PROJECT NARRATIVES
(Updated 30 October, 2015, for NCPC Concept Submission)
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II DESIGN TEAM

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III CIVIL NARRATIVE

SITE

The proposed site is located at the intersection of Meadow Road and Holly Spring Road. New York Avenue is located approximately 366 meters to the north and the Anacostia River is located approximately 488 meters to the east. The majority of the site will drain toward Hickey Run, a tributary to the Anacostia River which is located approximately 366 meters to the east.

UTILITIES

Map C-102 shows the proposed water and sewer layout. Additional details are outlined below.

Water

Water is to be provided to the Embracing Mountain Building, the Boat House and the Service Building. The Embracing Mountain and Service Building will also have automatic sprinkler systems. There will also be two fire hydrants proposed along Holly Spring Road. In addition there will be an irrigation system and a number of outdoor spigots. The details of these systems have not been tied down yet. Currently reviewed plans show a waterline along Holly Spring Road. At this time the size of this line is unknown. Due to the requirements to provide fire hydrants and automatic sprinkler systems an eight inch line is recommended. If the existing line is not adequate then a new 8” line should be installed running from waterline located at the intersection of Holly Spring Road and Hickory Hill Road to waterline at the intersection of Holly Spring Road and Meadow Road.

Sewer

Sewer is to be provided to the Embracing Mountain Building and the Support Services Building. There is currently no existing sewer outfalls located near the proposed site. Based on our preliminary review the best location to connect to the existing sewer line would be the sewer line running along New York Avenue.

Electrical

Proposed electrical panels and transformers located in both the Service Building and the Embracing Mountain Building will be sized to serve all twenty-six (26) structures. Existing records show electrical lines located north-west of the site near the intersection of Conifer Road and Meadow Road.

Communications

Communication lines will be provided to the Embracing Mountain and Support Services Building structures.

Natural Gas

Natural gas is not to be provided to the site.
STORMWATER MANAGEMENT /SEDIMENT CONTROL

The District of Columbia (District), like most ultra-urban areas, experiences increased stormwater runoff that results from development. This runoff places a burden on sewer systems and degrades aquatic resources when it is not managed adequately. Unmanaged stormwater runoff overloads the capacity of streams and storm sewers and is responsible for increased combined sewer overflow events and adverse downstream impacts, such as flash flooding, channel erosion, surface and groundwater pollution, and habitat degradation. Recognizing this issue, the District first adopted stormwater management regulations in 1988. These regulations (Chapter 5 of Title 21 of the District of Columbia Municipal Regulations) established requirements to manage both stormwater quality and quantity. Current regulations present a unified sizing approach for providing best management practices (BMPs) to meet pollutant removal goals, reduce peak discharges, and pass extreme floods. In addition, the Arboretum is located within the Anacostia Waterfront Development Zone requiring special sizing requirements. The sizing requirements the National China Garden will include stormwater retention volume based on the 90th percentile event, water quality treatment volume, and 2-year and 15-year control.

The District Stormwater Management Guidebook (July 2013) lists 13 general categories to meet the stormwater requirements. They include Green Roofs, Rainwater Harvesting, Impervious Surface Disconnection, Permeable Pavement Systems, Bioretention, Filtering Systems, Infiltration, Open Channel Systems, Ponds, Wetlands, Storage Practices, Proprietary Practices and Tree Planting and Preservation. The A/E Team examined all of these alternatives to determine which would be most applicable for the National China Garden Project. Based on the District’s Guidebook the following framework was used for the decision making process:

- **Regulatory Criteria**
  Can the BMP meet all stormwater sizing criteria at the site or are a combination of BMPs needed?

- **Land Use Factors**
  Which practices are best suited for the proposed land use at this site?

- **Physical Feasibility Factors**
  Are there any physical constraints at the project site that may restrict or preclude the use of a particular BMP?

- **Community and Environmental Factors**
  Do the remaining BMPs have any important community or environmental benefits or drawbacks that might influence the selection process?

- **Location and Permitting Considerations**
  What environmental features must be avoided or considered when locating the BMP system at a site to fully comply with District and federal regulations?

Based on these criteria the A/E team is proposing to provide a number of different types of treatments. They will include permeable pavement systems, bioretention areas, tree planting, ponds, wetlands, and rainwater harvesting. The proposed concept will be further refined as the project moves onto the next stage. Map C-103 outlines some of the proposed stormwater treatments.

Sediment Control measures will be required during construction of the site. Possible measures that would be implemented include stabilized construction entrances, silt fence, super silt fence, earth dikes, and sediment traps.
SITE SECURITY

A cursory review of the available information was conducted and site-related discussions among representatives from the National China Garden Foundation, the Chinese Team, the National Arboretum, the Agricultural Research Service (ARS) and the multi-disciplined A/E Team. The National Arboretum Master Plan report dated December 15, 2000 and applicable Master Plan Revisions dated May 2007 were also reviewed. These plans and reports were provided by the NCGF as part of the RFP documents (Exhibit H).

Exhibit E of the October 16, 2012, report (prepared by AECOM) depicts a 100’ setback as a site consideration (Page 6 of the Exhibits, page 41 of 62 of the PDF document). The 100’ setback is depicted and considered as a guideline and voluntary. In accordance with Chapter 2, Section 2.2, of the ARS Facilities Design Standards, published by Facilities Division, Facilities Engineering Branch AFM/ARS and dated May 12, 2012; general guidance is provided and references the need for a project-specific risk assessment. In addition a review of the ARS Facilities Design Standards, Section 3.2.3 Parking Security notes a recommended minimum setback distance between the building and parked vehicles range from 5 ft to 100 ft depending on the protection level desired for the project. Adjacent public parking should be directed to more distant or better protected areas, segregated from employee parking and away from the facility. If needed, risk assessments are to be done in accordance with the methodology outlined in “Physical Security Criteria for Federal Facilities” dated April 12, 2010 by the appropriate government agency.

No risk assessment was provided to the A/E Team at the start of the project. From a site security standpoint, no special measures appear to be warranted. While the 100’ setback might be desirable by some it may not be practical or necessary for the NCG facilities. Perimeter controls around the National Arboretum are expected to be part of the entire grounds of the National Arboretum. Gates should be closed to the public based on established hours of operation. Entry to guests and workers when gates are not open to the public should be through use of ID badges or visitor passes. Specific gate access should be cleared by guards or others who are assigned to monitor the entrances to the facility. Other measures to mitigate any real or perceived risks should be considered jointly by the National Arboretum, NCGF and the Chinese delegation as the design of the site and each facility progresses.
IV WATER BALANCE NARRATIVE

A water balance analysis was performed for the lake and two ponds at GE Garden and Mountain House. The analysis was performed to estimate how much make-up water is required to maintain the permanent pools of these facilities to within a specific tolerance. Tolerances evaluated included 50 mm, 150 mm and 300 mm below the design permanent pool stage.

ASSUMPTIONS

The water balance analysis is based on the following assumptions:
1. The lake, GE Garden pond and Mountain House pond are not connected; all function independently of each other, and only collect runoff from the watershed that drains to them.
2. Design permanent pool depths for the lake, GE Garden pond and Mountain House pond are 1.8 m, 1.25 m and 1.25 m, respectively.
3. Evaporation loss is a function of daily average temperature and monthly extraterrestrial radiation.
4. Evapotranspiration loss is a function of daily average, minimum and maximum temperatures, monthly extraterrestrial radiation and a crop coefficient of 1.0.
5. Wetland type vegetation is assumed to be 5 percent of the permanent pool surface area.
6. Loss of permanent pool due to infiltration is 6 mm/day.
7. Existing ground water table is located below invert of lake and ponds.
8. Permanent pool is controlled by a fixed spillway crest elevation. Inflow volume that exceeds the spillway crest elevations is assumed lost and not recaptured.
9. Permanent pools do not freeze.
10. Runoff is not produced from days with 1.5 mm or less of precipitation.

RAINFALL

Rainfall and temperature data from the weather station at Washington Reagan National Airport was obtained thought the United States National Climatic Data Center. This station is within 9.5 km of the site and has a 68 year period of record (1945-2013). Daily rainfall for the period of record was analyzed to determine an average precipitation year (1995) and a dry precipitation year (1965). In Washington, DC, an average year produces about 1000 mm of precipitation whereas a typical dry year produces roughly 675 mm.

RUNOFF

Daily precipitation was converted to runoff volume in the water balance model by multiplying precipitation depth times a volumetric runoff coefficient (Rv) times the drainage area to the permanent pool. Precipitation that falls directly onto the permanent pool surface was converted directly to runoff volume in the water balance model by multiplying precipitation depth times the surface area of the permanent pool that is exposed to rainfall. See Table 1 for a summary of the drainage area and Rv for each permanent pool.
Table 1: Summary of Drainage Areas and Volumetric Runoff Coefficients (Rv)

<table>
<thead>
<tr>
<th>Permanent Pool at</th>
<th>Volume of Permanent Pool</th>
<th>Area of Permanent Pool</th>
<th>Drainage Area to Permanent Pool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake</td>
<td>8,460 m³</td>
<td>5,946 m²</td>
<td>22,650 m²</td>
</tr>
<tr>
<td>GE Garden</td>
<td>265 m³</td>
<td>276 m²</td>
<td>3,558 m²</td>
</tr>
<tr>
<td>Mountain House</td>
<td>285 m³</td>
<td>286 m²</td>
<td>810 m²</td>
</tr>
</tbody>
</table>

**Losses**

Daily maximum and minimum temperatures were used to estimate daily potential evaporation (PE) and daily crop evaporation ($ET_c$) using theoretical equations as a function of temperature and extraterrestrial radiation. These functions are given as follows:

\[
PE \text{ (mm/day)} = \left(\frac{Re}{\lambda \rho}\right)(Ta + 5)(0.01), \ Ta + 5 > 0 \text{ then } PE = 0, \text{ Oudin el al (2005)}
\]

\[
ET_c \text{ (mm/day)} = K_cET_o.
\]

Where:

\[Re = \text{Extraterrestrial radiation (MJ/m}^2\text{/da)}\]
\[\lambda = \text{Latent heat flux (J/Kg)}\]
\[\rho = \text{Density of water (Kg/m}^3\text{)}\]
\[Ta = \text{Daily average temperature (°C)}\]
\[K_c = \text{Crop coefficient, assumed to be 1.0 for wetland plants}\]
\[ET_o \text{ (mm/day)} = 0.0023Re(Ta + 17.8)(Tmax - Tmin)^0.5, \text{ Hargreaves eqn., FAO Irrigation and drainage paper 56 (1998)}\]
\[Tmax \text{ and Tmin = Daily maximum and minimum temperatures, respectively (°C)}\]

**CONTINUOUS SIMULATION**

For each year (1995 and 1965), 365 days of actual precipitation, maximum temperature and minimum temperature were routed through the water balance model to estimate an amount of make-up water that would be required to hold permanent pool for the lake and two ponds to within a given tolerance. Tolerances evaluated included 50 mm, 150 mm and 300 mm below design permanent pool stage. If the permanent pool fell below the tolerance value on certain day then make-up water would be added at the end of the day to fill the permanent pool back to design level.

