MIAMIBEACH

OFFICE OF THE CITY MANAGER

NO. LTC # 091-2014

LETTER TO COMMISSION

TO: Mayor Philip Levine and Members of the City Commission

FROM: Jimmy Morales, City Manager

DATE: March 18, 2014

SUBJECT: Emergency Removal of Pine Trees in the Median on Pine Tree Drive

This letter will provide you with information regarding the current status of the Australian Pine Trees in the medians and right-of-way (ROW) along the Pine Tree Drive corridor.

A Tree Risk Assessment Report was provided by ISA Board Certified Master Arborist Chuck Lippi, on January 8, 2014 and presented to the Public Works Greenspace Management Division. The report evaluated the current conditions of all the Australian Pine trees along Pine Tree Drive from 30th Street to 46th Streets and included professional recommendations to assist with risk mitigation. In accordance with the report, two (2) Australian pine trees #'s 3495 & 3584 were classified as Priority 1 removals. The Priority 1 removal designation is defined as follows: "trees designated for removal have defects that cannot be cost-effectively or practically treated. The majority of the trees in this category has a large percentage of dead crowns, decay and/or poses an elevated level or risk for failure."

Recently Miami Dade County Right of Way Aesthetic and Assets Management has contacted Mr. Mark Williams, City of Miami Beach Urban Forester, to advise that they are requesting to perform emergency removal of all Australian pine trees with a Priority 1 removal designation. This is in accordance with the Chuck Lippi Risk Assessment Report and these trees represent a significant safety risk. The City Urban Forester shall document the removal process noting and photographing the extent of tree decay and any other risk factors for inclusion in future tree risk management discussions.

The required tree removals will affect the center median immediately adjacent to 37th Street and Pine Tree Drive across from 3559 Pine Tree Drive (tree #3495), and the center median in the vicinity of 31st street and Pine Tree Drive adjacent to 3009 Pine Tree Drive (tree #3584). The County shall be providing standard Maintenance of Traffic (MOT) while the tree removals are occurring. The trees are scheduled for removal the week of March 24, 2014.

A Public Meeting to explain the recommendations from the Lippi Report will be held, Monday, April 7, 2014, 6:00 p.m. in the City Manager's Large Conference Room, 4th floor, Miami Beach City Hall. The City's Urban Forester and Mr. Lippi, will make a presentation to the City's Historic Preservation Committee, Tuesday, April 8, 2014.

Should you have additional questions, please contact Eric Carpenter, Public Works Director, (305) 673-7080.

JM/MT/EC/JF/DM/MW

CC. Historic Preservation Board
Attachments: Chuck Lippi Report, County Mot

Australian Pine Risk Assessment for Pinetree Drive

January 8, 2014

by
Chuck Lippi
ISA Board Certified Master Arborist #FL0501B
ASCA Registered Consulting Arborist #443
and Danny Lippi
ISA Certified Arborist FL6145A

Summary

Overall the Australian pine population on Pinetree Drive is very healthy but has some significant structural problems mostly basal decay, which is difficult to measure, and long sprawling lateral branches that create increased leverage force on the decayed areas of the trees. Fifteen trees have been designated for removal. For proper maintenance and to help assure longevity many of the trees are in urgent need of end weight reduction pruning to reduce lever forces of wind on the sprawling branches.

Introduction

Background

In October, 2010 I performed a tree risk assessment of the then 295 historic Australian pine trees (*Casuarina equisetifolia*) located along Pinetree Drive in Miami Beach between 30th and 46th Streets. Prior to that five of the large trees had failed during the hurricanes of 2004 and 2005 and a sixth tree fell on a calm day in September, 2010. To my knowledge the fallen trees were not closely examined so the exact cause of failure is not known. But from accounts of the failures all six tree failures appeared to have been from basal decay. Because of the difficulty of detecting basal decay, which comes up from the soil below the trunk weakening the roots where they connect to the trunk, the previous Urban Forester for the Parks and Recreation Department of the City of Miami Beach, Dr. Christopher Latt, and I decided in 2011 that five of the most suspicious trees would be selected for removal and dissection. Subsequently, approval was obtained for the dissection and removal of the five trees. Based upon our findings, I prepared a follow-up report on October 28, 2011 regarding adjustments we made to the the risk assessment of the Australian pine trees.

In September, 2013 I was asked by the City of Miami Beach to submit a proposal to do a follow-up risk assessment of the Australian pine trees along Pinetree Drive to the City of Miami Beach and was issued a purchase order on October 18, 2013 with the understanding that we could not begin work until early December. The field work of this risk assessment was completed between Dec. 10 and 20th, 2013. It turns out another tree failed sometime since the last assessment in 2011 so there are 289 trees, not 290.

Assignment

My assignment was to:
1. Assess the current condition of the 289 trees.
2. Determine whether the condition of each tree warrants removal.
3. Recommend an appropriate course of action for remediation, mitigation and/or maintenance.

Purpose and Use of the Report

This report is prepared for the City of Miami Beach to evaluate the condition of the Australian pine trees in the public right-of-way along Pinetree Drive between 30th Street and 46th Street and provide mitigation and maintenance recommendations. I understand all written correspondence and reports given to the City are public record.

Assumptions

Field examinations of the site were made from December 10 to December 12 and December 16 and December 17, 2013. My observations and conclusions are as of those dates.

