

Appendices

Appendix A: Technical Memorandum #1

Appendix B: Technical Memorandum #2

Appendix C: Determination of Impairment

Appendices A and B contain technical memoranda that were developed as part of the decision making process documented in this EA. Some updates have occurred over time due to changing site conditions or new information. These updates are reflected in the EA document; however the technical memoranda have not been revised to reflect recent changes. The processes documented in these memoranda are now being incorporated into the ongoing design development process for further refinement.

Appendix A: Technical Memorandum #1

Technical Memorandum

To Marla McEnaney, NPS Page 1

CC Jim Jacobs, Bob Moore, Ann Honious, Ed Dodds (NPS); Matt Sutton (Schemmer); Erin Degutis, Joan DeGraff, Rob McGinnis, Roger Courtenay, Alan Harwood (AECOM)

Subject Ash Tree Replacement Short List Technical Memorandum

From Adriane D. Fowler

Date August 4, 2010

1. Introduction and Purpose

This technical memorandum was developed by AECOM for the National Park Service (NPS) as part of the scope of work of the Environmental Assessment (EA) for the implementation of an Emerald Ash Borer Strategy at Jefferson National Expansion Memorial (Memorial). It is intended to be included as an appendix to the EA document and assist NPS in making a final selection from the short list of a replacement tree for the Rosehill ash (see below for background information).

This memorandum documents the outcome of a one-day workshop meeting held at the Jefferson National Expansion Memorial on July 15, 2010 in coordination with the EA. The purpose of the tree selection workshop was to identify a short list of appropriate tree species for replacing the Rosehill ash on the Memorial grounds. The concurrent EA process will assess the impacts of replacing the historic planting with new trees in the same locations.

A significant character-defining feature of the cultural landscape of Jefferson National Expansion Memorial is the single-species allée plantings lining the walkways of the Memorial grounds. Designed by landscape architect Dan Kiley, these plantings were meant

to complement the Gateway Arch; Kiley originally identified tulip poplar (*Liriodendron tulipifera*) as the intended tree species. The planting of more than 900 Rosehill ash (*Fraxinus americana* 'Rosehill') trees were installed by the NPS in 1971 and 1979-80. While the Rosehill ash have generally thrived on the site, these trees are now reaching maturity. More urgently, the entire planting is threatened by the Emerald Ash Borer (*Agrilus planipennis* Fairmaire) (EAB), a wood-boring insect which infests ash trees, causing their decline and eventual mortality. Although EAB has not been confirmed at the Memorial or in the greater St. Louis area it has decimated ash populations elsewhere in the Midwest and is expected to appear in the city within the next few years if current patterns of spreading infestation continue.

This technical memorandum was developed in coordination with an Environmental Assessment (EA) for the implementation of an Emerald Ash Borer Strategy at Jefferson National Expansion Memorial. It is based on the process and outcome of a one-day workshop meeting held at the Memorial on July 15, 2010. The purpose of the tree selection workshop was to identify a short list of appropriate tree species for replacing the 'Rosehill' ash on the Memorial grounds. The concurrent EA process will assess the impacts of replacing the historic ash planting with new trees in the same locations.

2. Background and Methodology

A Microsoft-excel based "tree matrix" was created and developed by Jim Jacobs, Gardener Supervisor, and maintenance personnel at the Memorial, and was refined during a meeting of the EAB Management Workgroup in 2009 in an attempt to identify a list of trees appropriate for replacement of the Rosehill ash. The matrix includes more than 500 trees; while it was developed initially for the purpose of selecting a replacement for the Rosehill ash, it was later expanded to accommodate possible replacement of other tree plantings.

The matrix was provided to and revised by AECOM to reflect criteria prioritizing attributes reflecting Kiley's design intent as identified in the Cultural Landscape Report (CLR) (2010). AECOM's task was to review and use the matrix, with some strategic revisions, to create a defensible process for selecting trees that align to the Kiley design intent. The goal was to narrow down the list from over 500 trees to 40-60 candidate tree species.

2.1. EAB Management Workgroup

An EAB Management Workshop was held in August 2009 to review preservation goals for retaining and perpetuating the planting; develop a process for selecting substitute plants for the ash; draft an action plan for managing the planting based on EAB proximity; and develop recommendations for replacing trees. (See the attached EAB management workgroup summary for additional detail regarding the group's work, including comments and recommendations.)

The initial matrix of potential tree species, developed by Jacobs and his staff, was reviewed and discussed, using a three-step process to begin narrowing down trees for consideration; however, it was decided that the matrix needed to be further developed and enhanced to support making a final determination. The group emphasized the importance of retaining the integrity of Kiley's single-species planting. Participants recommended strategic replacement of missing trees with new ash trees in the immediate term, instead of removing trees one by one without replacement (current practice) or interplanting with different species.

2.2. Tree matrix development for short list selection

This tree selection process continued in 2010 with the task of selecting a short list from a broad selection of trees. The Excel matrix used by the EAB Management Workgroup had been expanded further by Jacobs and staff, and in June 2010, contained over 500 tree species and 75 attribute fields, describing specific characteristics or qualities, for each tree. Part of the expansion of the matrix was undertaken to accommodate possible replacement of other tree plantings besides the Rosehill ash.

The June 2010 matrix has some limitations. Due in part to its complexity, there have been ongoing issues with data entry consistency and completeness, tracking sources, consistency of attributes, and versioning that make some of the information less reliable or difficult to compare. For example, there were more than 40 different abbreviations indicating tree form, making sorting for similarity to Kiley's design form complex. In addition, the matrix includes a large amount of information not relevant for the ash replacement selection.

Using the information already in the table, and referring to Michael Dirr's *Manual of Woody Landscape Plants* (Champaign, IL: Stipes Publishing, 1998) and documented web-based

sources, AECOM revised the table to include consistent categories reflecting the relationship of trees to Kiley's design intent as described in the CLR.

3. Criteria

Criterion 1: Resemblance to Kiley design concept

The first criterion for selection considers the form of the replacement tree in comparison to the Kiley design concept for the allées. Form was the driving force behind Kiley's selection of potential trees for the Memorial landscape, and in particular, for selection of the trees forming the allées along the walks throughout the Memorial grounds.

“Kiley recognized that in the landscape, horizontal dimensions are typically much greater than vertical dimensions. Plants are often used as vertical elements to organize and delineate space. The use of trees closely spaced along the walks in an allée created a deliberate edge and sense of enclosure. The trees, spaced 30 feet on center, formed a dense overhead canopy providing enclosure for the visitor while affording carefully controlled glimpses towards the soaring Gateway Arch. Kiley said in a 1993 interview that he intended the trees to be cathedral-like, to create an “elevated, spiritual feeling.” The use of the same tree throughout the pedestrian path system strengthened the edge and provided visual continuity and fluidity. Kiley stated that the main goal in the landscape design was “to develop a sense of movement of spatial continuity. This was done by arranging undulating lines of high tulip poplar trees spaced very close together so they started from either entrance wide and narrowed down to a neck, and then as one turned to the side elevation of the Arch, the trees would widen up to the base. This development would happen on both sides of the Arch.” (Jefferson National Expansion Memorial CLR, 2010, 4-10)

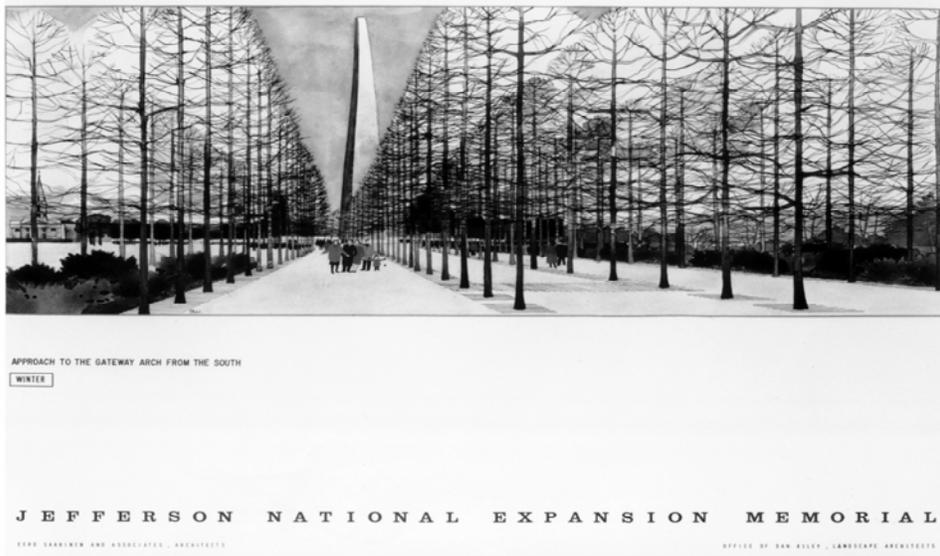
The dense, evenly-spaced triple allées create an enclosed, rhythmically ordered forest space which contrasts with the open space surrounding the Gateway Arch. The uniform height of the trees creates a dense ceiling canopy for the walks. The use of the same tree throughout the pedestrian path system provides visual continuity befitting the Memorial landscape.

“The formal elements of the plaza and the axial, tree lined mall leading to the Old Courthouse are contrasted with the romantic areas on each side of the axis-areas with pools, rock outcroppings, and winding paths. All the lines of the site plan, including the paths and roads, and even the railroad tunnels, have been brought into the same family of curves to which the great arch itself belongs. More and more I believe that all parts of an architectural composition must be parts of the same form-world.” (Aline B. Saarinen, ed., *Eero Saarinen on His Work*, New Haven and London: Yale University Press, 1962, 18)

Design concept drawings illustrate Kiley’s vision for the form of the trees in the allées as tall, straight, single-trunked, columnar to pyramidal, with horizontal branching, and a highly regular shape. The trees are shown as deciduous, with leaves missing in the winter landscape. Shown about 50 feet tall, the trees are limbed up to about 10 feet above the walks. Of course, these artistically depicted trees are not recording a real condition, but an ideal concept. It is very unlikely that an actual tree planting could ever approach the regularity of form and branching that Kiley’s concept embraced.

