DRAFT – FOR REVIEW ONLY

San Francisco Recreation & Park Department
Capital Improvement Program

Assessment of Urban Forestry Operations

Prepared for:
Recreation & Park Department
City of San Francisco
McLaren Lodge
501 Stanyan Street
San Francisco CA 94117

Prepared by:
HortScience, Inc.
2150 Rheem Dr., Suite A
Pleasanton, CA 94588

June 8, 2010

HORT SCIENCE

Assessment of Urban Forestry Operations

Recreation and Park Department
San Francisco CA

Executive Summary

San Francisco lacks native forest. As a result, most of the trees in the City's large parks were planted, during the late 1800s and early 1900s. The precise number of trees within the Department's responsibility is not known. The 1993 census found approximately 27,000 trees in Golden Gate Park. The Significant Natural Areas Management Plan estimates there to be 64,000 trees in the 868 acres of natural areas. We estimate there are 67,000 trees in the 2,389 acres outside of the Natural Areas, for a total of 131,000 trees on Recreation and Park Department properties in San Francisco.

The Department's Urban Forestry program is responsible for tree management, from pruning and tree removal to replanting. The program consists of thirty (30) full-time equivalent staff with a budget of $3.5 million. The staff is divided between tree maintenance (16 full-time equivalent positions) and reforestation (13 full-time equivalent positions) with one supervisor. Approximately 500 trees in Golden Gate Park and 750 trees in other properties are treated by the Department each year, putting the maintenance cycle for all trees at over 50 years.

Routine tree care includes pruning, removal, clean-up and inspection. Virtually all tree care activity is request-driven. There is little programmed tree maintenance. We recommend that over time the Department consider moving from a purely reactive mode of action to one where 50% of tree care is programmed.

The Department's planting program has been successful in Golden Gate Park,. In the Parks and Squares, planting of new trees has not kept pace with removal. No new trees have been planted by Urban Forestry on the golf courses.

The 2008 Clean and Green Park Bond provided funding for the Department to address tree hazards. Areas to receive treatment were prioritized by evaluating both the tree condition at each park property and the use and occupancy of park facilities. Eighteen (18) properties were identified as having the highest priority. An assessment protocol has been developed.

Sustaining the urban forest located on Recreation and Park Department properties will require intensive planting of both and non-native species. There is a need to develop tree management plans for individual properties, plans that will assess existing tree composition and structure, and recommend a program of new planting.

DRAFT – FOR REVIEW ONLY

Assessment of Urban Forestry Operations

Recreation and Park Department
San Francisco CA

Table of Contents

List of Tables

Appendices

DRAFT – FOR REVIEW ONLY

Introduction and Overview

The Recreation and Park Department manages over 200 properties located within the City limits. Together these properties comprise more than 3,000 acres. In addition, the Recreation and Park Department manages two properties located outside San Francisco's city limits: Sharp Park in Pacifica and Camp Mather in Groveland. Park properties range in size from over 1,000 acres to several thousand square feet.

The Recreation and Park Department is responsible for managing trees located on its properties. With few exceptions, trees are an integral part of the landscape of parks, squares and other Recreation and Park Department properties. A wide range of species and planting conditions create tremendous diversity, from large specimen trees to dense forest-like groves. Recreation and Park Department properties may be described in the following manner:

- **Mini-parks** are less than one acre is size. Facilities are generally limited to benches and tables. Trees are generally few in number, and are small to medium in size when mature. Mini-parks tend to be recent in origin.

- **Playgrounds and recreation centers** provide a range of recreational facilities, with sports fields and tennis courts. Average size is approximately 5 acres. Many playgrounds have recreation center associated with them. As a result, trees are generally moderate in number, located on the periphery of the facility.

- **Open space** areas are relatively small (averaging about 1.5 acres) areas of undeveloped land. As rule, there are few trees on these properties.

- **Parks, squares and plazas** average 5 acres in size. Included in this group, however, are properties such as McClaren and Lincoln Parks, both of which are over 100 acres. Parks, squares and plazas contain a diverse range of facilities but always have significant areas of lawn and landscape. In some properties, tree cover is extensive.

- **Golden Gate Park** is unique among Recreation and Park Department properties. At 1,032 acres, it is the largest park in San Francisco. There are extensive landscape plantings as well as large areas of woodland.

The actual number of trees on Recreation and Park Department properties in San Francisco is unknown. The Significant Natural Resources Areas Management Plan (2006) estimates that 64,000 trees are located in the 868 acres of designated natural areas of park properties within the City limits. There are 2,389 acres of Recreation and Park Department property in San Francisco that are not included in the Natural Areas Program. We estimate there to be 67,000 trees on these lands (Appendix C), yielding a total of 131,000 trees on Recreation and Park Department properties located in San Francisco. This total does not include either Sharp Park or Camp Mather.

In 2009, the Recreation and Park Department contracted with HortScience, Inc. to develop an **Assessment of Urban Forestry Operations**. The Department was interested in having "a set of recommendations for the healthy and sustainable long-term management of San Francisco's Recreation and Park Department's unique urban forest." Rather than being property-specific, the Department sought an overview of tree management on a city-wide basis.

This document addresses the Recreation and Park Department's interest by providing the following information:

- The operational context for the Department's tree management activities.
- A tree risk management policy and description of a risk assessment and abatement program.
- Recommendations for moving from a reactive program of care to a programmed approach.
- The importance of planting to sustaining the urban forest located on Recreation and Park Department properties.

Primary sources of information used in preparing this assessment were: 1) review of Recreation and Park Department records, 2) interviews with Urban Forestry staff and 3) site visits. A list of staff who were consulted is included in Appendix A. Urban foresters and professionals in related disciplines were consulted.

Project outreach included meetings with the Parks, Recreation and Open Space Committee, the Urban Forestry Council and other stakeholders such as Neighborhood Parks Council and San Francisco Parks Trust (see Appendix A).

The Origin of San Francisco's Urban Forest

> "Trees were probably never a conspicuous feature in the San Francisco landscape, but in the earliest days small trees of several kinds were found on the hills and summits." Howell, Raven and Rubtzoff, 1958.

No forest covered San Francisco prior to the arrival of the Spanish in the 1760s. Instead the City was covered with grassland, coastal scrub and bare sand dunes. The area of Golden Gate Park was described as a "great sand waste." Trees were present along creeks and in protected locations. In general, trees were a very minor part of the vegetation cover. Few species were present and overall tree canopy cover was low. Unlike other cities, there was no native forest upon which to build.

San Francisco's urban forest came into being in the late 1800s when intense programs of afforestation (tree planting) were initiated. The basic structure of vegetation in the City's large parks was created "over a 30 year period beginning in the 1880s" (McBride and Froehlich). Large parks include Golden Gate, McLaren, Stern Grove, Twin Peaks and Mountain Lake.

Although numerous tree species were planted, the City's urban forest has come to be dominated by just a few, notably Monterey pine (*Pinus radiata*), Monterey cypress (*Cupressus macrocarpa*) and blue gum eucalyptus (*Eucalyptus globulus*). They noted that pine and cypress were not regenerating while blue gum was regenerating from root sprouts. McBride and Froehlich also noted that half of the Monterey pine and eucalyptus trees, and one-third of the Monterey cypress trees, in older stands were in poor condition.

In summary, the urban forest managed by the Recreation and Park Department is almost entirely artificial, created by planting thousands of trees using species not native to San Francisco. Regeneration of this forest occurs largely in eucalyptus stands and not in pine or cypress groves.

It is clear that without a commitment to reforestation, the current forest cover managed by the Department cannot be sustained.

The Operational Context for Tree Management in the Recreation and Park Department

Tree management is the responsibility of the Recreation and Park Department's operations division. The Urban Forestry Section provides tree care activities to all Department properties from mini-parks to squares to golf courses to Golden Gate Park and Camp Mather. The Urban Forestry Section is responsible for planting and early care, pruning, removal, debris disposal and any other tree care activity. Because of its specialized equipment, Urban Forestry also supports other Departmental maintenance activities.

Guiding Documents

Because the forest areas of Golden Gate Park are artificial in origin, no natural regeneration has occurred. To address the long-term future of the forest areas of the park, the Golden Gate Forest Management Plan was developed in 1980. The Plan analyzed the composition and structure of the forest areas, finding that it was even-aged and generally mature. Forest areas were defined as "groupings of trees greater than 0.5 acres" in size. These comprised 623.5 acres, about 62% of the Park's 1,013 acres. Forested areas were concentrated in the western side of the Park. The Plan estimated that 33,342 trees were present.

In order to sustain forest cover, the Plan recommended a program of reforestation. The Plan envisioned a reforestation program that would move from even-aged to an uneven-aged where a range of tree age and size would be present. The Plan recommended a 25 year rotation. Over that period of time, all of the forest stands would be replanted. The Forest Management Plan does not discuss tree care activities such as pruning and removal. It is focused solely on reforestation.

Other than Golden Gate Park, few management plans have been prepared for Recreation and Park Department properties. A vegetation management plan for Mountain Lake Park was prepared by Joe McBride and Denice Lobel (University of California, Berkeley) in 1980.

HortScience, Inc has prepared specific Tree Management Plans for Washington Square Park, the Japanese Tea Garden at Golden Gate Park, and Pioneer Park. We are not aware of similar large scale forest management plans for other Recreation and Park Department properties.

Natural Areas Program

In 2006 a Management Plan for the Department's Significant Natural Resources Areas was created. The Plan recognized that remnants of pre-settlement vegetation were present within Recreation and Park Department properties. The Department set a goal to "preserve, restore and enhance" approximately 868 acres in 31 locations in San Francisco. The Department's Natural Areas Program developed the Plan which prioritized the locations for conservation and management activities.

