

# **APPENDIX D**

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## **Tree Shading Impact Report on Mosswood Park**

Prepared for:

Kaiser Permanente  
NFS Capital Projects, East Bay  
1100 San Leandro Boulevard, Suite 200  
San Leandro, CA 94577-1595

**KAISER OAKLAND MEDICAL CENTER (OMC)**

**MOSSWOOD PARK SHADING**

**TREE SHADING IMPACT REPORT**

Oakland, CA

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Prepared by:

Stephen Batchelder, Consulting Arborist  
1534 Rose Street  
Crockett, California 94525  
State Cont. Lic. (C-27) #533675  
Phone (510) 787-3075  
Fax (510) 787-3065

## SHADING OF MOSSWOOD PARK TREES

Assignment: Assess trees in Mosswood Park in Oakland with respect to trees that will have new shade for an average of 3.5 to 4.5 hours per day for the three month period from March 21 thru June 21. The shading is based on potential impact from the new Oakland Replacement Hospital and Parking Garage, which are planned to be constructed in 2009 through 2013. All trees located in Mosswood Park are owned and maintained by the City of Oakland.

### Scope of Investigation and Discussion

This assessment of the effect of new project shading on existing City trees in Mosswood Park focuses on shading effects during the spring season: the three month period from March 21 thru June 21 when sunlight is most critical for tree health. An estimate of 3.5 to 4.5 hours per day of new shading would occur during this period, in the morning. This estimate is the worst case scenario of *increased* shading that would occur during the year.

Trees were first assessed with regard to species. A list of the tree species and the number of trees represented by each of the species was made. The relative shade tolerance of each of the species was noted in the data.

The trees affected by new shading were subdivided into three groups based upon the distance from Broadway and the level of new shading expected. The first group was within 100 feet of Broadway. The first group would be shaded for the longest period of time because they are closest to the proposed structures. The second group of trees is between 100 and 200 feet from Broadway. The third group was within 350 feet of Broadway; this is about  $\frac{1}{2}$  the east-west park dimension. Other trees in the Park (outside the boundaries of the worst-case spring shading) would not be affected by new project Shading. A total of 111 trees in Mosswood Park were reviewed that were within 350 feet of the border with Broadway.

The investigation also utilized a Chlorophyll Fluorometer<sup>1</sup> to measure the health of four oak trees. The four trees were selected for sampling due to their location in the center of the area where the most new shading will occur and the high value of two of the trees. A general assessment of the site conditions was made as pertains to the health and condition of the tree roots.

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<sup>1</sup> Chlorophyll Fluorometer – Tool that calibrates leaf activity and light exchange capacity. Manufactured by Opti-Science.



## SUMMARY

There are some valuable and historically valuable trees in Mosswood Park. One Coast Live Oak (*Quercus agrifolia*) was noted as having a diameter (DBH) of 53 inches and having a spread of 110 feet. In the eastern half of the park where trees were surveyed, 111 trees with 28 different tree species were identified.

Though there will be increased shading of the trees during spring months as a result of the new structures, the adverse impact upon tree health is expected to be minimal. This is because most of the trees are of species that are known to be shade tolerant and in good health. The Giant Sequoia Redwoods (*Sequoiadendron giganteum*) and Cork Oak (*Quercus suber*) were the species that appear to be in the poorest health. Both species have minimal tolerance of turf and soils with limited gas exchange.

The assessment was based upon the general assumption of a loss of 3.5 to 4.5 hours of sunlight per day. This loss would be greater for the trees on the eastern half of Mosswood Park, toward Broadway. This is the worst case and does not apply to all affected trees.

The survey selected four oak trees that were subjected to leaf testing using a Chlorophyll Fluorometer. The four trees were selected due to their location, species, and size.

Chlorophyll Fluorometer readings were undertaken on these trees to assess the current health beyond visual observation. The readings provide baseline information and a method to track future tree health. The readings indicate that the four oak trees are likely in marginal health. The visual appearance of the oaks was that of healthy trees. There are a number of treatments that could be implemented to improve tree health and thereby reduce any potential adverse effects from the new shading.

