

THE BOARD OF SUPERVISORS OF THE COUNTY OF STANISLAUS
ACTION AGENDA SUMMARY

DEPT: Environmental Resources

[Handwritten initials]

BOARD AGENDA # *B-3

Urgent

Routine

AGENDA DATE November 4, 2008

CEO Concurs with Recommendation YES NO

(Information Attached)

4/5 Vote Required YES NO

SUBJECT:

Authorization to Enter into an Agreement with the California State University, Fresno Foundation for Continuation of a Food Processing By-product Research Project

STAFF RECOMMENDATIONS:

1. Authorize the Director of Environmental Resources, or her designee, to enter into an agreement with the California State University, Fresno Foundation for continuation of the Food Processing By-product Research Project for an amount not to exceed \$80,000 for Fiscal Years 2008-2009 and 2009-2010.
2. Direct the Auditor-Controller to set up appropriations and estimated revenue in the amount of \$47,197.76, per the attached Budget Journal, for Fiscal Year 2008-2009.

FISCAL IMPACT:

On February 12, 2008, the Board of Supervisors authorized the Department of Environmental Resources to contribute up to \$30,000 to partially fund the Food Processing By-product Research Project during the 2008-2009 Fiscal Year. The Board had previously authorized the creation of an interest-bearing special revenue fund for this research project.

(Continued on next page)

BOARD ACTION AS FOLLOWS:

No. 2008-752

On motion of Supervisor Grover, Seconded by Supervisor Monteith
 and approved by the following vote,
 Ayes: Supervisors: O'Brien, Grover, Monteith, and Vice Chairman DeMartini
 Noes: Supervisors: None
 Excused or Absent: Supervisors: Mayfield
 Abstaining: Supervisor: None

- 1) Approved as recommended
- 2) Denied
- 3) Approved as amended
- 4) Other:

MOTION:

Christine Ferraro

ATTEST: CHRISTINE FERRARO TALLMAN, Clerk

File No.

FISCAL IMPACT (Continued):

The Director of the Department of Environmental Resources was further authorized by the Board to accept funding from public and private sources desiring to contribute to this research project and granted approval to assess a \$0.10 per ton fee on food processing by-products used at permitted sites within Stanislaus County.

It is estimated that approximately \$20,000 will be collected from the Research Project Surcharge fee on the use of food processing by-products in Stanislaus County each year for Fiscal Years 2008-2009 and 2009-2010. These monies are deposited into Fund 1011, ER Food Processing By-products Research Project, which has a current balance of \$7,197.76.

The annual contributions for Fiscal Years 2008-2009 and 2009-2010, will come from a combination of Fund 1011 monies and up to \$30,000 from the Department's main budget, for a total of \$40,000 per contribution and will not exceed \$80,000 total.

DISCUSSION:

Stanislaus County has been involved in the research and development of programs supporting the reuse of materials that otherwise would be disposed of as waste products. Food processing by-products have become an essential commodity within the agricultural community, and the Department of Environmental Resources (Department) has worked closely with various state and local agencies, universities, the agricultural community, private industry, by-product haulers, and site operators to develop best management practices to handle the reuse of food processing by-products to minimize negative impacts to the environment and to prevent nuisance conditions. For 30 years, the program has successfully controlled nuisance conditions, recycled a valuable resource, and offered the local food processing industry an economically viable reuse option for what once was a production liability.

On June 13, 2006, the Board of Supervisors authorized the Director of the Department of Environmental Resources to support a Tentative Resolution with the Central Valley Regional Water Quality Control Board (CVRWQCB) regarding the reuse of food processing by-products utilized at permitted sites within Stanislaus County. The Tentative Resolution has allowed permitted sites in the Stanislaus County Food Processing By-product Use Program (Program) to continue to operate while progress is made toward the completion of Phase I of a research project to determine if the Program provides adequate protection of both surface and groundwater.

The Tentative Resolution, formally adopted by the CVRWQCB on June 22, 2006, included the following deliverables for Phase I of the research project: a review of relevant literature, a technical review of collected Program data, the development of a field-ready manual of best practices, and an Ordinance that provides for implementation and enforcement of the Program that assures adequate protection of soil and groundwater from the intrusion of deleterious constituents. An Ordinance for the Program was adopted on February 26, 2008, and the remaining Phase I research project deliverables will be completed by March 2009.

The Department has been involved in the research project collectively with the California State University, Fresno Foundation (CSUF Foundation) and project collaborators and cooperators, together with the CVRWQCB to scientifically evaluate and mitigate potential environmental impacts to soil and groundwater as a result of the land-application of food processing by-products at permitted sites. As a result of the scientific data that has been collected, the Ordinance that has been adopted and enforced, and the continued work of this research effort, the CVRWQCB has drafted language for the *Tentative Conditional Waiver of Reports of Waste Discharge and Waste Discharge Requirements for Specific Types of Discharge Within the Central Valley Region* that, when renewed in the coming months, would allow an approved County program like the one in Stanislaus County to provide oversight for permitted sites under this Waiver.

In order to fully obtain status as an approved County program, additional data is needed to scientifically support program guidelines and to identify environmental impacts requiring mitigation measures. This continued scientific research is what constitutes Phase II of the Research Project. The CSUF Foundation has indicated that Stanislaus County's obligation will not exceed \$80,000 in the proposed contract (Attachment "A") for the Phase II Research Project.

The Phase II Research Project Scope of Work includes: the collection and analysis of plant tissue samples, the study of soil moisture content, bench-scale studies to evaluate the movement of irrigation water and salts/solutes in different soil types, review of scientific documents, and revision of the *Manual of Best Practices for Application of Food Processing By-products on Farmlands (July 2007)*. Details of the proposed Phase II Research Project Scope of Work are included in the "Work Plan on Land Application of Food Processing By-products in Stanislaus County – Phase 2: *Developing Best Management Practices for the Application of Food Processing By-products on California Farmlands*" (Attachment "B," on pages 7-10).

In addition to the Department's contributions for Fiscal Years 2008-2009 and 2009-2010, the California State University Agricultural Research Initiative (ARI) System grant will provide \$155,000 toward the Phase II Research Project. In-kind service matches from Stanislaus County (totaling \$20,600), Mape's and Dos Rios Ranches (totaling \$30,000), and Del Monte Foods (totaling \$30,000) will also be contributed toward the Phase II Research Project budget.

The Phase II Research Project total budget includes:

- ARI grant funding of \$155,000
- Stanislaus County cash contribution of \$80,000
- In-kind match contributions of \$80,600

The total budget for the Phase II Research Project is \$315,600.

Authorization to Enter into an Agreement with the California State University, Fresno
Foundation for Continuation of a Food Processing By-product Research Project
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In order for Stanislaus County to make the Fiscal Year 2008-2009 contribution of \$40,000 to the CSUF Foundation, appropriations and estimated revenue must be set up per the attached Budget Journal form (Attachment "C"). The project budgets are included as Attachment "B," on pages 22-24, for reference.

POLICY ISSUE:

The Board of Supervisors should determine if entering into an agreement with the California State University, Fresno Foundation for continuation of a Food Processing By-product Research Project is consistent with the Board's priorities of a strong agricultural community/heritage, a healthy community, effective partnerships, and a well-planned infrastructure system. Programs such as the reuse of food processing by-products also help the County meet mandated landfill diversion requirements.

STAFFING IMPACTS:

There are no staffing impacts associated with this item.



BOARD OF SUPERVISORS

2010 DEC -8 A 11: 46

DEPARTMENT OF ENVIRONMENTAL RESOURCES

3800 Cornucopia Way, Suite C,

Modesto, Ca 95358-9492

Phone: (209) 525-6700

Fax: (209) 525-6774

**AGREEMENT FOR PROFESSIONAL SERVICES
BETWEEN
CALIFORNIA STATE UNIVERSITY, FRESNO FOUNDATION
and
STANISLAUS COUNTY**

WHEREAS, Stanislaus County, hereinafter referred to as "**the County**", requires knowledge of short and long-term environmental impacts resulting from direct land application of food processing by-products as set forth in the County Program requirements "County Code, Title 9, Chapter 9.88" and

WHEREAS, the California State University, Fresno Foundation hereinafter referred to as "Contractor," has previously assisted the County in Phase I of this effort, and is willing and able to assist the County in completing Phase II of this effort as set forth in this agreement;

NOW THEREFORE, Stanislaus County and the Contractor agrees as follows:

**ARTICLE I
SCOPE OF SERVICES**

- A. The **Contractor** agrees to contribute to the overall goals and objectives of the Funding Contract by providing professional and/or technical services to **the County**, in accordance with and pursuant to the details of this Agreement for Professional Services, and specifically **Attachment A – Scope of Work**, which is attached hereto and incorporated herein by this reference ("Work").
- B. The **Contractor** shall perform the specified Work and shall furnish all labor, materials, supplies, equipment, supervision, and services for the incident to the performance of the Work.
- C. The Services covered by this Agreement shall be performed in accordance with the provisions herein, including all Attachments A and B.
- D. With respect to the required Work, the **Contractor** agrees to be bound to **the County** except as expressly provided herein.
- E. In consideration of services rendered, **the County** agrees to pay the **Contractor** in accordance to the provisions of Article IV.

**ARTICLE II
GENERAL PROVISIONS**

- A. This Agreement, including attachments, shall form the entire agreement and understanding between **the County** and the **Contractor**. Except as provided in Article VII hereof, no other written or verbal statements, shall be binding upon the parties or construed as modifying this Agreement in any way.
- B. The governing law of this Agreement shall be the law of the State of California, excluding its choice of law provisions. The parties agree that Fresno County is the sole proper venue for the litigation of any and all disputes arising out of or relating to this Agreement.
- C. The **Contractor** is an independent contractor and will maintain complete control of and responsibility for its employees, agents, methods, and operations.
- D. Execution of the Agreement by **the County** will be authorized for the **Contractor** to proceed with the Work and Services specified herein.
- E. Programmatic and Fiscal Communications to **the County** shall be directed to:

Name: Sonya K. Harrigfeld
Title: Director
Address: Stanislaus County Department of Environmental Resources
3800 Cornucopia Way, Suite C
Modesto, CA 95357
Phone: (209) 525-6700 FAX: (209) 525-6773
Email: harrigfeld@envres.org

Programmatic Communications to **Contractor** shall be directed to:

Name: Joe Bezerra
Title: Executive Director/Director of Operations
California State University Agricultural Research Initiative (ARI)
Address: California Agricultural Technology Institute (CATI)
2910 E. Barstow Avenue M/S OF115
Fresno, CA 93740-8009
Phone: (559) 278-2361 FAX: (559) 278-4849
Email: buzzb@csufresno.edu

Fiscal Communications to **Contractor** shall be directed to:

Name: Linda Christian
Title: Grant Accounting Supervisor
Address: 4910 N. Chestnut
Fresno, CA 93726
(559) 278-0852 FAX: (559) 278-0992
Email: lindacar@csufresno.edu

ARTICLE III
TERM

The term of this Agreement shall be from September 1, 2008 through August 31, 2010.

**ARTICLE IV
CHARGES, INVOICING, AND PAYMENT**

- A. The total to be paid by **Stanislaus County** to the contractor shall not exceed **\$80,000.00** for the period indicated above. The **Contractor** will submit, in arrears, an itemized invoice along with supporting documentation, to Stanislaus County on a quarterly basis for services rendered in accordance with specified line items in **Attachment B, Itemized Budgets**. The final invoice shall be received no later than August 31, 2010.
- B. Within 20 business days following receipt of invoice, and subject to the provisions of Article IV (A), Stanislaus County will pay the **Contractor** for the approved invoice amount.

**ARTICLE V
INDEPENDENT CONTRACTOR STATUS**

This Agreement is by and between two independent contractors, and is not intended to and shall not be construed to create the relationship employer, employee, partnership, agent, servant, or joint venture with the **Contractor** or any persons employed by or representing the **Contractor** including subcontractors or employees thereof. The **Contractor** shall control the manner and means of accomplishing the performance of the Agreement.

**ARTICLE VI
INSURANCE AND INDEMINIFICATION**

- A. The **Contractor** shall maintain throughout the period of this Agreement the following insurance coverage, which shall be written on an "occurrence" basis:
 - 1. Worker's Compensation and Employer's Liability insurance, as required by law;
 - 2. Comprehensive General, Bodily Injury, and Property Damage Insurance, with \$1,000,000 combined single limits; and
 - 3. Comprehensive Automobile Liability for owned and rented/leased vehicles, including Bodily Injury and Property Damage coverage, with \$1,000,000 combined single limits.
- B. Unless otherwise expressly set forth in this Agreement, each party shall indemnify, defend, and save harmless the other, and their various directors, officers, agents, employees, boards, commissions, and departments, from and against all and all loss, damages, suits, claims (including actions by administrative agencies), penalties, costs, liabilities and expenses (including, but not limited to, a reasonable investigation, legal and paralegal expenses), that may arise out of this Agreement or the parties' respective performance hereunder provided that any such loss, damages, suits, claims, penalties, costs, liabilities and/or expenses does not arise out of the intentional or negligent acts or omissions of the indemnitee or its various directors, officers, agents, employees, boards, commissions, and departments.

**ARTICLE VII
MODIFICATIONS**

The terms of this Agreement and its attachments may be modified or amended only by a written instrument signed by both parties hereto.

**ARTICLE VIII
INCORPORATED TERMS**

The following General Terms and Conditions are hereby incorporated:

- A. OMB Circulars A-21, A-110 and A-133.
<http://www.whitehouse.gov/obm/circulars/index.html>

Use A-87 when contracting with State and Local Government and Tribal entities.

**ARTICLE IX
DISPUTES**

The parties may pursue their respective remedies at law or equity for any claim, controversy, or dispute relating to this Agreement.

**ARTICLE X
NON-ASSIGNMENT**

Neither party shall assign, transfer, or further subcontract this Agreement, in whole or in part, without prior written approval of the other.

**ARTICLE XI
SEVERABILITY AND SURVIVAL**

If any of the provisions herein are held for any reason to be invalid, illegal, or unenforceable in any respect, such invalidity, illegality, or unenforceability will not effect any other provision, and this Agreement will be construed as valid, legal and enforceable in all other respects.

**ARTICLE XII
TERMINATION**

- A. Each party retains the right to terminate this Agreement without cause upon thirty (30) days' advance notice to the other. Each party retains the right to terminate this Agreement for cause upon twenty-one (21) days' advance written notice to the other, which notice shall specify the cause.
- B. After termination, the Contractor will be reimbursed for Services rendered and necessary expenses incurred to the termination date upon submission of an invoice to Stanislaus County.

**ARTICLE XIII
ENTIRE DOCUMENT**


This Agreement represents the entire agreement between the parties and supersedes all prior agreements and understandings.