When discussing trees, the Significant Natural Resources Areas Plan points out that most of the species present in parks are non-native and invasive.

The recommendations within the Significant Natural Resources Areas Management Plan are now undergoing environmental review. This includes recommendations to transform designated natural areas to their pre-settlement vegetation over time. For the most part, restoration will involve some tree removal. The Plan also includes preservation and diversification of many of the Recreation and Park Department's areas of urban forest.

Urban Forestry Staff and Budget
For fiscal 2009 – 2010, Urban Forestry program had a budget of $3.5 million with 30 full-time-equivalent positions divided between tree maintenance (16 full-time equivalent staff) and reforestation (13 full-time equivalent staff) with a program supervisor.

- **Tree crews**
  Perform tree care activities such pruning, removal, and stump grinding.
  - Golden Gate Park. 4 staff.
  - Parks and Squares (all properties except Golden Gate Park and golf courses). 5 staff.
  - Golf courses. 4 staff.
  - Contract. 3 staff. Work on a contract basis for other City departments.

- **Reforestation**
  Perform site preparation, tree planting, watering, staking, weed management, pruning, and thinning of young reforestation stands.
  - Golden Gate Park. 8 staff.
  - Parks and Squares. 5 staff.

The Department has 13 staff involved in tree care activities including pruning and removal at Recreation and Park Department properties. Based on recent work records, crews at Golden Gate Park address (prune and remove) about 470 trees per year while crews at other properties (including the golf courses) prune and remove approximately 760 trees per year. Assuming 27,192 trees in Golden Gate Park, it would take the crew 54 years to complete one cycle of tree care. For Parks, Squares and golf courses, the cycle length is 49 years.

The Department of Public Works Bureau of Urban Forestry manages approximately 40,000 trees along San Francisco's major streets. Their goal is to maintain a 7 year maintenance cycle, although recent budget reductions have probably extended the cycle to 10 years. This is the average, as some locations receive more frequent maintenance and others, less.

There is no standard tree care cycle for trees in parks. Neither Vancouver Canada nor Portland OR has a systematic pruning cycle for park trees. In Seattle WA, the Parks Department has a goal of addressing park trees every 18 years. Current operations, however, result in a 40 year maintenance cycle. The Prospect Park Conservancy in Brooklyn NY manages 12,000 landscape trees with a goal of a 5 year maintenance cycle.

Trees along streets and near power lines require more frequent pruning, particularly to provide clearance A typical municipality addresses its street trees on 5 to 10 year cycle. The San Francisco Department of Public Works Bureau of Urban Forestry aims for a 5 year tree maintenance cycle but is currently operating on a 10 year cycle. Most utilities in California inspect trees in proximity to energized conductors on an annual basis.

At present, the Urban Forestry program is able to address only a small fraction of trees located on Recreation and Park Department properties. The Department's budgetary situation has been a source of concern for many years, extending beyond tree management into all areas of the Recreation and Park Department's responsibility. The Golden Gate Park Forest Management Plan (1980) noted that the "tree maintenance cress, though very dedicated, are understaffed." The history of budget reductions has been long. In fiscal year 2004 – 2005, Urban Forestry's budget was $3.2 million with 36 full-time equivalent staff. While the current budget is slightly higher, the number of staff has decreased from 36 to 30.

For the 2010-11 fiscal year, the Recreation and Park Department must reduce its budget by and additional 20% - 30%. Examples of impact of such reductions on operations abound. At the current time, trees receive maintenance once every 50 years. Budget reductions will only make this situation worse. A similar situation exists with reforestation. There is no planting at golf course. Planting at parks and squares does not replace losses due to removal. The reforestation in Golden Gate Park operates on a 35 year cycle instead of the 25 to 30-year cycle recommended in its Forest Management Plan. Department-wide, tree care activities are provided on a request-basis only. There is little or no program of routine care.

Tree Care Activity

Over the past 3 years, Urban Forestry staff pruned 882 trees per year, removed 380 and planted 1,180 (Table 1, following page). In general, the number of trees pruned in Golden Gate Park, the golf courses, and other properties (i.e., parks and squares) was similar. Approximately 40% of all tree removals took place in Golden Gate Park.

Over 90% of all trees planted by the Recreation and Park Department in the last 3 years were installed in Golden Gate Park, part of the property's reforestation program. Since the mid-1980s, a number of small blocks located in the Park's forested areas have replanted. There are approximately 600 acres of "forest" in Golden Gate Park, located on the west side of the property.

Reforestation staff work with gardeners to identify a suitable location for reforestation and select the species for planting. Installed plants are seedling size. From that point, the reforestation process consists of preparing the site, establishing irrigation, planting and replanting, thinning and pruning. Over time, less vigorous and structurally unsound trees are removed from the reforestation plots. Such thinning provides the remaining trees with more room to grow and develop.

Trees planted during that 1980s are now mature in size and form, having grown 1' to 2' per year in height and 1' in trunk diameter.

Over the last three years, seven trees were planted in Golden Gate Park for every tree removed (3202 planted vs. 435 removed). Not all trees survive establishment to become mature specimens but the result has been replacement of older pines and eucalyptus with younger, more vigorous material. The reforestation program Golden Gate Park has made significant strides towards establishing the next generation of trees in the forested areas.

Table 1. Tree care activities. Urban Forestry program. San Francisco Recreation & Park Department.

Activity & Location	Year 2007	2008	2009	Total
Trees pruned				
Golden Gate Park	304	362	311	
Parks & Squares	285	307	242	
Golf course	231	340	263	
Total	**820**	**1009**	**816**	**2645**
Trees removed				
Golden Gate Park	146	183	106	
Parks & Squares	124	110	130	
Golf course	73	83	97	
Total	**343**	**376**	**420**	**1139**
Trees planted				
Golden Gate Park	1367	965	870	
Parks & Squares	105	115	120	
Golf course	0	0	0	
Total	**1472**	**1080**	**990**	**3542**

Notes: Source: Recreation and Park Department urban forestry work records
No data was available for August 2007

Reforestation at the Recreation and Park Department's Parks and Squares also involves Urban Forestry reforestation and gardening staff who jointly decide which species to install in a particular location. Planting stock is generally small container size. Planting rates for parks and squares has not kept up with removals (364 trees removed vs. 302 planted). Some new trees will die, be stolen or vandalized, or simply not perform. Based solely on the number of trees planted, there will be less tree cover in the future than at present. The number of trees planted at Parks and Squares does not include those added to the properties as part of capital projects.

The situation is more extreme on the golf courses where over 200 trees were removed without any additional planting by Recreation and Park Department staff. Should this trend continue, there will be fewer and fewer trees at these properties.

Tree care activities are scheduled based on service requests. Within the Recreation and Park Department, such requests are made through the City's asset management program, TMA. Gardening staff make most of the service requests for tree care activity. Requests from the general public are made through the City's service inquiry program, 311.

Neither TMA nor 311 are tree-specific. TMA is a general program, encompassing a wide range of maintenance activity. While there is a code for tree work, the specifics are placed in the "comment" section. For this reason, work requests almost always require a site inspection by the Urban Forestry staff before work can be scheduled. The same is true for 311, which is even more general in nature.

We analyzed 1,330 TMA-based work requests to urban forestry over the period 2005 to 2009 (Table 2). We categorized the requested action as:

- Pruning (716 requests). Remove branches.
- Removal (308). Take down tree.
- Clean-up (150). Tree material is on the ground, and needs to be chipped, cut-up and removed.
- Inspection (73) Tree needs to visually assessed, commonly because of health and structural stability.
- Not tree related (45). Requests to use tree-equipment such as aerial lifts for non-tree tasks such as replacing light-bulbs.
- Planting (22). Install new trees.
- Staking (7). Newly planted trees need to have maintenance on support stakes.
- Miscellaneous (9).

We categorized the reason for the request action as:

- Hanger (434 requests). Branch is broken but hanging in the tree crown.
- Failure potential (155). Tree has structural defects that might lead to failure.
- Clearance (145). Low-hanging branches require removal.
- Dead (131). Tree is dead.
- Failed tree (105). Tree failed, needs to be removed.
- Failed branch (45). Branch failed, needs to be removed.
- No reason specified (80).
- Brush (31). Tree material is on ground and requires clean-up.
- Thinning (29). Either tree needs branches removed or group of trees requires removal of individuals.
- Cleaning (23). Tree requires pruning to remove dead, dying, diseased and otherwise structurally unsound branches.
- Health (25). Tree requires pruning or removal due to poor health.
- Miscellaneous (25).
- Other (102).

Among Recreation and Park Department properties, Golden Gate Park had the most TMA requests 465 (35% of the total). Other properties frequently requesting tree care were Lake Merced (114, 9%), Sharp Park (43, 3%) and Park Presidio Blvd. (36, 3%). All other properties had 35 or fewer TMA requests.

Staff noted several challenges to effective application of both TMA and 311 as work order systems. First, location information is very general, frequently leading to an inability to find the tree for which action is requested. Second, the action requested is also general in terms of tree number, urgency and specificity of maintenance task needed.

Table 2. Detailed for tree-related TMA work requests (2005 to 2009). Recreation and Park Department. San Francisco CA.

