CITY OF
GOLETA

TO: Mayor and Councilmembers

FROM: Daniel Singer, City Manager

CONTACT: Steve Wagner, Community Services Director

SUBJECT: Urban Forest Mapping Contract with Native Communities Development Corporation

RECOMMENDATION:

A. Authorize the City Manager to execute a professional services agreement with Native Communities Development Corporation in an amount not to exceed $17,450 for Urban Forest Mapping services.

B. Appropriate revenues in the amount $80,000 for Urban Forest Management Grant in account # 310-4-8500-4220

C. Appropriate expenses in the amount of $80,000 for Urban Forest Management Grant expenses in account # 310-5-5400-500

D. Appropriate expenses in the amount of $13,500 for Urban Forest Management Grant matching funds in account # 5-5400-550

BACKGROUND:

On March 18, 2008, the City Council approved acceptance of an $80,000 Urban Forestry Management Plan Grant from the California Department of Forestry and Fire Protection. The City of Goleta's General Plan, Chapter 4 Conservation Element, Section 14.5 Public Urban Forest Master Plan calls for the City to develop an Urban Forest Master Plan. This plan shall describe and map the City's Urban Forest, provide a vision statement for the City's Urban Forest Management Program, develop measurable performance standards, present a timeline for managing the Goleta urban forest, and include additional information as deemed appropriate. In order to begin this process additional consulting services are required to provide detailed maps of current urban forest conditions.

DISCUSSION:

The City's Urban Forest Management Plan is being developed in cooperation with Goleta Valley Beautiful. While a good deal of data exists regarding the publicly managed portions of the City's Urban Forest, additional information regarding the portion of the urban forest located on privately owned properties is needed.

Given the limited research funds available in the Urban Forest Management Grant for evaluating the existing status of the urban forest, Goleta Valley Beautiful prepared a Request for Proposal (RFP) and distributed it to qualified firms to determine if they could provide the required services within the available budget. A copy of the RFP is attached. The following firms were sent the RFP: URS, Rincon Consultants, UCSB Center for Spatial Studies, UCSB Geography Department and Native Communities Development Corporation.

The only company that submitted a proposal in response to the RFP was Native Communities Development Corporation (NCDC). NCDC is a privately owned company based in Colorado Springs, Colorado. A copy of the NCDC proposal is attached to this report. The total project cost is $17,450.

Upon reviewing the NCDC proposal it is apparent that the firm is highly qualified to provide the mapping needs for the City of Goleta's Urban Forest Master Plan. NCDC has developed nationally recognized expertise in providing innovative Remote Sensing and Geographic Information System (GIS) solutions through the use of high-resolution satellite imagery and automated feature extraction.

NCDC will provide maps identifying trees/forest, grass (irrigated and nonirrigated), impervious surfaces, water and bare soil. In addition to providing information about the urban forest canopy, staff will receive information on impervious surfaces which will assist the City's efforts in Stormwater Management Analysis, water usage, fire safe planning, and developing suitable locations for future tree planting sites. This information will be provided in a format compatible with the City's current mapping and GIS program.

The mapping information provided by NCDC will also be used to prepare the City's "State of the Urban Forest Report". This report will summarize current conditions of the City's urban forest and identify issues and potential strategies for managing both public and private forest areas. It is the first step in the development of the City's Urban Forest Management Plan.

The proposed contract will begin implementation immediately with an anticipated completion date of October 1, 2008

STRATEGIC PLAN:

A contract mapping of the Goleta urban forest is consistent with the objective in the Goleta Strategic Plan entitled "Park System Master Plan".

ALTERNATIVES:

The City Council may choose to not award the contract to NCDC and have the City staff rebid the project in accordance with standard bidding procedures. It appears that this option will only result in a delay in the project due to the re-bid process.

FISCAL IMPACTS:

The $80,000 Urban Forest Management Grant requires the City to provide an estimated $46,500 in matching funds over a 3 year period for staff time, use of City facilities and miscellaneous grant related expenses. A professional services contract with Goleta Valley Beautiful for management and implementation of the Urban Forest Management grant will be brought to the Council for consideration as soon as possible.

The actual hard costs or amount to be expended by the City for implementation of the grant over a two year period is $13,500. At this time staff recommends that the following new budget appropriations be authorized for implementation of Urban Forest Management grant:

1. Appropriate revenues in the amount $80,000 for Urban Forest Management Grant in account # 310-4-8500-4220.

2. Appropriate expenses in the amount of $80,000 for Urban Forest Management Grant expenses in account # 310-5-5400-500.

3. Appropriate expenses in the amount of $13,500 for Urban Forest Management Grant matching funds in account # 5-5400-550.

Submitted By: Approved By:

_____   _____

Steve Wagner   Dan Singer
Community Services   City Manager
Director

ATTACHMENTS:

1.   State of the Urban Forest Report RFP issued by Goleta Valley Beautiful

2.   NCDC Imaging Proposal

ATTACHMENT 1
RFP distributed by Goleta Valley Beautiful

Goleta Valley Beautiful

Mailing Address: P. O. Box 6756, Goleta, CA 93160-6756 www.goletavalleybeautiful.org

//www.goletavalleybeautiful.org/Office Address: 69 Calaveras Ave, Goleta, CA 93117 - (805) 685-7910 office – (805) 252-1952 cell

Board of Directors - Merlyn Cummings -*President*, David C. Fainer Jr - *VP*, Tami Mason - *Treasurer*, Zea Bauer -*Secretary*, Michael T. Bennett, J. Scott Bull, Oscar Briones, Maia Kazaks, Phebe Mansur, Alan Scholl, Melody Tan, Jill Tiegs, Al Turnbull, Treva Yang   Ken Knight-*Executive Director /Certified Arborist/Urban Forester*

May 9, 2008

Craig Woodman
Environmental Division Manager
URS
130 Robin Hill Road, Suite 100
Santa Barbara, CA 93117-3153

Dear Mr. Woodman,

Goleta Valley Beautiful, a non-profit environmental organization serving the Goleta Valley, is contracting with the City of Goleta to prepare an urban forest management plan. We would appreciate your review of the attached proposal to help us prepare a State of the City of Goleta Urban Forest Report. This report will provide supporting data for the development of the urban forest management plan.

You may contact Mark Broomfield at: (805) 685-7910 with any questions or concerns. We look forward to hearing from you by May 30th.

Sincerely,

Merlyn Cummings
President, Goleta Valley Beautiful

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May 9, 2008

Duane Vander Pluym
Vice President, Environmental Science
Rincon Consultants, Inc.
790 East Santa Clara Street
Ventura, CA 93001

Dear Mr. Vander Pluym,

Goleta Valley Beautiful, a non-profit environmental organization serving the
Goleta Valley, is contracting with the City of Goleta to prepare an urban forest
management plan. We would appreciate your review of the attached proposal to help us
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May 9, 2008

Dar Roberts
Vice Chair of the UCSB Geography Department
UCSB Geography Department
1832 Ellison Hall
UC Santa Barbara
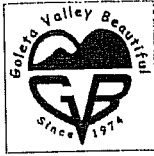Santa Barbara, CA 93106-4060

Dear Dr. Roberts,

Goleta Valley Beautiful, a non-profit environmental organization serving the Goleta Valley, is contracting with the City of Goleta to prepare an urban forest management plan. We would appreciate your review of the attached proposal to help us prepare a State of the City of Goleta Urban Forest Report. This report will provide supporting data for the development of the urban forest management plan.

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Goleta Valley Beautiful

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May 9, 2008

Donald Janelle
(Program Director)
Center for Spatial Studies
Department of Geography and the Institute for Social, Behavioral and Economic
Research
1832 Ellison Hall
UC Santa Barbara
Santa Barbara, CA 93106-4060

Dear Dr. Janelle,

Goleta Valley Beautiful, a non-profit environmental organization serving the
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May 9, 2008

Ian Hanou
Vice President of Business Development
Native Communities Development Corporation/Satellite Imaging and Mapping Division
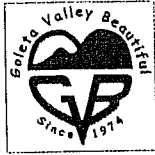1235 Lake Plaza Drive, Suite 221
Colorado Springs, CO 80906

Dear Mr. Hanou,

Goleta Valley Beautiful, a non-profit environmental organization serving the Goleta Valley, is contracting with the City of Goleta to prepare an urban forest management plan. We would appreciate your review of the attached proposal to help us prepare a State of the City of Goleta Urban Forest Report. This report will provide supporting data for the development of the urban forest management plan.

