



Executive Director's Recommendation

Commission Meeting: November 2, 2017

PROJECT Building Exterior, Vestibules, and Site Improvements National Air and Space Museum Independence Avenue at 6th Street, SW Washington, DC	NCPC FILE NUMBER 7585 NCPC MAP FILE NUMBER 1.41(38.00)44627
SUBMITTED BY Smithsonian Institution	APPLICANT'S REQUEST Approval of comments on revised concept design
REVIEW AUTHORITY Federal Projects in the District per 40 U.S.C. § 8722(b)(1) and (d)	PROPOSED ACTION Approve comments as requested
	ACTION ITEM TYPE Staff Presentation

PROJECT SUMMARY

The Smithsonian Institution (SI) has submitted a revised concept design for the terraces, landscape, and vestibules at the National Air and Space Museum (NASM). The NASM is located in Southwest Washington, DC on the National Mall. The site is bound by Jefferson Drive to the north, 4th Street to the east, 7th Street to the west, and Independence Avenue to the south. This submission is part of a larger revitalization effort that includes building exterior cladding replacement, security vestibule additions and terrace improvements. The Commission has provided comments on the concept design on two separate occasions. SI submitted an initial concept design in July 2016, which focused on terrace improvements and provided two options for landscape and perimeter security solutions at the four museum corners and at the north and south entrances. In July 2017, SI provided a revised concept design that analyzed the stone cladding replacement alternatives for the building exterior and terrace walls.

Since the Commission's last review, SI has significantly reduced the project scope due to budget constraints. The site improvements are now limited to the central portion of the grounds, including the north and south entrances, and the west end of the museum. The east end of the site will generally retain the existing planter configuration, and as a result the museum grounds will continue to lack direct access from the east. The overall height of the planters on the terrace will not change, and all the existing stairs into the grounds will be retained. The site finishes, including paving and planter cladding materials, will be updated across the entire site. In general, the project includes the following modifications:

1. The extent of changes to the existing terrace focuses on the west and central portions, and is now primarily limited to providing a continuous pedestrian circulation loop around the building terrace and adding accessible ramps on each side of the central stairs at the building entrances.

2. The “Delta Solar” sculpture proposed location is consistent with the previous concept review. However, the fountain in which the sculpture had been placed has been eliminated, changing from a wet to a dry plinth clad in a dark granite with a reflective finish. The plinth continues to be 36 inches in height along 7th Street for perimeter security purposes.
3. The proposed building canopy at the museum’s south entry, along Independence Avenue, has been eliminated.
4. The proposed photovoltaic panel array has been removed from the building’s main roof.
5. The landscape design has been modified to reflect the terrace design, and the tree spacing has increased from 30 to 45 feet on center in order to provide better growth conditions and solar access to the ground plane. As such, the total number of proposed trees has been reduced since the last concept review from approximately 205 to 116 trees.
6. The terrace paving material has been revised from granite pavers to cast-in place exposed aggregate concrete, with the exception of the museum entrances and around the base of the Delta Solar sculpture, which continue to incorporate granite pavers.

Finally, the design refines the stormwater management, landscape, and lighting plans, as well as the north vestibule canopy design. No changes to the previously reviewed Colonial Rose granite building cladding are proposed as part of the current submission.

KEY INFORMATION

- The NASM building sits on a plinth, surrounded by a system of planters. The building terrace occupies approximately 112,000 gross square feet. The underground parking extends beyond the main building footprint by about 2/3 of the terrace area. The roof membrane of the terrace must be replaced to address waterproofing issues affecting the underground parking garage.
- The Alejandro Otero “Delta Solar” sculpture, was dedicated in 1977, a year after the museum opening, as a gift from the Venezuelan government to celebrate the United States Bicentennial. The kinetic sculpture sits on a shallow one-foot deep reflecting pool on the west end of the site, near the corner of Seventh Street and Independence Avenue. The pool has been empty due to a leak into the garage below since 1995.
- The sculpture orientation and its reflection in the water played a key role during the sculpture site selection process in the 1970s. Today, the sculpture maintains its original configuration.
- Seventh Street is a key portal to the National Mall. It continues on from Silver Spring, Maryland to the Southwest Waterfront, connecting a series of cultural facilities and public spaces.
- The U.S. Commission of Fine Arts (CFA) reviewed and approved the revised concept design on October 19, 2017. CFA provided three specific suggestions to be resolved during design development: reconsider the placement of the “Delta Solar” sculpture, further study the evolution of the north canopy vestibule and its association with flight versus an organic shape, and prioritize the public space implications in the value engineering process.
- The major changes since the last concept review are the elimination of: four entry plazas at each corner of the museum grounds and associated benches, solar panels from the main building roof, and the south canopy along Independence Avenue and its associated solar

panels. Other changes include fewer trees, a dry plinth for the Delta Solar and a revised paving material for the terrace.

- The NASM is home to approximately 151 trees. Four trees will remain, and 147 trees will be removed during construction. The total quantity of proposed trees is 116. The total number of trees, including new and existing trees is 120 trees. After renovation, the site will have 31 trees less than the current conditions. However, shade trees will increase from 30 to 56 trees.
- There are no existing benches on the museum grounds, and only two bicycle racks in poor condition. The site furnishing plan, composed of benches, bike racks, and trash receptacles is under development and will be included in the next submission. In addition to the existing 18-inch high seat wall around the edge of the planters of the main terrace, the concept design proposes three seat walls near the Delta Solar sculpture.

RECOMMENDATION

The Commission:

Provides the following comments on the revised concept design for the National Air and Space Museum Building Exterior, Vestibules, and Site Improvements:

West End of the Site

Finds that the west end of the site, which contains the “Delta Solar” sculpture, contributes to the series of public spaces located along Seventh Street that connect the National Mall, the Southwest Waterfront and downtown.

Notes that the Delta Solar sculpture was originally installed in a shallow reflecting pool on the west end of the National Air and Space Museum in 1977. The pool has not been operational since 1995; however, the sculpture maintains its original configuration.

Finds that the reflection of the sculpture in the water is an integral part to the sculpture composition. The sculpture and its associated water feature contribute to the historic character of the museum and the National Mall.

Notes that the July 2016 concept design included the relocation of the Delta Solar sculpture closer to the corner of Independence Avenue and Seventh Street. The proposal included the replacement of the shallow pool with a plinth that had a similar proportion to the original pool. The plinth functioned as a water feature and an integrated perimeter security measure for the base of the sculpture.

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, and therefore;

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

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 paths 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.

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.

Notes that since the project submission to the National Capital Planning Commission, and the Commission of Fine Arts' review on October 19, 2017, the Smithsonian has committed to retaining a water feature for the Delta Solar, which will be incorporated into the preliminary and final design.

Overall Site

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.

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.

Recommends that the Smithsonian coordinate with the National Park Service regarding the relocation of the "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.

Notes that all paving, soil, and planter systems need to be removed to replace the terrace roof waterproof membrane. Therefore, 97 percent of the existing trees will be removed from the museum grounds.

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*.

PROJECT REVIEW TIMELINE

Previous actions	<p>July 10, 2014 – Information presentation for the Smithsonian National Air and Space Museum (NASM) Comprehensive Facilities Master Plan.</p> <p>July 7, 2016 – Approval of comments on two concept design alternatives for the terrace, and landscape improvements, and site visit to museum grounds.</p> <p>April 6, 2017 – Information presentation on the NASM exterior cladding options, and site visit to review cladding and paving aesthetic mockups.</p> <p>July 13, 2017 – Approval of comments on the revised concept design for the building exterior cladding replacement alternatives, and site visit to review Colonial Rose granite samples.</p>
Remaining actions (anticipated)	Approval of preliminary and final site and building plans

PROJECT ANALYSIS

Executive Summary

The revised site design will preserve most of the original terrace layout while providing modest circulation and accessibility improvements. The current approach builds upon earlier concepts but reduces the project scope significantly due to budget constraints. While recognizing budget constraints, the removal of so many streetscape features does not create a welcoming, usable public realm worthy of one of the most visited museums in the world, with an average of approximately seven million visitors per year.

The major change since the July 2016 concept is the elimination of the four entry plazas at each corner of the museum grounds, as such the museum will continue to be isolated from the surrounding context. The latest design simplifies the planters at the northwest and southwest corners of the building and around the north and south entrances to enhance circulation. The plan provides a continuous circulation loop around the terrace level for visitors and utility vehicles by eliminating the existing planters on the west end which are currently blocking circulation. The project will improve universal accessibility by adding symmetrical ramps, at each side of the stairs on the north and south entrances. The ramps will comply with the American with Disabilities Act

(ADA). Although, the scope of work is now limited, the project has the potential to improve the visual and functional connection along 7th Street between the National Mall, the waterfront and the rest of the city. The staff analysis that follows focuses on the major changes in the proposed design as compared to the previous Commission review.

Analysis

The revitalization of the NASM terrace and landscape entails the replacement of the terrace waterproofing, paving, planter wall cladding, and vegetation to address deferred maintenance, improve site accessibility and entrances, and stormwater management.

Objectives

The rehabilitation of the museum grounds have six primary objectives:

1. Provide adequate waterproofing and structural support for the building and its basement.
2. Improve access and visibility between the museum and the National Mall and surrounding context.
3. Create an accessible, welcoming, and comfortable environment for visitors.
4. Provide for future programming, and thematic interpretation on the museum grounds, as an integral element of the museum.
5. Reinforce the landscape, considering the scale of the building.
6. Accommodate increased visitation growth since the Museum's opening in 1976, and anticipate continued growth.

Based on the reconciliation between the project scope and budget, the Smithsonian has revised the design. The staff analysis will describe the major changes, along with any proposed recommendations for the Commission's consideration.

Terrace and Planters

The building sits on a plinth, and the existing landscape consists of a system of cascading planters which respond to topography changes. The high point of the site is located at the intersection of 7th Street and Independence Avenue and the site slopes gradually down to the east and north. The north and south building entrances are elevated above the street level, requiring steps and ramps to enter the building.

The underground parking extends beyond the main building by about 2/3 of the terrace area. Therefore, portions of the terrace serve as a green roof on top of the parking garage and loading dock. All paving, soil, and planter systems need be removed to replace the roof waterproof membrane. This offers an opportunity to address significant circulation, landscape, and perimeter security concerns.

Since the previous concept design, the extent of changes to the existing terrace layout has been significantly reduced, and is now primarily limited to providing a continuous pedestrian circulation loop around the site and accessible ramps at the building entrances. Overall, the proposed design retains the original terrace design, and addresses code deficiency adjustments to improve accessibility. For example, the planters along the north and south sides of the grounds have been

retained except for the insertion of the new accessible walkways on either side of the central stairs at the north and south entrances. The northeast and southeast corners now retain the existing planter layout, with no direct entrance into the grounds. In general, the planter walls maintain their existing height throughout the grounds.

Staff finds that by removing the four entry plazas and benches at the site corners as previously proposed, the site will continue to lack direct access, visibility, and gathering spaces at the sidewalk level. However, the current plan addresses basic circulation issues such as completing the pedestrian circulation loop at the terrace level and providing accessible ramps adjacent to the museum entrances. As the Smithsonian develops the landscape and site furnishing plan, staff recommends to provide attractive amenities to provide a safe and appealing public space. Streetscape furniture should be of high quality and design to enhance the museum grounds.

West End of the Site

The new concept design continues to show the relocation of the "Delta Solar" sculpture on the west end of the site. The size and placement of the sculpture base is consistent with the previous concept review, which included the relocated sculpture and proposed water fountain as part of the perimeter security.

The Delta Solar sculpture, by Alejandro Otero, was dedicated in 1977 as a gift from the Venezuelan government to celebrate the United States Bicentennial. The existing sculpture sits on a shallow one-foot deep reflecting pool surrounded by grass. The sculpture diagonal orientation facing the corner of Independence and Seventh Street was selected to best relate to the afternoon sun. The sculpture was designed to turn and sparkle in the wind. The sculpture is composed of an open geometric grid with stainless steel sails that rotate with the wind, exploring the connection between movement and reflected light. As such, its solar orientation and reflection in the water played a key role during its site selection process and contribute to the museum's historic character. Unfortunately, the pool has been empty for the last 22 years due to waterproofing issues. When the pool was in operation, its bottom was painted black to better reflect the Delta Solar twirling triangular sails above.

In the revised concept, the base of the Delta Solar sculpture no longer incorporates a water feature. Instead, the applicant proposed a dry plinth base that is made of a reflective stone finish. Three of seven willow oak trees that compose the memorial grove, located to the north of the Delta Solar, will be retained, as they complement the 'Delta Solar' setting and are part of the original landscape design.

Staff finds that the paved plaza and dry plinth around the Delta Solar will decrease the amount of pervious areas on the museum grounds and contribute to the heat island effect. The dry plinth configuration also alters the setting of the sculpture and detracts from the arrival experience at this important gateway to the National Mall. As such, staff recommends the **Commission 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.**

Staff encourages the applicant to achieve a public realm that welcomes pedestrians and allows civic enjoyment and social interactions through an attractive landscape. The west end of the museum grounds is currently underutilized and feels more like a service area or mechanical yard than a public space. The existing interpretative signage for the Delta Solar is carved on the west side of the stone edge surrounding the pool. The signage is difficult to find due to the lack of accessibility of the lawn surrounding the pool caused by the perimeter security walls along 7th Street, and the elevation change at the adjacent large exhibit access area toward the east.

Furthermore, there are no benches on the west end to sit and admire the movement of the sculpture and the pool has no water. The existing food cart and vending facilities that occupy the large exhibit access area are open seasonally, but remain in place throughout the year cluttering the space. The movable tables and chairs adjacent to the food cart are not inviting.

The Smithsonian has recently noted that they will add a fountain to respond to comments from CFA. However, they noted that the plinth would be seen in dry conditions for a significant part of the year. Staff encourages the Smithsonian to look for precedents such as the *Metropolitan Museum's New David H. Koch Plaza* in New York City, designed by Olin, which includes an operational year-round fountain. In winter, the water is warmed by recycled steam for year-round use.

The relationship between the water feature and the sculpture is crucial. When the plinth is dry, staff is concerned that it will read more as piece of infrastructure, such as a perimeter security barrier or resemble the elevated metro vent shaft walls that have been installed around the city as a flood hardening measure, which are also clad in granite with a similar stone configuration. The dry plinth will overshadow the beauty of the sculpture and will not provide an appropriate pedestal for the Delta Solar. It will also introduce a visual barrier, blocking views to the museum from the corner of Independence and 7th Street without enhancing the existing conditions. The perimeter security function will dominate the plaza and the west end will continue to be unattractive and uninviting.

Given the large scale and openness of the National Mall, intimate public spaces with shade are needed to provide a respite after visiting the museum exhibits. In terms of topography, the west end of the site is the only area of the museum grounds that is at the same level as the sidewalk, and therefore has the potential to be more accessible than the rest of the grounds. The fountain and sculpture could establish a focal point at the corner of 7th Street and Independence Avenue and also complement the building historic character. The west end of the site contributes to the series of public spaces located along Seventh Street that connect the National Mall, the Southwest Waterfront and downtown. The Smithsonian should further consider how this portion of the site could reinforce the network of active gathering spaces along 7th Street. **Therefore, staff suggests the Commission request 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 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 paths 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.**

Perimeter Security

In general, the current design retains the existing perimeter security, with the exception of the southwest corner. The underlying structural components will be retained and re-integrated with the new work whenever possible. The proposed design introduces a plinth composed of a secure wall with new bollards that tie back to the existing perimeter security system.

The existing perimeter security elements at the NASM site were previously reviewed and approved by the Commission. The existing perimeter security consist of 30-inch high free-standing walls with four-foot wide breaks at the west terrace to allow access to the lawn area; hardened raised terrace planters around the site; custom bollards and plinths at building entrances and site access locations; two guard booths along 4th Street and retractable bollards at the parking and loading entrances.

On February 5, 2004, the Commission reviewed an overall Mall-Wide Perimeter Security concept, which included all of Smithsonian museum buildings on the Mall, except for the National Museum of the American Indian, which plans were approved separately. At the time, the concept incorporated the *2005 Commission's National Capital Urban Design and Security Plan Objectives and Policies*. On September 9, 2004, NCPC approved preliminary and final site plans for perimeter security around the NASM, except for the exhibit plinths on the north entry which were approved in 2006. This perimeter project was implemented and is reflected in today's existing conditions.

In order to improve pedestrian access and enhance the active use of the open space, staff suggests the **Commission recommend 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.** This, in conjunction with the previous recommendations, could help enliven the plaza and contribute to its success as a public space.

Overall Site

Streetscape Amenities

The current proposal does not include benches. As a result of the elimination of the entry plazas, the limited number of metal benches included in the previous proposal, have been removed. The submission narrative indicates that a simple, contemporary, metal-based palette composed of benches, bike racks and trash receptacles is under development. At this stage, the applicant provided a seating diagram showing informal seating at the monumental stairs (north and east entrances) and the continuous 18-inch high seat wall around the edge of the planters of the main terrace. There are three additional seat walls shown at street grade adjacent to the Delta Solar sculpture. Additional amenities will benefit visitors and the public. Therefore, staff recommends the **Commission request a streetscape plan that incorporates the following amenities:**

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

Landscape Design

All paving, soil, and planter systems need to be removed in order to address significant waterproofing issues at the museum's terrace. Since the 2016 concept review, the planting palette has slightly changed. The palette has been revised to provide more species diversity, introduce more 'flight' oriented characteristics, and accentuate the massing of the museum building with a rhythm of canopy, foliage texture and color.

Tree Spacing

The landscape design intent is to open up views toward the museum by raising the tree canopy. As a result, the planting plan increases shade trees while decreasing the number of understory trees.

Analysis of the sun/shade studies, and the planting palette determined a need for greater sunlight to penetrate the ground plane. As a result, the latest landscape plan increases the spacing of the canopy trees on the grounds from 30 feet to 45 feet to allow more sun to penetrate and permit healthy understory growth. It will also increase shade for visitors.

Number of Trees

As shown in table 1 below, there are currently 151 trees on the museum grounds, 147 trees will be removed and four trees will be preserved. Smithsonian has indicated that relocating and transplanting existing trees to other areas of the city is not possible, since most of the trees are too mature to survive the shock of transplantation. Given the planter environment they are growing in, their root systems would likely be too compromised by excavation for them to survive.

Preserving additional trees is also a challenge due to the two proposed stormwater management cisterns, terrace layout and grading changes. Most of trees will be removed because they are on-structure and cannot be saved when replacing the terrace waterproofing. Some of the trees will be removed due to poor health. The four existing trees to remain include: three willow oaks on the west lawn and a scarlet oak on the east end of the site. The total caliper of these four trees to remain

is 121.5 inches diameter at breast height (DBH).

The current planting design proposes a total of 116 trees, with an approximate 405 inches of caliper DBH at installation. The submission materials indicate that the total number of trees, including new and existing trees is 120 trees, with an approximate total caliper of 526.5 inches at installation. Shade trees will be installed at roughly 4-inch caliper and flowering trees at 2-3 inch caliper. According to the applicant, an estimate of total caliper inches at maturity cannot reasonably be made. There are currently 30 shade trees. The planting plan proposes 56 shade trees. Therefore,

Tree Types	Existing Trees (Quantities and Caliper)	Trees to remain	Trees to be removed	Proposed Trees Current design	Proposed Trees (65% DD Feb 2017)
Shade trees	30 (529.5")	4 (121.5")	26 (408" caliper)	56	143
Conifers	13 (88.5")	0	13 (88.5" caliper)	0	0
Broadleaf Semi-evergreen (Sweetbay Magnolia)	3 (22")		3 (22" caliper)	10	20
Understory	105 (906")	0	105 (906" caliper)	50	42
Total	151 (1546" caliper)	4	147 (1424.5" caliper)	116	205

Table 1: Existing, Preserved and Proposed Trees

the tree canopy will eventually exceed the current conditions.

The number of shade canopy and small trees appropriate for the site has been determined based on access of sunlight to the ground plane planting. The design team has refined the planting plan, including tree spacing, selection and species to optimize sunlight for plants and shade for people. The total caliper of the 147 trees on the museum grounds to be removed is approximately 1424.5 inches, most of these trees are at maturity. Smithsonian has a policy of planting new trees at a size that has low risk for survivability, conditioning and adaptability, and short and long term maintenance. Fully mature trees will not be planted.

The Federal Environment Element includes policies related to tree canopy and vegetation, encouraging federal agencies to preserve existing vegetation, especially large stands of trees. When tree removal is necessary, trees should be replaced to prevent a net tree loss to the project area, according to the following procedures:

1. An evaluation of potential tree loss should be made prior to any removal. Trees shall be replaced in accordance with the regulations of the local jurisdiction.
2. Trees of 10 inch diameter or less will be replaced at a minimum of a one-to-one basis.
3. Significant trees (diameter greater than 10 inch) will be replaced at a rate derived from a formula of the International Society of Arboriculture, or as establish by the local jurisdiction's requirement for tree replacement.

4. The replacement of trees should be located on-site, on adjacent properties, or in areas within the site's jurisdiction.

The Federal Environment encourages federal agencies to enhance the environmental quality of the National Capital Region by replacing existing trees where they have been removed due to development. Tree replacement should adhere to the standards and guidelines of the local jurisdiction, but at a minimum prevent a net tree loss in the development area. Based on the District Department of Transportation Urban Forestry Division tree removal guidance, in order to protect the District's canopy and its largest trees, Special Trees (a tree with a circumference between 44 and 100 inches) should be replaced with a quantity of saplings whose aggregated circumference equals or exceeds the circumference of the Special Tree to be removed.

In order to maintain the tree canopy of the museum, staff suggests the **Commission request 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.**

Paving Design

The entrances will include monolithic stone pavers, while the rest of the terrace pavement will consist of cast-in-place concrete. The cladding mockup, which was reviewed by the Commission in July 2017, also included paving options. Two gray tone paving options remain under consideration for the special paving at the museum entrances: Chelmsford and Chester granites. The final stone paving selection will be reviewed in context with the exposed aggregate concrete samples which will be installed on the remaining of the terraces.

Staff finds that since the pavement material on the sidewalks and building terrace will have a similar material, consisting of exposed aggregate concrete, the visual transition between public and private space will need special attention to ensure that there is a sense of arrival into the museum grounds.

Streetscape Mall Manual

The perimeter of the property is under the jurisdiction of the National Park Service. Improvements to the public space will also benefit the visitor experience. The Streetscape Manual (updated in 2013) is an interagency initiative for the National Mall road improvement program. Some examples of existing streetscape elements that are inconsistent with the Mall Streetscape Manual include:

- The paving along 4th street is not consistent with the exposed aggregate concrete sidewalk.
- The lighting fixture along 4th Street is currently a Twin-Twenty Globe, instead of a Washington Globe.
- There are conflicts between planters and bus drop off and pick up areas along Jefferson Drive.
- Unprotected tree planters on Independence Avenue.

As such, staff suggests the **Commission recommend 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.**

Finally, the existing “Ad Astra” sculpture on the north side of the building will be relocated as part of the project. Given the volume of visitors entering the building from the National Mall side, it will be important to locate the sculpture in a way that is appropriate without adversely affecting circulation. Therefore, staff suggests the **Commission recommend that the Smithsonian coordinate with the National Park Service regarding the relocation of the “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.**

Vestibules

As part of the revised design, the proposed building canopy at the museum’s south entry, along Independence Avenue, has been eliminated. The north vestibule facing Jefferson Drive has been retained. Overall, the north canopy continues to have the same form and materials but its structural elements have been refined. The roof materials continue to be ETFE, a tensile fabric, and steel.

Photovoltaics

The current design eliminates the solar panels previously proposed on the building roof, and the south canopy vestibule, which included a film of solar panels integrated into the canopy. The applicant has indicated this is primarily due to the potential impacts to the roof structure and associated cost implications.