(signatures on the next page)

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed by their duly authorized representatives, as follows:

CONTRACTOR

California State University, Fresno Foundation
4910 N. Chestnut
Fresno, CA 93726
(559) 278-0850 / FAX (559) 278-0992

By 
Thomas McClanahan
Associate Vice President, CSUF-ORSP

Date 11/25/08

By 
Keith Kompsi
Director, Foundation Financial Services

Date 11-25-08

STANISLAUS COUNTY

County of Stanislaus
Department of Environmental Resources
3800 Cornucopia Way, Suite C
Modesto, CA 95351
(209) 525-6700

By 
Sonya K. Harrigfeld
Director

Date 11/10/08

Approved as to Form:
John P. Doering
County Counsel

By 
John P. Doering
County Counsel



Work Plan on Land Application of Food Processing By-products in Stanislaus County

Phase II:

*Developing Best Management Practices
for the Application of Food Processing
By-products on California Farmlands*

**DEVELOPING BEST MANAGEMENT PRACTICES FOR THE
APPLICATION OF FOOD PROCESSING BY-PRODUCTS ON
CALIFORNIA FARMLANDS**

Principal Investigator:

Dr. Sajeemas (Mint) Pasakdee, Soil Scientist/Agronomist
California Agricultural Technology Institute, California State University Fresno,
2910 East Barstow Ave., M/S OF115, Fresno, CA 93740
Tel. 559-278-2828
Fax. 559-278-4849
Email: spasakdee@csufresno.edu

Co-Principal Investigators:

Dr. Horacio Ferriz, Geologist
Department of Physics and Geology, California State University, Stanislaus
801 W. Monte Vista Ave.
Turlock, CA 95382
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Nat Dellavalle, Certified Professional Agronomist/ Soil Scientist
Dellavalle Laboratory, Inc.
1910 S. McKinley Ave., Suite 110
Fresno, CA 93728
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Email: ndellavalle@dellavallelab.com

Collaborators:

Sonya Harrigfeld, Director
Stanislaus County Dept. of Environmental Resources
3800 Cornucopia Way, Suite C, Modesto, CA 95358
Tel. 209-525-6770
Email: sharrigf@envres.org

Cooperators:

William (Bill) J. Lyons, Jr.
Mape's Ranches & Lyons' Investments
10555 Maze Rd., Modesto, CA 95358
Tel. 209-522-1762

Email: maperanch@aol.com

Martin Reyes, Stanislaus County Residue Use Committee
P.O. Box 56, Winton, CA 95388
Tel. 209-605-4079
E-mail: martin_reyes1@netzero.net

James Mortensen
Del Monte Foods-Plant No 1
4000 Yosemite Blvd., Modesto, CA 95357-6008
Tel. 209-527-3850, ext.223
Email: jim.mortensen@delmonte.com

Anticipated Project Timeline: **September 1st, 2008 to August 31st, 2010**

ARI Research Focus Areas: **1) Food Science 2) Public Policy**

ARI Funding:

Total	\$155,000
FY 2008-09	\$ 75,000
FY 2009-10	\$ 80,000

Matching Fund:

Total	\$160,600
Cash match (Stanislaus County)	
FY 2008-09	\$ 40,000
FY 2009-10	\$ 40,000
In-kind match (Stanislaus County)	
FY 2008-09	\$ 10,300
FY 2009-10	\$ 10,300
In-kind match (Industries)	
FY 2008-09	\$ 30,000
FY 2009-10	\$ 30,000

Anticipated Outcomes:

- anticipated impacts of the research on California agriculture
- presentation of results at industry and/or professional meetings
- consumer/industry-oriented publications that will be notified of research results
- publications that are likely to carry news articles

- refereed journal publications
- graduate thesis/senior projects
- number of graduate and undergraduate students to be employed
- equipment to be purchased or donated
- student research assistant quotes about the impact on their learning and career opportunities
- other (identify)

DEVELOPING BEST MANAGEMENT PRACTICES FOR THE APPLICATION OF FOOD PROCESSING BY-PRODUCTS ON CALIFORNIA FARMLANDS

PROJECT SUMMARY

The food-processing sector is one of the leading agricultural industries in California. Canneries, especially those that use raw fruit, nuts, and vegetable inputs, generate various types of food processing by-products or non-hazardous wastes. The application of such food processing by-products to agricultural farmlands, while certainly not new, has become an integral part of the industry. This practice is important not only for recycling nutrients back to the soil, but also for minimizing those elements of concern (e.g. nitrogen, sodium, and trace elements) that would otherwise be concentrated elsewhere. Land-application of non-hazardous wastes is projected to rise because of the public concerns regarding environmental impacts of their disposal to landfills, or incineration, and because of their perceived inherent agricultural benefits.

In partnership with local government, food processors, and growers, the Stanislaus County Food Processing By-Product Use Program (the Program) has managed the reuse of food processing by-products (solid, semi-solid, and slurry form) as a soil amendment since 1987. Although the Program has restrictive regulations for the handling and spreading of by-products, the California Regional Water Quality Control Board - Central Valley Region (RWQCB) has expressed concerns on the impacts of land-application of food processing by-products, which may have low pH, high TDS, and trace elements, insofar as this practice may impair soil and groundwater quality after its application on California farmlands (constituents of food processing by-products vary depending on the source of raw material and the substances associated with the canning processes).

We propose a multi-year study to continue to investigate and address this issue. The major goal of this work is to develop best management practices (BMPs) of sustainable reuse of food processing by-products as a soil amendment on California farmlands. We propose to monitor the fates of food processing by-products through the soil profile, crop removal of certain components, and the influence they might have in surface- and groundwater chemistry. In addition, we will perform an economic analysis of this practice. The result of this study will provide society and policy makers data to better understand impacts of food processing by-products application to agricultural farmlands based on available scientific-based information.

A. STATEMENT OF THE PROBLEM

The food processing industries in California are the leading producers of processed fruits and vegetables (Reed, 2006). More than 45% of the world processed tomato products, and 100% of the U.S. supply of canned peaches, fruit cocktail, and black ripe olives are produced in California (CLFP, 2006). These industries generate various types of food processing by-products or wastes, whose constituents vary depending on the source of raw materials and the substances associated with the canning processes.

The compositions of by-products often have high variability even though they are made of similar raw material. A number of factors, for example, the differences in crop variety, farming location (soil type and/or land history), and fertility practice (soil management) can

significantly influence concentrations of various elemental components in fresh fruits and vegetables in different ways. For instance, peach juices obtained from three cultivars showed distinctive nutrient compositions from one another (Versari et al., 2002). Particularly, various chemicals used during the canning processes such as for peeling and disinfection are ultimately collected in the waste stream, mixed with discarded raw materials, and become by-products' constituents.

The elemental composition of by-products consists of macro- and micronutrient, and trace elements similar to agricultural residues collected from various farmlands. However, enrichments of some elements occurred during processing and accumulated in by-products. Organic acid contents of fruit induces lower pH of by-products, while, salt accumulates from concentrated fruit and some chemicals utilized during the peeling or washing processes such as salts from sodium- and/or potassium-based materials.

The application of food processing by-products to agricultural farmlands, while certainly not new, has become increasingly widespread. This practice is important not only for the recycling nutrients back to the soil, but also for minimizing those elements of concern (e.g., nitrogen, sodium, and trace elements) that would otherwise be concentrated elsewhere. Land-application of non-hazardous wastes (e.g., food processing by-products) is projected to rise because of public concerns regarding environmental impacts of their disposal to landfills, or incineration, and because of their perceived inherent agricultural benefits (O'Connor et al., 2005).

The management of raw food processing by-products applied on farmlands can be safely performed to minimize detrimental impacts on soil and water quality (Singh et al., 2002). Interestingly, a large number of studies have focused on the use of these food processing by-products after being composted with other raw materials e.g. (Schaub and Leonard, 1996) rather than on studying the potential impacts of direct application of these materials on farmlands. Although composting helps produce a stabilized and homogenous product, and eliminates odor and potential pathogens (Gardiner and Miller, 2004), some researchers have reported that the production of compost from these materials was not economically feasible (McPartland, 2005).

Characteristics of low pH, medium to high total dissolved solids (TDS) and salinity (electrical conductivity or EC) of by-products may impair soil and water quality after a land application especially when they are not properly disposed and/or managed based on critical limit of elements of concerns under current farming conditions. However, such careful operations of land-applied by-products can provide a variety of essential plant nutrients as a substitute for commercial fertilizer as well as an organic source or soil amendment. Farmers can benefit from utilizing by-products on farmlands when they can reduce the need to buy fertilizer because by-product fertilizer-replacement value is feasible (Huang and Lu, 2000). They conclude that agricultural use of by-products can be the most economical way to manage an increasing amount of by-products generated by the growing population and economy.

The majority of California food processors are located in Central Valley region. The monitoring and reporting program developed by Department of Environmental Resources of Stanislaus County since 1987 fosters reuse of food processing by-products through land application, direct animal feed, dehydration, and composting (Harrigfeld, 2006). Although, this program was established to address a sustainable reuse option of food processing by-products, and especially to minimize their disposal in landfills, no scientific research had been conducted to assess the long-term effects of land application of these by-products on soil and water quality, and the economic feasibility of these operations. In addition, the RWQCB has expressed concerns about the potential impacts that land application of food processing by-products (which

could have low pH, high TDS, and trace elements) may degrade soil and groundwater quality after its application on California farmlands (Wyels, 2006).

The overall goal of this research project is to study and develop meaningful scientific understanding of the food processing by-products characteristics and the processes affecting their fates in the soil profile and groundwater, to study cost-effectiveness of applications of food processing by-products, and especially to develop a best-management practices program to ensure their sustainable applications on California farmlands.

This multidisciplinary team of researchers will conduct a two-year field research on effects of land-applied food processing by-products on soil and groundwater quality, and economic feasibility of this operation. The objectives of this study are:

1. To monitor the fates of food processing by-products through the soil profile, crop removal of certain components, and the influence they might have in surface- and groundwater chemistry.
2. To study cost-effectiveness of potential reuses of food processing by-products under various scenarios.
3. To develop a BMPs program that identifies the sustainable land application of food processing by-products on farmlands.

B. STATEMENT OF METHODOLOGY

We will use various analytical methods to assess on-farm plant nutrient, salt, and trace element budgets via crop removal and their movement through the soil profile. In addition, we will conduct basic modeling of soil and solute transport to investigate the movement of these by-products to surface- and groundwater. If modeling yields reasonable results, then we will recommend its use as a management tool for planning of application operations at different sites in California. In the course of this study we intend to address the following data gaps:

- 1. To establish crop nutrient balance from fields receiving by-products as a soil amendment*

We propose to collect plant tissue samples from various annual crop rotations in Stanislaus County. This study will improve our understanding of crop nutrient removal patterns from different types of by-products in various soil types. We will utilize these data to assist growers to decide on an appropriate crop pattern and how to sustainably apply by-products as a part of their fertilizer program. Growers will be able to maximize crop nutrient use efficiency, minimize nutrient loss, and preserve soil and water quality.

- 2. To monitor soil moisture content change after by-product applications*

We propose a repeat field study to investigate how soil moisture content at 0-7.5, 7.5-15, 15-22.5, and 22.5-30 cm depths will change over time after an application of by-products. We will collect soil samples before by-product application and 3 hours, 2 days and 8 days following by-product application.

- 3. Experimental field studies (site by site comparison, loading rate studies, and/or forage quality comparison)*

4. *Revising Manual of Best Practices for Application of Food Processing By-products on Farmlands (July 2007) with the update information*

We will update the current manual with additional information collected during the course of this study during Phase 1 and 2. For example, the rate of nutrient removal by various forage crops and the nutrient management plan for by-products application.

5. *Modeling studies for irrigation water movement on sites receiving by-products*

We propose to measure the movement of irrigation water through lysimeters. The lysimeters are Schedule 40 PVC cylinders, 18 inches in diameter and 24 inches high, which are sealed at the bottom and filled with soil. A valve at the bottom allows for withdrawal of water that has infiltrated to the bottom. From measurements of the input and infiltrated volume one can estimate, by difference, the amount of water removed by evapotranspiration.

The experimental setup for tasks 5 and 6 consists of 10 lysimeters. Lysimeters L-1 through L-5 will be filled with a sandy soil, whereas lysimeters L-6 through L-10 will be filled with clayey soil. Lysimeters L-1 through L-5 will be dosed with 250 grams of dried and aged poultry manure to add nitrogen and organic matter to the upper 3 inches of the sandy soil. The clayey soil used for lysimeters L-6 through L-10 has high content of organic matter and needs no additional amendments. Lysimeters L-1, L-2, L-6, and L-7 will be used for control and will not receive fruit and vegetable “byproducts”. Lysimeters 1 and 6 will be instrumented with soil moisture sensors installed at depths of 2, 6, 10, 14, and 18 inches. Data will be collected at 15-minute intervals by a data logger.

All ten lysimeters will be “flooded” for one week, to achieve total saturation of the soil. Afterward, all ten lysimeters will be allowed to equilibrate for one week before six of them receive an application of fruit and vegetable “byproducts”. Lysimeters L-3 through L-5, and L-8 through L-10 will each be dosed with two quarts of commercial fruit cocktail, two quarts of commercial canned tomatoes, one gram of KI and one gram of CuSO_4 . The purpose of this dosing is to have an identifiable anion (iodide) that can serve as proxy for the behavior of Cl, and an identifiable cation (copper) that can serve as a proxy for the behavior of heavy metals. The fruit-vegetable mixture will be allowed to air dry for one week, and will afterward be mixed with the upper three inches of the soil. After another week a rye grass will be planted in all 10 lysimeters, and “irrigation” will start on a weekly basis by applying 2 inches of water every Sunday evening.

Every Saturday evening the spigot at the base of each lysimeter will be opened, and the water that had infiltrated to the bottom of each lysimeter will be collected overnight. The volume will be carefully measured, and samples will be collected for chemical analysis. Infiltrated volume will be compared with input volume, and with the advance of the moisture front as recorded by the moisture sensors in L-1 and L-6.

Once a suitable database is recorded (1 month), the data will be used to calibrate an unsaturated flow model. At this time we are trying to get permission to use MIN3P (Mayer, 1999), the same modeling program used in the Hilmar study. [Mayer, K.U.,

1999. A numerical model for multicomponent reactive transport in variably saturated porous media. Ph.D. thesis, Department of Earth Sciences, University of Waterloo.]

The final deliverable for this task will be a summary of the experimental data, and a determination of the reproducibility of the experimental results by the MIN3P model.

6. *Modeling studies for salt/solute movement on sites receiving by-products*

The same experimental setup described in Task 5 will be used to document salt/solute movement. Once a week two statistically independent samples of irrigation water will be taken, and at the end of the week samples will be collected from each of the 10 lysimeters. pH and electric conductivity will be measured in the field, after which the pH of the sample will be adjusted to 5 to keep the ions in solution. The 12 samples collected every week will be submitted to the analytical laboratory retained by the project (UC Davis), but a split will be analyzed by the research team to provide “real time” monitoring of some parameters (e.g., nitrate, sodium, chloride, iodide, copper, TDS, and FDS).