The water balance model is based on the following mass balance relationship:

\[S_{start} + V_{in} - V_{out} - V_{spill} = (S_{end} + MUW_{end})\]

Where:

\[S_{start} = \text{Pond storage at start of day}\]
\[V_{in} = \text{Daily total runoff volume into pond including runoff from the catchment area plus direct runoff onto the pond surface}\]
\[V_{out} = \text{Daily total outflow volume from pond including evap. from open water, evapotrans. from wetland veg. and infiltration}\]
\[V_{spill} = \text{Daily spillover volume, which is zero on days when water-surface is below permanent pool}\]
\[S_{end} = \text{Pond storage at end of day}\]
\[MUW_{end} = \text{End of day Make-Up Water to top off the pond. If } S_{end} \text{ within fluctuation then } MUW_{end} = 0\]
RESULTS

The water balance analysis demonstrates that there is insufficient runoff volume from the watersheds of the lake and two ponds to overcome the evaporation, evapotranspiration and infiltration losses that occur. For this reason make-up water will be required from another source to maintain design permanent pools to within tolerance. Possible sources for make-up water are well water, the Anacostia River and City water. A separate study is warranted to evaluate the benefit-costs of these, and perhaps other, sources. There’s an existing United States Geological Survey ground water well at the Arboretum adjacent to New York Avenue. Records from this well indicate that ground water is approximately 1.8 m to 2.0 m below grade. A summary of the make-up water requirements for the lake and two ponds is provided in Tables 2 and 3.

Table 2: Summary of make-up water required for Average Year 1995

<table>
<thead>
<tr>
<th>Tolerance</th>
<th>Make-up water required (Millions of Liters)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Main Lake</td>
</tr>
<tr>
<td>50 mm</td>
<td>12</td>
</tr>
<tr>
<td>150 mm</td>
<td>10</td>
</tr>
<tr>
<td>300 mm</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 3: Summary of make-up water required for Dry Year 1965

<table>
<thead>
<tr>
<th>Tolerance</th>
<th>Make-up water required (Millions of Liters)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Main Lake</td>
</tr>
<tr>
<td>50 mm</td>
<td>14</td>
</tr>
<tr>
<td>150 mm</td>
<td>13</td>
</tr>
<tr>
<td>300 mm</td>
<td>12</td>
</tr>
</tbody>
</table>

Depending on tolerance in permanent pool fluctuation, the main lake would require between 9 and 14 Million Liters of water a year. The two smaller ponds combined would require a lesser amount between 0.36 to 1.1 Million Liters of water a year depending on tolerance. These values do not include the one-time fill up volume for the lake and two ponds after they’re constructed. It’s estimated that 8.5 Million Liters, 0.27 Million Liters and 0.29 Million Liters of water would be required to initially fill the main lake, GE Garden pond and Mountain House pond, respectively.

For planning purposes, it’s worth considering a water fluctuation tolerance of 150 mm for the main lake and 50 mm for the two smaller pond facilities in order to save on make-up water. Because the GE Garden and Mountain House ponds have smaller footprints than the main lake, aesthetics could be compromised if their permanent pools are allowed to fluctuate more than 50 mm; however, a fluctuation of 150 mm might be more manageable in the main lake provided it does not compromise aesthetics, plant growth and fish health, which would need to be addressed.
V SITE AND LANDSCAPE DESIGN

GENERAL DESCRIPTION

The National China Garden Site and Landscape 15% design effort focuses on site wide issues that relate to accessibility to the garden in compliance with the Americans with Disabilities Act (ADA). The goal is to make as much of the overall site and individual gardens compliant, while respecting the integrity of the original design of site, gardens, and structures by the Chinese team. The 15% design allows as much of the site and individual gardens and structures visitor accessibility with minimal alterations, or design changes to comply with code requirements. In addition to accessibility, access requirements have been incorporated for fire and medical emergency vehicles. The 15% documents illustrate our initial assessments and recommendations for change or modification to the site design and layout to accommodate code requirements for design of exterior spaces and to fit the landscape and gardens into the visual setting of the Arboretum.

Overall Site

The current design incorporates the 100’ setback requirement from Holly Spring Road as recommended in the Project Code Analysis prepared by AECOM dated October, 2012. This setback positions the entire China Garden complex and surrounding garden structures further into the site east and north than previous planned. An updated topographic survey was prepared by Dewberry, and was used as a basis for preparation of the 15% design documents. The documents illustrate the grading throughout the site and how grading affects pedestrian accessibility, including recommendations for adjustments to the existing design to accommodate access.

Parking Area: A small parking area has been incorporated into the site to the south of the Mountain House of Sliced Stones. The parking area accommodates 24 cars. Eight of the spaces are handicap accessible. Eight are allocated for staff parking, and eight for miscellaneous and maintenance parking. The location of the parking area has been set back from Holly Spring Road to allow for a landscape buffer planting to help conceal the parking area and set it in into the overall landscape. The parking area also provides handicap accessible parking in a location near the main entrances, the two major walled gardens, and surrounding landscape and structures.

Service Access: A service drive has been provided on the north side of the Ge Garden. It provides service access and loading for the Embracing Mountain Building. The access drive also provides emergency vehicle access further into the site. This extension would be a supported turf surface capable of accommodating a fire truck. It will be visually non-intrusive, and will be graded in a careful way to conceal it as much as possible within the site. The restrooms will be incorporated into the basement of the building.

Site Emergency Access: Emergency access will be required to within 45 m (150’) of building structures. This access applies to both fire and medical emergency vehicles. An access way of 6m (20’) wide is required. The surface must be capable of accommodating a fire truck. Supported turf could be used to conceal it within the landscape, or shared with other hardscape surfaces. We have carefully located these access ways to create minimal intrusion; we have suggested alterations to the existing design to accommodate them. L-102 illustrates where these access ways would be located, and where changes are recommended to accommodate them, and as follows:

- Access Way #1: From the south parking area and along the south edge of lake. This would provide access to the Floating Fragrance Pavilion, Boat Hall, and the Management and Restroom Building. The southeastern edge of the lake is shifted west slightly to allow adequate room for grading between the access way and the water’s edge, and to limit cutting into the hillside to the east.
• **Access Way #2:** Located along the front edge of the Ge Garden and Mountain House of Sliced Stone Gardens from Holly Spring Road. This will provide fire access to the two gardens and their internal structures. The rock features at the main entrance are shifted west to allow this access to bypass these rock features, so the design of the rockeries would not need to be altered to allow this access.

• **Access Way #3:** Located on the north side of the Ge Garden. The fire access way would extend beyond the service access drive. This would provide fire access to the Square and Peony Pavilions.

• **Access Way #4:** Located to the east of the Five Pavilion Terrace. The fire access way would utilize a portion of an existing road bed, but would also be supported turf to conceal it within the landscape.

**Overall Site Pedestrian Accessibility and Design Recommendations:** ADA accessibility has been provided throughout the site where possible. L-102 illustrates where both accessible and inaccessible pedestrian paths can be accommodated throughout the site. Accessible routes are those routes having gradients from 0%-5%, and 5%-8.3%. Pedestrian paths in excess of 5% gradient require handrails and are considered ramps by code. Accessibility can be achieved throughout the site to every building structure by one or more accessible paths. Paths considered inaccessible are those requiring steps where elevation changes are too great to allow a ramp or gentle grade change without excessive grading. L-102 also illustrates where changes are necessary or recommended to the site layout or grading to make the pedestrian paths accessible. These change recommendations are as follows:

• **Entrance to Mountain House of Sliced Stone Garden:** To retain the original design and architecture, including the steps at this entrance, we are recommending a separate ramp be added to provide accessibility to the main gate. The ramp would be added in a way that keeps the original Chinese design and architecture. The steps would remain. Two additional steps would be needed at this entrance to allow accessibility from Holly Spring Road to the main gate of this garden.

• **Boat Hall:** We are recommending an accessible path be added on the north and south side of Boat Hall. This would provide a flush (smooth) condition at the structure. Openings within the railings would be needed for passage. The original design also shows an opening in the railing on the east side facing the lake. A railing would be needed here for pedestrian safety. To allow pedestrian passage on the north side of Boat Hall, we recommend the west edge of the lake shift slightly east to accommodate this and allow for grading the lake edge.

• **Square Pavilion and Peony Pavilion:** To allow ADA accessibility to these pavilions we are recommending a separate bypass ramp be provided to one side, while retaining the design integrity of the steps on other side. The ramp would slope gently to one side to create a flush condition at the structure. The ramp would be graded at less than 5%, a slope that would not require handrails.

• **Five Pavilion Terrace:** To allow ADA accessibility to Five Pavilion Terrace, an additional path is recommended on the south side of the Pavilion. To retain the elevation relationship between the Five Pavilion Terrace and the lake, and to keep the path at a reasonable length, the path would include several ramps at 8.3% gradient. These would require handrails to comply with ADA code. In addition to the path we are recommending an ADA compliant ramp be added on the east side of the pavilion. This would allow the steps to remain in place on the north and south façade of the structure, preserving the architectural integrity of the design of this structure and its relationship to the landscape.

• **White Pagoda:** ADA accessibility to the White Pagoda can be achieved with a path gradient of less than 5%. This would not require handrails. A slight adjustment to the alignment of this path is recommended to help alleviate the slopes and grading between nearby paths. ADA accessibility would be limited to the main lower terrace of the White Pagoda. Able pedestrians can access the upper overlook via the stairs. It is also recommended the White Pagoda shift approximately two meters to the west to better position it within the evergreen tree clearing in an effort to reduce the amount of grading and additional tree clearing required.
• **Tai-Chi Isle**: After careful review of the design and placement of the Tai-Chi Isle, the American design team recommends the removal of this element for the following reasons:

  - The design team feels the Tai-Chi Isle is not appropriate to the overall design
  - The Arboretum is concerned with maintaining the island, as it would only be accessible by boat.