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State of the Urban Forest Report

I. Objective:

The City of Goleta, with Goleta Valley Beautiful acting as primary consultant, is preparing a report on the State of City of Goleta Urban Forest. The report will contain maps and data showing the characteristics of the City of Goleta urban forest. The data will be provided to a stakeholder working group that will assist the City in developing an urban forest management plan. The State of the City of Goleta Urban Forest report will be used as part of public outreach efforts to explain the need for the urban forest, and to demonstrate the costs and benefits of investing in the City of Goleta urban forest. The final report will be provided to the City of Goleta Council as part of an urban forest management plan

II. What We Are Requesting:

Using remote sensing technology, please identify the cost to calculate each of the following information items and the total cost for all items. Since the budget for this portion of the project does not exceed $14,000, the items are listed in priority order of importance to be completed:

a) The 2008 tree canopy coverage for the total area of the City of Goleta

b) The 2008 tree canopy coverage for the total area of the City of Goleta by assessor's parcel

c) The 2008 estimated number of trees for the total area of the City of Goleta

d) The 2008 estimated number of trees for the total area of the City of Goleta by assessor parcel number.

e) The 2008 vacant tree sites suitable for planting for the total area of the City of Goleta

f) The 2008 vacant tree sites suitable for planting for the total area of the City of Goleta by the area within an assessor's parcel

g) The 2008 percentage of impervious surfaces for the total area of the City of Goleta

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h) The 2008 percentage of imperious surfaces for the total area of the City of Goleta by the area within an assessor's parcel number.

i) The change in canopy coverage for the total area of the City of Goleta between 2008 and the earliest date available.

III. Format:

       Provide recommendations on software products to analyze, reconfigure, print, and update the data, with an emphasis on products that require ease of use.

IV. Supporting information

       Goleta Valley Beautiful has conducted inventories and research on the City of Goleta urban forest using STRATUM (Street Tree Resource Analysis Toll for Urban Forest Managers), part of the I-Tree Software Suite developed by the USDA Forest Service Urban and Community Forestry Program. This information will be available by contacting Ken Knight at (805) 968-8523 or kennethknight@cox.net.

V. Completion Dates:

       We request the cost estimates for this project by May 30, 2008.

       Upon completion of an agreement, we request the information be developed by September 1, 2008.

Contact

Mark Broomfield, Project Manager
Goleta Valley Beautiful
PO Box 6756
Goleta Ca 93160-6756

(805) 685-7910 office

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ATTACHMENT 2
NCDC Imaging Proposal

City of Goleta 2008 Urban Forest Mapping

Proposal

For the Goleta Valley Beautiful Council
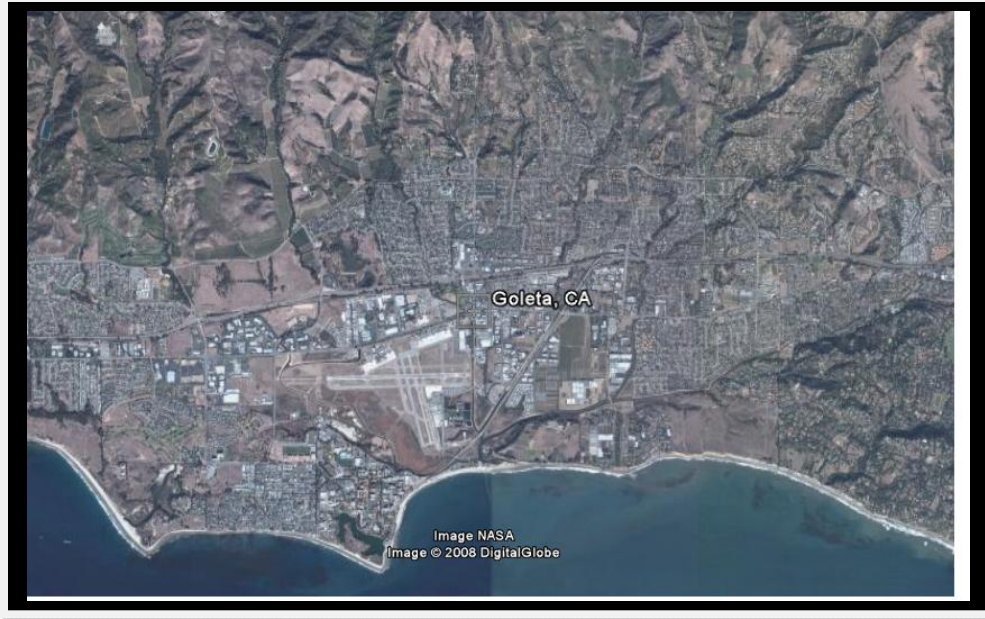
Photo from www.goletaca.com

Photo from www.goletaca.com

June 30, 2008

Goleta Valley Beautiful
Proposal:
Urban Forest Mapping
In the City of Goleta

Prepared for:

Merlyn Cummings
President
Goleta Valley Beautiful
69 Calaveras Avenue
P.O. Box 6756
Goleta, CA 93117-6756
(805) 685-7910

Prepared by:

Michaela Parlin
Production Manager
NCDC Imaging
1235 Lake Plaza Drive, Suite 127
Colorado Springs, CO 80906
Phone: (719) 579-9276
Fax: (719)- 314-2317

June 30, 2008

Company History

Native Communities Development Corporation is a private Native American-owned business based in Colorado Springs, Colorado. Founded in 2000, NCDC's mission is to provide its customers with innovative Remote Sensing and GIS solutions through the use of high-resolution satellite imagery and automated feature extraction (AFE). NCDC Imaging specializes in image processing, mapping services and training for tribal, federal, state and local agencies in addition to rural community organizations, fire protection districts, private companies and individual organizations.

NCDC works with a variety of strategic partnerships on both software and hardware in order to deliver customized solutions from start to finish.

NCDC utilizes state-of-the-art remote sensing, mapping and assessment technologies designed specifically for use with high-resolution imagery to support the market sectors and applications listed in the following table.

Environmental	Natural Resources	Emergency Planning
Watershed Management	Forest Composition	Wildfire Risk Assessment
Pervious / Impervious	Forest Biomass Assessment	Enhanced-911 (E9-1-1)
Water Conservation	Urban Forestry	Homeland Security
Air Quality	Utility Vegetation Management	Critical Infrastructure
	Invasive Species Detection	
	Forest Health & Infestation	
	Baseline Infrastructure & Resource Inventory	

NCDC Imaging & Mapping also provides assistance with GIS applications, economic planning and sustainability.

NCDC has specialized in remote sensing and GIS applications using high-resolution imagery for the past seven (7) years. We have performed numerous natural resource, forestry and environmental analysis projects for local, state and federal clients throughout the U.S. using advanced image analysis and automated feature extraction technology (AFE). We are very proud to be the recipient of the 2005 and 2006 Visual Learning Systems "AFE Analyst of the Year" award. Our technicians, analysts and project managers have all received a minimum of one accredited undergraduate degree in environmental studies, forestry or a related field. The staff at NCDC is encouraged and aided in the pursuit of continuing education for both personal and professional development, so that we might as a company, always be on the cutting edge of new developments in the remote sensing industry.

NCDC brings to the remote sensing industry a lead in analytical solutions aimed at helping managers deal with large areas, complexity, unknowns, short project timelines and tight budgets.

General Information

NCDC has eleven powerful workstations equipped with the fastest processors, no less than 3GB of memory and quad core or dual processors in each, and several GIS software platforms, including ESRI's ArcGIS 9.2, PCI Geomatica, VLS's Feature Analyst software, and ERDAS 9.2, that will be utilized to complete the project in a timely and efficient manner. Additionally we have 3TB of network attached storage and an automated tape archive system for extra data protection.

Quality Assurance and Guarantee

NCDC applies advanced technologies to satellite and high-resolution imaging, aerial photography and remote sensing services, GIS hardware and software, GPS equipment, and data delivery. The company maintains systematic and internationally recognized quality assurance procedures.