Lysimeters L-1 and L-2 will provide control for the “no-byproducts” case in sandy soil, while lysimeters L-3, L-4, and L-5 will measure the extent of solute movement through the 22-inch sandy soil column. Likewise, lysimeters L-6 and L-7 will provide control for the “no-byproducts” case in sandy soil, while lysimeters L-8, L-9, and L-10 will measure the extent of solute movement through the 22-inch clayey soil column.

Once a suitable database is recorded (3 months), the data will be used to calibrate an unsaturated mass transport model. At this time we are trying to get permission to use MIN3P (Mayer, 1999), the same modeling program used in the Hilmar study. The model includes advective-dispersive transport in the water phase, and allows the analysis of problems involving inorganic and organic chemicals. Geochemical reactions considered are hydrolysis, complexation, oxidation-reduction, ion exchange, gas dissolution-exsolution and dissolution-precipitation reactions. A general kinetic formulation is included for intra-aqueous and dissolution-precipitation reactions. Microbially mediated reactions can be described using a multiplicative Monod formulation.

The final deliverable for this task will be a summary of the experimental data, and a determination of the reproducibility of the experimental results by the MIN3P model.

7. *To review previous studies on reuse of other types of by-products on California farmlands, and to establish proper management and controls that are more appropriate for land-application of fruit processing by-products.*

We propose to review the following reports:

- (a) *Hilmar Supplemental Environmental Project*, submitted to the California Regional Water Quality Control Board Central Valley Region In Compliance With Order No. R5-2006-0025 by Rubin et al. (2007)
- (b) *Wine Institute Project*, submitted to California Regional Water Quality Control Board Central Valley Region in compliance with Resolution No. R5-2003-0106

(c) *Manual of Good Practice for Land Application of Food Processing/Rinse Water*, prepared for California League of Food Processors by Brown and Caldwell & Kennedy/Jenks Consultants (March 14, 2007)

C. PROJECT TIMELINE

We propose a two-year study to conduct a field research in Modesto, CA between September 1st, 2008 and August 31st, 2010. The detailed research activities and their timelines are shown on Attachment 1.

D. DISSEMINATION PLAN

The food processing industries in California are the leading U.S. producers of processed fruits and vegetables. Increasing demand of processed fruits and vegetables is anticipated because consumers prefer conveniently stored products. In addition, an expansion of land-applied organic wastes is projected to rise because of the public concerns regarding environmental impacts and economic restraints of their disposal to landfill or incineration.

A number of parties are involved in this research project. Food processors, farmers, government agencies, and universities come together to address this issue raised by the RWQCB. Our results will develop a meaningful guideline for sustainable reuse of food processing by-products on California farmlands. Our goals are to establish the BMPs of land-applied food processing by-products (solids, semi-solids, and slurry), and scientific information from effects of reuse this type of non-traditional organic wastes on soil and groundwater quality. Utilizing food processing by-products as soil amendments will help growers to reduce an amount of their fertilizer application rate and recycle other plant nutrients back to the soil. This reuse program may be an alternative disposal option for other food processors elsewhere. In addition, policy makers can utilize results of this study to make decisions on monitoring and enforcement programs.

E. STAFFING PLAN

Our research partnerships are among CSU Fresno, CSU Stanislaus, Stanislaus County, Del Monte and Mape's Ranches (Lyons' Investments). This research team has been established since July 2006 for an ongoing effort to address effects of land-applied food processing by-products under the Program. We assure that areas of expertise of PI and co-PI are appropriate to carry out the research goals and objectives. Please see attachments 2a and 2b for detailed curriculum vitae of Drs. Pasakdee and Ferriz, respectively.

F. ANTICIPATED OUTCOME STATEMENT

Public concerns of environmental impacts after land applications of food processing by-products on farmlands are rising. An outcome of this study is to provide society and policy makers with robust data to better understand potential impacts of application of food processing

by-products to agricultural farmlands based on available scientific information. The anticipated outcomes are follows:

1. To develop the BMPs program which may become a statewide manual for this type of food processing by-products.
2. To present and publish results of this research at industry and/or professional meetings, on consumer/industry-oriented publications, and peer-reviewed journal publications.
3. To enable agricultural research opportunities for CSU students in areas of soil science, hydrology, environmental science, and crop/agronomy sciences.
4. To provide scientific information for effects of reuse this type of food processing by-products on soil and ground water quality, and nutritional contents of forage crops
5. To illustrate field demonstration of food processing by-products shipping, handling, and land-applied under the Program,

G. FUNDING SOURCE

The current funding from California Department of Food and Agriculture Specialty Crop Program, Stanislaus County, and industries enable us to initiate this study since July 2006, however, this funding is ended in August 2008. Additional funding from ARI program is valuable to carry out the multi-year monitoring program in partnership with Stanislaus County, food processing industry, and growers to study and develop meaningful scientific understanding of the food processing by-products characteristics and the processes affecting their fates in the soil profile and groundwater, and especially to develop the BMPs program to ensure their sustainable land application. Please see Attachment 3 for details of requested funding.

Budget Narrative

We request the total budget commitment for this two-year project is \$155,000 from ARI System FY 08-10. Project funding will be utilized to conduct applied research, education, outreach, and technology transfer activities related to the land application of food processing plant by-products from September 1, 2008 to August 31, 2010. This project will allow the research team to proactively address an integral critical aspect of a much larger food processing industry production, environmental, and regulatory issue which potentially threatens the industry's long-term viability. The budget will fund research activities necessary for Stanislaus County to proactively respond to the California Regional Water Quality Control Board resolution number R5-2006-0052 regarding the application of food processing by-products on farmlands. The following narrative justification details major budget expenditures:

1. Salaries, Wages, and Benefits:

Principal investigator, Sajeemas Pasakdee, is a research scientist at College of Agricultural Science and Technology, CSU Fresno. She dedicates her time and attention to this project and works collaboratively with two co-principal investigators, Dr. Ferriz and Mr. Dellavalle. Therefore, 40% of Pasakdee's 2008-09 salary of \$18,870 and 40% of her 2009-10 salary of \$19,814 plus benefits is funded from the ARI project budget

Regular Staff line item. There is personal service (total benefit costs) budget funding of \$6,039 and \$6,341 for FY 08-09 and FY 09-10, respectively. A Co-PI, Horacio Ferriz, is a CSU Stanislaus faculty member. The interagency agreement will be established to fund his research activities for \$26,000 for each fiscal year. An in-kind match from Stanislaus County is at a total of \$20,600 (\$10,300 annually).

2. Operating Expense:

Operating expenses are for a total of \$8,550 and \$10,100 for FY 08-09 and FY 09-10, respectively. These include the purchase of an annual professional membership subscription, computer maintenance and related equipment such a copier, printer, etc. as well as normal and customary office and research supplies.

3. Travel:

This project requires in- and out-of-state travel. In-state travel primarily involves traveling to and from the participating universities and a number of field application sites and food processing facilities within Stanislaus and Fresno County by researchers for the purpose of monitoring, data collection, and management practice evaluation. Travel reimbursement for the project is also budgeted from in-state travel. Out-of-state travel focuses more on attending and/or presenting project information at industry and professional meetings and conferences relative to land-applied food processing by-products and related best management practices that are appropriate for California.

4. Contractual Services:

We anticipate the external cash match will pay for interagency agreement between CSU Fresno and CSU Stanislaus at a total of \$52,000 (\$26,000 annually), for contractual service (lab analysis cost) and consulting service provided by Dellavalle Inc. (Fresno, CA) and Mr. Nat Dellavalle for a total of \$39,000 and \$37,217 for FY 08-09 and FY 09-10, respectively. For contractual service provided by Mrs. Dawn Brunmeier (San Joaquin Ag Consultant, Modesto, CA) is for a total of \$10,000 (\$5,000 annually). The in-kind match will come from Del Monte and Lyon's Investments for a total of \$60,000 (\$30,000 annually).

5. Capitalized Equipment:

There is no plan to purchase any capitalized equipment costing over \$5,000.

6. Telephone Charges:

There are charges for an expense of cellular phone and office phone for a total of \$824 and \$1,245 for FY 08-09 and FY 09-10, respectively.

7. Indirect Charges:

There are charges for an indirect cost from CSU Foundation Office at a rate of 15%. We apply the formula (cash match*15% and divided by 1.15 factor) or a total of \$10,434 for FY 08-10.

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Attachment 1

Project Timeline

Major Activity
Areas/Objectives

Performance Period

JAS OND JFM AMJ JAS OND JFM AMJ

FY 08-09

FY 09-10

- Collecting plant, soil and water samples S-----C
- Analytical works for plant, soil and water analysis S-----C
- Soil moisture study S-----C
- Reviewing Hilmar Project Adjust timeline S--C
- Reviewing Wine Institute Project S--C
- Reviewing CA League of Food Processors Project S--C
- Compiling existing data S-----C
- Additional tasks requested by RWQCB S-----C
- Publications S-----C

S = start date

C = completion date

Attachment 2a

Sajeemas (Mint) Pasakdee, Ph.D., Soil Scientist/Agronomist

OFFICE: California Agricultural Technology Institute (CATI),

California State University Fresno

2910 East Barstow Ave. M/S OF 115, Fresno, CA 93740

TEL: 559-278-2828 FAX: 559-278-4849

Email: spasakdee@csufresno.edu

Education:

- Doctoral of Philosophy, Environmental Studies (Agroecology/Soil Science), University of California, Santa Cruz. December 2006. Dissertation: “*Nitrogen and Water Management in Organic Vegetable Production in California: Implications for Soil Properties, Plant Nutrient, and Farm Budget Analysis*”.
- Master of Science, Plant Science, California State University, Fresno. May 2001.
Thesis: “*Effect of Composted Biosolids on Trace Element Accumulation and Fruit Quality in Field-grown Apricots.*”
- Bachelor of Science, Plant Production Technology, Thammasat University, Bangkok Thailand. February 1995.

Professional Affiliations:

- Soil Science Society of America (SSSA); Crop Science Society of America (CSSA); American Society of Agronomy (ASA); Ecological Society of America (ESA); Soil and Water Conservation Society.

Professional Experience:

- Aug. 2006 to current: *Research Scientist/Project Director*, College of Agriculture-California Agricultural Technology Institute (CATI), California State University Fresno. The current research entitled “*Effects of land-applied food processing by-products on soil and water quality: Stanislaus County Model*”.
- Apr. 1998 to Jun. 2006: *Graduate Student Research Assistant*, USDA-ARS-Water Management Research Laboratory, Parlier, California (Dr. Gary Bañuelos’ Lab).
- Sep. 2001 to Jun. 2006: *Graduate Student Research Assistant*, Dept. of Environmental Studies, University of California, Santa Cruz (Dr. Weixin Cheng and Dr. Carol Shennan’s Lab).
- Aug. 1999 to Jun. 2004: *Graduate Teaching Assistant for the following courses:*
University of California, Santa Cruz
 - ENVS 23 Physical and Chemical in Environment (Dr. Michael Loik, spring 2004)
 - ENVS 133 Agroecology and Sustainable Agriculture (Dr. Steve Gliessman, fall 2003)
 - ENVS 161 Soil and Plant Nutrition (Dr. Weixin Cheng, spring 2003)
 - ENVS 133 Agroecology Practicum (Dr. Carol Shennan, winter 2003)California State University, Fresno
 - SW 100L Soil Science Laboratory (Dr. Sharon Benes, fall 1999)
- Jun. 1997 to Sept. 1997: *Student Research Assistant*, Seafood Laboratory, Oregon State University, Astoria (Dr. Hajung An’s Lab).
- Apr. 1995 to Jan. 1996: *International Coordinator*, World Agricultural, Environment and Industrial Exhibition (WORLDTECH’95 Thailand) organized by Royal Thai Government.

Publications:

1. Pasakdee, S., G.S. Bañuelos, C. Shennan, and W. Cheng. 2006. *Organic N fertilizers and Irrigation Influence Organic Broccoli Production*. Vegetable Science Journal. *In press*.
2. Bañuelos, G.S., S. Pasakdee, S.E. Benes, and L.A. Ledbetter. 2006. *Long-term Application of Biosolids on Apricot Production*. Communication of Soil Science and Plant Analysis Journal. *Accepted*.
3. Bañuelos, G.S., S. Sharmasarkar, and S. Pasakdee. 2004. *Utilization of Biosolids as a Fertilizer for Canola*. Compost Science and Utilization Journal, 12(1): 61-68.
4. Bañuelos, G.S., S. Pasakdee, and J.W. Finley. 2003. *Growth Response and Selenium and Boron Distribution in Broccoli Varieties Irrigated with Poor Quality Water*. Journal of Plant Nutrition, 26(12): 2537-2549.
5. Bañuelos, G.S. and S. Pasakdee. 2002. *Effect of Organic Fertilizer on Vegetable Production*. Biocycle 43(8):63.
6. Pasakdee, S. 2001. California State University, Fresno Master Thesis. *Effect of Composted Biosolids on Trace Element Accumulation and Fruit Quality in Field-Grown Apricots*. 90pp.

Manuscripts in preparation:

1. Pasakdee, S. and W. Cheng. 2008. *Fertilizer Use Efficiency and Priming Effects of Organic N Fertilizers Application on Organic Farm Soils*. Soil Biology&Biochemistry Journal.
2. Pasakdee, S., G.S. Bañuelos, C. Shennan, and W. Cheng. 2008. *Contribution of Organic N Fertilizer and Irrigation to Plant N and Soil Chemical Properties on Organic Broccoli in California*. Plant and Soil Journal.

Awards:

- Dept. of Environmental Studies Thesis Mini-grant award during 2002 to 2006.
- Center for Agroecology and Sustainable Food Systems, University of California, Santa Cruz Graduate Student Mini-grant award in 2002 and 2003.
- Dept. of Plant Science Graduate Student Nominee for College of Agricultural Science and Technology's Dean Medal in 2001.
- ASEAN Student Assistance Award Program (ASAAP) scholarship from NAFSA in 1999 and 2000.
- International student nominee tuition award scholarship from Dept. of Plant Science, California State University, Fresno from fall 1998 to spring 2000.
- Ag One Grant from School of Agricultural Science and Technology, California State University, Fresno from fall 1998 to spring 2000.
- Certificate of honors for Well-Behaved Student from the Buddhist Youth Association of Thailand under the Royal Thai Patronage, 1993 to 1994 academic year.
- Certificate of honors for "Outstanding Student for Public Service" from Department of Agricultural Technology, Faculty of Science and Technology, Thammasat University, 1991 to 1992 academic year.

