City of Encinitas

4.4.17 Assessment of Ficus Tree At 965 Second Street (Front-1)

SUBMITTED TO:

John Ugrob
Utility & Maintenance Supervisor
Street/ NPDES Division
City of Encinitas

PREPARED BY:

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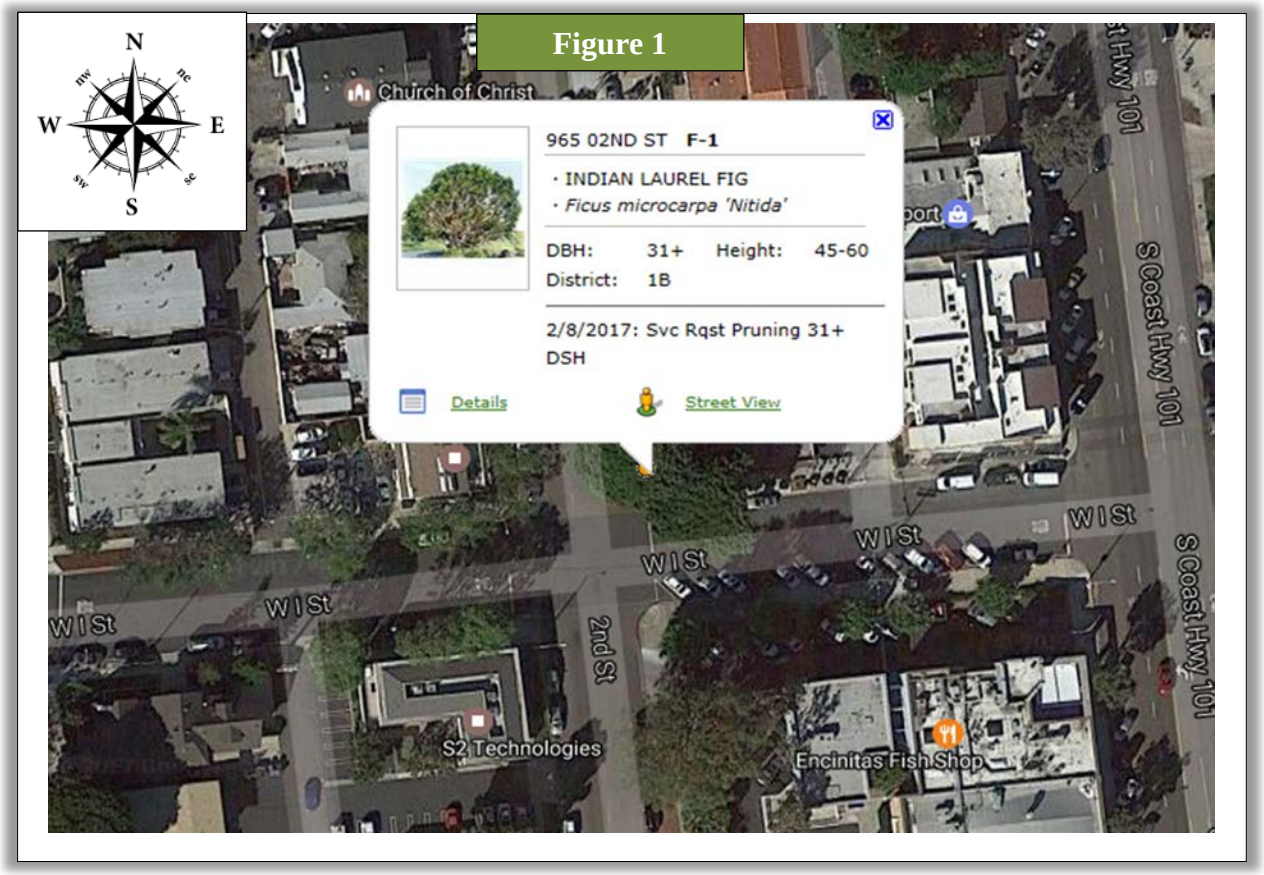
Certified Arborist # WE-10777A
Qualified Applicator License# 140768
Qualified Tree Risk Assessor

APRIL 4, 2017

BACKGROUND AND ASSIGNMENT

In March of 2017, West Coast Arborists, Inc., (WCA) was contacted by John Ugrob (City of Encinitas) in regard to the assessment of an Indian Laurel Fig tree (*Ficus microcarpa 'nitida'*) located in front of 965 2nd St. In ArborAccess (WCA's tree inventory database), the tree is inventoried as 965 02ND ST F-1 Facility I.D. # 5952ETREE (see Figure 1 below).