The July 2016 concept included rooftop photovoltaic array system installed on the 70,000 square-foot flat roof. The percentage of electricity contributions from the rooftop photovoltaics was approximately 6300,000 KiloWatt Hours per year (kWh/year), which is equivalent to 7% of the electricity load for the revitalized museum. The installation of the rooftop photovoltaic array was designed to minimize visibility from the Mall and surrounding streets. In addition, the previous design included a photovoltaic installation on the south canopy vestibule, which consisted of a flexible PV film joined with the proposed tensile fabric roof to create a form that protected visitors from the sun while harnessing its energy. With visibility to the visitors, the south canopy photovoltaic panels were meant to express the Museum’s mission by demonstrating the application of space age technology. The percentage of electricity contributions from the south canopy photovoltaics of vestibule design was as high as 70,000kWh/year, approximately 0.7% of the electricity load for the revitalized museum.

Staff notes that the solar panel array previously proposed on the main building roof has been removed due to cost implications associated with the required building structural reinforcement. As the value engineering process develops, staff recommends that the Smithsonian coordinate with the District Department of Energy and Environment regarding the reincorporation of solar panels on the museum’s building roof.

Stormwater Management

The stormwater management plan no longer includes collection from paved areas. However, according to the applicant, it still meets the District Department of Energy and Environment requirements. The plan includes two underground cisterns to collect roof runoff, one at the southeast corner near Independence Avenue and Fourth Street, and another one near the southwest corner near Independence and 7th Street. The plan also includes infiltration on the terrace planters. The existing impervious area on the site is 337,528 square feet. The post project impervious area is 349,647 square feet. The project will increase the site impervious area by 12,113 square feet.

Given the increase in impervious surface, staff recommends to provide additional low impact development practices such as bioretention facilities and permeable pavers, if appropriate to the site, to reduce stormwater runoff.

At final review, the applicant must submit a stormwater management plan and narrative addressing compliance with both local and federal stormwater management requirements. The federal regulations can be found in the *Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act of 2007*.

CONFORMANCE TO EXISTING PLANS, POLICIES AND RELATED GUIDANCE

Comprehensive Plan for the National Capital

The elements of the Comprehensive Plan that include policies applicable to this project are the Urban Design; Federal Environment; Historic Preservation; Visitors and Commemoration and Park and Open Space Elements.

National Historic Preservation Act

Both the Smithsonian and NCPC have an independent responsibility to satisfy the requirements of Section 106 of the National Historic Preservation Act (NHPA). NCPC has approval authority over federal projects located within the District of Columbia pursuant to the National Capital Planning Act. NCPC has designated SI as the lead federal agency to fulfill their collective Section 106 responsibility. The Smithsonian initiated consultation with the District of Columbia State Historic Preservation Officer (DC SHPO) in September 3, 2014.

The NASM is a contributing building to the National Mall Historic District, which is listed in the National Register of Historic Places. The NASM is not currently listed on the National Register of Historic Places or the District of Columbia Inventory of Historic Sites and is currently 41 years old. For purposes of Section 106 review, the DC SHPO, SI, and NCPC have agreed that the building is individually eligible for listing in the National Register, and shall be treated as such to maintain its existing character.

The SI, NCPC, and the DC SHPO determined that the undertaking will have an adverse effect on the NASM and the National Mall Historic District. As outlined in an assessment of the effects on

historic resources, cumulative adverse effects will result from altering the exterior stone cladding, which is one of the most notable character defining features of the museum and an element that establishes a strong visual connection to the similarly clad National Gallery of Art. In addition, adverse effects will result from changing several other features of the property's setting that contribute to its historic significance, including alteration to terraces, relocating sculptures and introducing new vestibules.

The SI, NCPC, DC SHPO and the Advisory Council on Historic Preservation (ACHP) will execute a Memorandum of Agreement (MOA) in November 2017, prior to the submission of the proposal to the Commission for final review. The Section 106 consultation is ongoing, the signatories and consulting parties are still negotiating potential mitigation measures commensurate to the level of adverse effects. The mitigation measures will be incorporated into NCPC's Finding of No Significant Impact issued in accordance with NEPA. Five consulting party meetings and two cladding mockup review opportunities have been conducted to date, as shown below.

Consultation Meetings and Cladding Mockup Review Opportunities	Date
Joint NEPA/Section 106 Public Scoping Meeting #1	November 12, 2014
Section 106 Consulting's Party Meeting #2 (Vestibules and Terraces)	February 22, 2016
Joint NEPA/Section 106 Public Meeting #3 (EA Discussion and Cladding Mockup Review Opportunity of four cladding options)	April 7, 2017
Additional Cladding Mockup Review Opportunity (four cladding options)	April 6, 2017
Joint NEPA/Section 106 Follow-up #4 (Cladding Mockup Review Opportunity of an additional stone - Colonial Rose)	June 8, 2017
Section 106 Consulting's Party Meeting #5 (Revised project scope and MOA mitigation measures)	October 24, 2017
<i>Table 1: Summary of consultation and mockup review opportunities (as of October 26, 2017)</i>	

National Environmental Policy Act

NCPC, in cooperation with SI, prepared the *Revitalization of the National Air and Space Museum Draft Environmental Assessment* (EA) to fulfill its obligation under the National Environmental Policy Act (NEPA). NCPC has an independent NEPA obligation resulting from its approval authority over the project, and is the lead responsible federal agency for NEPA compliance. The SI, a trust instrumentality of the United States, is the project owner.

The Draft EA analyzed the potential environmental impacts of a no action and three action alternatives for the revitalization of the NASM. The cladding alternatives under consideration included Tennessee Pink Marble in-kind replacement; other natural stones with similar appearance to original cladding such as granite and limestone; and a manufactured material, such as ultra-high performance concrete (UHPC). The Draft EA analyzed the 15 topic areas: historic resources; visual resources; visitor experience; circulation; planning policies; sustainability; air quality; noise

levels; vegetation; stormwater management; floodplains; topography; solid waste; hazardous materials and wastes; and climate change and carbon footprint.

NCPC solicited public input on the Draft EA by way of a public meeting and its website. The Draft EA was available for public comment from March 31 until May 1, 2017. NCPC will issue a Finding of No Significant Impact (FONSI) during final review stage, anticipated in February, 2018.

CONSULTATION

Coordinating Committee

The Coordinating Committee reviewed the proposal at its October 11, 2017 meeting. Without objection, the Committee forwarded the proposed comments on revised concept design to the Commission with the statement that the proposal has been coordinated with all participating agencies. The participating agencies were: NCPC; the District of Columbia Office of Planning (DCOP); the District Department of Transportation (DDOT); the District of Columbia State Historic Preservation Office (DCSHPO); the District Department of Energy and Environment (DOEE); the General Services Administration (GSA); and the Washington Metropolitan Area Transit Authority (WMATA). The SHPO noted that their coordination is conditioned upon satisfactory completion of project Section 106 Memorandum of Agreement.

Regarding the solar panel removal, DOEE mentioned that they helped funding a solar array and stormwater retention system at the DC United Soccer Stadium, and asked SI to contact them to explore potential funding opportunities for the solar array at the NASM main rooftop. They mentioned that new technology allows for lighter panels that would mitigate concerns with the building structure. SI indicated that the addition of photovoltaic panels on the roof requires significant structural reinforcement of the building foundation. In addition, the latest International Building Code (IBC 2018) for wind and fire resistance increased the structural requirements. The cost of reinforcing the structural frame of the building, concerns for the durability of the roof membrane, the limited operational benefit to the building and the ability to establish energy savings, contributed to removal of the PVs.

SI requires a highly durable roof membrane to protect the building interior and reduce the risk for future remediation measures. This performance requirement informed the selection of a modified bitumen roof membrane in lieu of the single ply PVC membrane that was previously proposed with the photovoltaic array. The fastening system required to attach the photovoltaic panels into the single ply PVC panel is not compatible with the modified bitumen roof.

U.S. Commission of Fine Arts

The U.S. Commission of Fine Arts (CFA) reviewed and approved the revised concept design at its October 19, 2017 meeting. Prior to this submission, CFA has reviewed the project on three additional occasions: June 2017, June 2016, and June 2015.

ONLINE REFERENCE

The following supporting documents for this project are available online:

- Submission Package

Prepared by Vivian Lee
11/1/2017

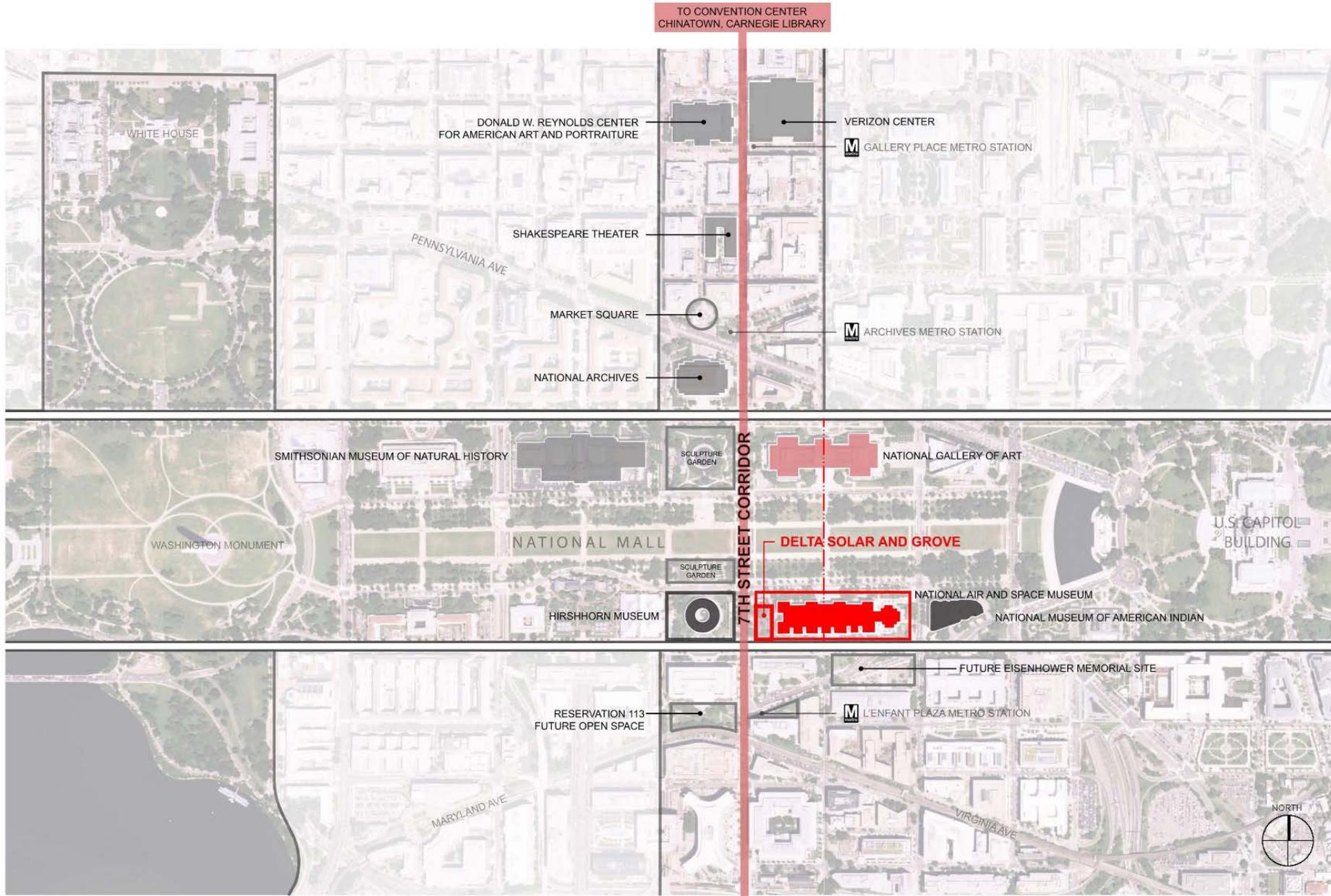
POWERPOINT (ATTACHED)

NCPC File # 7585
Smithsonian National Air and Space Museum
Building Exterior, Vestibules and Site
Improvements

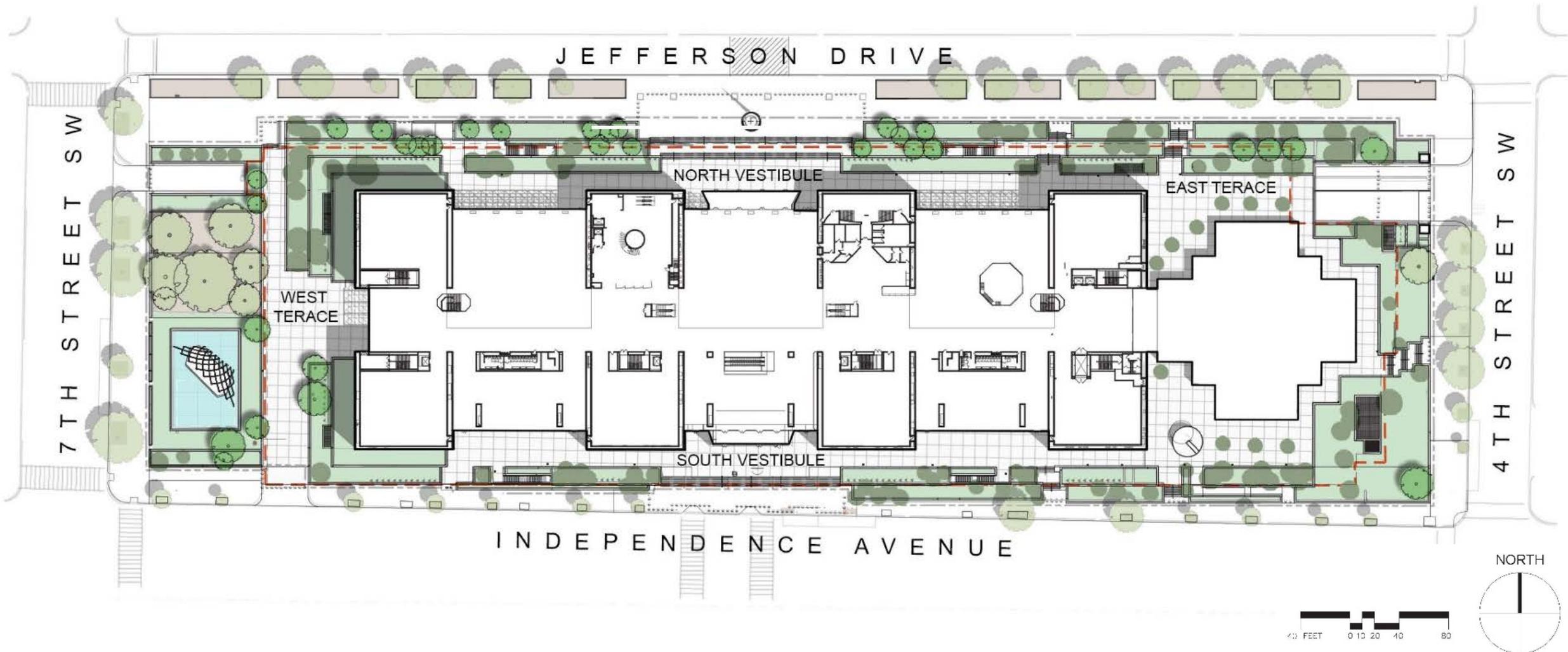
Independence Avenue at 6th Street, SW
Washington, DC 20560

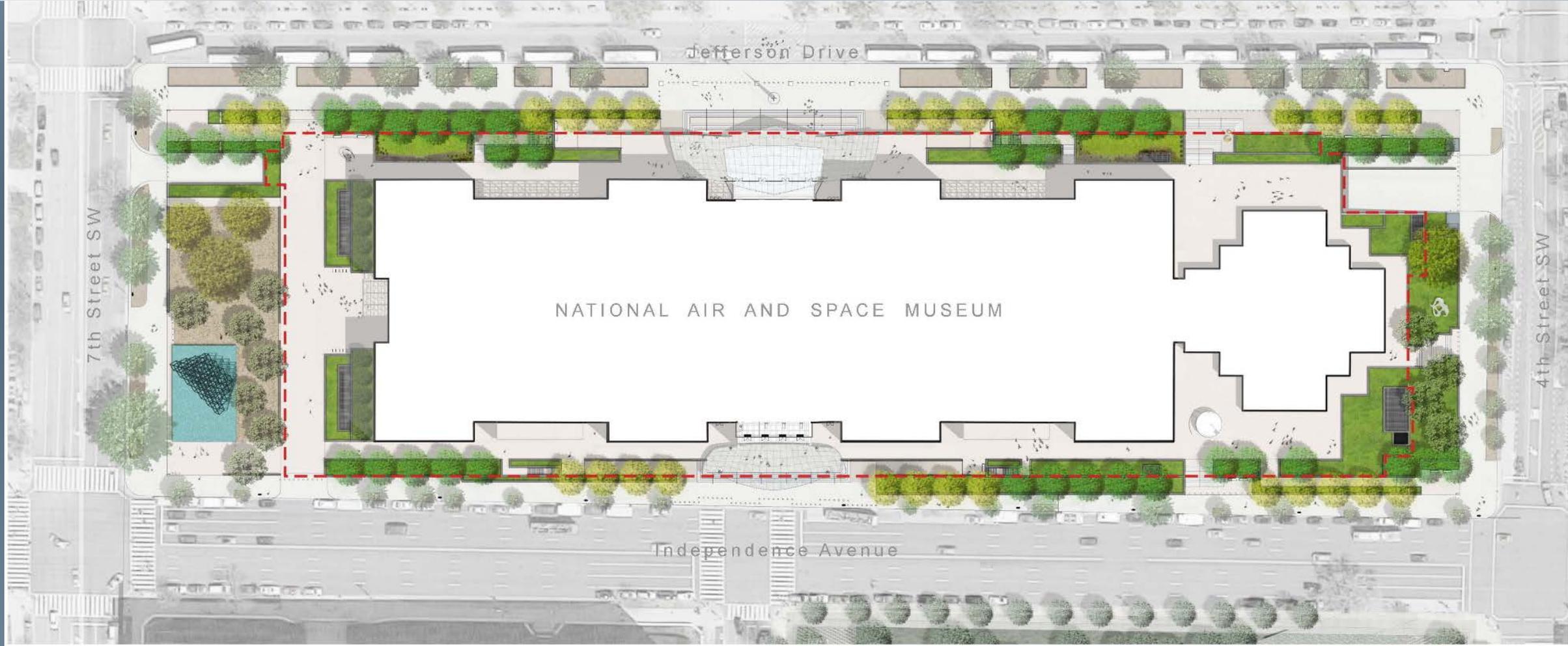
Smithsonian Institution

Revised Concept

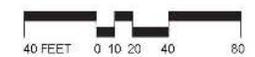


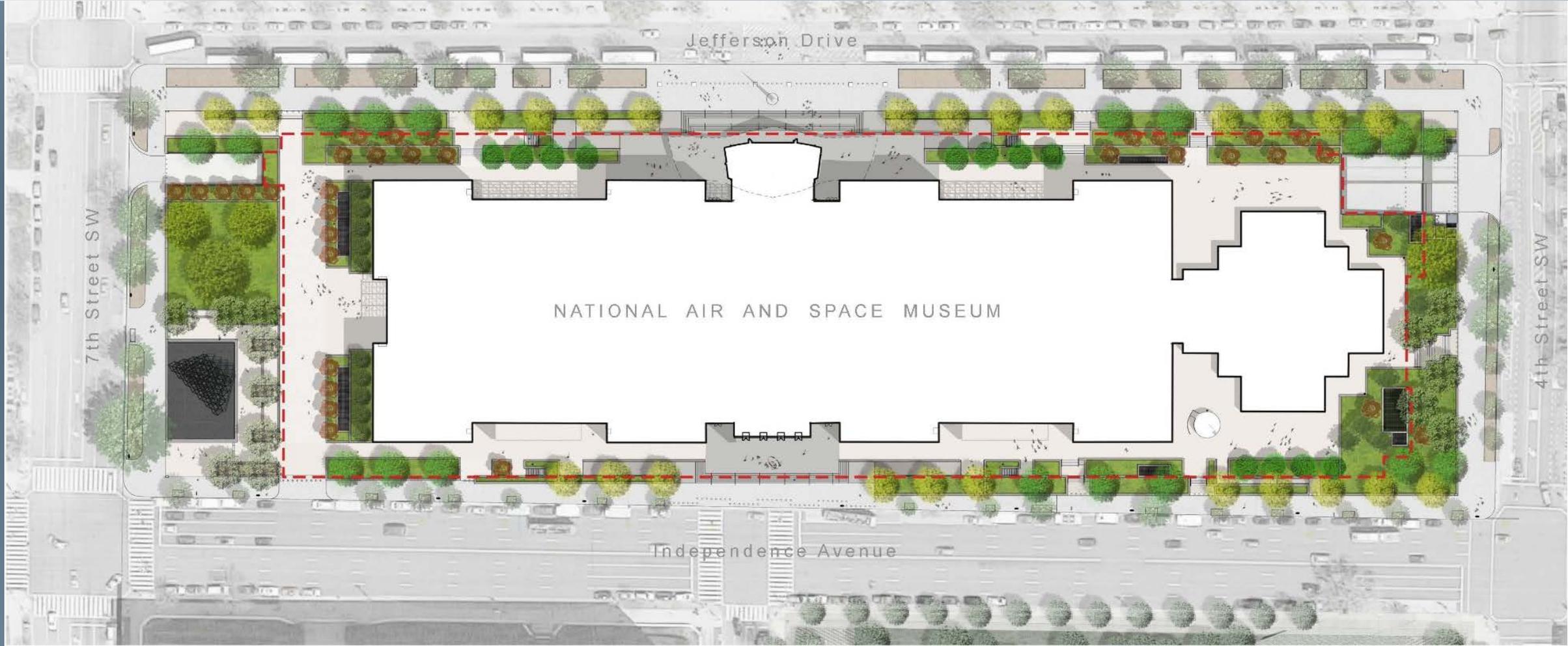




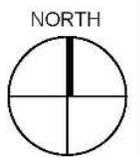
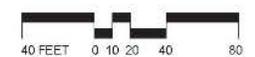