## Tree Health and Condition

Of the 28 species identified, 23 were listed as being in good condition. Five of the species appeared to be in fair condition. Only the Giant Sequoia Redwood trees were found to be in poor condition *The poor health of the Giant Sequoia trees is a reflection of the lack of species tolerance for clay loam soils and high water table. The poor health is reflected in the presence of the fungal organism Botryosphaeria dothidea that is causing the foliage dieback. This fungal canker is generally a problem only in trees that are already stressed due to environmental factors.*

The largest of the Coast Live Oak trees has a spread of 110 feet and a diameter of 53 inches. This tree is likely of historical significance and requires special attention. This tree, an adjacent Coast Live Oak, and two adjacent Cork Oak trees were the trees selected for the Chlorophyll Fluorometer readings.

The two Cork Oaks are also visibly in fair condition. The Cork Oaks generally perform poorly in turf. The two Cork Oak trees are currently subject to winter shading from the largest of Coast Live Oak trees located to the south.



**Table 1.**

The table below provides information on tree species<sup>2</sup> that will be in the area impacted by the increased shading. Column descriptions are provided below:

- Species – Botanical name of tree.
- Shade Tolerance – Tolerance for low light conditions. By their nature deciduous trees are tolerant of shade during winter months.
- Zone - Trees were placed in three categories based upon their distance from Broadway. Trees within 100 feet are noted in Zone 1. Zone 2 includes trees that are up to 200 feet from Broadway. Zone 3 includes trees up to 350 feet from Broadway. Appendix 1 contains graphic description of the areas.
- Current Health – Assessment of the current health of the tree.
- Notes – Pertinent notes.

Species	Shade Tolerance	Zone 1	Zone 2	Zone 3	Current Health	Notes
Acer buergeranum	Good		2		Good	
Acer Palmatum	Good		4		Good	
Araucaria heterophylla	Good			1	Good	
Arbutus unido	Poor			1	Good	
Betula pendula	Good		12		Good	
Cedrus atlantica	Fair	1			Good	
Cedrus deodara	Good	2		1	Good	
Cryptomeria japonica	Good	1			Good	
Eucalyptus ficifolia	Fair		1	1	Good	
Ginkgo biloba	Good	1		1	Good	
Juglans hindsii	Good			1	Good	
Magnolia campbellii	Good	5			Fair	
Magnolia grandiflora	Fair	1		1	Fair	
Magnolia soulangiana	Good	3		1	Good	
Metasequoia glyptostroboides	Good			3	Good	
Pinus pinea	Poor	1			Fair	Crowded,
Pittosporum undulatum	Good	1			Good	
Prunus lyonii	Good		7		Good	
Quercus agrifolia	Good	5	3	1	Good	Fluorometer on 2, stable health
Quercus falcata	Good		1		Good	
Quercus ilex	Fair			1	Good	
Quercus suber	Poor		2		Fair	Fluorometer on 2, stable health
Sequoia sempervirens	Good		13	14	Good	
Sequoiadendron giganteum	Poor	1	3	2	Poor	Poor health
Sophora japonica	Good			1	Fair	
Syzygium paniculatum	Good		4	2	Good	
Taxus baccata 'stricta'	Good	5			Good	
Ulmus sp.	Good		1		Good	
<b>TOTALS</b>		<b>26</b>	<b>53</b>	<b>32</b>		<b>111</b>

<sup>2</sup> Information about any of the tree species listed in table 1 can be found at the web site: [ufe.calpoly.edu](http://ufe.calpoly.edu)



## Chlorophyll Fluorometer

The table below provides the readings for the four trees tested. These readings can be used to compare tree health at a later date after the new shading is in place. Two of the nine Coast Live Oak trees were tested and both Cork Oak were tested. All trees are within a few hundred feet and located at the east end of the park, close to Broadway.

Healthy trees generally have readings ranging from .750 to .850. The readings for the four trees, 2 Coast Live Oak and 2 Cork Oak indicate the trees are in stable condition. The marginally low readings are likely a reflection of the impact of soil compaction and turf irrigation on health of the trees.

**Table 2.**

The table below provides results of the Chlorophyll Fluorometer readings. Five different readings were taken on all sides of each of the four oak trees that were selected for testing.