**Ge Garden Accessibility and Design Recommendations**: ADA accessibility can be achieved within a majority of the Ge Garden and individual structures with minimal modifications to grading and structures. The goal is to provide as much of the garden and its structures accessibility, while minimizing modifications and changes to the current design. Some areas have been identified as difficult, or not achievable for various reasons, or the limits of rocks or paths are unclear in the present drawings. As the design evolves, it will be possible to determine if accessibility can be achieved. All accessible paths within the garden would require a minimum with of .9 m for wheelchair passage. L-103 illustrates the accessible and inaccessible pedestrian paths throughout the garden as well as recommendations for changes or modifications to the existing design to achieve this, and as follows:

• **Main Entrance Gate**: The current design plans indicate steps at the bamboo entrance. We recommend the steps be removed and the pavement be made flush at these conditions. Path widths between rockeries are shown at .9 m (36”) to accommodate wheelchair passage. This clearance would apply throughout the garden between the rockeries and planting areas where we recommend accessibility.

• **Finding Phrase Pavilion**: We recommend providing a flush condition at the path to this pavilion. This would allow wheelchair access. This requires removal of the step, and a gentle grade change or ramp up to the floor elevation of the pavilion. No alterations to the structure would be required.

• **Joyful Rain Pavilion**: We recommend providing two flush condition access points on the east and west sides of the pavilion. This would allow wheelchair access. A gentle grade change or ramp up to the floor elevation of the pavilion is shown. No alterations to the structure would be required.

• **Breezy and Moonlit House**: We recommend providing one flush condition access point on the north side of the house. This would allow wheelchair access. No alterations to the structure would be required.

• **Crane Pavilion**: It appears that accessibility to this pavilion can be achieved. The plan is unclear as to the surface paving conditions to determine if accessibility can be achieved directly under the pavilion structure.

• **Gentle Ripple Pavilion**: We recommend providing a flush condition access point on the east and west side of the pavilion. This would allow wheelchair access. A gentle grade change or ramp up to the floor elevation of the pavilion is recommended. A minimum opening at the structure would need to be .9 m (36”) to allow passage of a wheelchair. The path leading to the pavilion would also need to meet the .9 m width.

• **Embracing Mountain Pavilion**: We recommend providing two flush condition access points on the east and west side of the pavilion. This would allow wheelchair access. This would require removal of the step(s) at these locations and a gentle grade change or ramp up to the floor elevation of the pavilion. The steps would remain to preserve the architectural character along the main elevation facing the garden.

• **Touching Cloud Pavilion**: We recommend keeping the steps to this pavilion, which would therefore be considered inaccessible. Providing accessibility to this pavilion we feel would compromise and diminish
the design integrity of the pavilion and its placement within the garden. Incorporation of an edge treatment would need to be considered as the pavilion is designed to provide a protective edge between the pavilion and path below.

**Mountain House of Sliced Stone Accessibility and Design Recommendations:** ADA accessibility to and within much of this garden can be achieved with minimal alterations. Recommendations include removal of steps to create flush conditions, to allow wheelchair access, and adding ramps to areas where steps are considered important to retain to respect the classical Chinese design. The goal is to provide accessibility to as much of the garden and its structures as possible, while minimizing modifications and changes to the current design. Due to the nature of the traditional classical design of the rockeries within the northern portion of the garden, and the challenges to make them accessible, we recommend this area be off limits to visitors to retain its classical Chinese Garden character. This portion of the garden would be viewed as a carefully composed scene or art piece, separated by an ornamental rope from access by visitors. L-104 illustrates the accessible and inaccessible pedestrian paths throughout the garden as well as recommendations for changes or modifications to the existing design to achieve this, and as follows:

- **Gate of Mountain House of Slice Stone:** We recommend adding a side ramp to the gate to provide wheelchair access. The ramp would be added to the exterior of the gate to keep the architecture and character of the gate design intact including the steps from the main path. Additional steps would be needed to allow accessibility from Holly Spring Road to this main entrance. We also recommend eliminating the 150 mm (6") step down to the interior of the garden to allow wheelchair access. The traditional threshold at the gate would remain. It is recommended the design team consider options for removable thresholds at all gate and pavilion doors to allow wheelchair accessibility throughout the garden pavilions while respecting the historic and cultural intent of the threshold.

- **Reflection Room:** We recommend providing a flush condition where the corridor meets the Reflection Room. This would allow wheelchair access. This would require adjusting the elevation of the corridor to meet the elevation of the Reflection Room floor.

- **Nanmu Hall:** We recommend providing two flush condition access points on the north and south side of the pavilion. This would allow wheelchair access. This would require removal of the step(s) at these locations and a gentle grade change or ramp up to the floor elevation of the pavilion.

- **Flat Bridge:** We recommend providing a protective element to the edge to the south side of the bridge. This could be a bench to reflect the current design on the north edge. This would provide some protection or guard for pedestrians and wheelchairs.

- **East Corridor:** We recommend providing three flush condition access points on the east edge of the corridor. This would allow wheelchair access. Raising the grade up .07 m (2.75") to the edge of the corridor at the three locations is suggested.

**Site & Landscape Lighting**
A preliminary assessment of the site lighting for the site and gardens was prepared. The intent of lighting the National China Garden is to provide a design that is harmonious with authentic Chinese cultural standards while complying with local United States codes and regulations. The general lighting approach for the site is to allow visitors to safely navigate throughout the site, highlight significant architectural and landscape details, and provide an engaging and visually dynamic experience. This will be achieved by carefully selecting lighting fixtures, locating them at pathways, bridges, landscaping, parking areas, and the exterior of structures. Collaboration between the Chinese and US design teams will be required to coordinate light fixtures selected by the US team, and those to be provided by the Chinese team.
Lighting Code Requirements

Code requirements will govern how specific areas of the site will need to be illuminated, including ADA accessible paths, and emergency access ways for fire and medical emergency purposes. See attached Code Requirements. While working to maintain cultural authenticity, it is critical to ensure compliance with all local codes and regulations. Nighttime outdoor illumination should be based on the expected level of activity as well as the ambient conditions of the location, with light levels responding to varying activity levels in order to maintain effects of light on the outdoor night environments and reduce energy use.

Lighting within parking areas must meet code requirements for safety and security and circulation (path) and security lighting must provide adequate levels to allow for safe egress. Obtrusive lighting must also be considered, making sure to position and aim lighting in a way that does not allow for light trespass onto surrounding areas. Lighting controls can also be utilized to create a time schedule to decrease light during late night hours, which help reduce unnecessary energy consumption.
Landscape Lighting
Taking into account relevant codes and regulations, careful consideration must be given to all landscape elements present, including softscape (trees, shrubs, flowers, and other plant material) and hardscape (rocks, cliffs, sidewalks, stairs, benches, planters, etc) and water features, in order to create a balanced composition. Varying color temperatures and levels of brightness will be used in order to create depth and visual interest. Collaboration must occur between the lighting designer and landscape architect and Chinese design team in order to determine characteristics of plant material as well as factors dictating selection and location of fixtures and equipment. While lighting is imperative to interaction with the garden at night, fixtures will still be visible during the daylight hours so it is important to integrate them into the landscape to make them less conspicuous.
Landscape and Structure Lighting – Precedent Images
Landscape and Structure Lighting – Precedent Images
Landscape and Structure Lighting - Approach
Landscape and Structure Lighting – Precedent Images
Landscape and Structure Lighting – Precedent Images
Plant List Analysis
A plant list was provided to the US team by the Chinese team in July. An initial assessment of the plant list was prepared in order to determine species availability in the United States, and possible substitutions of those plants that are unavailable commercially or difficult to find.

The attached spreadsheet lists all of the plants from the list provided by the Chinese team. Our analysis indicates whether these plants are readily available or not, and if not, what possible substitutes are. The American design team wishes to be thoughtful about substitutes and to avoid the appearance that we are trying to make the plant list generic with only plants that are easily available.
As we move into the next design phase, it will be important for the team to discuss several points related to planting. Our observations on this issue are below.

Philosophy of garden plantings - will the garden be:

1. A Chinese garden that features exclusively Chinese species?
2. A Chinese garden in America that explores the close relationship between Chinese and America’s shared horticultural heritage? Here a mix of Chinese and American species can be featured to show the close climatic conditions that both countries share. This would focus on American species of popular Chinese genus.
3. A Chinese garden that celebrates the Chinese species that have been widely adopted in America? This would focus on commercially available species, but avoid American species.