Presentations:

1. Pasakdee, S. 2006 *Nitrogen and Water Management in Organic Vegetable Production in California: Implications for Soil Properties, Plant Nutrient, and Farm Budget Analysis*. Dept. of Environmental Studies PhD Dissertation Exit Seminar. Apr. 24th UC Santa Cruz. Oral
2. Pasakdee, S., G.S. Bañuelos, C. Shennan, and W. Cheng. 2006. *Nitrogen and Irrigation Management in Organic Vegetable Production in California*. Proceedings of 14th World Fertilizer Congress Meetings. Jan. 22nd to 27th Chaing Mai, Thailand. Oral
3. Pasakdee S., G.S. Bañuelos, W. Cheng, and C. Shennan. 2005. *Contribution of Organic N Fertilizers and Irrigation to Plant and Soil N Availability on Organic Broccoli Farms in Central*

- Coastal California*. Proceedings of ASA-CSSA-SSSA Annual Meetings. Nov. 6th to 10th Salt Lake City, UT. Oral
4. Pasakdee, S., G.S. Bañuelos, and W. Cheng. 2005. *Influence of Organic N Fertilizers and Irrigation on Plant and Soil N Availability under Organic Broccoli Farms in California*. Proceedings of the 26th Annual Central California Research Symposium. Apr. 21st California State University, Fresno. Oral
 5. Pasakdee, S., W. Cheng, G.S. Bañuelos, and C. Shennan. 2004. *Tracing Natural ¹⁵N Abundance in Plants and Soils after Organic Fertilizer N Applications*. Proceedings of ASA-CSSA-SSSA Annual Meetings. Oct. 31st to Nov. 4th Seattle, WA. Poster
 6. Pasakdee, S., G.S. Bañuelos, W. Cheng, and C. Shennan. 2003. *Effects of Organic N Fertilizers and Water Management on Organic Broccoli Production*. Proceedings of ASA-CSSA-SSSA Annual Meetings. Nov. 2nd to 6th Denver, CO. Poster
 7. Pasakdee, S., G.S. Bañuelos, W. Cheng, and C. Shennan. 2002. *Influence of Irrigation and Organic Fertilizers on Nitrate Movement in Organic Broccoli Production*. Proceedings of ASA-CSSA-SSSA Annual Meetings. Nov. 6th to 10th Indianapolis, IN. Poster
 8. Pasakdee, S., G.S. Bañuelos and S. E. Benes. 2002. *The Effect of Composted Biosolids on Fruit Quality and Trace Element Accumulation in Field-Grown Apricots*. Proceedings of the 17th World Congress of Soil Science. Aug. 14th to 21st Bangkok, Thailand. Poster
 9. Pasakdee, S., G.S. Bañuelos, S. E. Benes and S. Gu. 2001. *Effect of Composted-Biosolids on Fruit Quality in Organically-Grown Apricots*. Proceedings of ASHS Annual Meetings. Jul. 22nd to 27th Sacramento, CA. Poster
 10. Pasakdee, S. 2001. *The Effect of Composted Biosolids on Fruit Quality and Trace Element Accumulation in Field-Grown Apricots*. Proceedings of the 15th Annual California State University Student Research Competition . Apr. 27th to 28th California State University, San Jose. Oral
 11. Pasakdee, S. 2001. *The Effect of Composted Biosolids on Fruit Quality and Trace Element Accumulation in Field-Grown Apricots*. Proceedings of the 22nd Annual Central California Research Symposium. Apr. 20th California State University, Fresno. Oral
 12. Pasakdee, S. 2001. *The Effect of Composted Biosolids on Fruit Quality and Trace Element Accumulation in Field-Grown Apricots*. Dept. of Plant Science Master Thesis Seminar. Apr. 20th California State University, Fresno. Oral
 13. Bañuelos, G.S. and S. Pasakdee. 2001. *Trace Element Accumulation in Canola Intercropped with Apricot Trees Amended with Biosolids*. Proceedings of the 11th West Coast Conference on Contaminated Soils, Sediments, and Water. Mar. 19th to 22nd San Diego, CA. Oral
 14. Pasakdee, S., G.S. Bañuelos, S. E. Benes, and S. Gu 2001. *The Effect of Composted Biosolids on Fruit Quality and Trace Element Accumulation in Field-Grown Apricots*. Proceedings of California Plant and Soil Conference. Feb. 4th Fresno, CA. Poster

Attachment 2b

HORACIO FERRIZ, Ph.D., PG, CEG

Curriculum Vitae

Dr. Horacio Ferriz leads the Applied Geology concentration of the CSU Stanislaus Geology program. He has 20 years of academic experience, having held teaching positions in Mexico's National University, Whittier College, Germany's Ruhr Universität-Bochum, and of course California State University Stanislaus. He was recently recognized as the 2004-2005 Outstanding Community Service Professor. Dr. Ferriz is a very popular professor, who often teaches to overflowing classrooms at the same time that the lecture is broadcasted to four peripheral campuses and the local cable network. His classes on Development and Management of Water Resources, Hydrogeology, Environmental Geology, and Engineering Geology are the base of the Applied Geology concentration at California State University, Stanislaus.

Dr. Ferriz is a registered Professional Geologist and a Certified Engineering Geologist in California and Mexico, and has more than 20 years of professional geologic, geotechnical, hydrogeologic, and environmental experience. Over this time period he has worked as geologic problem-solver in projects throughout the world involving environmental engineering, solid waste management, water supply, civil works design, geothermal exploration, and mineral exploration. Dr. Ferriz is an expert in environmental statistics, and the author of over 15 research papers dealing with the geology of California, development and management of water resources, landfill engineering, and stability analysis. For the last two years Dr. Ferriz has held the position of Stanislaus County Geologist, and in this capacity has dealt with many environmental quality issues in Stanislaus County.

CONTACT INFORMATION

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Turlock, CA 95382
Tel. (209) 667-3874
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EDUCATION

- 1980-84 Philosophy Doctor - Dept. of Applied Earth Sciences, Stanford University.
Emphasis on hydrogeology and engineering geology.
- 1978-80 Master in Science - Dept. of Applied Earth Sciences, Stanford University.
Emphasis on remote sensing of the environment and resource exploration.
- 1972-76 Engineer in Geology - School of Engineering, Mexico's National University.
Emphasis on engineering geology and hydrogeology

PROFESSIONAL EXPERIENCE

- 2004- Stanislaus County Geologist
- 1999- Professor - California State University, Stanislaus
Associate Professor of Applied Geology and Hydrogeology
- 1998- Principal - HF Geologic Engineering, Waterford, California
- 1993-98 Senior Engineering Geologist - GeoLogic Associates, Diamond Hill, California.
- 1992-93 Senior Environmental Geologist - CERES Environmental, Santa Fe Springs, California.

- 1989-91 Visiting Professor of Geology, Ruhr Universität-Bochum, Geology.
- 1976-79 Professor of Geology, Whittier College, California.
- 1976-79 Exploration Geologist, Mexico's Federal Power Company. Geothermal and uranium exploration.
- 1976-79 Exploration Geologist, Mexico's Atomic Energy Commission. Uranium exploration.
- 1972-75 Exploration Geologist, Mexico's Federal Oil Company. Petroleum exploration.

PROFESSIONAL LICENSES

- Certified Engineering Geologist No. 2018 (1996), California
 Professional Geologist No. 5757 (1993), California
 Registered Geologic Engineer No. 477675 (1976), Mexico
 Registered Environmental Assessor No. 98/94 (1994), Baja California, Mexico

RECENT PUBLICATIONS

- 2003 Ferriz, H., Alternative sources of water supply for the city of Guadalajara, Mexico: Geological Society of America Abstracts with Programs, Vol. 35, No. 4.
- 2002 Ferriz, H., Geology of the Cowhole Mountains, Mojave Desert, California: in Reynolds, R.E. (ed.), Between the Basins - Exploring the Western Mojave and Southern Basin and Range Province, California State University, Desert Studies Consortium (Dept. of Biological Science, CSU Fullerton, Fullerton, CA 92384), p. 76.
- 2002 Ferriz, H., Bizuneh, G., Development and management of water resources: in Proceedings of Ethioforum 2002, January 16- 20, (Addis Ababa, Ethiopia), p. 182-209.
- 2001 Ferriz, H., Anderson, R., (eds.), Engineering Geology Practice in Northern California: Association of Engineering Geologists Special Publication 12 and California Division of Mines and Geology Bulletin 210.
- 2001 Ferriz, H., Groundwater resources of Northern California - An overview: in Ferriz, H., Anderson, R., (eds.), Engineering Geology Practice in Northern California: Association of Engineering Geologists Special Publication 12 and California Division of Mines and Geology Bulletin 210, p.19-48.
- 2001 Ferriz, H., The basics of liquefaction analysis: in Ferriz, H., Anderson, R., (eds.), Engineering Geology Practice in Northern California: Association of Engineering Geologists Special Publication 12 and California Division of Mines and Geology Bulletin 210, 575-578.
- 2001 Ferriz, H., Hydrogeologic studies for landfill sites in fractured bedrock terrains: Proceedings of the Fractured Rock 2001 conference, Toronto, Canada, March 26 to 28, 2001, p. 125-132.
- 1999 Ferriz, H., Landfill gas issues for design of monofill alternative covers: *in* RTDF Alternative Cover Assessment Project Meeting, U.S. EPA, San Francisco, CA, March 22-23, 1999.
- 1999 Ferriz, H., Pedler, W., Borehole geophysics applied to the study of landfill sites in fractured bedrock terrains: Proceedings of the 12th Annual Symposium on the Application of Geophysics to Environmental and Engineering Problems, Environmental and Engineering Geophysical Society, Oakland, CA (March 14-18, 1999), p.831-840.
- 1999 Ferriz, H., Ferrier, R., Alternative landfill covers work in arid Southwest areas: APWA Reporter, American Public Works Association, March 1999, p.20-21.

Attachment 2C

Nat B. Dellavalle, Agronomist/Soil Scientist *Curriculum Vitae*

Education

B.S. - 1961 Soil Science, California Polytechnic State University, San Luis Obispo, CA.
March 1988 - California Polytechnic State University Short Course "Irrigation Evaluation",
San Luis Obispo, CA.

Certification

American Registry of Certified Professionals in Agronomy, Crops and Soils; Certified
Professional Soil Scientist/Agronomist, Certified Crop Advisor, Certification #1538.

Experience:

1978 to Present - President, Dellavalle Laboratory, Fresno, CA.
Designed, built and manages an analytical laboratory and consulting service, provides
analytical services to the public, consultant in soil and water science, irrigation management,
plant nutrition and effluent reuse and management; qualifies as an expert witness.

1968-1978 - Manager, Laboratory Division, T-M-T Chemical Co., Five Points, CA.
Designed, built and managed an analytical laboratory and consulting service, providing
service for soil, water, irrigation and plant nutrition management.

1963-1968 - Agronomist, Brown & Bryant, Shafter, CA.
Advised management on soil and water science, plant nutrition, quality control and product
development, fertilizers. Designed, built and operated an analytical laboratory, conducted
nutrient surveys and provided technical services to growers.

1961-1963 - Agriculturist, Coit Ranch, Mendota, CA.
Advised management in fields of soil and water science and plant nutrition; was responsible
for fertilizer programs, pest control, cantaloupe pollination, soil and tissue analysis, field
evaluation of varieties and cultural practices.

Professional Societies, Organizations and Activities

American Society of Agronomy (Agronomic Awards Committee 1990-92)
California Association of Agricultural Laboratories (President 1979)
Soil and Plant Analysis Council (Board of Directors 1968-90, 1995 - Present, Chair 1991-92)
Soil Conservation Society of America
Soil Science Society of America
California Certified Crop Advisors Board, 1999 to Present, Chair 2001

Professional Societies, Organizations and Activities

California Chapter of the American Society of Agronomy (Governing Board 1984-85,
Secretary Treasurer 1984-86, Executive Committee 1986-90, President 1989)

Fresno County & City Chamber of Commerce (Chair Water Resources Committee 1989-93;
Director since 1993; Vice President, Agriculture 1995-97)

Advisory Committees

California Irrigation Management Information Service (CIMIS), Department of Water Resources 1982-85
Department of Land, Air and Water Resources, University of California, Davis, 1983-93
Office of Water Conservation, Department of Water Resources, State of California, since 1985
Dean, College of Agriculture and Environmental Sciences, University of California, Davis, 1987-90
Fresno-Clovis Metropolitan, Water Management Plan, 1991-95
Public Works Task Force, Little Hoover Commission, City of Fresno, 1991
Fresno County Agricultural PM-10 Advisory Committee, 1989-1991
Citizens Advisory Group of Industries (Formerly Agricultural PM-10 Advisory Committee), 1991-95
California State University, Fresno, Department of Plant Science & Mechanized Agriculture, 1995
Fresno Fruit Fly Action Coalition Taskforce, Co-chair, 1995 - 1997
Western States Sample Exchange Advisory Committee, University of California, Davis, 1993-Present
North American Proficiency Testing Program for Agricultural Laboratories, Steering Committee, Soil and Plant Analysis Council, 1995 - Present
Western Regional Coordinating Committee, University of Idaho, Twin Falls, ID Plant Science Department, California State University, Fresno, 1995 - Present
Soil Science Department, California Polytechnic University, San Luis Obispo, CA 1996 - Present
School of Natural Science, California State University, Fresno, 1996 - Present

Awards

J.B. Jones Award, by the Soil & Plant Analysis Council, 1995

Foreign Assignments

Chile: Since 1988 - Inversiones Agricolas E Ind. Evaluation of soils for salinity and sodium status.

Barcelona, Spain: Since 1979 - Codorniu, S.A. Evaluation of soil chemistry and vine nutrition for wine production.

Taxco, Mexico: 1986 - Proyecto Nacional Conjunto UACH-CP-Fertimex. National symposium on analysis of agricultural soils. Lectured on laboratory quality control and quality assurance.

Baja California: 1982 - Uvas de California. Evaluated nutritional, pathological and soil conditions in vineyards in three regions of Baja California.

Egypt: 1977 - Superior Oil Company. Evaluated soils and waters for agricultural suitability.