Kiley stated, “I wanted something that soared up, cathedral-like with big, high trunks” (M. Hughes interview with Kiley, June 8, 1991). He later noted that the elimination of the tulip poplar in favor of a smaller tree “weakened the proportional link between arch and landscape which the scale of the tulip poplars would have established.” (Letter from Kiley to B. Moore, faxed June 26, 1998; on file in Historian’s files, JNEM)

Two images follow from Kiley’s concept drawings of the Memorial grounds, showing the conceptual form of the trees as part of the design:



The trees are identified as Level 1, 2, or 3 under Criterion 1. These values are determined as follows:

Level 1 trees: The highest value is assigned to the trees that Kiley suggested by name for the allée plantings, regardless of other maintenance and horticultural considerations. These include:

- Ginkgo (*Ginkgo biloba*)
- Honeylocust (*Gleditsia triacanthos*)
- Tulip poplar (*Liriodendron tulipifera*)
- London planetree (*Platanus x acerfolia (p. hybrida)*)
- Eastern cottonwood (*Populus deltoides*)

Level 2 trees: The second-highest value is assigned to trees with a form closely resembling Kiley's design concept drawings and descriptions of his intent regarding form, and are adapted from the EAB Management Workgroup and CLR. These are generally described as follows:

- deciduous canopy trees
- 40 to 70 feet in height
- spread that is either half or equal to the height of the tree (Kiley's preferred species have vertical to horizontal proportions of 2:1 or 1:1 generally)
- rounded, upright-oval, or pyramidal habit (no spreading, broad, columnar, vase-shaped forms)
- single, straight trunk (no multistemmed or irregular forms)
- horizontal branching (or close)

Trees were required to have a majority of these characteristics to be considered Level 2. These trees were ranked in a more detailed way by form, once Level 3 trees were eliminated from the list. Trees of same genus and species were grouped, and in a secondary pass through the list, the most suitable cultivars were identified.

Level 3 trees: These trees are removed from consideration for the allée planting due to a lack of resemblance to Kiley's concept. This includes those trees in the matrix which were intended for other types of plant replacement, such as small flowering understory trees, etc.

Criterion 1 is aimed at providing a "short list" of about 40 trees for consideration in the workshop, during which these other criteria will be discussed and applied.

Criterion 2: Critically incompatible characteristics

After limiting tree selection to those that pass Criteria 1 as Level 1 or 2 selections, additional trees will be eliminated from the list based on critical factors that could result in mortality or poor performance for the entire planting. These include such known considerations as:

- incompatible hardiness zone rating
- intolerance of site conditions
- high susceptibility to untreatable and/or fatal plant diseases or pests

Criterion 3: Maintenance considerations

After limiting tree selection to those that pass Criteria 1 and 2, remaining trees will be ranked based on maintenance considerations that, while not critical to the survival of the planting, could result in higher costs or more effort to maintain the overall planting. This includes:

- general susceptibility to treatable diseases and pests
- borderline hardiness and site condition tolerance
- nuisance issues (dropping of fruit or seeds, other inconvenient but manageable issues)

Native trees may be weighted above non-native as a factor in this last selection criterion as well.

4. Selecting the longer list**4.1. Process of applying the 1st criterion**

In advance of the tree selection workshop in July 2010, AECOM staff added information to the matrix to support determination of Criterion 1 attributes (including grouping form into six broader categories; adding categories for horizontal branching, single, straight trunk, and vertical to horizontal proportions of 1:1 to 2:1). The maximum height was capped at 70 feet based on recommendation from Jim Jacobs that larger trees would be too large for existing tree pits. Pyramidal form was also added based on Kiley drawings and narratives about preferred trees in the original design.

4.2. Results

Once Criterion 1 was applied, the 504 trees in the matrix were reduced to 96 qualifying trees. Using these criteria, AECOM created a preliminary list including all Level 1 and 2 trees. The list was further filtered for hardiness (trees with cold hardiness zone of 6 and higher were eliminated). The resulting list was 96 trees (these trees include cultivars of a single species; shown in list below as the number following the “x”, i.e. ash (*Fraxinus*) x 7 indicates that 7 types or cultivars of ash were on the list).

- Maple (*Acer sp.*) x 27
- Buckeye/Horsechestnut (*Aesculus sp.*) x 3
- Black Alder (*Alnus glutinosa*)
- Hickory (*Carya sp.*) x 2
- Trazel Turkish filbert (*Corylus x columnoides*)
- Common persimmon (*Diospyros virginiana*)
- Ash (*Fraxinus sp.*) x 7
- Ginkgo (*Ginkgo biloba*) x 6
- Honeylocust (*Gleditsia triacanthos*) x 2
- Kentucky coffeetree (*Gymnocladus dioicus*) x 5
- Butternut (*Juglans cinerea*)
- Larch (*Larix sp.*) x 2
- Sweetgum (*Liquidambar styraciflua*) x 4
- Tulip Poplar (*Liriodendron tulipifera*) x 3
- Black Gum (*Nyssa sylvatica*) x 3
- Corktree (*Phellodendron sp.*) x 2
- Planetree (*Platanus sp.*) x 5
- Goldenlarch (*Pseudolarix sp.*) x 2

- Oak (*Quercus sp.*) x 7
- Linden (*Tilia sp.*) x 9

5. Short list selection process

A preliminary examination of the 96 trees considered critically incompatible characteristics (Criterion 2) to screen out species that were impractical to consider due to known incompatibility with site conditions (alkaline soil, exposure to wind damage, pollution, urban setting) and high susceptibility to pests or disease; also considered known hazards (such as large fruting bodies and nuts that could be a slipping hazard on the walks and adjacent turf areas beneath the trees).

Availability was discussed as a factor. It was determined that availability was not a major consideration in this process because—due to the relatively long time frame and large quantity of trees to complete the replacement—a desirable tree could be contract-grown for this planting; regardless of market availability

Sixty-eight trees remained at the end of this screening. Questions remained including whether additional cultivars were available, the possibility of missing or conflicting cultural information in the matrix and other sources regarding certain species. Web-based resources and Dirr's *Manual of Woody Landscape Plants* (1998) were consulted on specific issues and information applied as possible to assist in decision making. The remaining trees were then subject to discussion regarding Criterion 3 – Maintenance Considerations; trees were not removed from the list immediately due solely to maintenance requirements.

Further considerations included:

- General susceptibility to treatable disease/pestilence
- Borderline hardiness (hardier trees preferable)
- Nuisance issues (fruit drop, etc.)
- Invasive to Missouri
- Native vs. non-native (in original matrix; not clear if this specifically means native to Missouri, or native to North America)

- Life cycle (urban trees have an abbreviated life span; trees that live longer are typically preferable)
- Rate of growth (moderate to fast-growing trees are preferable)

6. Trees removed from consideration

- Maple (*Acer sp.*) x 27
 - Silver maples: All silver maples were removed due to pest and disease susceptibility, being weak-wooded, being susceptible to wind damage, and having a form that is loose and irregular compared to Kiley's intent.
 - Norway maples: All Norway maples were removed because they are listed as an invasive species in multiple states; they are overplanted; and the dense, dark leaf canopy differs too much from Kiley depictions of intended form. Norway maples planted on the Memorial grounds received minor Japanese beetle damage, Jacobs reports.
 - Sugar maples: All sugar maples were removed from consideration based on a poor performance record on site according to Jacobs' experience; as a result.
 - Black maples: These were removed from consideration due to their similarity to sugar maples.
 - Red maples: These were removed from consideration because a large planting of red maples already exists at the Memorial making it potentially overplanted as well as a record of mediocre performance on site, according to J. Jacobs.
- Buckeye/Horsechestnut (*Aesculus sp.*) x 3: All cultivars were eliminated because the form is too irregular, the large fruit/nut drop causes a tripping hazard, they have a tendency toward disease susceptibility, and they are not proven as urban trees
- Black Alder (*Alnus glutinosa*): This species was eliminated because it is intolerant of alkaline soils. While generally tolerant of poor site conditions, this species is fast-growing, short-lived, weak-wooded, and susceptible to wind damage. It also

frequently grows multistemmed, which is not an acceptable form for this planting based on Kiley intent.

- Hickory (*Carya sp.*) x 2: This species was eliminated due to large fruit/nut drop hazard, and irregular form.
- Common Persimmon (*Diospyros virginiana*): This species was eliminated due to poor tolerance of urban conditions and alkaline soils, messy fruit, irregular form, suckers, slow growth rate, and it is not proven for large urban planting.
- Ash (*Fraxinus sp.*) x 7: All ash species were removed from consideration because of potential susceptibility to EAB.
- Honeylocust (*Gleditsia triacanthos*) x 2: This species was eliminated due to observation by J. Jacobs of trees planted on-site: this species has suffered substantial damage from frost/temperature changes on site and has experienced high mortality, slow growth rate, and pod dropping and thorns (some appear even on “thornless” cultivars) in proximity to walks.
- Kentucky coffeetree (*Gymnocladus dioicus*) x 5: This species was eliminated due to the irregular form of the species and of identified cultivars which does not represent Kiley’s design intent, it is very slow growing, has large and messy seed pods, and is unproven in an urban setting.
- Butternut (*Juglans cinerea*): This species was eliminated due to fruit/nut drop hazard, irregular form, and disease susceptibility.
- Larch (*Larix sp.*) x 2: Although this species is deciduous, it is coniferous and needle-bearing, so does not fulfill Kiley’s form intent. It is also susceptible to damage from wind, is untested in urban conditions, and prefers acid soils (site is alkaline).
- Sweetgum (*Liquidambar styraciflua*) x 4: This species was eliminated due to the tripping hazard of dropped fruit, the tendency of its roots to push up walks, and its poor performance in alkaline soil – gets chlorosis. The group noted that the form of this tree is really appropriate and a “seedless” cultivar such as *rotundifolia* could be considered but only if soil is renovated.