Figure 1



The City of Encinitas was concerned with the structure, health, and stability of the subject tree. Mr. Ugrob requested that WCA perform a health and risk assessment and present management recommendations in order to help determine a course of action regarding the subject tree. The assessments performed as part of this report are valid for a period of one year from the date of inspection unless there are any abnormal, site impacting changes or events. The contents of this report are intended to be used by Mr. Ugrob and the City of Encinitas.

OBSERVATIONS

I inspected the subject tree on March 29, 2017. On site, I performed a **Level 2**: **Basic Assessment[1].** I assessed the health and structural integrity of the tree using the **Best Management Practices (BMPs)** for tree risk assessment. I visually inspected the **crown** and **stem** of the tree, looking for structural defects such as **included bark**, **cavities**, **fungal fruiting bodies**, and/or **decay**. My inspection of defects in the crown was limited to a ground-level visual inspection. On site, I observed the following:

- The tree was growing in a 7.5 foot wide tree well on the east side of 2nd St. and in front of the 965 business address (see Photo #1 in Appendix A).

- Judging by the color and density of the foliage, the tree appeared to be in fair health for the species and time of year. The tree had a low **live crown ratio** of approximately 50% which is common for street trees necessitating raised crowns for vehicle/ building clearance (see Photo #1 in Appendix A).

- The tree had a DSH[2] measurement of 35 inches and a height of about 55 feet (measured with a TruPulse laser).

- The tree had multiple overextended **codominant stems** and branches with included bark which is indicative of poor structure (see Photo #2 in Appendix A).

- There appeared to be an injury/ **canker** about 7 feet up on the west facing stem (see Photo #2 in Appendix A).

- Some of the buttress roots were showing a **contact stress response** to growing next to the curb face. This phenomenon occurs when trees grow in close contact with infrastructure. Trunk and root tissues mold, and grow over the infrastructure element providing a level of structural support. There may be an increase in failure potential if the infrastructure element is removed or replaced (see Photo #3 in Appendix A).

- There was a sidewalk deflection on the south-west side of the tree (see Photo #3 in Appendix A).

[1] Terms appearing in boldface type are defined in the Glossary at the end of this report.
[2] Diameter at Standard Height (DSH) is the trunk diameter measured 4.5 feet above grade level.

- Judging by the lighter tone of concrete, it appeared that the sidewalk on 3 sides of the tree had been replaced within the last couple of years (see Photo #4 in Appendix A).

- On the south-east side of the tree, the 36 inch probe was inserted with relative ease its full length in multiple locations indicating very loose soil or air pockets below the surface (see Photo #5 in Appendix A).

- There was occasional bird activity (ravens) surrounding the tree as well as a large nest in the tree's upper canopy. Birds were not observed entering the nest during the time of visit.

Site Observations

- Vehicles appeared to use this area of 2nd Street frequently throughout the day.

RISK ASSESSMENT METHODOLOGY

According to the *Tree Risk Assessment Manual*, published by the International Society of Arboriculture (ISA), it is impossible to maintain trees free of risk. There is no way to guarantee that a tree will not fail. Tree benefits increase as the age and size of trees increase; however, some level of risk must be accepted to experience the benefits provided. The goal in assessing and managing trees is to strike a balance between the risk that a tree poses and the benefits that individuals and communities derive from trees.

Data collected from the Level 2 Basic Assessment is used to derive a level of risk based on the matrices found in the *ISA Tree Risk Assessment Manual* (see **Figure 2** below). The level of risk determined (low, moderate, high, or extreme) is to be used by risk managers to help in tree management decisions. When assessing risk, the value of targets is taken into consideration in order to categorize the consequences of failure (negligible, minor, significant, or severe). The people who use and frequent the target zone are generally the most important target with buildings, structures, and cars being secondary in importance. Factors such as occupancy rate and protection factors are used to help determine the target that constitutes the highest overall Risk Rating.

Figure 2

Matrix 1

This matrix is used to estimate the liklihood of a tree impacting a specified target.

Likelihood of Failure	Likelihood of Impacting a Target			
	Very Low	*Low*	*Medium*	*High*
Imminent	Unlikely	Somewhat Likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat Likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat Likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Matrix 2

This matrix is used to determine the level of risk as the combination of liklihood of a tree failing and impacting a target, and the severity of the consequences.