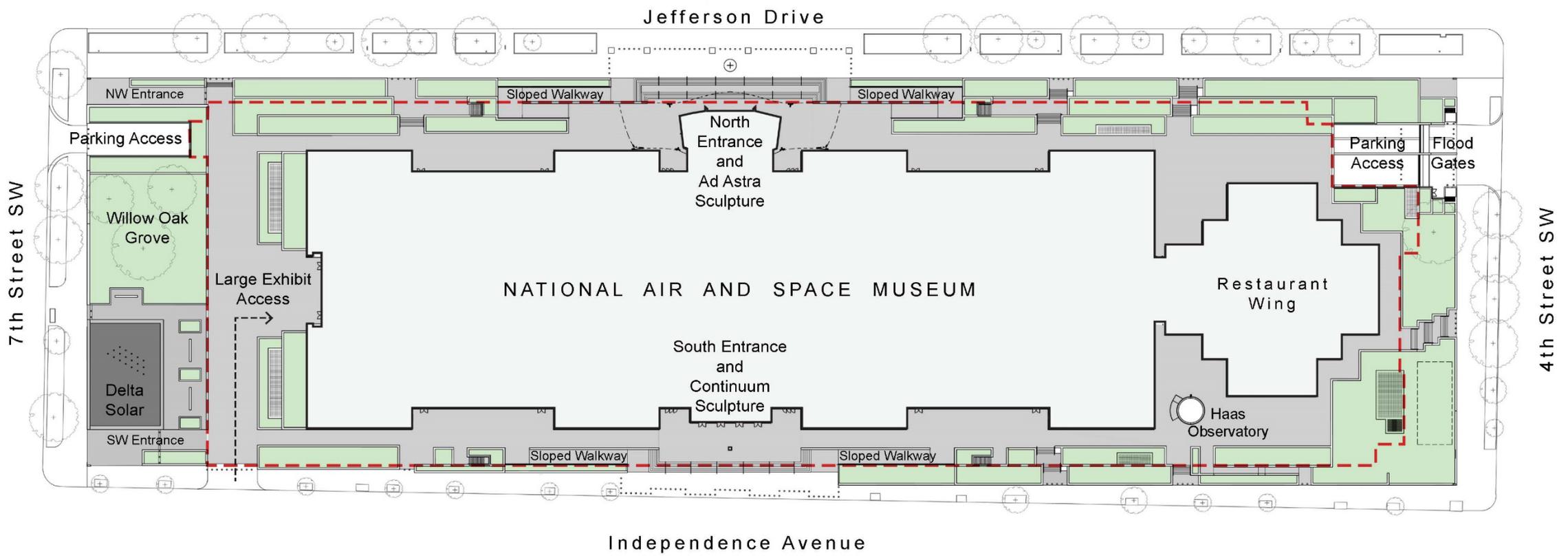
--- Basement Edge of Structure



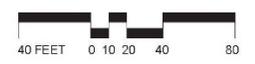


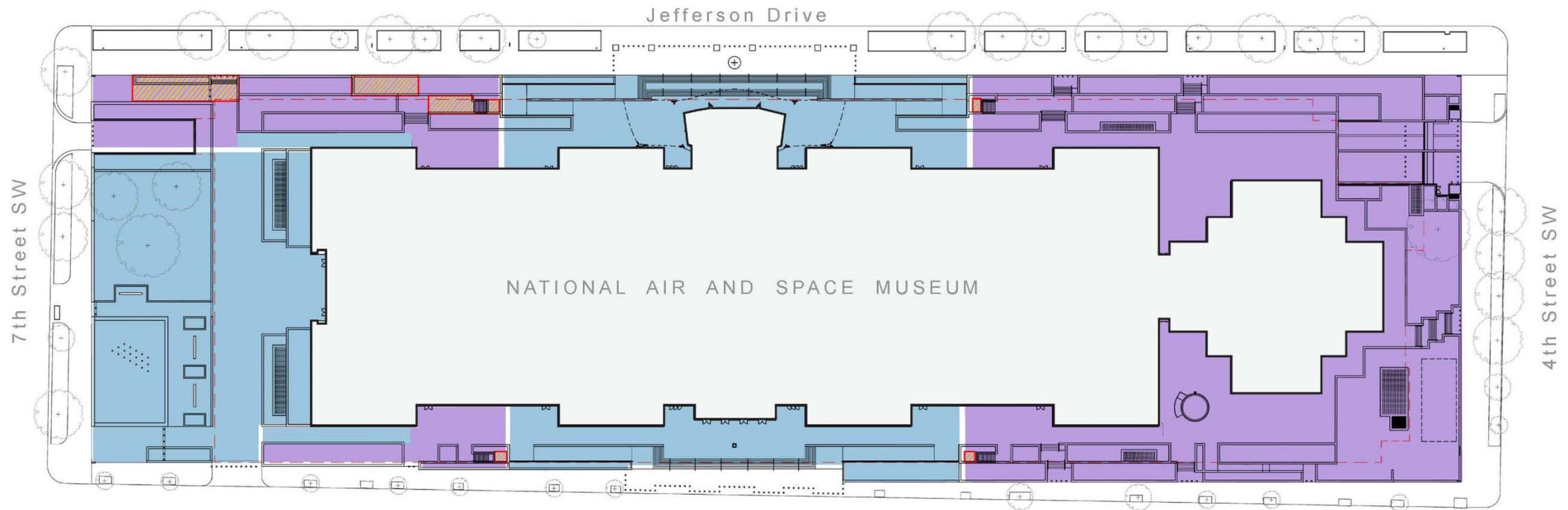
--- Basement Edge of Structure





--- Basement Edge of Structure





NATIONAL AIR AND SPACE MUSEUM

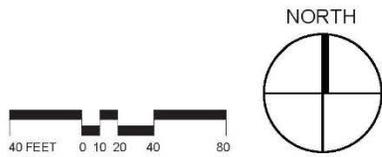
Independence Avenue

Jefferson Drive

7th Street SW

4th Street SW

- Existing Layout and Structural Condition To Remain** (Finishes change) 
- Concept Design** (Approved: CFA June 2016/NCPC July 2016) 
- Code Deficiency Adjustments** 
- Basement Edge of Structure** 



Northwest Corner – Existing Conditions and Proposed Designs



Entrance Perspective - Northwest Corner - Existing Condition

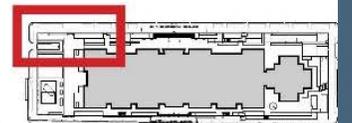
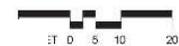
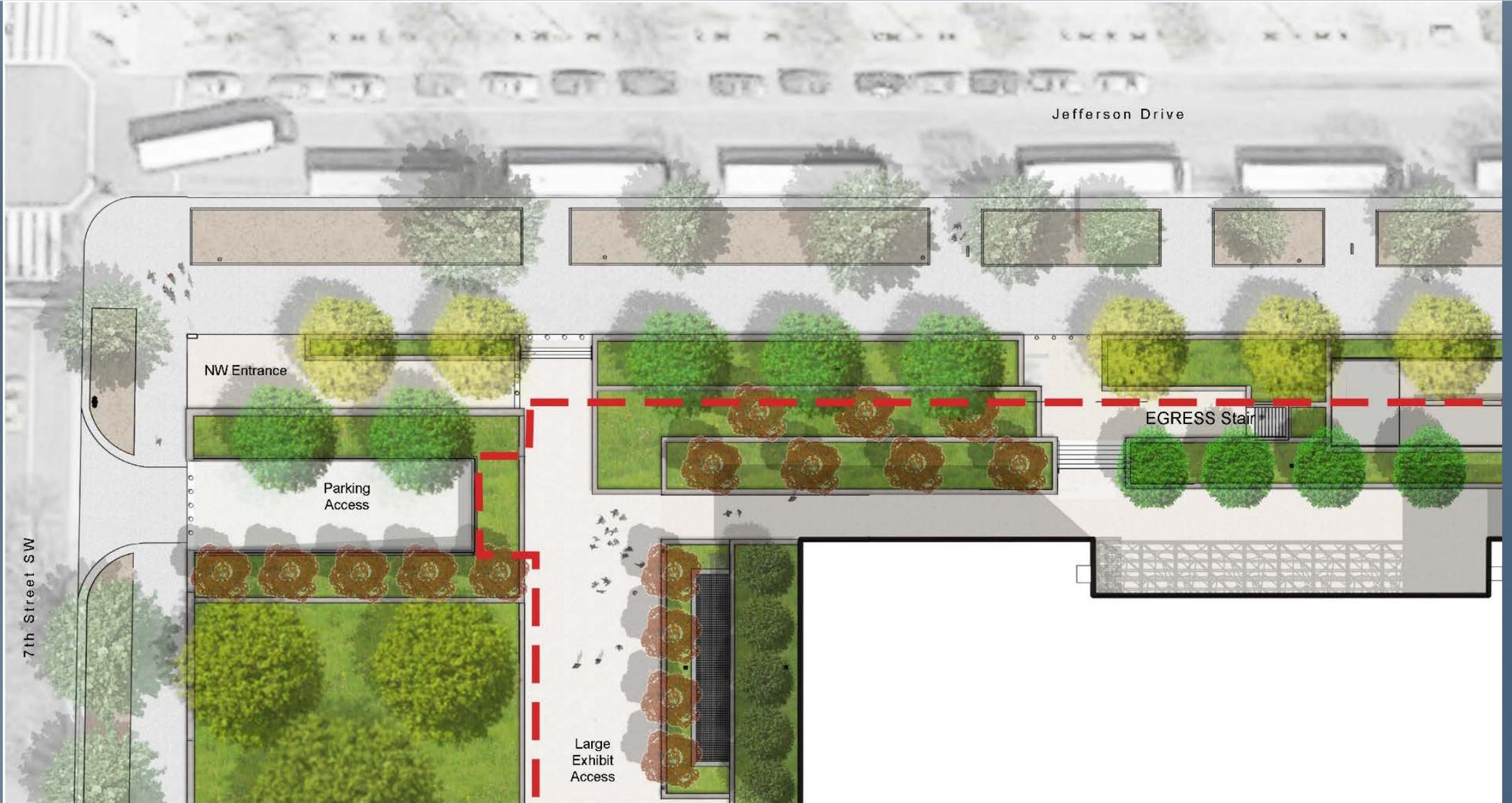


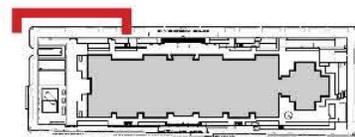
Entrance Perspective - Northwest Corner - Concept Design (Approved: CFA June 2016/NCPC July 2016)

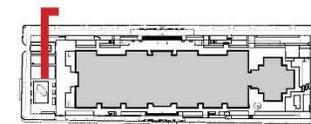


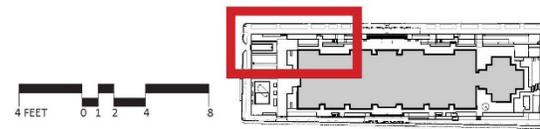
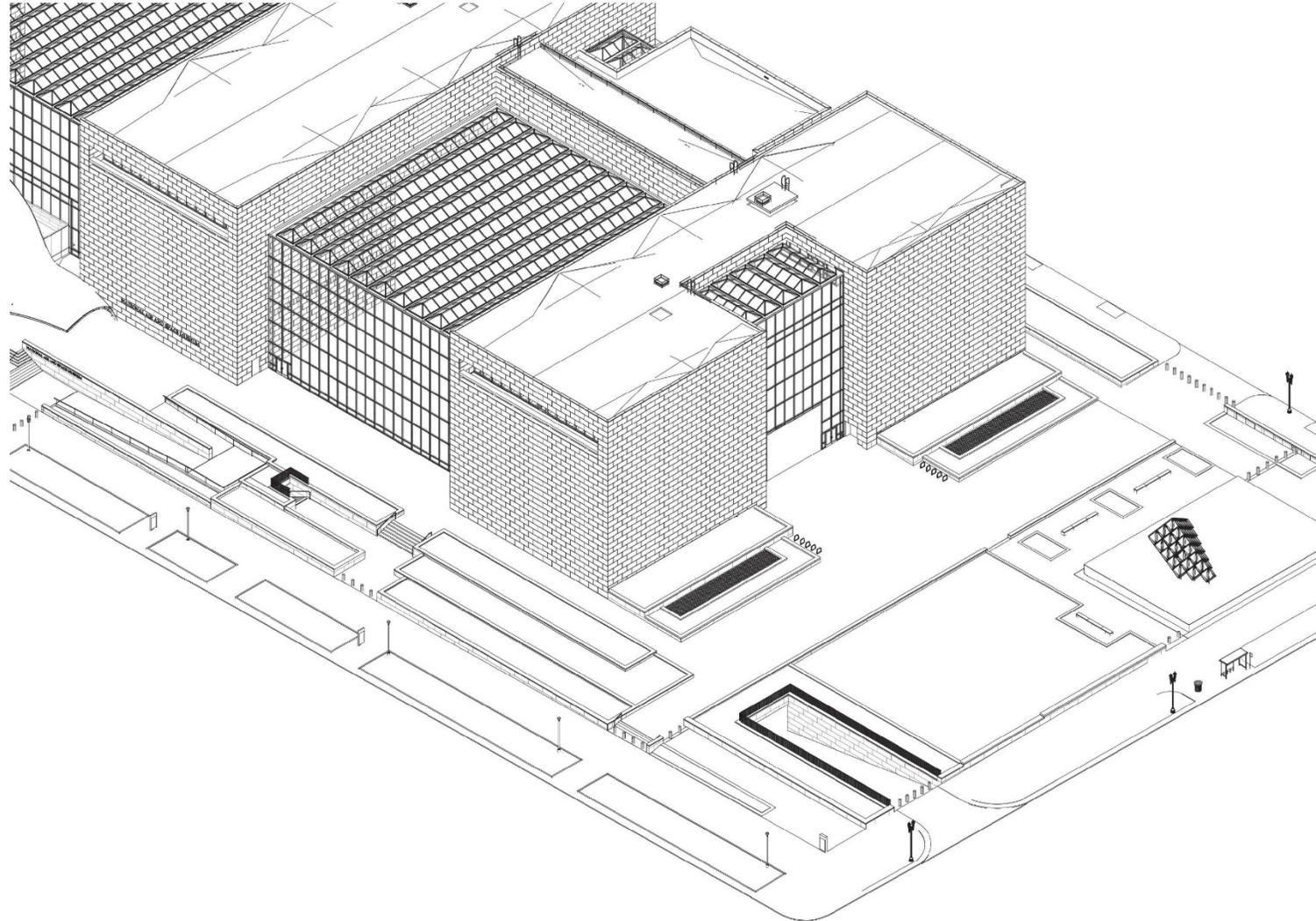
Entrance Perspective - Northwest Corner - Current Proposed Design

Enlarged Plan of Proposed Design - Northwest Corner









North Entrance - Existing Conditions and Proposed Designs



Entrance Perspective - North Building Entrance - Existing Condition

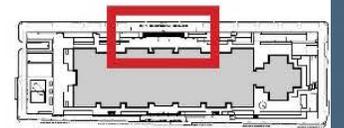
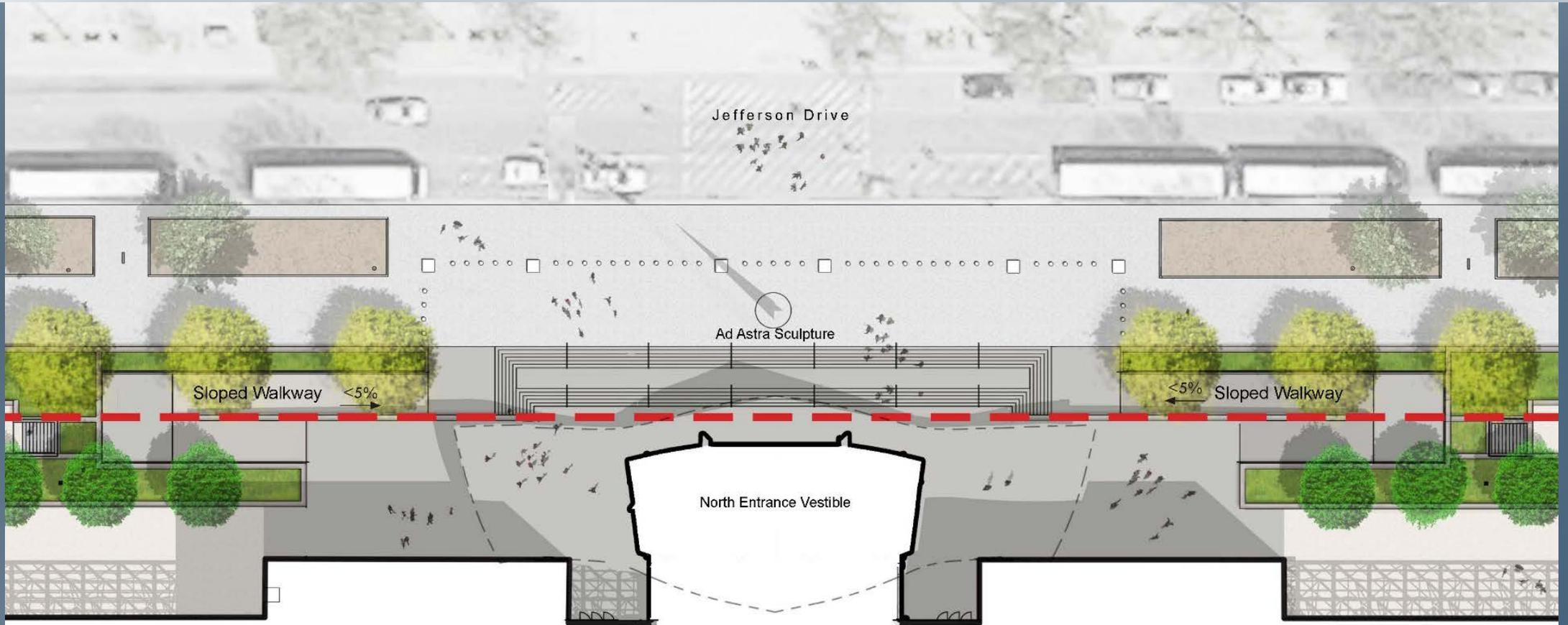


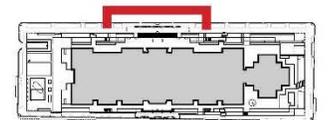
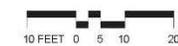
Entrance Perspective - North Building Entrance - Concept Design (Approved: CFA June 2016/NPC July 2016)

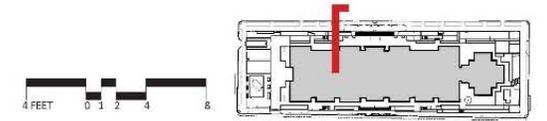
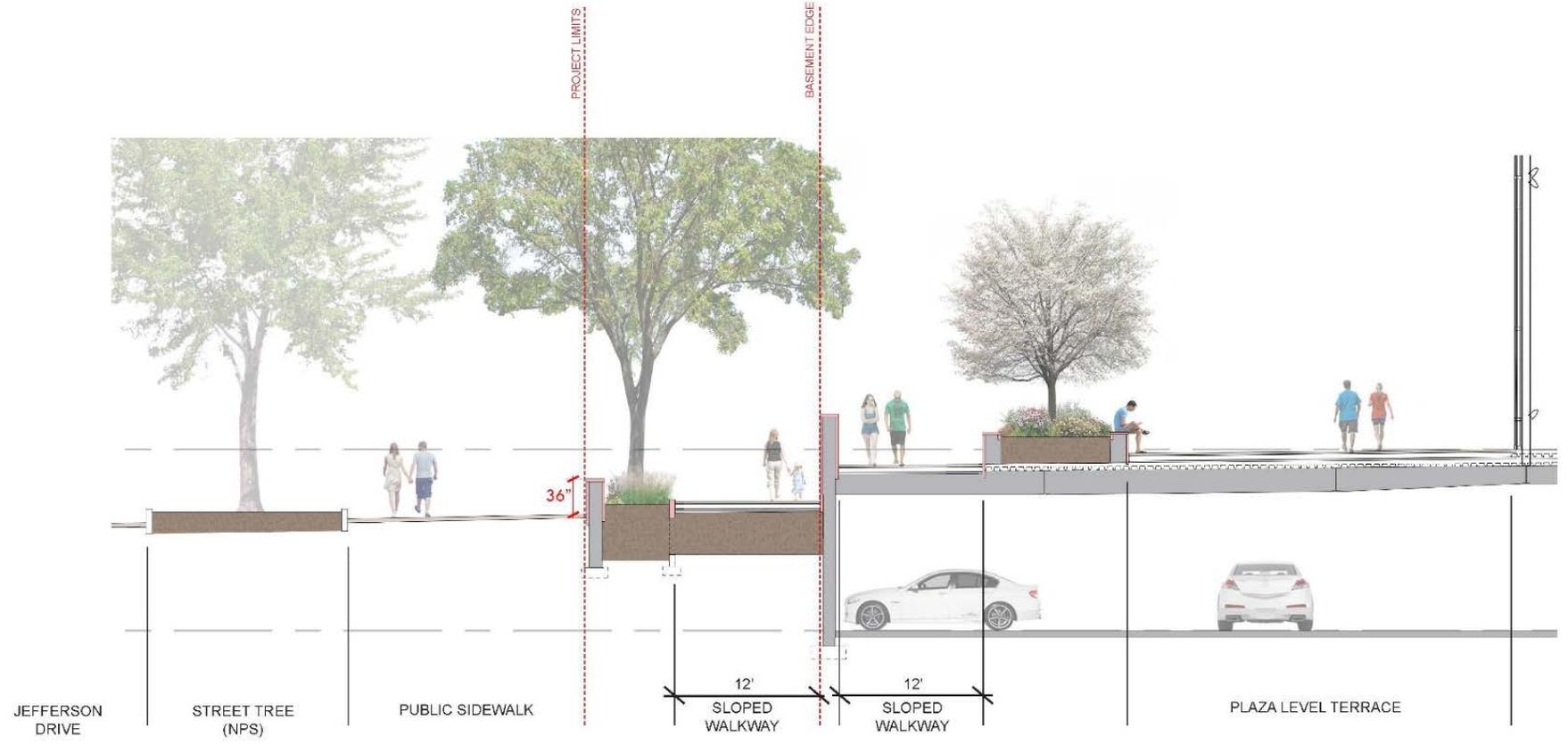


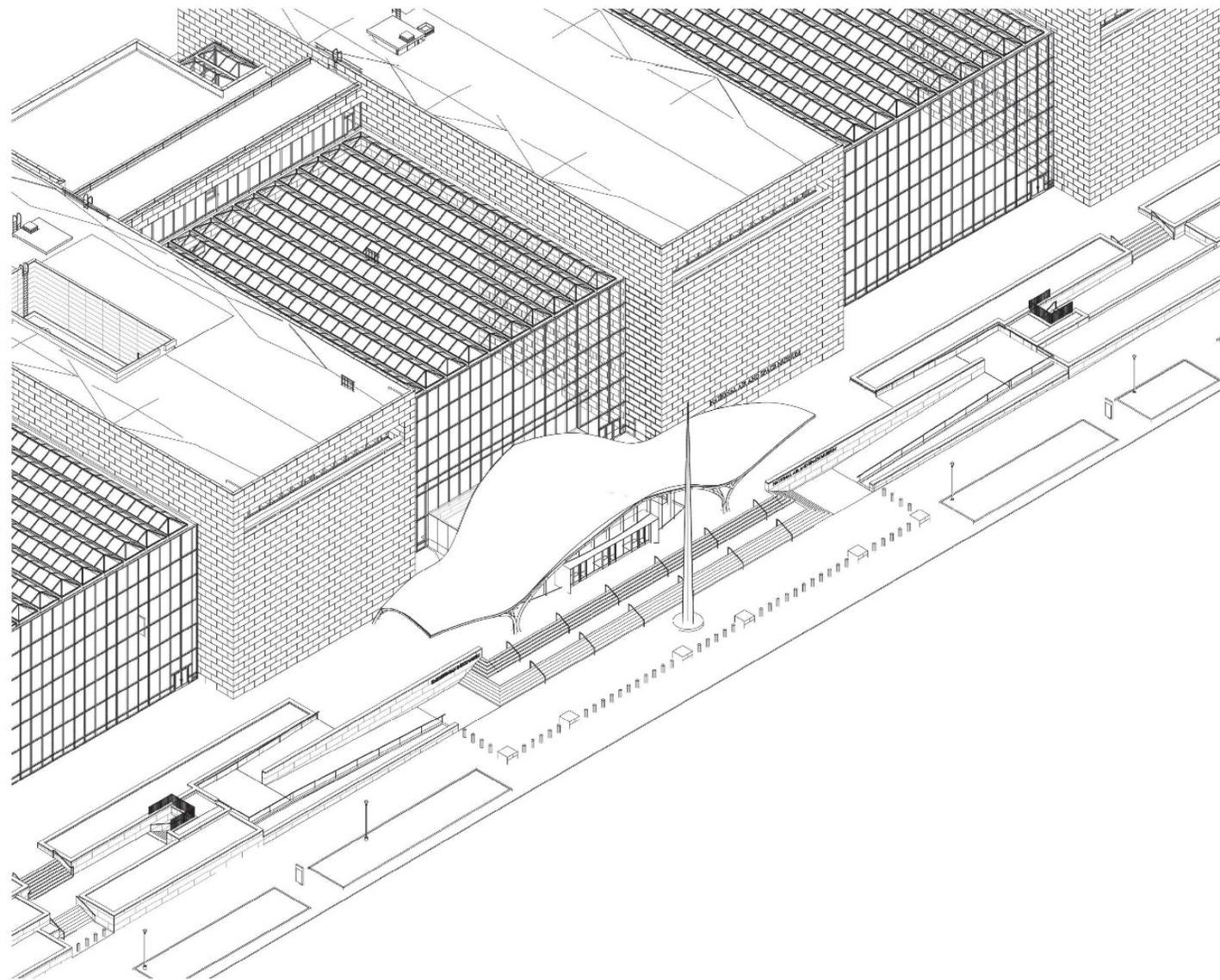
Entrance Perspective - North Building Entrance - Current Proposed Design