Requested Action	Reason for request													Total
	Hanger	Failure potential	Clearance	Dead	Failed tree	Failed branch	No reason	Brush	Thinning	Cleaning	Health	Misc.	Other	
Clean-up	--	--	--	--	77	42	--	31	--	--	--	--	--	150
Inspection	--	53	--	--	--	--	--	--	--	--	6	14	--	73
Miscellaneous	--	--	--	--	--	--	2	--	--	--	--	--	7	9
Not tree related	--	--	--	--	--	--	--	--	--	--	--	--	45	45
Planting	--	--	--	--	--	--	--	--	--	--	--	--	22	22
Pruning	434	21	138	--	--	3	48	--	24	23	--	4	21	716
Removal	--	81	7	131	28	--	30	--	5	--	19	7	--	308
Staking	--	--	--	--	--	--	--	--	--	--	--	--	7	7
Total	**434**	**155**	**145**	**131**	**105**	**45**	**80**	**31**	**29**	**23**	**25**	**25**	**102**	**1330**

Source: TMA work requests.

Wood waste management
Activities of the Urban Forestry program generate significant amounts of green waste, in three general forms: logs, ground woody debris, and chips. Ground woody debris is separated into organic matter and chips. Logs and chips are hauled off-site. The organic fraction is composted, then provided to gardening staff as a soil amendment. Recreation and Park Department staff estimates that over 50% of green waste is re-used by the Department.

Relationship with other Departments and Interest Groups
The Recreation and Park Department interacts with a number of other City Departments and Agencies with respect to tree management activities:

- **Department of Public Works** (DPW). The Department's Bureau of Urban Forestry "coordinates management of street trees and landscaped medians." The Bureau is also responsible for sidewalk repairs and installing curb ramps. Under the City's Public Works Code, the Bureau treats some trees within 10' of the street right-of-way as street trees. In addition, the Bureau maintains the list of designated Landmark trees.

- **Other Departments and Agencies**, such as the San Francisco Unified School District, may contract with Recreation and Park Department tree crews to provide tree care services.

- **Parks Recreation and Open Space Advisory Council** (PROSAC). An advisory group composed of citizens appointed by the Mayor and Supervisors. Members from Supervisory Districts act as liaison to the Recreation and Parks Commission.

- **Neighborhood Parks Council**. A non-profit citizen's group representing the interests of park users. The Council's Mission statement is, "Neighborhood Parks Council (NPC) advocates for a superior, equitable and sustainable park and recreation system. NPC provides leadership and support to park users through community-driven stewardship, education, planning and research."

- **San Francisco Parks Trust**. A non-profit citizen's groups supporting Department programs. The Parks Trust is "dedicated to providing leadership and support for San Francisco parks, recreation centers, and open spaces" (from the Trust's website).

- **San Francisco Urban Forestry Council** (convened by the Department of the Environment) "advises city departments, including the Board of Supervisors and the mayor. Its tasks are to develop a comprehensive urban forest plan; educate the public; develop tree-care standards; identify funding needs, staffing needs, and opportunities for urban forest programs; secure adequate resources for urban forest programs; facilitate coordination of tree-management responsibilities among agencies; and report on the state of the urban forest" (from the Council's website). Membership includes representatives of the public and City Departments involved in tree and forest management.

- **Other interested groups affiliated with specific properties or tree-related environmental issues such as** Friends of Washington Square, the Audubon, and the Pioneer Park project.

Reactive vs. Programmed Tree Management

Tree management within the Recreation and Park Department is organized on a reactive basis. Gardeners and other Departmental staff use TMA to request tree care activities. The City's 311 system operates in a similar manner for the general public. At the current time, the Urban Forestry staff operates under a back-log of some 450 requests from Golden Gate Park, the Parks and Squares, and golf courses.

This style of tree management is known as reactive, in that the Department reacts to requests from others to provide tree care services. It is a common style of management.

An alternative approach is programmed tree care, where all of the trees under the Department's management are treated in a systematic manner. In the best situation, a programmed approach would inspect and provide needed treatment to every tree over a fixed period of time, known as the pruning or maintenance cycle.

Programmed tree care offers three significant advantages over reactive pruning. First, it uses resources more efficiently. Instead of moving from one job site to another, the tree crew can focus on a number of trees in one location. Second, programmed tree care puts the burden of inspection in the hands of professional arborists. Under the current, reactive system, gardeners, the public and others not trained in tree care, make the bulk of the requests. Third, every tree gets attention in a programmed system where reactive care targets only trees that come to someone's attention. This permits trees to receive routine care, addressing potential problems while they are still small.

Communities that have transitioned from reactive to programmed care have found they maintain more trees per year and address problems more systematically. The most well-documented example is Modesto CA which moved to a programmed approach to street tree management in the 1980s. The number of trees being pruned doubled the first year. In addition, trees were being pruned in a comprehensive manner rather than just in response to a specific request such as "remove low-hanging limbs."

The transition from reactive to programmed tree care is not without its challenges. The most important issue was deferring requests from elected officials and the public who were accustomed to a rapid response. Modesto found that extensive contact with the public was needed to introduce the change. Modesto California's outreach effort to move from reactive to programmed tree care focused on five points:

1. Programmed pruning was more efficient and productive.
2. Programmed pruning provided consistency in that all trees in the City would receive equal service.
3. Addressing trees in an area was beneficial to tree growth and development.
4. Programmed pruning reduced the City's liability while enhancing public safety.
5. Residents who wanted immediate service could apply for a permit and have the work performed by a commercial tree care company, at their own cost.

The Recreation and Park Department would like to transition from a request-driven, reactive program to a one that is driven by program requirements. It is unlikely that current staff levels can achieve a complete transition to programmed care. Work records indicate that the tree crews are able to treat (prune or remove) approximately 1250 trees a year. Using the 64,000 tree estimate for trees within City limits, the maintenance cycle would be over 50 years. This does not include either Sharp Park or Camp Mather. Including those sites in the programmed tree care would likely double the maintenance cycle.

For this reason, we recommend that the Recreation and Park Department aim for a work system where the tree crews devote 50% of their time each year to programmed care. This assumes no additional reductions in staff and the use of bond funds to supplement routine care. As a comparison, the Department of Public Works Bureau of Urban Forestry operates on a 60% program / 40% reactive basis.

Recommendations for Transitioning to Program Pruning

Transitioning from a reactive to program pruning operation will require a fair amount of planning and public outreach. Within the Recreation and Park Department, planning needs to resolve how TMA and 311 requests will be managed as well as how routine tree care will be scheduled among the properties. Such planning will involve the gardening staff who are the primary requesters of tree work.

The following is a series of recommendations about the transition. It is likely that additional needs will arise as the program develops. I expect the planning portion will take 6 to 12 months.

1. Create an intradepartmental team from Neighborhood Service Area and Forestry staff charged with implementing programmed tree care. Establish a date for starting the new program.

2. Announce the plan to the department staff and major stakeholders including but not limited to, the Recreation and Parks Commission, PROSAC, Parks Trust, and the Neighborhood Parks Council.

3. Review of existing work orders. Evaluate those that are emergencies vs. routine pruning.

4. Clarify the responsibility for street and significant trees located on Recreation and Park Department properties. Traditionally, Recreation and Park Department has not maintained these trees. In recent years, however, it has become DPW practice to defer maintenance of these trees to the Recreation and Park Department.

5. Develop a work list for park properties and/or facilities. Use existing work orders to set-up the first round of scheduled care. Where possible provide service to an geographic area on a rotating basis.

6. Evaluate equipment requirements based on projected work load. It may be possible to care for mini-parks and properties using a small truck and chipper. These are facilities with relatively small trees and limited space.

7. Review of current urban forestry practices and approaches to pruning and removal. Establish best management practices based on the industry's American National Standards Institute standards and the International Society of Arboriculture's Best Management Practices.

8. Develop expertise on tree support systems within the Urban Forestry staff. Use of cables, bracing and props should be limited to high-value specimen trees.

9. Evaluate and implement improvements to TMA to better define the nature and scope of requested work, improve location finding and prioritization. In addition, evaluate how tree care activities through Bond and Capital projects, as well as any tree care performed by outside contractors, become documented in TMA.

10. Determine the relationship between gardeners and reforestation crew in post-planting care, particularly watering, stake maintenance, and mulch. Consider use of volunteers in the reforestation program. Incorporate early structural pruning into programmed efforts.

11. Engage gardening staff. Provide training in tree risk assessment with focus on the basics. Request their input on required tree care, particularly where recurring problems could be rectified by removal, redesign and replanting.

12. Develop best management practices for tree care and tree preservation for use on all Capital projects.

13. Engage Recreation and Park Department staff and outside stakeholders for input on the change in tree care.

Use of Park Bond funds in meeting the transition goal
The main opportunity provided by the 2008 Clean and Safe Neighborhood Parks Bond Forestry program funds is to address trees with significant defects in structure. Once the abatement work is performed, the need for emergency tree care in the affected properties should decrease. For example, spending almost $2 million on tree risk abatement in Golden Gate Park should reduce the number of TMA requests for tree care. A secondary benefit of bond funds is the group of tree assessments provided by this funding. The assessments should be used to outline needed tree maintenance.

Tree Risk Management

The Recreation and Park Department has the responsibility to manage trees on its properties. The Department aims to balance the safety of park staff, users and visitors, the available resources to provide tree care, and the knowledge that trees fail. To meet this goal, the Department provides the following tree risk management guidelines:

- The Recreation and Park Department's Director of Operations and Urban Forest Manager are responsible for administering tree care activities and related risk assessment. The Urban Forester has overall responsibility for tree inspection and abatement procedures, as well as documenting those actions.

- The Recreation and Park Department relies upon the Tree Risk Area Prioritization (next section) to identify those park facilities with the highest priority for assessment.

