



## COMBINED PRELIMINARY AND FINAL DESIGN REPORT

National Capital Planning Commission  
02 March 2018

### *Smithsonian's National Air and Space Museum National Mall Building Revitalization*

SF Project No. 1206101  
QEA Project No. 31301800



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INTRODUCTION	5
SITE DESIGN	19
PLANTING DESIGN	77
VESTIBULES	121
APPENDIX	137



**COMBINED PRELIMINARY AND FINAL DESIGN 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  
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Email: [passmj@si.edu](mailto:passmj@si.edu)



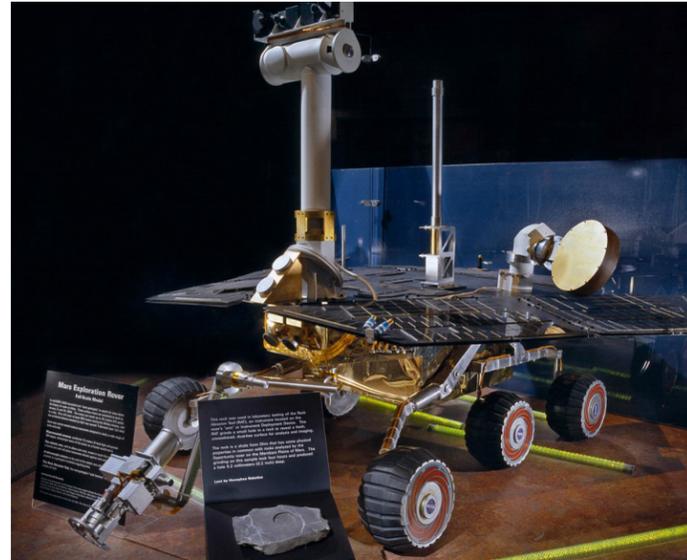


Museum Vision and Mission	6
Context Maps	7
Development Timeline	8
Existing Site Plan and First Floor Plan	9
Existing North and South Elevations	10
Existing East and West Elevations	11
Project Data	12
Section 106 Compliance	13
June 2015 Commission of Fine Arts Concept Approval Letter	15
June 2016 Commission of Fine Arts Concept Approval Letter	16
October 2017 Commission of Fine Arts Approval Letter	17
Section 106 Compliance Letter	18

**INTRODUCTION**



National Air and Space Museum Mall Building Revitalization



The Smithsonian Institution has completed the design of the NASM Mall Building Revitalization with the integration of agency feedback received to date and the development of construction documents. This report documents these updates with the following revisions:

- The plinth of the Delta Solar sculpture incorporates a water feature
- Exposed aggregate concrete is used throughout the paved areas of the grounds
- The tree planting plan has been further and carefully calibrated to balance shade for visitors and sunlight requirements for ground plane plantings.
- The proposed canopy at the south entrance has been retained as a construction option should funding become available

The remainder of the report consists of updates that were developed within the scope of the previously proposed design, including the planting plan, stormwater management, and north vestibule canopy.

The report is comprised of four primary components. The front end addresses existing conditions and project objectives. The site design and planting plan developments are documented in the second section. This is followed with an update to the vestibule scope. Relevant drawings from the Final Construction Documents are included in the appendices as a separate volume of half sized prints.

**NASM Vision: “Helping Build a Nation of Innovators and Explorers”**

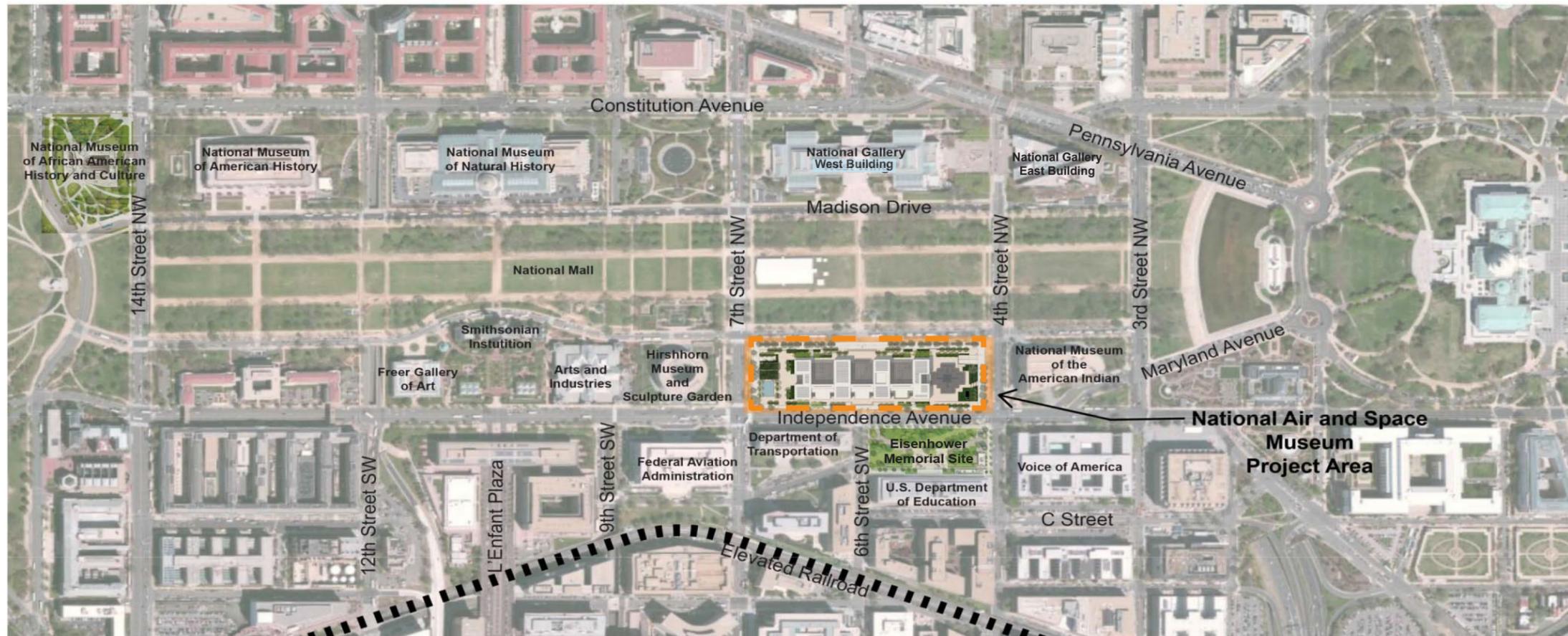
To keep America on the cutting-edge of discovery and human advancement, the Smithsonian’s National Air and Space Museum will help inspire, educate and inform the next generation of innovators and explorers.

**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.

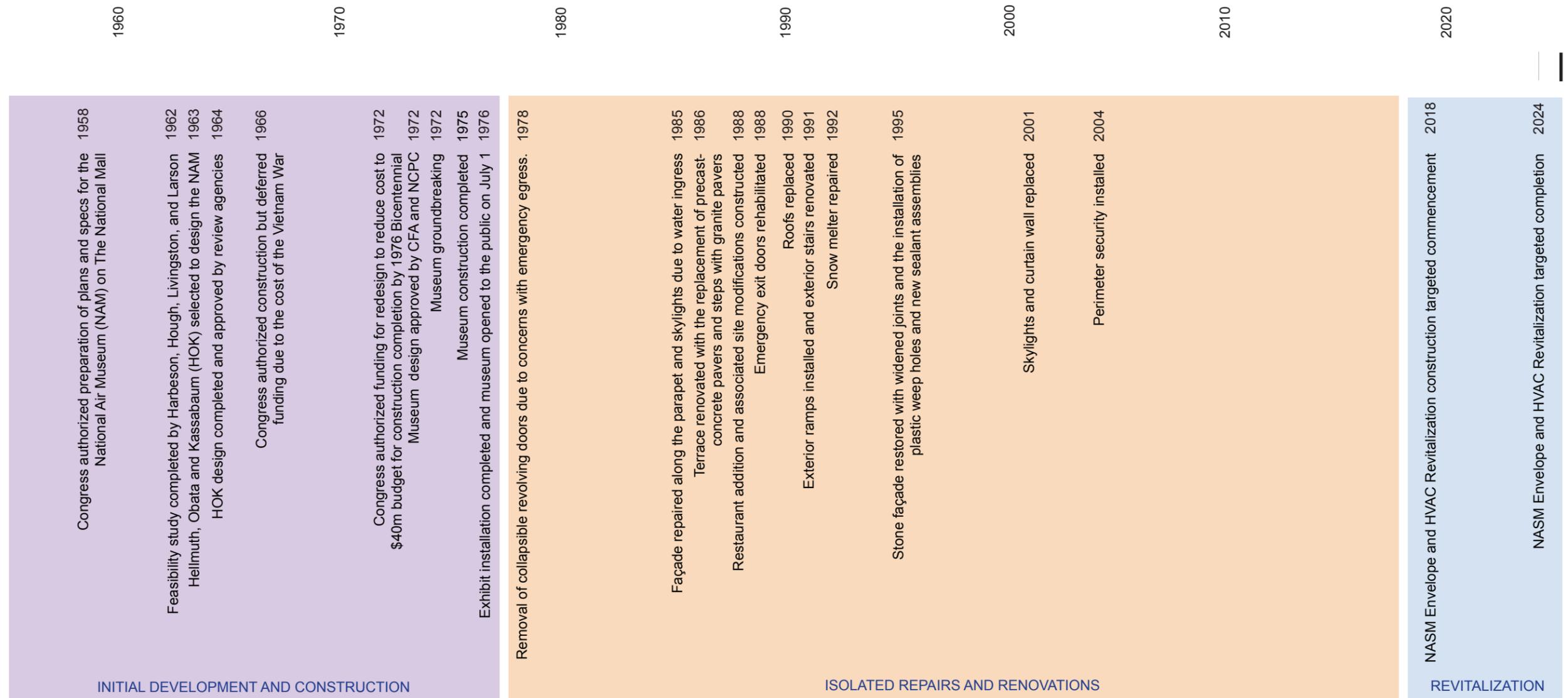
**Museum Vision and Mission**





### National Air and Space Museum Mall Building - Context Map





Early Proposal to Review Agencies in 1972



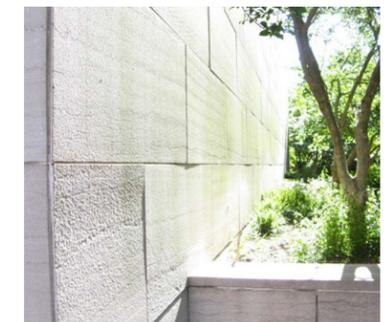
Grand Opening 1976



Restaurant Addition 1988



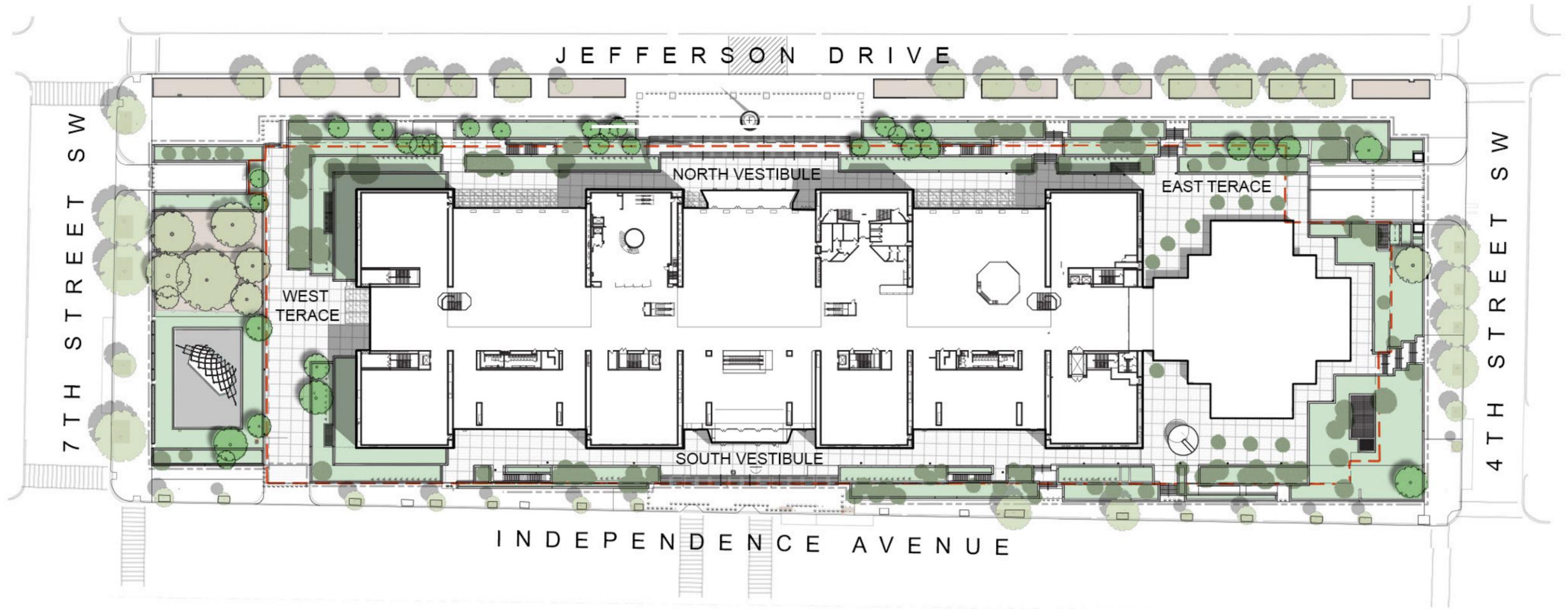
Perimeter Security 2004



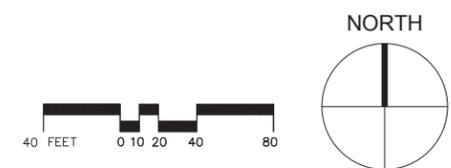
Proposed Revitalization 2024

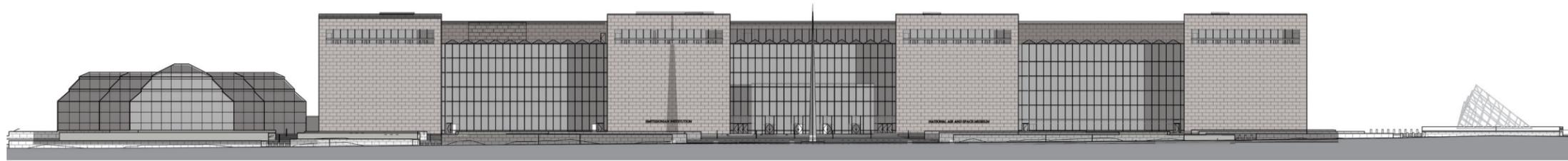
## National Mall Building Development Timeline



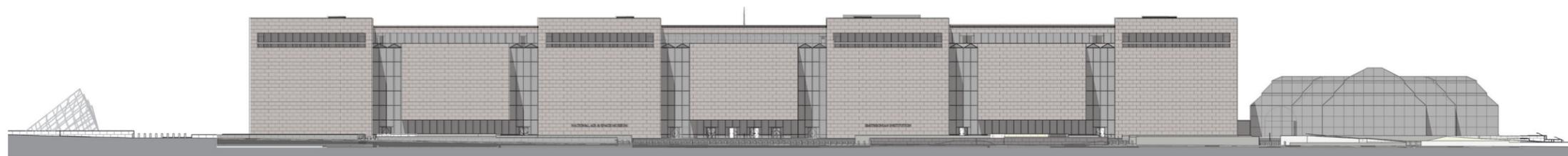


**Existing Site Plan and First Floor Plan**





Existing North Elevation

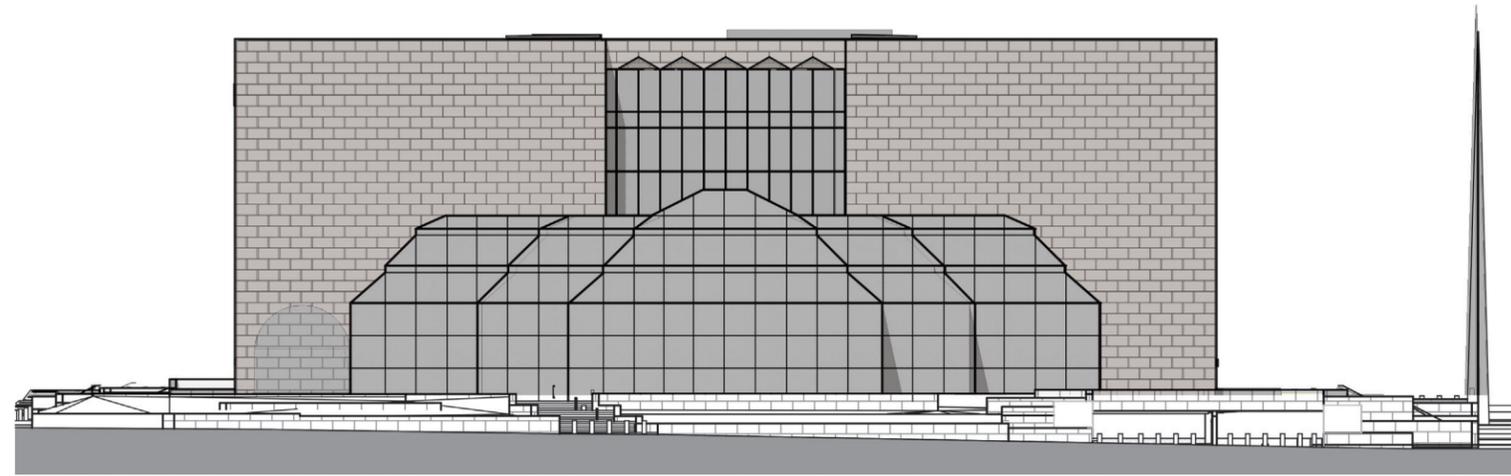


Existing South Elevation



## Existing Elevations



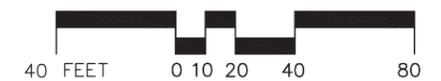


Existing East Elevation



Existing West Elevation

**Existing Elevations**



## 1.1 PROJECT DATA

Project Area & Building Area

The project comprises the renovation and restoration of the existing 687,000 gsf (63,824 m<sup>2</sup>) National Air and Space Museum (NASM) National Mall Building, including 112,000 gsf (10,405 m<sup>2</sup>) terrace revitalization. The overall site area is 448,530 gsf (41,670 m<sup>2</sup>). The cladding replacement includes 160,600 gsf (14,920 m<sup>2</sup>) stone facade, 40,000 gsf (3,716 m<sup>2</sup>) curtain wall, 52,000 gsf (4,830 m<sup>2</sup>) skylight, and 70,000 gsf (6,503 m<sup>2</sup>) roof. The north vestibule addition is 3,200 gsf (297 m<sup>2</sup>).

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 late 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

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 project objectives include the following goals:

- The revitalization of the museum to protect its mission for a century or more to come.
- The replacement of the currently failing Tennessee marble clad envelope with a material that is compatible with the original design of the building, has a life span of 100 years with proper maintenance, and meets requirements for energy performance and insulation.
- Select materials and systems that accommodate the project schedule and cost without increasing risk
- Maintain eligibility of the museum to be added to the National Register of Historic Places
- The replacement of currently outdated utility systems with upgrades that are to be designed and selected to endure for prolonged service timespans, maintainable and serviceable without major renovations.
- The enhancement of the visitor experience with greater accessibility and amenities.

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 identified as a contributing building to the National Mall Historic District, which was listed on the National Register of Historic Places in 1966. 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. A Determination of Eligibility study for NASM has been initiated by the Smithsonian. At the time of this report the building is 42 years old.

## Project Data and Narrative



## 2.0 TRANSPORTATION MANAGEMENT PROGRAM

Not applicable to this project because the assigned employees are below 500. NASM garage currently includes 399 non-public parking spots for official and private vehicles assigned to users across SI. After the renovation, there will be 275 spaces. Included in the existing parking count is approximately 40 to 50 spaces for SI vehicles, which will probably be reduced after the renovation.

## 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. NCPC serves as the Lead Federal Agency for this NEPA process. The NEPA scoping meeting was conducted on 12 November 2014. The Draft Environmental Assessment was issued on March 31, 2017. The Environmental Assessment public review period concluded on 1 May 2017. The remaining step is NCPC execution of FONSI following final approval.

## 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 on 3 September 2014. Four meetings with consulting parties have been conducted to date. The Memorandum of Agreement for Section 106 Compliance was signed by the Advisory Council on Historic Preservation in December 2017, per the document referenced on page 18 of this report.

## 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. In order to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains per Executive Order 11988, mitigation will include waterproofing and a flood wall at the garage entrance ramp that accommodates the 100-year flood plain plus 3 feet.

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 4<sup>th</sup> Street, SW, Suite E650  
Washington, D.C. 20024

Dear Mr. Lewis,

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 it 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*  
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

**Project Report, Section 106 Initiation Letter**

## Smithsonian Institution

Architectural History and Historic Preservation

5 September 2014

Mr. C. Andrew Lewis  
Senior Historic Preservation Specialist  
D.C. Historic Preservation Office  
1100 4<sup>th</sup> 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 it 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*  
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 17<sup>th</sup> and September 22<sup>nd</sup> 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](mailto:andrew.lewis@dc.gov) or 202-442-8841. Otherwise, thank you for providing this initial opportunity to comment.

Sincerely,

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

14-433  
cc: Jennifer Hirsch, NCPD

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

## Section 106 Initiation



Smithsonian Institution  
National Air and Space Museum

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. 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:

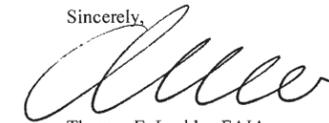
In its meeting of 18 June, the Commission of Fine Arts reviewed the concept proposal for replacing the exterior facades and terraces of the National Air and Space Museum on the National Mall. The Commission approved the concept with numerous comments for further consideration as the design is developed.

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 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



CFA Concept Approval

Smithsonian Institution  
National Air and Space Museum

## PREVIOUS NCPC COMMENTS ON CLADDING:

July 2016 Concept Submission of Vestibules and Site Improvements:

(NCPC) "Recommends that the applicant continue to work closely with NCPC, the U.S. Commission of Fine Arts, and the District of Columbia State Historic Preservation Office to identify an appropriate cladding material that meets the performance criteria. If Tennessee Pink Marble, the original stone, is determined to be infeasible, consider ways to achieve a seamless transition between the exterior cladding and the interior stone treatment, and to avoid, minimize, or mitigate adverse effects on the National Air and Space Museum Building and the National Mall Historic District."

## PREVIOUS NCPC COMMENTS ON CLADDING:

April 2017 Comments on Informational Briefing and Mockup Site Visit:

Commissioners who visited the mockup in the rain commented during the Informational Briefing on the value of having the mockup to evaluate cladding options but varied in their preferences and dislikes. Several commissioners favored the Ultra High Performance Concrete, several found the Echo Lake Granite to be too busy, and one suggested that Tennessee Pink be considered if technical and cost issues could be resolved. The Commission expressed flexibility regarding manmade vs. natural stone as well as emphasizing the criterion of an inherently beautiful material over that of matching the National Gallery of Art. The Colonial Rose (Lac Du Bonnet) granite was not part of the mockup seen on April 6, 2017.

## 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

23 June 2016

Dear General Dailey:

In its meeting of 16 June, the Commission of Fine Arts reviewed a revised concept design for the replacement of the terraces surrounding the Smithsonian Institution's National Air and Space Museum and for two new visitor screening pavilions, part of a larger project to renovate the museum's exterior. The Commission approved the proposed design for the terraces and provided comments for the designs of the pavilions as they are developed.

The Commission members expressed appreciation for the thorough presentation of a complex project encompassing numerous disparate conditions, and they supported the plan to provide expanded accessibility, to maintain perimeter security, and to increase visitor comfort. They strongly favored the Smithsonian's preferred Scheme A—which would create an enhanced pedestrian environment with larger shade trees and sequence of public spaces—over Scheme B—which would elaborate on the existing logic of terraces and planters in the building yard leading to the museum on a plinth. They suggested further refinement of the details of the freestanding barrier walls that line the pedestrian pathways, such as the potentially awkward end conditions of these walls. For the entrance pavilions, they expressed support for their elegant, curvilinear forms, but noted that full review of the design of the structures requires understanding their relationship to the building's new cladding material.

The Commission looks forward to the next review of this important project, which should include documentation of the proposed exterior cladding. As always, the staff is available to assist you.

Sincerely,



Thomas E. Luebke, FAIA  
Secretary

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

cc: Roger Courtenay, AECOM  
Larry Barr, Quinn Evans Architects

## CFA and NCPC Concept Approval - June 2016, July 2016 and April 2017 Comments



## PREVIOUS NCPC COMMENTS REGARDING THE SITE AND VESTIBULES:

October 2017 Revised Concept Submission of Vestibules and Site Improvements:

West End of the Site

(NCPC) "Requests that the Smithsonian submit a revised design for the west end plaza that incorporates the following:

- A water feature that operates year-round and maintains the relationship with the Delta Solar sculpture in a creative and sustainable manner.
- Programming for outdoor cultural events, gatherings, celebrations, and passive recreation. Flexible areas to accommodate congregating and place-making activities.
- Site amenities, including benches that take into account views toward the sculpture.
- Food vendors and its associated signage, as well as movable tables and chairs for casual seating areas.
- Low impact path within the existing grove of trees to allow visitors to experience the park and permeable pavers on the plaza.
- An integrated space that incorporates the adjacent exhibit access area as part of the plaza composition.
- Night views of the southwest corner, depicting the lighting approach for the plaza elements, including the water feature, sculpture and benches.
- Interpretive signage to inform the public regarding the history and design intent of the Delta Solar."

Overall Site

(NCPC) Requests a streetscape plan that incorporates the following amenities:

- Benches located near bus stops, building entrances, and terrace corners at the sidewalk and terrace levels.
- Bicycle facilities such as bicycle racks and a Capital Bikeshare station near the museum entrances and in proximity to guard booths.

(NCPC) Requests that the Smithsonian retain the south entrance canopy as a desirable option if future funding permits.

## 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

27 October 2017

Dear General Dailey:

In its meeting of 19 October, the Commission of Fine Arts reviewed a revised concept design for a new visitor screening pavilion and alterations to the terraces surrounding the Smithsonian Institution's National Air and Space Museum on the Mall, part of a larger project to renovate the museum's exterior. The Commission approved the concept submission and provided the following comments for the development of the design.

Acknowledging the compromises necessary to reduce the scope and cost of the project, the Commission members expressed support for most of the proposed revisions to the previously approved concept design. In their support for the proposal, which would retain much more of the existing stepped site and associated terrace walls, they expressed regret that the previously proposed open corners of the site would be left more constrained; the open corners would have created broad thresholds and welcome areas of respite amid the busy pedestrian activity on the Mall. They commented favorably on the proposed entry pavilion at the north entrance facing the Mall, supporting the intention to juxtapose an entrance expressing flight against the rectilinear museum building, but they cautioned that the pavilion's curving elements may be excessively organic in form, resembling a tree canopy; they suggested refining the design to emphasize the metaphor of flight and documenting how the structure connects to the existing building. They also supported the elimination of the previously proposed south entrance canopy at Independence Avenue. They expressed general support for the proposal for extensive herbaceous plantings, which they said would animate the design of the ground plane, although they questioned whether the level of maintenance needed would be sustainable.

For the site's monumental sculptures, the Commission members did not support the revised design as proposed. For *Continuum*, located at the south entrance, they recommended maintaining its current asymmetrical placement. For *Delta Solar*, they continued to support its relocation to the southwest corner of the site, but they expressed regret at the loss of its intended artistic setting on a base of water. They commented that the proposed new setting of this kinetic sculpture on a high, polished stone plinth would be inappropriate and would create a hot microclimate in an otherwise inviting landscape, and they recommended the reconsideration of this element of the site design. They advised that in the process of weighing alternatives for reducing the project's scope and cost, the water setting for *Delta Solar* should be considered as more important to include than large areas of stone pavement or complex herbaceous plantings that may incur high long-term costs of operation and maintenance.

The Commission looks forward to reviewing revisions to the design in a final submission. As always, the staff is available to assist you.

Sincerely,



Thomas E. Luebke, Secretary

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

cc: Roger Courtenay, AECOM  
Larry Barr, Quinn Evans Architects

## CFA and NCPC Concept Approval - October and November 2017 Comments



## Section 106 Compliance National Air and Space Museum Mall Building Revitalization

### MEMORANDUM OF AGREEMENT

The Smithsonian Institution has executed a Memorandum of Agreement regarding the NASM Revitalization project in December 2017, with the Advisory Council on Historic Preservation, DC State Historic Preservation Officer, and the National Capital Planning Commission. The MOA acknowledges compliance with Section 106 of the National Historic Preservation Act and its implementing regulations 36 CFR Part 800, and identifies ways to minimize and mitigate adverse effects on historic properties.



December 29, 2017

Sharon Park  
Federal Preservation Officer  
Smithsonian Facilities  
Office of Planning, Design & Construction  
Architectural History and Historic Preservation  
600 Maryland Avenue, SW, Suite 5001  
MRC 511 PO Box 37012  
Washington, DC 20013

REF: *Memorandum of Agreement Regarding the National Air and Space Museum National Mall Building Revitalization*

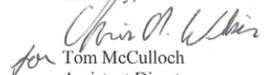
Dear Ms. Park:

Enclosed is your copy of the fully executed Memorandum of Agreement for the referenced project. By carrying out the terms of the Agreement, you will fulfill your responsibilities under Section 106 (54 U.S.C. § 306108) of the National Historic Preservation Act (NHPA) (54 U.S.C. § 300101 et seq.) and its implementing regulations, "Protection of Historic Properties" (36 C.F.R. Part 800). We have retained a copy of the executed agreement. Please remember to forward copies of the fully executed agreement to the appropriate signatories and consulting parties.

We commend the Smithsonian Institution for working closely with the National Capital Planning Commission, the District of Columbia State Historic Preservation Officer, the Commission of Fine Arts, the General Services Administration, the District of Columbia Preservation League, the National Gallery of Art, the Architect of the Capitol, the National Park Service and the National Trust for Historic Preservation.

If we may be of further assistance as the agreement is implemented, please contact Christopher Wilson at (202) 517-0229, or via e-mail at [cwilson@achp.gov](mailto:cwilson@achp.gov).

Sincerely,

  
for Tom McCulloch  
Assistant Director  
Office of Federal Agency Programs

Enclosures

ADVISORY COUNCIL ON HISTORIC PRESERVATION  
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National Air and Space Museum Mall Building Revitalization



Site Design Narrative 20

Illustrative Plan 28

Northwest Corner 30

North Building Entrance 34

Northeast Corner 40

Southeast Corner 46

South Building Entrance 52

Southwest Corner 58

Perimeter Security 66

Accessibility 67

Paving Design Concept 69

Lighting Plan 70

Site Art 73

Seating Diagram 74

Stormwater Management Strategy 75

**SITE DESIGN**



## INTRODUCTION

This submission incorporates changes associated with completing the final landscape design.

## DESIGN CHANGES AND IMPROVEMENTS

Key elements that have been altered since the agency presentations of 2016 and 2017 include:

- **The plinth of the Delta Solar sculpture incorporates a water feature:**
  - The plinth incorporates an animated water wall on all four sides, emanating from a shallow reflecting pool
    - The plinth is articulated with a horizontally-ribbed vertical wall system which will animate (but not delaminate) a thin film of water flowing over its surface.
    - Water sources are located under stone panels in a trench in the center of the plinth, which is designed to create a minimum-depth surface of water over its top, which water then flows over a continuous stainless steel 'infinite edge' down the walls of the plinth.
    - The entire plinth is clad in dark anorthosite stone, with proportions calibrated to those of the building and planter cladding. The darker stone will highlight the visibility of the flowing water film.
  - A plaza with both open (around the sculpture) and shaded (areas of repose) components is organized around the Delta Solar sculpture and plinth.
    - Stone seating is provided on a permanent basis, organizing and unifying the service access way into the plaza composition
    - The higher elevation of the east side of the plinth provides respite from the noise and motion of the adjacent intersection, while preserving the sculpture's new 'pride of place' at an important urban location.
- **The tree planting plan has been further and carefully calibrated to balance shade for visitors and sunlight requirements for ground plane plantings.**
- **Exposed aggregate concrete is used throughout the paved areas of the grounds:**
  - As the project gets underway, mock ups of proposed paving panels will be provided and shared for agency review with the Smithsonian.

- **Previously approved at 'Concept Design:'**

- The northwest corner entrance retains more of the existing layout and planters, and includes a safe and straightforward provision of an accessible route.
- The northeast and southeast corners retain the existing planter layouts – with entrance to the grounds provided by renovation of existing stairways and adjacent ramp (southeast corner).
- Planter walls retained maintain their existing height throughout the grounds.
- Exposed aggregate concrete is the basic paving material.

## BASIS OF DESIGN

The terrace of the museum requires renewal. The Museum's 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 Museums' opening in 1976, and anticipate continued growth.

## Site Narrative - Basis of Design



**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. 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 revised concept design proposal.

The Museum lies on seven acres of grounds between 4th Street SW and 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 all planting, opening up views over terraces surrounding the building for greater visual accessibility and clarity of design.
- 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.
- Focus improvements on the west end and central portions of the grounds, leaving the layout and structures of the east end of the grounds (east of the east end of the museum building) essentially as they currently exist, except for upgrading materials and finishes to coordinate with the rest of the project. This area is a future building project area.

**DESIGN OUTCOME**

The resultant design builds on earlier submissions and comments:

- Opens, reduces or eliminates planters at the northwest and southwest corners and around the north and south entrances to create clear and intuitive grounds entrance and wayfinding circulation.
- Provides universal access conditions at entrances to the grounds

and to the museum entrances on the north and south sides of the building.

- Creates entrances to the entirety of the museum grounds at the northwest and southwest corners, where none currently exist, by removing planter systems and more completely articulating entrance from the sidewalk.
- Develops complete circulation of the grounds within the property by removing west end planter systems, providing for complete 'in the round' thematic and museum-related activity on the grounds in the future.
- Improves visitor physical, tactile and visual approach to plant materials:
  - Provides an architectonic massing of shade and small trees that responds to the massing rhythms of the building, integrates well with the National Mall setting and creates open view relationships between grounds and the National Mall.
  - Adds thematic (and low) groundcover planting design to animate entrances and create interpretive opportunity.
- Further integrates the prominent 'Delta Solar' fountain at the southwest corner within its respective public realm:
  - 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, with a shallow pool and waterwall plinth.
  - Conserves the west memorial grove of willow oak trees, as an integral complement to the open plaza of the 'Delta Solar' setting.
- Builds on two key objectives identified in the NASM Master Plan (Smithsonian Institution, Ayers Saint Gross, 2013):
  - The improvement of the general usefulness and integration of museum grounds to the museum mission; and
  - 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 revised design proposal maintains the existing elevation datum point of the main terrace level, conserving the seating-height precedent elevation of the planter wall which describes the edge of the main terrace paving at the upper level. At the back of sidewalk around the perimeter of the grounds, the existing 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 at least the minimum secure perimeter height requirement. The planter layout of the proposed (revised) concept design closely follows the existing system, with significant eliminations or re-positioning of planters occurring only at the northwest and southwest corners, where new entrances to the entire grounds and museum building are proposed.

**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 wayfinding and mission.

**Site furnishings:** A simple, contemporary, metal-based palette composed of benches, bike racks, and litter receptacles.

**Perimeter security:** Little change is made to the layout of the perimeter. The underlying structural components are retained and re-integrated with the new work whenever possible.

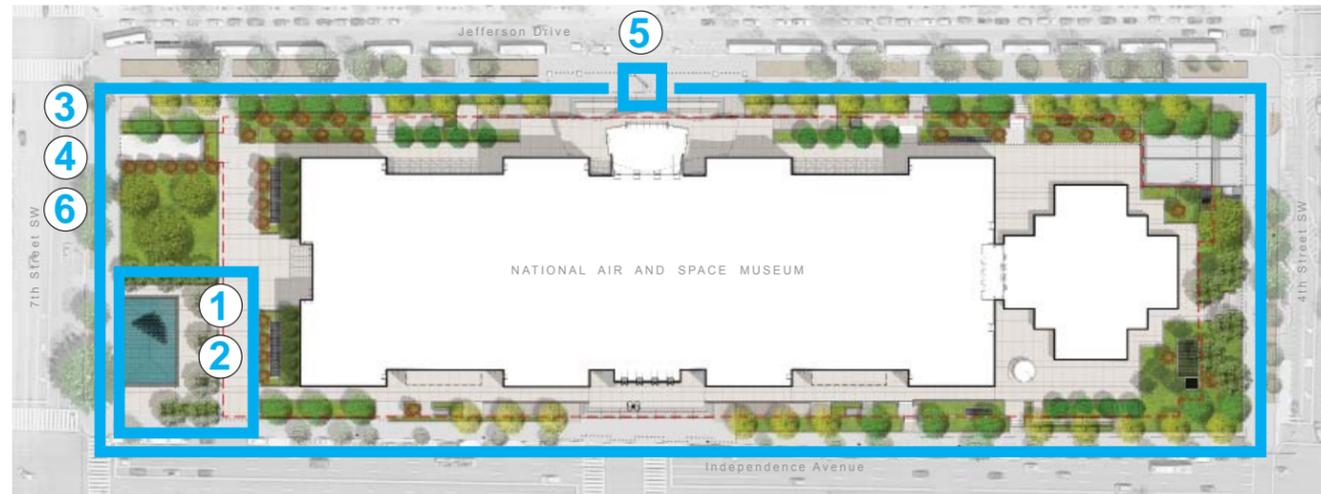
**Storm water management:** Water conservation is a fundamental issue for the museum. The site permeability is limited by the building below grade structure and its extent. The entire roof and paved terrace areas storm water run-off will be collected for re-use via on-site underground storage cisterns. Storm water falling on planted areas will be collected into root zones and available to plants. All planted areas of the site will be irrigated.

**APPENDIX: SELECTED CONSTRUCTION DRAWINGS**

An appendix of selected construction drawings further explains the detailed design and layout of key landscape features, including the Delta Solar sculpture plinth/water feature, integration of lighting into handrails and seat walls, and the replication of existing stone planter wall cladding details.

**Site Narrative - Design Approach**





Direct Quotation from November 2017 NCPC Commission Action Letter

- 1 “Does not support the revised configuration of the Delta Solar consisting of a dry plinth without a water feature as the sculpture base, because it does not create a welcoming entry to the museum and the National Mall, and negatively impacts the integrity of the sculpture;
 

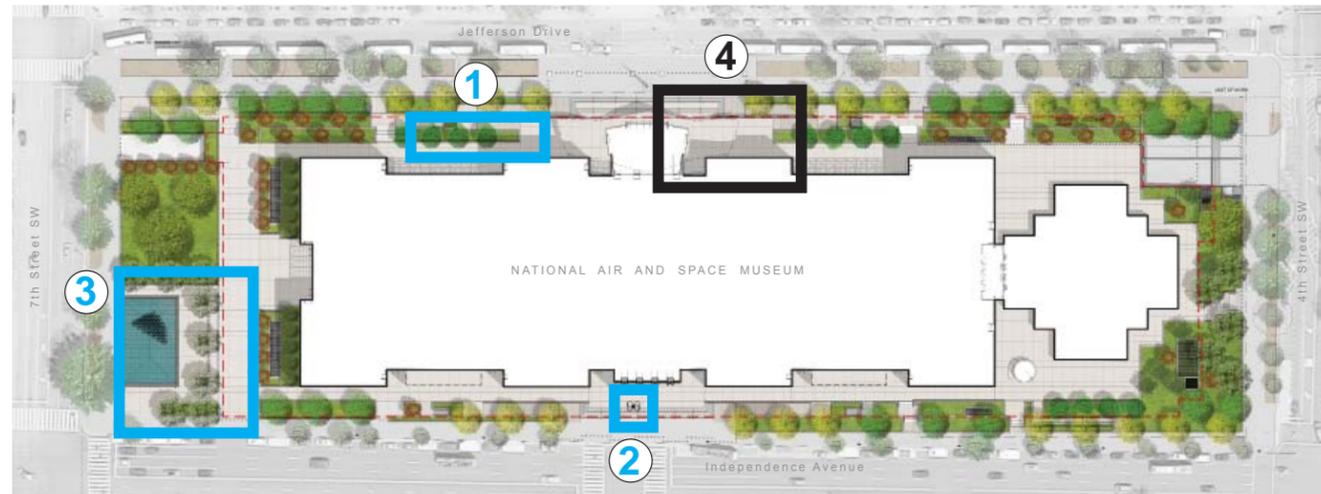
Recommends that the Smithsonian consider how this portion of the site could reinforce the network of active gathering spaces along 7th Street.”

  - Design has been updated to include an infinity-edge water feature on the proposed granite plinth of Delta Solar. Refer to drawings.
- 2 “Recommends that the Smithsonian evaluate the perimeter security along 7th Street to allow greater accessibility and visibility into the plaza. The applicant should also consider opportunities to integrate perimeter security elements that also function as public amenities, such as benches, bike racks, landscape and other streetscape elements.”
  - The final design maintains most of the site’s existing secure perimeter walls. Secure perimeter walls at the North and South entrances have been lowered to increase visibility into the site. The relocation of the Delta Solar sculpture and fountain plinth to the SW corner of the site integrates perimeter security into a public amenity.

- 3 “Requests a streetscape plan that incorporates the following amenities:
  - Benches located near bus stops, building entrances, and terrace corners at the sidewalk and terrace levels
  - Bicycle facilities such as bicycle racks and a Capital Bikeshare station near the museum entrances and in proximity to guard booths.”
  - The NASM site provides over 1700 linear feet of seat wall between the heights of 14-24”. New shaded, seat wall benches have been provided around the Delta Solar Fountain plaza and future movable seating is envisioned to be placed along the large exhibit accessway. Refer to seating diagram.
- 4 “Recommends that the Smithsonian work with the National Park Service to improve the streetscape surrounding the museum consistent with the National Mall Streetscape Manual, where applicable.”
  - The streetscape is outside the current scope of this project.
- 5 “Recommends that the Smithsonian coordinate with the National Park Service regarding the relocation of “Ad Astra” sculpture to the sidewalk space along Jefferson Drive, and ensure that the placement of the sculpture does not disrupt pedestrian flow and provides sufficient clearance for bus drop off and pick up areas.”
  - The Ad Astra sculpture’s stone plinth has been reduced in diameter from the existing 16’-0” to 10’-0” in order to better accommodate pedestrian flow at this critical sidewalk location. Refer to drawings.
- 6 “Requests that the Smithsonian submit landscape plans at preliminary review that include tree replacement to prevent net loss of tree canopy in accordance with the procedures established in the policies related to *Tree Canopy and Vegetation in the Comprehensive Plan for the National Capital*.”
  - Comparison diagram of existing and proposed tree caliper is included in planting design section of this report.

National Capital Planning Commission Comments, Revised Concept





- Direct Quotation from October 2017 CFA Letter
- Additional important update

- 1** “They expressed general support for extensive herbaceous plantings, which they said would animate the design of the ground plane, although they questioned whether the level of maintenance needed would be sustainable.”

  - Refer to Smithsonian Gardens narrative on the following page.
- 2** “For Continuum, located at the south entrance, they recommended maintaining its current asymmetrical placement.”