Likelihood of Failure and Impact	Consequences			
	Negligible	*Minor*	*Significant*	*Severe*
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat Likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

The risk matrices in Appendix C can guide you through the process used in determining the subject tree's overall risk.

Likelihood of Failure[3]

The defects of greatest concern were the signs of air pockets in the soil near potential root pruning in combination with the overextended growths among the canopy. These defects were assessed to give the tree a **probable** *likelihood of failure* for a windthrow/ root failure. This potential failure event would be most likely to occur during abnormal or extreme weather conditions.

Likelihood of Impacting Target

The main **target** chosen was vehicles due to their frequent occupancy and exposure to a potential failure. The *likelihood of impacting a target* (vehicle) was assessed as **high** because of these factors.

Consequences

Because of the fall distance and immense mass of the tree, the *consequences* of this possible failure were assessed to likely be **severe** (based on assumed damages and repair costs to the average vehicle in this area).

Based on the categorization of the above risk factors, this tree is currently presenting an overall **high risk** (see Appendix C for matrices).

[3] Italicized terms are those terms used in the risk rating matrices (see Appendix B).

DISCUSSION AND RECOMMENDATIONS

Canker – The subject tree was observed to have a canker/ injury on the large west facing stem. This species of tree is highly susceptible to a fungal disease called ficus canker (Botryospheria spp.) This disease generally attacks mature ficus trees growing in unfavorable conditions such as paved over or compacted root systems and inadequate irrigation. The main symptoms of progression are: leaf yellowing, premature leaf drop, branch dieback, crown thinning, and eventual death when found in trunk sections (as on this tree). To manage this disease, it is recommended to prune off cankered or dying limbs at least 6 inches below any canker; as well as reducing stresses such as poor soil health, inadequate irrigation, and excessive pruning. A sustainable/ long term solution is to plant less susceptible species that are well adapted to the local soil conditions and adequately matched with the growing space. Due to the location along the lower section of a large stem on the subject tree, removal of the infected area would not be a practical or advisable solution likely leading to decay and/or decline. WCA can send out tissue samples for lab testing at the City's request to identify the pathogen and help develop appropriate management options.

Risk and Mitigation – After performing a **Level 2 Basic Assessment**[4], the subject tree was assessed to have an overall high risk rating. This is likely an unacceptable risk for the City and action is suggested to reduce it. In regards to mitigating these risks, I present two options:

1. Remove the tree and replace it with a healthy site adequate species.

2. Reducing the overall canopy height by approximately 30% with the structure and canopy balance of the tree in mind. This recommended pruning should be done in compliance to ANSI A300 Arboricultural Standards and will need to be applied over multiple spaced out pruning doses to minimize health impacts on the tree. Pruning techniques such as **reduction pruning**, and **removal pruning cuts** should be used (not **topping**) to achieve this overall squattier appearance. If there are not suitable laterals meeting the 1/3rd size correlation, pruning other reduction cuts may only be considered under the direction of an ISA Certified Arborist. Some of these reduction pruning cuts will be done to a shoot, branch, or stem that extends nearly as far as the removed parent branch; if this is the case then additional subordination pruning cuts back to a bud or young growth may be acceptable in order to maintain a point of **apical dominance** and to achieve the reduction goal (further explained in Appendix B). The end outcome should be a reduction of **mechanical stress** from overextended loads. It will likely take multiple spaced out pruning doses (3-5) to achieve a residual risk of "Low" without topping or creating large injurious removal pruning cuts. A routine monitoring plan to look for signs of heaving should be implemented as part of this preservation plan. If the tree begins to go into decline despite efforts and care for preservation, then removal should be considered.

Hardscape Repairs – It appears evident that hardscape repairs and potential root pruning have occurred around the base of the tree. If future conflicts between roots and infrastructure occur, I recommend looking into alternative mitigation strategies such as **elevated root bridging**, or meandering sidewalks to minimize further damages to the tree's health and stability.
I present these recommendations with the health and safety of the community in mind.

[4] Terms appearing in boldface type are defined in the Glossary at the end of this report.

APPENDIX A – PHOTOS

Photo #1

- The tree (red arrow) was growing in a 7.5 foot wide tree well on the east side of 2nd St. and in front of the 965 business address.

- Judging by the color and density of the foliage, the tree appeared to be in fair health for the species and time of year. The tree had a low **live crown ratio** of approximately 50% which is common for street trees necessitating raised crowns for vehicle/ building clearance.