- The Recreation and Park Department manages tree risk using the general procedures contained in *A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas* (N. Matheny & J. Clark. 1994 (2nd edition. International Society of Arboriculture. Champaign IL). This method employs a ranking scale with a range between 3 (low) and 12 (high).

- The Recreation and Park Department employs a three-tiered inspection procedure.

    1. Gardeners and other gardening staff will receive training on identifying structural defects in trees.

2. When a tree problem comes to the attention of Recreation and Park Department staff, they use the TMA program to inform Urban Forestry staff and request action (e.g. abatement, further inspection). The Department's goal is to respond to requests for tree inspection within 2 business days.

3. As funds permit, tree assessments will be performed in individual park properties. See following section.

   In addition, the Department plants trees with good structure and provides a program of early care in order to prevent serious structural defects from developing.

- The Recreation and Park Department's Urban Forestry staff is responsible for abating tree risk. The general guideline is that all trees receiving a risk ranking of 9 or greater will receive abatement treatment. The Department's goal is to abate trees with ratings of 11 or 12 within 7 days and trees rated 9 and 10 within 6 months.

- The Recreation and Park Department normally provides a 30 day posting period for tree removals. Trees designated for risk abatement, those with risk rankings of 9 or greater, will not be posted.

- The Recreation and Park Department's Director of Operations and Urban Forestry staff will prepare an annual report on tree risk inspection and abatement for the SF Recreation and Parks Commission, describing the properties evaluated and the actions taken.

Tree Risk Area Prioritization

The Park Forestry program of the 2008 Clean & Safe Neighborhood Parks Bond is focused on "those sites that pose the greatest risk to public safety or property." In order identify such sites, HortScience, Inc. and Urban-Eyes Industries have worked with Recreation and Park Department staff to evaluate tree management information as well as consider the use and occupancy of individual park facilities.

The Recreation & Park Department distinguishes between properties and facilities. Properties are the individual parks and squares. Facilities are specific use areas such as playfields, children's play areas, buildings and parking lots. A number of facilities may be present within an individual property. We suggest that facilities are more representative of variations in site use and occupancy than properties.

Our approach to prioritizing risk assessments, and the associated abatement, is founded in the basic aspects of tree hazard assessment: that it involves both a tree and the targets around it.

Tree-based criteria

The following criteria consider the characteristics of trees on Recreation and Park Department properties. Assumptions include the idea that current and near-term future tree management is expressed by analyzing the histories of care and tree failure. Although not all requests for tree work need be risk/hazard related, those requests do reflect some aspects of the demand for tree work.

The following criteria were evaluated:

1. **TMA requests**
   Requests for tree work from gardeners and other Recreation and Park Department staff are directed through the TMA program. Urban forestry staff uses these requests as the basis for much of their work. 1,330 TMA tree-related work orders from July 2005 through July 2009 were compiled by property.

2. **Legal claims**
   82 tree-related claims were submitted to the City and County of San Francisco during the period 1999 to 2009.

3. **History of tree failure**
   The California Tree Failure Report Program (www.treefail.org) had 762 reports of tree failures in Recreation and Park Department properties over the period of 1992 to 2008.

4. **HortScience field scan of properties**
   HortScience staff performed a brief site assessment of properties and compiled information on previous assessments.

5. **Previous hazard assessments**
   In the period of 1983 – 1992, the Recreation and Park Department performed tree risk assessments in the parks and squares as well as in sections of Golden Gate Park. Results of the 100 assessments were compiled. The % of assessed trees rated as high hazard was calculated for each property.

6. **311 / ParkScan work requests**
   71 tree-related reports were made through the City's 311 phone line. The Neighborhood Parks Council ParkScan program provided 106 requests.

Facility based criteria
Among the Recreation and Park Department's 236 properties exists a wide range of facilities. Among the 56 different types of facilities are ball fields, trails, picnic areas, parking, interior roads and structures. Use and occupancy also varies widely among the Department's facilities. Soccer fields and tennis courts can be lighted to extend periods of play. Structures such as recreation centers and bathrooms have high occupancy but relatively moderate use. Parking lots may be occupied when the property is open but are likely to be used in good weather.

In addition to the above, park properties abut residential properties and city streets. Were a tree to fail from a Recreation and Park Department property onto a city street or private residence, the Department would have responsibility. For this reason, streets, parking and private property adjacent to park must also be considered facilities. We identified potential targets located on the perimeter of park properties including private parcels. Similarly, we identified all major streets (highways, freeways, and major streets) and other streets within 50' of Recreation and Park Department properties. We also identified Muni stops present within and immediately adjacent to Recreation and Park Department properties.

In order to evaluate the risk associated with each type of facility, we scored each facility on the following criteria:

1. **Hours of operation**
   Facilities open during daylight hours have lower occupancy than those that are open during the day and evening, and lower than those that are present 24 hours a day.

2. **Target: people or property?**
   Is the target most likely impacted by a tree failure a structure or a person? People inside a structure such as a bathroom or clubhouse have some measure of protection should a failure occur

3. **Activity**
   Is the activity associated with a facility stationary or moving? A park trail varies from a bathroom or roadway in this regard.

4. **Seasonality**
   Facility use varies by season, largely due to variations in weather. Some facilities are likely to be seasonal in use while others have year-round activity.

5. **Is use primarily by children?**
   Professional risk managers acknowledge that risks associated with children have more emotional weight. They identify areas where children are likely to be present as more significant than others. For this reason, the presence of children was considered for each facility.

Facilities with the highest use and occupancy were located on the perimeter of parks (streets and private property) as well as within the parks (internal roads, day camps and parking lots). This is not surprising as streets are used 24 hours a day, in any season (use may actually be greater when weather is poor) while parks are closed during the evening and have less use during poor weather. Not only can a vehicle be hit by a falling tree, it may also run into a tree that has fallen across a road.

Ideas Guiding Implementation
We suggest the following consideration for implementing assessments and follow-up tree work:

1. **Recreation and Park Department Properties with existing risk assessments should receive priority for abatement.** Sigmund Stern Grove and Pine Lake Park were assessed in 2003 but abatement has not been completed. Park Presidio Blvd. was assessed in 2008. While some work has occurred, abatement has not been completed on these two sites.

2. **Tree assessment and abatement on Recreation and Park Department properties will be linked to Neighborhood Park Bond capital projects.** Both assessment and abatement work will be performed using other funds for the Neighborhood Parks Program sites in the 2008 Clean and Safe Neighborhood Parks Bond Program. Examples of those projects include Mission Dolores Park and McCoppin Square.

3. **Where a Recreation and Park Department property is less than 15 acres in size, the entire property should be assessed and abated.**
The vast majority of parks are small. About 90% are less than 15 acres in size. In order to make best use of resources, we recommend that all facilities in a p-ark of 15 acres or less be assessed and abated. These properties are small enough to address at one time.

4. **Golden Gate Park is unique among Recreation and Park Department properties.**
At 1032 acres, Golden Gate Park is the largest of Department's properties, comprising over 30% of the area of the properties within the City limits. Golden Gate Park has very diverse use patterns encompassing 305 facilities. This is in contrast to the next largest property, John McLaren Park, which has 39 facilities. There are 448 street segments within and adjacent to Golden Gate Park, of which 142 are highways and major streets. Golden Gate Park hosts the largest number of events over 1,000 participants such as the Outside Lands Concert. In addition, Golden Gate Park is a significant destination offering the SF Botanical Garden, de Young Museum, California Academy of Sciences, and the Conservatory of Flowers.

   The tree maintenance needs at Golden Gate Park are also unique. Of the 1,330 requests for maintenance over the past 3 years, 465 (36%) have come from this property. Of tree-based legal claims (1999 to 2008), 33 of 83 (40%) were associated with Golden Gate Park. It also had 519 of the 738 (70%) tree failure reports (1991 to 2006) contained in the Calif. Tree Failure Report Program's database.

Tree Hazard Area Prioritization Ranking

Having assessed tree characteristics for each Recreation and Park Department property and the use and occupancy of each facility, we scored these two categories to arrive at a combination of tree and target. Results were sorted into three assessment priority groups (see attached table) based on overall score.

Priority Group 1. Eighteen (18) properties. Given the size of Golden Gate Park, we recommended dividing this into two, one consisting solely of Golden Gate Park and a second including the remaining 18 properties.

1a.	GOLDEN GATE PARK	1031.90	All facilities.
1b.	BUENA VISTA PARK	38.31	Park perimeter (streets & adj. private property).
	CROCKER AMAZON	57.30	Park perimeter (streets).
	GILMAN PLAYGROUND	4.53	Entire site.
	GLEN PARK	77.94	Park perimeter (streets).
	GOLDEN GATE HEIGHTS PARK	6.95	Entire site.
	HOLLY PARK	8.15	Entire site.
	JOHN MCLAREN PARK	312.54	Park perimeter (streets).
	LINCOLN PARK	112.03	Park perimeter (streets).
	MCCOPPIN SQUARE	7.99	Park perimeter (streets).
	MISSION DOLORES PARK	15.94	Entire site (south complete).
	MOUNTAIN LAKE PARK	13.35	Entire site.
	MT DAVIDSON PARK	40.71	Park perimeter (streets).
	PALACE OF FINE ARTS	19.37	Park perimeter (streets).
	PARK PRESIDIO BLVD	20.38	Entire site (completed).

PARKSIDE SQUARE	8.86	Entire site.
PINE LAKE PARK	30.77	Review 2003 assessment & follow-up.
SIGMUND STERN GROVE	34.78	Review 2003 assessment & follow-up.