NCDC additionally focuses on after sales service and provides a Product Guarantee for all its digital releases.

Learn more at www.ncdcimaging.com where you can download product documents, client testimonials, sample data and project reports, presentations and see a schedule of upcoming online educational events.

Description of Project

The region of interest is the City of Goleta, California and is an area of approximately 10 square miles.

The tasks include to purchase and georeference 2008 Quickbird imagery or utilize the city's existing aerial imagery for use in the development of a land cover classification map of the area, perform an Urban Tree Canopy (UTC) assessment on existing and possible tree canopy, and to optionally produce two CITYgreen reports, provide a change detection analysis on imagery provided by the client between two datasets from time periods decided upon by the client, prepare a concise report discussing methodology, tables, maps, and a few graphics.

Objective

To produce current land cover maps and UTC statistics for the area described above, that will assist the Goleta Valley Beautiful (GVB) cooperative in preparing a State of the City of Goleta Urban Forest Report, for the City of Goleta, that will assist in various aspects of urban forest management, maintenance, environmental impact mitigation and protection of valuable urban forest resources.

**Task 1 –** *Automated Land Cover Mapping*

Upon receipt of client provided imagery, to develop a five class land cover map, making use of automated feature extraction technology. The feature extractions will be performed on either a current year (2008) newly collected ortho-rectified Quickbird satellite imagery or uncompressed, high resolution aerial imagery, provided by GVB.

Develop Land Cover Maps using Automated Feature Extraction

A variety of options are available when classifying land cover from high-resolution imagery. Traditional spectral-based pixel classification has been performed for many years with adequate results from medium resolution imagery. "Automated feature extraction" (AFE) technology, using high-resolution digital imagery has recently become not only a viable option in the industry, but widely accepted as an accurate means to classify pixels and delineate areas of interest that are mutually exclusive.

To reduce labor and processing time and increase accuracy, NCDC has developed a proprietary analytical process using algorithms which maximize the power of an object oriented machine learning approach to automated feature extraction. This involves technology based on NASA and DOD research, which uses spatial context and advanced machine learning techniques to enhance the capability of feature extraction. NCDC's iterative analytical process has achieved high degrees of accuracy in wide area mapping, measurement and resource assessment applications.

The graphic below illustrates a model of NCDC hierarchical AFE technology.
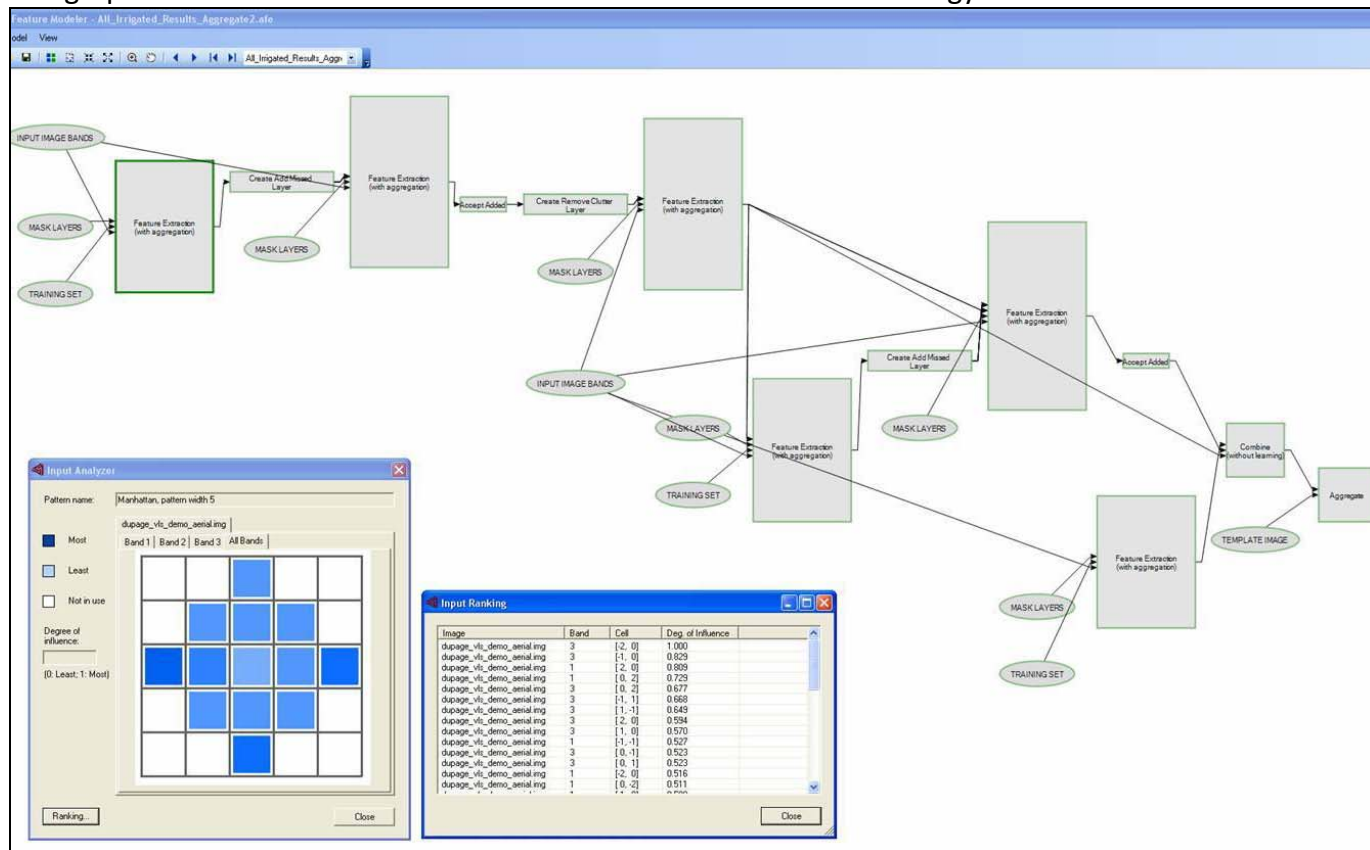
Over the past several years, NCDC has continued to refine our unique algorithms specifically designed for extracting particular land cover features. One algorithm is selected over another based on the following criteria: spatial context of the feature, size, spectral characteristics, pattern and texture. Image quality, including issues such as atmospheric haze, shadows, fog and smog, also dictate the effectiveness of one algorithm over another, and NCDC maintains an internal log (or library) to quickly determine the most suitable function for a particular task given varying image quality.

AFE technology is a learned art form and the order in which methods and processes are performed have a tremendous impact on final products. NCDC has focused on this for many years and perfected this process in-house. Land cover classes and features with the highest accuracies are typically extracted first and used as masks for subsequent classification procedures. Green versus gray data layers are sometimes identified first and separately, and then combined using machine learning algorithms to resolve ambiguity, thus producing land cover classifications that are mutually exclusive.

The resulting map will quickly and accurately delineate dominant land cover types. For Goleta City, NCDC is proposing a five class land cover shapefile to include the following

classes: trees/forest, grass-irrigated and non-irrigated, impervious surfaces, water, and bare soil.

NCDC will conduct an additional vegetation thresholding analysis in order to quickly and accurately classify low and high irrigated grass areas. These will be 2 of the 6 classes that will be delivered as part of the landcover map shapefile.

NCDC shall conduct manual quality checks throughout the processing to ensure each polygon feature class is accurate, complete, and that the topology exhibits no overlaps or gaps.

All maps and images will have FGDC compliant metadata associated with them.

Task 2 –*Analysis of Existing and Possible Urban Tree Canopy (UTC Assessment) & Quantify and Map Potential Planting Sites*

NCDC will conduct a UTC – Urban Tree Canopy – analysis on the City of Goleta. The analysis will provide Existing vs. Possible tree canopy statistics for one target geography (parcels), as well as by land use, if a zoning shapefile is provided by the client. Tables will additionally include some impervious area statistics by parcel and city-wide. This analysis model is based on tools created by U.S. Forest Service Northern Research Station and the University of Vermont, Spatial Analysis Lab.

