CITY OF LEMOORE

WASTEWATER REUSE STUDY
ENGINEERING REPORT

City of Lemoore Public Works Department
711 West Cinnamon Drive
Lemoore, CA 93245

March 4, 2011

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Acknowledgements

The key goal of this Study was to explore and identify the long-term wastewater reclamation options which would help to keep the City of Lemoore economically sustainable. This Study was made possible with funding from the U.S. Economic Development Administration (Award #07-79-05984).

Disclaimer

This publication (Study) was prepared for and by the City of Lemoore. The statements, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the Economic Development Administration.

Lemoore City Council

Mayor Willard Rodarmel
Mayor Pro Tem John Plourde
Councilmember John Gordon
Councilmember John Murray
Councilmember Billy Siegel

Lemoore City Staff

City Manager - Jeff Briltz
Public Works Director - David Wlaschin
Administrative Analyst – J.P. Prichard
City Engineer - Harry Tow, P.E. (Quad-Knopf)

Principal Authors - Provost & Pritchard Consulting Group

Donald Ikemiya, P.E.
David McGlasson, P.E.
Micah Bowman, E.I.T.
286 West Cromwell Avenue
Fresno, California 93711
Phone: (559) 449-2700
Fax: (559) 449-2715

REGISTERED PROFESSIONAL ENGINEER
DONALD J. IKEMIYA
No. 56,630
Civil
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
DAVID M. McGLASSON
NO. 38482
CIVIL
STATE OF CALIFORNIA

DATE SIGNED: 3/4/11

Abstract

This report identifies and analyzes the City of Lemoore's wastewater reclamation options as the City and its industries continue to grow. Leprino Foods' cheese production facilities are a valuable major economic driver and employer in the City.

The Leprino processing wastewater stream currently comprises over 50% of the total flow. This percentage is expected to grow over the next two years, and then gradually decrease as the City continues its steady population growth.

All effluent is currently conveyed to Westlake Farms, where Westlake blends it with irrigation water sourced from the Kings River and a variety of groundwater wells for discharges to their agricultural lands. Although Westlake Farms has been and ideally would continue to be the point of discharge for the wastewater, it is imperative for the City to identify long term and economically sustainable options. This includes the potential to purchase and control the reclamation area.

Three primary discharge options were identified: Westlands Water District, Naval Air Station Lemoore, and Westlake Farms. A significant level of analysis, discussion and deliberation has also occurred with the major stakeholders. This Study captures the effort and work which ultimately intends to provide direction and a level of certainty to the City.

CITY OF LEMOORE WASTEWATER REUSE STUDY ENGINEERING REPORT

TABLE OF CONTENTS

Executive Summary

Purpose & Goals ES-1

Historical & Institutional Background ES-2

Data, Analysis & Recommendations ES-2

Summary ES-5

Chapter 1 - Introduction

1.1 Purpose & Goals of the Wastewater Reuse Study 1

1.2 Wastewater Options and Study Areas 2

1.3 Additional Reuse Options Considered 2

1.4 Wastewater Reuse Study Scope of Work 3

Chapter 2 - Wastewater & Options Background

2.1 Lemoore WWTF Waste Discharge Requirements 5

2.2 Lemoore WWTF Treatment Processes 6

2.3 Existing Effluent Distribution 9

2.4 Current Wastewater Characteristics 9

2.5 Projected Wastewater Characteristics 10

2.6 Effluent Quality for Crop Irrigation 11

2.7 Soil and Geological Conditions 15

2.8 Cropping Options 16

2.9 Irrigation System Options 16

Chapter 3 - Wastewater Treatment Options

3.1 Effluent Reuse Options 17
3.2 Treatment Options 17
3.3 Impact on Reuse Options 19
3.4 Considerations 19

Chapter 4 - Study Area 1 – Westlands Water District Property

4.1 Background 21
4.2 Site Conditions 22
4.3 Soils 23
4.4 Groundwater Characteristics 23
4.5 Supplemental Water 24
4.6 Effluent Conveyance System 24
4.7 Water Balance 25
4.8 Storage Needs & Locations 26
4.9 Cost Analysis 26
4.10 Considerations 27

Chapter 5 - Study Area 2 – Naval Air Station Lemoore

5.1 Background 28
5.2 Site Conditions 28
5.3 Soils 29
5.4 Groundwater Characteristics 30
5.5 Irrigation Water Supply 30
5.6 Effluent Conveyance System 31
5.7 Water Balance 31
5.8 Storage Needs & Locations 32
5.9 Cost Analysis 33
5.10 Considerations 33

Chapter 6 - Study Area 3 – Westlake Farms

6.1 Background 34
6.2 Site Conditions 34
6.3 Soils 35
6.4 Groundwater Characteristics 35
6.5 Supplemental Water 35
6.6 Effluent Conveyance System 36
6.7 Water Balance 36
6.8 Storage Needs & Locations 38
6.9 Cost Analysis 38

Chapter 7 - Considerations

7.1 Preliminary Costs 39
7.2 Necessary Environmental Processes 40
7.3 Report of Waste Discharge 40
7.4 Necessary Agreements 41
7.5 Future Steps 41

LIST OF TABLES

Table 2-1 City of Lemoore Municipal Process Train 7
Table 2-2 City of Lemoore Leprino Process Train 7
Table 2-3 City of Lemoore WWTF Effluent Limitations 8
Table 2-4 Wastewater Production Projections 10
Table 2-5 2006-2007 WWTF Effluent Characteristics 12
Table 2-6 Supply Water Characteristics 13
Table 2-7 Salt Tolerance & Yield Potential of Selected Crops 14

Table 4-1 USDA Soil Characteristics 21
Table 4-2 Water Balance Summary 23

Table 5-1 USDA Soil Characteristics 25
Table 5-2 Water Balance Summary 28

Table 6-1 USDA Soil Characteristics 31
Table 6-2 Water Balance Summary 33

LIST OF EXHIBITS

EXHIBIT 1.1 VICINITY MAP
EXHIBIT 1.2 SITE MAP

EXHIBIT 2.1 WWTF AERIAL
EXHIBIT 2.2 WWTF FLOW DIAGRAM
EXHIBIT 2.3 EXISTING EFFLUENT RECLAMATION PIPELINE
EXHIBIT 2.4 CITY OF LEMOORE PROJECTED EFFLUENT 50 YEAR GROWTH
EXHIBIT 2.5 EFFLUENT FLOW RATE PROJECTION CHART

EXHIBIT 4.1 STUDY AREA 1 - AERIAL PHOTO (MAP)
EXHIBIT 4.2 STUDY AREA 1 – PARCELS AERIAL (MAP)
EXHIBIT 4.3 STUDY AREA 1 – GROUND SURFACE CONTOURS (MAP)
EXHIBIT 4.4 STUDY AREA 1 – FEMA FLOOD ZONES (MAP)
EXHIBIT 4.5 STUDY AREA 1 – SOIL TYPES (MAP)

EXHIBIT 5.1 STUDY AREA 2 - AERIAL PHOTO (MAP)
EXHIBIT 5.2 STUDY AREA 2 – 2007 LAND USE (CROPS MAP)
EXHIBIT 5.3 STUDY AREA 2 – 2008 LAND USE (CROPS MAP)
EXHIBIT 5.4 STUDY AREA 2 – GROUND SURFACE CONTOURS (MAP)
EXHIBIT 5.5 STUDY AREA 2 – FEMA FLOOD ZONES (MAP)
EXHIBIT 5.6 STUDY AREA 2 – SOIL TYPES (MAP)
EXHIBIT 5.7 STUDY AREA 2 – PROPOSED EFFLUENT PIPELINE (MAP)

EXHIBIT 6.1 STUDY AREA 3 - AERIAL PHOTO (MAP)
EXHIBIT 6.2 STUDY AREA 3 – PARCELS AERIAL (MAP)
EXHIBIT 6.3 STUDY AREA 3 – GROUND SURFACE CONTOURS (MAP)
EXHIBIT 6.4 STUDY AREA 3 – FEMA FLOOD ZONES (MAP)
EXHIBIT 6.5 STUDY AREA 3 – SOIL TYPES (MAP)

ES

EXECUTIVE SUMMARY

ES.1 This Executive Summary is a concise compilation of the key elements of the Wastewater Reuse Study Engineering Report (**WRS**) prepared for the City of Lemoore (**City**), to outline options for the long-term reuse of its municipal and industrial wastewater. Although the WRS is based on extensive technical data and analysis, it is intended to be a conceptual plan to guide future City decisions. Recommendations are subject to future revisions and improvements to adapt to unforeseen changes in the regulatory environment or local circumstances, or obstacles to the recommended alternatives. Exhibits referenced in this Executive Summary are located in the text of the WRS. Three parallel objectives were incorporated:

1) To minimize the long-term capital and operating costs for the City and its customers.
2) To maximize the beneficial agricultural reuse of the disinfected secondary treated municipal and industrial wastewater effluent from its wastewater treatment facility (**WWTF**) for the production of agricultural crops.
3) To maintain compliance with regulatory requirements.

ES.2 The original purpose and goals for the long-term reuse of the City's wastewater were focused on obtaining property now owned by the Westlands Water District (**WWD**). However, during the City's process of reviewing the feasibility of WWD land, WWD decided this land should be reserved for other WWD purposes and for the time being would not be available to the City. This prompted a significant change in the direction of the Study towards finding other options. Ultimately, the purpose and goals of the WRS are now to document the options to a point where in the future, this information can be used as a baseline document towards selecting a preferred option.

ES.3 This WRS is not intended to provide a final selection of a preferred option, details of an implantation plan, schedule or financing options. These items are subject to future development and review as circumstances like land availability and regulatory requirements become more defined.

ES.4 The City of Lemoore is located in Kings County California and is depicted in **Exhibit 1.1 "Vicinity Map".** The study areas are depicted in **Exhibit 1.2 "Site Map".**

ES.5 Four options were analyzed (using a significant amount of site data) for wastewater reuse based on current and projected horizon (**Year 2057**) wastewater flows and characteristics:

1) Wastewater treatment options, including industrial pre-treatment. Food processors are a major contributor to the wastewater load.
2) Wastewater reuse on specific agricultural lands within the WWD.
3) Wastewater reuse on agricultural lands within the Naval Air Station Lemoore (**NASL**) agricultural land.
4) Continued wastewater reuse at Westlake Farms, with additional conveyance options.

ES.6 Other wastewater reuse options were reviewed and discussed, but were not considered to be practically, economically or logistically feasible.

WASTEWATER & OPTIONS BACKGROUND

ES.7 The California Central Valley Regional Water Quality Control Board (**RWQCB or Water Board**) approved the current Waste Discharge Requirements **(WDRs)** Order No. 96-050 and Monitoring and Reporting Program (**MRPs**) No. 96-050 on February 23, 1996.

ES.8 Effluent quality is largely determined by the two wastewater treatment plants, one operated by the City for municipal flows, and the other operated by Leprino Foods and dedicated to Leprino's industrial waste stream. At present, the City's WWTP produces disinfected (to a level of 22 MPN) secondary effluent, though as a lagoon system, the plant sometimes struggles to meet the discharge specifications for suspended solids concentration without a mechanical clarifier. Leprino's plant is a Sequencing Batch Reactor, capable of reliably producing secondary-level effluent.

ES.9 This WRS is focused on the options available without significantly upgrading the treatment processes.

ES.10 The City's effluent is comprised of municipal sources (primarily residential, commercial, and some industrial from SK Foods/Olam West and AGUSA) and industrial process wastewater. Leprino Foods, which operates two mozzarella cheese production plants in Lemoore ("downtown" and "west" plants) generates about 54% of the total volume of wastewater produced in the City. All of the Leprino wastewater flows into a Leprino-owned pre-treatment facility located at the Lemoore WWTF site. The Leprino pre-treatment facility is a Sequencing Batch Reactor (**SBR**) process which beneficially results in a very low Biochemical Oxygen Demand (**BOD_5**) wastewater, but does not treat the relatively high EC/salinity. The

treated effluent from the SBR is introduced to the Lemoore WWTF outfall discharge pipeline.

ES.11 Westlake Farms receives all of the City's effluent and wishes to continue receiving the effluent. This arrangement has worked well for the City and the City also wishes to continue providing Westlake a supplemental water supply for their crops. The City recognizes the need to explore alternative wastewater reuse options, either to provide the City assurances of a long term City controlled solution or to provide Westlake the flexibility with their farming operations.

ES.12 The 2010 average combined (City municipal and Leprino) effluent characteristics are listed in **Table ES - 1**. Salinity is high while the other constituents are within acceptable ranges.

Table ES - 1
2010 Averaged Combined Effluent Characteristics

Constituent	Average	Units
BOD_5	18.0	(mg/l)
Settleable Solids	.036	(ml/l)
Total Coliform	<2 median	MPN
pH	7.1	(mg/l)
EC	1,976	(µmhos/cm)
Total Suspended Solids (**TSS**)	35.5	(mg/l)

ES.13 Wastewater flow projections are listed in **Table ES – 2**. As the higher EC Leprino effluent becomes a smaller percentage of the total, the lower EC of the municipal effluent dilutes the total effluent EC.

Table ES - 2
Wastewater Production Projections

Year	City Effluent (mgd)	Leprino Effluent (mgd)	Total Effluent (mgd)	EC Combined (umhos/cm)
2007	1.72	1.85	**3.58**	1,937
2010	1.89	2.26	**4.15**	1,976
2020	2.54	3.59	**6.13**	2,037
2030*	3.41	3.71	**7.12**	1,941
2040	4.59	3.82	**8.41**	1,843
2050	6.17	3.94	**10.10**	1,748
2057	7.48	4.02	**11.60**	1,684

* The City of Lemoore General Plan (2007) total wastewater flow projection for year 2030 is 6.3 mgd.

ES.14 Each Study Area water balance is summarized in **Tables ES – 3, 4, and 5** for three key years; 2010 – current flows, 2030 – coinciding with the General Plan (2007 update) year, and the build-out 2057 year.

ES.15 The reclamation acres needed, BOD5 loading, nitrogen loading, salt loading, and pond needs are listed. All sites are comparable to each other with only slight variations.

