Urban Forest Management Plan

"A Plan for the Public Trees of Morro Bay"

Morro Bay City Tree species is the Monterey Cypress (Cupressus macrocarpa)

When one tugs at a single thing in nature, he finds it attached to the rest of the world.

--John Muir--

Acknowledgements

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URBAN FOREST MANAGEMENT PLAN - "A PLAN FOR THE PUBLIC TREES OF MORRO BAY"

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Executive Summary

The preservation of the natural environment is essential to the resident and visitors of Morro Bay. The coastal setting and its stunning beauty of this area attracts people to visit and live here. The residents and visitors of Morro Bay deserve a healthy urban forest that is conserved for future generations. Therefore sound guardianship of this unique and attractive community is necessary if the quality of life is to be maintained. Many of such measures will have to be in the area of conservation and the maintenance of the urban forest. The Urban Forest Management Plan (UFMP) is a living document and a long range policy guide that will respond and develop over time.

The UFMP will require close partnership between policy makers, staff and the community. The UFMP will help the Public Services and the Recreation and Parks Departments define the goals for City of Morro Bay public trees. This UFMP is the road map for these departments and the Tree Committee to follow in order to get the desired results for the trees located in the public right of ways. The UFMP establishes guiding principles and associated goals that result in specific strategies for address the needs of public trees.

Vision Statement

A healthy urban forest with a thriving, sustainable mix of tree species which are cared for and valued by both the City and citizens of Morro Bay. As an essential environmental, economical and community asset, the urban forest provides an attractive location for businesses, residents and visitors. The Urban Forest Management Plan seeks to increase age and species diversity in the public tree population, and enhance the character and aesthetics of our City for the people who live and work here.

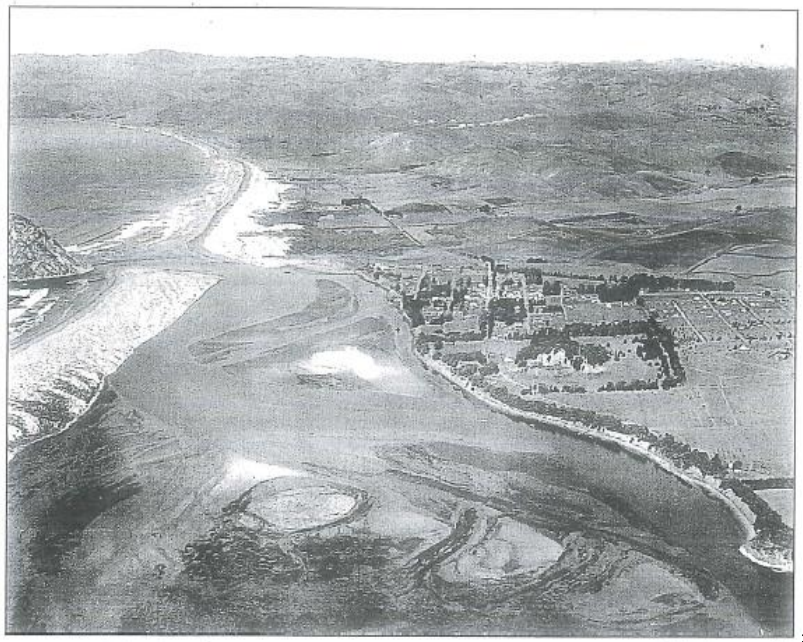
Mission Statement

The Urban Forest Management Plan seeks to ensure that all benefits of a healthy urban forest are available to Morro Bay's residents and visitors for future generations. The UFMP accomplishes this by increasing age and species diversity in the public tree population, augmenting biomass and canopy coverage, and enhancing the character and aesthetics of our City by achieving exemplary conservation and sustainable practices for the public trees from all who live, work and visit here.

Why we need an UFMP

The Urban Forest Management Plan serves as a guide for perpetuating and enhancing Morro Bay's public trees. Public trees are the trees located within the City Rights of Way. This UFMP establishes guiding principles and associated goals that result in specific strategies for addressing the needs of public trees. These goals were developed from community input, City needs, environmental and urban conditions. They are flexible enough to account for future changes.

The discipline of urban forestry strongly advocates for species and age diversity in the urban forest so that an invasive species cannot devastate the entire urban forest. From the picture below you can see that most trees present in 1931 were the Blue Gum Eucalyptus and were planted primarily as wind breaks.



Morro Bay's entire urban forest has more than 1,500 trees. There are 675 trees in the City Rights of Way (public trees). The tree population is aging and these trees will eventually need to be removed and replaced. Of the Monterey Pines that were planted in the 1950's, many have succumbed to the turpentine beetle, and the few that are left have begun to reach the end of their useful life. Removal of these trees is a big "hit" to the community since they are so large and also provide a larger canopy cover compared to the small 15 gallon tree that planted in their place. The Red flowering eucalyptuses, while a beautiful tree, are in small undersized tree wells and the trees drop woody seed capsules on the sidewalk posing a hazard to pedestrians.

This UFMP is essential in guiding the City toward a healthy sustainable urban forest. Proper tree selection and placement is vital to our Urban Forest future. An Urban Forest Management Plan is an essential tool for protecting this valuable resource. This UFMP discusses the makeup of our tree population through the tree inventory. It looks at the health of our trees and addresses the questions:

- Is this the right tree in the right place?
- Is there adequate species diversity?
- How can we improve age diversity with our aging population of trees?

The management plan will increase the public safety by managing the risk related to the public's infrastructure. The UFMP and tree inventory will provide lists of trees requiring priority removal and pruning that staff can carry out within the limits of a budget and

time. Adoption of this UFMP is the next significant step in Morro Bay's efforts to enhance the beautification of Morro Bay.

Historical Context

"Morro Bay was always the stuff of which dreams were made. A spectacular setting, with its magnificent rock, its rolling breakers in the outer bay, its sandspit and quiet inner bay, its picturesque shoreline extending as far as the eye can see". (Gates, Morro Bay Yesterdays)

In 1542, Juan Rodrigues Cabillo, a Portuguese navigator, sailed in the bay he named "Los Esteros" to anchor near the rock he named "El Moro" to supply his ship with wood and fresh water. Cabrillo was credited as the first European to discover the land of upper California, including the area now known as Estero Bay and Morro Bay.

Morro Bay's history has provided a foundation for the manner in which this community has grown over the years. Morro Bay originally developed because it provided access to shipping, an important asset to nearby farmers and ranchers. In the late 19th century, it became apparent to City founders that this bay offered economic potential, so they began to develop the harbor. If it had not been for a slump in the national economy at this time, Morro Bay could have easily become a miniature San Francisco. Instead, Morro Bay grew to be an important fishing port and an attraction to the touring public. (Gates)

Prior to about 1850 the only known trees in the area were the California Bay, Arroyo Willow, Fremont Cottonwood, California Sycamore, California Box Elder, Monterey Cypress, Tanbark Oak, Coat Live Oak, and Monterey Pine. After about 1875 the first home was built in Morro Bay by Franklin Riley at the intersection of Morro Bay Boulevard and Main Street. The home was made of the native willows. After the first few years, Riley realized the need for trees in the area. He made the first nursery at the intersection of Harbor Street and Morro Avenue where he grew Monterey Cypress and Blue Gum Eucalyptus. These trees were vital in stopping the sand filled wind and created a layer of topsoil as well as fire wood.

ARNOLD SCHNEIDER

First house built in Morro, it had two rooms and consisted of willow pines chinked with adobe clay. Franklin Riley, builder-owner, situated his home in what is now the locality of Main Street and Morro Bay Boulevard. He founded the town.

Image 2: Franklin Riley house, (Gates)

The City was incorporated in July of 1964 and the first tree ordinance was adopted in July of 1966. This ordinance has much of

the same language as the present day tree ordinance. Around the 1950's the Boy Scouts planted Monterey Pines throughout Morro Bay and in the early 1980's Mayor Warren Dorn had the Red Flowering Eucalyptus trees planted as street trees in the downtown area. After about 1985 the first Morro Bay Tree Committee was formed and created the first City master tree list. This list consisted of native drought tolerant and/or California native tree species. Also during this time the first Adopt A-Tree program was started. The tree committee was eventually eliminated and members of this committee were combined with the franchise committee to form the Public Works Advisory Board. In 2009, another Tree Committee was formed, a volunteer committee, which is very active in planting trees around the community. The Volunteer Tree Committee has developed a revised City master tree list, and also suggested trees for residential properties and open space.

Benefits of trees

Economic benefits - The urban forest contributes to the well-being of the residents of Morro Bay in many ways. Trees add value to adjacent homes and business. Research shows that businesses on treescaped streets show 20% higher income streams, which is often the essential competitive edge needed for "main street" store success, versus competition from plaza discount store prices. Realtor based estimates of street tree versus non street tree comparable streets relate a $15-25,000 increase in home and business value (Burden). This in turn adds to the tax base and operations budgets of a City allowing for added street maintenance.

Environmental benefits - Trees contribute to improving our air quality, water quality, and providing wildlife habitat. Trees leaf and branch structure absorb the first 30% of most precipitation, allowing evaporation back into the atmosphere. This moisture never hits the ground. Another 30% of precipitation is absorbed back into the ground and taken in and held onto by the root structure, then absorbed and transpired back to the air. Trees provide rain, sun and heat protection shielding wildlife, humans and structures. Tree coverage offers shade from direct sunlight, shelter from the rain and lowering the air temperatures by 5-15 degrees. Air quality is improved by trees and shrubs by absorbing carbon dioxide and other pollutants, removing dust and sand particulates, and releasing oxygen. Carbon dioxide is absorbed for the photosynthetic process, but other emissions such as nitrogen oxides, carbon monoxide, and volatile organic compounds are reduced significantly from the proximity to trees (Burden). The leaves and shrubs filter the air from moving dust and sand particles. Urban street trees provide a canopy, for birds to enjoy, a root structure and setting important for insect and bacterial life below the surface; at grade for pets and people to enjoy, all of which connects the urban human to the natural environment.

Social benefits – Trees seem to make life more pleasant in a couple of ways. They convert the streets, parking, and buildings into a more aesthetically pleasing environment. The paved roads, parking lots and structures that create cities are a grey visual and harsh environment without the trees and shrubs to soften and relieve the eye sore. Trees also improve health, emotion, and wellbeing for all ages. Studies have shown that trees can reduce stress, and that views of trees can speed the recovery of surgical patients (Burden). The advantage of trees expands past their physical benefits, by creating a more calming, visually pleasing environment for all to gain from.

Relationship to other City documents

General Plan- The UFMP is supported by elements of the City of Morro Bay's General Plan; Land Use Open Space, and Conservation Element. The City's General Plan, adopted in 1988, is a vintage document and the City will be updating this document in the coming years and incorporating new policies which also support the need for a strong urban forest program.

One of the "issues" identified in the Land Use, Conservation and Open Space element is: the maintenance of the natural image portrayed by the City and its surroundings must be guaranteed if one of the primary reasons people live in Morro Bay is to remain intact. The UFMP strives to do just this, by managing the trees and preserving the natural beauty in Morro Bay.

Morro Bay has taken steps to preserve the natural environment which could have easily been lost. As such, the City has attracted a population who has come not because it is close to where they work, but because of its qualities. Many of these qualities are environmental, but an equal amount has been created by such things as the atmosphere of the fishing port and its isolation from the faster paces of life. It is because the people of Morro Bay have more than a casual desire to live here that the need to take every measure possible to maintain this sense of identity is accentuated. Many of such measures will have to be in the area of conservation and the maintenance of the environment. It is also important to realize that the current residents were attracted, so too will the future residents be attracted. Therefore, sound guardianship of this unique and attractive community is necessary if the quality of life is to be maintained. (Land use, conservation open space element)

Municipal Code- The City of Morro Bay's Municipal Code addresses street trees regulations (MBMC 12.08). The regulations include provisions on tree removal by City for cause, tree care, planting and replanting. The City also has a bird nesting season from February 1st through June 30th. No trees within the public right of way can be removed or trimmed during this time except in the case of an emergency as determined by the Director of Public Services. The municipal code also has a section on frontage improvements which require property owners and/or applicants for significant development permits to install frontage improvements. These frontage improvements require a street tree to be planted and the tree to be one from the City's approved street tree list. The City recently adopted a Landmark tree ordinance which provides the guidelines for residents to nominate a tree within the public right of way as a landmark tree. Currently there are several nominees but these trees have not yet been approved by City Council.

Tree City USA- The City has been recognized for over twenty years, since 1989, by Tree City USA. In order to meet the Tree City USA recognition the City must have a tree board or department, a tree care ordinance, a community forestry program with at least an annual budget of $2 per capita and an Arbor Day observance and proclamation.

TREE CITY USA®

Environmental Setting

Morro Bay and its surrounding regions combine to form an environmental sensitive and delicate mixture of land, air, water and life. From Morro Rock, the sand spit, Black Hill, Morro, Chorro and Toro creeks down to the estuary itself, all make up the geologic region of Morro Bay. Morro Bay is part of the Franciscan Formation. It is made up of complex igneous, metamorphic and sedimentary rock layers formed in the Cretaceous period, 75 to 195 million years ago. The Morro's, or Seven Sister, including Morro Rock are volcanic plugs formed in the Pleistocene Period and are made up of serpentine and/or porphyritic dacite.

Soils

There are seven major soils groups that underline the City. These soils are Baywood Fines, Concepcion, Cropely, Diablo, Dune, Los Osos and Marimel. The most fertile areas in the Morro Bay area can be found in the valleys where most of the agriculture occurs. Streams have eroded soils upstream and have transported and deposited then along the valleys. There are two types of alluviums in Morro Bay. The older alluvium, characterized by course textured soils, is generally found in the Los Osos Creek Valley and coastal Plains of Morro Bay consisting of old stabilized dunes. These soils are subject to excessive drainage, rapid permeability, and wind and water erosion. The soils are generally not fertile and are used mainly for urban uses. The newer alluvium can be found in the Toro, Morro, and Chorro Valleys. These soils are characterized by level, but poorly drained clays.

The foothills of Morro Bay have been generally categorized as shallow uplands. Within this category, two soils groups can be identified. One consists of upland soils formed from firm shales, sandstones or mudslides and is highly prone to erosion. The second group is a clayey upland soil formed on shale or igneous bedrock. Situated on gently rolling terrain, erosion is moderate and the soil permeability is low.

Image 3: North Morro Bay's Soils

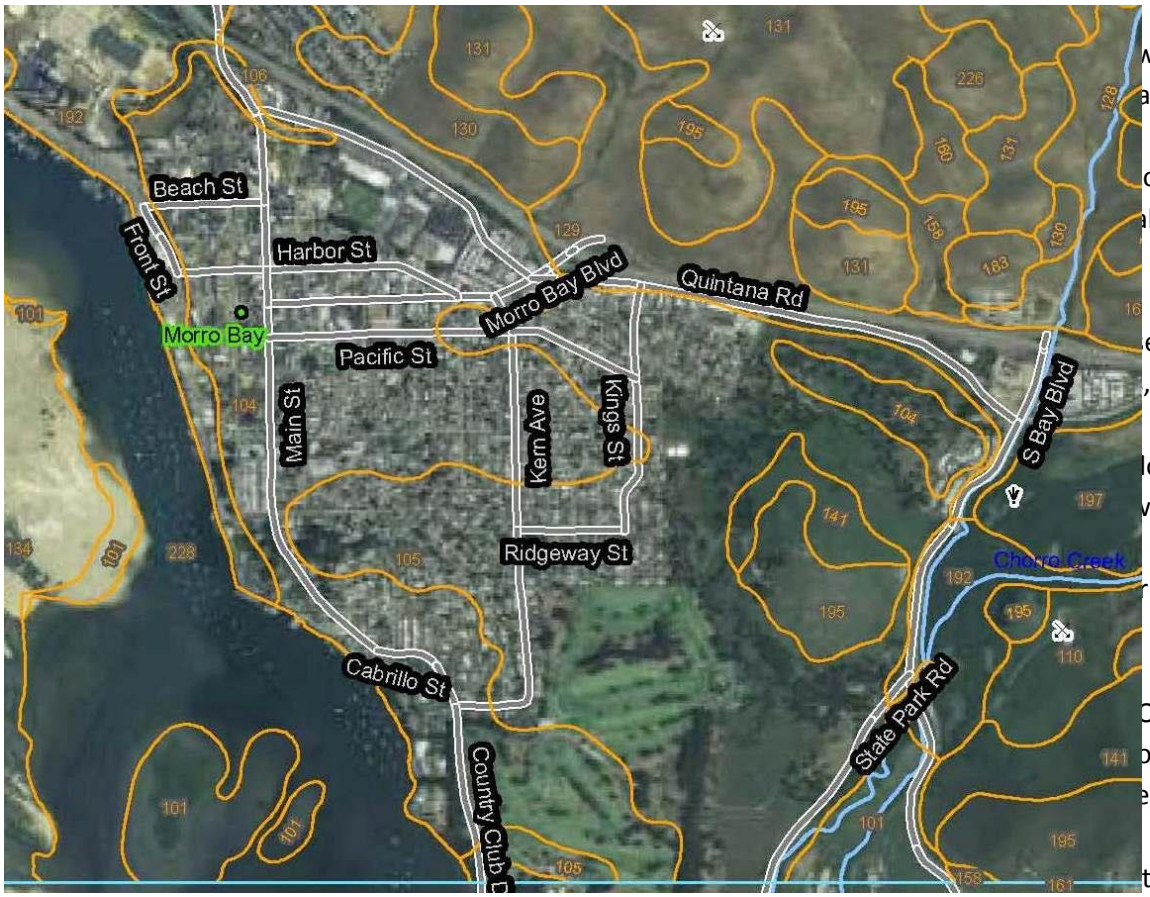


Image 4: South Morro Bay's Soils

wood fine sands series consist of deep, somewhat ained soils in old sand dunes near the coast.

on series consists of a shallow loam layer with an l change to a thick claypan limiting the transmittal of

eries consists of moderately deep clay soils over silty , moderately well drained soils formed from alluvium.

lo series consists of moderately deep clay soils, poorly veathered bedrock at around 58 inches.

ries consists of sand; these areas are the dune and

Osos series consists of shallow loam soil over clay to oils, moderately drained with weathered bedrock at es.

tion was acquired from the USDA Natural Resources Conservation Service (NRCS), see Appendix 2 for full soils description.

Climate

Morro Bay experiences a mild Mediterranean climate. Plants here seldom suffer a frost of any consequence. Morro Bay's climate is cool, wet winters, and cool summers with frequent fog or wind. The fog tends to come in high and fast, interposing a cooling and humidifying blanket between the sun and the earth, reducing the intensity of the light and sunshine.

Figure 1: Average Rainfalls in Morro Bay

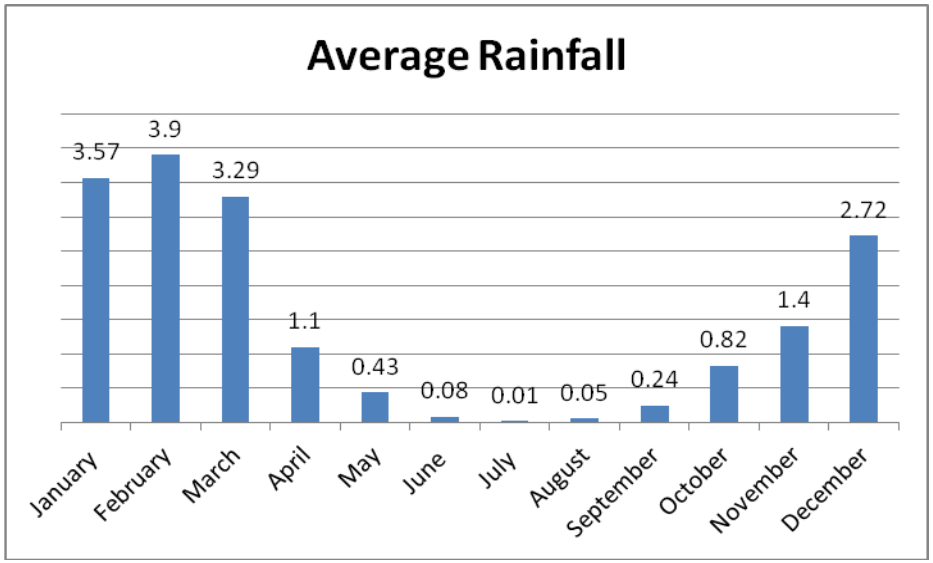
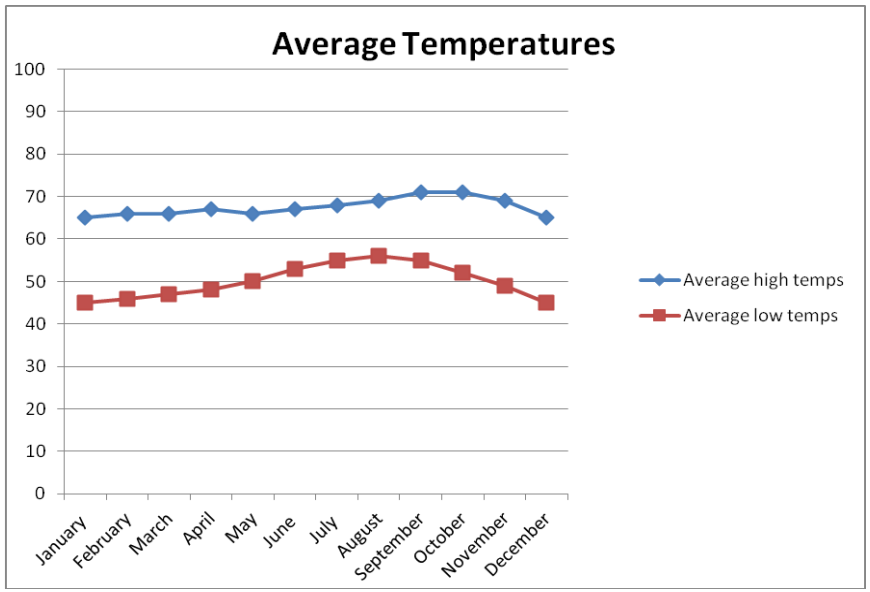


Figure 2: Average Temperatures in Morro Bay



The average temperature year round is 65 ^{0}F, typically with warmer winters and cooler foggy summers. Morro Bay does have several microclimates (see map below) which can affect the tree selection in various areas of town. For example several zones experience high winds with salt spray which can affect certain trees negatively. Therefore the tree selection in these areas should take into consideration the microclimates present here in Morro Bay.