APPENDIX A – PHOTOS

Photo #2

Close up of canker

Close up of included bark

- The tree had multiple overextended **codominant stems** (red arrows) and branches with included bark (green arrow) which is indicative of poor structure.
- There appeared to be an injury/ **canker** about 7 feet up on the west facing stem (see 2 red dotted ovals).

APPENDIX A – PHOTOS

Photo #3

- Some of the buttress roots were showing a **contact stress response** to growing next to the curb face (see red arrow). This phenomenon occurs when trees grow in close contact with infrastructure. Trunk and root tissues mold, and grow over the infrastructure element providing a level of structural support. There may be an increase in failure potential if the infrastructure element is removed or replaced.
- There was a sidewalk deflection on the south-west side of the tree (see blue arrow).

APPENDIX A – PHOTOS

Photo #4

- Judging by the lighter tone of concrete, it appeared that the sidewalk on 3 sides of the tree had been replaced within the last couple of years (see red dotted area).

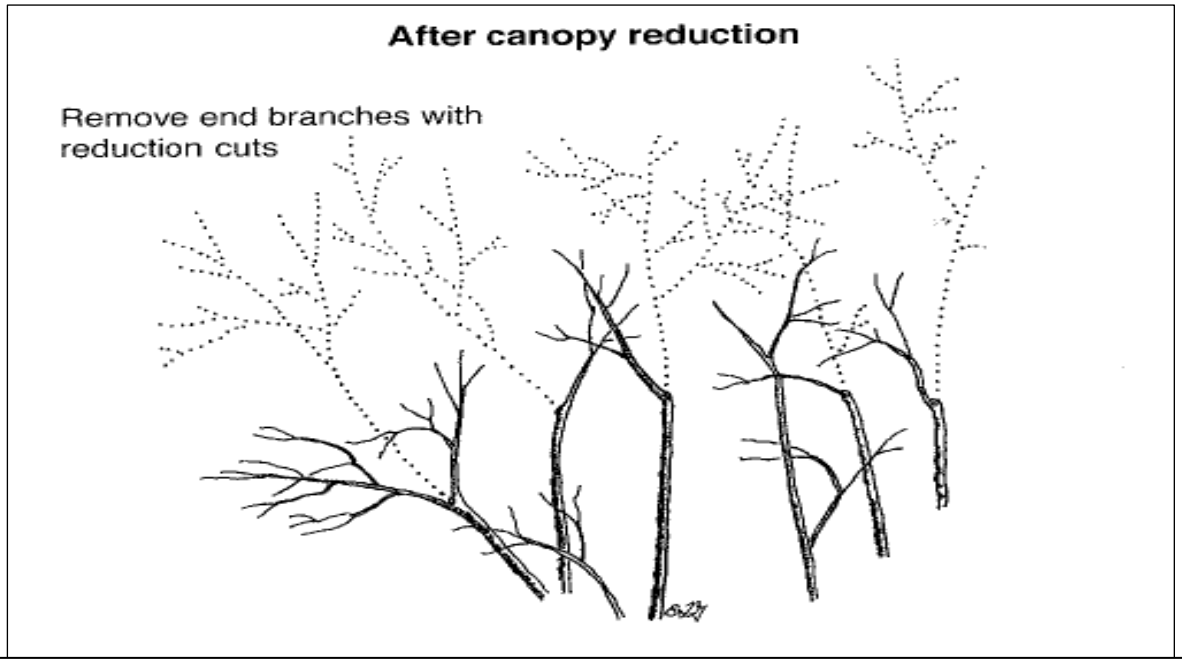
APPENDIX A – PHOTOS

Photo #5

36 Inch Probe Before Insertion

- On the south-east side of the tree, the 36 inch probe (red arrows) was inserted with relative ease its full length in multiple locations indicating very loose soil or air pockets below the surface.