Enlarged Plan of Current Design – North Entrance









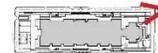
Northeast Corner - Existing Conditions and Proposed Designs



Entrance Perspective - Northeast Corner - Existing Condition



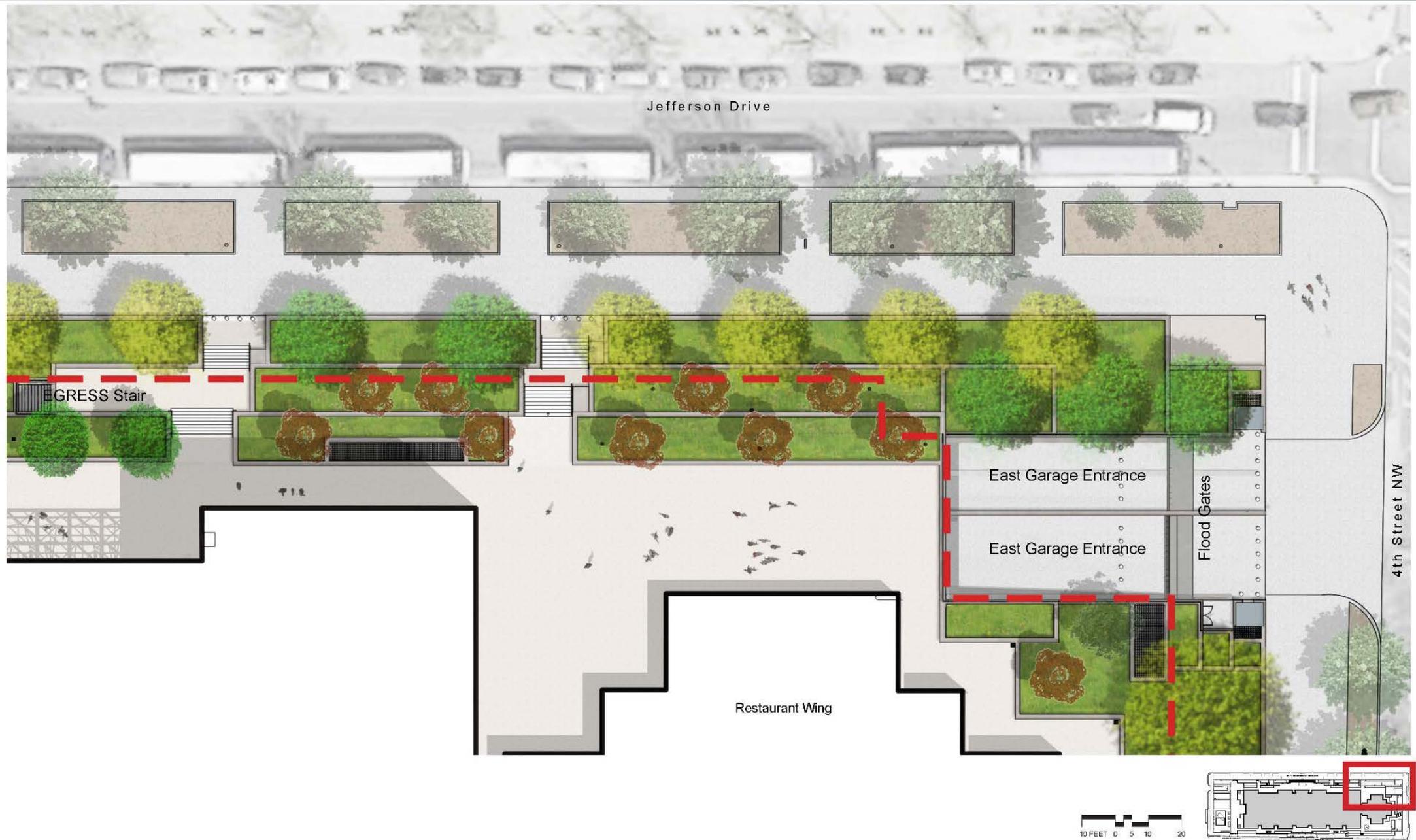
Entrance Perspective - Northeast Corner - Concept Design (Approved: CFA June 2016/NPC July 2016)

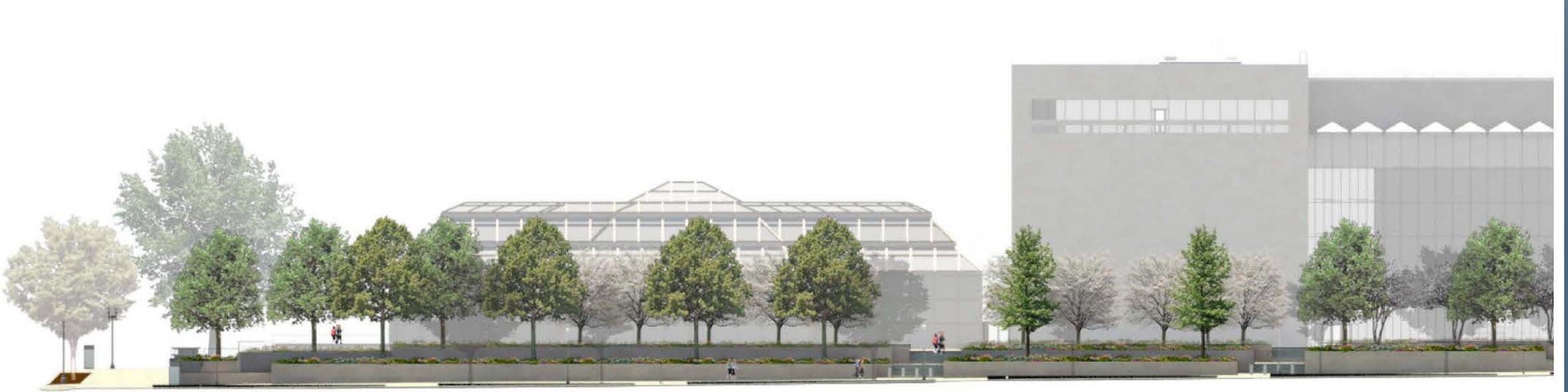


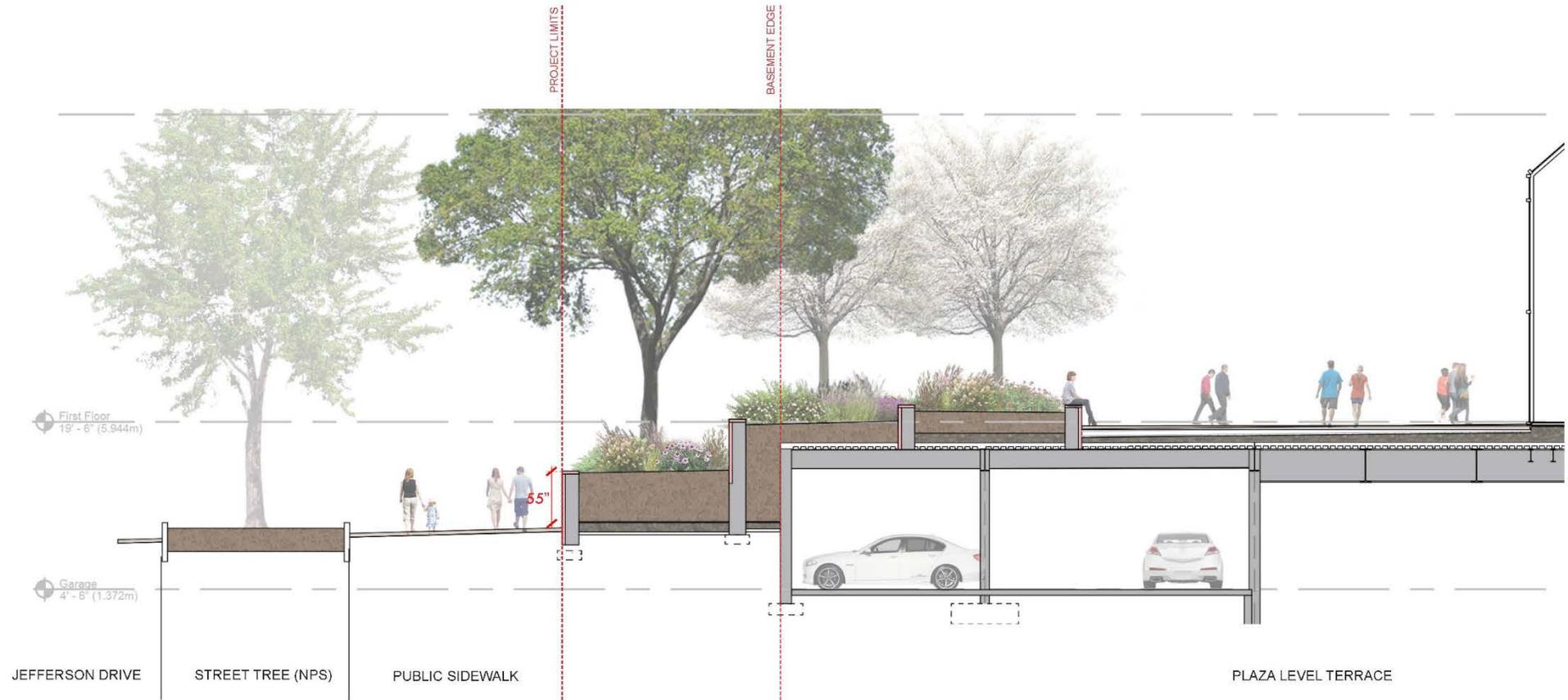
Entrance Perspective - Northeast Corner - Current Proposed Design

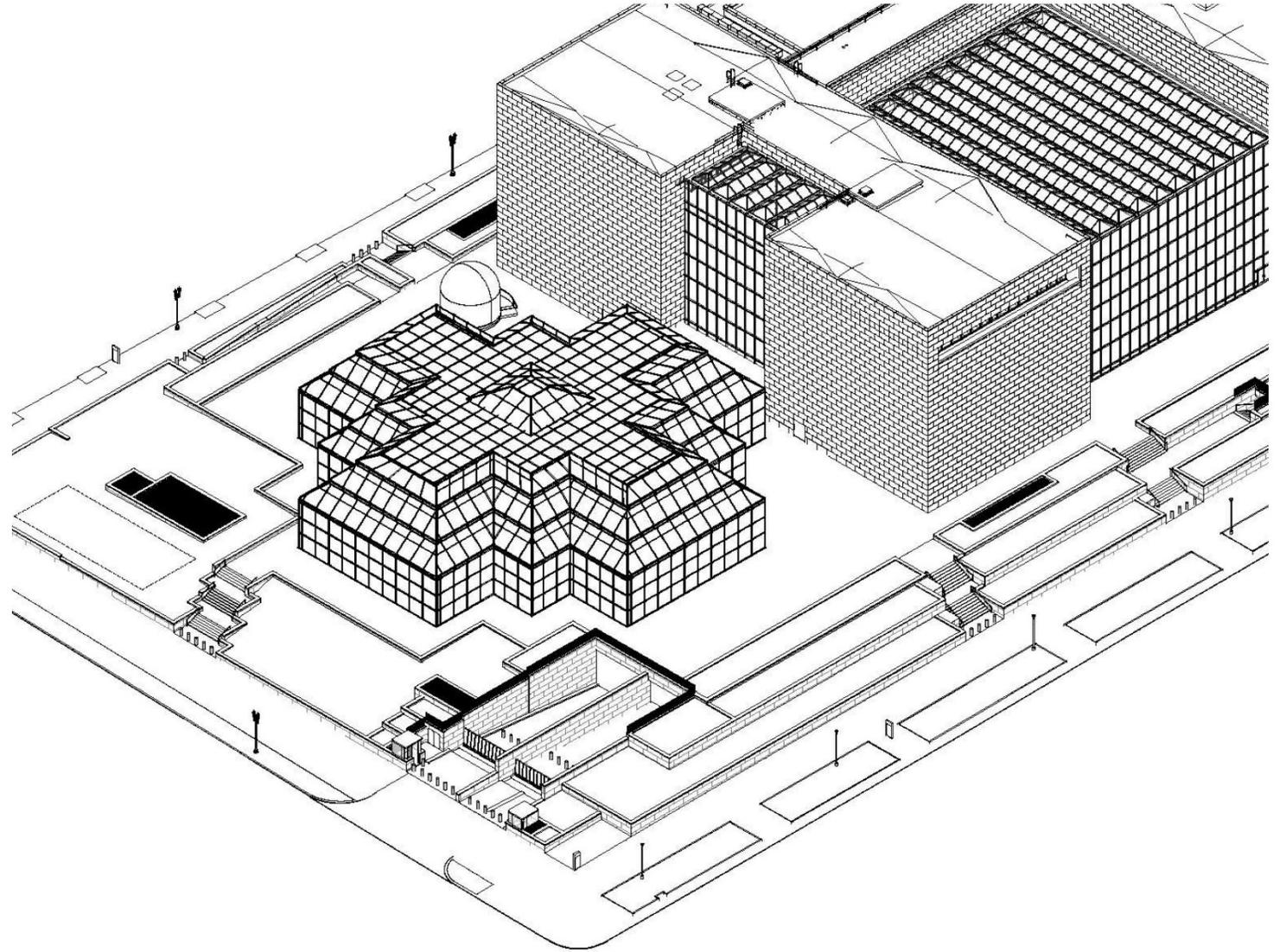


Enlarged Plan of Current Design – Northeast Corner









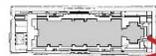
Southeast Corner - Existing Conditions and Proposed Designs



Entrance Perspective - Southeast Corner - Existing Condition



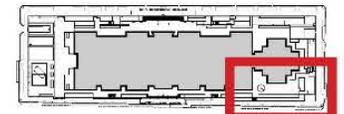
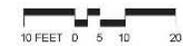
Entrance Perspective - Southeast Corner - Concept Design (Approved: CFA June 2016/NCPC July 2016)

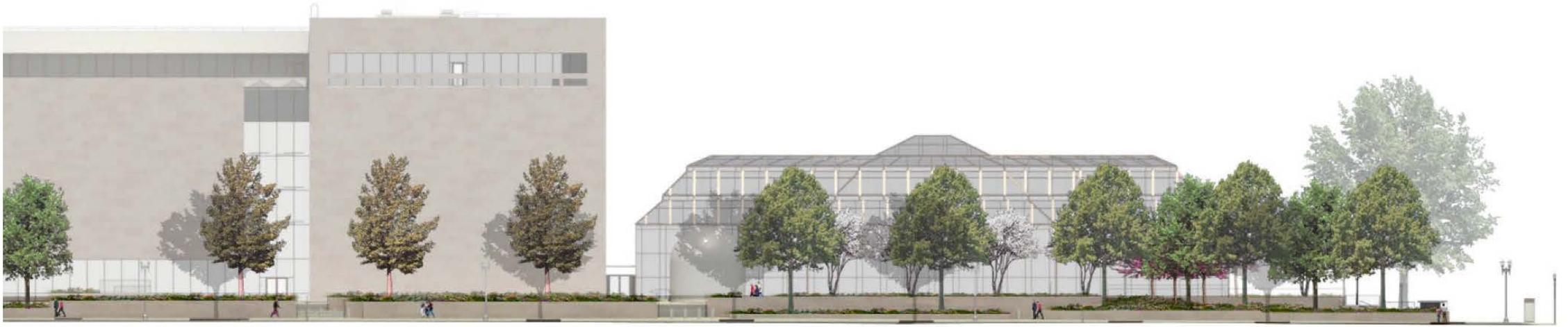


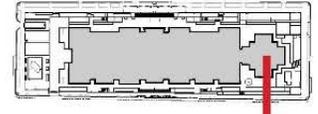
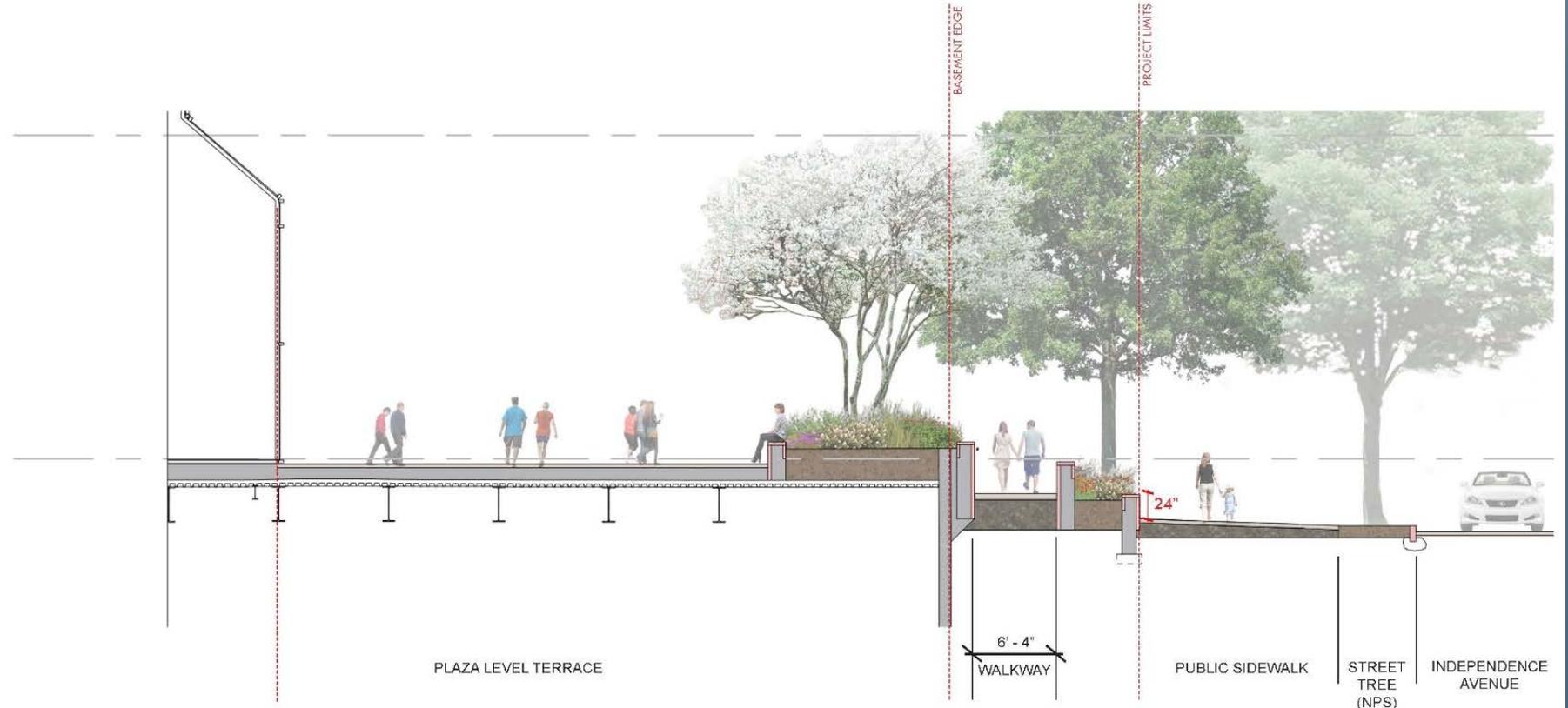
Entrance Perspective - Southeast Corner - Current Proposed Design

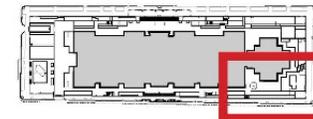
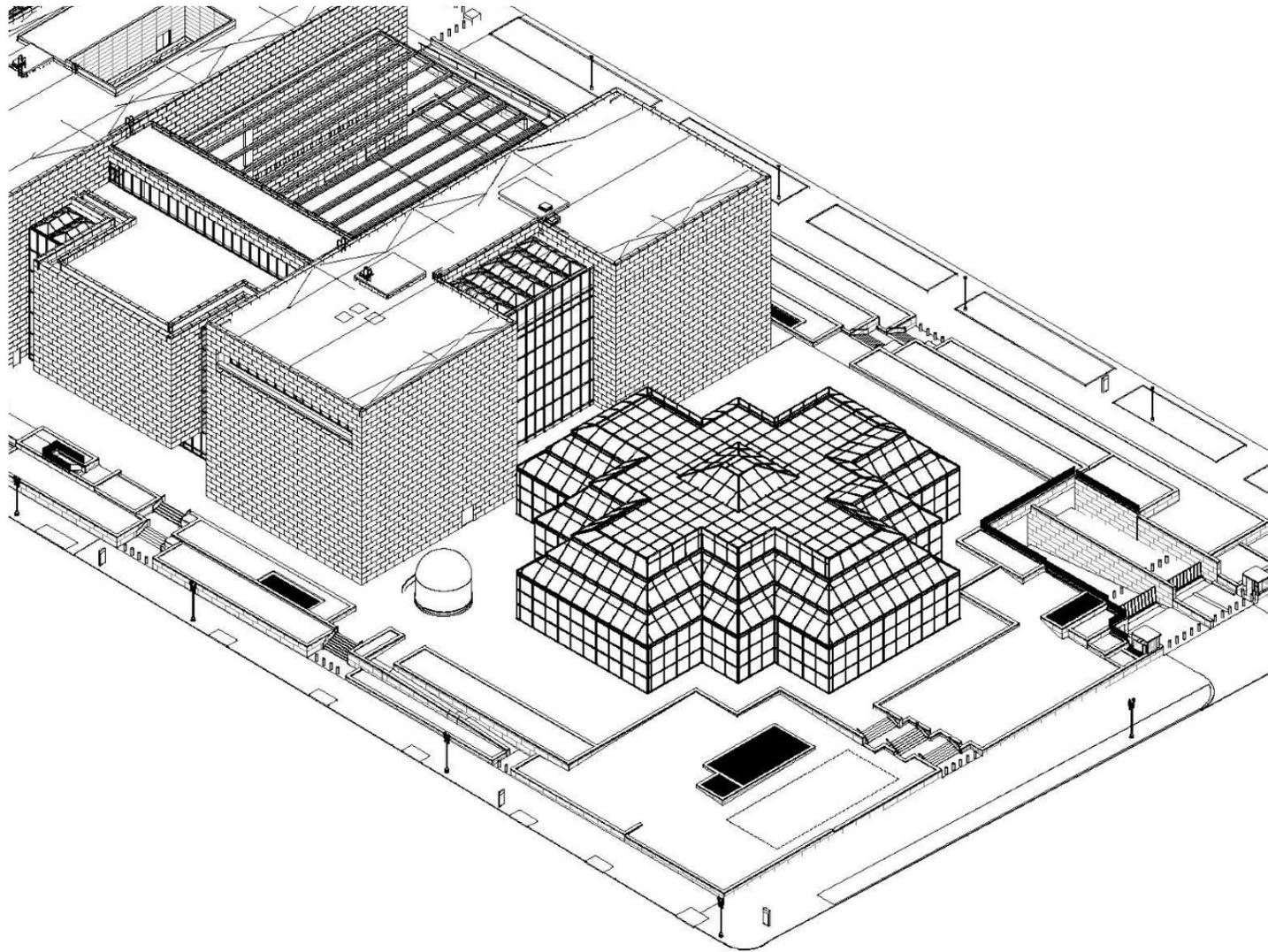