  - Continuum is proposed to maintain its current placement at the South Entrance. Refer to drawings.
- 3** “For Delta Solar, they continued to support its relocation to the southwest corner of the site, but they expressed regret at the loss of its intended artistic setting on a base of water.”

  - Design has been updated to include an infinity-edge water feature on the proposed granite plinth of Delta Solar. Refer to drawings.
- 4** Paving of the walks and terraces of the grounds will be exposed aggregate concrete. Mock-ups will be provided early in project construction for agency review and comment.

Commission of Fine Arts Comments, Revised Concept Design



The following statement has been provided by Mr. William Donnelly, - Landscape Architect of Smithsonian Gardens (SG), with reference to SG's strategic plan, mission statement and specifically to the proposed ground plane planting for the renovation of the National Air & Space Museum.

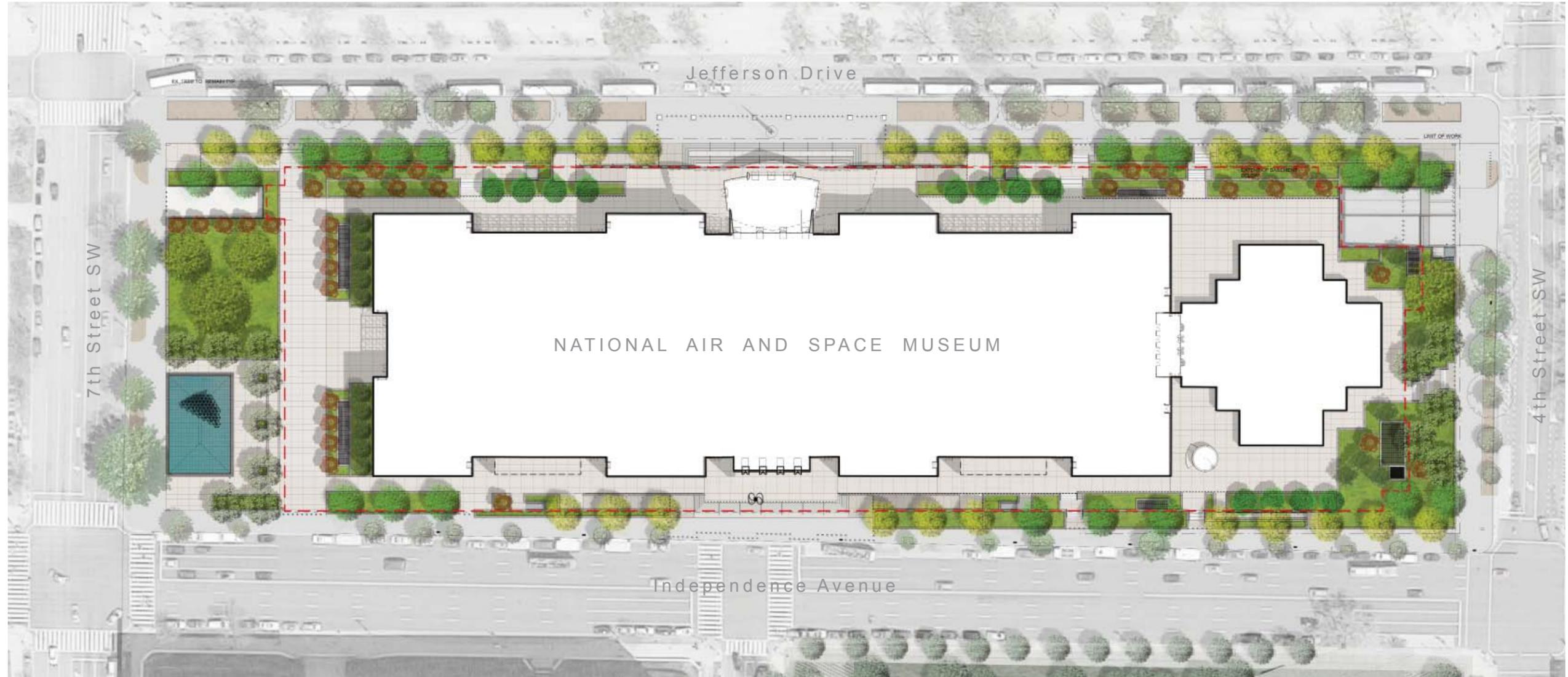
"Smithsonian Gardens have established a close relationship with Mr. Cullina and the many design professionals who have contributed their design expertise and extensive knowledge to this project. Smithsonian Gardens supports the ground plane planting design approach in its entirety and the developed strong sense of place at the National Air and Space Museum. As a result, Smithsonian Gardens is in direct line with this approach and endorse it as an economical, ecologically sensitive and supportable way to ensure "our commitment to inspire visitors with exceptional displays and educating them about horticulture, plants, the natural and built environments, and artistic design".

"Smithsonian Gardens has a staff of over 50 professional horticulturists, gardeners, biological technicians, landscape architects, arborists, entomologists, irrigation specialists and living collections management specialists who care for over 180 acres of mainly irrigated, intensely to partly landscaped public areas surrounding the museums throughout the District of Columbia, four major support facilities in the District of Columbia and in Suitland, Maryland, interiorscapes throughout the museums, and the SG Greenhouse facility. Our public gardens, turf areas, and interiorscapes incur constant public use, and the appearance and public safety of such areas are an important part of the visitor experience at the Smithsonian."

## Smithsonian Gardens - Mission Statement



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*National Air and Space Museum*

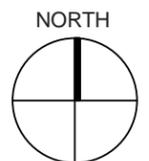
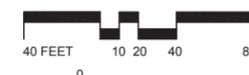


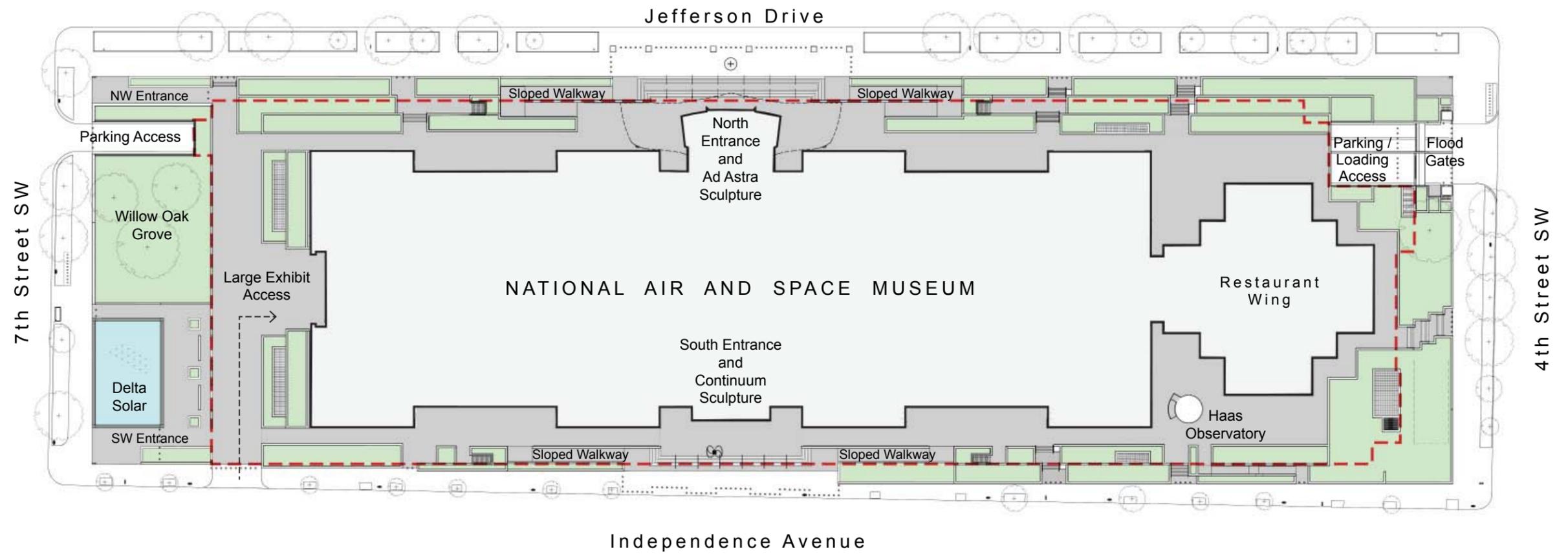
**Illustrative Plan - Final Design**



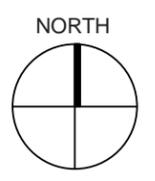
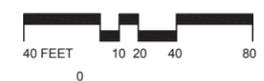
Smithsonian Institution  
*National Air and Space Museum*

--- Basement Edge of Structure



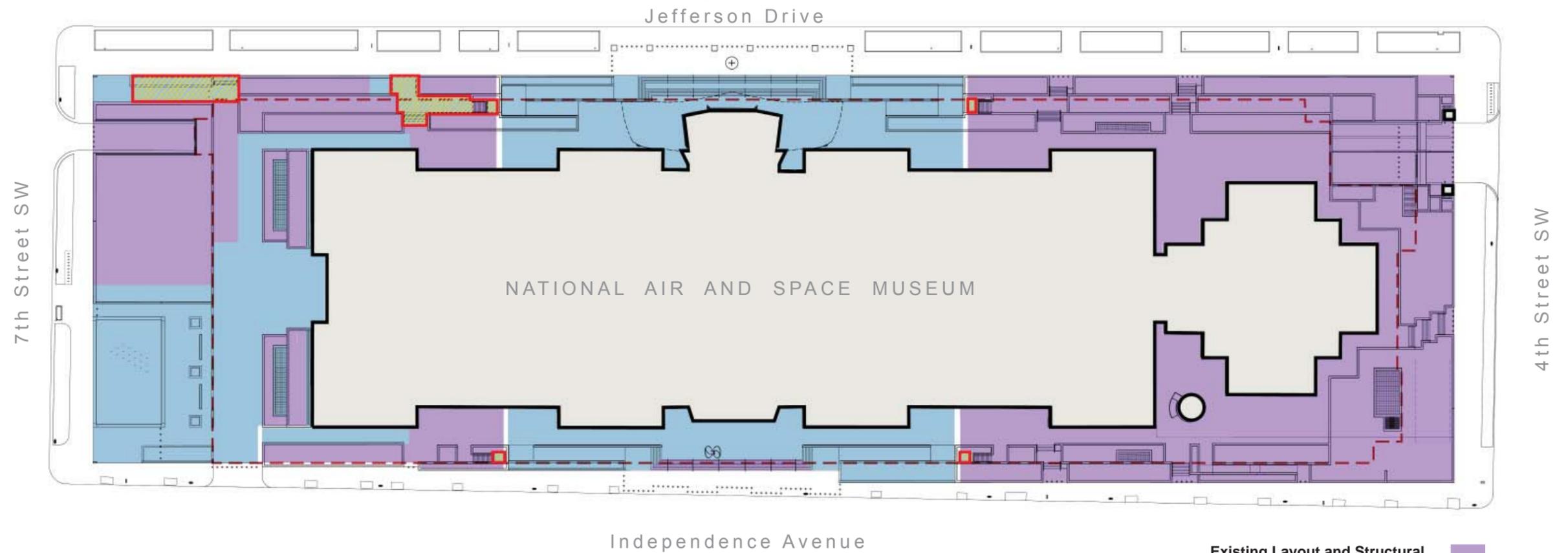


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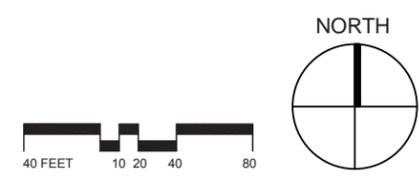


**Annotated Plan - Final Design**





- Existing Layout and Structural Condition To Remain (Finishes change) 
- Concept Design (Structure and Layout changes) 
- Code Deficiency Adjustments 
- Basement Edge of Structure 



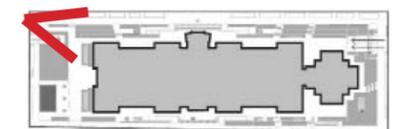
**Site Plan - Final Design**





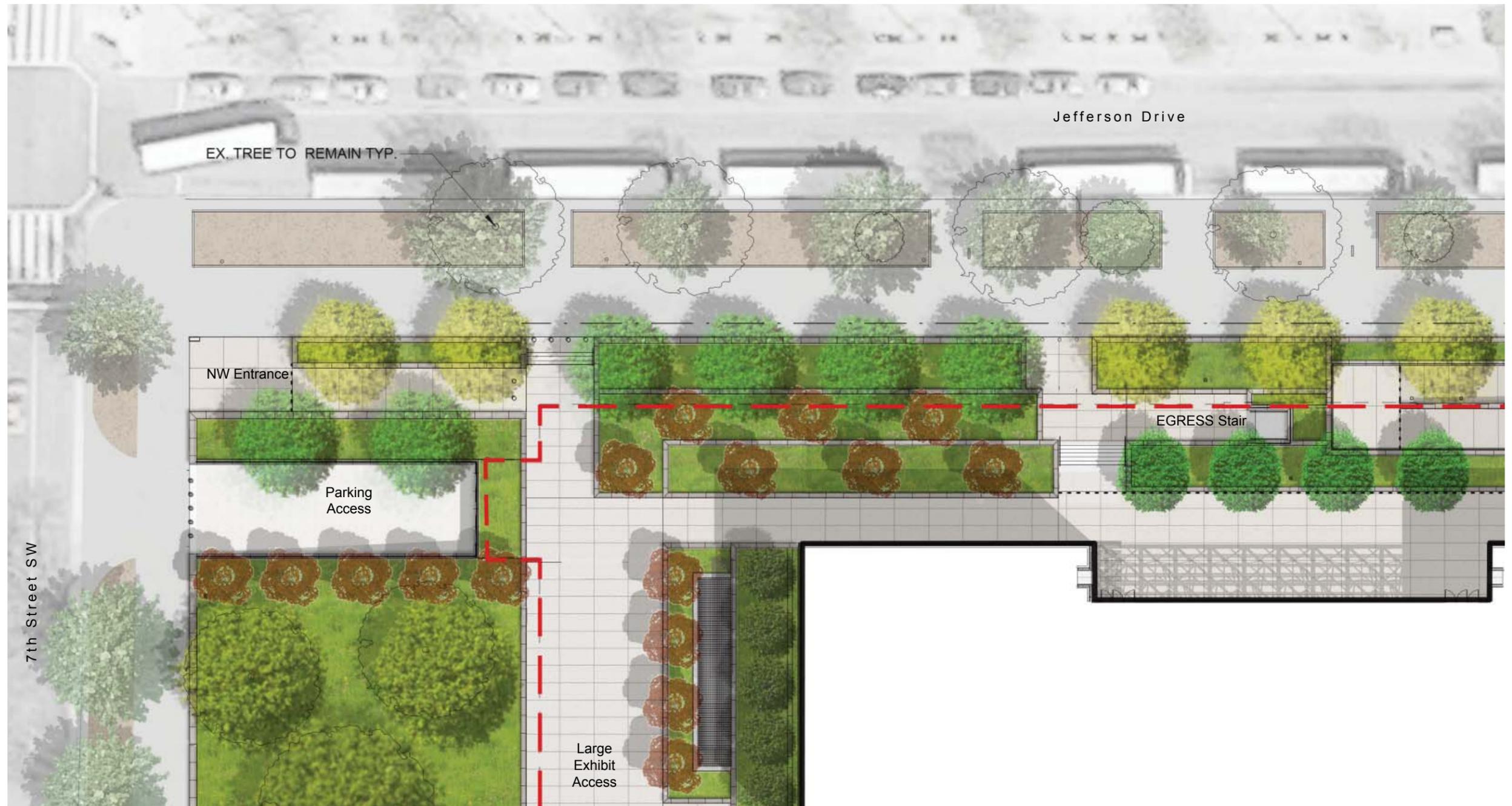
**Entrance Perspective - Northwest Corner - Existing Condition**



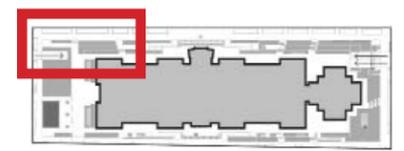


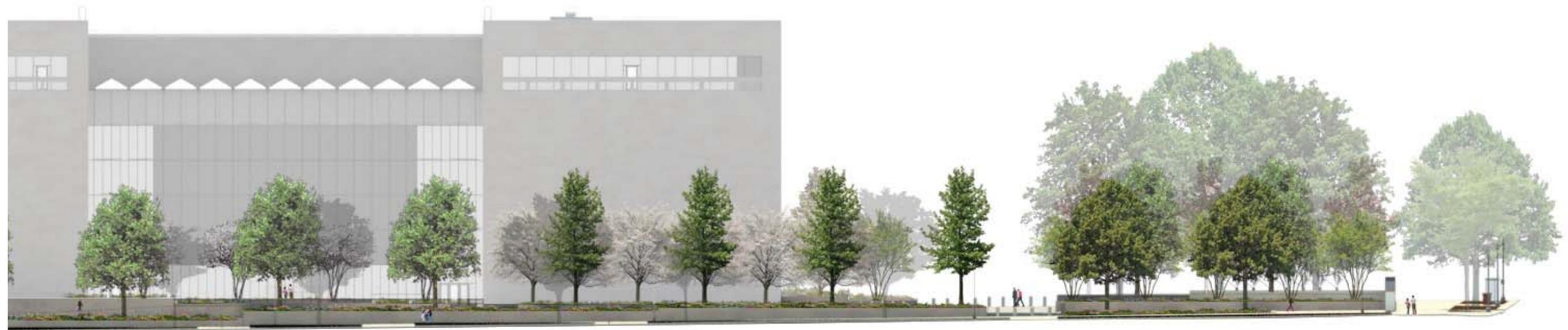
**Entrance Perspective - Northwest Corner - Final Design**





**Enlargement Plan - Northwest Corner - Final Design**

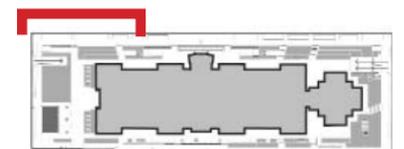




**Site Elevation - Northwest Corner - Final Design**



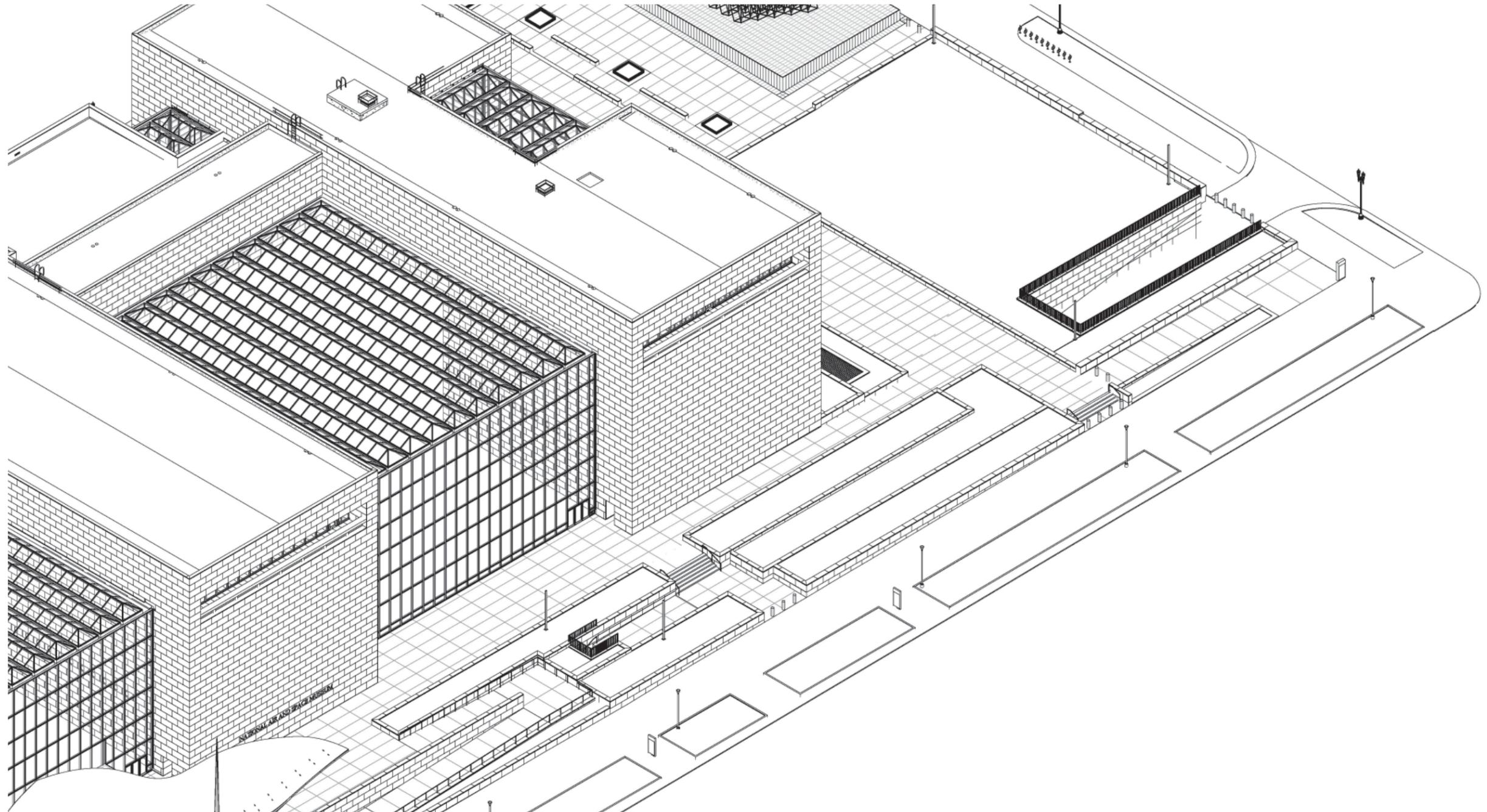
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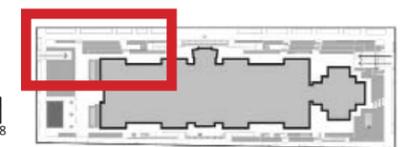


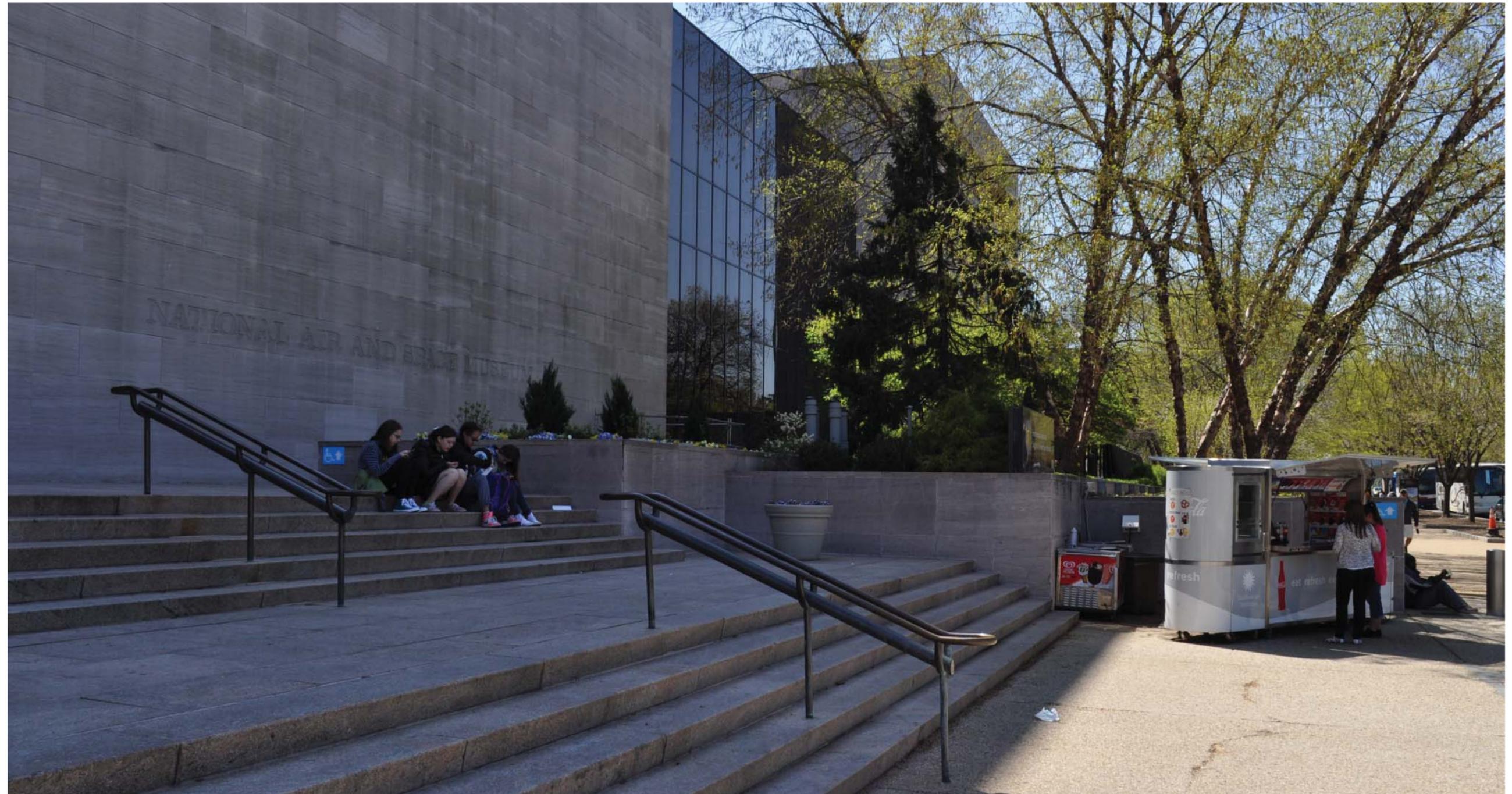
**Section - Northwest corner - Final Design**





**Axonometric Drawing** - Northwest corner - Final Design





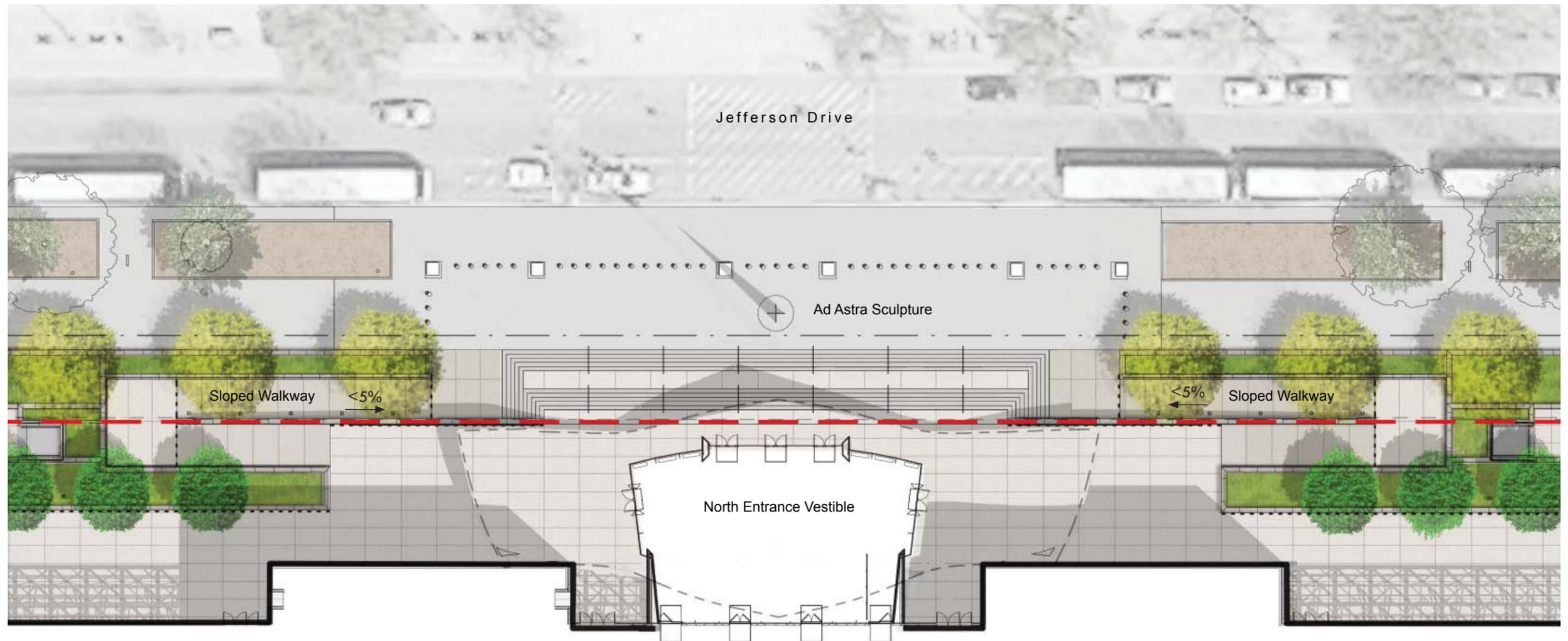
**Entrance Perspective - North Building Entrance - Existing Condition**





**Entrance Perspective - North Building Entrance - Final Design**





### Enlargement Plan - North Building Entrance - Final Design

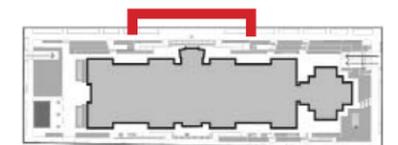


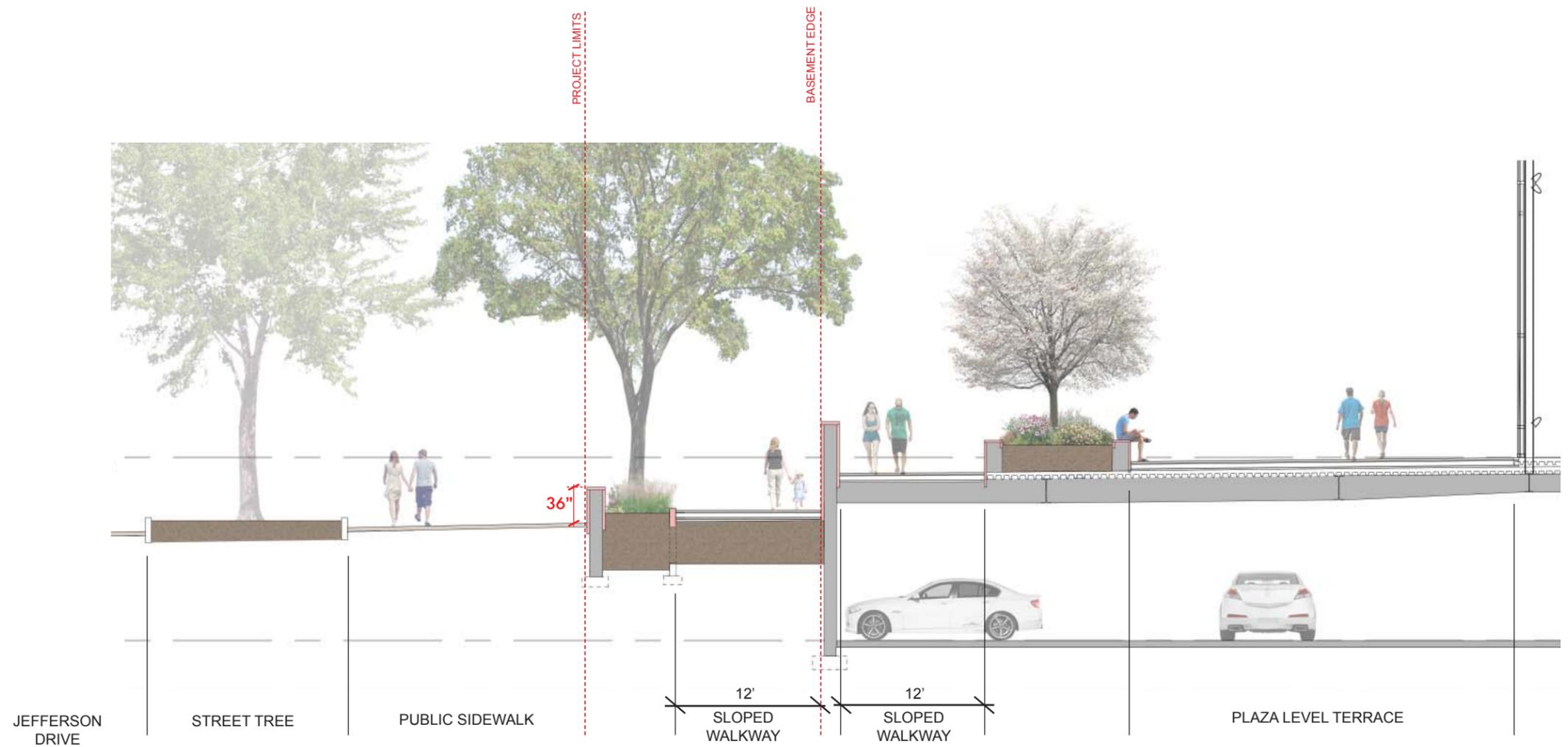


**Site Elevation - North Building Entrance - Final Design**



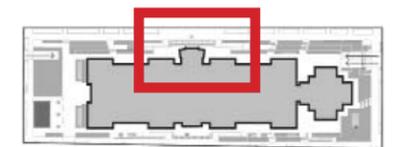
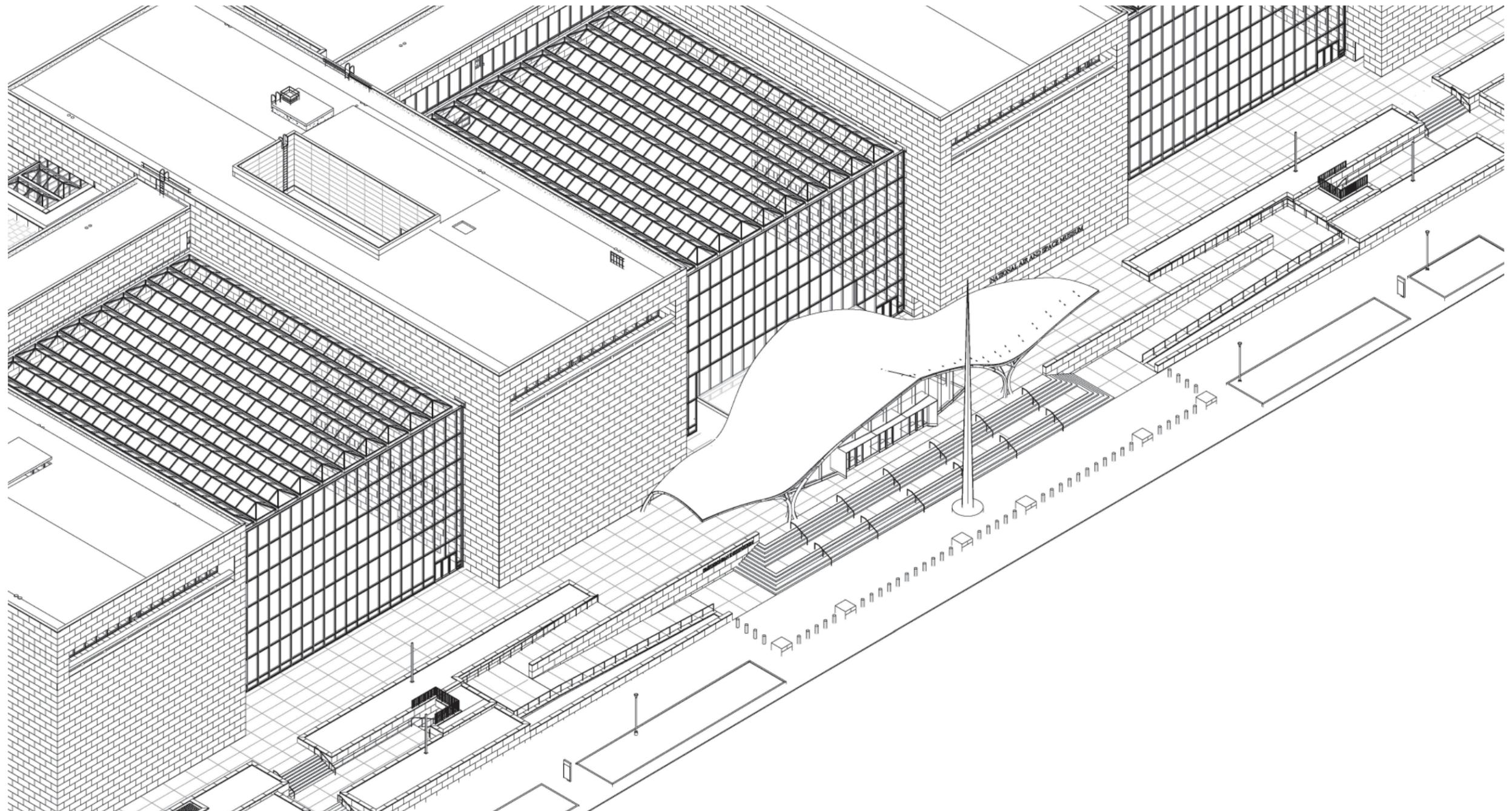
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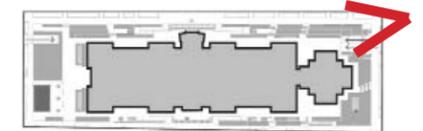
**Section - North Building Entrance - Final Design**





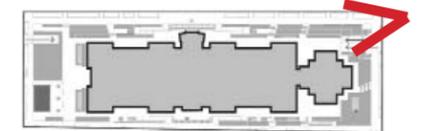
**Axonometric Drawing - North Building Entrance - Final Design**





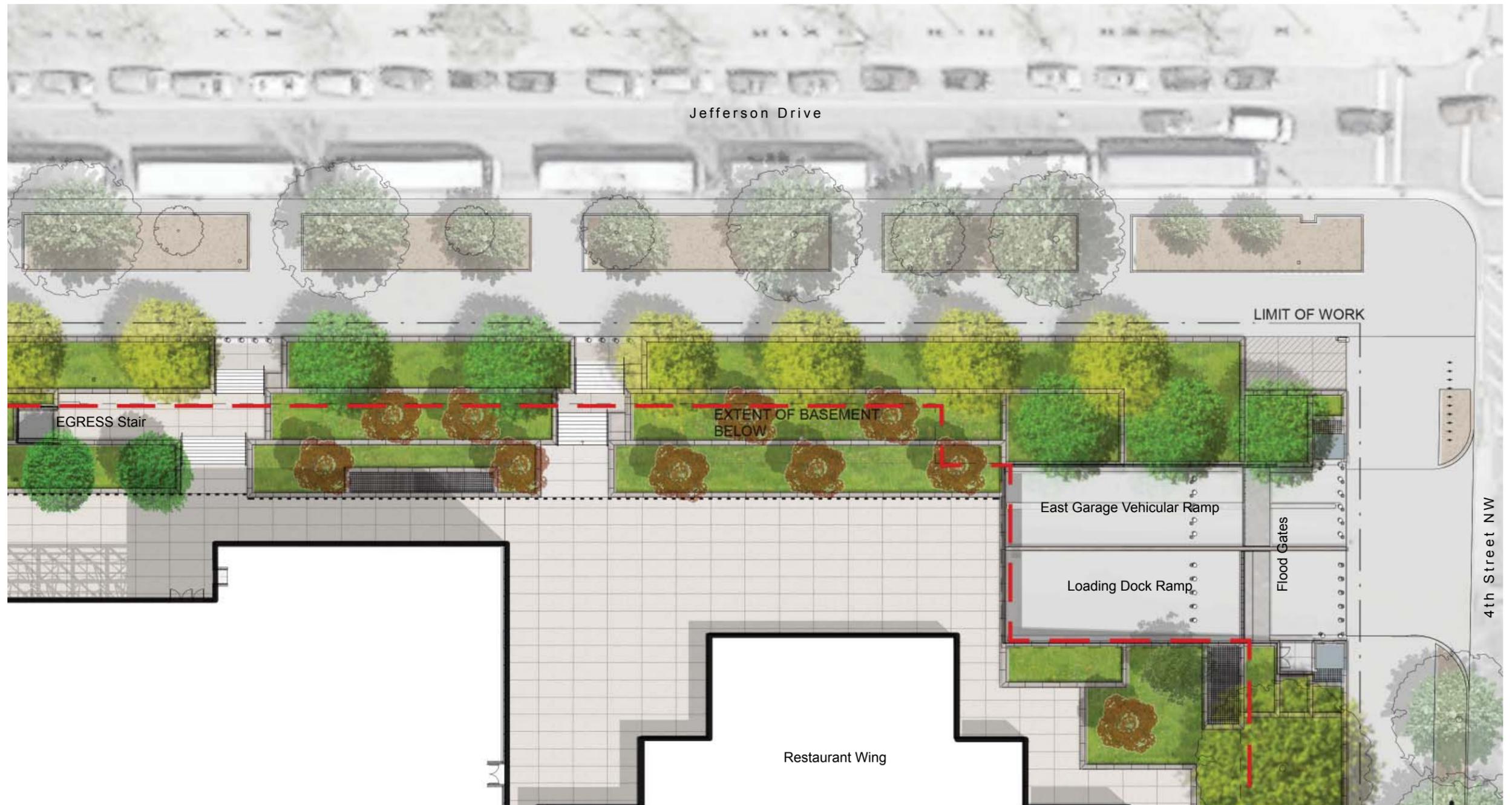
**Entrance Perspective - Northeast Corner - Existing Condition**



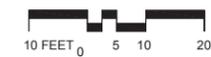


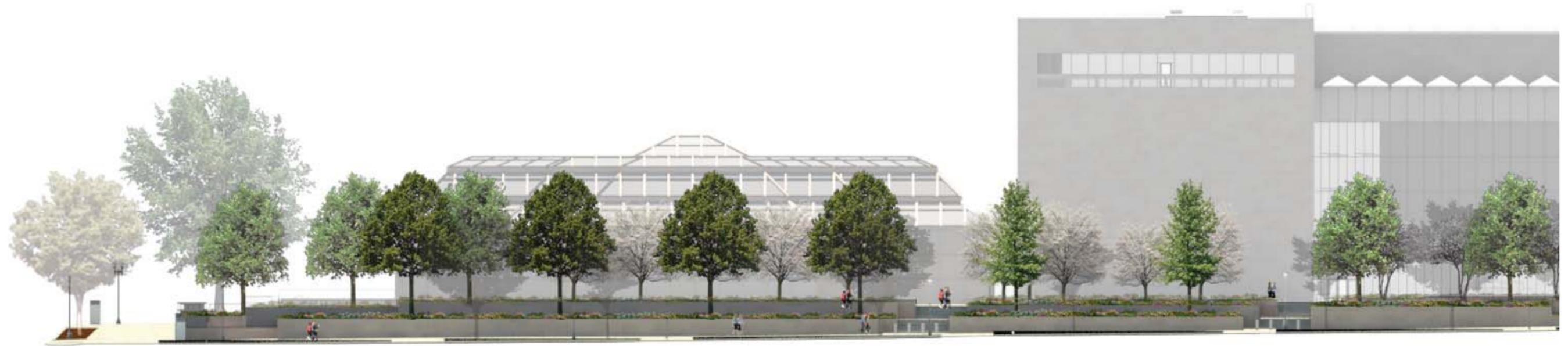
**Entrance Perspective - Northeast Corner - Final Design**