APPENDIX B – RECOMMENDED PRUNING TECHNIQUES

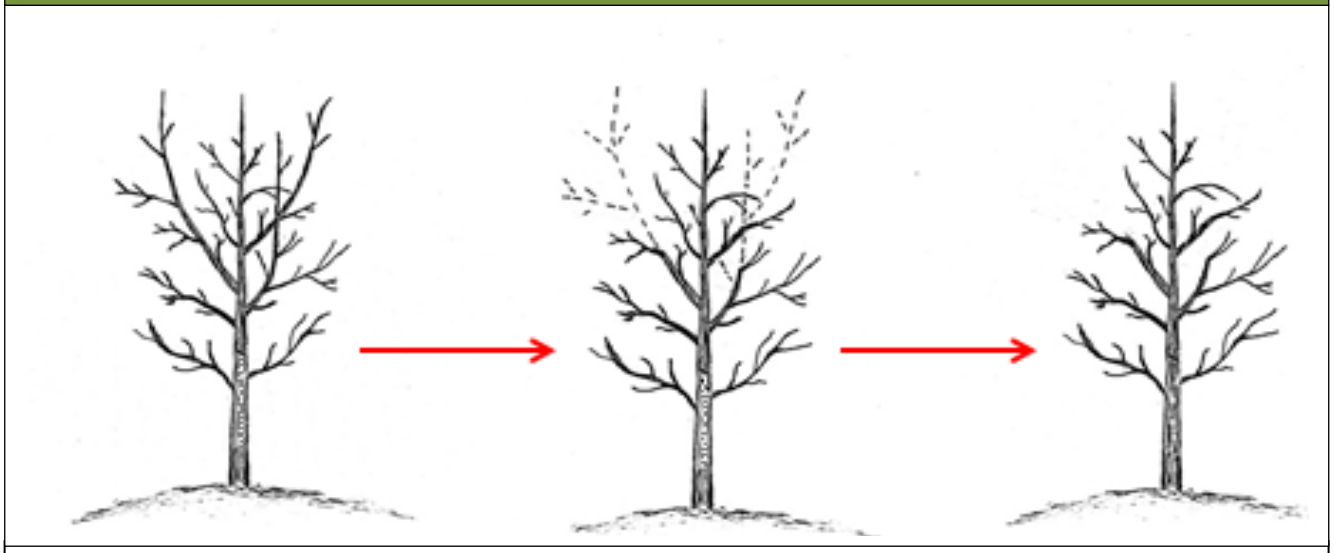


- Shown above is an example of reduction pruning techniques to achieve a canopy reduction. The diagram is from the International Society of Arboriculture "*Best Management Practices for Tree Pruning*" 2008 publication.

- If there are not suitable laterals meeting the 1/3rd size correlation, pruning other reduction cuts may only be considered under the direction of an ISA Certified Arborist. Some of these reduction pruning cuts will be done to a shoot, branch, or stem that extends nearly as far as the removed parent branch; if this is the case then additional subordination pruning cuts back to a bud or young growth may be acceptable in order to maintain a point of **apical dominance** and to achieve the reduction goal.

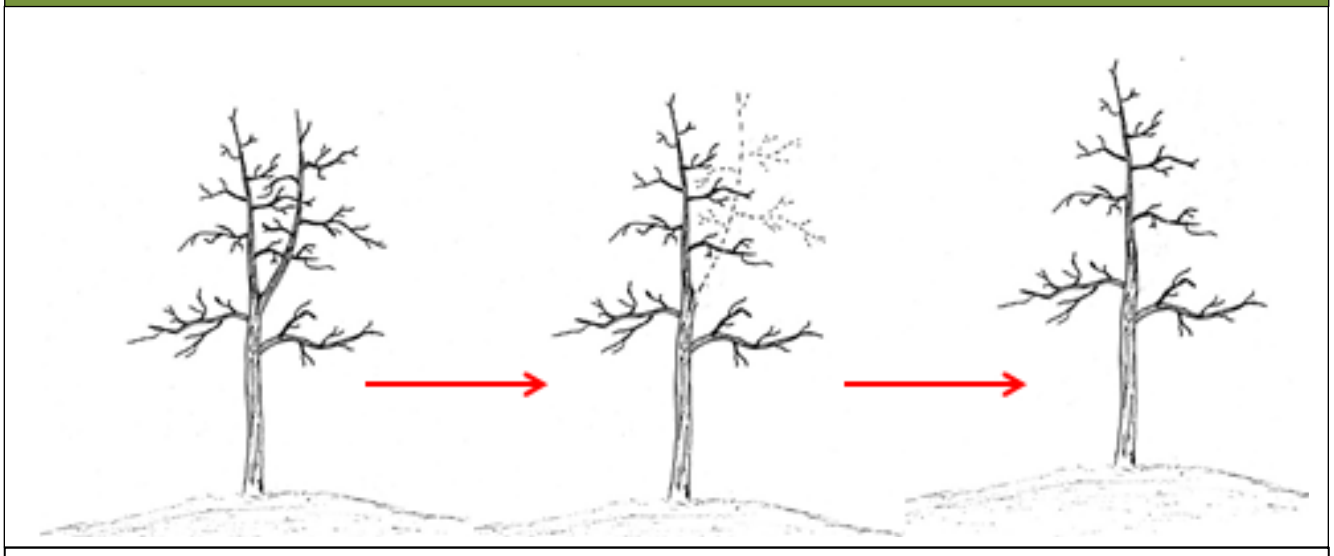
APPENDIX B – RECOMMENDED PRUNING TECHNIQUES

Reduction Pruning Techniques



Reduction pruning: A pruning cut that reduces the length of a branch or stem back to a live lateral branch large enough to assume apical dominance, typically at least 1/3 the diameter of the cut stem.