Consideration should be given to species that are not available in the U.S., and if they could be imported from China. This should be discussed in light of cost, regulatory, and schedule implications

Our team feels that the concept and interpretive intent of the Chinese team’s design should guide the planting design, rather than relying only on what is currently available in the commercial nursery trade in the U.S. We look forward to discussing this in collaboration with the Chinese team when we are in China and as the design goes forward.
# Plant List Analysis

**National China Garden**

*Items in yellow: plants that are unavailable commercially in the U.S., or difficult to find.*

<table>
<thead>
<tr>
<th>Plant List from Chinese Team</th>
<th>Readily Available</th>
<th>Possible Substitute</th>
<th>Possible Substitute</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Zelkova schneideriana</td>
<td>Difficult to find</td>
<td>Zelkova serrata</td>
<td></td>
<td>Brilliant wine red color of Schneider Zelkova</td>
</tr>
<tr>
<td>2. Aesculus chinensis</td>
<td>No</td>
<td>Aesculus pavia</td>
<td></td>
<td>Procurement will be difficult in the sizes shown.</td>
</tr>
<tr>
<td>3. Gingko biloba</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Salix x aureo-pendula</td>
<td>Possibly</td>
<td>Salix matsudana ‘Tortuosa’</td>
<td>Salix matsudana ‘Golden Cascade’</td>
<td>May require mail order</td>
</tr>
<tr>
<td>5. Fraxinus chinensis</td>
<td>No</td>
<td>Fraxinus pensylvanica ‘Patmore’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Acer buergerianum</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Acer mono Maxim</td>
<td>No</td>
<td>Acer saccharum ‘Legacy’</td>
<td>Acer pensylvanica</td>
<td>No American species is exact match</td>
</tr>
<tr>
<td>8. Metasequoia glyptostroboides</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Cryptomeria fortunei</td>
<td>No</td>
<td>Cryptomeria japonica ‘Yoshino’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Celtis tetranda ssp. Sinensis</td>
<td>No</td>
<td>Celtis occidentalis</td>
<td>Celtis laevigata</td>
<td>Available as a crop plant; large ornamental sizes will likely not be available. Does better in Zone 8 though can possibly survive Zone 7</td>
</tr>
<tr>
<td>11. Diospyros kaki</td>
<td>Yes</td>
<td>Diospyros virginiana</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Wisteria sinensis</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Cedrus deodara (Roeb)</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Pseudolarix kaempferi (Gord.)</td>
<td>Difficult to find</td>
<td></td>
<td>Needs to be sited in protected spot.</td>
<td></td>
</tr>
<tr>
<td>15. Pinus thunbergii Parl.</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Plant Name</td>
<td>Design</td>
<td>Common Name</td>
<td>Scientific Name</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------------</td>
<td>--------</td>
<td>------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>16</td>
<td>Sapindus mukurossi Gaertn</td>
<td>No</td>
<td>Sapindus drummondii</td>
<td>Sophora japonica 'Regent'</td>
</tr>
<tr>
<td>17</td>
<td>Koelreutia paniculata</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Liquidambar formosana Hance</td>
<td>No</td>
<td>Liquidambar styraciflua</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Acer palmatum cv Atropurpureum</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Magnolia liliiflora</td>
<td>Difficult to find</td>
<td>M. 'Anne', 'Betty', 'Jane', 'Judy', 'Pinkle', 'Randy', 'Ricki', and 'Susan'</td>
<td>M. liliiflora is the parent of many Magnolia cultivars, including the USNA 'Little Girl' hybrids</td>
</tr>
<tr>
<td>21</td>
<td>Magnolia x soulangeana</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Prunus persica duplex</td>
<td>Yes</td>
<td>Prunus persica 'Alba Plena'</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Prunus triloba Linni</td>
<td>Difficult to find</td>
<td>Prunus serrulata 'Kwanzan'</td>
<td>Prunus sargentii 'Acolade'</td>
</tr>
<tr>
<td>24</td>
<td>Prunus lannesiana Wils.</td>
<td>No</td>
<td>Prunus serrulata 'Kwanzan'</td>
<td>Prunus sargentii 'Acolade'</td>
</tr>
<tr>
<td>25</td>
<td>Rosa rugosa</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Malus halliana</td>
<td>Difficult to find</td>
<td>Malus 'Narragansett' (USNA)</td>
<td>Malus 'Donald Wyman'</td>
</tr>
<tr>
<td>27</td>
<td>Chaenomeles speciosa</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Cercis chinensis</td>
<td>Yes</td>
<td>Cercis canadensis</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Syringa obdata</td>
<td>Yes</td>
<td>Cultivars 'Betsy Ross,' 'Declaration,' &amp; 'Old Glory'</td>
<td>Plants in U.S. cultivation tend to be from the variety dillototo</td>
</tr>
<tr>
<td>30</td>
<td>Viburnum sargentii</td>
<td>Yes</td>
<td>Onondaga' &amp; 'Susquehanna' (USNA introductions)</td>
<td>Hypericum calycinum Hypericum kalmianum</td>
</tr>
<tr>
<td>31</td>
<td>Hypericum chinensis</td>
<td>No</td>
<td>Hypericum calycinum</td>
<td>Hypericum kalmianum</td>
</tr>
<tr>
<td>32</td>
<td>Jasminum floridanum</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Osmanthus fragrans</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Plant Name</td>
<td>Procurement</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------</td>
<td>---------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Chimonanthus praecox</td>
<td>Yes</td>
<td>Difficult but not impossible to procure</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Camellia sasanqua</td>
<td>Yes</td>
<td>Exact cultivars should be discussed</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Jasminum nudiforum</td>
<td>Yes</td>
<td>Southern nurseries more likely to carry</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Prunus mume</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Edgeworthia chrysantha</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Pyracantha fortuneana</td>
<td>No</td>
<td>Pyracantha koidzumii Pyracantha coccinea</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Ilex cornuta</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Buxus sinica</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Distylium racemosum</td>
<td>Difficult to find</td>
<td>Bringing a few dwarf cultivars on market. 'Emerald Jade' may be acceptable, but discussion is needed to understand its full height.</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Rosa hybrida</td>
<td>Yes</td>
<td>Many hybrids. Discuss design intent</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Photinia serrulata</td>
<td>No</td>
<td>Photinia serratifolia Viburnum 'Chindo' Uncommon, but worth finding</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Fatsia japonica</td>
<td>Yes</td>
<td>At the northern end of its range. Plant in sheltered spot.</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Pleioblastus angustifolius</td>
<td>No</td>
<td>Pleioblastus linearis May require mail order. Consider barrier to control spreading of bamboo</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Nelumbo nucifera</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Nymphaea tetragona</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Differences between the 2007 USNA Master Plan Concept Plan and the (15%) Design Plan

- **Overall Program and Layout:** The development footprint of the 2007 Master Plan concept occupies a larger area than the 15% concept. The 15% concept includes a similar program, based on traditional Chinese garden precedents, yet a more compressed layout that reduces the extent of land disturbance and grading. The 15% concept also includes fewer support facility buildings, as described below.

- **Holly Spring Road Setback:** The 2007 Master Plan concept shifts Holly Spring Road westward and does not include a buffer from Holly Spring Road. The 15% Concept includes a 100-foot setback from Holly Spring Road to allow space for buffer plantings, and does not shift Holly Spring Road.

- **Restroom support Buildings:** The 2007 Master Plan concept includes two stand-alone restroom buildings and one support services building. The 15% concept consolidates these facilities into a single building.

- **Lake:** The 2007 Master Plan concept includes a larger lake than the 15% concept.

- **Parking** The 2007 Master Plan concept includes one larger parking lot (24 spaces) off Holly Spring Road and handicap parking (2 spaces) at the east end of the garden. Based on the Chinese team’s most recent revisions, the 15% concept includes three smaller parking lots: a visitor parking lot (approximately 10-12 spaces), a staff parking lot (approximately 6 spaces), and a service parking lot (approximately 5-6 spaces), consolidated on one side of the site.

- **White Pagoda Location:** In the 2007 Master Plan concept, the White Pagoda is located at a higher elevation and in a vegetated area. The 15% concept locates the White Pagoda in a clearing to minimize tree disturbance, and at a lower elevation than the 2007 concept.

- **Breeze Pavilion:** In the 2007 Master Plan concept, a Breeze Pavilion was proposed at the top of the hill to the east. This pavilion and associated pathways have been eliminated from the 15% concept plan.

- **Grading:** Regrading in the 15% concept is expected to achieve a cut-and-fill balance.

- **Paths** The locations and alignments of paths were modified in the 15% concept, in order to improve accessibility throughout and minimize grading and disturbance to vegetation.
Environmental Assessment: Second Build Alternative

As recommended by NCPC staff in NEPA scoping comments and in subsequent conversations, the design team has been refining a second Build Alternative to be analyzed in the EA along with the concept previously detailed as part of this concept submission. A preliminary sketch of this additional alternative is shown in the accompanying figure.

Developed with input from the Chinese design team, this alternative responds to comments received from review agencies to date. Major variations from the original concept include the following:

1. **A relocated Maintenance Building**, now located in the northwest corner of the site.

2. **Consolidated parking and new service/maintenance access** in the vicinity of the relocated Support Services Building. Combined with the relocated Support Services Building, the new parking and access configuration is intended to address NCPC staff recommendations to consolidate parking and minimize the number of curb cuts along Holly Spring Road.

3. **An alternate location for the White Pagoda**, moved out of the existing clearing and into the woods at a similar elevation. The alternate location for the pagoda responds to concerns about the potential historic significance of the viewshed through the existing clearing from the Hickey Hill overlook.

4. **Inclusion of a designated overflow parking area** on supported grass to address parking needs, as needed, without adding another permanent parking lot and with simple rollover cuts for access.

5. **An additional restroom**, incorporated within the Mountain House of Sliced Stones complex, to compensate for the relocation of the Support Services Building (with internal restroom) to the northwest corner of the site. The additional restroom ensures that restrooms are conveniently located for garden visitors and for those attending classes or other events.
VI ARCHITECTURE NARRATIVE

OVERALL
The Design of the National China Garden features borrowed elements from several of the most representative classical Chinese gardens in the cities of Yangzhou, Suzhou and Hangzhou. The arrangement and recomposition of all these elements not only represents the traditional and classic ways Chinese garden makers have employed in their garden making over the years but reflects the philosophies that have deeply influenced the Chinese culture until today such as Taoism, Confucianism and Buddhism.

The National China Garden presents three prevalent types of classical Chinese gardens. The first type is private residential gardens. This type of garden was usually formed in the backyards of people of higher social status such as high officials, wealthy merchants or prominent scholars. These gardens are not necessarily grand in scale but the variety of ways to handle the architecture, garden spaces, paths, views, rocks, ponds and plants make the visitors' experience extremely rich. The second type is a garden close to major water bodies. This type is originated from royal gardens as the emperors and queens could afford to build extensive terraces and corridors, besides pavilions, on the edge of the lakes. Such gardens typically feature magnificent views over the water and beyond. The third type is a garden in woods. These gardens usually feature a single structure that is partially hidden behind the trees but also partially visible from afar. This partial visibility allures visitors to explore. Structures in such gardens are typically sited on hills. They reward visitors with commanding views.

GE GARDEN
Ge Garden replicates most of the four-season garden part of the original Ge Garden existing now in Yangzhou, China. The Ge Garden in Yangzhou was the private garden of Huang Zhijun (1770-1838) who was a prominent merchant in salt business in Qing Dynasty (1644-1912). He also earned his reputation as a talented painter. Huang was very fond of bamboo and the Chinese character for Ge is “个” which looks very much like the bamboo leaf. This was why Ge became the name of his garden. The Ge Garden in the National China Garden, as its precedent, features four main sections designated as four seasons with different rockeries and pavilions associated with spring, summer, fall and winter. Ge Garden represents Chinese residential gardens of grand scale.