Enlarged Plan of Current Design – Southeast Corner

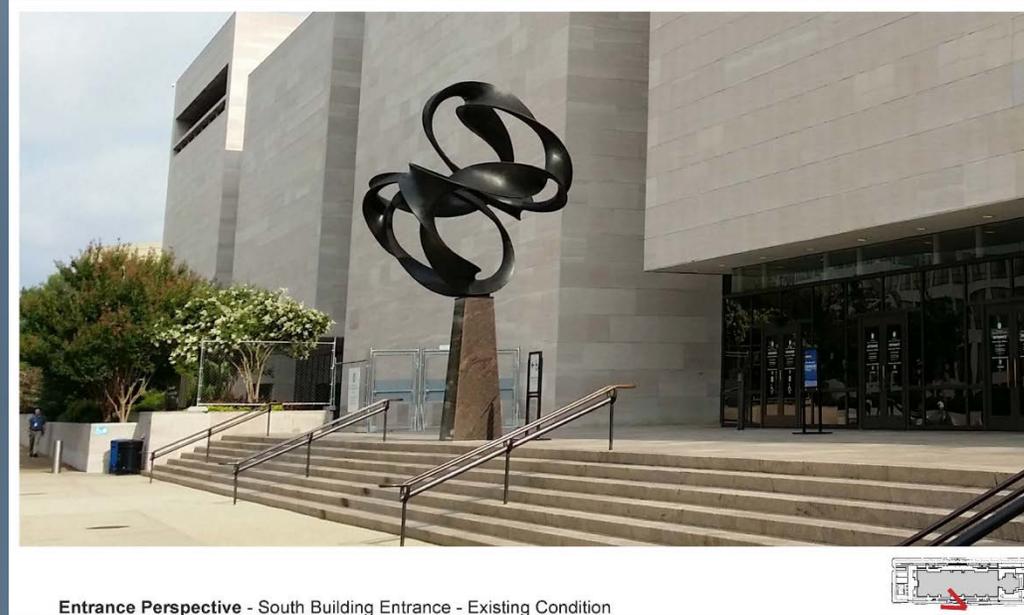




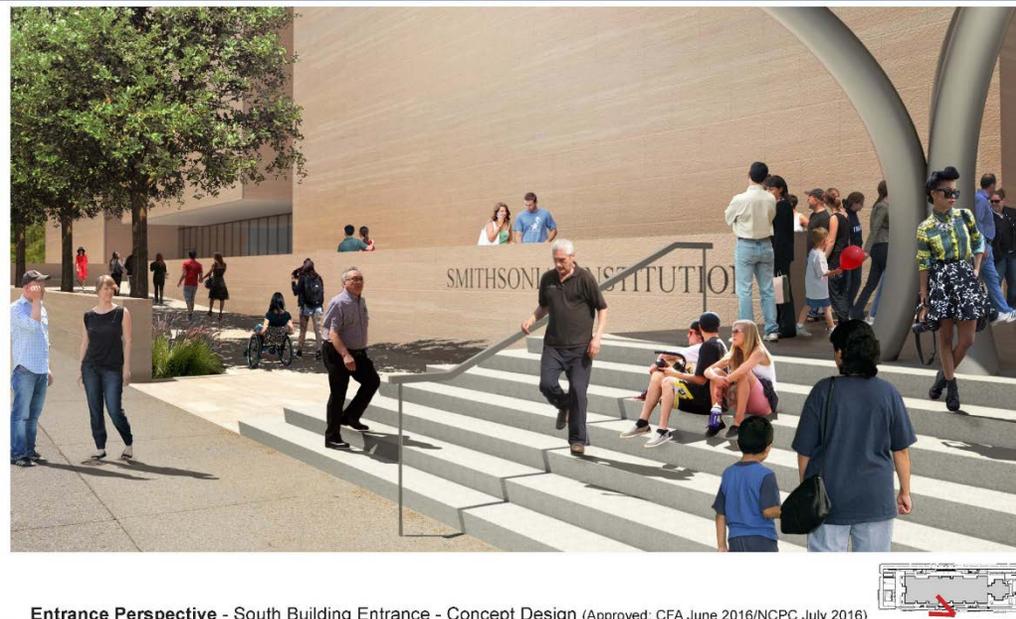




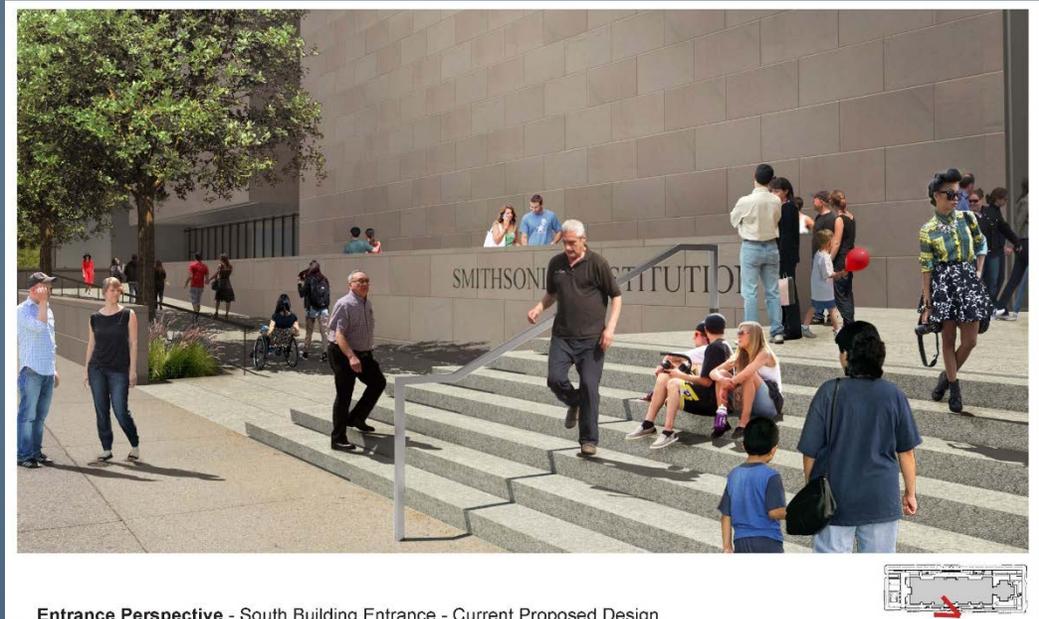
South Entrance – Existing Conditions and Proposed Designs



Entrance Perspective - South Building Entrance - Existing Condition

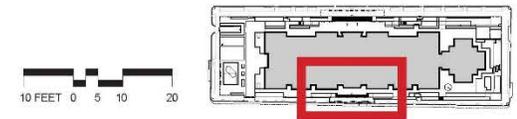
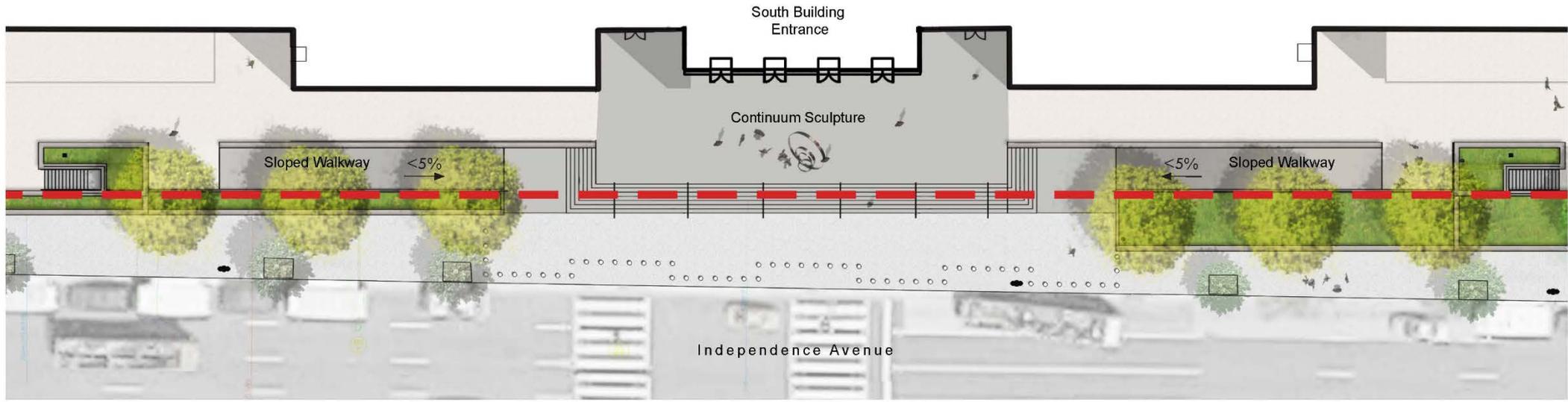


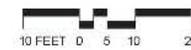
Entrance Perspective - South Building Entrance - Concept Design (Approved: CFA June 2016/NCPC July 2016)

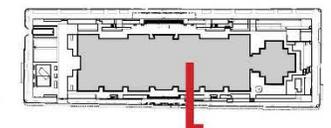
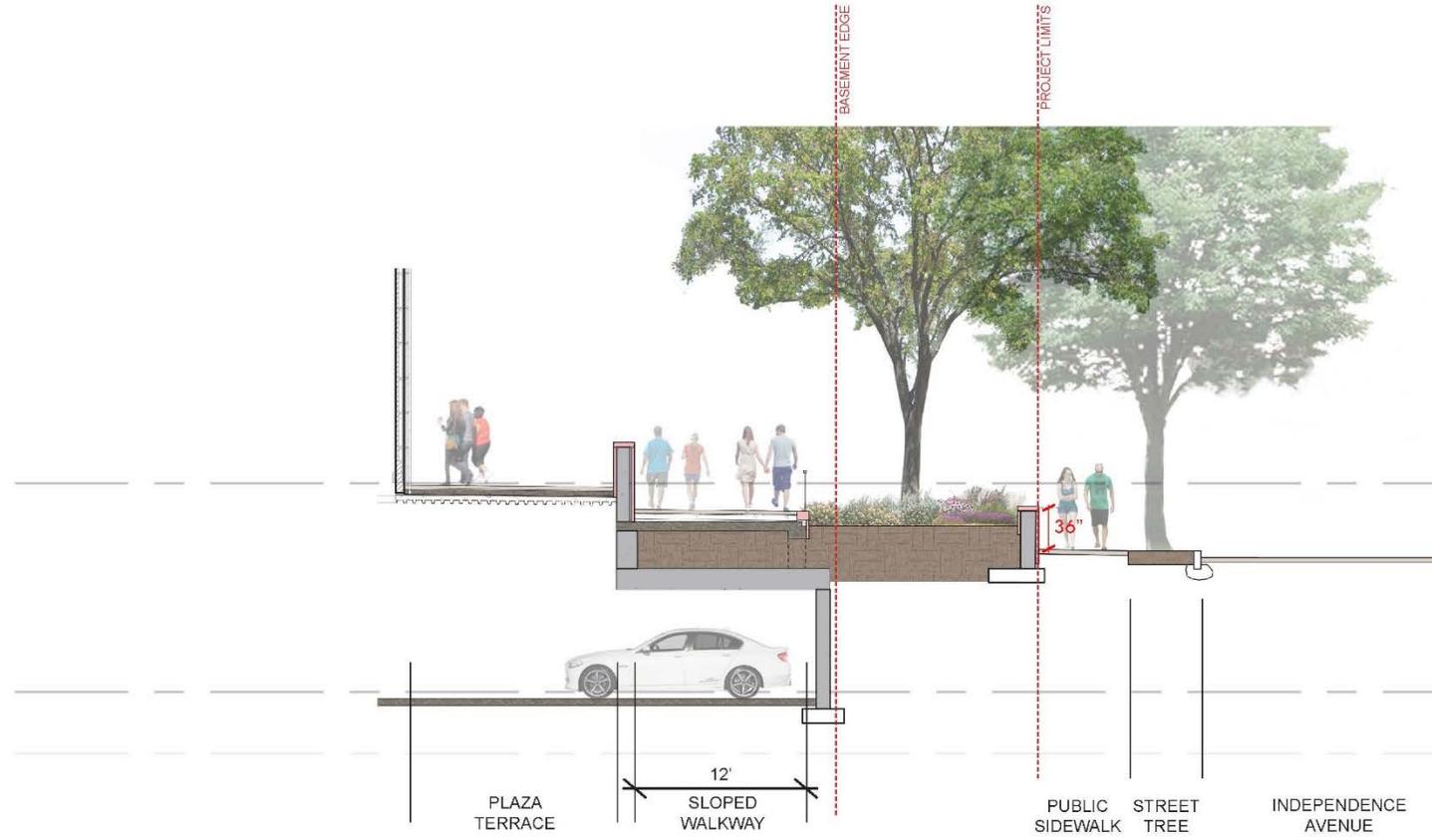


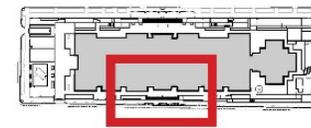
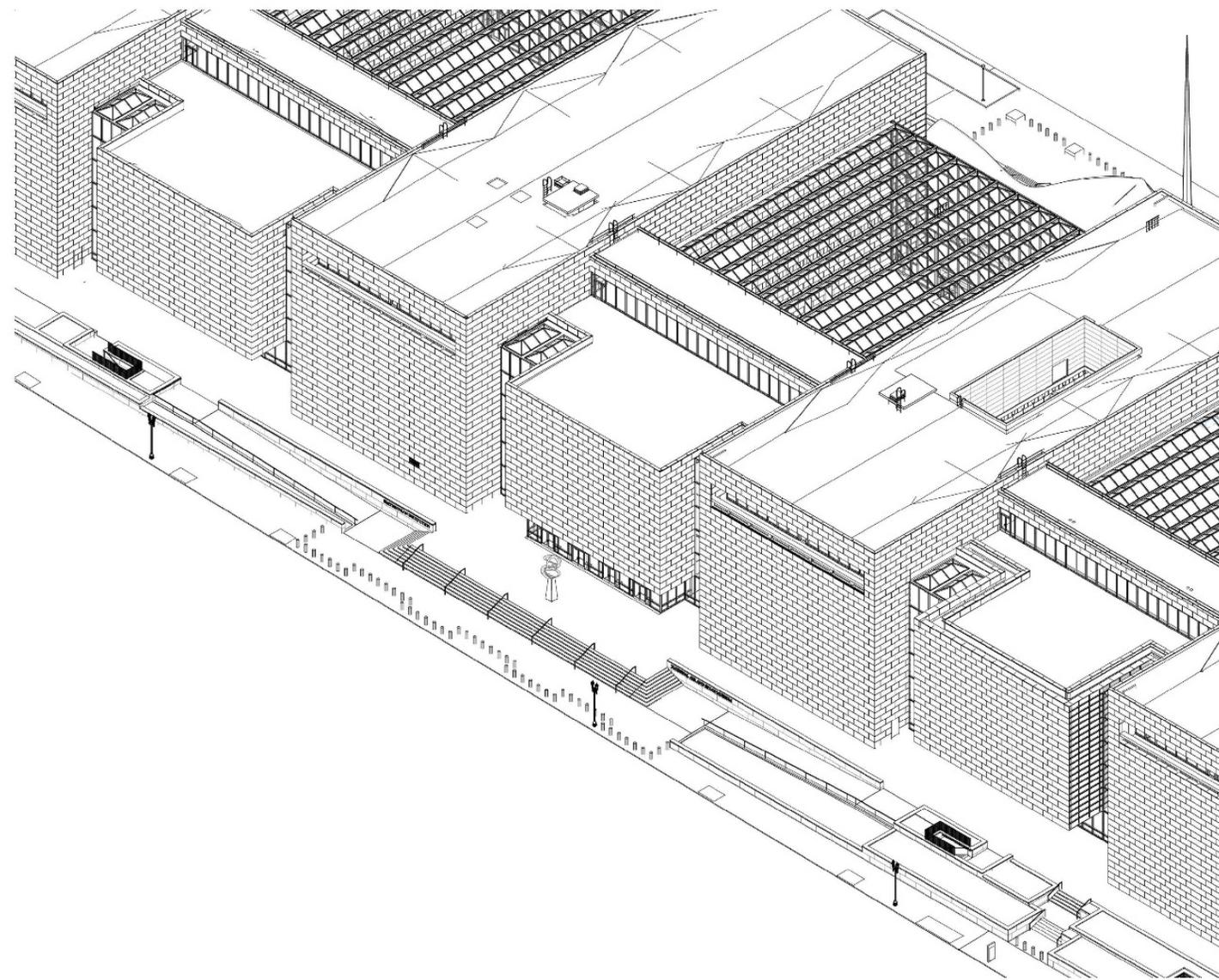
Entrance Perspective - South Building Entrance - Current Proposed Design

Enlarged Plan of Current Design – South Entrance









Southwest Corner – Existing Conditions and Proposed Designs



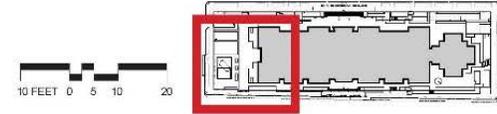
Entrance Perspective - Southwest Corner - Existing Condition

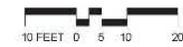


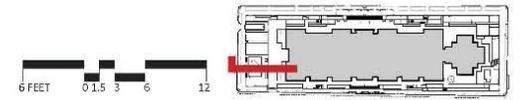
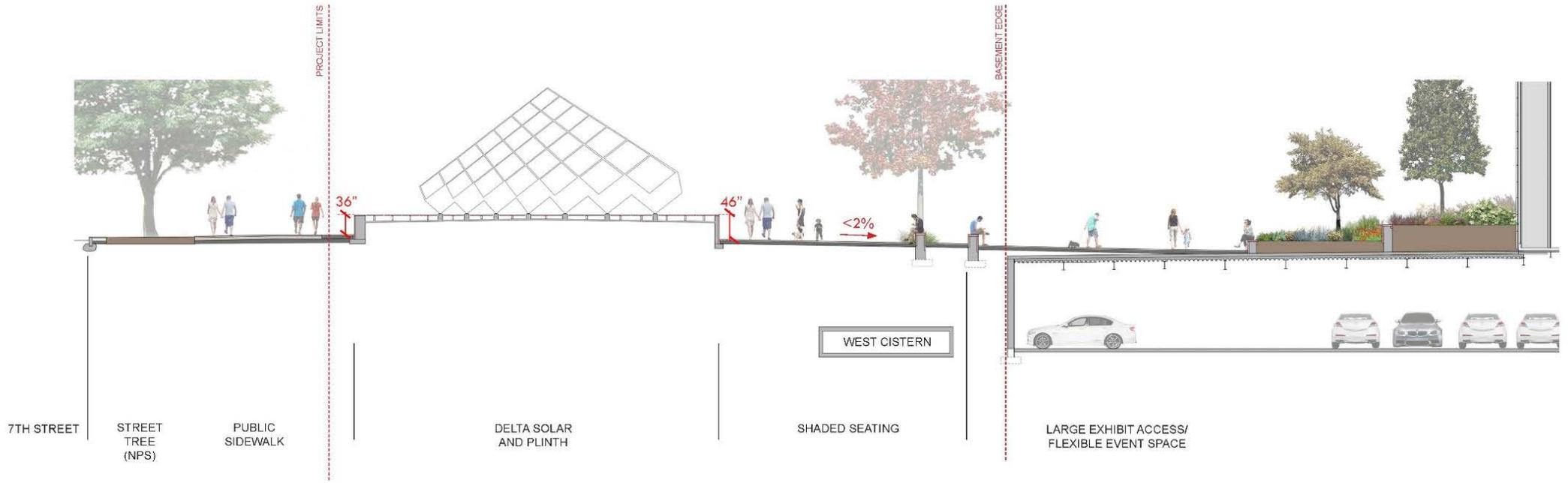
Entrance Perspective - Southwest Corner - Concept Design (Approved: CFA June 2016/NCPC July 2016)

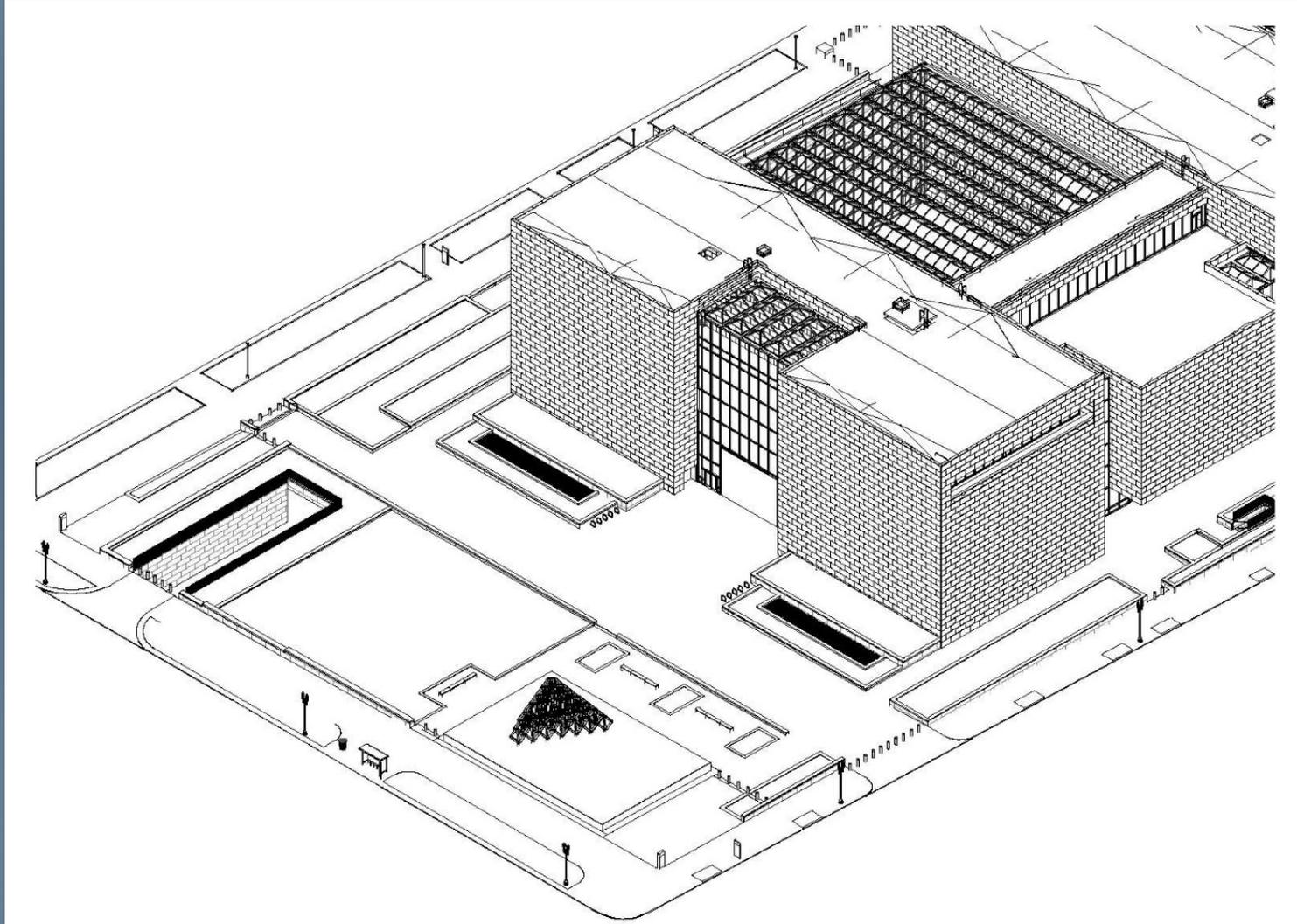


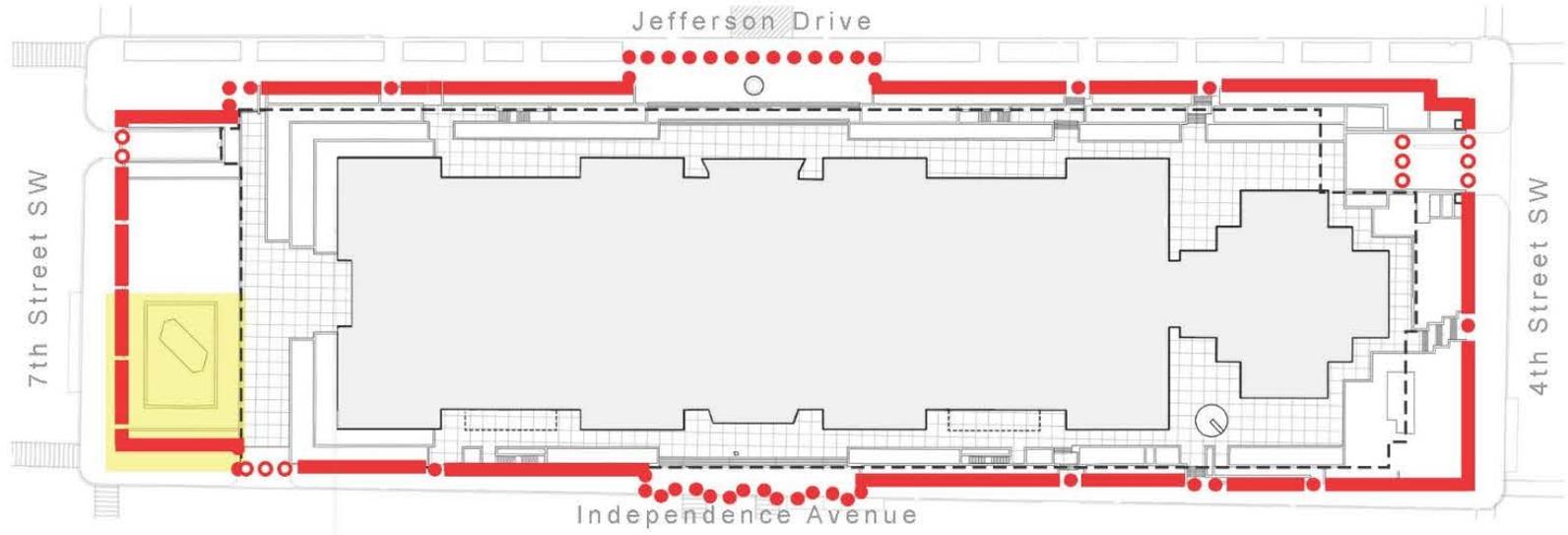
Entrance Perspective - Southwest Corner - Current Proposed Design