The City has seven microclimate zones identified by the "A Yards and Neighbors Brochure for California's Central Coastal Morro Bay Area". These microclimates areas have distinct weather conditions. In this brochure different trees are identified as to which microclimate it best suits. This logic and information can be used to help specify specific tree lists for different areas of town according to their microclimate, soils and surrounding environment.

Image 5 shows the different microclimates for Morro Bay. Zones 1 and 2 are located on the beach and directly adjacent to the beach where there is little protection from the wind and salt spray. These two zones have the most extreme conditions for trees, and only a select variety can survive with good health and vigor. Zones 3, 4 and 5 are located in the residential and downtown areas in Morro Bay. They receive some wind and salt spray blockage from the frontage buildings and trees, which increases the number of tree species that can tolerate the conditions. Zones 6 and 7 stretch out to the city limits. Highway 41 is considered zone 6, and Little Morro Creek Road is zone 7. These zones have a higher frost potential and receive strong winds. These zones have a large list of tree species that can tolerate the conditions.

The following two tables were generated to show which tree species could tolerate the different microclimate zones for both street tree locations and open space locations. Street trees need to primarily be a single stem tree, with a canopy high enough to walk and drive under, in addition to a tree with deeper roots and doesn't drop a lot of litter. Open space locations can include tree characteristics that are not favorable for street tree locations. All the tree species identified in the inventory along with potential trees were separated into the different zones. They were separated by current trees performances within the zones, along with tolerance ratings and suitable location information collected on each individual species.

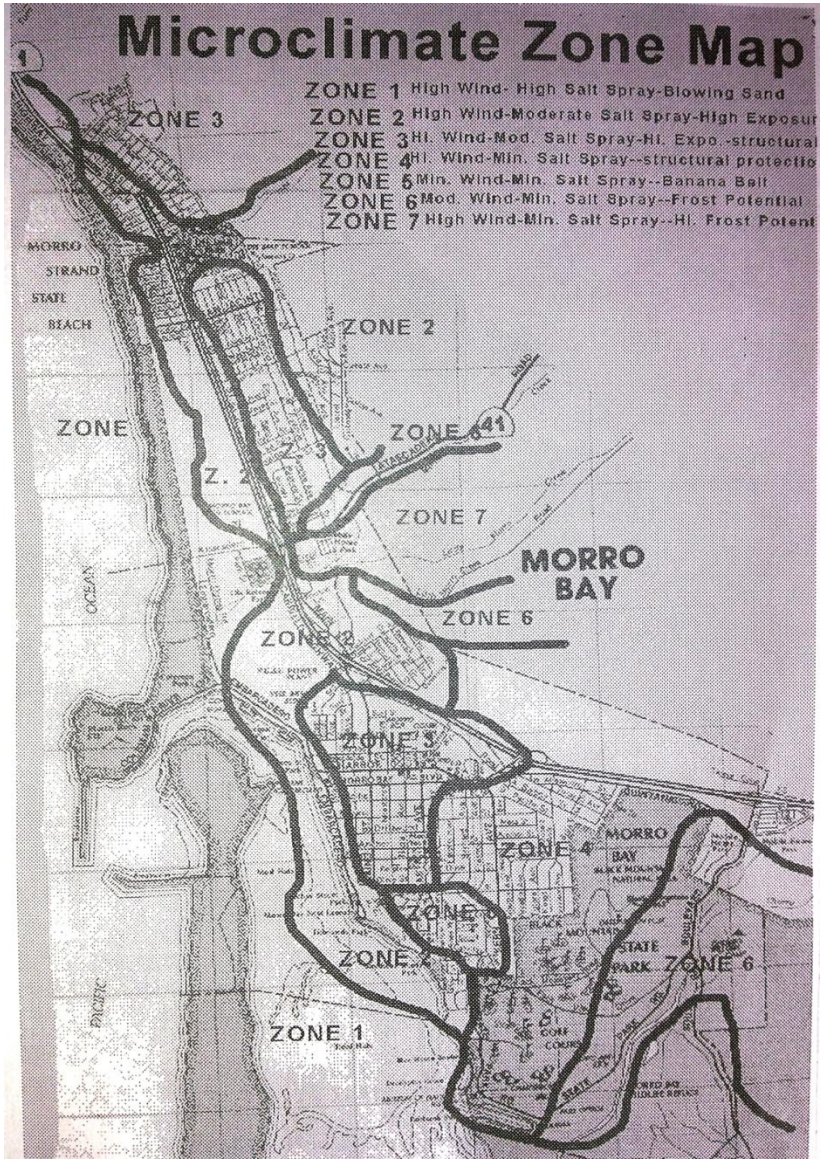


Image 5: Morro Bay Microclimate Zone Map

Table 1: Street Tree List

Zones 1-2		Zones 3-5		Zones 6-7	
Scientific name	**Common name**	**Scientific name**	**Common name**	**Scientific name**	**Common name**
Agonis flexuosa	Peppermint willow	Agonis flexuosa	Peppermint willow	Agonis flexuosa	Peppermint willow
Cupressus macrocarpa	Monterey cypress	Arbutus marina	Strawberry madrone	Arbutus marina	Strawberry madrone
Leptospermum laevigatum	Australian tea tree	Callistemon citrinus	Lemon Bottlebrush	Callistemon citrinus	Lemon Bottlebrush
Mitrosideros excelsus	New Zealeand Xmas tree	Callistemon viminals	weeping bottlebrush	Callistemon viminals	weeping bottlebrush
		Ceanothus 'Ray Hartman'	California Lilac	Ceanothus 'Ray Hartman'	California Lilac
		Cupaniopsis anacardioides	carrot wood	Cupaniopsis anacardioides	carrot wood
		Cupressus macrocarpa	Monterey cypress	Cupressus macrocarpa	Monterey cypress
		Eucalyptus citriodora	lemon scented gum	Eucalyptus citriodora	lemon scented gum
		Eucalyptus gunnii	cider gum	Eucalyptus gunnii	cider gum
		Eucalyptus nicholii	willow leafed peppermint	Eucalyptus nicholii	willow leafed peppermint
Current tree list		Eucalyptus tricarpa	red ironbark	Eucalyptus tricarpa	red ironbark
Inventoried trees		Geijera parviflora	Australian willow	Geijera parviflora	Australian willow
		Ginko biloba	maiden hair tree	Ginko biloba	maiden hair tree
		Lagunaria patersonii	Primrose tree	Lagunaria patersonii	Primrose tree
		Leptospermum laevigatum	Australian tea tree	Leptospermum laevigatum	Australian tea tree
		Lyonothamnus floribundus	Catalina ironwood	Lyonothamnus floribundus	Catalina ironwood
		Melaleuca nesophila	Pink Melaleuca	Melaleuca nesophila	Pink Melaleuca
		Melaleuca quinquenervia	Paper bark tea tree/Cajeput tree	Melaleuca quinquenervia	Paper bark tea tree/Cajeput tree
		Mitrosideros excelsus	New Zealeand Xmas tree	Mitrosideros excelsus	New Zealeand Xmas tree
		Pinus carnariensis	Canary Island pine	Persea americana	Avocado
		Pinus pinea	Italian stone pine	Phoenix canariensis	Canary Island Date palm
		Pittosporum undulatum	victorian box	Pinus carnariensis	Canary Island pine
		Prunus cerasifera	purple leafed plum	Pinus pinea	Italian stone pine
		Pyrus calleryana	ornamental pear	Pinus radiata	Monterey pine
		Quercus agrifolia	Coast live oak	Pittosporum undulatum	victorian box
		Quercus tomentella	Channel island oak	Prunus cerasifera	purple leafed plum
		Quercus virginiana	southern live oak	Pyrus calleryana	ornamental pear
		Rhus integrifolia	Lemonade sumac/Lemonade berry	Quercus agrifolia	Coast live oak
		Rhus lancae	African sumac	Quercus tomentella	Channel island oak
		Tristania laurina	Tristania	Quercus virginiana	southern live oak
		Tristiana conferta	Brush box	Rhus integrifolia	Lemonade sumac/Lemonade berry
		Ulmus parvifolia	Chinese elm	Rhus lancae	African sumac
				Syagrus romanzoffianum	Queen palm
				Tristania laurina	Tristania
				Tristiana conferta	Brush box
				Ulmus parvifolia	Chinese elm

Table 2: Open Space Tree List

Zones 1-2	
Scientific name	Common name
Cupressus macrocarpa	Monterey cypress
Eucalyptus globulus	Blue Gum
Juniperus chinensis 'Torulosa'	Hollywood juniper
Pinus pinea	Italian stone pine
Phoenix canariensis	Canary Island Date palm
Syagrus romanzoffianum	Queen palm
Yucca aloifolia	Spanish bayonet
Current tree list	
Inventoried trees	

Zones 3-5	
Scientific name	Common name
cupressocyparis leylandii	leyland cypress
Cupressus macrocarpa	Monterey cypress
Eucalyptus cornuta	Yate tree
Eucalyptus erythrocorys	red cap gum
Eucalyptus globulus	blue gum
Eucalyptus gunnii	cider gum
Eucalyptus rudis	desert gum
Heteromeles arbutifolia	Toyon/Holly
Juniperus chinensis 'Torulosa'	Hollywood juniper
Persea americana	Avocado
Phoenix canariensis	Canary Island Date palm
Pinus pinea	Italian stone pine
Pinus radiata	Monterey pine
Prunus lyonii	Catalina cherry
Quercus agrifolia	Coast live oak
Quercus tomentella	Channel island oak
quercus virginiana	southern live oak
Rhus lancae	African sumac
Syagrus romanzoffianum	Queen palm
Yucca aloifolia	Spanish bayonet

Zones 6-7	
Scientific name	Common name
cupressocyparis leylandii	leyland cypress
Eucalyptus erythrocorys	red cap gum
Eucalyptus ficifolia	Red flowering eucalyptus
Eucalyptus globulus	blue gum
Eucalyptus lehmannii	Bushy yate
Eucalyptus rudis	desert gum
Heteromeles arbutifolia	Toyon/Holly
Juniperus chinensis 'Torulosa'	Hollywood juniper
Yucca aloifolia	Spanish bayonet

Inventory

In the early planning of the Urban Forest Management Plan, it was decided that a complete inventory of all city owned trees in the commercial zones was needed. Data from prior sample inventories and tree maintenance records were useful, but in order to get a more accurate and updated impression of the urban forest, a complete inventory was completed with specific criteria surveyed for the data analysis process. The objective of the inventory was to collect information describing the characteristics and condition of the trees that later could be imported and analyzed in ArcMap and i-Tree Streets to create graphs, maps, and tables for forest management decisions. Environmental Systems Research Institute (Esri) is a supplier of GIS software applications. ArcMap is component of Esri's geospacial processing programs, which allows users to view, edit, create, and analyze geospacial data. ArcMap allows users to symbolize features and create maps. I-Tree is software developed by the USDA Forest Service that provides urban forestry analysis and benefits assessment.

Data Collection

The inventory was completed with a Topcon data collector, which has Global Positioning System (GPS) for identifying the location of the trees and ArcPad software for data collection. ArcPad is a mobile field mapping and data collections software developed by ESRI. The zones where trees were surveyed consisted of commercial areas including C-1, C-2, C-VS, G-O, MCR, and R-4. The inventory consisted of 672 trees in the public right of way, and at each tree, information on 25 different fields was gathered. The 25 fields included: Tree ID number, Street name, building address, Species common name, Species scientific name, Diameter at breast height (DBH), Height, Live crown ratio, Canopy spread, number of trunks, Hazard rating, Health, Age class, Site type, Crown class, Open tree well, Use under tree, Occupancy, Defect, Defect present, Pruning required, Conflicts, Photo, Date collected, and Comments.

The tree ID number is a very important field, because it gives each tree a unique identification. Each tree received a tag with a number punched into it starting at 1001. The tags were either, nailed into the base of the trunk of the tree, nailed into the post holding up a young tree, or hammered into the curb directly in front of the tree. Unique tree identification numbers and tags allows for easy explanation of which tree is being discussed or need maintenance.

Image 6: Tree Identification Tag

Street name and building address are two fields that identify what street the tree is on and what building it is in front of. These fields allow for locating the tree and explaining what side of a building it is on.

Species common/scientific name are two fields that are very useful and important for making forest management decisions. Identifying each tree species permits combing data to find the overall health of a species, what species grows best in specific locations, or even what species is causing the most sidewalk pavement damage.

The tree height and tree diameter fields were collected using tools. The diameter field was completed with a D-tape, and measured at DBH which is 4.5 feet above the base of the tree on the uphill side. Direct readings were used and measured in inches. Tree height was measure at each tree using a clinometer. Surveying tree heights allows for finding growth rates of trees, proximity to power lines, and other important issues.

Live crown ratio, canopy spread, and number of trunks were fields that were collected at each tree through pacing and observing. Live crown ratio is found by observing the lowest alive branch on the tree and comparing that height to the height of the entire tree. Canopy spread was found by pacing from the trunk of the tree to the furthest out reaching branch multiple. Finding the canopy spread allows for finding the amount of storm water retention, and amount of shade produced. The number of trunks was recorded based on the number of trunks each tree had that split below DBH.

The hazard rating and health fields were identified by observing the tree from all sides and from different distances. The hazard rating field gives each tree a risk rating ranging from low to extreme risk. The risk rating is a number from 3-12 and each number has an interpretation and implication. The health field is also indentified by observing the tree. Depending on the foliage, tree height, bark and more factors each tree is given a health rating of one of the following: excellent, average, fair, or poor.

Age class, site type, crown class, open tree well, use under tree, and occupancy are all fields that are quick to identify. The age class field is used in replace of an increment borer. Each tree was examined and grouped in one of the following age classes: Over-mature, mature, semi-mature, and young. The site type field explains what each tree is planted in. The majority of the trees surveyed in this inventory were planted in sidewalk tree wells, but the other options to choose from were open areas (lawn), raised bed, or a container. The crown class field identifies the height of each individual tree compared to the trees/buildings surrounding it. This field determines the amount of sunlight each tree receives. The options to choose from in the field were; dominate, co-dominate, intermediate, and suppressed. The open tree well field was created as a yes/no field to be able to locate all the open sidewalk tree wells that can be replanted. The use under tree field identifies what lies directly underneath that tree canopy. The options to choose from included: pedestrian, parking, recreation, traffic, utility lines, building, and landscape. In many cases there was more than one of the options underneath the tree canopy, and in those circumstances that most frequency use was selected. The occupancy field was created to identify how frequently human activity occurred under the tree canopy. The options to choose from in the field were; frequent use, occasional use, constant use, or intermittence use.

The defect, defect present, pruning required, and conflicts fields were all important for the data analysis process. The defect field gives each tree a rating based on the amount of defect evident on the tree. The defect present field has a long list of defects that are common and can be selected if the tree has evidence of the particular defect. The pruning field both identifies if the tree need pruning, and states what type of pruning needs to be performed. The conflicts field has a list of common conflicts that occur in unban forests. The most frequent conflict was sidewalk pavement damage.

Finally, the photo, date collected, and comments fields were all created for easier organization and identifying what time of the year the trees were surveyed, and in order to identify if a particular tree had anything out of the ordinary.

Inventory Results

A tree inventory establishes baseline data for a complete analysis of its street tree population by using ArcMap and software developed by the US Forest Service called i-Tree streets. ArcMap allows for detailed information to be combined and searched, to find specific criteria. By combining the data collected in the inventory along with city GIS information many important tree management queries can be answered including: where each tree species is growing best, which tree species is creating the least sidewalk damage, location of open tree wells along with what tree species will thrive in that location, and even what tree species is the least hazardous. In addition, the programs used in the data collector are only compatible with ArcMap for data extraction. The ArcMap software is also capable of creating maps with multiple layers showing the GPS location of every tree inventoried. The i-Tree streets analysis provides a dollar value indication of the environmental benefits provided by each tree. While i-Tree streets analysis provides information on the environmental performance of the entire forest, analyzing individual species provides detailed information on the performance of individual species. The i-tree streets software takes the information from the inventory and calculates the pounds of carbon absorbed, gallons of stormwater retained, and the amount of energy in kilowatt hours saved.

STREETS:

Running a STRATUM Analysis

Species and Population Distribution

Data from the inventory indicates that the commercial zones in Morro Bay are comprised of over 40 different species of trees. The large majority of the urban forest is consisting of the Red Flowering Eucalyptus (Eucalyptus ficifolia). Of the 673 trees collected in the inventory, 259 of them were Eucalyptus ficifolia, which can be seen in Figure 4 and is over 38% of the tree population. Fifty Cajeput (Melaleuca quinquenervia) trees and thirty-two Blue gum eucalyptus (Eucalyptus globolus) trees were surveyed. The most frequently inventoried trees are shown in the figure 3 and figure 4, which comprise of 71.4% of the entire survey. The rest of species surveyed had populations of 13 or fewer and together comprised of 28.6% of the trees surveyed. The distribution of tree species throughout the commercial zones is uniform for some species and isolated for others. The Red flowering eucalyptus tree is highly concentrated in the downtown area of Main Street, Morro Bay Boulevard, and Harbor Street, as well as scattered throughout the rest of the commercial zones on south Quintana, and north Main. The large Blue gum eucalyptus trees are distributed either on the Embarcadero, directly above the Embarcadero, or along the bike path at the Main street/Quintana road intersection. The following four maps show the location and distribution of individual trees by species for the entire inventory.