Testing and Analysis

ISA Certified Arborist Danny Lippi assisted me in the risk assessment. We examined each tree together sharing observations and did not split up to work separately. The Risk Assessment was done in accordance with ANSI A300 Standards on Tree Risk Assessment.[1] Tree structural recommendations follow techniques established by Dr. Ed Gilman,[2] professor at the University of Florida. Mature tree health recommendations follow procedures and techniques on mature tree care established by Dr. Kim Coder,[3] professor at the University of Georgia and Neville Fey,[4] who lectures and publishes widely on veteran trees, arboriculture and the development of appropriate techniques for managing veteran trees for risk and habitat. Health conditions were evaluated based upon standards published in ***Urban Tree Health: A Practical and Precise Estimation Method*** by Dr. Jerry Bond.[5]

Assessment Procedures - Testing was done following **Level 2 Basic Assessment** techniques and procedures outlined in ANSI A300 Standards on Tree Risk Assessment. A Level 2 Basic Assessment is a detailed visual inspection of a tree, the root flare, the trunk, the branch structure and the crown as well as the tree's surrounding site. The Level 2 Assessment includes a 360-degree visual inspection of each tree and sound testing of the lower trunk and root flares with a rubber mallet to listen for tonal variations that may indicate delaminating bark, dead cambium or internal hollows. The assessment also involves searching for basal cavities and openings with a probe. Any soil and leaf or needle duff that had accumulated around the base of each tree was pulled back to facilitate basal inspection.

Figure 1 *Inonotus dryadeus* conks are regularly seen on the lower trunks and decaying galls on Pinetree Drive. It is a butt rot or basal rot fungi. Identification is easy because of the amber droplets that form on a fresh conk (arrows).

Fungal Conks - During the previous assessment and the latest assessment of the trees, two decay organisms were identified in the field. The first is *Inonotus dryadeus* commonly called "weeping conk" for the amber droplets that form on the surface of fresh conks (Figure 1). It is a root and butt rot fungi and is considered a white rot but shows symptoms of soft rot by preferentially degrading cellulose first making the tree brittle. According to F.W.M.R. Schwarze, et. al., *Inonotus dryadeus* infected trees do not exhibit any symptoms in the crown for a long time "and apparently healthy trees can be suddenly blown down by the wind because their roots are destroyed."[6] The second fungus found at the site is *Kretzschmaria deusta*, commonly called "brittle cinder" for the burnt appearance (Figure 2) and the characteristic of making infected wood brittle. *Kretzschmaria deusta* is a soft rot that preferentially degrades cellulose before degrading lignin making the butt area brittle much like a ceramic. Samples of old dead

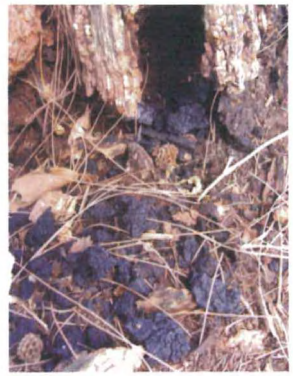

Figure 2 Pieces of black crusty psuedosclerotial plates of what I believe to be the pathogen *Kretzschmaria deusta* litter the ground below a basal cavity. These black crusty plates are found near the base of many of the Australian pines on Pinetree Drive.

stromata (psudosclerotial plates) of *Kretzschmaria deusta* were sent to the University of Florida Plant Diagnostic Clinic in Homestead, FL. Unfortunately no pathogens could be detected by the lab, only secondary fungi. The lab test did not locate spores of the pathogen which could be used to produce the pathogen in culture. The lab does not do a visual test. Often samples are cross contaminated in the field by other secondary fungi after having been lying at the base of a tree for many months. In spite of the negative laboratory results, I am very certain the decay organism is *Kretzschmaria deusta*. I am guided in my visual diagnosis by the photographs and description provided by Sinclair's authoritative textbook.[7]

Resistograph - In the previous assessment of the Australian pine population along Pinetree Drive, I used a Resistograph, a drilling device that measures and graphs decay as the drill bit passes through the different layers of solid and decayed wood. Because the main problem with the trees along Pinetree Drive is basal decay, I decided not to use the Resistograph this time. From my previous experience with this hard-wooded tree species, the Resistograph cannot adequately measure basal decay. And according to drill resistance research done by Francis W.M.R. Schwarze,[8] the Resistograph cannot distinguish differences between solid wood and wood decayed with *Kretzschmaria deusta*, which is the one of the main suspected basal decay organisms infecting the Pinetree Drive Australian pine trees.

Survey Techniques and Methods

Similar to the 2010 survey, I used a scoring method to determine a **Risk Score** for each tree surveyed. But unlike the earlier survey I made some changes in the rating categories to better reflect and quantify both the structural condition as well as the health condition of each tree. In the 2010 survey, I used the following categories to determine a Risk Score:

- Likelihood of a tree to fail
- Size of the part of the tree most likely to fail
- Lean of the tree
- Decay — the amount of basal, trunk or branch decay combined

In the current survey I use the following categories to determine a Risk Score:

- Likelihood of a tree to fail, 3 points (1=low likelihood, 2=moderate likelihood, 3=high likelihood)
- Size of the part of the tree most likely to fail,, 3 points (1=small size, 2=medium size, 3=large size entire tree)
- Tree health 3 points (1=good, 2=fair, 3=poor health)

- Decay – the amount of basal, trunk or branch decay combined, 3 points (1=nominal decay, 2=moderate decay, 3=extensive decay)

Tree decay -- Basal decay was also evaluated separately from decay in the trunk and lateral branches. The overall decay was combined in determining the decay risk score above. The condition of the numerous enlarged galls found on most of the trees was also included in the survey. The idea was to determine if there was relationship between overall decay in the tree and the easily observable gall decay. Previously I had found solid, intact galls were associated with solid trunk wood underneath. On the other hand I had found decaying galls were often associated with trunk decay beneath the gall.

Figure 3 The crown to trunk ratio is the ratio of the height of the tree's crown (red vertical line) compared to the overall height of the tree trunk (yellow vertical line) Photo from Dr. Jerry Bond, ***Urban Tree Health: A Practical and Precise Estimation Method***, Urban Forest Analytics LLC, 2012.