- Black Gum (*Nyssa sylvatica*) x 3: This species was eliminated due to very slow growth rate, intolerance of alkaline soils, and small size (barely reaches maximum height of 40-50 feet). The taproot also makes transplant difficult.
- Corktree (*Phellodendron sp.*) x 2: This species was eliminated because it's slow growing, weak wooded, and has a low resistance to wind damage. J. Jacobs noted that corktrees planted on site have displayed a lack of vigor.
- Goldenlarch (*Pseudolarix sp.*) x 2: See Larch – this species was also eliminated because it is coniferous, which means, though the tree is deciduous, it is not within Kiley's design intended form.
- Oak (*Quercus sp.*) x 7: All oaks were eliminated because:
 - Bur oak is already represented in a large planting in the Memorial grounds and its form is too irregular.
 - Nuttall oak displays borderline hardiness, and southern oak is intolerant of alkaline soils.
 - Forest Green oak is an extremely recent cultivar. No performance information is yet available, and while it is an entry in the matrix, it is uncited.
 - Chinkapin oak is difficult to transplant and has a very broad and irregular form that does not meet Kiley's design intent for form.
 - Scarlet oak is intolerant of alkaline soils.
 - Willow oak has a good form and is urban hardy, but is intolerant of alkaline soils.
- Linden (*Tilia sp.*) x 9: Littleleaf lindens (*T. cordata*) were eliminated due to experience on site with root girdling, heavy damage by Japanese beetles, and attracting bees. Jacobs believes, based on experience, that *T. cordata* would do poorly in small tree pits.

7. Final short list of trees

After the two reviews of the longer list, eight (8) remaining tree species were identified (most with multiple cultivars) as possible replacements for the Rosehill ash allées. These were

selected with an emphasis on form (Criterion 1) and known critical issues (Criterion 2). However, research questions remained for some attributes of the trees species without information readily available.

- Miyabei maple (*Acer miyabei*)
- Freeman maple (*Acer x fremanii*)
- Ginkgo (*Ginkgo biloba*)
- Tulip poplar (*Liriodendron tulipifera*)
- London planetree (*Platanus x acerifolia*)
- Trazel Turkish filbert (*Corylus x colurnoides*)
- American linden (*Tilia americana*)
- Silver linden (*Tilia tomentosa*)

Each of these trees is discussed below, including a short list of cultivars identified in the original matrix; opportunities and constraints related to its use in the planting; questions that came up in the meeting and attributes not recorded in the matrix that need further investigation; and limited additional information found to support specific research questions/topics.

Questions remained about many of these trees at the end of the meeting, mostly regarding technical/cultural information that was not in the matrix and is difficult to find in major sources consulted. There were also questions about other existing cultivars and their characteristics (for instance, “is there a less columnar non-fruiting cultivar of Ginkgo?”).

The EAB workgroup considered including local professionals to assist with the selection of the replacement tree species, such as arborists, horticulturists, urban foresters, landscape architects, nurserymen, experts affiliated with the Missouri Botanical Garden, the City of St. Louis Forestry Commissioner, and other appropriate specialists (Missouri Cooperative Extension, etc.).

7.1. Miyabei maple (*Acer miyabei*)

Cultivars:

- State Street maple (*Acer miyabei* 'Morton')
 - Upright-oval form is regular and attractive, according to Dirr.
 - This cultivar is reported as growing to a maximum of 30-40 feet at maturity (according to Dirr; matrix stated 40 feet); as a result, it may be too short.
 - Prefers acid soils, moist and well-drained, which could result in problems at the Memorial.
 - Additional information is available at <http://www.mobot.org/gardeninghelp/planfinder/plant.asp?code=R910>
- “Rugged Ridge”™ Maple (*Acer miyabei* 'KW-3ami')
 - Schmidt nursery introduction
 - Similar to the State Street maple

7.2. Freeman maple (*Acer x freemanii*)

- Red maple/silver maple hybrids that are only sold as cultivars; not discussed by Dirr.
- They are generally hardy, but may not tolerate the site’s alkaline soils.
- Uncertain how long Freeman maple hybrids have been available in the trade; reliable historical data on performance would be helpful if available.

Cultivars:

- “Autumn Blaze” Freeman maple (*Acer x freemanii* 'Jeffersred')
 - Jacobs reports that some of these were planted a few years ago in areas previously occupied by Red Maple; the “Autumn Blaze” Freeman maples have had no problems and look good.
- “Armstrong Two” Freeman maple (*Acer x freemanii* 'Armstrong II')
- “Autumn Fantasy” Freeman maple (*Acer x freemanii* 'Autumn Fantasy')
- “Celebration” Freeman maple (*Acer x freemanii* 'Celebration')

- “Firefall” Maple Freeman maple (*Acer x freemanii* 'Firefall')
- “Marmo” Freeman maple (*Acer x freemanii* 'Marmo')
- “Scarlet Sentinel” Freeman maple (*Acer x freemanii* 'Scarlet Sentinel')
- “Sienna Glen” Freeman maple (*Acer x freemanii* 'Sienna')
- Additional information is available at
<http://www.mobot.org/gardeninghelp/plantfinder/plant.asp?code=C789>

7.3. Ginkgo (*Ginkgo biloba*)

- On Kiley’s original list of potential trees for this planting.
- Must be a verified male-only cultivar. Most cultivars on the matrix list are relatively narrow (including “Fairmount,” “Golden Colonnade,” “Lakeview,” and “Magyar”), and would therefore not achieve the overarching enclosure feeling described by Kiley.
- Investigate these cultivars, described by Dirr as broader in form: Autumn Gold, Liberty Splendor, Palo Alto, The President (Schmidt Nursery), and Windover Gold.

7.4. Tulip poplar (*Liriodendron tulipifera*)

- This is the tree Kiley originally intended to be used in this planting.
- Native tree.
- Species grows large (60-90 feet tall, though may be smaller in urban setting) and is fast-growing.
- Pyramidal to broad-conical habit, fairly consistent in shape.
- Bright yellow fall color.
- Investigate these cultivars described by Dirr: Majestic Beauty, Aureomarginatum; look for additional cultivars that may be slightly smaller in stature.
- Shallow roots may damage walks more readily than some other trees.
- pH adaptable.
- Somewhat susceptible to wind/ice damage.

- Tulip Poplar “Arnold” was planted in an unirrigated median in the middle of Poplar Street in 2009; Jacobs reports that these were replaced by the contractor in spring 2010 because of excessive dieback in the upper branches. The contractor had similar problems with trees from the same group still located in the nursery. He reports that the replacement trees have had no problems.
- Additional information is available at <http://www.mobot.org/gardeninghelp/plantfinder/plant.asp?code=A878>

7.5. London planetree (*Platanus x acerifolia*)

- This species was on Kiley’s original list of potential trees for this planting.
- Urban-tolerant shade tree well tested for street tree use.
- Moderate growth rate.
- Drops litter (fruting balls, twigs, peeling bark, and large leaves) resulting in more clean-up requirements than some other trees.
- Smooth, light bark may attract vandalism.
- The species is susceptible to anthracnose, but many cultivars are resistant.
- Several London planetrees were planted in areas previously occupied by Greenspire Linden. Jacobs reports that there have been no known issues with the two planted on the grounds or with several others planted on the south side of Eads Bridge over a year ago.
- Investigate these cultivars mentioned in Dirr: Yarwood, Bloodgood, Columbia, Liberty.
- Additional information is available at <http://www.mobot.org/gardeninghelp/plantfinder/plant.asp?code=A892>

7.6. Trazel Turkish Filbert (*Corylus x colurnoides*)

- Urban hardy, highly rated as a street tree in Germany, and has been grown as a street tree in the U.S. Highly praised by Dirr and other tree experts/arboriculturists but availability appears to be limited; unclear why.

- Hybrid of common and Turkish hazel (*C. avellana* and *C. colurna*).
- Very regular pyramidal form and strong horizontal branching; limited pruning required.
- Ice damage and leaf scorch resistant; vigorous in urban conditions.
- Adaptable to a range of soils; drought tolerant once established.
- May be susceptible to Japanese beetles (unclear how much a problem).
- Slow to medium growth rate.
- Nuts may be a problem on the walks; it is reported to not heavily set fruit, but this needs to be confirmed.
- Little information is available about this tree and its cultivation online or from standard sources.
- Not native; not commonly used in the region.
- They do not sucker, are drought tolerant, and are alkaline soil tolerant.
- Additional information is available at <http://www.ces.ncsu.edu/fletcher/programs/nursery/metria/metria04/m43.pdf>

7.7. American linden (*Tilia americana*)

- Tend to attract large numbers of bees due to fragrant flowers. This could be a visitor issue during the flowering period (mid-June).
- pH adaptable.
- Considered less tolerant of urban conditions than some other trees.
- Native tree.

Cultivars:

- “Redmond” Linden (*Tilia americana* ‘Redmond’) – dense, broadly pyramidal
- “Boulevard” American Linden (*Tilia americana* ‘Boulevard’)
- “Continental Appeal” American Linden (*Tilia americana* ‘Continental Appeal’)

- “American Sentry” American Linden (*Tilia americana* 'McKSentry')
- “American Legend” Linden (*Tilia americana* 'Wandell')
- Additional information is available at
<http://www.mobot.org/gardeninghelp/plantfinder/plant.asp?code=A917>

7.8. Silver linden (*Tilia tomentosa*)

- Tend to attract large numbers of bees due to fragrant flowers. Swarms of bees could be a visitor issue during the flowering period (mid-June).
- pH adaptable.
- Considered less tolerant of urban conditions than other trees.

Cultivars:

- “Satin Shadow” Linden (*Tilia tomentosa* 'Sashazam')
- Additional information is available at
<http://www.mobot.org/gardeninghelp/plantfinder/plant.asp?code=A919>

8. Next Steps

Next steps were discussed in the meeting in a general way, although detailed planning for subsequent actions was not undertaken as part of this process. Some recommended next steps include the following:

- A public open house at the Memorial, inciting the interested public to view information about the “short list” trees;
- Consultation with local arborists to obtain additional detailed cultural information to assist in selecting a final tree; and
- Planting of test trees of each species on site (for those not already planted on site) to determine likely success of a larger planting in the future.

