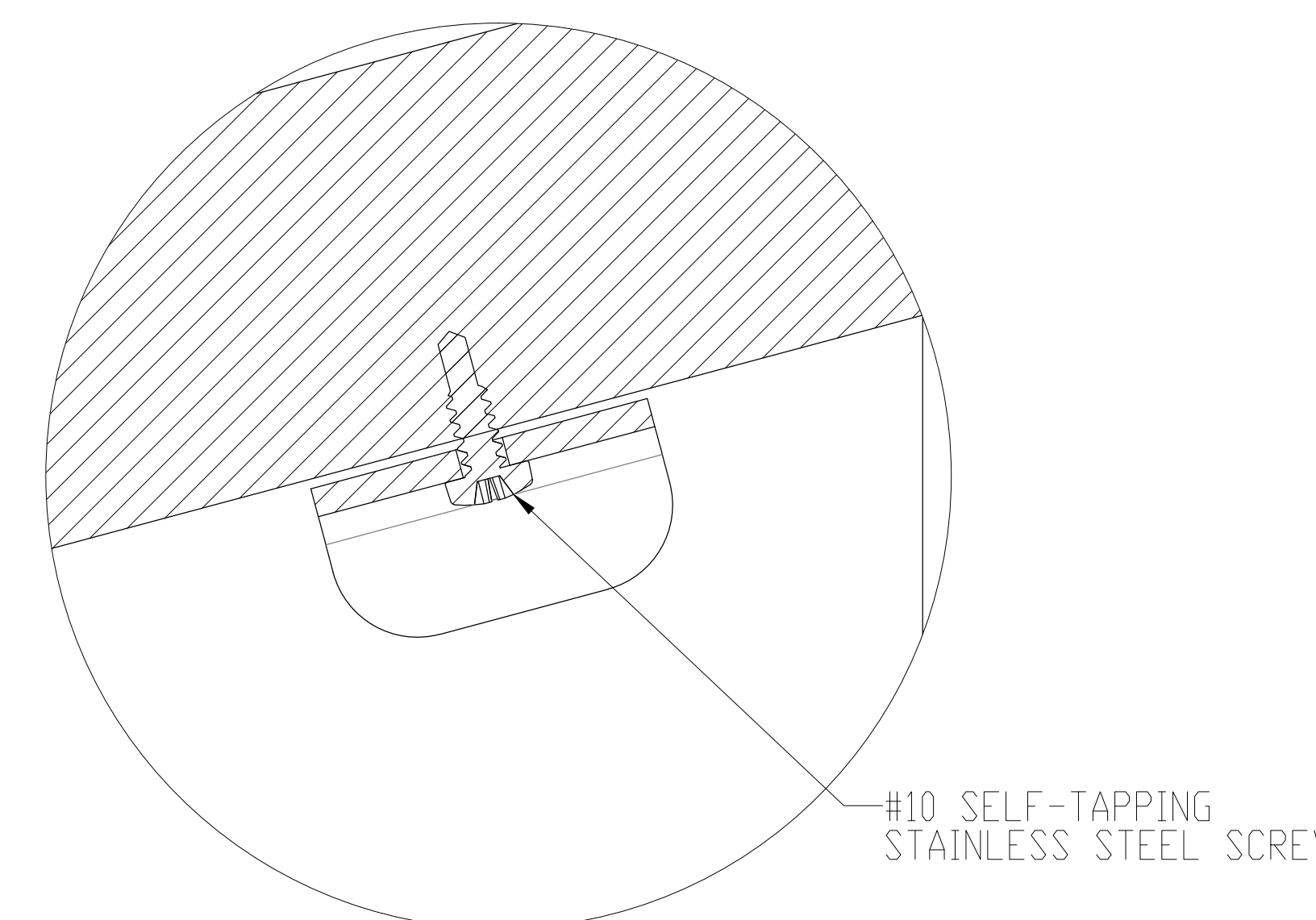
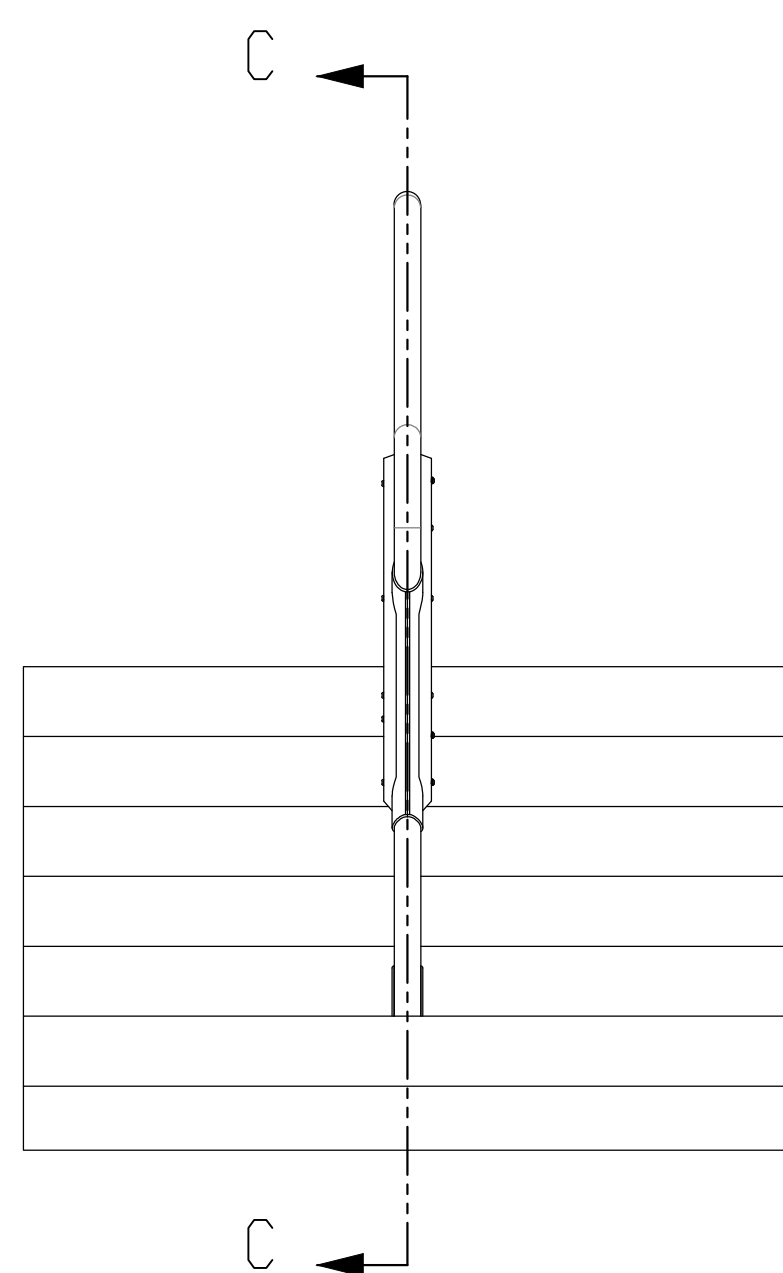