Task 2.1 - Summarizing Statistics for Existing and Possible UTC

NCDC imaging will apply UTC modeling processes during the analysis and derivation of Existing and Possible UTC values from geospatial data layers provided by the client and derived from automated feature extraction methodologies described in Task 1 and as needed to conduct the analysis.

The model intersects or overlays geospatial data layers upon which a series of calculations are applied to derive statistics on target geographies. Some of these statistics will be imported into a spreadsheet to generate the UTC metrics, and are attributed in the original data layers for future analyses and spatial representations where possible. Additionally, a few tables will be created that contain valuable computations that will be included with the deliverables for future use and reference.

Statistics will then be generated through a series of computations run on the combined layers, including the parcel layer provided to NCDC and the new landcover classification.

Existing UTC is a simple calculation of current tree canopy derived from the land cover classification. Possible UTC is defined as anywhere canopy could possibly exist. Possible UTC then, excludes water, buildings, roads, and areas of land where there is already existing UTC.

Task 2.2 - Quantify and Map Potential Tree Planting Sites

Not only determining existing tree canopy but also discerning potential tree planting sites is one of the most desired outcomes of this project. New models have recently been created and can be further improved upon to intelligently map and assess available tree planting space in urban settings using high-resolution remotely sensed data and geospatial rule sets. Two separate models that have yet to become one, focus on different aspects of the problem at hand, and a combination of these toolsets is proposed here.

In conjunction with the UTC assessment model proposed in Task 2.1, which again analyzes 'biophysically' Possible Tree Canopy area by land use type, NCDC is further proposing to utilize new techniques developed by US Forest Service Pacific Southwest Research Station specifically for the Los Angeles 1-Million Tree Planting Initiative. While the underlying core land use and land cover data inputs are similar, this iterative, rule-based model approaches the problem more from a "number of trees" and "minimum site specifications" approach rather than a "canopy area" perspective.

This model excels specifically by identifying small or medium vs. large planting space opportunities, critical to realistic, appropriate planting scenarios. Furthermore, the models starts by allocating spaces for large trees, then medium and lastly small trees, to promote and maximize environmental benefits which are greatest with mature large trees. The model also precludes the creation of duplicate planting spaces. For more information, see
www.fs.fed.us/psw/programs/cufr/products/psw_cufr689a_MillionTreesLA_final_web.pdf.

Setting up area specific rules such as the following decision rule-sets, also utilized for the Los Angeles canopy cover assessment, would be used for the GVB project, with some additions and modifications depending upon available expertise and GIS datasets in Goleta and should this model be favored as an optional deliverable.

- the crown diameter sizes at maturity for small, medium and large trees (15', 30, and 50' respectively)
- 2-ft buffer of impervious surfaces to avoid conflicts with sidewalks, driveways and buildings
- a minimum size requirement for a planting space for small, medium and large trees ($16ft^2$, $36ft^2$ and $100ft^2$ by crown size respectively)

It is important to note that instead of eliminating 50% of available planting sites due to social and other reasons as in the Los Angeles study, we will utilize varying percentages of the located sites by consulting with GVB.

The model developed for the Los Angeles Study involved a computer program created by the Center for Urban Forest Research (CUFR) and Qingfu Xiao of the University of California at Davis. This is the only model known to us that iteratively searches, tests and locates available planting sites for small, medium and large trees. We are assuming that this computer program be provided to us for this task, if the program cannot be provided, no additional cost will be added to recreate similar iterative feature modeling.

Dependent upon availability of certain GIS boundary layers, once potential planting sites have been identified, the following 'target geographies' can be incorporated and modeled to illustrate existing canopy cover and potential tree planting sites in tabular, chart and graphical format:

- By land use derived from Task 1, for example existing canopy cover (percent and area) as well as number of potential planting sites by government, residential, commercial and industrial property type

- By parcel, neighborhood, community district, zip code, ward, and voting district

- All parking lots by specific land use category, as described above

- By hydrology type; water districts, drainages and sub-basins, riparian and urparian corridors

Once available tree planting sites have been identified, tested and mapped, we can, with help from GVB on the ground in Goleta, perform an accuracy assessment and calibration procedure before the final results are utilized for urban forest growth and air quality modeling scenarios. The validation process will be similar to the one used in the Los Angeles study wherein sites will be sampled and the stratification, although still random, will be directional to ensure that all tree sizes (small, medium and large) from all land use types are present to a satisfactory sample size.

Task 4 – *2008 QuickBird Satellite Imagery Acquisition and Georeferencing*

Acquire and georeference 2008 .6m resolution QuickBird satellite imagery over the City of Goleta using USGS 10m NED (DEM) elevation data. The ortho-rectified image will be output in NAD83, California State Plane Coordinate System, Zone 5, and will be used as an alternative to client provided aerial imagery, if chosen, for use in extracting land cover features in Task 1.

Deliverables

- 6-class Landcover classification map – to include trees/forest, grass-irrigated and non-irrigated, impervious surfaces, water, and bare soil.ESRI shapefile format in NAD83, California State Plane Coordinate System, Zone 5, feet

- 1 Existing UTC shapefile – ESRI shapefile format in NAD83, California State Plane Coordinate System, Zone 5, feet

- 1 Possible UTC shapefile – ESRI shapefile format in NAD83, California State Plane Coordinate System, Zone 5, feet

- UTC Analysis – including tables of statistics by Parcel

- Locations and numbers of small, medium and large trees by land use type in ASCII or other formats TBD

- Report documenting methods, final geospatial rule-sets used, potential planting site results prior to accuracy assessment and after calibration, outcomes and possible recommendations on use of the data for this study or others

- Graphs, charts and tables describing existing canopy area and potential tree planting sites by the boundaries/target geographies chosen (listed in Task 2.2)

- Accuracy assessment of small, medium and large tree planting sites along with ratio estimators – (with guidance from GVB on ground truth samples)

- 2008 Quickbird ortho-rectified imagery in an ERDAS .img file format in NAD83, California State Plane Coordinate System, Zone 5, feet

Timeline

	Task Name	Start	Finish
1	⊟ Project Management - Goleta Valley Beautiful	Mon 6/16/08	Wed 8/6/08
2	⊟ Image Processing	Mon 6/16/08	Thu 6/19/08
3	DEM and Control Imagery download and editing	Mon 6/16/08	Mon 6/16/08
4	Ground Control extraction and Ortho-Rectification	Tue 6/17/08	Wed 6/18/08
5	Accuracy Assessment and Metadata	Thu 6/19/08	Thu 6/19/08
6	⊟ Land Use Land Cover Development	Fri 6/20/08	Fri 7/4/08
7	5-Class Land Cover Classification	Fri 6/20/08	Mon 6/30/08
8	Existing UTC Shapefile Creation	Tue 7/1/08	Tue 7/1/08
9	Possible UTC Shapefile Creation	Tue 7/1/08	Tue 7/1/08
10	QA/QC of Shapefiles	Wed 7/2/08	Fri 7/4/08
11	⊟ Quantify and Map Potential Tree Planting Sites	Mon 7/7/08	Mon 8/4/08
12	Statistical Analysis	Mon 7/7/08	Wed 7/9/08
13	UTC Analysis and Tree Cluttering	Thu 7/10/08	Mon 8/4/08
14	Creation of Tables and Graphs	Wed 7/30/08	Mon 8/4/08
15	CITYgreen Analysis and Reports	Mon 7/21/08	Mon 7/21/08
16	Land Cover Maps and UTC Analysis Delivery	Wed 8/6/08	Wed 8/6/08
17	Potential Planting Sites Maps and Analysis Delivery	Wed 8/6/08	Wed 8/6/08

Examples of AFE technology as applied for a variety of needs:

UTC Analysis by Target Geography
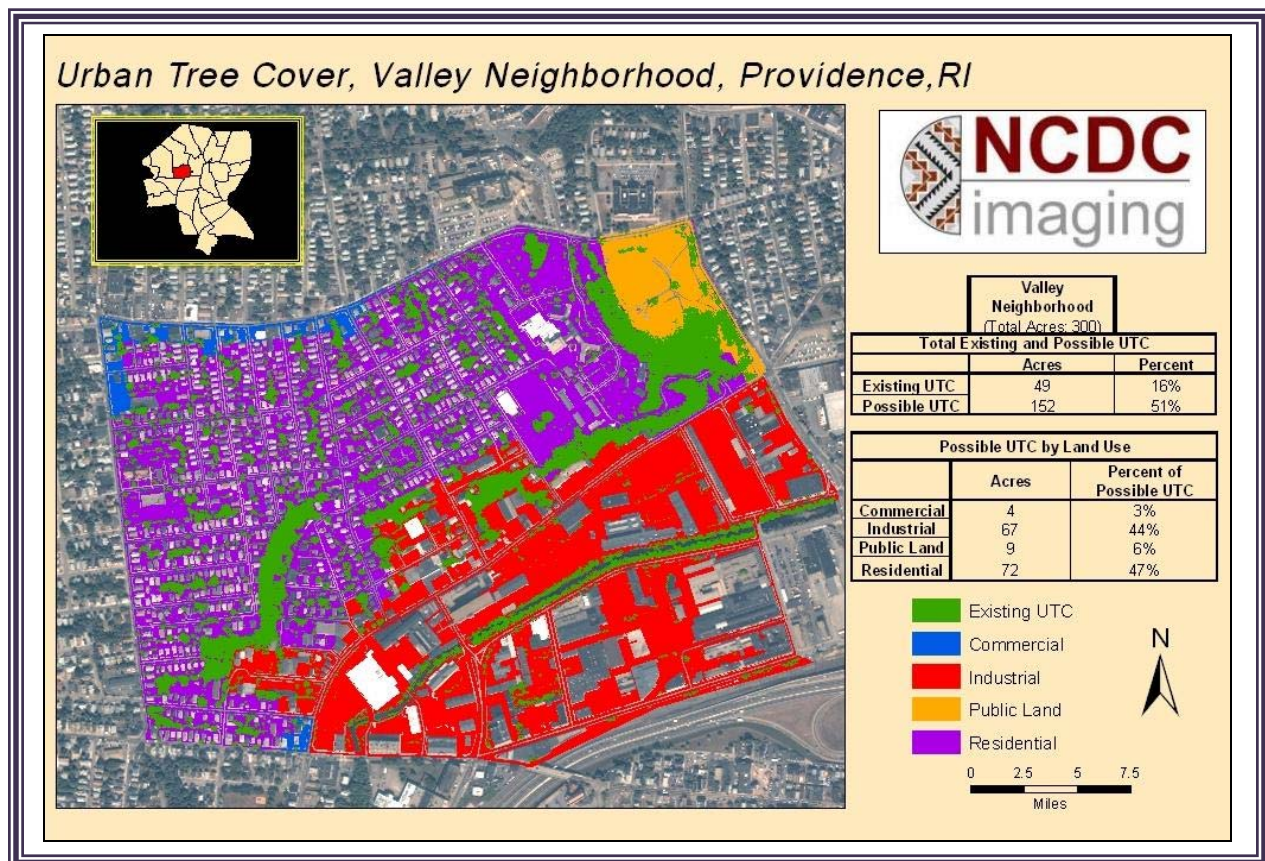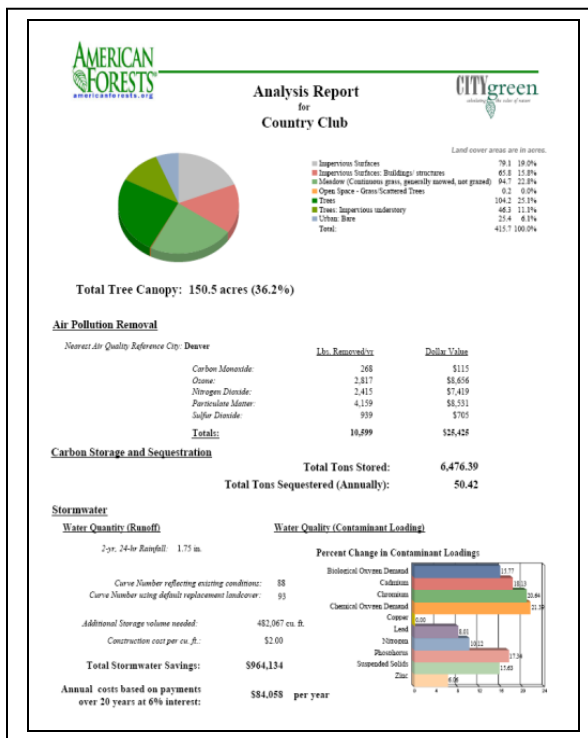
Land cover statistics
for South Park Hill
Neighborhood

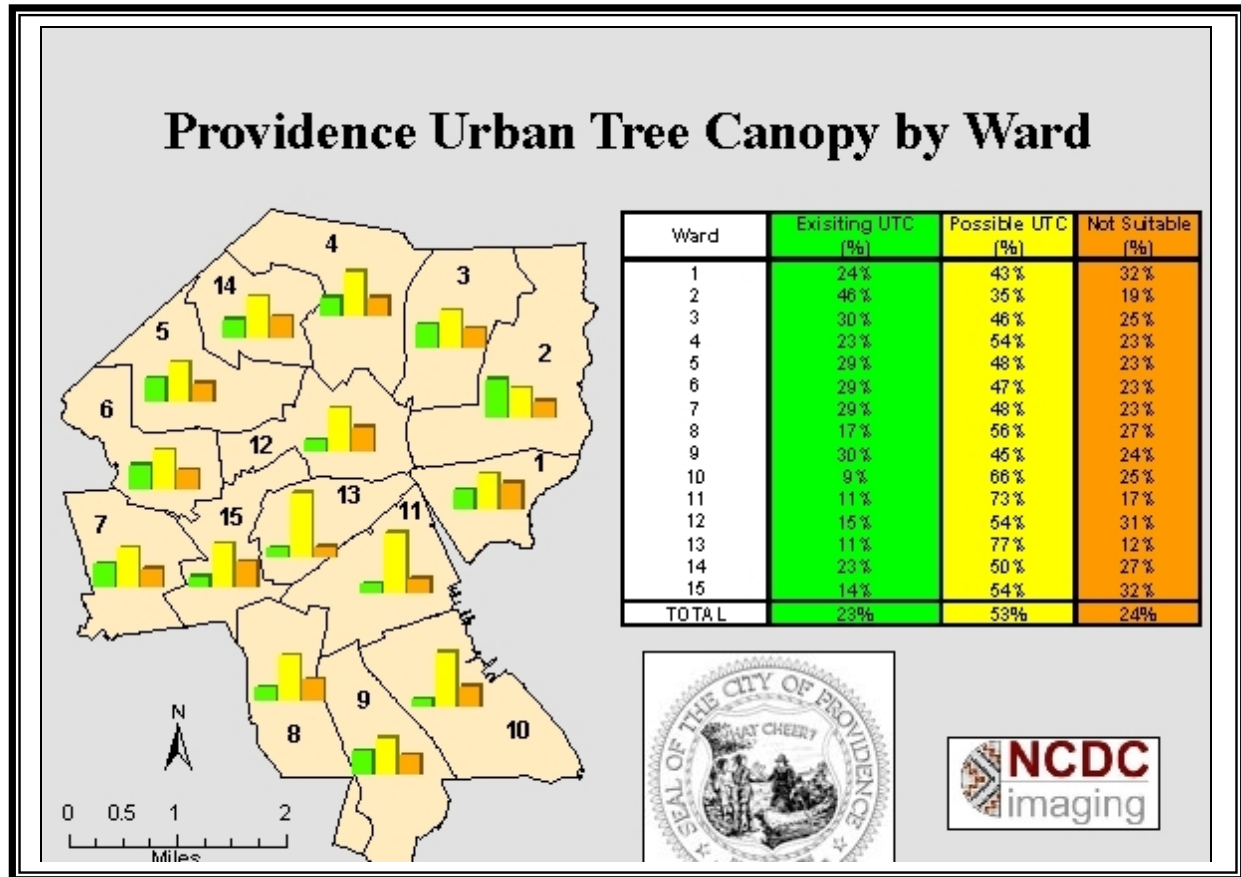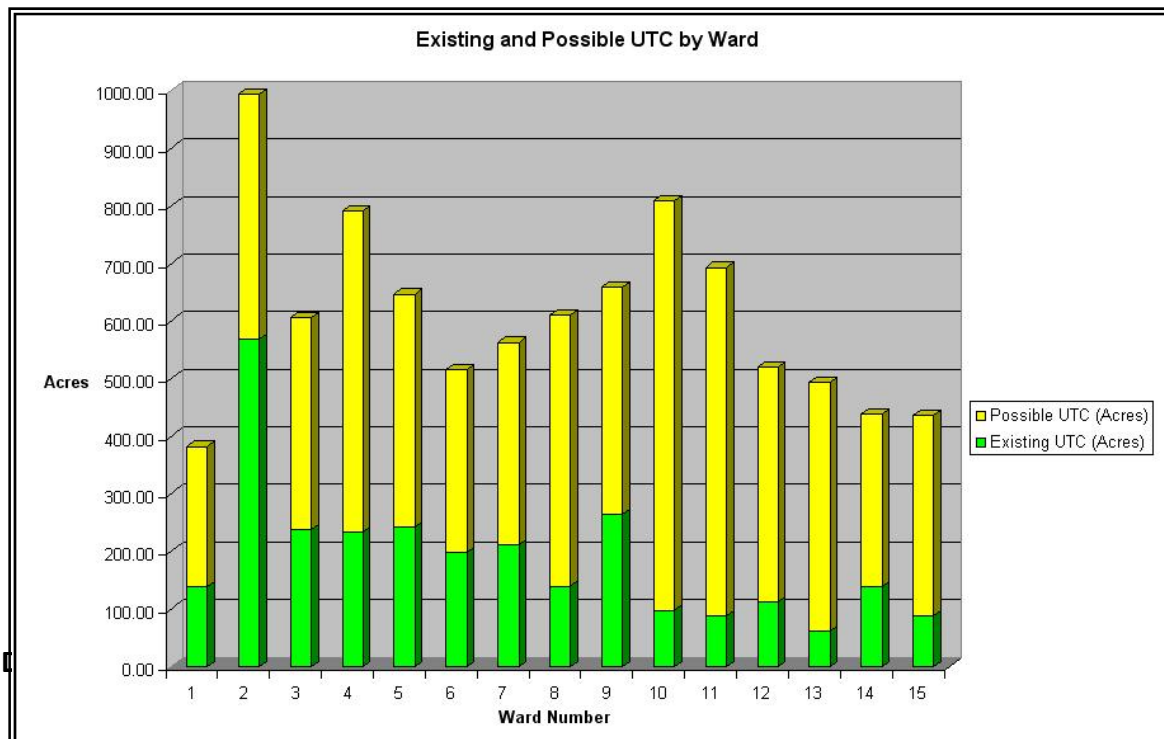|	
Impervious Surfaces:	42%
Tree Canopy:	27%
Bare Earth:	31%
Total:	100%