Figure 3: Populations of the 10 Most Common Tree Species

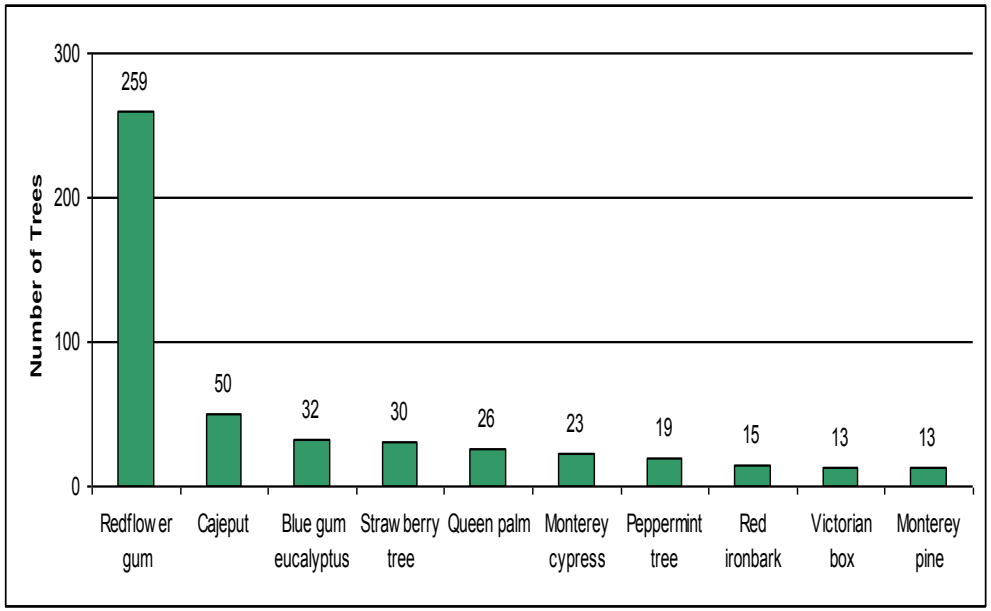


Figure 4: Species Distribution of Public Trees

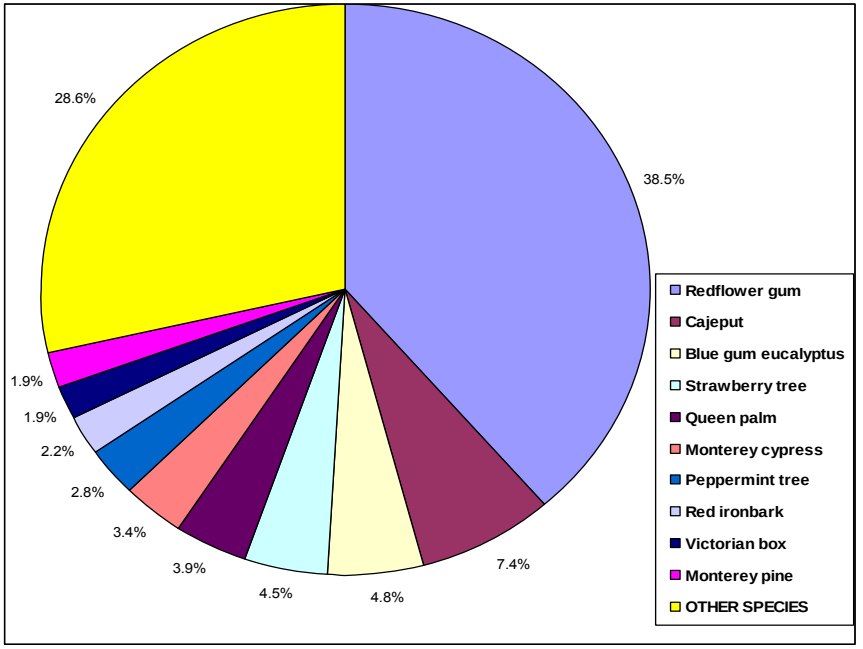


Figure 5: Tree Map of Upper North Main Area

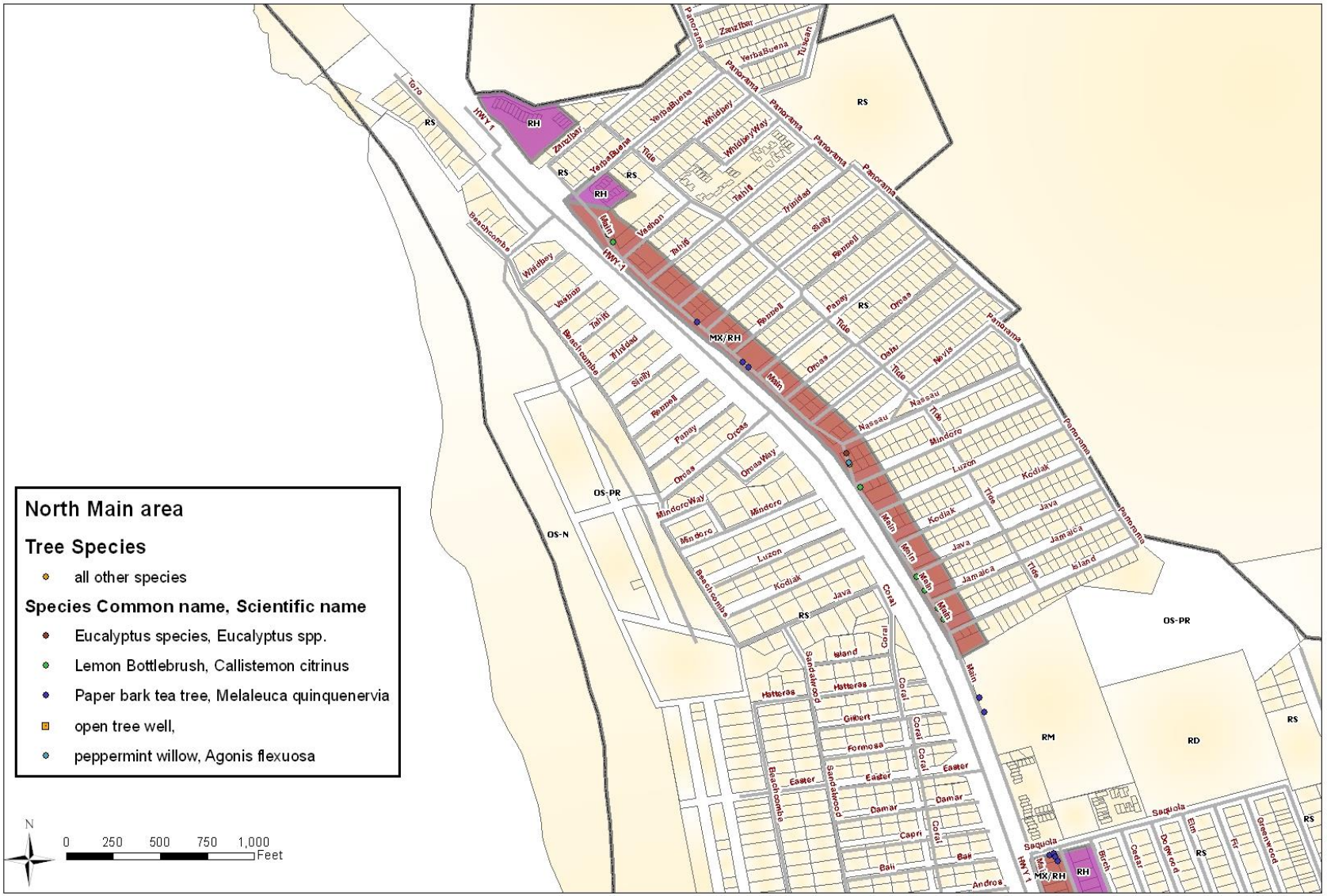


Figure 6: Tree Map of Lower North Main Area

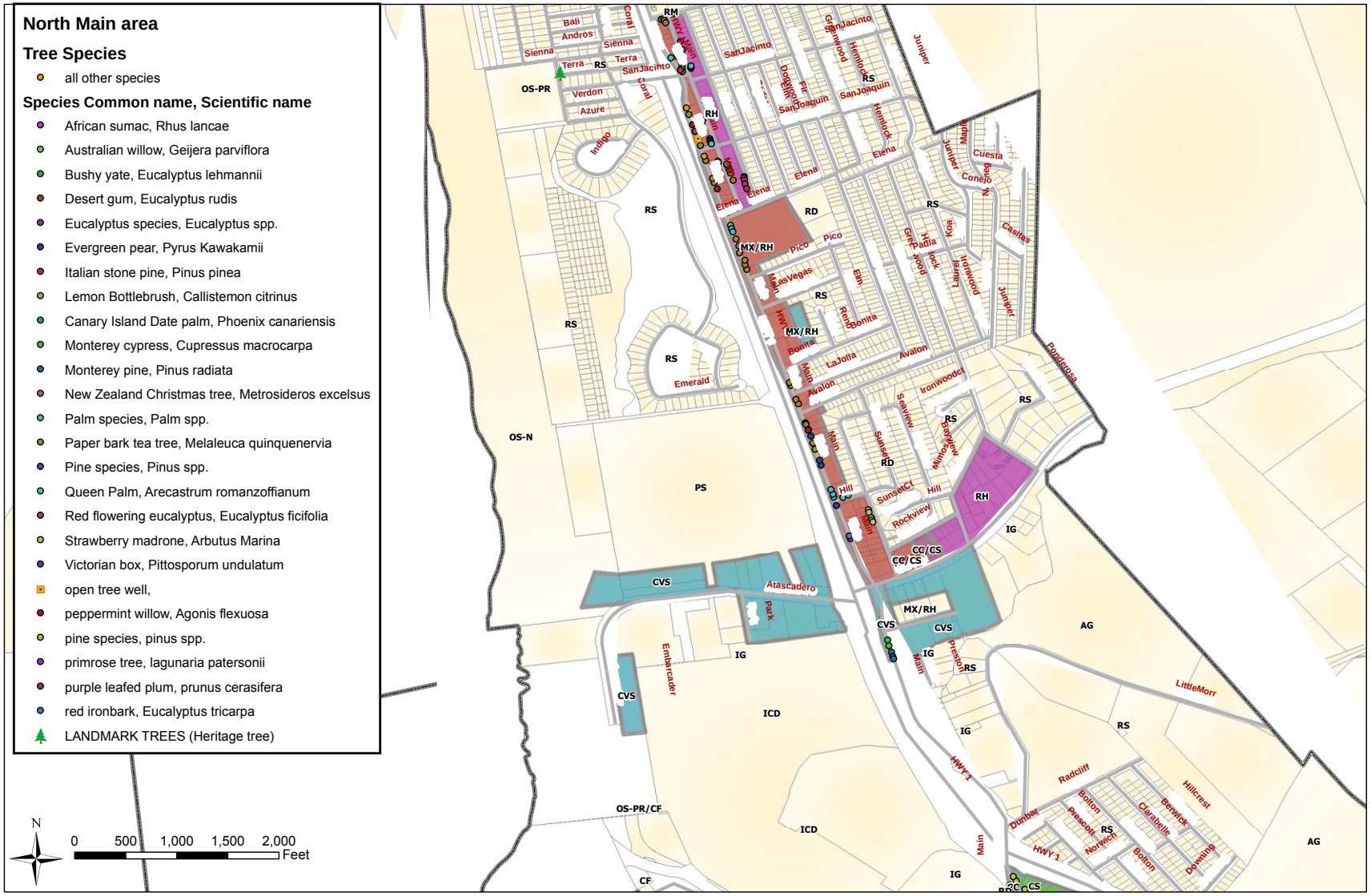
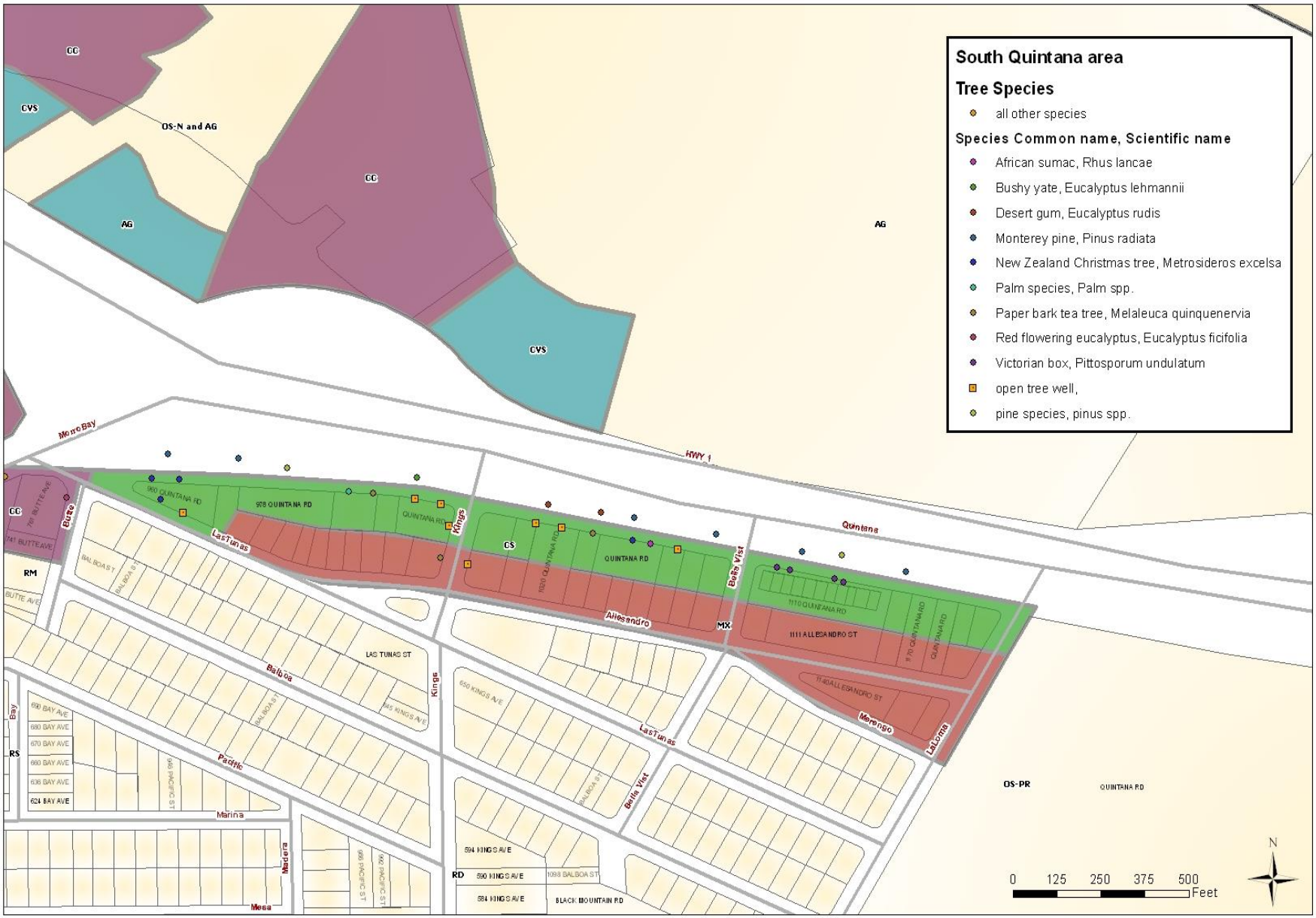


Figure 7: Tree Map of Downtown/Embarcadero Area

Figure 8: Tree Map of South Quintana Area



Tree Characteristics

The data collected on tree characteristics from the inventory, was analyzed and put into tables that present the numbers clearly. The following four tables are express information on tree diameter, tree height, and canopy spread. More tables on tree characteristics can be found in the appendix.

Tree diameters were collected at every tree inventoried. Later the diameters were grouped into diameter classes in order to find the distribution of diameters citywide. In the diameter class distribution table on the right it shows that the 58.55% of the commercial zone trees have a diameter between 6 inches and 24 inches. The table also shows that less that 6% of the inventoried trees have diameters greater than 36 inches

Table 3: Diameter Class Distribution

diameter class distribution	
Diameter class	Citywide total
0-3	9.06%
3-6	9.21%
6-12	19.02%
12-18	20.51%
18-24	19.02%
24-30	12.92%
30-36	4.46%
36-42	3.42%
>42	2.38%

Tree height is another important tree characteristic that was measured at every tree inventoried. Each tree heights was measured down to the foot, during the survey, and afterwards placed into height classes with 15 foot intervals. The tree height table on the right shows that 297 trees had a between 15 feet and 30 feet.

Table 4: Tree Height

Tree Height		
Tree height classes	**Tree count**	**% of public trees**
0'-15'	134	19%
15'-30'	297	44%
30'-45'	177	26%
45'-60'	19	3%
60'+	35	5%
N/A	11	2%

Canopy spread data was measured at each tree, and then later placed into canopy spread classes with 10 foot intervals. This table can be found in the appendix labeled “Canopy spread”. The canopy cover table on the right was produced from the canopy spread data and city street information. The table shows that 4.42% of the .45sq mi area surveyed is covered with tree canopy. The table also illustrates that 11.54% of the 13 linear miles sidewalk is shaded by tree canopy as well.

Table 5: Canopy Cover

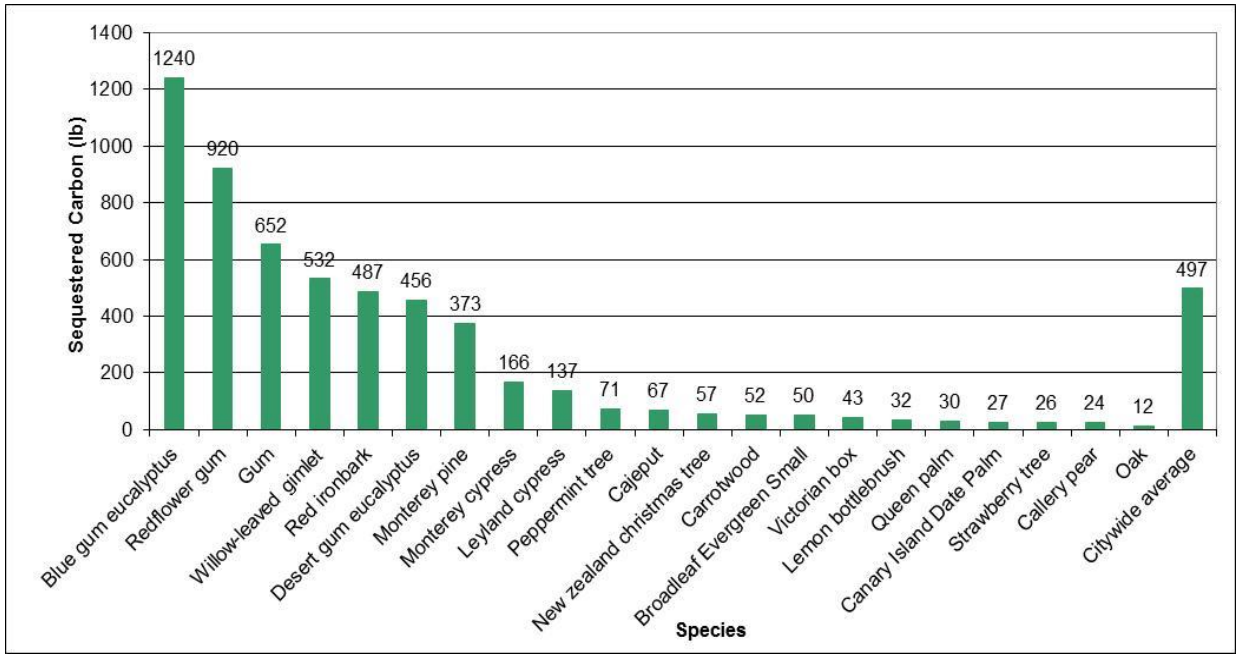
Canopy cover	canopy cover as %of total land area	Canopy Cover as % of Total streets and sidewalkws
	4.42	11.54

The condition of each tree was recorded during the survey, and later placed in a table showing the number of excellent, average, fair or poor condition trees each species has. This table can be found in the appendix labeled “condition of trees”. With this information we are able to identify if particular tree species grow better or can withstand the different microclimates. For example, the Cajeput tree (Melaleuca quinquenervia) has 19 trees that are either labeled fair or poor, 12 of which are located on the North main street pas HWY 41.

Environmental Benefits Results

Trees make our cities more attractive and provide many ecosystem services, including atmospheric carbon dioxide reduction, energy conservation, and stormwater interception. The information from the inventory was ran through software (i-tree streets) which calculated the pounds of carbon absorbed, amount of energy in kilowatt hours saved, and the gallons of stormwater retained annually by the urban forest. The size of the trees are included in the calculations to give an accurate representation of the current urban forest.

Figure 9: Pounds of Atmospheric Carbon Removed Annually by Individual Species



Carbon Sequestration Analysis

Image 7: Large Blue Gum Eucalyptus (Eucalyptus globulus) sequester more carbon than the other species

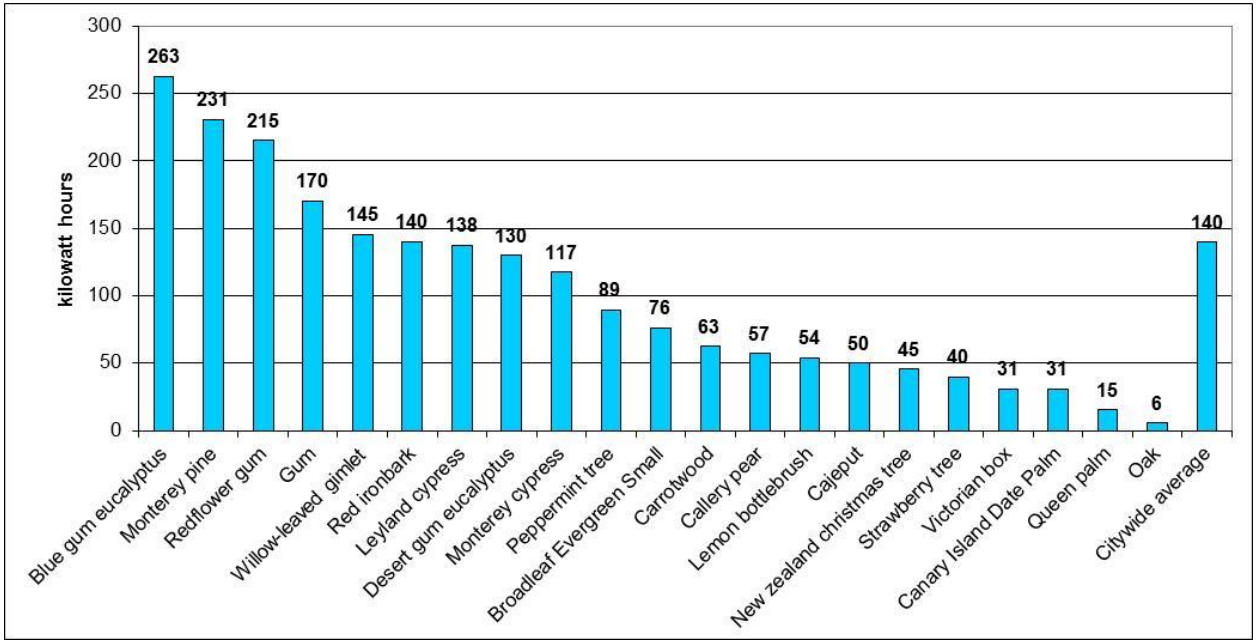
Carbon sequestration is the process by which carbon dioxide (CO2) is absorbed out of the atmosphere through trees trunks, branches, leaves, and roots as they grow. Urban forests can act as a carbon sink when there are enough trees to store more carbon than is released over time (McPherson). The figure above shows the pounds of carbon each individual species tree is absorbing annually. The trees in the commercial zone areas together are absorbing 334,655 pounds of carbon each year. The graph illustrates that one Blue gum eucalyptus is annually absorbing 1240 lbs. of carbon each year. The Blue gum is the largest tree species in the urban forest, increasing its productivity. A Red flowering eucalyptus absorbs 920 lbs. of carbon annually making it the second most efficient species. In general the Eucalyptus species is a great carbon sequester. From the large Blue gum eucalyptus to the shorter willow leafed gimlet, red ironbark, Desert gum eucalyptus, and red flowering eucalyptus, they all are on the top for the amount of carbon absorbed each year making them important contributors to the environment and reduction of emissions. The citywide average for one individual tree is 497 lbs. sequestered each year.

