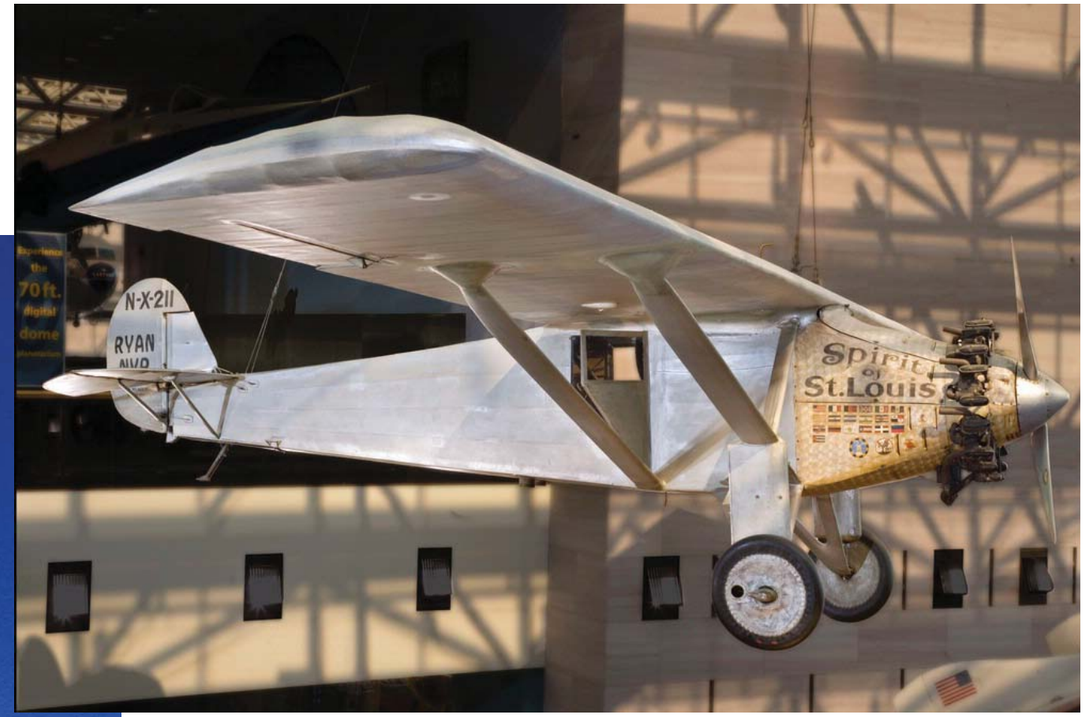

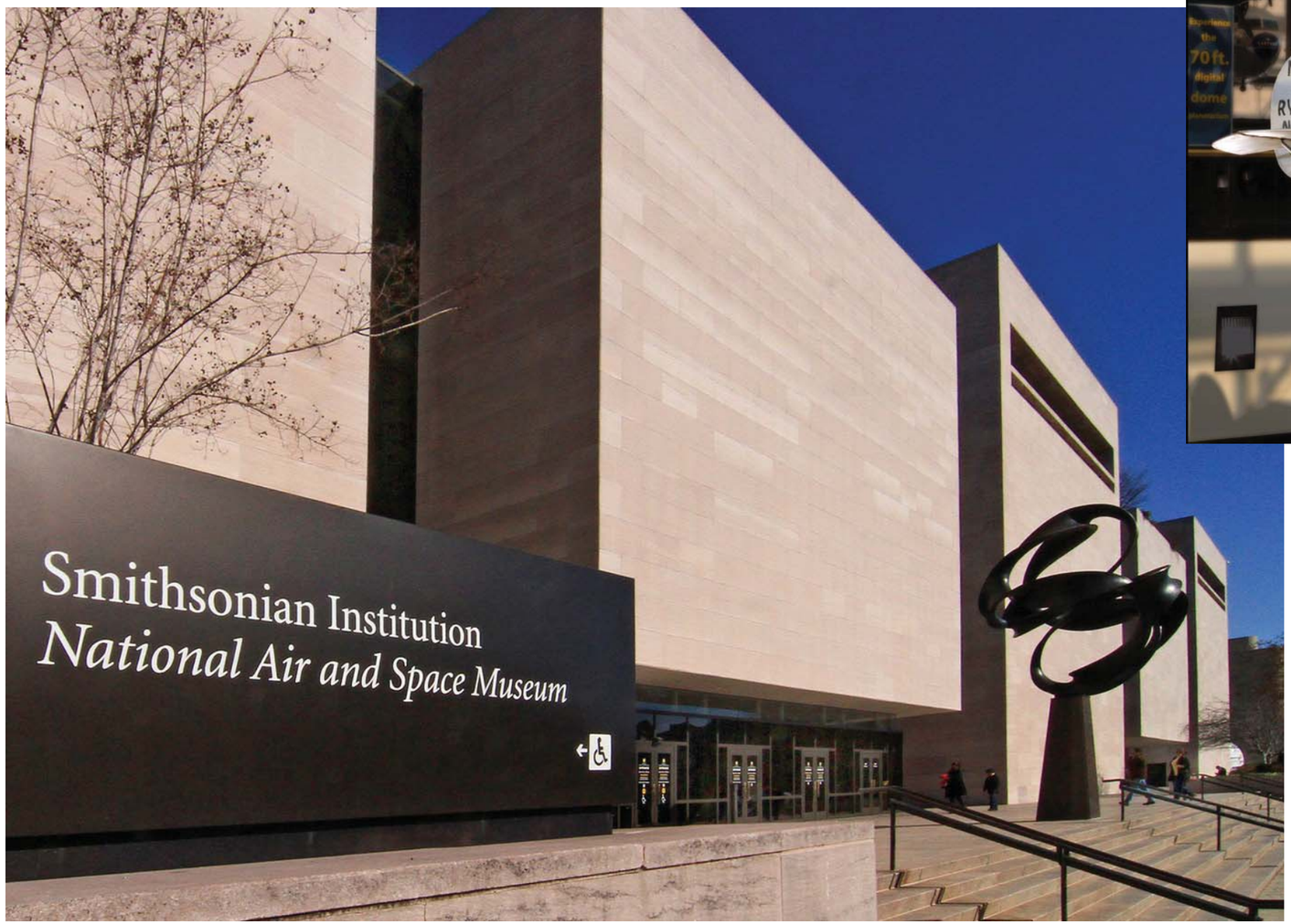

CONCEPT REPORT

National Capital Planning Commission
3 June 2016

Smithsonian's National Air and Space Museum
National Mall Building
Envelope and HVAC Revitalization

SF Project No. 1206101
QEA Project No. 31301800

QUINN EVANS
ARCHITECTS

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CONCEPT REPORT

PROJECT NAME

National Mall Building Envelope and HVAC Revitalization

LOCATION

Smithsonian Institution
National Air and Space Museum
Washington, DC

AGENCY AND CONTACT

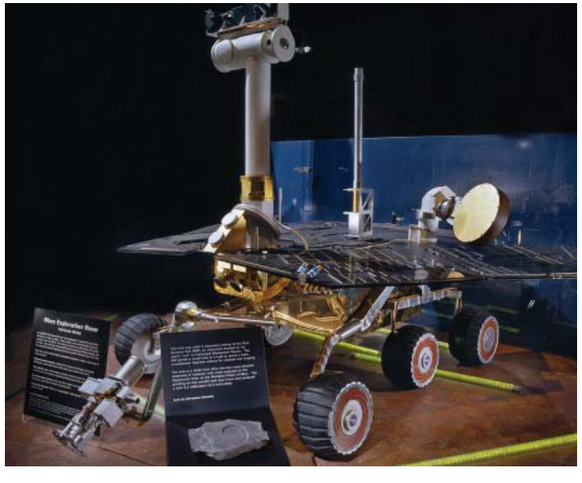
Smithsonian Institution
Smithsonian Facilities (SF)
Office of Planning, Design and Construction (OPDC)
Capital Gallery
600 Maryland Avenue SW Suite 5001
MRC 511, PO Box 37012
Washington, DC 20013-7012

Jane Passman, Senior Facilities Master Planner
Phone: 202.633.6549
Email: passmj@si.edu

INTRODUCTION

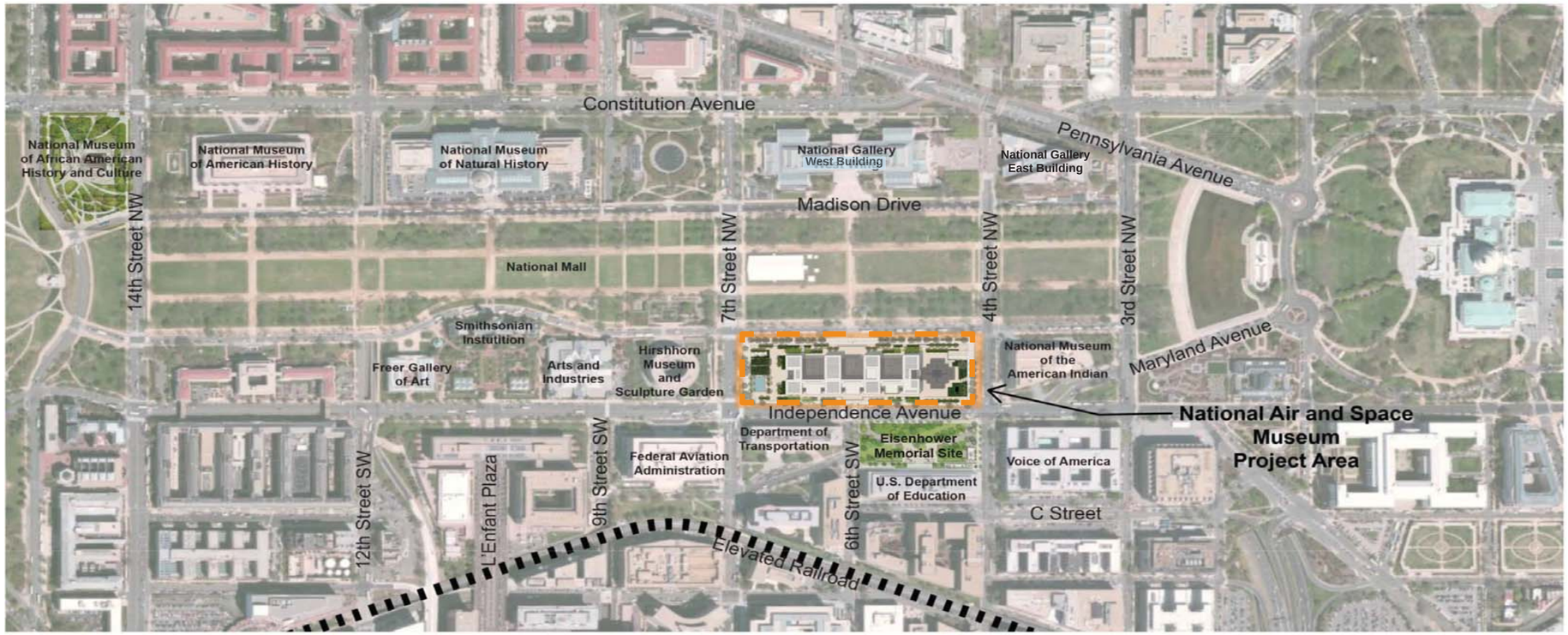
NASM Vision: “Transforming NASM for the future”

The Smithsonian’s National Air and Space Museum will assess and improve our programs, processes, and tools; revitalize our facilities and refresh our exhibitions to better engage and educate the public; preserve and share our collections; and perform original research in planetary science and the history of aviation and spaceflight.

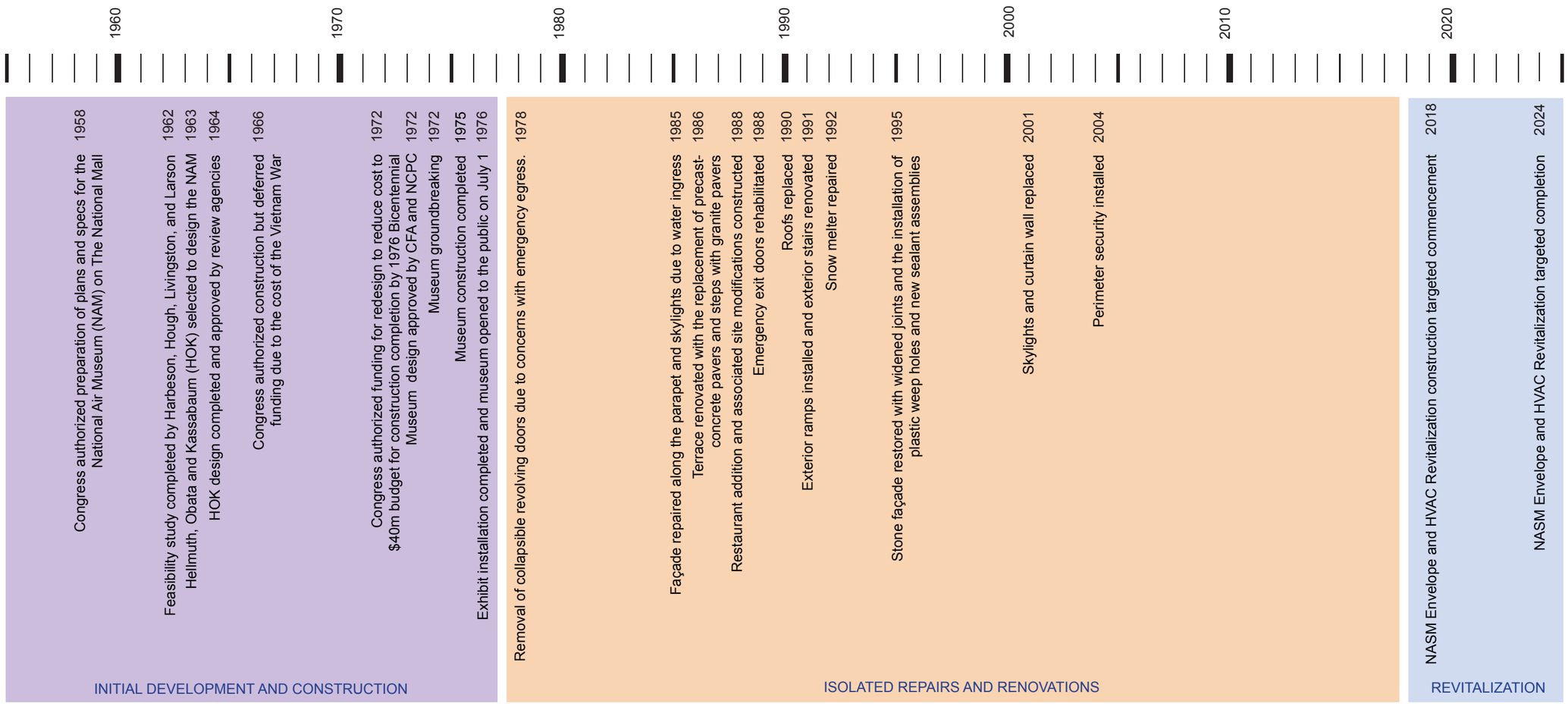


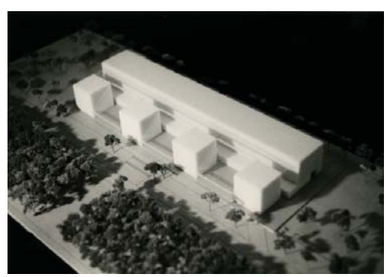
NASM Mission: “Commemorate, Educate, Inspire”

The Smithsonian’s National Air and Space Museum collects, preserves, studies, and exhibits artifacts, archival materials, and works of art related to the history, culture, and science of aviation and spaceflight and the study of the universe. Its research and outreach activities serve all audiences, within and beyond its walls. The Museum commemorates the past and is committed to educating and inspiring people to foster appreciation for the importance of flight to humanity.



National Air and Space Museum Mall Building - Context Map

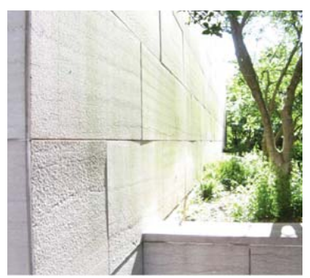



Early Proposal to Review Agencies in 1972

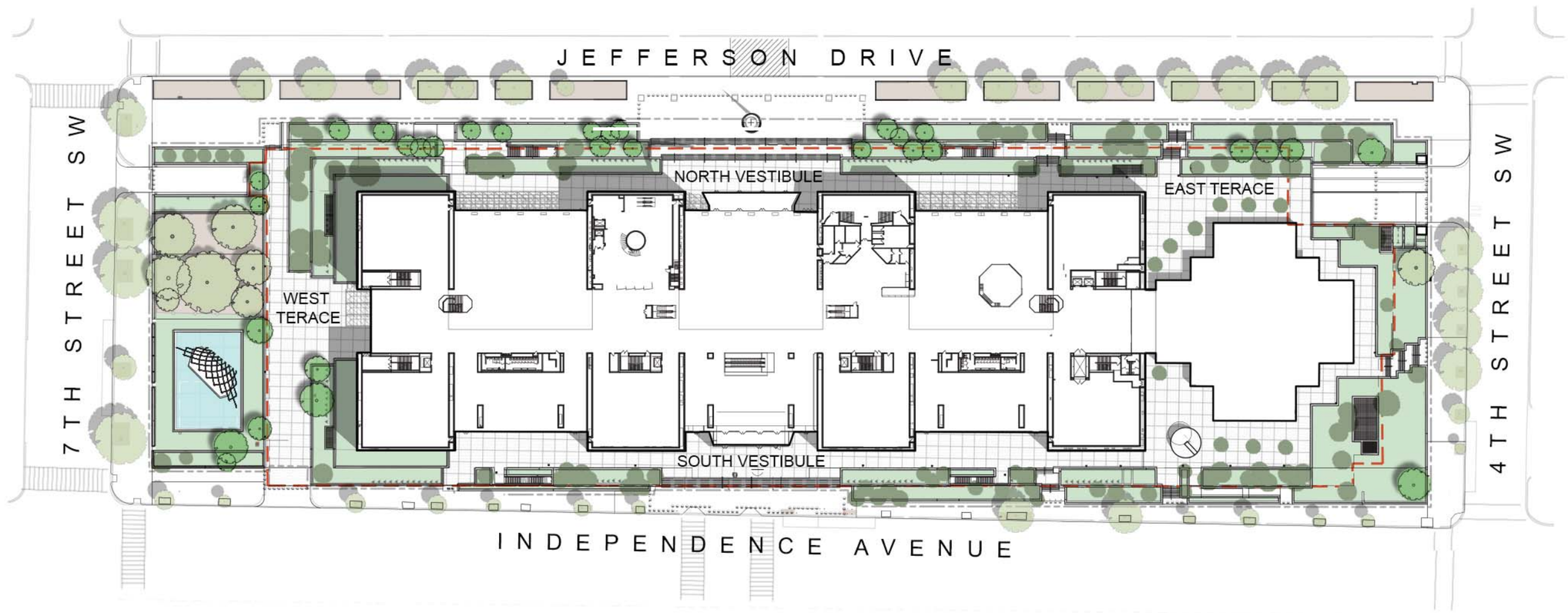

□rand Opening 1976


Restaurant Addition 1988


Perimeter Security 2004

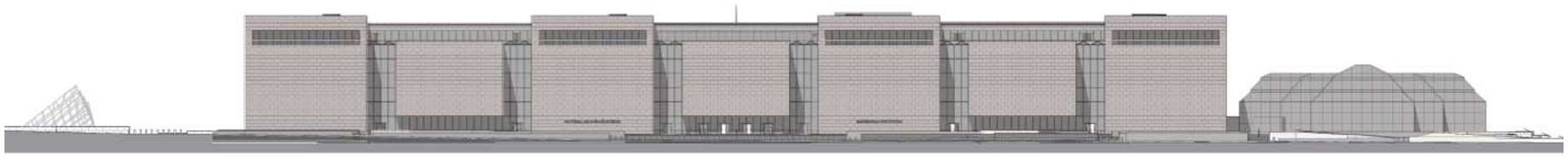

Proposed Revitalization 2024

National Mall Building Development Timeline



Existing Site Plan and First Floor Plan

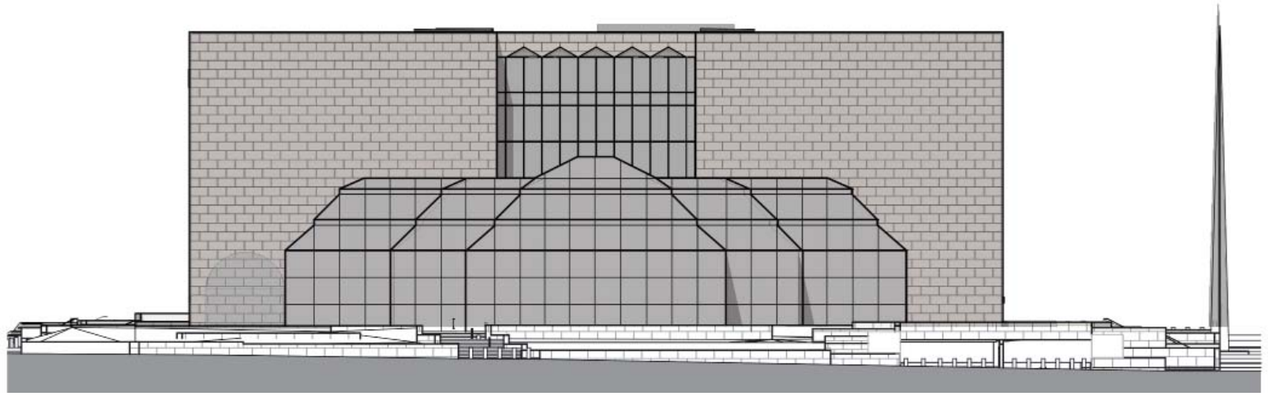
Existing North Elevation



Existing South Elevation

40 FEET 0 10 20 40 80

Existing Elevations



Existing East Elevation

Existing West Elevation

Existing Elevations

40 FEET 0 10 20 40 80

1.1 PROJECT DATA

Project Area & Building Area
The project comprises the renovation and restoration of the existing 687,000 gsf (63,824 m^2) National Air and Space Museum (NASM) National Mall Building, including 112,000 gsf (10,405 m^2) terrace revitalization. The overall site area is 448,530 gsf (41,670 m^2). The cladding replacement includes 160,600 gsf (14,920 m^2) stone facade, 40,000 gsf (3,716 m^2) curtain wall, 52,000 gsf (4,830 m^2) skylight, and 70,000 gsf (6,503 m^2) roof. The proposed vestibule additions are a combined 4,800 gsf (446 m^2).

Assigned Employment
There is a combined total of approximately 530 employees and volunteers assigned to the NASM Mall Building. No change of assigned employees is envisioned as a result of this project.

Schedule
The project is scheduled to be constructed beginning in early 2018 with an estimated six year period of construction. Public access to the Museum will be maintained but restricted while under construction.

Project Cost and Funding
The currently estimated construction cost is approximately $410M within a total project working budget of $600M. Federal funding for revitalization is expected to be requested in increments over FY18-FY22.

1.2 PROJECT NARRATIVE

The proposed design for the National Mall Building envelope and HVAC revitalization addresses the need for upgrades to a facility with out-of-date systems and significant deferred maintenance. The proposed upgrades include:

- The replacement of currently failing or outdated systems with upgrades that are to be designed and selected to endure for prolonged service timespans, maintainable and serviceable without major renovations, on the order of a 100-year cycle for building envelope components.
- The enhancement of the visitor experience with greater accessibility and amenities
- The retention and reuse of over 50% of storm water on site in accordance with the District of Columbia Department of Energy & Environment (DOEE) requirements put forward in July 2013.
- The incorporation of energy harvesting at appropriate roof areas.

Development History
The Smithsonian's aeronautical collection was established in 1876 with a group of kites acquired from the Chinese Imperial Commission. In 1946, Congress established a National Air Museum to memorialize the national development of aviation. In 1966, the name of the museum was changed to the National Air and Space Museum to memorialize the development of both aviation and spaceflight. In 1971, Congress passed a funding measure for $40 million toward the new building.

NASM became an important beacon of cultural and technological innovation in Washington, D.C. when it was added to the promenade of the National Mall in 1976. With the largest collection of historic aircraft and spacecraft in the world, the design of this museum offered both unique architectural opportunities and complex challenges.

In 1965, Hellmuth Obata and Kassabaum Architects (HOK) was commissioned to design the museum and surrounding landscape by the GSA, who at that time managed design and construction of Smithsonian facilities. Lead Architect Gyo Obata aspired to design a building that was in harmony with the character of the National Mall and reflected the architectural elements of the surrounding buildings, while also pursuing modern architectural principles. Through several iterations, Obata explored design ideas including the way the building meets the ground, attention to scale, the interplay between solids and voids, and the relationship to the surrounding buildings on the Mall.

Obata's solution was skillfully simple: four large marble-clad pavilions, separated by three recessed steel-and-glass atria. Drawing inspiration from neighboring buildings, primarily the National Gallery, Obata reflected formal massing and materials in his design. The alternation of solids and voids are placed and proportioned to respond to corresponding projections and recesses of the West Building of the National Gallery, which sits directly across the Mall. Equivalent volumes face Independence Avenue, but the recessed glass-enclosed bays of the Mall façade have been replaced by floating marble cubes, cantilevered to be flush with the south façade. The volumes are clad in Tennessee Pink marble, as used in the construction of its neoclassical predecessor.

In 1972, the design was approved by the federal review commissions after several revisions, as GSA oversaw the design of SI facilities at that time. Construction began later that year. The museum was opened on July 1, 1976. With this, the project requirements were accomplished by opening in time for the Bicentennial and within the $40 million construction budget. The project was awarded with the "anti-golden fleece" prize by Senator William Proxmire in honor of this feat.

The popularity of the museum brought more visitors than anticipated, creating increased impact on certain building systems. The weathering of the building was also accelerated by the limited longevity of certain building components that were downgraded as part of the original construction in order to reduce cost and meet the budget.

The initial building system repairs and replacements began in 1978 with the replacement of the collapsible revolving doors due to concerns regarding emergency egress. Later renovations included the replacement of precast concrete exterior pavers with granite in 1985. The acrylic skylights, which were introduced as a value engineering substitution for the glass enclosure originally proposed, were replaced in glass in 2001 as part of glazing replacement that included the curtain wall and vestibule as well.

The envelope and HVAC studies conducted by Quinn Evans Architects in 2013 determined the stone cladding system is failing, as well as the HVAC systems, which have reached the end of their usable life. Due to the integration of the exterior cladding with the mechanical air distribution system, it is necessary to undertake these upgrades together. Further analysis established that the waterproofing enclosure of the plaza and the main roof are similarly aging and beyond their projected life span.

Historic Preservation
NASM is not currently listed individually on the National Register of Historic Places or the District of Columbia Inventory of Historic Sites. However it is potentially eligible for individual listing, and is a contributing building to the National Mall Historic District. At the time of this report the building is 40 years old.

Organization of Report
The remainder of the report is divided into three sections: (1) envelope replacement, (2) terrace revitalization, (3) security vestibules, and (4) photovoltaics. Each of the sections includes a narrative describing the existing conditions and deficiencies, program requirements, and analysis of the design proposal. An appendix of intermediate progress images is included for reference.

2.0 TRANSPORTATION MANAGEMENT PROGRAM

Not applicable to this project because the assigned employees are below 500.

3.0 ENVIRONMENTAL DOCUMENTATION

NEPA Compliance
In accordance with the National Environmental Policy Act of 1969, the Smithsonian Institution has initiated an Environmental Assessment study for the National Air and Space Museum with public and agency scoping meetings having been conducted.

4.0 HISTORIC PRESERVATION DOCUMENTATION

Compliance
Refer to adjacent letter from the SI office of Architectural History and Historic Preservation that formally initiates the Section 106 process for this project. A consulting parties meeting was conducted. Additional consultation will be conducted in the future.

5.0 FLOOD PLAINS MANAGEMENT AND WETLANDS PROTECTION

Located Within Floodplain, No Impact on Wetlands
The north and east portions of the site are within the 100-year (1% annual chance) flood plain as designated by FEMA's 2010 map. This flood plain, with Base Flood Elevation (BFE) +/- 12.5 feet, overlaps the east garage ramp, which serves as the entrance to NASM's loading dock. Mitigation will include waterproofing and a flood wall at the garage entrance ramp.

This project does not impact a wetlands area.

Smithsonian Institution

Architectural History and Historic Preservation

3 September 2014

Mr. C. Andrew Lewis
Senior Historic Preservation Specialist
D.C. Historic Preservation Office
1100 4th Street, SW, Suite E650
Washington, D.C. 20024

Dear ~~Mr. Lewis,~~ Andrew

The Smithsonian's National Air and Space Museum was dedicated on 4 July 1976, just in time for the Bicentennial of the United States. To meet that deadline, new construction techniques and use of materials were used. These included the use of a thin Tennessee marble panel on a steel frame to create a curtain wall requiring less steel and marble.

Since that time, the marble has failed to the point where it needs to be entirely replaced. The Smithsonian is investigating if the original quarry can be reopened as well as using material that would closely match the original Tennessee marble in keeping with the *Secretary of the Interior's Standards for Treatment of Historic Buildings*.

Pursuant to 36 CFR 800.3(a), the Smithsonian has determined that the proposed replacement of the original Tennessee marble is an undertaking as defined in 800.16(y) and that is has the potential to cause effects on historic properties, in particular, the National Mall, a site listed on the National Register of Historic Places.

The Smithsonian wishes to initiate the Section 106 review process and seeks the assistance of the District of Columbia Historic Preservation Office (DCSHPO) in applying the criteria of adverse effect (800.5) to determine the effect the undertaking will have on historic properties.

The Smithsonian looks forward to working with you on this project, and will ensure that you receive proper documentation.

With kind regards

Amy Ballard
Senior Historic Preservation Specialist

cc: Jennifer Hirsch, National Capital Planning Commission

P.O. Box 37012 MRC 511
Washington. D.C. 20013-7012
Tel: 202-633-6535 direct

Smithsonian Institution

Architectural History and Historic Preservation

5 September 2014

Mr. C. Andrew Lewis
Senior Historic Preservation Specialist
D.C. Historic Preservation Office
1100 4th Street, SW, Suite E650
Washington, D.C. 20024

Dear Mr. Lewis,

The Smithsonian's National Air and Space Museum is one of the most highly visited museums in the world. Since September 11, 2001 the threat level has increased to the museum, and security was elevated upon entering the museum. These security measures consist of magnetometers and x ray machines manned by security officers.

Presently the security screening is conducted just as one enters the museum at the north and south entry points. In the summer and during school holidays, this creates long lines outside the museum and overcrowding inside. During inclement weather there is no place for visitors to shelter. Moreover there is no transition point between the security screening and the museum.

Pursuant to 36 CFR 800.3(a), the Smithsonian has determined that the proposed addition of security pavilions on the north and south entries to the National Air and Space Museum is an undertaking as defined in 800.16(y) and that is has the potential to cause effects on historic properties, in particular, the National Mall, a site listed on the National Register of Historic Places.

The Smithsonian wishes to initiate the Section 106 review process and seeks the assistance of the District of Columbia Historic Preservation Office (DCSHPO) in applying the criteria of adverse effect (800.5) to determine the effect the undertaking will have on historic properties.

The Smithsonian looks forward to working with you on this project, and will ensure that you receive proper documentation.

With kind regards

Amy Ballard
Senior Historic Preservation Specialist

cc: Jennifer Hirsch, National Capital Planning Commission

P.O. Box 37012 MRC 511
Washington. D.C. 20013-7012
Tel: 202-633-6535 direct

GOVERNMENT OF THE DISTRICT OF COLUMBIA
STATE HISTORIC PRESERVATION OFFICER

October 3, 2014

Ms. Amy Ballard, Senior Historic Preservation Specialist
Smithsonian Institution
Architectural History and Historic Preservation
P.O. Box 37012 MRC 511
Washington, DC 20013-7012

RE: Initiation of Section 106 Consultation; National Museum of Air & Space Façade Replacement Project

Dear Ms. Ballard:

Thank you for formally initiating consultation with the District of Columbia State Historic Preservation Officer (SHPO) regarding the above-referenced undertaking. We are writing in accordance with Section 106 of the National Historic Preservation Act and its implementing regulations, 36 CFR Part 800, to provide our initial comments regarding effects on historic properties.

As you are aware, the National Air & Space Museum is a contributing element of the National Register of Historic Places-listed National Mall Historic District. Based upon our review of the project submittal and our participation in the site visit and informal discussions held on June 17th and September 22nd of this year, we understand that the original, Tennessee marble panels that make up the exterior façades – and the museum's most prominent character-defining feature – are failing to the point that they must be completely replaced. Repair/reuse of the original marble is not an option because the panels are very thin and much of the deterioration consists of significant warping. However, we are encouraged that the Smithsonian Institution is actively investigating the possibility of reopening the original quarry and acquiring matching stone to complete the project. Since this approach has the potential to completely avoid adverse effects, we strongly encourage *in-kind* replacement if at all possible. Alternative materials such as granite, metal or synthetic panels are likely to result in adverse effects on the museum and the surrounding historic district.

Please keep us posted as more is learned about the possibility of obtaining matching marble panels. In the meantime, we look forward to continuing consultation with the Smithsonian Institution and other parties, including assisting in the preparation of an Area of Potential Effect (APE) and an initial list of potential consulting parties. If you should have any questions or comments regarding this matter, please contact me at andrew.lewis@dc.gov or 202-442-8841. Otherwise, thank you for providing this initial opportunity to comment.

Sincerely,

C. Andrew Lewis
Senior Historic Preservation Specialist
DC State Historic Preservation Office

14-433
cc: Jennifer Hirsch, NCPC

1100 4th Street, SW, Suite E650, Washington, DC 20024 Phone: 202-442-7600, Fax 202-442-7637

JUNE 2015 COMMISSION OF FINE ARTS CONCEPT HEARING

Following several months of consultation from agency staff, a concept report and presentation was provided in June 2015 of the following scope items for the NASM revitalization project:

- Terrace
- Vestibules
- Envelope Replacement
  - Stone Cladding
  - Glazing
  - Roof Solar Panels
  - Solar Wall

COMMISSION OF FINE ARTS CONCEPT APPROVAL

The concept proposal was granted concept approval for all aspects of the scope, with comments providing direction on how to advance the design.

The letter from the Commission of Fine Arts is included on this page for reference. The specific comments from the Commission are included in each section of this report to identify the relevant direction provided, and demonstrate they have been incorporated into the updated design. Additional design iterations are included in the appendix, documenting the progress made in developing the design with on-going consultation from agency staff towards the updated concept design proposal documented in this report.

U.S. COMMISSION OF FINE ARTS

ESTABLISHED BY CONGRESS 17 MAY 1910

401 F STREET NW SUITE 312 WASHINGTON DC 20001-2728 202-504-2200 FAX 202-504-2195 WWW.CFA.GOV

26 June 2015

Dear General Dailey:

In its meeting of 18 June, the Commission of Fine Arts reviewed the concept proposal for replacing the exterior facades and terraces of the National Air and Space Museum on the National Mall. The Commission approved the concept with numerous comments for further consideration as the design is developed.

In their discussion, the Commission members considered the project's complex issues of historic preservation, building technology, programmatic needs, and interpretive themes. While they noted the obvious competence of and care taken by the project team, they suggested that the design could go much further in expressing the technology of the museum's subject of flight and space exploration. While accepting the proposal to reclad the building in the same Tennessee Pink marble used in the original design, they expressed regret that other options for replacing the deteriorating stone panels with more modern materials—such as metal, enamel, ceramic, or glass—were not presented as viable options. They recognized the impetus of the space program in developing such technologies as photovoltaic panels, and they identified the great opportunity in this project to express these innovative technologies in a more comprehensive way in the renovation of the building. Instead of the current proposal to treat new entrance canopies and photovoltaic arrays as unrelated elements added to the reconstructed stone shell of the building, they recommended that these pieces be more fully integrated with each other—and even with the building enclosure panels—transforming the existing architecture to convey the critical role of technology in air and space travel.

For the redesign of the building's landscape, the Commission members expressed strong support for the proposal to simplify and open up the low terraces surrounding the building as these are rebuilt to accommodate modern requirements of accessibility and security. Observing that the site walls are not clearly related to the horizontal aesthetic of the building's plinth, they suggested consideration of lowering where possible the height of planter walls around the site.

The Commission members hope that the opportunity presented by this project to express themes of design and science is explored along with a more conventional preservation approach for this highly popular and prominent museum, and they look forward to further review as the concept is developed. As always, the staff is available to assist you with the next submission.

Sincerely,

Thomas E. Luebke, FAIA
Secretary

Gen. John R. Dailey, Director
National Air and Space Museum
Smithsonian Institution
P.O. Box 37012
Washington, DC 20013-7012

cc: Ann Trowbridge, Smithsonian Institution
Larry Barr, Quinn Evans Architects
Roger Courtenay, AECOM

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Envelope Replacement

1.2.3 CLADDING REPLACEMENT

This section summarizes the need for and methodology of the replacement of the stone cladding and glazing (curtain wall and skylight), as well as the incorporation of sustainability initiatives within the revitalized building envelope.

The revitalization of NASM will involve significant improvements to the building envelope systems (water, air, thermal, and vapor barriers) and require modifications to all of the building envelope components, including the exterior cladding, curtain walls, skylights, and roofing. This renovation project presents tremendous opportunities to improve the overall envelope performance through establishing water, air, thermal, and vapor barrier continuity. This will have significant impact on building energy use, provide appropriate system durability / service life, and establish NASM as a model for sustainable design.

1.2.3.1 STONE CLADDING REPLACEMENT

Original Design and Existing Conditions

The existing exterior walls consist of a 1 1/4" (32mm) thick Tennessee Pink Marble barrier wall system with backer rod and sealant filling the joints between 2'-6" (610mm) tall x 5'-0" (1220mm) wide panels and spray-applied urethane foam insulation covering the back of the stone. A vertical plenum within the wall cavity provides air flow through the interstitial space.

The stone facade must be removed for several reasons. Extensive warping ("hysteresis") and cracking is irreversible as exacerbated by the spray-foam insulation applied to the back of the stone panels, introducing a risk that some of the stone panels could fall from the building; temporary protection has been installed where needed to protect people from this risk. The existing exterior wall construction does not provide adequate resistance to water penetration or air infiltration. It also lacks effective flashings and does not include any means for air barrier continuity between the exterior walls and other building envelope systems (curtain wall, skylight, roofing, or soffits). Further, the reintroduction of mechanically-controlled humidification will create significant potential for condensation within the wall cavities inboard of the exterior wall assembly (particularly those used as return air plenums for the HVAC system) and this will drive certain design decisions related to the exterior wall concept.

Performance Criteria

The exterior wall assemblies must meet the following criteria:
- Durability/Strength
- Appearance: scale-giving, not monolithic; color; randomness; size and weight
- Procurement/installation risk
- Transition from interior to exterior
- Adherence to original design concept
- Prevent water infiltration
- Provide a continuous air barrier
- Minimize the potential for moisture accumulation within the exterior wall assembly and condensation, while maintaining interior operating conditions
- Provide thermally broken cladding attachment system to prevent condensation within the wall
- Provide blast resistance and limit fire propagation
- Provide the longest service life possible

Cladding Material Option Analysis

The analysis of cladding alternatives included consideration of a wide range of options in order to find the material that best suits the extensive performance criteria. Both natural and man-made panel systems were studied, with metallic, ceramic, stone, and composites reviewed among others along the way. Whereas many progressive systems provide the desired longevity, that was only one of many requirements that must be met. The unique nature of the building context was both inspiring and demanding of a material that not only meets technical standards, but numerous design objectives and regulatory requirements as well. Ultimately, the selection will be based on the material that appropriately meets the varied longevity, performance, stewardship, and mission criteria.

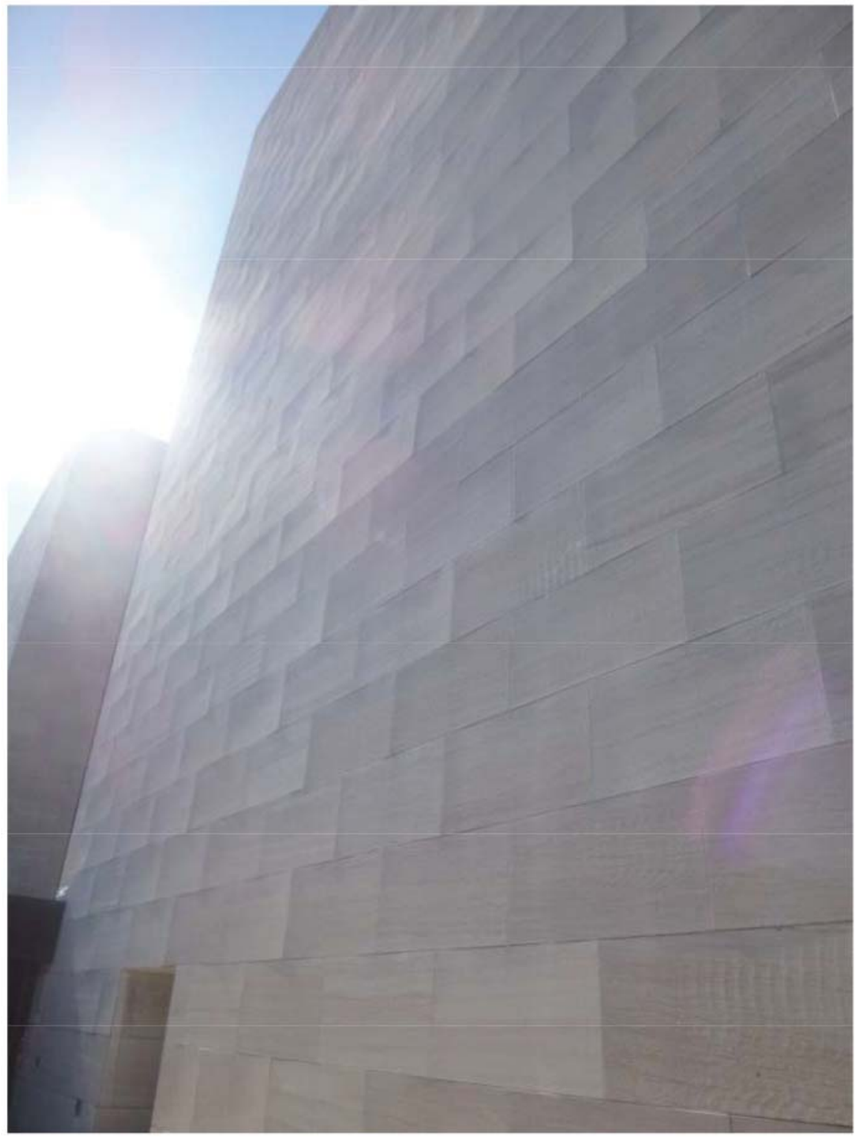
In order to preserve NASM's eligibility for potential future listing in the National Register of Historic Places per project requirements, the revitalization project must maintain the existing character of the building. Thus the design intent is to implement stone cladding with the facade replacement with a similar appearance to the original stone cladding installation.

Using a thicker 3" (76mm) stone provides the best balance of strength and weight, while provide a cladding that can be expected to meet Smithsonian's lifespan requirements. This additional thickness also permits increased allowances for anchorage positioning within the panel thickness which in turn translates to increased construction tolerances.

Risk Analysis Report and Stone Cladding Alternates

A risk analysis of the procurement of Tennessee Pink Marble relative to an alternate stone material is being conducted. The determination of a preferred alternate is pending the completion of due diligence. Both the original stone and the replacement candidates are being analyzed based on an extensive criteria including aesthetics, production and risk. From this process, numerous alternates have been identified, all of which have a slightly different appearance than the existing.

From an aesthetic perspective, a limited number of alternates have the striated pattern that closely resemble the sedimentary nature of the Tennessee Pink Marble. Detailing of the curtain wall separating interior and exterior surfaces will mitigate potential differences in plane or appearance. The analysis will continue towards a recommendation of the most suitable alternate through a process including material testing, aesthetic mockup panels, and testing mockup panels.



Warped Stone Panels on North Facade

Comments from the Commission of Fine Arts, Concept Design

"In their discussion, the Commission members considered the project's complex issues of historic preservation, building technology, programmatic needs, and interpretive themes. While they noted the obvious competence of and care taken by the project team, they suggested that the design could go much further in expressing the technology of the museum's subject of flight and space exploration. While **accepting the proposal to reclad the building in the same Tennessee Pink marble** used in the original design, they expressed **regret that other options for replacing the deteriorating stone panels with more modern materials** - such as metal, enamel, ceramic, or glass - **were not presented as viable options**."