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DETAIL E  
SCALE 1 : 6



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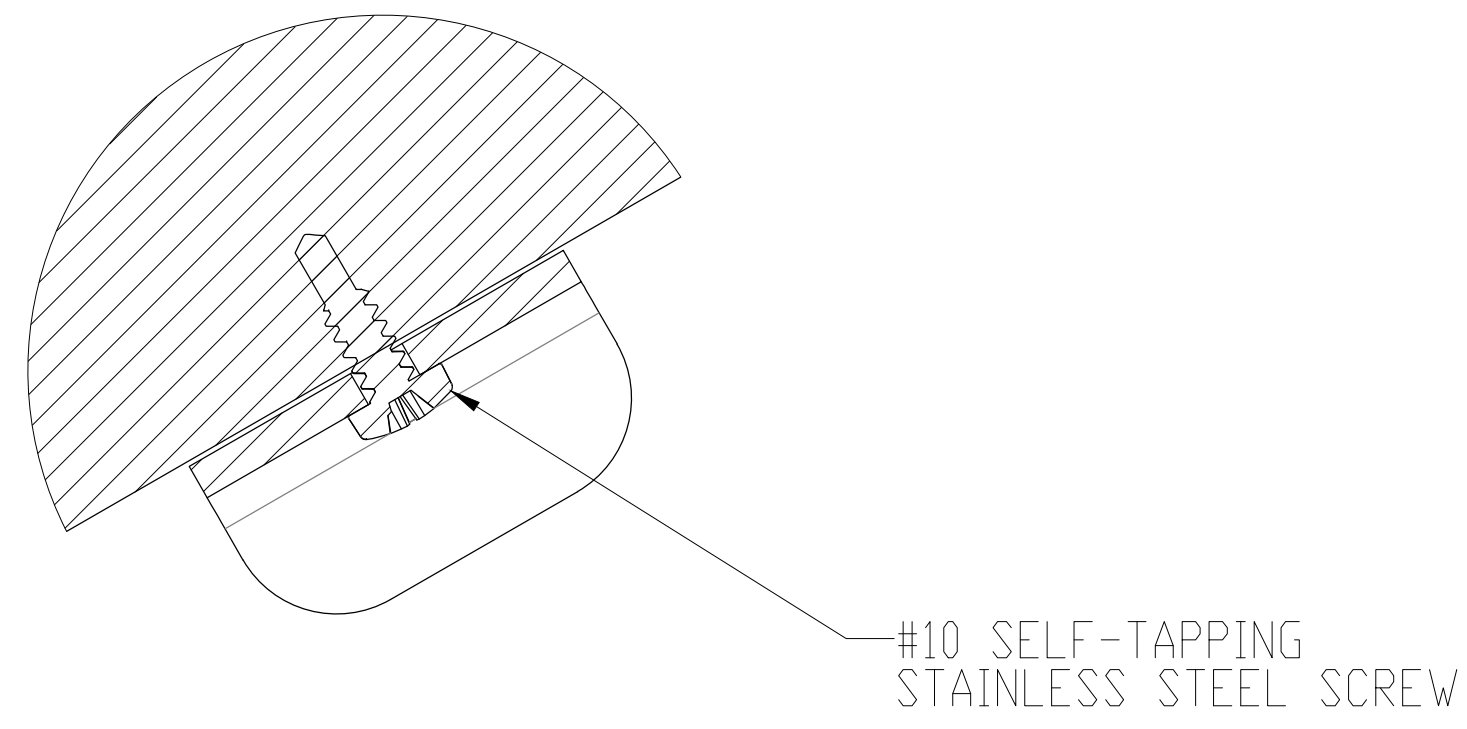


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