Energy Savings Analysis

Trees modify temperatures and conserve building energy use in three principal ways: shading, evaportranspiration, and wind speed reduction. The shade from tree canopies cools an area and reduces the amount of heat absorbed and stored by buildings. Evapotranspiration converts liquid water to water vapor which cools air that would otherwise result in heated air from the sun. Furthermore, a trees canopy slows cold winter winds thereby reducing the amount of heat loss from a home, especially where conductivity is high such as windows or skylights.
The shade and protection provided by the urban trees in the commercial areas save 93,900 kilowatt hours per year. The Monterey pine (Pinus radiata) is the second highest ranked species to reduce annual energy consumption saving 231 KWh each year by a single tree. The Monterey pine trees in Morro Bay have large dense canopies that create shade in addition to overlapping branches that form a wind break. Figure 4 below shows the number of kilowatt hours a single tree saves annually by species. The Blue gum eucalyptus saves 263 kilowatt hours annually, and the citywide average is 140 kilowatt hours.

Image 8: The Monterey Pine (Pinus radiata) shown above produces shading and protection for the building behind

Figure 10: Annual Savings of Kilowatt Hours of Electricity by Individual Species



Stormwater Interception Analysis

Urban stormwater runoff flows directly into the bay and ocean. The urban forest plays an important role in reducing the amount of pollutants entering the bay and ocean each year. Trees reduce runoff in several ways including: intercepting and storing rainfall on their leaves and branches, roots increase the rate at which rainfall infiltrates soil, tree canopies reduce soil erosion, and transpiration through tree leaves reduce soil moisture. The commercial zone trees alone intercept 1,375,118 gallons annually from entering the bay. Mature Monterey pine and Red Flowering Eucalyptus trees both can retain over 3,000 gallons of stormwater in a year compared to the palms downtown that retain less than 300 gallons. Figure 5 below shows the citywide average for stormwater retained annually to be 2043 gallons. Considering Morro Bay's 18" of rain per year average generates over 140,000,000 gallons of stormwater on the commercial areas alone, the stormwater interception and retention benefit from unban trees is the most effective solution in reducing the amount of stormwater entering the bay and ocean.

Figure 11: Average Gallons of Stormwater Retained Annually by Individual Species

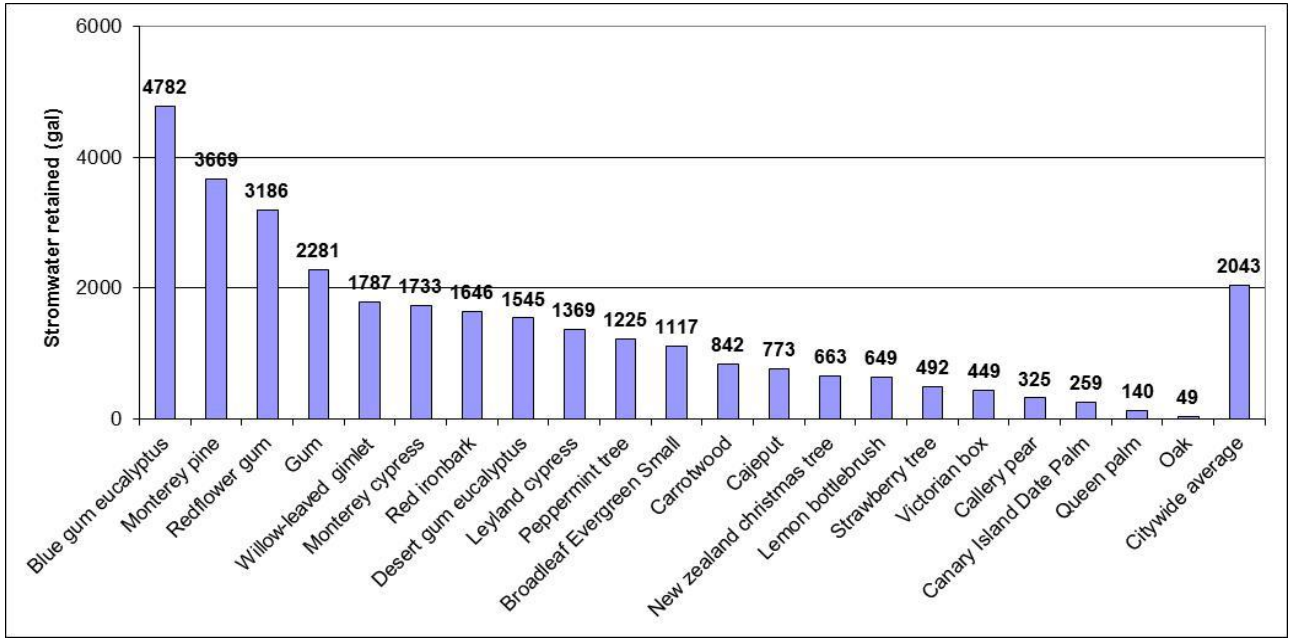
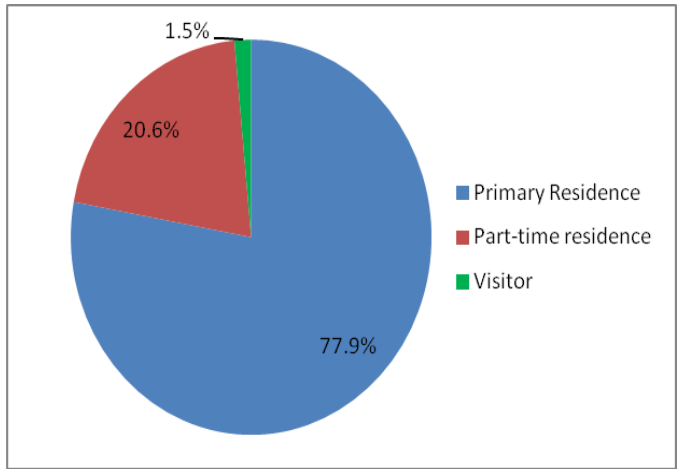


Image 9: The Red Flowering Eucalyptus shown above retains 3186 gallons of stormwater annually.

Stakeholders' Attitudes – Community Views of the Urban Forest

The wishes, attitudes and views of the community, have a large impact on our Urban Forest Management Plan. The City chose to conduct a survey to gather the community's input towards the UFMP and help develop various goals. The surveys were mailed with the water bills; therefore we reached a mix of residents, non residents, part-time residents and business owners.

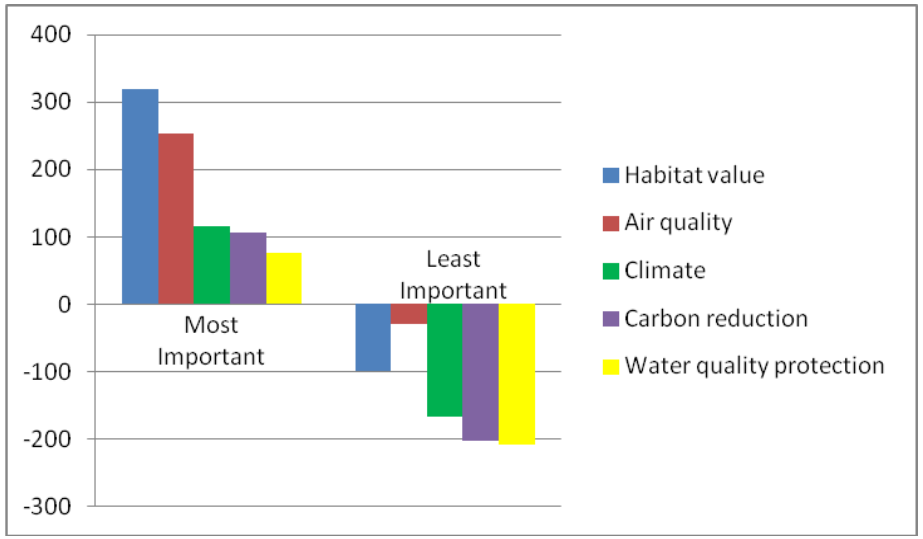
Figure 12: Survey Question 1



Survey Question 1 showed most of the respondents live in Morro Bay, but a portion, 21%, are part-time residents.

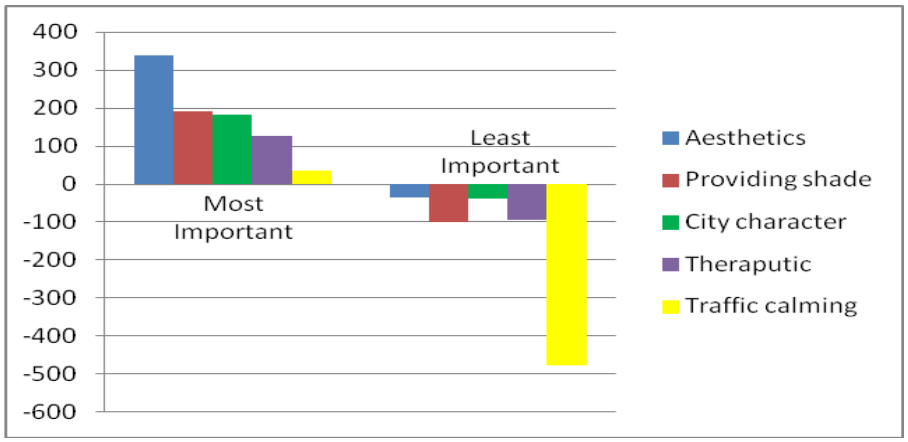
Typically with mailed surveys the response rate is low, less than 10%. The response rate of these surveys was very good, approximately 30% of surveys were returned. The survey results identified environmental benefits, social and economic qualities.

Figure 13: Survey Question 2



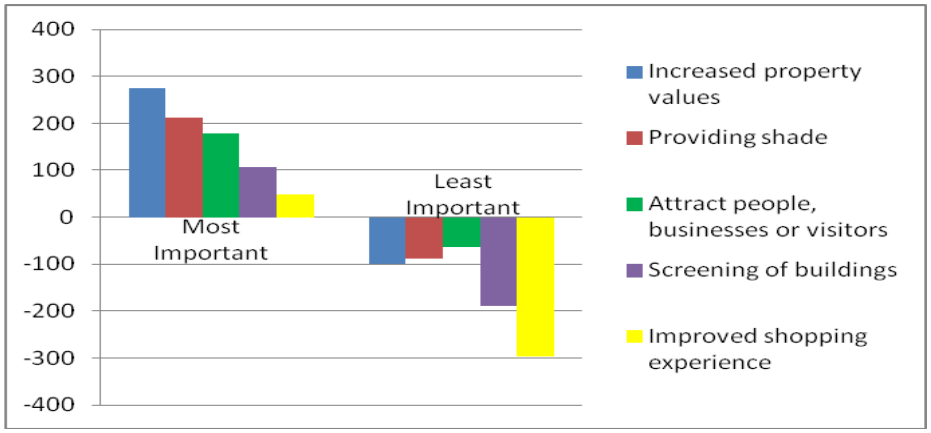
Survey respondents were asked in Question 2 what the most important environmental benefits are provided by public trees. Air quality and Habitat Value were viewed as the most important Environmental benefits provided by public trees.

Figure 14: Survey Question 3



Survey respondents were asked in Question 3 what the most important social benefit provided by public trees. The aesthetics and beauty of the City was viewed as the top social benefit given off by public trees.

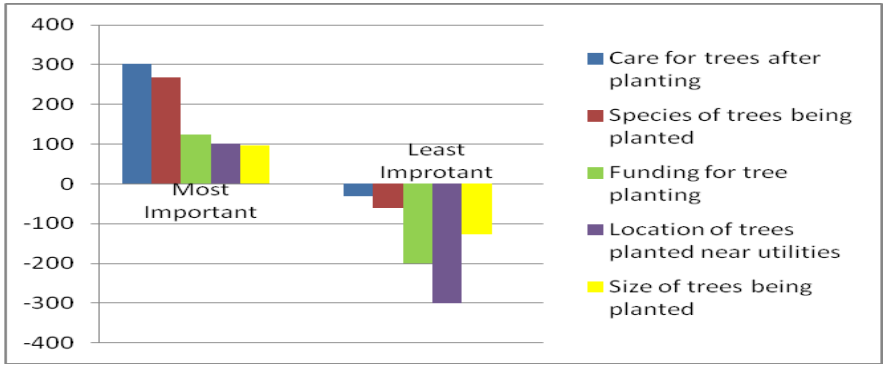
Figure 15: Survey Question 4



Survey respondents were asked in Question 4 what is the most important economic benefit provided by public trees. Increased property value was viewed as the most important.

Image 10: Canary Island Date Palm

Figure 16: Survey Question 5



Survey participants were asked in Question 5 what the most important concern related to public tree planting. Both care of trees after planting and choosing the species of tree being planted were very important. Location of trees planted near utilities was viewed as the least important.

Figure 17: Survey Question 6

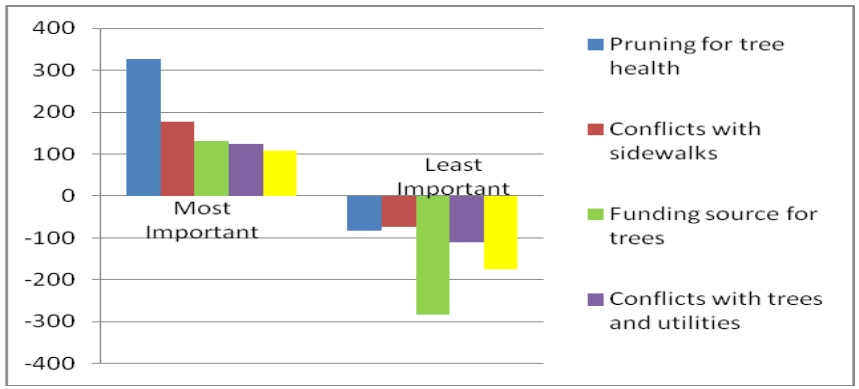


Image 11: Pruning for Good Shape

Survey participants were asked in Question 6; what are the most important considerations to you related to public tree maintenance and removal. Pruning for good shape and vigor as well as to stimulate new growth of the tree was viewed as the most important consideration.

Survey participants were asked in Question 9, in their neighborhood do they feel there are too many or two few public trees. Most thought there were not enough trees in their neighborhoods, compared to very few participants felt that there were too many trees.

Figure 18: Survey Question 9

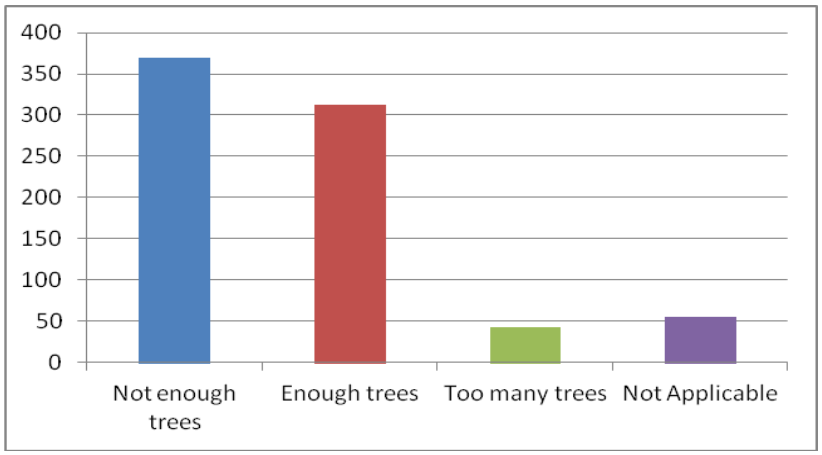


Image 12: Street View of Trees

The participants were also asked in Question 8; across the City are there too many or too few trees. Again most participants said there are not enough trees in the City.

Figure 19: Survey Question 8

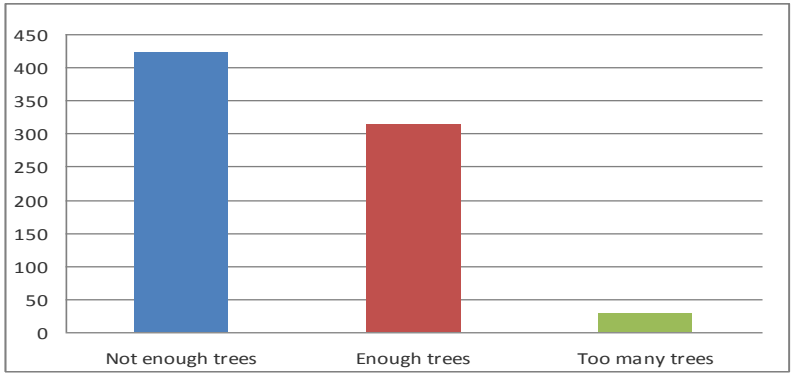


Image: 13 Aerial View of Trees

Survey participants were asked in Question 10, how they perceive the condition or health of public trees in the City. Over six hundred of the respondents believed that the public tree conditions are either moderate health or average health.

Figure 20: Survey Question 10

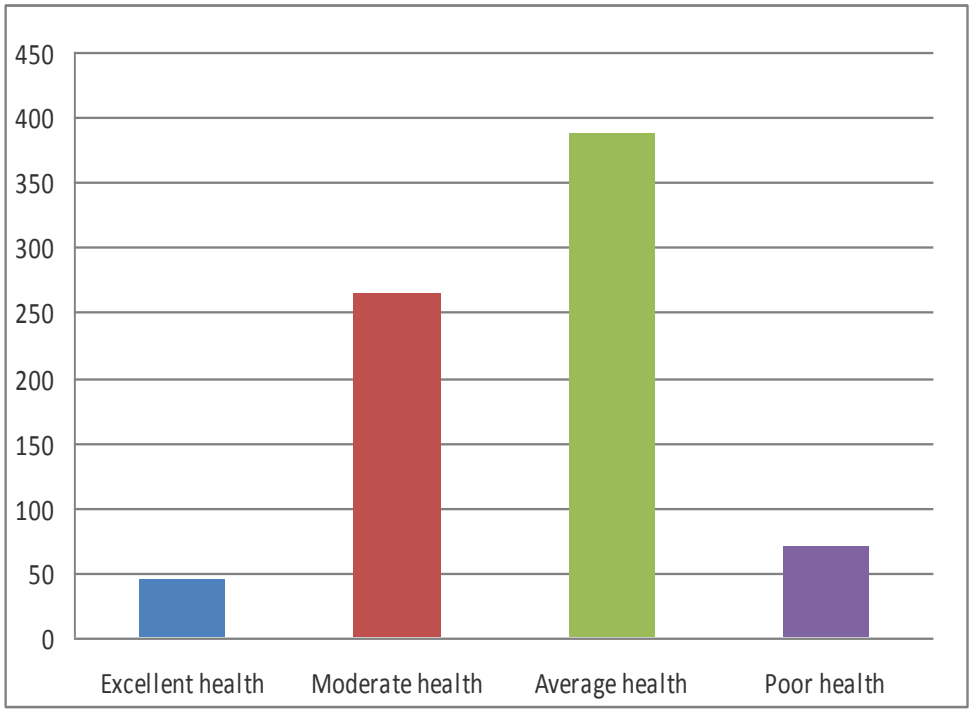
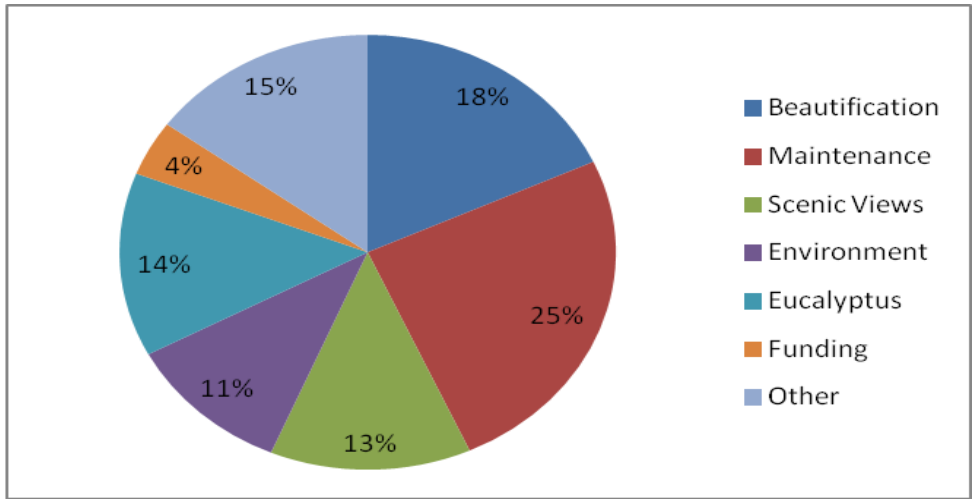


Image 14: Young Oak Tree

Figure 21: Common Resident Concerns



The community was asked what the number one goal of the Urban Forest Management Plan should be. The input ranged from broad ideas to specific policy changes. The topics that survey participants brought up the most are shown in Figure 14.

Maintenance was the number one topic express as a goal for the UFMP. Ideas within the maintenance topic included: adding more trees, sidewalk damage, root damage, trimming/pruning, removal of trees, keeping branches away from power lines, and care of trees after planting.

Beautification was the second highest topic expressed as a goal for the UFMP. The beautification ideas incorporated: tree shape, colorful flowers, aesthetics, aiding the beatification of the city, nice landscaping, planting beautiful looking trees, replacing ugly trees with nice ones, and improving the appearances of the entryways to the city.