Attachment 3

Land Application By-products Phase 2. SYSTEM ARI FY 2008-09 Budget					
Account Codes	Description	ARI Funding	External Match		Total Funding
			Cash	In-kind	
Salaries, Wages, and Benefits					35,209
601202	Part Time Faculty				0
601301	Management & Supervisory (Stanislaus County)			10,300	10,300
601401	Regular Staff (Pasakdee @ 40% time)	18,870			18,870
601701	Faculty Release				0
601701	Additional Employment (Summer Salary)				0
601701	Temporary Help				0
601801	Student Assistant				0
601802	Bridge Student Assistant				0
602100	Benefits	6,039			6,039
Operating Expense					8,550
603107	Computer Maintenance				0
603111	Dues & Subscriptions	500			500
603119	Memberships	500			500
603122	Multi-Media Services				0
603123	Non-Capitalized Computer Equipment	1,500			1,500
603124	Non-Capitalized Equipment	2,700			2,700
603126	Office Supplies	400			400
603127	Other Computer Services				0
603131	Postage	100			100
603132	Printing	200			200
603139	Software Non-Capitalized				0
603141	Software Licenses	400			400
603145	Supplies & Miscellaneous Expenses	2,250			2,250
Travel					5,500
603201	Travel In-State	3,000			3,000
603202	Travel Out-of-state	2,500			2,500
Contractual Services					100,000
603301	Consulting Services (Del Monte)			15,000	15,000
603301	Consulting Services (Lyon's)			15,000	15,000
603302	Equipment Rental/Lease Agreements				0
603303	Honoraria				0
603304	Interagency Agreements (CSU Stanislaus--Ferriz)		26,000		26,000
603310	Contractual Services and Consulting Services--Dellavalle	30,217	8,783		39,000
603310	Consulting Services--Dawn Brunmeier	5,000			5,000
Equipment					
603401	Equipment Over \$5,000/item				
603403	Computer Equipment Over \$5,000/item				
Telephone Charges					824
603501	Cell Phone	700			700
603504	Telephone Moves/Adds/Changes	50			50
603505	Telephone Usage	74			74
	Indirect Charge - 15%		5,217		5,217
TOTALS		75,000	40,000	40,300	155,300

Land Application By-products Phase 2. SYSTEM ARI FY 2009-10 Budget

Account Codes	Description	ARI Funding	External Match		Total Funding
			Cash	In-kind	
Salaries, Wages, and Benefits					36,455
601202	Part Time Faculty				0
601301	Management & Supervisory (Stanislaus County)			10,300	10,300
601401	Regular Staff (Pasakdee @ 40% time)	19,814			19,814
601701	Faculty Release				0
601701	Additional Employment (Summer Salary)				0
601701	Temporary Help				0
601801	Student Assistant				0
601802	Bridge Student Assistant				0
602100	Benefits	6,341			6,341
Operating Expense					10,100
603107	Computer Maintenance				0
603111	Dues & Subscriptions	500			500
603119	Memberships	500			500
603122	Multi-Media Services				0
603123	Non-Capitalized Computer Equipment	1,700			1,700
603124	Non-Capitalized Equipment	3,000			3,000
603126	Office Supplies	400			400
603127	Other Computer Services				0
603131	Postage	100			100
603132	Printing	500			500
603139	Software Non-Capitalized				0
603141	Software Licenses	400			400
603145	Supplies & Miscellaneous Expenses	3,000			3,000
Travel					7,500
603201	Travel In-State	4,000			4,000
603202	Travel Out-of-state	3,500			3,500
Contractual Services					99,783
603301	Consulting Services (Del Monte)			15,000	15,000
603301	Consulting Services (Lyon's)			15,000	15,000
603302	Equipment Rental/Lease Agreements				0
603303	Honoraria				0
603304	Interagency Agreements (CSU Stanislaus--Ferriz)		26,000		26,000
603310	Contractual Services and Consulting Services--Dellavalle	30,000	8,783		38,783
603310	Consulting Services--Dawn Brunmeier	5,000			5,000
Equipment					
603401	Equipment Over \$5,000/item				
603403	Computer Equipment Over \$5,000/item				
Telephone Charges					1,245
603501	Cell Phone	945			945
603504	Telephone Moves/Add/Changes	100			100
603505	Telephone Usage	200			200
	Indirect Charge - 15%		5,217		5,217
TOTALS		80,000	40,000	40,300	160,300

**Land Application By-products Phase 2. SYSTEM ARI
Total Budget (Round VIII FY2008-09 through 2009-10)**

Account Codes	Description	ARI Funding	External Match		Total Funding
			Cash	In-kind	
Salaries, Wages, and Benefits					71,664
601202	Part Time Faculty	0	0	0	0
601301	Management & Supervisory (Stanislaus County)	0	0	20,600	20,600
601401	Regular Staff (Pasakdee @ 40% time)	38,684	0	0	38,684
601701	Faculty Release	0	0	0	0
601701	Additional Employment (Summer Salary)	0	0	0	0
601701	Temporary Help	0	0	0	0
601801	Student Assistant	0	0	0	0
601802	Bridge Student Assistant	0	0	0	0
602100	Benefits	12,380	0	0	12,380
Operating Expense					18,650
603107	Computer Maintenance	0	0	0	0
603111	Dues & Subscriptions	1,000	0	0	1,000
603119	Memberships	1,000	0	0	1,000
603122	Multi-Media Services	0	0	0	0
603123	Non-Capitalized Computer Equipment	3,200	0	0	3,200
603124	Non-Capitalized Equipment	5,700	0	0	5,700
603126	Office Supplies	800	0	0	800
603127	Other Computer Services	0	0	0	0
603131	Postage	200	0	0	200
603132	Printing	700	0	0	700
603139	Software Non-Capitalized	0	0	0	0
603141	Software Licenses	800	0	0	800
603145	Supplies & Miscellaneous Expenses	5,250	0	0	5,250
Travel					13,000
603201	Travel In-State	7,000	0	0	7,000
603202	Travel Out-of-state	6,000	0	0	6,000
Contractual Services					199,783
603301	Consulting Services (Del Monte)	0	0	30,000	30,000
603301	Consulting Services (Lyon's)	0	0	30,000	30,000
603302	Equipment Rental/Lease Agreements	0	0	0	0
603303	Honoraria	0	0	0	0
603304	Interagency Agreements (CSU Stanislaus--Ferriz)	0	52,000	0	52,000
603310	Contractual Services and Consulting Services--Dellavalle	60,217	17,566	0	77,783
603310	Consulting Services--Dawn Brunmeier	10,000	0	0	10,000
Equipment					
603401	Equipment Over \$5,000/item				
603403	Computer Equipment Over \$5,000/item				
Telephone Charges					2,069
603501	Cell Phone	1,645	0	0	1,645
603504	Telephone Moves/Adds/Changes	150	0	0	150
603505	Telephone Usage	274	0	0	274
	Indirect Charge - 15%		10,434		10,434
TOTALS		155,000	80,000	80,600	315,600

**County of Stanislaus: Auditor-Controller
Legal Budget Journal**

Database
Set of Books

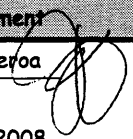
FMS11IDB.CO.STANISLAUS.CA.US.PROD
County of Stanislaus

Balance Type		Budget
Category	* List - Text	Budget - Upload
Source	* List - Text	
Currency	* List - Text	USD
Budget Name	List - Text	LEGAL BUDGET
Batch Name	Text	
Journal Name	Text	
Journal Description	Text	To set up appropriations
Journal Reference	Text	ER-Food Processing by-prod research
Organization	List - Text	Stanislaus Budget Org

Upl	Fund	Org	Acc't	GL Proj	Loc	Misc	Other	Debit incr appropriations decr est revenue (format > number > general)	Credit decr appropriations incr est revenue	Period Upper case MMMM-YY List - Text	Line Description Text
Rb	1011	0034225	63280	0000000	000000	000000	00000	47197.76		Oct-08	Set up appropriation
Rb	1011	0034225	33281	0000000	000000	000000	00000		10000	Oct-08	Set up appropriation
Rb	1011	0034225	46600	0000000	000000	000000	00000		30000	Oct-08	Set up appropriation

Totals: 47197.76 40000

Explanation: Set up appropriations for ER Food Processing by-products research project

Requesting Department		CEO	Data Entry		Auditors Office Only	
Jennifer Figueroa		Raul Mendez	Keyed by		Prepared By	
Signature		Signature	Date		Approved By	
10/7/	2008	10/7/2008			10-24-08	
Date		Date			Date	

Currency: USD
Balance Type: Year to Date
Fund Range: 1011 to 1011

Fund: 1011 ER Food Processing By-Products Research Project

Account	Description	Beginning Balance	Debits	Credits	Ending Balance
01000	Equity in Pooled Cash	5,927.81	1,269.95	0.00	7,197.76
01010	Investment - fair value adjustm	58.92	0.00	0.00	58.92
01130	Interest receivable- pool inves	30.25	0.00	0.00	30.25
03610	Fund bal/Retained earnings	(5,958.06)	0.00	0.00	(5,958.06)
03615	Fund bal-invest. fair value adj	(58.92)	0.00	0.00	(58.92)
49999	Total Revenue	0.00	0.00	1,269.95	(1,269.95)
		0.00	1,269.95	1,269.95	0.00

11/4/08
#33

Agreement Number A082608

BOARD OF SUPERVISORS



2010 DEC -8 A 11:49

DEPARTMENT OF ENVIRONMENTAL RESOURCES
3800 Cornucopia Way, Suite C,
Modesto, Ca 95358-9492
Phone: (209) 525-6700
Fax: (209) 525-6774

**AGREEMENT FOR PROFESSIONAL SERVICES
BETWEEN
CALIFORNIA STATE UNIVERSITY, FRESNO FOUNDATION
and
STANISLAUS COUNTY**

WHEREAS, Stanislaus County, hereinafter referred to as "**the County**", requires knowledge of short and long-term environmental impacts resulting from direct land application of food processing by-products as set forth in the County Program requirements "County Code, Title 9, Chapter 9.88" and

WHEREAS, the California State University, Fresno Foundation hereinafter referred to as "Contractor," has previously assisted the County in Phase I of this effort, and is willing and able to assist the County in completing Phase II of this effort as set forth in this agreement;

NOW THEREFORE, Stanislaus County and the Contractor agrees as follows:

**ARTICLE I
SCOPE OF SERVICES**

- A. The **Contractor** agrees to contribute to the overall goals and objectives of the Funding Contract by providing professional and/or technical services to **the County**, in accordance with and pursuant to the details of this Agreement for Professional Services, and specifically **Attachment A – Scope of Work**, which is attached hereto and incorporated herein by this reference ("Work").
- B. The **Contractor** shall perform the specified Work and shall furnish all labor, materials, supplies, equipment, supervision, and services for the incident to the performance of the Work.
- C. The Services covered by this Agreement shall be performed in accordance with the provisions herein, including all Attachments A and B.
- D. With respect to the required Work, the **Contractor** agrees to be bound to **the County** except as expressly provided herein.
- E. In consideration of services rendered, **the County** agrees to pay the **Contractor** in accordance to the provisions of Article IV.

**ARTICLE II
GENERAL PROVISIONS**

- A. This Agreement, including attachments, shall form the entire agreement and understanding between **the County** and the **Contractor**. Except as provided in Article VII hereof, no other written or verbal statements, shall be binding upon the parties or construed as modifying this Agreement in any way.
- B. The governing law of this Agreement shall be the law of the State of California, excluding its choice of law provisions. The parties agree that Fresno County is the sole proper venue for the litigation of any and all disputes arising out of or relating to this Agreement.
- C. The **Contractor** is an independent contractor and will maintain complete control of and responsibility for its employees, agents, methods, and operations.
- D. Execution of the Agreement by **the County** will be authorized for the **Contractor** to proceed with the Work and Services specified herein.
- E. Programmatic and Fiscal Communications to **the County** shall be directed to:

Name: Sonya K. Harrigfeld
Title: Director
Address: Stanislaus County Department of Environmental Resources
3800 Cornucopia Way, Suite C
Modesto, CA 95357
Phone: (209) 525-6700 FAX: (209) 525-6773
Email: harrigfeld@envres.org

Programmatic Communications to **Contractor** shall be directed to:

Name: Joe Bezerra
Title: Executive Director/Director of Operations
California State University Agricultural Research Initiative (ARI)
Address: California Agricultural Technology Institute (CATI)
2910 E. Barstow Avenue M/S OF115
Fresno, CA 93740-8009
Phone: (559) 278-2361 FAX: (559) 278-4849
Email: buzzb@csufresno.edu

Fiscal Communications to **Contractor** shall be directed to:

Name: Linda Christian
Title: Grant Accounting Supervisor
Address: 4910 N. Chestnut
Fresno, CA 93726
(559) 278-0852 FAX: (559) 278-0992
Email: lindacar@csufresno.edu

ARTICLE III TERM

The term of this Agreement shall be from September 1, 2008 through August 31, 2010.

**ARTICLE IV
CHARGES, INVOICING, AND PAYMENT**

- A. The total to be paid by **Stanislaus County** to the contractor shall not exceed **\$80,000.00** for the period indicated above. The **Contractor** will submit, in arrears, an itemized invoice along with supporting documentation, to Stanislaus County on a quarterly basis for services rendered in accordance with specified line items in **Attachment B, Itemized Budgets**. The final invoice shall be received no later than August 31, 2010.
- B. Within 20 business days following receipt of invoice, and subject to the provisions of Article IV (A), Stanislaus County will pay the **Contractor** for the approved invoice amount.

**ARTICLE V
INDEPENDENT CONTRACTOR STATUS**

This Agreement is by and between two independent contractors, and is not intended to and shall not be construed to create the relationship employer, employee, partnership, agent, servant, or joint venture with the **Contractor** or any persons employed by or representing the **Contractor** including subcontractors or employees thereof. The **Contractor** shall control the manner and means of accomplishing the performance of the Agreement.

**ARTICLE VI
INSURANCE AND INDEMINIFICATION**

- A. The **Contractor** shall maintain throughout the period of this Agreement the following insurance coverage, which shall be written on an "occurrence" basis:
1. Worker's Compensation and Employer's Liability insurance, as required by law;
 2. Comprehensive General, Bodily Injury, and Property Damage Insurance, with \$1,000,000 combined single limits; and
 3. Comprehensive Automobile Liability for owned and rented/leased vehicles, including Bodily Injury and Property Damage coverage, with \$1,000,000 combined single limits.
- B. Unless otherwise expressly set forth in this Agreement, each party shall indemnify, defend, and save harmless the other, and their various directors, officers, agents, employees, boards, commissions, and departments, from and against all and all loss, damages, suits, claims (including actions by administrative agencies), penalties, costs, liabilities and expenses (including, but not limited to, a reasonable investigation, legal and paralegal expenses), that may arise out of this Agreement or the parties' respective performance hereunder provided that any such loss, damages, suits, claims, penalties, costs, liabilities and/or expenses does not arise out of the intentional or negligent acts or omissions of the indemnitee or its various directors, officers, agents, employees, boards, commissions, and departments.

**ARTICLE VII
MODIFICATIONS**

The terms of this Agreement and its attachments may be modified or amended only by a written instrument signed by both parties hereto.

**ARTICLE VIII
INCORPORATED TERMS**

The following General Terms and Conditions are hereby incorporated:

- A. OMB Circulars A-21, A-110 and A-133.
<http://www.whitehouse.gov/obm/circulars/index.html>

Use A-87 when contracting with State and Local Government and Tribal entities.

**ARTICLE IX
DISPUTES**

The parties may pursue their respective remedies at law or equity for any claim, controversy, or dispute relating to this Agreement.

**ARTICLE X
NON-ASSIGNMENT**

Neither party shall assign, transfer, or further subcontract this Agreement, in whole or in part, without prior written approval of the other.