END

Summary Report – DRAFT (8/5/2009)
Jefferson National Expansion Memorial
Emerald Ash Borer Management Workshop
August 3 - 5, 2009

A significant historic character defining feature of the cultural landscape at Jefferson National Expansion Memorial (JEFF) is the White Ash lined walkways leading to the Arch. This monoculture is the strongest single feature of the Kiley site plan. The monoculture planting defines the pedestrian experience and effectively compliments the simplicity of the Arch. The historic monoculture is composed of approximately 1200 White Ash “Rosehill” site wide. Of these, approximately 900 line the primary walkways.

The Emerald Ash Borer (EAB) is a wood-boring insect which infests and causes ash tree decline and mortality. EAB activity has been located in Wayne County, MO, approximately 150 miles south of Saint Louis. As of August 2009, there has been no confirmed EAB evidence at JEFF or in surrounding Saint Louis. However, based on the potential threat that EAB may have to the JEFF cultural landscape, a workshop to discuss cultural resource management options was coordinated by the park.

Cultural landscape management recommendations associated with perpetuating the integrity and character of the monoculture planting are provided in this report. Refinement of these recommendations are needed to develop a site specific EAB management plan.

WORKSHOP GOALS AND PARTICIPANTS

- Review preservation goals for the JEFF cultural landscape specifically related to retaining and perpetuating the monoculture planting
- Develop a process for selecting substitute plants for the monoculture
- Develop a draft action plan for managing the monoculture based on EAB proximity
- Evaluate and develop recommendations for replacing trees in the monoculture

Participants

- Bob Moore, Historian, JEFF
- Kathryn Thomas, Curator, JEFF
- Jim Jacobs, Gardener Supervisor, JEFF
- David Bubac, Facility Manager, JEFF
- Marla McEnaney, Historical Landscape Architect, Midwest Regional Office
- Charles Pepper, Deputy Director, Olmsted Center for Landscape Preservation, Northeast Regional Office
- Regina Bellavia, Associate Director Grounds and Athletic Maintenance, Boston College and Author, Cultural Landscape Report for JEFF
- Adriane Fowler, Associate Landscape Architect, EDAW, Inc.

RECOMMENDATIONS

EAB Response Action Plan

Preservation of the monoculture is the primary cultural resource management goal for the landscape. Strategies to retain and strengthen the existing planting should be undertaken until such time that EAB becomes a greater threat to park resources. The following approach, based on proximity of EAB to JEFF is suggested.

Current - 150 Mile (+/-) EAB Confirmation

- Increase on-site monitoring of EAB. This may involve increasing numbers of monitoring traps; bark removal and inspection for EAB exit holes for every removed tree, etc.
- Remove all current dead and/or hazardous Ash trees
- Prepare a site specific EAB Management Plan
- Initiate 106 and EA compliance process
- Prepare PMIS statements and/or seek funding to support EAB Management Plan preparation and implementation, and consolidated sidewalk/irrigation/structural soil/tree replacement projects
- Initiate quarterly professional contact and strengthen working relationships with Missouri Department of Conservation, the multi-state Cooperative Emerald Ash Borer Program, National Park Service Integrated Pest Management Program coordinators (regional and national), Missouri Cooperative Extension and research universities for potential collaborations, updates on EAB status and control options
- Initiate public relations and educational programs to raise awareness of monoculture significance and planned preservation actions the park intends to implement
- Develop tree selection process and replacement strategy to perpetuate the monoculture (see draft below).
- Develop debris disposal plan in partnership with state regulatory agencies
- Develop cost benefit analysis comparing pesticide control and removal and replacement
- Cost out the removal of ash trees vs. chemical and other treatments

50 Mile EAB Confirmation

- Review short list of optional substitute plants for current feasibility such as cost, availability, other prominent pest issues
- Begin replacing dead, declining, stressed and hazardous trees with selected substitute species. Allow existing healthy Ash trees to remain.
- Release statement and educational materials to public regarding the initial implementation phase of tree replacement
- Submit final plant substitute selection for 106 Compliance
- Discuss project funding criticality with regional fund managers and directorate

15 Mile or Less EAB Confirmation

- Initiate phased or site-wide Ash tree removal and replacement strategy (needs development – considerations include design, funding, level and concentration of EAB infestation and tree mortality, etc.)
- Secure funding to support tree removal and replacement
- Contact local, state and national agencies regarding Ash tree removal, substitute species planting and associated debris removal policies
- Release statement and educational materials to public regarding the full implementation of tree removal and replacement

Substitute Plant Selection Process

An initial matrix for evaluating potential substitutes tree species was developed by Jim Jacobs and his staff. Using this matrix, the workgroup refined the evaluation process to emphasize selection criteria of preservation, sustainability and feasibility. Using a master list of 420 trees, this refined selection process resulted in a short list of seven trees that appear to be appropriate substitutes species for the site. Using a database that can effectively query a broader list of plants is recommended, i.e., USDA PLANTS database.

As part of this process the workgroup recommends that a review team of local plant specialists, arborists and horticulturists be convened to review the list of substitute plant options. It is recommended that the final selection be made by the park based on feasibility checks at 50 mile EAB confirmation.

The following three step process for identifying substitute plant species for the Ash monoculture include:

1. Preservation requirements (Provides a master list of potential species based on cultural landscape preservation objectives)
 - Single species (multiple cultivars with similar visual characteristics allowable)
 - Tree form (Ovate, Upright-Oval)
 - Height (40 to 80 feet)
 - Broadleaf deciduous
2. Sustainability goals (Results in short list by filtering master list to identify species that are well adapted to site specific conditions and requirements)
 - Zone hardiness
 - Soils adaptability
 - Tolerance of urban growing conditions
 - Pest resistance
 - Ease of maintenance
 - Tolerance of interplanting
3. Feasibility checks (Refines short list to currently identify best option for implementation)
 - Availability

- Cost
- Current pest resistance

Current Tree Replacement Options

1. RECOMMENDED - Replace with Rosehill Ash or potentially resistant variety (Manchurian Ash) – See below

Pros

- Sustains critically significant design feature of the monoculture
- Can begin replacements immediately, no 106 Compliance necessary
- Education opportunity to raise awareness of monoculture significance
- Opportunity to be “test ground” for EAB control
- Fill holes – immediately improves perception of continued maintenance

Cons

- Possible public relations concern associated with planting Ash trees
- Possible cost of removal at time of substitute species implementation

2. NOT RECOMMENDED – Continue Current Management – Remove dead and declining Ash and do not replace

Pros

- Retains monoculture of plants
- Allows time to develop plan
- No 106 Compliance necessary
- Education opportunity to raise awareness of monoculture significance

Cons

- Public perception of lack of maintenance increases
- Diminishes integrity of landscape character

3. NOT RECOMMENDED – Interplant with several optional substitute species

Pros (If on-site test plots are desired by the park, workgroup recommends that they are planted adjacent to the Maintenance Facility)

- Could inform next generation of site managers regarding viability of substitute species
- Fill holes – immediately improves perception of continued maintenance

Cons

- Adversely impacts integrity of landscape character
- Will require compliance and possible peer review before implementation, i.e., cannot be immediately implemented
- Information gained from on-site evaluations not of value before 10 years
- Possible cost of removal at time of substitute species implementation

A field evaluation of applying the recommended replacement of missing Ash in-kind was conducted by the workgroup. Of the current approximately 90 missing Ash trees along the walkways, the group recommends replacement of 20 to successfully preserve the integrity of the monoculture based on the following criteria:

- All trees missing within sidewalks
- First tree at the beginning of any row along sidewalk edges
- Where two or more consecutive on a sidewalk edge are missing, replace every other one
- Do not replace any in outside row(s)

Sources for Ash replacement options should include:

- Transplanting from existing on-site locations from outside of the walkways
- Working in partnership with the city of Saint Louis to identify street trees that they are interested in “donating” to the park
- Seeking research insect resistant varieties of Ash trees from universities and government agencies
- Acquiring Manchurian Ash (potential resistance) from nursery sources
- Acquiring Rosehill Ash trees from Missouri nurseries

REMAINING TO DO

- Develop broader and finalize “short plant list”
- Gather information for public relations/educational information
- Prepare EAB management plan

Appendix B:

Technical Memorandum #2

Technical Memorandum

To Marla McEnaney, National Park Service Page 1

CC Matt Sutton (Schemmer)
Joan DeGraff, Rob McGinnis

Re Environmental Assessment for Emerald Ash Borer Strategy

Subject Technical Memorandum – Action Alternatives and Key Issues Development

From Erin Degutis and Adriane Fowler

Date January 10, 2011

Executive Summary:

This technical memorandum documents a work session conducted on October 13, 2011. The purpose of the work session was to examine a range of possible alternatives, both no action and action, for replacing the Rosehill ash on the Jefferson National Expansion Memorial (the Memorial) grounds while retaining the character-defining qualities of the allée planting. Relevant impact topics were also discussed.

This memo will be used as the preliminary narrative in the alternatives section and provide key impact topics to be evaluated in the environmental assessment (EA). As a result of the work session, it was determined that the no action and one action alternative would be assessed.

1. Introduction and Purpose

One of the character-defining features of the Memorial grounds are the single-species allées that line the walkways. The allées are a major feature of the planting design by landscape architect Dan Kiley and contribute to the cultural landscape as well as defining views to the Memorial from the walkways. Originally intended to be tulip poplar, the allées were ultimately planted in Rosehill ash (*Fraxinus americana* 'Rosehill') in 1971 and 1979-1980. While this species of ash has grown well as an urban tree planting, today these trees are reaching the

end of a natural lifespan and are beginning to decline. A threat to the Memorial's Rosehill ash trees has also been identified in the Emerald Ash Borer (EAB), a wood-boring insect which infests ash trees and results in the premature decline and death of the trees. EAB has yet to be confirmed in the St. Louis area, however the disease has been diagnosed and has decimated ash populations elsewhere in the Midwest. If the current pattern and rate of spreading infestation continue, it is expected that EAB could appear in the city within a few years.