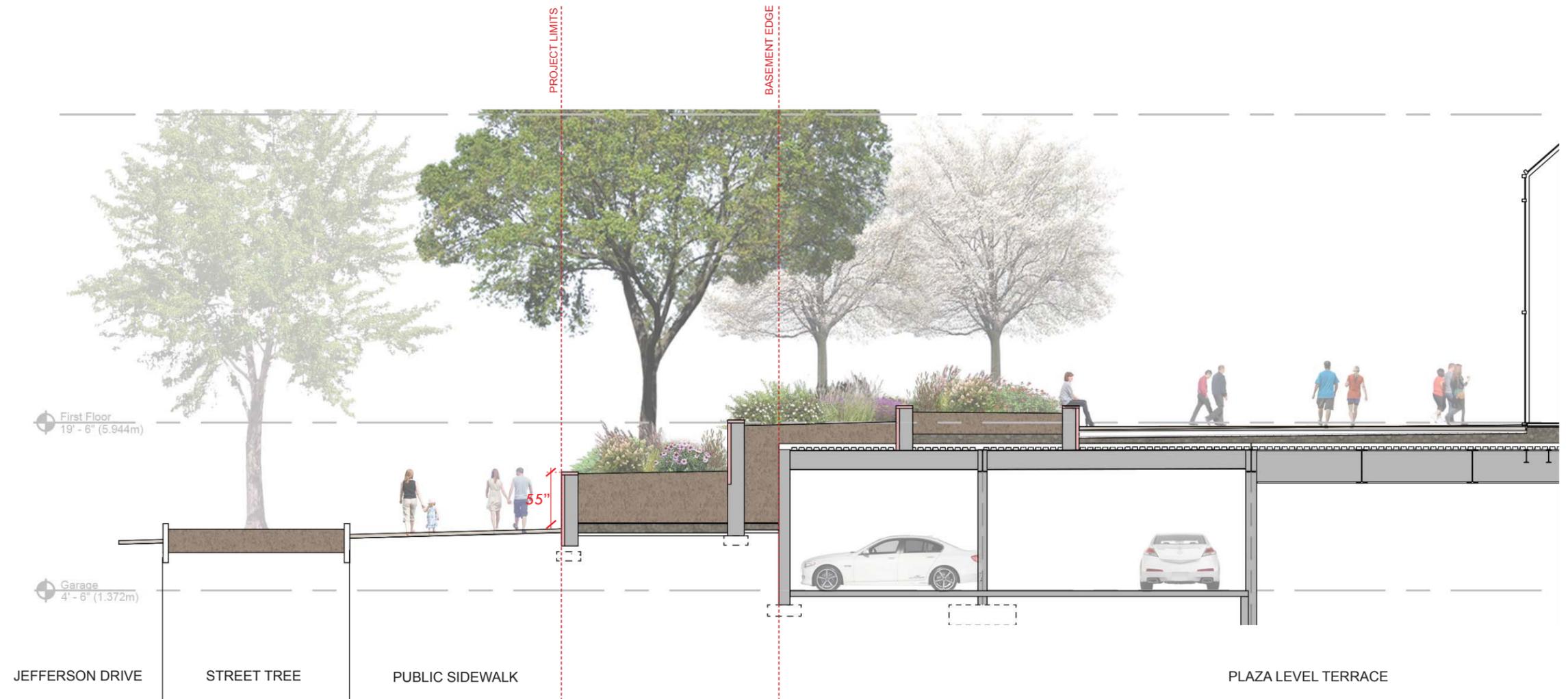
**Enlargement Plan - Northeast Corner - Final Design**



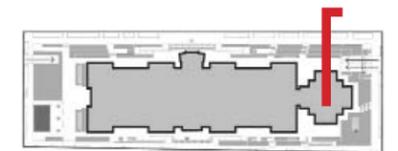


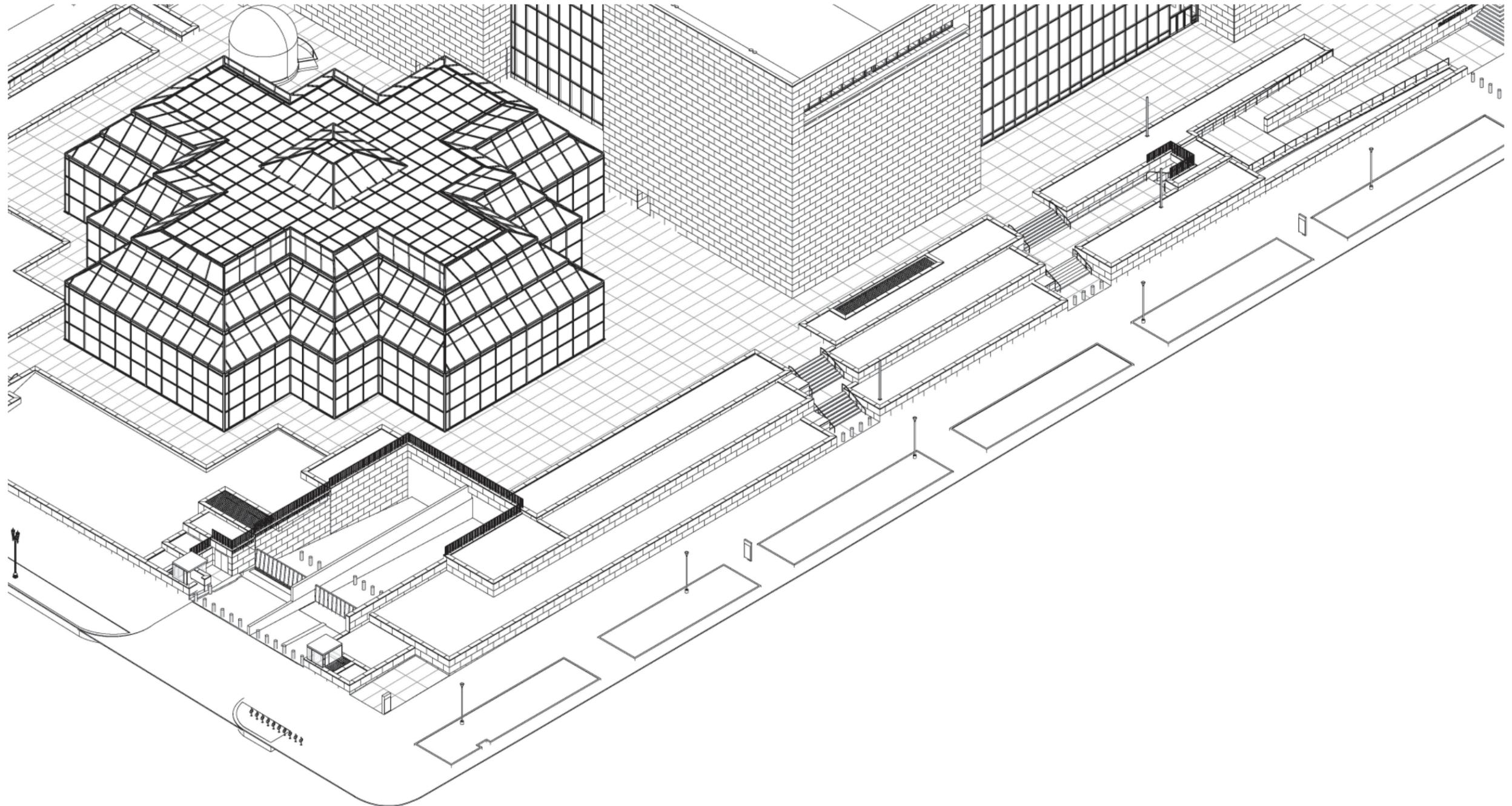
**Site Elevation - Northeast Corner - Final Design**





**Section - Northeast Corner - Final Design**



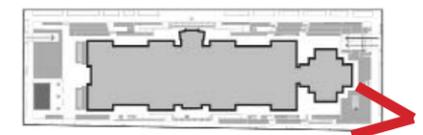


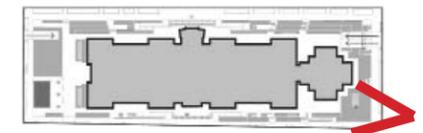
**Axonometric Drawing - Northeast Corner - Final Design**





**Entrance Perspective - Southeast Corner - Existing Condition**

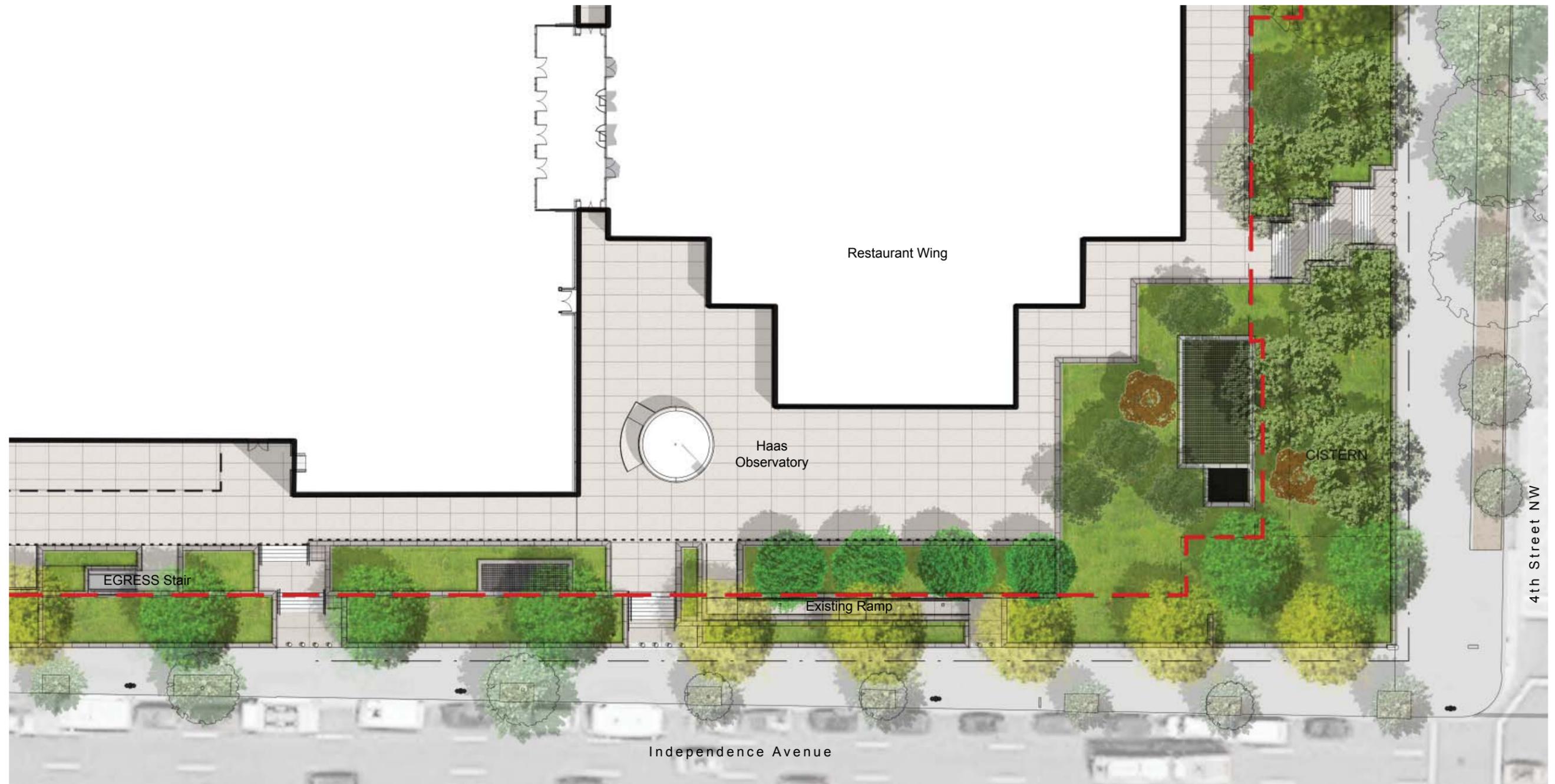




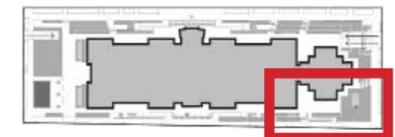
**Entrance Perspective - Southeast Corner - Final Design**



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*National Air and Space Museum*



**Enlargement Plan -Southeast Corner - Final Design**

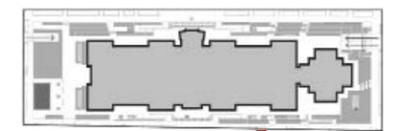


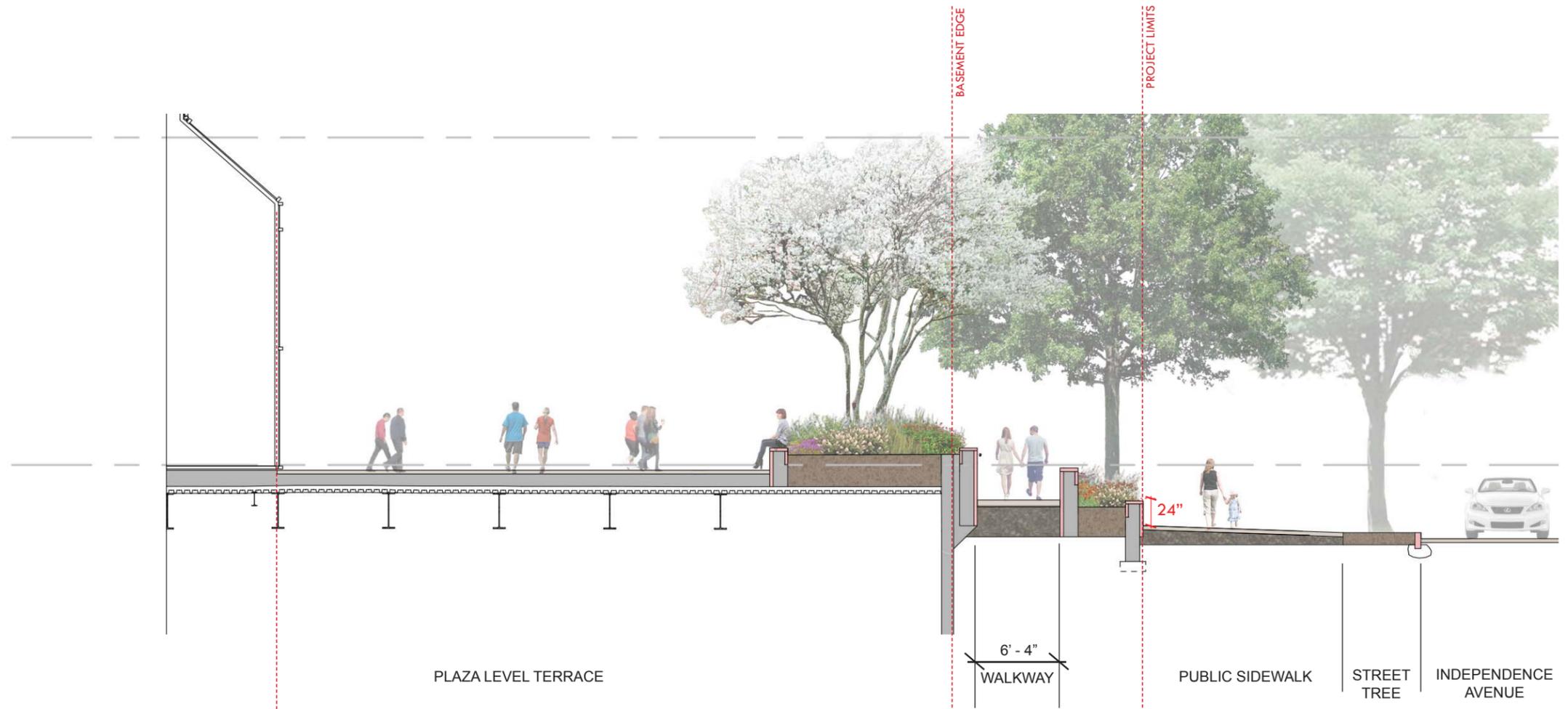


**Site Elevation - Southeast Corner - Final Design**

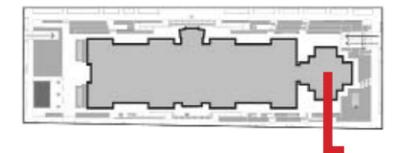


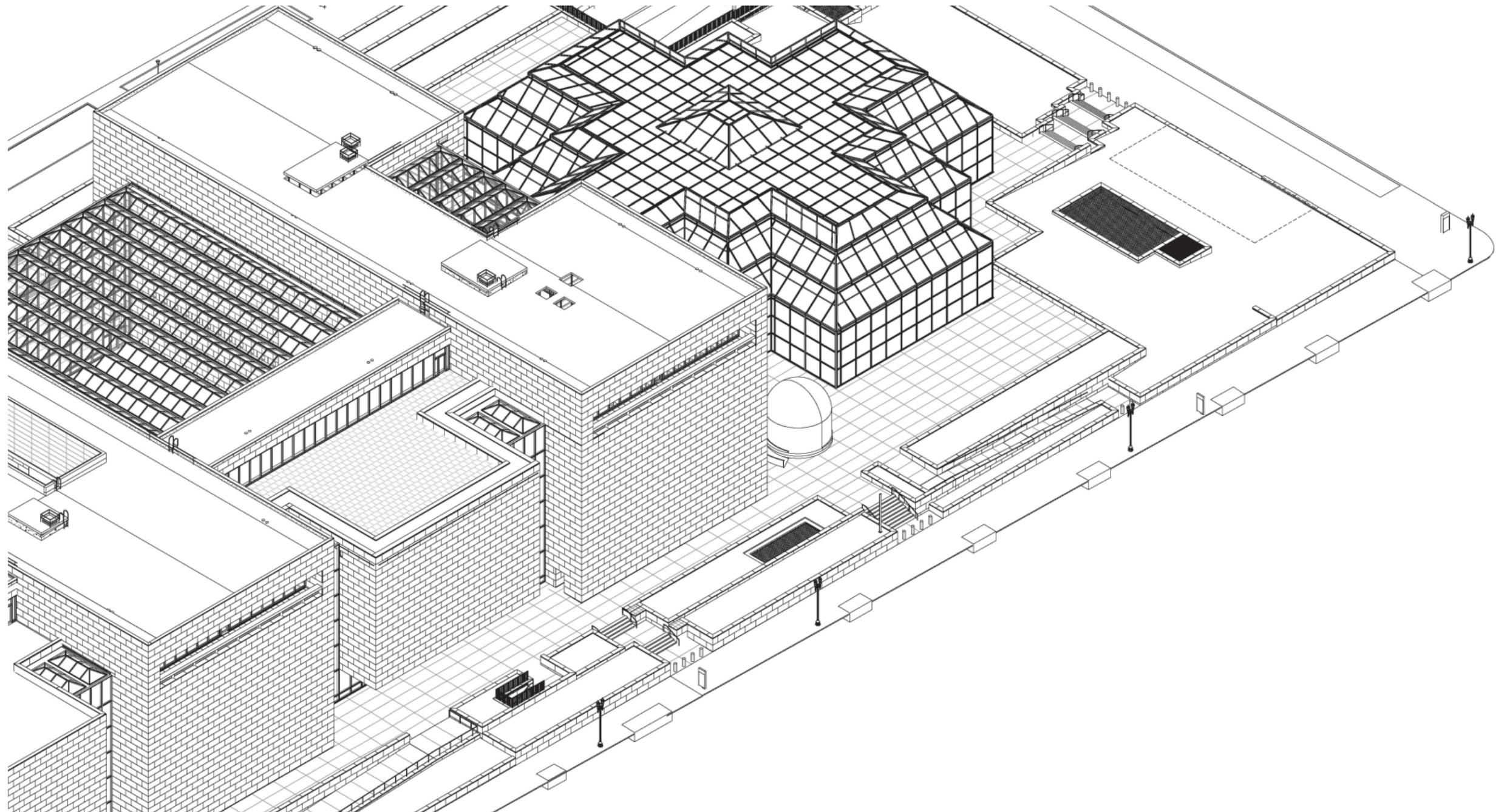
Smithsonian Institution  
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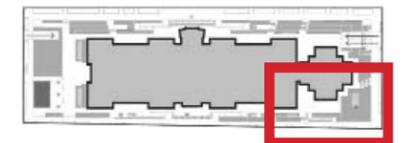


**Section - Southeast Corner - Final Design**





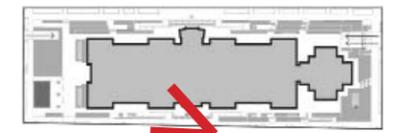
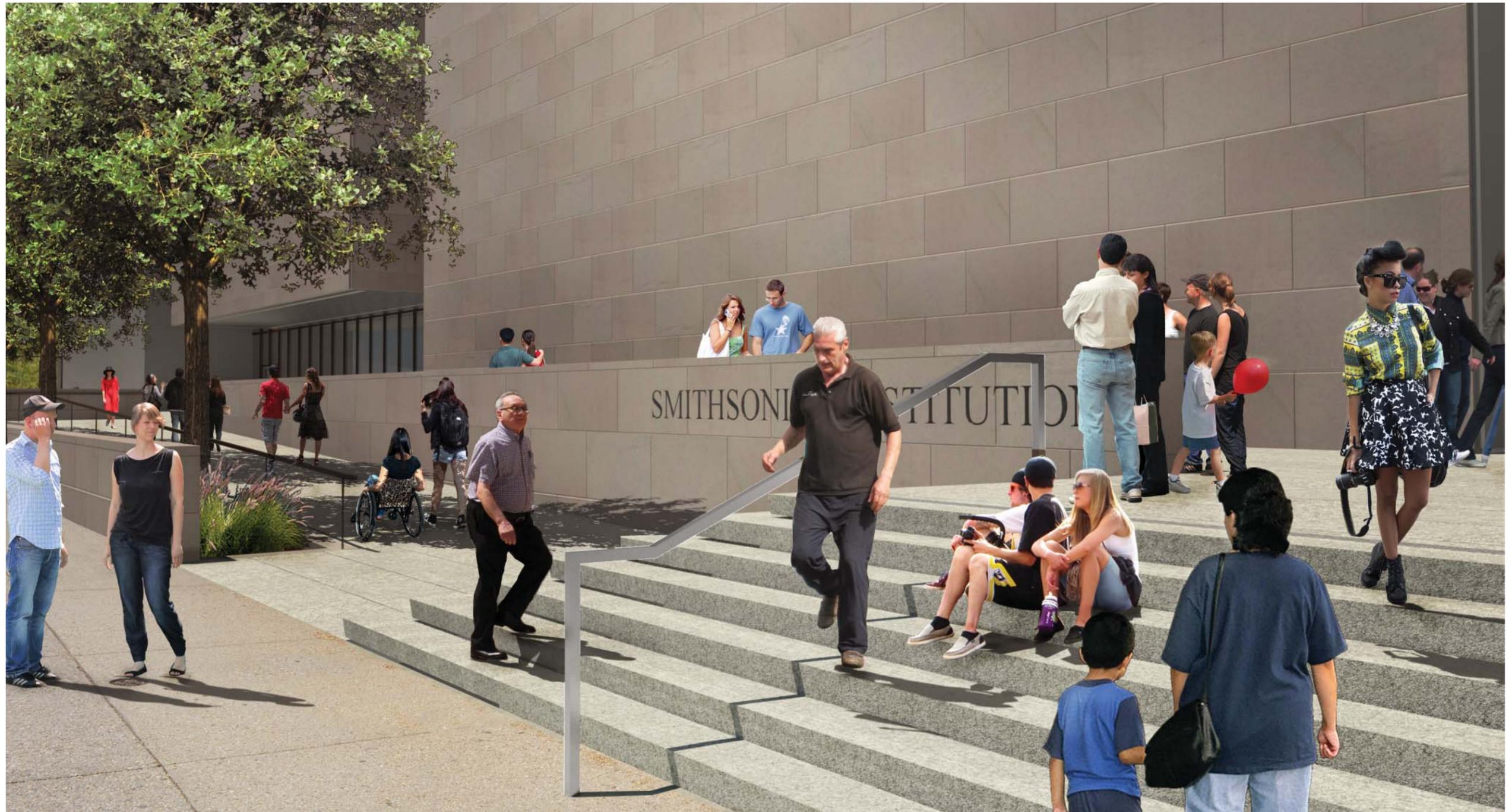
**Axonometric Drawing - Southeast Corner - Final Design**





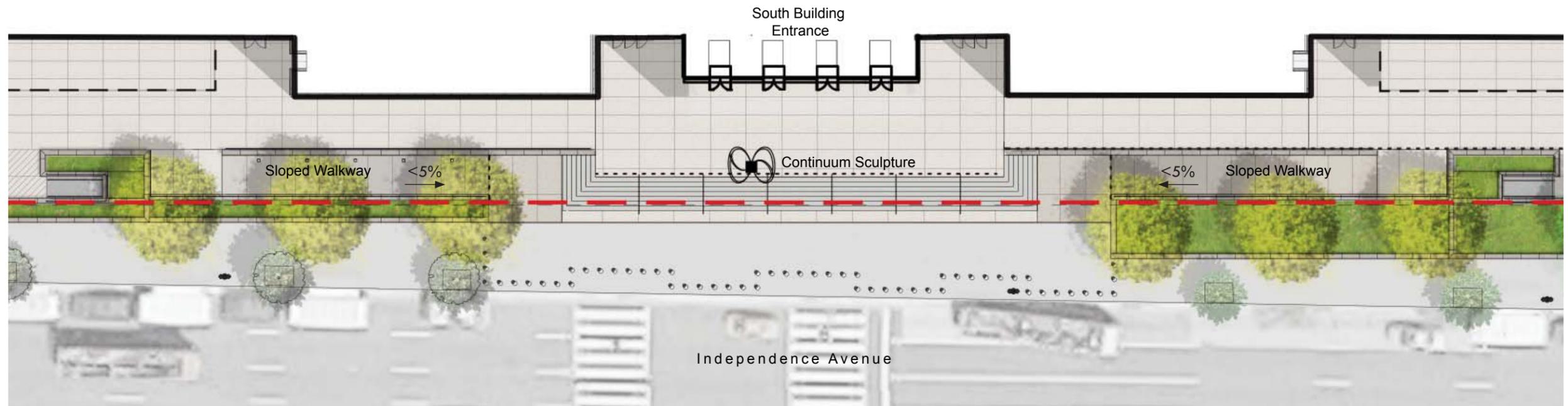
**Entrance Perspective - South Building Entrance - Existing Condition**



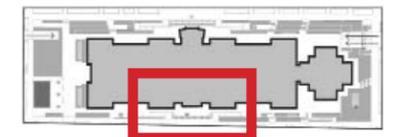


**Entrance Perspective - South Building Entrance - Final Design**



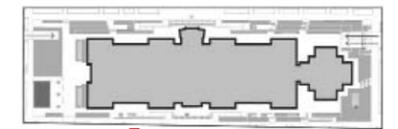


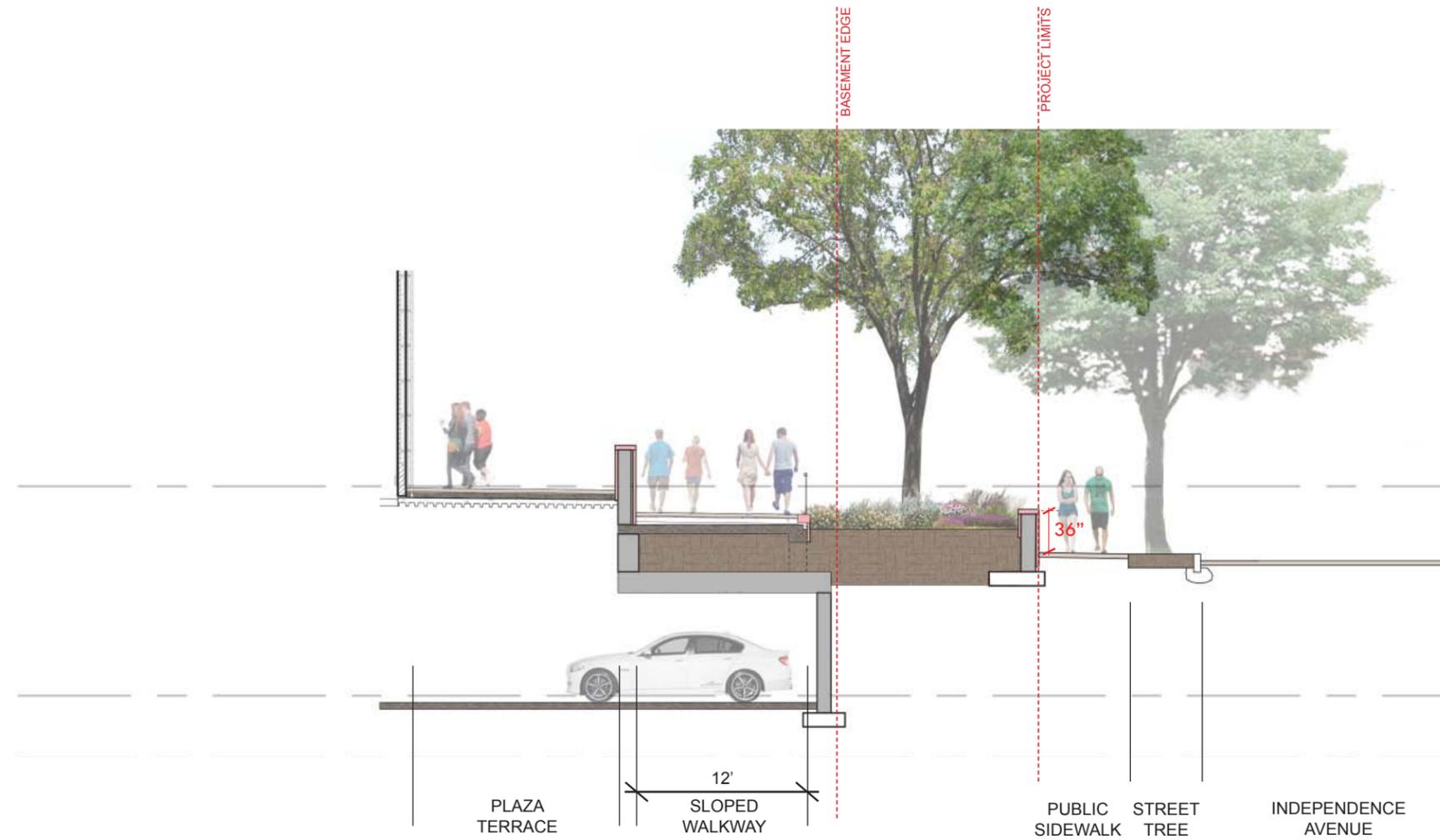
**Enlargement Plan -South Building Entrance - Final Design**



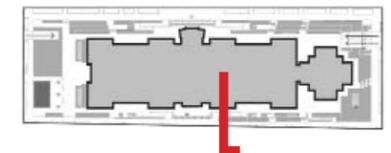


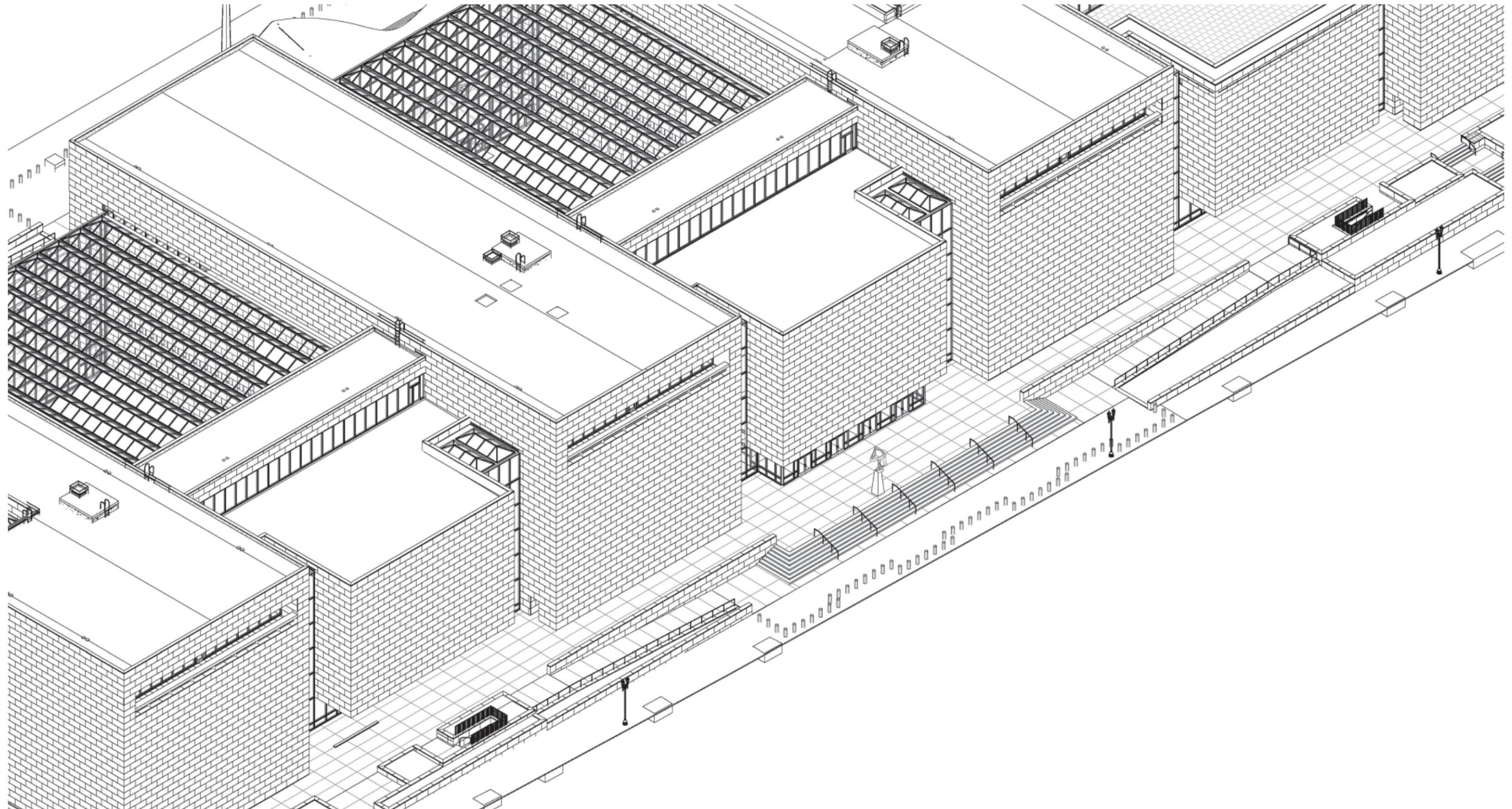
**Site Elevation - South Building Entrance - Final Design**



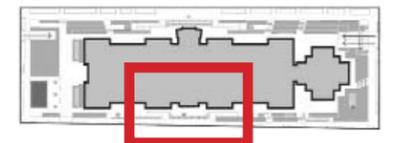


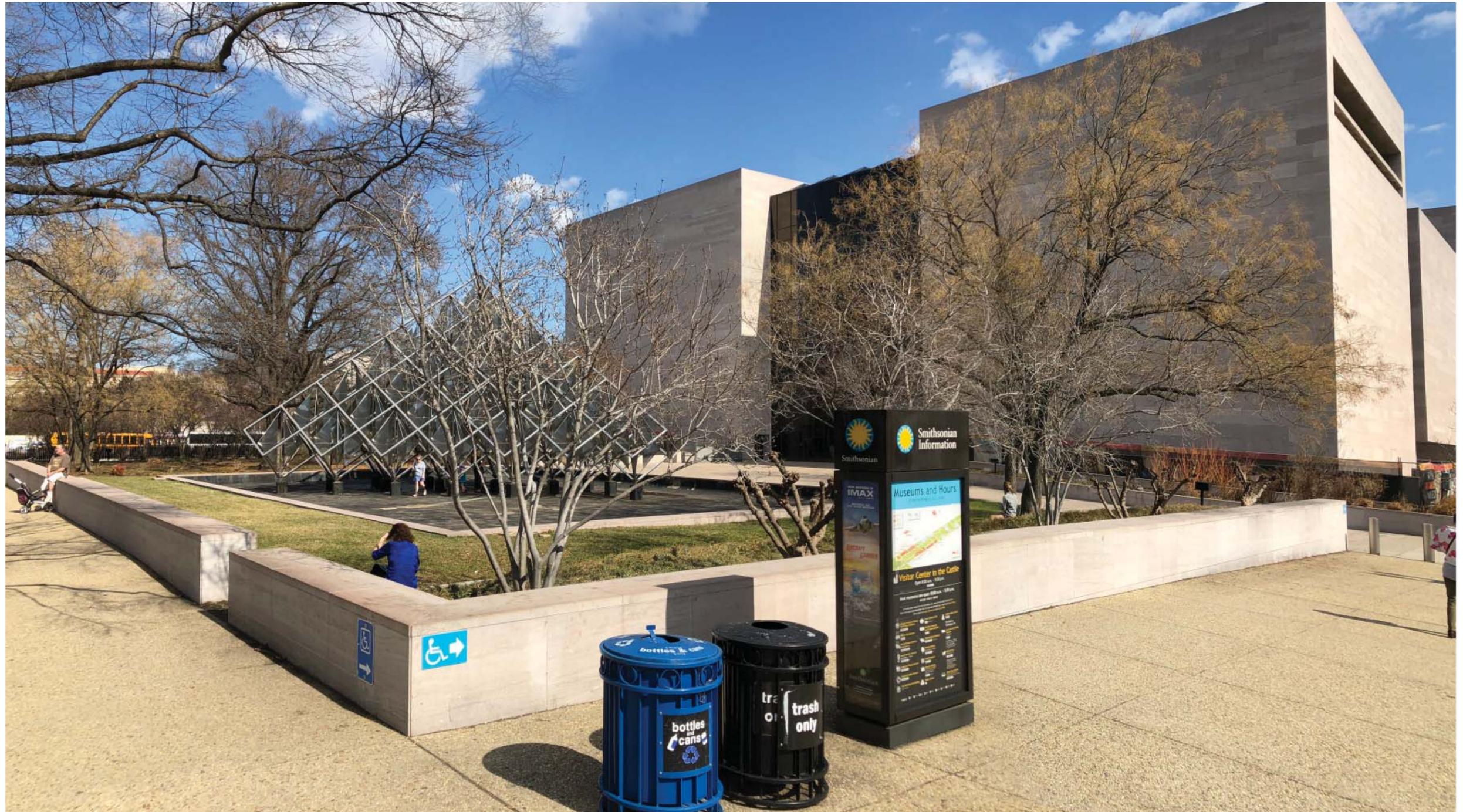
**Section - South Building Entrance - Final Design**



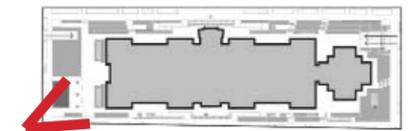


**Axonometric Drawing - South Building Entrance - Final Design**



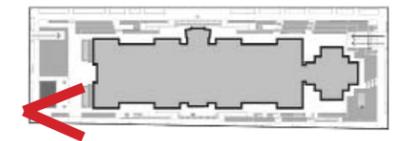


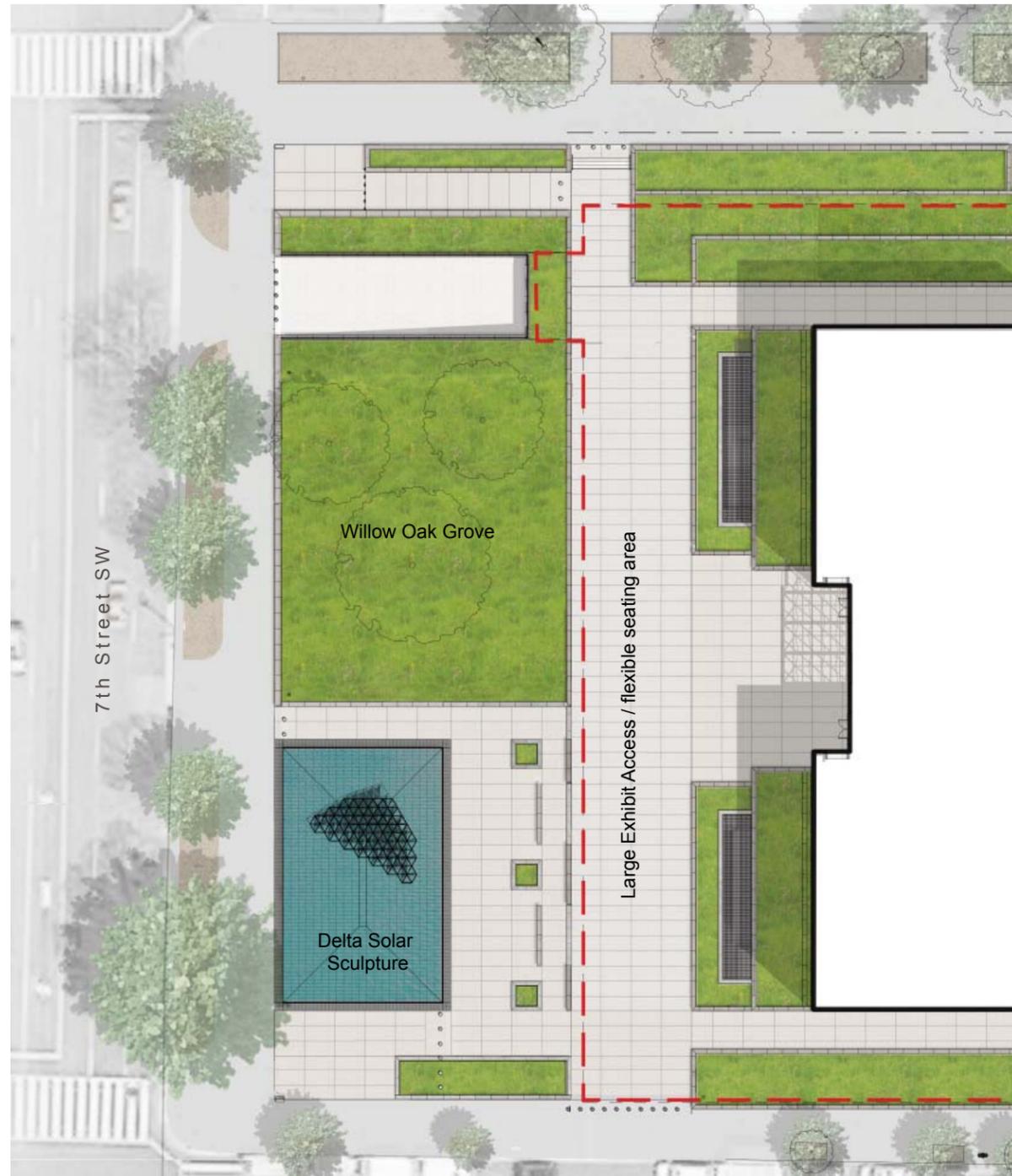
Entrance Perspective - Southwest Corner - Existing Condition