**ARTICLE XI
SEVERABILITY AND SURVIVAL**

If any of the provisions herein are held for any reason to be invalid, illegal, or unenforceable in any respect, such invalidity, illegality, or unenforceability will not effect any other provision, and this Agreement will be construed as valid, legal and enforceable in all other respects.

**ARTICLE XII
TERMINATION**

- A. Each party retains the right to terminate this Agreement without cause upon thirty (30) days' advance notice to the other. Each party retains the right to terminate this Agreement for cause upon twenty-one (21) days' advance written notice to the other, which notice shall specify the cause.
- B. After termination, the **Contractor** will be reimbursed for Services rendered and necessary expenses incurred to the termination date upon submission of an invoice to Stanislaus County.

**ARTICLE XIII
ENTIRE DOCUMENT**

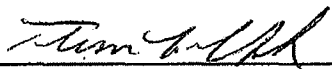
This Agreement represents the entire agreement between the parties and supersedes all prior agreements and understandings.

(signatures on the next page)

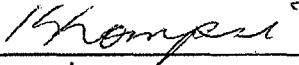
IN WITNESS WHEREOF, the parties have caused this Agreement to be executed by their duly authorized representatives, as follows:

CONTRACTOR

California State University, Fresno Foundation
4910 N. Chestnut
Fresno, CA 93726
(559) 278-0850 / FAX (559) 278-0992

By 
Thomas McClanahan
Associate Vice President, CSUF-ORSP


Date 11/25/08

By 
Keith Kompsi
Director, Foundation Financial Services

Date 11-25-08

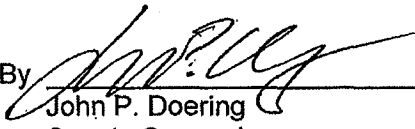
STANISLAUS COUNTY

County of Stanislaus
Department of Environmental Resources
3800 Cornucopia Way, Suite C
Modesto, CA 95351
(209) 525-6700

By 
Sonya K. Harrigfeld
Director

Date 11/10/08

Approved as to Form:
John P. Doering
County Counsel

By 
John P. Doering
County Counsel



Work Plan on Land Application of Food Processing By-products in Stanislaus County

Phase II:

*Developing Best Management Practices
for the Application of Food Processing
By-products on California Farmlands*

**DEVELOPING BEST MANAGEMENT PRACTICES FOR THE
APPLICATION OF FOOD PROCESSING BY-PRODUCTS ON
CALIFORNIA FARMLANDS**

Principal Investigator:

Dr. Sajeemas (Mint) Pasakdee, Soil Scientist/Agronomist
California Agricultural Technology Institute, California State University Fresno,
2910 East Barstow Ave., M/S OF115, Fresno, CA 93740
Tel. 559-278-2828
Fax. 559-278-4849
Email: spasakdee@csufresno.edu

Co-Principal Investigators:

Dr. Horacio Ferriz, Geologist
Department of Physics and Geology, California State University, Stanislaus
801 W. Monte Vista Ave.
Turlock, CA 95382
Tel. 209-667-3466
Email: hferriz@geology.csustan.edu

Nat Dellavalle, Certified Professional Agronomist/ Soil Scientist
Dellavalle Laboratory, Inc.
1910 S. McKinley Ave., Suite 110
Fresno, CA 93728
Tel. 559-647-5316
Email: ndellavalle@dellavallelab.com

Collaborators:

Sonya Harrigfeld, Director
Stanislaus County Dept. of Environmental Resources
3800 Cornucopia Way, Suite C, Modesto, CA 95358
Tel. 209-525-6770
Email: sharrigf@envres.org

Cooperators:

William (Bill) J. Lyons, Jr.
Mape's Ranches & Lyons' Investments
10555 Maze Rd., Modesto, CA 95358
Tel. 209-522-1762

Email: maperanch@aol.com

Martin Reyes, Stanislaus County Residue Use Committee
P.O. Box 56, Winton, CA 95388
Tel. 209-605-4079
E-mail: martin_reyes1@netzero.net

James Mortensen
Del Monte Foods-Plant No 1
4000 Yosemite Blvd., Modesto, CA 95357-6008
Tel. 209-527-3850, ext.223
Email: jim.mortensen@delmonte.com

Anticipated Project Timeline: **September 1st, 2008 to August 31st, 2010**

ARI Research Focus Areas: **1) Food Science 2) Public Policy**

ARI Funding:

Total	\$155,000
FY 2008-09	\$ 75,000
FY 2009-10	\$ 80,000

Matching Fund:

Total	\$160,600
Cash match (Stanislaus County)	
FY 2008-09	\$ 40,000
FY 2009-10	\$ 40,000
In-kind match (Stanislaus County)	
FY 2008-09	\$ 10,300
FY 2009-10	\$ 10,300
In-kind match (Industries)	
FY 2008-09	\$ 30,000
FY 2009-10	\$ 30,000

Anticipated Outcomes:

- anticipated impacts of the research on California agriculture
- presentation of results at industry and/or professional meetings
- consumer/industry-oriented publications that will be notified of research results
- publications that are likely to carry news articles

- refereed journal publications
- graduate thesis/senior projects
- number of graduate and undergraduate students to be employed
- equipment to be purchased or donated
- student research assistant quotes about the impact on their learning and career opportunities
- other (identify)

DEVELOPING BEST MANAGEMENT PRACTICES FOR THE APPLICATION OF FOOD PROCESSING BY-PRODUCTS ON CALIFORNIA FARMLANDS

PROJECT SUMMARY

The food-processing sector is one of the leading agricultural industries in California. Canneries, especially those that use raw fruit, nuts, and vegetable inputs, generate various types of food processing by-products or non-hazardous wastes. The application of such food processing by-products to agricultural farmlands, while certainly not new, has become an integral part of the industry. This practice is important not only for recycling nutrients back to the soil, but also for minimizing those elements of concern (e.g. nitrogen, sodium, and trace elements) that would otherwise be concentrated elsewhere. Land-application of non-hazardous wastes is projected to rise because of the public concerns regarding environmental impacts of their disposal to landfills, or incineration, and because of their perceived inherent agricultural benefits.

In partnership with local government, food processors, and growers, the Stanislaus County Food Processing By-Product Use Program (the Program) has managed the reuse of food processing by-products (solid, semi-solid, and slurry form) as a soil amendment since 1987. Although the Program has restrictive regulations for the handling and spreading of by-products, the California Regional Water Quality Control Board - Central Valley Region (RWQCB) has expressed concerns on the impacts of land-application of food processing by-products, which may have low pH, high TDS, and trace elements, insofar as this practice may impair soil and groundwater quality after its application on California farmlands (constituents of food processing by-products vary depending on the source of raw material and the substances associated with the canning processes).

We propose a multi-year study to continue to investigate and address this issue. The major goal of this work is to develop best management practices (BMPs) of sustainable reuse of food processing by-products as a soil amendment on California farmlands. We propose to monitor the fates of food processing by-products through the soil profile, crop removal of certain components, and the influence they might have in surface- and groundwater chemistry. In addition, we will perform an economic analysis of this practice. The result of this study will provide society and policy makers data to better understand impacts of food processing by-products application to agricultural farmlands based on available scientific-based information.

A. STATEMENT OF THE PROBLEM

The food processing industries in California are the leading producers of processed fruits and vegetables (Reed, 2006). More than 45% of the world processed tomato products, and 100% of the U.S. supply of canned peaches, fruit cocktail, and black ripe olives are produced in California (CLFP, 2006). These industries generate various types of food processing by-products or wastes, whose constituents vary depending on the source of raw materials and the substances associated with the canning processes.

The compositions of by-products often have high variability even though they are made of similar raw material. A number of factors, for example, the differences in crop variety, farming location (soil type and/or land history), and fertility practice (soil management) can

significantly influence concentrations of various elemental components in fresh fruits and vegetables in different ways. For instance, peach juices obtained from three cultivars showed distinctive nutrient compositions from one another (Versari et al., 2002). Particularly, various chemicals used during the canning processes such as for peeling and disinfection are ultimately collected in the waste stream, mixed with discarded raw materials, and become by-products' constituents.

The elemental composition of by-products consists of macro- and micronutrient, and trace elements similar to agricultural residues collected from various farmlands. However, enrichments of some elements occurred during processing and accumulated in by-products. Organic acid contents of fruit induces lower pH of by-products, while, salt accumulates from concentrated fruit and some chemicals utilized during the peeling or washing processes such as salts from sodium- and/or potassium-based materials.

The application of food processing by-products to agricultural farmlands, while certainly not new, has become increasingly widespread. This practice is important not only for the recycling nutrients back to the soil, but also for minimizing those elements of concern (e.g., nitrogen, sodium, and trace elements) that would otherwise be concentrated elsewhere. Land-application of non-hazardous wastes (e.g., food processing by-products) is projected to rise because of public concerns regarding environmental impacts of their disposal to landfills, or incineration, and because of their perceived inherent agricultural benefits (O'Connor et al., 2005).

The management of raw food processing by-products applied on farmlands can be safely performed to minimize detrimental impacts on soil and water quality (Singh et al., 2002). Interestingly, a large number of studies have focused on the use of these food processing by-products after being composted with other raw materials e.g. (Schaub and Leonard, 1996) rather than on studying the potential impacts of direct application of these materials on farmlands. Although composting helps produce a stabilized and homogenous product, and eliminates odor and potential pathogens (Gardiner and Miller, 2004), some researchers have reported that the production of compost from these materials was not economically feasible (McPartland, 2005).

Characteristics of low pH, medium to high total dissolved solids (TDS) and salinity (electrical conductivity or EC) of by-products may impair soil and water quality after a land application especially when they are not properly disposed and/or managed based on critical limit of elements of concerns under current farming conditions. However, such careful operations of land-applied by-products can provide a variety of essential plant nutrients as a substitute for commercial fertilizer as well as an organic source or soil amendment. Farmers can benefit from utilizing by-products on farmlands when they can reduce the need to buy fertilizer because by-product fertilizer-replacement value is feasible (Huang and Lu, 2000). They conclude that agricultural use of by-products can be the most economical way to manage an increasing amount of by-products generated by the growing population and economy.

The majority of California food processors are located in Central Valley region. The monitoring and reporting program developed by Department of Environmental Resources of Stanislaus County since 1987 fosters reuse of food processing by-products through land application, direct animal feed, dehydration, and composting (Harrigfeld, 2006). Although, this program was established to address a sustainable reuse option of food processing by-products, and especially to minimize their disposal in landfills, no scientific research had been conducted to assess the long-term effects of land application of these by-products on soil and water quality, and the economic feasibility of these operations. In addition, the RWQCB has expressed concerns about the potential impacts that land application of food processing by-products (which

could have low pH, high TDS, and trace elements) may degrade soil and groundwater quality after its application on California farmlands (Wyels, 2006).

The overall goal of this research project is to study and develop meaningful scientific understanding of the food processing by-products characteristics and the processes affecting their fates in the soil profile and groundwater, to study cost-effectiveness of applications of food processing by-products, and especially to develop a best-management practices program to ensure their sustainable applications on California farmlands.

This multidisciplinary team of researchers will conduct a two-year field research on effects of land-applied food processing by-products on soil and groundwater quality, and economic feasibility of this operation. The objectives of this study are:

1. To monitor the fates of food processing by-products through the soil profile, crop removal of certain components, and the influence they might have in surface- and groundwater chemistry.
2. To study cost-effectiveness of potential reuses of food processing by-products under various scenarios.
3. To develop a BMPs program that identifies the sustainable land application of food processing by-products on farmlands.

B. STATEMENT OF METHODOLOGY

We will use various analytical methods to assess on-farm plant nutrient, salt, and trace element budgets via crop removal and their movement through the soil profile. In addition, we will conduct basic modeling of soil and solute transport to investigate the movement of these by-products to surface- and groundwater. If modeling yields reasonable results, then we will recommend its use as a management tool for planning of application operations at different sites in California. In the course of this study we intend to address the following data gaps:

1. *To establish crop nutrient balance from fields receiving by-products as a soil amendment*

We propose to collect plant tissue samples from various annual crop rotations in Stanislaus County. This study will improve our understanding of crop nutrient removal patterns from different types of by-products in various soil types. We will utilize these data to assist growers to decide on an appropriate crop pattern and how to sustainably apply by-products as a part of their fertilizer program. Growers will be able to maximize crop nutrient use efficiency, minimize nutrient loss, and preserve soil and water quality.

2. *To monitor soil moisture content change after by-product applications*

We propose a repeat field study to investigate how soil moisture content at 0-7.5, 7.5-15, 15-22.5, and 22.5-30 cm depths will change over time after an application of by-products. We will collect soil samples before by-product application and 3 hours, 2 days and 8 days following by-product application.

3. *Experimental field studies (site by site comparison, loading rate studies, and/or forage quality comparison)*

4. *Revising Manual of Best Practices for Application of Food Processing By-products on Farmlands (July 2007) with the update information*

We will update the current manual with additional information collected during the course of this study during Phase 1 and 2. For example, the rate of nutrient removal by various forage crops and the nutrient management plan for by-products application.

5. *Modeling studies for irrigation water movement on sites receiving by-products*

We propose to measure the movement of irrigation water through lysimeters. The lysimeters are Schedule 40 PVC cylinders, 18 inches in diameter and 24 inches high, which are sealed at the bottom and filled with soil. A valve at the bottom allows for withdrawal of water that has infiltrated to the bottom. From measurements of the input and infiltrated volume one can estimate, by difference, the amount of water removed by evapotranspiration.

The experimental setup for tasks 5 and 6 consists of 10 lysimeters. Lysimeters L-1 through L-5 will be filled with a sandy soil, whereas lysimeters L-6 through L-10 will be filled with clayey soil. Lysimeters L-1 through L-5 will be dosed with 250 grams of dried and aged poultry manure to add nitrogen and organic matter to the upper 3 inches of the sandy soil. The clayey soil used for lysimeters L-6 through L-10 has high content of organic matter and needs no additional amendments. Lysimeters L-1, L-2, L-6, and L-7 will be used for control and will not receive fruit and vegetable "byproducts". Lysimeters 1 and 6 will be instrumented with soil moisture sensors installed at depths of 2, 6, 10, 14, and 18 inches. Data will be collected at 15-minute intervals by a data logger.

All ten lysimeters will be "flooded" for one week, to achieve total saturation of the soil. Afterward, all ten lysimeters will be allowed to equilibrate for one week before six of them receive an application of fruit and vegetable "byproducts". Lysimeters L-3 through L-5, and L-8 through L-10 will each be dosed with two quarts of commercial fruit cocktail, two quarts of commercial canned tomatoes, one gram of KI and one gram of CuSO_4 . The purpose of this dosing is to have an identifiable anion (iodide) that can serve as proxy for the behavior of Cl, and an identifiable cation (copper) that can serve as a proxy for the behavior of heavy metals. The fruit-vegetable mixture will be allowed to air dry for one week, and will afterward be mixed with the upper three inches of the soil. After another week a rye grass will be planted in all 10 lysimeters, and "irrigation" will start on a weekly basis by applying 2 inches of water every Sunday evening.