It has been determined that an EA is required to examine the potential impacts of the replacement of the ash trees. Resources most likely to be impacted as a result of proposed replacement of the ash trees include the cultural landscape, visitor experience, and park operations. The selection of a replacement tree species will occur independently from this EA.

This EA is being undertaken concurrently with the international design competition (Framing a Modern Masterpiece: The City – The Arch – The River 2015), completed in September 2010 and the subsequent development of the winning design concept occurring as part of the implementation of the Memorial's 2009 General Management Plan (GMP) Preferred Alternative. The selected design from the competition is currently in development by the Michael Van Valkenburgh Associates team (MVVA). While the EA process includes coordination with and involvement of the MVVA team, the type of trees specified for replacement, will be addressed in future NEPA and NHPA compliance efforts associated with the design concept rather than this current EA.

2. Purpose of the Alternatives Development

The development of an action alternative provides a means of accomplishing the Memorial's goals, while protecting and minimizing impacts to resources identified in the GMP and the CLR. The alternative development process addresses elements of each impact topic and further refines what would be categorized as a part of the No Action and Action Alternatives. The No Action Alternative is developed to provide a baseline of existing impacts that would continue into the future. The No Action Alternative would continue present management

actions identified in the GMP and would be compared with the impacts of any Action Alternatives.

3. Impact Topics

Mandatory resource topics to be examined during the development of an EA or EIS are discussed in DO-12 and include:

- Land use plans, policies, and controls
- Energy requirements and conservation potential
- Natural or depletable resource requirements and conservation potential
- Urban quality, historic and cultural resources, and design of the built environment
- Socially or economically disadvantage populations (environmental justice)
- Wetlands and floodplains
- Prime and unique farmlands
- Endangered or threatened plants and animals
- Important scientific, archaeological, and other cultural resources, including historic properties on the National Register of Historic Places (NRHP)
- Ecologically critical areas, Wild and Scenic Rivers, or other unique natural resources
- Public health and safety
- Sacred sites
- Indian trust resources

The 2009 GMP/EIS addressed all the mandatory topics as will the EA, however the GMP/EIS dismissed several topics from further consideration. Topics retained for detailed examination in the GMP/EIS included cultural resources, natural resources, visitor opportunities and use, transportation and access, land use, socioeconomics, and NPS operations. Selected GMP/EIS impact topics were eliminated from analysis in this EA due to the narrow range of potential impacts to the character-defining planting; the limited footprint

of the single-species allées and other affected Rosehill ash plantings within the Memorial; and, the absence of direct, indirect, and cumulative effects relevant to the other resource topic areas. The following impact topics were excluded from further consideration in the EA: socioeconomic, land use, threatened and endangered species and species of special concern, wildlife and fisheries habitat, wetland and riparian areas, ecologically critical areas, wild and scenic rivers, environmental justice, Native American resources and religious concerns, archaeological and paleontological resources, curatorial resources and museum collections, hazardous waste and solid waste, noise/soundscape, air quality, and prime and unique farmlands.

4. Alternative Development

4.1. Alternatives Development Workshop

Memorial and Midwest Region NPS personnel and AECOM staff met on October 13, 2010, for a daylong work session to develop a range of alternatives for the EA. Michael Van Valkenburgh of MVVA participated at the request of NPS to provide additional information and context regarding the overall design concept for the Memorial and its envisioned development and implementation.

Alternative development was composed of two steps: a “brainstorming” session during which a variety of issues and topics were discussed, and a refinement exercise where selected elements were developed into a matrix of options for action alternatives. The elements of each potential action were organized and aligned with topic areas. As a result of this process, the NPS elected to develop one Action Alternative to accompany the required No Action Alternative.

Replacement of the Rosehill ash trees was discussed as were the potential actions and issues associated with the replacement. While specific replacement species for the Rosehill ash was not a part of the alternative development and refinement discussion, a short list of potential replacements resulting from conversations during development of the GMP/EIS, the CLR, and the early stages of the scoping of the EA was available during the work session. Common considerations were identified:

- Removal of all of the Rosehill ash trees in one phase.

- Removal of the Rosehill ash trees over the course of several phases.
- Use a different replacement species for plantings in locations other than the allée.
- Timing of tree removal: spring versus fall.
- Size of replacement tree (caliper, height, and spread of crown).
- Replacement of the ash trees and not altering the existing growing conditions, including soil, drainage and irrigation.
- Improve the existing growing conditions by amending the soil in the tree pits, plan and design an improved drainage system and modify the irrigation system to accommodate the replacement trees.
- Replacement of the existing sidewalks at the time of tree replacement.
- Retention versus removal of the existing tree grates.
- Incorporate educational elements as a part of the tree removal process: informational boards on the action, sustainability principles and “Construction Theater.”
- Visitor access during tree removal and replacement process.
- Visitor’s visual experience during the tree removal and replacement.
- Location of construction staging areas and debris removal.
- Implementation of sustainable principles in context to demolition and debris removal.
- Need for staff or contractors with climbing experience to maintain tall-growing tree species.
- Maintaining consistency and compatibility with Kiley’s original design intent.

After the brainstorming session, ten elements were identified and developed from the issues discussed and brought forward to an alternatives development matrix:

- Size of tree
- Tree replacement phasing
- Tree pits/soil

- Timing
- Construction staging
- Debris removal
- Visitor experience
- Visitor circulation
- Walkways
- Operations

The Brainstorming (Worksheet #1) and Alternative Development (Worksheet #2) Matrix provides additional detail regarding the proposed elements of each topic area. These matrices are attached to this document.

5. Alternative Refinement by Impact Topics

As a part of alternative refinement, the elements identified and developed during the alternative work session were aligned with each impact topic. The following impact topics were identified for further consideration in the EA:

- Natural resources
- Cultural resources
- Visitor opportunities and use
- NPS operations
- Public health and safety
- Transportation and access

Other impact topics were dismissed from further consideration due to the focused nature of the project. The dismissed impact topics will be identified in the EA accompanied by narrative explaining why each topic was dismissed.

A third matrix, Worksheet #3: Impact Topics, was developed to structure each impact topic area with corresponding elements and identify the no action and action alternative to be

analyzed in the EA. However, several elements were associated with more than one impact topic. The overlap of an element with an impact topic identifies that there are several issues that may affect an impact topic, but may not be a prime issue. The following table identifies the prime and secondary issues associated with those impact topic carried forward in analysis.

Table 1: Relevancy of Prime Elements to Each Impact Topic

Impact Topic	Element	Relevancy
Natural Resources (Vegetation)	Tree Replacement Phasing: Area	Prime: contributing to cultural landscape
	Size of Tree	Secondary to cultural resources
Cultural Resources (Cultural Landscapes)	Walkways	Prime: contributing to cultural landscape
	Size of Tree	Prime: contributing to cultural landscape
	Tree Pits/ Soil	Prime: contributing to cultural landscape
	Visitor Experience	Prime: contributing to cultural landscape
	Tree Replacement Phasing: Area	Prime: contributing to cultural landscape
Cultural Resources (Views and Aesthetic Resources)	Timing	Prime: contributing to cultural landscape
	Size of Tree	Prime: contributing to cultural landscape
	Tree Replacement: Phasing	Prime: contributing to cultural landscape
Visitor Opportunities and Use (Visitor Experience)	Timing	Prime: contributing to cultural landscape
	Construction Staging	Prime: affects views
	Debris Disposal	Secondary: temporary measure
NPS Operations	Timing	Prime: affects operations
	Operations	Prime: affects schedule and staffing
	Construction Staging	Prime: affects operations
	Debris Disposal	Prime: affects operations
Public Health & Safety	Debris Disposal	Prime: affects safety of visitors
	Walkways	Secondary to historic resources
	Visitor Experience	Secondary to visitor opportunities
	Visitor Circulation	Secondary to transportation and access
Transportation and Access (Access)	Construction Staging	Prime: affects circulation
	Debris Disposal	Secondary to public health and safety
	Visitor Circulation	Prime: affects visitor experience

6. Alternatives Comparison

A fourth matrix, Alternatives Comparison, was developed (Worksheet #4). This matrix is similar to the Alternatives Comparison table shown in the 2009 GMP/EIS as Table 2.4 (pages 2-45 through 2-47). This matrix is intended to develop the impacts by topic area a

step further by summarizing the differences between the Action and No-Action Alternatives by impact topic.

END

Attachments:

Meeting Minutes – October 13, 2010

Alternatives Matrix Information

Worksheet #1: Brainstorming

Worksheet #2: Alternative Development

Worksheet #3: Impact Topics

Worksheet #4: Alternatives Comparison

Meeting Notes

Subject	Meeting 2 - Alternatives Workshop
Date	October 13, 2010
Time	9:00 AM – 5:00 PM
Location	Old Courthouse, Jefferson National Expansion Memorial, St. Louis, Missouri
AECOM Project No.	10180044.01
Project Name	Environmental Assessment for Emerald Ash Borer Strategy

1. Participants.
 - a. National Park Service: Tom Bradley, Bob Moore, Jim Jacobs, and Marla McEnaney
 - b. Michael Van Valkenburgh & Associates: Michael Van Valkenburgh
 - c. AECOM: Rob McGinnis, Roger Courtenay, Adriane Fowler, and Erin Degutis
2. Project status.
 - a. Marla McEnaney provided background on the project to date, including the public scoping meeting.
 - i. The public scoping meeting was held on Tuesday, October 12th at the Old Courthouse. Bob Moore and Adriane Fowlers presented a PowerPoint presentation outlining the goals of the tree selection and EAB Strategy followed by a question and answer session. Two illustrative boards of the EAB and EA were on display for attendees to review.
 - ii. Team members who attended the public meeting briefly discussed the public comments/concern about single species and other feedback.
3. Review and discuss the Environmental Assessment (EA) goals and alternative development process.
 - a. The EA process to assess the Rosehill ash began prior to the design competition. The EA's alternatives focus is on the impact to the Memorial, not about the tree species selected to replace the Rosehill ash. The primary NEPA issue for the environmental assessment is the removal of the Rosehill ash, soil preparation, and reinstallation of the replacement trees. NEPA requires that both a No Action and Action Alternatives be developed.
 - b. A No Action Alternative could include actions such as the Memorial not replacing the Rosehill ash trees after they die and are removed. The No Action Alternative could include trying to save the Rosehill ash using methods not currently in use. These methods could include soil injections, or other treatments.
 - c. Michael Van Valkenburgh and Associates (MVVA) will incorporate the results of the EA. Michael Van Valkenburgh, the winner of the design competition, was invited to the meeting as an agent of NPS.
 - d. The 2009 EAB Strategy Working Group summary report explains one approach to implementing a replacement tree for the Rosehill ash.