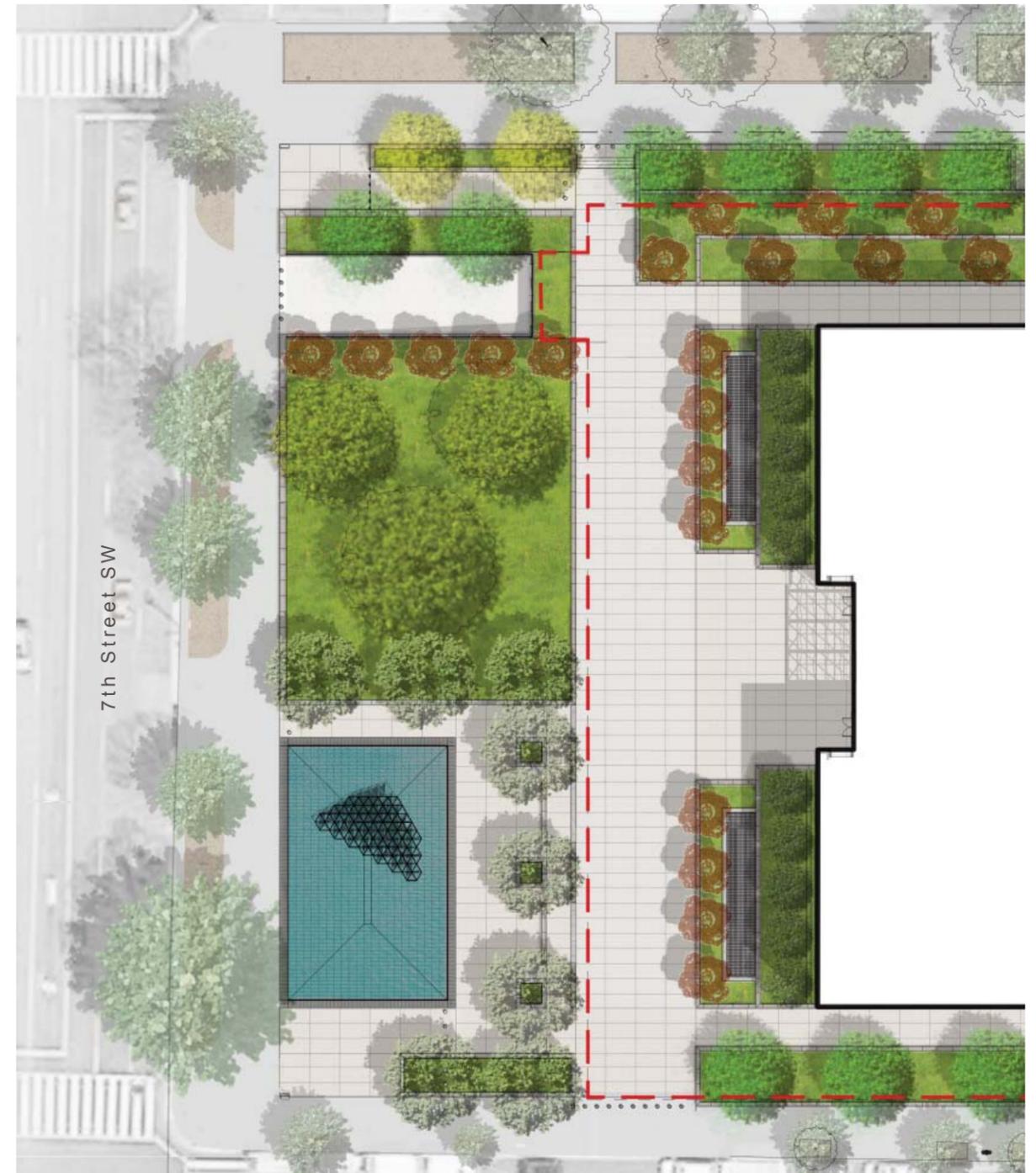


Entrance Perspective - Southwest Corner - Final Design



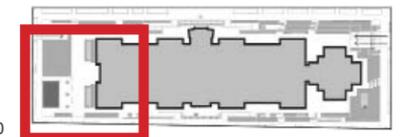


Ground Plane Plan



Tree Canopy Plan

### Enlargement Plan - Southwest Corner - Final Design

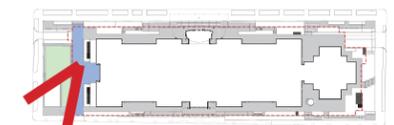


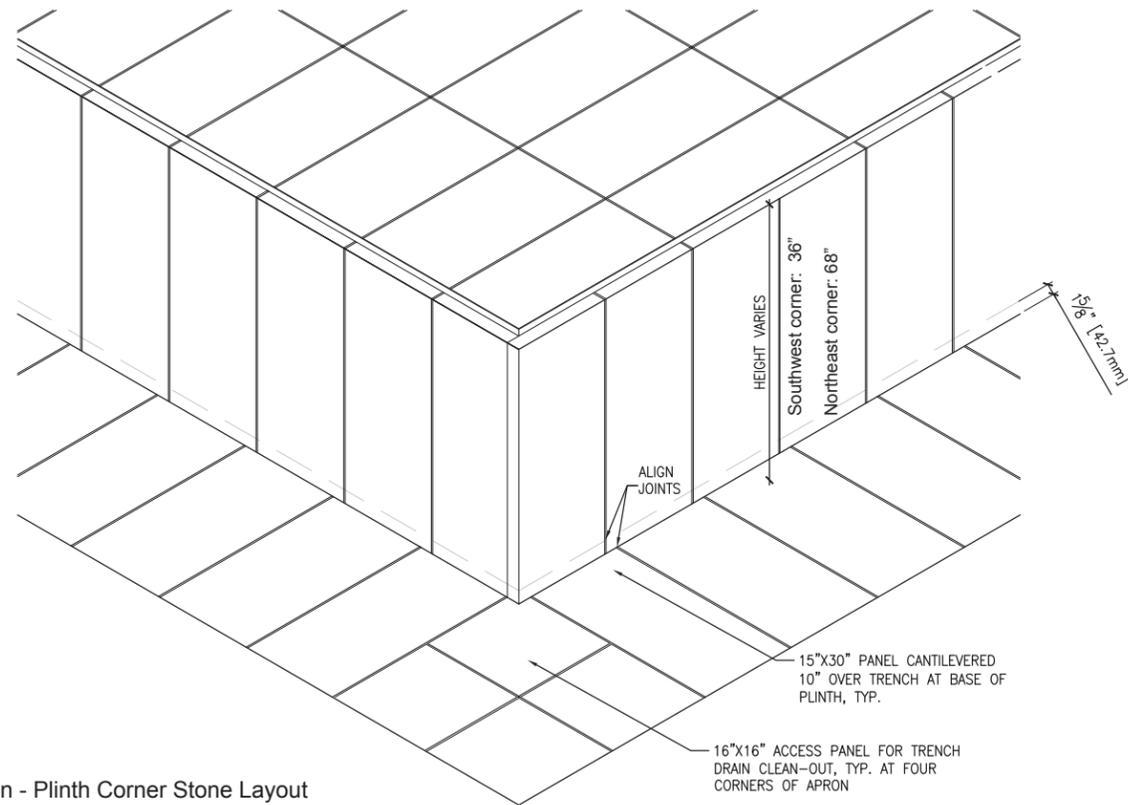


**Fountain Plaza - Southwest Corner - Final Design**

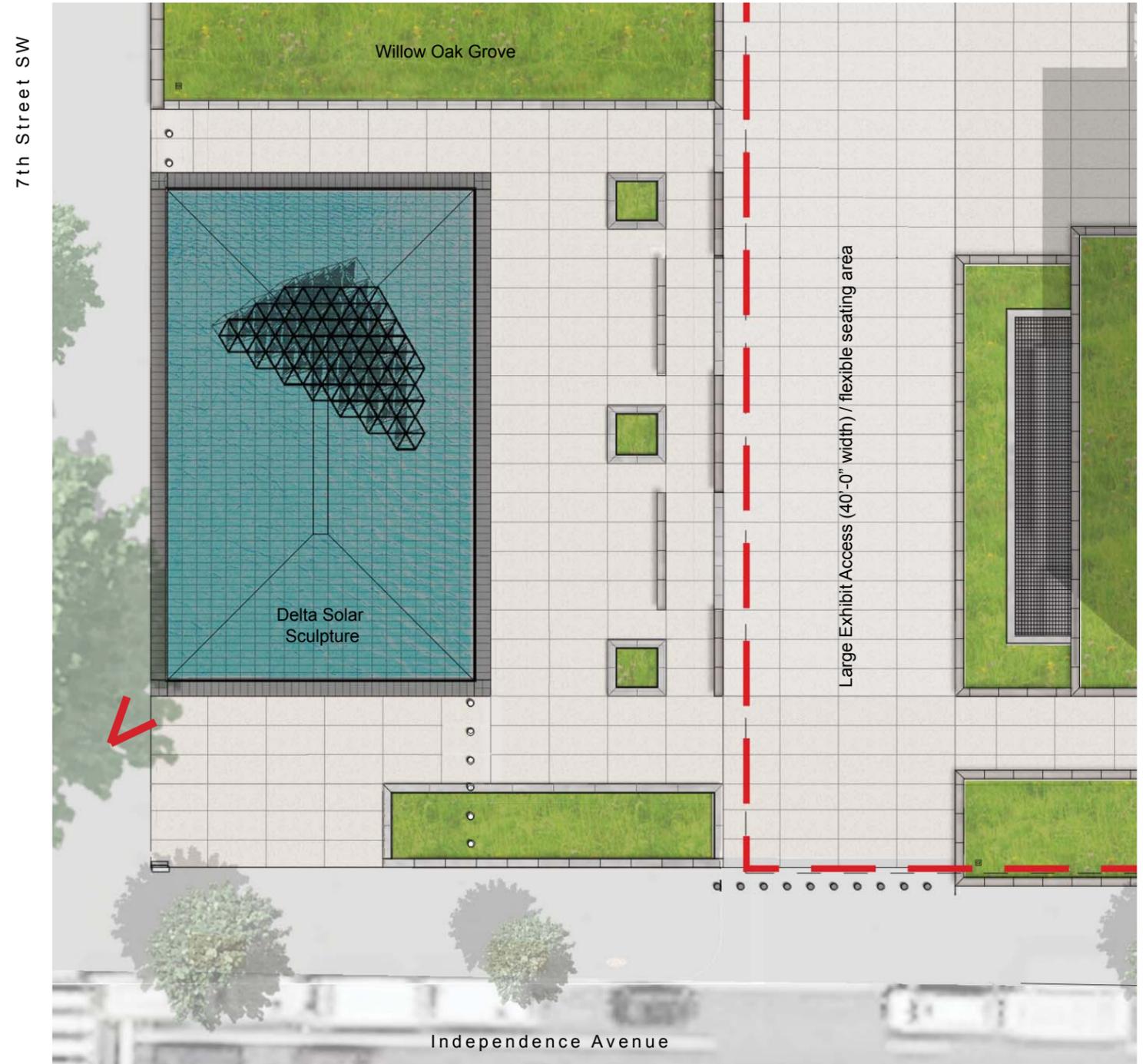


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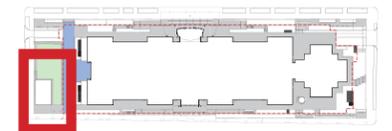




Axon - Plinth Corner Stone Layout

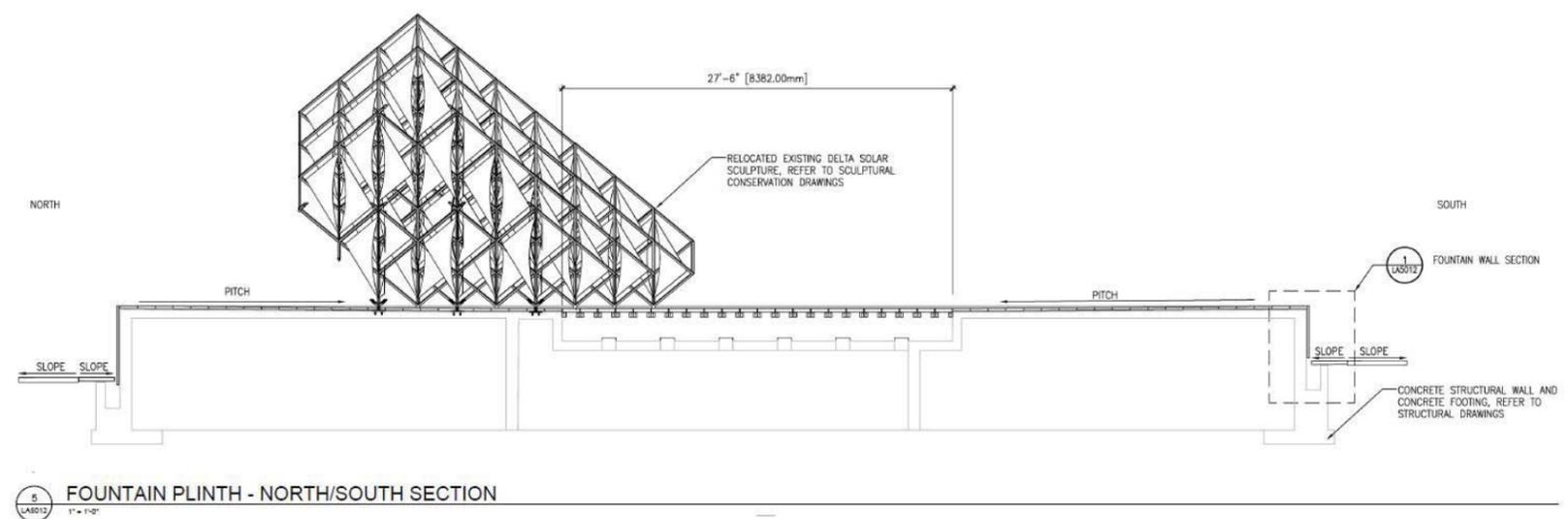
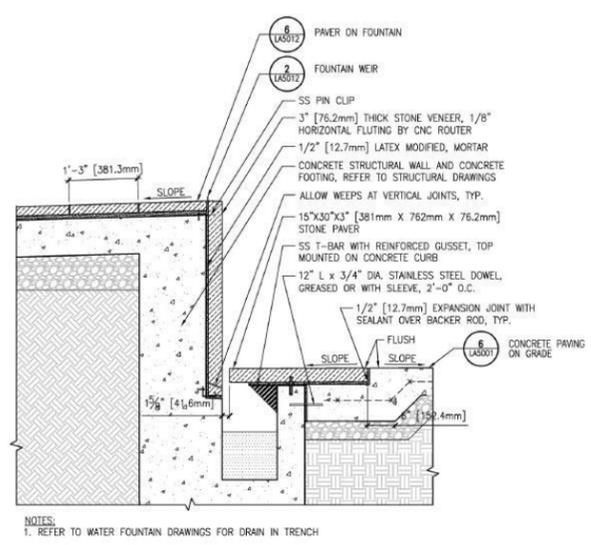
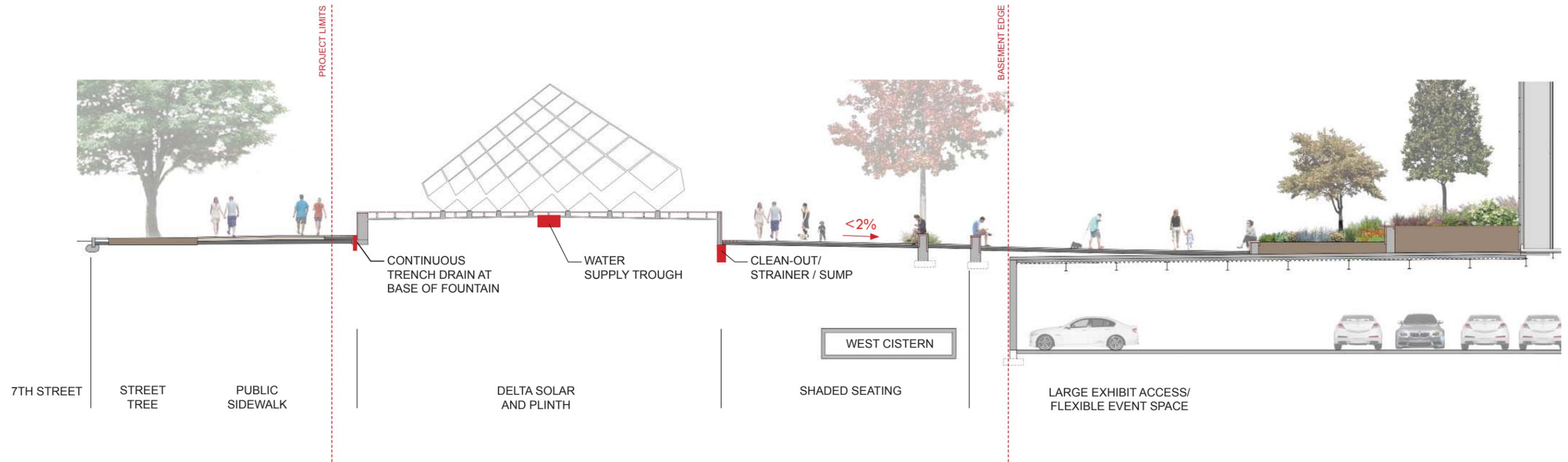


Plan - Fountain Plaza Layout



### Fountain Plaza Details - Southwest Corner - Final Design





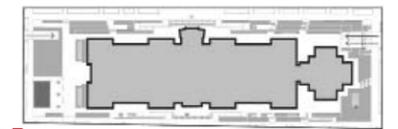
1 FOUNTAIN WALL  
1" = 1'-0"

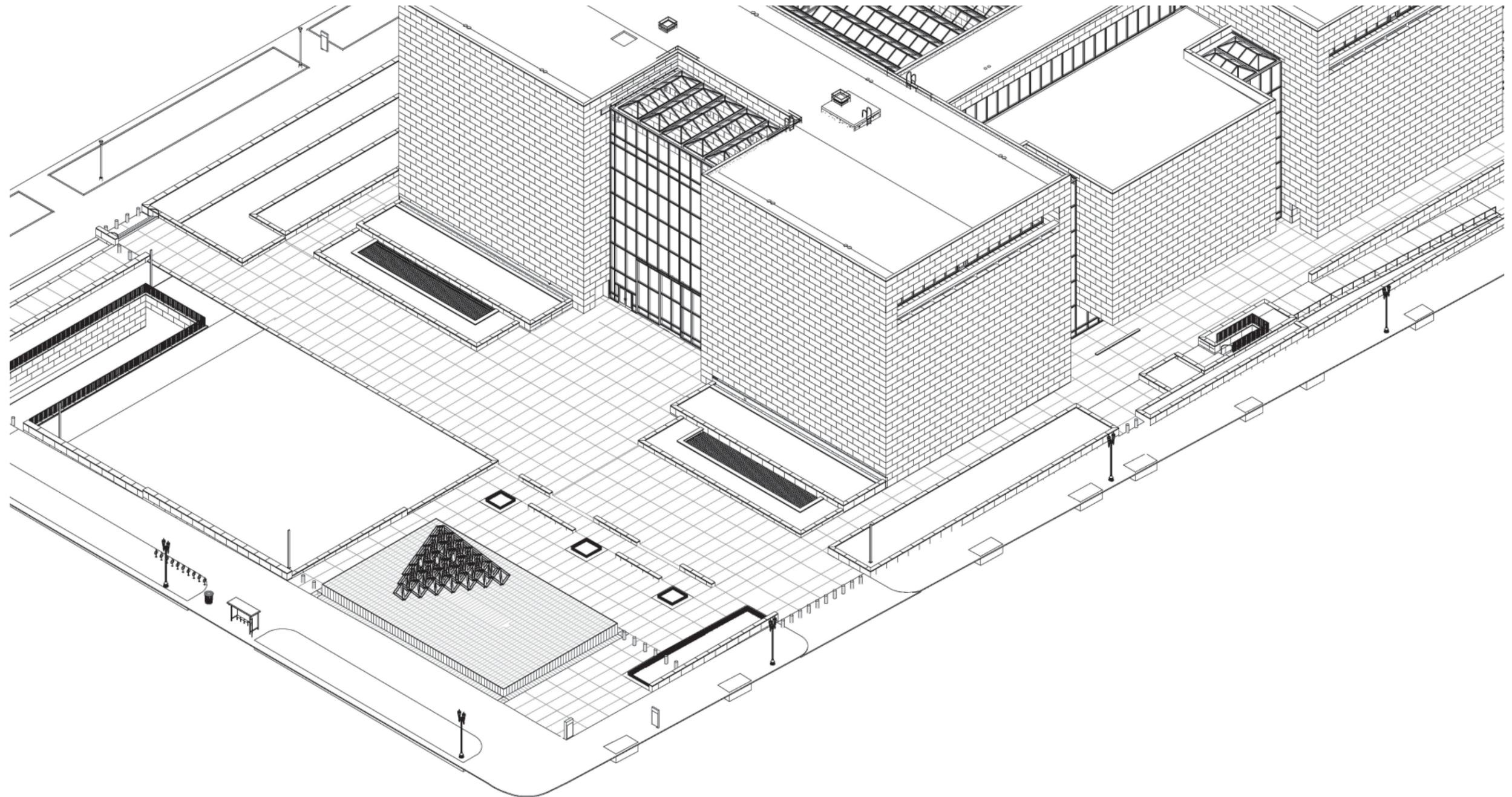
Section - Southwest Corner - Final Design



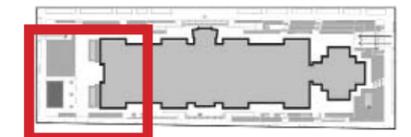


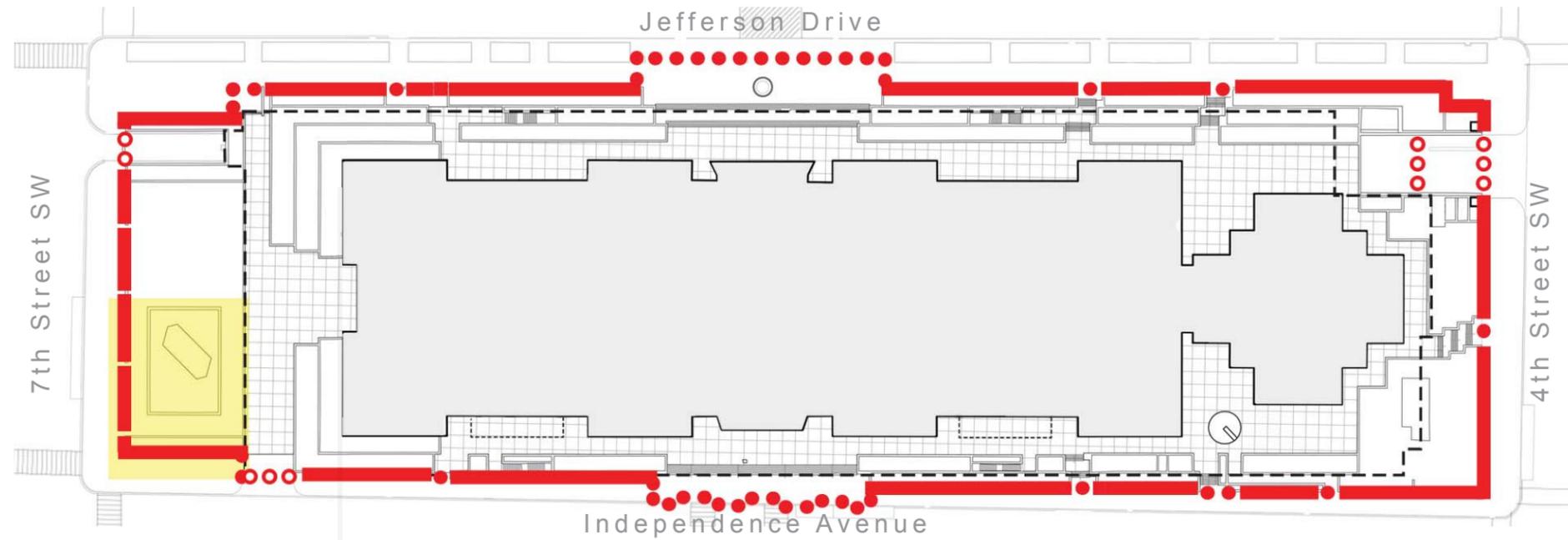
**Site Elevation - Southwest Corner - Final Design**



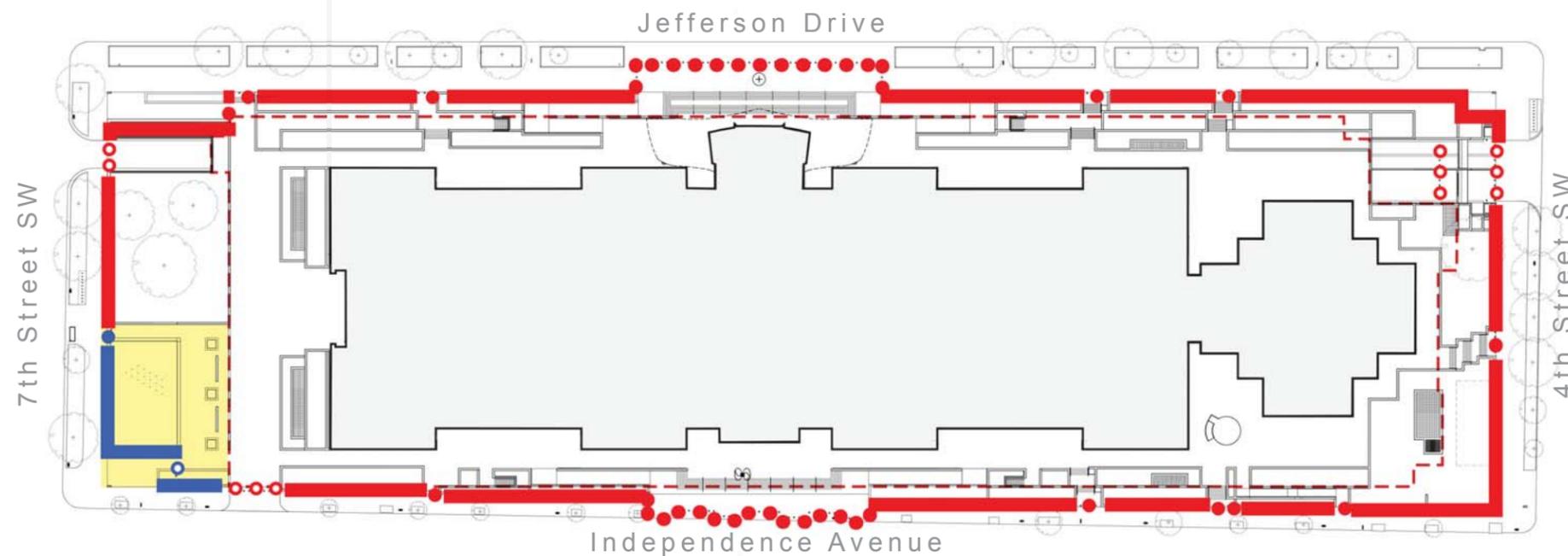


**Axonometric Drawing - Southwest Corner - Final Design**



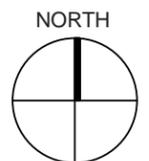


Existing Conditions



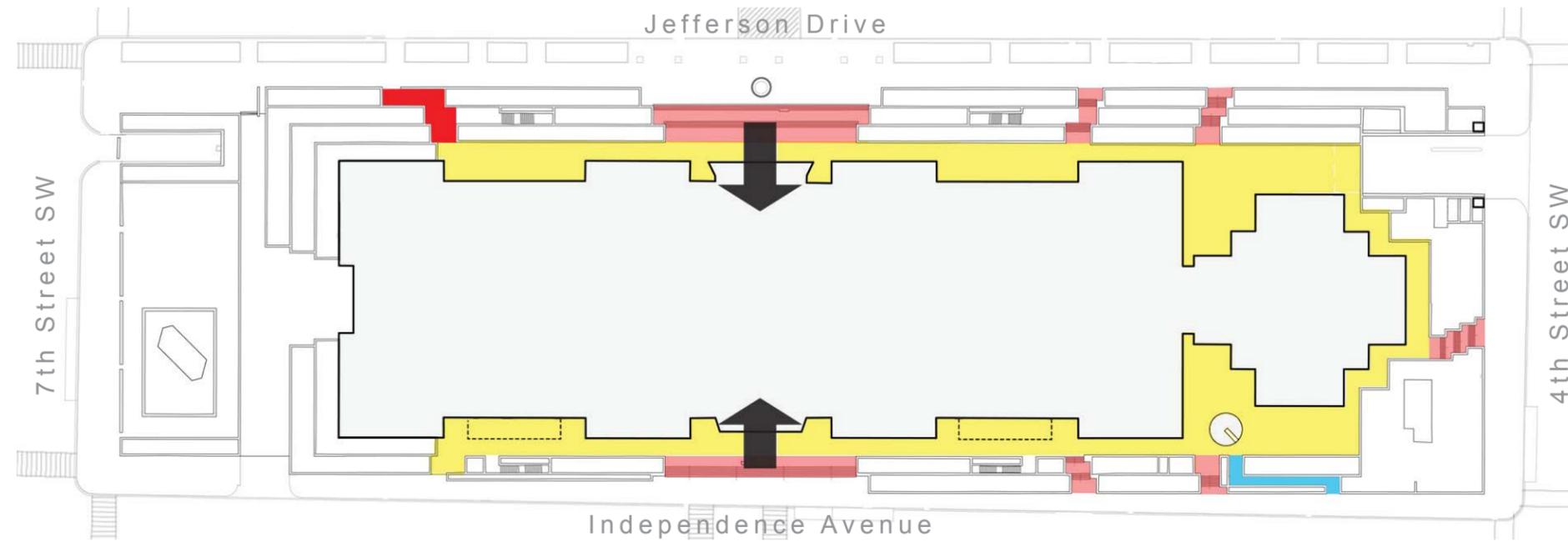
Final Design

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



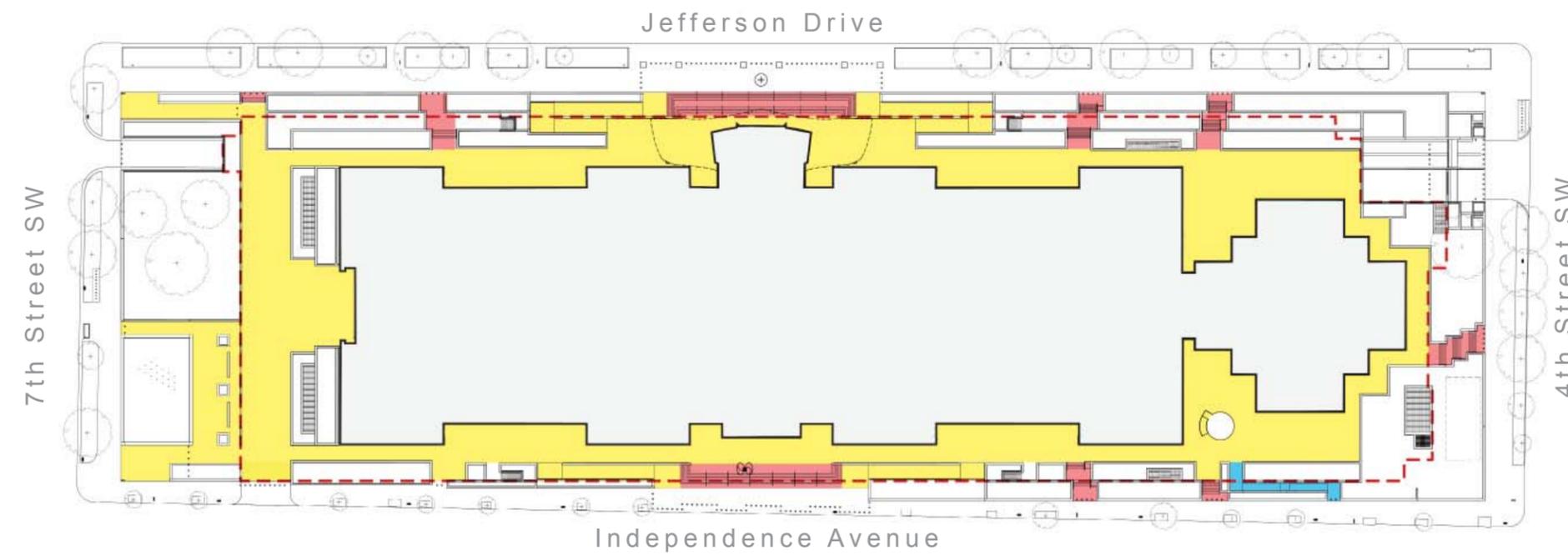
Perimeter Security





Existing Conditions

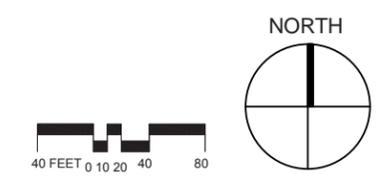
- Non ADA Compliant Ramp (1)
- Stairs (7)
- ADA Compliant Ramp (1)
- Accessible, At Grade Route (1)

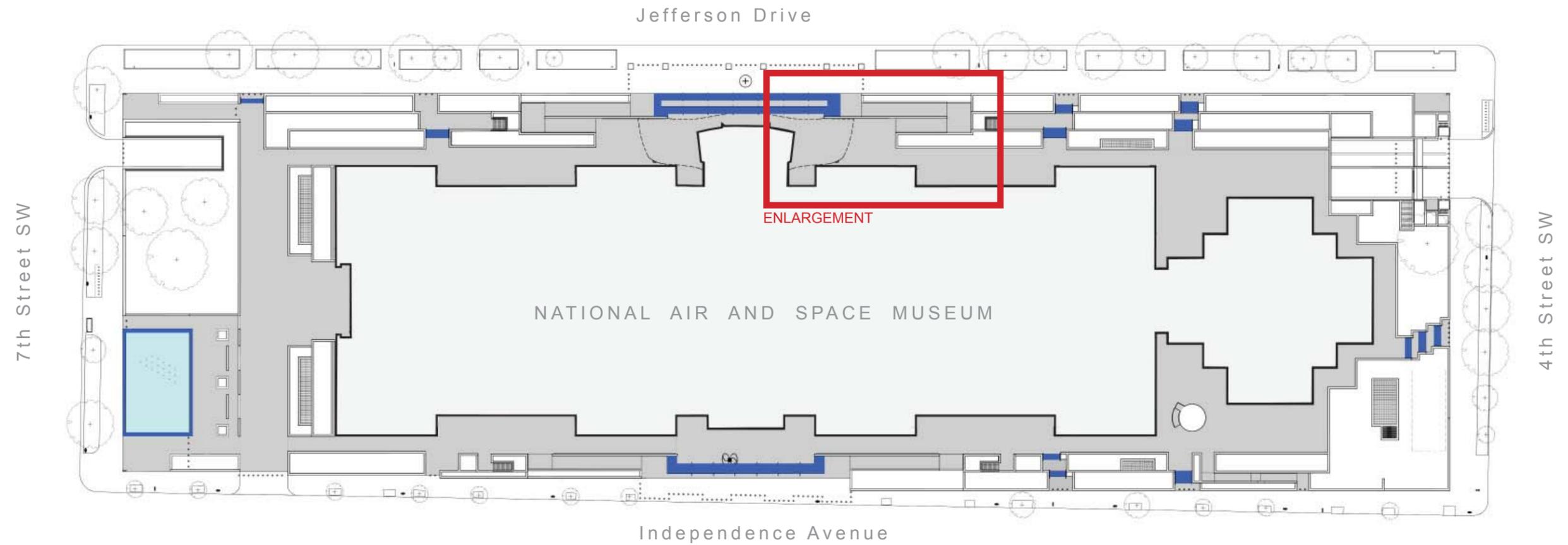


Final Design

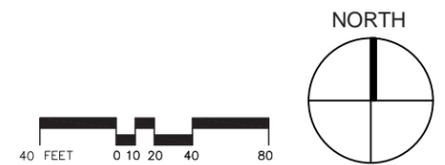
- Stairs (9)
- ADA Compliant Ramp (1)
- Accessible, At Grade Route (7)

Accessibility



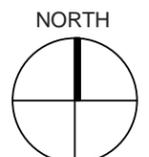
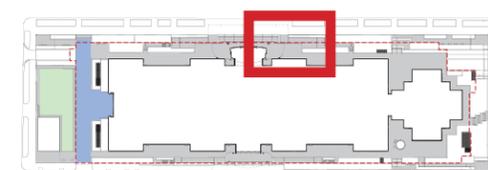
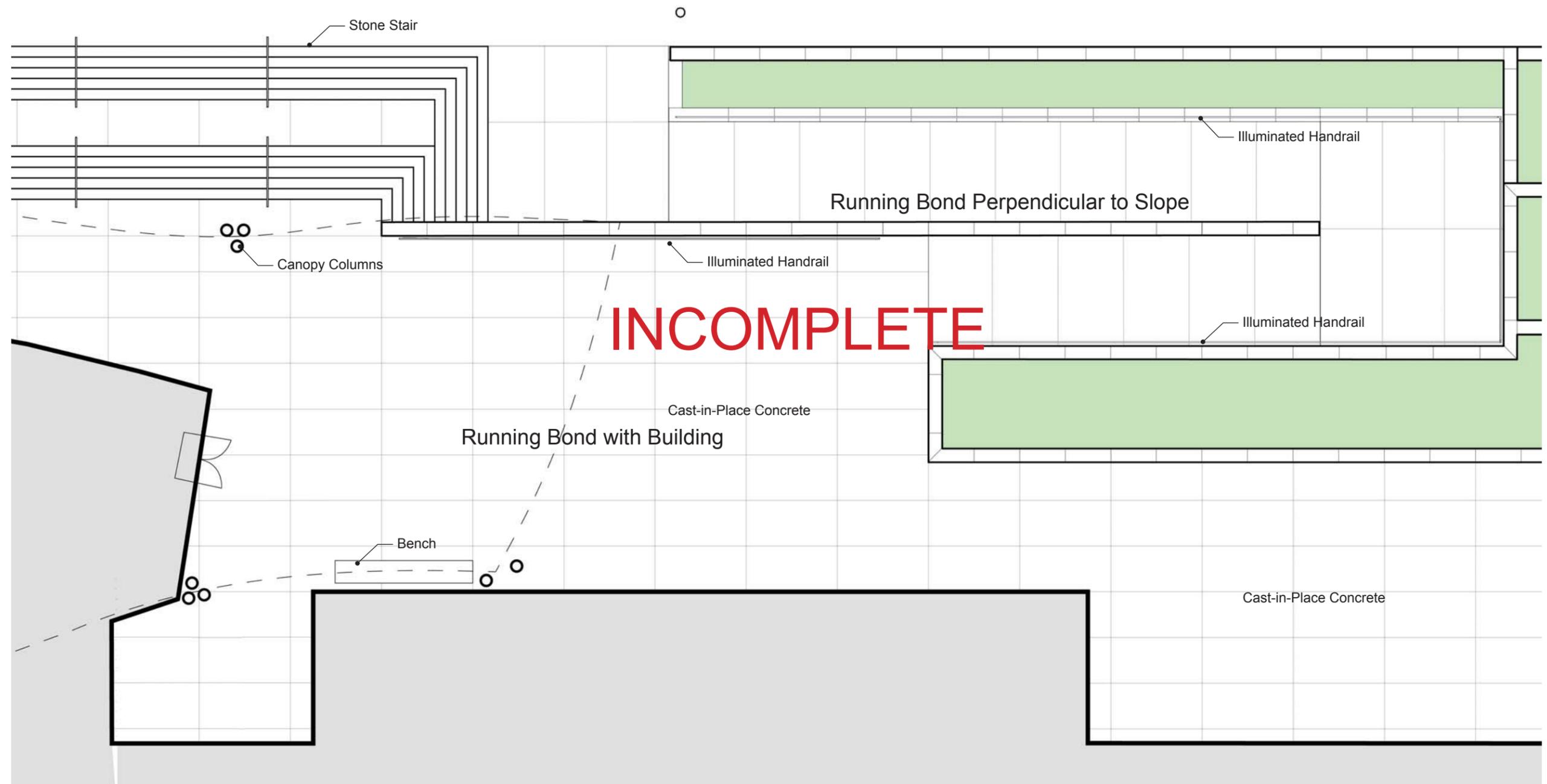


- Cast-in-Place Concrete, Exposed Aggregate, Grid Joint Pattern
- Stone
- Basement Edge of Structure



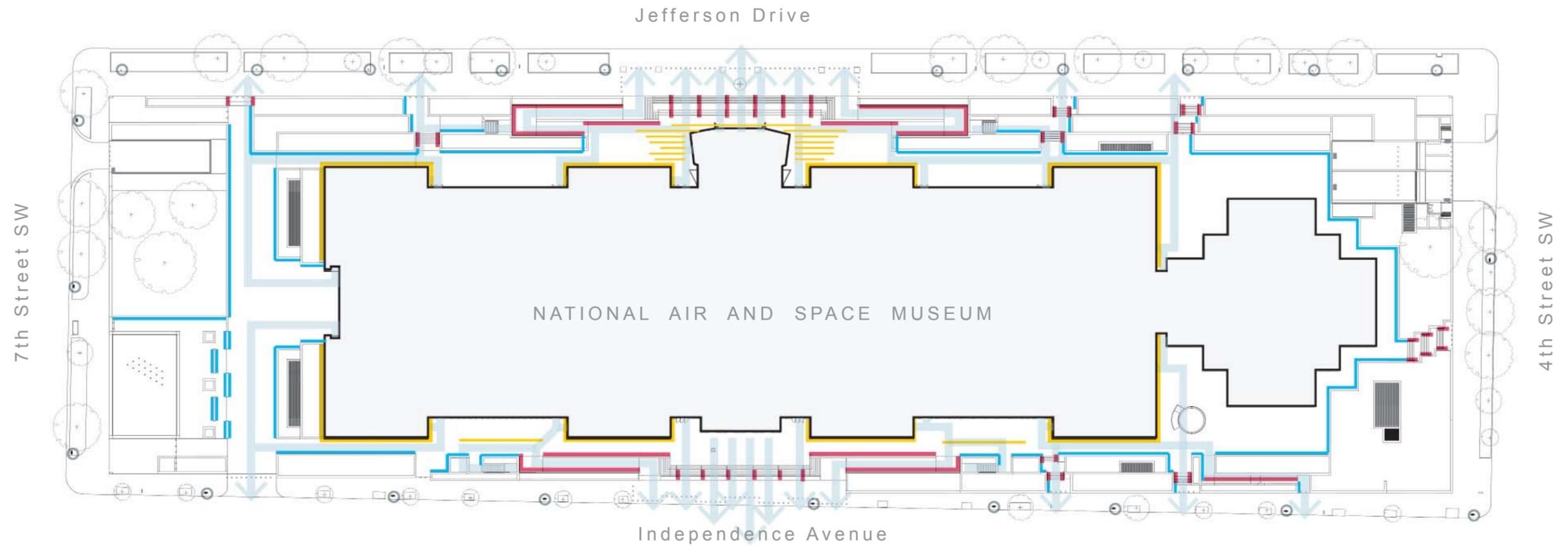
Paving Design Concept, Overall Plan



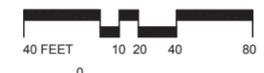
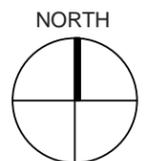