Tree #	DBH <sup>3</sup>	1	2	3	4	5	Average
Coast Live Oak	53	.778	.742	.732	.756	.691	.740
Coast Live Oak	43	.749	.759	.724	.735	.686	.731
Cork Oak	27	.660	.769	.752	.699	.727	.721
Cork Oak	21	.769	.740	.737	.743	.757	.749

## Effects of Shading

For the purpose of this report, tree health is defined as the level of energy (stored starch) in the roots and sapwood of the tree. Tree health is also reflected in data from the Chlorophyll Fluorometer readings in Table 2 above. Any decline in future tree health would be reflected in lower readings.

Most of the 28 tree species in the area affected by the new shading in spring are known to be shade tolerant. Species that are least tolerant are Cork Oak (*Quercus suber*) and Strawberry Tree (*Arbutus unido*). The Giant Sequoia Redwoods are also less tolerant of shading and are currently in poor health.

## Analysis of Effects of Increased Shading

The increased shading in spring will have only minimal impact on the park trees. This is due to the inherent tolerance of most of the tree species of low light growing conditions. One of the more critical effects to consider when assessing the potential effects of increased shading is the understanding of the reduced moisture needs of the trees. This should be taken into account in the irrigation. Refinement of park irrigation along with

<sup>3</sup> DBH – Tree diameter measured at 54 inches above average soil grade.



mulching in large areas surrounding the trees would likely mitigate any potential adverse effects of the new shading. This is to say that the loss in energy production (photosynthesis) from the shading would be offset by increased energy production during times when sunlight is available.

### **Treatments to Improve Tree Energy Reserves**

It is important that plant energy reserves not be allowed to drop as such plants become attractive hosts to additional problems. The treatments are primarily directed toward improving soil gas exchange and limiting excess moisture application. These measures could be implemented immediately to improve current tree health prior to the new project shading or at a later time if plant health begins to decline. Some of the possible treatments are listed below:

**Water Audit** – The refinement of moisture application to the area would provide the most benefit to the tree health. The increased shading will reduce the amount of supplemental moisture needed.

A water audit provides information on the amount of water being applied and the uniformity with which the watering occurs. The water audit looks at soil type and infiltration rate. It may be advisable to make adjustments to eliminate water spray within 10 to 20 feet from the base of many of the trees.

**Mulch** – It is recommended that an area of mulch be created around all trees. For some of the more valuable trees such as the Coast Live Oak with a 110 foot spread, mulching would be best if extended to the outer limit of the canopy. The mulch would reduce soil compaction and keep mowing equipment well away from the trees where some mower damage is evident. The mulch will further reduce the need for supplemental irrigation water.

**Soil Amendment** – The best soil amendment is good quality compost. Fertilization is only allowed after soil and leaf tissue analysis has identified problems and the amount of amendment required.

**Treatment of Soil Compaction** – Soil compaction is one of the major limitations. It is suspected to be the primary reason for the apparent decline in the Giant Sequoia Redwoods. Three possible treatments are listed below.

1. **Radial Trenching** – A method used to mitigate and replace soil inside the tree root protection zone. Soil is removed from trenches that are 8-12 inches wide and 18-36 inches deep. Trenches are excavated in direct lines toward the base of the tree using air spade, hydraulic excavation or careful hand excavation. Backfill can be amended soil, structural soil, a mix of sand and compost, or any combination deemed to be appropriate for the situation.
2. **Vertical Core Venting** – A that procedure that creates vertical holes, usually about 2-inches in diameter, that extend down through compacted soil. The holes can be from 18-inches to over 3-feet deep. Holes are spaced from 6-inches to 2-feet depending upon the site soil conditions. Holes are crated with an augur, water jet or using an air spade.



3. **Water Jet** - A procedure that uses high-pressure water and a probe to create air passages in the soil. Primary reason for use is mitigation for compacted soil. Water Jet can be used in conjunction with liquid fertilization only when soil and leaf tissue analysis indicate nutrient limitation.

**END**

Submitted by:

Steve Batchelder, Consulting Arborist



## Zone Location Map

*The graphic diagram below shows the areas where the three zones are located. The area circled is the area where the Chlorophyll Fluorometer was used to sample leaf tissue. The zones are based upon the distance from Broadway. They are respectively 100, 200 and 350 feet from the eastern boarder of the park.*

*Shadow generated from the new structures is on September 21 at 9 A.M..*