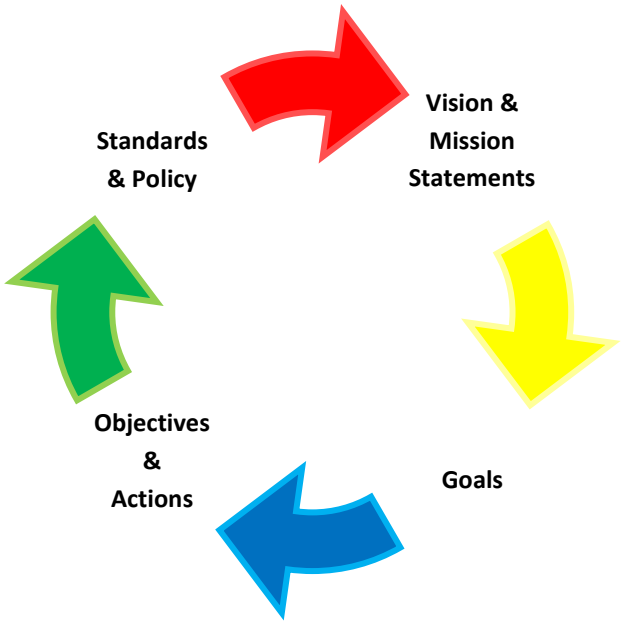
Scenic views were another topic commonly expressed for a goal of the UFMP. Responses for this topic included: removing tree for views, stop blocking ocean views, screening fence along Highway 1, planting trees on the barren hills, planting more short trees, blocking the wind, blocking views of mobile home parks, and decreasing property value.

Another topic that was expressed by citizens as a goal for the UFMP fell under the Eucalyptus topic. This topic was mainly referring to the hazards Blue gum and Red flowering eucalyptus, but also included: getting rid of the downtown trees, removing red sappy trees, plant more variety than eucalyptus, remove smelly eucalyptus, plant native trees instead of eucalyptus, plant trees that don't make you trip, leaving the eucalyptus tree along.

The environment was a topic that 11% of the respondents thought should be the number one goal for the UFMP. Ideas within the topic included: reducing carbon, providing habitat for birds, less pollen, native wildlife habitats, trees that resist pests, providing shade, drought tolerant trees, improve air quality, and Stormwater treatment.

The other topic expressed as a goal was funding for the UFMP. Combined I they consisted of 19% of the responses, but only a handful were about the same specific idea or problem. Many of the responses were either off topic or about a problem relating to a specific tree on their property.

Strategic Plan



Developing Policy and Standards through the Urban Forest Goals

The goals were developed through the Stakeholders survey results and further refined through the Vision and Mission statements. The goals define the objectives and actions which give the road map on implementing this UFMP. These goals provide opportunities for continuous improvement and flexibility in the future. As the urban forest continues to grow and evolve, new strategies that develop will be incorporated as part of this living document.

The City of Morro Bay's public trees are an important part of the City's infrastructure. Public trees located along the City streets offset the impacts of the urban environment and provide residents and tourist a healthy, sustainable, peaceful place for recreation or social interaction while providing habitat for urban wildlife. Trees are an important part of the City's infrastructure by treating stormwater runoff, shading streets and buildings to reduce the urban heat island effect, reduces air pollution, controls erosion, stores and sequesters carbon, and provides human and wildlife habitat.

The Citizens who participated in the survey expressed tree maintenance as the number one goal for the Urban Forest Management Plan. The City agrees maintenance of the trees is vital for the long term sustainability of the urban forest. Due to the limited funding available to maintain the City's street trees one solution could be to limit the areas where the City is responsible to maintain trees, therefore Goal #1, defining public trees was developed. The survey participants expressed beautification as the second goal for the urban forest management plan. In order for the City to achieve this goal the City developed goal #2, enhancing the Urban Forest. The other goals expressed by the survey participants are integrated into all the goals of the UFMP, e.g. scenic view, goal #1, Eucalyptus goal #2 and the environment in goal #2 and goal #3.

Goal 1: Defining Public trees

The City has wide Rights of Way and therefore much of the public treats sections of unpaved Rights of Way as an extension of their property. For the most part the trees planted in the residential Rights of Way were planted by the residents for their personal pleasure/benefit. Due to the vast number of trees planted in these wide Rights of Way in the residential areas, it is a large financial and liability burden to the City. The City spends the majority of the annual tree budget on these trees. The City would like to encourage residents to continue to plant and maintain these trees. In order to enhance and maintain the urban forest to the desired level, the City will need to limit the scope of trees to one that the City can manage. With the cost savings of not maintaining public trees in the residential areas, more money could be spent on replanting and maintaining public trees in the commercial/downtown districts. Currently the City has guidelines for private trees, but in order to protect private trees the city would need to adopt a tree ordinance.

Objective 1.1

Define the Downtown and Commercial Right of Way areas where the City will maintain the trees. Propose an ordinance revision which requires the City to maintain those trees in the Right of Ways of the Downtown and commercial sections of town. The trees in the residential areas will be maintained by the adjoining property owners.

Action 1.1

The Public Services Department will define these trees areas and develop the ordinance within two years of plan adoption.

Objective 1.2

Maintain tree inventory in Downtown and commercially zoned areas.

Action 1.2

The Public Services Department will complete the inventory within one year of plan adoption and maintain the inventory on an ongoing basis.

Objective 1.3

Develop regulations for the private trees that will protect and enhance the urban forest over time. Define the public trees that the City will maintain.

Action 1.3

Adopt a private tree ordinance within three years of plan adoption that will accomplish the goals of the urban forest for the private trees in Morro Bay. Include in this ordinance the defined public trees that will be the City's responsibility to maintain.

Goal 2: Enhancing the Urban Forest

The enhancement of the Urban Forest considers the life cycle of the urban forest and recognizes that it is a dynamic, natural system. Establish and maintain an optimal level of age and species diversity and increased levels of trees to maximize ecosystem benefits provided by the urban forest, (maintain air quality, reduce energy use, moderate stormwater runoff, and provide a favorable environment for city residents).

Objective 2.1

Plant the appropriate species of tree in vacant or replacement locations with diligent consideration of; age diversity, climate, soil

type, wind, salt spray, utilities, biogenetic emissions, Integrated Pest Management and public safety. Utilizing the existing street tree list, add additional species, if needed, of trees to provide more diversity, focusing in the seven microclimates.

Action 2.1

The Public Services and Recreation and Parks Departments will develop and define a list of trees suitable for the appropriate location. These departments will work with the Tree Committee to determine a list of tree species for each different zone in Morro Bay. This will begin within year one of the plan adoption.

Objective 2.2

Develop a master tree planting scheme for the commercial areas within the City focusing on species diversity, and microclimates.

Action 2.2

The Public Services and Recreation and Parks Departments will work with the Tree Committee to develop the tree planting scheme plan, to be completed within three years of plan adoption.

Objective 2.3

In order to diversify the tree species, new trees should always be planted as trees are removed. Develop a subcommittee of one or two member of the Public Works Advisory Board, Volunteer Tree Committee and a staff member to assist in the tree selection and planting of replacement trees. Identify vacant tree wells in downtown areas, and work with the Tree Committee and the Public Works Advisory Board to find volunteer residents who are willing to care for the tree for the first 2 years. Work with the subcommittee to determine which tree species to plant for a given tree well and define the watering for the trees survival.

Action 2.3

The Public Services Department will work with the Recreation and Parks Department and the Tree Committee to define this subcommittee and implement a tree watering program. This will be completed within two years of the plan adoption.

Objective 2.4

Monitor canopy cover every five years. Compare with previous data.

Action 2.4

The Public Services Department will check will Cal Fire in March 2015 to see if State-provided information is available on canopy cover and when it is available, compare coverage every 5 years.

Objective 2.5

Assess the progress regarding environmental benefits gained from the urban forest. Prepare a report on these environmental benefits and provide it on the City's website.

Action 2.5

The baseline has been established in the inventory section, and the Public Services Department will update the information every 5 years on the website.

Goal 3: Protecting Wildlife

Morro Bay is a bird sanctuary and therefore protecting the nesting birds is essential. Further define the nesting season and explore Best Management Practices for the nesting birds and tree trimming.

Objective 3.1

Research and determine the appropriate time frame for nesting

birds throughout the Central Coast.

Action 3.1

The Public Services Department will research the appropriate nesting season for Morro Bay within two years of the plan adoption.

Objective 3.2

Identify pruning needs of various tree species and the appropriate time of year trimming. Investigate Best Management Practices (BMP) for trimming and or removals during nesting season. Develop a policy and protocol that integrates the bird nesting patterns and the appropriate timing for trimming the trees.

Action 3.2

The Public Services Department will research the appropriate time of year for trimming trees, BMPs for trimming and removals during these times and correlate this with the nesting season, within three years of plan adoption.

Goal 4: Educate the Public on the Benefits of Trees

Provide the public with a general understanding of the value and benefits that the Urban Forest provides. Educate residents, business owners, and the development community with Best Management Practices, including planting and care of trees.

Objective 4.1

Provide information on the City's website regarding the City's tree care program, benefits of trees, landmark trees, and proper tree care.

Action 4.1

The Public Services Department will make available this information on the City website within year one of the plan adoption.

Objective 4.2

Continue the partnership with the Public Works Advisory Board and Volunteer Tree Committee.

Action 4.2

The Public Services and the Recreation and Parks Departments will continue this partnership with the UFMP adoption and throughout the entire life of the UFMP.

Objective 4.3

Enhance the City's Arbor Day program and its Tree City USA status.

Action 4.3

The Recreation and Parks Department will ensure the City keep the Tree City USA status and continue with the Arbor Day program from the UFMP adoption and throughout the entire life of the UFMP.

Goal 5: Tree Conservation

Conservation of the Urban Forest is important to preserve the forest for future generations. The conservation efforts include maintenance standards for ongoing management of trees. The City's urban forest should be maintained with standards that are consistent with good cultural best management practices.

Objective 5.1

Maintain trees using tree care guidelines provided in Appendix 3, in order to get the maximum benefits possible from the urban forest. City crews are to be trained in these maintenance practices.

Action 5.1

Recreation and Parks Department will train staff on these standards

in Appendix 3 within three years of plan adoption.

Objective 5.2

Maintain the comprehensive GIS data base of all public trees in the City. Routine data will be entered into the database as trees are pruned, removed or planted.

Action 5.2

A comprehensive update will be performed by the Public Services Department every 10 years.

Objective 5.3

Develop a tree care program that includes appropriate trimming schedules, integrated pest management policy.

Action 5.3

The Recreation and Parks Department will develop this program within three years of the plan adoption.

References

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APPENDIX 1

Tree Inventory

Morro Bay

Annual Energy Benefits of Public Trees By Species

2/4/2013

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Redflower gum	55.7	7,375	1,310.5	1,710	9,085	(N/A)	38.5	59.8	35.08
Cajeput	2.5	333	35.7	47	380	(N/A)	7.4	2.5	7.60
Blue gum eucalyptus	8.4	1,110	158.1	206	1,316	(N/A)	4.8	8.7	41.12
Strawberry tree	1.2	157	26.1	34	191	(N/A)	4.5	1.3	6.36
Queen palm	0.4	53	12.1	16	69	(N/A)	3.9	0.5	2.66
Monterey cypress	2.7	361	56.2	73	434	(N/A)	3.4	2.9	18.88
Broadleaf Evergreen	1.6	214	32.2	42	256	(N/A)	3.1	1.7	12.19
Gum	3.4	443	82.7	108	551	(N/A)	3.0	3.6	27.56
Peppermint tree	1.7	221	32.2	42	263	(N/A)	2.8	1.7	13.82
Oak	0.1	10	2.7	4	14	(N/A)	2.7	0.1	0.77
Red ironbark	2.1	279	57.7	75	354	(N/A)	2.2	2.3	23.62
Lemon bottlebrush	0.7	90	14.7	19	110	(N/A)	1.9	0.7	8.43
Monterey pine	3.0	394	58.0	76	470	(N/A)	1.9	3.1	36.14
Victorian box	0.4	58	6.8	9	67	(N/A)	1.9	0.4	5.15
Mexican fan palm	0.4	48	10.9	14	62	(N/A)	1.9	0.4	4.76
Willow-leaved gimlet	1.6	217	43.8	57	274	(N/A)	1.6	1.8	24.89
New zealand christmas	0.5	63	6.4	8	72	(N/A)	1.6	0.5	6.50
Desert gum eucalyptus	1.3	173	35.4	46	219	(N/A)	1.5	1.5	21.95
Carrotwood	0.5	64	9.7	13	77	(N/A)	1.2	0.5	9.62
Leyland cypress	1.1	147	26.1	34	182	(N/A)	1.2	1.2	22.69
Callery pear	0.4	48	8.8	12	60	(N/A)	1.0	0.4	8.50
OTHER STREET TREES	4.3	562	88.6	116	678	(N/A)	7.9	4.5	12.79
Citywide total	93.9	12,422	2,115.6	2,760	15,182	(N/A)	100.0	100.0	22.56

Morro Bay

Canopy Spread for Public Trees by Zone

2/4/2013

Zone	Canopy Spread	Tree Count	Standard Error	% of Zone	% of Public Trees
1	0'-10'	174	(N/A)	25.85	25.85
	10'-20'	182	(N/A)	27.04	27.04
	20'-30'	198	(N/A)	29.42	29.42
	30'-40'	70	(N/A)	10.40	10.40
	40'-50'	35	(N/A)	5.20	5.20
	50'+	12	(N/A)	1.78	1.78
	N/A	2	(N/A)	0.30	0.30
	Total	673	(N/A)	100.00	100.00
Citywide	0'-10'	174	(N/A)	25.85	25.85
	10'-20'	182	(N/A)	27.04	27.04
	20'-30'	198	(N/A)	29.42	29.42
	30'-40'	70	(N/A)	10.40	10.40
	40'-50'	35	(N/A)	5.20	5.20
	50'+	12	(N/A)	1.78	1.78
	N/A	2	(N/A)	0.30	0.30
	Total	673	(N/A)	100.00	100.00

Morro Bay

Structural (Woody) Condition of Public Trees by Species

2/4/2013

Species	Condition	Tree Count	Standard Error	% of Species	% of Public Trees
African sumac	excellent	0	(N/A)	0.00	0.00
	average	2	(N/A)	100.00	0.30
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.30
Aloe yucca	excellent	0	(N/A)	0.00	0.00
	average	1	(N/A)	100.00	0.15
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.15
Araucaria	excellent	1	(N/A)	50.00	0.15
	average	0	(N/A)	0.00	0.00
	fair	1	(N/A)	50.00	0.15
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.30
Avocado	excellent	0	(N/A)	0.00	0.00
	average	1	(N/A)	50.00	0.15
	fair	0	(N/A)	0.00	0.00
	poor	1	(N/A)	50.00	0.15
	N/A	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.30
Bailey acacia	excellent	0	(N/A)	0.00	0.00
	average	1	(N/A)	100.00	0.15
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.15
Blue gum eucalyptus	excellent	19	(N/A)	59.38	2.82
	average	13	(N/A)	40.63	1.93
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	32	(N/A)	100.00	4.75
Brisbane box	excellent	4	(N/A)	100.00	0.59
	average	0	(N/A)	0.00	0.00
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	4	(N/A)	100.00	0.59
Broadleaf Evergreen Small	excellent	9	(N/A)	42.86	1.34
	average	9	(N/A)	42.86	1.34
	fair	3	(N/A)	14.29	0.45
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	21	(N/A)	100.00	3.12
Bushy yate	excellent	1	(N/A)	100.00	0.15
	average	0	(N/A)	0.00	0.00
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.15

Morro Bay

Structural (Woody) Condition of Public Trees by Species

2/4/2013

Species	Condition	Tree Count	Standard Error	% of Species	% of Public Trees
Cajeput	excellent	10	(N/A)	20.00	1.49
	average	21	(N/A)	42.00	3.12
	fair	12	(N/A)	24.00	1.78
	poor	7	(N/A)	14.00	1.04
	N/A	0	(N/A)	0.00	0.00
	Total	50	(N/A)	100.00	7.43
Callery pear	excellent	0	(N/A)	0.00	0.00
	average	6	(N/A)	85.71	0.89
	fair	1	(N/A)	14.29	0.15
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	7	(N/A)	100.00	1.04
Carrotwood	excellent	1	(N/A)	12.50	0.15
	average	4	(N/A)	50.00	0.59
	fair	1	(N/A)	12.50	0.15
	poor	2	(N/A)	25.00	0.30
	N/A	0	(N/A)	0.00	0.00
	Total	8	(N/A)	100.00	1.19
Cherry plum	excellent	1	(N/A)	25.00	0.15
	average	2	(N/A)	50.00	0.30
	fair	1	(N/A)	25.00	0.15
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	4	(N/A)	100.00	0.59
Cicer gum eucalyptus	excellent	1	(N/A)	100.00	0.15
	average	0	(N/A)	0.00	0.00
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.15
Coast redwood	excellent	1	(N/A)	100.00	0.15
	average	0	(N/A)	0.00	0.00
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.15
Conifer Evergreen Medium	excellent	2	(N/A)	40.00	0.30
	average	2	(N/A)	40.00	0.30
	fair	0	(N/A)	0.00	0.00
	poor	1	(N/A)	20.00	0.15
	N/A	0	(N/A)	0.00	0.00
	Total	5	(N/A)	100.00	0.74
Conifer Evergreen Small	excellent	2	(N/A)	50.00	0.30
	average	1	(N/A)	25.00	0.15
	fair	0	(N/A)	0.00	0.00
	poor	1	(N/A)	25.00	0.15
	N/A	0	(N/A)	0.00	0.00
	Total	4	(N/A)	100.00	0.59
Deodar cedar	excellent	0	(N/A)	0.00	0.00
	average	1	(N/A)	50.00	0.15
	fair	1	(N/A)	50.00	0.15
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.30

Morro Bay

Structural (Woody) Condition of Public Trees by Species

2/4/2013

Species	Condition	Tree Count	Standard Error	% of Species	% of Public Trees
Desert gum eucalyptus	excellent	1	(N/A)	10.00	0.15
	average	7	(N/A)	70.00	1.04
	fair	2	(N/A)	20.00	0.30
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	10	(N/A)	100.00	1.49
Evergreen pear	excellent	0	(N/A)	0.00	0.00
	average	4	(N/A)	100.00	0.59
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	4	(N/A)	100.00	0.59
Ginkgo	excellent	2	(N/A)	100.00	0.30
	average	0	(N/A)	0.00	0.00
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.30
Gum	excellent	5	(N/A)	25.00	0.74
	average	9	(N/A)	45.00	1.34
	fair	6	(N/A)	30.00	0.89
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	20	(N/A)	100.00	2.97
Hawthorn	excellent	0	(N/A)	0.00	0.00
	average	1	(N/A)	100.00	0.15
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.15
Itailian stone pine	excellent	4	(N/A)	66.67	0.59
	average	1	(N/A)	16.67	0.15
	fair	1	(N/A)	16.67	0.15
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	6	(N/A)	100.00	0.89
Lemon bottlebrush	excellent	3	(N/A)	23.08	0.45
	average	6	(N/A)	46.15	0.89
	fair	4	(N/A)	30.77	0.59
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	13	(N/A)	100.00	1.93
Lemonscented gum	excellent	1	(N/A)	100.00	0.15
	average	0	(N/A)	0.00	0.00
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.15
Leyland cypress	excellent	0	(N/A)	0.00	0.00
	average	5	(N/A)	62.50	0.74
	fair	1	(N/A)	12.50	0.15
	poor	2	(N/A)	25.00	0.30
	N/A	0	(N/A)	0.00	0.00
	Total	8	(N/A)	100.00	1.19

Morro Bay

Structural (Woody) Condition of Public Trees by Species

2/4/2013

Species	Condition	Tree Count	Standard Error	% of Species	% of Public Trees
Live oak	excellent	0	(N/A)	0.00	0.00
	average	2	(N/A)	100.00	0.30
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.30
Lyontree	excellent	0	(N/A)	0.00	0.00
	average	0	(N/A)	0.00	0.00
	fair	2	(N/A)	100.00	0.30
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.30
Mexican fan palm	excellent	11	(N/A)	84.62	1.63
	average	2	(N/A)	15.38	0.30
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	13	(N/A)	100.00	1.93
Monterey cypress	excellent	16	(N/A)	69.57	2.38
	average	6	(N/A)	26.09	0.89
	fair	1	(N/A)	4.35	0.15
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	23	(N/A)	100.00	3.42
Monterey pine	excellent	2	(N/A)	15.38	0.30
	average	8	(N/A)	61.54	1.19
	fair	3	(N/A)	23.08	0.45
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	13	(N/A)	100.00	1.93
New zealand christmas tree	excellent	6	(N/A)	54.55	0.89
	average	5	(N/A)	45.45	0.74
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	11	(N/A)	100.00	1.63
Oak	excellent	1	(N/A)	5.56	0.15
	average	14	(N/A)	77.78	2.08
	fair	2	(N/A)	11.11	0.30
	poor	1	(N/A)	5.56	0.15
	N/A	0	(N/A)	0.00	0.00
	Total	18	(N/A)	100.00	2.67
Palm Evergreen Medium	excellent	0	(N/A)	0.00	0.00
	average	1	(N/A)	100.00	0.15
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.15
Peppermint tree	excellent	9	(N/A)	47.37	1.34
	average	8	(N/A)	42.11	1.19
	fair	2	(N/A)	10.53	0.30
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	19	(N/A)	100.00	2.82