Paving Design Concept, North Entrance Enlargement



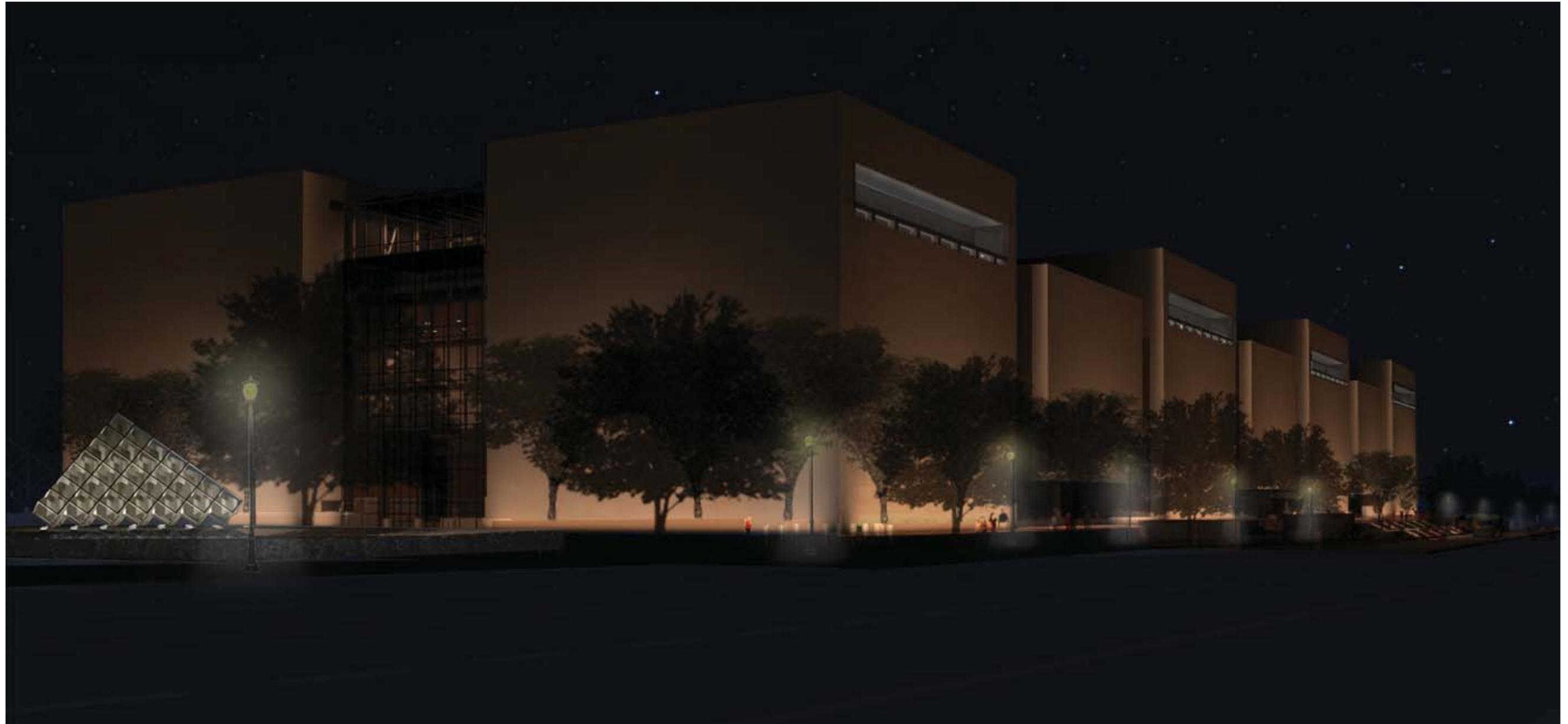


-  EGRESS path
-  Feature Uplight
-  Facade Uplight
-  Linear Canopy Uplight
-  Pedestrian Postlight
-  Illuminated Handrail
-  Linear Seatwall Detail
-  Garage Access Lighting
-  Existing Street Light



Lighting Plan - Gary Steffy Lighting Design





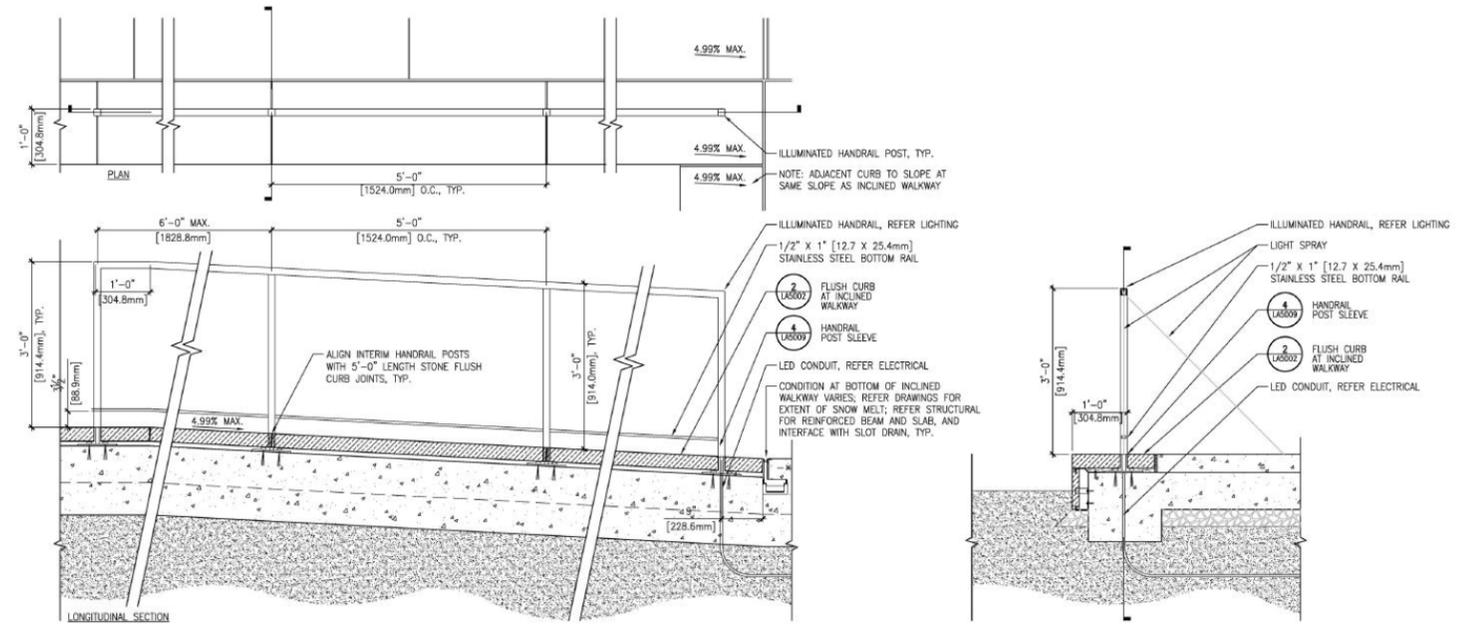
Lighting Rendering - Gary Steffy Lighting Design



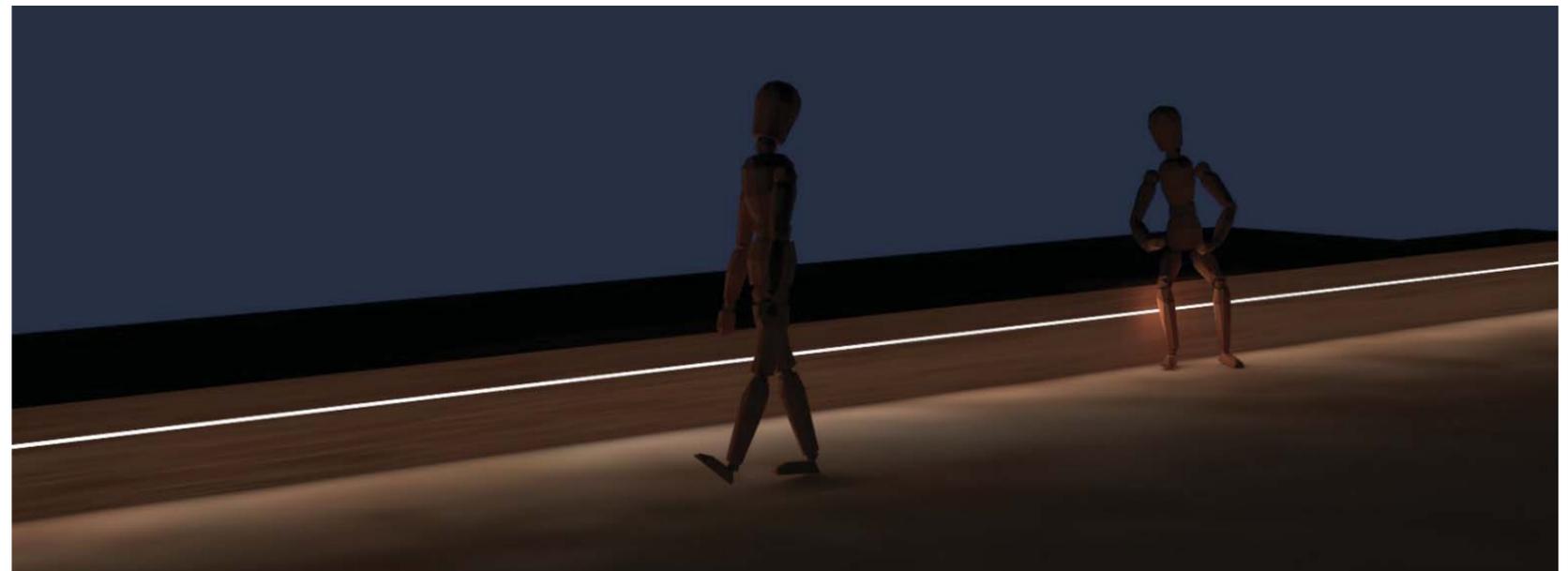
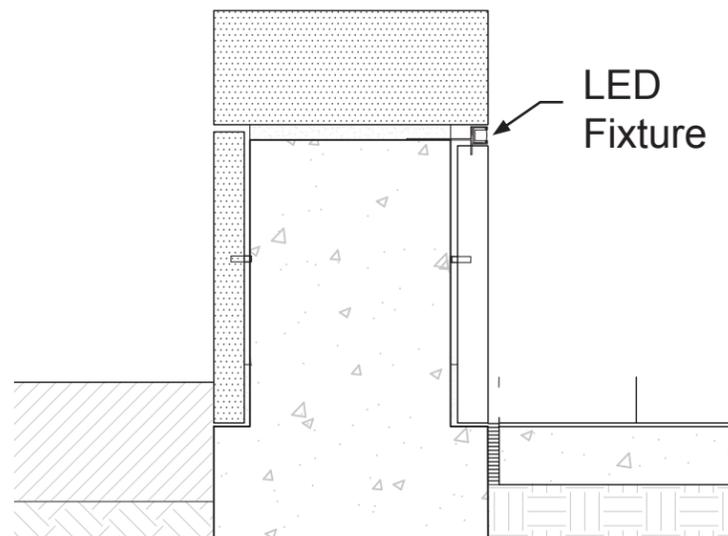
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*National Air and Space Museum*



Illuminated Handrail



Illuminated Handrail, Flush Curb Detail

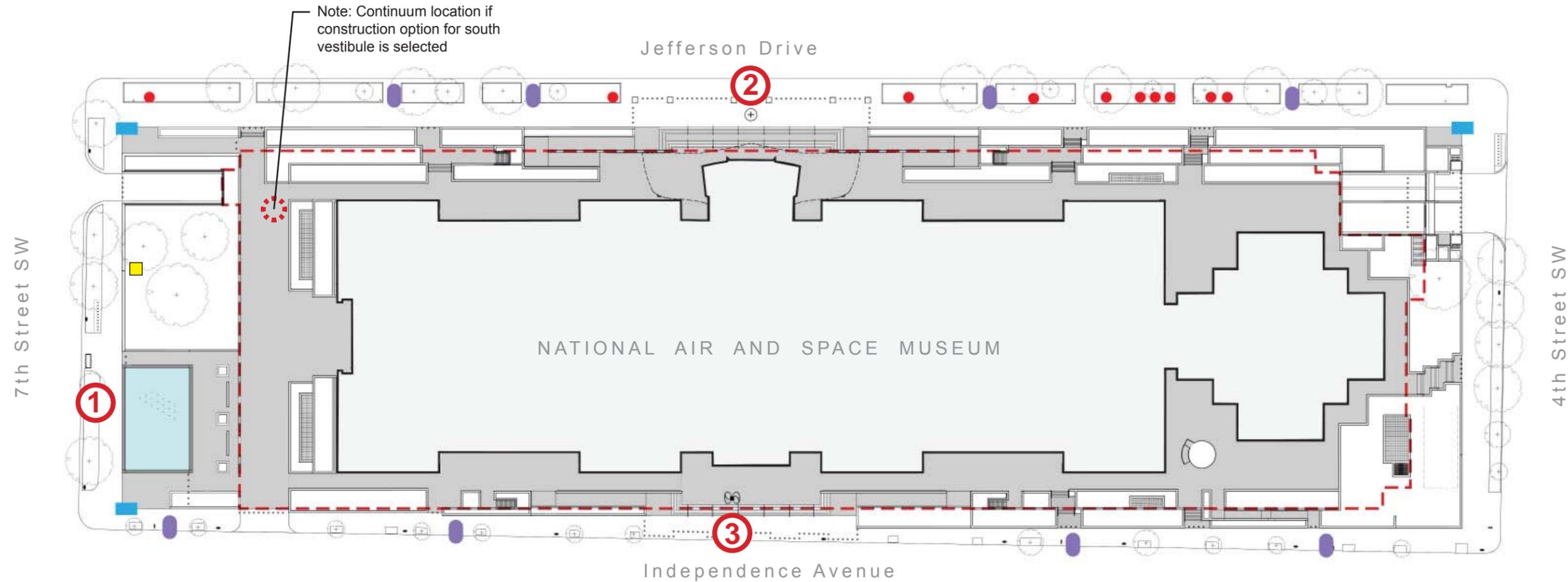


Linear Seat Wall

Lighting - Gary Steffy Lighting Design



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National Air and Space Museum



① Delta Solar



② Ad Astra



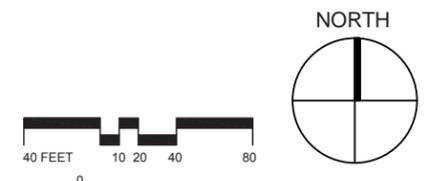
③ Continuum

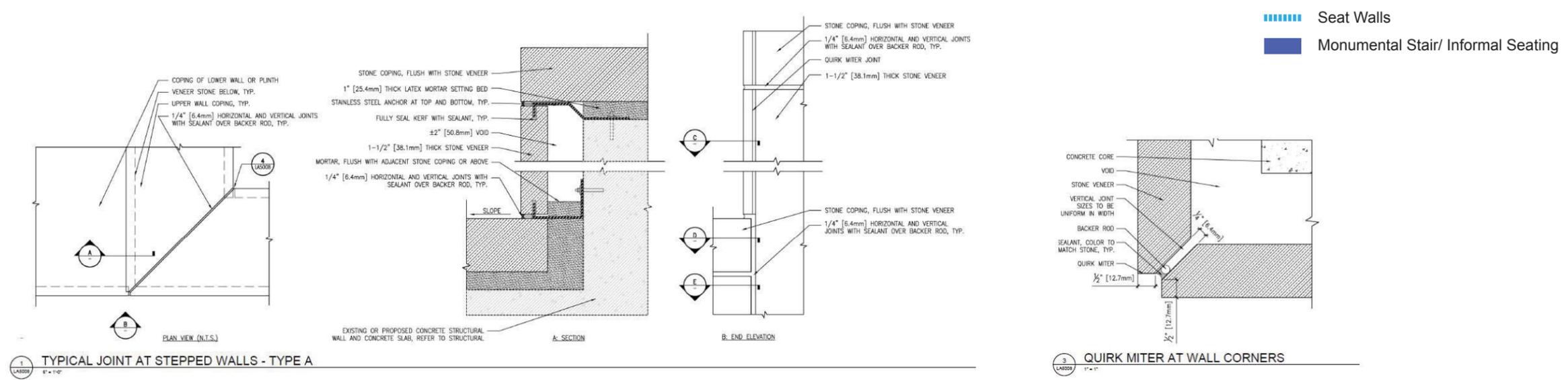
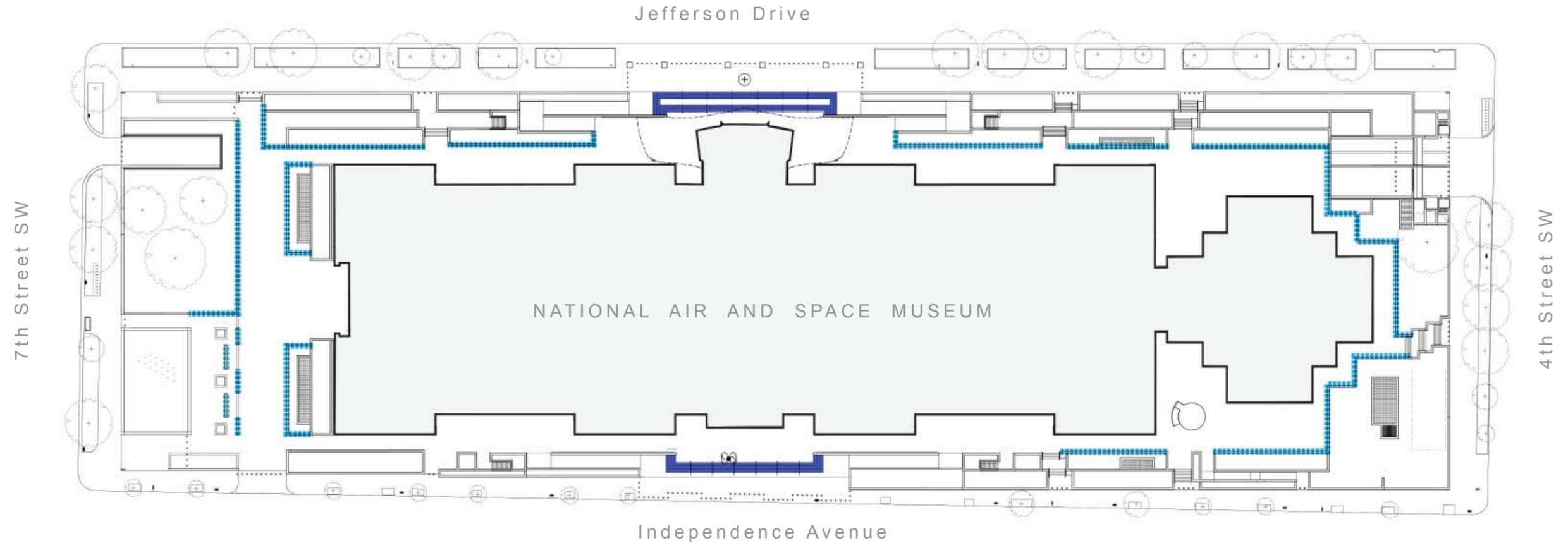


• Voyage Exhibition

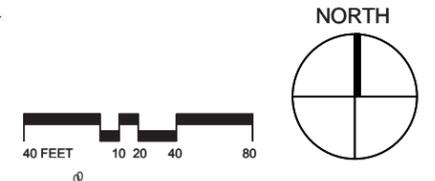
- ① Existing Sculpture
- 'Voyage' Exhibit (NTS)
- SI-wide Signage (NTS)
- SI Program Signs (NTS)
- Cosmonaut Memorial (NTS)

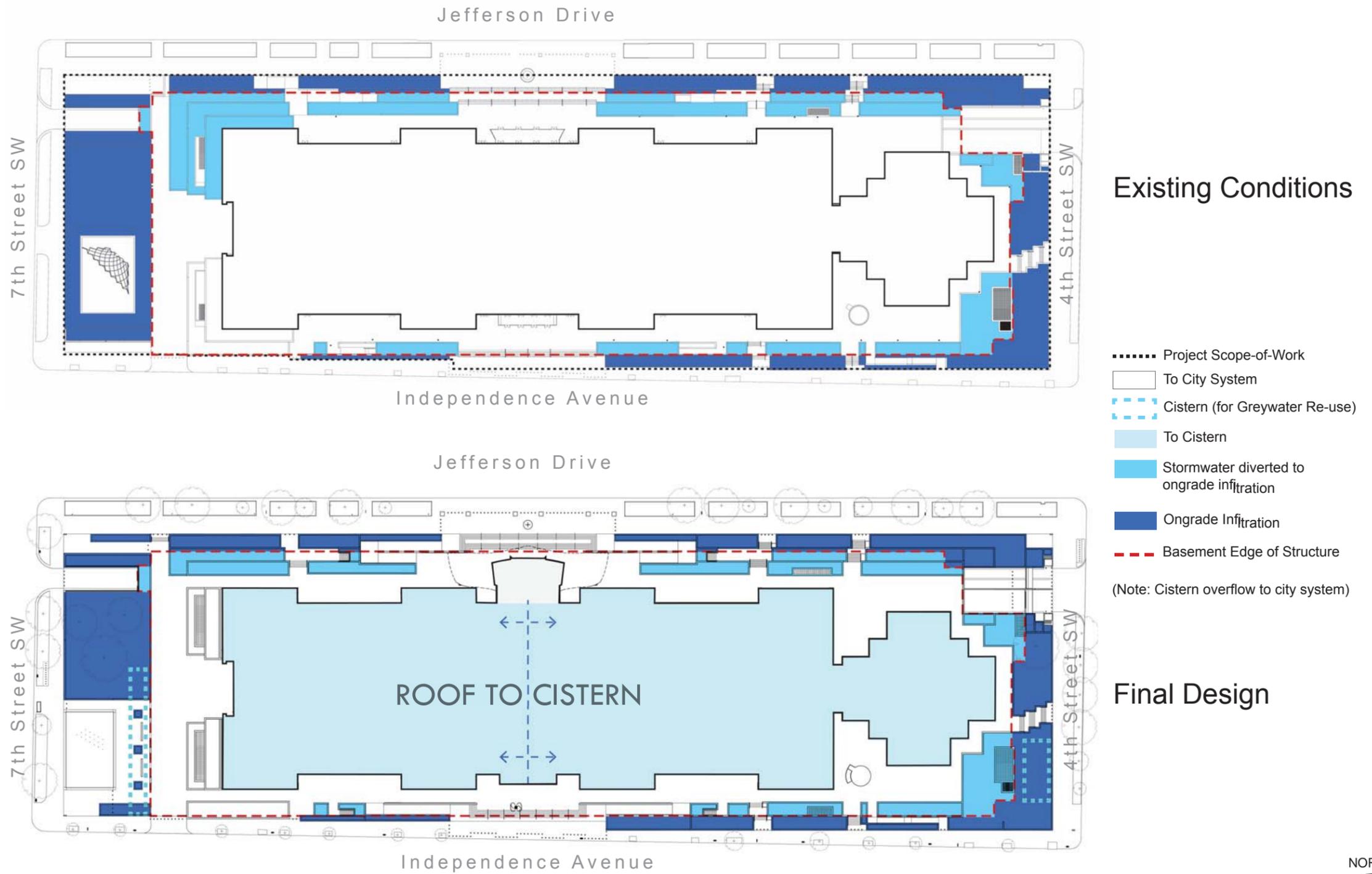
Site Art - Sculpture, Memorials and SI Signage Program



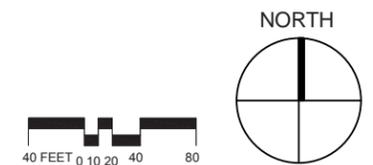


Seating Diagram, Wall Details





Stormwater Management Strategy



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Planting Design Narrative 78

Context 80

Trees 82

Ground Plane 93

Ground Plane/Planting Approach 97



**PLANTING DESIGN**



### TREE PLANTING DESIGN

The tree planting design closely follows the architectonic suggestions of the Master Plan, varying only in the development of a varied palette of tree species rather than favoring a single monoculture. Oak species are used as the backbone of the scheme, selected for their upright vertical habit and strong contrast to the Mall elms, and for their high ecological services in support of pollinators – birds and insects – of the ground plane plantings. The plan maintains a consistent rhythm on north and south sides of grounds.

Different palettes are applied north and south to help differentiate, clarify orientation, and to address greater insolation/heat issues on the south side. As specific examples of site sensitivity, black gum (*Nyssa sylvatica*) is used in planters not over structure on the north side, where they will be highly visible and have deep rooting opportunity. Again, two-winged silver bell (*Halesia diptera* var. *magniflora*) is applied as a consistent character smaller tree in situations 'closer' to the building, highlighting its habit and flowering characteristics against the backdrop of the building masonry. The design develops the east end grove as a diverse native setting, with thematic and ecological services highlighted in both canopy and understory trees. At the west end three magnificent willow oaks are preserved, made healthier with minor modifications to drainage, soil and renewal of the ground plane planting.

Minor offsets in the linear east-west planting of trees will guard against the monotony of a single row, helping to organize the variety of tree species into 'sub-sets' which fall into place against the rhythm of the museum's massing. Trees mark the architectural premise of the building and serve to underpin the human comfort zone created for its visitors.

#### A note on proposed tree quantities and caliper measurements

- The current planting design proposes a total of approximately 405" of caliper DBH at installation. Shade trees will be installed at roughly 4" caliper and flowering trees at 2-3" caliper. The total quantity of all proposed trees is 120.
- The total caliper of the 4 trees to remain is 121.5". Thus the total tree caliper at installation (proposed and existing to be preserved trees) is 526.5" at installation. An estimate of total caliper inches at maturity cannot reasonably be made, but as the number of large shade trees in the proposed scheme (55) far outnumbers the number of shade trees currently on the grounds (28), it can be fairly expected that total caliper tree inches will eventually exceed those of the current condition.
- Total caliper of the 148 trees on the museum grounds (28 shade, 5 conifers, 105 small) to be removed is approximately 1,425" – most of these trees are at or nearly at maturity.

### TREE PLANTING LAYOUT

- Trees are spaced on an average 45' on center concept, but this is dependent on the length of the planter and soil volume accommodated therein.
  - As an example, one planter has two trees at 56' spacing – but placing three trees would reduce spacing to +/- 20.'
  - Existing planter length plays a significant role in determining tree spacing.
  - Refer to Tree Spacing Diagram
- All shade trees are planted over ground, not over basement structure:
  - Therefore tree lifespan is not limited to that of basement building systems repair or replacement
- Tree spacing is based on multiple viability criteria:
  - Sufficient room above ground for trees to grow and spread their canopy over a lifetime
  - Sufficient soil volume available for healthy root growth
  - Sufficient annual growing period insolation for sunlight to reach ground plane planting
  - Reasonable spacing so that root systems can connect and communicate (scientific finding of health benefits)
- All planters are designed with irrigation for both trees and ground plane planting
  - Root volume areas under paving are generally irrigated as well, in order to incentivize root growth
- At 45' spacing, an urban street tree scale spacing is maintained, harmonizing with adjacent sidewalk street tree spacing and in concert with the scale and typical plantings around the National Mall
  - For reference, spacing of the Elms on the National Mall is +/- 50'.
- Species diversity is designed to:
  - Create rhythms in keeping with those of the massing of the building
    - Species characteristics emphasize particular aspects, for example:
      - Trees at the four corners are the same species - pyramidal, open and welcoming
      - Trees at the north and south entrances are similar species – broad, rounded canopy, large darker foliage
    - Provide wider healthier ecological services in a non-monoculture environment
    - Provide species whose characteristics support the museum theme of flight (upright habit, seed structure, attraction to birds and winged insects, etc.)

The NASM tree species have been specifically selected for their known urban hardiness and climate change adaptation resilience. They will grow well in the carefully designed conditions but may not reach full potential height and spread for the species, and may or may not have a shorter lifespan, as compared to plants of the same open-grown species located in a metropolitan-urban public realm environment.

### TREE PLANTING SOIL VOLUMES

- Planters create a more constrained growing environment than typical urban street tree conditions (less total root expansion potential, more thermal variation due to planter wall exposure)
- Soil volumes meet or exceed Casey Tree Foundation (CTF) recommendations for Washington DC
  - Soil volumes exceeding recommendations provide greater suppression of the effects of thermal variability across the seasons
- Soil volumes are extended under paving when the associated planter is below CTF recommendations:
  - Paving is supported by grade beams and/or designed structural soil to provide root growth volume
- Soils in planters are specifically designed for the planter environments
  - Soils in planters are specifically designed to enhance water retention for plant uptake

**Soils design takes into account the challenges of the grounds' planter architecture, and ameliorates these conditions with 'best in practice' soils and agronomist expertise to provide the most robust growing environments achievable, aligned and coordinated with irrigation and tree and ground cover planting selection.**

### SOLAR ACCESS TO THE GROUND PLANE

- Spacing is optimized at +/- 45' spacing for both tree and ground plane planting
- A +/-30' spacing was analyzed with an annual solar analysis:
  - Finding indicated insufficient insolation to support even shady ground plane planting at a robust and maintainable level of viability
  - 30' spacing is not typical of street tree spacing in confined environments; the planter environment is less tolerant still
  - At 45' spacing sufficient sunlight reaches the ground plane over the growing season to reasonably maintain sun/shade tolerant plants
- Trees must be planted at 3-4" diameter in order to lower risk of loss and utilize the flexibility of younger plants to adjust and adapt to the planter environment

**Solar access to the ground plane is vital to creating a strong visual and tactile landscape and garden environment that will enthrall visitors and offer insights into the origins of man's long love affair with flight and exploration. Plant selection of canopy tree species and ground plane herbaceous materials has been carefully calibrated for 'at installation' conditions and to anticipate expansion of shade qualities over time as the shade canopy expands.**

*continued to next page...*

## Planting Design Narrative

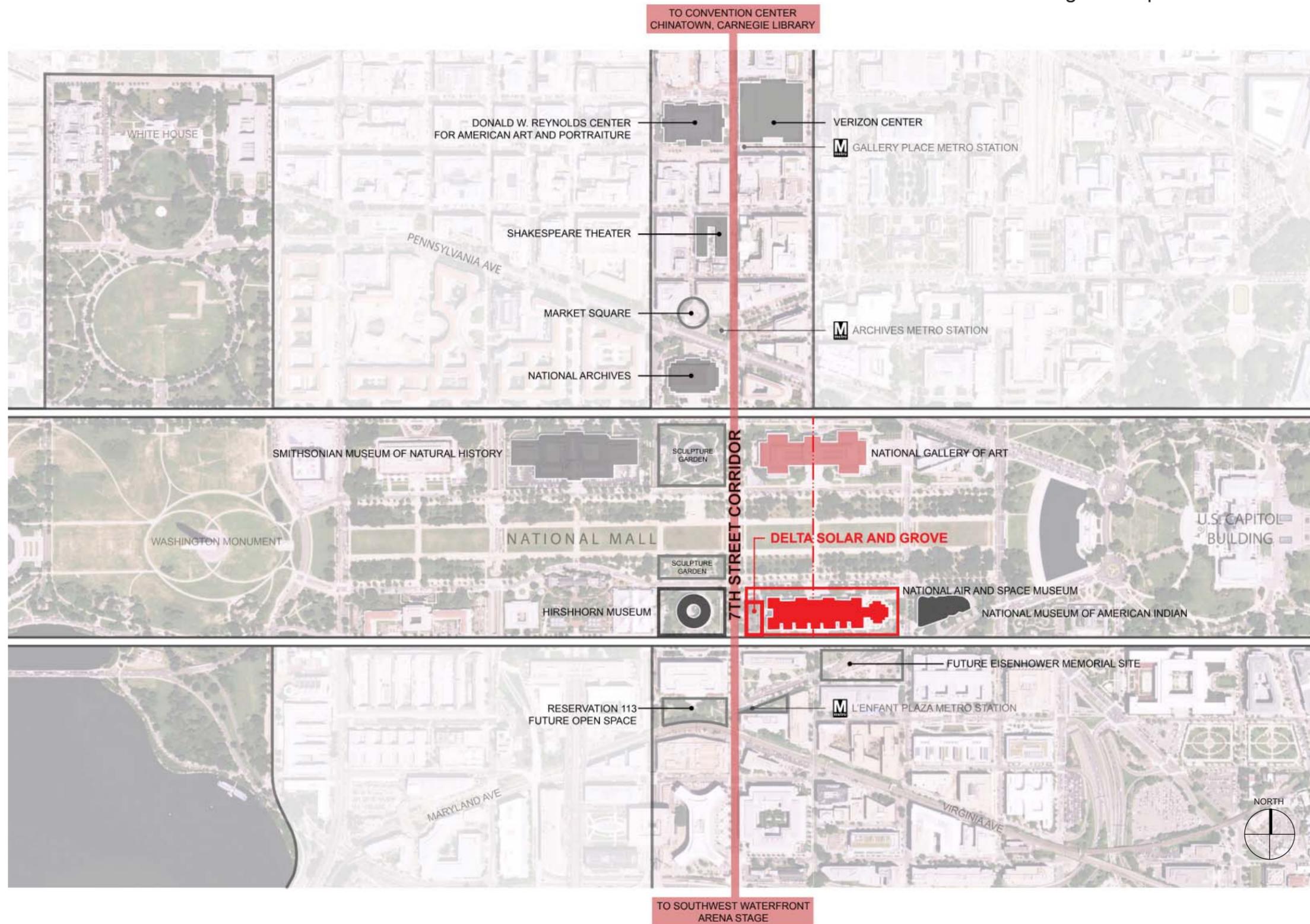


### GROUND PLANE PLANTING IN RESPONSE TO TREE COVER

- Ground plane planting has been designed by noted horticulturalist Patrick Cullina, who contributed to the Highline project in New York City, with specific reference to his experience in designing for environmentally and structurally constrained environments.
- 45' spacing of shade trees provides sufficient insolation to support ground plane planting
  - Plant species list is developed to anticipate changing and emerging shade conditions as the trees grow and canopies spread
  - Sun, sun/shade and shade tolerant species are planted to ensure grow-in, variety and variability, over time
    - SI Gardens fully supports the planting approach, designed to create a vigorous and more maintainable ground plane with thematic and tactile qualities especially focused on the themes of the Museum

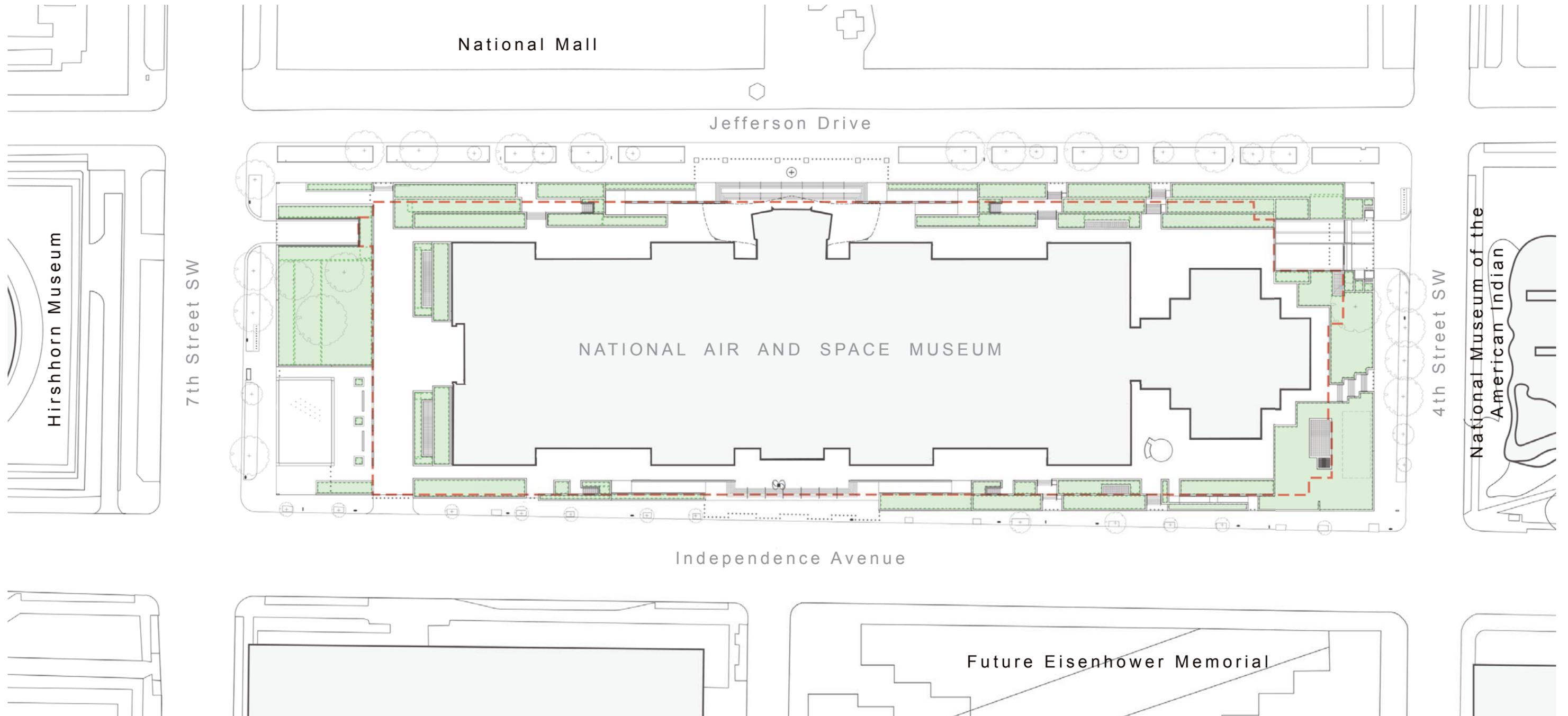
**A lively variety of herbaceous materials creates a lively and powerful counterpoint to the orthodoxy of the building and planter architecture. The contrast is meant to be inviting and thought-provoking, and plant selection for their 'flight' characteristics and attraction to flighted animals is fundamental to the planting concept.**





Urban Context

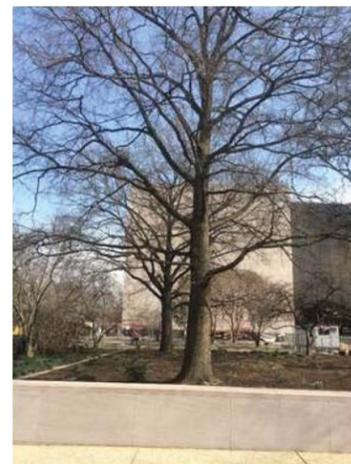
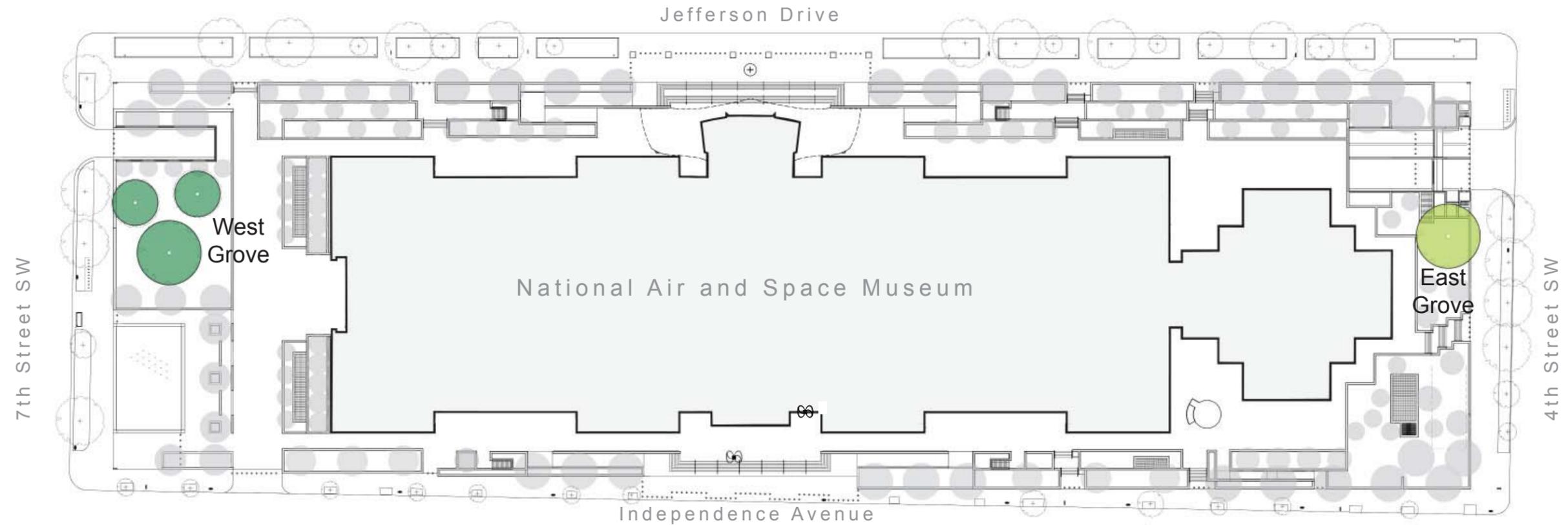




**Local Context**



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*National Air and Space Museum*



#870 Willow Oak



#875 Willow Oak

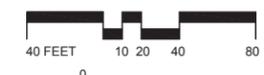


#880 Willow Oak



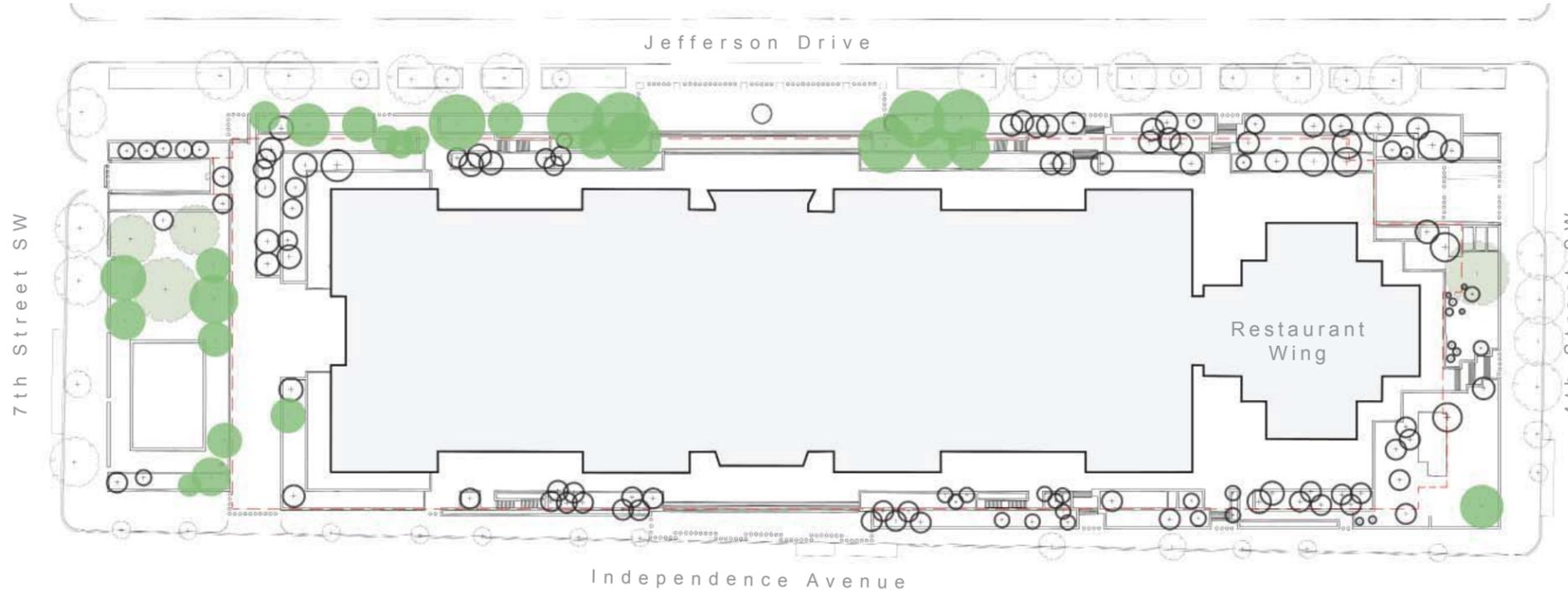
#2157 Scarlet Oak

-  Willow Oak (3)
-  Scarlet Oak (1)