From the letter, June 26 2015, from Thomas E. Luebke, FAIA, Secretary

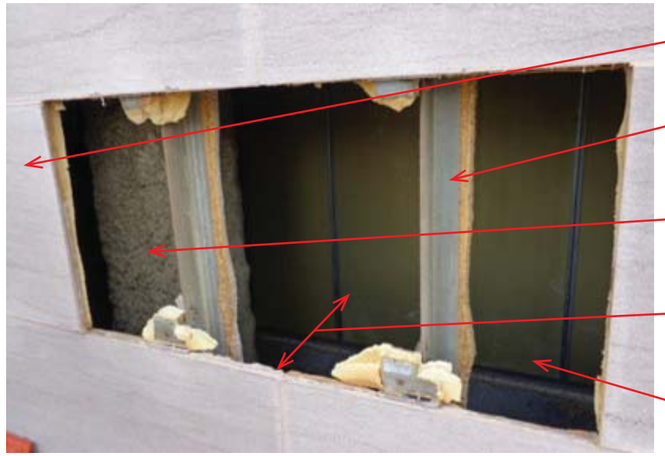
Smithsonian Institution Consideration of CFA Comments

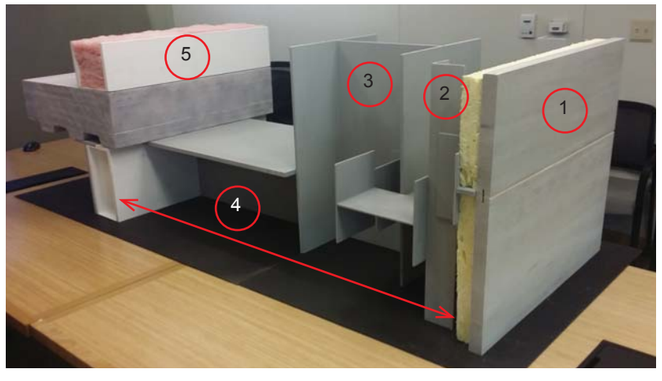
The Smithsonian has addressed the comments of June 18, 2015 with the following actions:

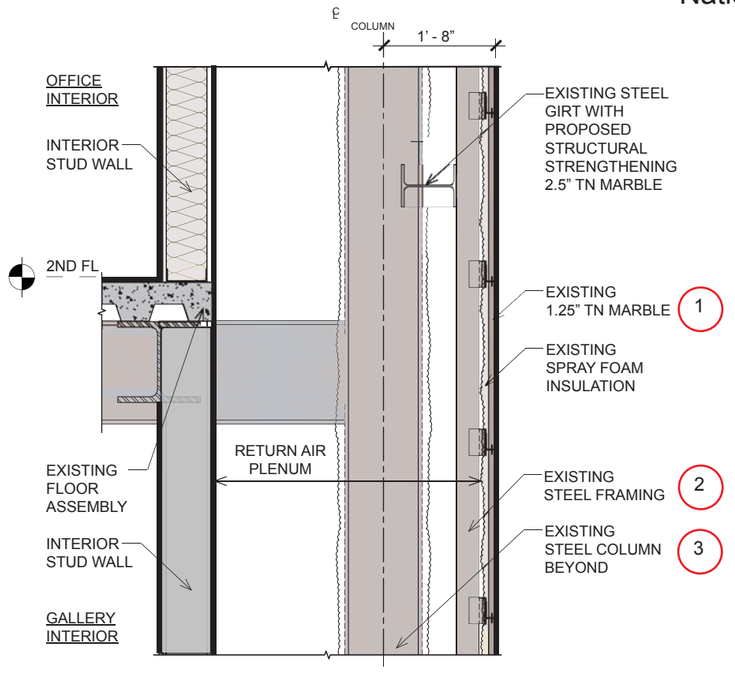
- The analysis of different material options is included on page 19 of this report. Alternate replacement materials such as titanium, ceramic, and other stones were considered as documented in renderings of the numerous options presented for comparison.
- A risk assessment is being conducted
- There has been an exploration of 80 different alternate stone cladding options to find the best match to the Tennessee Pink marble of the existing building

Warped Stone Panels on West Facade

The photos on this page document hysteresis, or warping, of the stone panels as created by the application of spray foam insulation on the back face of the exterior cladding. This trapped moisture at the interface with the insulation, while exposure to the exterior allowed water to evaporate, causing differential expansion conditions within the section of the facade material.



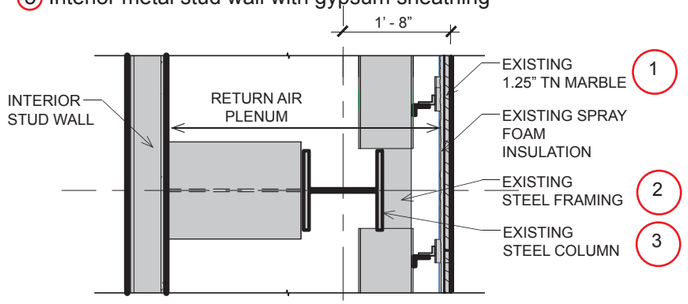




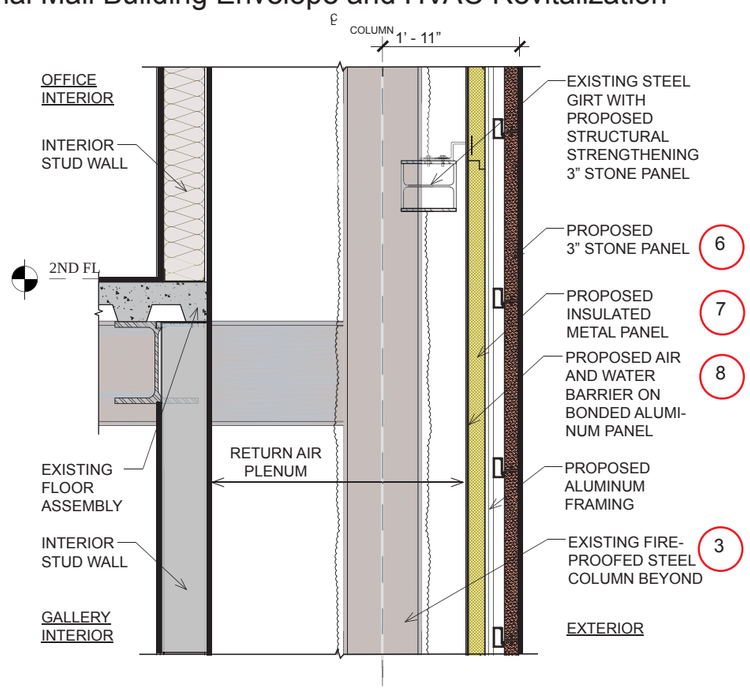
Existing Wall Section

The typical exterior wall construction consists of the following from exterior to interior:

1. 1.25" Tennessee Pink Stone panels with spray foam insulation
2. Steel framing
3. Steel column
4. Air Cavity (Return Air Plenum)
5. Interior metal stud wall with gypsum sheathing



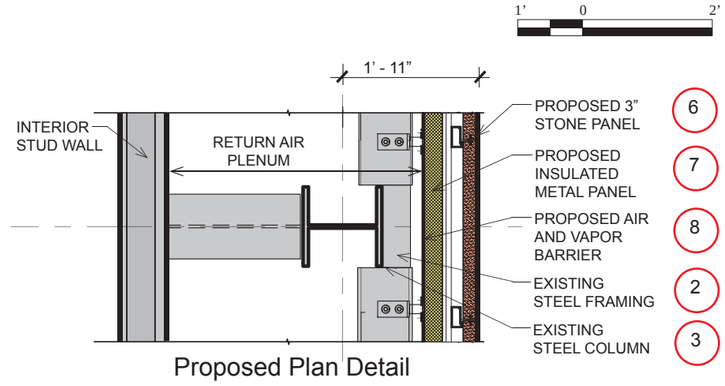
Existing Plan Detail



Proposed Wall Section

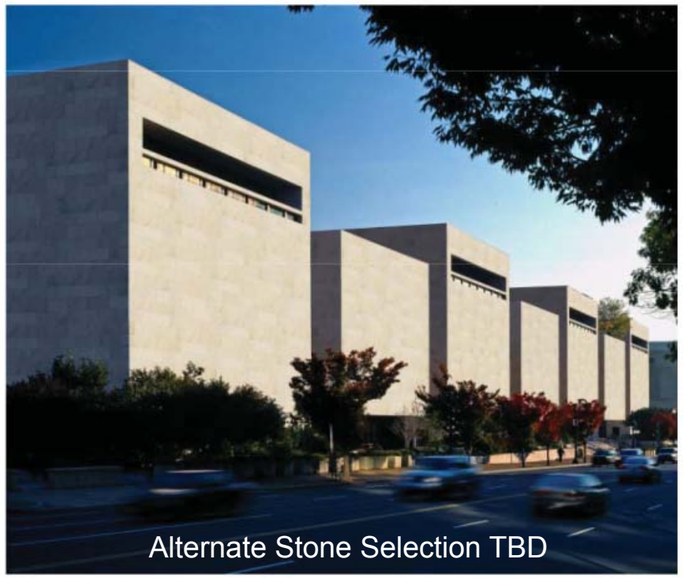
Proposed new wall construction consists of the following upgrades from exterior to interior:

6. Proposed 3" Stone Panel
7. Proposed Insulated Metal Panel
8. Proposed Air and Water Barrier (Rain Screen)

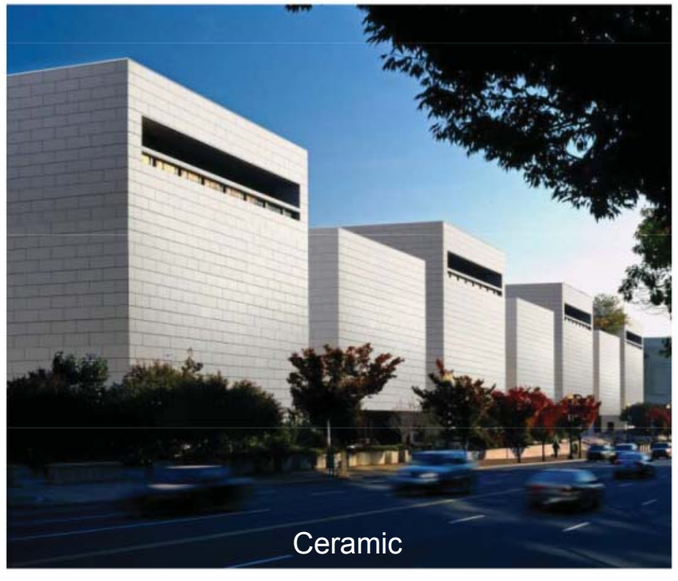


Proposed Plan Detail


Tennessee Pink Marble


Alternate Stone Selection TBD


Titanium


Ceramic

The analysis of cladding alternatives included consideration of a wide range of options in order to find the material that best suits the extensive performance criteria. The images shown here are renderings of the museum based on a photograph of the southwest elevation, with a digital application of scanned images of various materials.

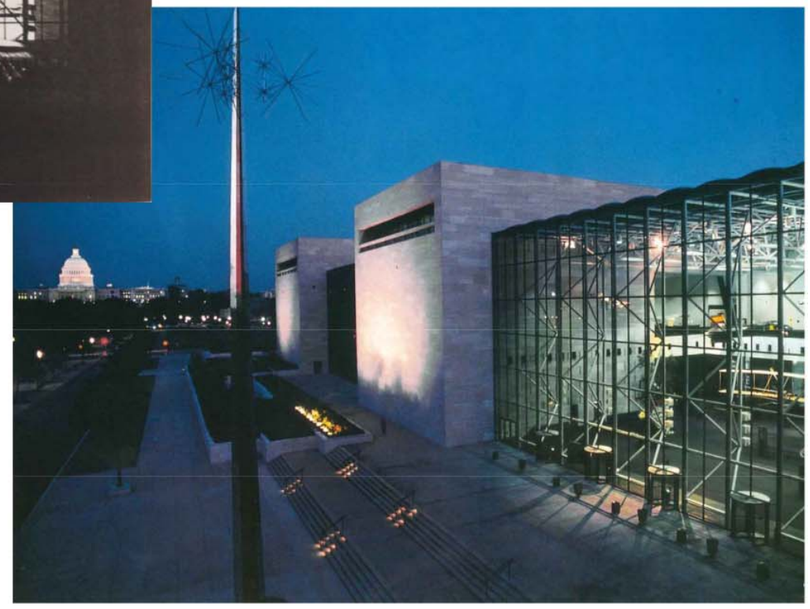
The Tennessee Pink Marble rendering represents a replacement of the existing stone cladding with a thicker panel. Among the alternate stones being considered are materials that have a similar pattern to Tennessee Pink Marble and several technical advantages. However, the color of these alternates is noticeably different than Tennessee Pink; this could create a visual contrast if the replacement stone is only installed on the exterior, with the existing Tennessee Pink to remain on the interior atrium walls in a coplanar application.

The analysis of man-made materials included the study of ceramic and titanium panels among others. Both materials offer a substantial duration of usable life, but do not meet the performance criteria for 100 years. Although there is a benefit of using such lightweight materials that include contemporary, technological associations similar to that of the exhibits within the museum, their monochromatic appearance lacks the visual randomness and scale-giving modulation of the original Tennessee Pink Marble. Further, a man-made material would significantly alter the character of the building, creating an issue for compliance with Section 106.

Cladding Alternatives

1.2.3.2 GLAZING REPLACEMENT

Original 1976 Installation



Original Design and Existing Conditions

Curtain walls and skylights make up a large portion of the exterior envelope of the NASM building, providing a glazed infill between the stone clad pavilions that allow access to daylight and provide views to and from the museum galleries. However the original 47% visible light transmittance (VLT) curtain wall glazing and domed acrylic sky-lights were replaced in 2001 due to performance issues with solar heat gain, leaking, and excessive exposure to ultraviolet (UV) rays.

The 2001 installation of 22% VLT curtain wall glazing and 8% VLT skylight glazing remains as the existing condition, but has been plagued with similar performance issues and needs to be replaced. The problems include solar heat gain, leaking, and excessive exposure to UV rays. The dark appearance of the glazing lessens the views of the gallery interior from the Mall and to the sky above from within the gallery. Additionally, the humidification system that was designed to help protect the exhibits was deactivated due to condensation on the curtain wall and skylight as created by the lack of a thermally broken glazing assembly.

Performance Criteria

The glazing replacement must meet the following criteria:

- blast resistance
- structural capacity for wind and snow loading
- effective resistance to water penetration and air leakage
- thermal barrier
- condensation control to allow the humidification system to be reactivated
- limited exposure to harmful UV rays
- mitigated solar heat gain
- greater visual connection to the gallery interior from the Mall, and to the sky above from within the gallery

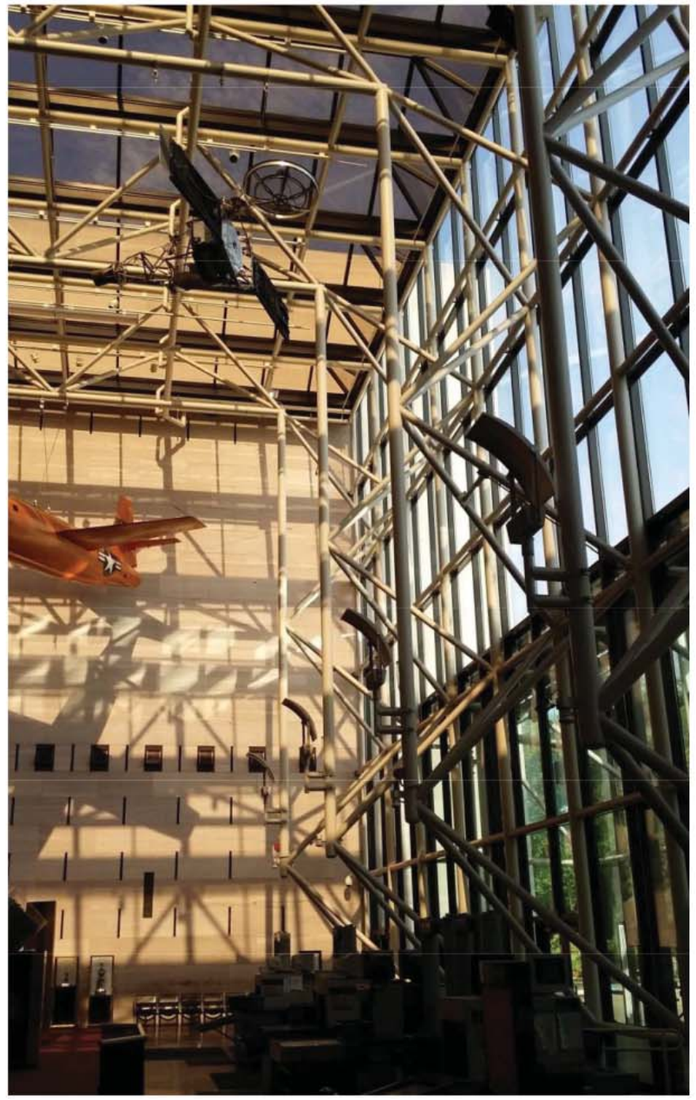
Glazing Selection

The curtain wall assembly will be a unitized curtain wall that meets the performance criteria. The current design of 26% VLT glazing allows for an incremental increase in visibility of the gallery interior from the Mall per the original design intent. The system is com-prised of triple glazed, thermally broken, glazing panels, factory-fabricated with an aluminum frame, with internal steel reinforcing for blast resistance.

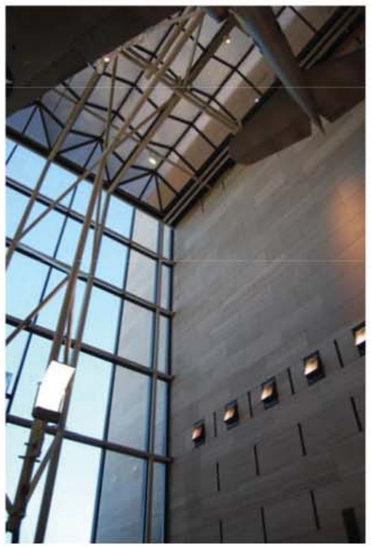
The skylight assembly includes 6% VLT glazing to provide greater protection to the exhibits within the galleries. This is partially made possible with interior baffles that block the sun while maintaining a view of the sky when viewed at an angle from locations on the first floor and second level mezzanine. The design of the baffles incorporate a similar geometry and color as the proposed vestibule canopies, providing a unified design that links interior to exterior.

The original curtain wall installation as seen from the north side of the National Mall (image source: Smithsonian Institution)

Original Glazing Installation: North Elevation



Existing skylight and curtain wall as seen from within a gallery



Existing skylight and curtain wall as seen from within a gallery

2001 curtain wall replacement included a reduction in visible light transmittance from 47% to 22% with the intent to protect the interior exhibit pieces from exposure to harmful UV rays. Since 2001, technology has continued to improve and it is now possible to prevent the sun's harmful effects to an even greater degree. The planned glazing replacement will enable the Museum to house and care for its treasures for years to come in Milestones Hall.

Existing curtain as seen from outside the north entrance

Terrace Improvements

1.2.1 TERRACE IMPROVEMENTS

Basis of Design

The terrace of the museum requires renewal. The Museum underground parking and basement extends beyond the main building by about 2/3 of the terrace area. Substantial waterproofing and related failures have been uncovered. As a result all paving, soil, and planter systems are to be removed in order to remedy the situation. Depending on the degree of technical involvement, some of the original structure above the base slab and basement envelope will be retained, in particular elements of the structured secure perimeter. These building envelope issues mean that opportunities have arisen to address significant museum and grounds concerns such as accessibility and circulation, way-finding, human comfort, soil and plant materials, as well as aesthetic and programmatic design concerns.

Goals and Objectives of Design

There are six primary objectives for the new design being proposed as a part of the rehabilitation of the grounds:

- Provide for adequate waterproofing and structural support for the building and its basement.
- Improve access and visibility between the museum and the National Mall and surrounding context.
- Create an accessible, welcoming and comfortable environment for visitors.
- Provide for future programming, thematic interpretation and related amenity and enterprise development on the museum grounds, as an integral element of the museum.
- Reinforce the gardens and grounds as an element in the overall design, in scale and appropriate to the museum building.
- Accommodate increased growth in visitation since the Museum's opening in 1976, and anticipate continued growth.

Precedent and Context

A number of architectonic design elements were used in the original HOK design and in subsequent additions and modifications by HOK and others (see illustrative on page 50). These include: planters and planter wall design; free-standing, parapet and retaining walls, and ramps. These precedents have been retained and applied in the current proposal.

The Museum lies on seven acres of grounds bordered to the North by Jefferson Drive, to the East by 4th Street SW, to the South by Independence Avenue, and to the West by 7th Street SW. As envisaged by federal and City (District) planners, 7th Street will reassert an important corridor between the southwest waterfront and the downtown north of the Mall.

The National Air and Space Museum is a key portal to the Smithsonian museums and the National Mall from the south and Independence Avenue.

Design Approach

Parti

The design parti for the grounds of the National Air and Space Museum proposes to:

- Preserve the original organizational concept of the grounds;
- Simplify and open up the low terraces surrounding the building for greater visual accessibility and clarity of design;
- Lower when possible the planter wall heights along the back of sidewalk to improve physical and visual access to museum plantings and setting;
- Open the grounds to become a welcoming, fully accessible experience;
- Strengthen desired viewsheds to and from the museum and museum terrace;
- Improve microclimate and human comfort for all visitors with access to increased tree canopy shade; and
- Create an architectonic composition of tree and landscape plantings to complement the scale and rhythm of the museum.

Design Outcome

The resultant design options ('A' and 'B') build on earlier submissions and comments. They both:

1. Reduce the impact of planter massing on visual access and way-finding by lowering and simplifying planter layout and massing -- opening the planters to create needed circulation;
2. Provide universal access conditions at entrances to the grounds and to the museum entrances on north and south by using ascending walkways - all of which are under 5% in slope;
3. Create entrances to the museum grounds at the four arrival corners;
4. Develop complete circulation of the grounds within the property, providing for thematic and museum-related activity on the grounds in the future;
5. Improve visitor physical, tactile and visual approach to plant materials;
   5.1. Provide an architectonic massing of shade and small trees that integrates well with the National Mall setting and creates open view relationships between grounds and Mall;
   5.2. Add thematic (and low) groundcover planting design to animate entrances and create interpretive opportunity;
6. Further integrate the prominent 'Delta Solar' fountain at the southwest corner within its respective public realm:
   6.1. Relocates the fountain as a more highly visible component of the perimeter positioning it as an important 'signifier' of welcome on the 7th Street corridor;
   6.2. Conserves the west memorial grove of trees, as an accessible, occupiable and integral part of the 'Delta Solar' setting;
7. Build on two key objectives identified in the NASM Master Plan (Smithsonian Institution, Ayers Saint Gross, 2013):
   7.1. The improvement of the general usefulness and integration of museum grounds with the museum mission; and
   7.2. The development of a comprehensive thematic and architectonic approach to planting design.

Massing of the building platform

The current grounds, a result of several eras of additions to the original executed design of 1976, consist of a system of design elements that for the most part follows the planter and access point design of the original design. Rectangular planters of varying widths, lengths and heights characterize the landscape setting.

The proposed design re-establishes a pre-existing elevation datum point and introduces a new one. At the main terrace level, the original seating-height elevation of the planter wall is maintained and describes the edge of the main terrace paving at the upper level. At the back of sidewalk around the perimeter of the grounds, a perimeter secure-height planter wall establishes a second, 'adjusting,' datum elevation. This datum elevation changes from west to east as the topography of the surrounding context drops from an at-grade relationship in varying rates and totals (for example, at the northeast corner grade drops some 2.9 meters (9.5 feet) from terrace to sidewalk). The horizontal planters step down along the back of sidewalk, maintaining the minimum secure perimeter height requirement.

Planter options A and B

Two options are presented for planter design and massing of the building platform. The plan layout of both options is similar with variation evident in the elevation of planting beds and the scale of associated planting.

1. Option 'A' applies a 'ground-level' approach to planter expression at six of the main museum grounds entrances (north and south entrances, and the four corners), opening up the east and west ends of some planter massing. Ground level planting beds create soil root volume adequate for shade trees, connecting to continuous and contiguous sub-slab soil vaults.
2. Option 'B' applies a more comprehensive 'planter' approach, resulting in the continuous articulation of a three-dimensional raised planter system reminiscent of the current design expression. Available soil volume in some planters is more limited, constraining plant selection to smaller species.

Site Systems

Amenities: An unobstructed, continuous and paved pedestrian loop is provided for visitors' access and service utility vehicles. Wider areas provide for future site furnishing, interpretation, and vendor venues. Public Art (sculpture) and signage elements are keys to way-finding and mission, and locations have been suggested for these elements.

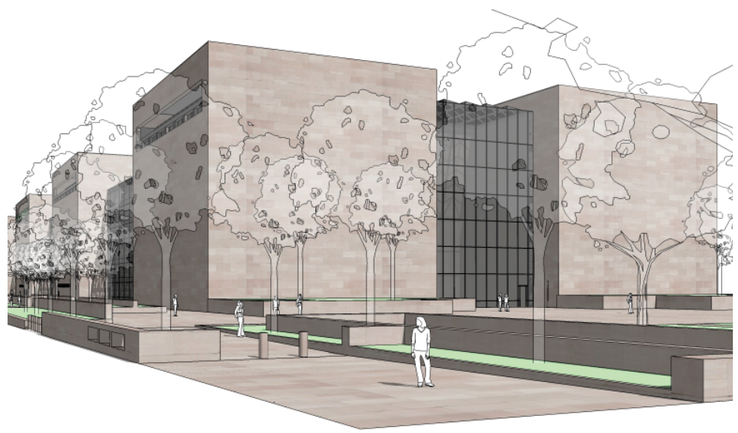
Site furnishing: A simple, contemporary, metal-based palette composed of benches, bike racks, and litter receptacles is under development.

Perimeter security: Little change in the layout of the perimeter is anticipated. The two options make marginal changes to the existing perimeter, whose underlying structural components will be retained and re-integrated with the new work whenever possible.

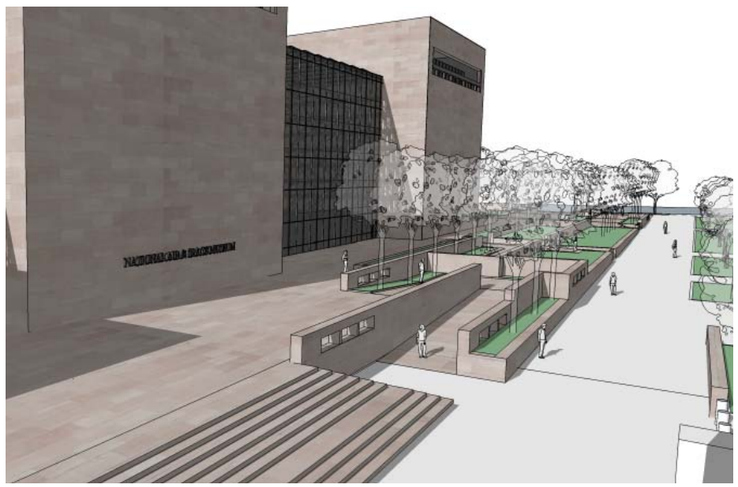
Storm water management: Water conservation is a fundamental issue for the museum. Because the site permeability is limited by the extents of the building's basement, much of the rainwater that falls on structure will be collected and stored in two underground storage cisterns for greywater re-use. Rain water that falls on planted areas will be stored temporarily by the soil and root zones with excess water directed to the city system. All planted areas will be supplemented by irrigation.

Prior Design Development Studies

An appendix of design studies of planter massing and layout, and related conditions, is provided for reference. These studies have been a significant element in meetings and discussions with CFA, NCPC and SHPO staff since June of 2015.

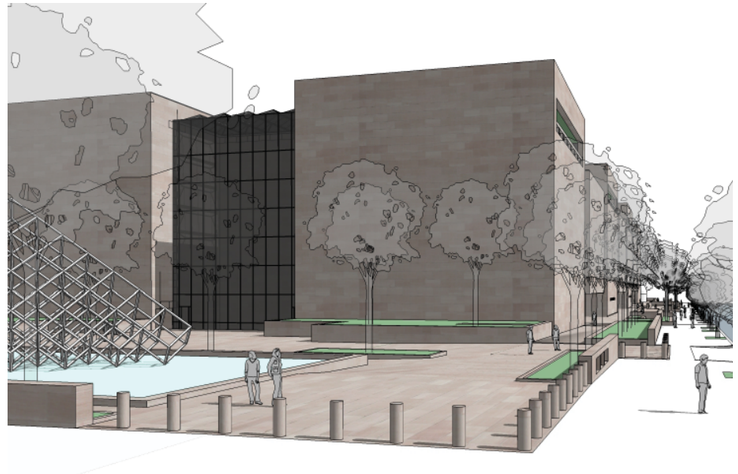


Northwest

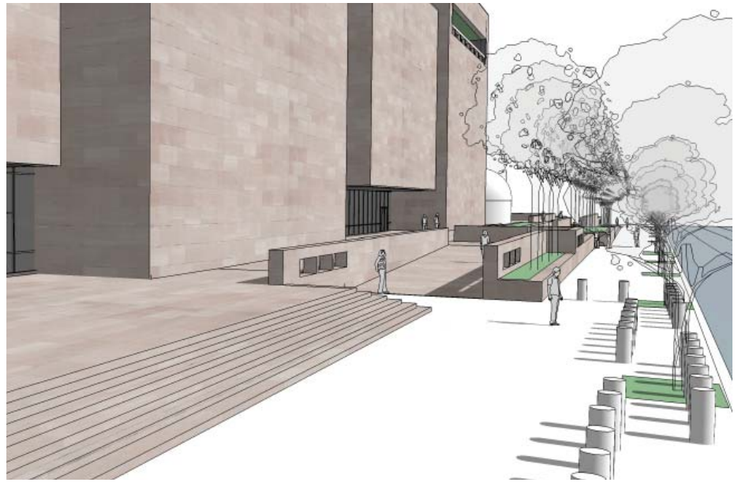


North Entrance

Northeast

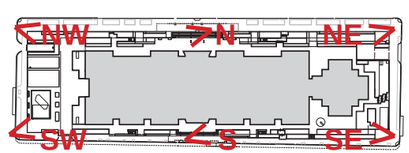


Southwest



South Entrance

Southeast



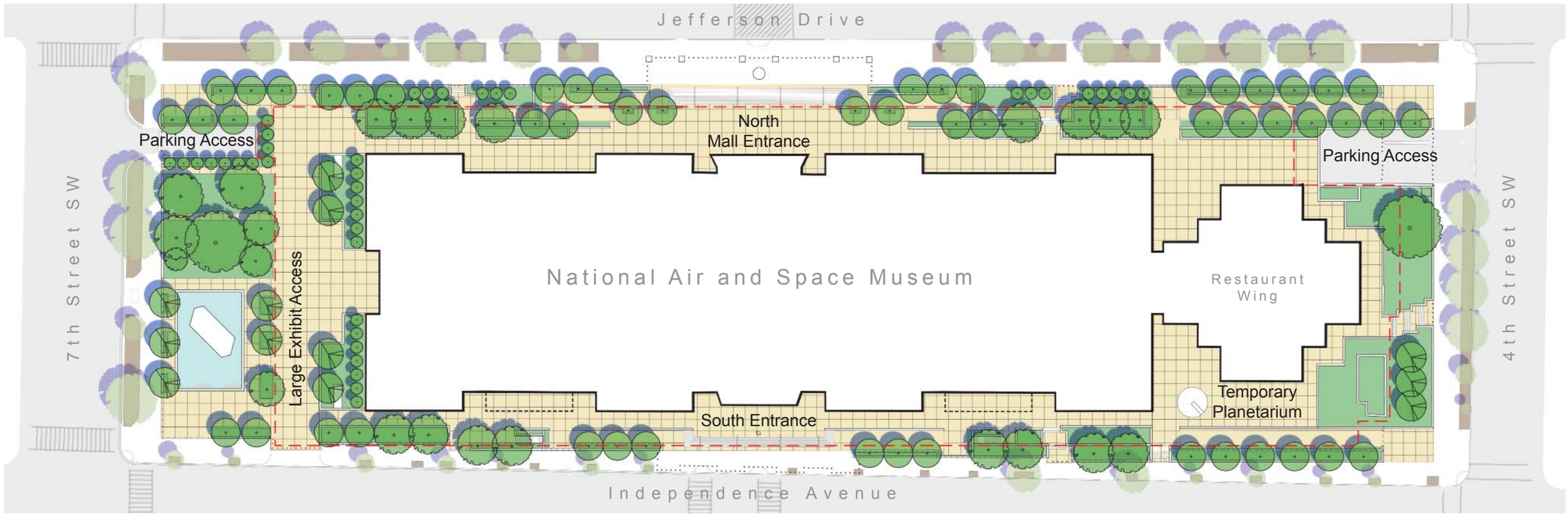
Site Perspectives, June 2015

Commission of Fine Arts Comments, Concept Design

"For the redesign of the building's landscape, the Commission members expressed strong support for the proposal to **simplify** and **open up the low terraces** surrounding the building as these are rebuilt to accommodate **modern requirements of accessibility** and **security**. Observing that the site walls are not clearly related to the horizontal aesthetic of the building's plinth, they suggested consideration of **lowering** where possible the height of **planter walls** around the site."

From the letter, June 26 2015, from Thomas E. Luebke, FAIA, Secretary

The exploration of design response to CFA comments of June 2015 is presented in this report



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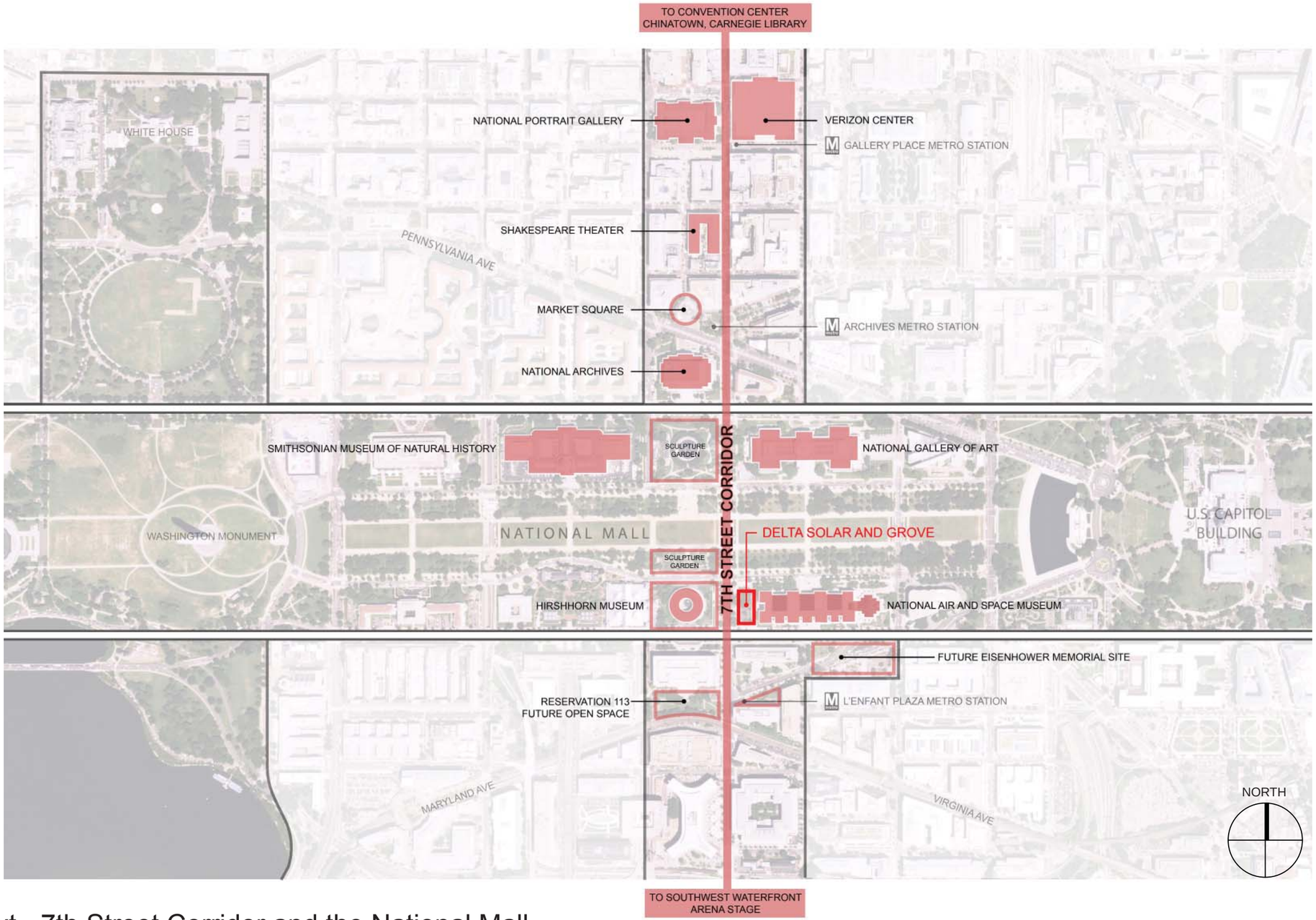
Background



Urban Context - 7th Street Corridor and the National Mall

NORTH

40 FEET 0 10 20 40 80

Existing Aerial Photograph (04/2015)

Existing Conditions - North Entrance Visitor Queuing

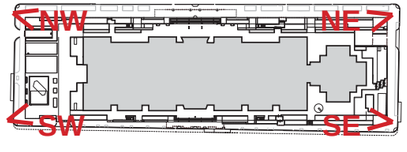
Northwest

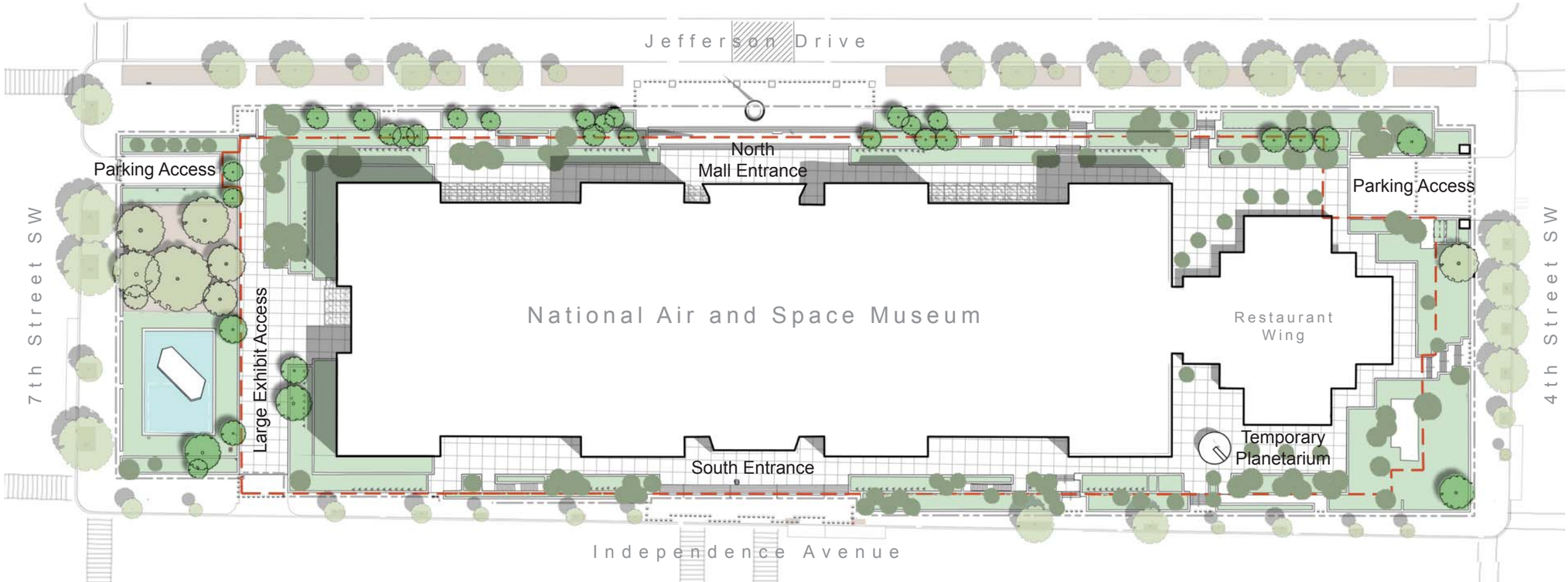
Northeast

The four corners of the museum site present challenges to wayfinding, visibility, appreciation of the building, and sense of welcome.

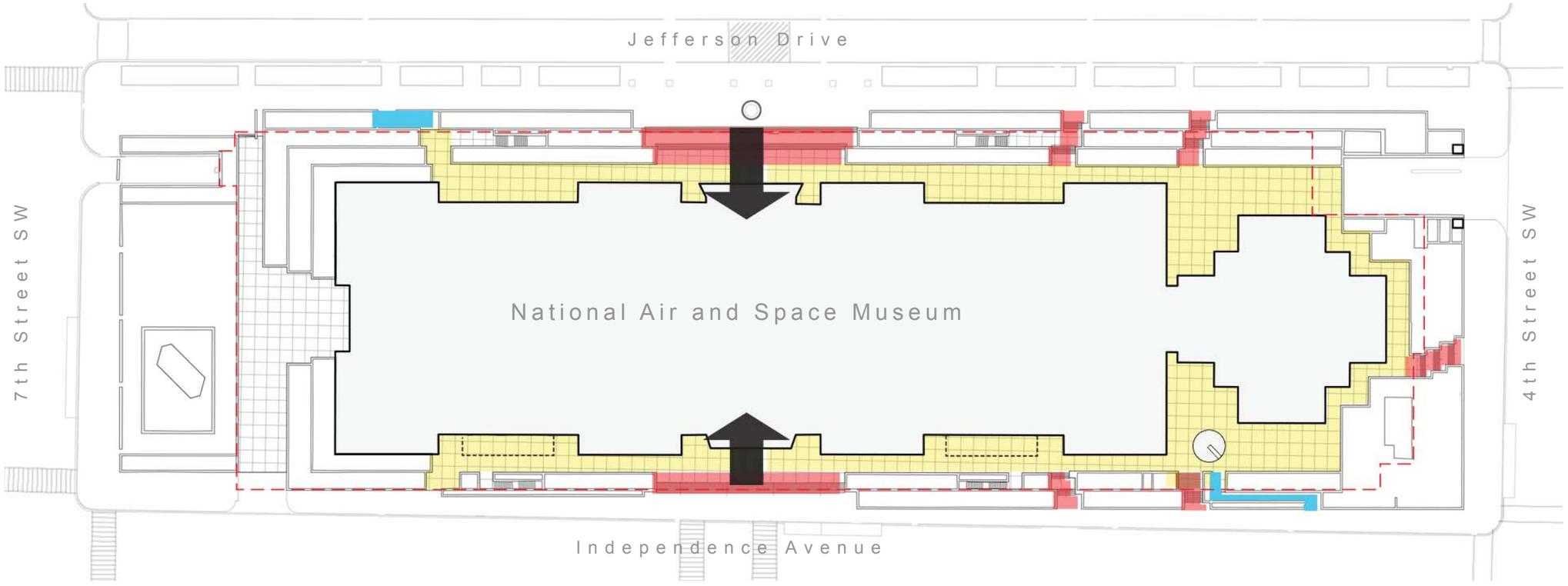
Southwest

Southeast

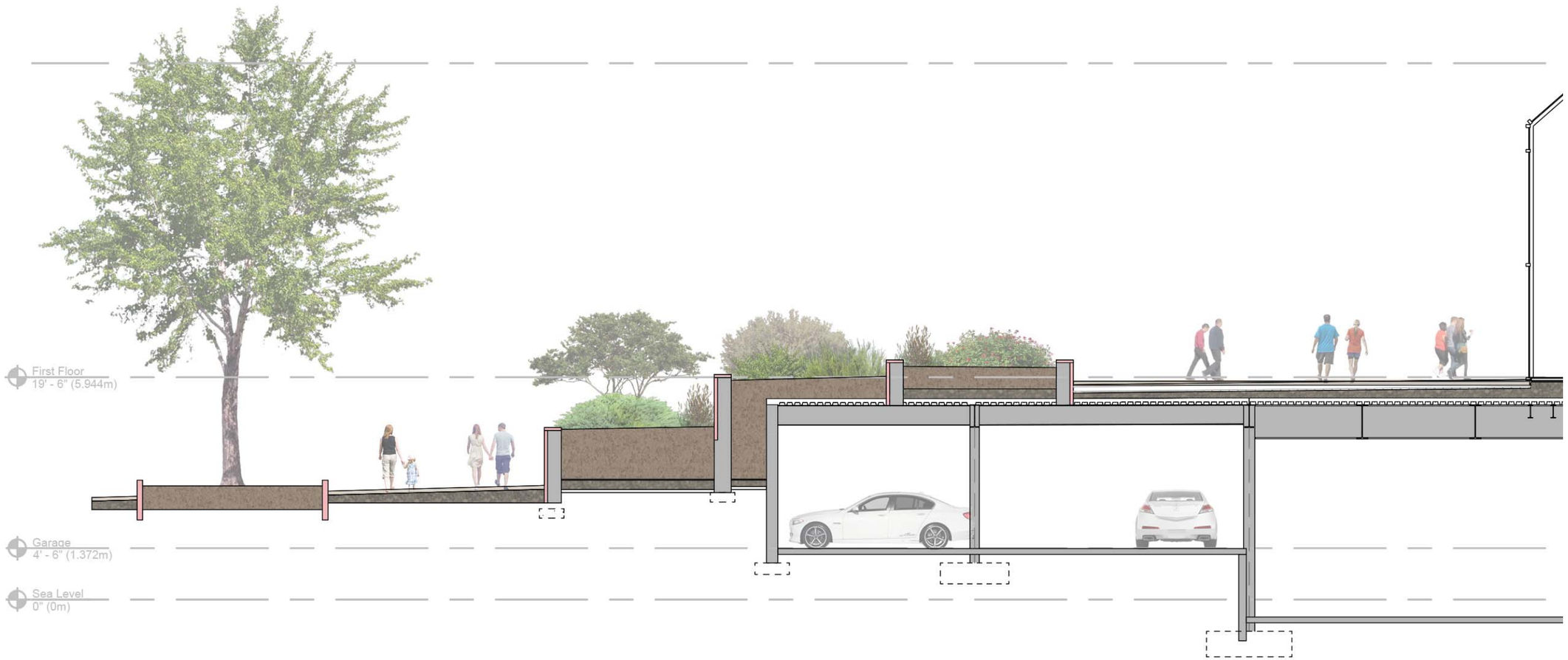


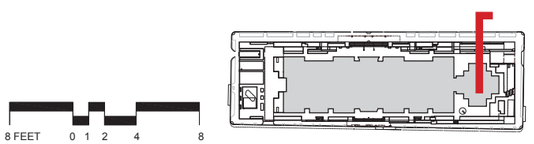


Existing Conditions Site Plan

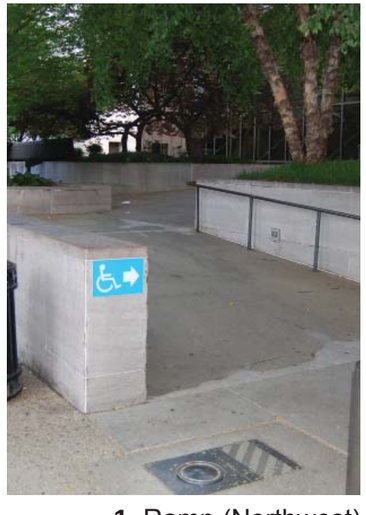


Existing Pedestrian Access to the Museum

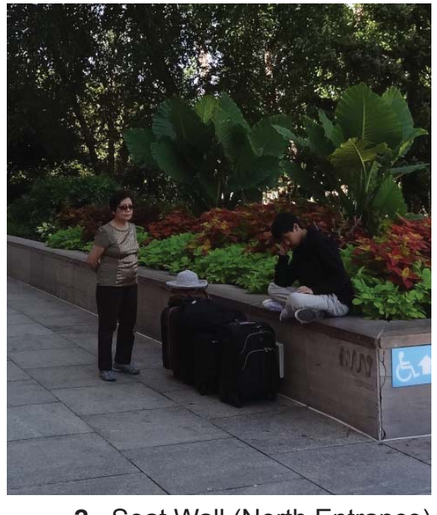




Typical Planter Section



1. Ramp (Northwest) - ~1991



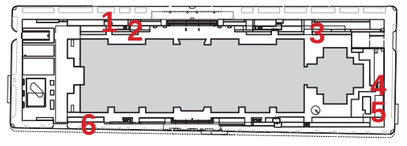
2. Seat Wall (North Entrance) - HOK 1976

3. Monumental Stair (Northeast) - HOK 1976

4. Free-standing Wall (East Stair) - HOK 1988

5. Stepped Wall (East) ~1991

6. Low Perimeter Wall (South) - HOK 1976



Design Precedents: Site Walls, Planters and Stairs

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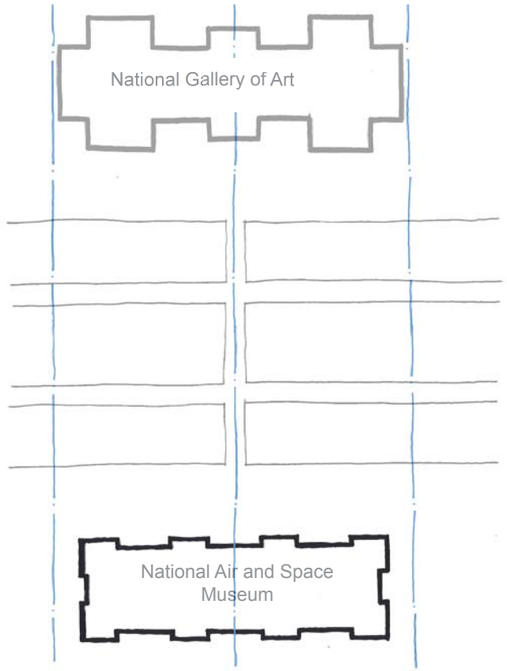
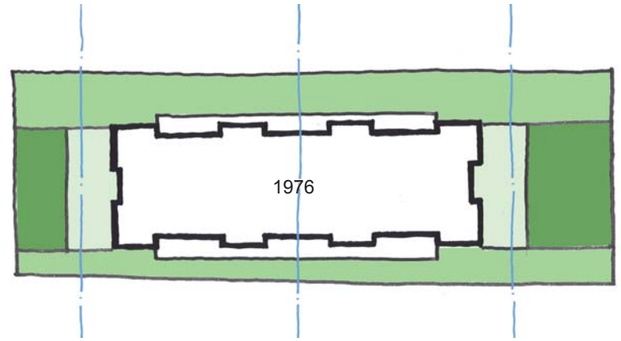
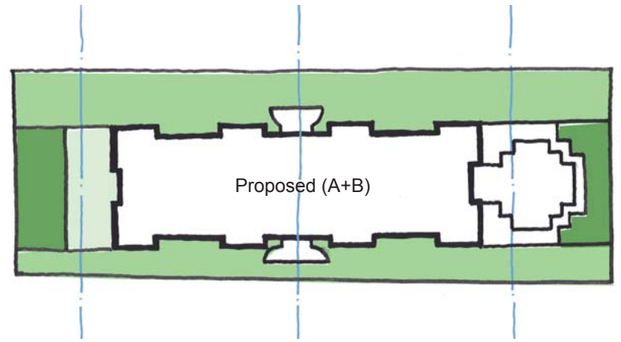
Design Parti

Building form



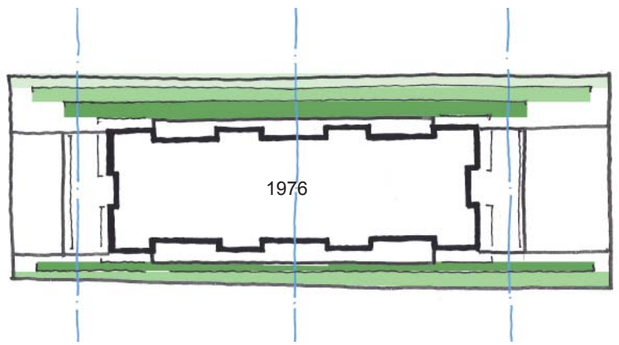
Mall Context



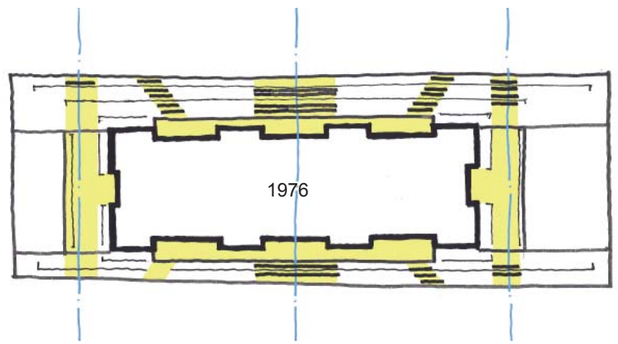


Maintain
Site Landscape

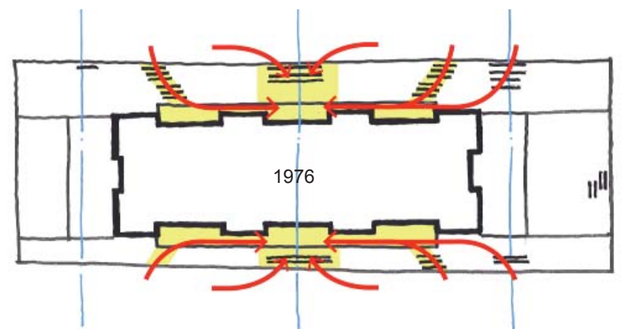
- Groves
- Layered Landscape
- Garden Promenades



Strengthen
Site Structure



Complete
Site Access



Improve
Building Access

East - West Planters/
Building Plinth

Commission of Fine Arts Comments, Concept Design

"For the redesign of the building's landscape, the Commission members expressed strong support for the proposal to **simplify** and **open up the low terraces** surrounding the building as these are rebuilt to accommodate **modern requirements of accessibility** and **security**. Observing that the site walls are not clearly related to the horizontal aesthetic of the building's plinth, they suggested consideration of **lowering** where possible the height of **planter walls** around the site."