Table ES - 3
WWD Property Water Balance Summary

Year	Effluent Flow Rate (mgd)	Reclamation Area Needed (ac)	BOD Loading (lbs/ac/day)	N Loading (lb/acre/yr)	Salt Loading (lbs/ac/yr)	Pond Storage Needed (ac-ft)	Pond Area Needed (ac)
2010	4.15	2,251	0.29	157	6,000	1,154	68
2030	7.12	3,800	0.30	159	6,000	1,981	116
2057	11.60	5,377	0.34	183	6,000	3,227	186

Table ES - 4
NASL Water Balance Summary

Year	Effluent Flow Rate (mgd)	Reclamation Area Needed (ac)	BOD Loading (lbs/ac/day)	N Loading (lb/acre/yr)	Salt Loading (lbs/ac/yr)	Pond Storage Needed (ac-ft)	Pond Area Needed (ac)
2010	4.15	2,245	0.28	153	5,858	1,198	71
2030	7.12	3,961	0.28	153	5,761	1,952	114
2057	11.60	5,363	0.34	184	6,000	3,348	193

Table ES - 5
Westlake Farms Water Balance Summary

Year	Effluent Flow Rate (mgd)	Reclamation Area Needed (ac)	BOD Loading (lbs/ac/day)	N Loading (lb/acre/yr)	Salt Loading (lbs/ac/yr)	Pond Storage Needed (ac-ft)	Pond Area Needed (ac)
2010	4.15	2,251	0.29	157	6,000	1,154	68
2030	7.12	3,800	0.30	159	6,000	1,981	116
2057	11.60	5,377	0.34	183	6,000	3,227	186

ES.16 A preliminary cost analysis was performed for each of the three years studied. The analysis took into consideration the purchase of the land, construction of the storage ponds, construction of the conveyance system, and other miscellaneous items.

ES.17 Table ES – 6 is a summary of the estimated costs from the Study for each flow year project. The overall differences for each site pertain to the current owner more so than the site conditions.

Table ES - 6
Options Summary Table

Description	Study Area 1 WWD	Study Area 2 NASL	Study Area 3 Westlake Farms
Water Availability	No WWD water, 2 ac-ft/year application, limited groundwater	WWD water available	Empire Westside, Kings River
Land Availability	Purchase	Reuse Agreement or Lease	Purchase
2010 Costs (4.15 mgd)	$16,300,000	$17,000,000	$18,200,000
2030 Costs (7.12 mgd)	$27,100,000	$21,400,000	$24,600,000
2057 Costs (11.60 mgd)	$35,200,000	$29,700,000	$33,600,000

ES.18 Once a specific option is selected, an early next step would be to prepare a preliminary estimate of total project cost. This would include land, right of way, conveyance system, irrigation system, over-winter storage, treatment, and other costs. Operating costs would also be included.

ES.19 The necessary environmental processes will be needed including CEQA compliance and a new RWQCB permit.

ES.20 This Study provides the necessary background and support information to move forward on a long-term sustainable option for wastewater reclamation. However, proceeding on a preferred site or project is subject to the availability of the reclamation areas identified. While the current option of discharge to Westlake Farms remains the preferred option as long as it is available and feasible, the City is in a good position to use this Study towards the regulatory and permitting needs of a preferred project in the coming years.

1

INTRODUCTION

1.1 PURPOSE & GOALS OF THE WASTEWATER REUSE STUDY

1.1.1 This Wastewater Reuse Study Engineering Report (WRS) was prepared for the City of Lemoore (**City**) to outline options for the long-term reuse of its municipal and industrial wastewater. Three parallel objectives were incorporated:

1) Minimize the long-term capital and operating costs for the City and its customers.
2) Maximize the beneficial agricultural reuse of the disinfected secondary treated municipal and industrial wastewater effluent from its wastewater treatment facility (WWTF) for the production of agricultural crops.
3) Allow the City to remain in compliance with current regulatory requirements.

1.1.2 The original purpose and goals for the long-term reuse of the City's wastewater were focused on property currently owned by the Westlands Water District (**WWD**). However, during the City's review of the feasibility of WWD land, WWD decided the land should be reserved for other WWD purposes and for the time being would not be available to the City. This prompted a significant change in the direction of the Study towards finding other options. Ultimately, the purpose and goals of the WRS are now to document the options to a point where in the future, this information can be used as a baseline document towards selecting a preferred option.

1.1.3 The WRS is based on extensive technical data and analysis and is intended to function as a conceptual outline to guide the City towards a long term, sustainable reuse option.

1.1.4 This WRS is not intended to provide a final selection of a preferred option, details of an implantation plan, schedule or financing options. These items are subject to future interpretation and review as circumstances unfold (e.g. land availability) and regulatory requirements become more defined.

1.1.5 Numerous meetings and discussions were held with staff from the City of Lemoore, Leprino Foods, Westlands Water District, and Naval Air Station Lemoore (**NASL**). Westlake Farms (**Westlake**) has had a good relationship with the City for nearly 40 years. All stakeholders are to be complimented for their efforts and contributions towards the development of viable options for the City.

1.2 WASTEWATER OPTIONS AND STUDY AREAS

1.2.1 The City of Lemoore is located in Kings County California and is depicted in **Exhibit 1.1 "Vicinity Map"**. The study areas are depicted in **Exhibit 1.2 "Site Map"**.

1.2.2 Four options were analyzed for wastewater reuse based on current and projected (**Year 2030**) wastewater flows and characteristics:

1) Wastewater treatment options, including industrial pre-treatment. Food processors are a major contributor to the wastewater load.
2) Wastewater reuse on specific agricultural lands within the WWD.
3) Wastewater reuse on agricultural lands within the NASL agricultural land.
4) Continued wastewater reuse at Westlake Farms, with additional conveyance options.

1.2.3 A significant amount of information, including groundwater depths, groundwater quality, existing well logs, soils profiles, and cropping patterns, was collected for each of the study areas (WWD, NASL and Westlake).

1.2.4 The development of study area basemaps (multiple layers of information displayed individually as needed) was crucial for the understanding and visual display of existing conditions, how changes would be incorporated and what the impacts would be. The basemaps were created with ArcView version 3.2a and AutoCAD version 2009 and were prepared with source data provided by the City of Lemoore and NASL, and other available data. The basemap is based on NAD 83 California Zone 5 coordinates in feet using the City of Lemoore's standard GIS format. GIS source data includes:

a) Aerial Photography.
b) Property ownership.
c) Crop use maps.
d) USGS topographic maps.
e) FEMA Flood zone data.
f) USDA NRCS Soil Survey data.
g) Existing effluent distribution system information provided by the City.

1.3 ADDITIONAL REUSE OPTIONS CONSIDERED

1.3.1 Other wastewater reuse options were reviewed and discussed, but were not considered to be practically, economically or logistically feasible. These wastewater options included:

a) Deep well injection of wastewater.

b) Addition of tertiary treatment at the existing WWTF, which would have expanded the possible land uses for the reclaimed water.
c) Constructed wetlands for use of wastewater.
d) Segregating food processing wastewater away from the City, where the food processor would need to determine methods of reuse.

1.4 WASTEWATER REUSE STUDY SCOPE OF WORK

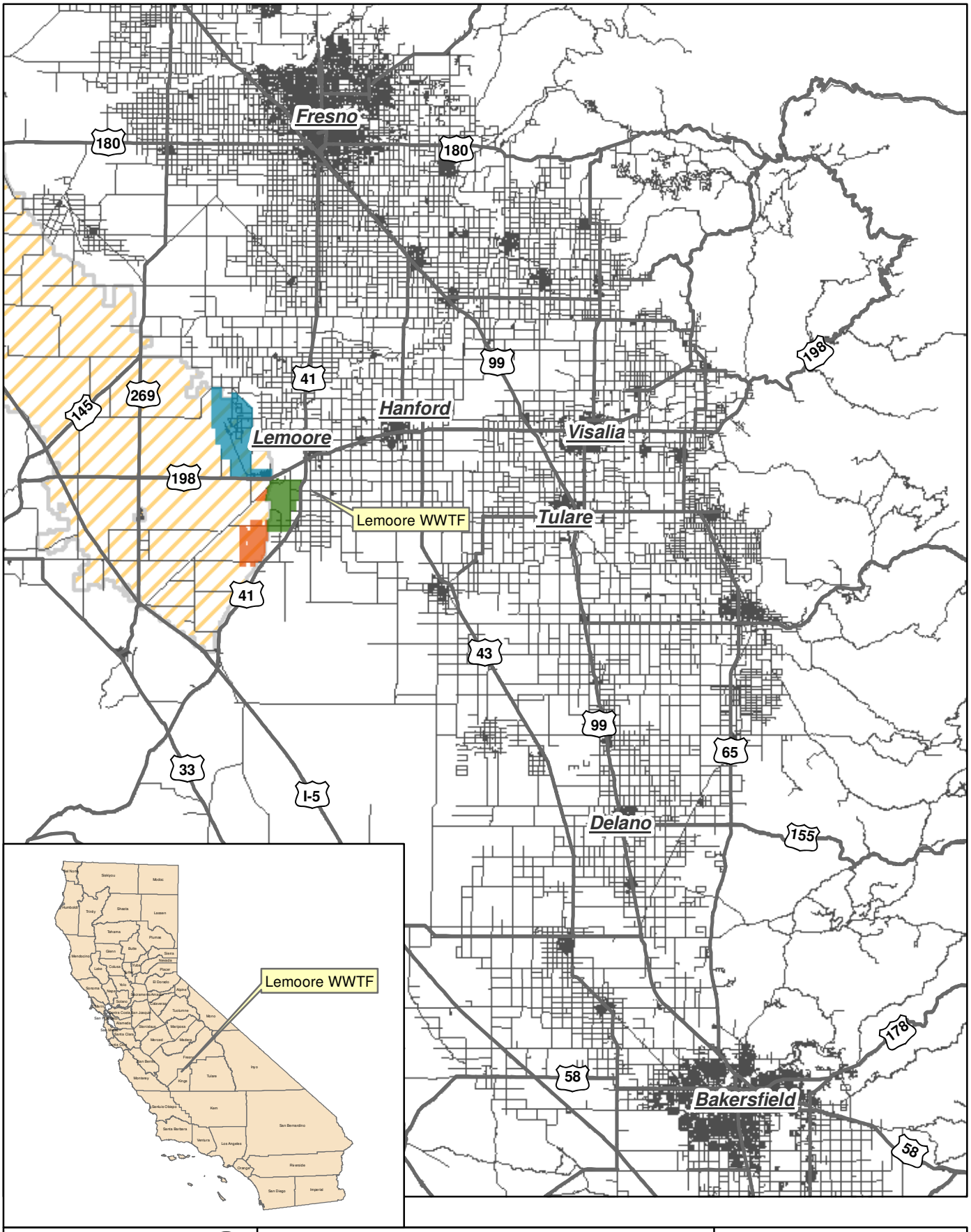
1.4.1 The Scope of Work tasks needed to accomplish the goals of this Wastewater Reuse Study are listed below.

Task 1. Project City meetings
Task 2. Project management
Task 3. Data collection and research
Task 4. Stakeholder project meetings
Task 5. Industrial and municipal wastewater projections
Task 6. Development of reuse options
Task 7. Analysis of wastewater conveyance, storage needs, locations, acreage requirements, site conditions, mapping, groundwater characteristics, cropping options, irrigation constraints
Task 8. Preparation of Administrative Draft Report
Task 9. Preparation of Final Report
Task 10. Presentation and comments from City Council
Task 11. Preparation of Final Report Addenda

1.4.2 The following assumptions were established and used for this Wastewater Reuse Study.

1) The City would be purchasing the reclamation farmland and would lease out the land to a contract farmer. Under an agreement with the City of Lemoore, farmers would secure long-term leases for a minimum of 10 years to upwards of 20 years.
2) The farmer would receive the wastewater at minimal cost and be provided with a delivery point near the reclamation field.
3) The wastewater treatment processes will remain the same. The City's treatment facilities include a headworks, aerated lagoons, and effluent chlorination. Located on the same site are secondary treatment-level Sequencing Batch Reactors and effluent ponding facilities for Leprino's industrial wastewater stream.
4) Bio-solids generated at the City of Lemoore WWTF will continue to be disposed off site and not applied to the wastewater reclamation land.
5) The effluent reuse site would be designed for a maximum flow of 11.6 mgd.

6) Reuse alternatives will be designed to handle water use rates during wet year (100 year return interval) and normal year rainfall scenarios.
7) Effluent reuse quality requirements and treatment needs will be set by the California Department of Public Health (**CDPH**) and the California Regional Water Quality Control Board (**RWQCB**).
8) Seasonal winter storage will be via surface ponds.
9) Prior to any construction, the City will carry out appropriate environmental impact analyses of the project pursuant to California Environmental Quality Act (**CEQA**) and, if necessary, National Environmental Policy Act (**NEPA**). All mitigation measures identified at that time will become part of the project.