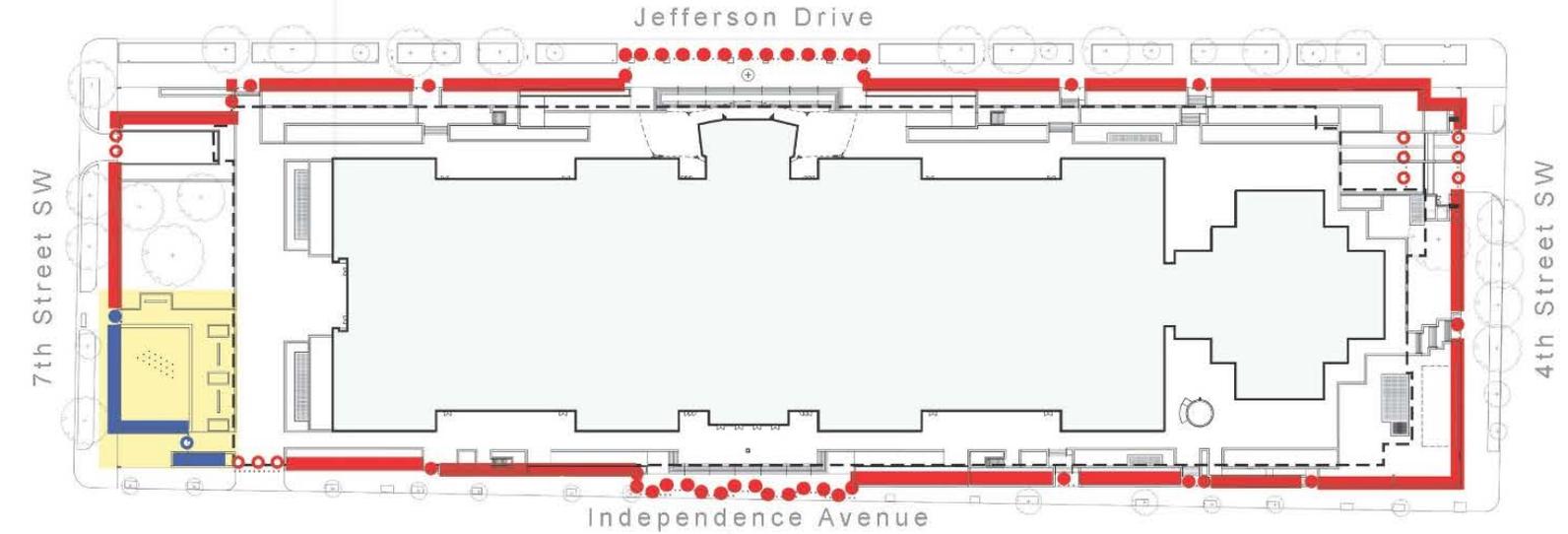






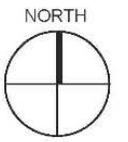


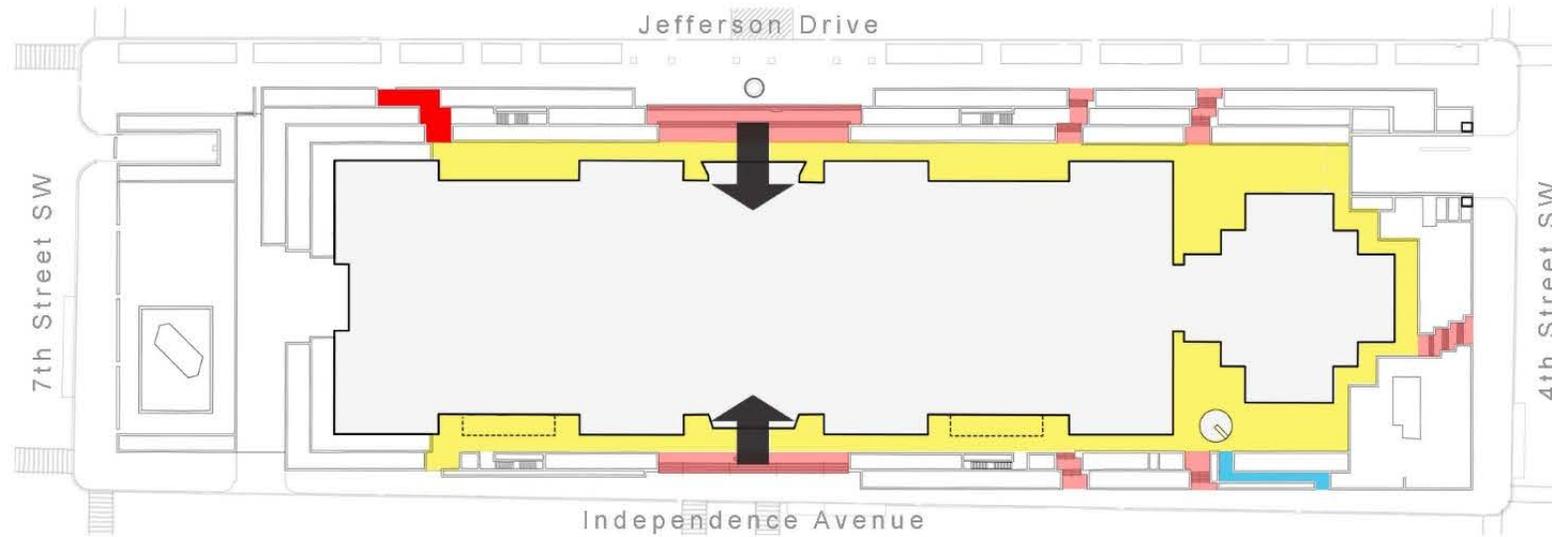
Existing Conditions



Current Proposed Design

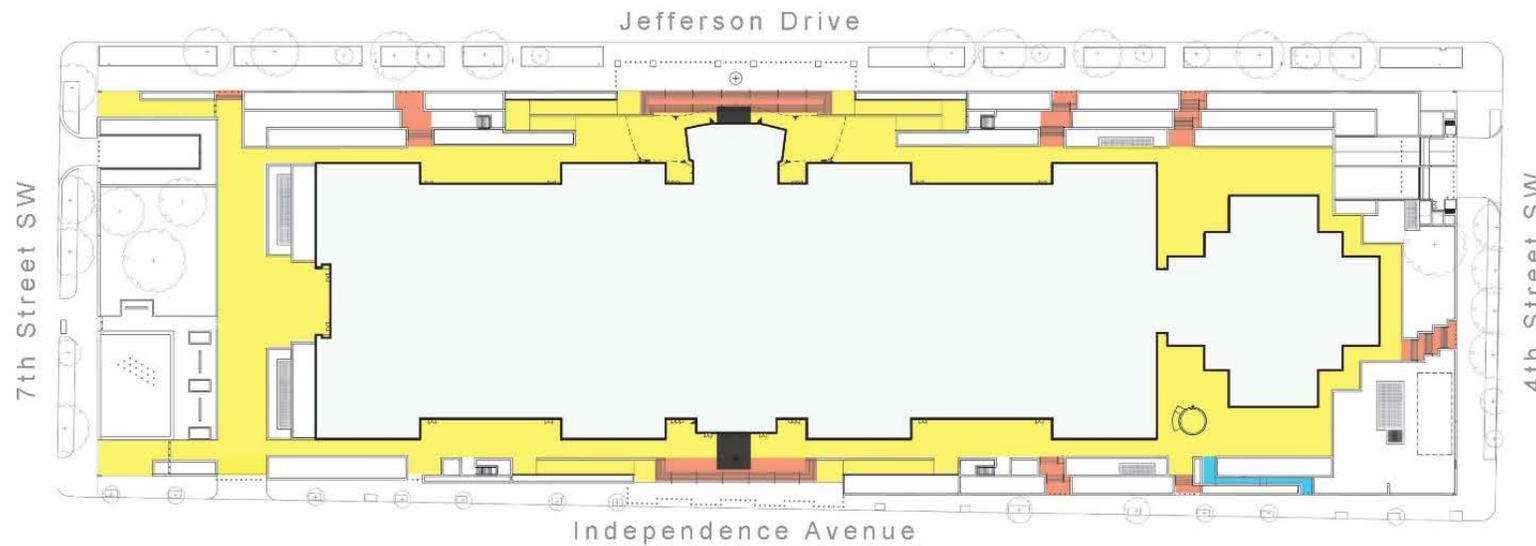
- █ Existing Secure Wall
- █ Proposed Secure Wall
- Existing Bollards
- Existing Operable Bollards
- Proposed Bollards
- Proposed Operable Bollards
- Areas of Difference





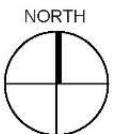
Existing Conditions

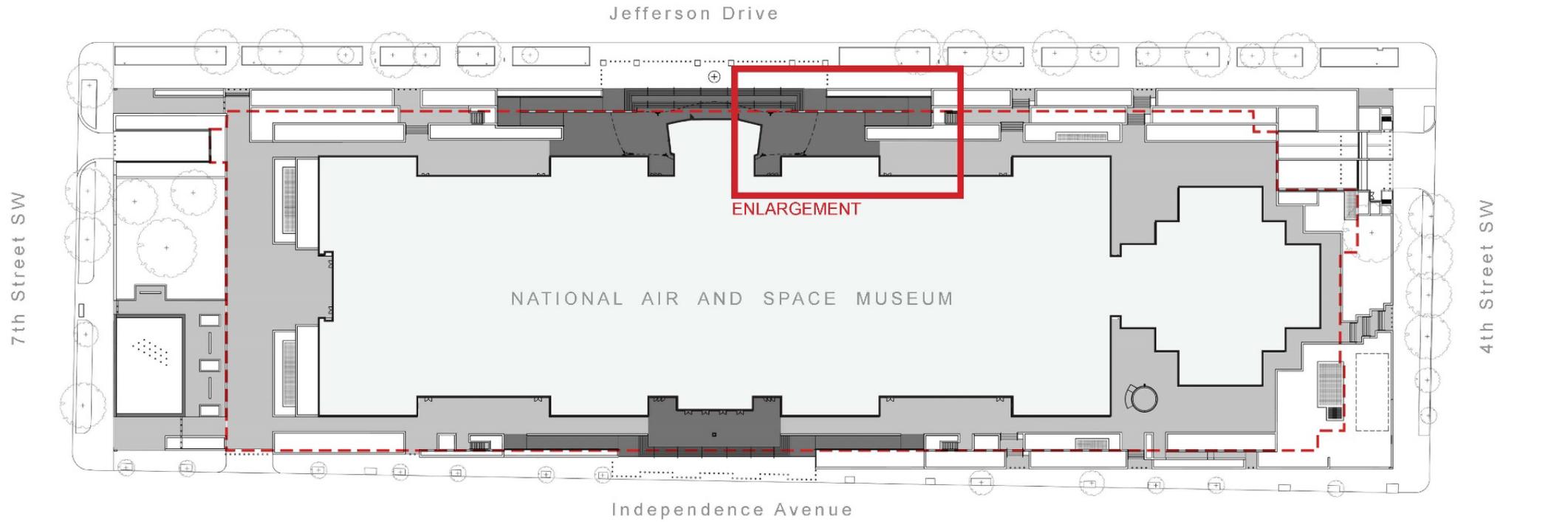
- Non ADA Compliant Ramp (1)
- Stairs (7)
- Accessible Walkways (1)
- At Grade Route (1)



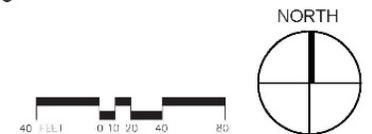
Current Proposed Design

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



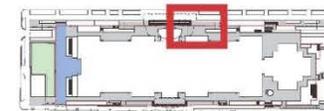
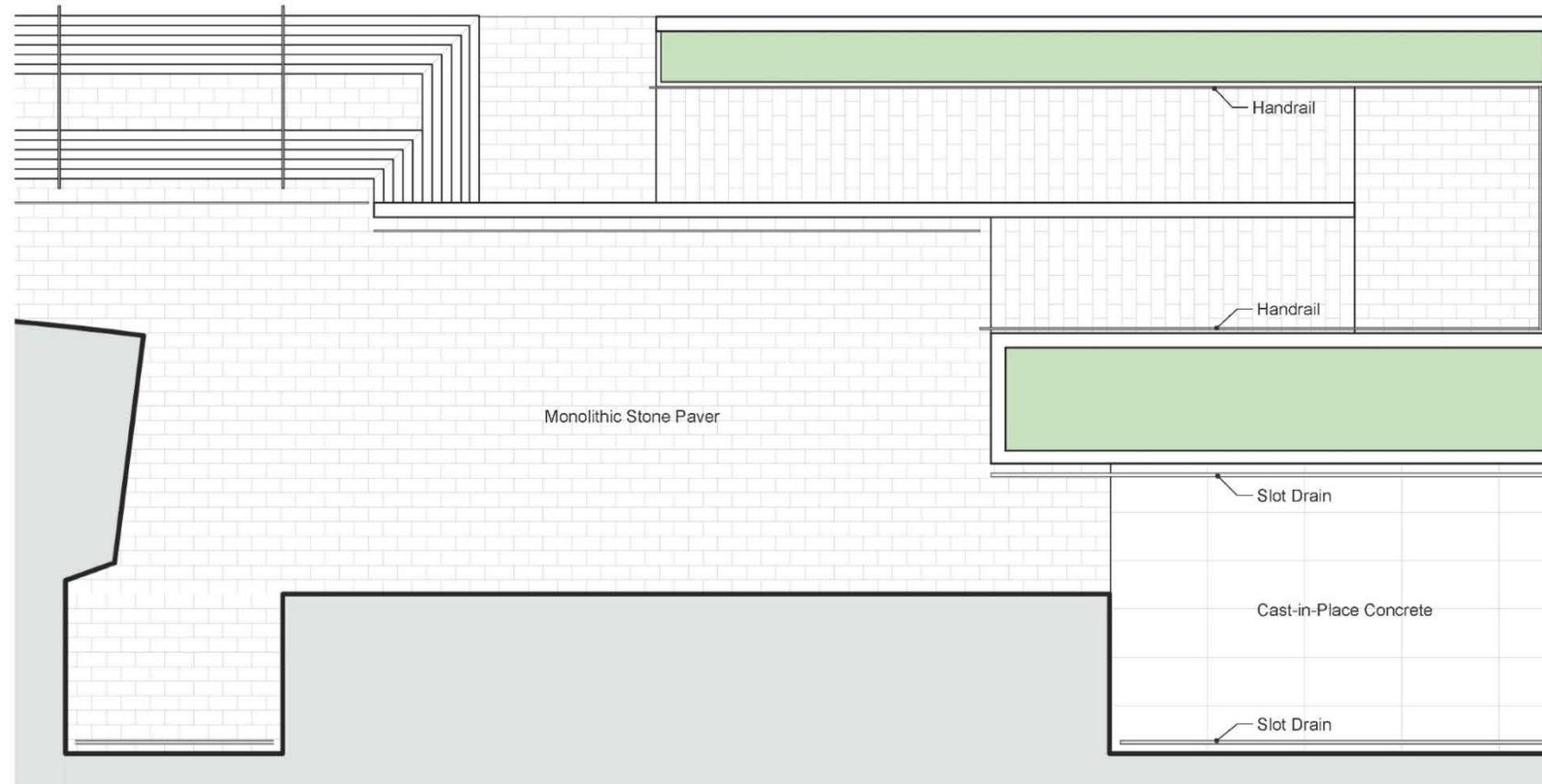


- Cast-in-Place Concrete, Exposed Aggregate, Grid Joint Pattern
- Monolithic Stone Paver, Running Bond Pattern
- Basement Edge of Structure



Site Design

National Air and Space Museum Mall Building Revitalization



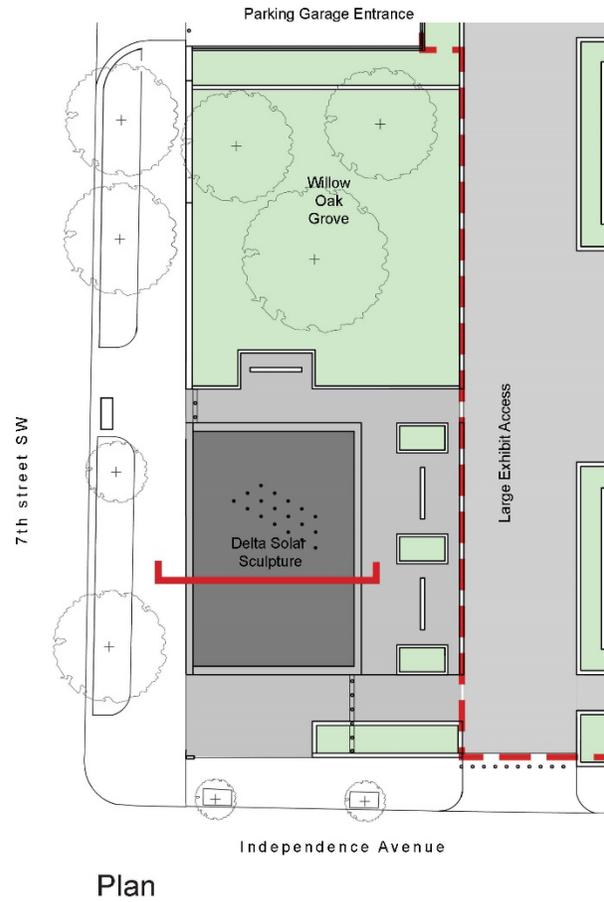
Paving Design Concept - North Entrance Enlargement



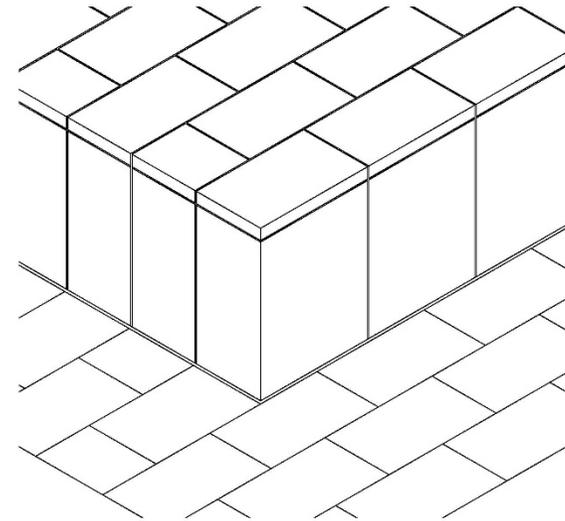
Smithsonian Institution
National Air and Space Museum

Site Design

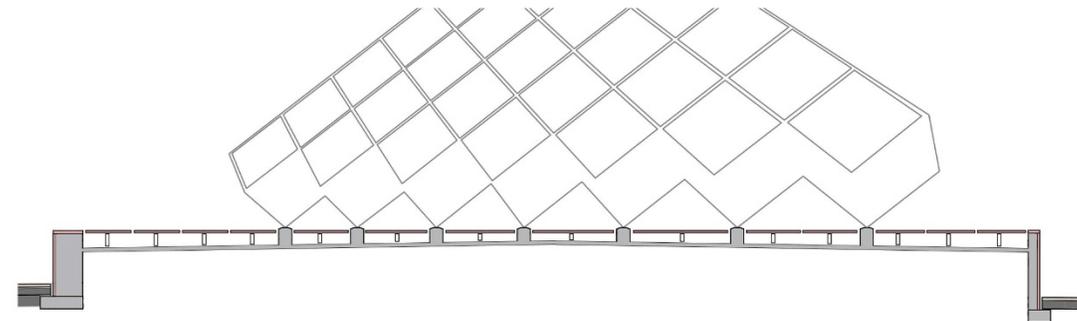
National Air and Space Museum Mall Building Revitalization



Plan



Axon - Plinth Corner Stone



Section

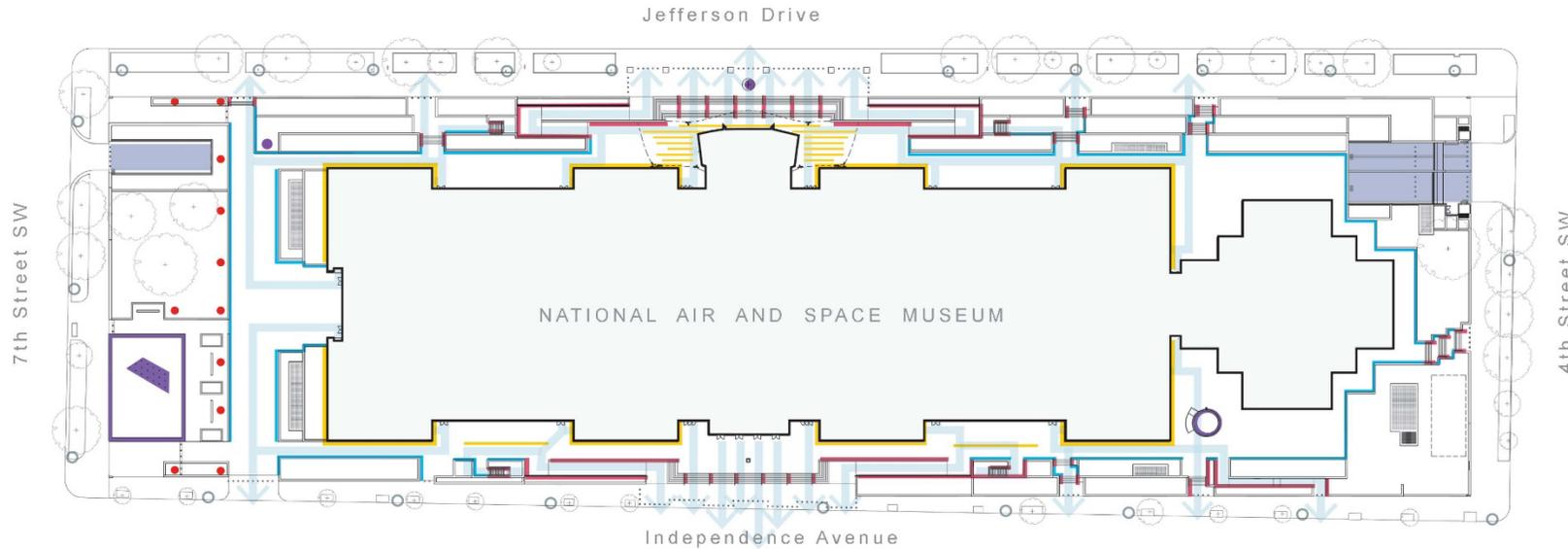
Delta Solar Plinth



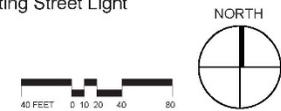
Smithsonian Institution
National Air and Space Museum