From the letter, June 26 2015, from Thomas E. Luebke, FAIA, Secretary

Smithsonian Institution Consideration of CFA Comments

The design team has addressed the comments of June 18 2015, in a number of specific ways. The team has:

① **'simplify... lowering planter walls:'**

- **Lowered and simplified the planter walls** on both North and South elevations

② **'modern requirements of... accessibility:'**

- Continued to **provide expanded accessibility and circulation** within the grounds of the Museum:
  - Maintained the development of access points at the four corners of the grounds and focused symmetrically around the north and south entrances
  - Provided more clearly-accessible routes onto the main terrace of the Museum and thus to its entrances

'modern requirements of... security:'

③ Maintained the **secure perimeter**

④ Adjusted the location and expression of the **Delta Solar pool with the emerging north-south 7th Street cultural corridor**

⑤ **'open up the low terraces / planter walls:'**

Developed a planting plan that **enhances view relationships** between Museum and National Mall

⑥ Developed **two schemes addressing planter expression** and canopy shade development for review and comment

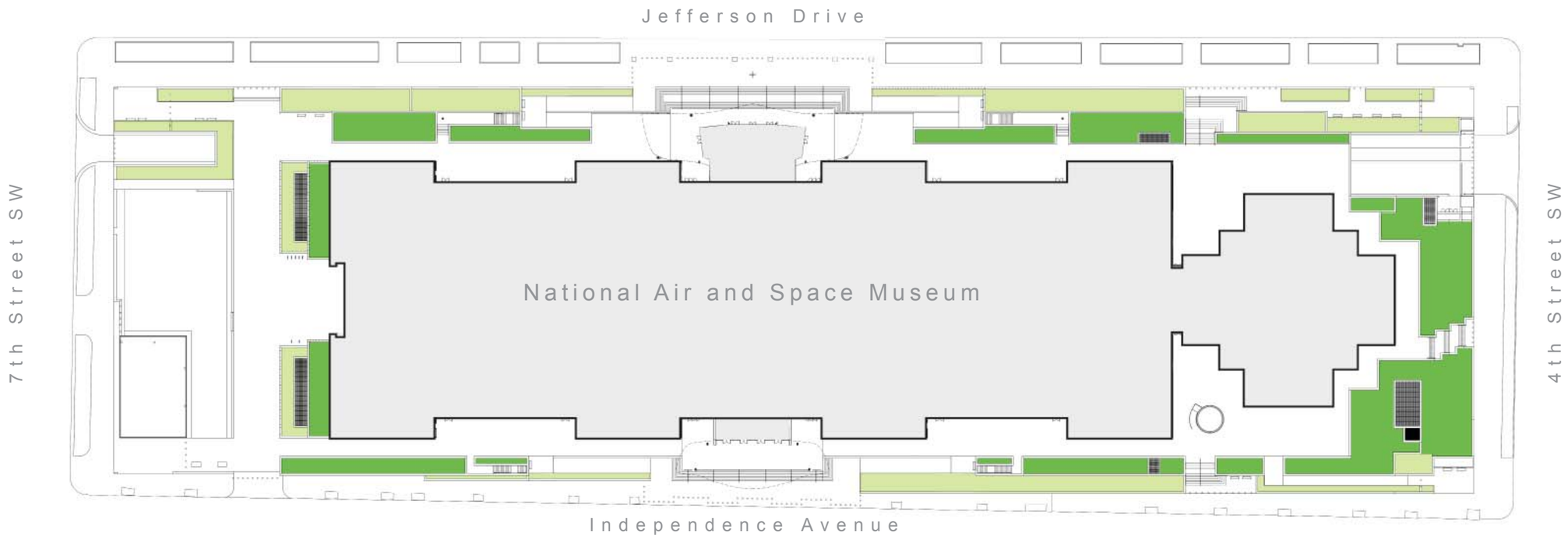
- The two schemes address different possible expressions of planting and wall/planter relationships at the four corners of the grounds and at the north and south entrances (the remainder of the grounds is treated in the same way in both schemes). Circulation and layout is the same in both schemes – the schemes focus on suggesting different three dimensional expression of grade change and planting areas. The report is organized around presenting the two schemes.
- Scheme A shows how the planting areas at the entrances and corners can be lowered to ground level, opening generous view corridors into the grounds and placing plant materials next to the visitor.
- Scheme B shows how the planter idiom of the current existing condition can be retained at the four corners and at the entrances, with walkways cut through their massing to provide access to the grounds.
- The design studies illustrate the similarities, differences and opportunities of the two schemes.

direct quotation from CFA comments

Important response to CFA comments

Both Schemes propose a general lowering of the outside, back-of-sidewalk, planters to a minimum height required by perimeter security standards. The three tier system of planters on the north side is simplified to two, creating wider more expansive planting opportunity that is more visually accessible to the passing visitor. The planters lining the edge of the main terrace – which is at the elevation of the museum entrances – are maintained at seat height. This maintains a single datum elevation at the base of the building as seen from both within and outside the museum grounds.

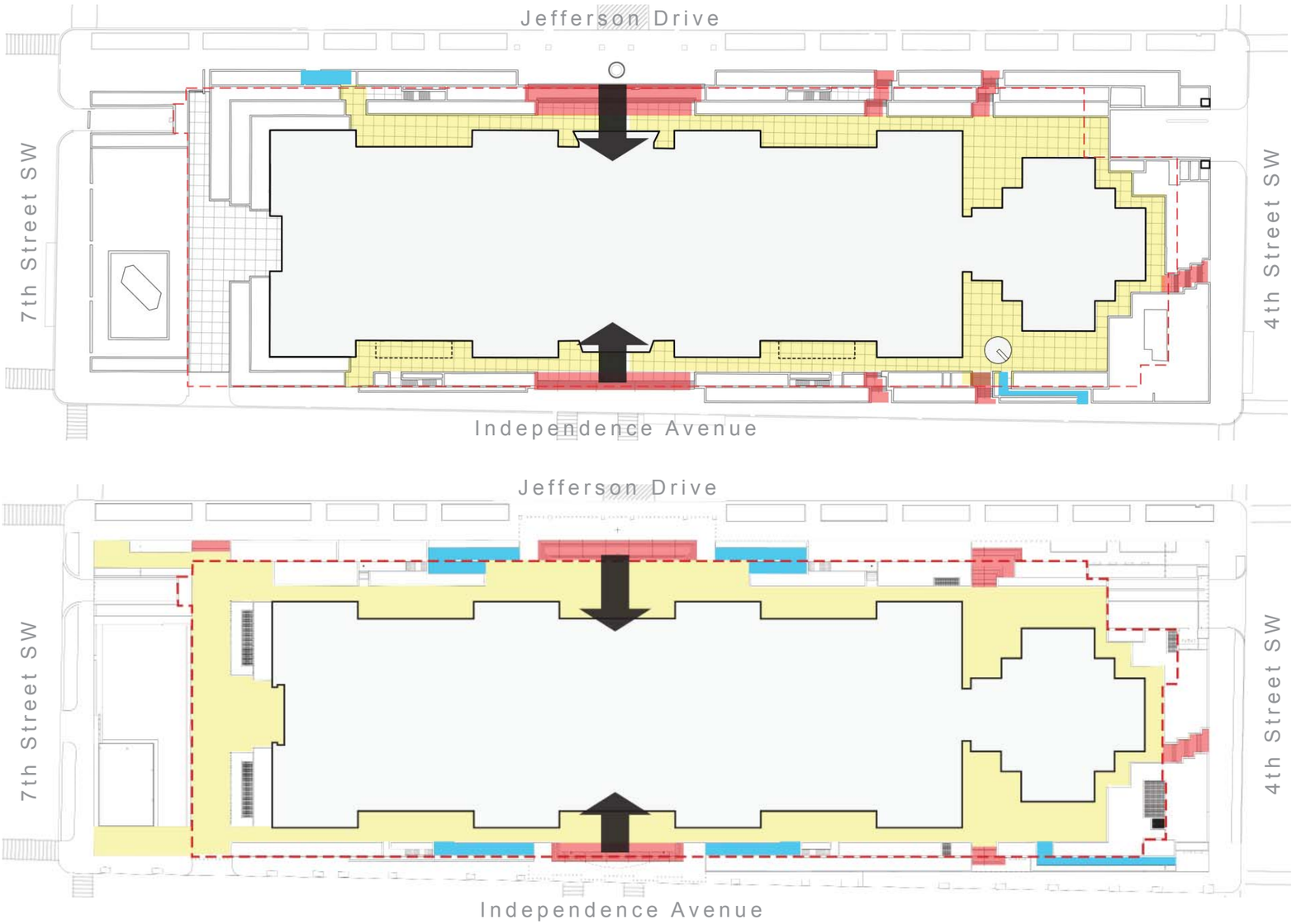
The planters and walls will be stone clad, designed and finished like the original to be an extension of the cladding of the building. Final design decisions on planter cladding will be made with decisions on building cladding.



Proposed Planter Heights, Scheme A/B

Terrace Improvements - Design Parti

National Mall Building Envelope and HVAC Revitalization



The general scheme continues to create new grounds entrances at all four corners, provide universal access at both north and south entrances, and unify the grounds with connected terrace circulation around the entire building. In all, five new ways into the grounds are proposed.

Existing

- Stairs (7)
- Accessible Walkways (2)
- At Grade Route (1)

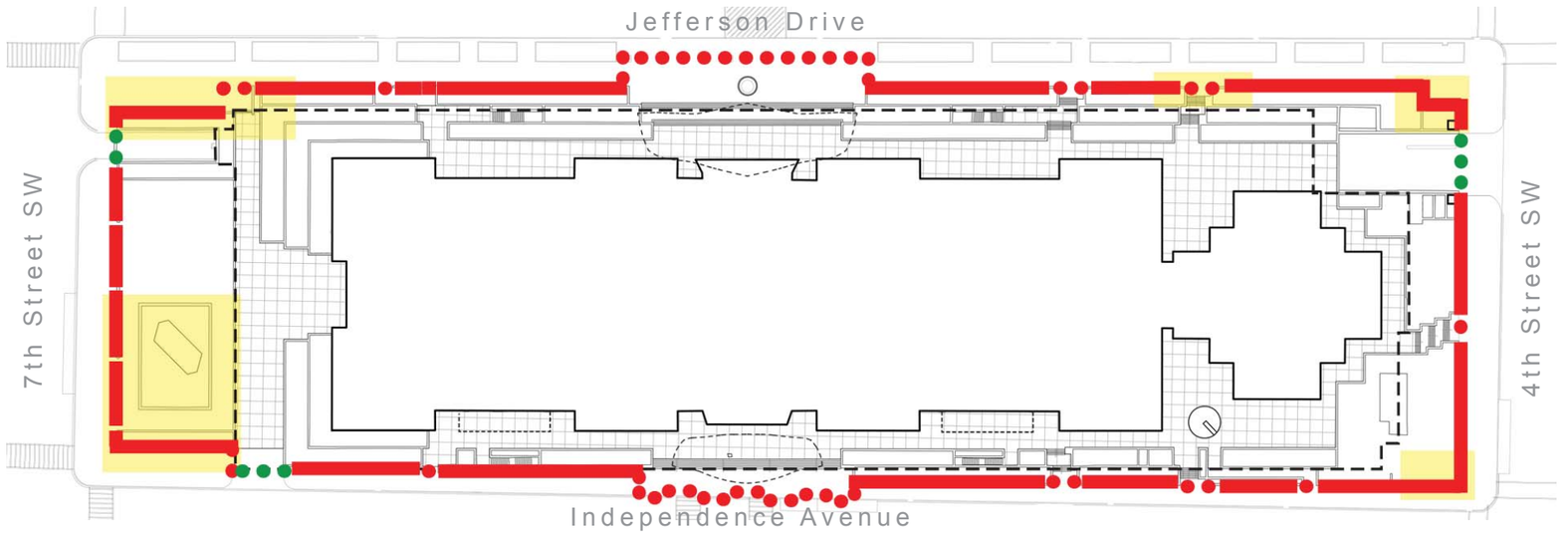
Proposed (Scheme A/B)

- Stairs (6)
- Accessible Walkways (5)
- At Grade Route (4)

NORTH

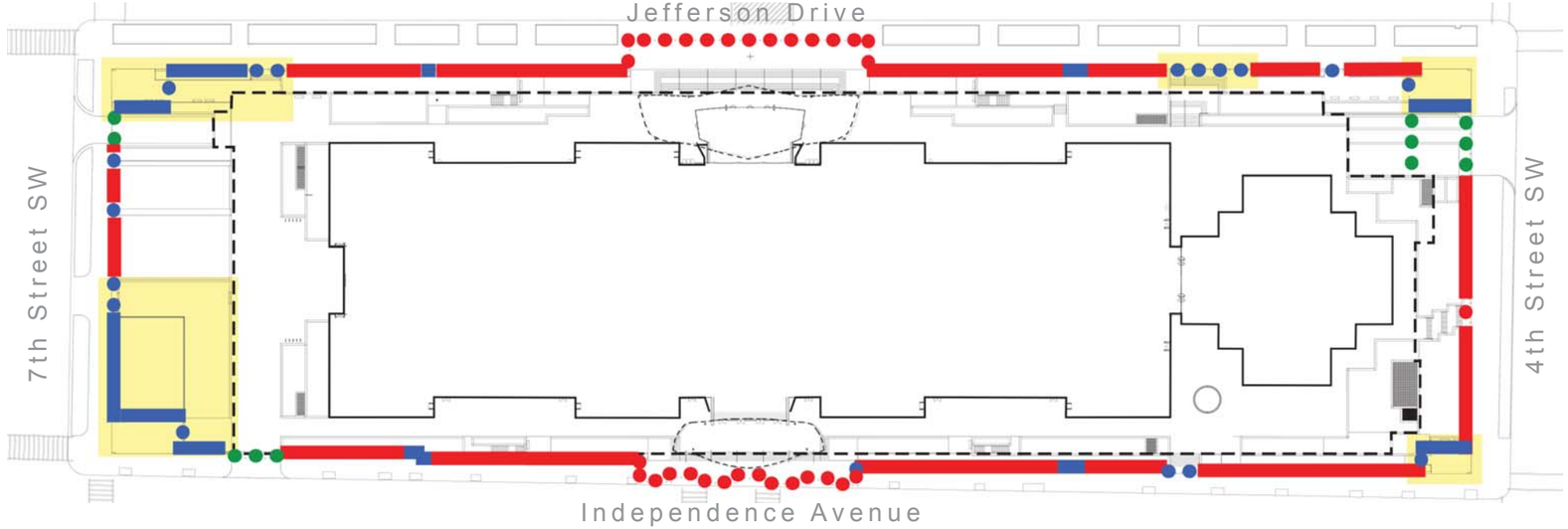
40 FEET 0 10 20 40 80

Visitor Access, Comparison between existing condition and Scheme A/B



The secure perimeter remains essentially unchanged from existing conditions. Minor adjustments are made to accommodate the new grounds entrances at the four corners.

Existing



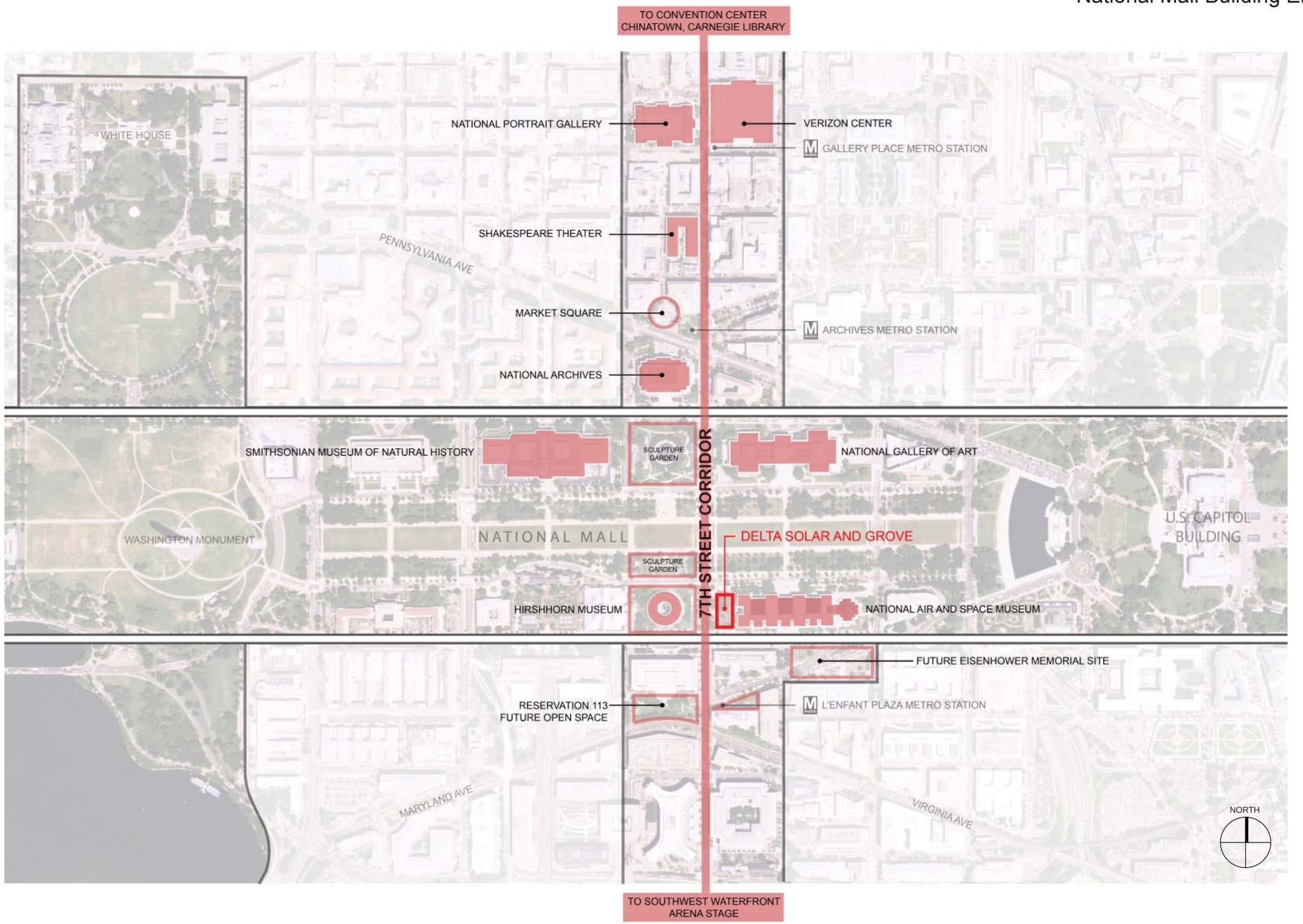
Proposed (Scheme A/B)

- Existing Secure Wall
- Proposed Secure Wall
- Existing Bollards
- Proposed Bollards
- Operable Bollards
- Areas of Difference

NORTH

40 FEET 0 10 20 40 80

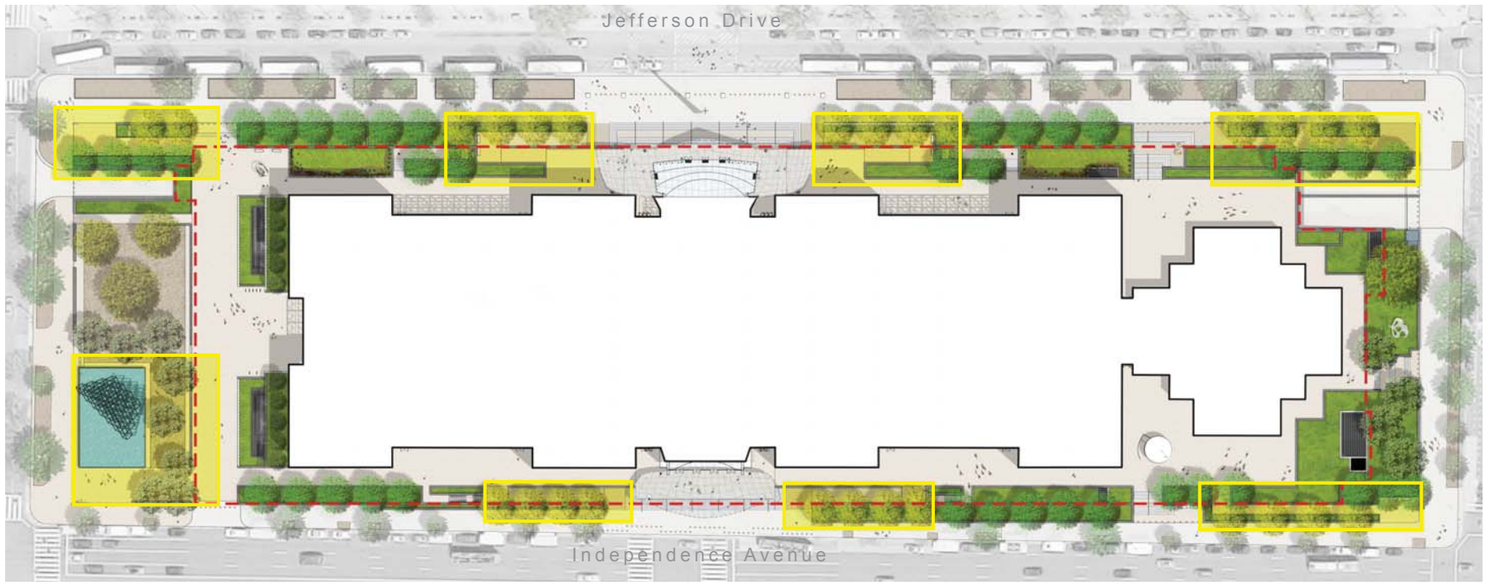
Secure Perimeter



A key design proposal is moving the Delta Solar sculpture and its pool to a more prominent location on the south east corner of the grounds where it currently resides.

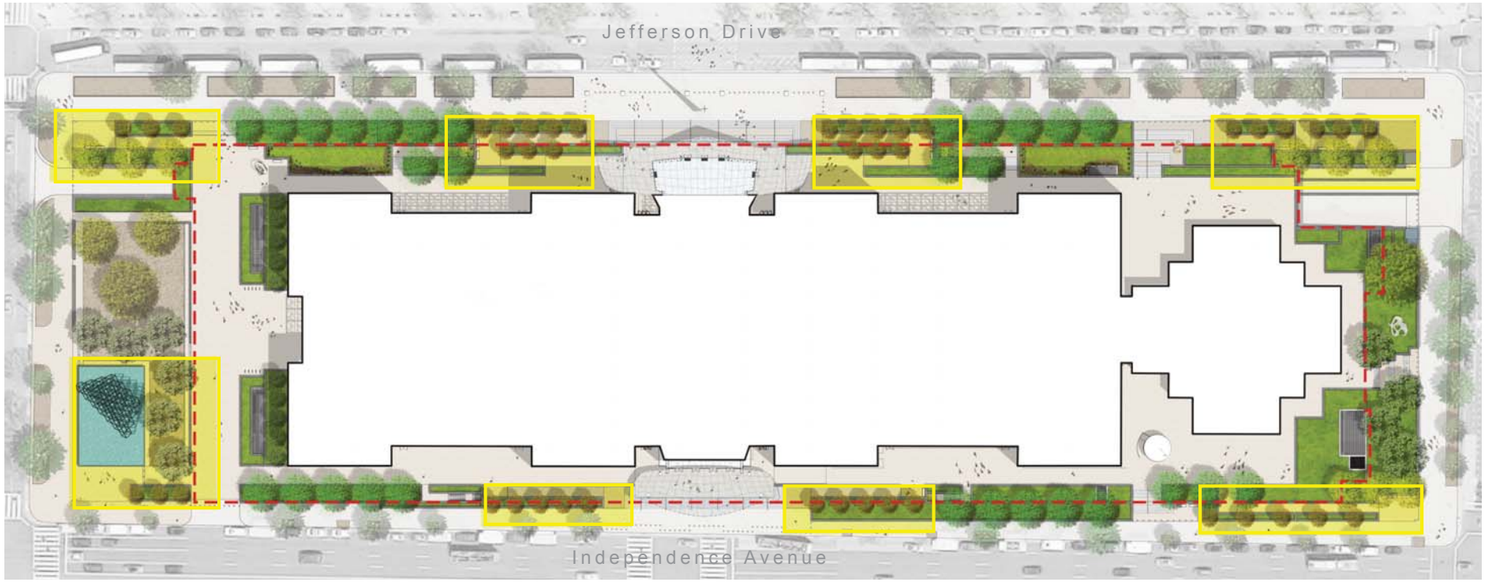
By moving it much closer to the 7th Street SW and Independence Avenue sidewalks, and raising the pool appropriately, the composition can be integrated as a seamless part of the secure perimeter, and perform as a more significant marker on the emerging 7th Street cultural corridor connecting the Southwest waterfront with downtown.

Urban Context - 7th Street Corridor and the National Mall



This couplet shows the areas of difference between the two schemes as developed – at the four corners and the north and south entrances. Besides a difference in 'material' expression, the areas differ in the size of trees that can be accommodated, meaning that differing amounts of shade are created, and a different aesthetic expression.

Scheme A



Scheme B

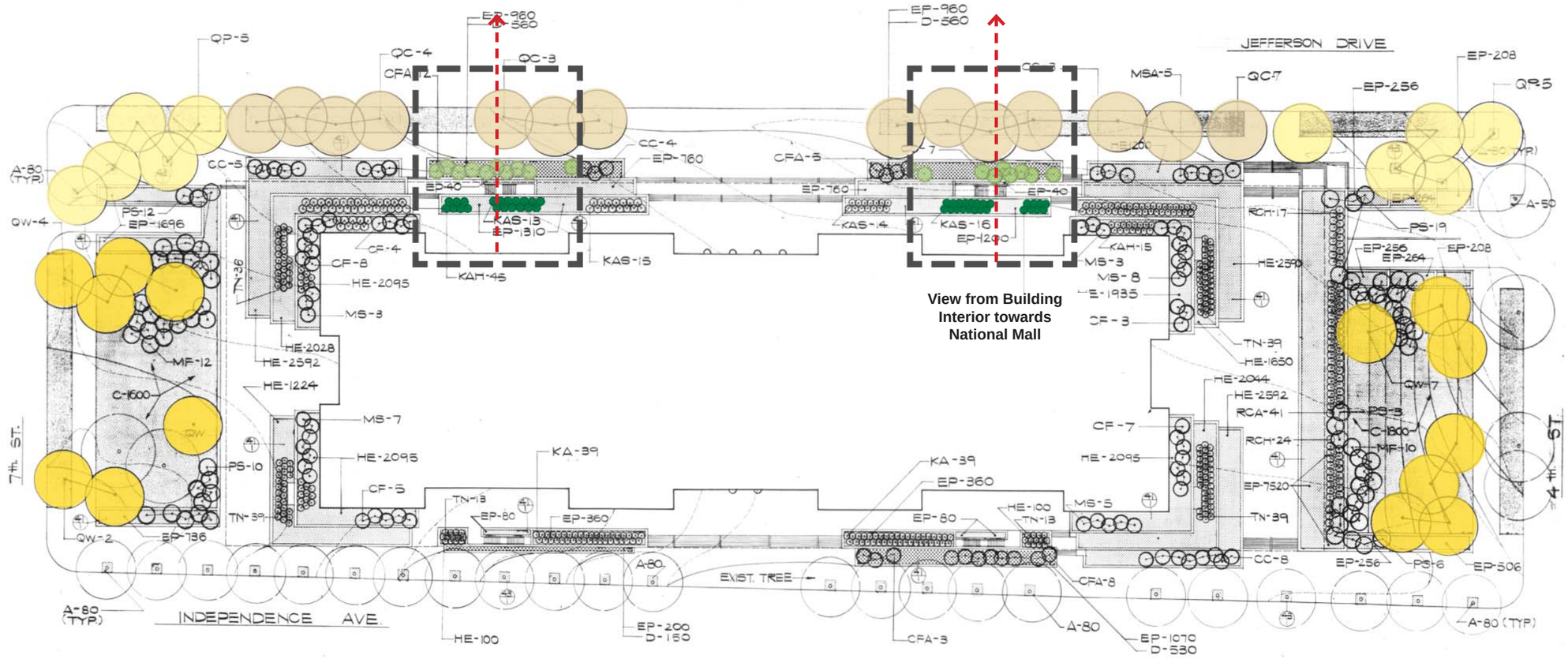
Areas of Difference

Basement Edge of Structure

NORTH

40 FEET 0 10 20 40 80

Scheme A, B Site Plan - Areas of Difference



The lead architect of the museum, Gyo Obata, organized the design of the building in close respect of the National Gallery of Art north across the Mall. Additionally, he thought about how the Mall and museum contents might be visible one from the other.

As the Historic Building and Landscape Report mentions (page 25), “Plant materials were also selected that did not screen views of the building from the Mall and from the interior of the site out to the Mall. As described by the architect, “This blending of indoors and outdoors contributes to a more pleasant interior environment, creating a sense of enticement and welcome. It also strengthens the relationship between the museum and Mall, intensifying the building’s sense of belonging on this site.”

Consequently, the proposed design, in both Schemes, proposes to reinforce the visual connectivity between building and Mall, between building and sidewalk. The sections presented demonstrate how view relationships will be strengthened by both lowering planter heights and selecting a planting palette emphasizing low ground plane planting and high under-canopy shade tree species selection (and pruning).

Original Planting area in front of North Atrium

Canopy Tree
(Willow, Pin, Scarlet Oak)

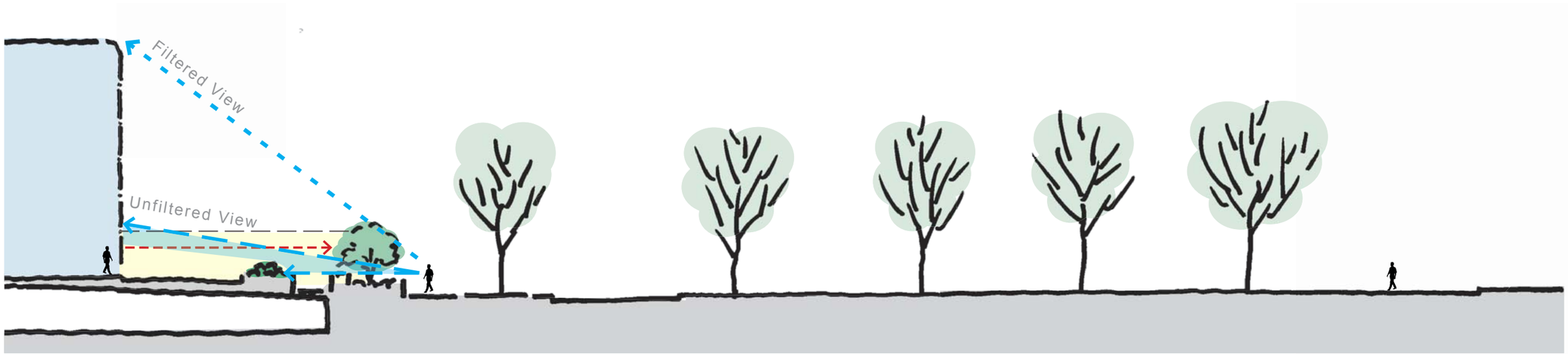
Small Tree
(Eastern Redbud, Japanese Flowering Dogwood)

Evergreen Shrub
(Japanese Azalea)

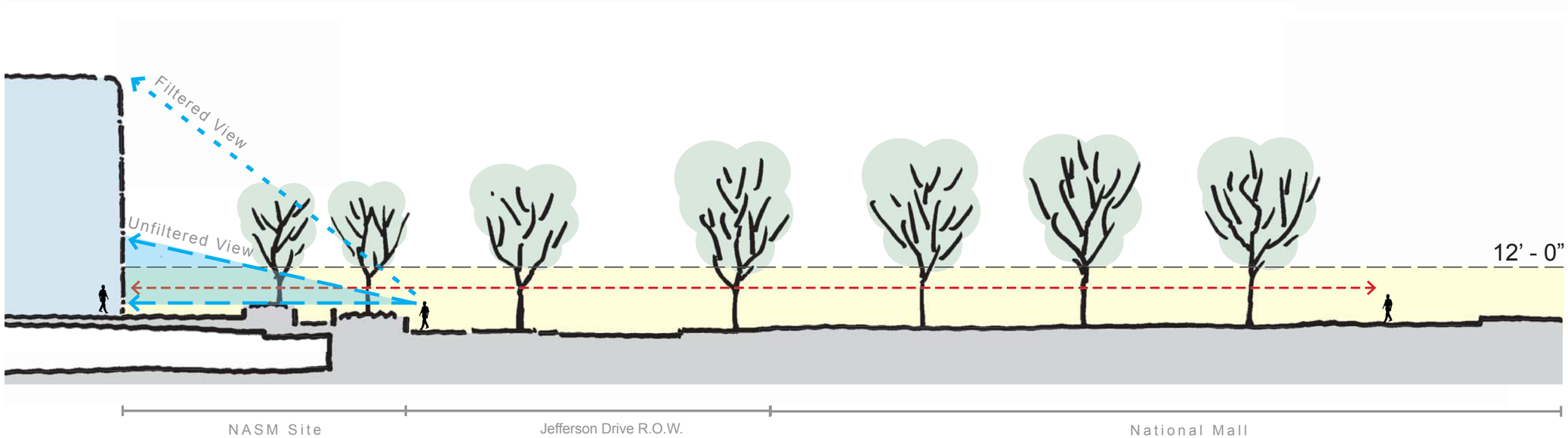
NORTH

40 FEET 0 10 20 40 80

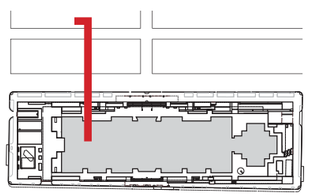
Original Planting Plan (1972)



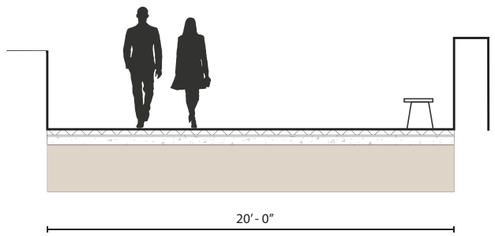
1976 / Existing Condition



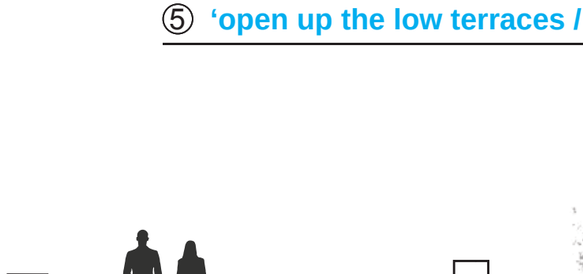
Scheme A / B Planter



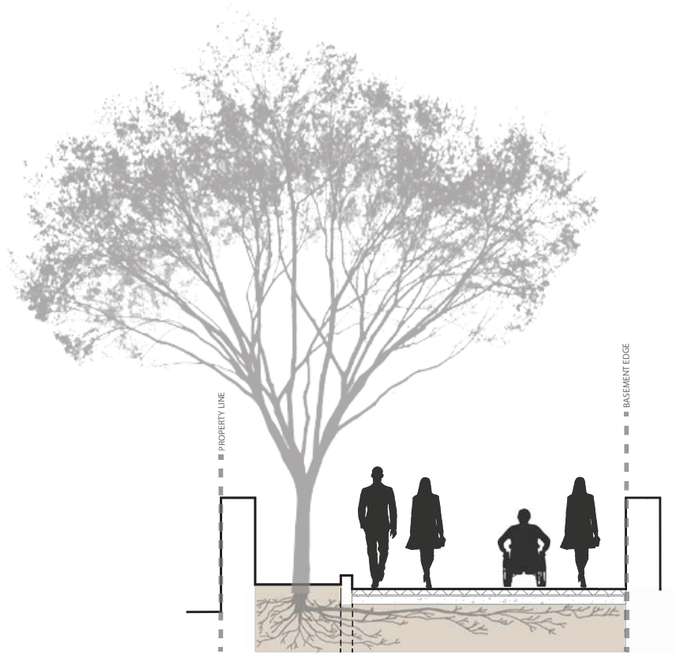
Views from Atrium Galleries to National Mall

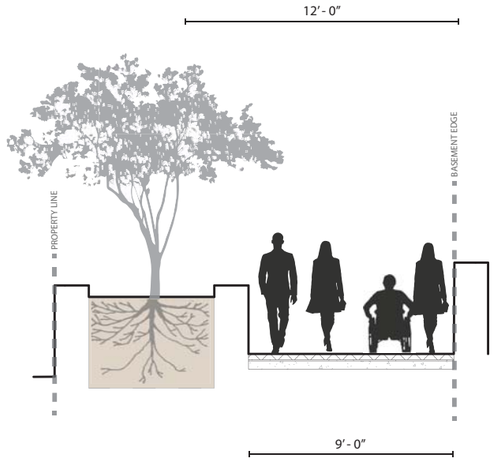


1. Entrance Landing Width,
Typical Scheme A + B



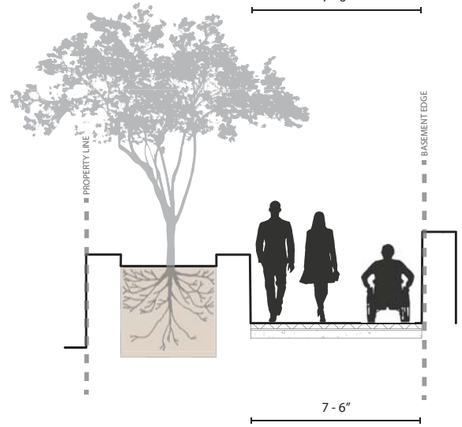
SOURCE: Charles Harris, Nicholas Dines Time-Saver Standards for Landscape Architecture





2. N Entrance Sloped Walkway

Scheme A



3. SE Sloped Walkway

Scheme B

Ascending Walkway Width Diagram, Typical landing, North Entrance, SE Section

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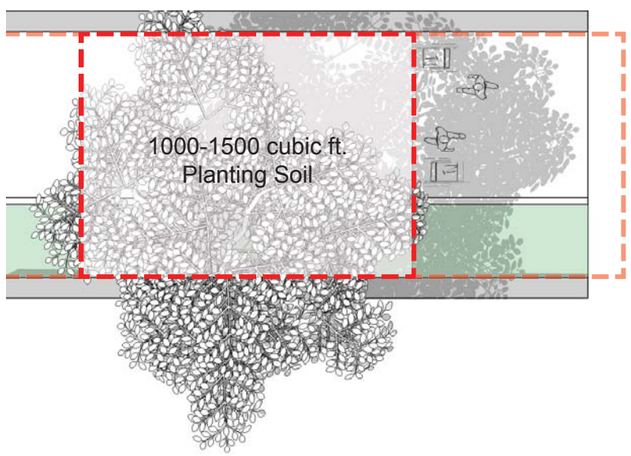
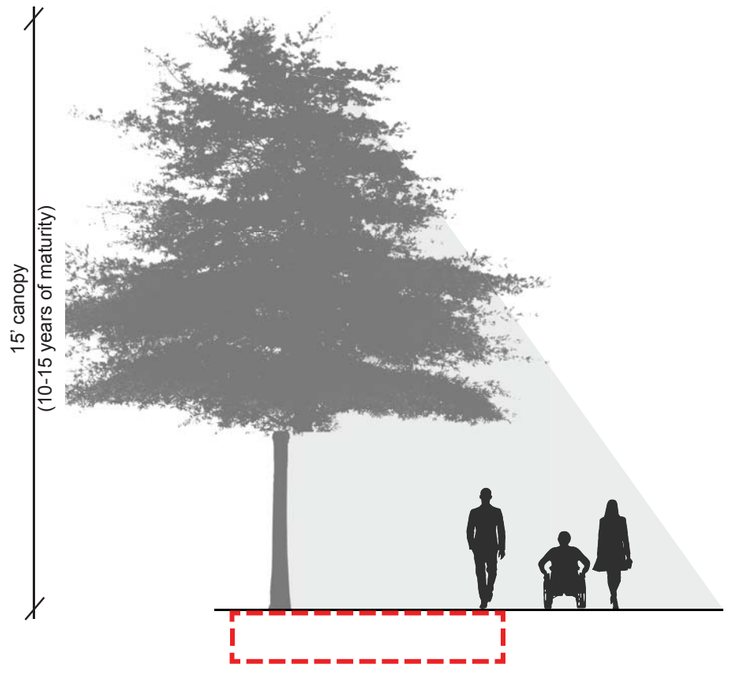
National Mall Building Envelope and HVAC Revitalization

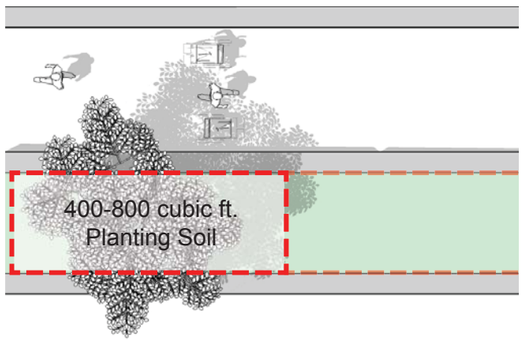


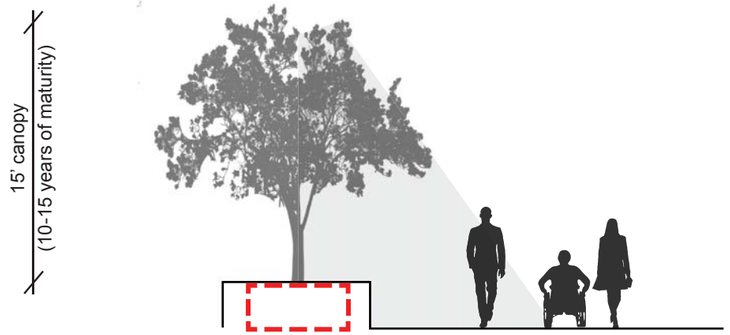


The four corner entrances and the ascending walkways (at the north and south entrances and southeast corner) and their immediate planted environs are affected by the ‘lowered (curbed) groundplane’ (Scheme A) and ‘planter’ (Scheme B) approaches. Scheme A permits a wider walkway because the planted surface can be narrower and still accommodate shade canopy trees. This is possible because the root zone can be extended under the walkway with continuous soil panels and irrigation. Scheme B portends a narrower walkway, as in order to accommodate sufficient soil in a raised planter condition – for even a small tree - a wider planter is required.