Spring section of Ge Garden starts from the entrance of the whole garden complex. There are two raised planters forming a passage way between which leads toward the moon gate of the garden. Among the bamboos in these planters are some stones with shape of “bamboo shoots” growing out of the grass adding more to the spring scene. To the left of the moon gate, there tucked in the corner is the Finding-Phrase Pavilion. The name comes from the time the owner would spend in composing poems to express his excitement for the coming spring. Finding-Phrase Pavilion has corridors wrapping around its east and west facades, extending along the garden walls, pointed toward the other parts of the garden.
Summer section of Ge Garden is anchored by the Joyful-Rain Pavilion located at the central part of the garden. In traditional Chinese architecture term, this pavilion is called four- façade pavilion which means every façade is important and furnished with transparent screens open to the views all around. When it rains, people can take a shelter in this pavilion and still enjoy the beauty of nature. To the northwest of Joyful-Rain Pavilion is the Summer Mount made by layers and layers of gray shade rocks put on top of each other. The Summer Mount also looks like a big cloud and there is a stone bridge going into a cave in this mount. People can have a cool time there in the hot summer days. There is a tunnel through the cave and there are steps leading up to the top of the Summer Mount where the Crane Pavilion perches. From the top of the Summer Mount visitors can go to the upper level of the Embracing-Mountain Building which is part of the Fall section of Ge Garden.

Fall section of Ge Garden is composed by the Embracing-Mountain Building and the Fall Mount. Embracing-Mountain Building is the only two-story building of the National China Garden and is also the largest one. It flanks along the north part of the Ge Garden from west to east. It not only serves as the backdrop for the whole Ge Garden, but also functions as the space for various programs and activities when the National China Garden opens to the public. Given its position and size, it shields well other components of the Ge garden from the chilly wind in the winter time from the north. From the long porch at the second floor, visitors can have a commanding view over the entire Ge Garden. The spectacular colonnade leads to the Touching-Cloud Pavilion to the east that sits on the top of the Fall Mount. The Fall Mount is no smaller than the Embracing-Mountain Building and consists of rocks of square and stout shape. The Touching-Cloud Pavilion provides the highest point for people to view the Ge Garden and beyond on the top of the brown rock hill, the name of this pavilion helps with the imagination that you are so up high that you can touch the clouds already below you.
Winter section of the Ge Garden is the next one after the Fall section clockwise on the plan. It is composed of the Breezy-and-Moonlit House and the Winter Mount. The house originally served as the reception place for the hostess of the Ho family to meet her female guests. One special feature of the architecture of the Breezy-and-Moonlit House is that all the columns in the room are of square shape as “squareness and cleanness” is a good virtue sought after in the ladies of the old China. The Winter Mount is a cluster of white-color rocks stacked against the south wall of Ge Garden. In the shade behind the wall, the rocks would look like piles of snow that never seems to melt. Under the moon light, the “snow” would look even whiter and colder, especially with the winter wind whistling through the round holes on the wall. Despite all this “coldness”, the Spring section is right within the sight again to the west. The four-season cycles never end in the Ge Garden.
MOUNTAIN HOUSE OF SLICED STONES
The Mountain House of Sliced Stones is also a replicate of a garden with the same name existing now in Yangzhou, China. It is said to be originally built by Shi Tao (1641-1718). He was from the royal family of Ming Dynasty (1368-1644) and had to convert to a monk to avoid persecution when Qing Dynasty (1644-1912) started to take power all over China. The style of this garden exemplifies how to make a garden of modest size feel big and rich in experience.

Reflection Room serves as the study room of a scholar. This is the place for the owner to read books and ponder about life. In traditional Chinese culture, a well-educated person should be good at four things: Chinese harp (Guzheng), Go game (Weiqi), calligraphy and painting. Here in the Reflection Room (Study), there will be a well where the sound of flowing water is like the melody from a harp; a tree stump with a Go game grid; a reading desk and a window framing a beautiful view into a picture.

Nanmu Hall is located at the central part of the Mountain House of Sliced Stones. It was the living room where the owner would meet his visitors. This pavilion will now serve as a photo-op space for people and features fine traditional Chinese furniture made of various rare-to-find wood.
Corridors are special space making elements in the Mountain-House of Sliced Stones. The West Corridor that stretches from north to south connects the rockeries, the gate and the Reflection Room. The East Corridor extends from the West Corridor and links it to the Nanmu Hall. Outer East Corridor serves as the transition space from the inner part of the Mountain-House of Sliced Stones to the outside of the compound. Besides connecting spaces, these corridors also frame views, shelter visitors and enrich their walking experience.

GARDEN ON LAKE
Garden on Lake consists of several pavilions, structures and scenic areas around the main lake. They are Boat Hall, Zigzag Bridge, Fish-Viewing-in-Flowers, Floating-Fragrance Hall, Bird-Listening-in-Willows, Cascade, Peony Garden and Cultural Corridor.

Boat Hall is a replicate of the Boat Hall in Yangzhou. It is a transition point from residential garden area to the open-space garden area. Its name comes from the feature that the building platform is half on the land and half in the water. It will mainly serve as a tea house in the National China Garden where people can drink tea while enjoying the views toward the lake and beyond. Boat Hall can also hold small-scale lectures.

Zigzag Bridge is part of the trail along the lake and runs across a small cove of water. Its zigzag shape provides good water frontage where people can feed the koi fish in the water. For this reason, this area is also one of the best places to do Fish-Viewing-in-Flowers in the National China Garden.
Floating-Fragrance Hall in the National China Garden is a moderately enlarged replicate of a pavilion with the same name in Suzhou, China. The fragrance is floating from the lotus flowers and water lilies planted in the lake in the form of Tai-Chi pattern. Lotus flowers have always been a symbol of good character in Chinese culture and there is a saying: they grow from the silt but not stained. This pavilion will serve as a classroom for people to learn about poetry, painting and other Chinese art.

Bird-Listening-in-Willows is a re-creation of a renowned scene on West Lake, Hangzhou. There will be willow trees planted on the lake edge along the trail. In addition to the chirping birds, people will also enjoy the sound of water flowing down from a small Cascade.
Cultural Corridor provides a sweeping view toward the lake on one side as visitors move between Peony Pavilion and Square Pavilion. The other side of the Cultural Corridor is a wall decorated with Chinese calligraphy and artifacts with motif related to the big rivers in China. Adding to the “dot” forms of Boat Hall and Floating-Fragrance Hall, Cultural Corridor features a “linear” form decorating the lake shore.

URBAN FOREST
Nested in the trees on the west side of the hill are the White Pagoda and the Five-Pavilion Terrace in the Urban Forest. They are of distinctively different forms and add more interest in the landscape in the National China Garden and the National Arboretum.

White Pagoda takes the form of an existing pagoda on Slender West Lake of Yangzhou. This type of pagoda originates from the Stupa of Buddhism and shows the deep influence of Buddhism on the Chinese Culture. The White Pagoda in Yangzhou is famed for its pleasing proportion.
**Five-Pavilion Terrace** borrows the architectural elements from the Five-Pavilion Bridge in Yangzhou, China. There are five pavilions sitting on a platform with four at the corners and one in the center. From afar, this structure would also look like a booming lotus which is a much cherished flower in Taoism. Five-Pavilion Terrace symbolizes the influence on Chinese culture by Taoism which emphasizes the union of human and nature.

**ARRANGEMENT OF OBJECTS AND VIEWS**
In traditional Chinese garden design, it is important to arrange or take advantage of various objects in views from near to far. For example from Boat Hall, visitors will look out and view sceneries in different layers from relatively close object (Floating-Fragrance Hall) to things far away (White Pagoda and Five-Pavilion Terrace) with hills and trees as the backdrop. From Floating-Fragrance Hall, there is Tai-Chi Isle of lotus flowers in the near view and Cultural Corridor in the distance. From Cultural Corridor, visitors can have ever-changing views toward different objects while moving in the corridor space.

**SUPPORT SERVICES BUILDING**
The Support Services Building is located at the northwest corner of the project site (building alternative 2) with parking at the front for the visitors in need and parking at the back for the staff. It functions as the maintenance center of the National China Garden. It uses traditional Chinese architectural language for the exterior while the interior is fully equipped with modern amenities for office use. The basement space is for various mechanical, electrical equipment serving not just this building but the water system for the lake.
VII MEP DESIGN NARRATIVE

A. HEATING VENTILATING AND AIR CONDITIONING:

1. Inside Design Conditions for the Support Services Building and the Embracing-Mountain Building:

   Summer 73°F±2°F/50% RH ±10%
   Winter 72°F±2°F (No Humidity Control)

2. Inside Design Conditions for all of the other seven (7) enclosed buildings consisting of the Boat Hall, Floating-Fragrance Hall, Joyful-Rain Pavilion, Breezy-and-Moonlit House, Finding-Phrase Pavilion, Reflection Room, and Nanmu Hall

   Summer Natural Ventilation *
   Winter 50°F±2°F (No Humidity Control)

   * No air conditioning or mechanical ventilation will be provided for these seven (7) enclosed buildings. Each of these seven (7) enclosed buildings will have operable windows to be used for natural ventilation.