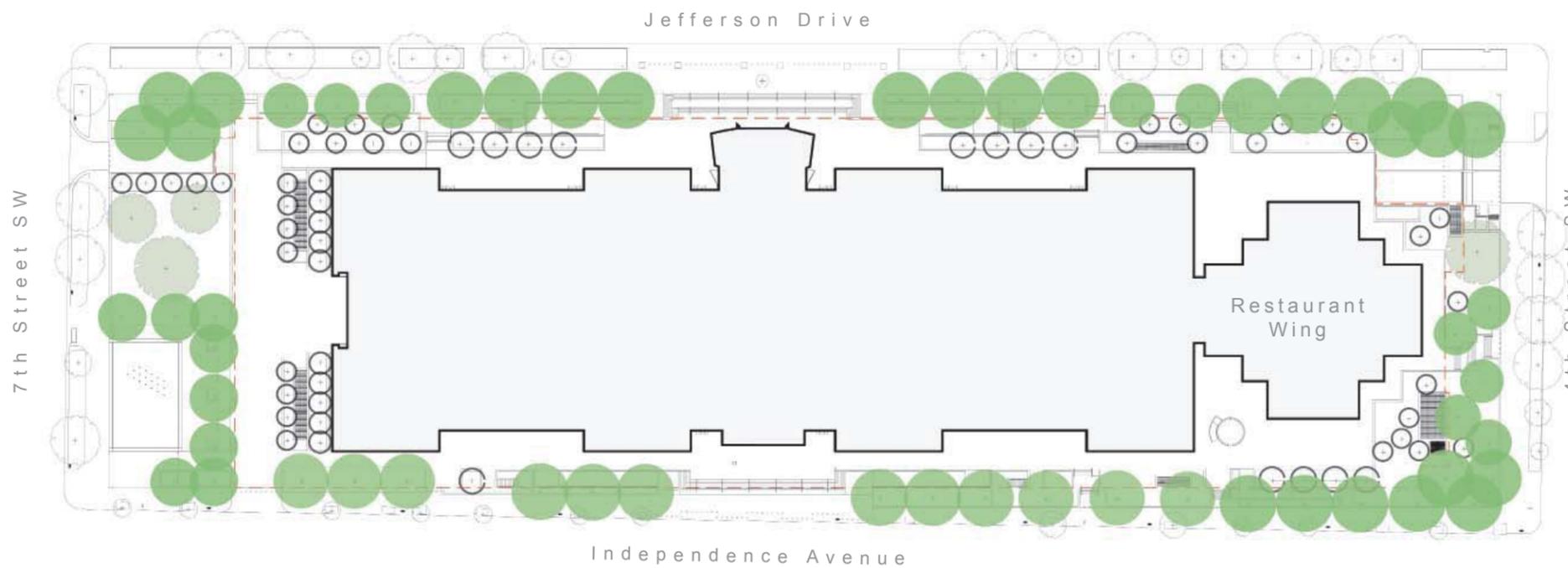
### Existing Trees to Remain





**EXISTING**

●	Existing Shade Trees to be Removed:	(408 inch Caliper)
●	Existing Trees to Remain:	
○	Existing Understory to be Removed:	(1,070.5 inch Caliper)
		(121.5 inch Caliper)
	<b>Total Existing Tree Caliper:</b>	<b>1,600 inch Caliper</b>



**FINAL DESIGN**

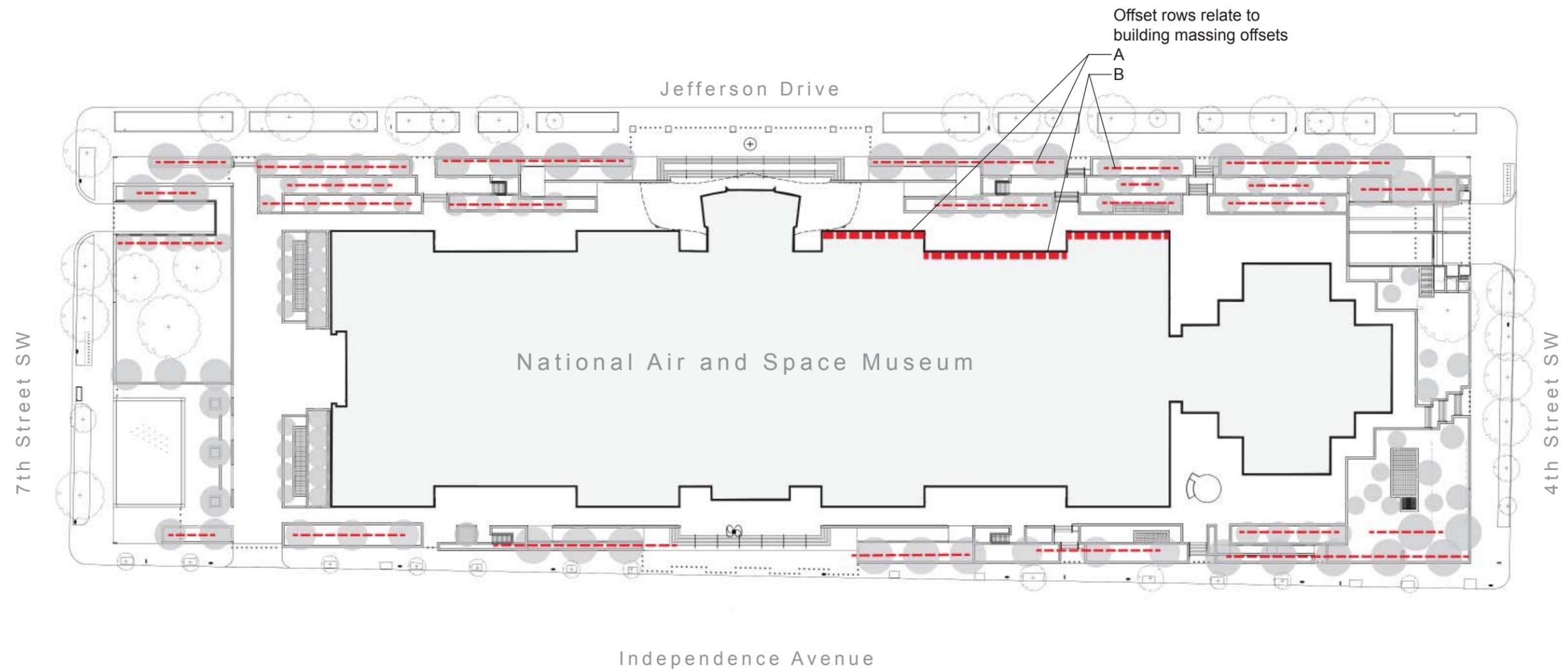
●	Proposed Shade Trees	(224.0 inch Caliper at Installation)
●	Existing Trees to Remain	(121.5 inch Caliper)
○	Proposed Understory	(180.0 inch Caliper at Installation)
		(1008 inch Caliper at 25-30 years)
	<b>Total Estimated Proposed and Preserved Tree Caliper:</b>	<b>1,659.5 inch Caliper at 25-30 years</b>
---	Basement Edge of Structure	(1500 inch Caliper at 25-30 years)

**Notes:**

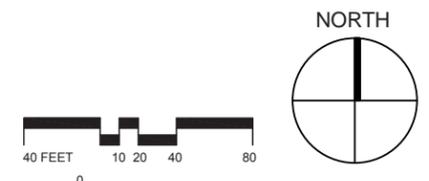
- Existing tree size and locations are based on tree inventory from SI Gardens and AMT.
- Total tree Caliper at 25-30 years is estimated by Wetland Studies and Solutions and AECOM based on average growth rate in an urban condition.

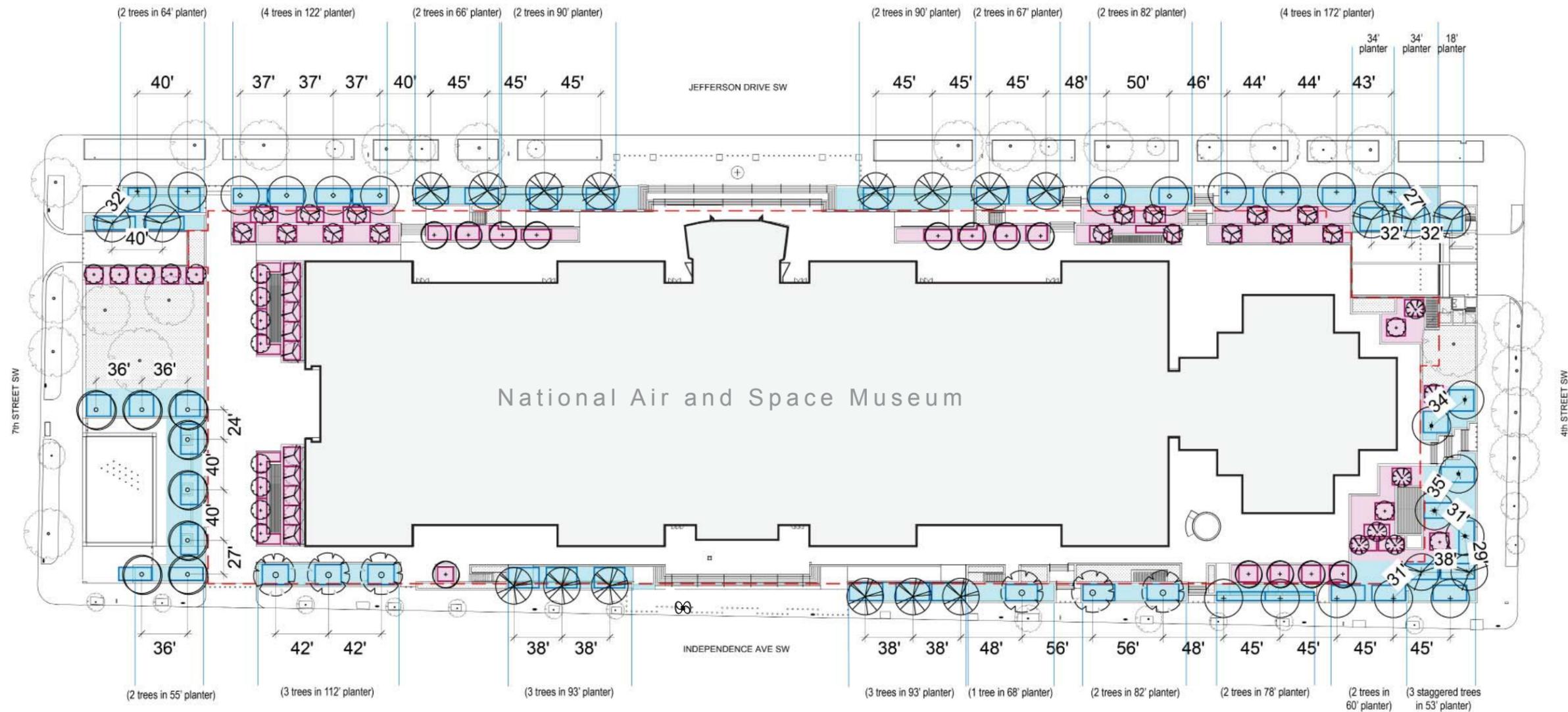
**Tree Caliper Comparison**





**Tree Layout - Offset Rows**

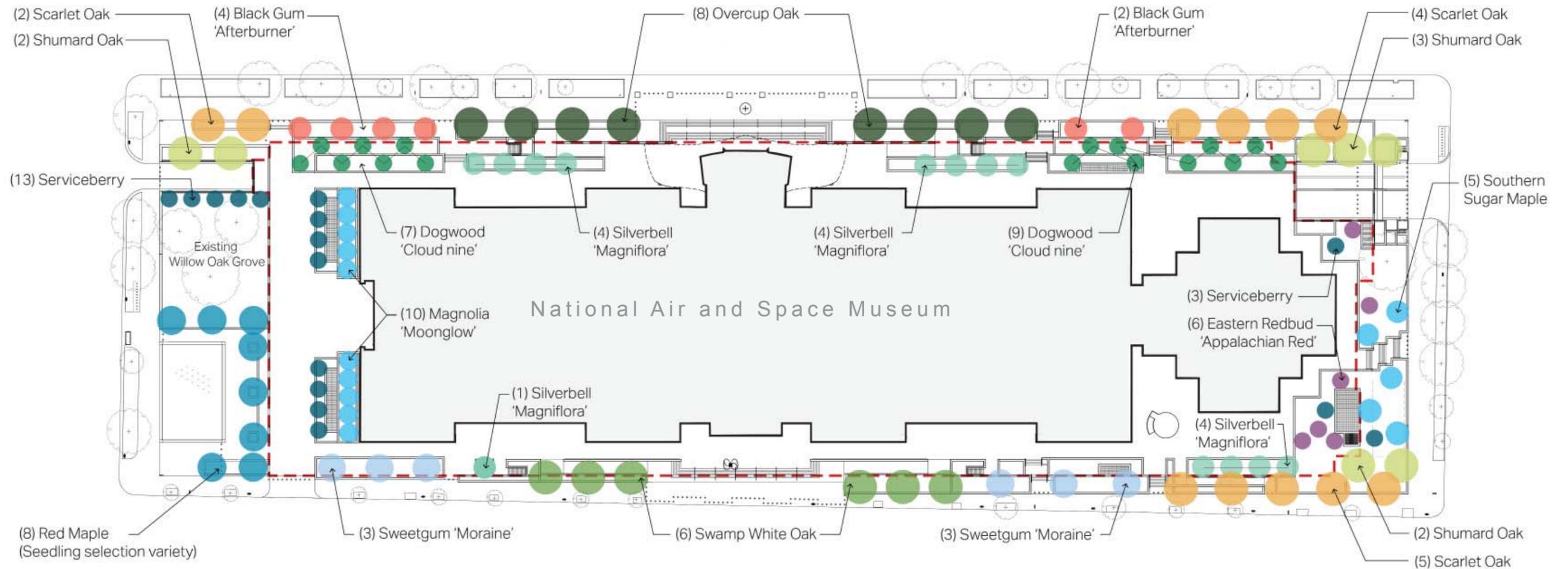




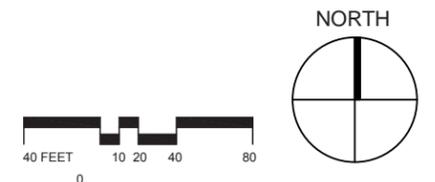
- Canopy Tree Soil Volume  
(1,100 cf min. per tree)
- Secondary Tree Soil Volume  
(600 cf min. per tree)
- Basement Edge of Structure

**TREE** Spacing, Planter Constraints, Soil Volume



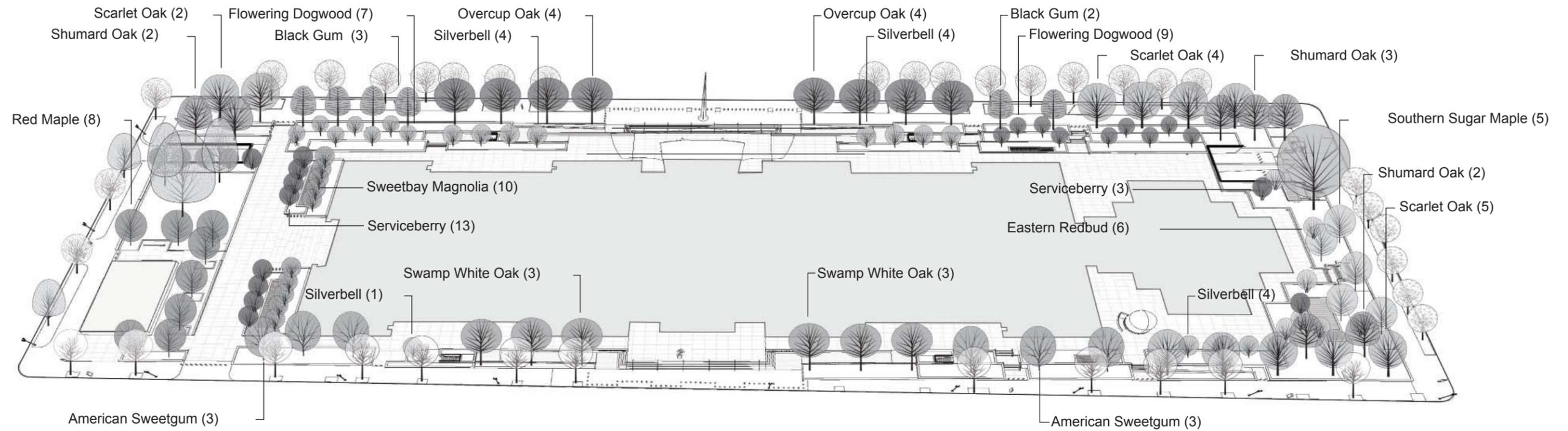


- |    |   |                         |    |   |                                  |
|----|---|-------------------------|----|---|----------------------------------|
| 8  | ● | Overcup Oak             | 16 | ● | Serviceberry                     |
| 6  | ● | Swamp White Oak         | 13 | ● | Silverbell 'Magniflora'          |
| 11 | ● | Scarlet Oak             | 10 | ● | Magnolia 'Moonglow'              |
| 7  | ● | Shumard Oak             | 6  | ● | Eastern Redbud 'Appalachian Red' |
| 5  | ● | Southern Sugar Maple    | 15 | ● | Dogwood 'Cloud Nine'             |
| 8  | ● | Red Maple               |    |   |                                  |
| 5  | ● | Black Gum 'Afterburner' |    |   |                                  |
| 6  | ● | Sweetgum 'Moraine'      |    |   |                                  |



**Tree Species**

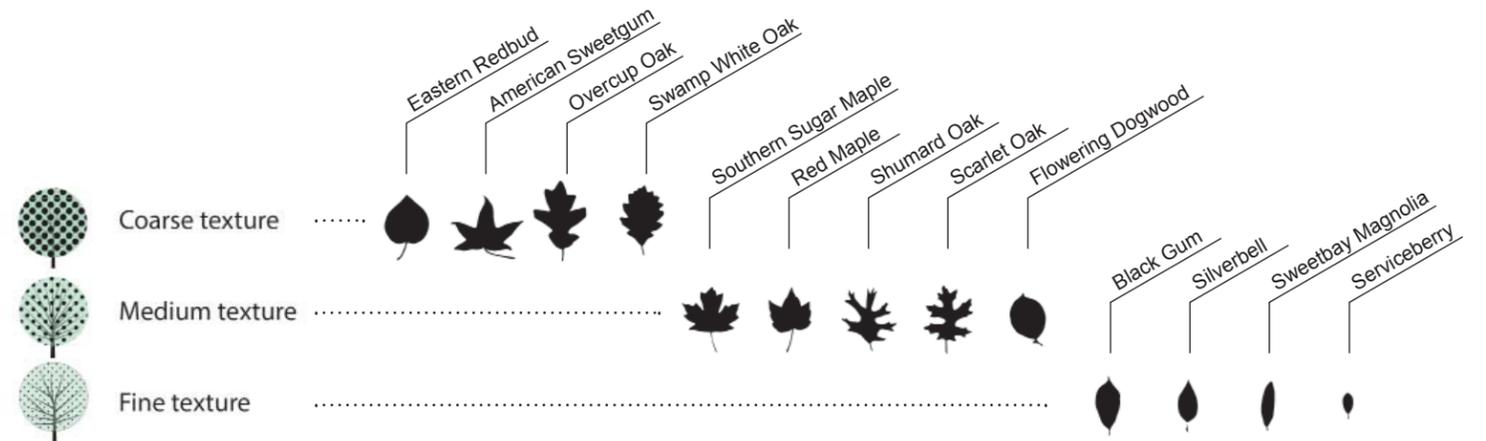
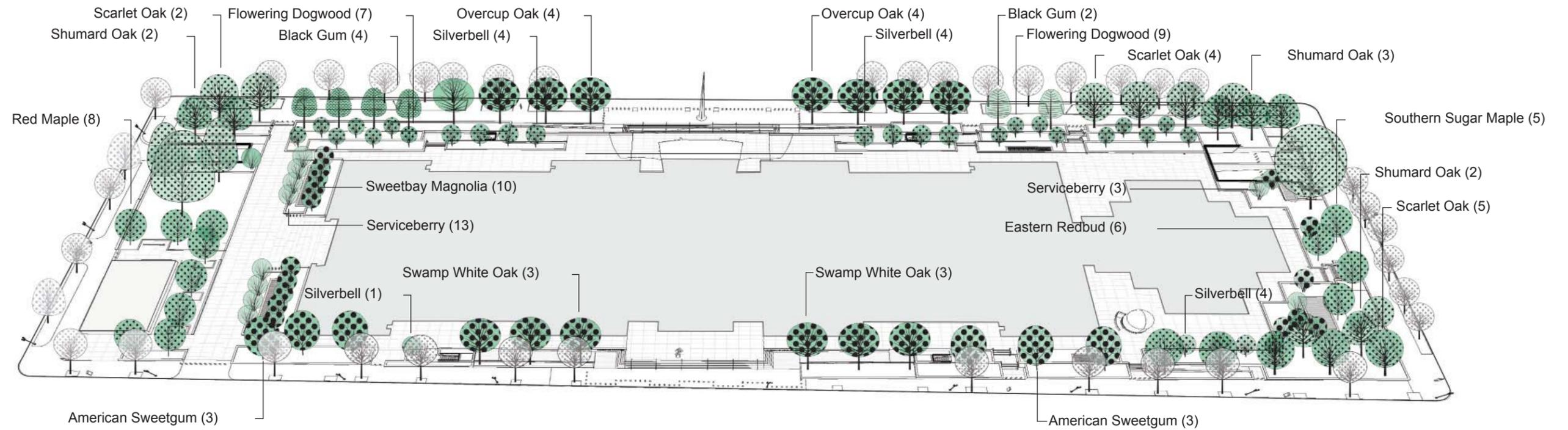




- |   |   |  |   |  |
|---|---|--|---|--|
|  <b>Willow Oak</b><br><i>Quercus phellos</i><br>Oblong-oval to rounded                 |  <b>Swamp White Oak</b><br><i>Quercus lyrata</i><br>Ovate                  |  <b>Overcup Oak</b><br><i>Quercus lyrata</i><br>Ovate             |  <b>Serviceberry</b><br><i>Amelanchier laevis</i><br>Rounded         |  <b>Eastern Redbud</b><br><i>Cercis canadensis 'Appalachian Red'</i><br>Rounded |
|  <b>Scarlet Oak</b><br><i>Quercus coccinea</i><br>Rounded open                         |  <b>Shumard Oak</b><br><i>Quercus shumardii</i><br>Pyramidal to broad open |  <b>Red Maple</b><br><i>Acer rubrum</i><br>Oval                   |  <b>Silverbell</b><br><i>Halesia diptera 'Magniflora'</i><br>Rounded |  <b>Flowering Dogwood</b><br><i>Cornus florida 'Cloud Nine'</i><br>Rounded      |
|  <b>American Sweetgum</b><br><i>Liquidambar styraciflua 'Moraine'</i><br>Round to oval |  <b>Southern Sugar Maple</b><br><i>Acer floridanum</i><br>Elliptical       |  <b>Black Gum</b><br><i>Nyssa sylvatica 'Afterburner'</i><br>Oval |  <b>Sweetbay Magnolia</b><br><i>Magnolia virginiana</i><br>Rounded   |  |

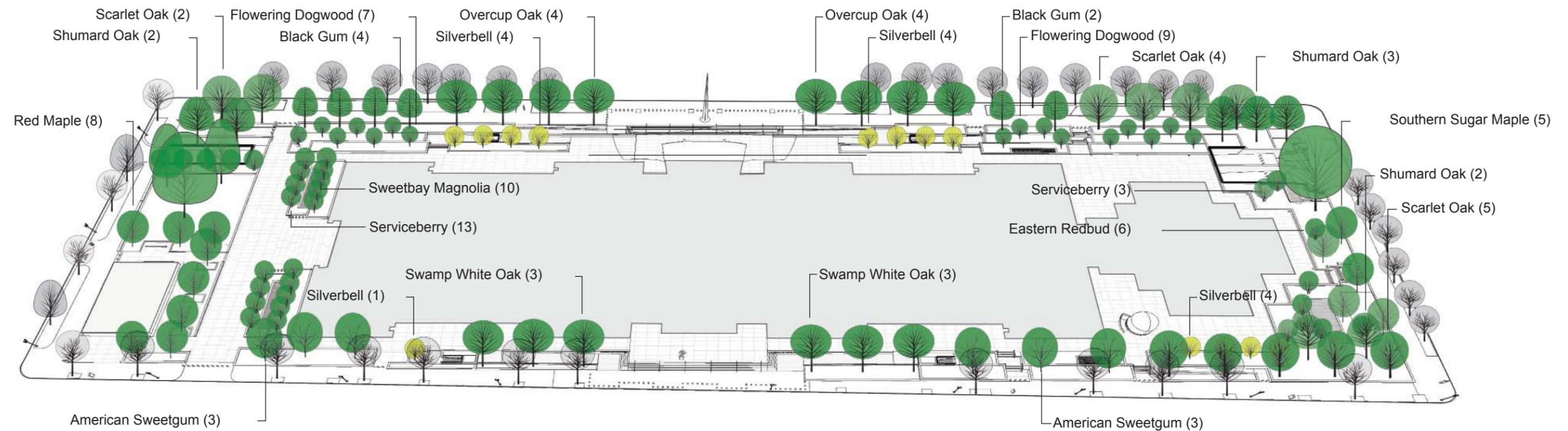
**Tree Habit**





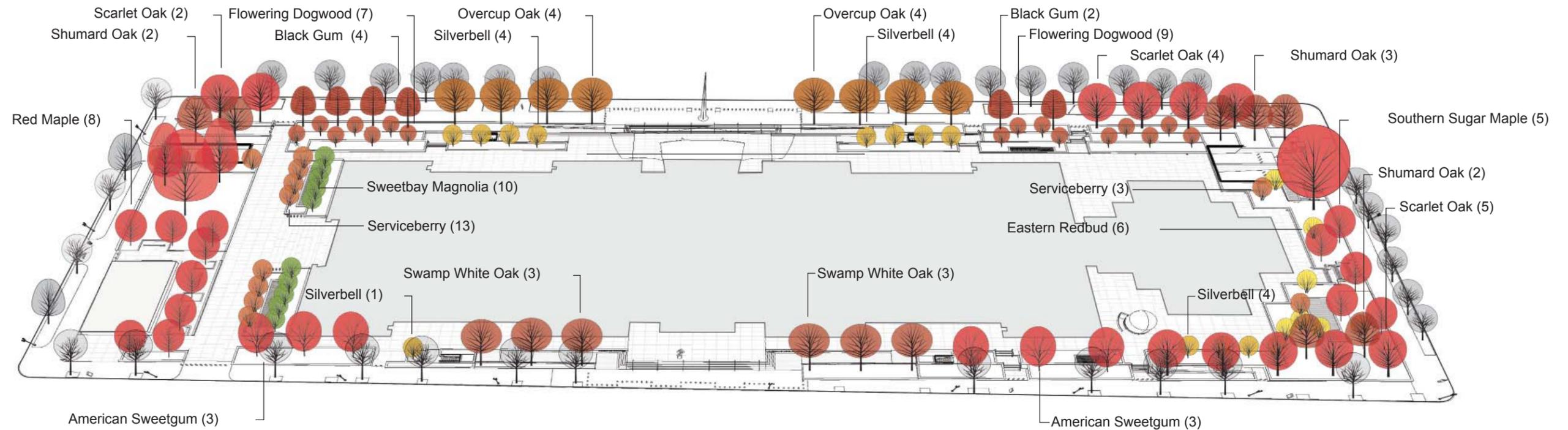
## Tree Foliage





**Tree Summer Color**





- |   |   |   |   |   |  |   |   |   |  |
|---|---|---|---|---|--|---|---|---|--|
|  | <b>Willow Oak</b><br><i>Quercus phellos</i><br>Oblong-oval to rounded                 |  | <b>Swamp White Oak</b><br><i>Quercus lyrata</i><br>Ovate                  |  | <b>Overcup Oak</b><br><i>Quercus lyrata</i><br>Ovate             |  | <b>Serviceberry</b><br><i>Amelanchier laevis</i><br>Rounded         |  | <b>Eastern Redbud</b><br><i>Cercis canadensis 'Appalachian Red'</i><br>Rounded |
|  | <b>Scarlet Oak</b><br><i>Quercus coccinea</i><br>Rounded open                         |  | <b>Southern Sugar Maple</b><br><i>Acer floridanum</i><br>Elliptical       |  | <b>Red Maple</b><br><i>Acer rubrum</i><br>Oval                   |  | <b>Silverbell</b><br><i>Halesia diptera 'Magniflora'</i><br>Rounded |  | <b>Flowering Dogwood</b><br><i>Cornus florida 'Cloud Nine'</i><br>Rounded      |
|  | <b>American Sweetgum</b><br><i>Liquidambar styraciflua 'Moraine'</i><br>Round to oval |  | <b>Shumard Oak</b><br><i>Quercus shumardii</i><br>Pyramidal to broad open |  | <b>Black Gum</b><br><i>Nyssa sylvatica 'Afterburner'</i><br>Oval |  | <b>Sweetbay Magnolia</b><br><i>Magnolia virginiana</i><br>Rounded   |   |  |

Tree Autumn Color



**CANOPY**

NAME	LEAF	COLOR	FORM	STRUCTURE
<b>Overcup Oak</b> <i>Quercus lyrata</i> Broad rounded H*W: 40-60' X 40-60'				
<b>Swamp White Oak</b> <i>Quercus bicolor</i> Broad rounded H*W: 50-60' X 50-60'				
<b>Scarlet Oak</b> <i>Quercus coccinea</i> Rounded open H*W: 50-70' X 40-50'				
<b>Shumard Oak</b> <i>Quercus shumardii</i> Pyramidal to broad open H*W: 40-60' X 30-40'				
<b>Southern Sugar Maple</b> <i>Acer floridanum</i> Elliptical H*W: 40-70' X 30-50'				
<b>Red Maple</b> <i>Acer rubrum (Seedling Selection Variety)</i> Oval H*W: 40-70' X 30-50'				
<b>Black Gum</b> <i>Nyssa sylvatica 'Afterburner'</i> Pyramidal, Maturing to rounded H*W: 30-50' X 20-30'				

NAME	LEAF	COLOR	FORM	STRUCTURE
<b>American Sweetgum</b> <i>Liquidambar styraciflua 'Moraine'</i> Round to oval H*W: 60-80' X 40-60'				

**SECONDARY**

<b>Serviceberry</b> <i>Amelanchier laevis</i> Rounded H*W: 15-40' X 15-40'				
<b>Silverbell</b> <i>Halesia diptera 'Magniflora'</i> Rounded H*W: 30-40' X 20-35'				
<b>Sweetbay Magnolia</b> <i>Magnolia virginiana</i> Rounded H*W: 10-35' X 10-35'				
<b>Eastern Redbud</b> <i>Cercis canadensis 'Appalachian Red'</i> Rounded H*W: 20-30' X 25-35'				
<b>Flowering Dogwood</b> <i>Cornus florida 'Cloud Nine'</i> Rounded H*W: 15-30' X 15-30'				

**Tree Summary Character**





Squirrel - *Quercus*



Samara - *Acer rubrum*

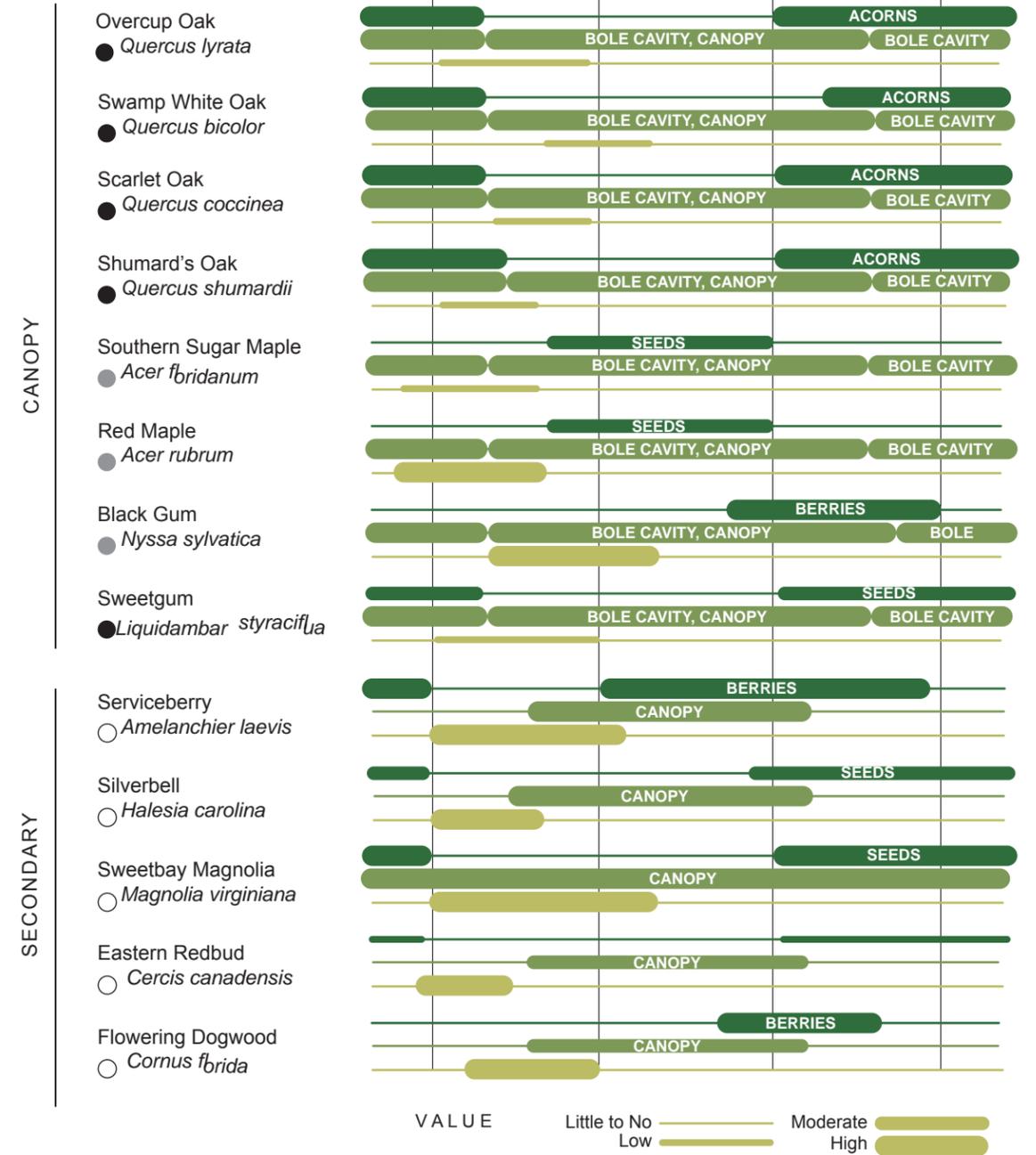


Cedar Waxwing - *Amelanchier*



Seed - *Magnolia virginiana*

**Pollinator/Wildlife Phenological Calendar**



- CO<sub>2</sub> SEQUESTRATION**
- High (100-180 lbs/per yr)
  - Moderate (40-100 lbs/per yr)
  - Low (>70 lbs/per yr)

FORAGE (birds, mammals)	POLLINATOR (habitat/larva host)	POLLINATOR (forage)
-fruit -seeds	-canopy, leaves -bole cavity	-nectar -pollen

**Trees Ecological Services**



Smithsonian Institution  
National Air and Space Museum

**PRINCIPLES**

The planting design for the ground plane of the National Air & Space Museum follows three organizing principles: structure, function, and theme(s).

**STRUCTURE**

The ground plane is structured around a perennial species palette focused on renewing and robust species adaptable to the planter regime of the museum environment, solar orientation and insolation realities, and to low height objectives in order to preserve and guide views into the grounds and towards the museum building and its entrances.

**FUNCTION**

There are several key functions for the ground plane planting plan. The plan creates a robust, year-round, highly seasonal herbaceous expression, covering all earthen surfaces of the grounds. It develops the NW, NE and SE entrance corners with similar, identifiable and distinct character species. The SW corner, with the Delta Solar sculpture as its focus, has its own unique planting regimen.

The design is conceived to create interest at the point of visitor approach and orientation. Entrance points to the grounds are planted with species hardy enough to both make and take more attention, animating entrances with attractive presentation and character. Placement and massing of taller species is managed so as to preserve visual access to site and building and introduce some rhythm, background, and scale connectivity to the massing of the building. The ground plane planting design is based on providing a rich variety and diversity of species, increasing the viability of an ecological web along with a variety and unity of color, texture, habit, foliage and smell – in this way creating a rich tapestry in counterpoint to the singularity of the building.

**THEMES****Nature is the Inspiration**

The museum is the repository of many great stories. Flight, discovery and inspiration flavor many, if not all, of them. The museum is a place with a particular spirit, one based in discovery and inspiration, perseverance and bravery.

The garden and grounds provide a venue to examine nature's role in the inspiration for human flight. The design proposes to reveal the 'flight' identity of plants, insects and birds, and the 'ready-at-hand' technologies that exist in nature and provided direct inspirations for invention. The temporality of life and the role of time in physics are fundamental to explaining and designing for air and space exploration. The design seeks to reveal the seasons, the arc of the sun, the direct way in which

physics and the cycle of life play out over time, influencing and directing human decisions, plans and outcomes.

**Life is complex, diverse**

Complex systems design and redundancy are fundamental to the survival of life on the planet, and for humans in the air and in space. 'Platform' stability is invaluable – underpinned by a wide, diverse and generous base. Here, the planting plan harnesses:

- The interrelatedness of all things.
- The idea of complex technologies – the multiple related, redundant, and integrated systems necessary for flight or survival in space - as revealed in nature by the diversity of plant life, the ecosystem web, and the movement of resources: water, energy, nutrition, oxygen and carbon dioxide... the dispersal of seeds and thereby, the prolongation of life.
- The unity and integrated nature and aesthetics (design) of a fully explored and developed planting palette and layout.

**Life is context-specific**

The National Air & Space Museum has many site-specific site conditions which create a specific environmental context for plant life success, just as the context of flight and space travel are conditioned by contextual challenges. The regional life-supporting ecological platform (a bit of 'spaceship Earth') of the Mid-Atlantic/District of Columbia Metropolitan/National Mall locale create the conditions for certain plants in certain places – planting design is context-specific, just as are aeronautical and space engineering solutions.

**GROUND PLANE DESIGN PART I****INFLUENCES AND SCALES**

- Make context, monumentality and human scale work together across contextual influences and scales, across the grounds as a unity and into each planter.
- Respect the monumentality and cultural significance of the museum.
- Consider the rigor and reality of orientation, exposure and microclimate (and design soil, water supply and planter environment to respond to these realities).

**ANIMATION**

- The planting design proposes a constantly changing and purposefully choreographed and animated environment.
- The planting design is diurnal, seasonal, and annual, seizing on the traits and habits of bird and insect flight and movement, seed and foliage flight, the growth and diminishment of plant structure, foliage, and flowering over time.
- The annual and diurnal path of the sun is integral to establishing the palette and its disposition across the grounds.