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Fresno, CA 93711-6162
(559) 449-2700

Legend

- Highways
- Naval Air Station Lemoore
- Westlake Farms Study Area
- Westlands WD Study Area
- Westlands Water District

Exhibit 1.1

Wastewater Treatment Facility Vicinity Map

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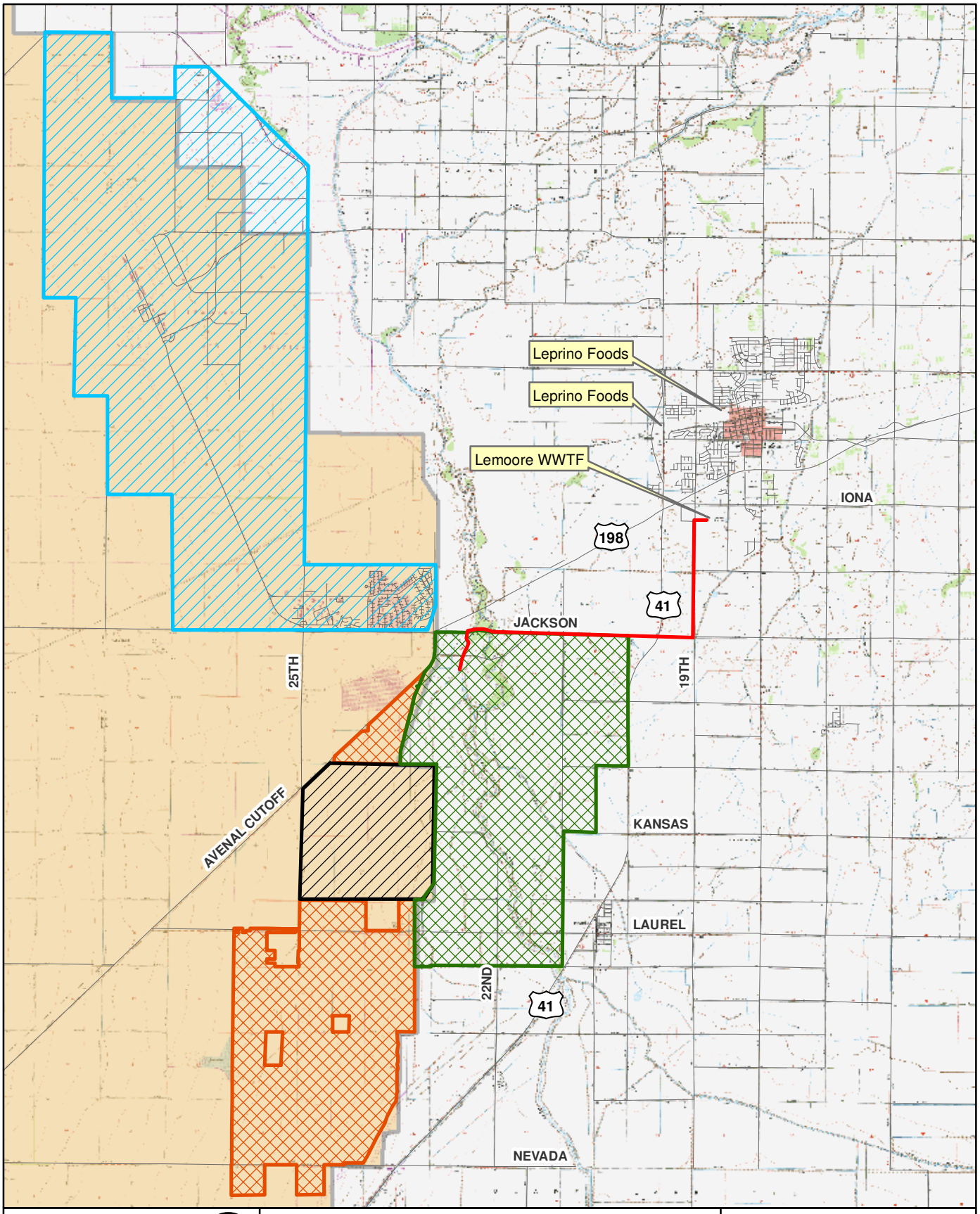

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Legend

- Naval Air Station Lemoore
- Westlake Farms Study Area
- Westlands WD Study Area
- Olam West Coast Reclamation Area
- Westlands Water District
- 30" WWTF Pipeline

USGS Quadrangles
- Burrel, Calfax, Five Points
- Guernsey, Hanford, Huron
- Laton, Lemoore, Riverdale
- Stratford, Vanguard, Westhaven

Exhibit 1.2

Reclamation Study Areas
Site Map

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2

WASTEWATER & OPTIONS BACKGROUND

2.1 LEMOORE WWTF WASTE DISCHARGE REQUIREMENTS

2.1.1 The California Central Valley Regional Water Quality Control Board (**RWQCB or Water Board**) approved the current Waste Discharge Requirements **(WDRs)** Order No. 96-050 and Monitoring and Reporting Program (**MRPs**) No. 96-050 on February 23, 1996. **Table 2-1** is a summary of the current discharge specifications. Note that the Water Board has allowed the City to discharge up to the outfall pipeline capacity of 5.5 million gallons per day (**mgd**).

Table 2 - 1
City of Lemoore WWTF Discharge Specifications

Description	Limits	Notes
Effluent Discharge	2.5 mgd with up to 5.5 mgd	Monthly average
Effluent BOD_5	40 mg/l 80 mg/l	Monthly average Maximum
Effluent Settleable Solids	0.2 ml/l 0.5 ml/l	Monthly average Maximum
Effluent Coliform Organisms	23 MPN/ 100 ml 500 MPN/ 100 ml	Monthly median Maximum
Discharge pH	6.0 to 9.0	pH unit range
Discharge Electrical Conductivity (**EC**)	≤ Source water plus 500 umhos/cm	Maximum EC
Pond Wastewater Dissolved Oxygen	≥ 1.0 mg/l	In upper 1 foot of wastewater ponds
Dissolved Oxygen Receiving Waters	≥ 5.0 mg/l	At Westlake Canal
Discharge Area	Westlake Farms	Mix with surface and groundwater irrigation supplies

2.1.2 The City's effluent is comprised of municipal sources (primarily residential, commercial, and some industrial from SK Foods/Olam West and AGUSA) and industrial process wastewater. Leprino Foods, which operates two mozzarella

cheese production plants in Lemoore ("downtown" and "west" plants) generates about 54% of the total volume of wastewater produced in the City. All of the Leprino wastewater flows into a Leprino owned pre-treatment facility located at the Lemoore WWTF site. The Leprino pre-treatment facility is a Sequencing Batch Reactor (**SBR**) process which beneficially results in a very low Biochemical Oxygen Demand (**BOD_5**) wastewater, but unfortunately does not treat the relatively high EC/salinity found in the Leprino wastewater stream. The treated effluent from the SBR is introduced to the Lemoore WWTF outfall discharge pipeline upstream of the chlorine injector.

2.1.3 Westlake Farms receives all of the City's effluent and wishes to continue receiving the effluent. This arrangement has worked well for the City and the City also wishes to continue providing Westlake a supplemental water supply for their crops. The City recognizes the need to explore alternative wastewater reuse options, either to provide the City assurances of a long term City controlled solution or to provide Westlake the flexibility with their farming operations.

2.1.4 The Water Board will eventually revise the City of Lemoore's WDRs and MRPs in accordance with their program to review and update WDRs on a periodic basis. An update is anticipated to occur within the next few years and significantly more stringent provisions in the WDRs and MRPs are expected.

2.2 LEMOORE WWTF TREATMENT PROCESSES

2.2.1 The City of Lemoore wastewater treatment facilities are located on Champion Street, south of State Route 198 in Section 15, T19S, R20E, Mount Diablo Base & Meridian. As described above the treatment facilities are comprised of two distinct treatment streams with a single discharge. The two influent streams are referred to below as the "municipal" and "Leprino" wastewater streams.

2.2.2 The municipal wastewater treatment process consists of four ponds. The two aeration ponds (1A and 1B) operate in parallel. Both can receive wastewater directly from the City headworks. These ponds are aerated with rotary surface aerators. Pond 1A can also receive Leprino Downtown facility "cow water" (low strength process water from milk condensing) and treated effluent from the Leprino SBR process. The other ponds (referred to as Ponds 2 and 3) are operated in series, as quiescent settling areas. A small rotary aerator at the discharge point of Pond 3 raises dissolved oxygen concentrations of the treated effluent prior to discharge into the delivery pipeline, and allows for on-going biochemical oxygen demand (**BOD_5**) reduction during transport. **Exhibit 2.1** is an aerial depiction of the WWTF annotating the location of the items described above.

2.2.3 The municipal treatment stream is a reliable primary treatment system, but does not have clarifiers or digesters. Therefore, achievement of secondary quality effluent results on the municipal treatment stream for suspended solids, while possible in the quiescent lagoons, is problematic and does not reliably occur. A flow diagram of the WWTF is shown in **Exhibit 2.2**.

2.2.4 The treatment capacity of the municipal stream currently is approximately 2.5 mgd, however the lagoon volume is very large, and with additional aerators, the rated capacity of the WWTF could be increased to as much 5.5 mgd without violating design guidelines from retention time. The City anticipates continuing to use this treatment process as long as discharge requirements will allow, as it provides economical and reliable treatment of the municipal wastewater. Should the City's Waste Discharge Requirements become more stringent in the future, it is likely that a more sophisticated plant with greater suspended solids removal capability will become necessary. The municipal process stream is summarized in **Table 2-2 City of Lemoore Municipal & Leprino Wastewater Streams**.

2.2.5 The Leprino treatment train is a Sequencing Batch Reactor (**SBR**) plant with a current treatment capacity of approximately 2.5 mgd. All Leprino process wastewater influent comes from the two Leprino cheese manufacturing plants and consists only of non-hazardous food processing waste water. All domestic wastewater from the two cheese plants is source-segregated at the plants and flows separately into the City's municipal treatment system. A majority of the Leprino pre-treated effluent from the SBR plant by passes the municipal treatment system completely. Some Leprino wastewater may enter City Pond 1A as needed to handle peak flows.

2.2.6 Both the BOD_5 and Suspended Solids removal capacity of the Leprino stream greatly exceed the requirements of the current Waste Discharge Requirements, and the process is anticipated to be adequate for many years. The Leprino SBR treatment stream produces very high quality effluent. The SBR system could be upgraded to meet Title 22 effluent requirements with the addition of filters. Due to the modular design inherent to the SBR plant, additional treatment capacity can be added if and when Leprino increases production. The Leprino process stream is also summarized in **Table 2-2**.

Table 2 - 2
City of Lemoore Municipal & Leprino Wastewater Streams

Description	City Municipal	Leprino
2010 Production Volume	1.89 mgd - Domestic wastewater generated from a population of nearly 26,000*.	2.26 mgd – with increases due to recent expansion expected to hit 3.5 mgd by year 2012.
Current Treatment Capacity	2.5 mgd treatment, with 5.5 mgd total combined with Leprino, limited by outfall pipeline flow capacity.	Leprino treatment capacity should be increased to 3.5+ mgd by the year 2012.
2057 Projected Production Volume	7.58 mgd - Based on 50 year wastewater production projections, with flows increasing 3% per year.	4.02 mgd - based on a recent expansion and Leprino's 50 year wastewater production projections.
Treatment Process	Advanced Primary - Two aerobic lagoons, two quiescent settling lagoons, chlorine gas disinfection at plant discharge.	Secondary - Sequencing Batch Reactor with discharge to municipal effluent pipeline upstream of disinfection. Aerated storage lagoon for off-spec effluent, which is recycled thorough the SBR plant.
Bio-soild	Accumulates in Ponds Periodically cleaned and hauled off site.	Dried in drying beds and hauled off site for disposal.

** California Department of Finance - January 1, 2010 population of 25,461.*

2.2.7 The City provides disinfection of the combined effluent stream by introduction of chlorine gas into the discharge pipeline as it leaves the treatment facilities. Disinfection is not a requirement of the City's current Waste Discharge Requirements, but was added in 1997 as part of the agreement with Westlake Farms for effluent reuse. Typical coliform bacteria counts in the disinfected effluent are below a most probable number (**MPN**) of 20. Without greater Suspended Solids removal by mechanical clarification and/or filtration, disinfection to the less restricted reuse level of 2.2 MPN on a consistent basis is not considered feasible.

2.2.8 The discharge lines exit the plant near 19th Avenue and Enterprise Drive, as shown on the **Exhibit 2.1**. All facilities are located on land owned by the City.

2.3 EXISTING EFFLUENT DISTRIBUTION

2.3.1 The existing effluent conveyance system consists of approximately 6 miles of 30-inch C-905 PVC mainline with a gravity flow capacity of 5.5 mgd. The outfall of this pipe discharges into the head of the existing Westlake Canal, a private canal operated by Westlake Farms. The pipeline is designed to allow future pressurization to increase pipeline capacity flows to approximately 10.6 mgd. A map of the existing effluent pipeline is included as **Exhibit 2.3.**

2.3.2 The City's effluent provides a small portion of the total irrigation water that Westlake Farms uses each year. It is heavily diluted by pumped groundwater discharged into the Westlake Canal about 50 feet from the City's outfall and by surface water diverted from the Kings River surface by the Lemoore Canal and Irrigation Company at Empire Weir #2, located less than one mile upstream of the City's discharge point. The Westlake Canal connects to the Blakely Canal approximately eight (8) miles downstream of the effluent outfall. Both canals are located on Westlake Farms property.

2.3.3 The nature of the crops grown by Westlake Farms (historically cotton, flax and winter wheat) have made the mixing of the City's effluent feasible while still maintaining compliance with the water reclamation guidelines promulgated by the California Department of Public Health. As Westlake Farms has begun to sell off its lands for other purposes (most notably to Los Angeles County Sanitation District, for use as a repository for their treated bio-solids), Westlake's water demands have dropped. Westlake management continues to express interest in receiving the City's effluent. The discharge to the Westlake Canal, with the Canal's inherent ability to store over-winter discharge that cannot be immediately used for irrigation, is the simplest solution for the City for as long as the agreement can continue.

2.4 CURRENT WASTEWATER CHARACTERISTICS

2.4.1 The combined municipal and Leprino effluent quality data for final effluent leaving the WWTF and discharged into the pipeline, from January 2010 to December 2010 are summarized in **Table 2-3**.

Table 2 - 3
2010 Averaged Combined Effluent Characteristics

Constituent	Average	Units
BOD_5	18.0	(mg/l)
Settleable Solids	.036	(ml/l)
Total Coliform	<2 median	MPN
pH	7.1	(mg/l)
EC	1,976	(µmhos/cm)
Total Suspended Solids (**TSS**)	35.5	(mg/l)

2.4.2 The WWTF effluent has high levels of EC, primarily due to the industrial flow from Leprino Foods. 2010 wastewater quality data from Leprino results in an average EC of 2,647 µmhos/cm and 2010 combined effluent data from the WWTF results in an average EC of 1,976 µmhos/cm. Since EC is not removed in either the City's pond-based treatment system or Leprino's SBR plant, it was calculated that the municipal wastewater EC concentration at the point of discharge is approximately 1,174 µmhos/cm. Because the RWQCB's Tulare Lake Basin Plan limits EC in effluent discharges to the "background" level (as measured in the source water) plus 500 µmhos/cm, the current blended level of EC exceeds the Basin Plan limit. Since the majority of the high EC is from Leprino's operation, it is likely that industrial dischargers to the WWTF will one day need to comply with an EC discharge limit.