Removal Pruning Cut Techniques



Removal Pruning Cut: A pruning cut that takes off a branch back to the trunk or parent stem to just beyond the branch collar.

APPENDIX B

Crown Reduction Pruning Goal

This tree had a measured height of 55 feet (see purple arrow). The proposed goal is to achieve a 30% (16.5 feet) **crown reduction through a multi-year pruning plan (up to five years)** leaving the tree with a height of approximately 39 feet (see red dotted line and arrow) after the final pruning dose.

APPENDIX C - RISK MATRICES

The red arrows are used to guide you through the process of determining the overall risk associated with the subject tree.

Matrix 1 Windthrow/ Root Failure

This matrix is used to estimate the likelihood of the specified tree failure and impact to a parked vehicle. The pink box exemplifies a likely failure and impact scenario in the next year if no mitigation is implemented.

Likelihood of Failure	**Likelihood of Impacting Target**			
	Very Low	Low	Medium	High
Imminent	Unlikely	Somewhat Likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat Likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat Likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Matrix 2 Windthrow/ Root Failure

This matrix is used to determine the overall level of risk associated with the subject tree by using the likelihood of failure and impact in combination with severity of the consequences. The pink box exemplifies an overall high risk for the tree under discussion at its current state.

Likelihood of Failure and Impact	**Consequences**			
	Negligible	Minor	Significant	Severe
Very likley	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

ASSUMPTIONS AND LIMITING CONDITIONS

1. Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible; however, the Consultant can neither guarantee nor be responsible for the accuracy of information provided by others. Standard of Care has been met with regards to this project within reasonable and normal conditions.

2. The Consultant will not be required to give testimony or to attend court by reason of this report unless subsequent contractual agreements are made, including payment of an additional fee for such services as described in the fee schedule and contract of engagement.

3. Loss or alteration of any part of this report invalidates the entire report.

4. Possession of this report or a copy thereof does not imply right of publication or use for any purpose by any other than the person to whom it is addressed, without the prior written consent of the Consultant.

5. This report and any values expressed herein represent the opinion of the Consultant, and the Consultant's fee is in no way contingent upon the reporting of a stipulated result, a specified value, the occurrence of a subsequent event, nor upon any finding to be reported.

6. Unless expressed otherwise: 1) information contained in this report covers only those items that were examined and reflects the condition of those items at the time of inspection; and 2) the inspection is limited to visual examination of accessible items without dissection, excavation, or coring, unless otherwise stated. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the tree(s) or property in question may not arise in the future.

7. Arborists are tree specialists who use their education, knowledge, training, and experience to examine trees, recommend measures to enhance the beauty and health of trees, and attempt to reduce the risk of living near trees. It is highly recommended that you follow the arborist recommendations; however, you may choose to accept or disregard the recommendations and/or seek additional advice.

8. 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 or safe under all circumstances, or for a specific period of time.

9. Any recommendation and/or performed treatments (including, but not limited to, pruning or removal) of trees may involve considerations beyond the scope of the arborist's services, such as property boundaries, property ownership, site lines, disputes between neighbors, and any other related issues. Arborists cannot take such considerations into account unless complete and accurate information is disclosed to the arborist. An arborist can then be expected to consider and reasonably rely on the completeness and accuracy of the information provided.

10. The author has no personal interest or bias with respect to the subject matter of this report or the parties involved. He/she has inspected the subject tree(s) and to the best of their knowledge and belief, all statements and information presented in the report are true and correct.

11. Unless otherwise stated, trees were examined using the risk assessment criteria detailed by the International Society of Arboriculture's publications *Best Management Practices – Tree Risk Assessment* and the *Tree Risk Assessment Manual*.

BIBLIOGRAPHY

Harris, Richard W., James R. Clark, and Nelda P. Matheny. *Arboriculture: Integrated Management of Landscape Tree, Shrubs, and Vines.* New Jersey: Prentice Hall, 2004. Print (ISA) *International Society of Arboriculture*. Web. 15 March 2014.