Priority Group 2. Forty-eight (48) properties.

Priority Group 3. One hundred sixty-three (163) properties.

Implementation
Existing Assessments, Phase 1a (Golden Gate Park) and Phase 1b (group 1): Budget $3.2M

- **Phase 1a**
  GOLDEN GATE PARK

- **Existing Assessments in Place**

PARK PRESIDIO BLVD.	Assessment is complete. Abatement is underway. Review needed for a contract to undertake tree pruning.
PINE LAKE & STERN GROVE	These facilities were assessed in 2003. Some abatement has been completed. Need to review the assessments and abatement that has occurred, then determine if additional assessment and abatement is needed.

- **Phase 1b (Group 1)**
  Among the properties in Priority Group 1b, we recommend they be assessed in the following order:

PARKSIDE SQUARE.	Problematic tree population.
MCCOPPIN SQUARE	Site was partially assessed as part of the Park Bond program.
MISSION DOLORES PARK	Site was partially assessed as part of the Park Bond program. Complete assessment of north side of property.
BUENA VISTA PARK	Next highest rank facility
LINCOLN PARK	Next highest rank facility
JOHN MCLAREN PARK	Next highest rank facility

Based on our initial estimates, the sites listed above, including Golden Gate Park, will cost approximately $3.2M to assess, abate and provide reforestation. The remaining sites listed below in Phase 1b are estimated to cost $800K. The assessments and abatement for these sites cannot begin until the bond contingency is released (anticipated with 3rd bond sale in Spring 2011).

- **Phase 1b (Group 2): Budget $800K**

CROCKER AMAZON	GILMAN PLAYGROUND
GLEN PARK	GOLDEN GATE HEIGHTS PARK
HOLLY PARK	MOUNTAIN LAKE PARK
MT DAVIDSON PARK	PALACE OF FINE ARTS

- **Phase 2 (as budget allows):**
  Budget may allow for assessment, abatement, and reforestation of Phase 2 sites. This work would proceed in order of prioritization rank and the forestry team will update the commission on the plan to address these sites if funds remain.

Assessment Procedure

SF Recreation and Park Department staff and outside contractors will perform tree assessments. The minimum qualification shall be current status as either a Registered Consulting Arborist of the American Society of Consulting Arborist or an International Society of Arboriculture Certified Arborist.

Trees will be inspected based on the priority rankings. Specific field procedures are found in Appendix D.

Risk Ranking System

Tree risk assessment is the systematic process of evaluating the potential for a tree or one of its parts to fail and, in so doing, injure people or damage property. All trees have the potential to fail. The degree of risk will vary with the size of the tree, type and location of the defect, tree species, and the nature of the target. Tree risk assessment involves three components:

1. a tree with the potential to fail,
2. an environment that may contribute to that failure, and
3. a person or object that would be injured or damaged (i.e. the target).

The Recreation and Park Department employs the general procedures contained in *A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas* (N. Matheny & J. Clark. 1994 (2nd edition. International Society of Arboriculture. Champaign IL). Tree risk is ranked through the following components:

- **Failure potential** (4 points) - identifies the most likely failure and rates the likelihood that the structural defect(s) will result in failure within (specify time period?). The part of the tree most likely to fail is assessed using the following scale:
  1 - low - defects are minor (e.g. dieback of twigs, small wounds with good woundwood development)
  2 - medium - defects are present and obvious (e.g. lean or bow that has developed over time, cavity encompassing 10-25% of the circumference of the stem, codominant stems without included bark)
  3 - high - compounding and/or significant defects present (e.g. severe lean, cavity encompassing 30-50% of the circumference of the stem, multiple pruning wounds with decay along a branch)
  4 - severe - defects are very severe (e.g. partial uprooting of leaning tree, decay conks along the main stem, cavity encompassing more than 50% of the stem)

- **Size of defective part** (4 points) - rates the size of the part most likely to fail. Larger parts present a greater potential for damage. Therefore, the size of the failure affects the potential for injury or damage. The scoring system is:
  1 - most likely failure less than 6" in diameter
  2 - most likely failure 6 - 18" in diameter
  3 - most likely failure 18 - 30" in diameter
  4 - most likely failure greater than 30" in diameter

- **Target rating** (4 points) - rates the use and occupancy of the area that would be struck by the defective part. The following scoring is:
  1 - occasional use (e.g. lawn area)
  2 - intermittent use (e.g. sidewalk, benches)
  3 - frequent use (e.g. street parking, clubhouse)
  4 - constant use (e.g. children's play area, city streets).

  Target ratings for Recreation and Park Department facilities is found in Table 3.

Table 3. Recommended Target Ratings for Tree Risk Assessments. Recreation and Park Department. San Francisco CA.

Facility type	Target Rating
Adjacent non- Recreation and Park Department property parcel -- residence, building or other property	4
Building -- historic, day camp, clubhouse, activity center, stadium	4
Children's play area	4
Golf course -- clubhouse, maintenance facility	4
Highways & city streets	4
School yard	4
Adjacent parcel – yard	3
Building -- day camp, clubhouse, activity center	3
Golf course -- parking area	3
Golf course -- tee, green	3
Muni stop	3
Parking -- adjacent street	3
Parking – lot	3
Paved multi-use play area or, skatepark	3
Maintenance roads – Recreation and Park Department use only	3
Bench	2
Building -- bathroom, concession, fieldhouse, parking garage	2
Dog play area	2
Golf Course -- fairways, cart paths	2
Performance space	2
Picnic area	2
Sidewalk/designated trail	2
Sports field/facility	2
Golf Course -- rough, out of play	1
Lawn, garden, greenspace, landscape, hardscape	1
Marina	1
Natural Area	1
Trail, unpaved social	1
Water Body	1

The points in each category are added to obtain the overall tree risk ranking, with 3 being the minimum and 12 being the maximum value.

Risk ranking = failure potential + size of defective part + target rating

Detailed descriptions of the method to be used in tree assessments are contained in *A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas* and *Trees and Development: A technical guide to the preservation of trees during land development*. See Appendix A for complete citations.

The goals of the assessment process are three-fold. The first is to identify trees posing the highest risk to park staff and users. The assessment procedure contains a tree risk ranking method to address this goal. The second goal is to establish a database of trees present in Recreation and Park Department properties. To that end, data collection should be standardized so that results within and among properties may be compared. Results from the assessments will be incorporated into the Department's geographic information system, allowing for more effective and efficient management in the future. Third, where assessments are associated with capital projects, the suitability of trees to be assets to the new project is evaluated. As a result, trees within and adjacent to the proposed project may be considered for removal, relocation and replacement.

Sustaining San Francisco's Parks

Sustainability represents providing for the needs of today without compromising the ability of future generations to meet their needs. For San Francisco's Recreation and Park Department properties, sustainability suggests that we act to ensure that assemblages of large trees and well-developed landscapes will be present in the future. Because large trees take so long to mature, it is incumbent upon the Department to have a strong program of reforestation with tall-growing, large canopy species.

There is, however, an inherent conflict between maintaining tree canopy today and providing for it in the future. Trees have finite life-spans. For example, the maximum life-span for Monterey pines is between 120 and 150 years. Most trees die before this time. This is particularly the case given the intensity of disease and insect problems associated with the species. The life-span of common landscape trees such as blackwood acacia (*Acacia melanoxylon*) and Victorian box (*Pittosporum undulatum*) is a few decades. In contrast, the life-span of blue gum, the most common eucalyptus species, is unknown.

Many of the pine, eucalyptus and cypress trees that form the vast bulk of the canopy in San Francisco's parks are mature in development, having been planted in the late 1800s and early 1900s. Smaller parks and squares that are more cultivated landscapes are more recent in origin but also contain mature plants.

Given its natural history, San Francisco cannot rely on a native tree resource to sustain the urban forest on park properties. Fundamentally, there is no native tree resource in the form of forest stands or preserves to build on. The number of tree species native to the city is small. And of that group, most are small to medium in stature. Many native species were associated with creeks and streams that have been removed. For all of the assets San Francisco possesses, a natural forest cover is not one of them.

The Department's Natural Areas Program is its primary vehicle for conserving and restoring the native vegetation on park properties including trees. As the Program's management plan is implemented, there will be a 1:1 of trees removed to trees planted. As exotic trees are removed, native species will be installed.

Planting and Reforestation
Outside of Natural Area Program-designated properties, sustaining the canopy in the City's parks will require extensive use of non-native species such as Monterey pine and Monterey cypress that dominate the canopy today. Rather than have most of the canopy-size trees be the same age, a reforestation program would aim for a diverse mix of ages and sizes. As mature trees are removed, established young trees will be present to take their place.

Between Golden Gate Park reforestation and the Natural Areas Program, large sections of the Department's properties are being addressed. There appear to be, however, gaps in other areas, notably the non-forest sections of Golden Gate Park, the Park and Squares and golf courses. In Parks and Squares, planting is not replacing removed trees. At golf courses, there has not been a planting program to speak of.

A number of properties have had site-wide tree assessments. Examples include Washington Square and Pioneer Parks. Three consistent themes emerge from such assessments.

1. Mature trees dominant these properties.

2. Few young or semi-mature trees are present.

3. Landscapes at Recreation and Park Department have specific design intent. Tree selection and new planting should respect, reflect and to some degree improve upon the overall design intent.

It appears that reforestation often occurs in pulses rather than continuously. A large group of trees are planted at one time either from reforestation or associated capital projects. These mature together and are then removed and replaced at one time.