2.4.3 It is recommended that Leprino take measures to reduce the EC of their wastewater, either by conducting a salt study to determine how salts are generated within the food processing facility and/or by providing pre-treatment of the wastewater to reduce discharge EC levels.

2.5 PROJECTED WASTEWATER CHARACTERISTICS

2.5.1 Municipal effluent growth was estimated by increasing the current flows of 1.89 mgd (year 2010) by a projected 3 percent per year to the year 2057. The effluent flow rate from the City municipal users is estimated to be about 7.58 mgd in the year 2057, as shown in **Table 2-4**. Additionally, other significant milestone years are depicted in **Table 2-4**.

2.5.2 According to Leprino Foods, a recent expansion to the Leprino West facility, will increase their flow to 3.5 mgd by the year 2012. Leprino had been projecting an overall 50% increase in flows from the year 2007 to the year 2057. With the recent expansion, the flows after 2012 were normalized to grow at a sustained rate to

2057. This results in a wastewater flow increase from 2.26 mgd in 2010 to 4.02 mgd by the year 2057. Wastewater production projections are shown in **Table 2-4**.

2.5.3 A 50 year year by year flow growth, EC, and inorganic dissolved solids (**IDS**) projection for the City, Leprino and the combined total is depicted in **Exhibit 2.4**. The year 2010 data is from actual flow and EC records for the City and Leprino. Leprino has recently begun to reduce their EC levels significantly. With salts being the limiting factor in restricting the options available to the City, Leprino's EC reduction is a great benefit to the City. This growth trend and proportional ratio of municipal versus Leprino effluent is graphically depicted in **Exhibit 2.5**.

Table 2 - 4
Wastewater Production Projections

Year	City Effluent (mgd)	Leprino Effluent (mgd)	Total Effluent (mgd)	EC Combined (umhos/cm)
2007	1.72	1.85	**3.58**	1,937
2010	1.89	2.26	**4.15**	1,976
2020	2.54	3.59	**6.13**	2,037
2030*	3.41	3.71	**7.12**	1,941
2040	4.59	3.82	**8.41**	1,843
2050	6.17	3.94	**10.10**	1,748
2057	7.48	4.02	**11.60**	1,684

* The City of Lemoore General Plan (2007) total wastewater flow projection for year 2030 is 6.3 mgd.

2.5.4 It is assumed that future effluent quality from both industrial and municipal users will be similar to historic values, however City wastewater production is projected to experience more growth than Leprino over the next 50 years, and thus the combined effluent EC will go down over time.

2.6 EFFLUENT QUALITY FOR CROP IRRIGATION

2.6.1 The critical components of a sustainable wastewater agricultural reuse program are the quality of the wastewater and the loading rates to land. The salinity of the wastewater is of particular importance in this instance not only because of the high salinity in the wastewater, but also in the native soils and underlining groundwater. Because salt is the limiting constituent for determining the acres needed for proper wastewater reclamation and productive crop yields for the City, greater detail is provided in this section. For additional background, refer to the publication "Water Quality for Agriculture" by Ayers and Westcott, 1985.

2.6.2 Characteristics that define the quality of water for use in agriculture include the following five parameters:

1) Salinity
2) Water infiltration rate
3) Specific ion toxicity
4) Nutrients
5) Miscellaneous items including cosmetic deposits, corrosion of equipment and others.

2.6.3 Effluent water quality and irrigation supply water quality is summarized in **Table 2-5**. Irrigation water supply is from Westlands Water District surface water data. The effluent crop suitability quality characteristics are averaged from August 2005 to February 2008. These may not exactly match the current averages but should provide the necessary information for cropping purposes.

Table 2 - 5
Effluent and Irrigation Supply Water Characteristics

Constituent	Units	Range and Degree of Problem	Lemoore Combined Effluent		Irrigation Supply Water	
			Values	Interpretation	Values	Interpretation
EC	umhos/cm	750 – 3,000, high	1,976	High	240 - 540	OK
SAR		Above 9, severe	10.3	Severe	0.6 - 1.8	OK
Sodium (Na)	mg/L	Above 70, high	289	High	0.59 - 1.5	OK
Chloride (Cl)	mg/L	140 - 350, plant injury can occur	320	High	0.18 - 1.3	OK
Boron (B)	mg/L	Above 1.0, high	0.65	OK	0 - 0.3	OK
Nitrate as N NO_3-N	mg/L	Within crop loading agronomic limits	5.2	OK	0.76 - 5.3	OK
pH	pH units	Between 6.5 - 8.4, normal	6.9	OK	--	--

Salinity

2.6.4 Salts of all types within the root zone impact plant growth. The ability of plants to extract water from the soil decreases as root zone salinity increases. When salinity levels are above a certain threshold, which varies from crop to crop, yield reduction occurs. Plant growth and crop yield decrease as salinity increases above this threshold concentration. Both the threshold salinity and the rates at which yields decrease above the thresholds are known as the salt tolerance coefficients (**Table 2-6**). These coefficients vary among plant species being considered for the project.

2.6.5 For a given plant species, salinity impacts can vary with stage of growth. Although excess salinity can delay seed germination, this stage of crop growth is usually the most salt tolerant, whereas the seedling growth stage is often the most salt sensitive. Less is known about the interactions between salt tolerance and crop growth stage than about the overall salt tolerance coefficients of crops after the seedling growth stage is finished.

2.6.6 The level of soil salinity achieved during irrigation depends on the salinity and quantity of infiltrated water. The relative amount of infiltrated water used by the plant decreases as the amount of applied water increases. The fraction of the applied water that is not used by the crop passes through the root zone. This fraction of unused water is known as the leaching fraction. For a given quality of irrigation water, the soil salinity can be lowered by increasing the leaching fraction.

Table 2 - 6
Salt Tolerance & Yield Potential of Selected Crops[1/]

	Yield Potential									
Crop	**100%**		**90%**		**75%**		**50%**		**0%**	
	EC_e [2/]	**EC_w [2/]**	**EC_e**	**EC_w**	**EC_e**	**EC_w**	**EC_e**	**EC_w**	**EC_e**	**EC_w**
Barley	8	5.3	10	6.7	13	8.7	18	12	28	19
Wheat	6	4	7.4	4.9	9.5	6.3	13	8.7	20	13
Alfalfa	2	1.3	3.4	2.2	5.4	3.6	8.8	5.9	16	10
Sudan	2.8	1.9	5.1	3.4	8.6	5.7	14	9.6	26	17
Cotton	7.7	5.1	9.6	6.4	13	8.4	17	12	27	18

1/ Taken from Ayers and Westcot. Data is for relative tolerances. Absolute tolerances vary depending upon environmental conditions and cultural practices. See Ayers and Westcot for additional notes.

2/ EC_e means average salinity of the root zone soil. EC_w means salinity of irrigation water. Both are expressed as dS/m (deciSiemens/meter). Conversion: umhos/cm = dS/m x 1,000 at 25° C.

2.6.7 The salt tolerance data in **Table 2-6** assumes leaching fractions much lower than those anticipated. Higher leaching fractions will result in much less limitation due to salinity.

2.6.8 Salinity becomes more concentrated in the soil solution as evapo-transpiration occurs. Subsequent irrigations will leach accumulated salinity toward underlying groundwater. In time, the salinity of the groundwater may be impacted.

2.6.9 Although the wastewater EC averages 1,976 umhos/cm and is generally within a range of no or little yield reductions for the crops listed in **Table 2-6**, the perched water conditions and salt build-up in the soil root zone will need to be addressed.

Infiltration

2.6.10 Two water characteristics impact infiltration and crusting properties of soils: salinity and sodicity. Salinity below 0.5 dS/m (500 µmhos/cm) tends to deflocculate soil colloids, resulting in reduced infiltration rates. Also at this salinity, the propensity for reduction of infiltration rates increases as the sodium adsorption ratio (**SAR**) increase above 3.0. These two properties operate at the same time, creating a complex interaction.

Specific Ion Toxicity

2.6.11 Economic toxicity problems occur when a constituent is present in concentrations sufficient to reduce crop value. Boron, sodium and chloride, when present in high concentrations, cause leaf burn, reduced growth or plant death. Toxicity occurs from plant uptake from the soil solution or from direct absorption of the constituent on leaf surfaces.

2.6.12 If leaf burn occurs at the seedling stage, the impacts can be severe. If, on the other hand, leaf burn develops slowly, there may be no impact on plant growth because the leaf has been fully functional during most or all of the time it contributes to plant growth. Cosmetic leaf burn in and of itself reduces value of some crops. For example, any tip burn of leafy vegetables reduces value. Leaf burn of forage crops may reduce biomass and therefore, yields. Leaf burn of the same crops grown for grain may have little economic impact.

Nutrients

2.6.13 Accumulation of excessive quantities of nitrogen can cause lodging (defined as the breakage of the stalk below the ear/seed which results in increased harvest losses of grain or forage crops), reduced fruit set, excessive growth of some crops or other undesirable responses. A primary concern is that unused nitrogen will leach from the soil and contaminate groundwater. Excess phosphorus can be eroded into surface water supplies. Soil erosion into surface waters is not expected to be a factor in the studied sites. Leaching into groundwater is possible but not probable.

Miscellaneous

2.6.14 Miscellaneous items include cosmetic deposits, corrosion of equipment, and others. Evaporation of water from plant surfaces can result in unsightly deposit of lime on leaf surfaces but should not be a limitation in production of forages. Plugging of low-pressure irrigation systems can be significant, as can corrosion of aluminum or brass fixtures. Properties having low water infiltration rates can impact insect vectors and other nuisances.

Recommendations

2.6.15 When a new site and/or crop is selected for effluent reuse, the agricultural water quality issues discussed above must be considered to ensure the viability of reclamation at the site for the crop being produced.

- To the extent possible, match nitrogen and phosphorus loading and application with crop requirement and provide uniform application of irrigation water to protect against groundwater contamination with nitrate.
- To protect against salt (TDS or EC) accumulation in the root zone, maintain an adequate leaching fraction.

2.7 SOIL AND GEOLOGICAL CONDITIONS

2.7.1 While soil permeability will be slow due to high clay content in all the study areas, it can be further influenced by salinity EC of the water (**ECw**) or EC of the soil extract (**ECe**) and sodicity (**SAR or ESP**) of water and soil and impact water infiltration rates by affecting the way soil particles form aggregates or function separately. When small particles separate, they plug soil pores. As the SAR increases or as the ECw decreases, the infiltration rate decreases. The addition of gypsum to water or the soil surface will ameliorate salinity or sodicity-impaired infiltration rates. Gypsum both increases salinity and decreases SAR and is a common practice on Westside San Joaquin Valley farms to open up the soil and improve drainage to leach the more damaging inorganic salts.

2.7.2 Without artificial drainage, there is no means to remove salt from the root zone other than the limited amount that can occur due to 'natural' drainage. The salinity of the crops rootzone affects crop growth and salinity along with sodicity in the rootzone affects permeability. Eventually, a subsurface drainage system would be needed in order to sustain crop yields.

2.7.3 The Tulare Lake Bed (**Lake Bed**) area lies in the trough of the Central Valley near the Valley's topographic low. The source of the sedimentary soils in the Lake Bed area are primarily from the Coast Range alluvium and to a certain extent the Sierra Nevada alluvium, carried to the Lake Bottom by flood events.

2.7.4 The ancient formations and deposits formed six major identifiable lake deposits over time. These have been labeled, from shallowest/youngest to deepest/oldest as the "A" through "F" clays. These clays form important groundwater barriers and separate waters of differing water qualities. The "E" clay, also known as the Corcoran Clay, is the largest and most extensive of the Lake Bed deposits. In this area, the top of the Corcoran clay is approximately at 650 to 700 feet below ground surface (**bgs**).

2.7.5 The hydrogeology of this area can be separated vertically into four zones or aquifers. The zones are :

1) The shallow zone of water perched above the A clay. The A clay is about 40 feet bgs. Dept to shallow groundwater is about 5 feet bgs in this area. This shallow water has elevated salt concentrations with TDS from 2,800 to 68,000 mg/l.
2) An upper zone of semi-confied to unconfined groundwater is below the A clay and above the Corcoran clay. The water in this aquifer has EC values ranging from 600 to 1,200 umhos/cm.
3) A confined zone is below the Corcoran clay. The EC of this water is excellent and is between 250 and 650 umhos/cm.
4) A deep zone of saline marine water below the confined zone.