Smiley, Thomas E., Nelda Matheny, and Sharon Lilly. *Best Management Practices: Tree Risk Assessment.* Illinois: International Society of Arboriculture, 2011. Print.

Kelby Fite, E. Thomas Smiley. *Best Management Practices: Managing Trees During Construction.* Illinois: International Society of Arboriculture, 2008. Print.

Edward F. Gilman, Brian Kempf, Nelda Matheny, Jim Clark. *Structural Pruning, A Guide For The Green Industry:* Urban Tree Foundation, 2013.

GLOSSARY

Best Management Practices (BMPs) – The International Society of Arboriculture has developed a series of Best Management Practices (BMPs) for the purpose of interpreting tree care standards and providing guidelines of practice for arborists, tree workers, and the people who employ their services.

Bending Moment - The algebraic sum of all the moments to one side of a cross-section ofa beam or other structural support.

Buttress Root- Large structural roots most common to trees native to rainforest soils where nutrients are not as abundant or accessible in the deeper soil layers.

Canker – A dead, discolored, often sunken area (lesion) on branch, root, stem, or trunk.

Canopy – The part of the crown composed of leaves and small twigs (Harris, Clark, and Matheny 526).

Cavity – An open wound, characterized by the presence of decay and resulting in a hollow (Harris, Clark, and Matheny 527).

Codominant – Equal in size and relative importance, usually associated with either the trunks/stems or scaffold limbs/branches in the crown (Harris, Clark, and Matheny 527).

Compartmentalization – Natural defense process in trees by which chemical and physical boundaries are created that act to limit the spread of disease and decay organisms.

Crown – The leaves and branches of a tree measured from the lowest branch on the trunk to the top of the tree (Harris, Clark, and Matheny 527).

Decay – Process of degradation of woody tissues by fungi and bacteria through the decomposition of cellulose and lignin (Harris, Clark, and Matheny 527).

Elevated Root Bridging- Root bridging and ramps can be used to create a spatial separation between infrastructure elements (typically sidewalks) and the root zone. This is an important yet costly remedial design option when root pruning is not possible. An added benefit of this technique is the facilitation of root evaluation when fitted with removable steel plates. Coarse aggregate material and drains can be implemented to reduce water and debris accumulation within the gap if necessary.

Failure – Breakage of stem, branch, roots, or loss of mechanical support in the root system (Smiley, Matheny, and Lilly 48).

Fungal Fruiting Bodies – Any complex fungal structure that contains or bears spores.

Frass- Solid fecal matter produced by certain insects.

Included Bark – Pattern of development at branch junctions where bark is turned inward rather than pushed out (Harris, Clark, and Matheny 529).

Level 2: **Basic Assessment -** A Level 2 or basic assessment is a detailed visual inspection of a tree and its surrounding site, and a synthesis of the information collected. It requires that a tree risk assessor walk completely around a tree looking at the site, buttress roots, trunk, and branches. A basic assessment may include the use of simple tools to gain additional information about the tree or defects. This is the standard assessment that is performed by arborists in response to a client's request for tree risk assessment (Smiley, Matheny, and Lilly 15).

Level 3: Advanced Assessment – Advanced assessments (generally more time intensive) that are performed in conjunction with or after a Level 2 assessment to provide detailed information about specific tree parts, defects, targets, or site conditions. Specialized equipment, data collection and analysis, and/or expertise are usually required for advanced assessments. Procedures and methodologies should be selected and applied as appropriate, with consideration for what is reasonable to specific conditions and situations. All technologies involve some uncertainty and have their limitations; any evaluation of an individual tree will not be an accurate measure, but a qualified estimation. Information collected from advanced assessments can aid in making a final tree removal or retention recommendation.

Live Crown Ratio – The ratio of the height of the live crown to the height of the entire tree.

Minor Consequence – A consequences that involves low to moderate property damage, small disruptions to traffic or communication utility, or a very minor injury, examples include:

- A small branch striking a house roof from a high height.
- A medium sized branch striking a deck from a moderate height.
- A large part striking a structure and causing moderate monetary damage.
- Short term disruption of power at a service drop to a house.
- Temporary disruption of traffic on a neighborhood street.

Negligible Consequence – A consequence that involves low-value property damage or disruption that can be replaced or repaired; they do not involve personal injury, examples include:

- A small branch striking a fence.
- A medium-sized branch striking a shrub bed.
- A large branch striking a structure and causing low monetary damage.
- Disruption of power to landscape lighting.