3. Outdoor Conditions:

   Summer 95°F DB for outdoor ambient
          93°F DB/75°F WB Coincident
   Winter 10°F DB

4. Lighting:

   Support Services Building 1.0 watts/square foot (100% to space)
   Embracing-Mountain Building 1.0 watts/square foot (100% to space)

5. Equipment or Receptacle Load:

   Support Services Building 2.5 watts/square foot
   Embracing-Mountain Building 0.5 watts/square foot

6. Occupancy:

   Support Services Building 1 person/200 useable square foot
   Embracing-Mountain Building 1 person/30 useable square foot

7. Perimeter Skin Heat Transfer Values (applies only to the Embracing-Mountain Building and the Support Services Buildings):

   a. Glass SC = 0.35 to 0.36
   b. Glass U = 0.30 to 0.40
   c. Wall and Spandrel U = 0.07 to 0.08
   d. Roof U = 0.05 to 0.06
8. **HVAC systems for the Support Services Building:**

   a. **Heating and Cooling Equipment:** The spaces will be heated and cooled by a variable refrigerant flow heat recovery system consisting of multiple indoor terminal units, one (1) branch selector controller, and one (1) outdoor heat recovery unit. The indoor terminal units will be ducted horizontal style with direct drive ECM fans, minimum 80% efficient MERV 13 replaceable media type filters, expansion valves, integral condensate pumps, and controls. The outdoor heat recovery unit and the branch selector controller will allow multiple indoor terminal units to be in heating mode or cooling mode simultaneously (e.g. the conference room may be in cooling while the offices are in heating). The outdoor heat recovery unit shall be located within approximately 300 feet from the building. Refer to Drawing M0-0.0 and M5-1.1 for additional information.

   b. **Ductwork and Air Distribution Devices:** Air will be supplied through internally lined or externally insulated ductwork. Ductwork will be in accordance with SMACNA guidelines. Supply diffusers will typically be 24" x 24" louvered or perforated face diffusers, slot diffusers, or linear diffusers depending on the architectural requirements of the space and type of ceiling construction.

   c. **Return Air:** Air will be returned to the ceiling plenums through heat extract type light fixtures, return air grilles, and through either combination supply/return air slot diffusers at the perimeter curtain wall or through architectural return air slots.

   d. **Outside Air and Exhaust/Relief Air:** Outside Air will be filtered and pre-conditioned (cooled, dehumidified and heated) through an outside air handling unit located in the Level B1 mechanical room and outdoor condensing unit located within approximately 100 feet from the outside air handling unit. Outside air will be drawn in from an outside air intake louver located at least 12” above grade and at least 10 feet from the exhaust/relief air louver. The intake louver shall have 3 square feet minimum free area (approximately 36” x 24” with a 50% free area louver). Outside air will be distributed to the inlet of each of the indoor terminal units. Filtration system will consist of minimum 80% efficient MERV-13 filters. Exhaust/Relief air will be discharged through an exhaust/relief air louver located at least 12” above grade and at least 10 feet from the outside air intake louver. The exhaust/relief louver shall have 2 square feet minimum free area (approximately 24” x 24” with a 50% free area louver).

   e. **Indoor Terminal Unit Zoning:** Each indoor terminal unit will constitute a separate thermostatically controlled zone of temperature control.

   f. **Ductwork and Equipment Insulation Liner:** Internally lined ductwork and equipment will be minimized for indoor air quality purposes and limited to select areas within the HVAC system necessary for acoustic purposes. Ductwork, air handling units and terminal units with internal insulation will have a cleanable 24 gauge perforated metal liner that separates insulation fibers from the air stream. All other supply air ductwork that is not internally insulated will be wrapped with external insulation.
9. **HVAC systems for the Embracing-Mountain Building:**

   a. **Heating and Cooling Equipment:** The spaces will be heated and cooled with two (2) split system air handling units (AHU) and two (2) outdoor heat pumps; one (1) AHU will serve Level B1 and Level 1, and one (1) AHU will serve Level 2. Each air handling unit will be a ducted horizontal unit with a constant volume supply fan, DX cooling coil, electric heating coil, expansion valve, minimum 80% efficient MERV 13 replaceable media type filters, mixing section with integral outside air and return air dampers, integral condensate pump, and controls. The outdoor heat pump shall be located within approximately 100 feet from the air handling unit. Refer to Drawing M0-0.0 and M1-6.1 for additional information.

   b. **Ductwork and Air Distribution Devices:** Air will be supplied through internally lined or externally insulated ductwork. Ductwork will be in accordance with SMACNA guidelines. Supply diffusers will typically be bar grilles or linear diffusers depending on the architectural requirements of the space and type of ceiling construction. A 4.5 square foot minimum clear duct chase is required to route supply ductwork from the air handling unit in the Level B1 mechanical room to the floor mounted supply grilles within the Level 2 floor.

   c. **Return Air:** Air will be returned to the air handling units through floor mounted return air grilles. Return ductwork will be routed above the Level B1 ceiling to floor mounted return air grilles within the Level 1 floor. A 4 square foot minimum duct chase is required to route return ductwork from the floor mounted return grilles within the Level 2 floor to the air handling unit in the Level B1 mechanical room.

   d. **Outside Air and Relief Air:** Outside Air will be supplied to the mixing section of each of the two air handling units. The inline outside air fan shall be sized for 3,000 cfm at 0.6” external static pressure. Outside air will be drawn in from an outside air intake louver located at least 12” above grade and at least 10 feet from the exhaust/relief air louver. The intake louver shall have 6 square feet minimum free area (approximately 48” x 36” with a 50% free area louver). Relief/exhaust air will be discharge through an exhaust louver located at least 12” above grade and at least 10 feet from the outside air intake louver. The relief/exhaust louver shall have 2.5 square feet minimum free area (approximately 30” x 24” with a 50% free area louver).

   e. **Terminal Device Zoning:** Each air handling unit will constitute a separate thermostatically controlled zone of temperature control.

   f. **Ductwork and Equipment Insulation Liner:** Internally lined ductwork and equipment will be minimized for indoor air quality purposes and limited to select areas within the HVAC system necessary for acoustic purposes. Ductwork and air handling units with internal insulation will have a cleanable 24 gauge perforated metal liner that separates insulation fibers from the air stream. All other supply air ductwork that is not internally insulated will be wrapped with external insulation.
10. **Heating System for the Seven (7) Enclosed Buildings having Natural Ventilation:**

a. **Underfloor Ducted Forced Air Heating System:** An inline fan with minimum 30% efficiency MERV 8 pre-filter installed upstream of the fan will supply air to a duct mounted electric heating coil prior to discharging supply air to floor mounted supply grilles. The inline fan inlet will be ducted to a floor mounted return grille. The ductwork, sized for 0.08" static pressure per 100 linear feet of ductwork, shall be routed below the floor within a crawl space. Supply and return grilles shall be sized for a Noise Criteria (NC) design goal at or below NC 30. The inline fans shall be selected with 0.75" external static pressure. Access openings or panels will be required to provide maintenance access and service clearance to the fan, electric heating coil, and pre-filter. The size of the inline fan and electric heating coil for each of the seven (7) enclosed buildings shall be as follows.

1) Joyful- Rain Pavilion - 20 kW electric heating coil, 2,000 cfm inline fan  
2) Finding-Phrase Pavilion - 9 kW electric heating coil, 900 cfm inline fan  
3) Breezy-and-Moonlit House - 18 kW electric heating coil, 1,800 cfm inline fan  
4) Reflection Room - 9 kW electric heating coil, 900 cfm inline fan  
5) Nanmu Hall - 15 kW electric heating coil, 1,500 cfm inline fan  
6) Boat Hall - 15 kW electric heating coil, 1,500 cfm inline fan  
7) Floating-Fragrance Hall - 15 kW electric heating coil, 1,500 cfm inline fan  

b. **Unit Heater (Alternate 1):** Electric unit heaters, similar to Markel model 5800 Series can be provided in lieu of the underfloor ducted forced air heating system described above as a cost savings alternate. The electric unit heaters can be mounted on fixed or removable mounting brackets and provided with cord and plug electrical connections for easy removal when heating is not required. The size of the unit heaters for each of the seven (7) enclosed buildings shall be as follows.

1) Joyful-Rain Pavilion - Four (4) unit heaters at 5 kW each.  
2) Finding-Phrase Pavilion - Two (2) unit heaters at 4.5 kW each.  
3) Breezy-and-Moonlit House - Four (4) unit heaters at 4.5 kW each.  
4) Reflection Room - Two (2) unit heaters at 4.5 kW each.  
5) Nanmu Hall - Three (3) unit heaters at 5 kW each.  
6) Boat Hall - Three (3) unit heaters at 5 kW each.  
7) Floating-Fragrance Hall - Three (3) unit heaters at 5 kW each.

c. **Electric Radiant Floor Heating (Alternate 2):** Electric radiant floor heating systems, similar to WarmFloorSource model WarmCable, can be provided in lieu of the underfloor ducted forced air heating system described above as a cost savings alternate. However, indoor electric radiant floor heating input power is limited to 15 watts per square foot of floor space by the UL Listing requirements. Due to the UL Listing input power limits, the buildings will only be maintained at approximately 15°F above the outdoor air temperature (e.g. 25°F room temperature during a 10°F outside air temperature design day). If this is acceptable to the owner, electric radiant floor systems consisting of one thermostat per 100 square foot floor area with 2" cable space and 15 watts per square foot input power would be provided for each of the seven (7) enclosed buildings having natural ventilation. Refer to architectural drawings for the area of each enclosed building. The floor slab will need to be insulated below the electric radiant floor heating system to maintain the heat within each building.

d. **Alternate Heating Systems Considered:**
Multiple heating systems were considered throughout the design process. The above mentioned heating systems were specified to minimize operational costs and maintenance costs, while limiting first cost. The following alternate heating systems were considered, but not included in the design for various reasons as described below.

1) **Ground Source Heat Pumps (Geothermal):** Ground source heat pumps would have a high first cost due to the boring requirements, water cleaning, pumps, piping and accessories, etc. that are required for this system. The maintenance cost and maintenance requirements were also significant factors in this system not being selected as a feasible option to heat the buildings.

2) **Natural Gas Hydronic Heating:** Natural gas hydronic heating would have a higher first cost due to the amount of gas piping that would be required to be routed to each of the heated buildings, as well as the required boilers, pumps, piping and accessories that are required for this system. The maintenance cost associated with the system was also a significant factor in this system not being selected as a feasible option to heat the buildings.

e. **Outside Air:** Outside air for the seven (7) enclosed buildings having natural ventilation will be provided through the use of operable windows having a minimum free area of 4% of the floor area as required by code for naturally ventilated spaces.

11. **Temperature Controls and Energy Management:**

Standalone individual local temperature controls will be provided for the various HVAC systems serving the nine (9) enclosed buildings. This will consist of programmable thermostats to control the indoor terminal units located in the Support Services Building, programmable thermostats to control the air handling units located in the Embracing-Mountain Building, and individual thermostats to control the heating within the seven (7) other enclosed buildings. A centralized energy management and control system is not to be provided.

12. **Overall Building Air Balance:**

The outside air, toilet exhaust, and relief air exhaust systems will be provided and balanced in the Embracing-Mountain Building and the Support Services Building to achieve an overall positive building pressure on each level of the building to minimize infiltration.