An alternative approach would involve removal and replacement on a regular basis, where mature trees are removed and new ones installed as individuals or small groups. Where space and light allow, it is possible to install "understudy" trees. To that end, when a large mature tree is removed, the replacement is well-established and growing. For example, the large mature Monterey cypress tree in front of McLaren Lodge is a valued specimen. Installing an understudy tree nearby would reduce the negative impact that will occur should the large tree die or fail.

Another key feature of reforestation at Recreation and Park Department properties involves capital projects. All large-scale site renovation and construction projects involve tree removal and replacement to some degree. Projects normally include landscape architects who are responsible for the selection and placement of new trees. As projects development, the landscape design program should incorporate goals of reforestation as well as providing opportunities for native and/or drought-tolerant plantings. In addition, new trees added to Recreation and Park Department properties as part of capital projects should be included in the annual summary of trees planted.

There are several design considerations to enhancing reforestation planting in the non-forested areas of Golden Gate Park as well at the Parks and Squares. One is use of drought tolerant species. This is a group that will also be dominated by non-native species. A second consideration involves use of native species in the landscape at a scale smaller than canopy trees. There are a large number of shrub and ground-cover plants that are drought-tolerant. Creating small-scale landscapes in park properties using native plants seems to be a natural design opportunity. One of the benefits of increased use of natives is enhanced wildlife habitat, a topic that is discussed in the Significant Natural Areas Management Plan.

Finally, reforestation offers the opportunity for parks to develop their own personality, creating a unique landscape experience. The landscape at the Cayuga Playground, for example, presents a whimsical experience of sculpture combined with a wide-ranging palette of shrubs and herbaceous plants. Another example is Pioneer Park, where vistas of San Francisco Bay had been obscured by tall-growing trees. Selective removal of trees and replanting with low-growing shrubs and groundcovers will serve to maintain the vista into the future.

Tree maintenance
As noted in a previous section, the current tree maintenance cycle for trees outside the Natural Area Program is over 50 years (Table 4). This does not include either Sharp Park or Camp Mather. Although there are no national standards for a maintenance cycle for trees in parks, the current cycle length is beyond the life-span of many trees species.

What would be required to reduce the annual maintenance cycle to 10 years (Table 4)? At the current time, 4 full-time equivalent staff are assigned to manage the 27,000 trees in Golden Gate Park. They address an average of 471 trees per year. To reduce the maintenance cycle to 11.5 years would involve maintaining 2,700 trees per year. To do so would require a staff of 20 or more, dedicated directly to Golden Gate Park (Table 4).

A somewhat similar situation exists in the Parks, Squares and golf courses where a staff of 9 full-time equivalent staff maintains about 760 trees per year. A staff of 45 would be required to reduce the maintenance cycle to about 10 years (Table 4)

In order to reduce the tree maintenance cycle from the current 50 years to a more reasonable 10 years would require an increase in tree care staff from 13 full-time equivalents to more than 65 staff. This estimate is based on current production rates.

Table 4. Projected staffing requirements to reduce tree maintenance cycle to approximately 10 years. San Francisco Recreation and Park Department.

Area of responsibility	**No. of trees** (estimated)	**Work force** (full-time equivalent staff)	**No. of Trees Maintained** (annual)	**Maintenance cycle** (years)
Golden Gate Park	27,000	4	471	57
		8	942	28
		12	1413	19
		16	1884	14
		20	2355	11.5
Parks, Squares, City golf courses	40,000	9	762	53
		18	1524	26
		27	2286	17.5
		36	3048	13
		45	3810	10.5

Notes: Golden Gate Park estimated number of trees (27,000) from 1998 Master Plan.

Parks, Squares & City golf courses number of trees based on estimate of 67,000 on Recreation and Park Department properties minus 27,000 in Golden Gate Park.

Opportunities to involve Stakeholders in Sustaining San Francisco's Parks
The Recreation and Park Department has an interested, diverse group of supportive stakeholders. There are several that this could be extended to tree management.

- **Partner with non-profit organizations on specific tree projects**
  The USDA Forest Service Urban and Community Forestry program provides grant funds to states for the purpose of enhancing urban and community forestry. In California, grant funds are administered by California ReLeaf (http://californiareleaf.org) under contract with State of California's CalFire Department. For the most part, only registered non-profit (501C3 status) are able to apply for funds. In San Francisco, Friends of the Urban Forest is such an organization and is a member of the ReLeaf Network of organizations. Groups such as the Parks Trust and Neighborhood Parks Council could acquire 501(c)3 status.

  Federal funds must be matched by the partner organization. This is often in the form of volunteer contribution. There are also several state-funded grant programs for urban forest projects. These have the same general requirements as the federal program.

  California ReLeaf's grants have traditionally focused on tree planting. Grants funds are used to acquire trees, which are planted by volunteers. CalFire has, however, encouraged and supported a diverse set of project areas including the creation of tree management plans.

- **Create a volunteer stewardship program**
  Given the nature of tree care and its requirements for technical skills, volunteers cannot be integrated in routine maintenance operations such as tree removal and pruning. There is, however, an important role for volunteers in a wide range of stewardship, particularly related to tree management and reforestation.

  While the Recreation and Park Department has had strong record of reforestation, developing a volunteer program could extend existing resources. Volunteers could assist in initial site clearing and preparation, planting, and early tree care in the form of mulching, weeding and watering. Other needs include managing invasive plants (such as vines growing up the trunks of mature trees) and nurturing specific plant groups (such as the windbreak in Golden Gate Park).

- **Expand the existing volunteer program**
  The Recreation and Park Department uses volunteers in a variety of ways ranging from the Natural Areas Program to the National AIDS Memorial Grove. The Department could encourage participation for some aspects of tree maintenance (planting and early care).

Each of these options would require the Recreation and Park Department to support volunteer coordination within the specific unit or park.

Incorporating Findings into Urban Forestry Operations
In an effort to support the Recreation and Park Department, several organizations have prepared Tree Management Plans and/or tree risk assessments for specific park properties. Included in this group are:

- Mountain Lake Park. 1980.
- Japanese Tea Garden. San Francisco Parks Trust. October 2006.
- Strybing Arboretum. April 2007.
- Washington Square Park. Friends of Washington Square. March 2008.
- Hayes Valley Playground. Trust for Public Land. October 2008.
- Boeddeker Park. Trust for Public Land. December 2008.
- Balboa Park. Trust for Public Land. December 2008.
- Pioneer Park. Pioneer Park Project. November 2008.
- Golden Gate Park Soccer Fields. City Fields Foundation. Under development.

Similar plans are also likely to be prepared for other properties.

In addition, the Recreation and Park Department's Capital Projects Division has incorporated tree assessment into projects associated with the 2008 Park Bond. Tree assessments have been prepared for the following properties:

- Mission Dolores (part of site). December 2009 (draft).
- Sunset Recreation Center. December 2009 (draft).
- Mission Playground. February 2010.
- Fulton Playground. February 2010.
- West Sunset Playground (part of site). February 2010.
- Cayuga Playground. March 2010.
- Potrero Hill Recreation Center (part of site). March 2010.
- Palega Playground. March 2010
- Interior Green Belt (proposed trail). May 2010.
- Corona Heights (proposed trail). In preparation.
- Oak woodlands in Golden Gate Park. In preparation.
- Kimball Playground. In preparation.
- Grandview Open Space. In preparation.
- Billy Goat Hill. In preparation.

At the current time, the Recreation and Park Department lacks a process for incorporating results of these assessments into urban forestry operations. With the existing reactive program of tree care, a TMA request would be filed. Whether the request receives a response in the form of tree care service is entirely dependent upon the work load at the time the request was received and its perceived priority.

In order for outside assessments and plans to be integrated into urban forestry, the Recreation and Park Department must first ensure that the content and scope of the report is appropriate, and that the information has been prepared by a qualified arborist. To that end, reports to be prepared by outside groups and associated with Capital projects should:

- Be prepared by an American Society of Consulting Arborists Registered Consulting Arborist or State of California Registered Professional Forester.

- Conform to the methodology established for tree assessments (previous section).

- Using proposed plans, evaluate and assess the impact of proposed construction projects including landscape renovation on existing trees.

- Provide recommendations for tree preservation, removal and relocation based on proposed project plans.

- Summarize findings in the form of a report which would include the following sections:
  - ❖ Introduction and Overview. Background description of the site and proposed project. Contents of the report.
  - ❖ Survey Methods.
  - ❖ Description of Trees.
  - ❖ Suitability for Preservation.
  - ❖ Assessment of Potential for Tree Relocation.
  - ❖ Tree Risk.
  - ❖ Evaluation of Impacts from the Proposed Project.
  - ❖ Recommendations for Preservation and Removal.
  - ❖ Tree Preservation Guidelines.
  - ❖ General Tree Management Recommendations.

- Provide electronic file of the Tree Survey Form. The tree survey form shall include: tree tag number, common name, trunk diameter, condition rating, suitability rating, comments, most likely failure, target that would be impacted, the risk rating (failure potential, size of part, target, sum) and abatement needs.

- Provide electronic file of the Tree Location Map which must be compatible or with the City GIS's system.

- Be submitted to the Recreation and Park Department's Director of Operations for review by the Urban Forestry Manager and appropriate gardening staff. Feedback from the Department about the recommendations must be incorporated before the finalization and acceptance of the report. It should include an estimate of the cost to perform the recommended work.

- The Recreation and Park Department should be prepared to make sample reports available to interested parties.

Upon acceptance of any report or plan by the Recreation and Park Department, the Director of Operations shall request that the Urban Forestry Manager incorporate the findings into the unit's plan of programmed work.