Morro Bay

Structural (Woody) Condition of Public Trees by Species

2/4/2013

Species	Condition	Tree Count	Standard Error	% of Species	% of Public Trees
Primrose tree; cow itch tree	excellent	1	(N/A)	100.00	0.15
	average	0	(N/A)	0.00	0.00
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.15
Queen palm	excellent	10	(N/A)	38.46	1.49
	average	13	(N/A)	50.00	1.93
	fair	2	(N/A)	7.69	0.30
	poor	0	(N/A)	0.00	0.00
	N/A	1	(N/A)	3.85	0.15
	Total	26	(N/A)	100.00	3.86
Red ironbark	excellent	2	(N/A)	13.33	0.30
	average	12	(N/A)	80.00	1.78
	fair	1	(N/A)	6.67	0.15
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	15	(N/A)	100.00	2.23
Redflower gum	excellent	59	(N/A)	22.78	8.77
	average	164	(N/A)	63.32	24.37
	fair	25	(N/A)	9.65	3.71
	poor	9	(N/A)	3.47	1.34
	N/A	2	(N/A)	0.77	0.30
	Total	259	(N/A)	100.00	38.48
Strawberry tree	excellent	24	(N/A)	80.00	3.57
	average	5	(N/A)	16.67	0.74
	fair	1	(N/A)	3.33	0.15
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	30	(N/A)	100.00	4.46
Victorian box	excellent	0	(N/A)	0.00	0.00
	average	10	(N/A)	76.92	1.49
	fair	1	(N/A)	7.69	0.15
	poor	2	(N/A)	15.38	0.30
	N/A	0	(N/A)	0.00	0.00
	Total	13	(N/A)	100.00	1.93
Wilga; australian willow	excellent	1	(N/A)	33.33	0.15
	average	2	(N/A)	66.67	0.30
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	3	(N/A)	100.00	0.45
Willow-leaved gimlet	excellent	1	(N/A)	9.09	0.15
	average	10	(N/A)	90.91	1.49
	fair	0	(N/A)	0.00	0.00
	poor	0	(N/A)	0.00	0.00
	N/A	0	(N/A)	0.00	0.00
	Total	11	(N/A)	100.00	1.63

Morro Bay

Population Summary of Public Trees

2/4/2013

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error
Broadleaf Deciduous Large (BDL)											
Oak	18	0	0	0	0	0	0	0	0	18	
BDL OTHER	0	0	0	0	0	0	0	0	0	0	
Total	**18**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**18**	**(±NaN)**
Broadleaf Deciduous Medium (BDM)											
Callery pear	0	6	1	0	0	0	0	0	0	7	
BDM OTHER	0	2	0	0	0	0	0	0	0	2	
Total	**0**	**8**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**(±NaN)**
Broadleaf Deciduous Small (BDS)											
BDS OTHER	1	3	1	0	0	0	0	0	0	5	
Total	**1**	**3**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**(±NaN)**
Broadleaf Evergreen Large (BEL)											
Blue gum eucalyptus	1	1	0	5	5	3	2	5	10	32	
Gum	0	0	6	7	3	2	1	1	0	20	
Red ironbark	0	0	4	9	2	0	0	0	0	15	
Desert gum eucalyptus	0	1	3	4	2	0	0	0	0	10	
BEL OTHER	1	3	2	1	1	0	0	0	0	8	
Total	**2**	**5**	**15**	**26**	**13**	**5**	**3**	**6**	**10**	**85**	**(±NaN)**
Broadleaf Evergreen Medium (BEM)											
Redflower gum	7	1	4	51	96	66	19	13	2	259	
Cajeput	1	7	23	18	1	0	0	0	0	50	
Victorian box	0	8	3	2	0	0	0	0	0	13	
Willow-leaved gimlet	0	0	3	5	3	0	0	0	0	11	
New zealand christmas	1	1	6	3	0	0	0	0	0	11	
BEM OTHER	0	0	7	2	0	0	0	0	0	9	
Total	**9**	**17**	**46**	**81**	**100**	**66**	**19**	**13**	**2**	**353**	**(±NaN)**
Broadleaf Evergreen Small (BES)											
Strawberry tree	14	7	7	1	1	0	0	0	0	30	
Broadleaf Evergreen	4	3	8	3	0	1	1	0	1	21	
Peppermint tree	0	4	6	8	1	0	0	0	0	19	
Lemon bottlebrush	1	5	7	0	0	0	0	0	0	13	
Carrotwood	3	1	2	1	1	0	0	0	0	8	
BES OTHER	0	0	6	1	0	0	0	0	0	7	
Total	**22**	**20**	**36**	**14**	**3**	**1**	**1**	**0**	**1**	**98**	**(±NaN)**
Conifer Evergreen Large (CEL)											
Monterey cypress	6	3	3	2	2	5	0	1	1	23	
Monterey pine	0	0	0	1	4	2	3	1	2	13	
CEL OTHER	1	0	4	0	2	2	1	1	0	11	
Total	**7**	**3**	**7**	**3**	**8**	**9**	**4**	**3**	**3**	**47**	**(±NaN)**
Conifer Evergreen Medium (CEM)											
Leyland cypress	0	1	1	3	3	0	0	0	0	8	
CEM OTHER	0	1	2	1	1	0	0	0	0	5	
Total	**0**	**2**	**3**	**4**	**4**	**0**	**0**	**0**	**0**	**13**	**(±NaN)**
Conifer Evergreen Small (CES)											
CES OTHER	1	1	1	0	0	0	0	1	0	4	
Total	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**4**	**(±NaN)**
Palm Evergreen Large (PEL)											
PEL OTHER	0	0	0	0	0	0	0	0	0	0	
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**(±NaN)**
Palm Evergreen Medium (PEM)											
PEM OTHER	0	0	1	0	0	0	0	0	0	1	

Morro Bay

Population Summary of Public Trees

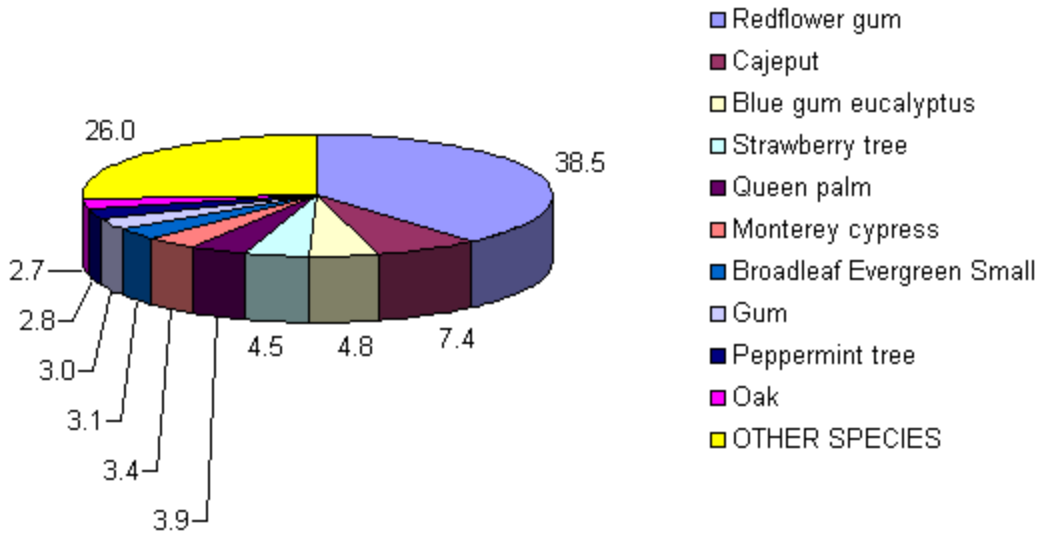
2/4/2013

Species	DBH Class (in) 0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	Standard Error
Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1 (±NaN)**	
Palm Evergreen Small (PES)											
Queen palm	1	2	12	10	0	1	0	0	0	26	
Mexican fan palm	0	0	5	0	0	5	3	0	0	13	
PES OTHER	0	1	0	0	0	0	0	0	0	1	
Total	**1**	**3**	**17**	**10**	**0**	**6**	**3**	**0**	**0**	**40 (±NaN)**	
Grand Total	**61**	**62**	**128**	**138**	**128**	**87**	**30**	**23**	**16**	**673 (±0)**	

Morro Bay

Species Distribution of All Trees (%)

2/4/2013

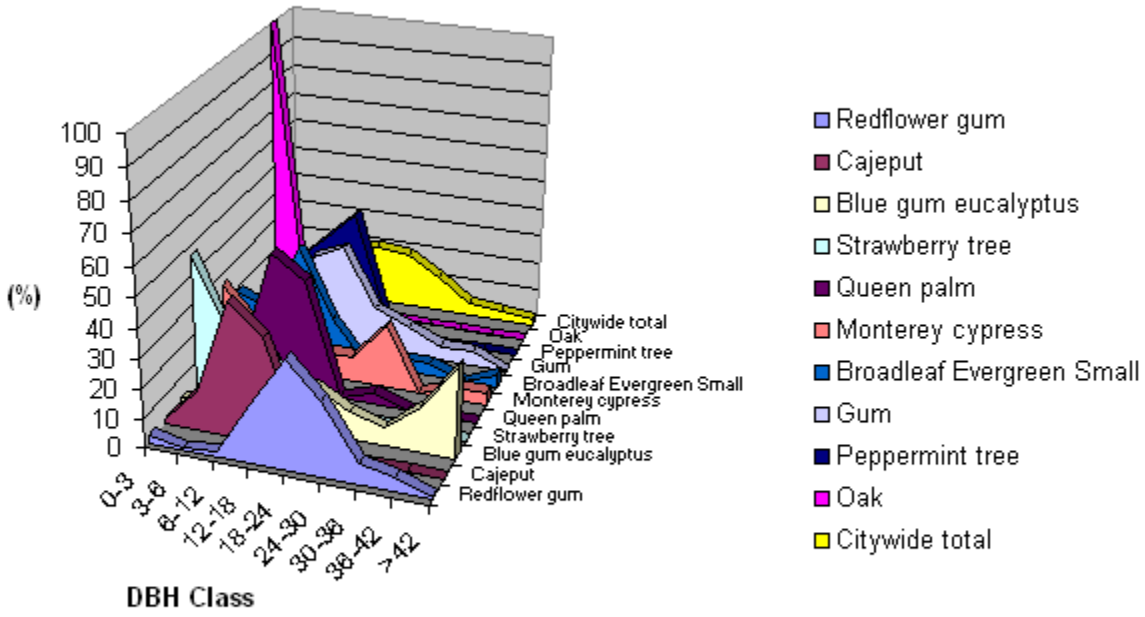


Species	Percent
Redflower gum	38.5
Cajeput	7.4
Blue gum eucalyptus	4.8
Strawberry tree	4.5
Queen palm	3.9
Monterey cypress	3.4
Broadleaf Evergreen	3.1
Gum	3.0
Peppermint tree	2.8
Oak	2.7
OTHER SPECIES	26.0
Total	100.0

Morro Bay

Relative Age Distribution of Top 10 Public Tree Species (%)

2/4/2013



DBH class (in)

Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Redflower gum	2.70	0.39	1.54	19.69	37.07	25.48	7.34	5.02	0.77
Cajeput	2.00	14.00	46.00	36.00	2.00	0.00	0.00	0.00	0.00
Blue gum eucalyptus	3.13	3.13	0.00	15.63	15.63	9.38	6.25	15.63	31.25
Strawberry tree	46.67	23.33	23.33	3.33	3.33	0.00	0.00	0.00	0.00
Queen palm	3.85	7.69	46.15	38.46	0.00	3.85	0.00	0.00	0.00
Monterey cypress	26.09	13.04	13.04	8.70	8.70	21.74	0.00	4.35	4.35
Broadleaf Evergreen	19.05	14.29	38.10	14.29	0.00	4.76	4.76	0.00	4.76
Gum	0.00	0.00	30.00	35.00	15.00	10.00	5.00	5.00	0.00
Peppermint tree	0.00	21.05	31.58	42.11	5.26	0.00	0.00	0.00	0.00
Oak	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Citywide total	9.06	9.21	19.02	20.51	19.02	12.93	4.46	3.42	2.38

Morro Bay

Annual CO_2 Benefits of Public Trees by Species

2/4/2013

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Redflower gum	238,345	1,788	-31,993	-30	-240	46,860	351	253,182	1,899	(N/A)	38.5	69.1	7.33
Cajeput	3,355	25	-512	-6	-4	2,118	16	4,954	37	(N/A)	7.4	1.4	0.74
Blue gum eucalyptus	39,688	298	-8,588	-4	-64	7,049	53	38,146	286	(N/A)	4.8	10.4	8.94
Strawberry tree	780	6	-66	-4	-1	995	7	1,705	13	(N/A)	4.5	0.5	0.43
Queen palm	777	6	-172	-3	-1	339	3	941	7	(N/A)	3.9	0.3	0.27
Monterey cypress	3,815	29	-624	-3	-5	2,293	17	5,481	41	(N/A)	3.4	1.5	1.79
Broadleaf Evergreen	1,059	8	-207	-2	-2	1,359	10	2,209	17	(N/A)	3.1	0.6	0.79
Gum	13,047	98	-1,558	-2	-12	2,816	21	14,303	107	(N/A)	3.0	3.9	5.36
Peppermint tree	1,357	10	-143	-2	-1	1,401	11	2,613	20	(N/A)	2.8	0.7	1.03
Oak	207	2	-2	-2	0	66	0	268	2	(N/A)	2.7	0.1	0.11
Red ironbark	7,307	55	-533	-2	-4	1,773	13	8,546	64	(N/A)	2.2	2.3	4.27
Lemon bottlebrush	418	3	-27	-2	0	575	4	964	7	(N/A)	1.9	0.3	0.56
Monterey pine	4,846	36	-919	-2	-7	2,505	19	6,430	48	(N/A)	1.9	1.8	3.71
Victorian box	565	4	-66	-2	-1	369	3	865	6	(N/A)	1.9	0.2	0.50
Mexican fan palm	348	3	-120	-2	-1	303	2	529	4	(N/A)	1.9	0.1	0.31
Willow-leaved gimlet	5,848	44	-464	-1	-3	1,376	10	6,758	51	(N/A)	1.6	1.9	4.61
New zealand christmas	622	5	-89	-1	-1	401	3	932	7	(N/A)	1.6	0.3	0.64
Desert gum eucalyptus	4,558	34	-345	-1	-3	1,101	8	5,313	40	(N/A)	1.5	1.5	3.98
Carrotwood	412	3	-45	-1	0	409	3	774	6	(N/A)	1.2	0.2	0.73
Leyland cypress	1,097	8	-110	-1	-1	937	7	1,923	14	(N/A)	1.2	0.5	1.80
Callery pear	169	1	-8	-1	0	305	2	465	3	(N/A)	1.0	0.1	0.50
OTHER STREET	6,035	45	-704	-6	-5	3,573	27	8,897	67	(N/A)	7.9	2.4	1.26
Citywide total	334,655	2,510	-47,298	-79	-355	78,922	592	366,199	2,747	(N/A)	100.0	100.0	4.08

Morro Bay

Stored CO2 Benefits of Public Trees by Species

2/4/2013

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Redflower gum	3,332,603	24,995	(N/A)	38.5	67.6	96.50
Cajeput	53,318	400	(N/A)	7.4	1.1	8.00
Blue gum	894,538	6,709	(N/A)	4.8	18.2	209.66
Strawberry tree	6,919	52	(N/A)	4.5	0.1	1.73
Queen palm	17,922	134	(N/A)	3.9	0.4	5.17
Monterey cypress	65,048	488	(N/A)	3.4	1.3	21.21
Broadleaf	21,580	162	(N/A)	3.1	0.4	7.71
Gum	162,315	1,217	(N/A)	3.0	3.3	60.87
Peppermint tree	14,879	112	(N/A)	2.8	0.3	5.87
Oak	250	2	(N/A)	2.7	0.0	0.10
Red ironbark	55,514	416	(N/A)	2.2	1.1	27.76
Lemon bottlebrush	2,792	21	(N/A)	1.9	0.1	1.61
Monterey pine	95,718	718	(N/A)	1.9	1.9	55.22
Victorian box	6,922	52	(N/A)	1.9	0.1	3.99
Mexican fan palm	12,551	94	(N/A)	1.9	0.3	7.24
Willow-leaved	48,379	363	(N/A)	1.6	1.0	32.99
New zealand	9,315	70	(N/A)	1.6	0.2	6.35
Desert gum	35,905	269	(N/A)	1.5	0.7	26.93
Carrotwood	4,735	36	(N/A)	1.2	0.1	4.44
Leyland cypress	11,479	86	(N/A)	1.2	0.2	10.76
Callery pear	818	6	(N/A)	1.0	0.0	0.88
OTHER STREET	33,287	550	(N/A)	7.9	1.5	10.38
Citywide total	4,926,885	36,952	(N/A)	100.0	100.0	54.91

The value of stored carbon dioxide is calculated as the total amount of carbon dioxide sequestered annually over the life of each tree, summed for the population. This value should not be added to the Replacement Value or double-counting of the carbon dioxide storage benefit will occur.

Morro Bay

Annual Stormwater Benefits of Public Trees by Species

2/4/2013

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Redflower gum	825,234	3,301	(N/A)	38.5	60.0	12.75
Cajeput	38,642	155	(N/A)	7.4	2.8	3.09
Blue gum eucalyptus	153,032	612	(N/A)	4.8	11.1	19.13
Strawberry tree	14,747	59	(N/A)	4.5	1.1	1.97
Queen palm	3,628	15	(N/A)	3.9	0.3	0.56
Monterey cypress	39,870	159	(N/A)	3.4	2.9	6.93
Broadleaf Evergreen Small	23,459	94	(N/A)	3.1	1.7	4.47
Gum	45,611	182	(N/A)	3.0	3.3	9.12
Peppermint tree	23,273	93	(N/A)	2.8	1.7	4.90
Oak	880	4	(N/A)	2.7	0.1	0.20
Red ironbark	24,683	99	(N/A)	2.2	1.8	6.58
Lemon bottlebrush	8,443	34	(N/A)	1.9	0.6	2.60
Monterey pine	47,697	191	(N/A)	1.9	3.5	14.68
Victorian box	5,838	23	(N/A)	1.9	0.4	1.80
Mexican fan palm	3,373	13	(N/A)	1.9	0.3	1.04
Willow-leaved gimlet	19,654	79	(N/A)	1.6	1.4	7.15
New zealand christmas tree	7,288	29	(N/A)	1.6	0.5	2.65
Desert gum eucalyptus	15,446	62	(N/A)	1.5	1.1	6.18
Carrotwood	6,738	27	(N/A)	1.2	0.5	3.37
Leyland cypress	10,949	44	(N/A)	1.2	0.8	5.47
Callery pear	2,272	9	(N/A)	1.0	0.2	1.30
OTHER STREET TREES	54,360	217	(N/A)	7.9	4.0	4.10
Citywide total	1,375,118	5,501	(N/A)	100.0	100.0	8.17

Morro Bay

Tree Height for Public Trees by Zone

2/4/2013

Zone	Tree Height	Tree Count	Standard Error	% of Zone	% of Public Trees
1	0'-15'	134	(N/A)	19.91	19.91
	15'-30'	297	(N/A)	44.13	44.13
	30'-45'	177	(N/A)	26.30	26.30
	45'-60'	19	(N/A)	2.82	2.82
	60'+	35	(N/A)	5.20	5.20
	N/A	11	(N/A)	1.63	1.63
	Total	673	(N/A)	100.00	100.00
Citywide	0'-15'	134	(N/A)	19.91	19.91
	15'-30'	297	(N/A)	44.13	44.13
	30'-45'	177	(N/A)	26.30	26.30
	45'-60'	19	(N/A)	2.82	2.82
	60'+	35	(N/A)	5.20	5.20
	N/A	11	(N/A)	1.63	1.63
	Total	673	(N/A)	100.00	100.00

APPENDIX 2

Soils


120° 52' 45"
120° 50' 12"
35° 24' 58"
35° 24' 55"
35° 22' 9"
35° 22' 6"
120° 52' 49"
120° 50' 16"
693000
693600
694200
694800
695400
696000
3921000
3920400
3919800
3919200
3918600
3918000
3917400
3916800
3916200
Toro Creek
Beachcomber St
Sandalwood Ave
San Jacinto St
Elena St
Greenwood Ave
Ironwood Ave
Main St
Avalon St
State Hwy 41
Morro Creek
Little Morro Creek
Quintana Rd
Beach St
Map Scale: 1:24,900 if printed on A size (8.5" x 11") sheet.
N
Meters
0 200 400 800 1,200
Feet
0 500 1,000 2,000 3,000

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:24,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

Date(s) aerial images were photographed: 6/6/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