Site Design

National Air and Space Museum Mall Building Revitalization



-  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



Smithsonian Institution
National Air and Space Museum

Site Design

National Air and Space Museum Mall Building Revitalization



Southwest Corner - Gary Steffy Lighting Design Facade Concept



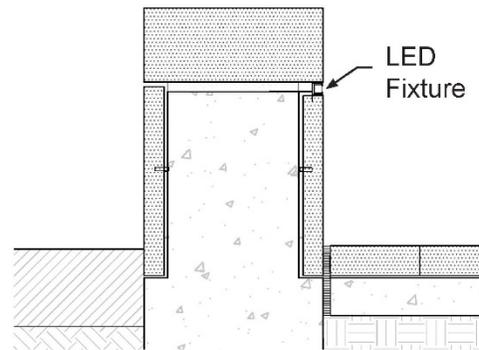
Smithsonian Institution
National Air and Space Museum

Site Design

National Air and Space Museum Mall Building Revitalization



Illuminated Handrail



Linear Seat Wall

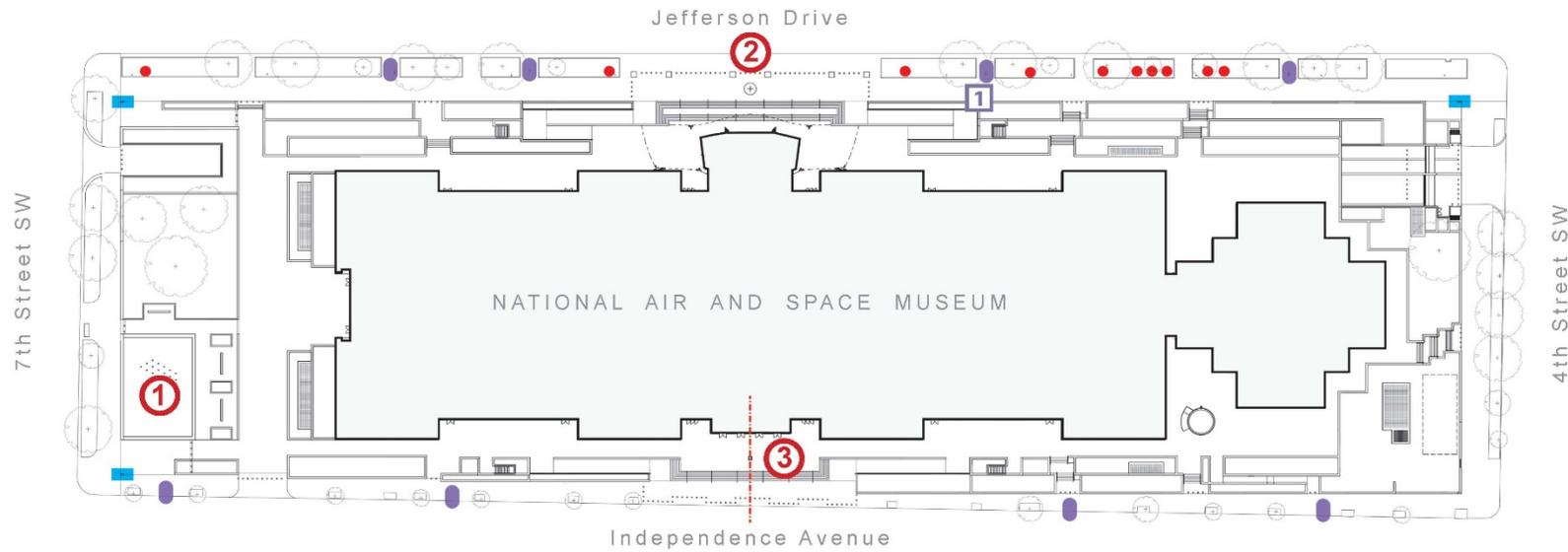
Lighting Detail - Gary Steffy Lighting Design



Smithsonian Institution
National Air and Space Museum

Site Design

National Air and Space Museum Mall Building Revitalization



① Delta Solar



② Ad Astra



③ Continuum



• Voyage Exhibition



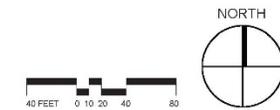
④ T.S.C. Lowe Plaque - New position same location

- ① Existing Sculpture Relocation/Proposed
- 'Voyage' Exhibit
- Wayfinding Signage Columns
- Exhibit Signage Columns
- Commemorative Plaques

Site Art - Exhibit - Interpretation

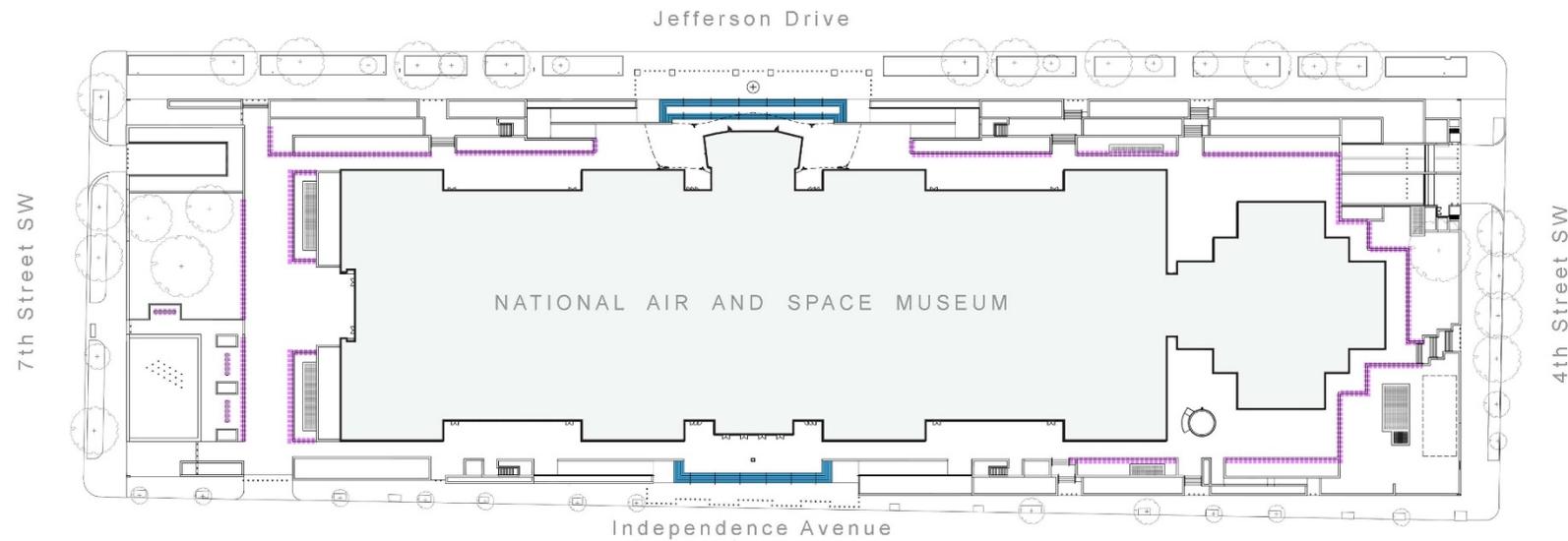


Smithsonian Institution
National Air and Space Museum



Site Design

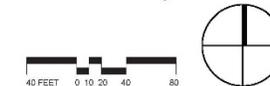
National Air and Space Museum Mall Building Revitalization



Seat Walls

Monumental Stair/ Informal Seating

NORTH



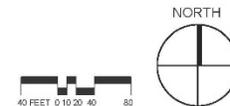
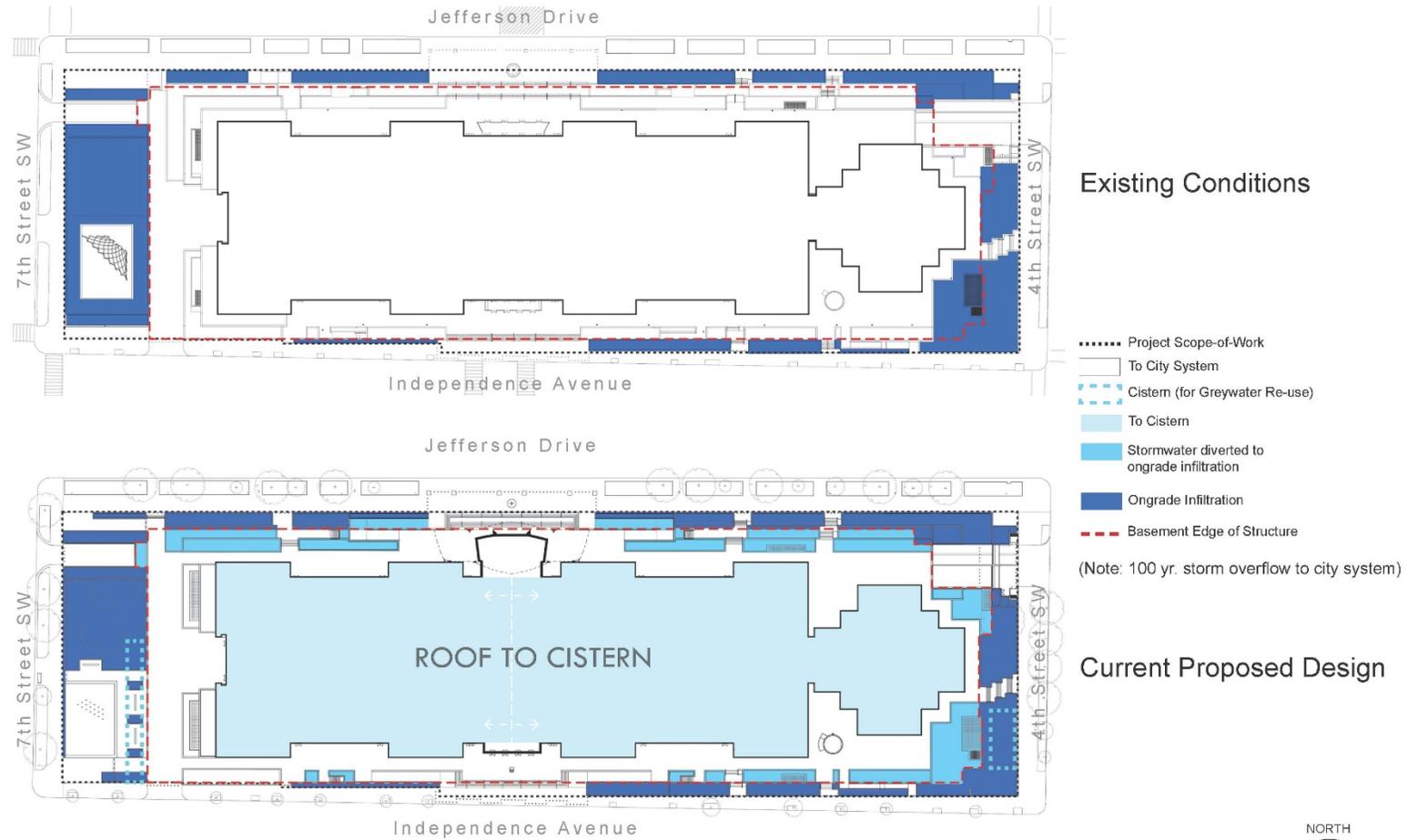
Seating Diagram



Smithsonian Institution
National Air and Space Museum

Site Design

National Air and Space Museum Mall Building Revitalization

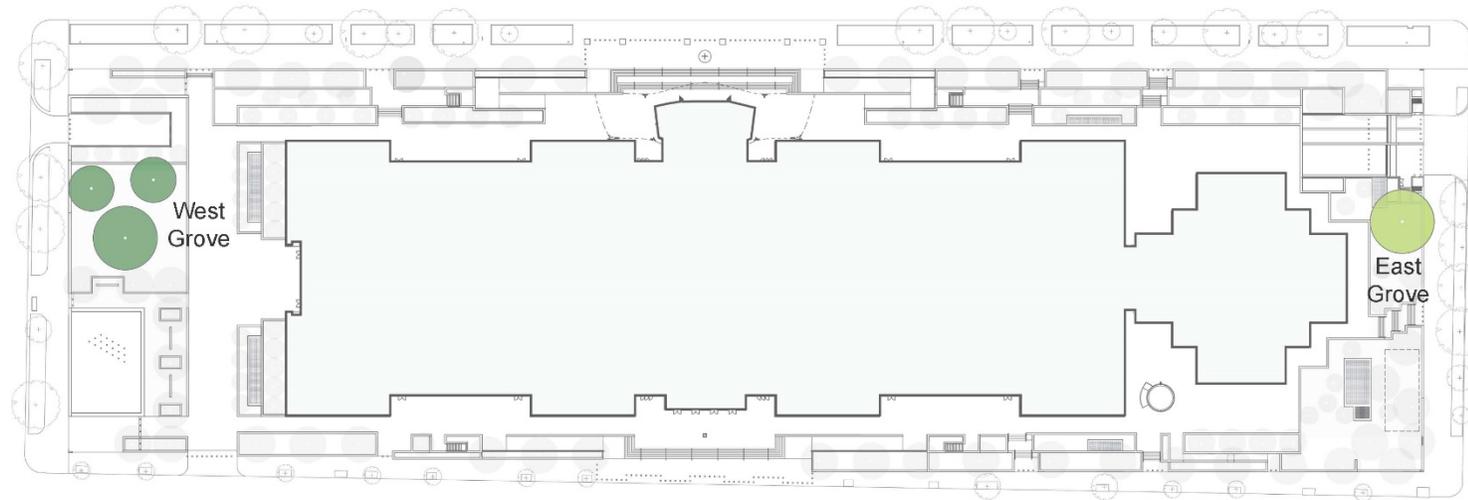


Stormwater Management Strategy



Planting Design

National Air and Space Museum Mall Building Revitalization



#870 Willow Oak



#875 Willow Oak

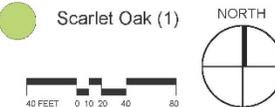


#880 Willow Oak



#2157 Scarlet Oak

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



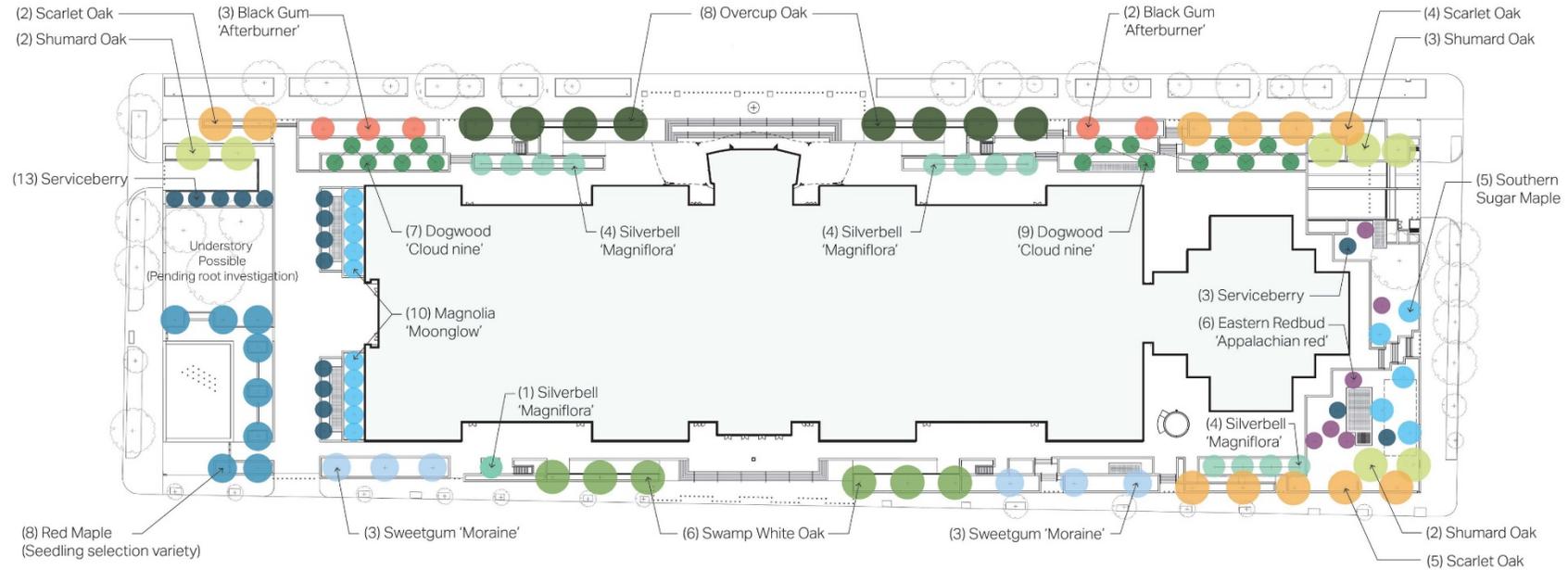
Existing Trees to Remain



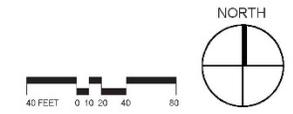
Smithsonian Institution
National Air and Space Museum

Planting Design

National Air and Space Museum Mall Building Revitalization



- | | | | |
|----|-------------------------|----|----------------------------------|
| 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' | | |



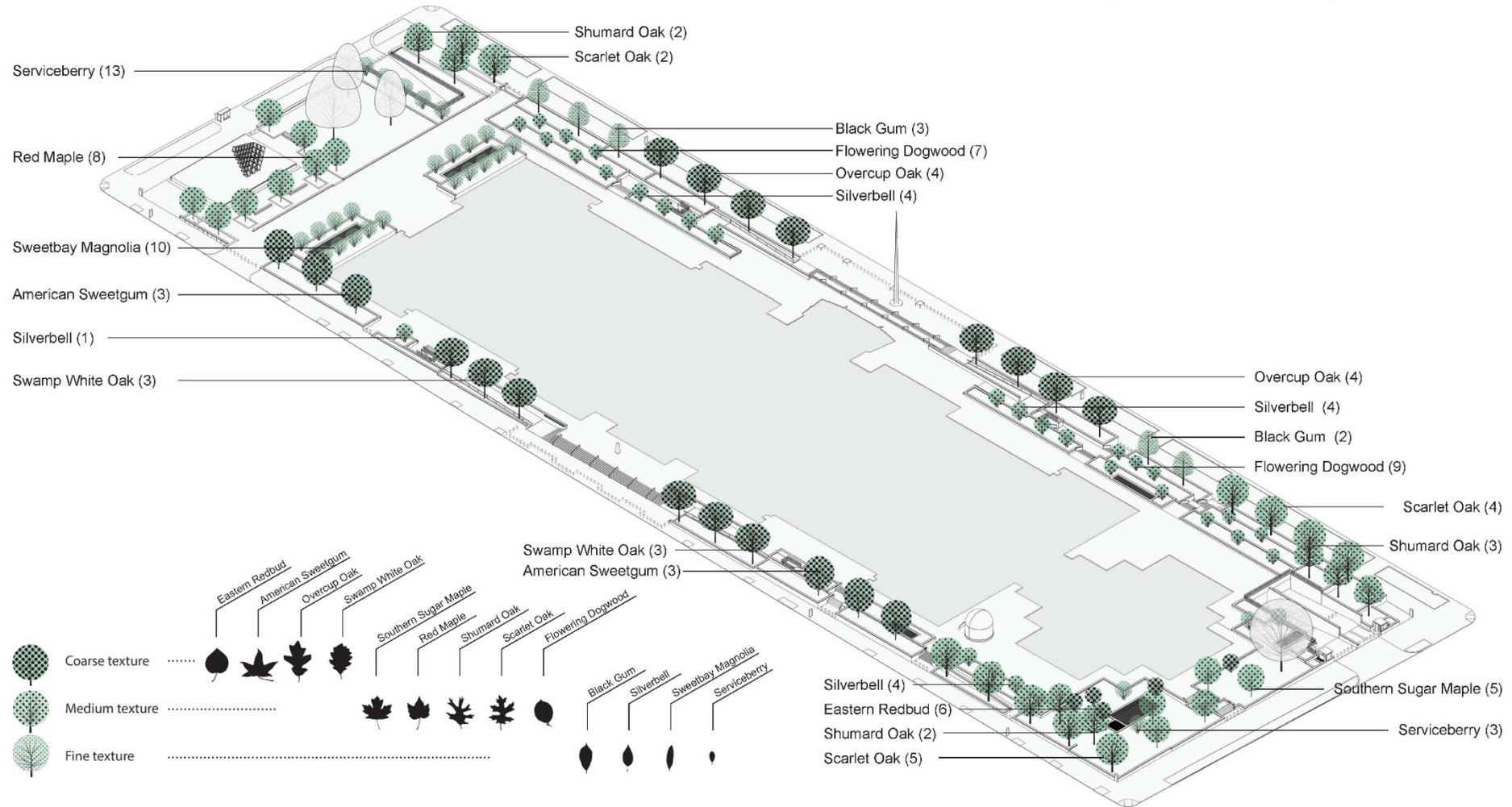
Tree - Species



Smithsonian Institution
National Air and Space Museum

Planting Design

National Air and Space Museum Mall Building Revitalization



Tree - Foliage



Planting Design

National Air and Space Museum Mall Building Revitalization

CANOPY

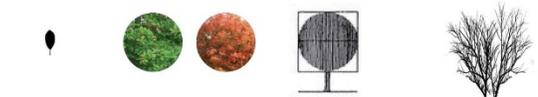
NAME	LEAF	COLOR	FORM	STRUCTURE
Scarlet Oak <i>Quercus coccinea</i> Rounded open H*W: 50-70' X 40-50'				
Shumard Oak <i>Quercus shumardii</i> Pyramidal to broad open H*W: 40-60' X 30-40'				
Southern Sugar Maple <i>Acer floridanum</i> Elliptical H*W: 40-70' X 30-50'				
Red Maple <i>Acer rubrum</i> (Seedling Selection Variety) Oval H*W: 40-70' X 30-50'				
Black Gum <i>Nyssa sylvatica</i> 'Afterburner' Pyramidal, Maturing to rounded H*W: 30-50' X 20-30'				
American Sweetgum <i>Liquidambar styraciflua</i> 'Moraine' Round to oval H*W: 60-80' X 40-60'				
Overcup Oak <i>Quercus lyrata</i> Broad rounded H*W: 40-60' X 40-60'				

Swamp White Oak
Quercus bicolor
Broad rounded
H*W: 50-60' X 50-60'

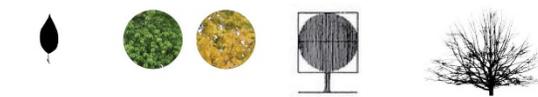


SECONDARY

Serviceberry
Amelanchier laevis
Rounded
H*W: 15-40' X 15-40'



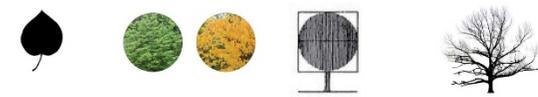
Silverbell
Halesia diptera 'Magniflora'
Rounded
H*W: 30-40' X 20-35'



Sweetbay Magnolia
Magnolia virginiana
Rounded
H*W: 10-35' X 10-35'



Eastern Redbud
Cercis canadensis 'Appalachian Red'
Rounded
H*W: 20-30' X 25-35'



Flowering Dogwood
Cornus florida 'Cloud Nine'
Rounded
H*W: 15-30' X 15-30'