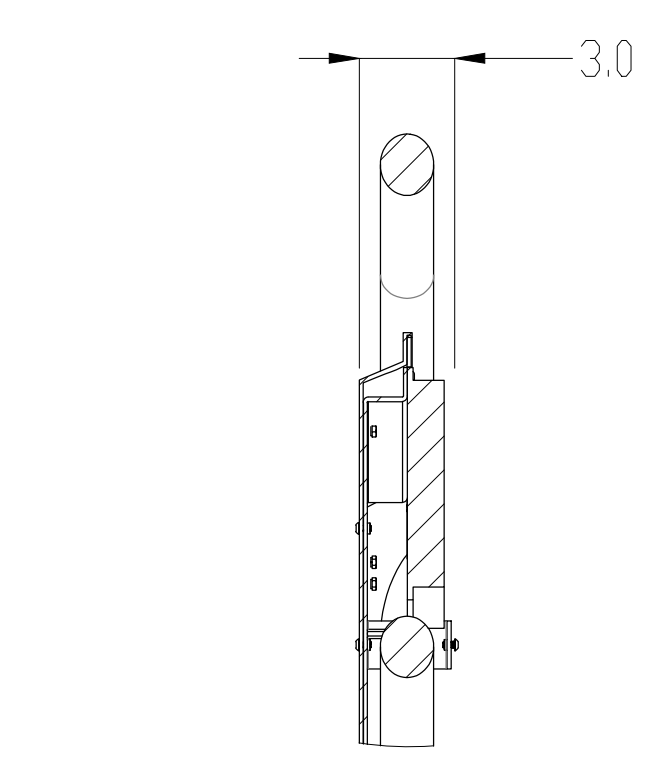
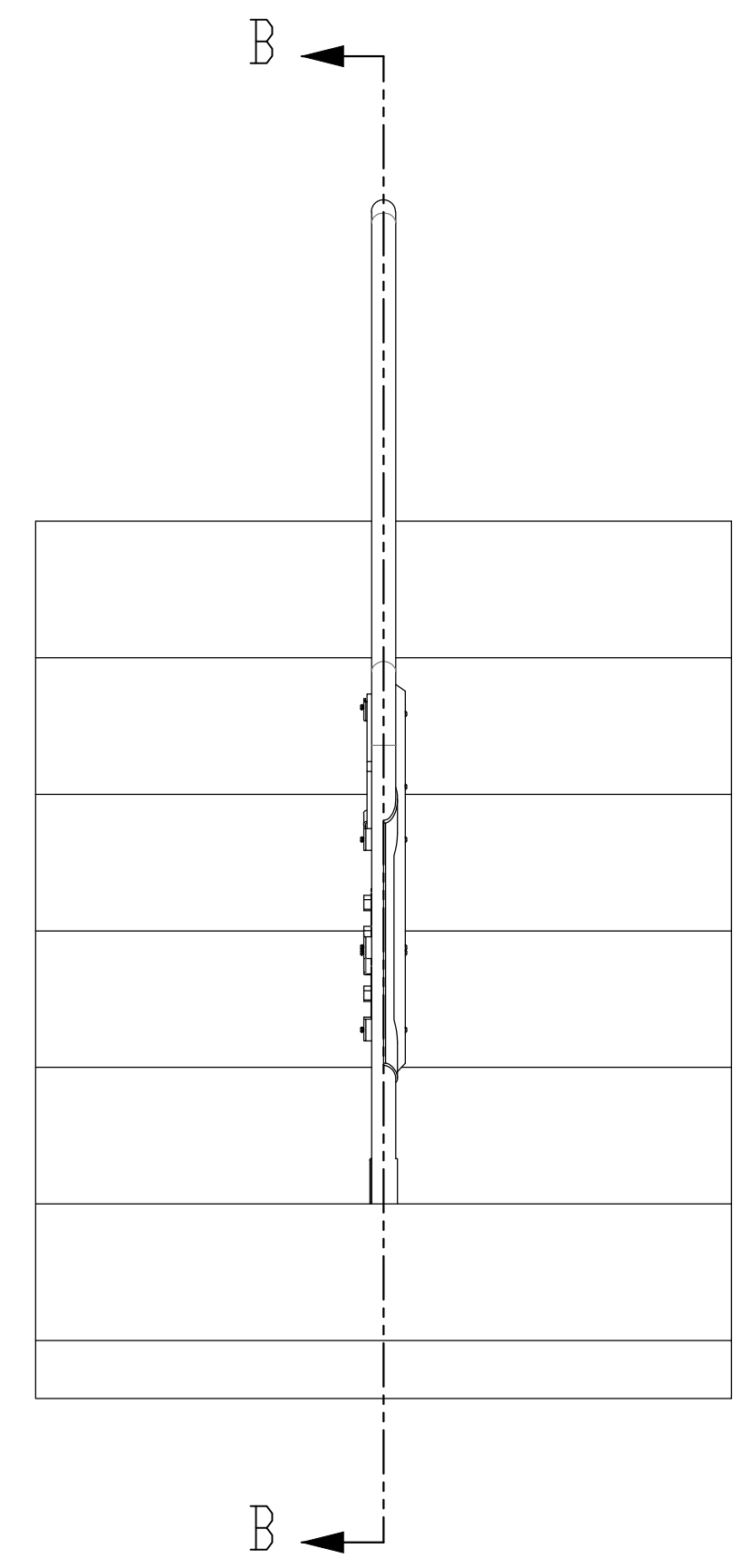


A M P T H I N K