2.8 CROPPING OPTIONS

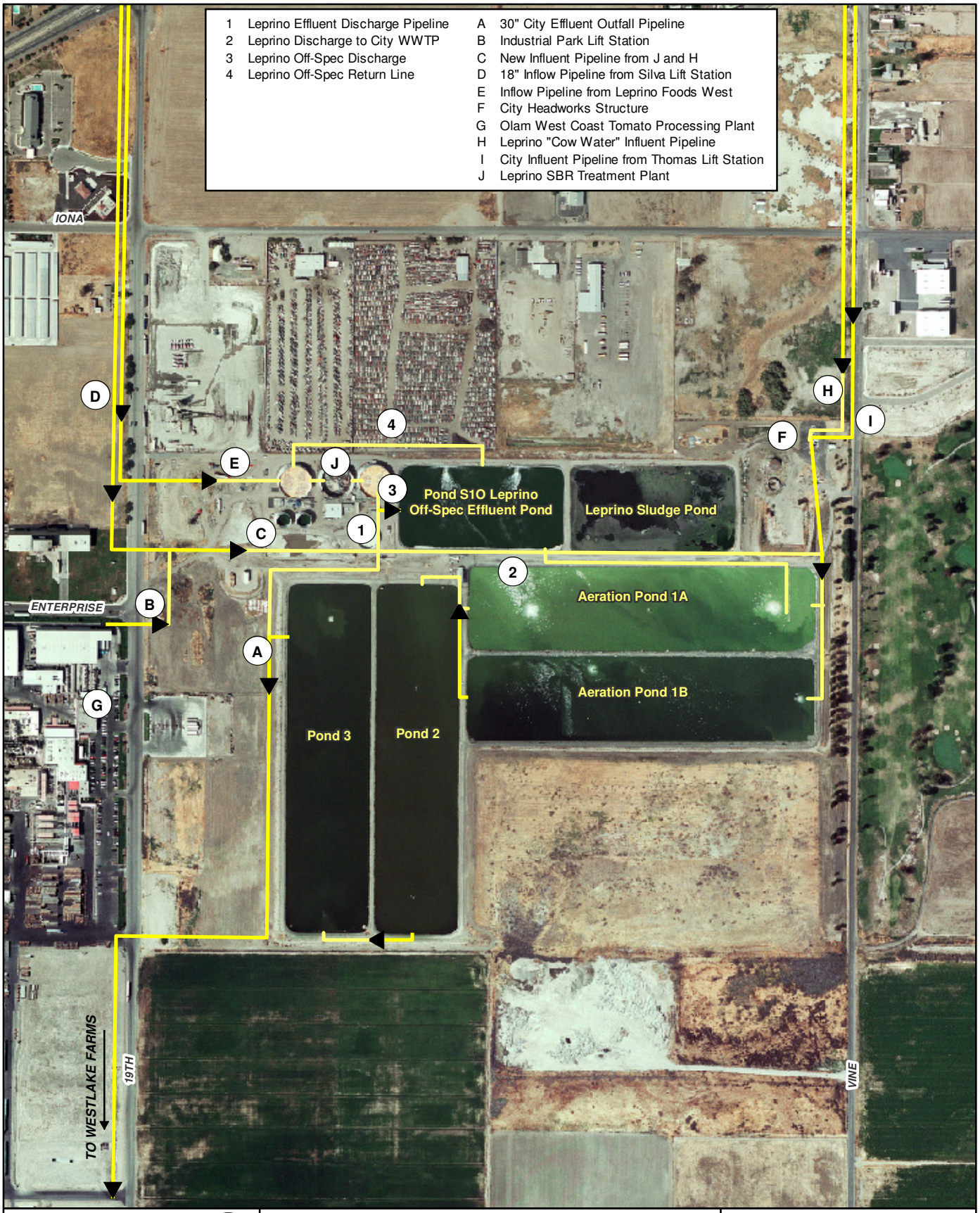
2.8.1 Over 80 crops were reviewed, from exotic to common crops. Those crops were narrowed down to three feasible crops. These crops were evaluated based on salt tolerance, crop ET, perched water conditions, cultural practices, and marketability. The most feasible crops are cotton, alfalfa, and feed grains.

2.9 IRRIGATION SYSTEM OPTIONS

2.9.1 We assessed the on-site irrigation system constraints with regards to water delivery schedules, available flow rates, wastewater and irrigation water mixing, soils, drainage, topography, crop timing, energy needs, operation and maintenance.

2.9.2 The Regional Board may not allow sprinkler irrigation systems, to avoid drift. Flood irrigation will likely be preferred, although high chlorides and EC in the effluent are a concern.

2.9.3 Storage ponds will be required to store and reduce excessive applications during the rainy season for use during higher demand periods. They may also be used as regulating or mixing reservoirs if blending is required. Construction in shallow groundwater conditions is a concern, so ponds may need to be elevated and depths will be limited. Storage ponds may be located at the WWTF site or reclamation area; this may depend on fencing costs, delivery limitations, and location of mixing.



0 250 500 Feet

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Exhibit 2.1

City of Lemoore
WWTF Aerial

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03/04/2011

Existing Wastewater Treatment Plant Flow Diagram

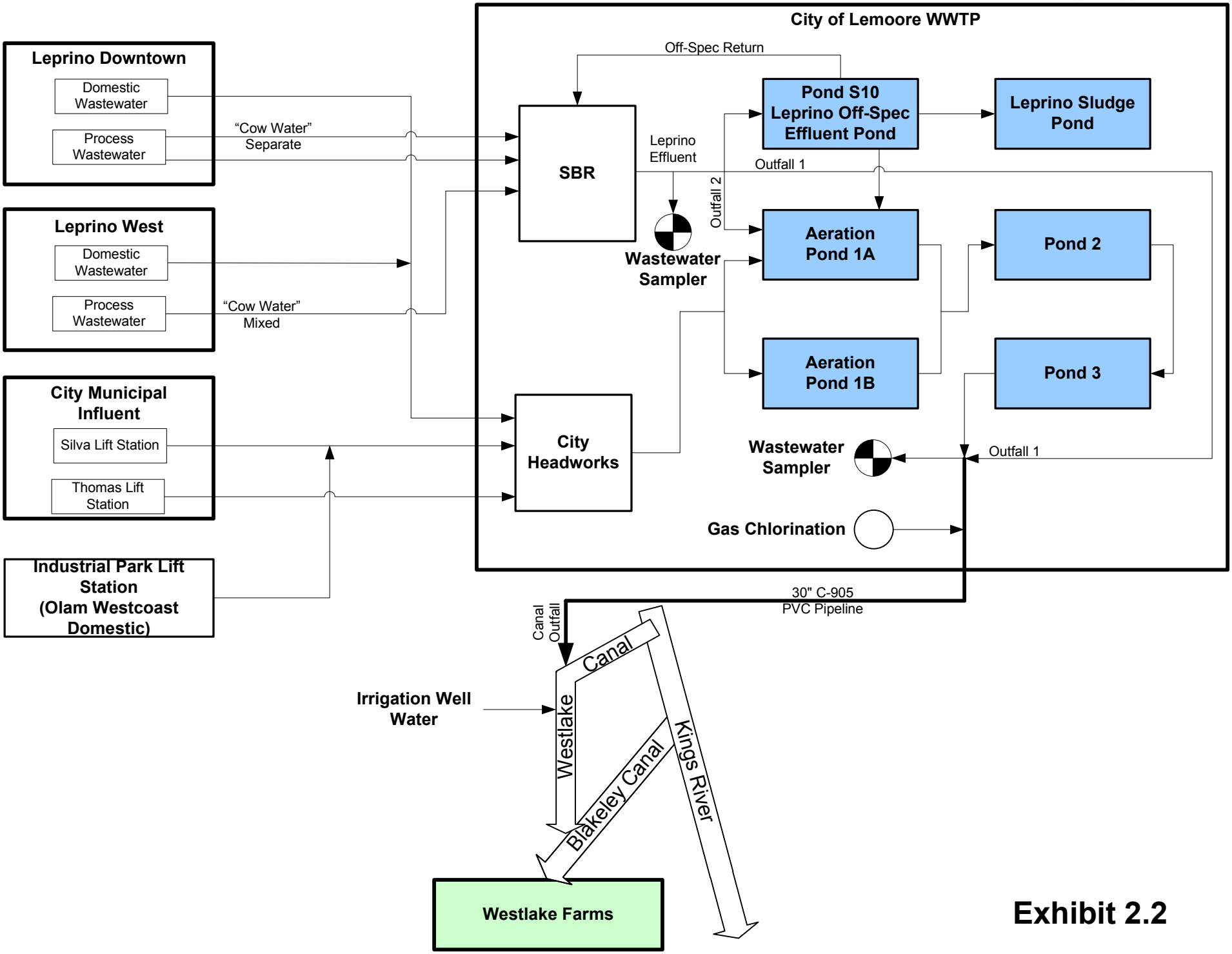
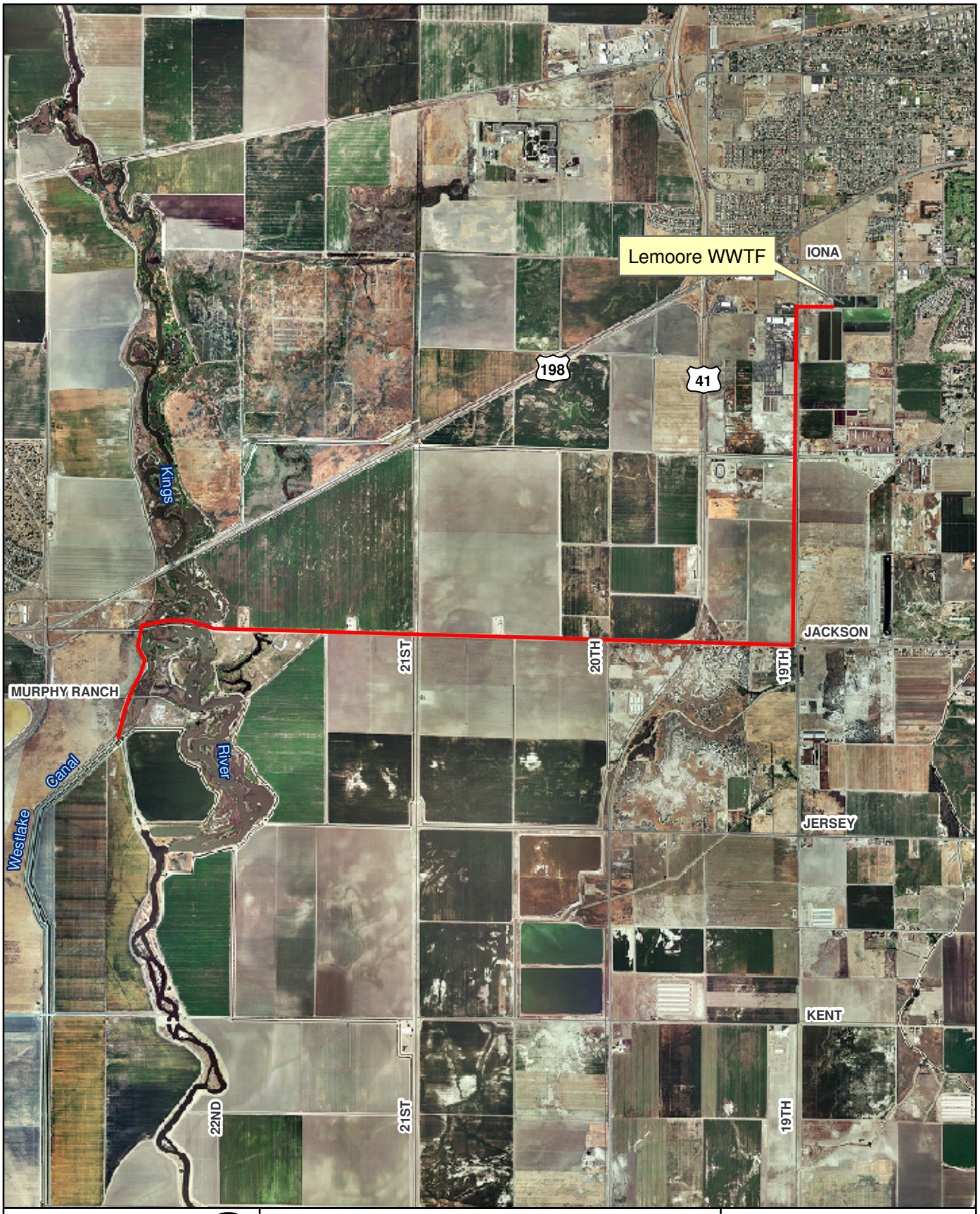


Exhibit 2.2



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Legend

30" WWTF Pipeline

Exhibit 2.3

Existing Effluent Reclamation Pipeline

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City of Lemoore Projected Effluent 50 yr Growth