13. **HVAC System Acoustics:**

Unless otherwise indicated, the maximum interior Noise Criteria (NC) design goal will be NC 40 throughout the occupied areas within the nine (9) enclosed buildings. Areas located in close proximity to equipment such as areas directly adjacent to the AHU or equipment rooms will have a maximum interior NC design goal of NC 45. All equipment and systems will be designed and selected to meet these NC goals. This criteria does not include noise sources from outside the building.

14. **Elevator Machine Rooms:**
The Embracing-Mountain Building elevator machine room will be conditioned using a 9.5 MBH indoor ductless split system direct expansion air handling unit (similar to Mitsubishi model MS-A09WA) with an outdoor air cooled condensing unit (similar to Mitsubishi model MU-A09WA) located within approximately 100 feet from the air handling unit.

15. HVAC System Selection Summary:

The above mentioned HVAC systems were specified to minimize operating cost and maintenance cost, while limiting first cost and maximizing energy efficiency. The variable refrigerant flow system serving the Support Services Building provides the ability to use heat extracted from air conditioned spaces (e.g. conference rooms) to efficiently heat adjacent spaces that may require heating (e.g. exterior offices). The heat pump units serving the Embracing Mountain Building provide the ability to efficiently and effectively heat the building during moderately cool periods of the year reducing the runtime hours of the less efficient electric heating coils. The specified HVAC systems are not complex and require a limited amount of maintenance without greatly sacrificing energy efficiency.

B. PLUMBING AND FIRE SUPPRESSION:

1. Plumbing Fixtures:

Water closets, urinals, lavatories, services sinks, and other miscellaneous plumbing fixtures as indicated by the architect will be provided in the Service Support Building and the Embracing-Mountain Building. No other building will have plumbing fixtures.

2. Domestic Hot Water:

A 50-gallon 6-kW electric water heater will be provided within the Service Support Building and the Embracing-Mountain Building to provide hot water to the various plumbing fixtures. A recirculating pump shall be provided at each electric water heater to keep the hot water within the lines. Water tempering valves will be provided in the outlet piping from each water heater to supply tempered water to lavatory faucets. No other building will have domestic hot water.

3. Domestic Cold Water:

Domestic cold water will be provided to all plumbing fixtures located within the Service Support Building and the Embracing-Mountain Building. In addition, a domestic cold water line shall be extended into the Boat Hall to serve a water dispenser. Domestic cold water will not be extended into any of the other buildings.

4. Storm Sewer:

Storm roof drainage piping systems will not be required at any building. Architectural gutters and downspouts or other methods of storm roof drainage will be determined by the architect.
5. **Sanitary Sewer:**

A complete system of sanitary sewer waste and vent piping will be provided to each plumbing fixture and drain within the Service Support Building and the Embracing-Mountain Building. The sanitary drainage piping will tie into site drainage system. No other building will have sanitary drainage piping.

6. **Fire Suppression System:**

A combination automatic wet type sprinkler standpipe fire suppression system will be provided to serve the Service Support Building and the Embracing-Mountain Building. The wet type sprinkler system will be a combination fire sprinkler standpipe riser and sprinkler drain riser with floor control valve and firefighter’s fire hose valve connection within each stairwell at each level. An exterior fire department connection will be provided at each of these two buildings to be sprinklered. No other building will have a sprinkler fire suppression system.

C. **ELECTRICAL AND FIRE ALARM:**

1. **Utility Service Entrance and Main Distribution:**
   
a. **Utility Service Entrance:** Electrical service for all of the buildings will be provided by the local utility company via pad-mounted switch and utility transformer located outside of the Support Services Building. Utility service will be 460 volt, 3 phase, 4 wire service. The utility transformer will feed an 800 amp C.T. cabinet and 600 amp service disconnect. This service will feed the 600 amp high voltage panel located within the Support Services Building. Refer to Drawing E6-0.1 for additional information.

2. **Typical Distribution:**
   
a. **High Voltage Panels:** One (1) 42 pole, 265/460 volt, three phase, four wire, main circuit breaker, copper bus, panel will be provided in the Support Services Building and in the Embracing-Mountain Building to serve mechanical equipment, lighting, and other high voltage loads. Branch circuits for high voltage loads located within the remaining buildings on the site will be provided from these panels. Loads in the Ge Garden region and portions of the Garden on Lake region will be served from the Embracing-Mountain Building; loads in the Mountain House of Sliced Stone region will be served from the Support Services Building; loads in the Urban Forest region and portions of the Garden on Lake region will be served from the Floating-Fragrance Hall. Refer to Drawings E1-6.1, E5-1.1 and E6-0.1 for additional information.

b. **Transformers and Low Voltage Panels:** One (1) 75 kVA, dry type 460:120/208 volt three phase, four wire, transformer will be provided in the Support Services Building and in the Embracing-Mountain Building. Each transformer will feed two (2) 42 pole 120/208 volt panels located within each of these buildings. In addition, one (1) 42 pole 120/208 volt panel will be provided in the Floating-Fragrance Hall. Branch circuits for low voltage loads located within the remaining buildings on the site will be provided from these panels. Loads in the Ge Garden region and portions of the Garden on Lake region will be served from the Embracing-Mountain Building; loads in the Mountain House of Sliced Stone region will be served from the Support Services Building; loads in the Urban Forest region and portions of the Garden on Lake region will be served from the Floating-Fragrance Hall. Each panel will include door within door cover, three phase, four wire, copper bus, main
c. **Local Means of Disconnect:** For each building without panelboards, local disconnect switches will be provided to allow the receptacle, lighting, and heating circuits to be turned off for maintenance or service.

3. **Available Electrical System Capacities:**

a. **Lighting:**

   Typical interior space 1.0 watt/square foot  
   Typical exterior spaces 0.2 watt/square foot

b. **Receptacles: 120/208V:**

   Typical interior space 4.0 watt/square foot

c. **General:** These lighting and receptacle capacities are in addition to the electric power requirements needed for mechanical equipment.

4. **Lighting:** Lighting levels will be in accordance with Illumination Engineering Society (IES) guidelines.

   a. **Buildings:** Interior lighting of the buildings on the site will be provided as required by the Architect and the Lighting Consultant.

   b. **Parking Areas:** Pole mounted LED lighting fixtures will be provided for the parking areas.

   c. **Exterior Site and Facade Lighting:** Exterior lighting of the buildings, adjacent areas, and walking paths will be provided as required by the Architect and the Lighting Consultant. Fixtures will be moisture resistant and rated for outdoor temperature conditions.

   d. **Lighting Control:** A limited lighting control system will be provided to control the power circuits serving the interior and exterior lighting. The lighting control system shall provide automatic programmed on-off control via time clock and/or photocell. Lighting controls will be accessed from within the Support Services Building.

5. **Raceways:**

   All power wiring will be in conduit or EMT. The use of AC and MC cable will also be permitted within interior spaces outside of the electrical closets in accordance with the NEC. Direct buried or concrete encased PVC conduits will be utilized for below grade services throughout the site.

6. **Emergency Power:**

   Battery packs shall be provided for emergency egress lighting where required by the IBC and other applicable local codes.

7. **Fire Alarm System:**
A code compliant fire alarm system will be provided within the Support Services Building and the Embracing-Mountain Building. Central control for the fire alarm system will be located within the Support Services Building.

8. **Lightning Protection:**

A Lightning Protection System will be provided for all structures on the site and each structure will be designed to receive an Underwriters Laboratory (UL) master label.

9. **Grounding:**

All grounding shall be in strict accordance with the adopted version of the National Electric Code NFPA 70.

### D. TELEPHONE / DATA:

1. **Service Entrance:**

   Telephone service will be provided to the electrical/IT room located within the Support Services Building. Incoming service raceway shall consist of one 4" conduit.

2. **Buildings:**

   Provisions for telephone connection facilities will be provided within the Support Services Building and within the Embracing-Mountain Building.

### E. ADDITIONAL INFORMATION:

1. **Applicable Code:**

   The complete base building scope of work and related systems as installed on this project shall be in compliance and meet the requirements of applicable local and national codes as adopted and modified by the local code authorities.
VIII  FIRE PROTECTION AND CODE ANALYSIS NARRATIVE

FIRE PROTECTION CODES, REGULATIONS, STANDARDS, GUIDELINES AND CRITERIA

a) Applicable Codes, including, but not limited to:
   v) NFPA Standards that are referenced in the ICC Codes.
   x) Uniform Federal Accessibility Standards (UFAS) 1968 As Updated

b) The Authority Having Jurisdiction (AHJ) for this project is the U.S. Department of Agriculture (USDA). The USDA adopts the ARS Facility Design Standard that is focused on buildings being used for agricultural research services. This project is outside of the scope of the ARS Facility Design Standard therefore it has not been adopted for this specific project.

CLASSIFICATION OF OCCUPANCY AND CONSTRUCTION

a) The garden is divided into several distinct sections. Additional structures are located on the property, but these are treated as un-occupiable art pieces.

b) NFPA 101 will be used to govern the means of egress system. The occupant loading factors of Table 7.3.1.2 will be used. Additionally, an occupant load factor of 2.79 square meters/occupant will be utilized for gallery space which most closely resembles the use in many of these structures. Further, some structures will have a Maximum Occupancy based on programming that is less than the occupant load that would be obtained based solely on the occupant load factor over the area provided.

c) The following occupiable structures and occupancies are part of the Garden space:

   i) Embracing Mountain Building

      (1) The Primary Occupancy Classification for the Embracing Mountain Building is Use Group A-3, Assembly (exhibition hall).

      (2) The building will be classified as a single occupancy building.

      (3) The building is two (2) stories, 10.45 meters in height, and has a maximum building area (footprint) of 562.3 m²; this includes the building, adjacent corridor, and Touching Cloud Pavilion. The building is fully sprinklered, and is permitted to have an increase in allowable height by one (1) story. The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.
ii) Joyful Rain Pavilion

(1) The Primary Occupancy Classification for the Joyful Rain Pavilion is Use Group A-3, Assembly (exhibition hall)

(2) The building will be classified as a non-separated single occupancy building.

(3) The building is one (1) story, 8.25 meters in height, and has a maximum building area (footprint) of 189.2 m². The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.

iii) Breezy and Moonlit House

(1) The Primary Occupancy Classification for the Breezy and Moonlit House is Use Group A-3, Assembly (classrooms)

(2) The building will be classified as a single occupancy building.