These conditions are more fully explained in section and plan on the following pages.

Scheme A



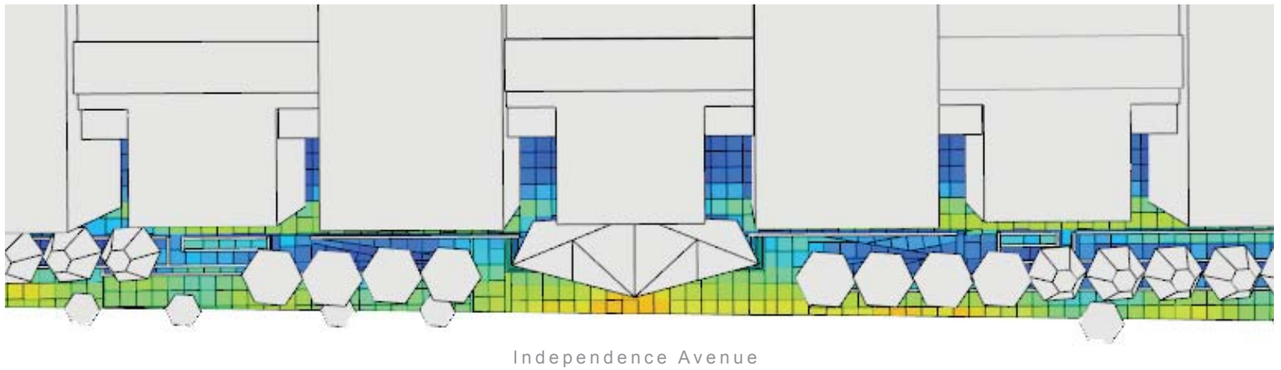


Scheme B

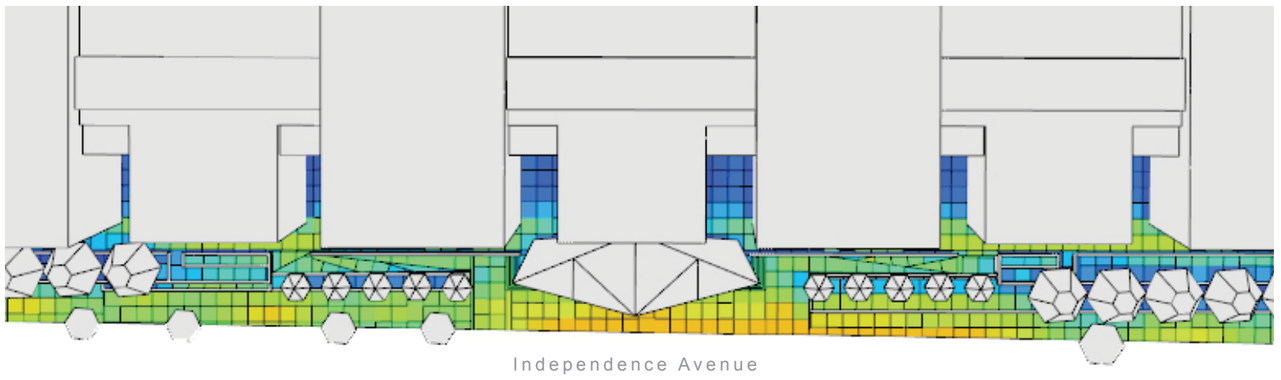
Scheme A+B - Relationship of Soil Volume to Tree Size to Shade

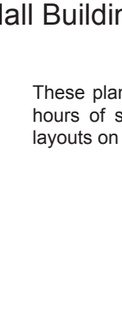
These plan enlargements of the South entrance illustrate the likely hours of solar exposure on the ground given the respective tree layouts on each scheme, on June 15.

Scheme A



Scheme B

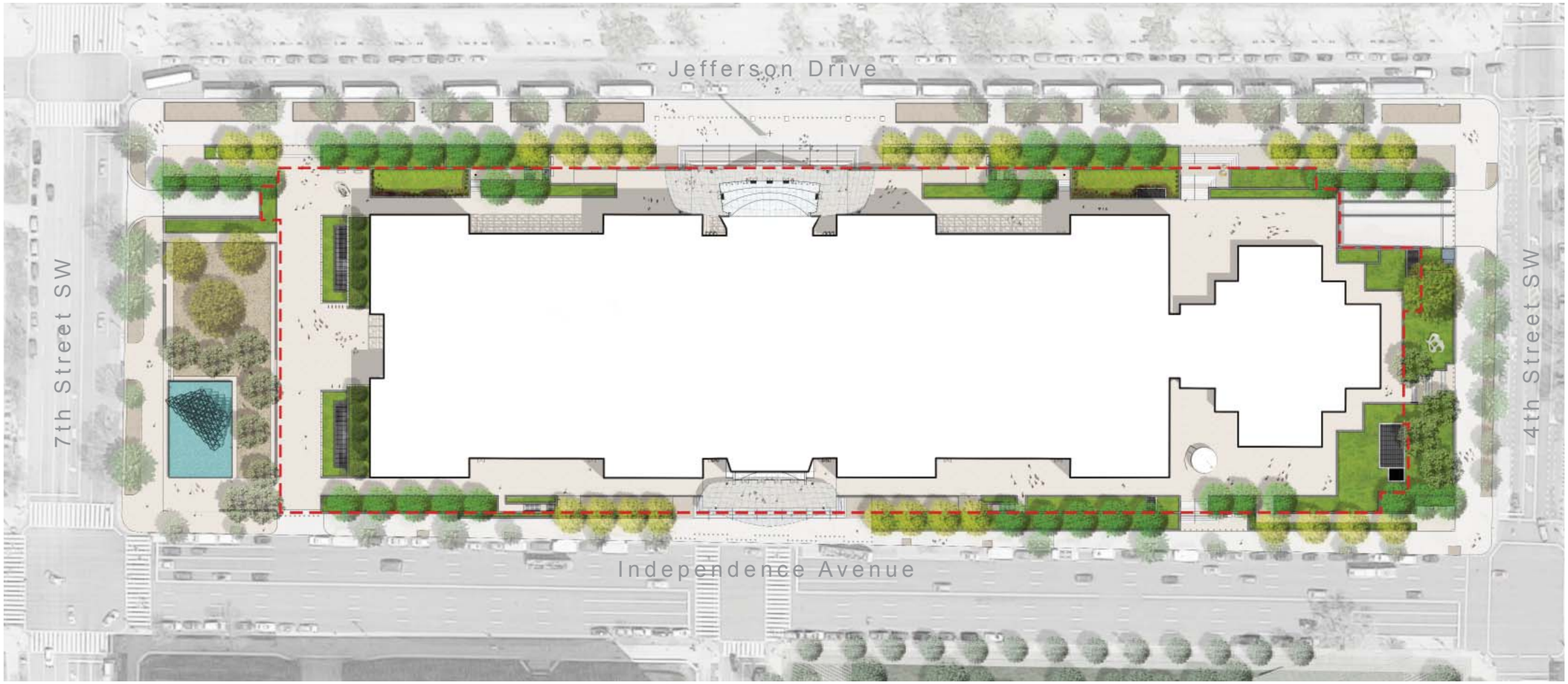




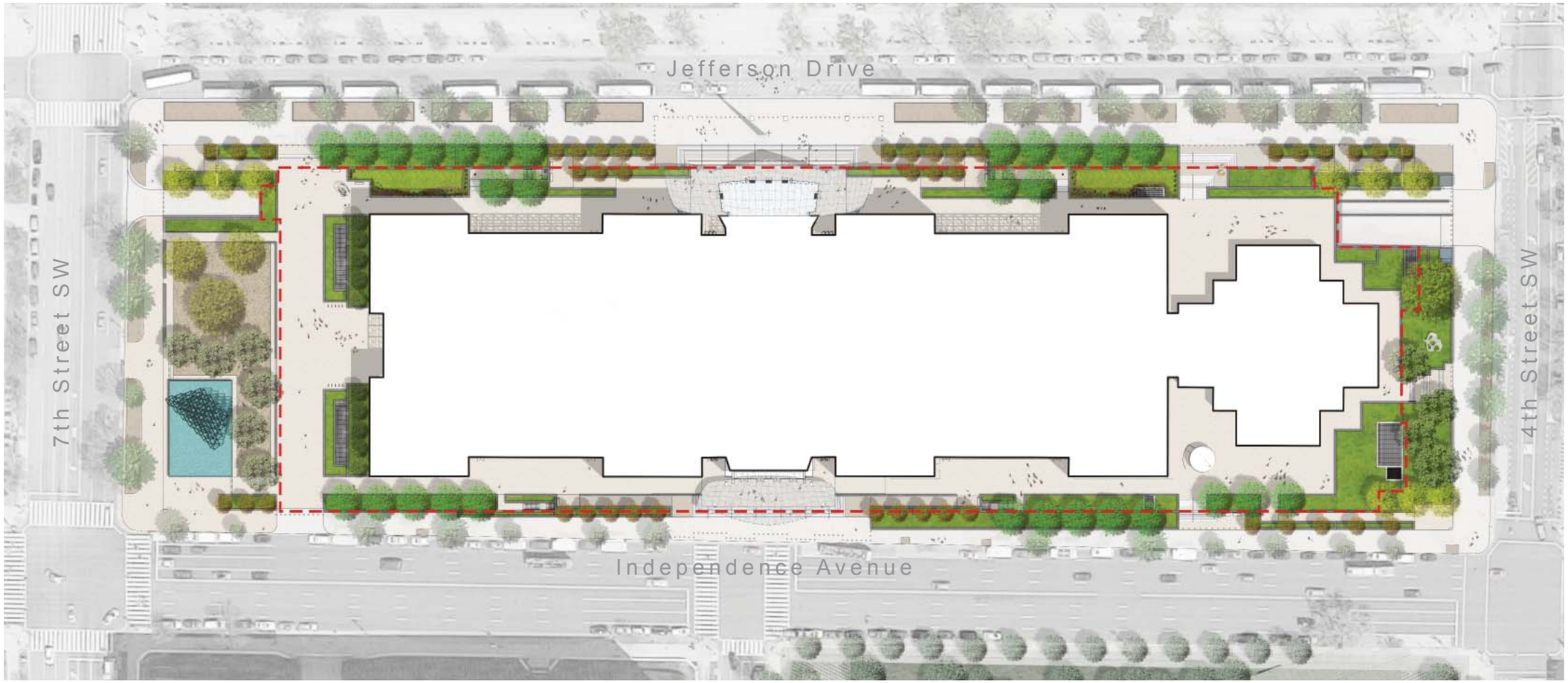
Hours of sunlight on June 15th

Scheme A+B - Shade Analysis (South entrance enlargement)

Design Scheme Studies



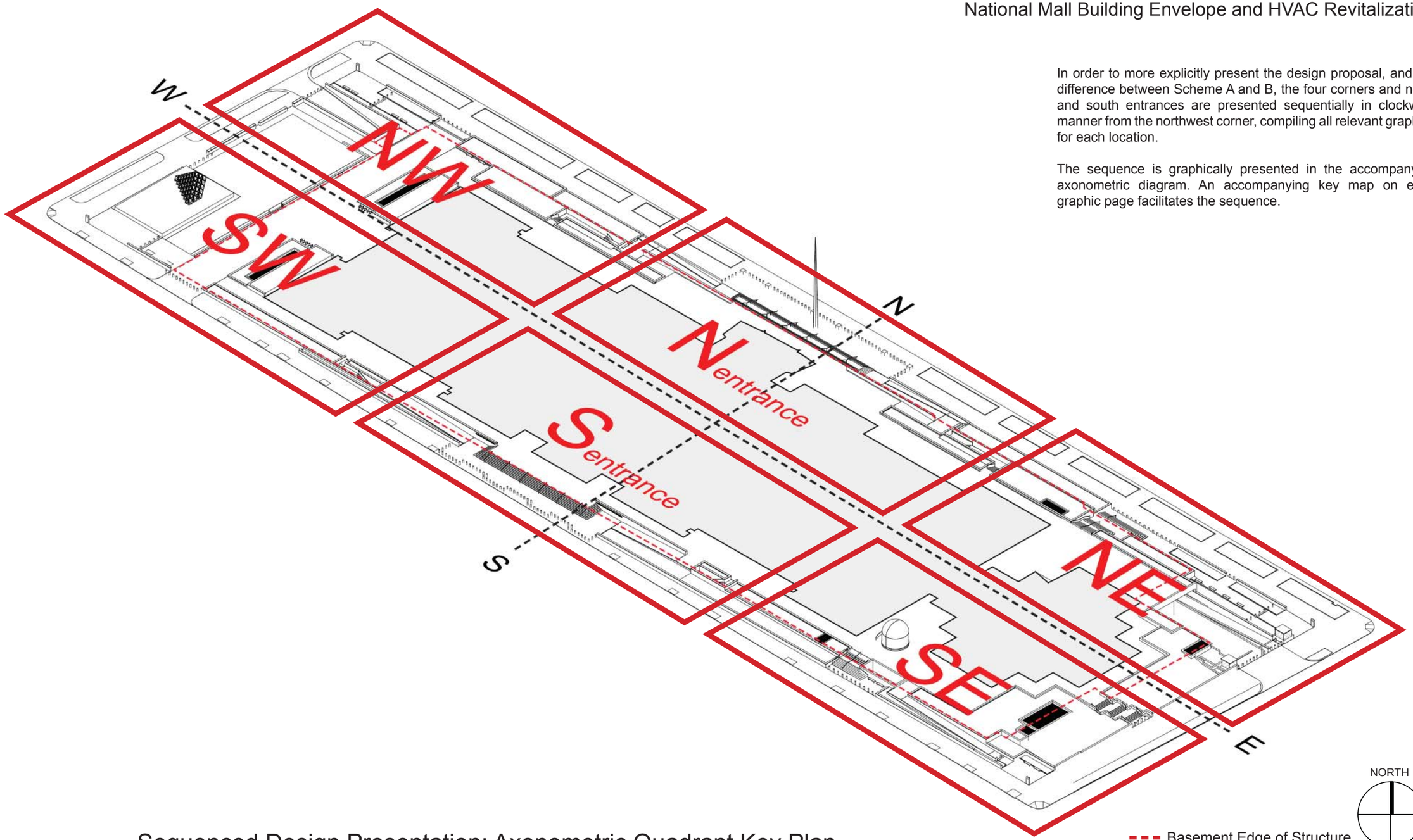
Scheme A Site Plan



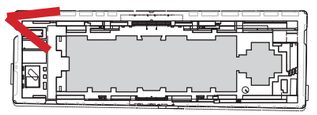
Scheme B Site Plan

In order to more explicitly present the design proposal, and the difference between Scheme A and B, the four corners and north and south entrances are presented sequentially in clockwise manner from the northwest corner, compiling all relevant graphics for each location.

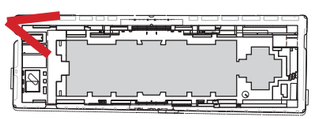
The sequence is graphically presented in the accompanying axonometric diagram. An accompanying key map on each graphic page facilitates the sequence.



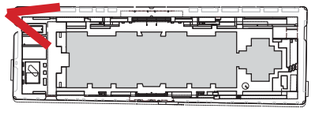
Sequenced Design Presentation: Axonometric Quadrant Key Plan



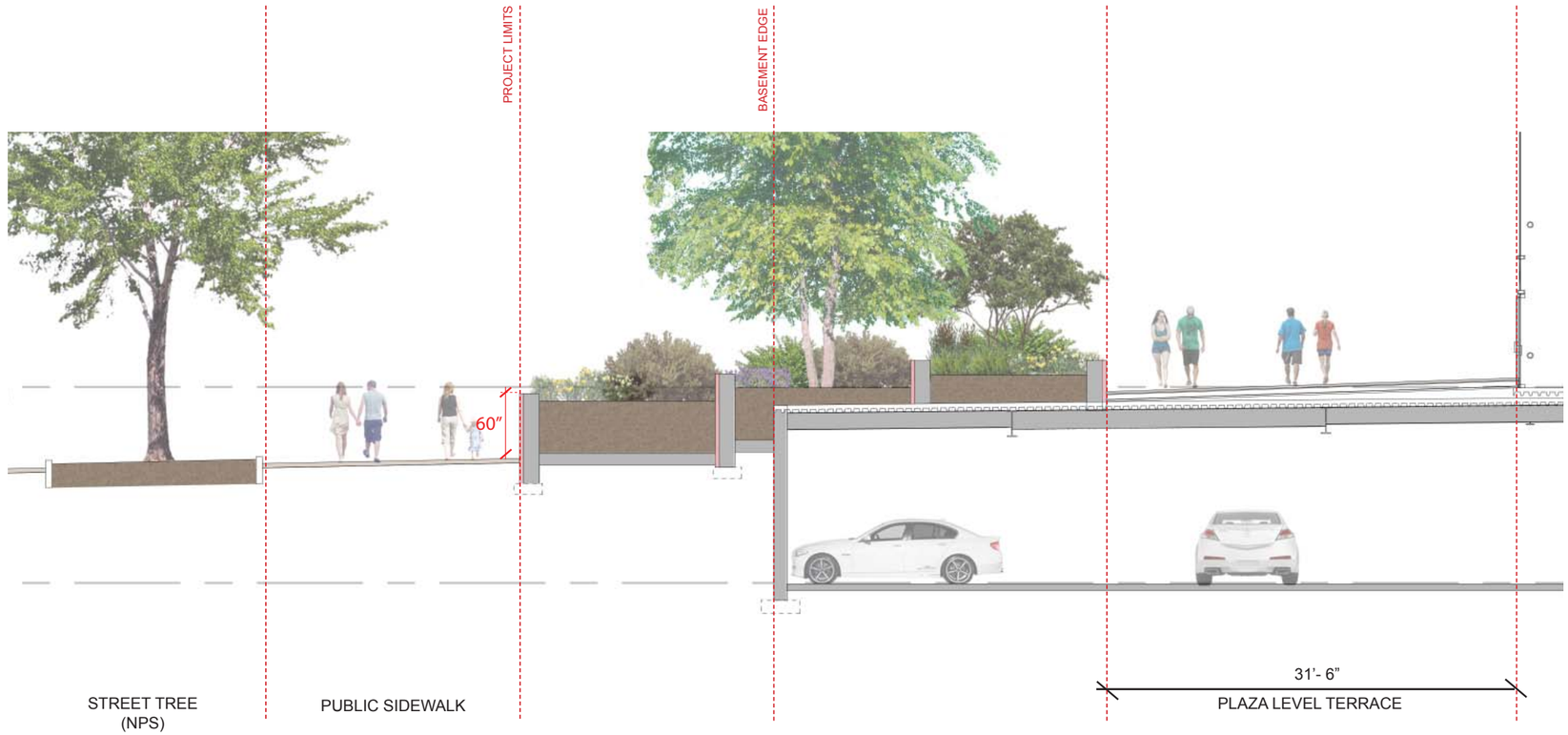
Existing - Northwest Corner

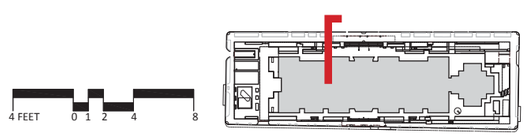


Scheme A - Northwest Corner



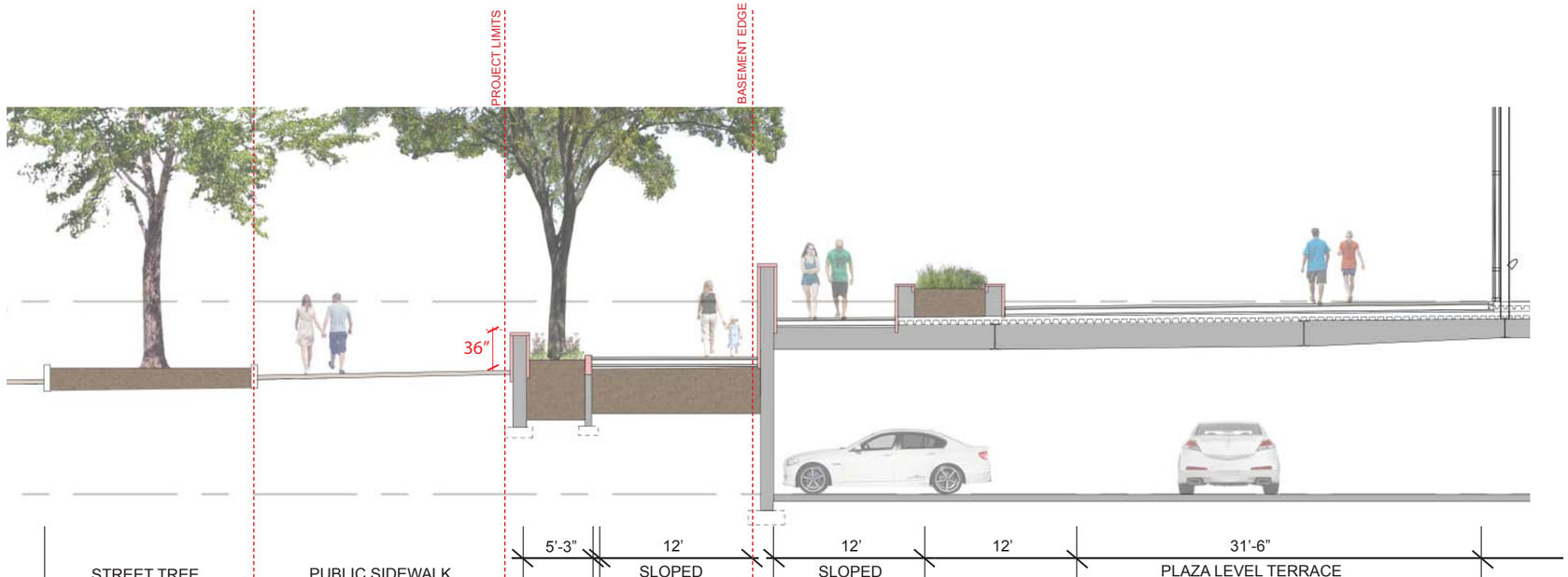
Scheme B - Northwest Corner



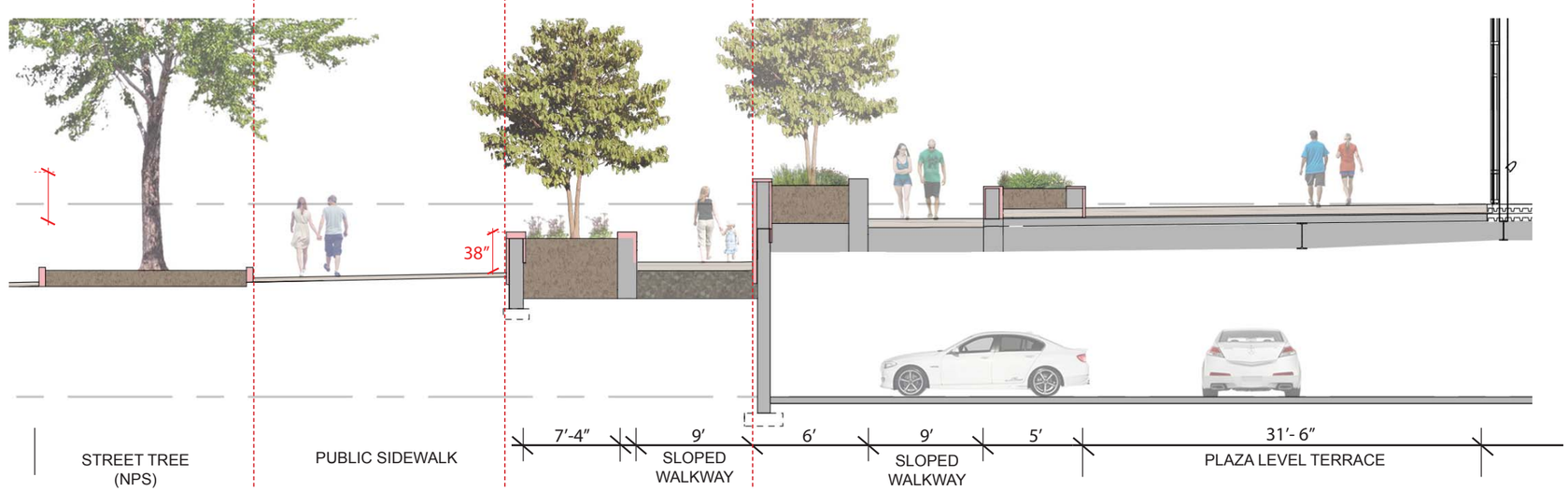


Existing - Northwest Section

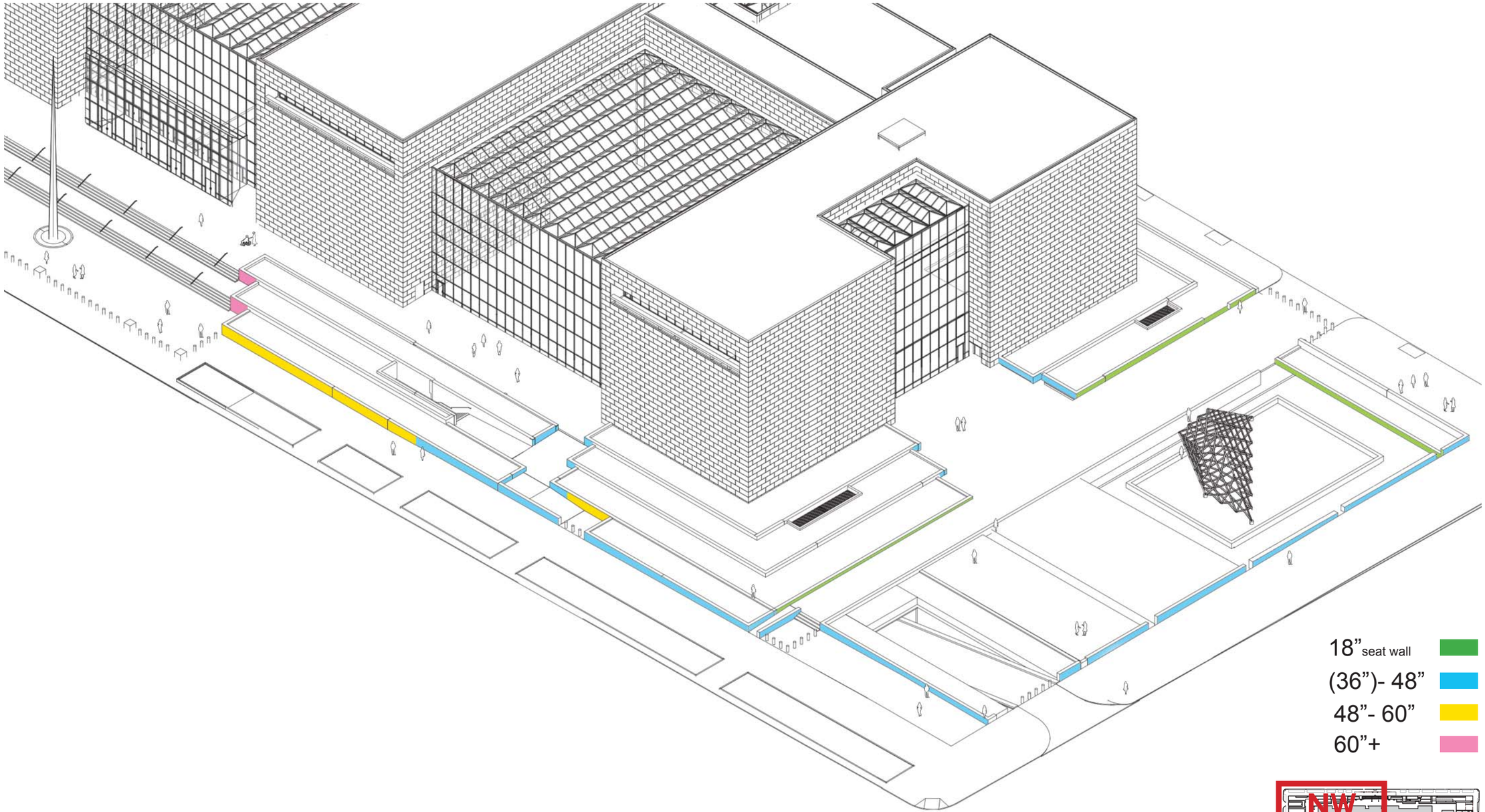
Scheme A



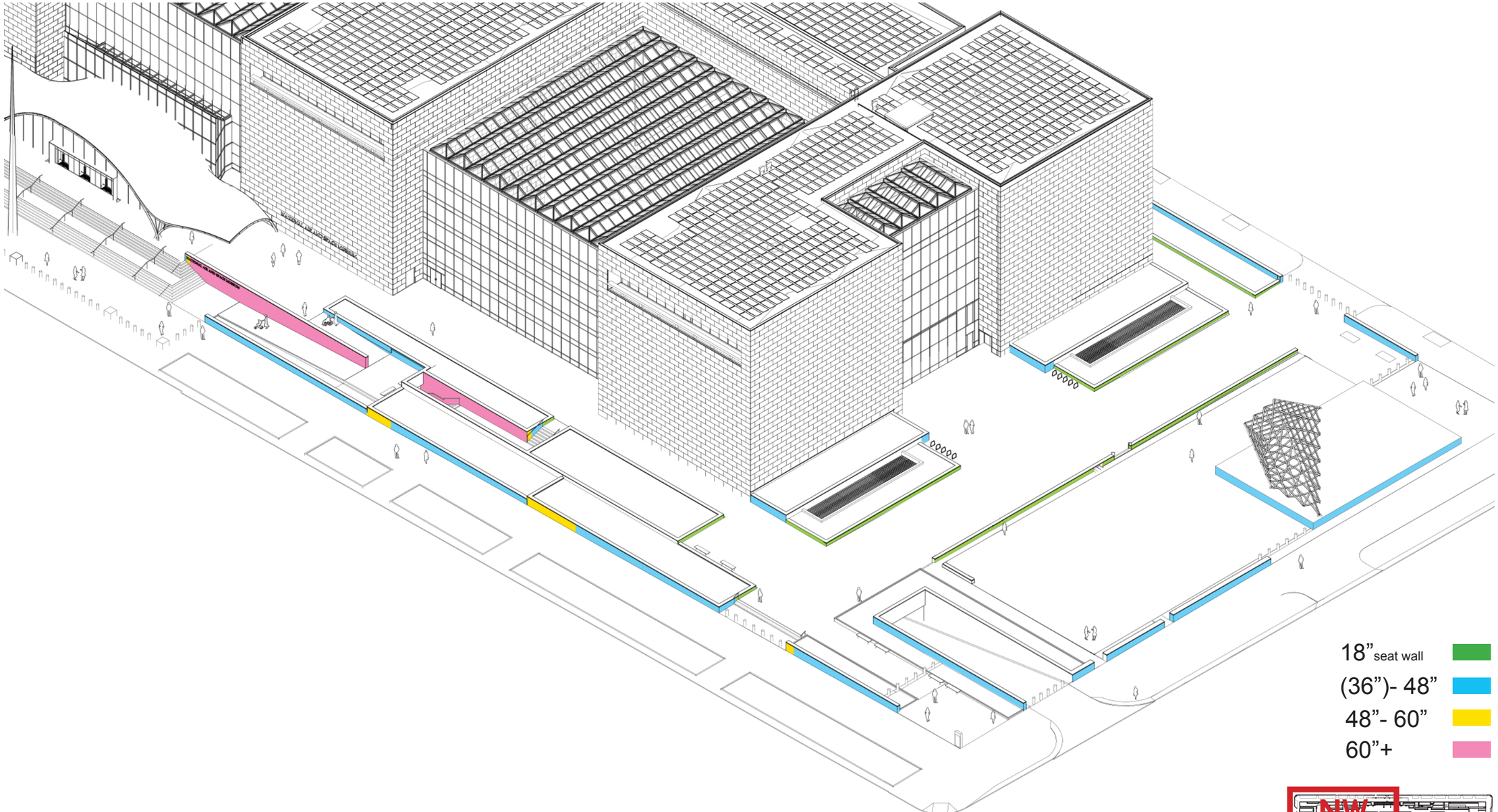
Scheme B



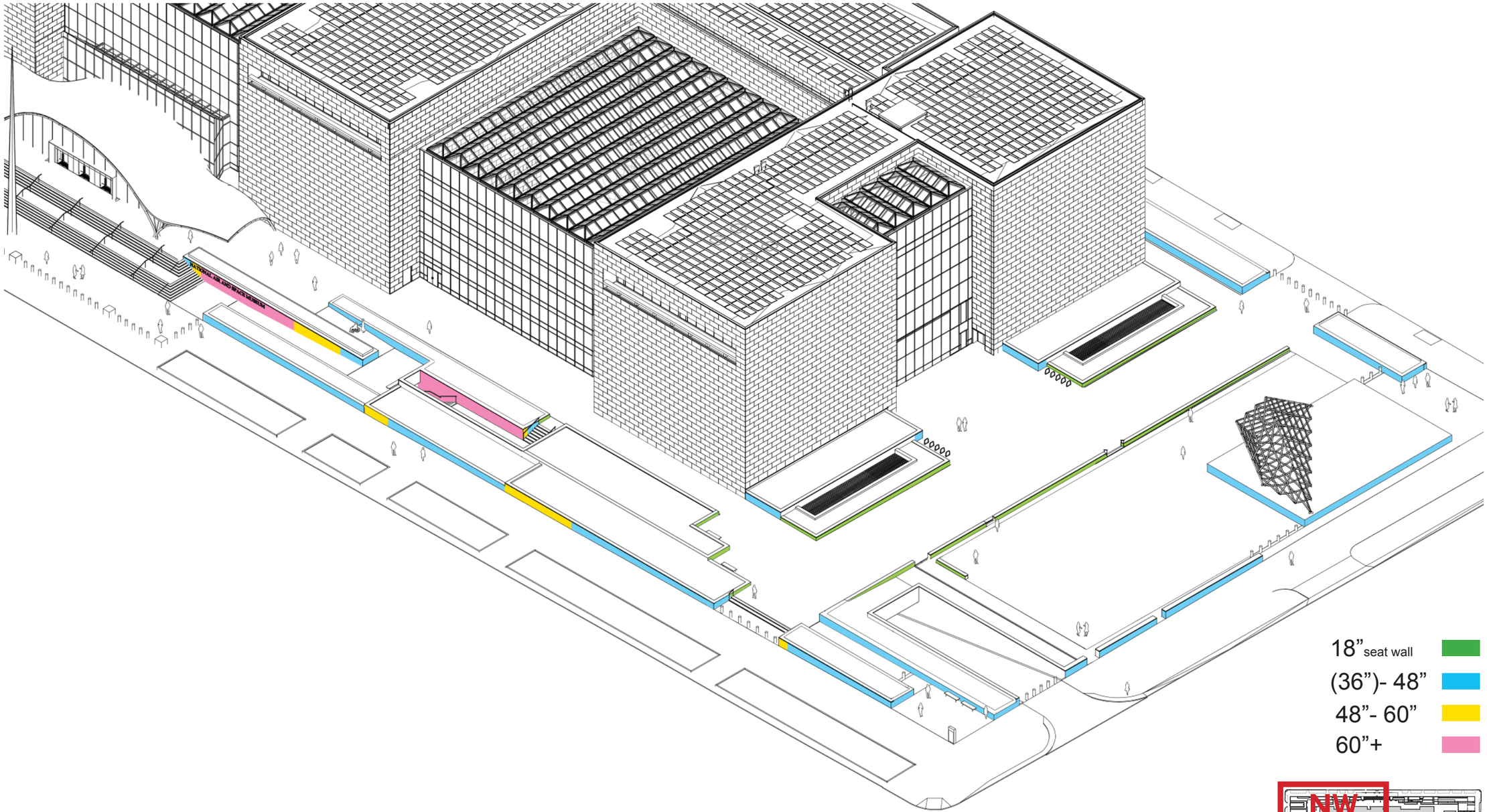
Scheme A + B - Northwest Section



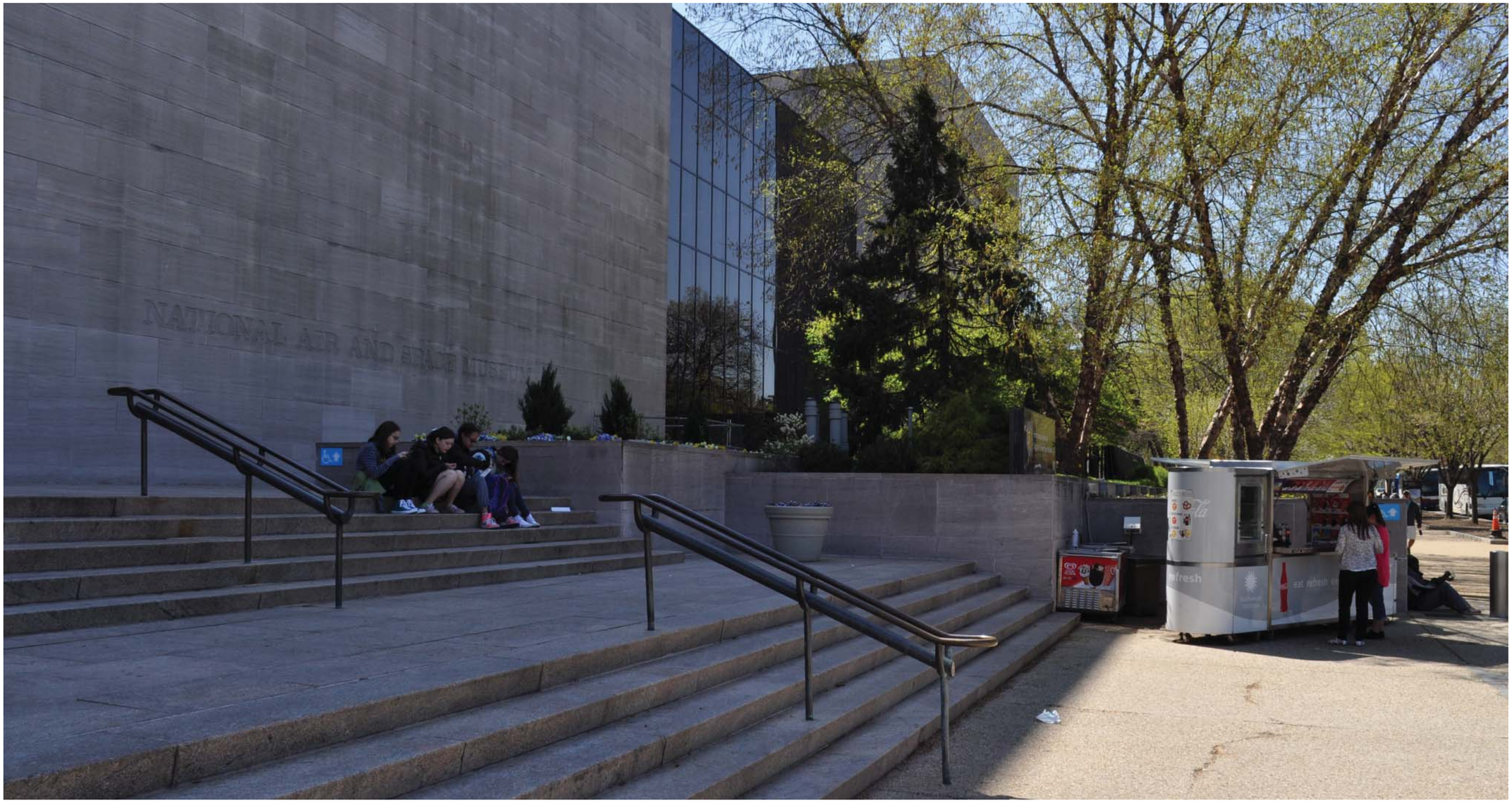
Existing Planter Wall Heights - Northwest Corner Axon



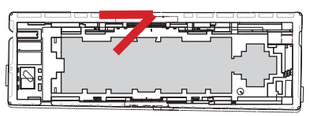
Scheme A Planter Wall Heights - Northwest Corner Axon