Tree health – It was thought that including an evaluation of tree health would provide a new perspective for determining a Risk Score. Tree health was divided into three separate categories:

- **Tree opacity** is the percentage of light visibly blocked by branches, foliage and reproductive structures of the actual upper live crown. Opacity provides an estimate of the actual photosynthetic tissue within the crown of the tree. A higher percentage is most desirable.
- **Tree vitality** – is the percentage of the upper crown that is free from recent mortality on branches with fine twigs, beginning at the terminal portion of a branch in proceeding toward the trunk. This is exemplified by dead branches in the mid and upper crown. A higher percentage (few or no dead branches) is most desirable.
- **Crown to trunk ratio** — is the ratio of the live crown height to the total live tree height, expressed as a percentage. Again, a higher percentage is most desirable (Figure 3).

Each of the four Risk Score categories (likelihood of failure, size of part, health and decay) was given a score between "1" and "3" with "3" being the highest risk and "1" being the least. The total possible score was "12" being the highest risk.

The lowest possible total score was "4" being the lowest risk. The distribution of the Risk Scores is illustrated on page 21 of this report.

Limits of the Assignment

There are line-of-sight problems with trees near intersections and driveways. Also many trees have been hit by vehicles over the years causing wounds and subsequent decay on the lower trunks and root flares. The many wounded trunks observed while doing the survey are evidence of the ongoing tree-vehicle encounters. This report does not deal with these traffic safety issues.

Observations

In my initial report dated November 7, 2010, I provided some basic background information on the history of the trees, information about the species and information about the site. Some of this background information has been repeated in this report under Observations "The Trees" and "The Site" below for benefit of those who have not seen the first report.

The Trees

The Australian pines growing along Pinetree Drive in Miami Beach are a dichotomy. On the one hand, the 289 trees examined are all *Casuarina equisetifolia,* which is a Category I invasive exotic plant. Category I invasive exotic plants are those that are altering native plant communities based on the documented ecological damage. On the other hand the same trees were also designated as historic trees and the street, Pinetree Drive, a historic site by the Miami Beach City Commission in June, 2001.[9] According to early records[10], John Collins, was one of the first settlers in what was to become Miami Beach. In 1910, Collins planted Australian pines as a windbreak to protect his young avocado and mango groves. The same pines planted in 1910 now stand along what has become Pinetree Drive in the City of Miami Beach.

According to Dr. Ed Gilman, University of Florida Professor of Urban Trees & Landscape Plants in the Environmental Horticulture Department and one of the country's leading arboricultural researchers, "Long-favored for use in erosion control along beaches, the Australian pine tree is now outlawed in many parts of Florida due to its invasive nature, rapid growth rate, and non-native status. It is not a true pine tree and is not related to the pines. A straight, upright tree capable of reaching 70 to 90 feet in height and possessing rough, fissured, dark-gray

bark, Australian pine has what appear to be long, soft, gray/green needles but these 'needles' are actually multi-jointed branchlets, the true leaves being rather inconspicuous." [11]

The trees along Pinetree Drive range in diameter from approximately 16 inches to an estimated 42 inches with a predominance of the smaller diameter trees growing in the narrow median to the south of 41st Street. I presume from the historical records provided to me in 2010 by Dr. Chris Latt that all the trees are approximately the same age. The large range in trunk diameter may be readily explained by the difference in root space by the relatively narrow 9-foot wide median south of 41st Street and the more root friendly 30-foot wide median north of 41st Street. Or possibly some of the trees especially on the south end may have been planted at a later date. Most of the trees are leaning generally toward the west north of 41st Street. And the west row of trees is often suppressed by trees growing in the east row forcing the west row of trees to lean toward the west and causing sprawling branches to form toward the west. Any lean appears to be generally stable but during storm events the lean along with the reduced root space, sprawling branches and basal decay can affect stability and make some of the trees more likely to blow over.

A **DBH** measurement of trunk diameter of each tree was not taken because the trees are heavily infested with large trunk galls or tumors, which I believe are caused by the bacterium *Agrobacterium tumefaciens.* If so, the galls are technically called crown galls or crown gall tumors, but for simplicity I will refer to them as galls in this report. The large galls are often located on the trunk where the DBH measurement should be taken and the presence of the galls makes accurate DBH measurements difficult. A majority of the trees (93 percent) had medium to very large galls on their trunks. Only seven percent of the trees were free of galls.

According to the records used to designate the trees as historic, the trees are approximately 100 years old. Some experts[12] say the average life span of Australian pines in Florida is around 40 to 50 years with some specimens reportedly living "hundreds of years in parts of their native range."[13] The Australian pines appear to be well over their average age and should be treated as veteran trees, in my opinion. See the **Management Options** section.

According to the Smithsonian Marine Station at Ft. Pierce, "Early on, Australian pine was also utilized in Florida as a a lumber species and in ditch and canal stabilization. It ultimately proved to be poorly suited to this latter use, again due to its shallow root system and its tendency to be blown down. More troubling than

its poor utility as a purpose-cultivated species, *C. equisetifolia* revealed itself to be a highly invasive species in Florida. The species' ability to colonize disturbed and nutrient-poor sites, its high fecundity, protracted reproductive season, broadcast seed dispersal, and tendency to form monospecific stands are traits that make it a highly competent invader." And the article continues, "Australian pine is generally the dominant species in competitive interactions with native Florida vegetation. Dense thickets of Australian pine can outcompete and displace mangroves and other native coastal vegetation in Florida. There is evidence that the fallen branchlets are allelopathic in nature, containing chemical compounds that inhibit growth, survival, or recolonization by native plant species."[14]

Predominant Failure The type of tree failures that have been reported along Pinetree Drive have been the entire tree falling over caused by root or basal decay. According to verbal accounts, five Australian pine trees fell during the hurricanes of 2004 and 2005. Then a large Australian pine fell on September 15, 2010 across Pinetree Drive at 34th Avenue (Figure 4). The cause of this failure on a calm day also appears to have been basal rot. Some small lateral branch failures have occurred from time to time but these are not documented and appear to be without incident and minor in nature. Apparently there has been another tree failure on Pinetree Drive sometime after the previous 2010-2011 assessment. However, that incident occurred before the City's current Urban Forester Mark Williams was hired so there is no historical information available on the exact cause of the failure.