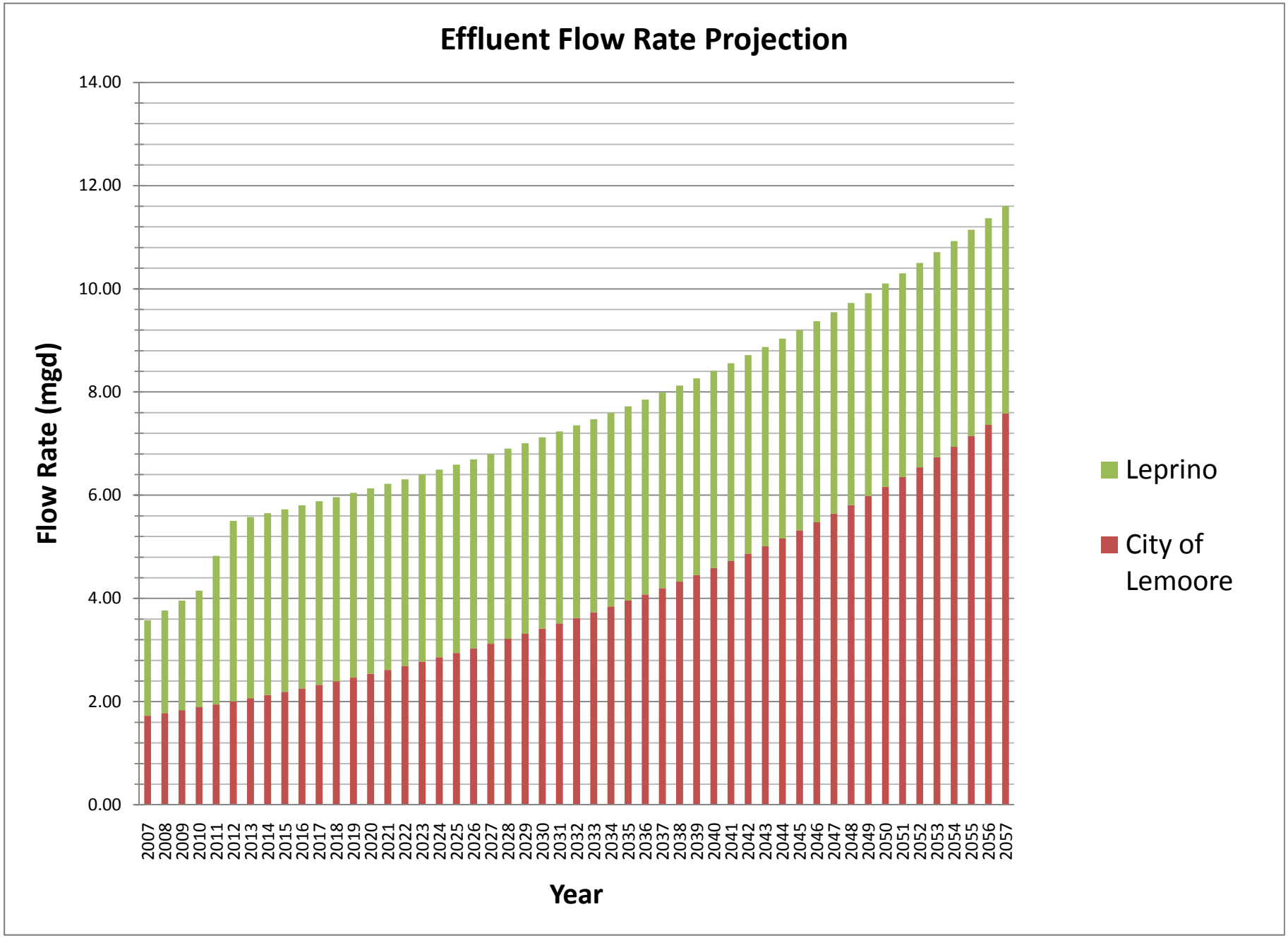
Increase/year = 3%

City Ec 1,174 umhos/cm
Leprino Ec 2,647 umhos/cm
Total Ec 1,976 umhos/cm

Year	Year	City Effluent (mgd)	Leprino Effluent (mgd) **	Total Effluent (mgd)	Total Effluent Ec (umhos/cm)	Total Effluent IDS (mg/L)
0	2007	1.72	1.85	3.58	1,937	1,126
1	2008	1.78	1.99	3.77	1,951	1,135
2	2009	1.83	2.12	3.96	1,965	1,143
3	2010	1.89	2.26	4.15	1,976	1,149
4	2011	1.95	2.88	4.83	2,053	1,194
5	2012	2.01	3.50	5.51	2,110	1,227
6	2013	2.07	3.51	5.58	2,101	1,222
7	2014	2.13	3.52	5.65	2,092	1,217
8	2015	2.19	3.53	5.73	2,083	1,212
9	2016	2.26	3.55	5.80	2,074	1,206
10	2017	2.32	3.56	5.88	2,065	1,201
11	2018	2.39	3.57	5.96	2,055	1,196
12	2019	2.47	3.58	6.05	2,046	1,190
13	2020	2.54	3.59	6.13	2,037	1,185
14	2021	2.62	3.60	6.22	2,027	1,179
15	2022	2.69	3.62	6.31	2,018	1,174
16	2023	2.78	3.63	6.40	2,008	1,168
17	2024	2.86	3.64	6.50	1,999	1,163
18	2025	2.94	3.65	6.59	1,989	1,157
19	2026	3.03	3.66	6.69	1,980	1,151
20	2027	3.12	3.67	6.80	1,970	1,146
21	2028	3.22	3.68	6.90	1,960	1,140
22	2029	3.31	3.70	7.01	1,950	1,134
23*	2030	3.41	3.71	7.12	1,941	1,129
24	2031	3.52	3.72	7.24	1,931	1,123
25	2032	3.62	3.73	7.35	1,921	1,117
26	2033	3.73	3.74	7.47	1,912	1,112
27	2034	3.84	3.75	7.60	1,902	1,106
28	2035	3.96	3.77	7.72	1,892	1,100
29	2036	4.08	3.78	7.85	1,882	1,095
30	2037	4.20	3.79	7.99	1,873	1,089
31	2038	4.32	3.80	8.12	1,863	1,083
32	2039	4.45	3.81	8.27	1,853	1,078
33	2040	4.59	3.82	8.41	1,843	1,072
34	2041	4.73	3.83	8.56	1,834	1,067
35	2042	4.87	3.85	8.71	1,824	1,061
36	2043	5.01	3.86	8.87	1,814	1,055
37	2044	5.16	3.87	9.03	1,805	1,050
38	2045	5.32	3.88	9.20	1,795	1,044
39	2046	5.48	3.89	9.37	1,786	1,039
40	2047	5.64	3.90	9.55	1,776	1,033
41	2048	5.81	3.92	9.73	1,767	1,028
42	2049	5.99	3.93	9.91	1,757	1,022
43	2050	6.17	3.94	10.10	1,748	1,017
44	2051	6.35	3.95	10.30	1,739	1,011
45	2052	6.54	3.96	10.50	1,729	1,006
46	2053	6.74	3.97	10.71	1,720	1,001
47	2054	6.94	3.99	10.92	1,711	995
48	2055	7.15	4.00	11.14	1,702	990
49	2056	7.36	4.01	11.37	1,693	985
50	2057	**7.58**	**4.02**	**11.60**	**1,684**	**980**

** 6.3 mgd projected in General Plan*
*** Leprino projects 50% growth from 2007 to 2057*

Exhibit 2.4


Effluent Flow Rate Projection
Flow Rate (mgd)
14.00
12.00
10.00
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2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057
Year
Leprino
City of Lemoore

Exhibit 2.5

3

WASTEWATER TREATMENT OPTIONS

3.1 EFFLUENT REUSE OPTIONS

3.1.1 SSC Farms II (for the Olam Foods tomato processing facility) purchased property from WWD and is utilizing their process wastewater as a supplemental irrigation supply. Initially, the purchase of Westlands Water District owned land by the City had been determined to be a viable option for long-term reuse of the City's wastewater. However, with WWD's desire to retain the property for now, other reuse locations were needed for consideration for effluent reuse. The reuse locations include delivering effluent to NASL owned lands or continue to deliver effluent to Westlake Farms.

3.1.2 Ultimately, regardless of where the final delivery point is located, the quality of the wastewater is restricted by its high EC to a limited selection of crops. This section of the Report addresses the option of treatment for producing higher-quality wastewater, which would expand the reuse options, regardless of location.

3.1.3 These options included pre-treating wastewater to remove salts at the WWTF or at Leprino, blending with supplemental supply water to reduce the effluent salt concentration and detaching Leprino from the City WWTF. Based on initial evaluations, construction of wetlands and detaching Leprino from the City wastewater treatment and reuse system were removed from consideration. The remaining four options will be considered further in the following chapters.

3.2 TREATMENT OPTIONS

3.2.1 The first option evaluated to reduce EC in the wastewater flow from Leprino Foods was to pre-treat the Leprino wastewater stream using a reverse osmosis (**RO**) system. The second alternative is to use a source of fresh water to blend with the highly salt-concentrated Leprino flows in order to reduce overall EC to acceptable levels. Various combinations of treatment levels and blending were analyzed to determine the optimum combination based on capital requirements and operating costs.

3.2.2 Several assumptions were made in this evaluation. All of these assumptions may be adjusted if more realistic values become available. Changes to these assumptions may have a significant impact on the results of the evaluation. The evaluation was based on usage of Westlands Water District retired lands for effluent reuse.

Evaluation characteristics, including cost of land, cost of water, irrigation rates, and target EC values, will change for other lands. The assumptions made for this evaluation include:

- The evaluation is based on 50-year wastewater production projections discussed in Chapter 2.
- City of Lemoore wastewater flow in 2057 will be 7.58 mgd, based on an assumed growth rate of 3% per year.
- Leprino wastewater flow in 2057 will be 4.02 mgd, based on a flow of 3.5 mgd by year 2012 an assumed total growth around 50% over 50 years since the year 2007.
- Cost to purchase and transport fresh water for blending ranges from $400 to $1,000 per AF.
- Capital cost for treatment is $1.3 per gallon, plus a base of $500,000.
- Cost of land within the Westlands retirement area is $400 per acre.
- Cost of additional land for irrigation is $500 per acre.
- Allowable irrigation rate within Westlands is 2.0 AF/ac average.
- Allowable irrigation rate on additional land is 4.0 AF/ac.
- Year 2010 EC of City of Lemoore wastewater flows is 1,174 µmhos/cm.
- Year 2010 EC of Leprino wastewater flows is 2,647 µmhos/cm.
- EC of fresh water for blending is 240 - 540 µmhos/cm.
- Target long-term EC for reuse (after treatment and/or blending) is in the 1,600 to 1,800 µmhos/cm range, but could be defined by future regulatory requirements.
- EC removal by the RO system is 95%.
- Westlands land available for irrigation is approximately 6,700 acres.
- For build-out flows in year 2057 the maximum baseline land required to apply flows from the City of Lemoore and Leprino based on irrigation rates assumed above, with no blending, is approximately 5,400 acres for the Study Areas.
- RO units could be purchased at present cost, with capacity of 25 year flows, and then replaced in 25 years with units capable of treating 50 year flows.
- One time purchase of land sufficient for 50 year flows.
- Capital costs to be paid over 25 years (for RO units) or 50 years (for land) at a market or below market interest rate.
- O&M costs based on flows in 10 year increments, averaged over 50 years.

3.2.3 Based on the assumptions above, calculations were made to determine the annual cost of treatment and blending, including capital and O&M costs, under a high-end estimate of $1,000 per AF of fresh water, and low end estimate of $400 per AF.

3.2.4 Based on the assumptions evaluated, no treatment scenario requires fresh water for blending; City flows are sufficient to maintain the target EC level. Currently, flows

from the City and Leprino total about 4.15 mgd, and blending between the two is about 46% and 54% respectively. 50 years from now, when the flow projections for the City are 65% and 35% for Leprino, the blend will produce even lower ECs..

3.2.5 It is important to note that the assumptions listed above are based on currently available information. However, when making final treatment decisions, more accurate EC levels will need to be determined, as well as verification of costs associated with treatment, land, and water supply. While current City and Leprino ECs predict that no freshwater will be needed to [produce a satisfactory blend, changes in the source water or Leprino's process could affect that conclusion.

3.3 IMPACT ON REUSE OPTIONS

3.3.1 Decisions regarding increased treatment or use of fresh water for blending with effluent will impact the reuse options discussed in the following chapters in various ways. By reducing EC through either treatment or blending, less reuse area per acre-foot of water would be required based on a nutrient balance specific to the selected crops. However, if blending is utilized to reduce EC levels, there will be a greater volume of water to reuse, and therefore more reclamation area would be required based on the water balance.

3.4 CONSIDERATIONS

3.4.1 Treating or blending effluent to reduce EC will also allow for more cropping options, as salt sensitivity is a limiting factor in the selection of crops. All of these considerations must be analyzed when finalizing a reuse site and cropping pattern. Next steps would include:

- Implement a Citywide EC discharge limit for large industrial dischargers (e.g. 20,000+ gpd) to the Lemoore wastewater system. The discharge limitation should be phased in over time (perhaps 3 years). The industrial EC discharge limit could be 1,600 µmhos/cm. The Water Board may eventually require the City to reduce EC, which would then force the City to institute an EC discharge limit.
- Charge sewer fees on large industrial dischargers based on flow volume, BOD_5, and TSS. Fees can be on a tiered rate schedule where fees increase at certain levels (step charges), to discourage discharges of high-strength wastewater and encourage pretreatment.
- Require large industrial dischargers to install volumetric composite samplers with non-intrusive flow meters.
- Purchase (or option to purchase) as much of the Westlands property as possible.
- Consider setting an increased wastewater fee schedule for ratepayers.
- Secure a supplemental water supply (e.g. groundwater, surface water other than Westlands water) for growing crops.

- Prepare a Report of Waste Discharge for blended flows to Westlands with 50-year projected flow volumes.
- Comply with the California Environmental Quality Act (**CEQA**) for blended flows to Westlands with 50-year projected flow volumes.
- Continue discharges to Westlake Farms until no longer allowed or permitted.
- When discharge to Westlands lands starts; monitor groundwater, land application loading, soil, and wastewater.
- There is always the option to install subsurface drainage when needed, with installation of an Integrated Farm Drainage Management (IFDM) system of the City's own, or tie into Westlands WD planned future large scale IFDM system.

4

STUDY AREA 1
WESTLANDS WATER DISTRICT PROPERTY

4.1 BACKGROUND

4.1.1 Westlands Water District owns approximately 6,700 acres of agricultural land near the City of Lemoore, which was potentially available for reclamation purposes. This land is part of the land retirement program in which WWD bought the land from private landowners as part of a settlement with the U.S. Bureau of Reclamation.

4.1.2 The WWD is designated as Study Area 1. Study Area 1 is located approximately 6.5 miles southwest of the City of Lemoore WWTF. It is comprised of sections 26, 34, and 35 of Township 19S, Range 19E; sections 14, 15, 16, 21, 22, 23, 26, 27, 28, 33, 34, and 35 of Township 20S, Range 19E; and sections 3 and 4 of Township 21S, Range 19E; all on Mount Diablo Base and Meridian.

4.1.3 The land retirement program makes WWD water unavailable to these retired parcels. Kings River water is available during wet years; however, this supply is not reliable nor primarily available. Groundwater quality in the area is not good due to very high EC of 4,000+ umhos/cm.

4.1.4 WWD has in the past imposed several conditions on growers irrigating lands in the retirement program, regardless of the source of the irrigation supply. These include:

- This land is not eligible to receive any allocation of WWD water.
- Irrigation must be by sprinkler or drip only; no flood irrigation is allowed.
- Irrigation is limited to 2.0 AF/acre/year.
- Groundwater pumping from the parcels is limited to 1.0 AF/acre/year.
- The number of groundwater wells permitted on site is limited.

4.1.5 The intent of these restrictions is to limit the impact to perched groundwater conditions which may adversely affect neighboring properties and to make more WWD water available to lands outside of the retired lands. Study Area 1 parcels do not have subsurface drainage systems installed.

4.1.6 WWD has an existing, closed pipeline distribution system throughout the proposed project parcels. WWD had stated they were willing to sell the system to the land purchaser. Once sold, the connection to the WWD supply lines would be

disconnected. The existing system could then be plumbed to transport the City's wastewater throughout the parcels.

4.1.7 WWD currently has tenant farmers leasing these parcels. They have a 2-year term and no water supply from WWD. The District is not aware of any other water supply to these farmers and the land is assumed to be dry-farmed.

4.2 SITE CONDITIONS

4.2.1 Aerial photography (flight date 2008) of the study area depicted in **Exhibit 4.1** was used to help identify land use and to provide a visual bearing of the site. SSC Farms II purchased approximately 2,600 acres of land from WWD for use as their tomato processing wastewater reuse area. The SK Foods processing facility has since been purchased by Olam West Coast but the reclamation area is still under SK Foods ownership.