Scheme B Planter Wall Heights - Northwest Corner Axon

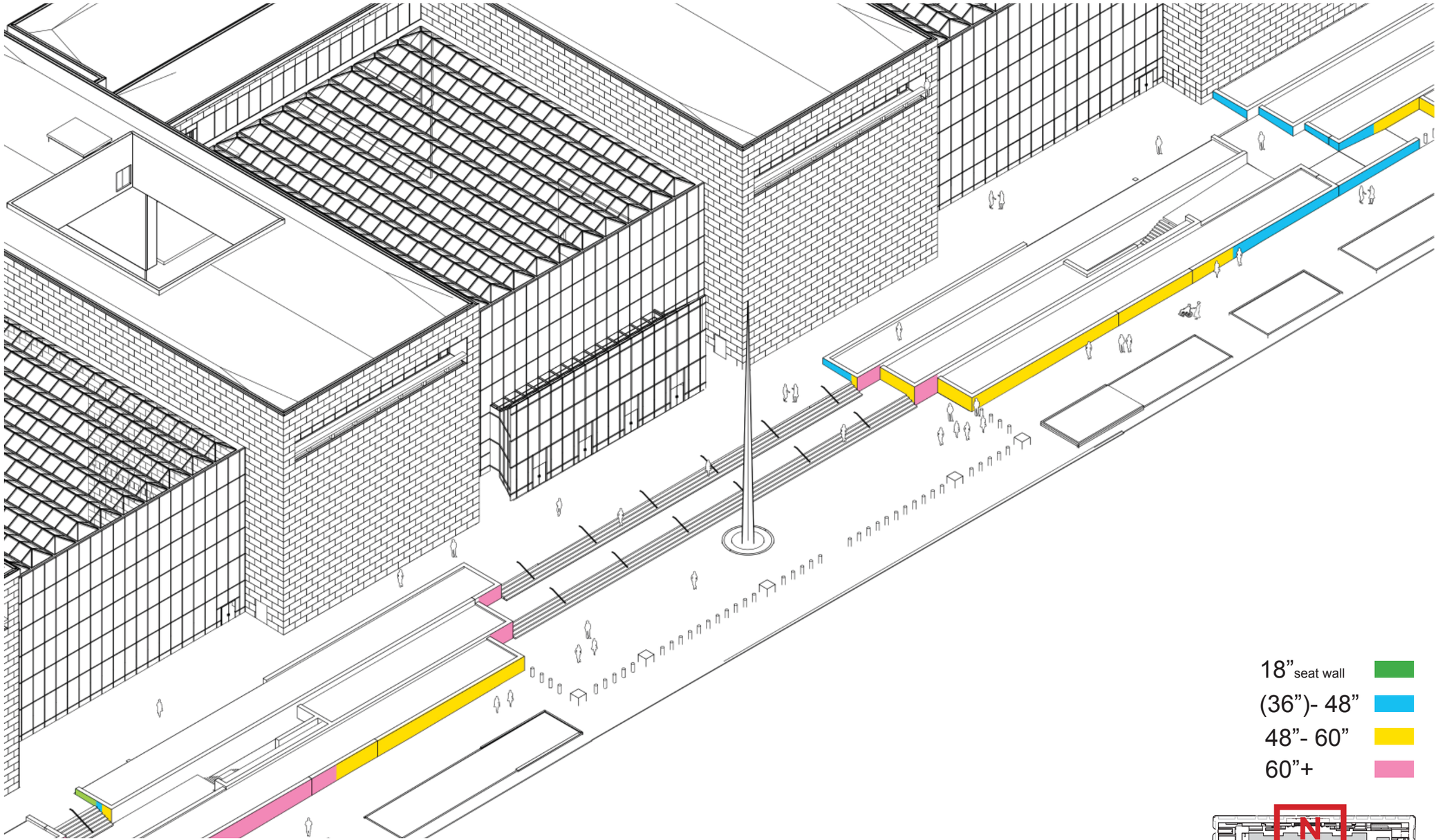


Existing - North Entrance

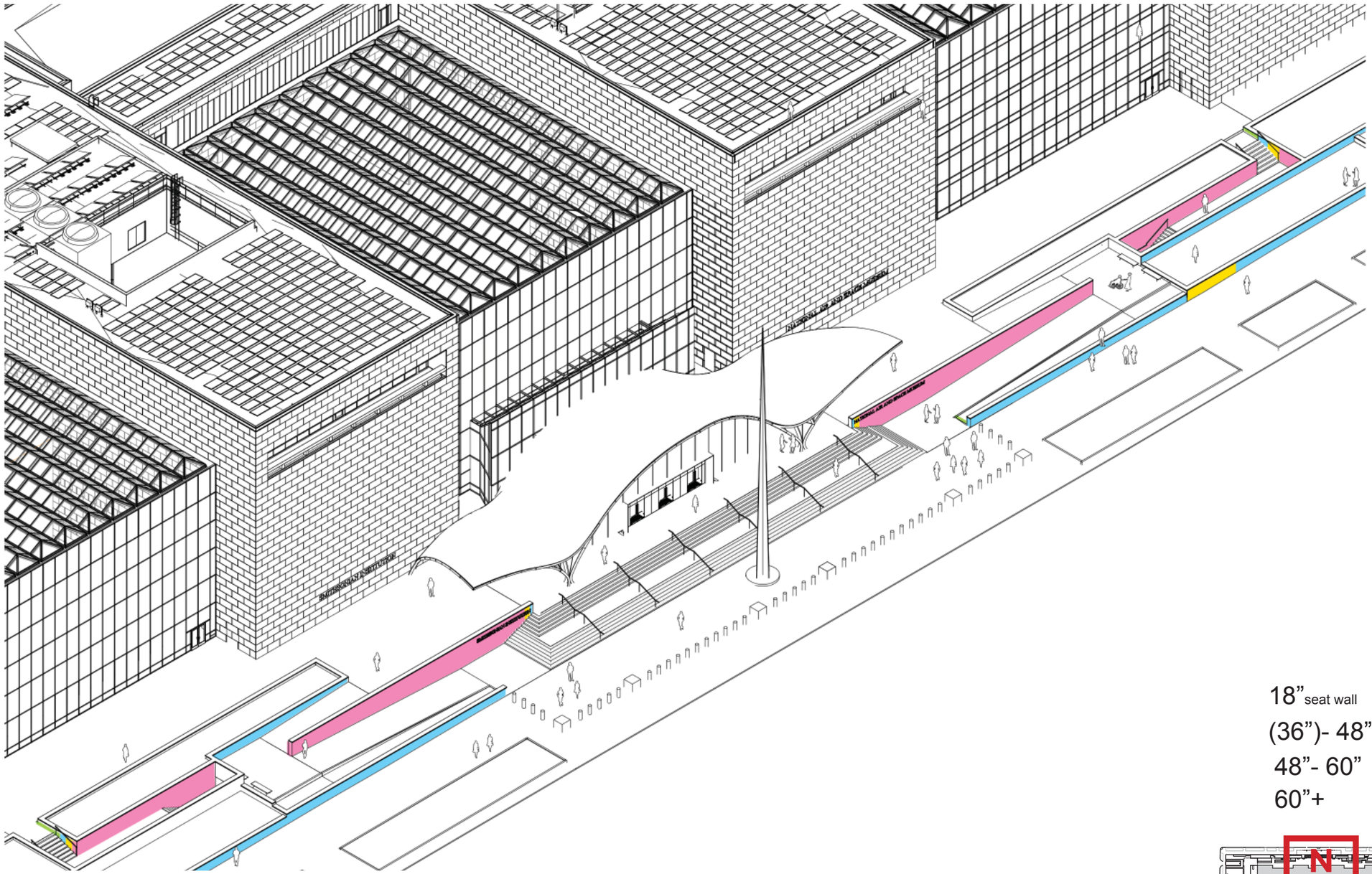


Scheme A - North Entrance

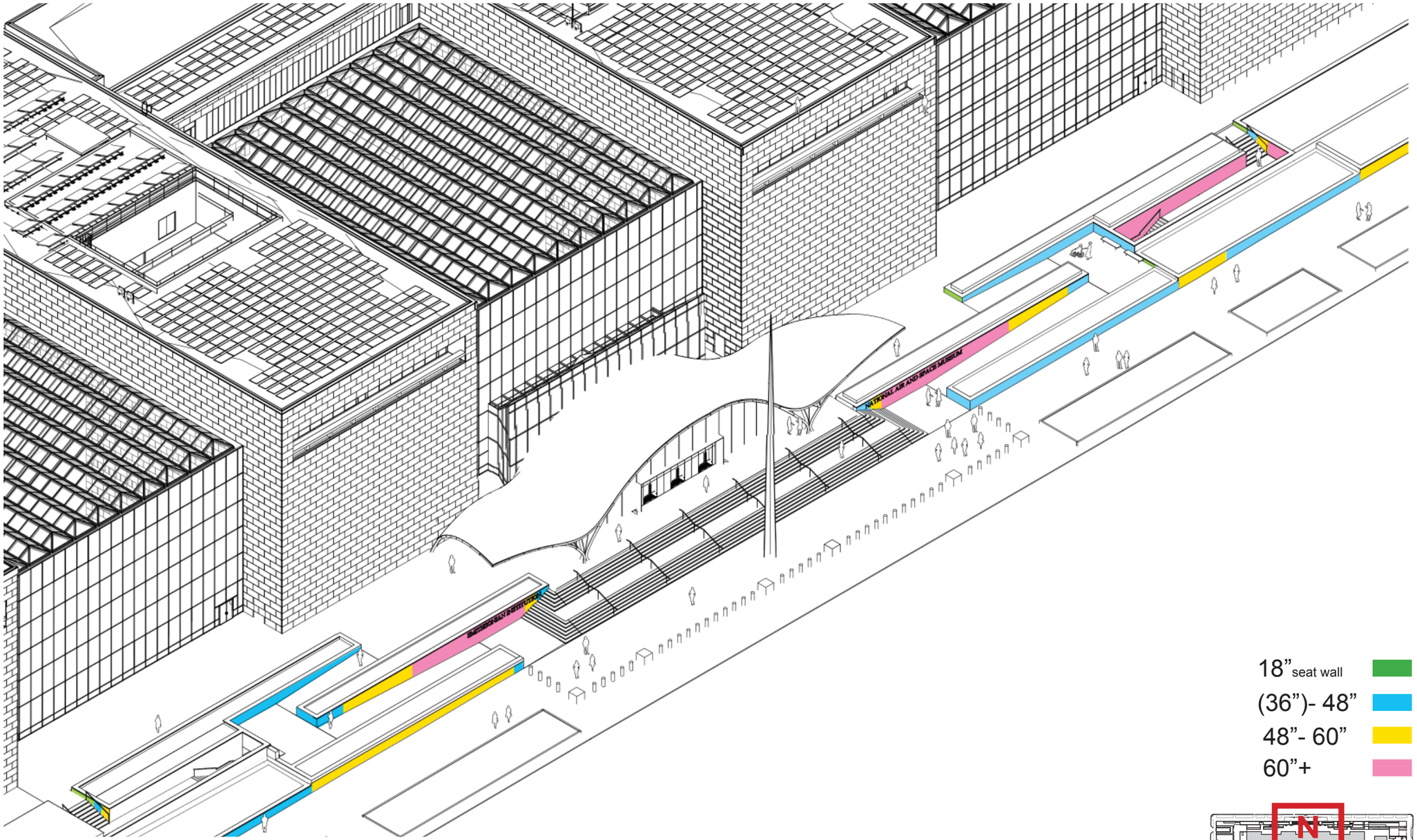
Scheme B - North Entrance



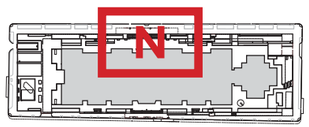
Existing Planter Wall Heights - North Entrance Axon



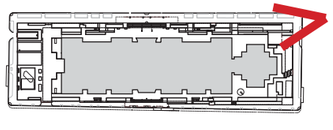
Scheme A Planter Wall Heights - North Entrance Axon



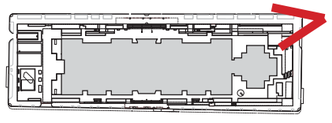
18” seat wall
(36”)- 48”
48”- 60”
60”+



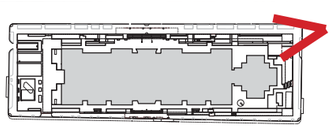
Scheme B Planter Wall Heights - North Entrance Axon



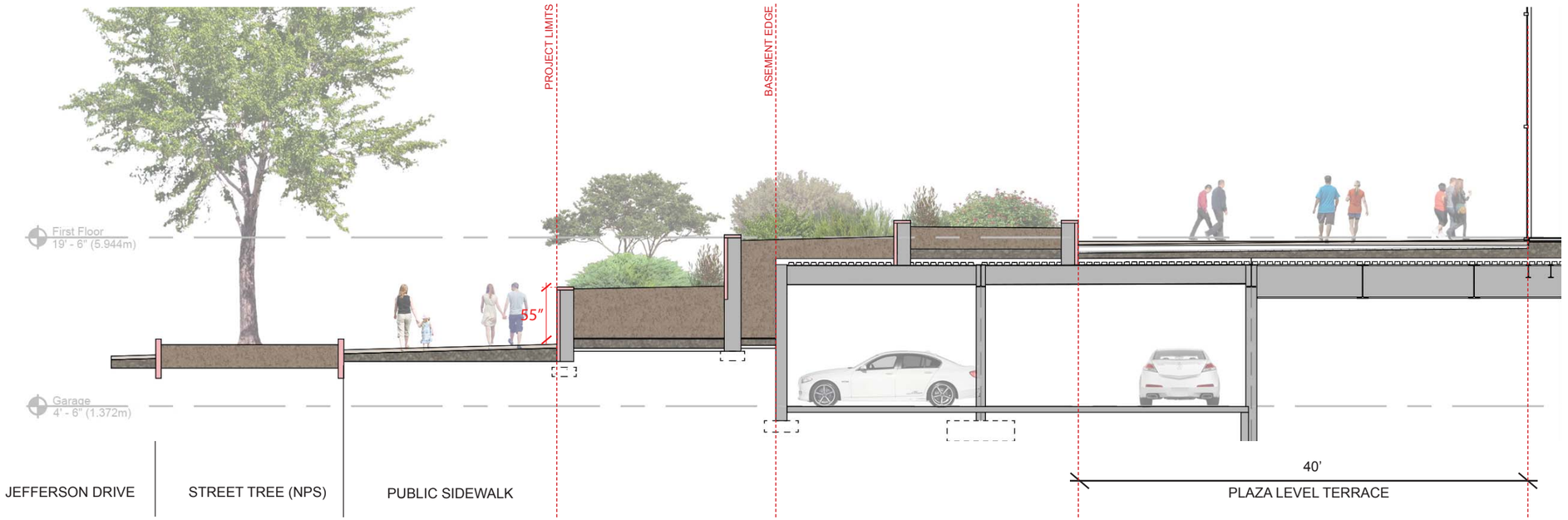
Existing - Northeast Corner

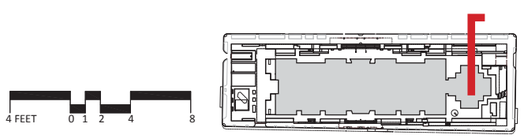


Scheme A - Northeast Corner



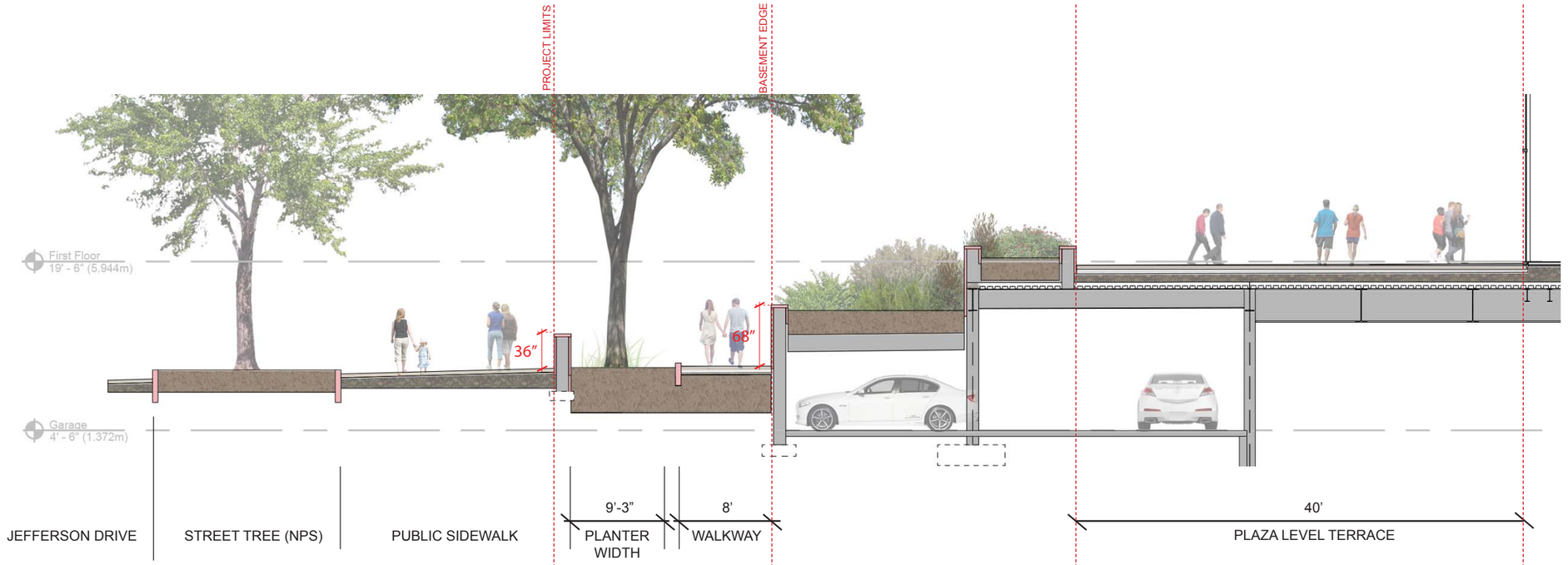
Scheme B - Northeast Corner





Existing - Northeast Section 1

Scheme A

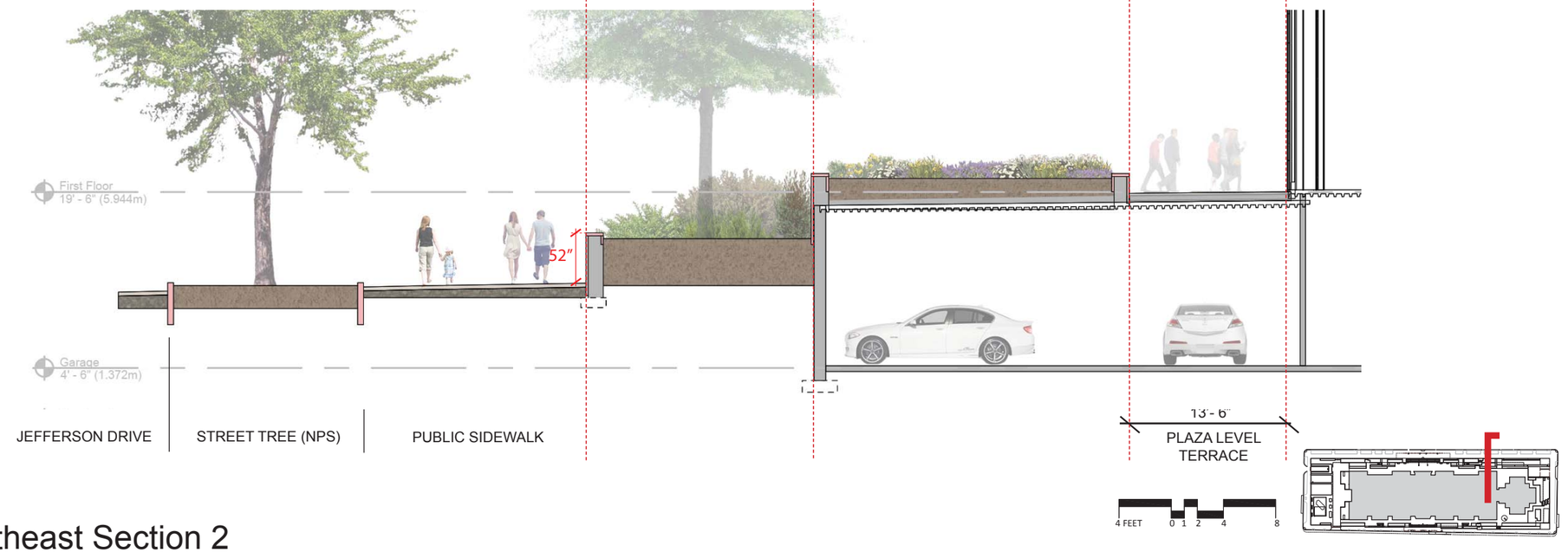


Scheme B

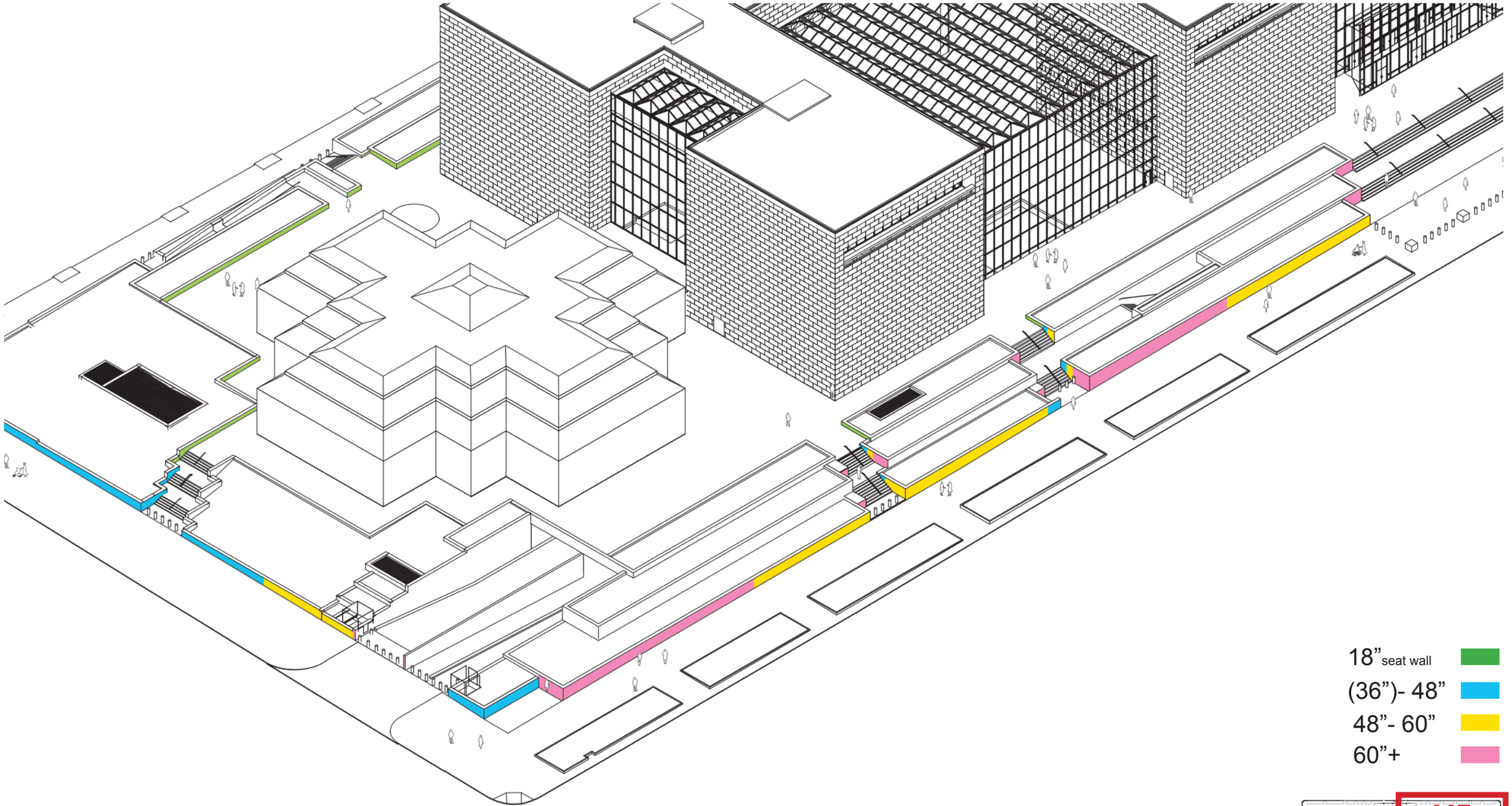
Scheme A + B - Northeast Section 1

Existing

Scheme A/B



Existing - Northeast Section 2



18” seat wall
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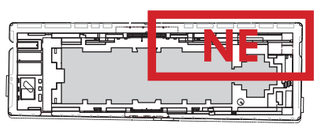
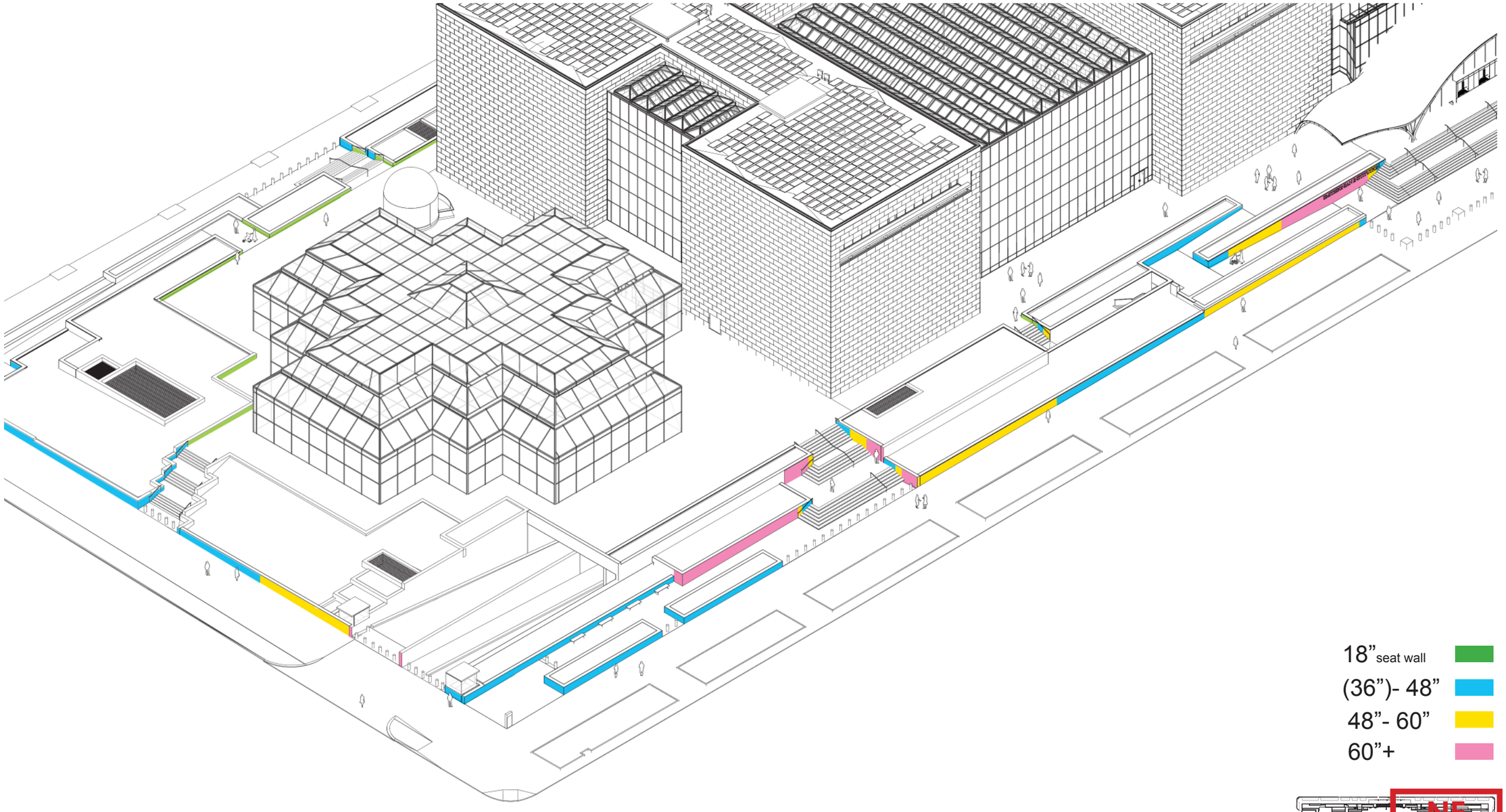


Existing Planter Wall Heights - Northeast Corner Axon

18” seat wall
(36”)- 48”
48”- 60”
60”+

Scheme A Planter Wall Heights - Northeast Corner Axon



18” seat wall
(36”)- 48”
48”- 60”
60”+

Scheme B Planter Wall Heights - Northeast Corner Axon

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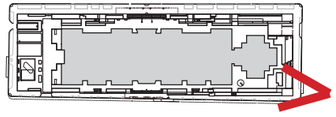
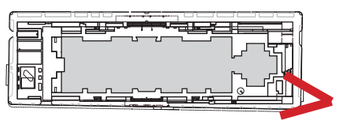
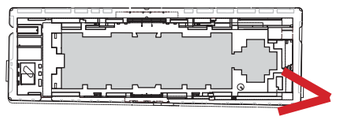


Existing - Southeast Corner

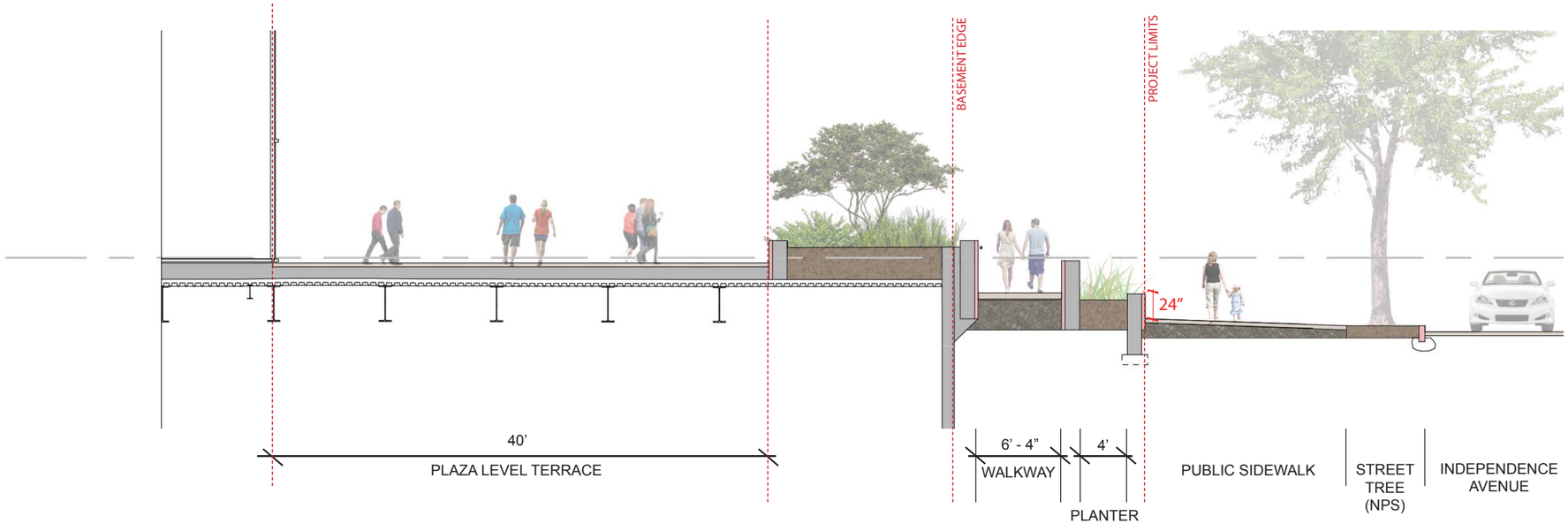


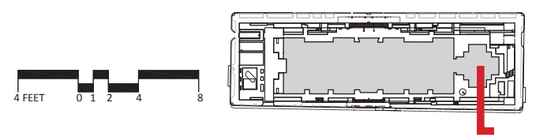
Scheme A - Southeast Corner



Scheme B - Southeast Corner

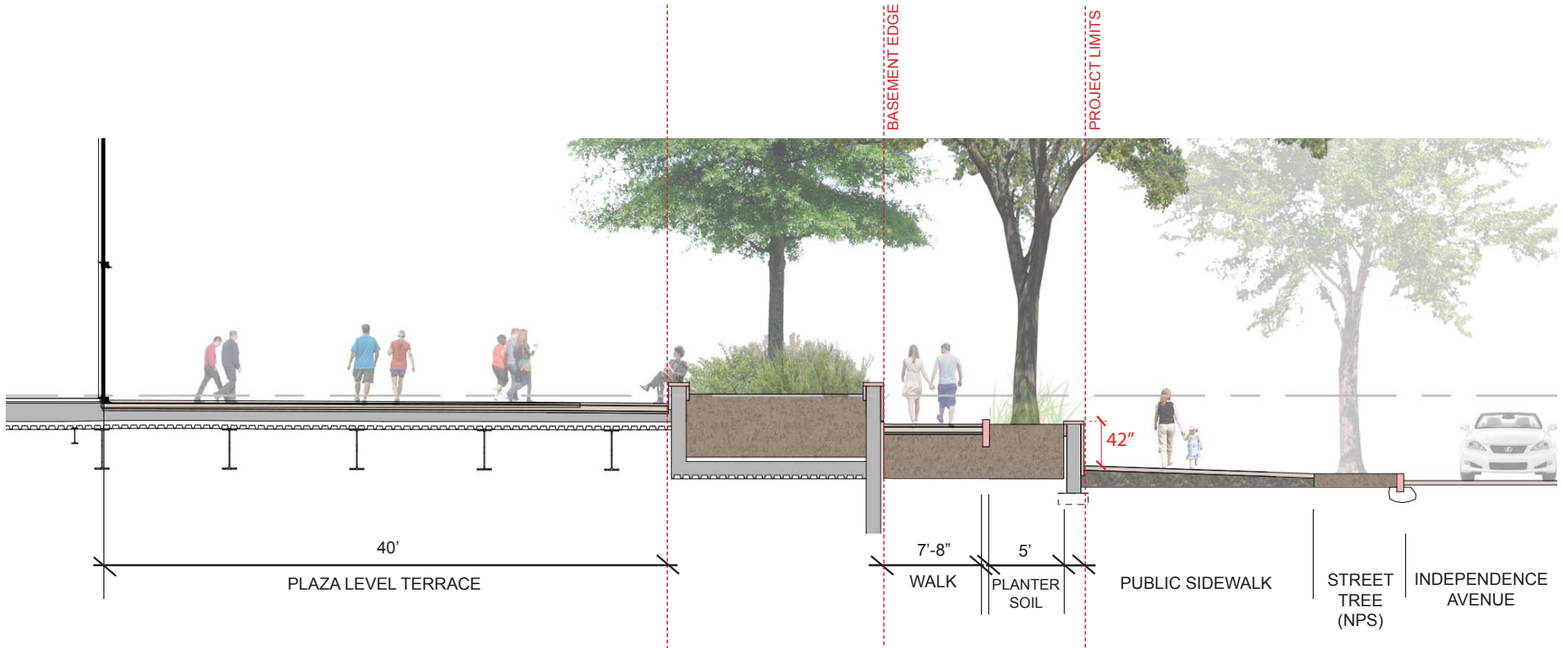
Existing



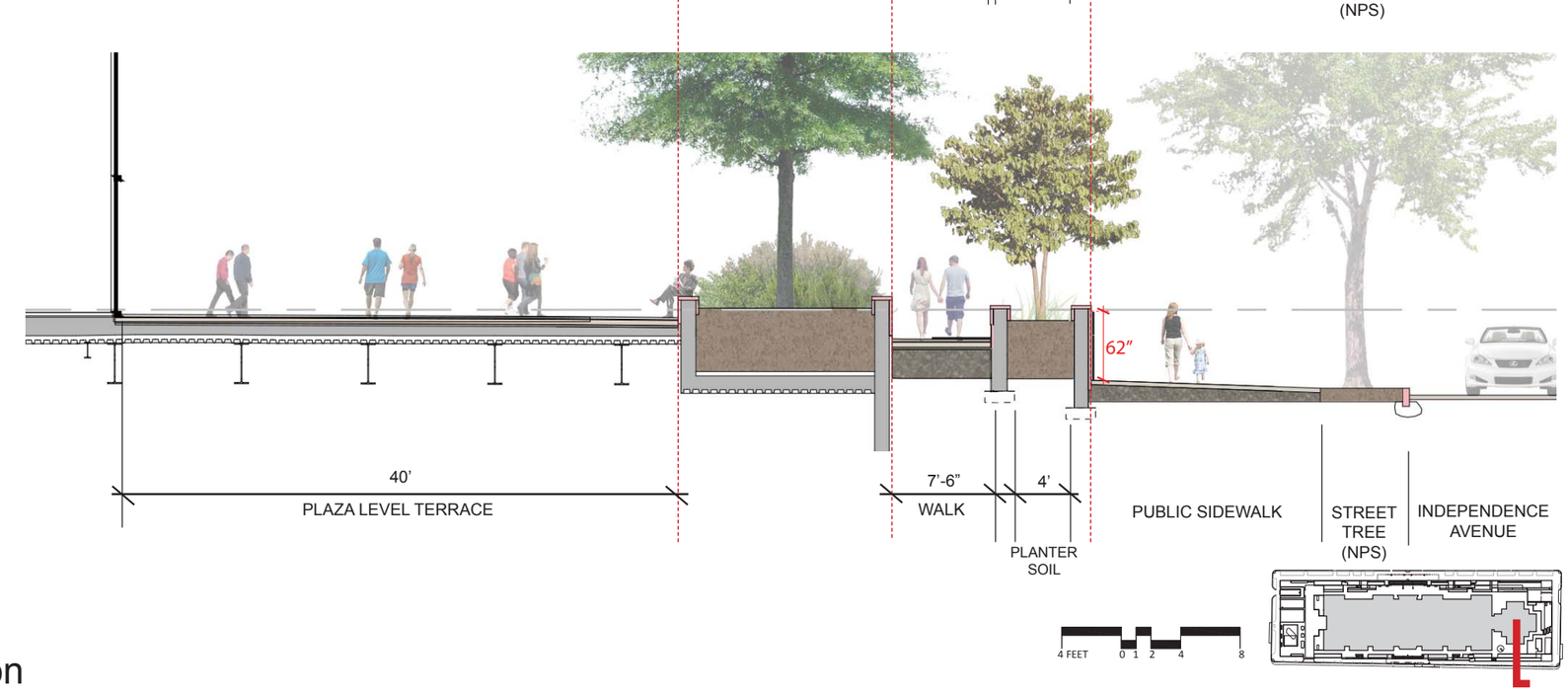


Existing - Southeast Section

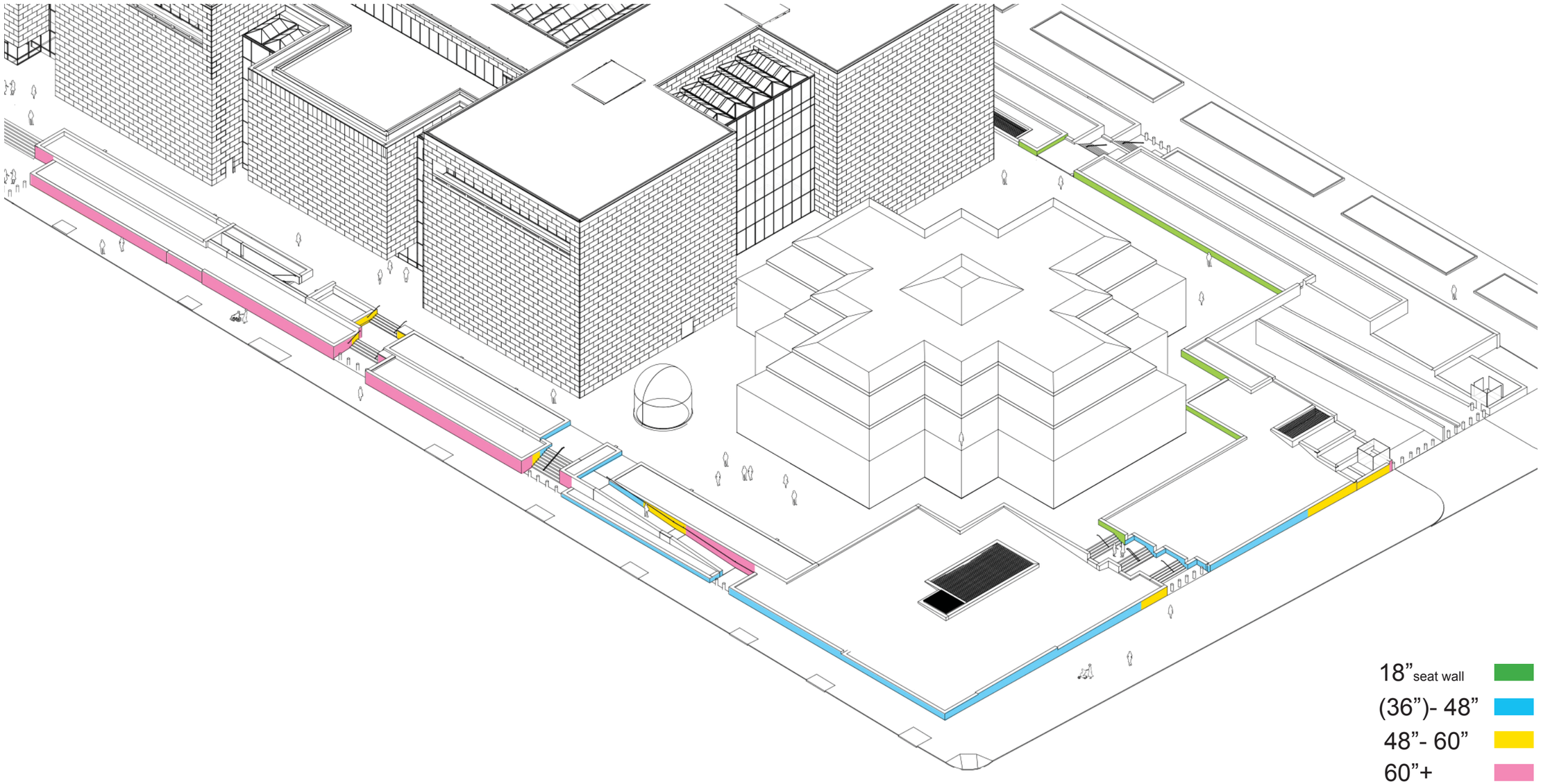
Scheme A



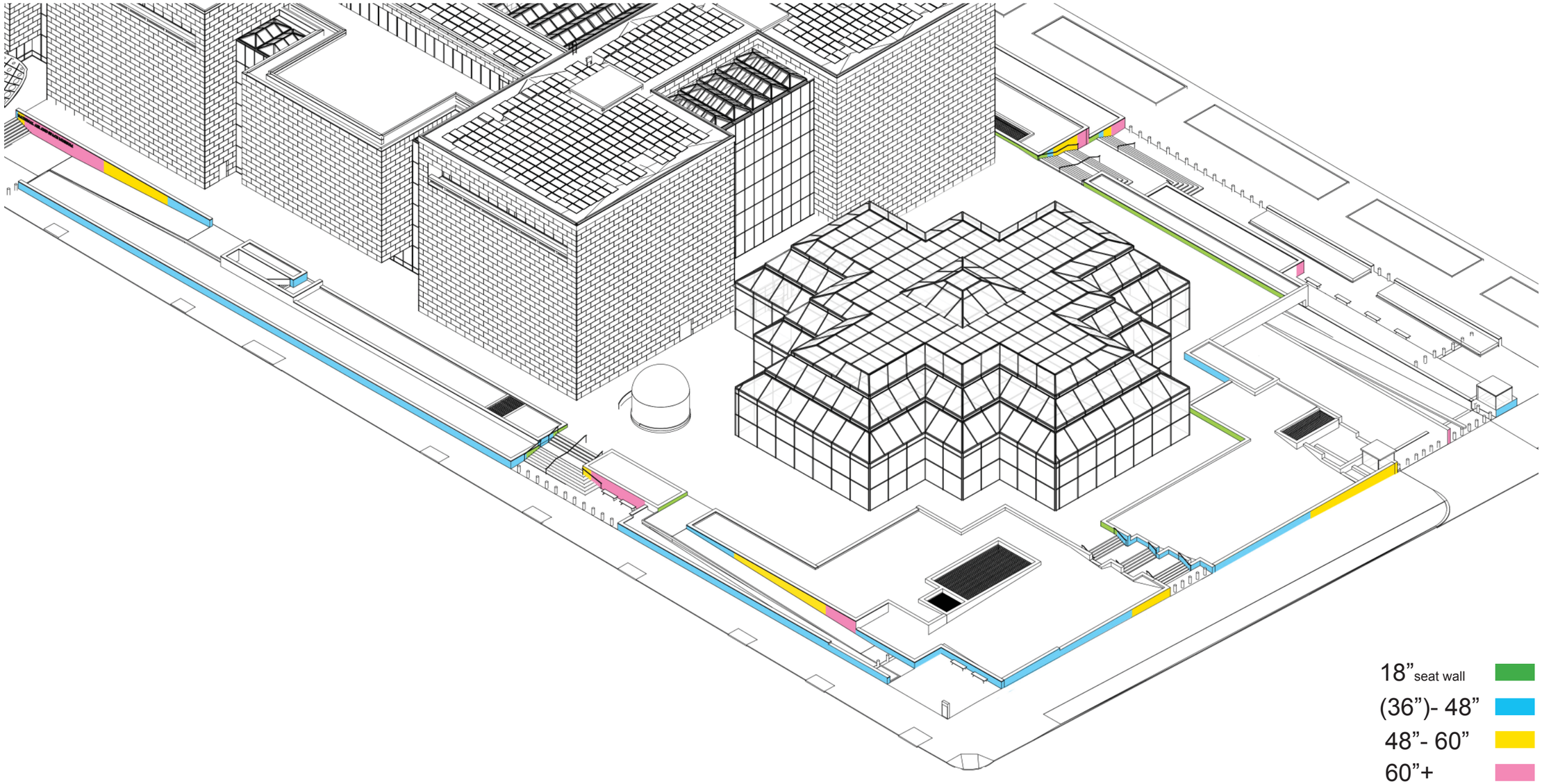
Scheme B



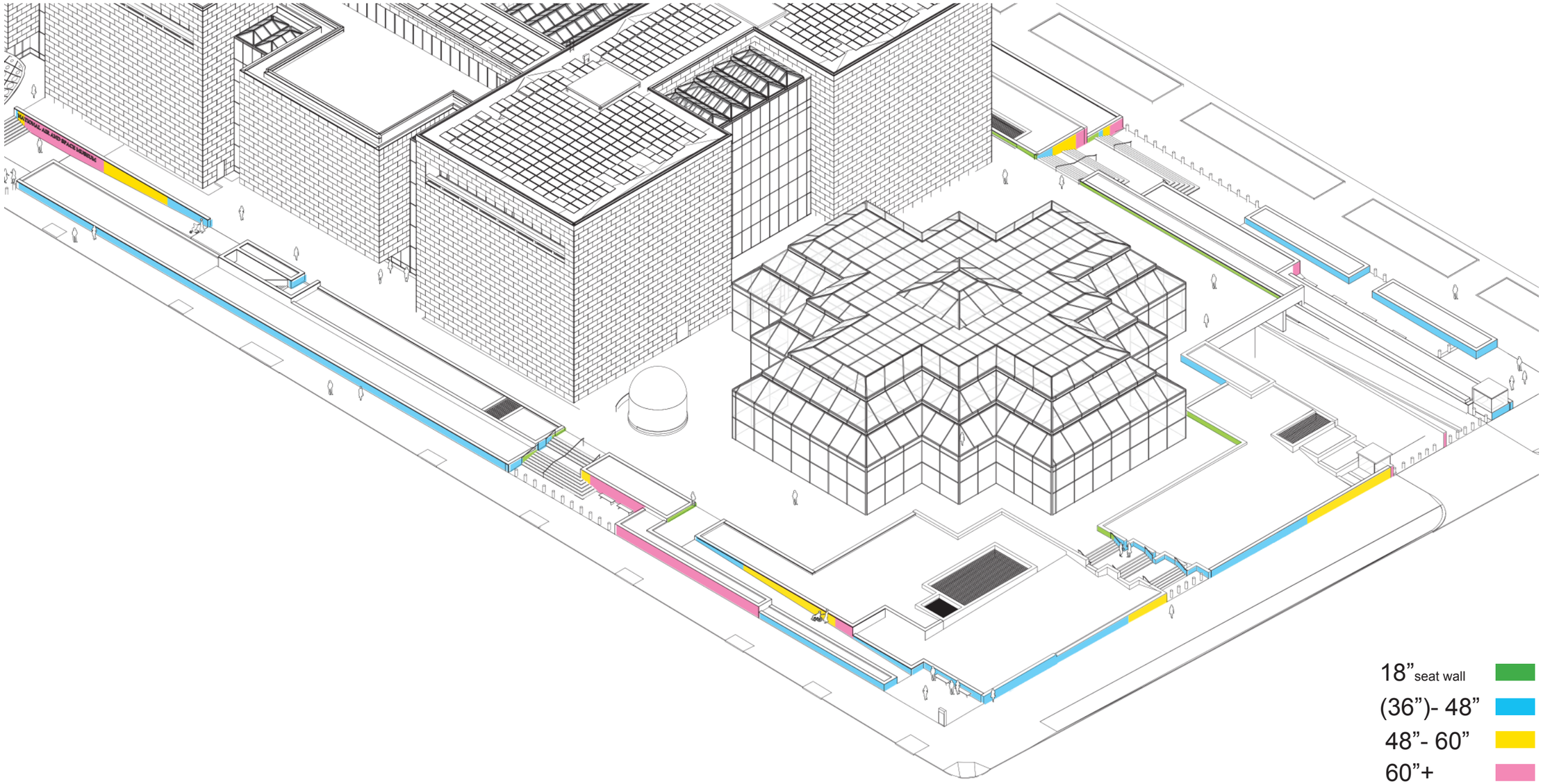
Existing - Southeast Section



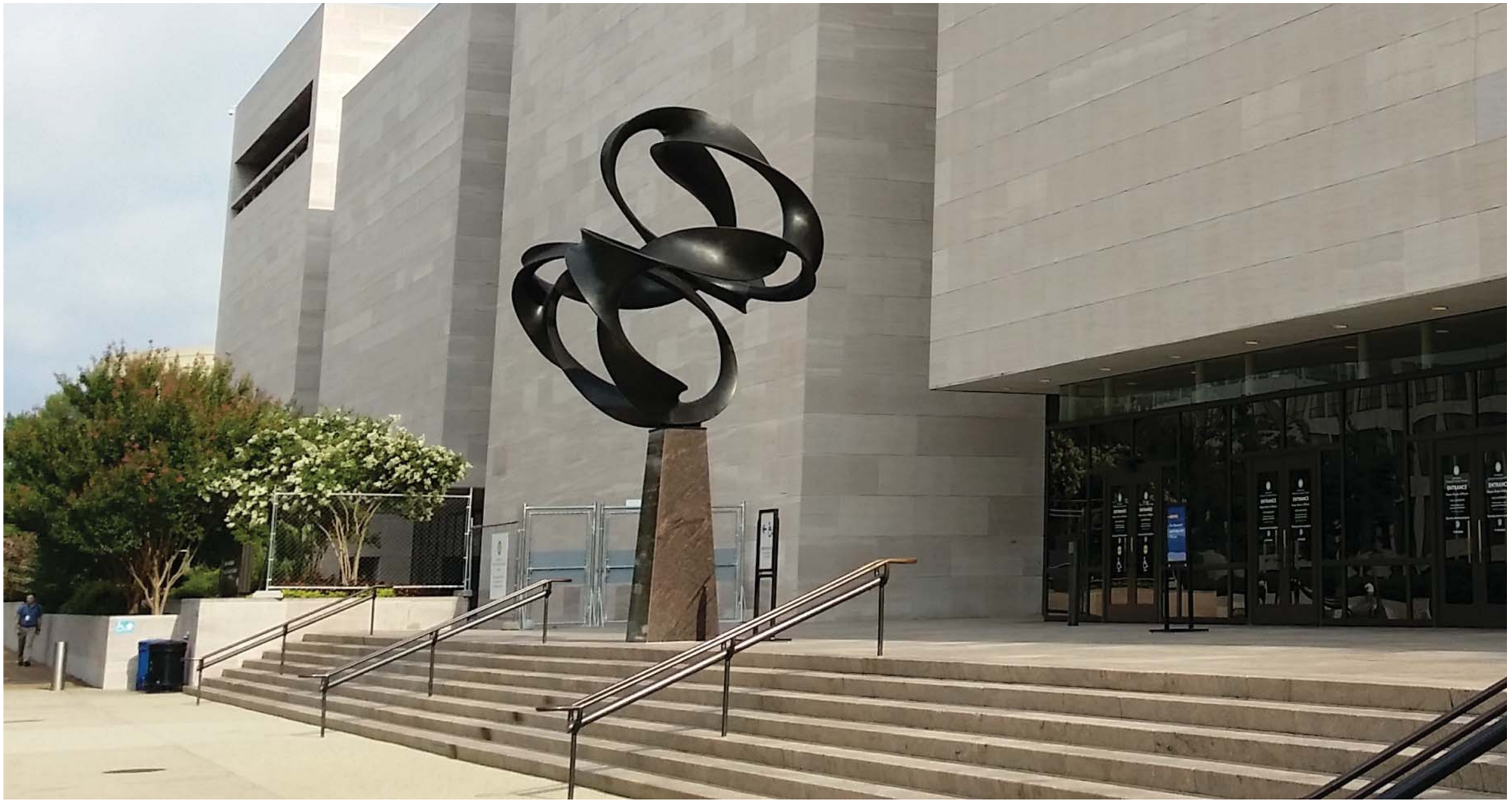
Existing Planter Wall Heights - Southeast Corner Axon