Figure 4 This tree fell on a calm morning on September 15, 2010. Notice the base of the tree is decayed and has become disconnected from any supporting roots.

The Site

There are 289 trees growing in the right-of-way with trees growing in a double row in a 30-foot wide median between 41st Street and 46th Street, and trees are growing in a single row in an approximately 9-foot wide median between 41st Street and 30th Street. There are also approximately 21 or 22[15] Australian pine trees growing on the west side of the street in the right-of-way between 30th Street and 34th Street. The narrow median has a curb at the edge of the street on the east side and no curb on the west side of the median. On the west side of the street tree roots are lifting the asphalt pavement in some places. On the east side of the median there is little evidence of root damage to the pavement which raises the probability that at one time the tree roots had been cut for the installation of the curb. The north end of the double row of trees just south of 46th Street is approximately 4 feet higher than the street grade. This berm gradually lowers to street grade approaching 41st Street.

Data Collection

Data was collected on each tree with an iPhone using the database HanDbase, which was customized for the assignment. Data was frequently emailed as a backup and uploaded at the end of the assessment to a Microsoft Excel spreadsheet for analysis and presentation. In several instances when Priority 1 removals (see page 14 for a description) were found, this data was emailed directly to the Miami Beach Urban Forester so maintenance could be scheduled as soon as possible instead of waiting for the full data set to be analyzed and the report written. For identification purposes during the first assessment in 2010, a small plastic, sequentially numbered tag had been attached to each tree a height of 7 to 8 feet above the ground. These identifier tags have been used in the current survey. Several trees are missing tags but locating the trees is not difficult because the tree tags are in sequence. The following data was collected during the latest assessment:

Basal Decay: The categories are: none apparent, visible cavity-small, visible cavity-moderate, visible cavity-large, suspected cavity but not visible. This category was used to separate basal decay, a difficult to assess defect, from trunk and branch decay, which is more easily assessed and not always serious.

Gall Condition: The categories are: No galls present, solid, Some decay, Extensively decayed. A solid gall usually is an indication of solid wood in the trunk underneath the gall. A decayed gall was usually observed with trunk decay too. Gall decay seems to be a precursor to trunk decay.

Mallet Test— Sounding the trunk and root flare with a rubber mallet provides one of three possible results: Negative, which means no hollow cavity was found, positive, which means a hollow area was found, and inconclusive, which means a possible cavity but sounding was not conclusive (Figure 5).

Figure 5 A rubber mallet was used to test each tree for hollows or hidden cavities in the trunk. The mallet is very effective for detecting trunk decay but not for detecting basal decay. A probe is used to test for basal cavities near the base of each tree (see arrow).

Health Condition was divided into three categories:
Health - Opacity:
81%-100% (most dense foliage, best)
61%-80%
41%-60%
21%-40%
less than 21% (least dense foliage, worst)

Health - Vitality:
81%-100% (no dieback, best)
61%-80%
41%-60%
21%-40%
less than 21% (significant dieback, worst)

Health - Ratio:
81%-100% (most foliage at mid and lower portions of the trunk, best)
61%-80%
41%-60%
21%-40%
less than 21% (least foliage at mid and lower portions of the trunk, worst)

Structure: an indication of structural condition
Excellent
Good
Fair
Poor

Structural Problems: These were observed problems or defects such as extensive decay, moderate decay or nominal decay in the lower trunk, mid trunk

and branches, sprawling lateral branches, dead branches over median, dead branches over street, codominant leaders, visible fungal conk, lean, etc.

Work Recommended:

Trees that were marked for some form of maintenance received one of the following descriptive classifications. All work should follow ANSI A300 Pruning Standards[16]:

- ***Priority 1 Removal*** Trees designated for removal have defects that cannot be cost-effectively or practically treated. The majority of the trees in this category have a large percentage of dead crown, decay and/or pose an elevated level or risk for failure. This category includes any hazards that could be seen as potential dangers to persons or property. Large dead and dying trees that are high liability risks are included in this category. These trees are the first ones that should be removed.
- ***Priority 2 Removal*** Trees that should be removed but do not pose a liability as great as the first priority are in this group. This category would need attention as soon as "Priority 1" trees are removed and "Priority 1 Prune" is done.
- ***Priority 3 Removal*** Trees in this category are those that should be removed, but pose minimal liability to persons or property.
- ***Priority 1 Prune*** Trees that require priority one pruning are recommended for mitigation trimming to remove hazardous deadwood, hangers, or broken branches. These trees have broken or hanging limbs, hazardous deadwood, and dead, dying, or diseased limbs or leaders greater than four inches in diameter. End weight reduction pruning is considered part of this priority.
- ***Priority 2 Prune*** These trees have dead, dying, diseased, or weakened branches between two and four inches in diameter and are potential safety hazards. End weight reduction pruning is considered part of this priority.
- ***Routine Prune*** These trees require routine pruning to correct structural problems, shorten sprawling branches with excessive end weight, remove dead branches or vines, or correct growth patterns which would eventually obstruct traffic or interfere with utility wires or buildings. End weight reduction pruning is considered part of "Routine" pruning.

Observations: this category allowed for comments about each tree's specific defects, condition and/or maintenance.