4.2.2 Westlake Farms sold most of the retirement lands to the WWD and is leasing back some of these lands for dry-land farming. Dry land farming crops typically consist of safflower or a winter grain.

4.2.3 The Study Area 1 Kings County Assessor Parcel Numbers (**APNs**) information is depicted in **Exhibit 4.2**. This map provides a general location; more detailed information is available upon request.

4.2.4 Other information WWD has available includes: Phase I and possibly Phase II environmental assessments, maps of the canal easements retained by Westlake Farms, drainage rights-of-way and site geology, hydrology and water quality data for the property.

4.2.5 Topographic information is important for the analysis and determination of land preparation needs and irrigation system selection and performance. Topographic data from the United States Geological Survey (**USGS**) 7.5-minute quadrangle maps, was formatted with five (5) foot contour lines and merged into the standard base map used in this WRS. The resulting topographic map for Study Area 1 is included as **Exhibit 4.3**. The general slope is from the west to the east, with an elevation drop of 10 feet or greater per mile. Because WWD restricts irrigation methods to sprinkler or drip, the design of the system will require precise engineering to compensate for elevation differences. Runoff from the reclamation area must be contained on-site to avoid runoff into the Kings River.

4.2.6 The Federal Emergency Management Agency (**FEMA**) Flood Insurance Rate Maps were the source for flood zone data. This data was modified, formatted, and merged into the standard base map used in this WRS. The FEMA flood zone map for Study Area 1 is included as **Exhibit 4.4**. The WWD reclamation area is located in

Zone X, outside the 500 year flood zone, and therefore flooding should not be a concern.

4.3 SOILS

4.3.1 The USDA Natural Resources Conservation Service (**NRCS**) soil survey data for Study Area 1 was compiled and formatted to the standard base map for use in this WRS. It is included as **Exhibit 4.5**.

4.3.2 The predominant soil type in the USDA soil survey for the Westlands Water District area is Lethent clay loam. Twisselman silty clay is also present. Pertinent soil characteristics from the **USDA Soil Survey** are presented in **Table 4 - 1.**

Table 4 - 1
USDA Soil Characteristics

Soil Name	Depth from Surface (inches)	USDA Texture	Permeability (inches/hour)	Water Holding Capacity (in/in of soil)
Lethent	0 - 60	Clay Loam	0.06 – 0.20	0.02 – 0.15
Twisselman	0 - 60	Silty Clay	<0.06	0.03 – 0.12

4.4 GROUNDWATER CHARACTERISTICS

4.4.1 Perched groundwater in the Westlands Water District area has EC levels of 10,000 to 30,000 µmhos/cm and greater. The top of the perched groundwater is located at about 10 feet bgs or shallower. The majority of usable groundwater is deep below the Corcoran Clay. Groundwater above the Corcoran Clay is of undetermined quality. Limited well logs have been secured from WWD and have been reviewed.

4.4.2 Soil subsidence is a concern in this area, when pumping groundwater below the Corcoran Clay. From 1925 to 1977 there was a 9 meter drop in ground elevation levels. Pumping below the Corcoran Clay is therefore not allowed by WWD on this land.

4.4.3 The high salinity in the perched groundwater makes irrigated agriculture difficult to sustain in this area. A subsurface drainage system will be necessary to flush salts from the root zone. Disposal of the drained water will present another set of issues beyond the scope of this report.

4.5 SUPPLEMENTAL WATER

4.5.1 Because the proposed WWD reclamation area is restricted from receiving WWD water allocations, the source and quantity of supplemental water is limited. Possible sources for supplemental water are from wells on the reclamation land, wells on the WWTF site, or surface water from the Lemoore Canal Company. The quantity of water that may be applied to the reclamation parcels, 2 AF/acre, is not sufficient to grow most crops. Typically, about 4 AF/acre of water is necessary.

4.5.2 One option is to purchase twice the acreage needed for reclamation and apply 4 AF/acre of water to half that land. It might also be possible to petition WWD to allow for an increase in the amount of water applied to the parcels by showing that crop uptake is well in excess of 2 AF/acre and that there would not be an impact to the perched groundwater.

4.6 EFFLUENT CONVEYANCE SYSTEM

4.6.1 Currently, a 30-inch C-905 PVC gravity pipeline conveys the wastewater from the City of Lemoore WWTF approximately 6 miles to the Westlake Canal where it discharges. From the WWTF the pipeline runs south along 19th Avenue to Jackson Avenue. It runs west along Jackson Avenue where it passes over the Kings River (attached to a bridge) and turns south where it meets the Westlake Canal.

4.6.2 The gravity flow capacity of the pipeline is 4.5 mgd. Pumps will be needed to pressurize the pipeline to raise flow above 5.5 mgd. The existing 100 psi pipeline should be adequate to handle the pressure induced by the pumps to meet a flow rate of 10.6 mgd.

4.6.3 Effluent from the WWTF may no longer be allowed to be conveyed in an open canal. It is proposed that a new pipeline will be constructed to convey the wastewater effluent to the northeastern edge of Study Area 1. The proposed pipeline will connect to the existing pipeline near the current Westlake Canal discharge point. The proposed pipeline will be approximately 9.9 miles of 30-inch C-905 PVC. **Exhibit 4.1** depicts the alignment of the existing and proposed pipelines to convey the wastewater to Study Area 1.

4.6.4 Using the projected flow rates for 2010, 2030, and 2057 along with the topography from **Exhibit 4.3** and size of the existing pipeline, the approximate size of pumps were calculated. The assumption was that the pump(s) would need to produce the projected flow with enough pressure to convey it to the discharge point. The existing pipeline is capable of supporting gravity flows until 2012 after which flows will exceed 5.5 mgd. However, approximately 31 hp would be needed to pump water up gradient in an extended pipe to the WWD reclamation area for even 2010 flows. In 2030 it is anticipated that 100 hp of pumping capacity will be needed to

deliver the projected flow rate. In 2057 it is anticipated that 350 hp of pumping capacity will be needed to deliver the projected flow rate.

4.7 WATER BALANCE

4.7.1 A water balance calculation was performed for three years 2010, 2030, and 2057 using the wastewater effluent projections from **Table 2-2**. The purpose of the water balance is to determine the amount of wastewater and irrigation water needed to grow a crop, the reclamation crop acreage needed, and the loading rates of BOD_5, Nitrogen, and Salts. Additionally, the amount of water percolating below the rootzone and the pond size needed are calculated.

4.7.2 The reclamation area is to utilize the applied nutrients from the wastewater by growing a crop. A double crop rotation of summer Sudan grass and winter barley were used in the water balance calculations for the uptake of nutrients. The rootzone depths for Sudan grass and barley are 4 feet and 3.5 feet respectively. The crop rootzone depth used in the water balance calculations was 4 feet.

4.7.3 The soil available water holding capacity (**AWHC**) refers to the quantity of water that the soil is capable of storing within the rootzone of the crops grown. The AWHC of the area is the sum of the individual soil type's AWHC multiplied by the area. It was determined that the AWHC for Study Area 1 is 0.09 inches per inch. The Sudan grass and barley rootzone AWHC was therefore determined to be 4.32 inches.

4.7.4 Using the existing wastewater effluent characteristics the future effluent characteristics were projected using the wastewater effluent flow projections. The assumption was made that the municipal and industrial effluent characteristics would remain consistent over time. Due to the lower salt concentration of the municipal effluent, as the projected effluent flow rates increase over time, and the ratio of municipal flow rate to industrial flow rate increases, the salt concentration will decrease. The constituent of concern is salt and specifically the inorganic salts. Inorganic salts are comprised of calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates. The combined concentration of these constituents expressed as inorganic total dissolved solids (**IDS**) for the 2010, 2030, and 2057 years are 1,159 mg/l, 1,129 mg/l, and 980 mg/l. These IDS concentrations are used in the corresponding water balances to determine the inorganic salt loading on the reclamation area.

4.7.5 It was determined that the salt loading was the limiting factor in the application of wastewater to the fields. The reclamation area was sized to limit the salt loading to a maximum of 6,000 lbs/ac/yr. With the planting of salt tolerant crops and a leaching fraction of lower EC water to the flush of salts out of the rootzone, the higher salt loading could be accommodated. Ultimately a subsurface drainage system and a final disposal site for the drainage water will be needed.

4.7.6 A summary of the normal rainfall year water balance calculation is shown in **Table 4-2**.

Table 4 – 2
WWD Property Water Balance Summary

Year	Effluent Flow Rate (mgd)	Reclamation Area Needed (ac)	BOD Loading (lbs/ac/day)	N Loading (lb/acre/yr)	Salt Loading (lbs/ac/yr)	Pond Storage Needed (ac-ft)	Pond Area Needed (ac)
2010	4.15	2,251	0.29	157	6,000	1,154	68
2030	7.12	3,800	0.30	159	6,000	1,981	116
2057	11.60	5,377	0.34	183	6,000	3,227	186

4.8 STORAGE NEEDS & LOCATIONS

4.8.1 The assumption was made that wastewater wouldn't be applied to the reclamation area during the winter months of October, November, and December. Thus storage is necessary for the 90 days that the effluent is being produced but not used. The storage ponds would be managed such that the ponds would be empty by September of each year. Managing the ponds in this manner minimizes the storage volume, resulting in smaller ponds.

4.8.2 The corresponding total pond sizes needed for the 2010, 2030, and 2057 projected effluent flow rates are 68 acres, 116 acres, and 186 acres respectively. The ponds were assumed to be square in shape and 20 feet deep. Because of the perched water conditions, the ponds may need to be built above ground or shallower with a larger footprint.

4.9 COST ANALYSIS

4.9.1 A preliminary cost analysis was performed for each of the three years studied. The analysis took into consideration the purchase of the land, construction of the storage ponds, construction of the conveyance system, and other miscellaneous items.

4.9.2 The cost per acre of land was assumed to be $400 per acre; which is based on the approximate price paid by SSC Farms II in September 2007. The costs associated with the construction of the pipeline, storage ponds and other costs are based on recent local estimates.

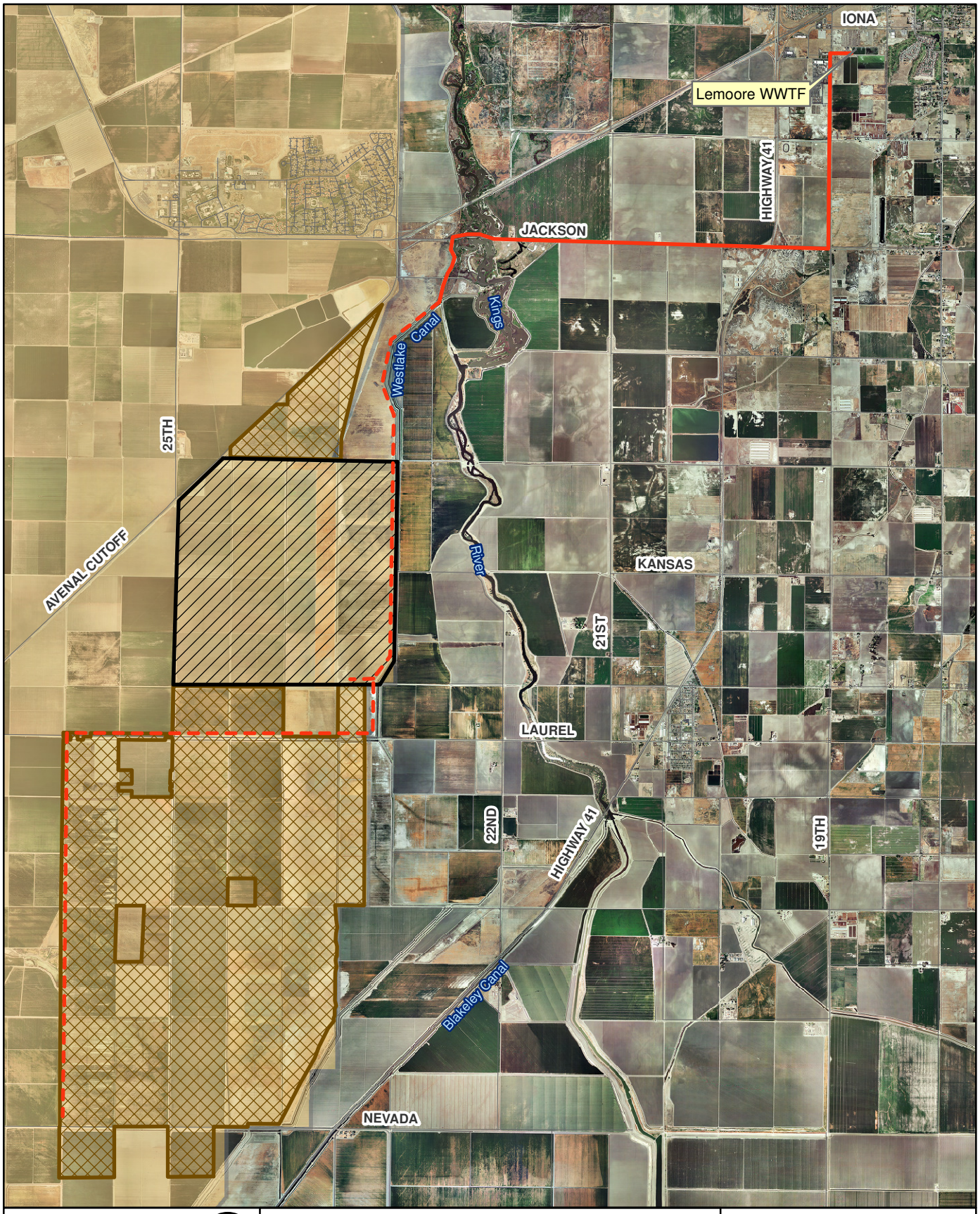
4.9.3 The preliminary cost estimates for Study Area 1 using the information from the 2010 (4.15 mgd), 2030 (7.12 mgd), and 2057 (11.60 mgd) flow rates is approximately

$16,300,000, $27,100,000, and $35,200,000 respectively. All estimates are in present cost dollars and are for total costs as if the entire flow rate required project was built today.