Purpose: Support "Million Tree Planting Initiative" planning, urban forest management and stormwater modeling

Urban Tree Canopy by Land Use

Providence Urban Tree Canopy by Ward

Ward	Exisiting UTC (%)	Possible UTC (%)	Not Suitable (%)
1	24%	43%	32%
2	46%	35%	19%
3	30%	46%	25%
4	23%	54%	23%
5	29%	48%	23%
6	29%	47%	23%
7	29%	48%	23%
8	17%	56%	27%
9	30%	45%	24%
10	9%	66%	25%
11	11%	73%	17%
12	15%	54%	31%
13	11%	77%	12%
14	23%	50%	27%
15	14%	54%	32%
TOTAL	23%	53%	24%

Existing vs. Possible Tree Cover

Existing and Possible UTC by Ward

NCDC specializes in developing innovative remote sensing and GIS solutions using high-resolution imagery data sets. We have performed numerous natural resource management, forestry and environmental analysis projects for local, state and federal clients using automated feature extraction technology (AFE). We are proud to be the recipient of the 2005 and 2006 Visual Learning Systems "AFE Analyst of the Year" award, which comes as a result of creating new uses of this technology for complex, landscape-scale projects.

1. Experience relevant to the Scope of Services, relevant projects and results or impacts of the project/work performed.

City and County of Denver, Colorado
What: "Urban Tree Inventory Mapping Project"
When: Summer 2006
Size: 150 square miles
Scope: Tree Canopy Mapping & GIS Analysis
Point of Contact: Michael Swanson, (303) 698-4906, michael.swanson@ci.denver.co.us.
Highlights: NCDC mapped coniferous and deciduous urban tree canopy throughout the city and county boundary using 2-ft resolution QuickBird satellite imagery, then provided percent tree canopy by neighborhood in GIS-ready digital format, in a 5x7' color poster and in a brief project summary technical report. This data is being used for planning and monitoring purposes as part of Mayor Hickenlooper's "Million Tree Planting Initiative". Michael Swanson co-presented the results with NCDC at the Front Range Urban Forest Council's May 2007 meeting in Golden, CO.
Testimonial: "Through a great interdepartmental effort between Denver's Parks and Recreational Department and Denver's Public Works Wastewater Management Department, we were able to complete our most recent canopy mapping project."
Mike Swanson, Denver Parks & Recreation
Results/Impacts: over 12,000 trees were planted throughout Denver during Arbor Day weekend in April 2007 and the best location for these tree plantings was determined using NCDC's tree canopy analysis. Results from this project support funding, decision-making and planting strategies within Denver's 77 neighborhoods. Increase in urban forest canopy from the planting initiative will be monitored using similar technology in 5-7 years.

City of Aurora, Colorado
What: "Water Resource Mapping Project"
When: Winter and Spring, 2006
Size: 150 square miles
Scope: Anderson Level 1 Classification
Point of Contact: Rich Vidmar, (303) 739-7326, rvidmar@auroragov.org.
Highlights: NCDC was contracted to map Anderson Level 1 urban land cover in Aurora, CO which includes the following classes: tree cover, impervious, open space/grass, bare

soil and water. The information was derived through advanced image classification of QuickBird satellite imagery and used to support the city's lawn irrigation return-flow litigation to take place in October 2007. Other city departments using the land cover classification data include stormwater, water conservation, parks & recreation and city forestry.

Testimonial: "We had no data to create informational water budgets. This crucial link to our customers was severely lacking and we couldn't begin to address what a customer should be using on their landscape without first having irrigated area square footage and pervious vs. impervious cover." Kevin Reidy, Water Conservation Supervisor, Aurora Water

Results/Impacts: Litigation will occur in October where the land cover mapping will be utilized. The city's water conservation department is currently incorporating irrigated area, tree canopy and landscape composition into their state water conservation plan and a large irrigator program. The city forestry department plans to use the land cover classification to prioritize planting strategy and for CITYgreen reporting.

Public Service Company of New Mexico (PNM)

What: "Remote Sensing & GIS Approach to Forest Biomass Resource Assessment"
When: Summer and Fall, 2005
Size: 300 square miles (3 QuickBird AOIs) and 3 Landsat AOIs with 50 to 60-mile radius
Scope: Forest Density and Biomass Calculations through Individual Tree Crown Extraction
Point of Contact: Wayne Pilz, (505) 241-2700, wpilz@pnm.com.
Highlights: NCDC was contracted to develop a comprehensive, spatially explicit estimation of the amount of bone-dry woody biomass available within the State of New Mexico using satellite imagery, field methods and GIS. The results of the analysis were scientifically-defensible and helped to justify the development of at least one biomass-fueled electrical generation plant in New Mexico. Individual tree crowns were extracted from QuickBird satellite imagery over three, 100 square mile areas. Landsat 7 TM satellite imagery was used to develop a sub-pixel classification of both forest cover type and forest density over three 50- to 60-mile radius areas. QuickBird-derived biomass estimates were extrapolated to the stratified Landsat sub-pixel classification results. 10-meter NED data was also used to derive a stratified biomass layer which included slope and aspect classes. The total bone dry tons were then further subdivided by land owner type, slope exclusion zones and other characteristics to calculate what biomass was available for removal and use in co-generation.