Risk Score — is a total of the scores from each of the following four categories:

Likelihood of failure – identifies the most likely failure and rates the likelihood that the structural defect(s) including the decay will result in failure before the next inspection. In this case the inspection interval has been three years. Failure prediction is the most problematic risk rating factor requiring skill and experience. It includes evaluation of wood strength (strength loss), root damage, decay, wounds, structural defects such as fork attachments, pests, tree taper, crown size, etc. A tree with few apparent defects would be scored "1". A tree with some defects would be scored "2". A tree with numerous and or extensive defects such as visible basal cavities would be scored "3".

Size of part most likely to fail – because basal decay was the most common type of failure, that meant that the size of the tree part most likely to fail was the entire tree so this category generally received a score of two or three points when extensive basal decay as well as trunk decay was observed. When a branch was more likely to fail, the rating could be either one or two points depending upon the size of the branch and the defects observed (such as decay or sprawling).

Health — the health condition when measured by the three criteria — opacity, vitality and trunk ratio.

Decay –The Decay score is a combination of amount of both basal decay and trunk and branch decay. Trees with nominal crown decay in the mid trunk and branches and little or no visible basal decay were scored "1". Trees with moderate levels of basal decay and/or a moderate level of crown decay were scored "2". Trees with moderate to large visible basal decay and/or extensive crown decay were scored "3". Because we really don't understand how much basal decay is tolerable and how to accurately quantify the amount of basal decay without invasive procedures, any basal cavity extending a significant distance under the trunk was rated as a "2" or "3". Trunk decay was judged differently because the amount of sound wood around the cavity is often measurable.

Survey Results

I'll start with the results I believe are most important, not the order the categories appear on the data sheets:

Structural Defects (Figure 6): The two main defects are sprawling branches and visible decay (Figures 7 and 8). The sprawling branches were noted in the previous survey as branches requiring shortening to reduce the lever effect that can make the branches more prone to breakage. A long sprawling branch acts as a long lever. A longer lever acts with greater force on the branch connections when a force such as wind is applied to the lever. The long branches also place more stress on the basal area where the roots are connected to the trunk, which is the predominant failure point of trees with basal decay. The Australian pine trees are old, veteran trees and as such have a considerable amount of decay in the basal area, trunk and branches. The third defect is dead branches. Thirty-seven percent of the trees have dead branches either over the median or the street (Figure 9). Dead branches continue to decay and will eventually fall to the

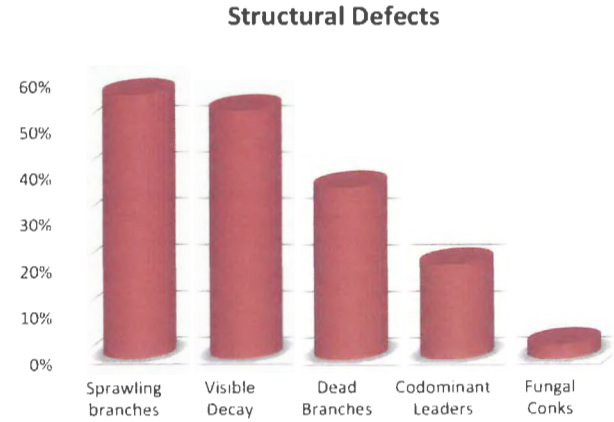

Figure 6 The most common defects observed are sprawling branches that should be shortened, visible decay, dead branches that must be removed, and codominant leaders. Fungal conks are the fruiting bodies of decay fungi. Not all decay will produce fruiting bodies at the same time.

ground or street if not attended to through regular maintenance. **Codominant** leaders are a structural defect that makes a branch fork more prone to failure. Shortening the leaders above the codominant fork is the proper mitigation for codominant leaders on aging trees. Finally fungal conks are fruiting bodies. Only a small portion of trees with decay will exhibit fruiting bodies of wood-decay fungi at one time.

Decay: Decay is considered in this report a structural defect not a health defect. Two types of decay were classified — basal decay (Figure 7) which causes the roots to decay where they meet the trunk and decay in the trunk and branches (Figure 8). Basal decay can cause catastrophic failure of the entire tree falling over. Trunk and branch decay can cause portions of the trunk or branches to fail. Reducing weight by pruning above the decayed area, if the decayed area is not too large, is one way to mitigate the decay defect without removing the tree.

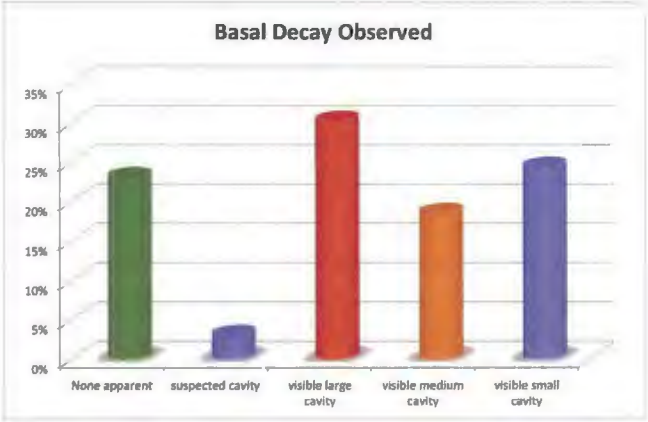

Figure 7 Combined, the large and medium size basal cavities (red and orange) were apparent visually on 49 percent of the trees.