(3) The building is one (1) story, 7.55 meters in height, and has a maximum building area (footprint) of 98.5 m². The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.

iv) Finding Phrase Pavilion

(1) The Primary Occupancy Classification for the Finding Phrase Pavilion is Use Group A-3, Assembly (exhibition hall)

(2) The building will be classified as a single occupancy building.

(3) The building is one (1) story, 6.45 meters in height, and has a maximum building area (footprint) of 66.7 m². The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.

v) Gentle Ripple Pavilion

(1) The Primary Occupancy Classification for the Gentle Ripple Pavilion is Use Group A-3, Assembly

(2) The building will be classified as a single occupancy building.

(3) The building is one (1) story, 3.37 meters in height, and has a maximum building area (footprint) of 22.0 m². The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.

vi) Combined buildings

(1) The Joyful Rain Pavilion and Breezy and Moonlit House have a fire separation distance of less than 3.05 meters and fire rated walls between structures is not feasible. When these structures are considered as one building per IBC Section 503.1.2, they have a combined area of 184.3 m². The construction Type VB, Unprotected Wood Frame is still permitted when analyzed as a single building.
d) The following occupiable structures and occupancies are part of the Mountain House of Sliced Stones space:

(1) Nanmu Hall
   (a) The Primary Occupancy Classification for the Nanmu Hall is Use Group A-3, Assembly (exhibition hall)
   (b) The building will be classified as a single occupancy building.
   (c) The building is one (1) story, 7.27 meters in height, and has a maximum building area (footprint) of 144.3 m². The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.

(2) Reflection Room
   (a) The Primary Occupancy Classification for the Reflection Room is Use Group A-3, Assembly.
   (b) The building will be classified as a single occupancy building.
   (c) The building is one (1) story, 5.0 meters in height, and has a maximum building area (footprint) of 55.2 m². The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.

(3) Boat Hall
   (a) The Primary Occupancy Classification for the Boat Hall is Group A-3, Assembly
   (b) The building will be classified as a single occupancy building.
   (c) The building is one (1) story, 8.52 meters in height, and has a maximum building area (footprint) of 171.7 m². The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.

(4) West Corridor
   (a) The Primary Occupancy Classification for the West Corridor is Group A-3, Assembly.
   (b) The building will be classified as a single occupancy building.
   (c) The building is one (1) story, 2.9 meters in height, and has a maximum building area (footprint) of 44.7 m². The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.

(5) Outer East Corridor
   (a) The Primary Occupancy Classification for the Outer East Corridor is Group A-3, Assembly.
   (b) The building will be classified as a single occupancy building.
   (c) The building is one (1) story, 4.87 meters in height, and has a maximum building area (footprint) of 80.7 m². The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.
(6) Combined Buildings

(a) The Nanmu Hall, Reflection Room, Boat Hall, West Corridor, and Outer East Corridor have a fire separation distance of less than 3.05 meters and are connected by open air covered corridors. Based on the functions of these structures, it is not feasible to provide fire rated walls to distinguish them as separate buildings. When these structures are considered as one building per IBC Section 503.1.2, they have a combined area of 516.2 m². The construction Type VB, Unprotected Wood Frame is still permitted when analyzed as a single building.

e) The following occupiable structures and occupancies are located on the remainder of the property:

(1) Floating Fragrance Hall

(a) The Primary Occupancy Classification for the Floating Fragrance Hall is Group A-3, Assembly.

(b) The building will be classified as a single occupancy building.

(c) The building is one (1) story, 7.20 meters in height, and has a maximum building area (footprint) of 183.5 m². The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.

(2) Cultural Corridor

(a) The Primary Occupancy Classification for the Cultural Corridor is Group A-3, Assembly.

(b) The building will be classified as a single occupancy building.

(c) The building is one (1) story, 3.35 meters in height, and has a maximum building area (footprint) of 170.5 m². The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.

(3) Service Building

(a) The Primary Occupancy Classifications for the Service building are:

   (i) Use Group S-1, Storage

   (ii) Use Group B, Offices

(b) The building will be classified as a non-separated mixed-use occupancy building.

(c) The building is one (1) story above grade, with a basement, 7.8 meters in height, and has a maximum building area (footprint) of 278.64 m². The code analysis determined the minimum construction type per 2012 IBC Table 503 with respect to the building use group(s), height and area allowance as Type VB, Unprotected Wood Frame.

OVERVIEW OF THE ACTIVE FIRE PROTECTION SYSTEMS

a) Fire Alarm System

   i) The requirements for a fire alarm system are outlined in IBC Section 907.2.

      (1) For Group A occupancies, when there are more than 300 occupants, a manual fire alarm system is required to activate notification appliances. Manual fire alarm boxes are not required when the building is equipped with an NFAP 13 fire sprinkler system and the notification appliances activate upon water flow.

      (2) For Group B occupancies, a manual fire alarm system is required when any of the following conditions exist: the occupant load from all floors exceeds 499; if there are more than 100 occupants on a floor other than the level of exit discharge; or if there is an ambulatory care facility.
(3) For Group S occupancies, fire alarm systems may be required when high-piled storage is present, which does not apply to any of these buildings.

   ii) A fire alarm system will be provided for the Embracing Mountain Building and Service Building. Notification appliances will be provided and the fire sprinkler systems will be monitored.

b) Automatic Fire Sprinkler System

   i) The requirements for a fire sprinkler system are outlined in IBC Section 903.2.

      (1) For Group A-3 occupancies, an automatic sprinkler system is required when any of the following conditions exist: the fire area exceeds 1115 square meters, the occupant load is greater than 299; or the fire area is located on a floor other than the level of exit discharge.

      (2) For Group B occupancies, there is no specific requirement per Chapter 9 and is only required when stipulated by other code sections.

      (3) For Group S-1 occupancies, an automatic sprinkler system is required when any of the following conditions exist: the fire area exceeds 1115 square meters; the fire area is located more than three stories above grade plane; the combined area of all fire areas exceeds 2230 square meters; the fire area exceeds 464 square meter for storage of commercial trucks or buses; or the storage of upholstered furniture or mattresses exceeds 232 square meters.

   ii) An automatic wet pipe sprinkler system will be provided for the Embracing Mountain Building and Service Building.

PASSIVE FIRE PROTECTION

a) Building Elements

   i) Fire Resistance rating requirements for building elements shall be in accordance with the IBC Chapter 6. All buildings are Type VB Construction. Rating is noted in hours.

<table>
<thead>
<tr>
<th>Building Element</th>
<th>Type VB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Structural frame includes columns, girders, trusses¹ (IBC T-601)</td>
<td>0</td>
</tr>
<tr>
<td>2. Floor Construction, including supporting beams and joists (IBC T-601)</td>
<td>0</td>
</tr>
<tr>
<td>3. Roof construction</td>
<td>0</td>
</tr>
<tr>
<td>4. Bearing² Walls (IBC T-601)</td>
<td>0</td>
</tr>
<tr>
<td>5. Nonbearing (IBC T-602)</td>
<td></td>
</tr>
</tbody>
</table>

Fire Separation Distance³ (FSD): 0 to 3.05 m (10 ft)⁴

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| FSD: Greater than 3.05 m (10 ft) | 1 |
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1 Not less than the rating of the building element supported (IBC 706.4).
2 Not less than the fire resistance rating based on fire separation distance.
3 Fire Separation Distance – the distance measured from the building face to the closest interior lot line, to the centerline of a street alley, or public way, or to an imaginary line between two buildings on the lot.
4 Walls should be rated from both sides where FSD is less than 3048mm (10 ft) (IBC 705.5).
ii) Exterior Wall Openings

1) Maximum area of exterior wall openings as based on fire separation distance and degree of opening protection are as follows (IBC Table 705.8). All openings are unprotected.

<table>
<thead>
<tr>
<th>Fire Separation Distance (FSD):</th>
<th>Unsprinklered</th>
<th>Sprinklered</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to less than 0.91 m (3 ft.)</td>
<td>Not permitted</td>
<td>Not permitted</td>
</tr>
<tr>
<td>0.91 to less than 1.52 m (5 ft.)</td>
<td>Not permitted</td>
<td>15%</td>
</tr>
<tr>
<td>1.52 to less than 3.05 m (10 ft.)</td>
<td>10%</td>
<td>25%</td>
</tr>
<tr>
<td>3.05 to less than 4.57 m (15 ft.)</td>
<td>15%</td>
<td>45%</td>
</tr>
<tr>
<td>4.57 to less than 6.10 m (20 ft.)</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>6.10 to less than 9.14 m (30 ft.)</td>
<td>45%</td>
<td>No limit</td>
</tr>
<tr>
<td>Greater than 9.14 m (30 ft.)</td>
<td>No limit</td>
<td>No limit</td>
</tr>
</tbody>
</table>

b) Fire Resistance Rated Construction

i) Fire Resistance rated construction shall be in accordance with the IBC Chapter 7 and as indicated on the life safety drawings.

ii) The enclosed elevator shaft will be provided with 1-hour fire resistance rated construction and required opening protection.

MEAN OF EGRESS

a) Provide a means of egress that complies with NFPA 101 Life Safety Code (LSC) Chapter 7 requirements.

b) Occupant Load factors will be used based on LSC Table 7.3.1.2 for the function most similar to that presented in the table.

i) Art viewing / Gallery space: 2.79 square meter per occupant, net area

ii) Assembly, Unconcentrated: 1.4 square meter per occupant, net area

iii) Assembly, Concentrated: 0.65 square meter per occupant, net area

iv) Assembly, bench seating: 1 person / 455 linear mm

v) Classroom: 1.9 square meter per occupant, net area

vi) Library, Reading room: 4.6 square meter per occupant, net area

vii) Mercantile, grade level: 2.8 square meter per occupant, gross area

viii) Circulation and business uses: 9.3 square meter per occupant, gross area

ix) Mechanical/Storage: 27.9 square meter per occupant, gross area

x) Some Assembly spaces may have a defined occupant load based on their uses.

c) Egress capacity width factors to be 7.6 mm per occupant for stairways and 5.0 mm per occupant for other egress components (LSC Table 7.3.3.1).

d) The required clear width for egress components shall be as determined by LSC Chapter 7.

e) The means of egress shall be illuminated in accordance with LSC Section 7.8.

f) Exit signs are to be provided in accordance with LSC Section 7.10.