Testimonial: "The major cost and limiting factor in siting a biomass fueled power-plant is the volume and distribution of the fuel supply. NCDC's woody biomass assessment provided us with the information needed to determine the viability of constructing multiple biomass fueled power-plant sites." Wayne Pilz, Special Projects Manager, Public Service Company of New Mexico

Results/Impacts: The engineering company that won the development project has subsequently contracted with NCDC to aid in justifying the fuel budget for the new

plant. This project is currently under environment review before final consideration will be made.

Pueblo County, Colorado
What: "Wildfire Risk Assessment"
When: Fall 2006
Size: 600 square miles
Scope: 4-class Vegetative Fuels Ladder & Emergency Management Data Mapping
Point of Contact: Chris Markuson, (719) 583-6240, chris.markuson@co.pueblo.co.us
Highlights: Pueblo County GIS Manager Chris Markuson sole-source contracted with NCDC in July 2006 to obtain wildland fire vegetation information over the southwest ¼ of Pueblo County for completion of a Community Wildfire Protection Plan (CWPP). Leveraging 10% grant funding and 90% general funds, the County was able to acquire new 2-ft orthorectified satellite imagery as a base map for the fuels mapping. NCDC delivered individual tree crown data that was further analyzed to provide both forest density on a 1-acre grid system and biomass for pinion-juniper woodlands. Grass, shrub and scrub categories were also extracted as separate classes throughout the project area to aid in fire spread modeling and risk assessment. This information is particularly useful given that the majority of wildfire events in the County start in the prairie-step environment. NCDC also provided the County's first power line and 2-track road vector data, as well as an updated point-GIS layer of all visible structures, which were incorporated into the plan as well.
Testimonial: "NCDC was an obvious choice when we needed to quickly put together a proposed wildland fire preparedness and mitigation strategy for the county. Their innovative methodologies and the ability to quickly generate accurate tree-stand-level data will greatly help us create a highly specific plan, showing near-current field conditions. This data will give us the ability to communicate, with unprecedented sophistication, exactly which forest management strategies to employ – even on a house-by-house level." Chris Markuson, Pueblo County GIS Manager
Results/Impacts: The County has recently completed their first Community Wildfire Protection Plan (CWPP) using the mapping data NCDC provided. Private landowners in the wildland urban interface are consulted on a weekly basis and shown the risks and potential mitigation strategies available for their property.

Castle Rock Utilities, Colorado
What: "Water Resource Mapping Project"
When: Spring 2007
Size: 75 square miles
Scope: Anderson Level 1 Classification
Point of Contact: Al Yoga, (720) 733-6039, ajoga@crgov.com
Highlights: Castle Rock Utilities contracted with NCDC to develop residential and commercial water budgets from the results of a detailed land cover analysis from high-resolution QuickBird satellite imagery. Irrigated area, individual conifer vs. deciduous trees, non-grass landscaped area and impervious surfaces were delineated using expert

feature extraction techniques over 20,000 parcels and then analyzed to provide the square feet of each category by parcel. Lot size and irrigated area will be utilized in conjunction with evapotranspiration rates to calculate the parcel-based water budget and rate structure. The data will serve as a benchmark for monitoring programs and will be re-assessed and updated using change detection algorithms and subsequent image acquisitions as urban development continues.

Results/Impacts: This project was delivered during the 2nd week of May 2007 and results and impacts have not yet been realized. Castle Rock Utilities will use the land cover statistics this summer to develop the city's water budget program for implementation in late 2007.

COCAMAR, Brazil Automated Crop Delineation and Change Detection
What: NCDC was recently contracted to perform an automated image interpretation of several crop types over an area 25,000 square kilometers in size using DMC 32m resolution imagery. After the initial delineation of crops a change detection analysis over the same area will be performed using a current year collection of the same area.
When: Spring 2008
Size: 25,558 square kilometers/6315460.42 acres
Scope: Multi-Class Land Cover Classification
Point of Contact: Ulfh Palme, inteligeo99@gail.com
Highlights: The crops had to be delineated to within 5-10% of the actual area and the classification specifications were no less than 90% accurate which NCDC successfully hit for the nine crop types delineated.
Results/Impacts: This is a multi-year contract in which NCDC will provide data and analysis assistance to large-scale agricultural co-ops in South America to aid in not only determining land usage and land cover, but to monitor agricultural practices, and assess economic impacts.

2. Specific experience with public entities, especially large municipalities.

Large Municipalities

City & County of Denver – with a population of over 2 million in the Denver metro region, tree canopy evaluation using a remote sensing method is a logical step when starting a massive tree planting program such as Denver's 1 Million Tree Planting Initiative. The program, initiated by Mayor Hickenlooper, was one of many reasons that the Department of Parks & Recreation and Denver Waste Water contracted with NCDC for their first urban tree canopy inventory. The information gained from this project has proved useful to many organizations in the Denver area including Denver Water, Water Conservation, the Urban Drainage & Flood Control District and even for the US Forest Service in their urban FIA program. NCDC gained invaluable experience working when with varying city officials on budgetary and time constraints as well as logistical issues while completing this project.

City of Colorado Springs – NCDC currently has a 5-year contract with the Colorado Springs Stormwater Enterprise to acquire and orthorectify 2-ft resolution, multispectral orthorectified QuickBird satellite imagery. Imagery acquisitions every 6 months for the next 5 years will allow the city to update impervious surface area central to their stormwater billing fees. NCDC was required to contact multiple city and county departments to obtain ortho support data and authorization to use this information, as well as work with these different departments to determine the best imagery product for their short and long-term needs.

Indianapolis, IN – NCDC has recently completed a contract with Keep Indianapolis Beautiful (KIB), a non-profit whose primary goal is "Uniting people, to beautify the city, improve the environment and foster pride in the community." KIB, local universities and the city of Indianapolis have worked closely together to analyze satellite data for urban tree canopy and impervious surfaces to identify 'hot spot' neighborhoods with the most critical need for green space improvement. NCDC worked with these entities and using CITYgreen software to evaluate the economic and environmental benefits of the current urban forest cover compared with the goal of reaching 25% canopy.

City of Providence, RI – NCDC recently completed a contract for Providence. NCDC acquired Quickbird Satellite Imagery of the area, ortho-rectified it and performed an Anderson Level I classification of the entire scene. From the newly derived landcover classification, NCDC provided an Urban Tree Canopy Analysis. The UTC Analysis involves many steps during which calculations are run against the data layers to determine existing and possible tree canopy. This much needed analytical data supports the city's efforts to "green up" for the economic, aesthetic, and environmental benefits, to list just a few.

Non-Municipal Public Entities

U.S. Army Corp of Engineers, Albuquerque District – for numerous projects, NCDC has acquired and orthorectified 2-ft resolution, multispectral orthorectified QuickBird satellite imagery for the USACE Albuquerque District. Projects involved communicating with Army Corp personnel in operations, land management and risk assessment. Goals ranged from simple base map updates to map run book creation to complete wildfire risk assessment systems involving daily weather updates from MET stations and how emergency crews position themselves throughout the city accordingly.

Wisconsin Department of Natural Resources – NCDC has contracted with the WI DNR on several projects for applications involving forest health, urban forest assessment and satellite image acquisition and orthorectification. When providing an Anderson Level 1 classification of a Wisconsin community in only a five-day period, NCDC needed to quickly and simultaneously communicate with city officials, the Dane County Land

Information Office and various entities within the DNR to obtain ortho support and planimetric data. The DNR continues to work with NCDC on webinars, co-presentations and urban forestry education.

Colorado State Forest Service (CSFS) – an extension of Colorado State University, the CSFS maintains and manages large areas of rural and mountainous property throughout the state of Colorado. NCDC was contracted on three projects by the CSFS to provide high-resolution satellite imagery and analyze forest information such as beetle infestation, density, composition/structure and biomass. These projects helped to prioritize and plan for wildfire fuels and Firewise mitigation efforts as well as educate the public on forest stewardship and management.