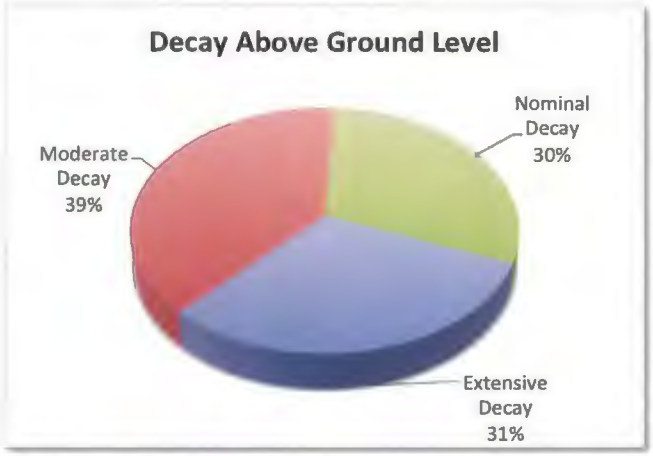

Figure 8 Seventy percent of the trees had either moderate or extensive decay on the trunk and or branches.

Figure 9 Of the 107 trees that had dead branches, 63 percent were over the street and had a higher potential for causing damage or injury if they were to fail. The dead branches over the median posed a lower threat.

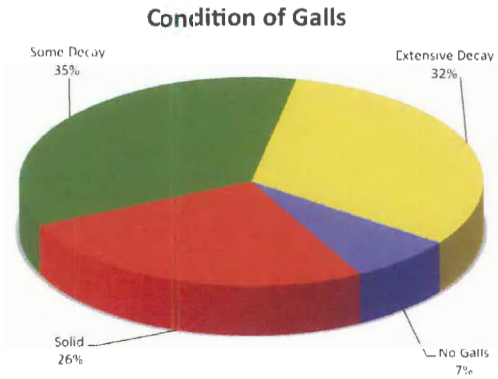

Figure 10 We have observed that galls with more extensive decay tend to pass that decay into the trunk

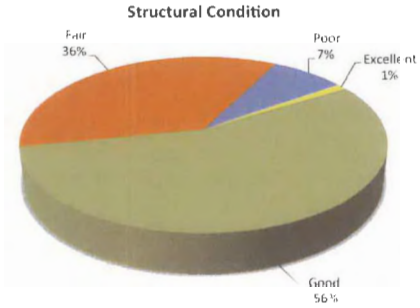

Figure 11 When the overall tree structure was evaluated, 56 percent of the trees are considered good with 36 percent considered fair.

Tree Health: You can have a healthy tree that can fail because of structural defects. And you can also have an unhealthy tree that is structurally sound. Tree structure is very different and independent of tree health. This is why you sometimes have seen a tree full of green leaves and a full crown that has fallen over. So both health and structure should be considered when doing an assessment. In the case of the Australian pines on Pinetree Drive, the health condition when measured by the three criteria – opacity, vitality and trunk ratio –is very good (Figure 9). This is good news because a healthy tree is producing food in the form of sugars for itself and is better able to compensate for decay by producing response growth and reaction wood. We have even observed new adventitious roots that have formed adjacent to areas where basal decay was visible (tree #3371). Such response growth can only be done by a healthy tree.

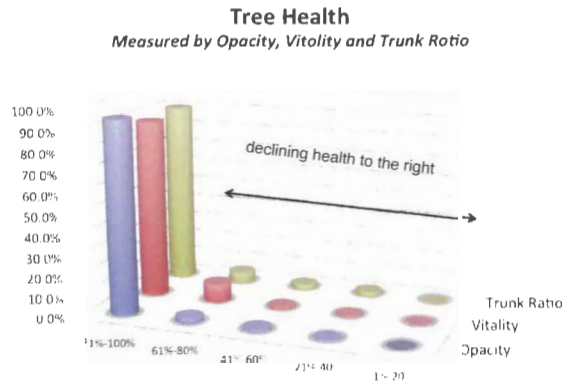

Figure 12 Tree health was very good considering opacity, vitality and trunk ratio. The entire population is generally very healthy.

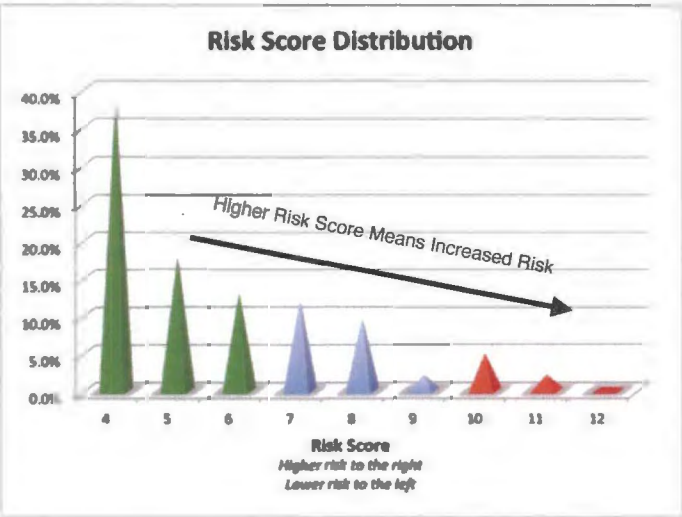

Figure 13 Twenty-one trees have a Risk Score of 10 to 12. Sixty-nine have scores between 7 and 9 and 199 trees have low Risk Scores from 4 to 6.

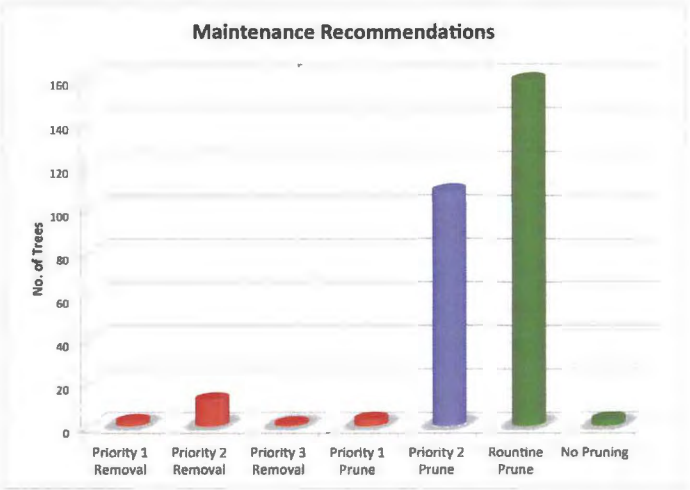

Figure 14 Fifteen trees were selected for removal. Three trees were marked for Priority 1 prune which means there was a hanger or urgent problem to correct. One hundred eight trees were marked for corrective pruning as soon as the removals and Priority 1 pruning had been done.