San Luis Obispo County, California, Coastal Part (CA664)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
107	Beaches	71.7	2.6%
110	Briones-Tierra complex, 15 to 50 percent slopes	34.2	1.3%
120	Concepcion loam, 2 to 5 percent slopes	199.6	7.3%
127	Cropley clay, 0 to 2 percent slopes	6.2	0.2%
128	Cropley clay, 2 to 9 percent slopes	227.3	8.3%
129	Diablo clay, 5 to 9 percent slopes	5.8	0.2%
130	Diablo and Cibo clays, 9 to 15 percent slopes	83.7	3.1%
131	Diablo and Cibo clays, 15 to 30 percent slopes	81.2	3.0%
132	Diablo and Cibo clays, 30 to 50 percent slopes	148.7	5.5%
133	Diablo-Lodo complex, 15 to 50 percent slopes	64.8	2.4%
134	Dune land	176.4	6.5%
142	Gaviota fine sandy loam, 15 to 50 percent slopes	69.6	2.6%
148	Lodo clay loam, 15 to 30 percent slopes	53.2	2.0%
149	Lodo clay loam, 30 to 50 percent slopes	100.1	3.7%
150	Lodo clay loam, 50 to 75 percent slopes	7.6	0.3%
156	Lopez very shaly clay loam, 30 to 75 percent slopes	33.3	1.2%
160	Los Osos loam, 15 to 30 percent slopes	39.8	1.5%
161	Los Osos loam, 30 to 50 percent slopes	98.5	3.6%
164	Los Osos-Diablo complex, 15 to 30 percent slopes	6.6	0.2%
165	Los Osos-Diablo complex, 30 to 50 percent slopes	72.8	2.7%
170	Marimel silty clay loam, drained	49.3	1.8%
178	Nacimiento silty clay loam, 30 to 50 percent slopes	10.5	0.4%
183	Obispo-Rock outcrop complex, 15 to 75 percent slopes	115.4	4.2%
192	Psamments and Fluvents, occasionally flooded	156.9	5.8%
198	Salinas silty clay loam, 2 to 9 percent slopes	112.6	4.1%
223	Xerorthents, escarpment	2.8	0.1%
Subtotals for Soil Survey Area		**2,028.9**	**74.5%**
Totals for Area of Interest		**2,723.5**	**100.0%**

(South Morro Bay)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:25,200 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

Date(s) aerial images were photographed: 6/6/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

San Luis Obispo County, California, Coastal Part (CA664)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
101	Aquolls, saline	105.3	3.2%
104	Baywood fine sand, 2 to 9 percent slopes	493.6	15.1%
105	Baywood fine sand, 9 to 15 percent slopes	462.7	14.2%
106	Baywood fine sand, 15 to 30 percent slopes	11.8	0.4%
107	Beaches	40.6	1.2%
109	Briones-Pismo loamy sands, 9 to 30 percent slopes	7.7	0.2%
110	Briones-Tierra complex, 15 to 50 percent slopes	41.1	1.3%
128	Cropley clay, 2 to 9 percent slopes	56.7	1.7%
129	Diablo clay, 5 to 9 percent slopes	177.6	5.4%
130	Diablo and Cibo clays, 9 to 15 percent slopes	54.2	1.7%
131	Diablo and Cibo clays, 15 to 30 percent slopes	276.3	8.5%
132	Diablo and Cibo clays, 30 to 50 percent slopes	45.2	1.4%
134	Dune land	231.7	7.1%
141	Gaviota sandy loam, 50 to 75 percent slopes	74.1	2.3%
148	Lodo clay loam, 15 to 30 percent slopes	8.7	0.3%
149	Lodo clay loam, 30 to 50 percent slopes	2.5	0.1%
158	Los Osos loam, 5 to 9 percent slopes	19.7	0.6%
160	Los Osos loam, 15 to 30 percent slopes	44.4	1.4%
161	Los Osos loam, 30 to 50 percent slopes	16.7	0.5%
183	Obispo-Rock outcrop complex, 15 to 75 percent slopes	13.9	0.4%
192	Psamments and Fluvents, occasionally flooded	180.0	5.5%
195	Rock outcrop-Lithic Haploxerolls complex, 30 to 75 percent slopes	139.0	4.3%
197	Salinas silty clay loam, 0 to 2 percent slopes	61.1	1.9%
223	Xerorthents, escarpment	0.3	0.0%
226	Zaca clay, 30 to 50 percent slopes	18.0	0.6%
228	Water	361.8	11.1%
Subtotals for Soil Survey Area		**2,944.5**	**90.3%**
Totals for Area of Interest		**3,259.6**	**100.0%**

San Luis Obispo County, California, Coastal Part

104—Baywood fine sand, 2 to 9 percent slopes

Map Unit Setting

Elevation: 0 to 500 feet
Mean annual precipitation: 15 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 325 to 350 days

Map Unit Composition

Baywood and similar soils: 85 percent
Minor components: 12 percent

Description of Baywood

Setting

Landform: Dunes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Eolian sands

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability (nonirrigated): 6e
Ecological site: SANDY (R014XD059CA)

Typical profile

0 to 36 inches: Fine sand
36 to 90 inches: Fine sand

Minor Components

Oceano sand

Percent of map unit: 3 percent

Unnamed

Percent of map unit: 3 percent

Unnamed

Percent of map unit: 3 percent

Baywood/concepcion
Percent of map unit: 3 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

105—Baywood fine sand, 9 to 15 percent slopes

Map Unit Setting

Elevation: 0 to 500 feet
Mean annual precipitation: 15 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 325 to 350 days

Map Unit Composition

Baywood and similar soils: 85 percent
Minor components: 12 percent

Description of Baywood

Setting

Landform: Dunes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Eolian sands

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability (nonirrigated): 6e
Ecological site: SANDY (R014XD059CA)

Typical profile

0 to 36 inches: Fine sand
36 to 90 inches: Fine sand

Minor Components

Oceano sand

Percent of map unit: 3 percent

Unnamed

Percent of map unit: 3 percent

Capistrano sandy loam

Percent of map unit: 3 percent

Fine sand over loam soil
Percent of map unit: 3 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

106—Baywood fine sand, 15 to 30 percent slopes

Map Unit Setting

Elevation: 0 to 500 feet
Mean annual precipitation: 15 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 325 to 350 days

Map Unit Composition

Baywood and similar soils: 85 percent
Minor components: 12 percent

Description of Baywood

Setting

Landform: Dunes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Eolian sands

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability (nonirrigated): 6e
Ecological site: SANDY (R014XD059CA)

Typical profile

0 to 36 inches: Fine sand
36 to 90 inches: Fine sand

Minor Components

Oceano sand

Percent of map unit: 3 percent

Unnamed

Percent of map unit: 3 percent

Capistano sandy loam

Percent of map unit: 3 percent

Garcy

Percent of map unit: 3 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

120—Concepcion loam, 2 to 5 percent slopes

Map Unit Setting

Elevation: 10 to 800 feet
Mean annual precipitation: 17 to 24 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 300 to 330 days

Map Unit Composition

Concepcion and similar soils: 85 percent
Minor components: 12 percent

Description of Concepcion

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 10 to 21 inches to abrupt textural change
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability (nonirrigated): 3e
Ecological site: LOAMY CLAYPAN (R014XD105CA)

Typical profile

0 to 19 inches: Loam
19 to 47 inches: Clay
47 to 63 inches: Sandy clay loam

Minor Components

Cropley clay

Percent of map unit: 3 percent

Los osos loam

Percent of map unit: 3 percent

Tierra loam
Percent of map unit: 3 percent

San simeon sandy loam
Percent of map unit: 3 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

128—Cropley clay, 2 to 9 percent slopes

Map Unit Setting

Elevation: 100 to 700 feet
Mean annual precipitation: 14 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 250 to 330 days

Map Unit Composition

Cropley and similar soils: 85 percent
Minor components: 6 percent

Description of Cropley

Setting

Landform: Alluvial flats, alluvial fans
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability (nonirrigated): 3s
Ecological site: CLAYEY (R014XD001CA)

Typical profile

0 to 36 inches: Clay
36 to 60 inches: Silty clay loam

Minor Components

Los osos loam

Percent of map unit: 3 percent

Salinas silty clay loam
Percent of map unit: 3 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

129—Diablo clay, 5 to 9 percent slopes

Map Unit Setting

Elevation: 200 to 600 feet
Mean annual precipitation: 14 to 25 inches
Mean annual air temperature: 59 degrees F
Frost-free period: 275 to 350 days

Map Unit Composition

Diablo and similar soils: 85 percent
Minor components: 6 percent

Description of Diablo

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone, sandstone and/or shale

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: 45 to 58 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability (nonirrigated): 3e
Ecological site: CLAYEY (R015XD001CA)

Typical profile

0 to 38 inches: Clay
38 to 58 inches: Clay
58 to 62 inches: Weathered bedrock

Minor Components

Cropley clay

Percent of map unit: 3 percent

Unnamed
Percent of map unit: 3 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

129—Diablo clay, 5 to 9 percent slopes

Map Unit Setting

Elevation: 200 to 600 feet
Mean annual precipitation: 14 to 25 inches
Mean annual air temperature: 59 degrees F
Frost-free period: 275 to 350 days

Map Unit Composition

Diablo and similar soils: 85 percent
Minor components: 6 percent

Description of Diablo

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone, sandstone and/or shale

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: 45 to 58 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability (nonirrigated): 3e
Ecological site: CLAYEY (R015XD001CA)

Typical profile

0 to 38 inches: Clay
38 to 58 inches: Clay
58 to 62 inches: Weathered bedrock

Minor Components

Cropley clay

Percent of map unit: 3 percent

Unnamed

Percent of map unit: 3 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

130—Diablo and Cibo clays, 9 to 15 percent slopes

Map Unit Setting

Elevation: 200 to 600 feet
Mean annual precipitation: 14 to 25 inches
Mean annual air temperature: 59 degrees F
Frost-free period: 275 to 350 days

Map Unit Composition

Cibo and similar soils: 45 percent
Diablo and similar soils: 45 percent
Minor components: 3 percent

Description of Diablo

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone, sandstone and/or shale

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: 45 to 58 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability (nonirrigated): 3e
Ecological site: CLAYEY (R015XD001CA)

Typical profile

0 to 38 inches: Clay
38 to 58 inches: Clay
58 to 62 inches: Weathered bedrock

Description of Cibo

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, summit

Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from metasedimentary rock

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability (nonirrigated): 3e
Ecological site: CLAYEY (R015XD001CA)

Typical profile

0 to 31 inches: Clay
31 to 39 inches: Clay
39 to 43 inches: Unweathered bedrock

Minor Components

Zaca soils

Percent of map unit: 3 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

131—Diablo and Cibo clays, 15 to 30 percent slopes

Map Unit Setting

Elevation: 200 to 3,000 feet
Mean annual precipitation: 14 to 28 inches
Mean annual air temperature: 59 degrees F
Frost-free period: 275 to 350 days

Map Unit Composition

Cibo and similar soils: 45 percent
Diablo and similar soils: 45 percent
Minor components: 8 percent

Description of Diablo

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountainflank, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone, sandstone and/or shale

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 45 to 58 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Ecological site: CLAYEY (R015XD001CA)

Typical profile

0 to 38 inches: Clay
38 to 58 inches: Clay
58 to 62 inches: Weathered bedrock

Description of Cibo

Setting

Landform: Mountains, hills

Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountainflank, side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Residuum weathered from metasedimentary rock

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Ecological site: CLAYEY (R015XD001CA)

Typical profile

0 to 31 inches: Clay
31 to 39 inches: Clay
39 to 43 inches: Unweathered bedrock

Minor Components

Lodo clay loam

Percent of map unit: 2 percent

Los osos loam

Percent of map unit: 2 percent

Zaca clay

Percent of map unit: 2 percent

Rock outcrop

Percent of map unit: 2 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

132—Diablo and Cibo clays, 30 to 50 percent slopes

Map Unit Setting

Elevation: 200 to 3,000 feet
Mean annual precipitation: 14 to 28 inches
Mean annual air temperature: 59 degrees F
Frost-free period: 275 to 350 days

Map Unit Composition

Cibo and similar soils: 45 percent
Diablo and similar soils: 45 percent
Minor components: 9 percent

Description of Diablo

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountainflank, crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Residuum weathered from mudstone, sandstone and/or shale

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 45 to 58 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability (nonirrigated): 6e
Ecological site: CLAYEY (R015XD001CA)

Typical profile

0 to 38 inches: Clay
38 to 58 inches: Clay
58 to 62 inches: Weathered bedrock

Description of Cibo

Setting

Landform: Hills, mountains

Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountainflank, crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Residuum weathered from metasedimentary rock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability (nonirrigated): 6e
Ecological site: CLAYEY (R015XD001CA)

Typical profile

0 to 31 inches: Clay
31 to 39 inches: Clay
39 to 43 inches: Unweathered bedrock

Minor Components

Lodo clay loam

Percent of map unit: 3 percent

Los osos loam

Percent of map unit: 3 percent

Rock outcrop

Percent of map unit: 3 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

134—Dune land

Map Unit Composition

Dune land: 90 percent
Minor components: 9 percent

Description of Dune Land

Setting

Landform: Dunes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread

Interpretive groups

Land capability classification (irrigated): 8e
Land capability (nonirrigated): 8e

Typical profile

0 to 6 inches: Fine sand
6 to 60 inches: Fine sand

Minor Components

Baywood

Percent of map unit: 3 percent

Capistrano soils

Percent of map unit: 3 percent

Beaches

Percent of map unit: 3 percent
Landform: Beaches

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

158—Los Osos loam, 5 to 9 percent slopes

Map Unit Setting

Elevation: 100 to 2,000 feet
Mean annual precipitation: 15 to 25 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 275 to 350 days

Map Unit Composition

Los osos and similar soils: 85 percent
Minor components: 14 percent

Description of Los Osos

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountaintop, crest, side slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Residuum weathered from sandstone and shale

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability (nonirrigated): 3e
Ecological site: LOAMY CLAYPAN (R015XD049CA)

Typical profile

0 to 14 inches: Loam
14 to 32 inches: Clay
32 to 39 inches: Sandy loam, loam, clay loam
39 to 43 inches: Weathered bedrock

Minor Components

Cibo clay

Percent of map unit: 2 percent

Diablo clay

Percent of map unit: 2 percent

Gazos clay loam
Percent of map unit: 2 percent

Lodo clay loam
Percent of map unit: 2 percent

Millsap loam
Percent of map unit: 2 percent

Rock outcrop
Percent of map unit: 2 percent

Unnamed
Percent of map unit: 2 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

160—Los Osos loam, 15 to 30 percent slopes

Map Unit Setting

Elevation: 100 to 3,000 feet
Mean annual precipitation: 15 to 35 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 275 to 350 days

Map Unit Composition

Los osos and similar soils: 85 percent
Minor components: 15 percent

Description of Los Osos

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountaintop, crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex, linear
Parent material: Residuum weathered from sandstone and shale

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability (nonirrigated): 6e
Ecological site: LOAMY CLAYPAN (R015XD049CA)

Typical profile

0 to 14 inches: Loam
14 to 32 inches: Clay
32 to 39 inches: Sandy loam
39 to 43 inches: Weathered bedrock

Minor Components

Cibo clay

Percent of map unit: 2 percent

Diablo clay

Percent of map unit: 2 percent

Gazos clay loam
Percent of map unit: 2 percent

Lodo clay loam
Percent of map unit: 2 percent

Millsap loam
Percent of map unit: 2 percent

Lompico
Percent of map unit: 2 percent

Mcmullin
Percent of map unit: 2 percent

Rock outcrop
Percent of map unit: 1 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

161—Los Osos loam, 30 to 50 percent slopes

Map Unit Setting

Elevation: 100 to 3,000 feet
Mean annual precipitation: 15 to 35 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 275 to 350 days

Map Unit Composition

Los osos and similar soils: 85 percent
Minor components: 14 percent

Description of Los Osos

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Mountaintop, crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex, linear
Parent material: Residuum weathered from sandstone and shale

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e
Ecological site: LOAMY CLAYPAN (R015XD049CA)

Typical profile

0 to 14 inches: Loam
14 to 32 inches: Clay
32 to 39 inches: Sandy loam
39 to 43 inches: Weathered bedrock

Minor Components

Cibo clay

Percent of map unit: 2 percent

Diablo clay

Percent of map unit: 2 percent

Gazos clay loam
Percent of map unit: 2 percent

Lodo clay loam
Percent of map unit: 2 percent

Rock outcrop
Percent of map unit: 2 percent

Lompico
Percent of map unit: 2 percent

Mcmullin
Percent of map unit: 2 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

183—Obispo-Rock outcrop complex, 15 to 75 percent slopes

Map Unit Setting

Elevation: 200 to 4,000 feet
Mean annual precipitation: 8 to 35 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 110 to 350 days

Map Unit Composition

Obispo and similar soils: 50 percent
Rock outcrop: 30 percent
Minor components: 20 percent

Description of Obispo

Setting

Landform: Mountain slopes, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, mountaintop
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from serpentinite

Properties and qualities

Slope: 15 to 75 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability (nonirrigated): 7e
Ecological site: SHALLOW CLAYEY SERPENTINE (R015XD146CA)

Typical profile

0 to 11 inches: Clay
11 to 18 inches: Weathered bedrock
18 to 22 inches: Unweathered bedrock

Description of Rock Outcrop

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex

Across-slope shape: Convex

Properties and qualities

Slope: 15 to 75 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): 8
Land capability (nonirrigated): 8

Typical profile

0 to 60 inches: Unweathered bedrock

Minor Components

Diablo clay

Percent of map unit: 7 percent

Henneke clay loam

Percent of map unit: 7 percent

Unnamed

Percent of map unit: 6 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

San Luis Obispo County, California, Coastal Part

192—Psamments and Fluvents, occasionally flooded

Map Unit Setting

Elevation: 10 to 1,500 feet
Mean annual precipitation: 14 to 25 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 275 to 325 days

Map Unit Composition

Fluvents and similar soils: 45 percent
Psamments and similar soils: 45 percent
Minor components: 10 percent

Description of Psamments

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water capacity: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability (nonirrigated): 6w

Typical profile

0 to 12 inches: Sand
12 to 48 inches: Sand
48 to 60 inches: Stratified gravelly sand to gravelly loamy sand

Description of Fluvents

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water capacity: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability (nonirrigated): 6w

Typical profile

0 to 12 inches: Loamy sand
12 to 48 inches: Loamy sand
48 to 60 inches: Stratified gravelly sand to gravelly loamy sand

Minor Components

Riverwash

Percent of map unit: 2 percent
Landform: Drainageways

Unnamed

Percent of map unit: 2 percent
Landform: Depressions

Unnamed

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Corralitos

Percent of map unit: 2 percent

Tujunga

Percent of map unit: 2 percent

Data Source Information

Soil Survey Area: San Luis Obispo County, California, Coastal Part
Survey Area Data: Version 4, Jan 2, 2008

APPENDIX 3

Tree Care Guidelines

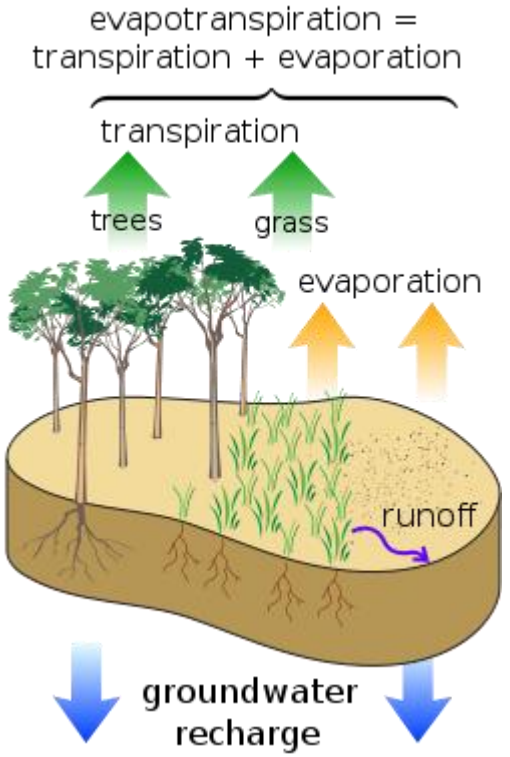
Plant health and vigorous growth are important for young trees to quickly fulfill their landscape purposes. The amount of water that might be saved by being frugal is not worth the possible result of reduced growth or even death. New plantings require more frequent watering (especially at the rootball) until they develop established root systems. Be cautious when transitioning to minimum irrigation because plants must adapt to lower soil moisture conditions.

Shallow watering encourages surface rooting, which makes the tree more vulnerable to drying out during periods of drought. Infrequent, deep soakings encourage the production of a deeper root system and more drought-tolerant trees. If the soil is allowed to dry between irrigations, natural shrinking and swelling improves soil structure. Conversely, frequent, shallow irrigation tends to compact the soil surface and reduce the rate of water infiltration.

Water should be distributed evenly to as much of the root system as possible. Watering the lower trunk (root collar) should be avoided because it can lead to increased fungal decay problems for the tree. Topography affects water distribution. Soil tends to dry faster on hills, while water may accumulate in valleys and low areas. The water application rate should not exceed the soil infiltration rate. If water is applied too quickly, runoff can cause erosion problems and reduced infiltration. Ponding or runoff that results from high application rates wastes water and can be detrimental to root growth and function.

Understanding Soil/Plant/Water Relationships

Plant and soil water loss (evapotranspiration, or ET) are commonly used to schedule irrigations and to indicate how much water to apply. ET rates are dependent on environmental conditions, including light, temperature, wind, and humidity. The California Irrigation Management Information System (CIMIS) supplies this information (http://wwwcimis.water.ca.gov/cimis/welcome.jsp), and your organization may already subscribe to it.