Reduction Pruning – Pruning cut that reduces the length of a branch back to live lateral branch large enough to assume apical dominance. Typically at least one-third the diameter of the cut parent branch.

Response Growth - New wood produced in response to loads to compensate for higher strain in marginal fibers; includes reaction wood (compression and tension) and woundwood (Smiley, Matheny, and Lilly 50).

Removal Pruning Cut: A pruning cut that takes off a branch back to the trunk or parent stem to just beyond the branch collar.

Risk – The combination of the likelihood of an event and the severity of the potential consequences. In the context of trees, risk is the likelihood of a conflict or tree failure occurring and affecting a target, and the severity of the associated consequence—personal injury, property damage, or disruption of activities (Smiley, Matheny, and Lilly 50).

Severe Consequence – A consequence that could involve serious personal injury or death, disruption of important activities, damage to high-value property, examples include:

- Injury that may result in hospitalization or permanent damage.
- A medium- sized part striking an occupied vehicle.
- A large part striking an occupied house.
- Serious disruption of high-voltage distribution and transmission powerline.
- Disruption of arterial traffic or motorways.

Significant Consequence – A consequence that involves property damage of moderate – high value, considerable disruption, or personal injury, examples include:

- A medium sized part striking an unoccupied vehicle from a moderate to high height.
- A large part striking a structure and resulting in high monetary damage.
- Disruption of distribution primary or secondary voltage power lines, including individual services and street- lighting circuits.
- Disruption to traffic on a secondary street.

Stem – The main trunk of a tree or other plant (Harris, Clark, and Matheny 533).

Structural Pruning – Pruning that influences the orientation, spacing, growth rate, strength of attachment or ultimate size of branches and stems, resulting in a strong tree.

Target – People, property, or activities that could be injured, damaged, or disrupted by a tree (Smiley, Matheny, and Lilly 50).

Target zone – The area where a tree or branch is likely to land if it were to fail (Smiley, Matheny, and Lilly 50).

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City of Encinitas
Ficus Tree Risk Assessments
Overview
(Revised 16 Oct 2017)
Legend
Grid Boundary
Inventory Point (by Tree Risk)
High
Low
Moderate
Inventory data is created and maintained by West Coast Arborists, Inc. (westcoastarborists.com). Centerline and polygon data is derived from ©OpenStreetMap contributors (openstreetmap.org/copyright).
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Moonlight Lane
West D Street
West E Street
West F Street
West G Street
West H Street
West I Street
West J Street
Seaside Drive
Playa Blanca
Paseo Pacifica
Vista del Rey Drive
Pescado Place
Triton Circle
South Vulcan Av.
East D Street
East E Street
East East Street
McNeill Av.
East F Street
Requeza Street
East G Street
East H Street
Briggs Av.
Melba Road
East I Street
East J Street
Dewitt Av.
Cornish Drive
San Dieguito Drive

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WCA
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Legend
Grid Boundary
Inventory Point (by Tree Risk)
High
Low
Moderate
N
Scale 1:1,000
50 0 50 100 150 200 250 300 ft

West F Street
West F Street
West F Street
West G Street
West G Street
West H Street
West H Street
4th Street
4th Street
4th Street
3rd Street
3rd Street
3rd Street
3rd Street
2nd Street
2nd Street
2nd Street
2nd Street
29
28
44
46
45
WCA
West Coast Arborists, Inc.
2200 E Via Burton, Anaheim, CA 92806
Phone: (714) 991-1900
Fax: (714) 991-7844
City of Encinitas
Ficus Tree Risk Assessments
Grid 4
(Revised 16 Oct 2017)
Legend
Grid Boundary
Inventory Point (by Tree Risk)
High
Low
Moderate
Inventory data is created and maintained by West Coast Arborists, Inc. (westcoastarborists.com). Centerline and polygon data is derived from ©OpenStreetMap contributors (openstreetmap.org/copyright).
N
Scale 1:1,000
50 0 50 100 150 200 250 300 ft

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City of Encinitas
Ficus Tree Risk Assessments
Grid 5
(Revised 16 Oct 2017)
Legend
Grid Boundary
Inventory Point (by Tree Risk)
High
Low
Moderate
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N
Scale 1:1,000
50 0 50 100 150 200 250 300 ft
4th Street
West H Street
3rd Street
2nd Street
Seaflame Drive
West I Street
West J Street
31
30
47
36
37
51
50
48
49