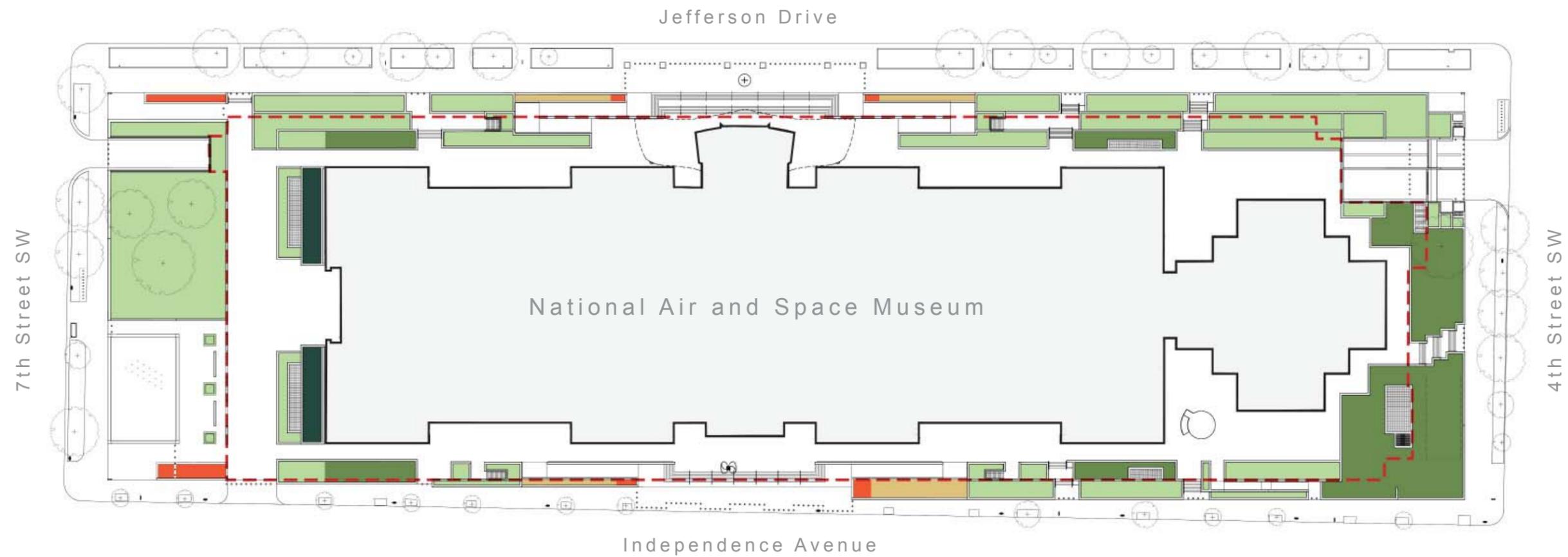
**PLANTING EXPRESSION**

Planting design and palette seek to reveal the themes with a readily accessible and understandable display of diverse plant and site attributes:

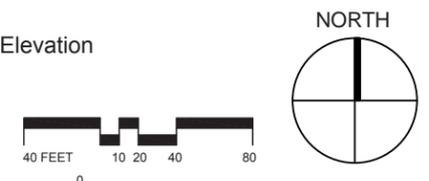
- Height, structure and habit
- Mass and density
- Visual interest, flavor, and porosity
- Texture and tactility
- Flowering timeline, color, structure and character
- Foliage shape, tactility, color and character over time
- Saturation, density, tone, reflectivity, and movement of plants and plant parts
- Kinetics: plant and animal movement – flight; diurnal and seasonal; celestial; human movement through gardens and grounds

**The design creates a visually-arresting and museum-specific (planting design) aesthetic. There is a syncopated approach to expression. An animated layout of the planting palette, both within the planter and across planters - in which each planter 'recognizes' relationships within the larger canvas of the museum grounds – serves to unify and differentiate the length and breadth of the grounds. This is an ordered, varied and environmentally-responsive planting display featuring primarily native plants.**

**Ground Plane Narrative**

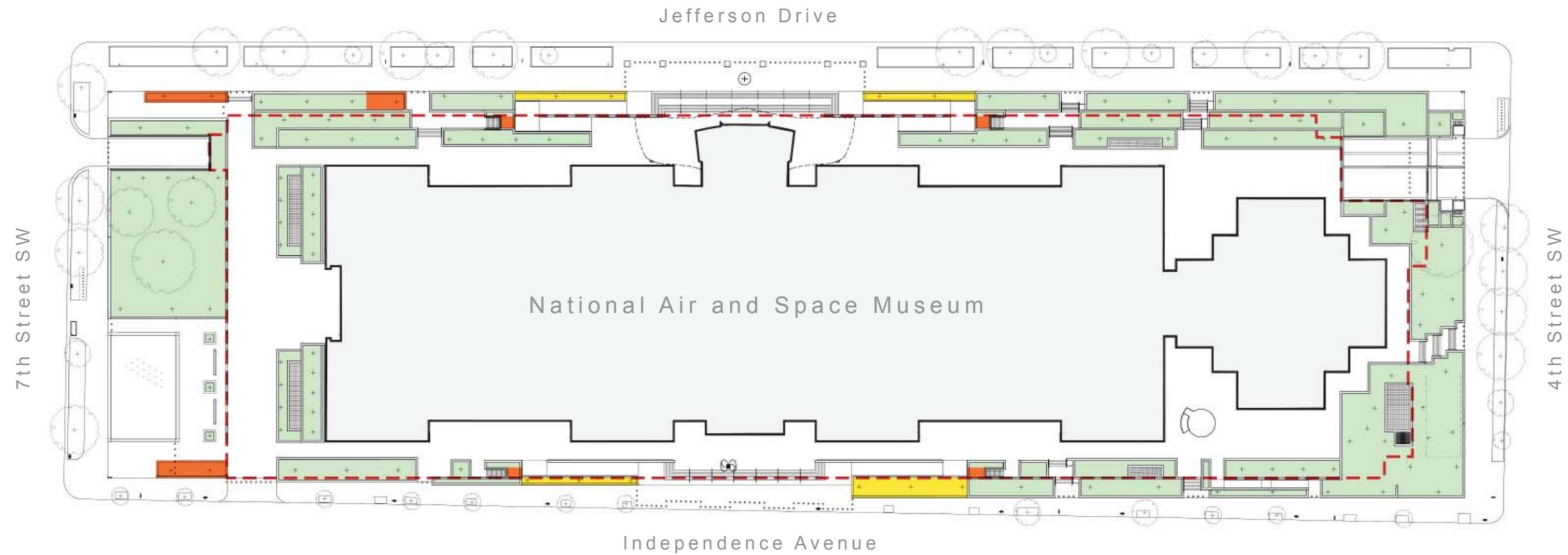


- Entry: At-Grade Planter
- Slope: At-Grade Planter
- Low planting (Preserve sight lines)
- Potential for taller planting
- Taller planting adjacent to wall at West Elevation

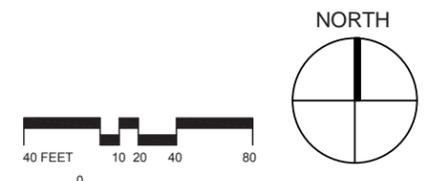


### Ground Plane Planter Typology



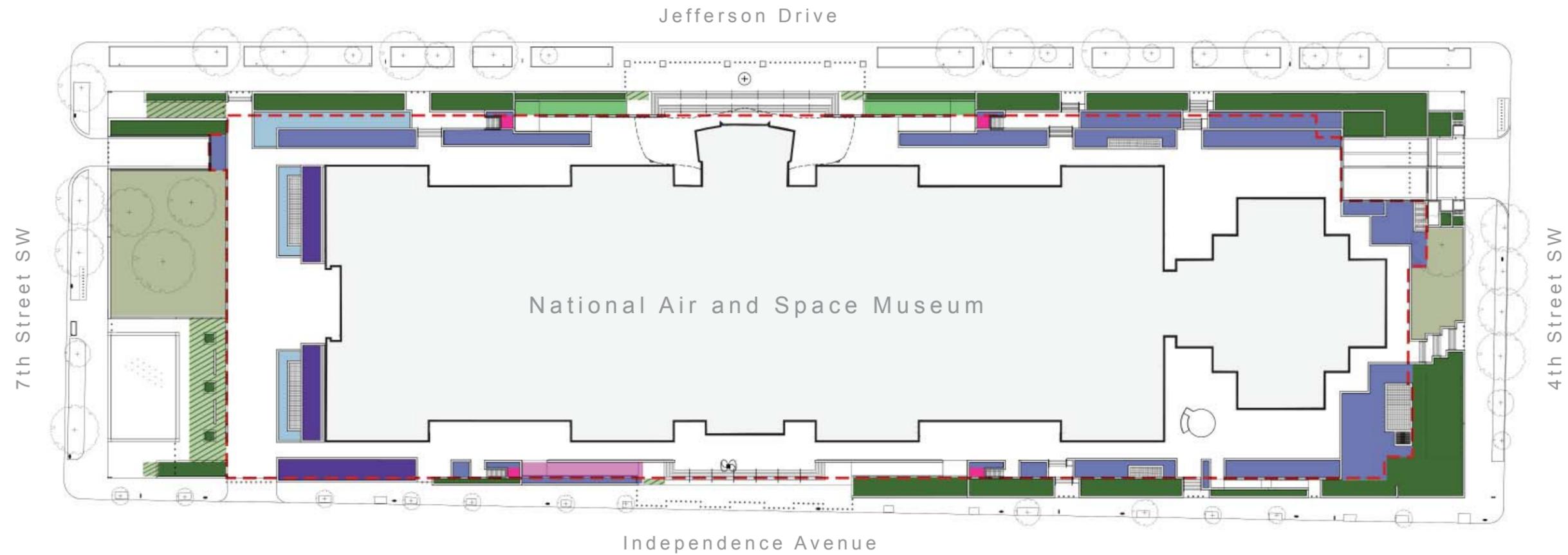


- Basement Edge of Structure
- Lower than Existing
- Same as Existing
- New Planter



### Ground Plane Planter Heights





**On Structure\***

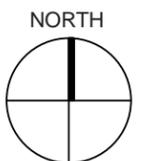
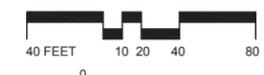
- 8"-44" Planter Depth under Inclined Walkway
- 21" Planter Depth
- 24" Planter Depth
- 30" Planter Depth
- 32" Planter Depth
- 37" Planter Depth

\* all depths on structure are approximate

**On Grade**

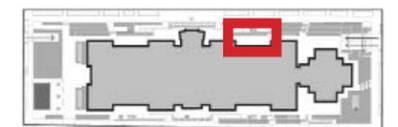
- 36" Planter under Inclined Walkway
- 48" Structural Soil under Pavement
- 36" Planter Depth
- Soil for Existing Trees
- Basement Edge of Structure

**Ground Plane Planter Soil Depth**



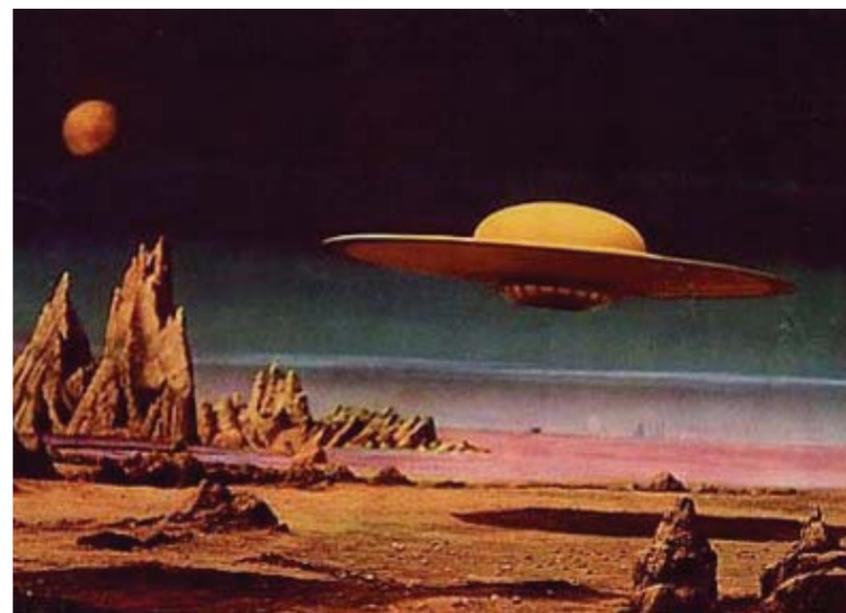
# Ground Plane / Planting Approach





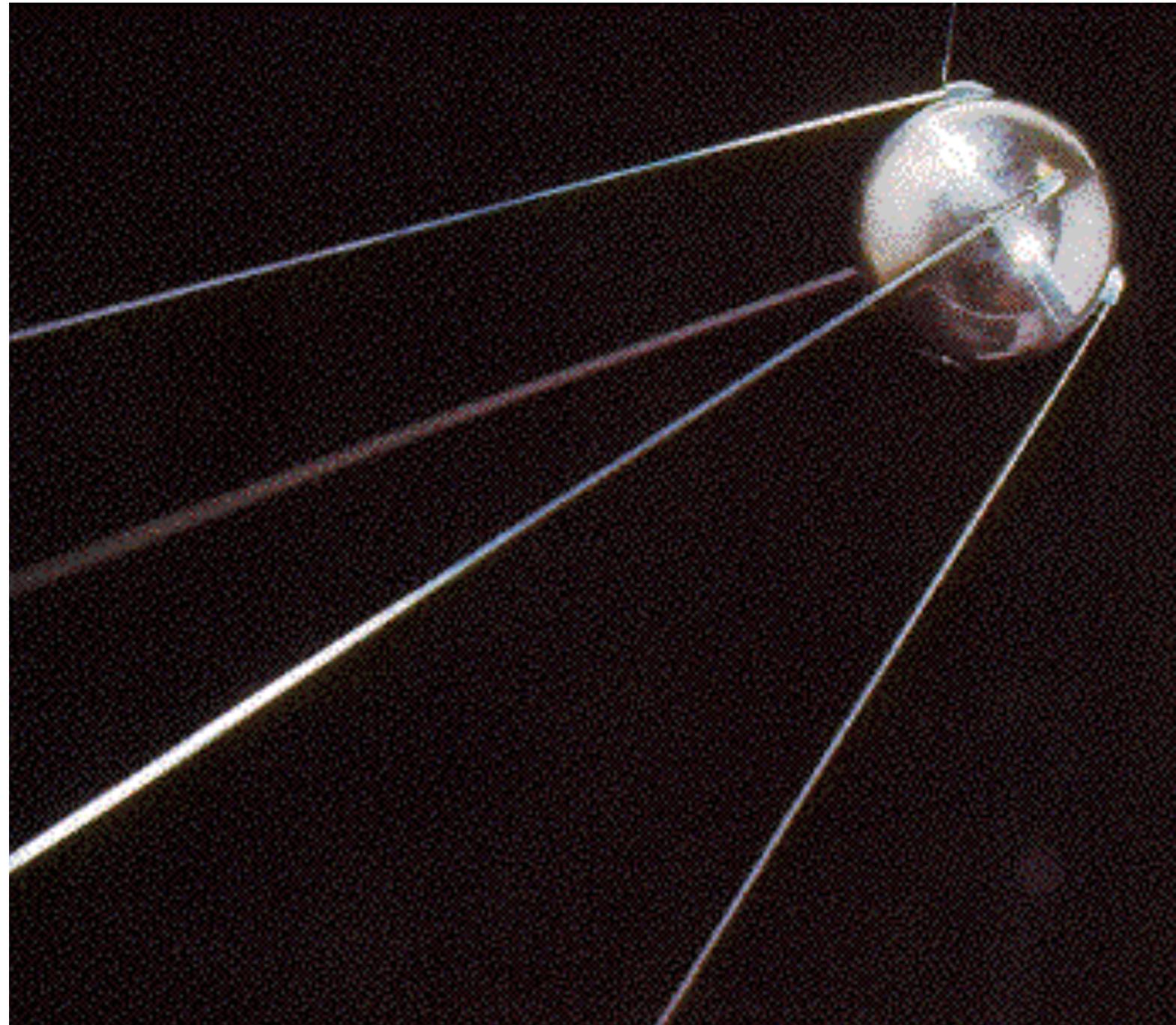
**Herbaceous Ground Plane Planting - Partial Planter Perspective, Late Summer**





**Aeronautical structure of plants**

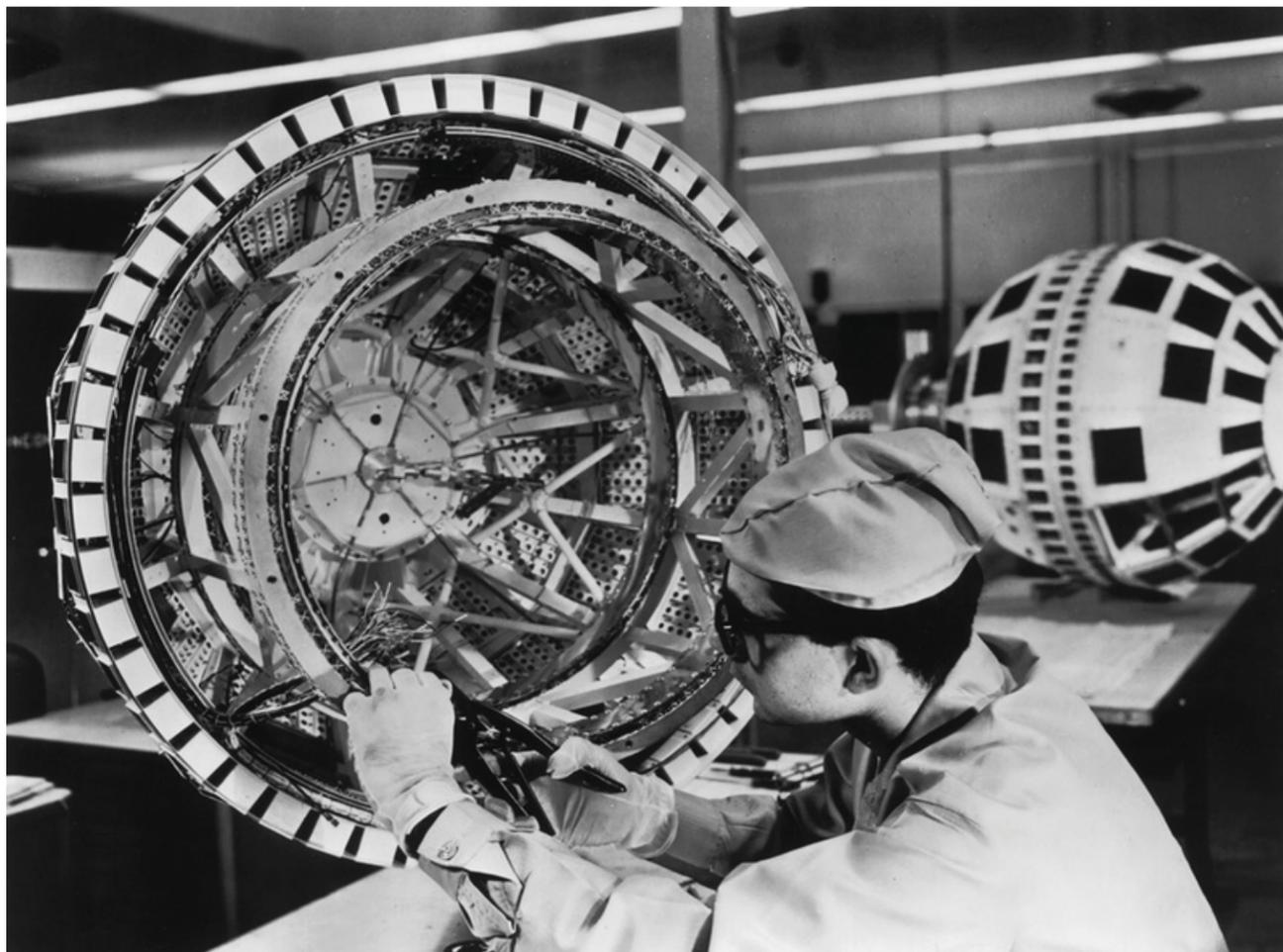




### Aeronautical structure of plants



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*National Air and Space Museum*



## Aeronautical structure of plants



Smithsonian Institution  
*National Air and Space Museum*



**Dynamic Character of Plants** Thimbleflower





**Dynamic Character of Plants** Butterflyweed

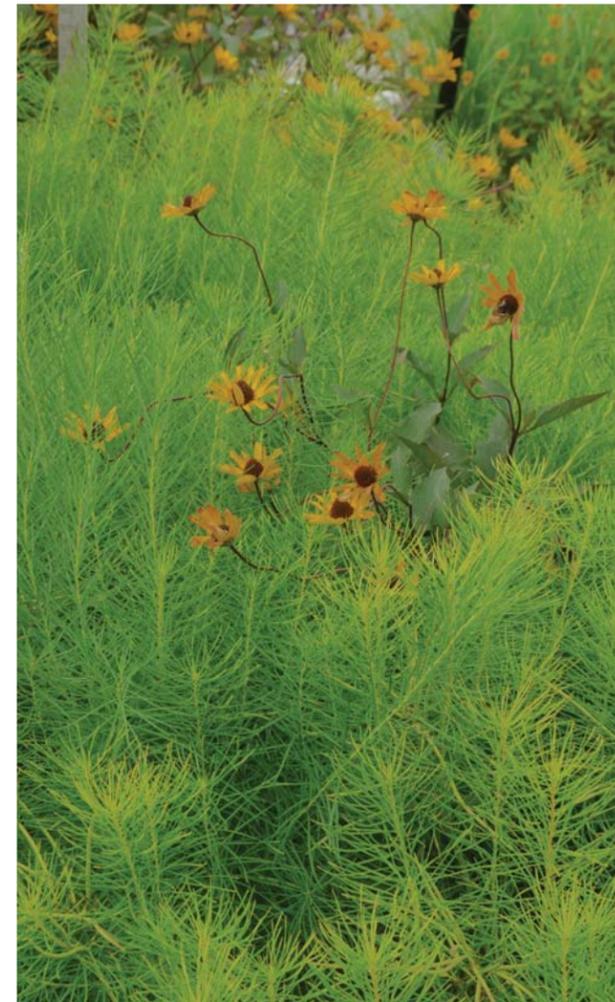


Smithsonian Institution  
*National Air and Space Museum*



**Dynamic Plantings** Habitat for Flight-Driven Creatures





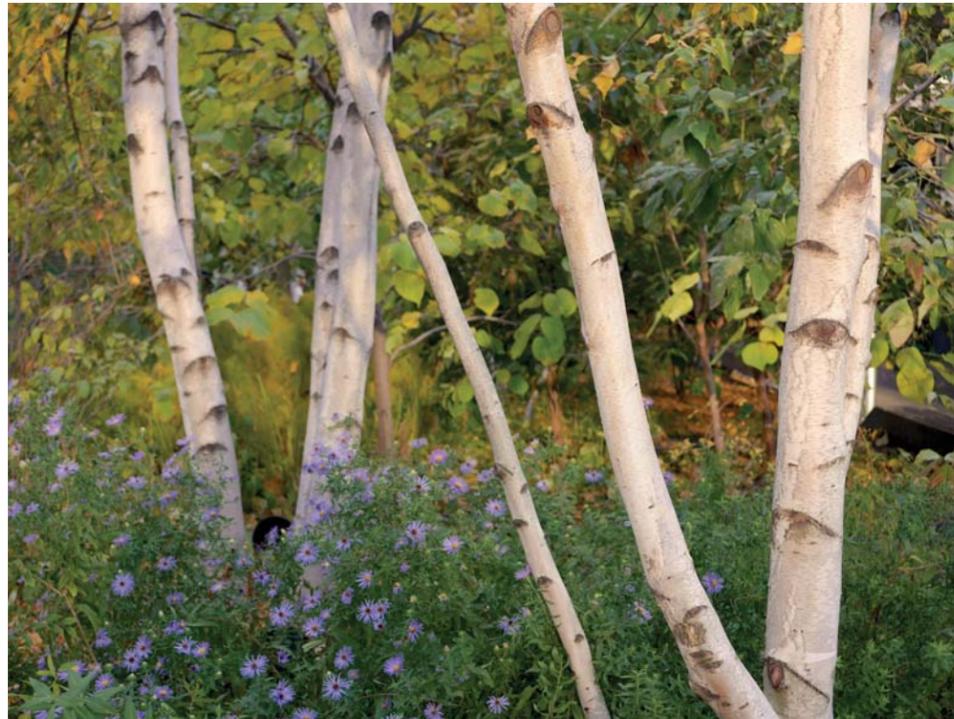
**Dynamic Plantings** Vertical Elements Pierce Ground Plane Sequentially/Seasonally





**Dynamic Plantings** Varying Degrees of Complexity Anchored by Grasses/Foliar Texture Plants





**Dynamic Plantings Seasonal Progression**

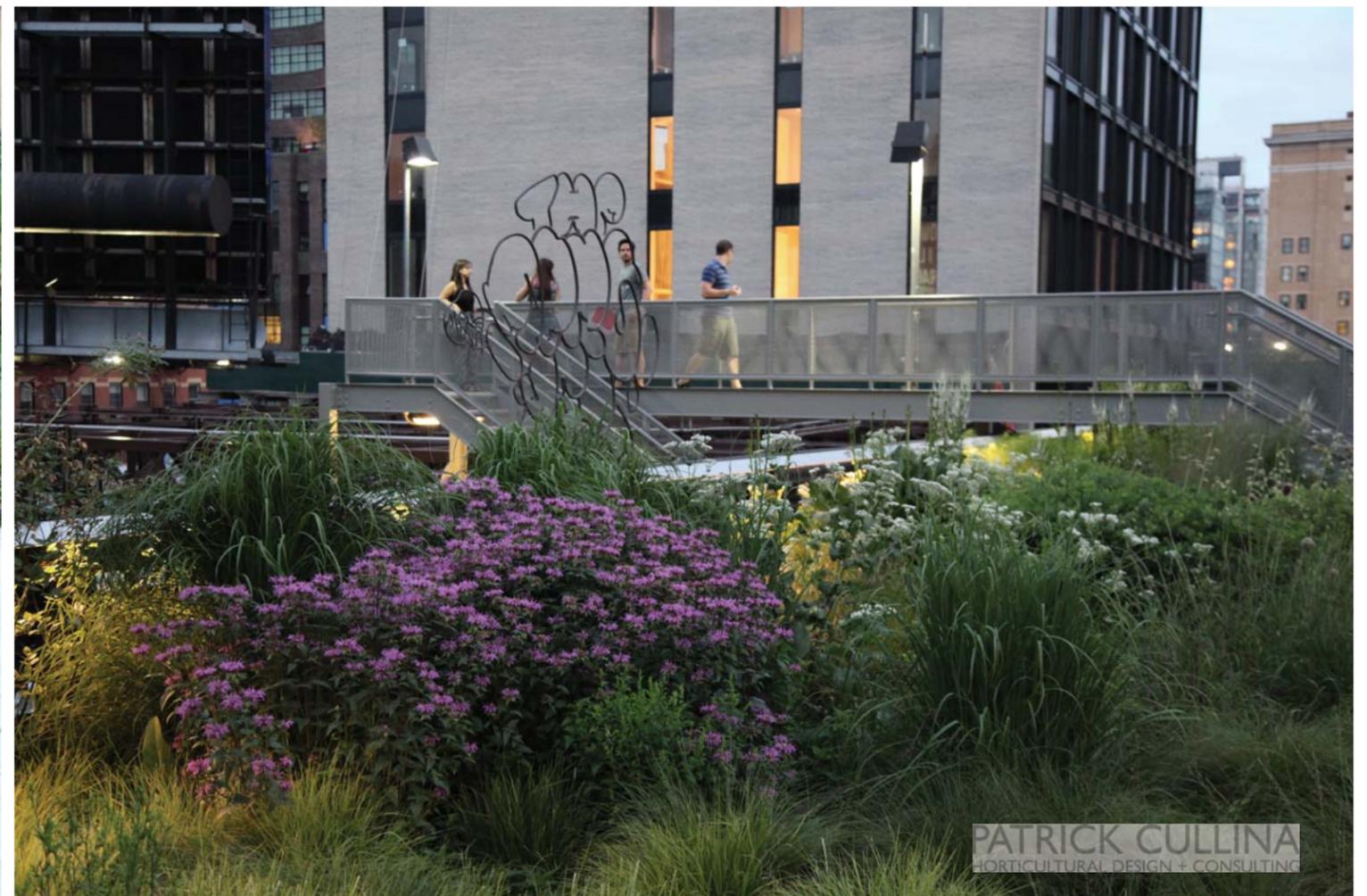




**Dynamic Plantings** An Immersive Habitat for People and Pollinators Alike







PATRICK CULLINA  
HORTICULTURAL DESIGN + CONSULTING

## Dynamic Plantings in Constructed Landscapes and/or Restricted Soil Depths



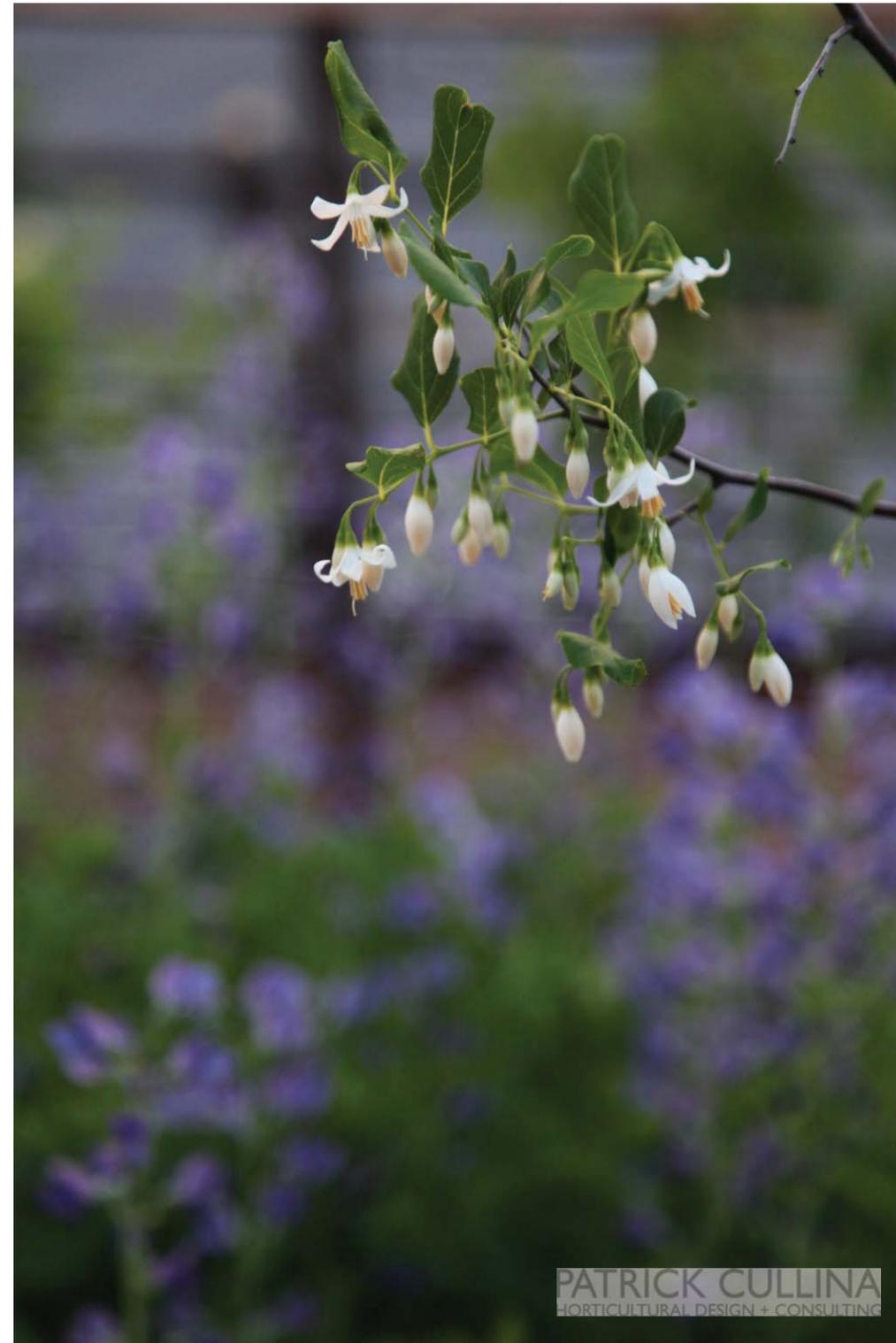
Smithsonian Institution  
*National Air and Space Museum*



**Dynamic Landscape Progression The High Line**

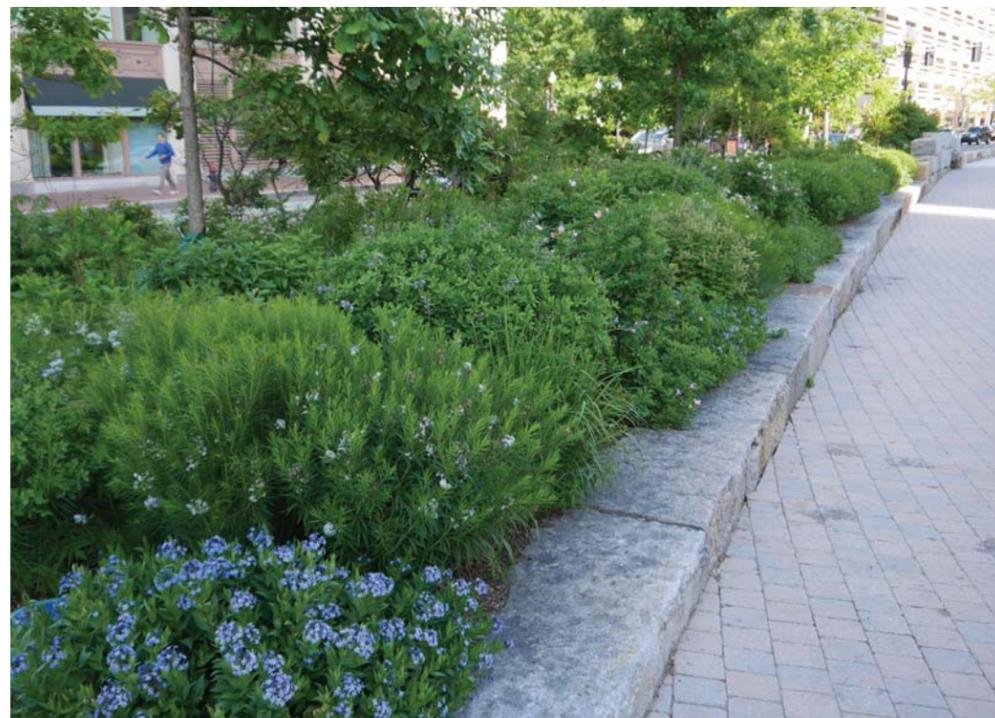


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*National Air and Space Museum*



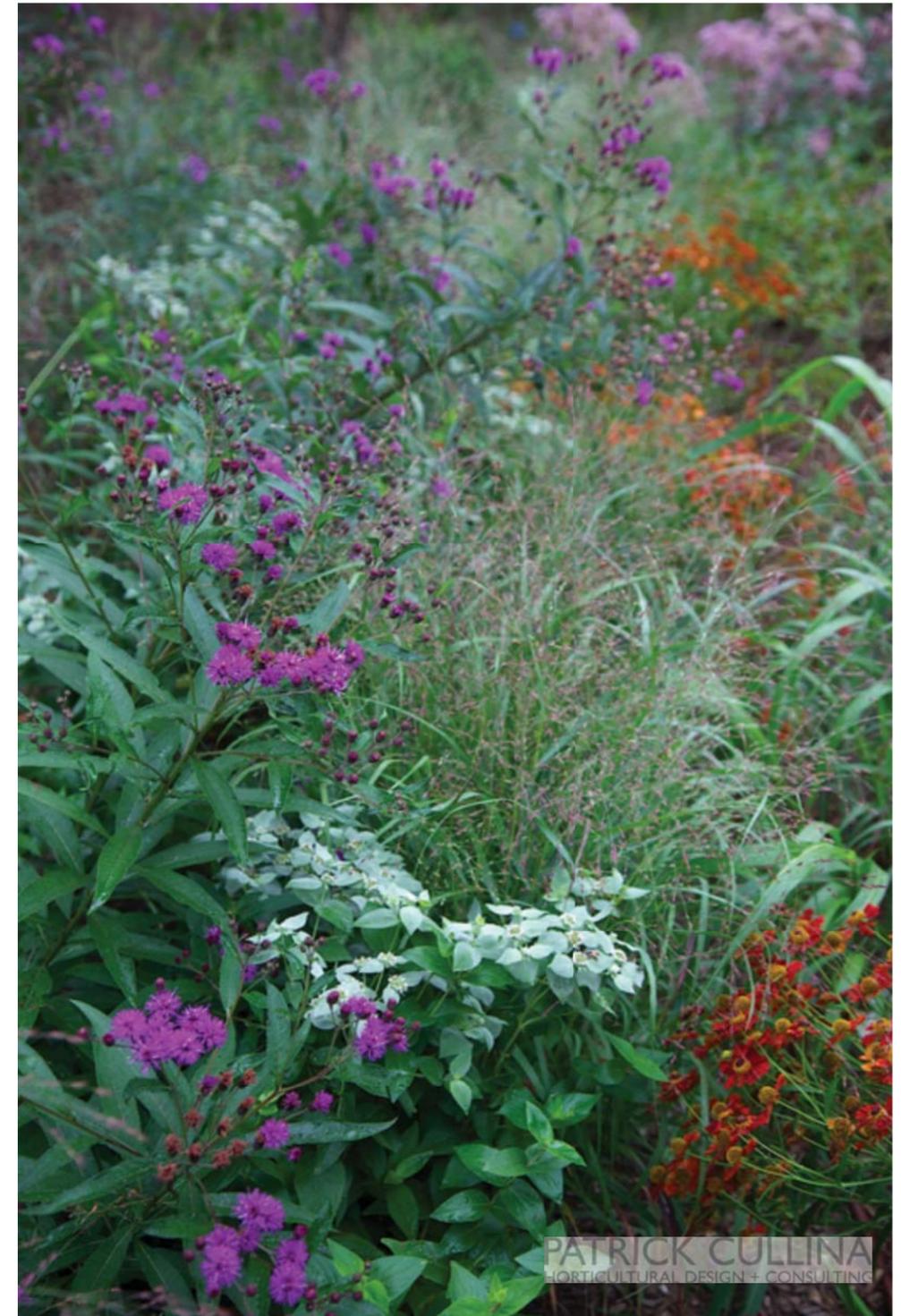
**Dynamic Landscapes Hoover-Mason Trestle/Bethlehem Steel**





**Dynamic Landscapes** Rose F. Kennedy Greenway, Boston (Parcel 15)

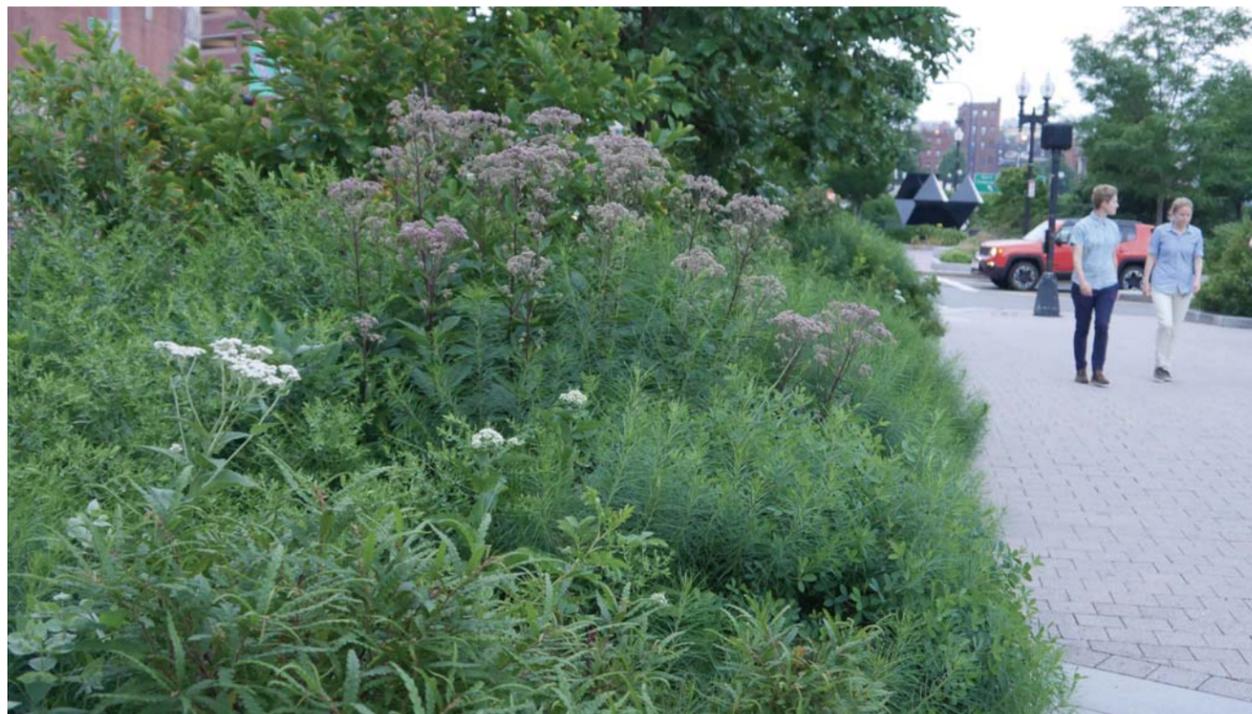




**Dynamic Landscapes** Rose F. Kennedy Greenway, Boston (Parcel 17)



Smithsonian Institution  
*National Air and Space Museum*



**Dynamic Landscapes** Rose F. Kennedy Greenway, Boston (Parcel 17/top; 14/bottom)





**Dynamic Landscapes** Hot Color Range for Sun/Part Sun





**Dynamic Landscapes** Cool Color Range for Sun/Part Sun





**Dynamic Landscapes** Vertical Elements for Shade/Part Shade





**Dynamic Landscapes** Ground Plane Flowering Perennials, Ferns and Sedges for Shade/Part Shade



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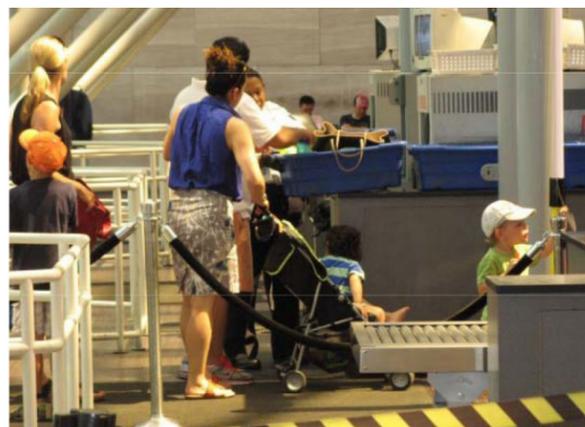
National Air and Space Museum Mall Building Revitalization



Vestibule Narrative	122
October 2017 Concept CFA Report and Commission Response	123
Security / Visitor Experience	126
North Vestibule Final Design: Floor Plan	127
North Vestibule Final Design: Full and Partial North Elevation	128
North Vestibule Final Design: Exterior Perspective	129
North Vestibule Final Design: Facade Lighting Concept	130
North Vestibule Final Design - Wall Sections and Canopy Base	131
North Vestibule Final Design - North Vestibule Details	132
Full Building Section	133
South Vestibule Final Design: Floor Plan	134
South Vestibule Final Design: Perspective Elevations	135
South Vestibule Final Design: Perspective from Southeast	136

**VESTIBULES**





1.2.2 SECURITY VESTIBULES

Existing Conditions

The visitor experience at NASM currently begins with an 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 the aviation and space treasures located just inside one of America’s most visited museums. With approximately 7 million visitors per year, the existing physical security screening systems are incapable of allowing entrance to the museum at a rate that is 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.



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<sup>2</sup>) Vestibule  
480sf (44.5m<sup>2</sup>) Screening Equipment
  - Independence Ave Side: 1,500sf (139.4m<sup>2</sup>) Vestibule  
360sf (33.5m<sup>2</sup>) Screening Equipment
- Protected Outdoor Screening



Final Design Base Scope and Option

The base scope for the north vestibule revitalization is comprised of the exterior expansion of the vestibule footprint, and addition of a tensile roof canopy. The base scope for the south vestibule revitalization is comprised of the interior expansion of the footprint that maintains the existing exterior enclosure. A construction option for the south vestibule is included in the final design, which is comprised of the interior and exterior expansion of th vestibule footprint, with the addition of a tensile roof canopy with integrated thin film photovoltaics.

Massing and Materiality of Proposed Vestibules

The design of the north vestibule was informed by the mission of the museum “to commemorate, educate, and inspire”. Thus the north vestibule was developed with inspiration from the geometry and details of the early flying machines of Leonardo DaVinci and the Wright Brothers as exhibited within the museum galleries. This approach provided the basis of a tensile membrane canopy that has an abstract shape of wings.

In addition to allusions to the early history of manned flight through air, the form of the canopy references the exploration and analysis of outer space as it is comprised of series of intersecting hyperbolic paraboloids. The hyperbolic paraboloid is relevant to the studies of astrophysics conducted by researchers at the museum as it combines the hyperbola as the “arc of escape” and the parabola as the “arc of infinity”, representative of the trajectories of any object around a central body with more than enough speed to simply escape the central object’s gravitational pull, or continue outward to infinity. Hyperbolic paraboloids are also a highly efficient structural form as it combines these intersecting curves to establish rigidity.

The canopy provides many functions. The fabric membrane establishes the roof enclosure for the vestibule below, and extends beyond to offer shade and overhead coverage from precipitation for exterior queuing areas. The contrast of the canopy relative to the existing museum building also provides an element of wayfinding to mark the entrance.

The form of the canopy was developed to respond to the architectural rhythm of the existing building. The shape of the roof is expanded and contracted in various locations to create a large covered area on the central axis of the building at the north entrance where the new curtainwall-enclosed vestibule is located. The canopy has a reduced in height in the areas directly adjacent to the central axis, with raised wings on the east and west ends to provide expanded coverage to protect the queues in front of flanking building Zones 3 and 5. This architectural undulation helps evoke the imagery of flight, similar to the early explorations by DaVinci and the Wright Brothers, with the incorporation of contemporary and progressive methods of construction that allow this structure to be built more efficiently in the present day.

The organic form of the canopy also provides a visual connection to the adjacent landscape planting proposed for the museum terrace grounds.