Discussion

Overall the Australian pine population on Pinetree Drive is very healthy but has some significant structural problems, mostly basal decay, which is difficult to measure, and long sprawling lateral branches that create increased leverage force on the decayed areas of the trees.

Arboricultural researcher Dr. Tom Smiley says, "Assessing root decay is complicated by the fact that the decay is frequently more severe than detection procedures will indicate. Subsequently, whenever any root or basal decay is encountered, the tree care specialist should be aware that root disease may be more severe than anticipated."[17]

In my 2010 report I listed several management options including a Static Pull Test in which a tree is subjected to a pulling force while the tree's reaction is recorded by devices documenting stem angle and fiber length changes. Recent research by Francis Schwarze published in his text ***Diagnosis and Prognosis of the Development of Wood Decay in Urban Trees*** discusses the difficulty in measuring basal decay caused by *Kretzschmaria deusta*,[18] "Detection of decay by *K. deusta* during tree risk assessment is difficult. Because of the inconspicuous ascocarps and brittle nature of the decayed wood, infected trees do not show typical defect symptoms (e.g. bulges or bottle butt)." Schwarze further discusses the inability of stress wave timers, static pull tests and Resistograph drilling for penetration resistance on *Kretzschmaria deusta* infected wood.[19] Schwarze did, however, find that the Picus acoustic tomograph, a minimally destructive diagnostic instrument, did allow for accurate depiction of *Kretzschmaria deusta*-caused basal decay.[20]

Management Options

Reduction Pruning The trees along Pinetree Drive must be managed as the aging veteran trees that they are. Dr. Kim Coder, arboriculture professor at the University of Georgia, writes articles and speaks regularly to Florida arborists about maintenance of aging veteran trees. In addition to structural problems caused by sprawling branches and weak fork arrangements, Dr. Coder says veteran trees also have: [21]

- reduced photosynthesis
- vascular problems
- increased sapwood respiration
- reduction in defensive chemical production
- reduction in resources available in the soil

Dr. Coder recommends several therapeutic treatments for veteran trees which include:

- **Provide organic matter to the soil** to improve the biological health and physical features of the soil. The Australian pines are self-mulching so extra mulch is probably not necessary.
- **Remove competing plants** As trees age they are less able to complete with surrounding landscape plants. There are only a few areas with surrounding plants most notably a section of sansevieria plants in the area of trees #543 through tree #548. These plants should be removed.
- **Improve branch structure** "Old trees are burdened by their mass, reach and size. Reduction of tree reach, extent and mass above ground can reduce risk of structural failure and improve transport path problems," writes Coder.

Coder goes on to describe how branch end weight reduction and crown size reduction achieve the goals of reducing risk of structural failure and improving vascular pathways. He adds that branch reductions "should be timed so that a number of years occur between treatments." [22] In other words reducing the crown size and spread of aging trees will reduce risk of failure and reduce vascular problems caused by damage to long vascular pathways. But crown reduction must be done carefully. Pruning that removes too many leaves, which produce carbohydrates, and branches, where carbohydrates are stored, can weaken a tree.

One method of mitigation is crown reduction which can reduce the forces placed on the trunk and base of the tree by wind events, excessive lean or long, sprawling lateral branches. Crown reduction can be even more useful where root

space is limited for the trees such as in the 9 foot wide median south of 41st Street and where many of the trees have some degree of lean.

Figure 15 Here are three examples of crown reduction management of declining veteran trees in Europe Even with heavily decayed trunks the smaller managed crowns exert less force on the trunks allowing the trees to remain in a reduced form long beyond their prime. Photos provided by Philip van Wassenaer, ISA Certified Arborist and tree preservation specialist from Mississauga, Ontario.

Long Term Crown Reduction Management Plan - This type of treatment of crown reduction was described at a veteran tree conference given in Asheville, NC in 2008 by tree preservation specialists Philip van Wassenaer and Neville Fay. Crown reduction can be used as a specific risk reduction technique when used on aging trees. The conference concentrated on European methods of preserving and maintaining aging and declining veteran trees mainly through gradual crown reduction. Aging trees are managed instead of being allowed to naturally senesce, break apart and fall over. Longer branches are shortened and height is reduced gradually over a period of years similar to the crown reduction pruning treatments described by Dr. Coder. Left alone an aging tree would begin shedding its longer, taller branches through the activity of decay and the forces of wind storms. This haphazard branch and sometimes trunk shedding is dangerous and uncontrolled. But a crown reduction management program could allow many the declining Australian pine trees to continue to live on Pinetree Drive for many more years with reduced risk to those who use the street.

At the veteran tree conference photos were shown of many aging broadleaf trees in Europe that had large open trunk cavities. These trees were well over their prime and by U.S. standards of tree health and esthetics would have been cut

down years ago due to their many defects and "ugly" appearance. But these trees in their special way are beauties that continue to live and provide a valuable link to the past in the communities where they grow (Figure 15)

Conclusions

On this tree assessment assignment I have been more conservative than on the previous survey in selecting trees for removal. I've done this with a better understanding of the historic importance of these trees to groups in the community. There is a delicate balance between risk tolerance and historic significance. For this reason I ask that the removals called for on two Priority 1 Removal trees, 12 Priority 2 Removal trees and one Priority 3 Removal trees be given serious consideration. I also ask that the inspection interval be reduced from three years to one year and even sooner if a major storm event occurs in the area. The remaining trees along Pinetree Drive can be properly managed through end weight reduction pruning, which should be done soon on the trees with a Priority 1 Prune and Priority 2 Prune designation.