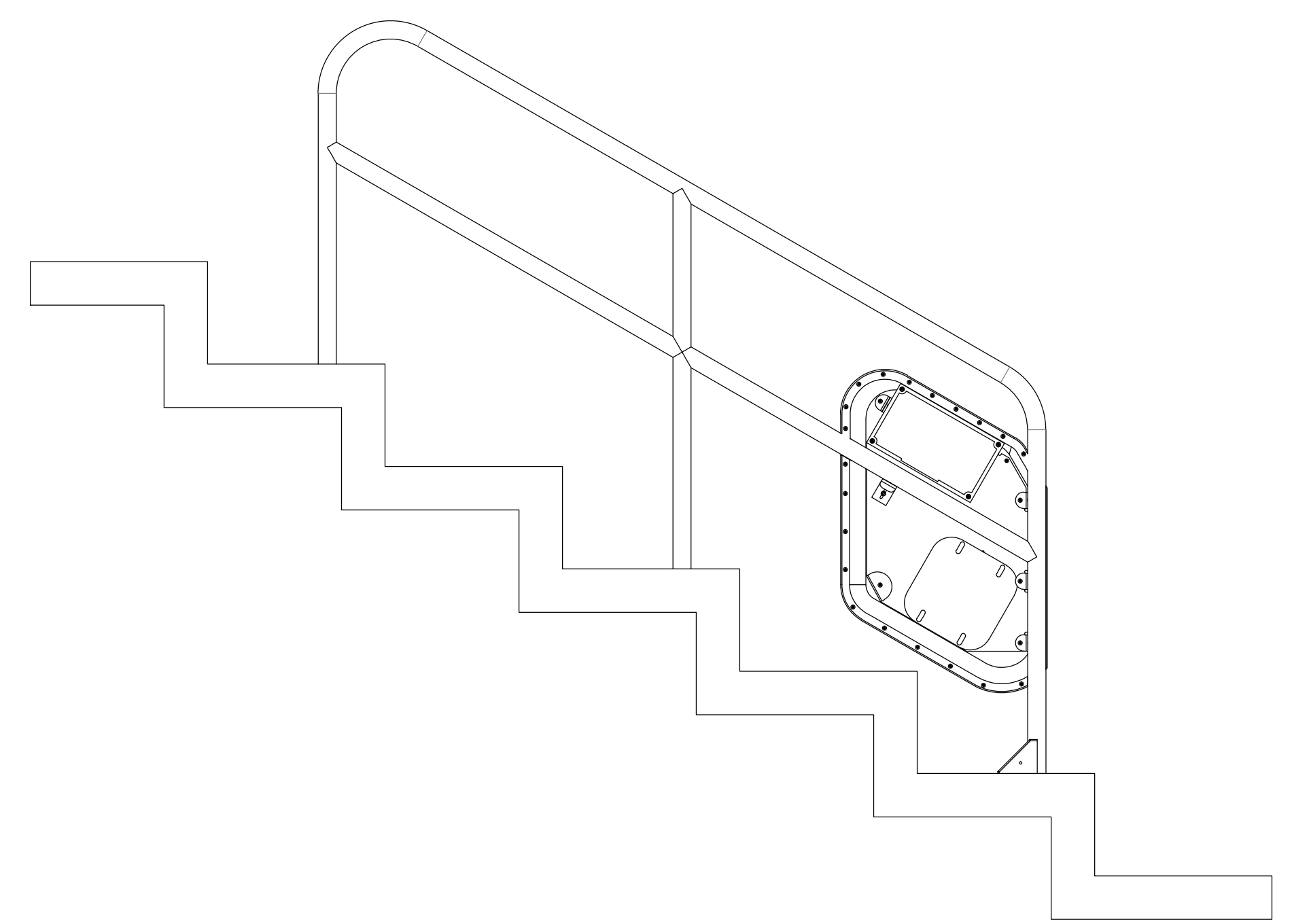
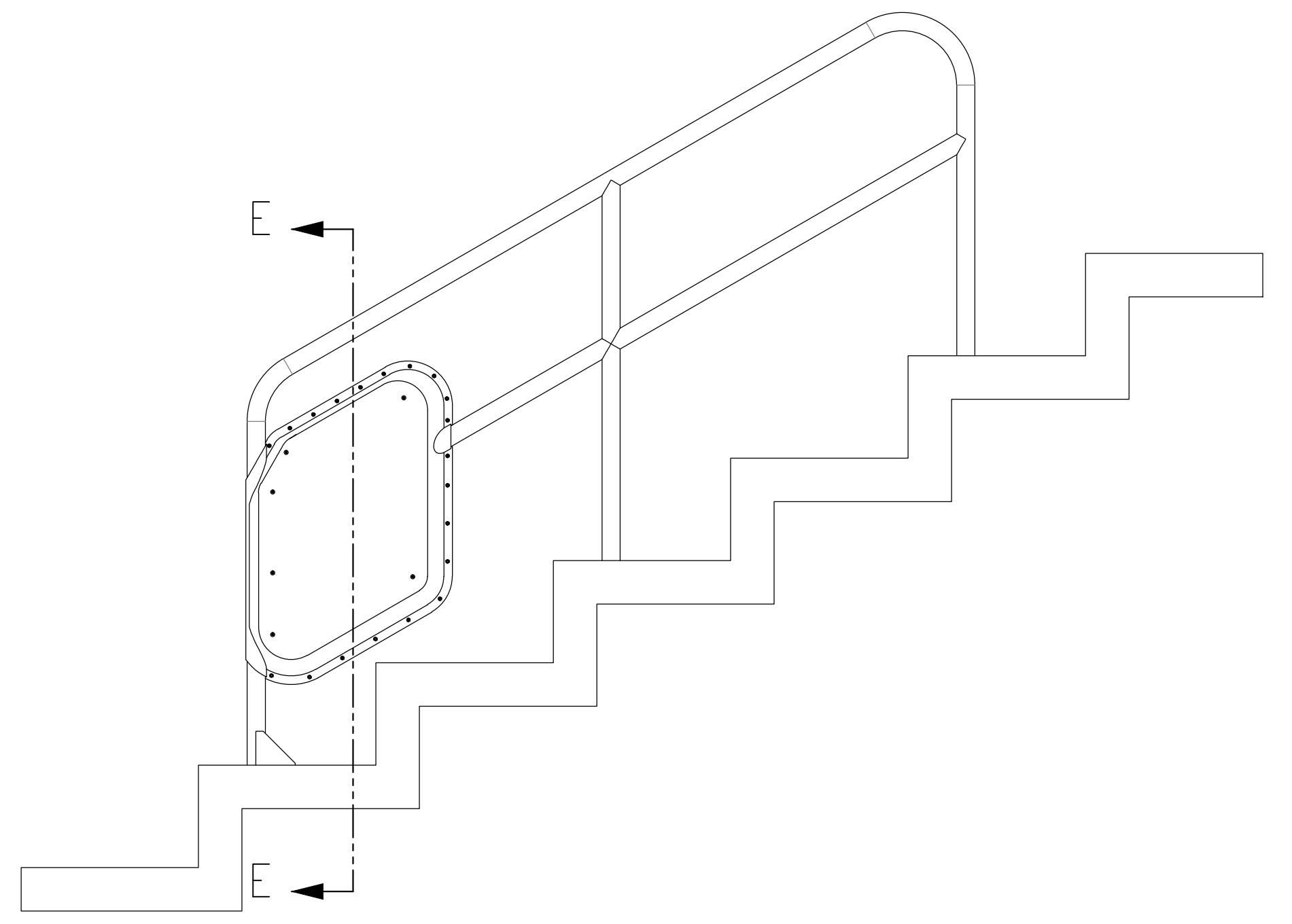
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