- e. Attendees discussed the issues of isolating tree replacement from other design considerations and existing conditions that are closely related, such as walks or tree pits, drainage, and soil quality. Attendees agreed that even if assessment is to focus on impacts of replacing trees in the existing conditions, it is important to consider these site improvements – even if it is done outside the scope of the EA. Tom Bradley pointed out that while the potential tree replacement is in the PMIS system, this does not include replacing the walks
 - f. The schedule and scope for the EIS for the design competition is expected to coincide with the development of the EA. The group discussed whether changes to the walks and trees would be within the new design scope. Michael Van Valkenburgh noted that the design team understands the significance of the existing walks and allees and does not intend to suggest any alterations to their form, aside from proposing a replacement species for the Rosehill ash and addressing potential improvements to tree pits and drainage.
 - g. The EAB Strategy Working Group summary report identifies recommended actions based on decreasing future distances of EAB occurrence from the Memorial. A critical management threshold identified in the summary report would be the occurrence of EAB within fifteen miles of the Memorial, at which point the report recommends removal of all Rosehill ash trees at the Memorial to eliminate the spread of EAB to the site.
 - h. Jim Jacobs noted that the approach to managing EAB has changed quickly in the last few years, and total removal of Rosehill ash due to the presence of EAB in the area may not be considered appropriate today. Research has identified that EAB may exist for several years before becoming evident. There is also the high probability that the sidewalks will have to be redesigned and the Rosehill ash may be removed for this reason.
 - i. The No Action Alternative for the EA should be aligned with the No Action Alternative in the 2009 GMP/EIS, as well as the No Action Alternative in the Design EIS. The EA No Action Alternative could include leaving the Rosehill ash trees in place and removing trees as they die.
4. The team discussed the public information meeting, tree selection process, design competition, and related projects at the Memorial. The range of public comments included:
- a. Concern about the environmental issues of single-species plantings in general, and for replacement of the Rosehill ash.
 - b. Concern with subsurface conditions and the existing soil will affect the success of the new trees.
 - c. Questions and suggestions regarding how trees would be grown and acquired, including availability of 900 matched specimens.
 - d. Concerns about replanting in the same tree pit.
 - e. If a single species is used for the replacement of the Rosehill ash, it was suggested that the Memorial use a species that is native, hardy, and not marginally present.
 - f. Suggestion that NPS consider a tree species that grows on ridge tops and levees in the St. Louis area. These species may be tolerant of alkaline soil.
 - g. Current landscape maintenance does not include fertilizing or amending soil in the tree pits. Maintenance of the Rosehill ash trees currently includes pruning.

- h. It was noted that during the earlier public meetings for the Arch GMP and design competition, those expressing concern or disagreement with maintaining the single-species planting represented less than ten percent of the attendees.
5. Alternative development. A two-phased matrix was developed to facilitate the development of the Action and No Action Alternatives. See attached matrix
- a. The group provided elements for the matrix which included a range of potential actions to develop an Action and No Action Alternative. The first spreadsheet collected all of the potential components of the alternatives. The group considered limiting factors of the site, maintenance operations, and overall feasibility.
 - b. According to the current schedule, within 90 days AECOM expects to draft Chapters 1 and 2 of the EA; reference to affected environment (chapter 3) in the GMP, then Chapter 4 will mostly be new.
 - c. The EA was initiated prior to the design competition. The larger picture of change at the Memorial, including any alterations to the tree pits, walks, and irrigation, are expected to be addressed in the EIS. After this meeting, this was subsequently reinforced in discussions with Nick Chevance MWRO compliance specialist, and Sandra Washington, ARD for Planning and Legislation.
 - d. The EA is expected to deal with a limited and specific issue, while the EIS is expected to be more holistic.
 - i. The EA should recognize the design competition is occurring.
 - ii. For the EAB EA, alternatives might generally say that implementation (all at once or phased) could develop related to design as it develops, driven by phasing.
 - e. Ages of replacement trees was considered by the group as part of a potential phased replacement strategy. Contract growing: trees would all be planted at the same age in different phases, or, planted at different sizes/ages in different phases to meet the design goal of all trees being uniform in appearance.
 - i. Availability of the necessary large number of trees (900+) was discussed as a concern. Consideration may be given to using smaller sizes in each successive phase.
 - ii. Another option is to plant larger trees which would restore shade more quickly. It was noted that smaller trees will take longer to restore a mature canopy and shade the walks, which affects visitor experience, and has a greater impact on the appearance of the Memorial grounds than planting larger trees. Installing larger trees also has some risks, such as viability after planting.
 - iii. Trees with a caliper of 3 ½" are typically available in this area. Contract growing would eliminate availability issues. Large trees (over 5" caliper) are hard to obtain and move and adjust less readily to transplanting. It was noted that within 10 years, a 3 ½" tree will be the same size as a tree planted at 5" caliper at the same time.
 - f. Tree pit issue.
 - i. Discussion of existing tree pits and their poor construction; consideration of the need to replace entire walk and redesign subsurface conditions to improve poor soil and drainage.

- ii. There are several unknowns about the existing soil, which is primarily urban fill. Construction debris is located under 4"-6" of topsoil and consists of bricks, rocks, and concrete. There is sand under the Arch. Fill is layered in compacted lifts that affect the site's drainage.
 - iii. The use of structural soil was discussed.
 - iv. It was suggested that trees could be planted at a smaller size along outside of walks because they will grow faster. Larger trees could be placed within the tree pits.
- g. Contract grow the replacement trees in the correct soil type.
- h. The existing spacing of trees 15'-20' on center is considered close together, but is part of the designed form of the planting and is significant, therefore must be maintained.
- i. Jim Jacobs was concerned that tulip poplars would grow too tall, and that the park does not have a climbing crew to maintain tall trees.
 - i. It was noted that the Rosehill ash growing in natural conditions would be much taller but they are stunted by urban conditions. Tulip poplars would have same issue when growing in urban conditions.
 - ii. The level of maintenance on the Memorial grounds was discussed. An increased level of maintenance will likely be necessary to maintain the redesigned Memorial grounds, as well as to maintain newly planted trees. This may include fertilization, frequent pruning, adjustment of staking, etc.
- j. Loosely staked trees are not preferred by park staff. The biggest problem with installing new trees is setting the root ball. Consider the removal of tree grates as part the alternative.
 - i. Safety, visual quality issues should be considered regarding staking.
 - ii. 2 ½ to 3 inch trees are not as susceptible to wind damage as larger trees.
 - iii. Park staff currently does not wrap trunks of new trees.
 - iv. Discussion of using temporary measures such as armoring trees and temporary access.
 - v. Events at the Memorial have caused damage to the landscape due to heavy pedestrian and vehicular traffic. Examples include bark loss during the 1980s Fair St. Louis; trucks impacting turfgrass areas, etc. Now there are restrictions.
- k. Principal visitor access points are to the north and west of the Memorial (parking garage). Maintenance circulation is from the south where the maintenance facility is located. There are several possibilities to temporarily re-route circulation during tree replacement.
 - i. Discussion of visitor experience considerations. Could use panels to hide views and mitigate the visual impacts of the construction. Avoid orange snow fencing. UVA uses green panels as demure hiding devices.
 - ii. Michael Van Valkenburgh suggested taking the opportunity of the changes to stage "construction theater." One example of this was when Michael Graves created a decorative curtain on the scaffolding at the Washington Monument, which was an artistic approach to engage the public in the construction process. Could apply this concept to the construction at the Memorial in general, as well as specifically to tree replacement. Could extend this

- technique through recycling and debris disposal, etc. as an interpretive and educational opportunity.
- I. Discussed how to implement construction staging, materials and equipment storage, demolition, and recycling.
 - i. This may depend on how the larger design is built. At this time, there is no place in the core of the Memorial grounds for staging and there would likely be off-site impacts. Teardrop areas could be used, but then completely rehabilitated with new irrigation, soil, and turfgrass.
 - ii. Based on how EAB quarantines have been implemented in other states, any EAB-infested wood would likely need to be disposed of within St. Louis County. Transportation costs of removing trees could be reduced by grinding/chipping wood (consider double-chipping) in a parking lot. Despite its adjacency to river, using barges are not practical due to the Memorial's grade change. It was noted that sixty trees lost in a storm a few years ago presented a major disposal issue for the Memorial, and so disposal of wood associated with replacement of 900 trees is a very substantial task.
 - iii. Timing of construction relative to peak visitation is another consideration that was discussed. It should be determined which construction and staging activities would be acceptable to locate close to visitor areas and which are not (factors such as dust, hazardous materials or equipment, etc.). There is the potential to use a combination of on- and off-site staging locations.
 - m. Late October is ideal for planting, typically. Planting period will depend on the selected tree species.
 - i. When trees are replaced, any changes to walks and drainage as part of MVVA design would be a consideration. However, the changes associated with future design are not intended to be addressed or speculated upon in this EA.
 - n. The group discussed possibilities of future design that could strongly affect the viability of the replaced trees, including cantilevered walks, structural soils, and modifications to ground plane, how root ball is set in relation to walk and tree pit, use of mulch, cobble, tree grates or permeable aggregate with a binding agent.
 - o. What is needed programmatically for operations at the Memorial?
 - i. The replacement of the Rosehill Ash is an action considered to be a replacement in-kind.
 - ii. The related design decisions will drive operations. Space for more equipment, staff, etc. depends on each alternative, as do changes to maintenance staffing levels.
 - p. Because the existing drainage system doesn't work well for trees, if nothing is changed besides tree replacement, the trees will have to be replaced more often in the future due to existing flaws (tree pits, poor soils, etc.).
 - q. The size of trees at installation, their speed of growth, and the survival rate of trees would affect the visitor experience.
 - r. Affects of new species selection on visitor experience: different fall color, shade, and other qualities.
 - s. Shaded walks are a desirable condition for visitor experience.
 - t. Consider testing the selected tree species for performance on site. This could also be an interpretive opportunity for visitors. Some trees have been tested already. Test