In my report following the 2010 assessment of the trees on Pinetree Drive I indicated that end weight reduction pruning should be done to properly maintain this aging population of Australian pines. Unfortunately this pruning does not appear to have been done. Now the need for end weight reduction pruning is even more urgent as the sprawling branches increase the stress forces on branch crotches and aging trunks with some basal decay. In my opinion given proper reduction pruning, many of the Australian pines along Pinetree Drive can be maintained for many more years. Without significant end weight reduction pruning on the sprawling branches, branch breakage as well as catastrophic tree failure is more likely. And once large branch breakage occurs, the tree structure will have been damaged probably irreparably.

Although the instrument is expensive as arborist tools go somewhere in the range of $17,000, consideration should be given to obtaining a Picus Acoustic Tomograph instrument for future testing of suspect trees. Rental might be a possibility.

Finally, if and when another tree failure occurs on Pinetree Drive, the fallen tree should be examined and photos taken as soon as possible to try to determine the cause of the failure. If possible, the remains of the tree should be temporarily stored off site for further inspection. And the stump should be left on site for examination and possible further dissection.

Appendix A
Definitions

Basal Decay -- (also called **Butt Rot** or **Butt Decay**) decay caused by fungi that invade the lower trunk from below and root crown area of a tree.
Codominant Leaders – a tree with multiple trunks often beginning as a single leader and dividing into two or more leaders of similar size higher up on the trunk. Codominant leaders are considered a structural defect because they can be prone to failure (splitting)
Compartmentalization – the ability of a tree to isolate (wall off) damage and decay and continue to grow around the damaged area. Trees that are good compartmentalizers are better able to withstand damage from injuries such as pruning cuts, gashes, lightning strikes, etc.
Condition – an evaluation of a tree's structure and health
Critical Root Zone – this an area around a tree where roots must be protected and is another term for Tree Protection Zone
DBH – diameter at breast height, a measurement of a tree's diameter usually measured approximately four and one half feet above the ground
Dripline – the outer edge of a tree canopy
End Weight Reduction Pruning — A recommended pruning method that reduces (subordinates) codominant leaders and large side branches by reducing their size from the outside in. Reduction pruning is often the preferred method of taking weight off the ends of branches versus the commonly utilized but undesirable method known as "lion tailing" which removes interior branches and keeps only the branches out at the end creating instability and increasing risk of branch or trunk failure.
Epicormic sprouts – Excessive sprouting. Short twigs and small leaves growing along the upper surface of one or more main branches. The presence of epicormic sprouts is an indication of poor tree health, over-pruning, and/or a weakened tree.
Reduction Pruning – see **End Weight Reduction Pruning**
Resistograph – a diagnostic tool that utilizes a 1/8-inch diameter drill bit to measure decay inside a tree trunk or branch by measuring and graphing the resistance of the drill bit as it moves through the wood.
Root Flare – also called **Root Crown** -- the area at the base of the tree trunk that becomes wider (flares out) where roots grow horizontally in the soil. The individual root flares are where the roots are connected to the base of the tree trunk.

Certification of Performance

I, Chuck Lippi, certify that:

- Arborists cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways we do not fully understand. Conditions are often hidden within trees and below ground. Arborists cannot guarantee that a tree will be healthy, safe or adequately protected under all circumstances or for a specified period of time. Likewise, remedial, protective and mitigating treatments and recommendations cannot be guaranteed.
- I have no current or prospective interest in the vegetation or the property that is the subject of this report and have no personal interest or bias with respect to the party or parties involved.
- I certify that all the statements made in this report are true, complete and correct to the best of my knowledge and belief and are made in good faith.
- The analysis, opinions and conclusions stated herein are my own and are based on current scientific procedures and facts.
- My analysis, opinions and conclusions were developed and this report has been prepared according to commonly accepted arboricultural practices.
- My compensation is not contingent upon the reporting of a predetermined conclusion that favors the cause of the client or any other party nor upon the results of the assessment, the attainment of stipulated results or the occurrence of any subsequent events.
- There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the plants or property in question may not arise in the future.
- I reserve the right to change my reports/opinions on the basis of new or different evidence.
- Loss or alteration of any part of this report invalidates the entire report.

I further certify that I am a member in good standing of the American Society of Consulting Arborists (ASCA), the International Society of Arboriculture (ISA) and the Florida Urban Forestry Council and am an ISA Board Certified Master Arborist FL-0501B and an ASCA Registered Consulting Arborist #443.

ASCA AMERICAN SOCIETY OF CONSULTING ARBORISTS

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[4] Aboricultural consultant in the United Kingdom and Director ***Treework Environmental Practice.*** He is a leading lecturer on veteran tree care. More information can be found at http://www.treeworks.co.uk/neville_fay.php.

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[13] Linda Conway Duever from the Floridata website http://www.floridata.com/ref/c/casu_equ.cfm downloaded Oct. 30, 2010. Linda is a conservation ecologist with nearly 30 years experience in resource inventory/evaluation and natural area management.

[14] Smithsonian Marine Station at Ft. Pierce http://www.sms.si.edu/irlspec/casuarina_equisetifolia.htm Website downloaded Oct. 30, 2010

[15] The latest tree failure may have been one of the swale trees growing on the west side of the street south of 41st Street based upon conversations with a resident.

[16] American National Standards Institute (ANSI) for Tree Care Operations – Tree Shrub and Other Woody Plant Maintenance – Standard Practices (Pruning), part 1, 2008

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[20] *Ibid.* pp. 223-235.

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