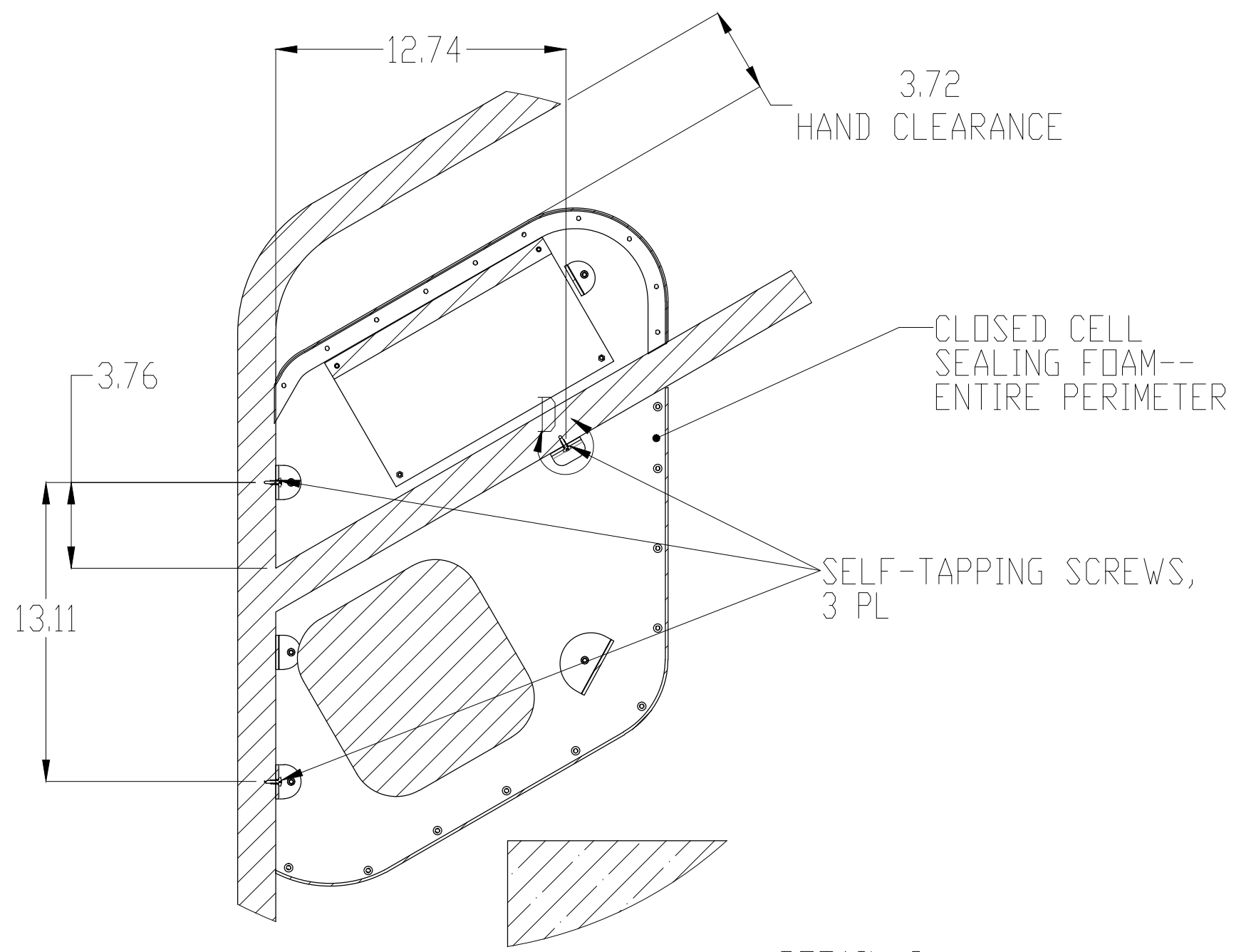
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