Every Saturday evening the spigot at the base of each lysimeter will be opened, and the water that had infiltrated to the bottom of each lysimeter will be collected overnight. The volume will be carefully measured, and samples will be collected for chemical analysis. Infiltrated volume will be compared with input volume, and with the advance of the moisture front as recorded by the moisture sensors in L-1 and L-6.

Once a suitable database is recorded (1 month), the data will be used to calibrate an unsaturated flow model. At this time we are trying to get permission to use MIN3P (Mayer, 1999), the same modeling program used in the Hilmar study. [Mayer, K.U.,

1999. A numerical model for multicomponent reactive transport in variably saturated porous media. Ph.D. thesis, Department of Earth Sciences, University of Waterloo.]

The final deliverable for this task will be a summary of the experimental data, and a determination of the reproducibility of the experimental results by the MIN3P model.

6. *Modeling studies for salt/solute movement on sites receiving by-products*

The same experimental setup described in Task 5 will be used to document salt/solute movement. Once a week two statistically independent samples of irrigation water will be taken, and at the end of the week samples will be collected from each of the 10 lysimeters. pH and electric conductivity will be measured in the field, after which the pH of the sample will be adjusted to 5 to keep the ions in solution. The 12 samples collected every week will be submitted to the analytical laboratory retained by the project (UC Davis), but a split will be analyzed by the research team to provide “real time” monitoring of some parameters (e.g., nitrate, sodium, chloride, iodide, copper, TDS, and FDS).

Lysimeters L-1 and L-2 will provide control for the “no-byproducts” case in sandy soil, while lysimeters L-3, L-4, and L-5 will measure the extent of solute movement through the 22-inch sandy soil column. Likewise, lysimeters L-6 and L-7 will provide control for the “no-byproducts” case in sandy soil, while lysimeters L-8, L-9, and L-10 will measure the extent of solute movement through the 22-inch clayey soil column.

Once a suitable database is recorded (3 months), the data will be used to calibrate an unsaturated mass transport model. At this time we are trying to get permission to use MIN3P (Mayer, 1999), the same modeling program used in the Hilmar study. The model includes advective-dispersive transport in the water phase, and allows the analysis of problems involving inorganic and organic chemicals. Geochemical reactions considered are hydrolysis, complexation, oxidation-reduction, ion exchange, gas dissolution-exsolution and dissolution-precipitation reactions. A general kinetic formulation is included for intra-aqueous and dissolution-precipitation reactions. Microbially mediated reactions can be described using a multiplicative Monod formulation.

The final deliverable for this task will be a summary of the experimental data, and a determination of the reproducibility of the experimental results by the MIN3P model.

7. *To review previous studies on reuse of other types of by-products on California farmlands, and to establish proper management and controls that are more appropriate for land-application of fruit processing by-products.*

We propose to review the following reports:

- (a) *Hilmar Supplemental Environmental Project*, submitted to the California Regional Water Quality Control Board Central Valley Region In Compliance With Order No. R5-2006-0025 by Rubin et al. (2007)
- (b) *Wine Institute Project*, submitted to California Regional Water Quality Control Board Central Valley Region in compliance with Resolution No. R5-2003-0106

(c) *Manual of Good Practice for Land Application of Food Processing/Rinse Water*, prepared for California League of Food Processors by Brown and Caldwell & Kennedy/Jenks Consultants (March 14, 2007)

C. PROJECT TIMELINE

We propose a two-year study to conduct a field research in Modesto, CA between September 1st, 2008 and August 31st, 2010. The detailed research activities and their timelines are shown on Attachment 1.

D. DISSEMINATION PLAN

The food processing industries in California are the leading U.S. producers of processed fruits and vegetables. Increasing demand of processed fruits and vegetables is anticipated because consumers prefer conveniently stored products. In addition, an expansion of land-applied organic wastes is projected to rise because of the public concerns regarding environmental impacts and economic restraints of their disposal to landfill or incineration.

A number of parties are involved in this research project. Food processors, farmers, government agencies, and universities come together to address this issue raised by the RWQCB. Our results will develop a meaningful guideline for sustainable reuse of food processing by-products on California farmlands. Our goals are to establish the BMPs of land-applied food processing by-products (solids, semi-solids, and slurry), and scientific information from effects of reuse this type of non-traditional organic wastes on soil and groundwater quality. Utilizing food processing by-products as soil amendments will help growers to reduce an amount of their fertilizer application rate and recycle other plant nutrients back to the soil. This reuse program may be an alternative disposal option for other food processors elsewhere. In addition, policy makers can utilize results of this study to make decisions on monitoring and enforcement programs.

E. STAFFING PLAN

Our research partnerships are among CSU Fresno, CSU Stanislaus, Stanislaus County, Del Monte and Mape's Ranches (Lyons' Investments). This research team has been established since July 2006 for an ongoing effort to address effects of land-applied food processing by-products under the Program. We assure that areas of expertise of PI and co-PI are appropriate to carry out the research goals and objectives. Please see attachments 2a and 2b for detailed curriculum vitae of Drs. Pasakdee and Ferriz, respectively.

F. ANTICIPATED OUTCOME STATEMENT

Public concerns of environmental impacts after land applications of food processing by-products on farmlands are rising. An outcome of this study is to provide society and policy makers with robust data to better understand potential impacts of application of food processing

by-products to agricultural farmlands based on available scientific information. The anticipated outcomes are follows:

1. To develop the BMPs program which may become a statewide manual for this type of food processing by-products.
2. To present and publish results of this research at industry and/or professional meetings, on consumer/industry-oriented publications, and peer-reviewed journal publications.
3. To enable agricultural research opportunities for CSU students in areas of soil science, hydrology, environmental science, and crop/agronomy sciences.
4. To provide scientific information for effects of reuse this type of food processing by-products on soil and ground water quality, and nutritional contents of forage crops
5. To illustrate field demonstration of food processing by-products shipping, handling, and land-applied under the Program,

G. FUNDING SOURCE

The current funding from California Department of Food and Agriculture Specialty Crop Program, Stanislaus County, and industries enable us to initiate this study since July 2006, however, this funding is ended in August 2008. Additional funding from ARI program is valuable to carry out the multi-year monitoring program in partnership with Stanislaus County, food processing industry, and growers to study and develop meaningful scientific understanding of the food processing by-products characteristics and the processes affecting their fates in the soil profile and groundwater, and especially to develop the BMPs program to ensure their sustainable land application. Please see Attachment 3 for details of requested funding.

Budget Narrative

We request the total budget commitment for this two-year project is \$155,000 from ARI System FY 08-10. Project funding will be utilized to conduct applied research, education, outreach, and technology transfer activities related to the land application of food processing plant by-products from September 1, 2008 to August 31, 2010. This project will allow the research team to proactively address an integral critical aspect of a much larger food processing industry production, environmental, and regulatory issue which potentially threatens the industry's long-term viability. The budget will fund research activities necessary for Stanislaus County to proactively respond to the California Regional Water Quality Control Board resolution number R5-2006-0052 regarding the application of food processing by-products on farmlands. The following narrative justification details major budget expenditures:

1. Salaries, Wages, and Benefits:

Principal investigator, Sajeemas Pasakdee, is a research scientist at College of Agricultural Science and Technology, CSU Fresno. She dedicates her time and attention to this project and works collaboratively with two co-principal investigators, Dr. Ferriz and Mr. Dellavalle. Therefore, 40% of Pasakdee's 2008-09 salary of \$18,870 and 40% of her 2009-10 salary of \$19,814 plus benefits is funded from the ARI project budget

Regular Staff line item. There is personal service (total benefit costs) budget funding of \$6,039 and \$6,341 for FY 08-09 and FY 09-10, respectively. A Co-PI, Horacio Ferriz, is a CSU Stanislaus faculty member. The interagency agreement will be established to fund his research activities for \$26,000 for each fiscal year. An in-kind match from Stanislaus County is at a total of \$20,600 (\$10,300 annually).

2. Operating Expense:

Operating expenses are for a total of \$8,550 and \$10,100 for FY 08-09 and FY 09-10, respectively. These include the purchase of an annual professional membership subscription, computer maintenance and related equipment such a copier, printer, etc. as well as normal and customary office and research supplies.

3. Travel:

This project requires in- and out-of-state travel. In-state travel primarily involves traveling to and from the participating universities and a number of field application sites and food processing facilities within Stanislaus and Fresno County by researchers for the purpose of monitoring, data collection, and management practice evaluation. Travel reimbursement for the project is also budgeted from in-state travel. Out-of-state travel focuses more on attending and/or presenting project information at industry and professional meetings and conferences relative to land-applied food processing by-products and related best management practices that are appropriate for California.

4. Contractual Services:

We anticipate the external cash match will pay for interagency agreement between CSU Fresno and CSU Stanislaus at a total of \$52,000 (\$26,000 annually), for contractual service (lab analysis cost) and consulting service provided by Dellavalle Inc. (Fresno, CA) and Mr. Nat Dellavalle for a total of \$39,000 and \$37,217 for FY 08-09 and FY 09-10, respectively. For contractual service provided by Mrs. Dawn Brunmeier (San Joaquin Ag Consultant, Modesto, CA) is for a total of \$10,000 (\$5,000 annually). The in-kind match will come from Del Monte and Lyon's Investments for a total of \$60,000 (\$30,000 annually).

5. Capitalized Equipment:

There is no plan to purchase any capitalized equipment costing over \$5,000.

6. Telephone Charges:

There are charges for an expense of cellular phone and office phone for a total of \$824 and \$1,245 for FY 08-09 and FY 09-10, respectively.

7. Indirect Charges:

There are charges for an indirect cost from CSU Foundation Office at a rate of 15%. We apply the formula (cash match*15% and divided by 1.15 factor) or a total of \$10,434 for FY 08-10.

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- Wyels, W. 2006. Adoption of Resolution Regarding the Reuse of Food Processing by-Products within Stanislaus County [Online]. Available by Central Valley Regional Water Board http://www.swrcb.ca.gov/rwqcb5/adopted_orders/Resolutions/R5-2006-0052.pdf (posted August 24, 2006; verified July 14).

Attachment 1

Project Timeline

Major Activity
Areas/Objectives

Performance Period

JAS OND JFM AMJ JAS OND JFM AMJ
 FY 08-09 FY 09-10

- Collecting plant, soil and water samples S-----C
- Analytical works for plant, soil and water analysis S-----C
- Soil moisture study S-----C
- Reviewing Hilmar Project Adjust timeline S--C
- Reviewing Wine Institute Project S--C
- Reviewing CA League of Food Processors Project S--C
- Compiling existing data S-----C
- Additional tasks requested by RWQCB S-----C
- Publications S-----C

S = start date
C = completion date

Attachment 2a

Sajeemas (Mint) Pasakdee, Ph.D., Soil Scientist/Agronomist

OFFICE: California Agricultural Technology Institute (CATI),

California State University Fresno

2910 East Barstow Ave. M/S OF 115, Fresno, CA 93740

TEL: 559-278-2828 FAX: 559-278-4849

Email: spasakdee@csufresno.edu

Education:

- Doctoral of Philosophy, Environmental Studies (Agroecology/Soil Science), University of California, Santa Cruz. December 2006. Dissertation: "*Nitrogen and Water Management in Organic Vegetable Production in California: Implications for Soil Properties, Plant Nutrient, and Farm Budget Analysis*".
- Master of Science, Plant Science, California State University, Fresno. May 2001. Thesis: "*Effect of Composted Biosolids on Trace Element Accumulation and Fruit Quality in Field-grown Apricots.*"
- Bachelor of Science, Plant Production Technology, Thammasat University, Bangkok Thailand. February 1995.

Professional Affiliations:

- Soil Science Society of America (SSSA); Crop Science Society of America (CSSA); American Society of Agronomy (ASA); Ecological Society of America (ESA); Soil and Water Conservation Society.

Professional Experience:

- Aug. 2006 to current: *Research Scientist/Project Director*, College of Agriculture-California Agricultural Technology Institute (CATI), California State University Fresno. The current research entitled "*Effects of land-applied food processing by-products on soil and water quality: Stanislaus County Model*".
- Apr. 1998 to Jun. 2006: *Graduate Student Research Assistant*, USDA-ARS-Water Management Research Laboratory, Parlier, California (Dr. Gary Bañuelos' Lab).
- Sep. 2001 to Jun. 2006: *Graduate Student Research Assistant*, Dept. of Environmental Studies, University of California, Santa Cruz (Dr. Weixin Cheng and Dr. Carol Shennan's Lab).
- Aug. 1999 to Jun. 2004: *Graduate Teaching Assistant for the following courses:*
University of California, Santa Cruz
 - ENVS 23 Physical and Chemical in Environment (Dr. Michael Loik, spring 2004)
 - ENVS 133 Agroecology and Sustainable Agriculture (Dr. Steve Gliessman, fall 2003)
 - ENVS 161 Soil and Plant Nutrition (Dr. Weixin Cheng, spring 2003)
 - ENVS 133 Agroecology Practicum (Dr. Carol Shennan, winter 2003)California State University, Fresno
 - SW 100L Soil Science Laboratory (Dr. Sharon Benes, fall 1999)
- Jun. 1997 to Sept. 1997: *Student Research Assistant*, Seafood Laboratory, Oregon State University, Astoria (Dr. Hajung An's Lab).
- Apr. 1995 to Jan. 1996: *International Coordinator*, World Agricultural, Environment and Industrial Exhibition (WORLDTECH'95 Thailand) organized by Royal Thai Government.

Publications:

1. Pasakdee, S., G.S. Bañuelos, C. Shennan, and W. Cheng. 2006. *Organic N fertilizers and Irrigation Influence Organic Broccoli Production*. Vegetable Science Journal. *In press*.
2. Bañuelos, G.S., S. Pasakdee, S.E. Benes, and L.A. Ledbetter. 2006. *Long-term Application of Biosolids on Apricot Production*. Communication of Soil Science and Plant Analysis Journal. *Accepted*.
3. Bañuelos, G.S., S. Sharmasarkar, and S. Pasakdee. 2004. *Utilization of Biosolids as a Fertilizer for Canola*. Compost Science and Utilization Journal, 12(1): 61-68.
4. Bañuelos, G.S., S. Pasakdee, and J.W. Finley. 2003. *Growth Response and Selenium and Boron Distribution in Broccoli Varieties Irrigated with Poor Quality Water*. Journal of Plant Nutrition, 26(12): 2537-2549.
5. Bañuelos, G.S. and S. Pasakdee. 2002. *Effect of Organic Fertilizer on Vegetable Production*. Biocycle 43(8):63.
6. Pasakdee, S. 2001. California State University, Fresno Master Thesis. *Effect of Composted Biosolids on Trace Element Accumulation and Fruit Quality in Field-Grown Apricots*. 90pp.