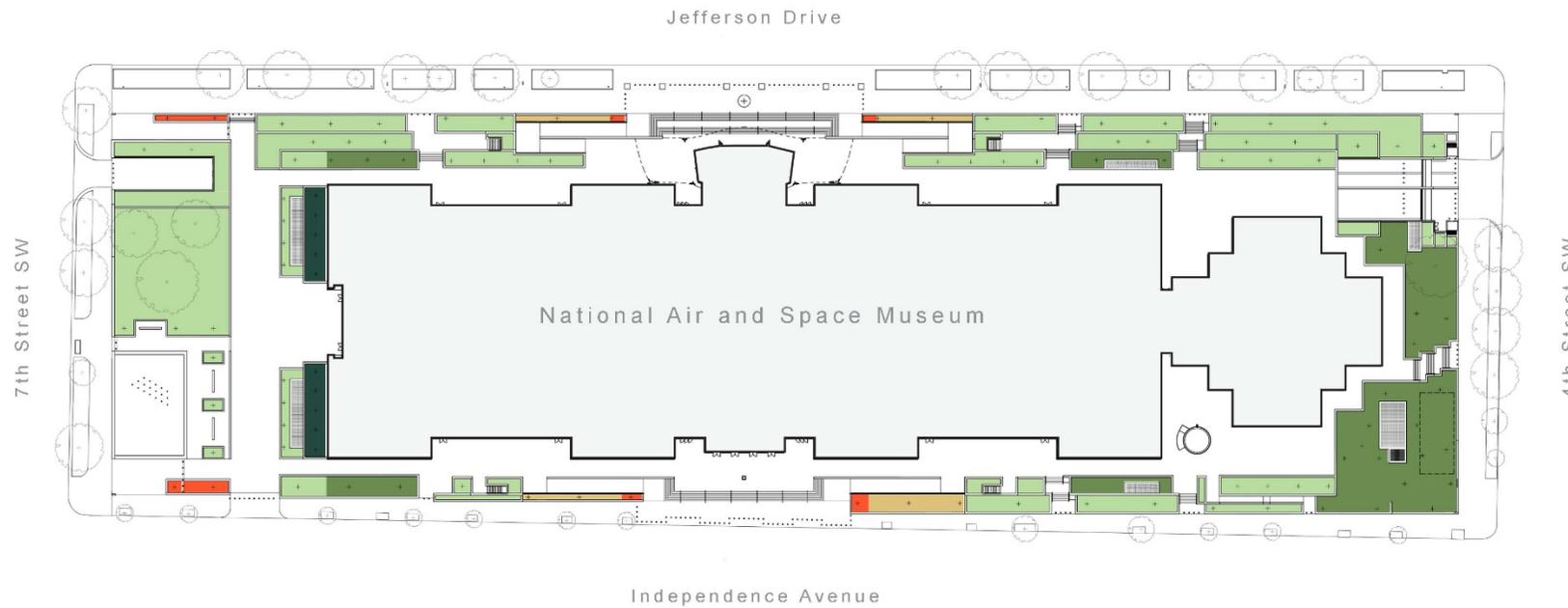


Tree - Summary Character

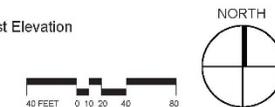


Planting Design

National Air and Space Museum Mall Building Revitalization



- 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

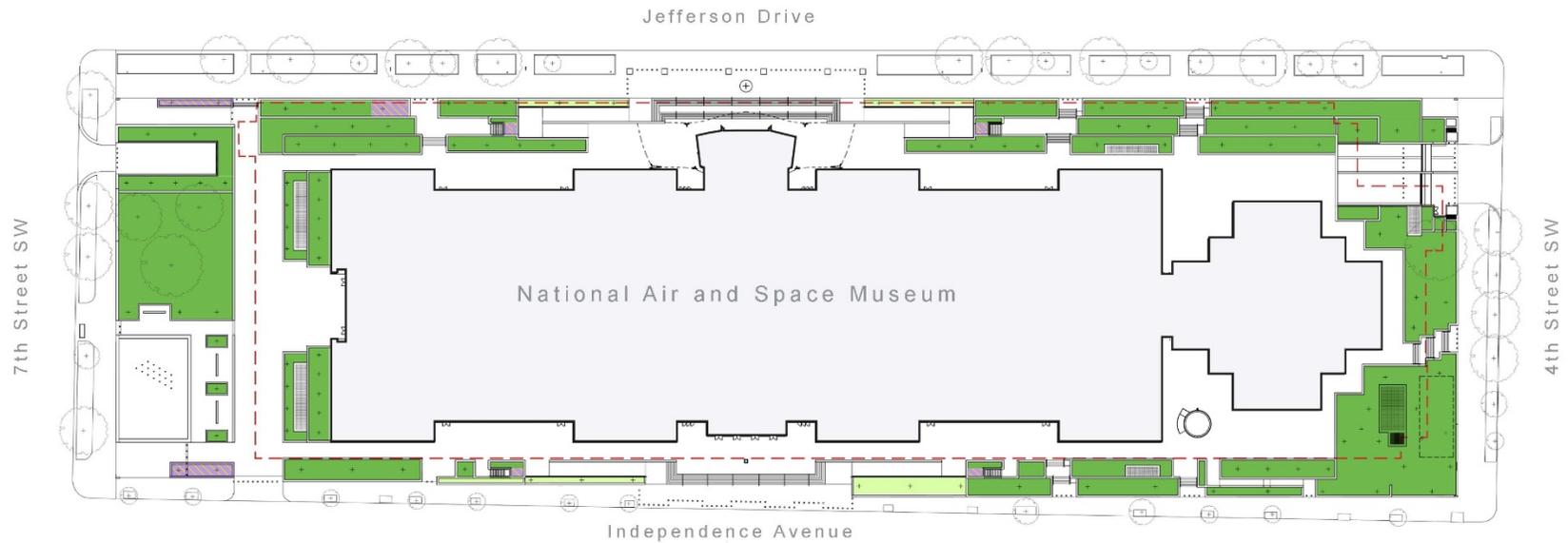


Ground Plane - Planter Typology

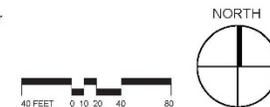


Planting Design

National Air and Space Museum Mall Building Revitalization



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

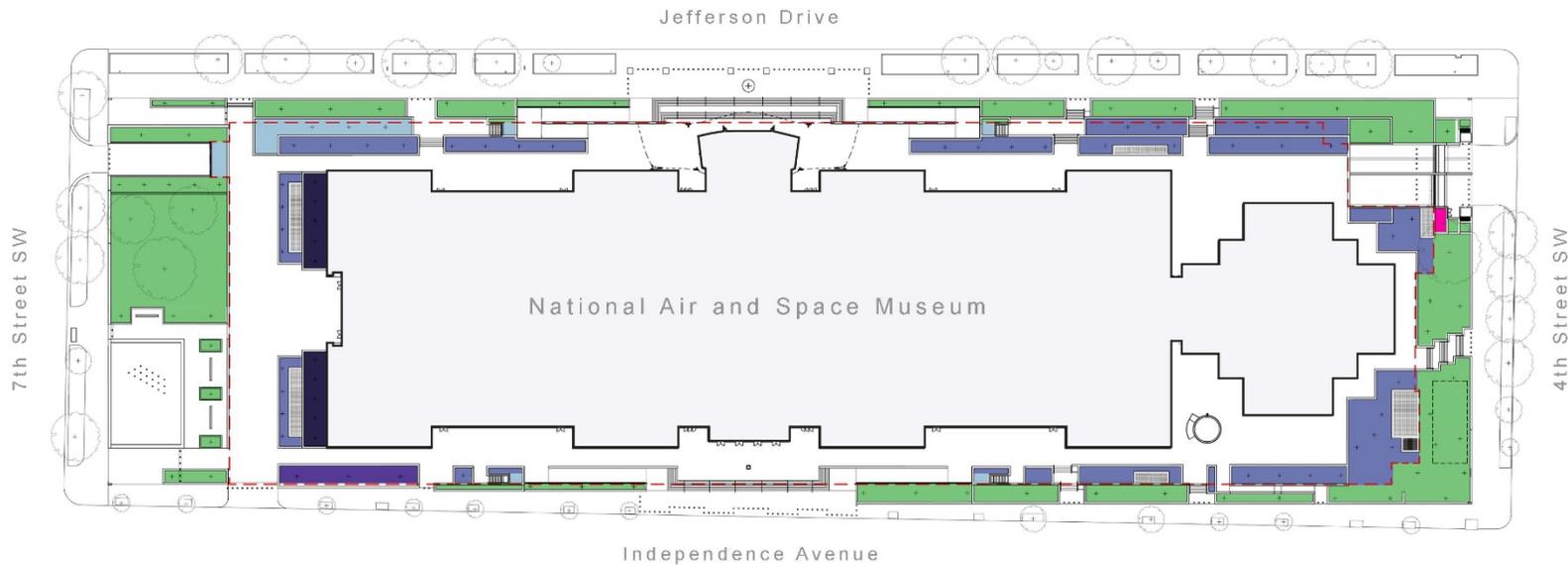


Ground Plane - Planter Heights



Planting Design

National Air and Space Museum Mall Building Revitalization



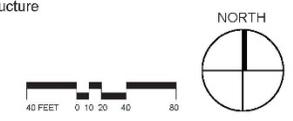
On Structure

- TBD Green Roof
- 24" Planting Soil Depth
- 32" Planting Soil Depth
- 44" Planting Soil Depth
- 52" Planting Soil Depth

On Grade

- Planting Soil Depth

Basement Edge of Structure

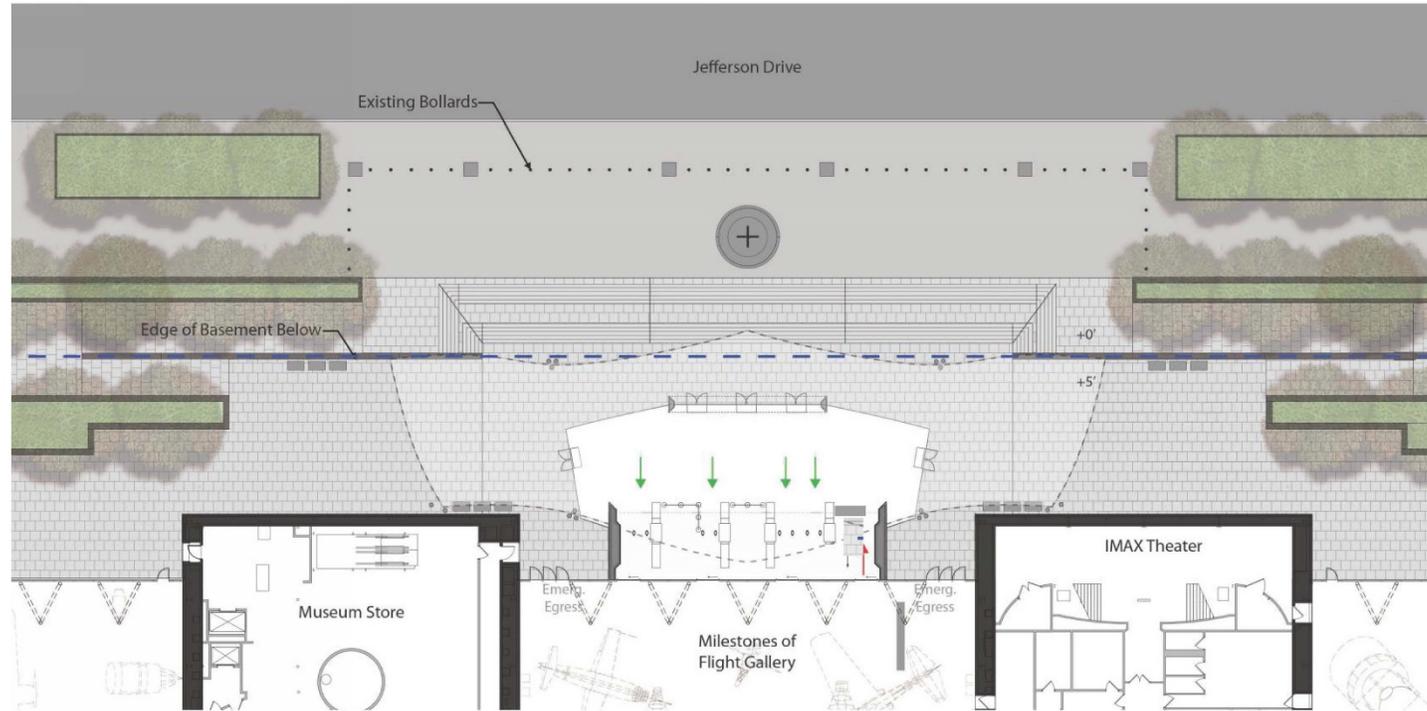


Ground Plane - Planter Soil Depth



Vestibules

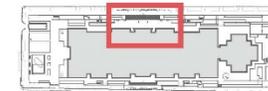
National Air and Space Museum Mall Building Revitalization



North Vestibule Proposal - Floor Plan



Smithsonian Institution
National Air and Space Museum



0' 8' 16' 48'



Vestibules

National Air and Space Museum Mall Building Revitalization

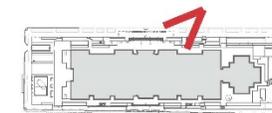


North Vestibule Proposal - Full and Partial North Elevation



Vestibules

National Air and Space Museum Mall Building Revitalization



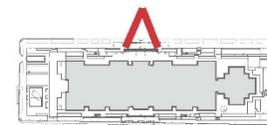
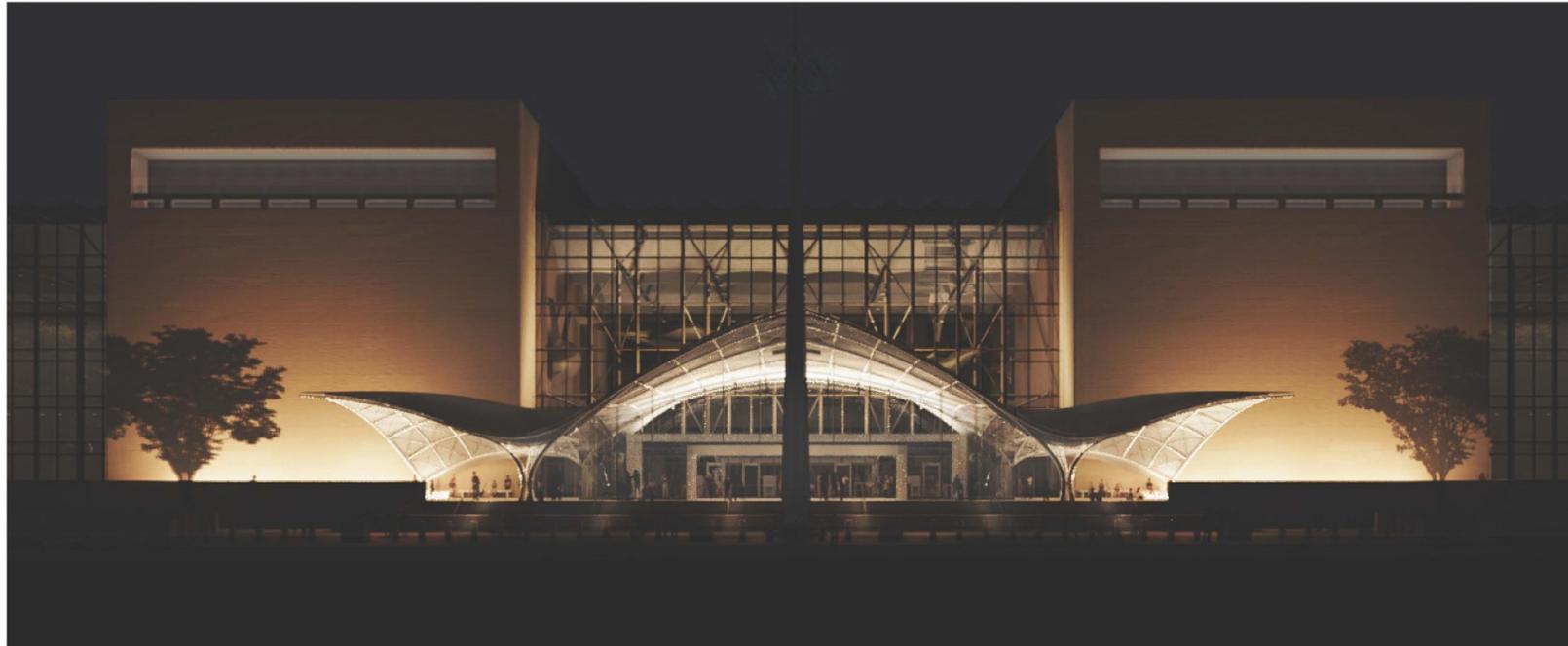
North Vestibule Proposal - Exterior Perspective



Smithsonian Institution
National Air and Space Museum

Vestibules

National Air and Space Museum Mall Building Revitalization



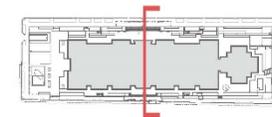
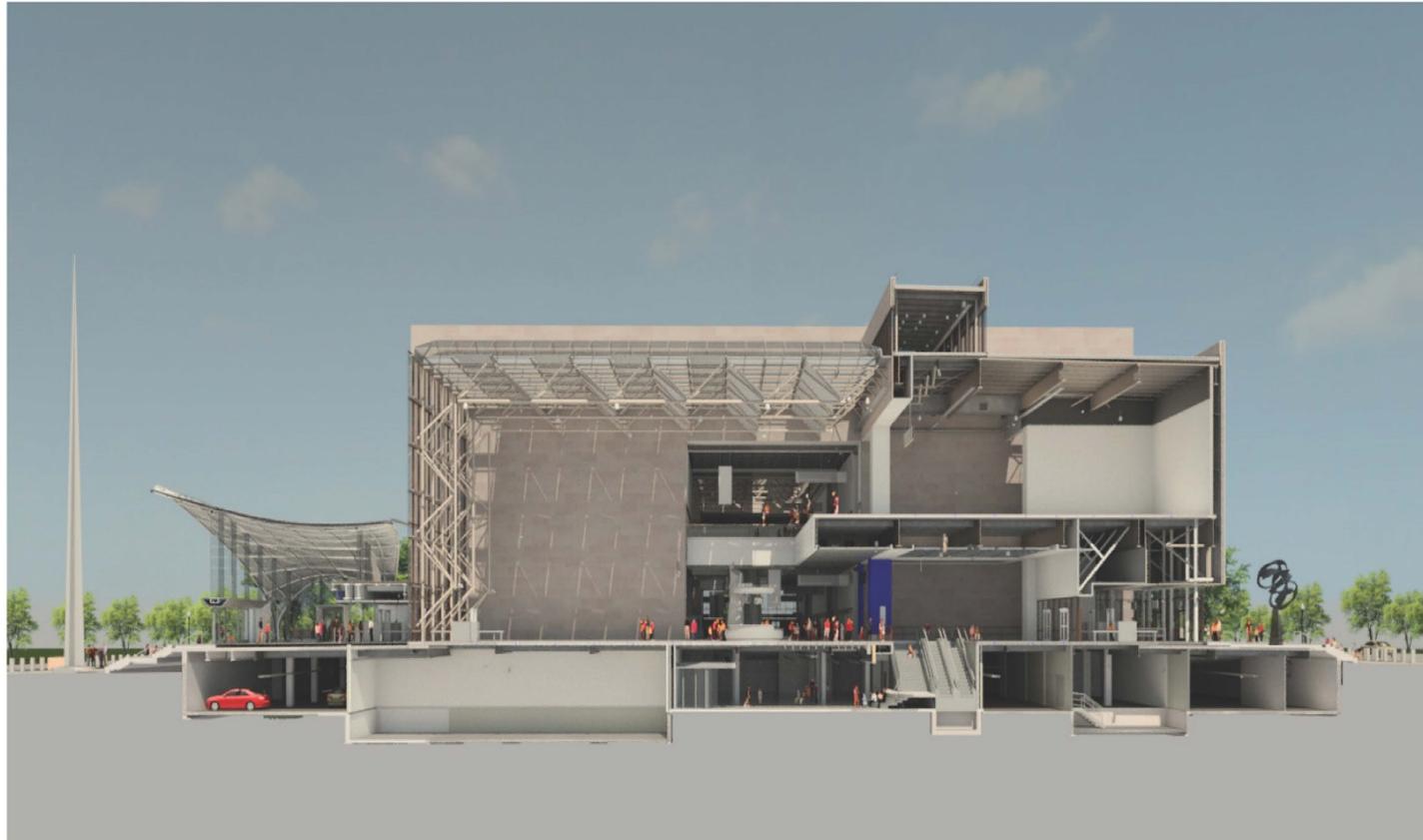
North Vestibule Proposal - Gary Steffy Lighting Design Facade Concept



Smithsonian Institution
National Air and Space Museum

Vestibules

National Air and Space Museum Mall Building Revitalization



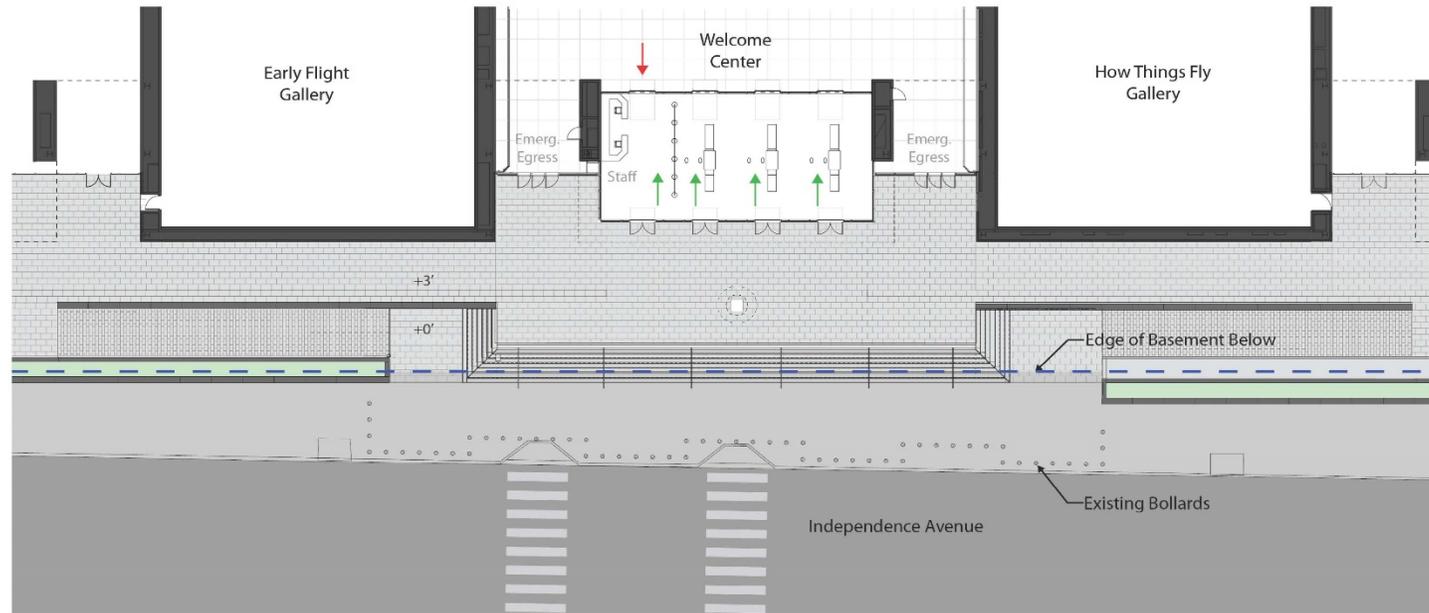
Full Building Section



Smithsonian Institution
National Air and Space Museum

Vestibules

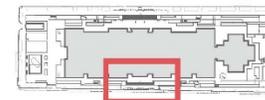
National Air and Space Museum Mall Building Revitalization



South Vestibule Proposal - Floor Plan



Smithsonian Institution
National Air and Space Museum



Vestibules

National Air and Space Museum Mall Building Revitalization



South Vestibule Proposal - Full and Partial South Perspective Elevations



Vestibules

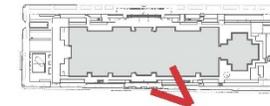
National Air and Space Museum Mall Building Revitalization



South Vestibule Proposal - Perspective from Southeast



Smithsonian Institution
National Air and Space Museum



NCPC Revised Concept Report | 29 September 2017
Page 130