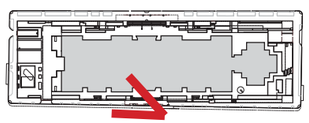


Scheme A Planter Wall Heights - Southeast Corner Axon

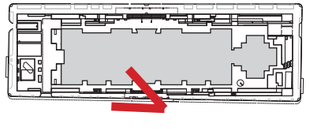


Scheme B Planter Wall Heights - Southeast Corner Axon

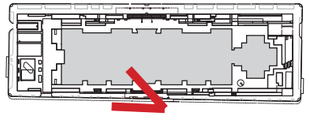




Existing - South Entrance

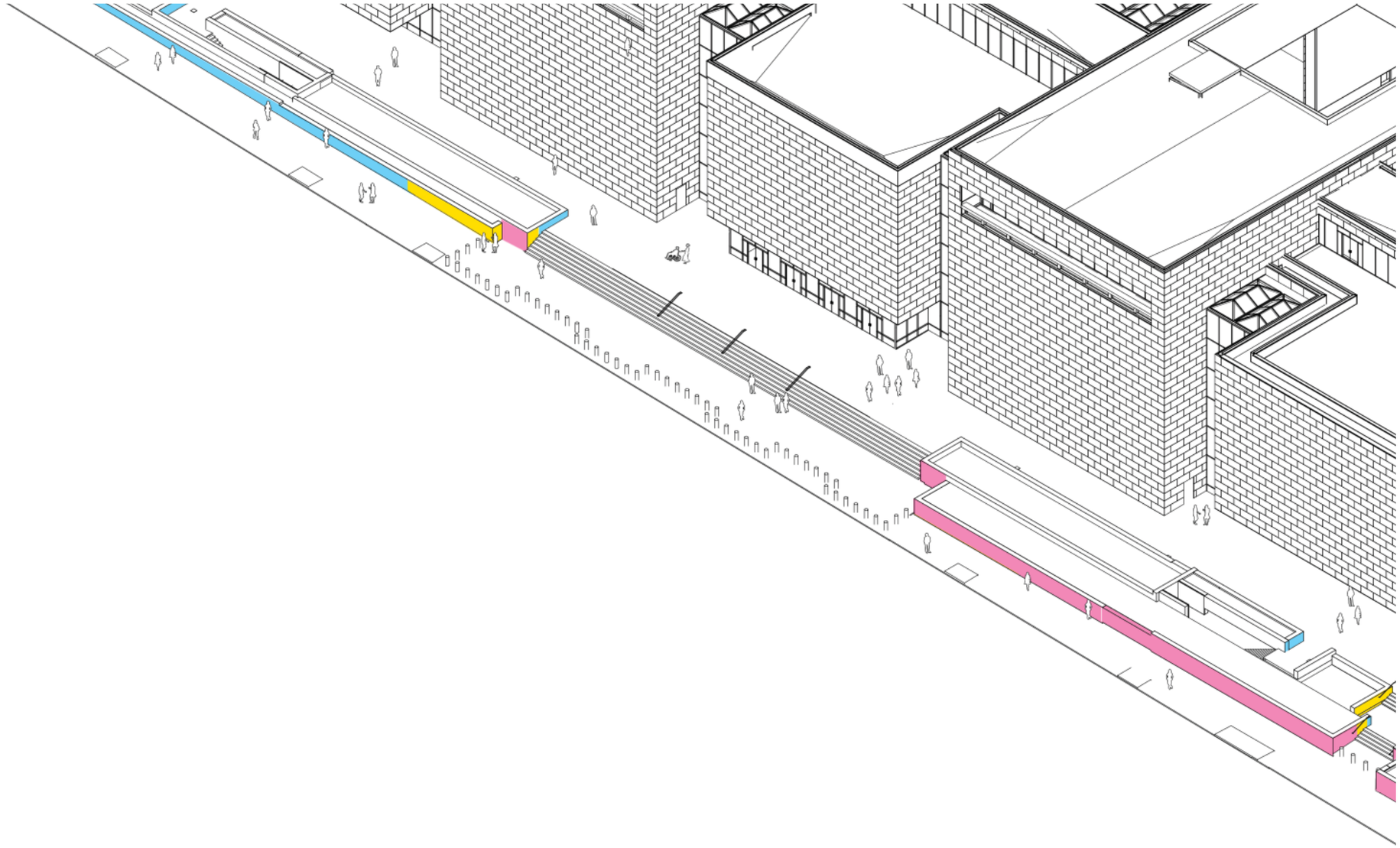


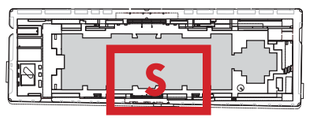
Scheme A - South Entrance



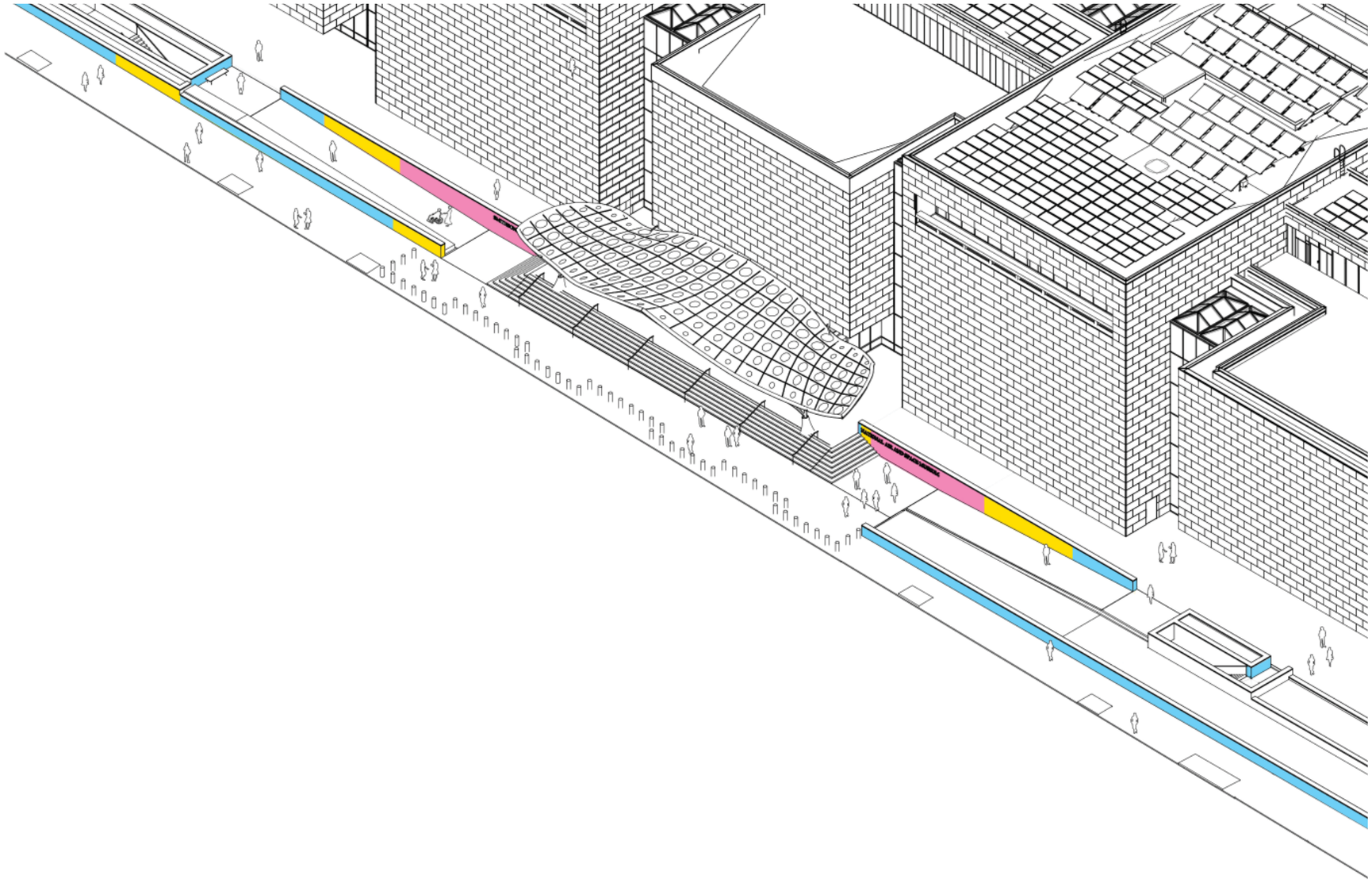
Scheme B - South Entrance

Smithsonian Institution
National Air and Space Museum



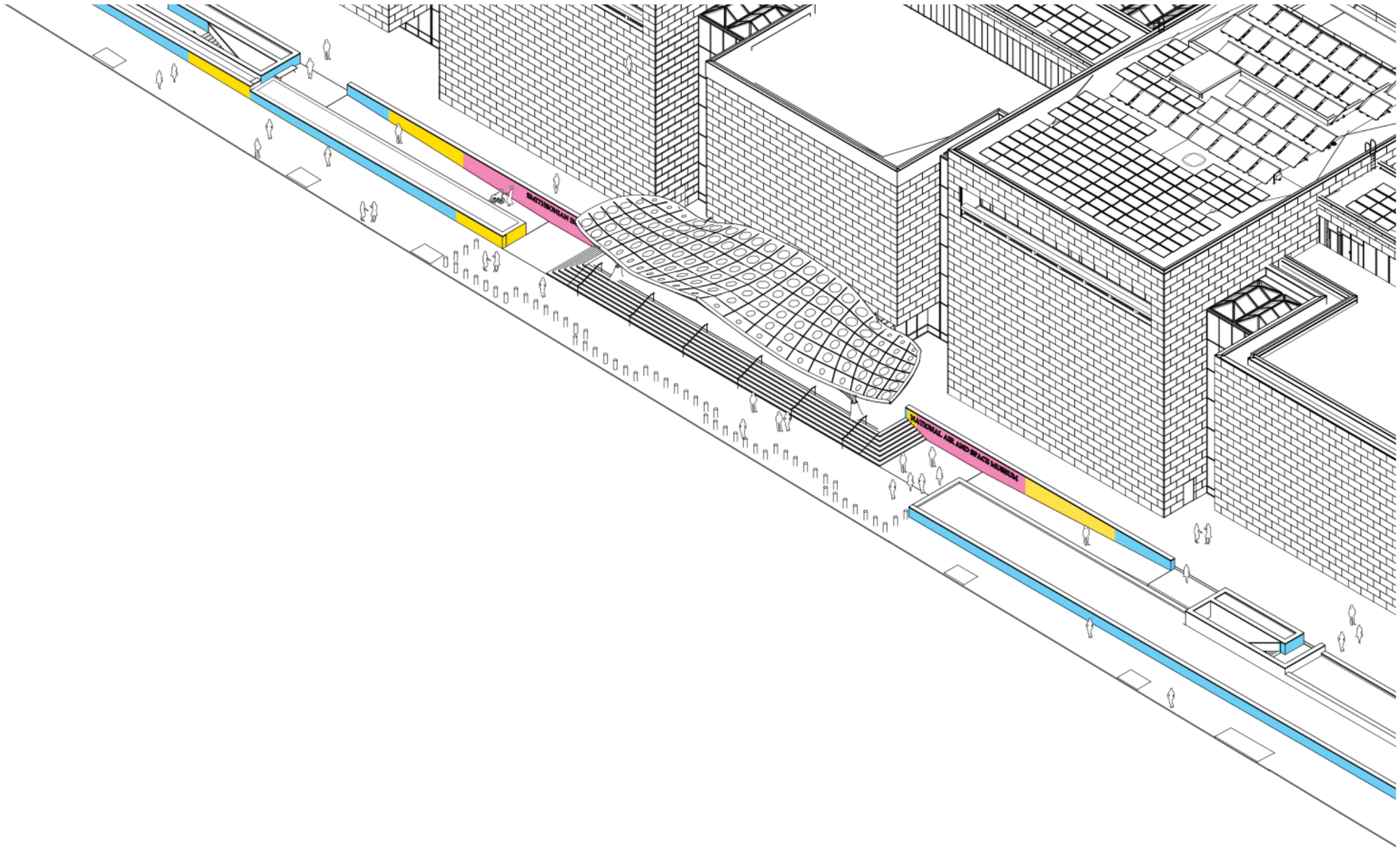


Existing Planter Wall Heights - South Entrance Axon

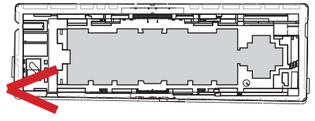


18” seat wall
(36”)- 48”
48”- 60”
60”+

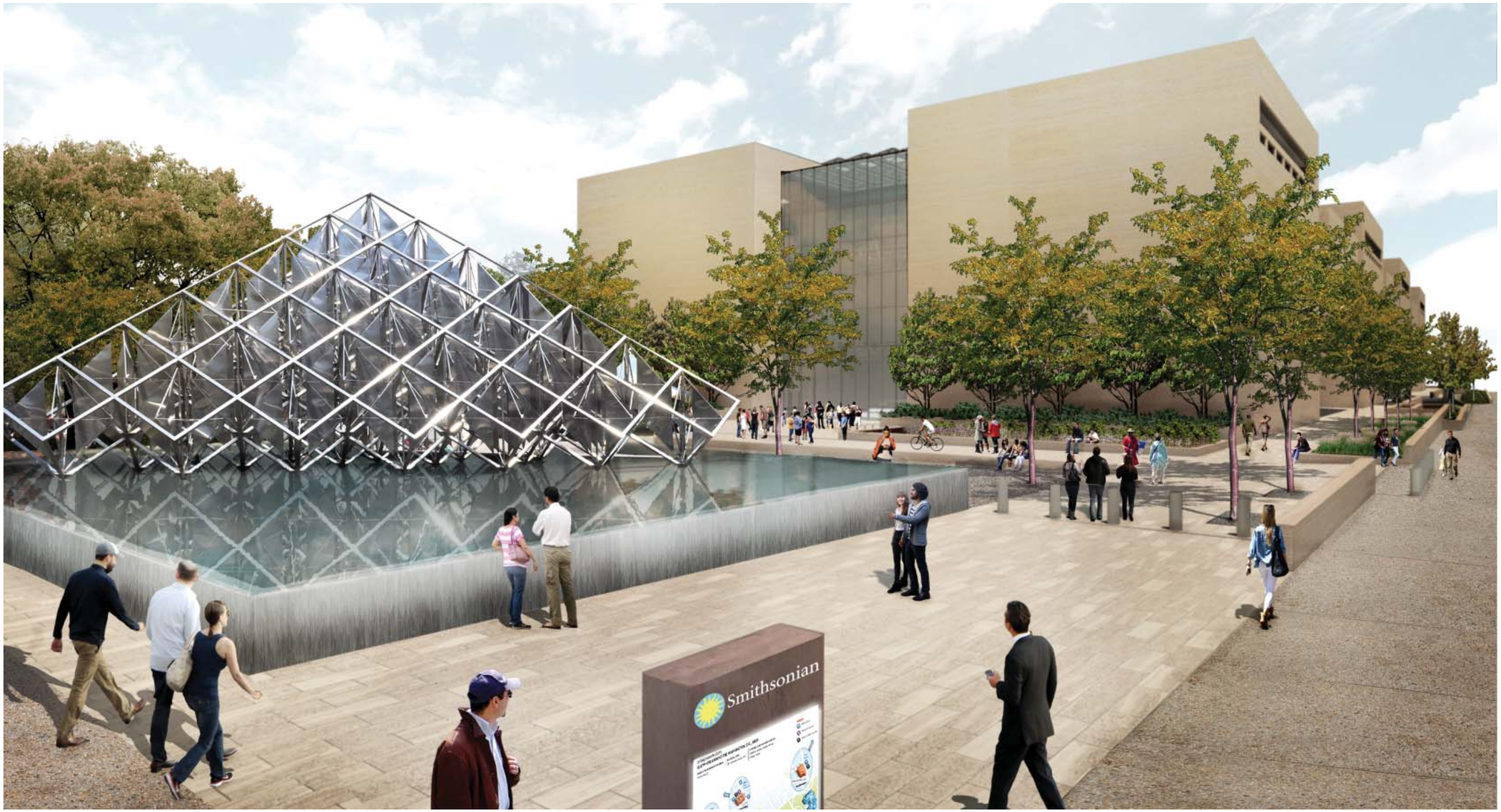
Scheme A Planter Wall Heights - South Entrance Axon

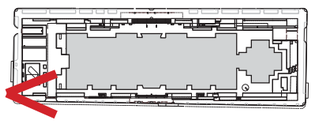


Scheme B Planter Wall Heights - South Entrance Axon

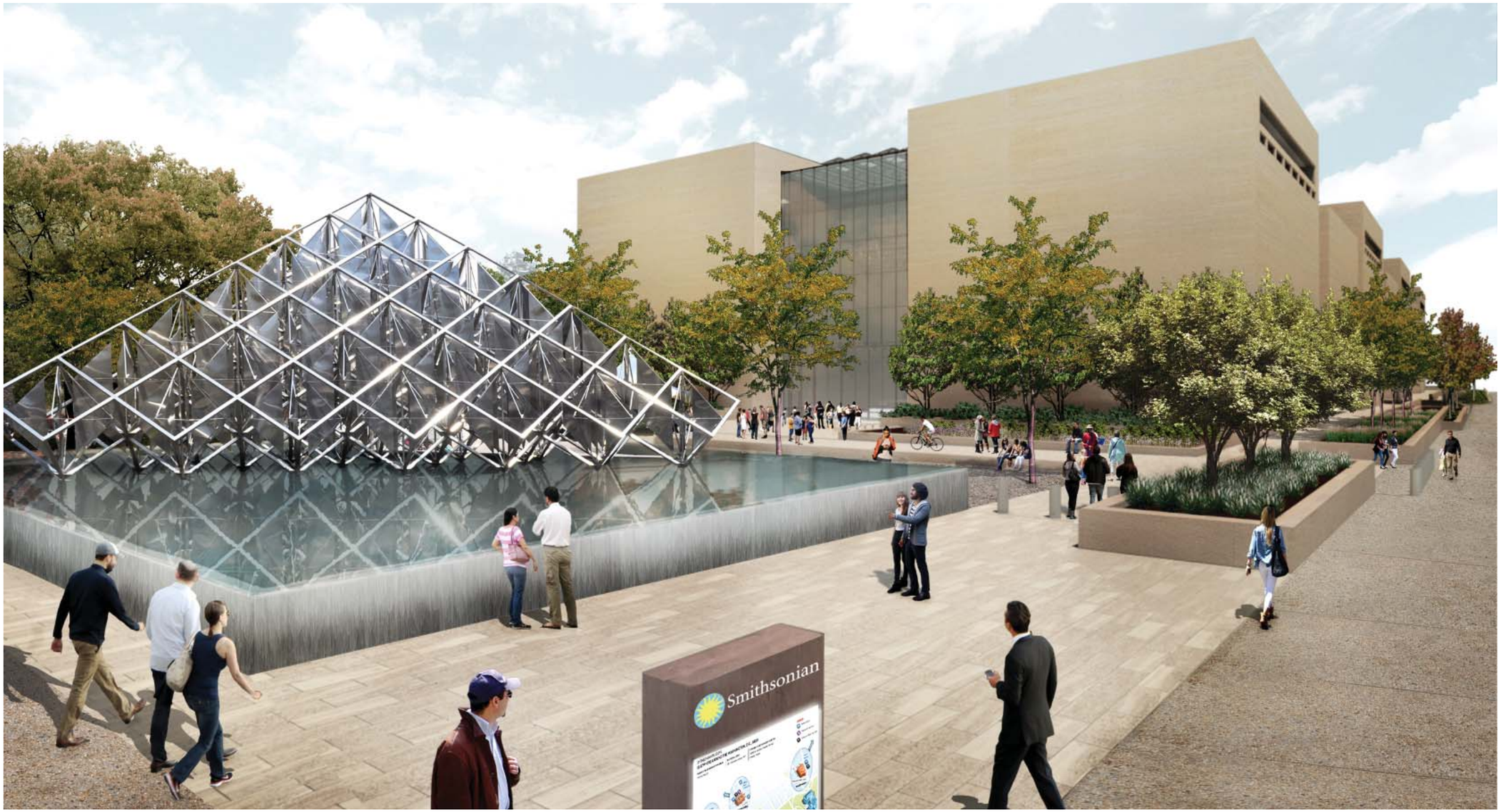


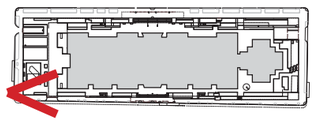
Existing - Southwest Corner



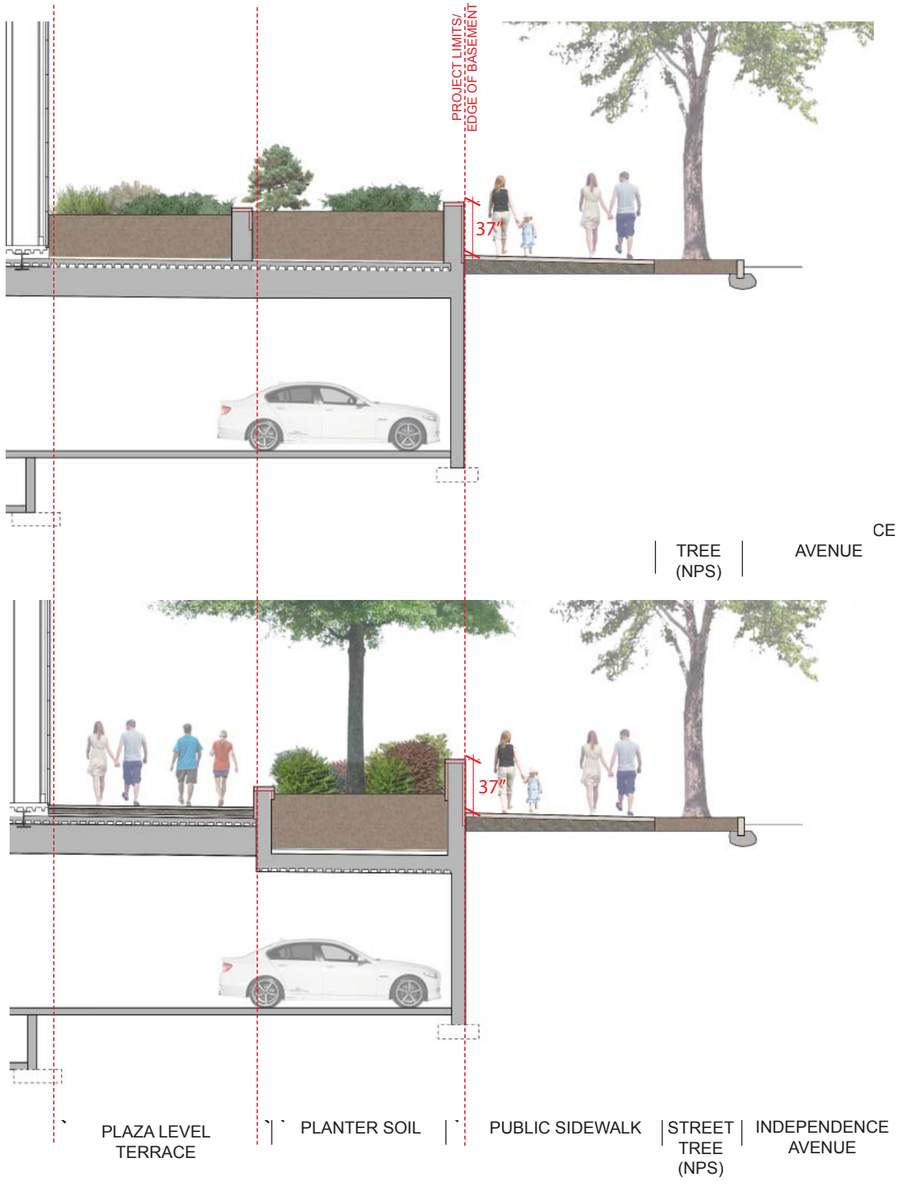


Scheme A - Southwest Corner



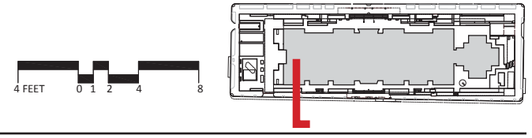


Scheme B - Southwest Corner



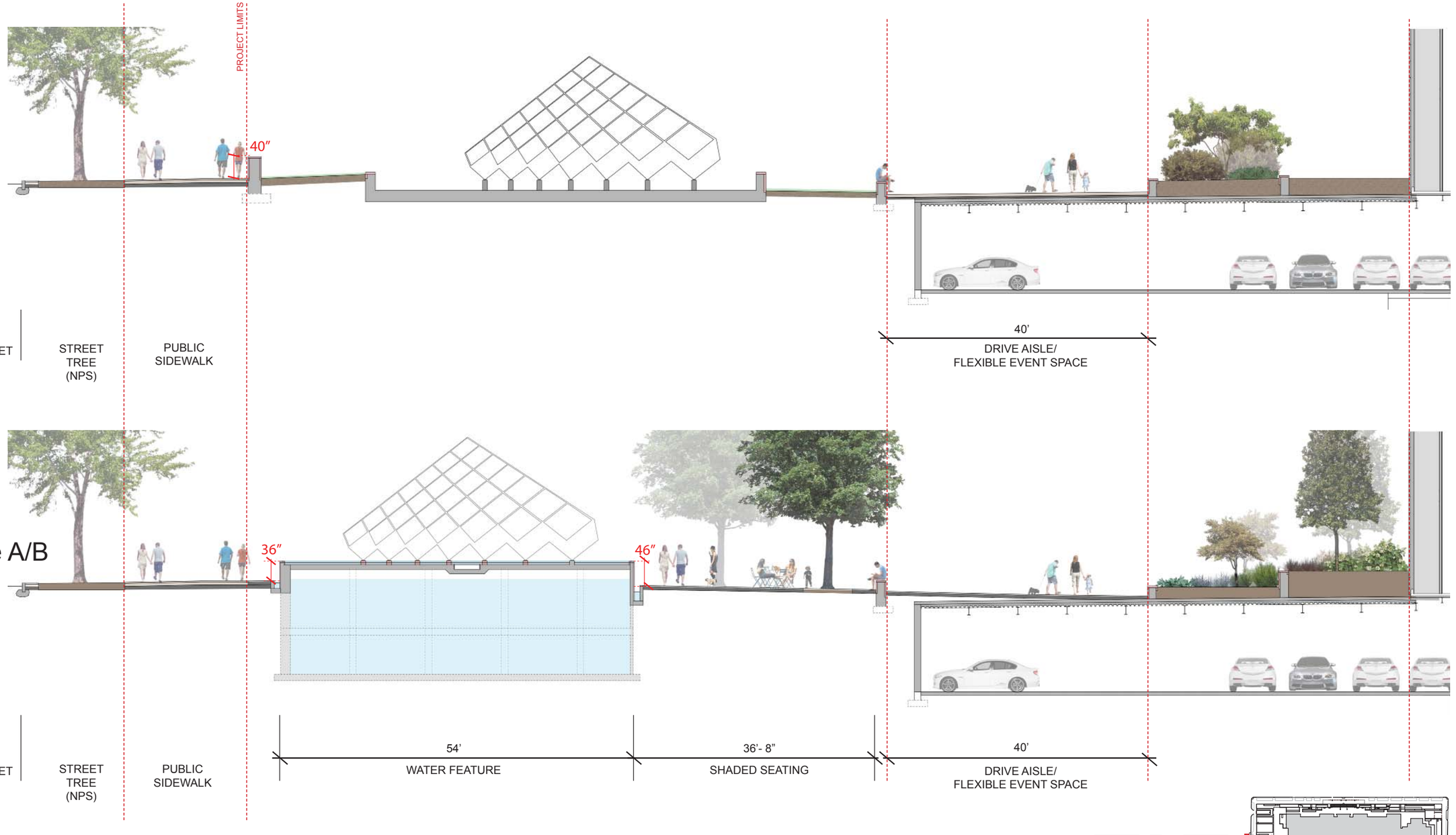
Existing

Scheme A/B



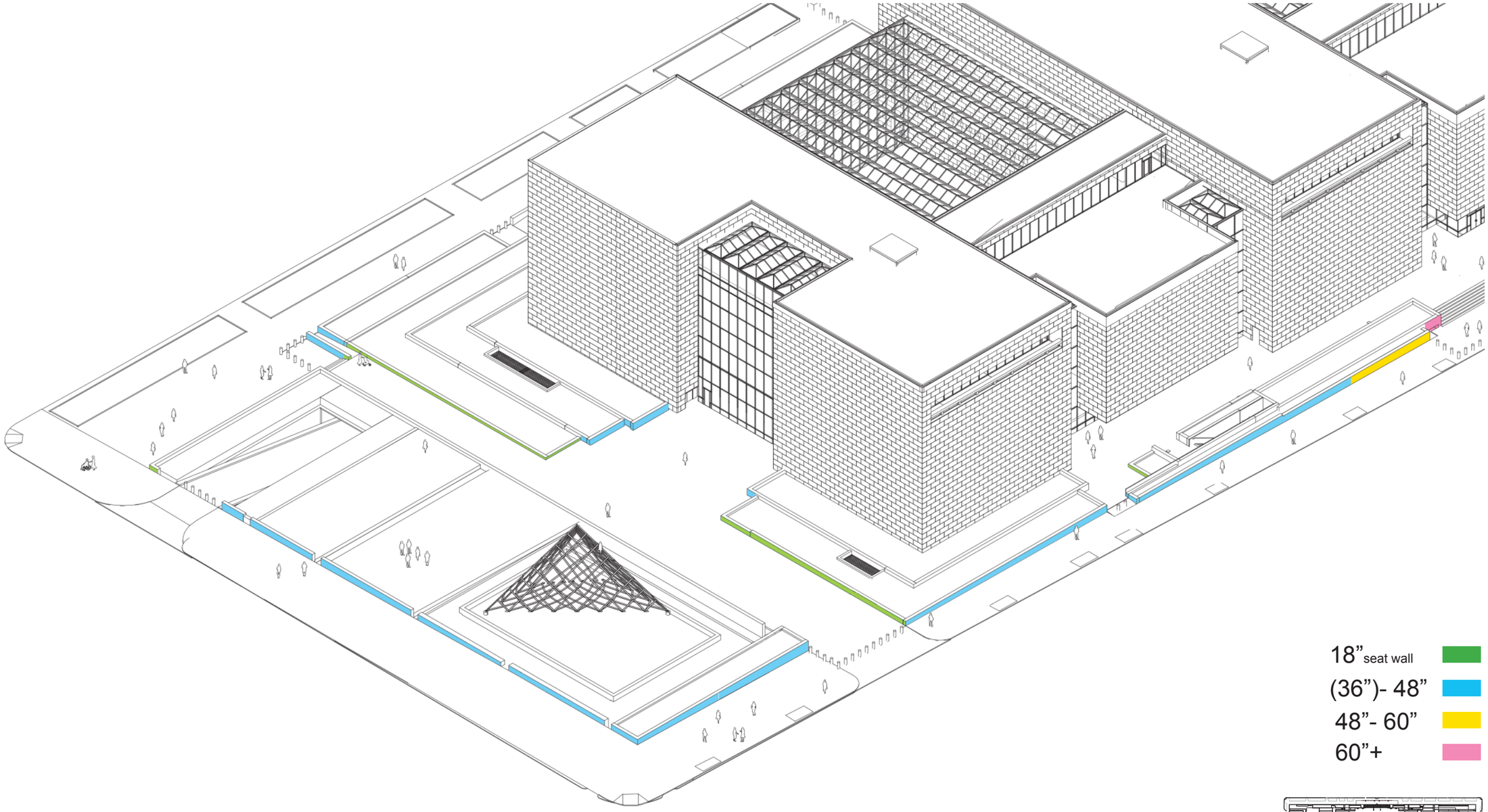
Existing - Southwest Section 1

Existing

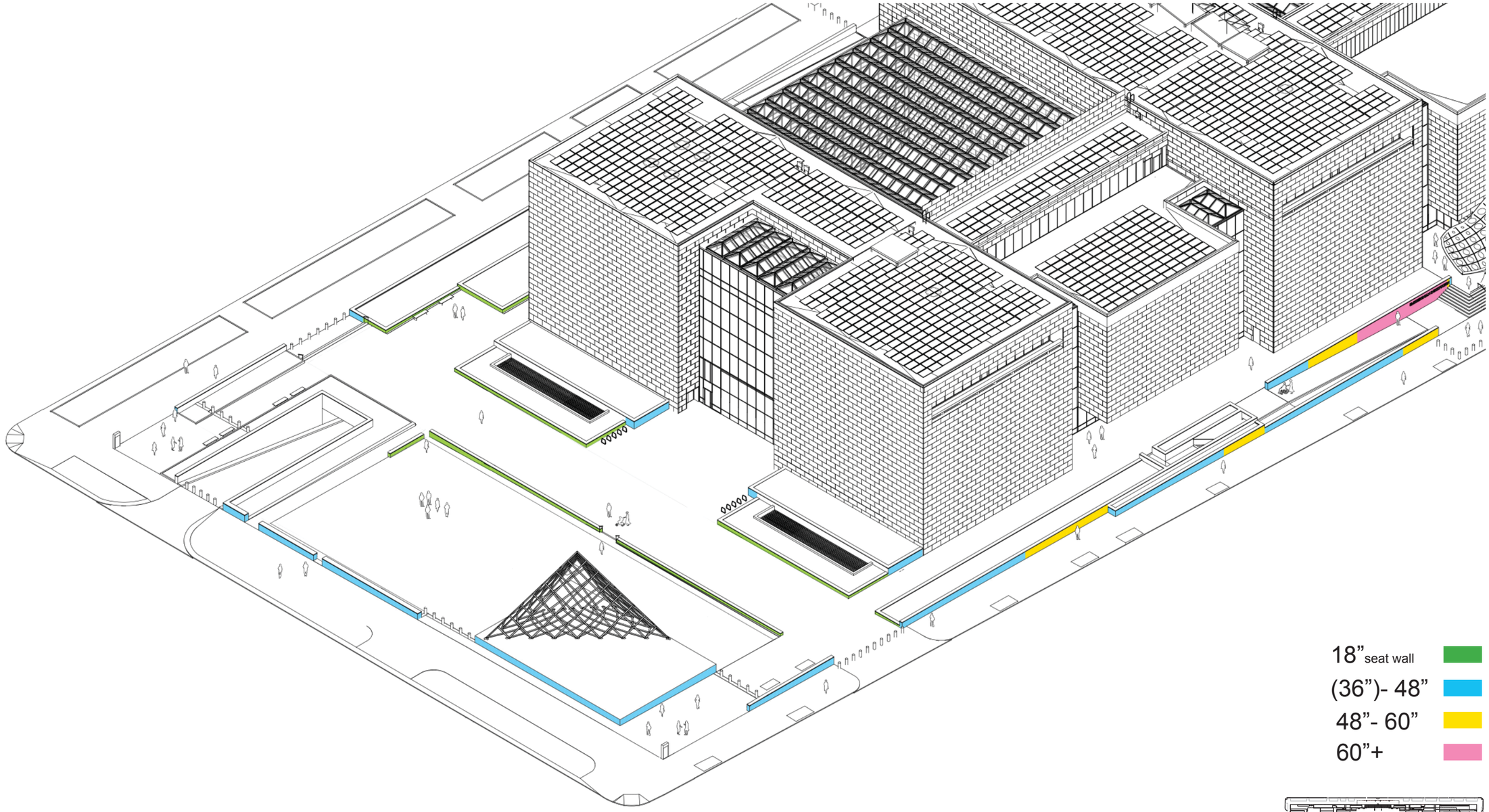


Scheme A/B

Existing - Southwest Section 2

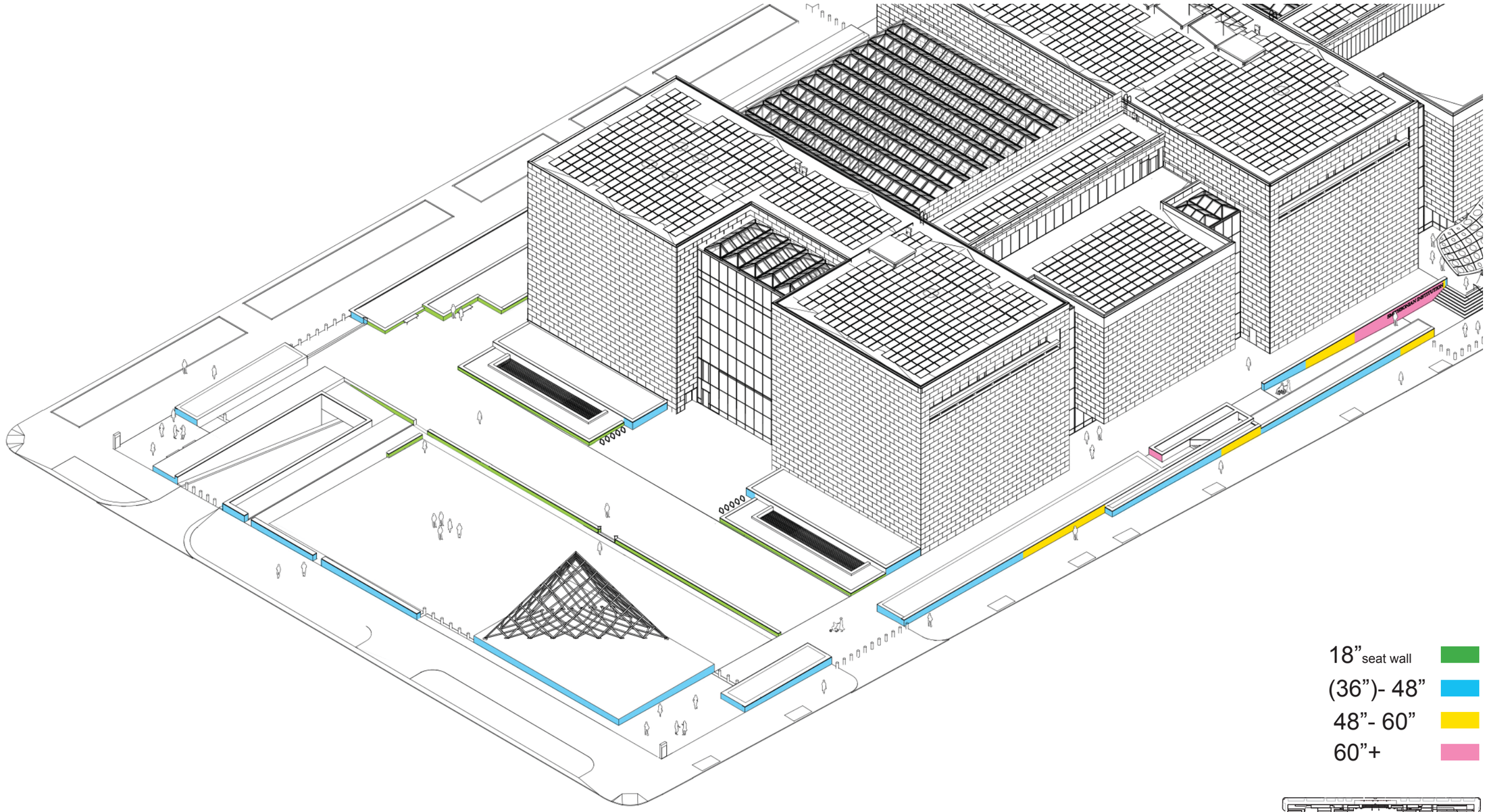


Existing Planter Wall Heights - Southwest Corner Axon



18” seat wall
(36”)- 48”
48”- 60”
60”+

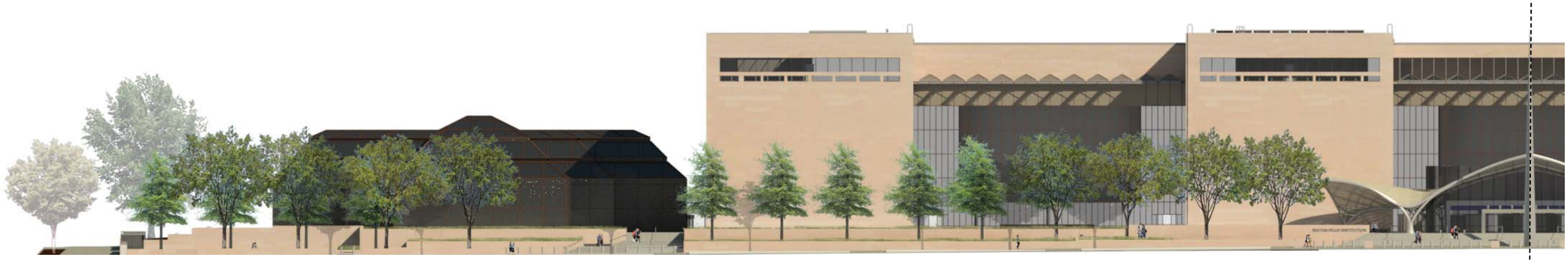
Scheme A Planter Wall Heights - Southwest Corner Axon