Salt Lake City, Utah
What: To collaborate, implement and test the efficacy and costs of remote sensing technology as it relates to benchmarking, analyzing, managing and monitoring the urban forest and related resources and to test and demonstrate the potential to apply remote sensing technologies to monitor and evaluate the status, vitality and sustainability of urban forests.
When: Summer and Fall 2008
Size: 10 square miles (25 square kilometers) within the city limits of Salt Lake City
Scope: Objectives fall into 3 results-oriented categories which aim to enhance the quality of life through assessment and forecasting of urban forest management choices and their associated outcomes. These categories are research, performance and sustainability.
Research – This project will collect (map), analyze, incorporate and distribute spatial information on urban forest status and other resources values. This includes the following parameters; soil type, available planting space, water consumption / availability, genus and species types, size, structure, age, distribution, location, diversity, vitality and contributions.
Performance – Enable the City & County to correlate the above parameters to current forest stewardship policies and practices, including but not limited to pruning standards and cycles, planting practices, tree removal work, age / species diversity and tree protection.
Sustainability – Utilize research results to identify and project the impact to forest vitality and sustainability from alternative management strategies different from those applied in the past. Possible alternative strategies where tradeoffs will be studied include conversion to smaller, native, drought-tolerant species, expanding tree planting and green space initiatives, and selection and placement of large species to improve energy conservation, air quality, and reduction of glare for the well being of the community and public health.
Highlights: Beyond urban forestry, a wall-to-wall land cover classification is useful in sustainable land use planning and modeling stormwater runoff, air quality, public health/safety and wildfire risk. Some of the classes listed above will be further sub-classified. Although 4-band multispectral imagery does not allow for species-specific

mapping in most cases, the trees land cover layer will be sub-classified into 10 or more unique classes by their spectral characteristics through two unique processes. The resultant classification may include some individual species (e.g. Russian-Olive, Blue Spruce, highly chlorotic trees) but mostly will highlight grouping of genus or species types, thus testing and enabling the identification of distribution, structure and diversity of the urban forest. The first process will analyze July 2005 QuickBird imagery and is expected to produce 5-7 classes. Taking this one step further, the 2nd process will leverage fall colors in late October QuickBird imagery and classify the tree canopy into more groupings. After identifying land use and land cover and further classifying tree species, etc NCDC will additionally create tree canopy metrics for researching urban forest vitality, structure, distribution and diversity will include CITYgreen reports, LiDAR-derived height and structure as well as vegetation indices from the multispectral satellite imagery. American Forests' CITYgreen software is an extension to ArcGIS and places a dollar value on the environmental benefits of urban trees.

Results/Impacts: Remote sensing and GIS products will provide Salt Lake City and other stakeholders with information used to research and test performance and sustainability of the urban forest as well as target and improve land use planning, greening and conservation programs. NCDC will perform the proposed mapping services using internally developed high-resolution land cover mapping algorithms.

Professional Qualifications of Staff and Relevant Experience

Employees at NCDC bring to the project between one and ten years of experience each, with imagery and GIS analysis. All employees hold, at minimum, a four year degree from various Universities and Colleges around the United States in the field of geography and environmental studies. NCDC as a company embraces the concept of good land management and environmental protection and aspires to creating the highest quality products.

Jason San Souci is Vice President of Geospatial Applications at NCDC. He is an Authorized Training Partner (ATP) of ESRI and the only certified trainer of Feature Analyst from Visual Learning Systems. He has been with NCDC since 2002, is a Certified GIS Professional (GISP), active member of ASPRS, on the Board of Trustees for TreeLink.org, and is Chairman of the Internal Outreach Committee for GISCI. His educational background includes a Master of Engineering from University of Colorado, Colorado Springs and Bachelor of Science from the U.S. Air Force Academy.

Ian Hanou is the Business Development Manager at NCDC. He formerly worked for three years at DigitalGlobe, Inc., the owner and supplier of QuickBird satellite imagery, the highest resolution, commercially available imagery in the world. Mr. Hanou has seven years experience in remote sensing and GIS applications pertaining to forest management, environmental remediation, natural resource management, water

resources and the agriculture industry. He is an active and participating member of the Indiana Arborist Association, Wisconsin Arborist Association, Society of American Foresters (SAF), National Arbor Day Foundation and Colorado's Front Range Urban Forest Council. His educational background includes a Bachelor of Science in Forest Management and Spatial Information Management Systems from Colorado State University.

Michaela Parlin is Production Manager at NCDC. She has 8 years experience in the orthophotography production industry. In a previous position as Sanborn Mapping Company's Data Manager and Operations Project Coordinator, she participated in and helped manage large projects including but not limited to, a recurring project involving statewide aerial acquisition for 6 whole states simultaneously, all of which were areas of interest in the annual NAIP-National Agricultural Imagery Program for the USDA/FSA/APFO. (NAIP involves the acquisition of imagery during Continental US agricultural growing seasons: this program required that all aspects of collection and delivery of end user product be completely delivered within one year. The timelines were extremely stringent, only 30 days to deliver initial product, a CCM-County Compressed Mosaic for the FSA's initial assessment from time of acquisition; 90 days to deliver DOQQ's and metadata for imagery included in the CCM.) She was responsible for assisting the PM's in overseeing the daily progress of 5-7 aerial vendors, 2-3 film processing vendors, and the inter-departmental flow of data, including gps processing, in-house scanning, production of AT photo files/AT blocks, digital acquisition management and workflow, task scheduling, monitoring and tracking daily aerial acquisition in dynamic SQL database/proprietary software, coordinating on technical issues between engineering team and production floor, quality assurance, updating and managing status reports, and all aspects of data management company-wide as well as per project. Her educational background includes a Bachelor of Arts in Geography and Environmental Studies from the University of Colorado, Colorado Springs and a 2-year degree in Applied Sciences from Pikes Peak Community College.

Dara Lynn is a Project Manager at NCDC. She has 10 years of experience working with Geographical Information Systems and is a certified GIS Professional. She holds a Bachelor of Arts degree in Physical Geography, with a minor in Environmental Studies, which she obtained from the State University of New York at Buffalo. She further received a Master's degree in Natural Resource Management from the University of Alaska at Fairbanks where she prepared research for a thesis titled, *Deforestation in Bosnia using GIS and Remote Sensing.* The research included interpreting and classifying Landsat Thematic Mapper images.

Small Business Economic Development Advocacy Program

NCDC qualifies as a Small Business Enterprise (SBE) according to the Small Business Administration's (SBA) size standard for a small business (both in number of employees and average annual receipts). According to SBA's website, "To qualify as a small business concern for most SBA programs, small business size standards define the maximum size that a firm, including all of its affiliates, may be. The SBA has established two widely used size standards – 500 employees for most manufacturing and mining industries and $6.5 million in average annual receipts for most non-manufacturing industries." They continue in saying that "For the service industries, the most common size standard is $6.5 million in average annual receipts," and added that "there is no "official" certification process that determines a small business. It is a self-certifying and paperless procedure."

NCDC imaging

Cost Estimate

1235 Lake Plaza ǀ Suite 127
Colorado Springs, CO 80906
Phone 719.579.9276   Fax 719.632.5614

DATE   6/30/2008
Quotation #   220
Customer ID   1196-278-29

Prepared For:
Merlyn Cummings
President
Goleta Valley Beautiful
69 Calaveras Avenue
Goleta, CA 93117
(805) 685-7910

Quotation valid until: 7/30/2008
Prepared by: Michaela Parlin

Goleta Valley Beautiful, California Landcover Mapping 2008	PRICE
Landcover Mapping - 6-Class -- to include trees/forest, grass-irrigated and non-irrigated, impervious surfaces, water, and bare soil. Land cover map output in vector, ESRI shapefile format, CA State Plane Coordinate System, Zone 5, feet	$7,800.00
UTC Analysis, Tree Cluttering, and Potential Planting Site - Methodology Report, Parcel Statistics, Tables, Charts, Graphs, accuracy assessments, and Maps of Existing UTC and Possible UTC Shapefiles in ESRI (.shp) format output in CA State Plane Coordinate System, Zone 5, feet	$7,000.00
Data Delivery and Media	$50.00
Multispectral Imagery - 2008 Ortho-Rectified QuickBird Imagery - 4-Band Multispectral, 2-foot resolution	$2,600.00
Total	**$17,450.00**

Please contact Michaela Parlin (719-579-9276) if you have any questions concerning this quotation.
mparlin@ncdcimaging.com

Submitted: _____   Date: 30-Jun-08
Michaela Parlin, NCDC