- trees are not placed in tree pits due to need to preserve the single-species character, but have been planted near maintenance facility and elsewhere.
- u. Phasing of tree replacement: all at once, or in phases? This would be dependent on design construction phasing.
 - v. Maintaining continuity of design intent is critical for visitor experience.
6. Michael Van Valkenburgh described his background, and his substantial appreciation for the context and concept of the Memorial landscape and respect for Kiley and Saarinen's design intentions. He briefly discussed his design concepts that relate to the single-species allee tree plantings and walks to apprise the team of where the design development would likely overlap EA issues, and concurred with the EA approach to the tree replacement.
 - a. MVVA would likely remove all the trees at once, similar to what was done in classical French gardens subject to storms in the past twenty years (Sceaux and Versailles, 1992 and 1999 storms). In rethinking tree grates and subsurface drainage, he noted that a common trench for both is critical, as are structural soils (which may also mitigate alkalinity).
 - b. MVVA is thinking of the Memorial not as a static piece of artwork, but as a sustainable system or set of systems. While respecting the aesthetic and designation of site as it exists, the design goal would be to make it more viable while retaining original aesthetic principles.
 7. Review revised outline for the Environmental Assessment.
 - a. A detailed outline has been developed. It reflects the topics to be addressed and groups other resource topics that are not anticipated to be carried into further into the analysis.
 8. Review roles and responsibilities for next steps.
 - a. AECOM will develop draft meeting minutes for the group to review.
 - b. AECOM will draft Chapters 1-4 of the EA, based upon the finalized Action and No Action Alternatives.
 - c. The Memorial is collecting comments from the Public Information Meeting.
 9. Review project schedule.
 10. Action items.
 - a. AECOM to transmit DVD of Public Meeting Boards to Marla McEnaney.
 - b. AECOM to send draft meeting minutes and matrix to project team.
 - c. AECOM to provide Tech Memo #1 to Michael Van Valkenburgh. (Hard copy provided to him at meeting)
 - d. Marla McEnaney to discuss with Nick Chevance the EA and EIS coordination.
 - e. AECOM to transmit the detailed outline of the EA. AECOM will draft Chapters 1-4 of the EA, based upon the finalized Action and No Action Alternatives.
 - f. Park staff is collecting comments from the Public Information Meeting. Park staff will be responsible for organizing and summarizing comments.

END

Environmental Assessment for Emerald Ash Borer Strategy
 Jefferson National Expansion Memorial
 October 13, 2010

Alternatives Development Worksheet
 Worksheet #1: Brainstorming Table

Goal: Identify and list up to five feasible ways to accomplish each component (regardless of relationship to other components).

Indicates that component carried forward to alternative development spreadsheet.

A		B	C	D	E	F	G	H	I
Components of Each Alternative:									
Tree Replacement Phasing: Timing	Spring or fall planting of trees.	Replacement at one time (during one planting season).	Replace over phases. (phased implementation over several planting seasons)	*Other considerations: challenge and logistics of contract growing replacement trees.	*Coordinate with design and construction phasing.				
Tree Replacement Phasing: Area	Wholesale replacement (example: storms in Europe affected large trees in the 1990s and many trees replaced)	Phased replacement of trees in blocks/groups similar to planting plan per Riley design. (two phases)	Phasing to coincide with MVVA design competition or other considerations.	Consider other phasing option driven by programming or special events, annual events. (Democratic Convention in 2012?)	Coordinate with sidewalk system changes/replacement.				
Tree Pits/Soil	Keep existing tree pits and soil. (No Action Alternative)	Create new trench drainage system with amended soil and new drainage infrastructure.	Keep existing tree grates. (No Action Alternative)	Remove tree grates, keep notches in the sidewalk.	Plant at existing level in relationship with existing pavement; do not put Belgian block over root ball; use structural soil.	Use of camilevered system for walkways over the root ball. (promenade)	Develop a new system to protect the exposed root ball.	Modify the notch design for historic preservation or environmental reasons.	Plant below existing level.
Visitor Circulation	Maintain existing walkway system (line, form)	Use of Construction Theater to provide an educational opportunity to visitors and mitigate potential visual impacts.	Integrate temporary circulation patterns using existing walks during the tree replacement.	Phase construction to allow at least one access point and promenade to remain open.					
Construction Staging	Location of interim staging areas on-site for plant material. This may include the teardrop-shaped areas. Identify construction staging sites in context to parking, access, circulation.	Location of interim staging areas for plant material, soil. (off site). Consider impacts to traffic, pedestrian circulation, and promenades.	Phase construction to allow at least one access point and promenade to remain open.	Combination of on-site and off-site options for construction staging. (% TBD later)	Location of construction staging in relationship to the timing of the project (on-site).				
Debris Disposal	Recycle ash trees (double-chip), root material, soil and walkways; remove from site (keep in St. Louis County).	Recycle ash trees, rootball, walkways, soil, and other demolished materials. Re-use the material on site. Use the debris disposal as an educational opportunity for sustainability principles.	Interim debris piles for material to be recycled.	Process debris on-site.	Disposal, amend and re-use of soil.	Hazardous soil removal (to be sent off-site).			
Walkways	Keep existing walks (alignment, line, form) - preserve EA pavement and repair/maintain in place (No Action Alternative or Alternative 1, 2)	Keep existing EA walks - remove specific areas of walks and patch with similar materials to maintain form, line, color, texture.	Remove all exposed aggregate walks and replace with new walks with similar exposed aggregate color, texture; maintain line, form.	Retain and repair existing promenade per the Park's maintenance plan. (No Action Alternative)	Replace promenade to accommodate drainage, improved soils, and new walk surface.				

Operations	Selection of smaller trees v. larger trees at installation. Consideration of maintaining smaller trees after planting.	Access to the canopy of taller trees for pruning activities. Park presently does not have a climbing crew. (Impacts on staffing when the trees reach their mature height)	Integrate temporary visual resource measures during the tree replacement. Examples include Grave's decorative scaffolding or UVA's green screen.	Use of parking lots, area under bridge to chip/grind/load chips prior to removal from site or re-use on site.	Temporary pedestrian circulation paths during construction.	Solutions for notches in the sidewalk: loose v. hard materials	*Requirement of additional staff (contract out some activities: tree climbing for large trees in 10-15 yrs., other activities in the near term). *Coordination w/ local conservancy	Plan construction to maintain existing operations: access, lighting, security, snow removal, leaf pickup, mulching, pruning.	
Size of tree	All one size - at time of replacement during each phase.	Several sizes of tree over an extended period of replacement, (smaller - earlier phase; larger - later phase) Refer to the Kiley phasing/sizes	Smaller trees within the turf areas and larger trees along / adjacent to the paved areas.	*Consider replacing trees along Memorial Drive (and other than allees) with species other than the selected single-species tree. * Other tree species used in compatible, but non-contributing planting areas.	Views and vistas of areas - newly planted areas and staging areas at the teardrops or triangles.	Views of allees - enclosed landscape is removed because of installation of smaller trees. Reduction of shade along promenade due to growth rate of trees.	Maintain compatibility with original design intent. (see Kiley, CLT)	*Reduction of shade because of smaller trees with less dense canopies on the microclimate along the promenade.	
Visitor Experience	Visitor experience: views and location/number/size of active staging and construction areas (potential issues with dust, noise, glare, aroma). If more than one staging area, consider division of use.	Timing of construction (hours of construction, season when construction occurs), physical size of areas under construction (small phased areas, all areas, one leg at a time) v. the visitor experience. Use of Construction Theater as an educational opportunity and mitigation for visual impact.	Potential issue with pedestrian circulation and the raised root balls. (trip hazard)			*Creation of Interpretation and educational opportunities before, during and after the construction period. (can separate and link to design competition)			
Treatment Around Trees (roll into tree pits)	Keep root ball down - potential trip hazard.	Change configuration of promenade and bring root ball up and use lightweight mulch (can wash away). Notches are larger to create a more planar situation, changes design detail.	Surface appearance around the tree pits.						

Environmental Assessment for Emerald Ash Borer Strategy
 Jefferson National Expansion Memorial
 October 13, 2010
 Goal: Select components from Brainstorming Table to compose a feasible action alternative.
 Alternatives Development Workshop
Worksheet #2: Alternatives Table

Alternatives	Size of Tree	Tree Replacement Phasing: Area	Tree Pits/Soil	Timing	Construction Staging	Debris Disposal	Visitor Experience	Visitor Circulation	Walkways	Operations
Alternative 1	All one size - at time of replacement during each phase.	Phasing to coincide with MVVA design competition or other considerations.	Create new trench-like drainage system with amended soil and new drainage infrastructure.	Spring or fall planting of trees, (species selection will determine the planting season)	Location of staging areas on-site for plant material, soil, and other materials. (located in teardrop areas; mitigate soil and irrigation system after project); identify on-site staging areas in context to parking, access, and pedestrian circulation.	Recycle ash trees, walkways, soil, and other demolished materials; re-use on site.	Creation of interpretation and educational opportunities prior to, during and after the construction period. Can be separate or linked to the design competition.	Maintain existing walkway system (line, circulation).	Remove all exposed aggregate walks and replace with new walks with similar exposed aggregate (color, texture) and maintain the line and form of the walks.	Integrate temporary replacement measures during the tree replacement (i.e. Michael Graves decorative scaffolding). *Requirement of additional staff: contract out some activities such as tree climbing for large trees in 10-15 yrs., other activities in the near term.
	*Consider replacing trees along Memorial Drive (and other than allee) with species other than the selected single-species tree. *Other tree species used in compatible, but non-contributing planting areas.			Remove existing metal tree grates and keep the notches in the sidewalk.	Phased implementation over one or more seasons	Location of construction staging areas in relationship to the timing of the project.	Implement sustainability principles and take advantage of the educational opportunity for visitors.	Maintain consistency and compatibility with Kiley's original design intent.	Utilize Construction Theater prior to and during demolition and construction as an education and interpretive opportunity as well as for visual impact.	Replace promenade to accommodate drainage, improved soils, and new walk surface.
No Action Alternative	The existing Rosehill ash trees would continue to grow.	Rosehill ash trees would not be replaced with another species.	Tree pits would remain unaltered. The existing soil in each tree pit would not be amended.	There would be no set timeline for tree removal. Rosehill ash trees would be removed as they decline/die due to the EAB.	There would be no large-scale construction staging. Small areas would be cordoned off temporarily while dead/dying Rosehill ash trees are removed.	Rosehill ash trees would be removed from the single species; planting and either chipped and disposed on site or at a designated location in St. Louis County.	Visitor experience to remain the same: no Construction Theater. Minor adjustments for during the removal of trees. (note: discuss in 4.0 impacts to the views/vistas; circulation due to tree removal)	Visitor circulation would be the same. Minor and temporary changes in circulation may occur to accommodate maintenance activities related to the removal of the Rosehill ash trees.	The existing walkways would remain in location and material type.	Operational activities related to the care and maintenance of the Rosehill ash trees would continue. Monitoring for EAB would continue.