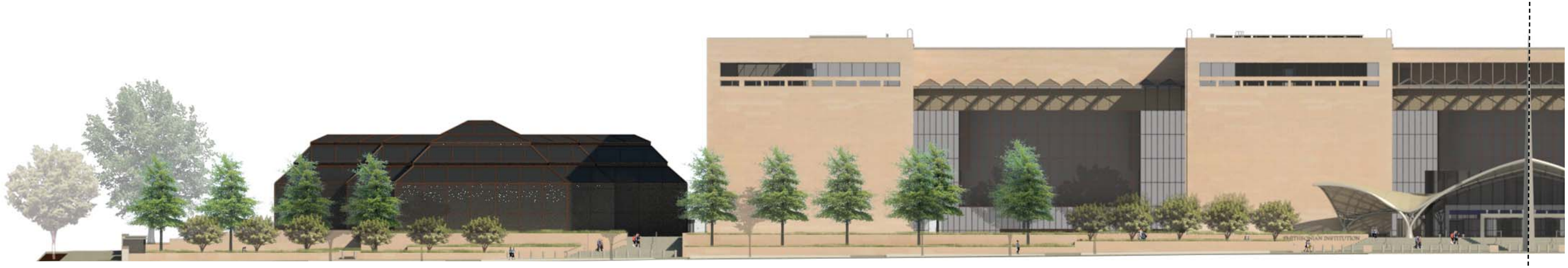
18” seat wall
(36”)- 48”
48”- 60”
60”+

Scheme B Planter Wall Heights - Southwest Corner Axon

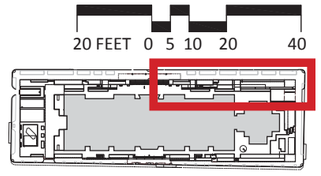
Elevations



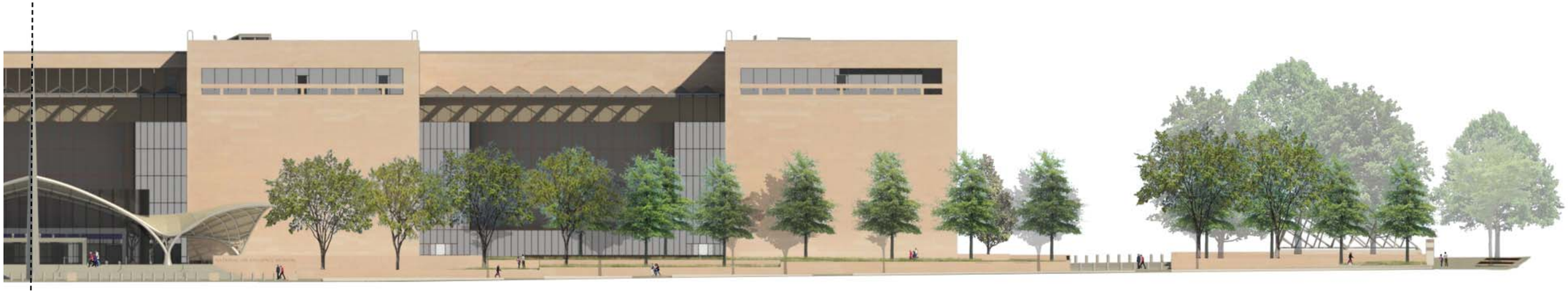
Scheme A



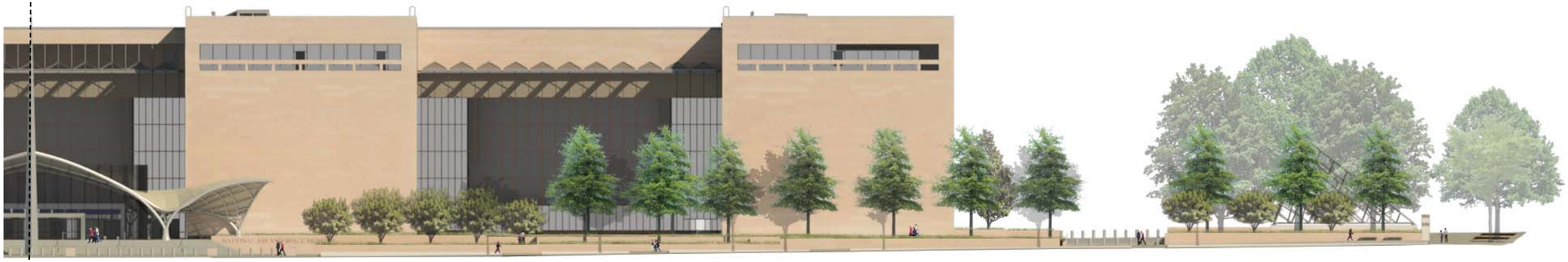
Scheme B



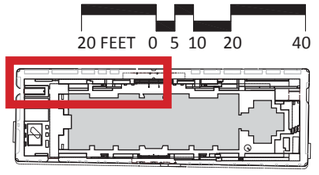
Scheme A+B - North Elevation



Scheme A



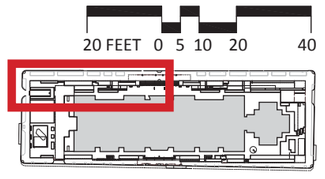
Scheme B



Scheme A+B - North Elevation

Scheme A

Scheme B

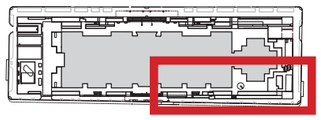


Scheme A+B - South Elevation

Scheme A

Scheme B

20 FEET 0 5 10 20 40



Scheme A+B - South Elevation

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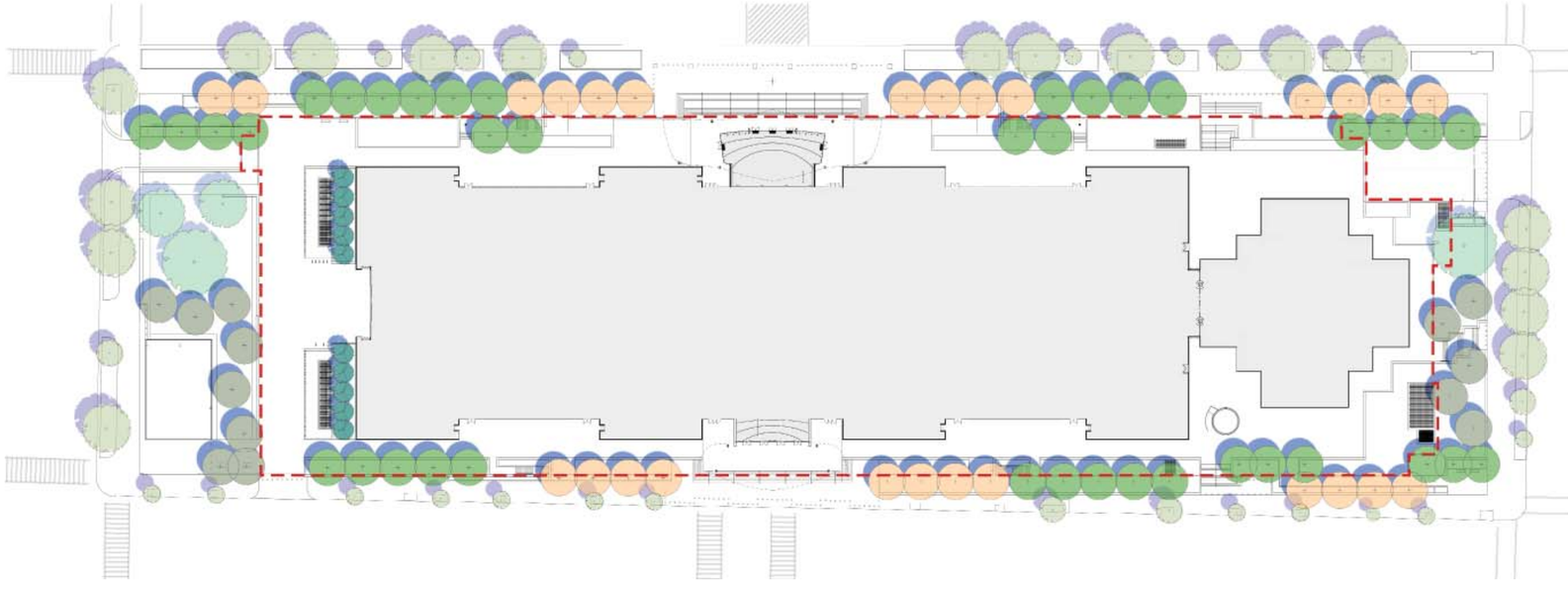
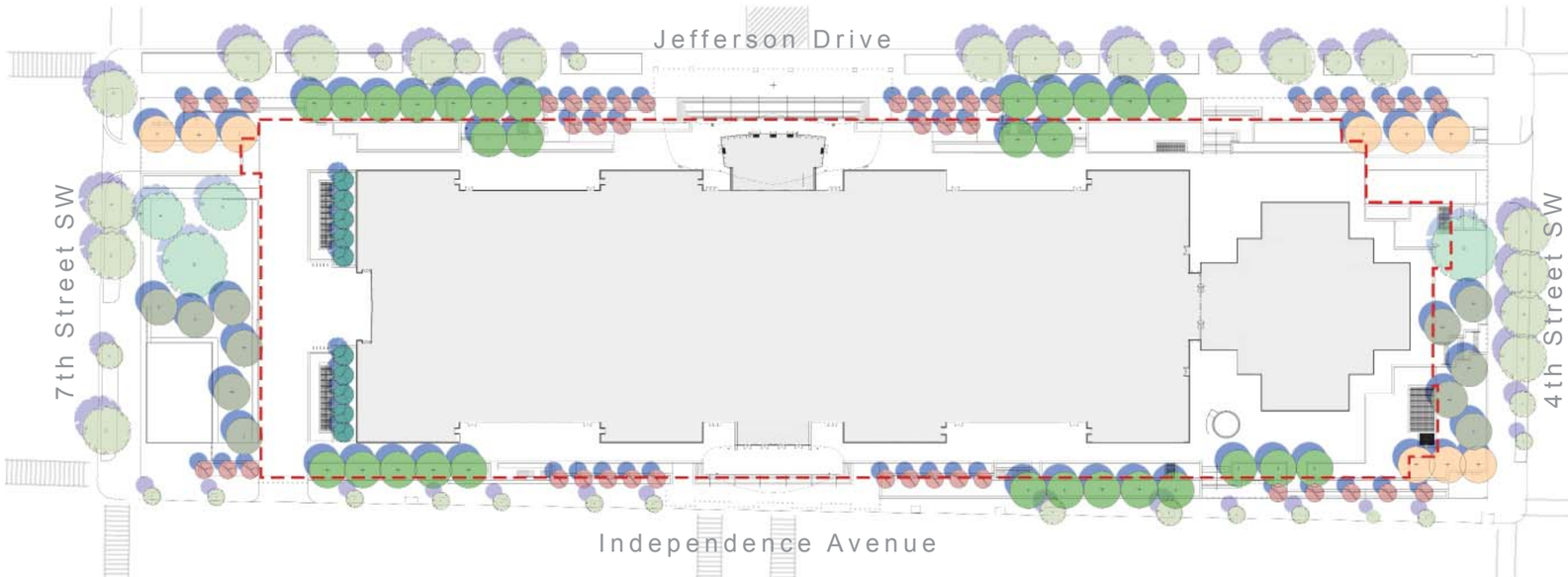
Plants, Soils, Water



Scheme A



Scheme B

- Pyramidal Canopy Tree
- Vase-shaped Canopy Tree
- Small Tree
- Evergreen Small Tree
- Existing Canopy Tree to remain
- Existing Sidewalk Tree
- Basement Edge of Structure

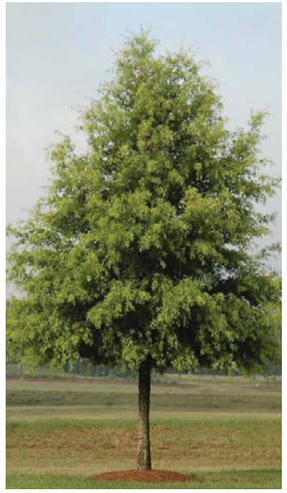
NORTH

40 FEET 0 10 20 40 80

Scheme A + B - Tree Canopy Plan

Shade Canopy Tree

'PRINCETON' AMERICAN ELM
Ulmus americana 'Princeton'



'HIGHTOWER' WILLOW OAK
Quercus phellos 'Hightower'

RED OAK
Quercus rubra

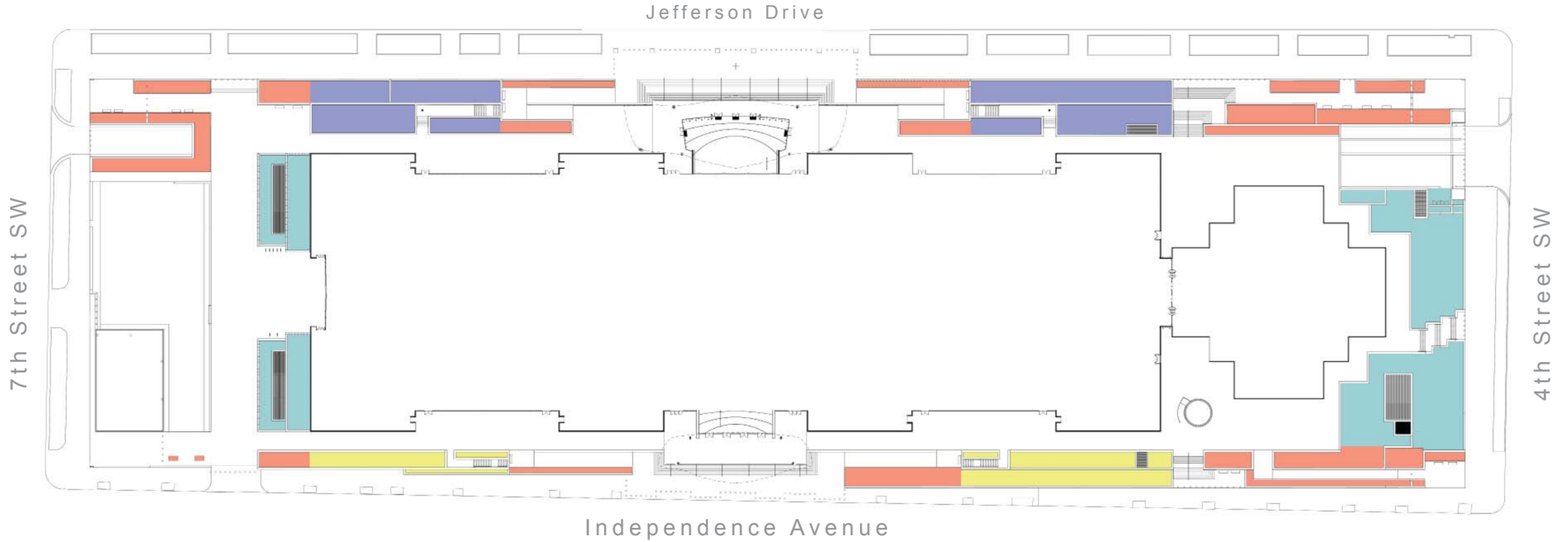
SWAMP WHITE OAK
Quercus bicolor

Small Tree

SERVICEBERRY
Amelanchier canadensis

IRONWOOD
Carpinus caroliniana

AMERICAN HOPHORNBEAM
Ostrya virginiana



LIFT-OFF

EARTH

MOON

SUN

NORTH

40 FEET 0 10 20 40 80

Ground Plane Planting Theme


Culver's Root
Veronicastrum virginicum'album'


Oakleaf Hydrangea
Hydrangea quercifolia 'Pee Wee'


Snowdrop
Galanthus nivalis


Sunflower
Helianthus x multiflorus'Sunshine Daydream'


Surprise lily
Lycoris squamigera


Dwarf Fountain Grass
Pennisetum alopecuroides 'Hameln'


Foamflower
Tiarella cordifolia


Bloodtwig Dogwood
Cornus sanguinea 'Midwinter Fire'


Feather Reed Grass
Calamagrostis x acutiflora'Karl Foerster'


Dwarf Fothergilla
Fothergilla gardenii


Hosta
Hosta 'Prairie Sky'


Bluestar Amsonia
Amsonia hubrichtii

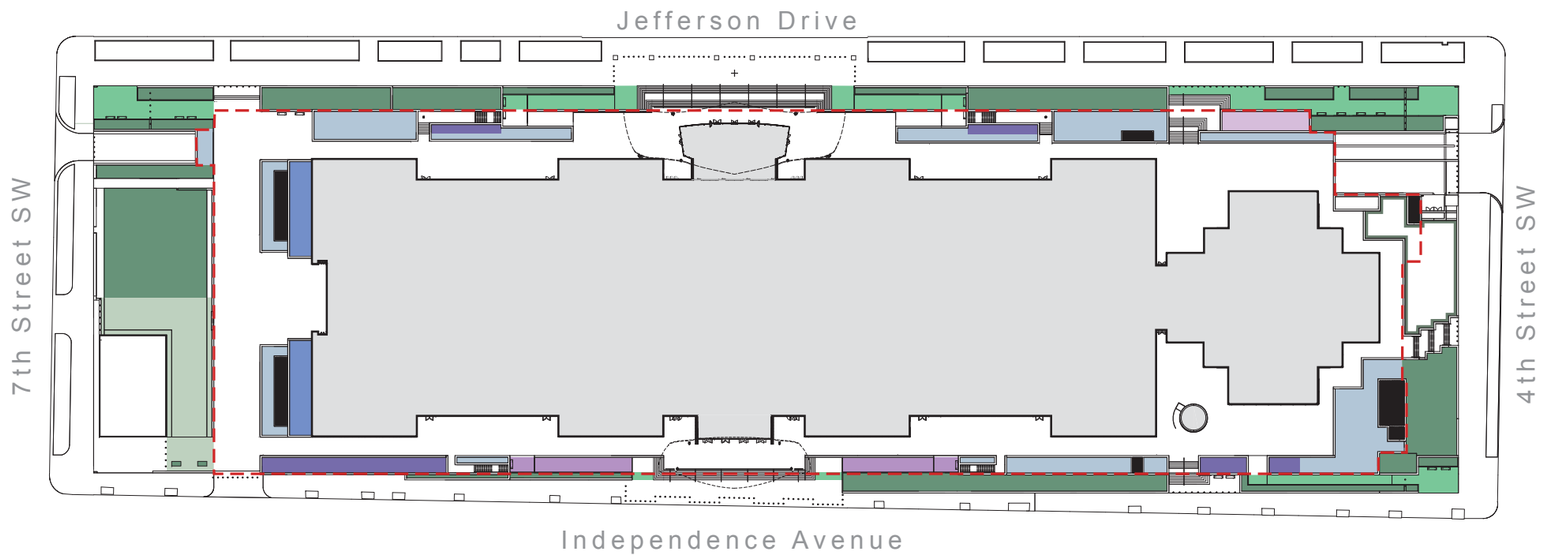
LIFT-OFF

EARTH

MOON

SUN

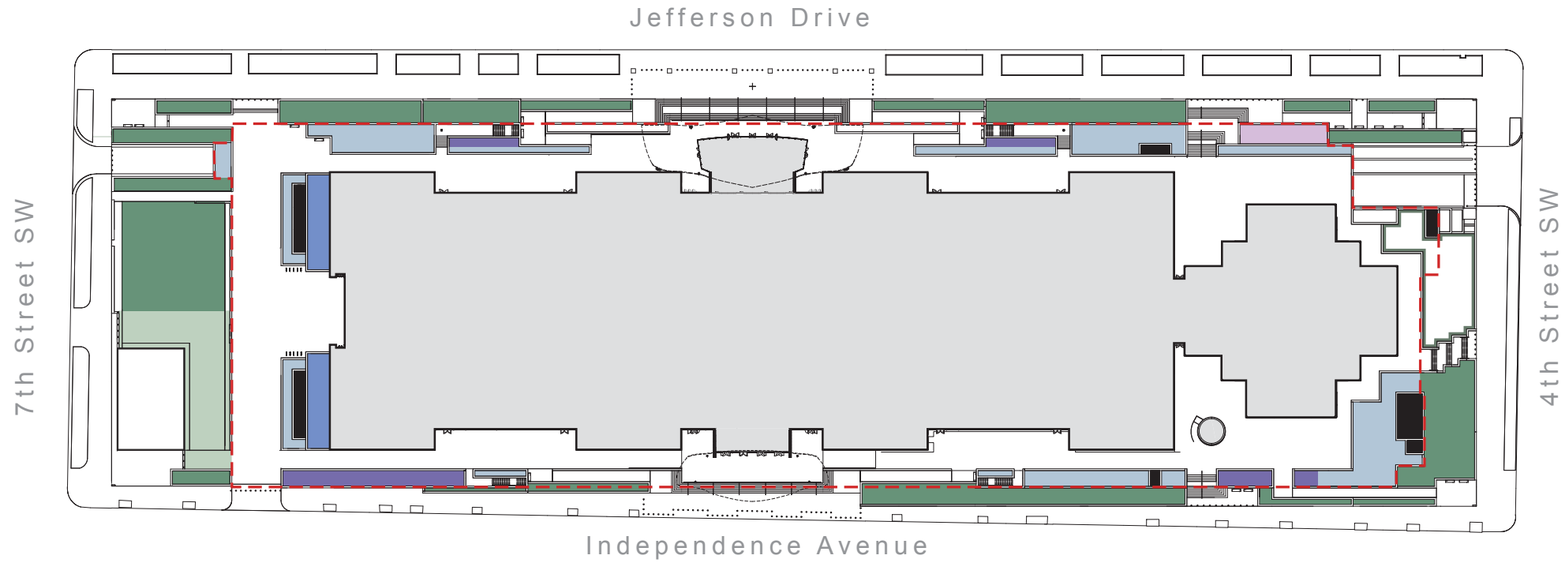
Ground Plane Planting, Tentative



Scheme A

Planting Soil Depth

- 24” on Existing Structure
- 24” on Modified Structure
- 48” on Existing Structure
- 48” on Modified Structure
- 36” under Supported Slab
- 36” on Grade



Structural Soil Depth

- 36” on Modified Structure
- 36” on Grade

Planting Area to Remain

- Basement Edge of Structure

Scheme B

NORTH

40 FEET 0 10 20 40 80

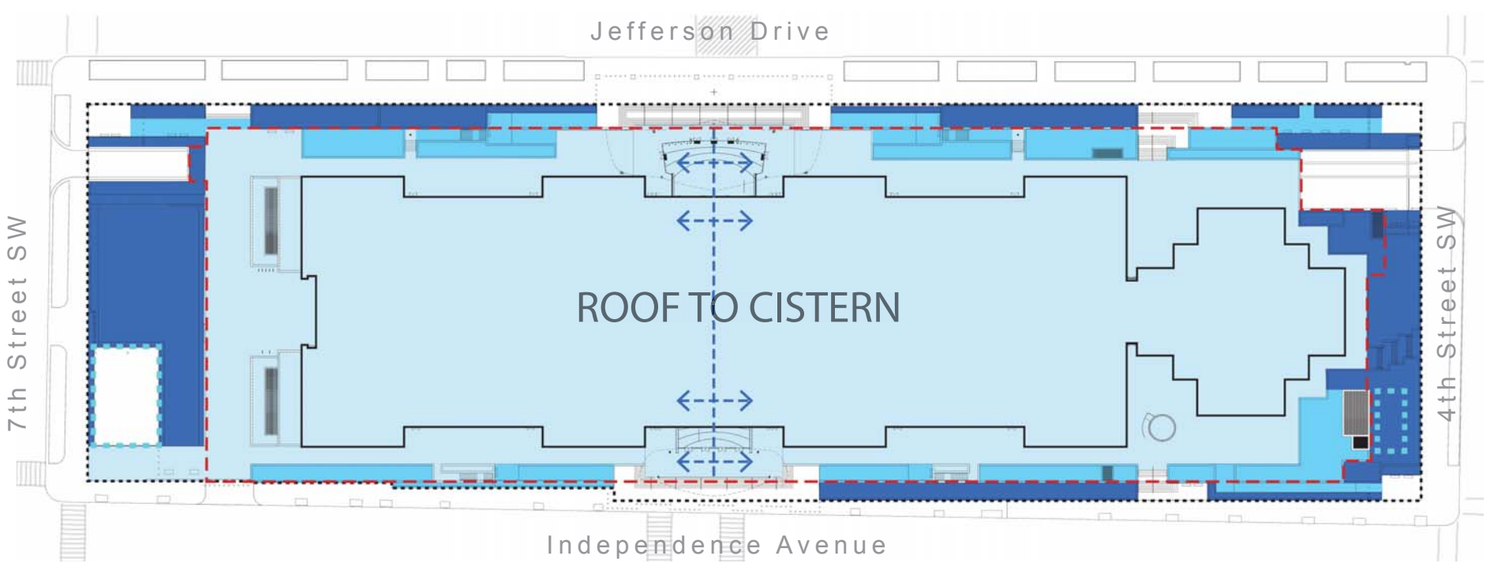
Scheme A+B - Planting Soil Diagram

Smithsonian Institution
National Air and Space Museum

Existing

- Project Scope-of-Work
- To City System
- Cistern (for Greywater Re-use)
- To Cistern
- Stormwater diverted to ongrade infiltration
- Ongrade Infiltration
- Basement Edge of Structure

(Note: 100 yr. storm overflow to city system)



Scheme A/B

NORTH

40 FEET 0 10 20 40 80

Stormwater Management Strategy

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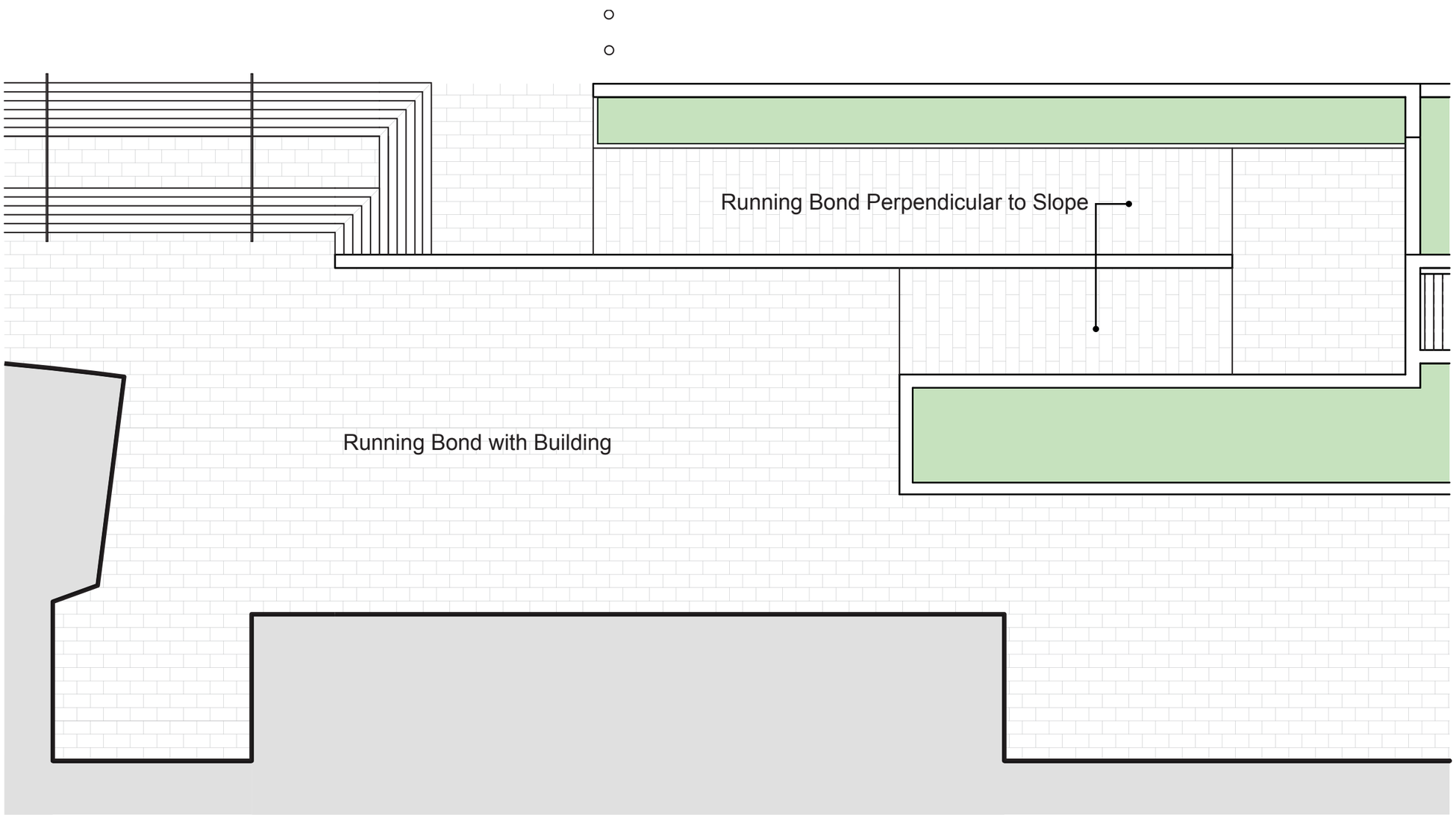
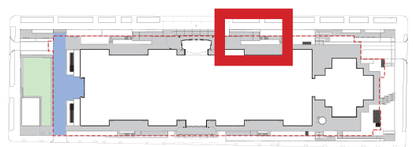
Visitor Environment





6 FEET 0 1.5 3 6 12

NORTH

Paving Design Concept, North Entrance Enlargement

Paving design simply reflects the monolithic character of the entire architectural composition. A running bond pattern of stone pavers laid out east-west to coincide with the building's principal elevations give the overall governing basis to the paving composition. All four corners and the base entrance areas at the north and south entrances pick up this extended pattern, reinforcing a visual connection to the building itself.

On the ascending walkways – all of which are under 5% in slope – the running bond paving pattern will be laid perpendicular to the slope so as to minimize joint drainage funneling and improve traction.

The kind of stone, and its finish, are to be determined with the selection of the building cladding stone.

Monolithic Stone Paver, Running Bond pattern

Monolithic Stone Paver, Reinforced

Permeable Paving Surface

Basement Edge of Structure

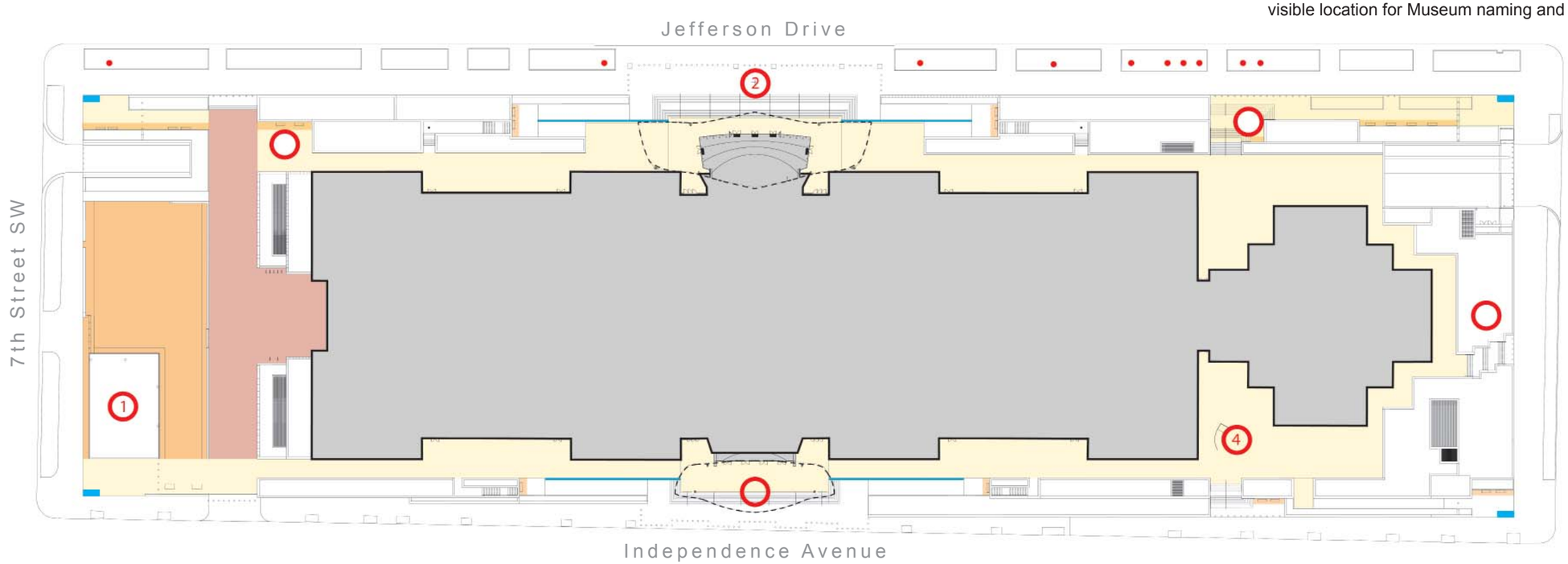
NORTH

40 FEET 0 10 20 40 80

Paving Design Concept, Plan Diagram

With a complete unified grounds design, the terraces and paved areas of the museum are more extensively available for future sculpture placement, interpretation and exhibits. Seating and supporting visitor amenities will be provided in a comprehensive fashion.

While signage design and planning is not a part of this presentation, it is worth noting that the walls at the north and south entrances provide a convenient and highly visible location for Museum naming and signage.



Sculptures and Site Amenities:

1. Delta Solar
2. Ad Astra
3. Continuum (location to be determined)
4. Haas Observatory

Potential Future Sculpture Location

‘Voyage’ Exhibition

Circulation/Potential Seating and Exhibition

Seating Area/Potential Interpretation

Flexible Exhibition Area

Signage

NORTH

40 FEET 0 10 20 40 80

Amenities

① Delta Solar

② Ad Astra

③ Continuum

④ Haas Observatory

Sculpture and Observatory Photos

North Entrance Wall - signage study

Vestibules

1.2.2 SECURITY VESTIBULES

Existing Conditions

The visitor experience at NASM currently begins with an inadequate entry experience that lacks sufficient wayfinding, modern security features, protection from the elements, and the kind of welcoming, well organized, and logical flow more fitting to introduce aviation and space treasures just inside one of America's most visited museums. With an average of approximately 7 million visitors per year, the existing physical security screening systems is incapable of allowing entrance to the museum fast enough to keep up with demand on a typical weekend in the summer or during holidays. This leads to extensive queues of several hundred people at the north and south entrances with wait times over 30 minutes in frequently inclement weather conditions.

The security gates resemble airport security checkpoints, with magnetometers and x-ray machines. There are no signs explaining the procedure, and with the number of foreign visitors, there is sometimes a language barrier. Because the security gates are located only 8-10 ft. inside the inner vestibule doors, visitors do not see what they have to do until they are almost at the security gate itself. Parents with strollers have to remove all the bags and other accoutrements from the strollers, place them in the bins, and then re-pack the strollers at the other end of the x-ray machine. Unlike at airports, there are no tables on which people can place their things as they approach the x-ray machines.

Master Plan

The 2013 Master Plan recommended the construction of security vestibules to address the problems of long, inhospitable lines and the fact that the security stations detract from the exhibits within the Milestones of Flight gallery where many of the museum's most important collections are exhibited -- including the Spirit of St. Louis and the Mercury space capsule. The performance criteria for the vestibules listed below is as prescribed by the Master Plan.

- Security
  - Mall Side: 4 lanes
  - Independence Ave Side: 3 lanes
- Inside Queuing
  - Maximum wait time: 5 minutes inside
    - Mall Side: 2,000sf (185.8m^2) Vestibule
      480sf (44.5m^2) Screening Equipment
    - Independence Ave Side: 1,500sf (139.4m^2) Vestibule
      360sf (33.5m^2) Screening Equipment
- Protected Outdoor Screening

Massing and Materiality of Proposed Vestibules

As informed by SI's recommendation to incorporate the mission of the museum "to commemorate, educate, and inspire" in the vestibule design, the proposal evokes the images of the early flying machines developed by Leonardo DaVinci and the Wright Brothers as exhibited within the building by implementing a tensile roof that has the abstract shape of wings. This continuous roof encloses a curtain wall vestibule and provides protection of adjacent exterior queue areas.

The integration of these forms in plan and elevation responds to the architectural rhythm of the existing building. The shape of the roof expands and contracts to create larger covered areas on the central axis of the building at the north entrance, then reduces in size before enlarging again to protect the queues in front of the flanking stone clad pavilions. This dynamic undulation helps evoke the imagery of flight, similar to the earlier explorations for DaVinci and the Wright Brothers, with the update of contemporary, progressive methods of construction that allow these structures to be built more efficiently in the present day. The organic shape of the roof form also helps the visual integration of the landscape with the building.

The security screening is located within a transitional space of reduced width and lower ceiling height, creating the impression of spatial "compression" before being "released" into the large expanse of the Milestones of Flight gallery, energizing the visitor experience.

Facilitating Visitor Flow

A method of increasing "through-put" without increasing security staff requirements is the use of "divest and composure" tables located before and after the security equipment respectively in the visitor entry sequence. This provides visitors an opportunity to prepare for the screening process by placing their bags in a bin on a divest conveyor belt, with the collection of their possessions from the composure tables without obstructing visitor flow. When combined with improved signage to inform visitors of the screening requirements in advance of arriving at the security lanes, these methods can accelerate the security screening process. The use of divest and composure tables requires an increase in area beyond the prescribed totals listed in the Master Plan in order to accommodate these functions.

North Vestibule Perspective View from National Mall -- June 2015 Concept CFA Report

North Vestibule Perspective View From Northeast -- June 2015 Concept CFA Report

Comments from the Commission of Fine Arts, Concept Design

[The Commissioners] **recognized the impetus of the space program in developing such technologies as photovoltaic panels**, and they identified the great opportunity in this project to express these innovative technologies in a more comprehensive way in the renovation of the building.

Instead of the current proposal to treat new entrance canopies and photovoltaic arrays as unrelated elements added to the reconstructed stone shell of the building, they **recommended that these pieces be more fully integrated with each other**-and even with the building enclosure panels-transforming the existing architecture to convey the critical role of technology in air and space travel.

From the letter, June 26 2015, from Thomas E. Luebke, FAIA, Secretary

Smithsonian Institution Consideration of CFA Comments

The design team has addressed the comments of June 18 2015, in a number of specific ways. The team has:

- Combined the application of the photovoltaic panels with the development of the vestibule canopy.
  - Thin film photovoltaics adapt to the curvilinear form of the canopy, providing shelter from sun while capturing its energy with the use of space age technology
  - Integrated solution more fully develops the intervention while maintaining the character of the existing building
- The proposed north and south canopies were further designed to provide a more consistent form as applied to both locations as variation on a theme

South Vestibule Perspective View from South -- June 2015 Concept CFA Report

South Vestibule and South Wall Solar Panel Array Perspective View from Southeast June 2015 Concept CFA Report

South Vestibule Perspective View from Southeast -- June 2015 Concept CFA Report

Visitors waiting in line to enter the museum at the north entrance

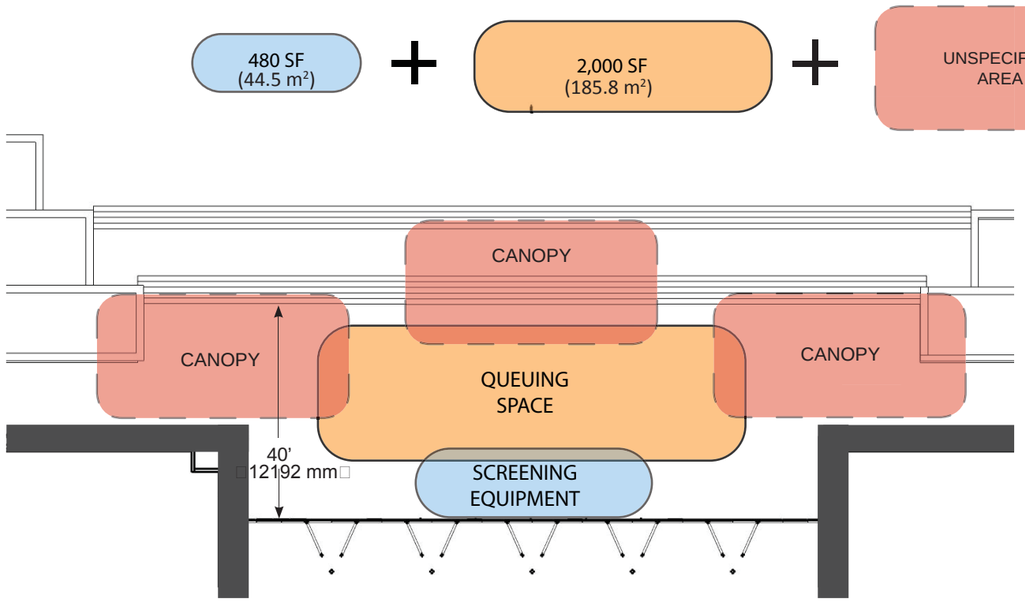
Entrance queue within north vestibule

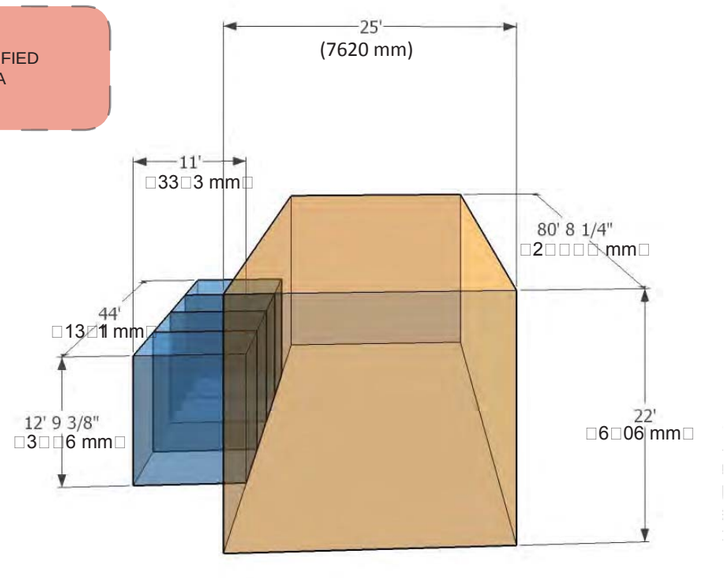
Security screening inside the north entrance

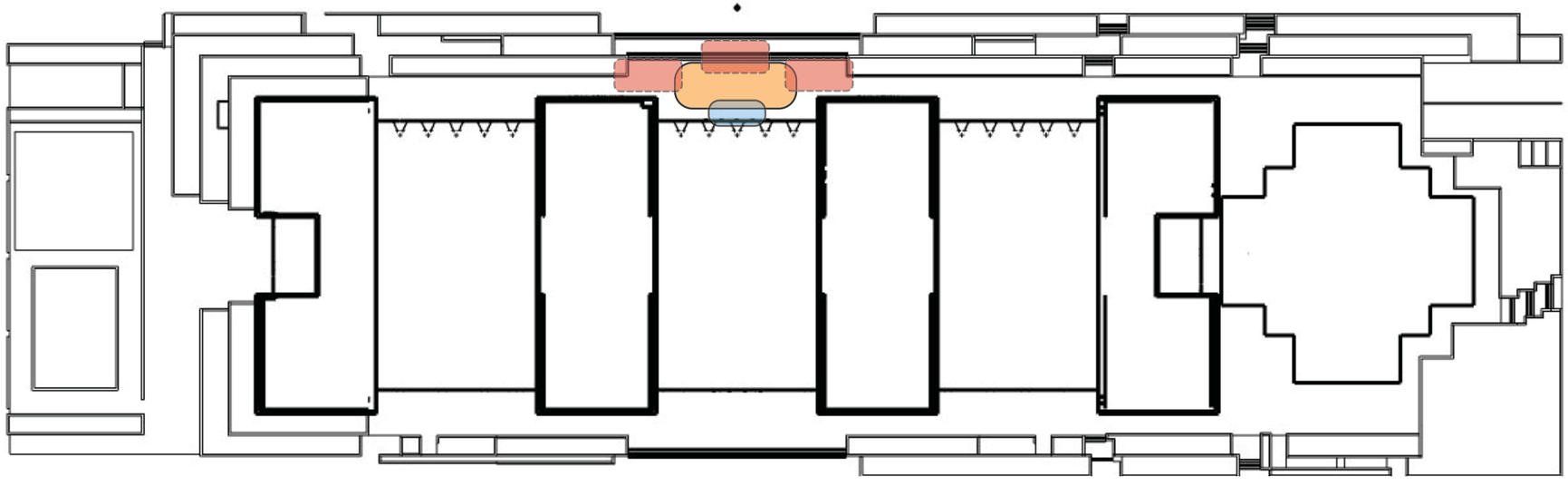
Visitors waiting in line to enter the museum at the south entrance