Golf Courses
The Recreation and Park Department is responsible for tree maintenance at the Lincoln Park, Harding Park, Golden Gate Park and Sharp Park golf courses. In each case, a concessionaire manages operations at the course. When tree services are required, golf courses use TMA to request service. In the past three years, 31% of the trees removed by the Department and 23% of the trees pruned were located on golf courses. One tree crew is essentially devoted to golf courses on a full-time basis.

Mature trees, largely Monterey cypress, Monterey pine and eucalyptus, dominate all of the courses. Records indicate that little or no tree planting has occurred. Trees are being removed from golf courses at a rate of several hundred per year but are not being replaced. This is an unsustainable situation. Either an intensive program of tree planting needs to be implemented or the architecture of the course needs to be revised to reflect reduced tree canopy.

This situation is apparent at Sharp Park. The trees are entirely mature with no young trees developing as replacements. Numerous standing dead trees were present. Trees are planted in long rows along fairways. As individual trees die or fall, it exposes remaining trees to higher wind loads and increases the overall failure rate.

There is a compelling need to upgrade tree maintenance operations at all of the golf courses, particularly Sharp Park. One option would be to place the burden of tree maintenance and replanting in the concessionaire's contract. An alternative would be to increase staffing in the urban forestry unit. Without any change in management, the urban forestry unit's resources will be stretched even further and the tree canopy at golf courses will continue to decline.

Summary and Recommendations

One unique aspect of the 2008 Clean and Safe Park Bond was the inclusion of tree management activities. The Tree Risk Area Prioritization section of this report is directly derived from the Bond. The Recreation and Park Forestry aspects of the Bond also raised a number of issues associated with the Department's tree care program. This plan has described the basic operation of the program including its current staffing, budget and operational activities.

In the broadest sense, the Recreation and Park Department's Urban Forestry program has two missions. The first is short-term: to ensure that trees located on park properties are healthy and in structurally sound condition. Urban Forestry meets this mission by pruning, tree removal and other tree maintenance activities. The second mission is long-term in nature: to plant trees which will be enjoyed by park users of the future. To that end, Urban Forestry plants trees.

It seems clear that the Recreation and Park Department's Urban Forestry program generally provides a minimal response to its first mission while falling short in the second. The program can hardly respond to requests for tree service. No programmed tree care occurs. The focus of pruning and removal is on the immediate and short-term, and lacks any long-term considerations. Unfortunately, staff can only problem-solve. There is little or no capacity to provide need tree maintenance.

Because San Francisco lacks a native tree resource, the only way to sustain tree canopy cover is through planting. The Recreation and Park Department's Urban Forestry program has been successful in one area: the reforestation of the Golden Gate Park forest areas. Despite continuing budget challenges, the reforestation efforts has successfully nurtured a new generation of tall-growing trees. This effort has gone largely unnoticed but should be considered the central success of the program

Planting at other locations of Golden Gate Park and in the Parks and Squares has been less successful. Over the past three years, new planting has not kept up with tree removal. Put another way, there may be fewer trees in these locations today than there were 3 years ago. The situation at the golf courses is even worse: no trees have been planted.

It is also clear that the Recreation and Park Department cannot expect budget relief, let alone an increase. On the other hand, San Francisco voters have provided bond support for parks. It seems likely that they will do so in the future. For this reason, Urban Forestry must adapt to a two-tiered approach to tree management. The first level involves day-to-day operations of the existing staff. The second is the use of outside contractors supported by bond funding. The challenge is to meld the two approaches so that the Urban Forestry program's missions are supported.

Based on my assessment of the Recreation and Park Department's Urban Forestry program, I recommend the following:

- **Develop better documentation of tree care activities**. It is critical that all tree maintenance operations find be documented in some way. A key challenge here is documenting the tree abatement work to be performed by outside contractors. Incorporating results of tree assessments and abatement actions, either associated with Park Bond funding, Capital projects or stakeholder groups, will require revision of the Department's work flow documentation procedures. Implementing this task will require additional staff time, both clerical and administrative.

- **Commit the Recreation and Park Department's Urban Forestry program to making the transition from reactive to programmed tree management**. Set a goal of 50% that tree care activity should be program based rather than simply reactive.

- **Commit the Recreation and Park Department's Urban Forestry program to the industry's best standards and best management practices**. Replacing the "tree topper" position title with something more appropriate (e.g. arborist, tree climber) would be a first step.

- **Evaluate how changes to TMA can better support work and information flow related to the Recreation and Park Department's Urban Forestry program**. TMA should increase the effectiveness and efficiency of Urban Forestry activities. Doing so requires enhancing the existing system.

- **Expand reforestation efforts,** particularly in the Parks and Squares and golf course. Simply put: too few trees are being installed in these locations. Because tree planting and early care are one of the most successful uses of volunteers, it may be possible to increase the number of trees planted and their early care without further burdening existing staff. Grant funds are available to non-profits groups to purchase trees. This area seems like a natural place for cooperation with outside groups that have non-profit status. Reforestation efforts must be in harmony with aspects of park use. For example, the Golden Gate Forest Management Plan (1980) was incorporated into the overall Master Plan for the Park (1998).

  This is not just an issue of inadequate labor to procure, install and maintain young trees. There is also an issue of leadership for reforestation. It appears that reforestation in Parks and Squares is supposed to be a cooperative effort between the gardening and reforestation staff. How this cooperation proceeds is not clear. There does not appear to be a documented process for installation. Further, the involvement of outside stakeholders in reforestation decisions has not been added to the reforestation process.

Even with a volunteer stewardship program, the Recreation and Park Department will have to provide staff time to organize and oversee these activities. In addition, increasing reforestation will require the Department to resolve issues of design issues associated with plant selection, use of drought-tolerant species, coordination with capital improvement projects, and installation into existing landscapes.

There is also a need for demonstration plantings as part of reforestation. No one knows where the Golden Gate Park forestation plots are located. Signage would help explain the process of reforestation. The Panhandle was once a collection of a wide range of species, a design intent that has been lost as trees have been removed. Another demonstration could involve the use of varying size nursery stock to illustrate the performance of small material. It would not be inappropriate for parks and squares to incorporate small sections of native plants.

There is also the need to experiment with natural regeneration, particularly with Monterey cypress, Monterey pine and coast live oak. Under some conditions, notably where chipped branches are spread and when overstory trees are removed, seedlings of these species proliferate. It may be possible to recruit these seedlings into a reforestation effort. This approach, however, requires pilot testing before it can be implemented as a routine practice.

- **Develop a reforestation plan for golf courses**. The complete lack of planting suggests that the current expectations for play will change as trees are removed. Removing trees change the structure of a golf hole, and may adversely impact how it is played. In addition, removing trees increases the amount of wind on a course. For these reasons, reforestation on golf courses must respond to the design needs of the course.

  I recommend that a complete assessment of tree care needs be made at all golf courses but particularly at Sharp Park. Based on my observations, all of the trees at that facility are mature or overmature in development. No young trees were present. Numerous standing dead trees were evident. There is a great deal of deferred tree maintenance at Sharp Park's golf course, which only adds to the demand on the Recreation and Park Department's Urban Forestry staff.

- **Continue to expand the palette of trees used in reforestation efforts.** Given the lack of native trees species, the Recreation and Park Department's urban forest will continue to be dominated by planted, non-native species.

HortScience, Inc.

James R. Clark, Ph.D.
Certified Arborist WE-0846
Registered Consulting Arborist #357

Appendices

A. Sources of Information and Project Outreach.

B. Glossary.

C. The Number of Trees on Recreation and Park Department Properties in San Francisco.

D. Tree Risk Assessment Procedures. Recreation and Park Department properties.

Appendix A. Sources of Information and Project Outreach

Recreation and Park Department staff
Phil Ginsburg, General Manager
Davida Kapler, Reforestation supervisor
Dennis Kern, Director of Operations
Dawn Kamalanathan, Director of Capital Planning
Katharine Petrucione, Director of Finance
Kelly Cornell, Tree Topper II and Urban Forestry program manager
Karen Mauney-Brodek, Planner
Rick Thall, Project Manager
Sean Stasio, GIS Analyst
Lisa Wayne, Natural Areas Program Manager

Interest Groups
Friends of the Urban Forest
Golden Gate Audubon Society
Neighborhood Parks Council
San Francisco Park and Recreation Open Space Advisory Committee
San Francisco Parks Trust

Individuals
Peter Ehrlich. The Presidio Trust. San Francisco CA.
Greg Gaar. San Francisco CA.
Alicia Noyola. San Francisco CA.
Tanya Pollack. The Presidio Trust. San Francisco Ca.
Carla Short. Department of Public Works. San Francisco CA.
Jake Sigg. San Francisco CA.
Michael Sullivan. San Francisco CA.
Nancy Wuerfel. San Francisco Ca.

Other cities and agencies
Rob Crouch. City of Portland Parks. Portland OR.
Drew Gilchrist. Vancouver (Canada) Parks Board.
Katherine Jones. University of California Cooperative Extension. Half Moon Bay CA.
Joe McBride. University of California. Berkeley CA
Mark Mead. Park Department. Seattle WA.
David Nowak. USDA Forest Service. Syracuse NY.
Fiona Watt. Parks Department. New York NY.
Anne Wong. Prospect Park Conservancy. Brooklyn NY.

Documents
California, State of. 1980. *Golden Gate Park Forest Management Plan.* The Resources Agency. Sacramento CA.

Gaar, G. and R. Miller. 2006. *San Francisco: A Natural History*. Arcadia Publishing. Charleston SC.