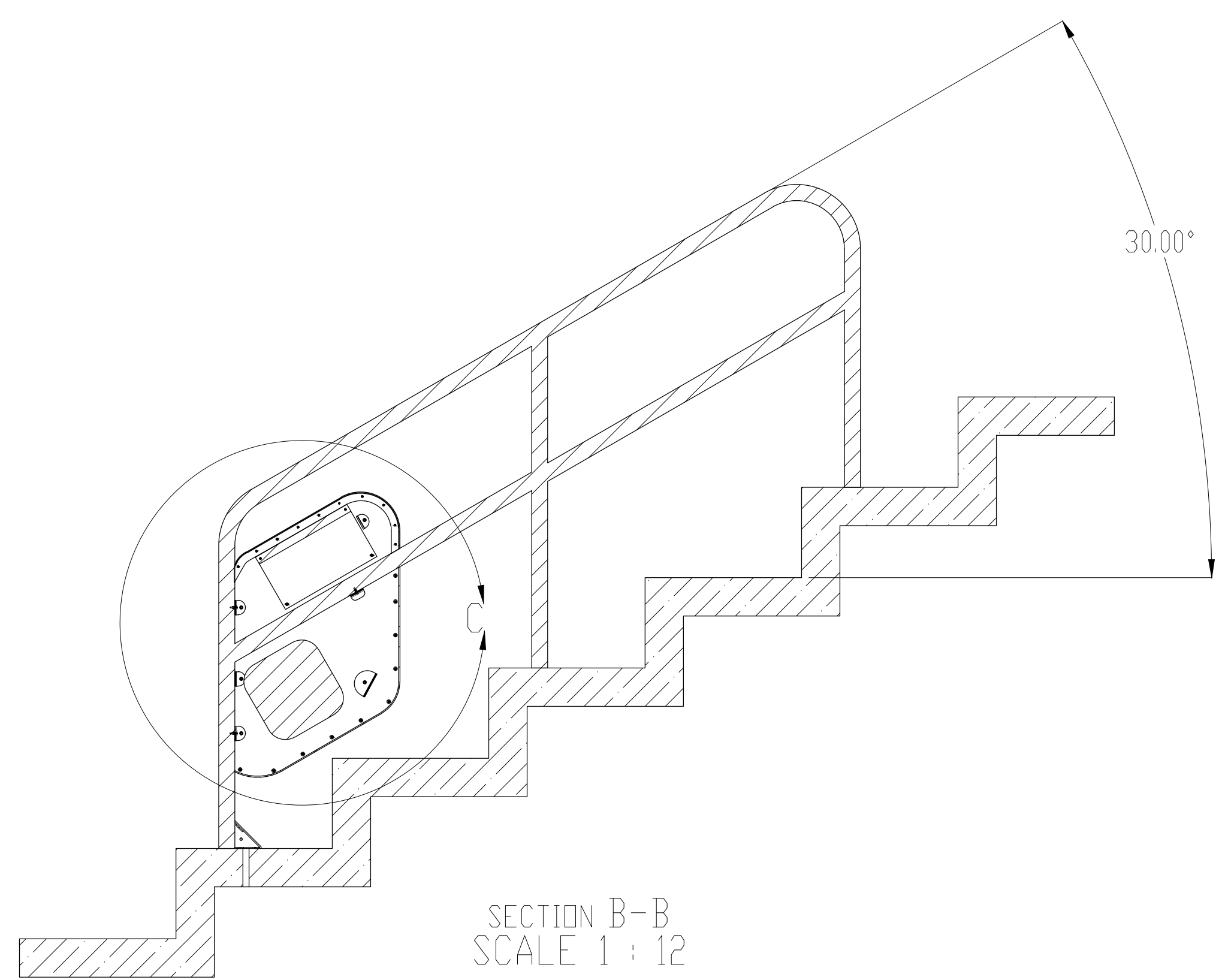
DETAIL F  
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SECTION E-E  
SCALE 1 : 12



DETAIL C  
SCALE 1 : 6



SECTION B-B  
SCALE 1 : 12



AMP THINK