Variations in the weather and length of day, adequacy of previous irrigation or rainfall, depth and spread of roots, and size of the tree top affect the moisture requirements. Besides measuring ET, you can employ some hands-on techniques.

Observe the trees. Most plants wilt noticeably when too little water is available. Leaves that were once shiny become dull, and bright green leaves turn gray-green. You do not want your trees to reach this level of stress.

Feel the soil. With experience, the moisture content can be estimated by the feel of the soil provided it is representative of the site. Collect a sample with a soil probe or shovel. To estimate moisture adequacy, roll or squeeze small sample of soil into a ball. If the soil will not mold into a ball, it is too dry to supply adequate water to plants. If the ball formed will not crumble when rubbed, the soil is too wet. If it can be molded into a ball that will crumble when rubbed, the moisture is probably about right. Sandy soils, however, will crumble even when wet.

Soil moisture sensors, such as tensiometers, can also be used to determine irrigation needs.

By the end of the first year, if the trees are growing vigorously, you may be able to reduce the amount of water applied by 15 to 20 percent, but some trees still may require irrigation on this same schedule.

Container material is the most common type of nursery stock in California, however bare root tree stock in the winter is a good alternative when appropriate.

Selecting Quality Container Nursery Stock

Trees should meet the following minimum standards. Trees that do not meet these requirements should be rejected. Tree planting specifications for selection of quality tree stock should be as follows:

- All trees should be true to type or botanical name as ordered or shown on planting plans or contract orders.
- All trees should have a single, relatively straight trunk with a good taper and branch distribution vertically, laterally and radially with a live crown ratio (distance from bottom of canopy to tree top/tree height) of at least sixty percent (60%). All branches in the canopy should be less than two-third (2/3) the trunk diameter and free of included bark. The trunk and main branches should be free of wounds except for properly made pruning cuts, damaged areas, conks, bleeding and signs of insects or disease.
- All trees should be healthy, have a form typical for the species or cultivar, and be well-rooted and pruned as appropriate for the species.
- All trees should have sufficient trunk diameter and taper so that it can remain vertical without the support of a nursery stake within six months.
- The root ball of all trees should be moist throughout and the crown should show no sign of moisture stress.

Individual tree specifications are as follows:

- The tree should be well rooted in the soil mix. The point where the topmost root in the root ball emerges from the trunk should be visible at the soil surface of the root ball. When the container is removed, the root ball should remain intact. When the tree is lifted, the trunk and root system should move as one.
- All trees should comply with federal and state laws requiring inspection for plant diseases and pest infestations.
- No tree should be accepted that has been severely topped, headed back or lion-tailed.
- No tree should be accepted with co-dominant stems or excessive weak branch attachments that cannot be correctively pruned without jeopardizing the natural form of the species.
- No tree should be accepted that is root bound, shows evidence of girdling or kinking roots, or has roots protruding above the soil (a.k.a. “knees”).
- No tree should be accepted that has roots greater than one-fifth (1/5) the size of the trunk diameter growing out of the bottom of the container.

Planting Specifications

General

The City of Morro Bay shall be the responsible authority for determining the appropriate species or variety of trees planted within the public rights-of-way or easements.

Specific Planting Policies

a. Trees shall be planted in conformance with the approved master plan and in accordance with Public Services Engineering Standard Specifications.

b. A minimum of one street tree shall be planted per lot. Property with frontage of 65 feet or more shall have trees planted at an average maximum spacing of 35 feet (tree to tree) on center. The actual number of trees and spacing for planting will be based on the established canopy width of the designated species as approved by the (department name). To preserve the integrity of the street pattern, where site constraints preclude planting of a street tree within the right-of-way trees may be planted on private property in those instances where an easement for that purpose has been provided.

c. Property owners may plant trees at the owner's expense in accordance with Department standards and subject to prior written approval of the Department.

d. Planting of street trees shall be required at the time the property abutting the right-of-way is developed. The owner of the abutting property shall be responsible for the costs of furnishing, installing and providing a minimum of the first two years of maintenance for all street tree plantings.

e. To maximize the square footage of tree canopy and its benefit to the City, all new and redeveloped properties both residential and commercial shall be required to provide funding for public trees. Fees are established by the City Council. The City through its (contractor or in house staff) will schedule planting of the street trees on or before the time occupancy permits are issued.

f. The Department within 120 days of removal shall replace trees removed by the Department. If possible, no trees will be planted by the City between June 1st and September 30th.

g. Tree removal through a permit by other agencies shall be subject to both a mitigation and replacement fee and shall be replaced by the City's (dept. responsible) within 120 days. If possible no trees will be planted by the city between June 1st and September 30th.

h. Watering of all street trees within the City shall be the responsibility of the abutting property owner, except in reverse frontage and median strips that are maintained by the city. The Department is responsible for all other maintenance after completion of the maintenance period and the written acceptance by the Department.

i. Trees shall not be required to be planted in street right-of-way abutting undeveloped property. If the property owner desires to plant the street right-of-way abutting the owner's undeveloped property, the owner must provide an automatic irrigation system and shall be responsible for the cost of installation and maintenance. The Director may require the posting of a bond of a sufficient amount to guarantee the installation and care of the appropriate improvements.

j. When the sidewalk is located next to the curb, the trees shall be planted a minimum of one foot from the right –of-way line within the public street right-of-way line or easement. Where right-of-way is not available adjacent to the sidewalk, the trees should be planted in easements behind the sidewalk whenever possible. When a tree well in he sidewalk is the only possible solution, a tree will be selected that will not cause or result in long-range curb and or sidewalk damage.

B. In the interest of public safety and maintenance trees shall be planted:

a. A minimum distance from the intersection to provide adequate sight distance. Minimum distance shall be 30 feet from beginning of curve at the curb return, except at secondary and arterial streets; the minimum shall be 50 feet.

b. Five (5) feet minimum from fire hydrants, service walks and driveways.

c. Ten (10) feet minimum from sewer laterals, other utility services laterals and water meters.

d. Fifteen (15) feet minimum from lamp standards.

e. With consideration given to those varieties of trees that will not create a conflict with existing overhead electric utility lines.

f. All trees, other than palm trees, shall be planted a minimum 15-gallon size in residential areas and 24" box size in commercial areas. A 15-gallon or 24" box is defined/determined by the American Association of Nurserymen. Smaller/larger sizes may be permitted/required by the City if warranted.

g. All newly planted trees shall have the nursery stakes removed and replaced with others per Department standards.

h. All staked trees shall be inspected twice a year and the stakes are to be adjusted or removed as necessary.

i. All trees planted in tree wells shall be installed and irrigated in a manner to promote deep rooting per Department standards. All trees in wells shall be installed with an automatic irrigation system.

Percolation and Soil Fertility

Prior to planting the following procedure should be followed:

- Check the soil type and structure. If the soil is compacted, then it should be physically cultivated and have organic material added. Tree should be selected to match the soil type.

Sites for New Street Trees

Typically street trees will be planted where there is an existing vacancy that is unoccupied, as a replacement tree, or if there is a break in the established street tree pattern that should be filled.

Street trees will not be approved for planting under the following conditions:

• The tree would interfere with the growth of other trees in the area.

• The vacant tree well site is overshadowed by other trees nearby creating an unsuitable growing condition for the proposed new tree.

• Utility meters are in the way.

• The tree could block scenic views or views of oncoming traffic.

Street Tree Spacing

The following guidelines shall be followed when planting new street trees. The standard street tree spacing is as follows:

• 30-35 feet on center

• 30 feet from the corner property line

• 20-25 feet on center for smaller statured trees

• 10 feet from driveway approaches

• 10 feet from light poles

• 5 feet from utility meter boxes

• 1 tree per 50feet of property frontage

Planting Procedures

• All planting locations shall be checked for underground conflicts. It is mandatory that Dig Alert is notified to detect all underground utilities prior to any digging.

• Dig planting holes 2-3 times as wide as the container. The depth of the planting pit shall be equal to the size of the rootball. Place the tree in the planting pit so the trunk flare or the top of the rootball is at least one-half inch to 1 inch (1/2” to 1”) above finish grade. In grass covered parkways the top of the rootball shall be higher than the surrounding soil by one-half inch to one inch (1/2” to 1”). In a concrete tree well, the rootball shall be one inch (1”) above the level of the finished surface of the surrounding concrete.

• When obtaining a tree from a nursery, always carry the tree by its container or rootball, never by the trunk.

• After removing the tree from the container, cut circling roots and matted roots off the bottom. Check for any circling roots missed during initial inspection. Any roots less than one-third (1/3) the size of the trunk shall be removed with a sharp pruning tool.

• Before placing the tree in the planting pit, examine the root ball for injured roots and the canopy for broken branches. Damaged roots shall be cleanly cut off at a point

just in front of the break. Broken branches shall be cut out of the canopy making sure that the branch collar is not damaged.

- Backfill with soil removed from the planting hole. Only add fertilizer or compost if soil analysis indicates it is required. Build a temporary four to six inches (4” to 6”) water retention berm around the root ball to allow for establishment watering. Immediately after planting the tree, water it thoroughly by filling the water retention basin twice.
- Eliminate all air pockets while backfilling the planting pit by watering the soil as it is put into the hole. Do not compact the backfill by tamping it down.
- All trees shall be staked with two wooden lodge poles and two ties per pole. The minimum diameter of a lodge pole is two inches (2”), but may be larger for 36” and 48” box trees. Place the tree ties at one-third (1/3) and two-third (2/3) of the trunk height. Drive the stake into the ground approximately twenty-four to thirty inches (24” to 30”) below grade making sure not to penetrate the root ball.
- Mulch with a two to four inch (2” to 4”) layer of mulch where appropriate to conserve soil moisture, provide protection from extreme temperatures and prevent damage from weed eaters. Mulch shall be kept three to four inches (3” to 4”) away from the tree trunk and shall extend at minimum to the boundary of the water retention basin. It may extend further if desired.
- The soil around the new tree shall be kept moist, but not saturated, by watering at least once a week during the cooler winter months and twice a week during the hot summer months.

Tree Planting by Residents

Residents are allowed to plant the approved designated street tree in a parkway or tree well. Residents may plant any size tree they choose however the minimum size acceptable to the City will be in a 15-gallon container. Tree planting may only be done after obtaining a permit issued by the Public Services Department. The City will request that the resident water the tree for the first year to ensure the will survive. The tree will then be incorporated into the City’s tree inventory and become the City’s responsibility to maintain.

Tree Preservation Guidelines

Trees are an essential element of Morro Bay's image and quality of life. Hardscape elements, such as sidewalks, curbs, gutters, and driveways are also indicative of the City of Morro Bay 's commitment to maintain its infrastructure. Over the years, broken and damaged sidewalks, curbs, and gutters and driveways will have to be replaced throughout the City as a result, many trees will be involved. Whenever possible, curbs, gutters, and sidewalks should be meandered away from the tree thereby providing more growing space for roots. Trees will probably also be impacted during new construction and need to be protected. To mange this process and protect existing trees, the following guidelines have been established:

1. **Root Pruning**
   - **a.** Whenever sidewalk, curb gutter or driveway replacements occurs within four feet of a tree, the site will be inspected by an Arborist for tree impact assessment. Root pruning may be performed on any tree that a certified arborist in coordination with the Recreation and Parks Department determines can be safely performed without jeopardizing the life of the tree.

   - **b.** All roots greater than two (2) two inches in diameter must be cleanly cut to encourage good callus tissue. It is recommended that roots be pruned back to the next root node.

2. **Sidewalk Renovation**

   Trees that would be seriously impacted by root pruning during sidewalk replacements will be inspected by a certified arborist in coordination with the Recreation and Parks Department to determine whether:

   - **a.** The repair work can be deferred and a temporary asphalt patch used to eliminate any hazard until other steps can be reviewed and implemented.
   - **b.** The tree can be saved by narrowing the sidewalk near the tree, while still leaving sufficient sidewalk width for disabled access. Standard disability access width is four (4) feet with variances given to 38 inches where absolutely necessary.
   - **c.** Relocating the sidewalk onto private property and negotiating the appropriate easement with the adjacent property owner can save the tree.
   - **d.** The tree can be saved by replacing the sidewalk with minimal disruption of the roots (alternatives: a temporary asphalt sidewalk; rubberized sidewalk; use of root barrier fabric; raising the grade over the roots; and immoral walkway; or other options).

e. To remove the tree and replace it with a minimum 24" boxed replacement tree.

3. Curb and Gutter Replacement

Trees that would be seriously impacted by root pruning during curb/gutter replacement will be inspected by a certified arborist in coordination with the Recreation and Parks Department to determine whether:

a. The repair work can be deferred if it does not create drainage problems or otherwise increase street maintenance unnecessarily and is not a hazard.
b. The tree can be saved by relocating the curb and gutter into the street at lease one foot (ideally two (2) to six (6) feet), thereby narrowing the street width, which in effect may cause the elimination of some street parking.
c. Where six or more trees along one side of a block are severely affected, consideration is to be given to relocating the curb and gutter into the street along the entire block.
d. The tree can be saved by replacing the curb and gutter with minimal disruption of the roots (alternatives: temporary asphalt curb and gutter, use of root barrier fabric: or other similar options).

4. Recovery Period

When significant root pruning on two sides of a tree is required, there will be a 24-month separation between sidewalk and curb/gutter repair to allow time for the tree roots to recover. An exception to this policy may be made if the curb/gutter or sidewalk is relocated away from the tree or other measures are employed that reduce or eliminate root involvement or it is otherwise determined by the (responsible party, department etc.) that the root involvement is minimal.

5. Construction Projects

The following guidelines have been developed to protect trees on City property during construction projects:

a. A root protection zone shall be defined by a minimum 42" high barrier constructed around any potentially impacted tree. This barrier shall be at the drip line or at a distance from the trunk equal to 6 inches for each inch of trunk diameter 4.5 feet above the ground if this method defines a larger area.

b. Should it be necessary to install irrigation lines within this area, the line shall be located by boring, or an alternate location for the trench is to be established.

The minimum clearance between an open trench and a street tree shall be one (1) foot or six inches for each inch of trunk diameter measured at 4.5 feet above existing grade if this method defines a larger distance. The maximum clearance shall be ten (10) feet.

c. At no time shall any equipment, materials, supplies or fill be allowed within the prescribed root protection zone unless otherwise directed by the agency.

It is recognized that failure to abide by these provisions will result in substantial root damage to trees that may not be immediately apparent. The City can therefore assess damages according to the International Society of Arboriculture standards and bill the responsible party.

Tree Pruning Guidelines

Need for Pruning

Trees are pruned principally to preserve their health and appearance and to prevent damage to human life and to property. Broken, dead, or diseased branches are pruned to prevent decay from spreading. Live branches are removed to permit penetration of sunlight and air circulation which helps maintain a strong and healthy tree.

All of Morro Bay's street trees should be completely pruned on aperiodic basis based on species needs. Frequency also depends on funding levels.

Additional tree pruning is done on an "as needed" basis. Specific examples of where "as needed" work is authorized are:

- Pruning tree limbs that interfere with utility lines.
- Pruning tree limbs that interfere with street, parking lot or security light illumination.
- Pruning tree limbs that interfere with buildings or other private or public facilities.
- Pruning hazardous limbs, such as large dead limbs greater than two (2) inches in diameter, hangers, and structurally unsound limbs.
- Pruning tree limbs that interfere with safe vehicular or pedestrian traffic.
- Sucker pruning.

Property Owners Ability to Prune Trees

The public may apply for a permit (a no fee encroachment permit) and hire their own contractor who is licensed and insured to trim the tree(s) according to these standards contained here in.

Tree Pruning Specifications

Any tree work performed on a City tree should be done according to the specifications outlined here in. There are different criteria for pruning depending on the purpose for the pruning.

- Complete Pruning Specifications are used when the entire tree needs to be fully pruned.
- Safety Pruning Specifications require less pruning and are used when specific, possibly hazardous (dead/dying) limbs need removal to eliminate all safety concerns. Safety pruning may be recommended in some circumstances instead of complete pruning. Safety pruning specifications are used for "as needed" pruning and address only safety concerns. Safety pruning includes only the basic requirements to address the problem.

Tree Pruning and Removal near overhead power lines

Where overhead wires pass through trees, safety and reliability of service demand that tree trimming be done in order that the wires may clear branches and foliage by a reasonable distance. The City allows PG&E to maintain their power lines on a yearly basis. PG&E is required by rules and regulations adopted by the California Public Utilities Commission (CPUC) to maintain certain clearances between vegetation and power lines and otherwise maintain its facilities to ensure the safe and reliable provision of electric power to the state. Local jurisdictions do not have the discretion to change or veto these rules and regulations or to second guess the utility's vegetation management program. Thus, they lack the authority to require PG&E to obtain discretionary tree trimming and removal permits because the operation and maintenance (including vegetation management and removal activities) of electric power lines fall within the jurisdiction of the California Public Utilities Commission (CPUC) and is preempted.

Method of Operation

The following trimming specifications are for the use of any pruning of City trees.

a. Lightly trim all trees to lighten and balance the trees, removing no more than 15 to 20% of the tree.
b. Remove dead wood and cross branches.
c. Remove all suckers.
d. Remove all diseased branches.
e. Encourage radial distribution of all branches to provide sufficient number of scaffold branches to fill the circular spaces as concentrically as possible around the trunk.
f. Final trimming cuts shall be made without leaving a stub. Cuts shall be made just outside the shoulder ring area. Extremely flush cuts, which produce large wounds and weaken the tree at the cut, shall not be made.
g. All trimming shall provide adequate clearance for any obstructed (street, directional etc.) sign, streetlight, safety light or other approved standard.
h. Over sidewalks, limbs shall be raised a minimum of seven and a maximum of eight feet from grade to wood. Where sidewalks do not occur or are located on the street side of a parkway, limbs may be retained below the minimum elevation as long as they conform to the natural shape of the species.
i. Over residential streets, limbs shall be raised gradually from ten (10) feet to fourteen (14) feet over traffic lanes from grade to wood giving the appearance of an arch rather than an angle. Near driveways where automated refuse containers are placed, it is imperative to have fifteen (15) feet of clearance. (Insert all, some or none if appropriate)
j. Over arterial streets, limbs should be raised a minimum of twelve (12) and a maximum of fourteen (14) feet from grade to wood. A major arterial street

may require a higher maximum over central traffic lanes for existing, mature canopy-forming limbs. (Use if appropriate)

k. Whether over sidewalk or street, where the lowest limb is attached to a trunk above the desired elevation but extends below that elevation, if possible, rather than removed all together, in order to avoid giving the trunk a skinned appearance.

l. Trimming shall not exceed the amount necessary to achieve the specified elevation at the time of raising. NO attempt to trim to a higher elevation to allow for future growth shall be permitted.

m. No limb over three inches in diameter will be removed without prior (agency name) approval.

n. No lion-tailing. An effect known as "lion-tailing" results from pruning out the inside lateral branches. Lion-tailing, by removing all the inner foliage, displaces the weight to the ends of the branches and may result in sunburned branches, water sprouts, weaken branch structure and limb breakage.

o. Topping, stump cutting, hat raking pollarding, etc. is not acceptable.

Trees with known pathogens

Trees with known pathogens that can be spread with pruning tools shall be pruned using additional caution.

Avoid pruning on windy days in order to reduce the transmission of spores - Sterilize tools in between cuts on diseased trees that can be transmitted on pruning tools. Acceptable sterilization methods include fifty percent (50%) bleach solution for ten (10) minutes or handheld butane torch heating for fifteen (15) seconds per side.

Wood with known wood boring insect infestations shall be chipped into pieces smaller than four inches (4") and spread. - Wood that is infected with disease shall be handled and disposed of in a manner that minimizes the possibility of transmission of disease. This may include:

a. Not working on windy days to reduce transmission of spores.

b. Transporting greenwaste in covered containers.

General Staff Requirements

a. **City Tree Workers** – All persons performing tree work on City trees should be trained according to tree care standards accepted by the International Society of Arboriculture.

b. **Certified Arborists** – Any contracted tree company shall employ a full-time, permanent Certified Arborist, as accredited by the International Society of Arboriculture. This person is responsible for ensuring that the contractor's crews are performing work according these specifications. This individual must be present along with the crew at all times.

c. **Contractor Qualifications** – All contractors are required to have a state contractor's license for tree work (C-61) and that the contractor adheres to the specifications provide in the bid documents.

General Work Site Requirements

a. Proper disposal of all tree green products generated is required mindful of recycling.
b. Assure good traffic control and minimum disruptions to the public.
c. Assure adequate safety of employees and the public.

Wildlife Avoidance/Migratory Bird Treaty Compliance

The Migratory Bird Treaty Act, the Endangered Species Act and local laws protect birds and wildlife located in trees. An arborist that is also a Certified Wildlife Protector can inspect trees. To minimize conflicts with nests, trees should be inspected carefully for nests and cavities using binoculars prior to pruning. The recommended criteria shall apply to tree pruning or removal activities to protect wildlife:

- As feasible, trees should be scheduled for removal during non-breeding/non-nesting season.
- Trees scheduled for pruning or removal during the breeding/nesting seasons shall be visually inspected at ground-level.
- If wildlife is located in the tree, the tree shall not be pruned and the Public Services Department notified.

Safety Tree Pruning Specifications

Safety tree pruning shall consist of the total removal of those dead or living branches as may menace the future health, strength and attractiveness of trees. Specifically, trees shall be pruned according to the Tree Pruning Specifications as outlined previously in this section.