Entrance queue at south entrance

Security screening inside south entrance

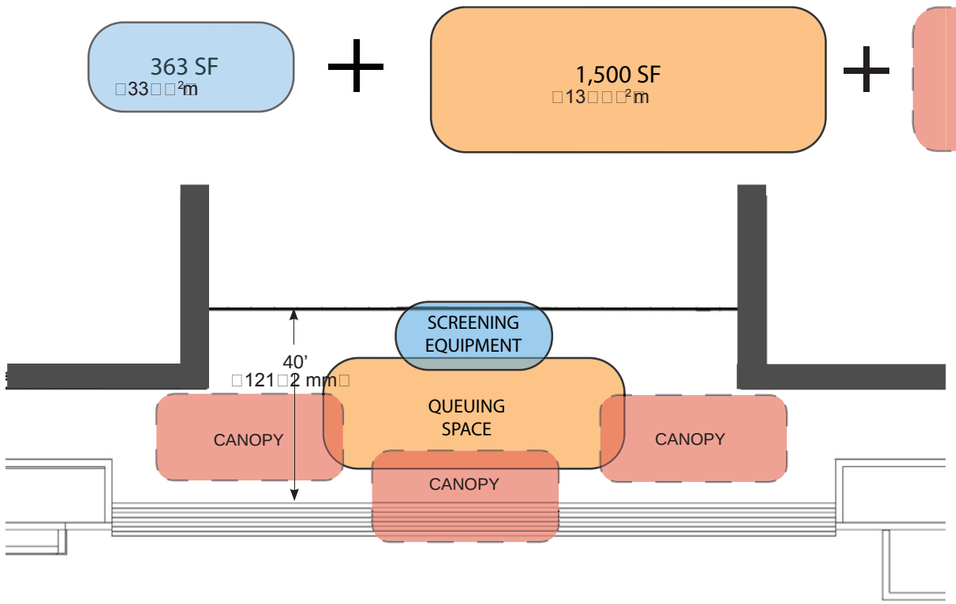


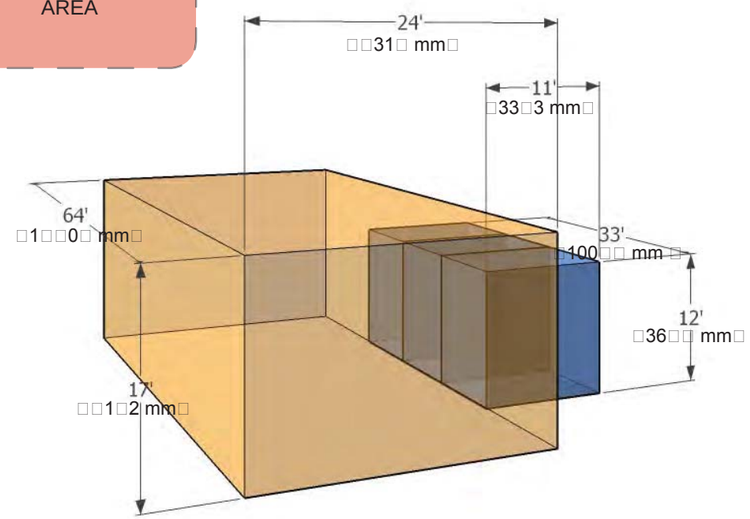


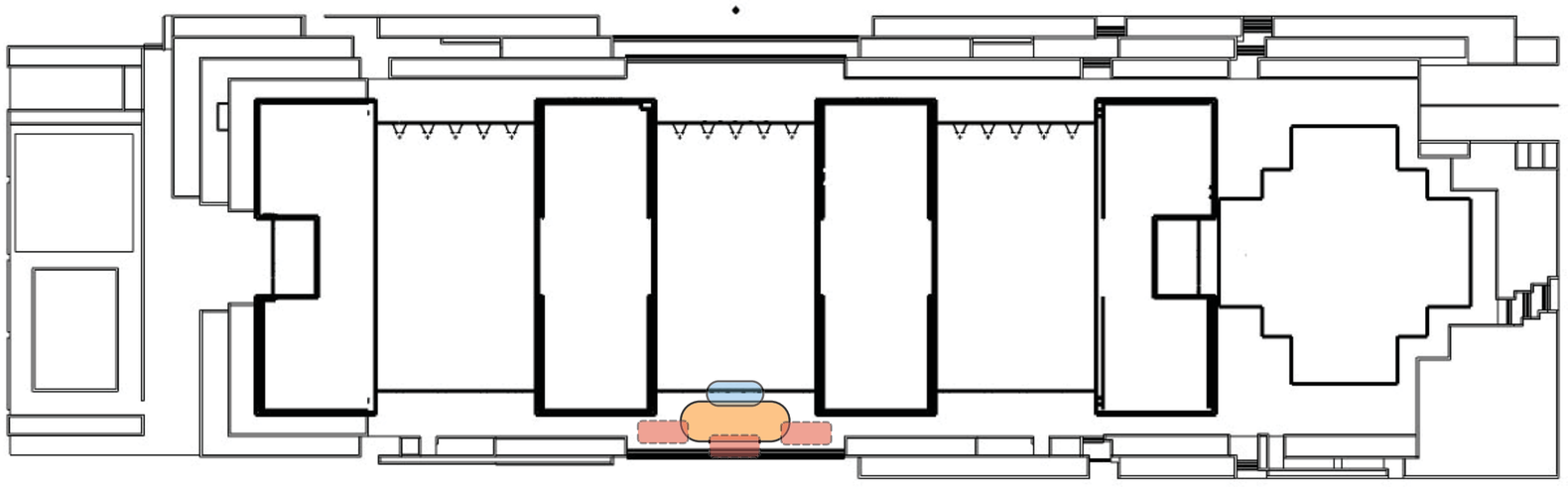


NORTH

North Entrance Master Plan Requirements







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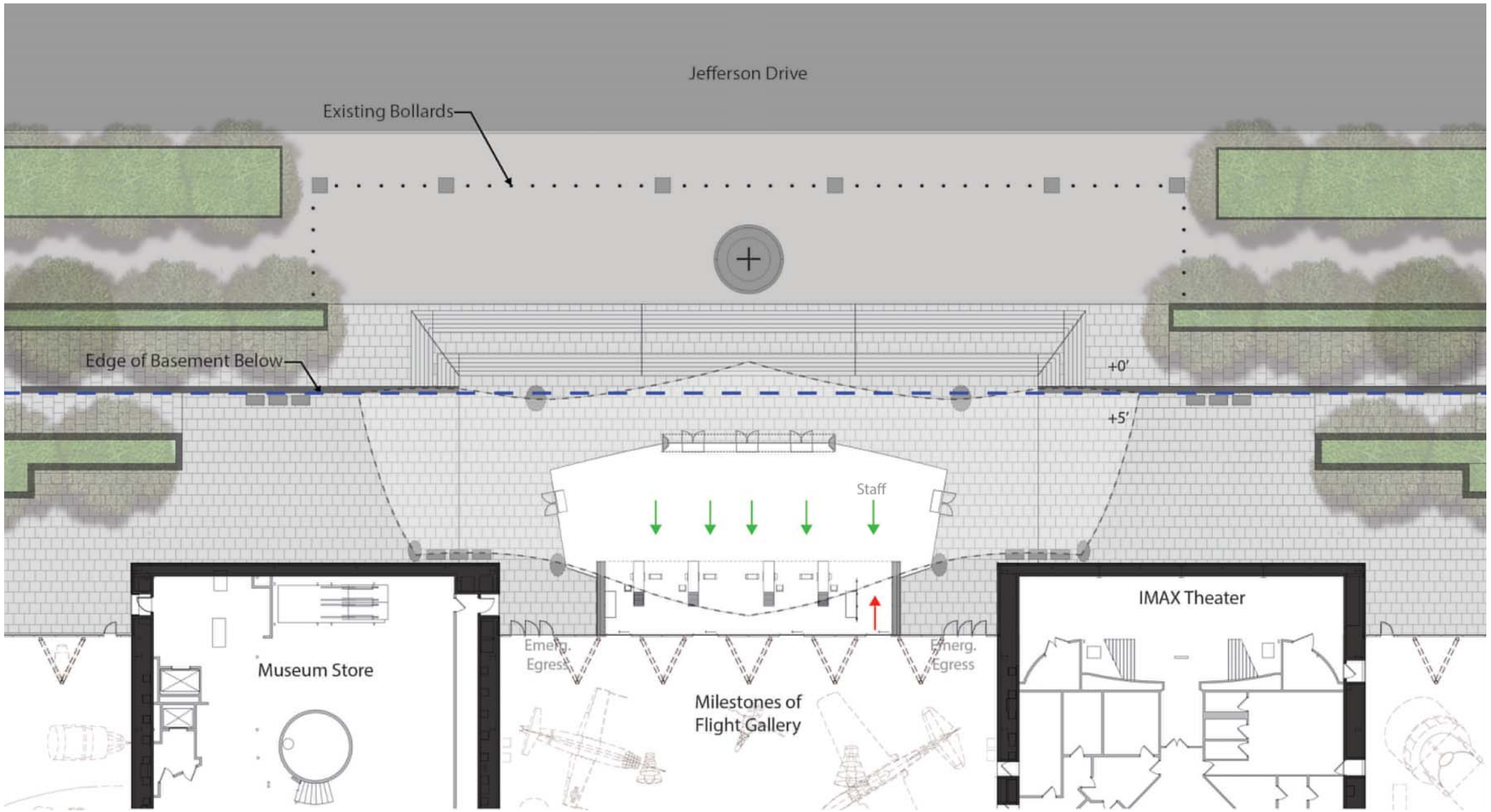
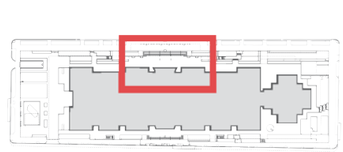
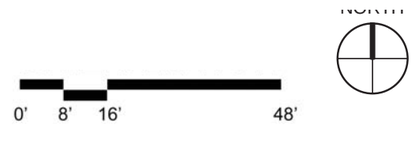
South Entrance Master Plan Requirements

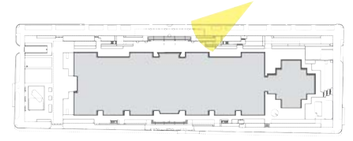




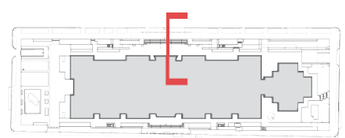


North Vestibule Proposal: Floor Plan

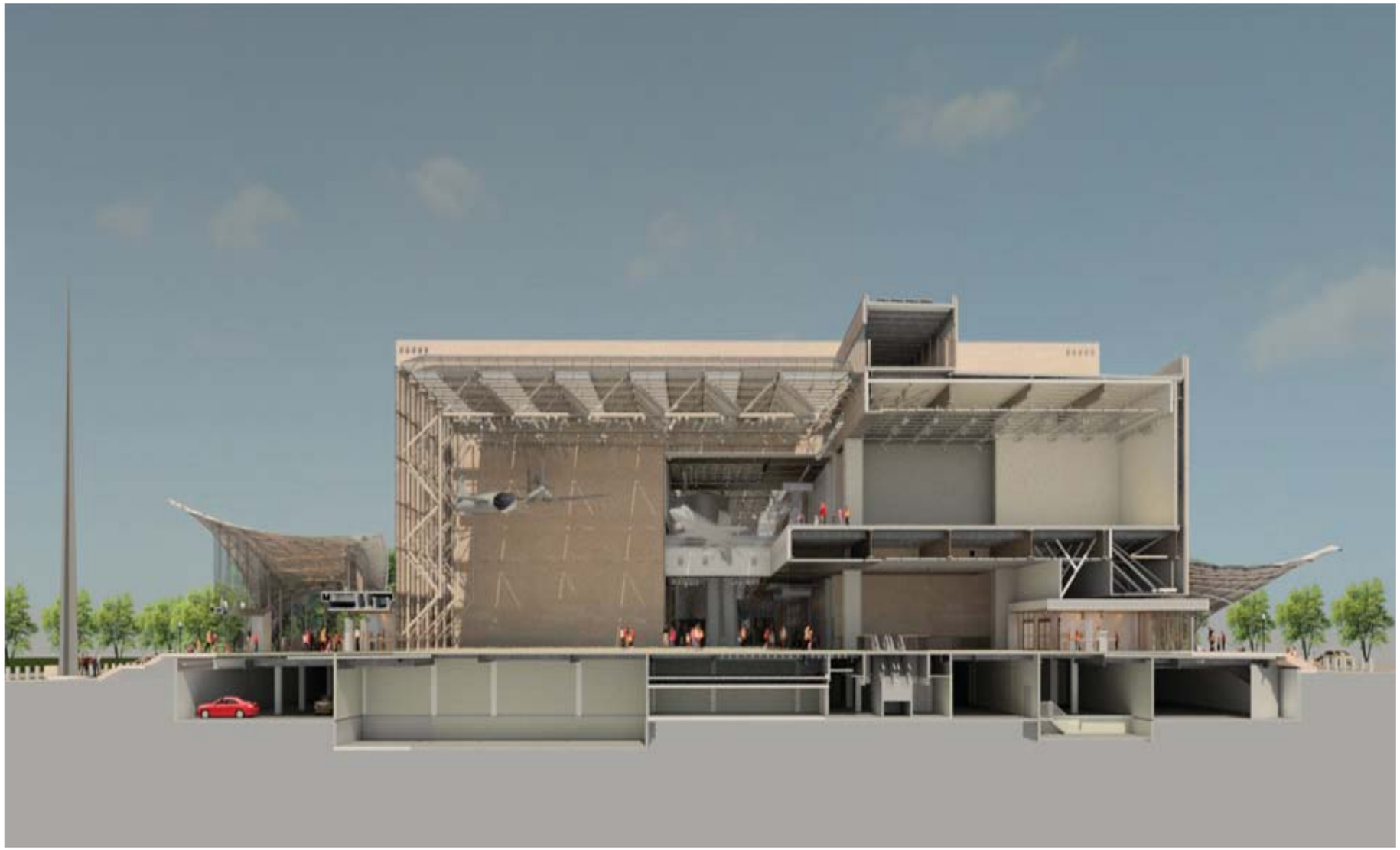
North Vestibule Proposal: Full and Partial North Elevation

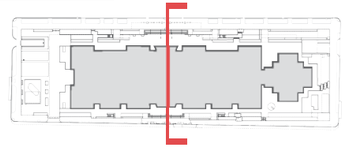


North Vestibule Proposal: Exterior Perspective

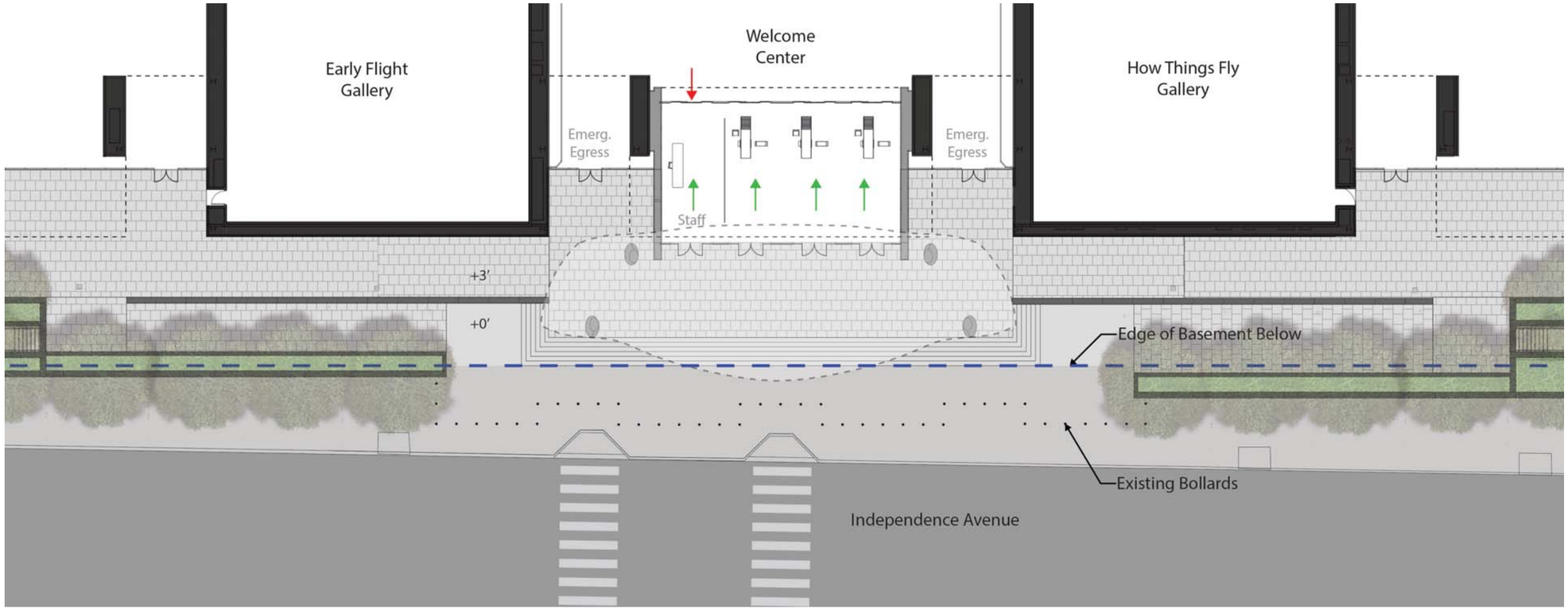


North Vestibule Proposal: Section

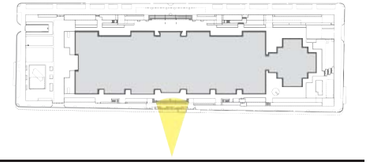




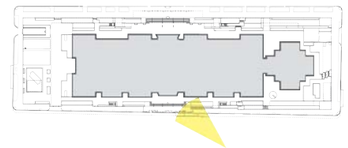
Full Building Section



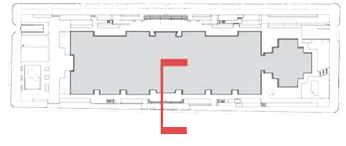
South Vestibule Proposal: Floor Plan



South Vestibule Proposal: Full and Partial South Perspective Elevations



South Vestibule Proposal: Perspective From Southeast



South Vestibule Proposal: Perspective Section

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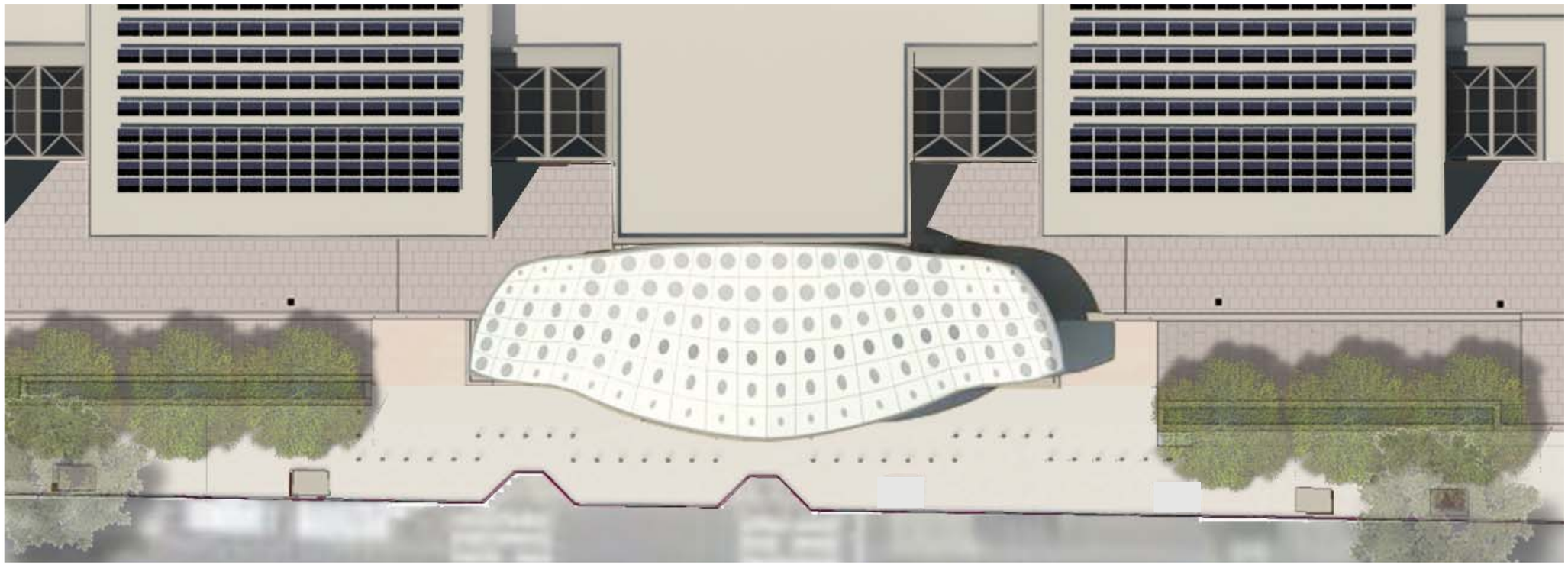
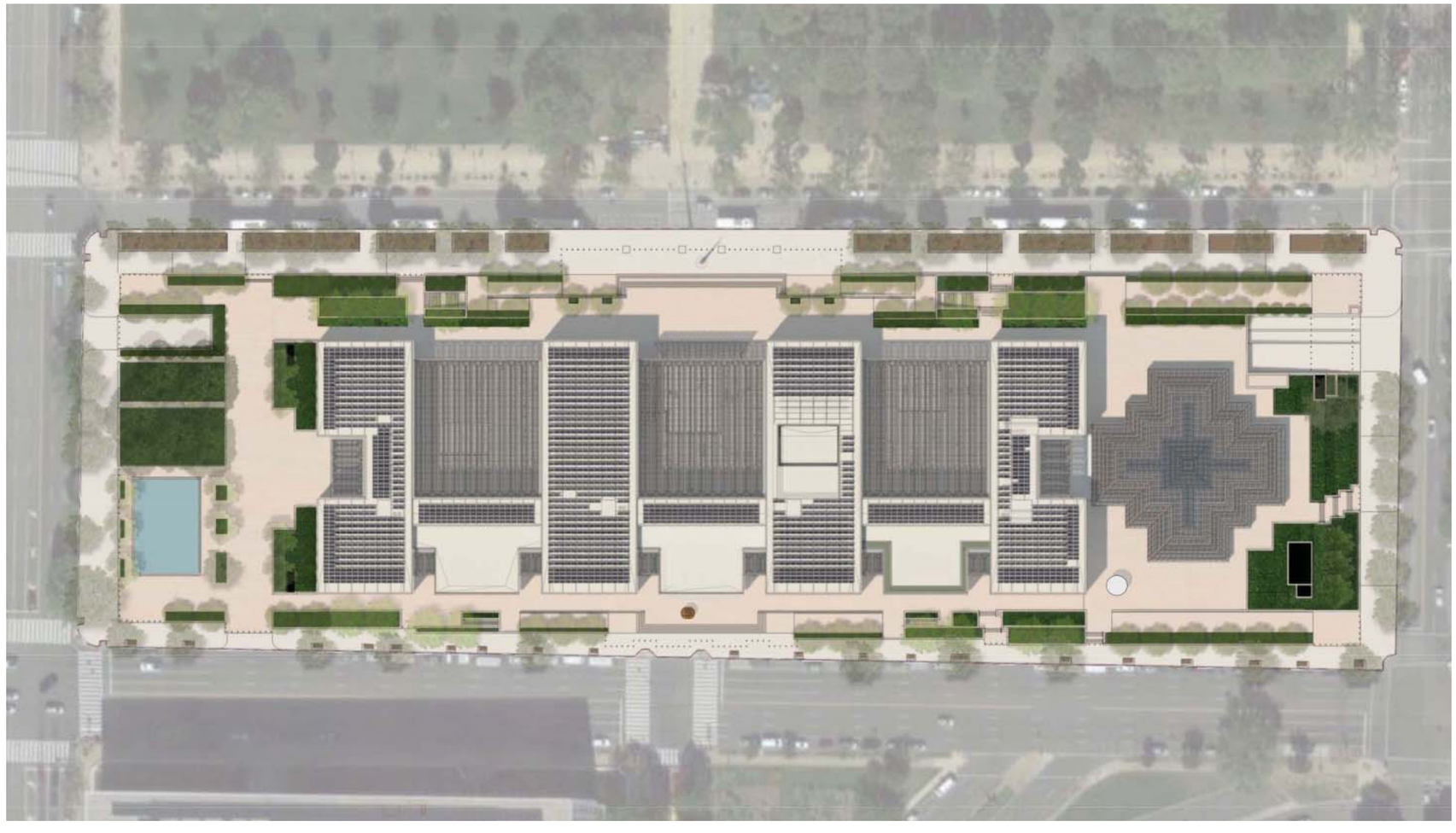
Photovoltaics



NASM's renewal is an opportunity not only to create a high performance building, but one that speaks to the Museum's mission and connection with technology, innovative materials, and space. Specifically, the south side of NASM represents a tremendous opportunity to harvest solar energy and demonstrate the application of space age technology. The NASM building enclosure should speak to the future and the next generation of "hyper" facades that are engaging aesthetically and capture and use solar energy.

The use of Building Integrated Photovoltaics (BIPVs) that incorporate solar harvesting into building envelopes has grown exponentially in the past decade. Solar harvesting opportunities now exist in a range of exterior envelope applications, including skylights, curtain walls, window walls, and rain screen applications. A BIPV installation on the south canopy would be developed as a flexible PV film to be joined with the proposed tensile fabric roof to create a form that protects visitors from the sun while harnessing its energy.

Solar Canopy Roof Plan



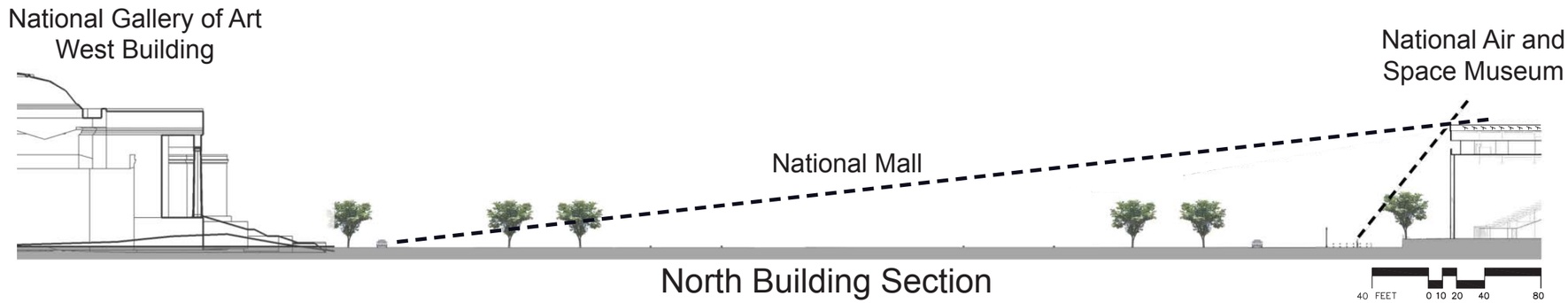
Proposed Solar Panel
<u>Roof Installation:</u>

- 70,000sf (6,503m^2) roof area
- 1,300 PV panels
- 21.5% efficient
- 345-watt each
- Could generate approximately 630,000 KWh/yr
- Equivalent of roughly 7% to 10% of electrical load of revitalized building

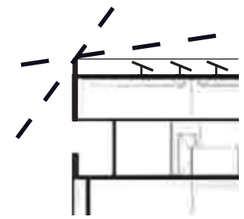
NORTH

0' 8' 16' 48'

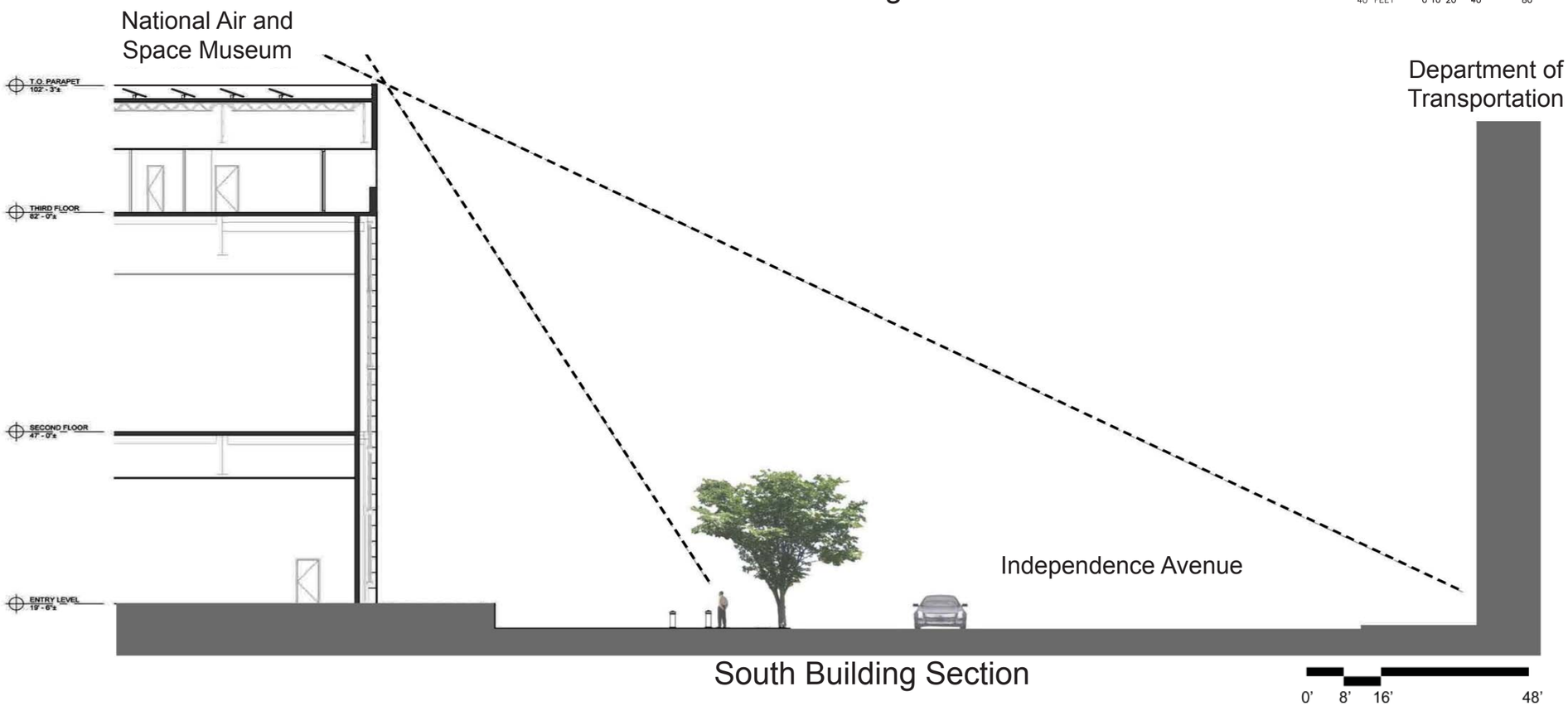
Proposed Roof PV Array Plan



North Building Section



North Section Detail



South Building Section

Proposed Roof PV Array Building Section

Roof PV Array View From the Washington Monument

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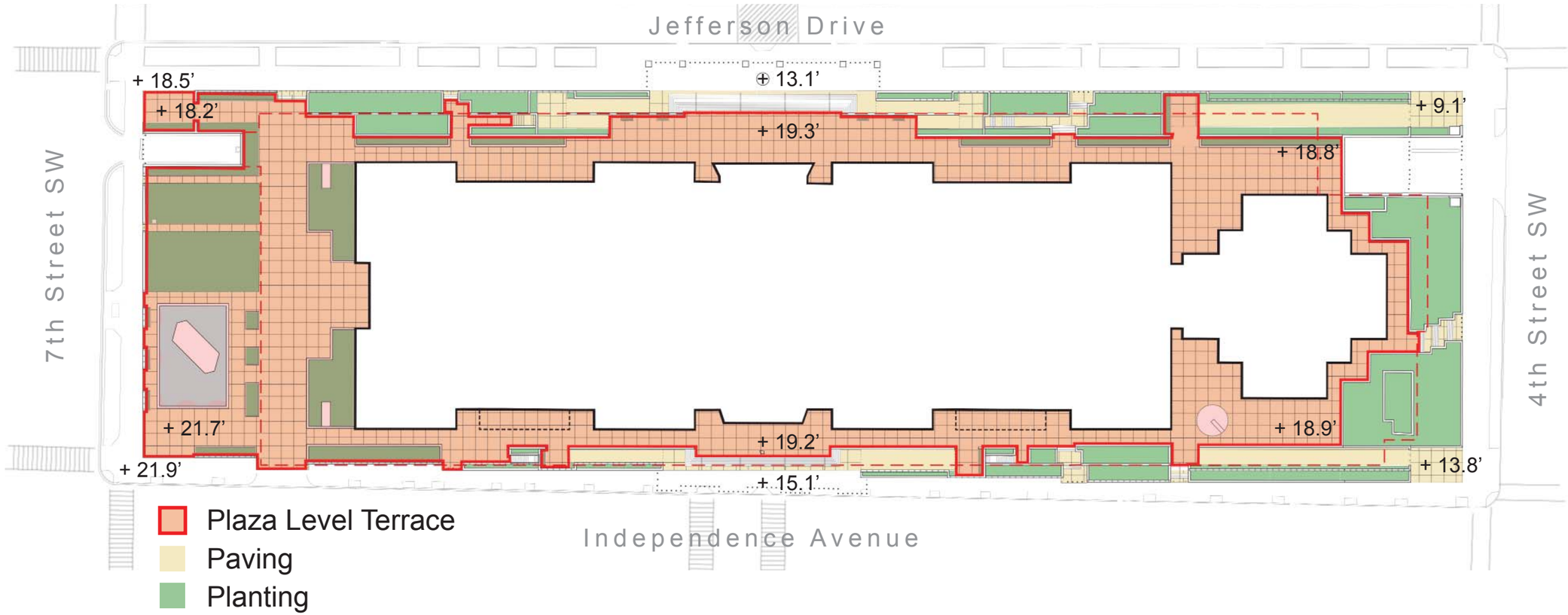
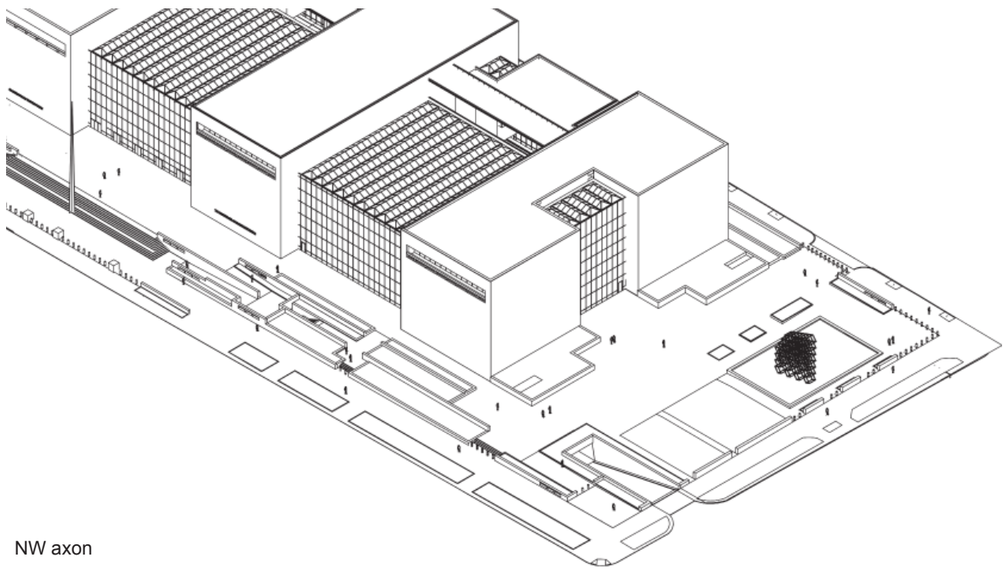
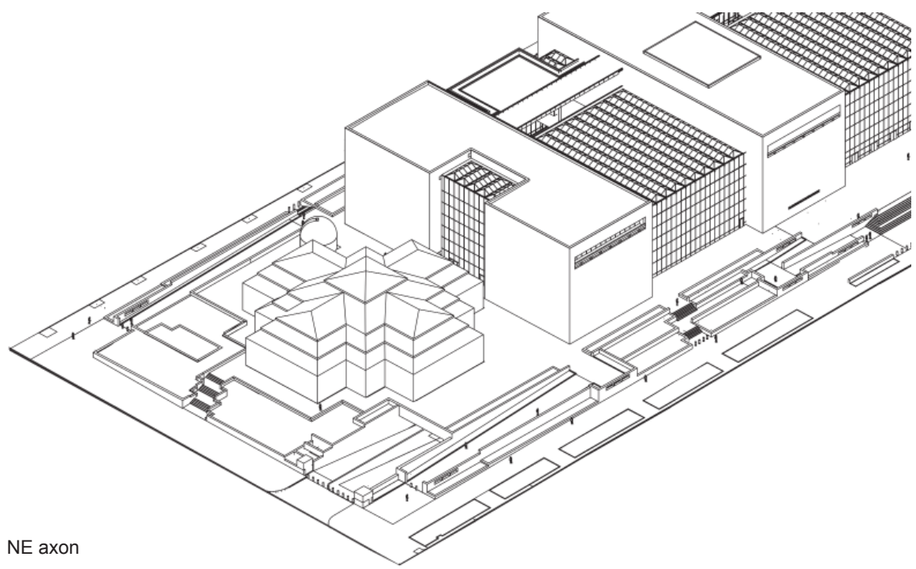
Appendix



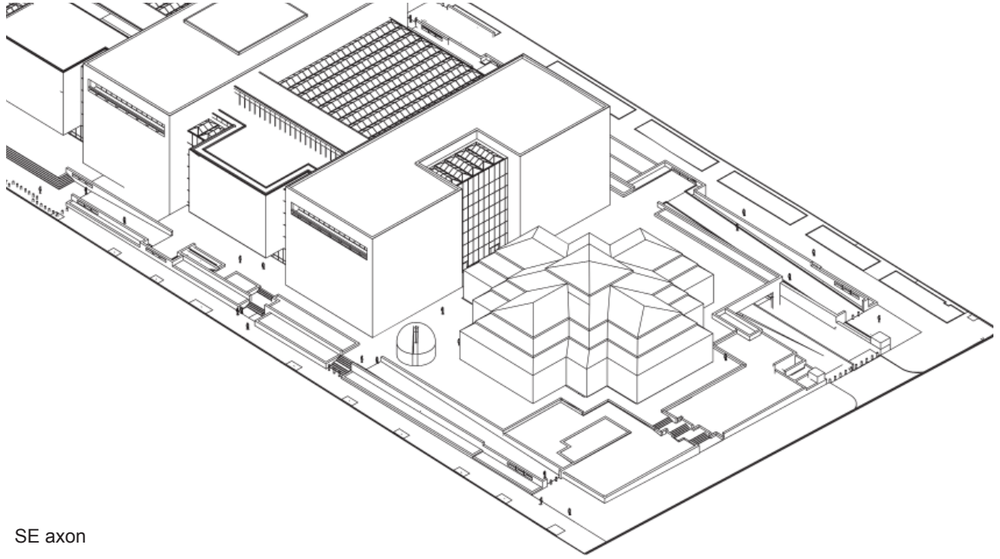
CFA Concept Approval (June 2015) - Ground Plane Plan



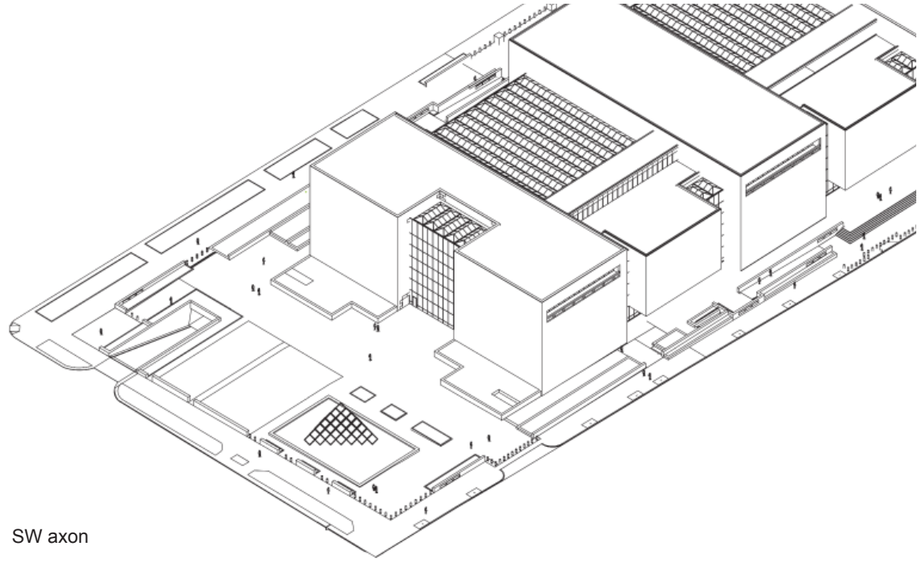
NW axon



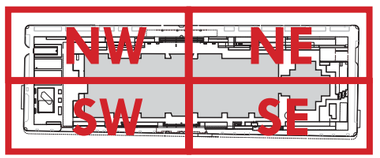
NE axon

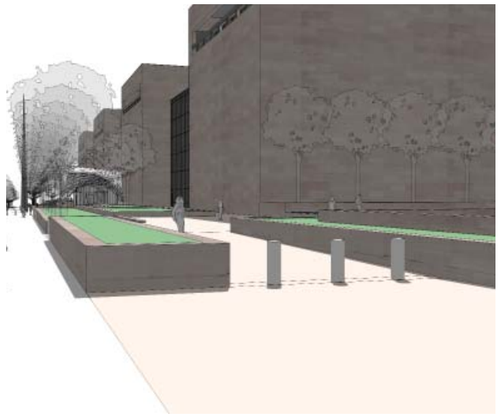


SE axon



SW axon





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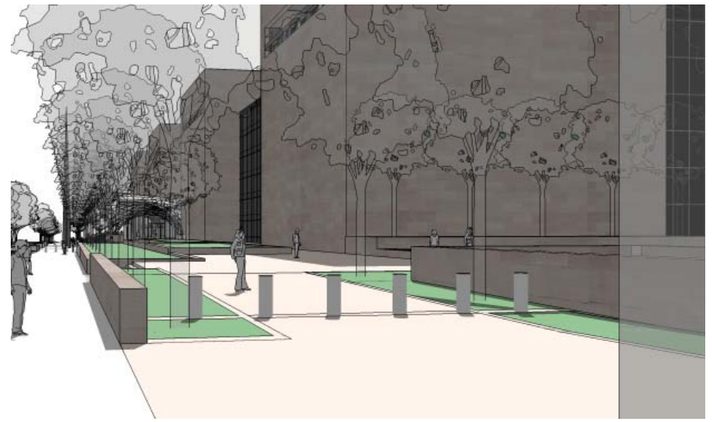

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FROM ENTRANCE: SCHEME B

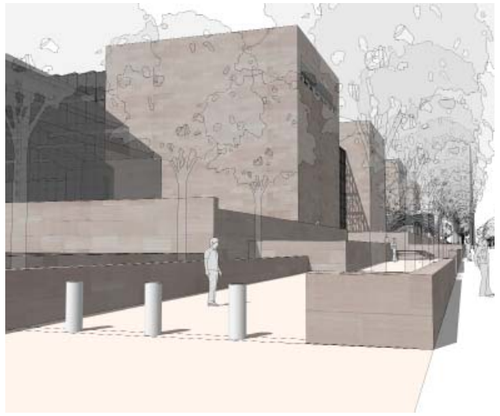
BOXED PLANTER (WITHOUT TREES)

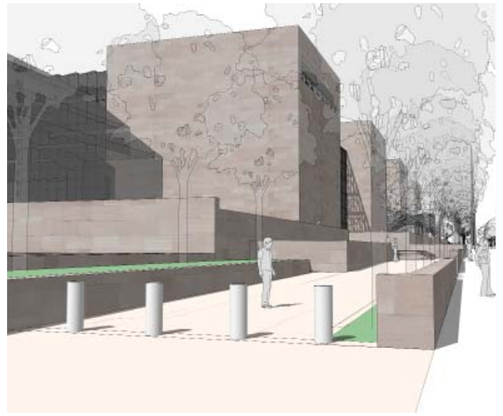
ENCLOSURE

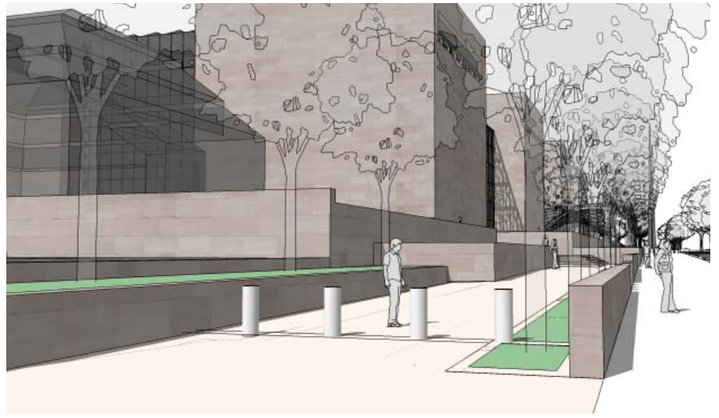
TAB

FROM ENTRANCE: SCHEME A

FROM SIDEWALK: SCHEME B







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FROM ENTRANCE: SCHEME B

BOXED PLANTER (WITHOUT TREES)

ENCLOSURE

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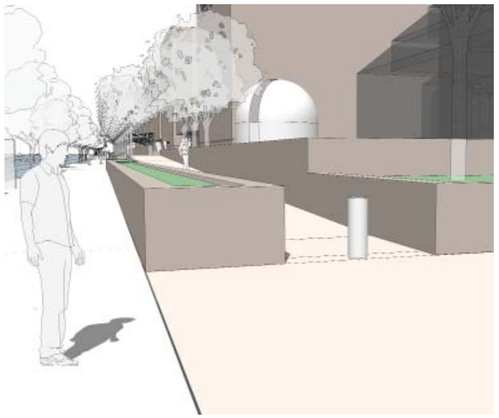

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FROM ENTRANCE: SCHEME B

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ENCLOSURE

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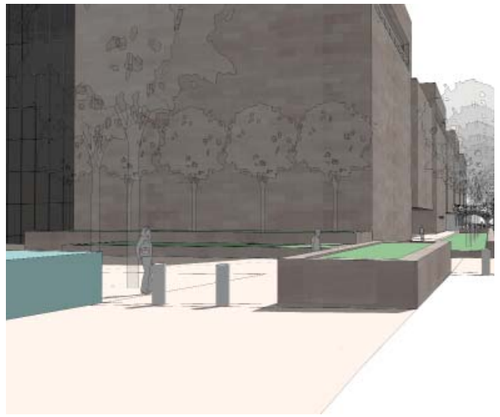

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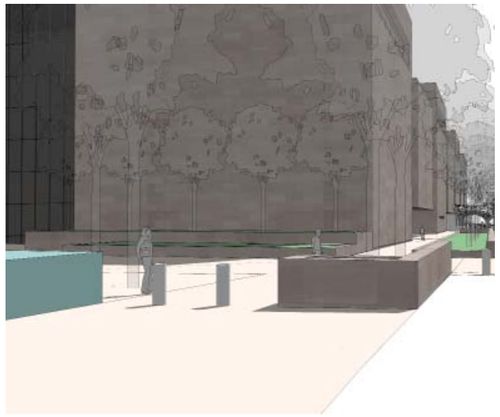

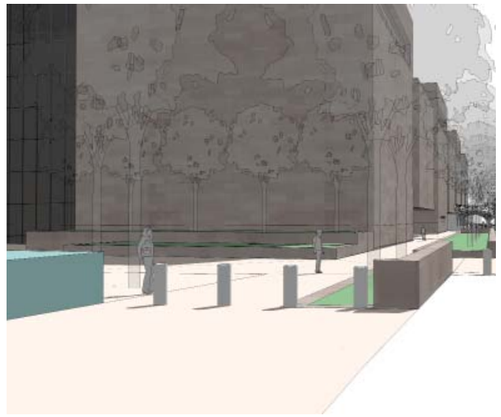

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FROM ENTRANCE: SCHEME B

BOXED PLANTER (WITHOUT TREES)

ENCLOSURE

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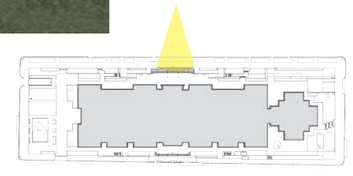
FROM ENTRANCE: SCHEME A

Proposed Option

3% Reduction

7% Reduction

12% Reduction



June 2015 CFA Report North Vestibule Scale Studies

August 2015 Agency Staff Consultation South Vestibule Progress Studies

North Vestibule Perspective View from National Mall -- September 2015 Vestibule Schematic Design Report

South Vestibule Perspective View from South -- September 2015 Vestibule Schematic Design Report

North Vestibule Perspective View From Northeast -- September 2015 Vestibule Schematic Design Report

South Vestibule Perspective View from Southeast -- September 2015 Vestibule Schematic

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