Manuscripts in preparation:

1. Pasakdee, S. and W. Cheng. 2008. *Fertilizer Use Efficiency and Priming Effects of Organic N Fertilizers Application on Organic Farm Soils*. Soil Biology & Biochemistry Journal.
2. Pasakdee, S., G.S. Bañuelos, C. Shennan, and W. Cheng. 2008. *Contribution of Organic N Fertilizer and Irrigation to Plant N and Soil Chemical Properties on Organic Broccoli in California*. Plant and Soil Journal.

Awards:

- Dept. of Environmental Studies Thesis Mini-grant award during 2002 to 2006.
- Center for Agroecology and Sustainable Food Systems, University of California, Santa Cruz Graduate Student Mini-grant award in 2002 and 2003.
- Dept. of Plant Science Graduate Student Nominee for College of Agricultural Science and Technology's Dean Medal in 2001.
- ASEAN Student Assistance Award Program (ASAAP) scholarship from NAFSA in 1999 and 2000.
- International student nominee tuition award scholarship from Dept. of Plant Science, California State University, Fresno from fall 1998 to spring 2000.
- Ag One Grant from School of Agricultural Science and Technology, California State University, Fresno from fall 1998 to spring 2000.
- Certificate of honors for Well-Behaved Student from the Buddhist Youth Association of Thailand under the Royal Thai Patronage, 1993 to 1994 academic year.
- Certificate of honors for "Outstanding Student for Public Service" from Department of Agricultural Technology, Faculty of Science and Technology, Thammasat University, 1991 to 1992 academic year.

Presentations:

1. Pasakdee, S. 2006 *Nitrogen and Water Management in Organic Vegetable Production in California: Implications for Soil Properties, Plant Nutrient, and Farm Budget Analysis*. Dept. of Environmental Studies PhD Dissertation Exit Seminar. Apr. 24th UC Santa Cruz. Oral
2. Pasakdee, S., G.S. Bañuelos, C. Shennan, and W. Cheng. 2006. *Nitrogen and Irrigation Management in Organic Vegetable Production in California*. Proceedings of 14th World Fertilizer Congress Meetings. Jan. 22nd to 27th Chaing Mai, Thailand. Oral
3. Pasakdee S., G.S. Bañuelos, W. Cheng, and C. Shennan. 2005. *Contribution of Organic N Fertilizers and Irrigation to Plant and Soil N Availability on Organic Broccoli Farms in Central*

- Coastal California*. Proceedings of ASA-CSSA-SSSA Annual Meetings. Nov. 6th to 10th Salt Lake City, UT. Oral
4. Pasakdee, S., G.S. Bañuelos, and W. Cheng. 2005. *Influence of Organic N Fertilizers and Irrigation on Plant and Soil N Availability under Organic Broccoli Farms in California*. Proceedings of the 26th Annual Central California Research Symposium. Apr. 21st California State University, Fresno. Oral
 5. Pasakdee, S., W. Cheng, G.S. Bañuelos, and C. Shennan. 2004. *Tracing Natural ¹⁵N Abundance in Plants and Soils after Organic Fertilizer N Applications*. Proceedings of ASA-CSSA-SSSA Annual Meetings. Oct. 31st to Nov. 4th Seattle, WA. Poster
 6. Pasakdee, S., G.S. Bañuelos, W. Cheng, and C. Shennan. 2003. *Effects of Organic N Fertilizers and Water Management on Organic Broccoli Production*. Proceedings of ASA-CSSA-SSSA Annual Meetings. Nov. 2nd to 6th Denver, CO. Poster
 7. Pasakdee, S., G.S. Bañuelos, W. Cheng, and C. Shennan. 2002. *Influence of Irrigation and Organic Fertilizers on Nitrate Movement in Organic Broccoli Production*. Proceedings of ASA-CSSA-SSSA Annual Meetings. Nov. 6th to 10th Indianapolis, IN. Poster
 8. Pasakdee, S., G.S. Bañuelos and S. E. Benes. 2002. *The Effect of Composted Biosolids on Fruit Quality and Trace Element Accumulation in Field-Grown Apricots*. Proceedings of the 17th World Congress of Soil Science. Aug. 14th to 21st Bangkok, Thailand. Poster
 9. Pasakdee, S., G.S. Bañuelos, S. E. Benes and S. Gu. 2001. *Effect of Composted-Biosolids on Fruit Quality in Organically-Grown Apricots*. Proceedings of ASHS Annual Meetings. Jul. 22nd to 27th Sacramento, CA. Poster
 10. Pasakdee, S. 2001. *The Effect of Composted Biosolids on Fruit Quality and Trace Element Accumulation in Field-Grown Apricots*. Proceedings of the 15th Annual California State University Student Research Competition. Apr. 27th to 28th California State University, San Jose. Oral
 11. Pasakdee, S. 2001. *The Effect of Composted Biosolids on Fruit Quality and Trace Element Accumulation in Field-Grown Apricots*. Proceedings of the 22nd Annual Central California Research Symposium. Apr. 20th California State University, Fresno. Oral
 12. Pasakdee, S. 2001. *The Effect of Composted Biosolids on Fruit Quality and Trace Element Accumulation in Field-Grown Apricots*. Dept. of Plant Science Master Thesis Seminar. Apr. 20th California State University, Fresno. Oral
 13. Bañuelos, G.S. and S. Pasakdee. 2001. *Trace Element Accumulation in Canola Intercropped with Apricot Trees Amended with Biosolids*. Proceedings of the 11th West Coast Conference on Contaminated Soils, Sediments, and Water. Mar. 19th to 22nd San Diego, CA. Oral
 14. Pasakdee, S., G.S. Bañuelos, S. E. Benes, and S. Gu 2001. *The Effect of Composted Biosolids on Fruit Quality and Trace Element Accumulation in Field-Grown Apricots*. Proceedings of California Plant and Soil Conference. Feb. 4th Fresno, CA. Poster

Fresno County & City Chamber of Commerce (Chair Water Resources Committee 1989-93;
Director since 1993; Vice President, Agriculture 1995-97)

Advisory Committees

California Irrigation Management Information Service (CIMIS), Department of Water
Resources 1982-85
Department of Land, Air and Water Resources, University of California, Davis, 1983-93
Office of Water Conservation, Department of Water Resources, State of California, since
1985
Dean, College of Agriculture and Environmental Sciences, University of California, Davis,
1987-90
Fresno-Clovis Metropolitan, Water Management Plan, 1991-95
Public Works Task Force, Little Hoover Commission, City of Fresno, 1991
Fresno County Agricultural PM-10 Advisory Committee, 1989-1991
Citizens Advisory Group of Industries (Formerly Agricultural PM-10 Advisory Committee),
1991-95
California State University, Fresno, Department of Plant Science & Mechanized Agriculture,
1995
Fresno Fruit Fly Action Coalition Taskforce, Co-chair, 1995 - 1997
Western States Sample Exchange Advisory Committee, University of California, Davis,
1993-Present
North American Proficiency Testing Program for Agricultural Laboratories, Steering
Committee, Soil and Plant Analysis Council, 1995 - Present
Western Regional Coordinating Committee, University of Idaho, Twin Falls, ID
Plant Science Department, California State University, Fresno, 1995 - Present
Soil Science Department, California Polytechnic University, San Luis Obispo, CA 1996 -
Present
School of Natural Science, California State University, Fresno, 1996 - Present

Awards

J.B. Jones Award, by the Soil & Plant Analysis Council, 1995

Foreign Assignments

Chile: Since 1988 - Inversiones Agrícolas E Ind. Evaluation of soils for salinity and sodium
status.
Barcelona, Spain: Since 1979 - Codorniu, S.A. Evaluation of soil chemistry and vine
nutrition for wine production.
Taxco, Mexico: 1986 - Proyecto Nacional Conjunto UACH-CP-Fertimex. National
symposium on analysis of agricultural soils. Lectured on laboratory quality control and
quality assurance.
Baja California: 1982 - Uvas de California. Evaluated nutritional, pathological and soil
conditions in vineyards in three regions of Baja California.
Egypt: 1977 - Superior Oil Company. Evaluated soils and waters for agricultural suitability.

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Attachment 3

Land Application By-products Phase 2. SYSTEM ARI FY 2008-09 Budget					
Account Codes	Description	ARI Funding	External Match		Total Funding
			Cash	In-kind	
Salaries, Wages, and Benefits					35,209
601202	Part Time Faculty				0
601301	Management & Supervisory (Stanislaus County)			10,300	10,300
601401	Regular Staff (Pasakdee @ 40% time)	18,870			18,870
601701	Faculty Release				0
601701	Additional Employment (Summer Salary)				0
601701	Temporary Help				0
601801	Student Assistant				0
601802	Bridge Student Assistant				0
602100	Benefits	6,039			6,039
Operating Expense					8,550
603107	Computer Maintenance				0
603111	Dues & Subscriptions	500			500
603119	Memberships	500			500
603122	Multi-Media Services				0
603123	Non-Capitalized Computer Equipment	1,500			1,500
603124	Non-Capitalized Equipment	2,700			2,700
603126	Office Supplies	400			400
603127	Other Computer Services				0
603131	Postage	100			100
603132	Printing	200			200
603139	Software Non-Capitalized				0
603141	Software Licenses	400			400
603145	Supplies & Miscellaneous Expenses	2,250			2,250
Travel					5,500
603201	Travel In-State	3,000			3,000
603202	Travel Out-of-state	2,500			2,500
Contractual Services					100,000
603301	Consulting Services (Del Monte)			15,000	15,000
603301	Consulting Services (Lyon's)			15,000	15,000
603302	Equipment Rental/Lease Agreements				0
603303	Honoraria				0
603304	Interagency Agreements (CSU Stanislaus--Ferriz)		26,000		26,000
603310	Contractual Services and Consulting Services--Dellavalle	30,217	8,783		39,000
603310	Consulting Services--Dawn Brunmeier	5,000			5,000
Equipment					
603401	Equipment Over \$5,000/item				
603403	Computer Equipment Over \$5,000/item				
Telephone Charges					824
603501	Cell Phone	700			700
603504	Telephone Moves/Add/Changes	50			50
603505	Telephone Usage	74			74
	Indirect Charge - 15%		5,217		5,217
TOTALS		75,000	40,000	40,300	155,300

Land Application By-products Phase 2. SYSTEM ARI FY 2009-10 Budget

Account Codes	Description	ARI Funding	External Match		Total Funding
			Cash	In-kind	
Salaries, Wages, and Benefits					36,455
601202	Part Time Faculty				0
601301	Management & Supervisory (Stanislaus County)			10,300	10,300
601401	Regular Staff (Pasakdee @ 40% time)	19,814			19,814
601701	Faculty Release				0
601701	Additional Employment (Summer Salary)				0
601701	Temporary Help				0
601801	Student Assistant				0
601802	Bridge Student Assistant				0
602100	Benefits	6,341			6,341
Operating Expense					10,100
603107	Computer Maintenance				0
603111	Dues & Subscriptions	500			500
603119	Memberships	500			500
603122	Multi-Media Services				0
603123	Non-Capitalized Computer Equipment	1,700			1,700
603124	Non-Capitalized Equipment	3,000			3,000
603126	Office Supplies	400			400
603127	Other Computer Services				0
603131	Postage	100			100
603132	Printing	500			500
603139	Software Non-Capitalized				0
603141	Software Licenses	400			400
603145	Supplies & Miscellaneous Expenses	3,000			3,000
Travel					7,500
603201	Travel In-State	4,000			4,000
603202	Travel Out-of-state	3,500			3,500
Contractual Services					99,783
603301	Consulting Services (Del Monte)			15,000	15,000
603301	Consulting Services (Lyon's)			15,000	15,000
603302	Equipment Rental/Lease Agreements				0
603303	Honoraria				0
603304	Interagency Agreements (CSU Stanislaus--Ferriz)		26,000		26,000
603310	Contractual Services and Consulting Services--Dellavalle	30,000	8,783		38,783
603310	Consulting Services--Dawn Brunmeier	5,000			5,000
Equipment					
603401	Equipment Over \$5,000/item				
603403	Computer Equipment Over \$5,000/item				
Telephone Charges					1,245
603501	Cell Phone	945			945
603504	Telephone Moves/Adds/Changes	100			100
603505	Telephone Usage	200			200
	Indirect Charge - 15%		5,217		5,217
TOTALS		80,000	40,000	40,300	160,300

**Land Application By-products Phase 2. SYSTEM ARI
Total Budget (Round VIII FY2008-09 through 2009-10)**

Account Codes	Description	ARI Funding	External Match		Total Funding
			Cash	In-kind	
Salaries, Wages, and Benefits					71,664
601202	Part Time Faculty	0	0	0	0
601301	Management & Supervisory (Stanislaus County)	0	0	20,600	20,600
601401	Regular Staff (Pasakdee @ 40% time)	38,684	0	0	38,684
601701	Faculty Release	0	0	0	0
601701	Additional Employment (Summer Salary)	0	0	0	0
601701	Temporary Help	0	0	0	0
601801	Student Assistant	0	0	0	0
601802	Bridge Student Assistant	0	0	0	0
602100	Benefits	12,380	0	0	12,380
Operating Expense					18,650
603107	Computer Maintenance	0	0	0	0
603111	Dues & Subscriptions	1,000	0	0	1,000
603119	Memberships	1,000	0	0	1,000
603122	Multi-Media Services	0	0	0	0
603123	Non-Capitalized Computer Equipment	3,200	0	0	3,200
603124	Non-Capitalized Equipment	5,700	0	0	5,700
603126	Office Supplies	800	0	0	800
603127	Other Computer Services	0	0	0	0
603131	Postage	200	0	0	200
603132	Printing	700	0	0	700
603139	Software Non-Capitalized	0	0	0	0
603141	Software Licenses	800	0	0	800
603145	Supplies & Miscellaneous Expenses	5,250	0	0	5,250
Travel					13,000
603201	Travel In-State	7,000	0	0	7,000
603202	Travel Out-of-state	6,000	0	0	6,000
Contractual Services					199,783
603301	Consulting Services (Del Monte)	0	0	30,000	30,000
603301	Consulting Services (Lyon's)	0	0	30,000	30,000
603302	Equipment Rental/Lease Agreements	0	0	0	0
603303	Honoraria	0	0	0	0
603304	Interagency Agreements (CSU Stanislaus--Ferriz)	0	52,000	0	52,000
603310	Contractual Services and Consulting Services--Dellavalle	60,217	17,566	0	77,783
603310	Consulting Services--Dawn Brunmeier	10,000	0	0	10,000
Equipment					
603401	Equipment Over \$5,000/item				
603403	Computer Equipment Over \$5,000/item				
Telephone Charges					2,069
603501	Cell Phone	1,645	0	0	1,645
603504	Telephone Moves/Adds/Changes	150	0	0	150
603505	Telephone Usage	274	0	0	274
	Indirect Charge - 15%		10,434		10,434
TOTALS		155,000	80,000	80,600	315,600