Howell, J., P. Raven and P. Rubtzoff. 1958. *A Flora of San Francisco California*. Univ. of San Francisco. San Francisco CA.

McBride, J. and D. Froehlich. 1984. Structure and condition of older stands in parks and open space areas of San Francisco CA. *Urban Ecology*. 8: 165 - 178.

Royston Hanamoto Alley & Abey. 1998. *Golden Gate Park Master Plan*. Mill Valley CA.
San Francisco, City of. 1997. *Recreation and Park Department Tree Removal Procedures*. Recreation and Park Department.

San Francisco, City of. 2006. Significant Natural Resource Areas. San Francisco Recreation and Park Department. San Francisco CA.

San Francisco, City of. 2007. 2008 Clean & Safe Neighborhood Parks Bond.

San Francisco, City of. 2009. DRAFT Recreation & Open Space: An Element of the General Plan of the City and County of San Francisco. San Francisco Planning Department.

Resources

Matheny, N. and J. Clark. 1994. *A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas*. 2nd edition. Champaign IL. International Society of Arboriculture.

Matheny, N. and J. Clark. 1998. *Trees and Development: A technical guide to tree preservation during land development*. Champaign IL. International Society of Arboriculture.

Appendix B. Glossary

Canopy-sized tree	Tall-growing and/or wide-spreading species that provide stature and overstory to the urban forest.
Invasive	Non-native species likely to spread, disrupting and preventing reproduction of native plants and wildlife.
Native	Plant present within the geographic limits of present-day San Francisco prior to the arrival of the Portola expedition in 1769. Based on Howell, Raven and Ruztboff, 1958.
Non-native	Plant not present within the geographic limits of present-day San Francisco prior to the arrival of the Portola expedition in 1769. Not mentioned in Howell, Raven and Ruztboff, 1958. Syn. exotic.
Reforestation	The re-establishment of forest cover either by natural or artificial means.
Stand	Group of trees similar in age, structure and composition. Syn. grove, woodland.
Sustainability	Meeting the needs of the present without compromising the ability of future generations to meet their own needs (US EPA).
Tree	Woody perennial usually having one dominant trunk and a mature height of 15 or greater
Understudy tree	Tree planted in the same vicinity as an important specimen, grown to be the replacement.
Urban forest	The naturally occurring and planted trees located within the geographic limits of the City and County of San Francisco.

Appendix C. The Number of Trees on Recreation and Park Department Properties in San Francisco.

How many trees are located in the 3,415 acres of San Francisco's parks?

There is not a definitive answer. The 1998 Golden Gate Park Master Plan cited a 1993 tree count for Golden Gate Park: 27,192 trees. The 2008 Master Plan for the Significant Natural Areas (NAP) estimated that 64,000 trees were located on the 883 acres of Natural Areas in San Francisco. The Department is responsible for 2,532 acres of park property that are not included in the Natural Areas Program.

The following are three approaches to estimating the number of trees on Recreation and Park Department properties in San Francisco.

Golden Gate Park approach
Using the 1993 figure of 27,192 trees in Golden Gate Park's 1,032 acres yields an average of 26.4 trees/acre. There are 2,532 non-NAP acres in San Francisco (including Golden Gate Park). Applying the Golden Gate Park average to all non-NAP properties results in an estimate of 66,850 trees.

This approach yields a total of **130,850** trees on Recreation and Park Department properties in San Francisco (64,000 NAP plus 66,850 non-NAP).

UFORE approach
The 2005 UFORE analysis prepared by the USDA Forest Service calculated that open space areas in San Francisco had 37 trees/acre. Applying this figure to the 1,230 acres of parkland outside of NAP properties and not in Golden Gate Park results in an estimate of 45,500 trees.

This approach yields a total of **136,700** trees on Recreation and Park Department properties in San Francisco (64,000 NAP plus 27,200 in Golden Gate Park plus 45,500 in other Recreation and Park Department properties).

Stratified approach
HortScience, Inc. has surveyed trees on approximately 15 park properties. Results from these properties can be divided into parks, squares and playgrounds. I calculated the number of trees / acre for each, then applied those figures to the all non-NAP acreage outside of Golden Gate Park, yielding an estimate of 62,750 trees.

This approach yields a total of **126,750** trees on Recreation and Park Department properties in San Francisco (64,000 NAP plus 27,200 in Golden Gate Park plus 35,550 in other Recreation and Park Department properties).

Based on the above, the average number of trees outside of NAP areas is 67,000. When added to the estimate of 64,000 trees on NAP properties in San Francisco, this yields **131,000** trees for all Recreation and Park Department properties.

Appendix D. Tree Risk Assessment Field Procedures

When planning the assessment, the inspector should review available information related to the property. Where possible, information on past tree failures (if any) should be reviewed. Other considerations include general features such as stand age, tree vigor, locations where water accumulates and the direction of prevailing strong winds.

The site examination must be performed in a systematic manner. Assessments will be based on Recreation and Park Department facilities and shall consider trees 6" or greater in diameter (measured 54" above grade). The tree risk ranking system will be applied to park facilities in order of priority. The procedure will be:

1. **Identify areas of assessment**
   The target area includes any trees that would strike the facility. Estimate the height of dominant trees around the targets to determine how far into the canopy to inspect; the height of the dominant trees is the distance back from the targets that must be examined. Note landmarks that will serve as boundaries of the inspection area.

2a. For parks and squares 15 acres or less in area, assess all trees, as follows:

a. Attach a numerically coded metal tag to the trunk. Place the tag on the north side of the tree, as high as possible.
b. Note tree number and location using GPS coordinates or other map.
c. Identify tree species.
d. Measure the diameter at 4.5' above mean natural grade. Adjust height of measurement to avoid deformations, swellings, branches, if necessary. For multiple-trunked trees branching below 4', measure each trunk. If the separation of trunks originates below the soil level and there is soil between them, tag and assess as separate trees.
e. Visually assess tree health and structural condition on a 0 to 5 scale where 0 = dead, 1 = very poor, 2 = poor, 3 = fair, 4 = good and 5 = excellent condition.
f. Assess the suitability for preservation of each tree within and immediately adjacent to facilities using a 3 level scale of poor, moderate and good.
g. Describe all significant tree defects, beginning at the base of the tree and working upwards. Identify major pest or disease problems that might influence tree vigor and development of hazards. Infestations of mistletoe, bark beetles or aphids have little effect on tree stability. The following pests may pose problems to structural stability:
h. Identify the defect(s) most likely to fail within the inspection period (four to five years)
i. Identify the target(s) the tree would hit if it failed.
j. Assess the failure potential: the likelihood that the defect(s) will result in failure (rated as 1 to 4 points).
k. Assess the size of the defective part most likely to fail and hit the target (rated as 1 to 4 points).
l. Assess the target that would be impacted should the failure occur, based on use and occupancy (rated as 1 to 4 points).
m. Calculate the risk rating as the Target Rating + Defect Rating + Size of defective part.
n. Identify treatments to abate the risk posed by the tree.

2b. For parks and squares greater than 15 acres, assess trees as follows:
Visually assess the health and structural condition of each tree larger than 6" in diameter. If trees appear in good condition with only minor defects in structure, move to the next tree. For those trees that either are in poor, dead and dying condition or possess significant defects in structure:

a. Attach a numerically coded metal tag to the trunk. Place the tag on the north side of the tree, as high as possible.
b. Note tree number and location using GPS coordinates or other map.
c. Identify tree species.
d. Measure the diameter at 4.5' above mean natural grade. Adjust height of measurement to avoid deformations, swellings, branches, if necessary. For multiple-trunked trees branching below 4', measure each trunk. If the separation of trunks originates below the soil level and there is soil between them, tag and assess as separate trees.
e. Visually assess tree health and structural condition on a 0 to 5 scale where 0 = dead, 1 = very poor, 2 = poor, 3 = fair, 4 = good and 5 = excellent condition.
f. Assess the suitability for preservation of each within and immediately adjacent to areas proposed for development using a 3 level scale of poor, moderate and good.
g. Describe all significant tree defects, beginning at the base of the tree and working upwards. Identify major pest or disease problems that might influence tree vigor and development of hazards. Infestations of mistletoe, bark beetles or aphids have little effect on tree stability. The following pests may pose problems to structural stability:
h. Identify the defect(s) most likely to fail within the inspection period (four to five years)
i. Identify the target(s) the tree would hit if it failed.
j. Assess the failure potential: the likelihood that the defect(s) will result in failure (rated as 1 to 4 points).
k. Assess the size of the defective part most likely to fail and hit the target (rated as 1 to 4 points).
l. Assess the target that would be impacted should the failure occur, based on use and occupancy (rated as 1 to 4 points).
m. Calculate the risk rating as the Target Rating + Defect Rating + Size of defective part.
n. Identify treatments to abate the risk posed by the tree.

2c. Trails in designated natural areas, assess trees as follows:

Visually assess the health and structural condition of each tree larger than 6" in diameter located within 50' on either side of the trail. For those trees that either are in poor, dead and dying condition or possess significant defects in structure that require removal:

a. Mark the trunk with identifying paint.
b. Identify the species and estimate the trunk diameter at a point 54" above grade.
c. Locate the tree's position on a map / GPS.
d. Summarize the results in the form of a tally sheet recording species, diameter class, abatement, and reason for abatement (e.g. tree dead, failing at base, excessive lean).
e. Provide a Microsoft Excel workbook file containing the information collected in the field.

Continue in a logical fashion, examining trees and assessing those with/without significant defects through the inspection area.