**Vestibule Narrative**



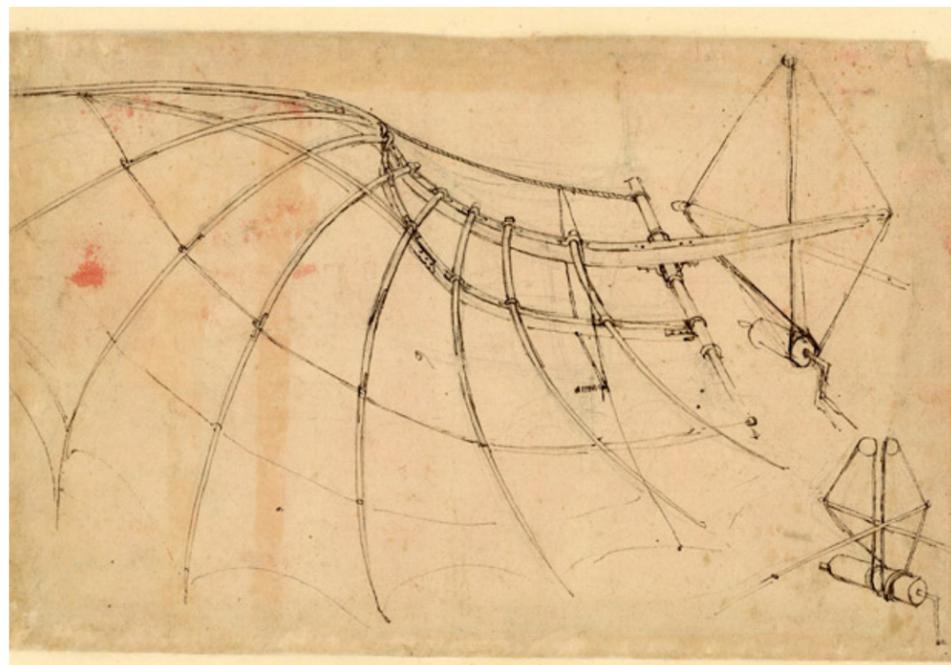
**Comments from the Commission of Fine Arts, Concept Design**

[The Commissioners] cautioned that the pavilion's curving elements may be excessively organic in form, resembling a tree canopy; they suggested refining the design to emphasize the metaphor of flight and documenting how the structure connects to the existing building.

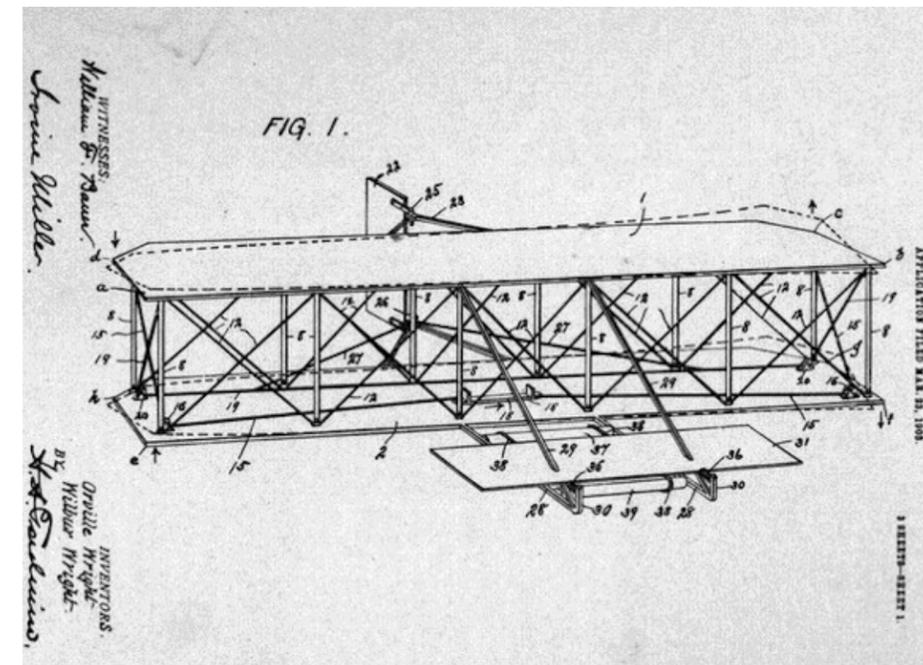
From the letter CFA letter dated October 27, 2017, from Thomas E. Luebke, FAIA, Secretary

The form and detail of the north vestibule canopy were developed to express the mission of the museum, and evoke the imagery of the artifacts exhibited within the interior galleries. The early flying machines developed by Leonardo DaVinci and the Wright Brothers are precedents that informed the design as they represent significant moments within the history of manned flight, and serve a significant role in the Smithsonian's permanent collection for the National Air and Space Museum.

These exhibits demonstrate how organic forms inspired the early explorations into flight, as well as the technical components of lightweight tensioned frames. The final design of the north vestibule canopy integrates the curvilinear forms and cross-bracing tension rods that provide structural support, and aesthetic cues to the mission of the museum.



Da Vinci's Codex on the Flight of Birds



Wright Flyer



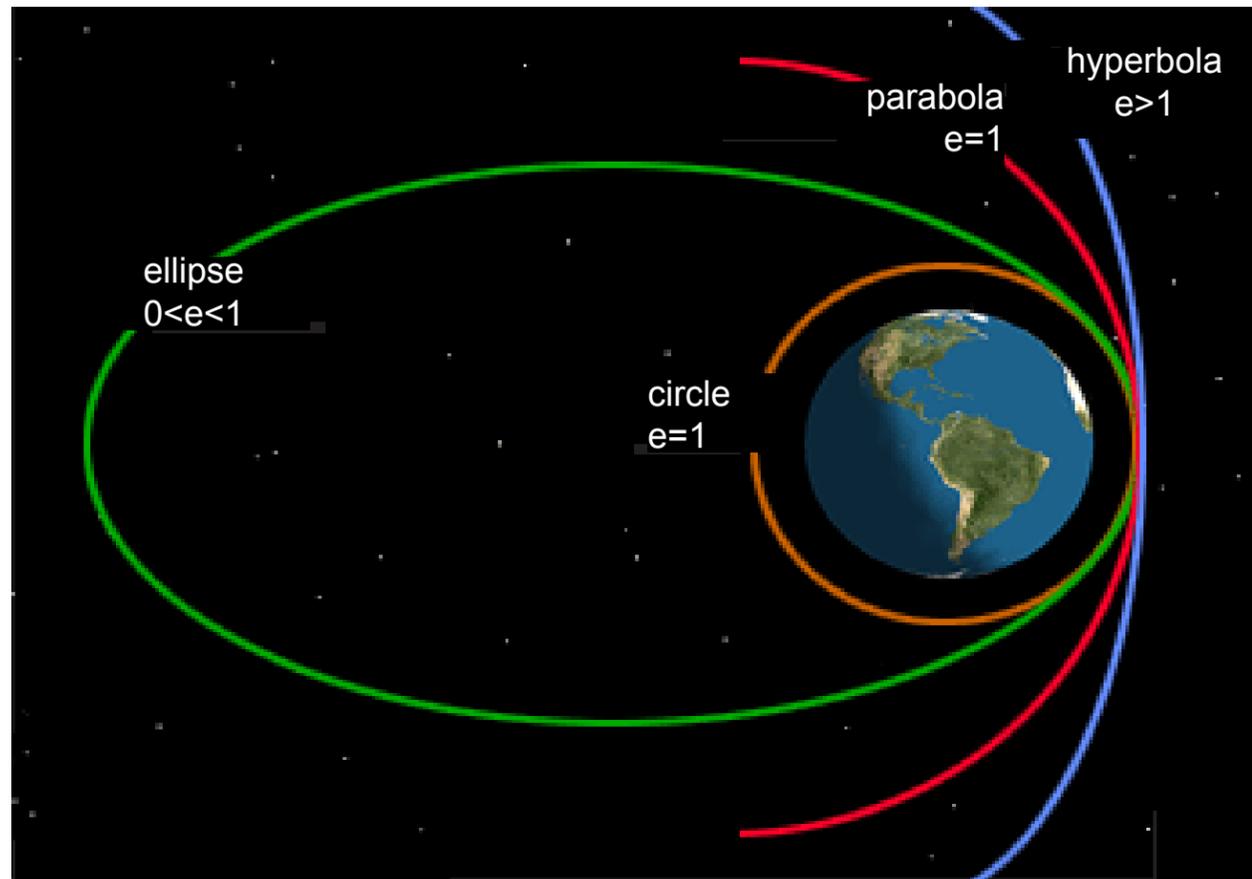
Da Vinci's Ornithopter as Exhibited within National Air and Space Museum



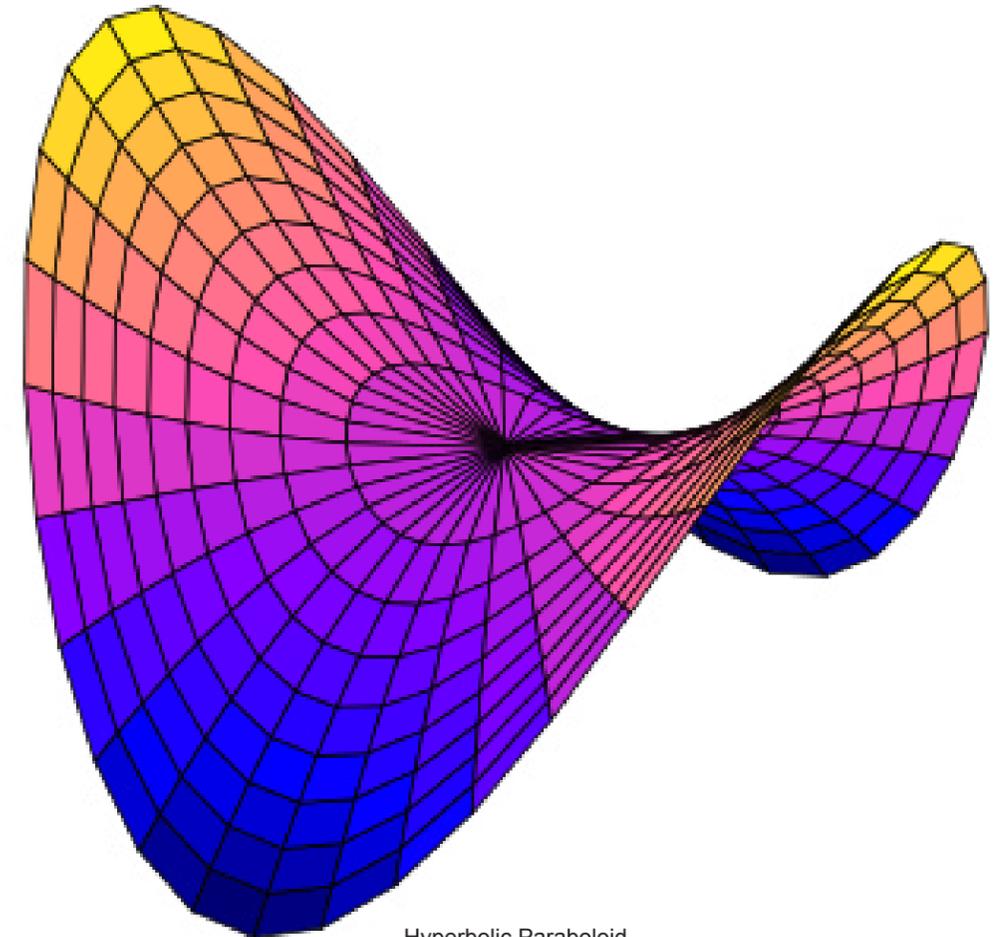
Wright Flyer as Exhibited within National Air and Space Museum

**October 2017 Revised Concept CFA Report and Commissioner Response - "Air" Precedent: Early Flying Machines**





Circular, Elliptical, Parabolic, and Hyperbolic Paths



Hyperbolic Paraboloid

**Comments from the Commission of Fine Arts. Concept Design**

[The Commissioners] cautioned that the pavilion's curving elements may be excessively organic in form, resembling a tree canopy; they suggested refining the design to emphasize the metaphor of flight and documenting how the structure connects to the existing building.

From the letter CFA letter dated October 27, 2017, from Thomas E. Luebke, FAIA, Secretary

Whereas the early flying machines are a precedent of the history of flight through air, the hyperbolic paraboloid is a precedent for the studies of space as it combines the hyperbola ("the arc of escape"), and the parabola ("the arc of infinity"). The form of the north vestibule canopy is derived from a grouping of hyperbolic paraboloids, combined to create a continuous curvilinear form. Drawing inspiration from the early flying machines and hyperbolic paraboloids links the north vestibule design with both components of air and space of the museum's mission.

**October 2017 Revised Concept CFA Report and Commissioner Response - "Space" Precedent: Hyperbolic Paraboloid**



**Comments from the Commission of Fine Arts, Concept Design**

[The Commissioners] cautioned that the pavilion's curving elements may be excessively organic in form, resembling a tree canopy; they suggested refining the design to emphasize the metaphor of flight and documenting how the structure connects to the existing building.

From the letter CFA letter dated October 27, 2017, from Thomas E. Luebke, FAIA, Secretary

The canopy frame rests on the upper terrace, but does not connect to the walls of the museum superstructure. The landing points are formed by a gathering of the slender tubular frame sections of the canopy above, which are broadened in size to create a tricolonnade with a wider base. The security portal is a rectilinear form clad with stainless steel panels that establishes a transition from the curvilinear shape of the canopy to the orthogonal geometry of the existing building.

The addition of the vestibule contrasts with the existing building, a sound preservation practice in keeping with the intent to preserve eligibility for listing on the National Register of Historic Places. The visual undulation of the canopy aligns with the architectural rhythm of the existing building facade beyond, with materiality, form, and detailing that expresses the mission of the museum.



**October 2017 Revised Concept CFA Report and Commissioner Response -- Connection to Existing Building**





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



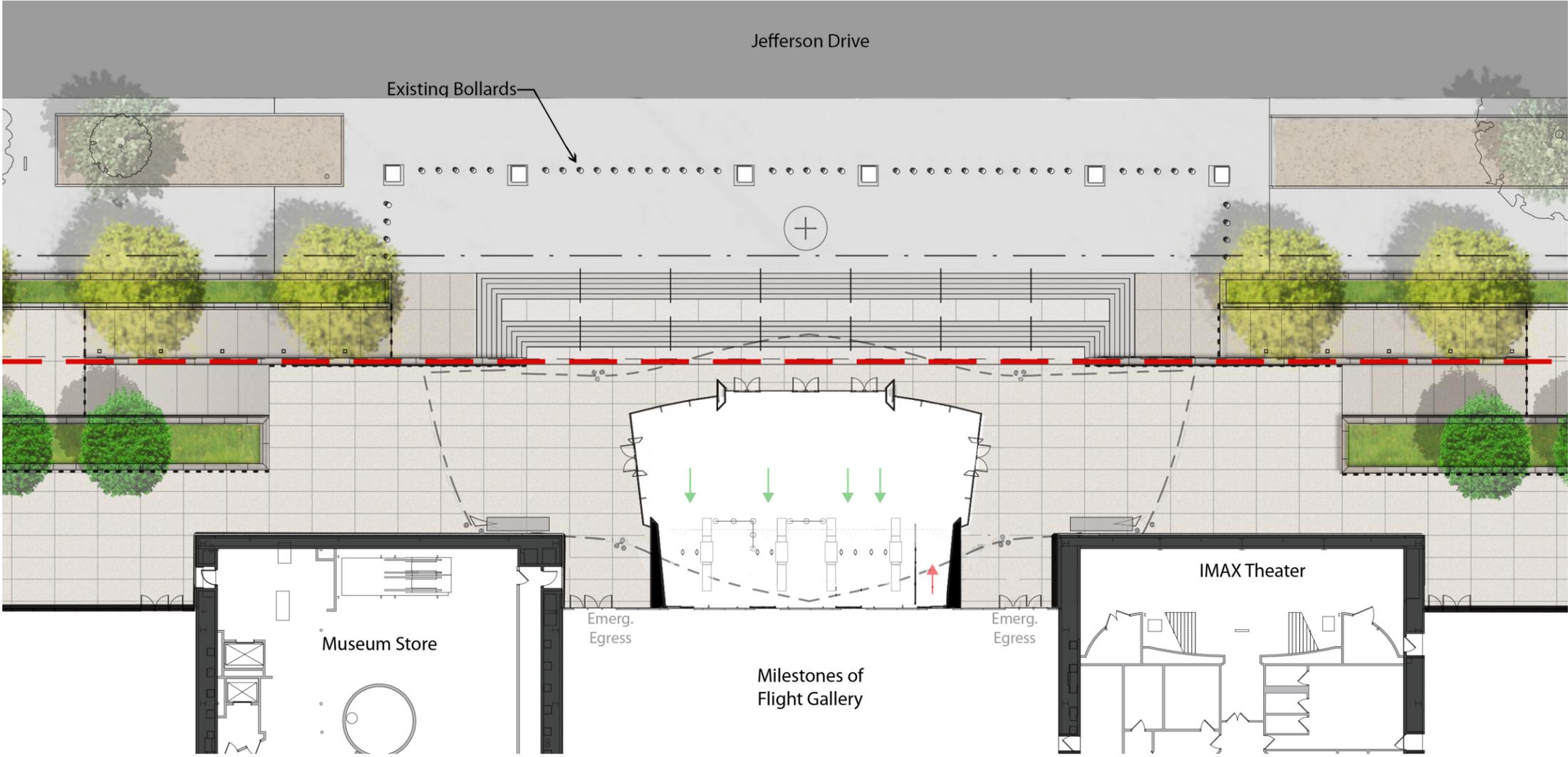
Entrance queue at south entrance



Security screening inside south entrance

**Security / Visitor Experience**





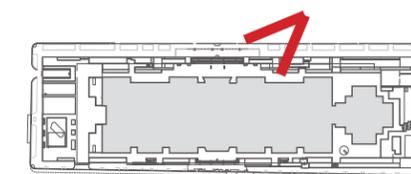
North Vestibule Final Design - Floor Plan





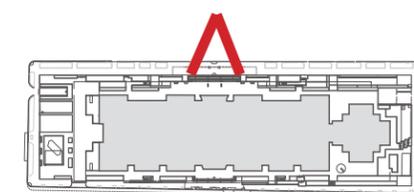
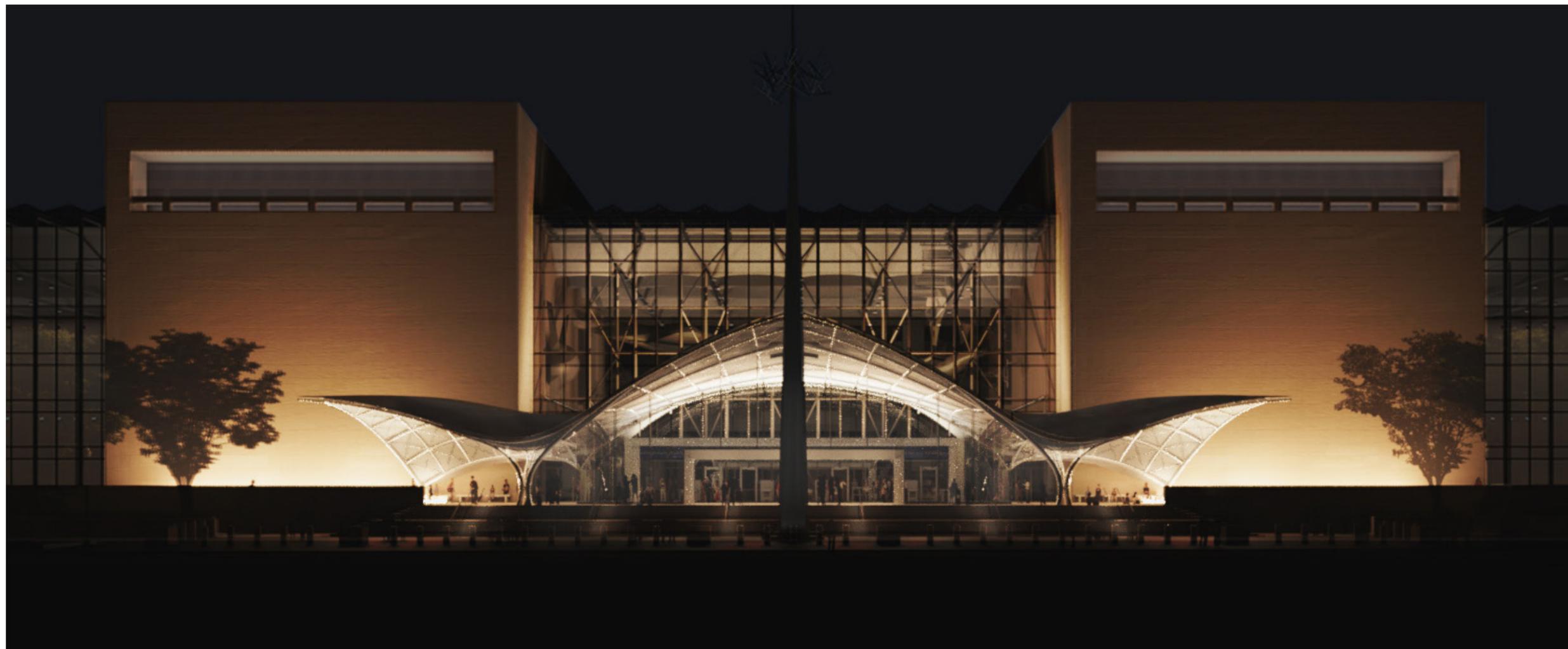
**North Vestibule Final Design - Full and Partial North Elevation**





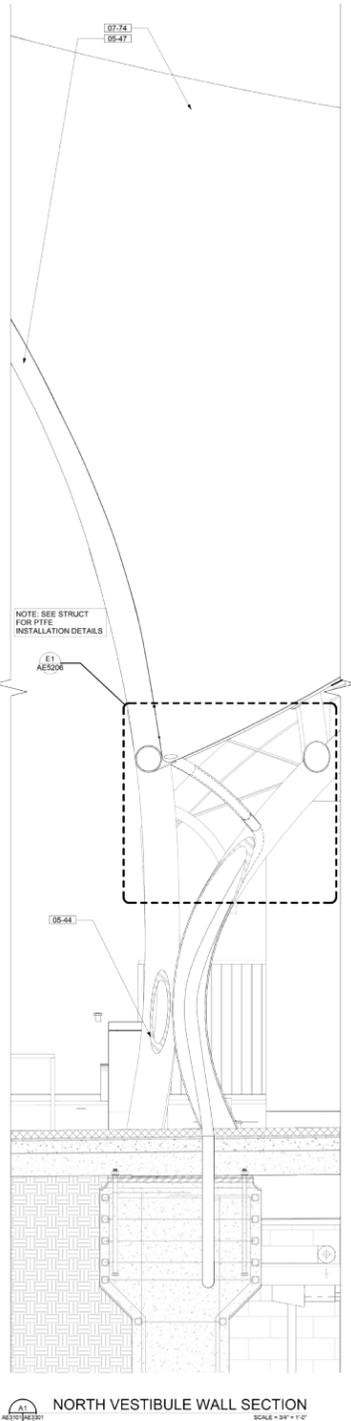
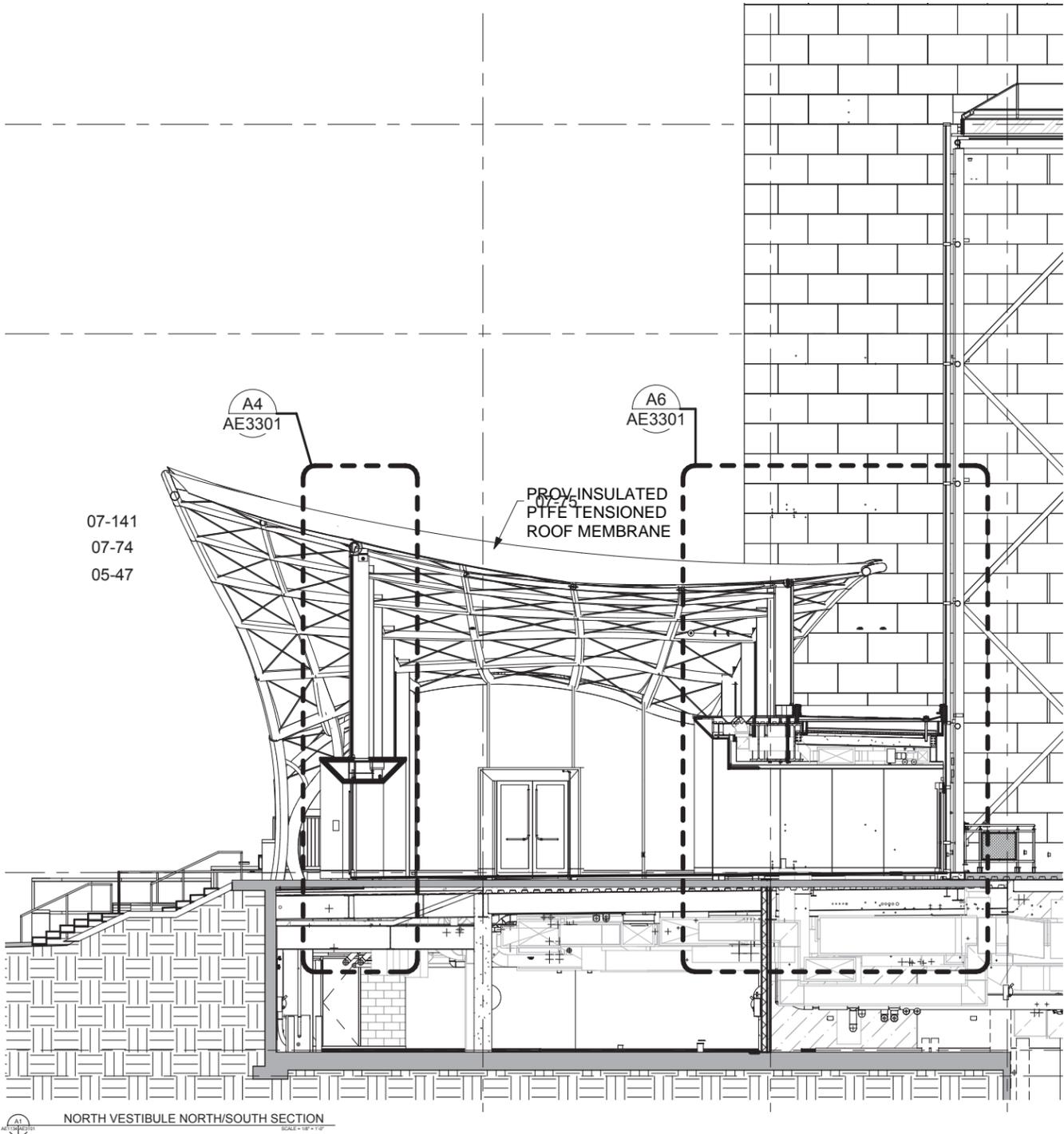
**North Vestibule Final Design - Exterior Perspective**





**North Vestibule Final Design - Gary Steffy Lighting Design Facade Concept**

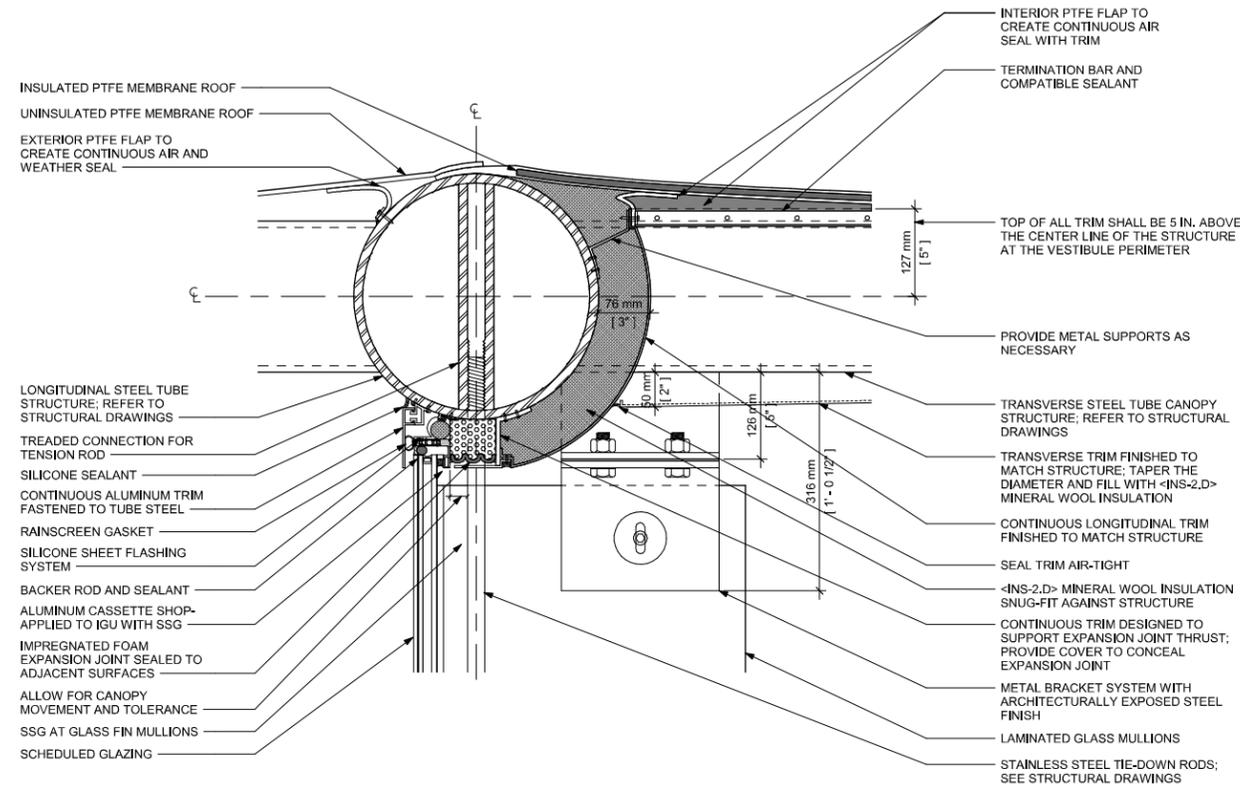




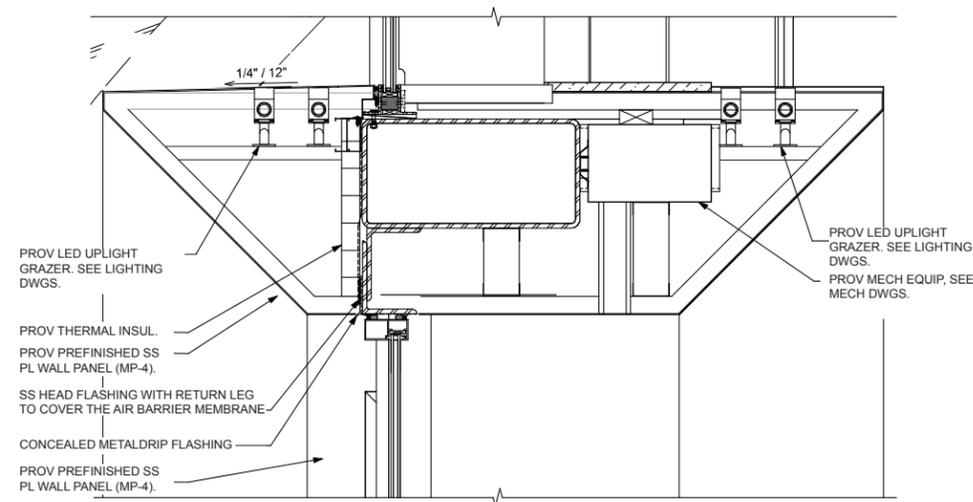
North Vestibule Canopy Base

North Vestibule Final Design - North Vestibule Wall Sections and Canopy Base

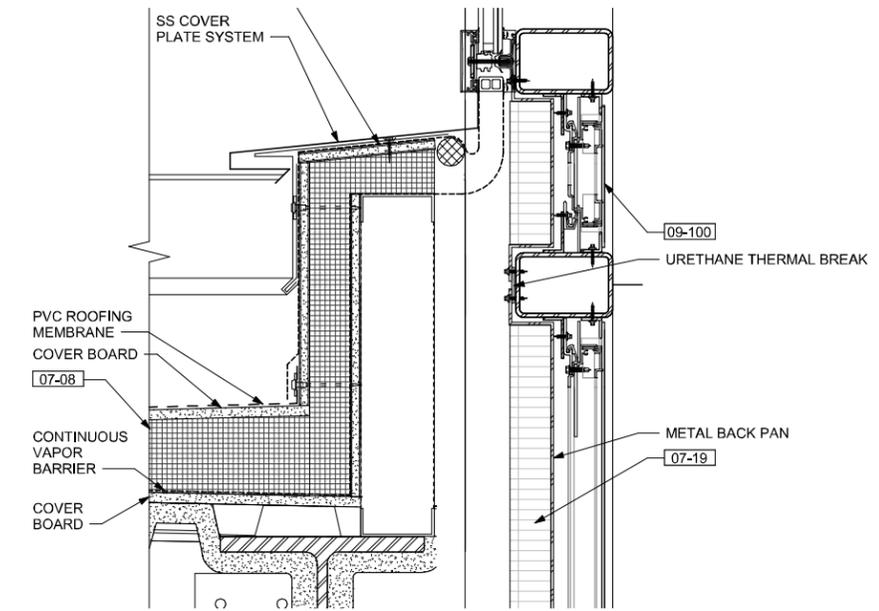




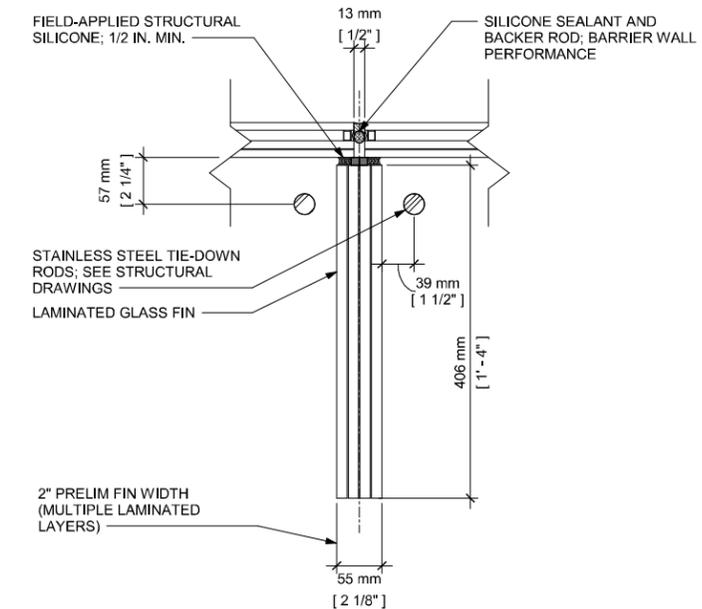
**E4** NORTH VESTIBULE CURTAINWALL HEAD SECTION DETAIL  
AE5203 SCALE = 3" = 1'-0"



**K1** NORTH VESTIBULE FRONT DOOR FRAME HEAD DETAIL  
AE5204 SCALE = 1 1/2" = 1'-0"



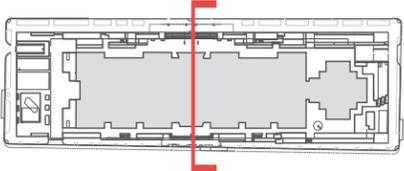
**D4** NORTH VESTIBULE SECURITY PORTAL ROOF DETAIL  
AE5203 SCALE = 3" = 1'-0"



**12** PLAN DETAIL - TYPICAL VERTICAL MULLION  
AE5204 SCALE = 3" = 1'-0"

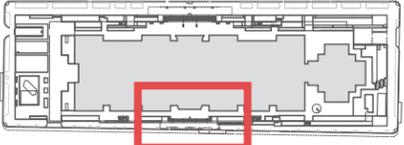
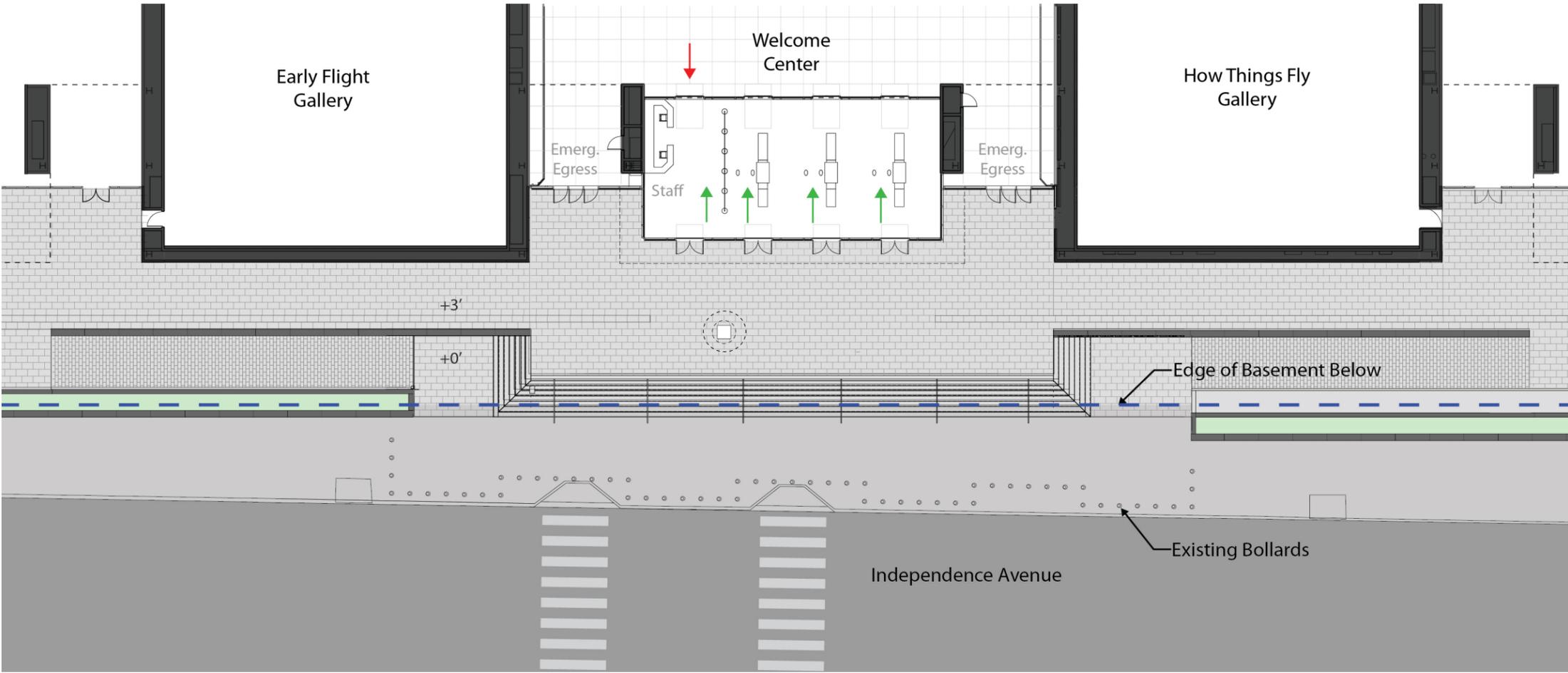
North Vestibule Final Design - North Vestibule Details





**Full Building Section**





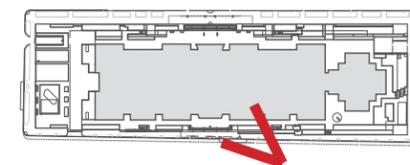
South Vestibule Final Design - Floor Plan





**South Vestibule Final Design - Full and Partial South Perspective Elevations**





**South Vestibule Final Design - Perspective from Southeast**





Environmental Assessment

View Sheds 138

Security Vestibules

Construction Option - South Vestibule Replacement with Photovoltaic Canopy Addition 140

Construction Documents

Applicable Drawings of the Final Construction Documents Separate Cover

**APPENDIX**



View from top of Washington Monument toward U.S. Capitol Building

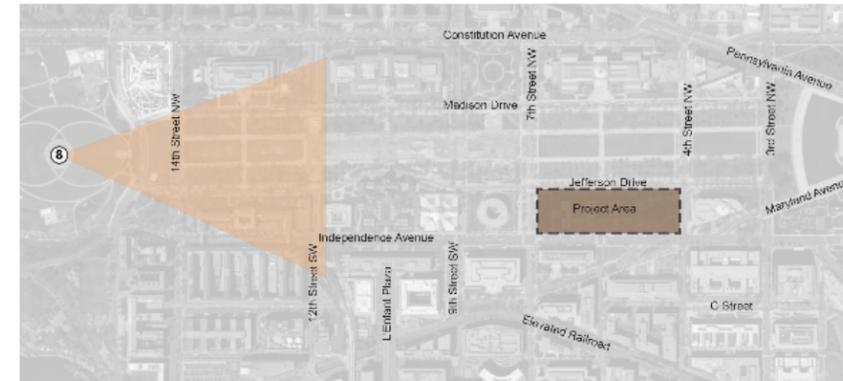


Existing Condition



Final Design

View Location



## North Vestibule Final Design - View Sheds



View from National Gallery West Building facing south toward the north facade of NASM



Existing Condition

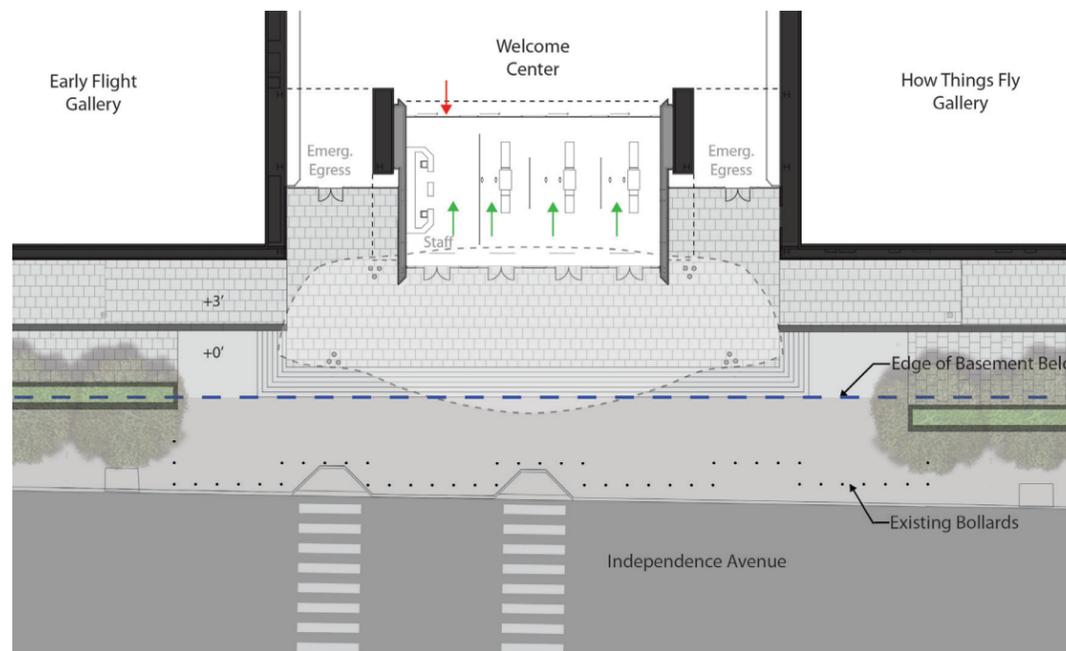
View Location



Final Design

**North Vestibule Final Design - View Sheds**





Floor Plan



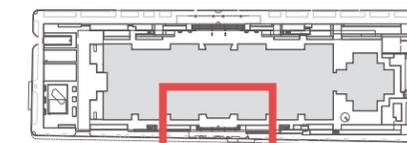
Partial South Perspective Elevation



Section Perspective



Perspective from Southeast



### Construction Option - South Vestibule Replacement with Photovoltaic Canopy Addition