Worksheet #3: Impacts Topics

Impact Topics*								
Impact Sub-Topic(s)	Natural Resources		Cultural Resources		Visitor Opportunities and Use	NPS Operations	Public Health & Safety	Transportation and Access
	Vegetation	Cultural Landscapes	Historic Properties / NRHP	Visual and Aesthetic Resources	Visitor Experience			Access
Element(s) Associated with Impact Topic	Walkways					Timing	Debris Disposal	
	Tree Replacement Phasing: Area	Size of Tree	Tree Replacement Phasing: Area	Tree Replacement Phasing: Area	Timing	Operations	Walkways	Construction Staging
	Tree Replacement Phasing: Area	Visitor Experience	Walkways	Size of Tree	Construction Staging	Construction Staging	Visitor Experience	Debris Disposal
	Size of Tree	Tree Replacement Phasing: Area	Tree Pits/Soil	Timing	Debris Disposal	Debris Disposal	Visitor Circulation	Visitor Circulation

* Impact topics are from the JNEM GMP ES or DO-12 Handbook and Director's Order.

Elements Specific to Each Alternative										
Action Alternative	Size of Tree	Tree Replacement Phasing: Area	Tree Pits/Soil	Timing	Construction Staging	Debris Disposal	Visitor Experience	Visitor Circulation	Walkways	Operations
		Replace trees along Memorial Drive (and areas other than allees) with a different species other than the selected single-species tree. Use other species in compatible, but not contributing planting areas.	Phase tree replacement to coincide with design competition or other considerations.	Plan and design a new trench-like drainage system that includes amended soil and new drainage infrastructure.	Spring or fall planting of trees. (fall planting is preferred, however the species selection will determine the appropriate planting season)	Location of staging areas on-site for plant material, soil, and other materials. Identify on-site staging areas in context to parking, access, and pedestrian circulation.	Recycle ash trees, walkway materials, soil, and other demolished materials; re-use on site.	Create interpretation and educational opportunities prior to, during and after the construction period (include sustainability principles). Utilize Construction Theater prior to and during demolition and construction as an education and interpretive opportunity.	Maintain existing walkway system with the layout of the walks and pedestrian circulation.	Remove all exposed aggregate walks and replace with new walks with similar exposed aggregate (color, texture) and maintain the line of the walks.
	All one caliper/height/width at time of replacement during each phase.		Remove the existing metal tree grates and keep the notches in the sidewalk.	Phased implementation over more than one planting season.	Locate construction staging areas in relationship to the phasing of the tree replacement.	Implement sustainability principles.	Maintain consistency and compatibility with Kiley's original design intent.		Replace promenade to accommodate drainage, improved soils, and new walk surface.	Plan construction to maintain the existing Park operations: access, lighting, security, snow removal, leaf pickup, mulching, pruning.
No Action Alternative	The existing Rosehill ash trees would continue to grow.	Rosehill ash trees would not be replaced with another species when they die and are removed.	Tree pits would remain unaltered. The existing soil in each tree pit would not be amended.	There would be no defined timeline for tree removal. Rosehill ash trees would be removed as they decline/die.	There would be no large-scale construction staging. Small areas would be cordoned off temporarily when dead/dying Rosehill ash trees are removed.	Rosehill ash trees would be removed from the single species planting and either chipped and disposed on site or at a designated location in St. Louis County.	Visitor experience to remain the same; no Construction Theater. Minor adjustments for during the removal of trees.	Visitor circulation would be the same. Minor and temporary changes in circulation may occur to accommodate maintenance activities related to the removal of the Rosehill ash trees.	The existing walkways would remain in location and material type.	Operational activities related to the care and maintenance of the Rosehill ash trees and walks would continue.

Worksheet#4: Alternatives Comparison by Impact Topic

Impact Topic	Impact Sub-topic	Action Alternative	No-Action Alternative	
Natural Resources	Vegetation	Tree replacement would be phased to coincide with new design or other considerations in compliance with the 2009 GMP.	The existing Rosehill ash trees would continue to grow and decline.	
		The trees in the allées would be replaced with trees of similar caliper, height, and spread in multiple phases.	Rosehill ash trees would not be replaced with another species when they die and are removed. Tree pits would remain unaltered.	
		Rosehill ash trees in all areas outside of the allées, such as along Memorial Drive, would be replaced with a species other than the single-species tree selected for the allées.	Rosehill ash in other areas outside the allées would be removed and not replaced.	
		In the related design competition process, soil improvements would be undertaken to enhance growing conditions for the allée trees planted in the tree pits within the walks.	The existing soil in each tree pit would not be amended and drainage would not be altered.	
Cultural Resources	Cultural Landscapes	Consistency and compatibility with Kiley's original design intent would be a major priority of the tree replacement process.	Plantings would not be altered to align more closely to Kiley design concept and intent. All other features, both contributing and non-contributing, would remain in place as existing.	
		In all areas other than the allées, other species would be used to replace Rosehill ash.	Rosehill ash in areas of the Memorial grounds outside the allées would be removed and not replaced.	
		Phased replanting with trees that are of similar size (caliper, height, and spread).	Rosehill ash trees would be removed as they decline and die.	
		Provision of interpretive and educational opportunities prior to, during, and after the construction period regarding the significance of the Saarinen/Kiley design and the place of the single-species allée plan.	No educational opportunities would be provided when the trees decline and die.	
	Historic Properties/NRHP	Retention of the integrity of the National Historic Landmark would be a primary consideration in all aspects of the tree replacement.		
		The replacement process would retain the existing tree spacing; the alignment, width, and layout of the associated walks; and other contributing characteristics of the allées and walks as defined in the 2010 CLR.	Other contributing features, such as the walkways, would remain unchanged.	
		As part of the GMP design process/projects outside the scope of the tree replacement, the paving of the existing exposed aggregate walks would be removed to install drainage and improved soils as part of the GMP design process. All walk alterations developed as part of design projects would be coordinated with tree replacement phasing accordingly. The paving would be replaced with similar exposed aggregate (color, texture) and their widths and alignments maintained. A new trench-like drainage system would be planned with amended or structural soil and improved drainage infrastructure underlying the walks. The existing metal grates on the tree pits would be removed and the tree pits retained as notches.	The walkways, a contributing feature of the NHL, would remain unchanged.	
	Visual and Aesthetic Resources	Phased replanting of trees that are all of similar size in caliper, height, and spread.	Rosehill ash trees would not be replaced with another species when they die and are removed.	
	Visitor Opportunities and Use	Visitor Experience	Phased implementation over more than one planting season.	The trees would not be replaced with another tree after they die.
			The location of staging areas for plants, soil, and other materials would be identified on-site in context of parking, access, and pedestrian circulation needs, as well as in relationship to the phasing of the tree replacement.	There would be no staging areas for plants, soil, and other materials, as dead trees would be removed and not replaced.
Use the "construction theater" concept to provide an educational opportunity and attraction.			There would be no new educational opportunities or attractions related to construction activities.	
Education about recycling materials and sustainability would be integrated into the tree replacement process.				
NPS Operations		Tree replacement would be planned to coordinate with existing Memorial operations, including but not limited to: access, lighting, security, snow removal, leaf pickup, mulching, and pruning.	Operational activities related to the care and maintenance of the Rosehill ash trees and walks would continue as existing.	
		Phased implementation would be coordinated with operations needs in addition to other requirements (preferred seasonality of tree planting; visitor experience and access; other phased design projects related to GMP).		
			There would be no large-scale construction staging. Small areas would be cordoned off temporarily when dead/dying Rosehill ash trees are removed.	
		The tree replacement would be an opportunity to implement sustainability principles (recycle ash trees, soil, and other demolished materials; re-use on site).		
Public Health & Safety		The tree replacement would provide opportunities for implementing sustainability principles, such as recycling and re-use of materials.	Rosehill ash trees would be removed from the single species planting and either chipped and disposed on site or at a designated location in St. Louis County (if EAB).	
		Construction staging would be planned to minimize dust, noise, and hazards to visitors and staff.	There would be no large-scale construction staging. Small areas would be cordoned off temporarily when dead/dying Rosehill ash trees are removed.	
Transportation & Access	Access	The alignment, width, and location of the existing system of walks would be maintained.	The alignment, width, and location of the existing system of walks would be maintained.	
		Phase construction activities in order to maintain visitor circulation to the Gateway Arch from various points on the Memorial perimeter.	Access and circulation would remain the same as current. There would be occasional closures of walks to remove declining Rosehill ash trees.	
		Staging areas for plants, soil, and other materials would be located on-site in context of parking, access, and pedestrian circulation, and in relationship to the phasing of the tree replacement.		