4.10 CONSIDERATIONS

4.10.1 WWD has decided to not sell the property to the City of Lemoore at this time. WWD is currently evaluating the long-term land use potential for the property. Selling to the City of Lemoore may still be an option but other uses such as agricultural drainage treatment and reuse facility (possibly by the year 2017), large utility scale solar power generation facility and other uses are being considered by the District.

4.10.2 There are interior parcels within Study Area 1 that WWD was unable to acquire and are privately held. These lands may need to be considered for purchase by the City if WWD parcels become available.



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Legend

- Westlands WD Study Area
- Westlands Water District
- Olam West Coast Reclamation Area
- 30" WWTF Pipeline
- Proposed Pipeline

Exhibit 4.1

Westlands Water District
Aerial

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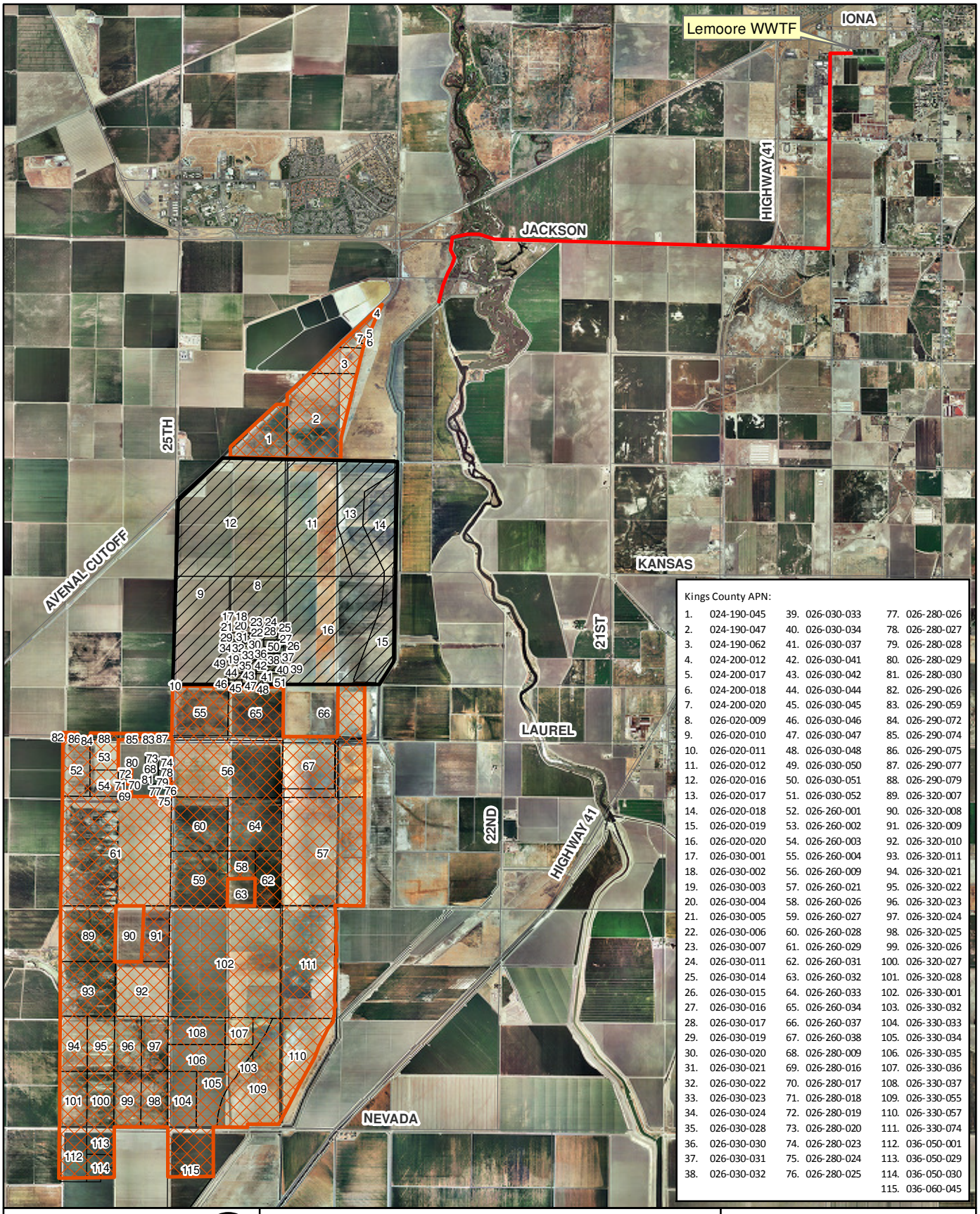

Kings County APN:

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3.	024-190-062	41.	026-030-037	79.	026-280-028
4.	024-200-012	42.	026-030-041	80.	026-280-029
5.	024-200-017	43.	026-030-042	81.	026-280-030
6.	024-200-018	44.	026-030-044	82.	026-290-026
7.	024-200-020	45.	026-030-045	83.	026-290-059
8.	026-020-009	46.	026-030-046	84.	026-290-072
9.	026-020-010	47.	026-030-047	85.	026-290-074
10.	026-020-011	48.	026-030-048	86.	026-290-075
11.	026-020-012	49.	026-030-050	87.	026-290-077
12.	026-020-016	50.	026-030-051	88.	026-290-079
13.	026-020-017	51.	026-030-052	89.	026-320-007
14.	026-020-018	52.	026-260-001	90.	026-320-008
15.	026-020-019	53.	026-260-002	91.	026-320-009
16.	026-020-020	54.	026-260-003	92.	026-320-010
17.	026-030-001	55.	026-260-004	93.	026-320-011
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23.	026-030-007	61.	026-260-029	99.	026-320-026
24.	026-030-011	62.	026-260-031	100.	026-320-027
25.	026-030-014	63.	026-260-032	101.	026-320-028
26.	026-030-015	64.	026-260-033	102.	026-330-001
27.	026-030-016	65.	026-260-034	103.	026-330-032
28.	026-030-017	66.	026-260-037	104.	026-330-033
29.	026-030-019	67.	026-260-038	105.	026-330-034
30.	026-030-020	68.	026-280-009	106.	026-330-035
31.	026-030-021	69.	026-280-016	107.	026-330-036
32.	026-030-022	70.	026-280-017	108.	026-330-037
33.	026-030-023	71.	026-280-018	109.	026-330-055
34.	026-030-024	72.	026-280-019	110.	026-330-057
35.	026-030-028	73.	026-280-020	111.	026-330-074
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- Westlands WD Study Area
- Olam West Coast Reclamation Area
- 30" WWTF Pipeline

Exhibit 4.2

Westlands Water District
Aerial - Parcels

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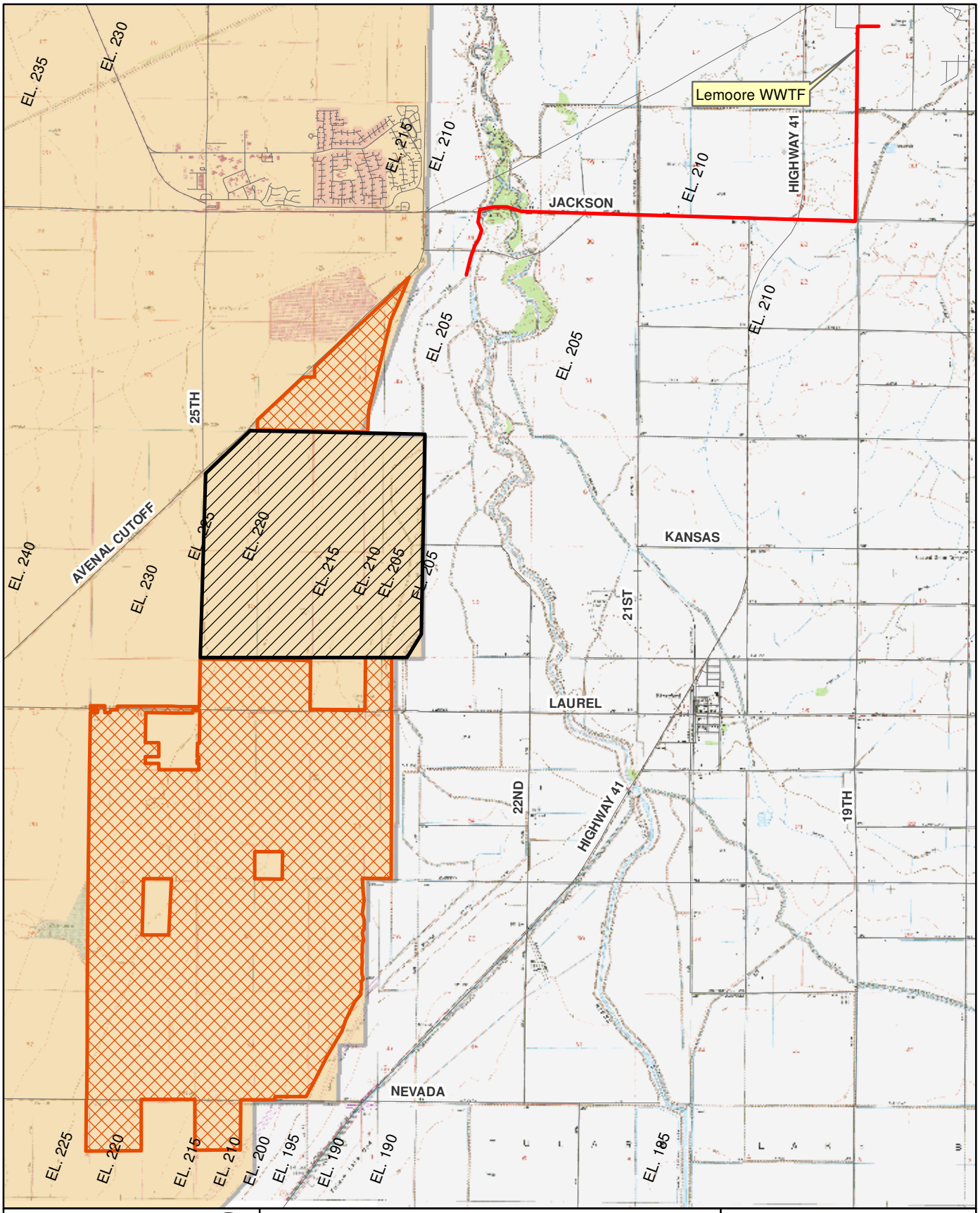

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USGS Quadrangles
- Lemoore
- Stratford
- Vanguard
- Westhaven

Exhibit 4.3

Westlands Water District
Ground Surface Contours

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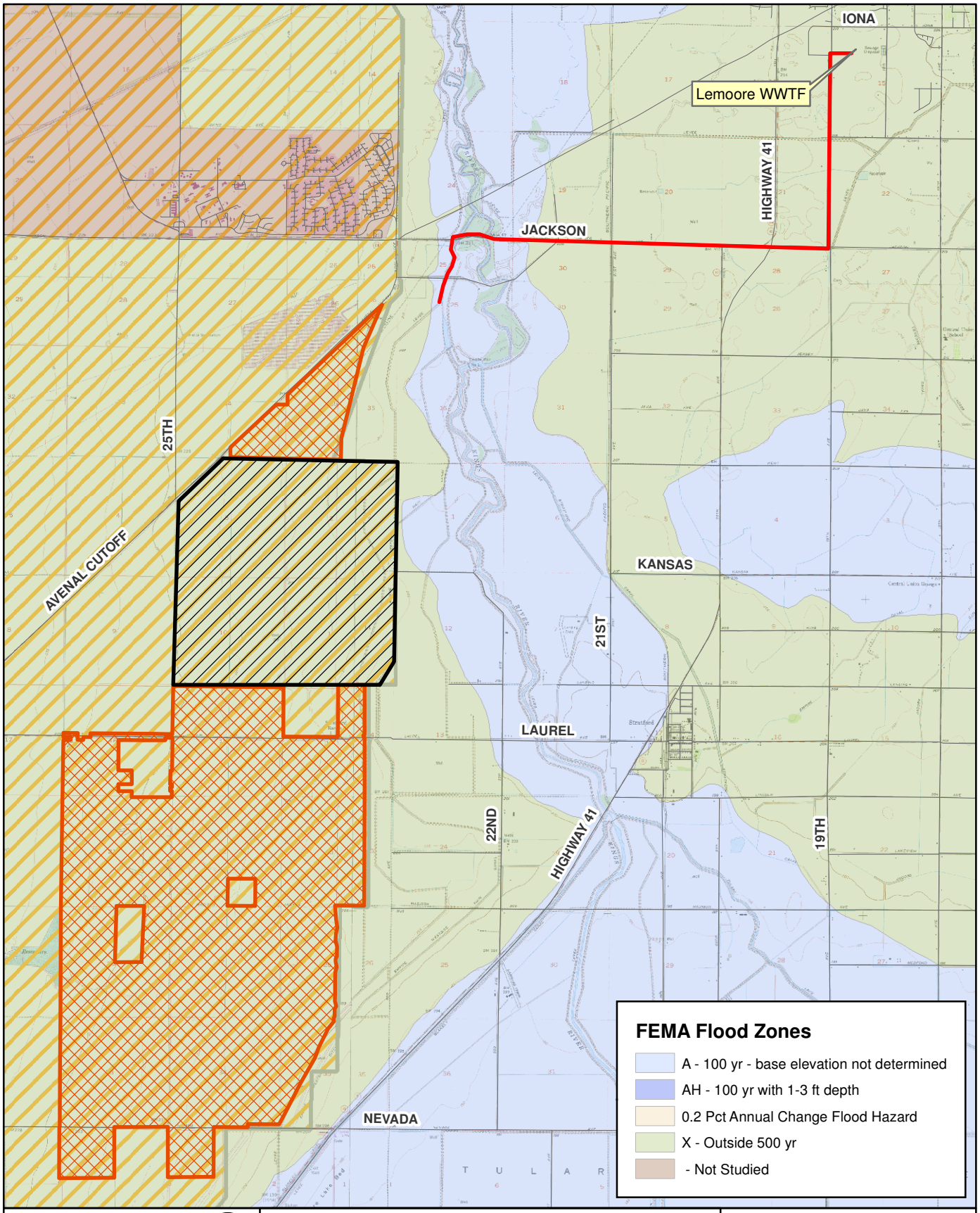

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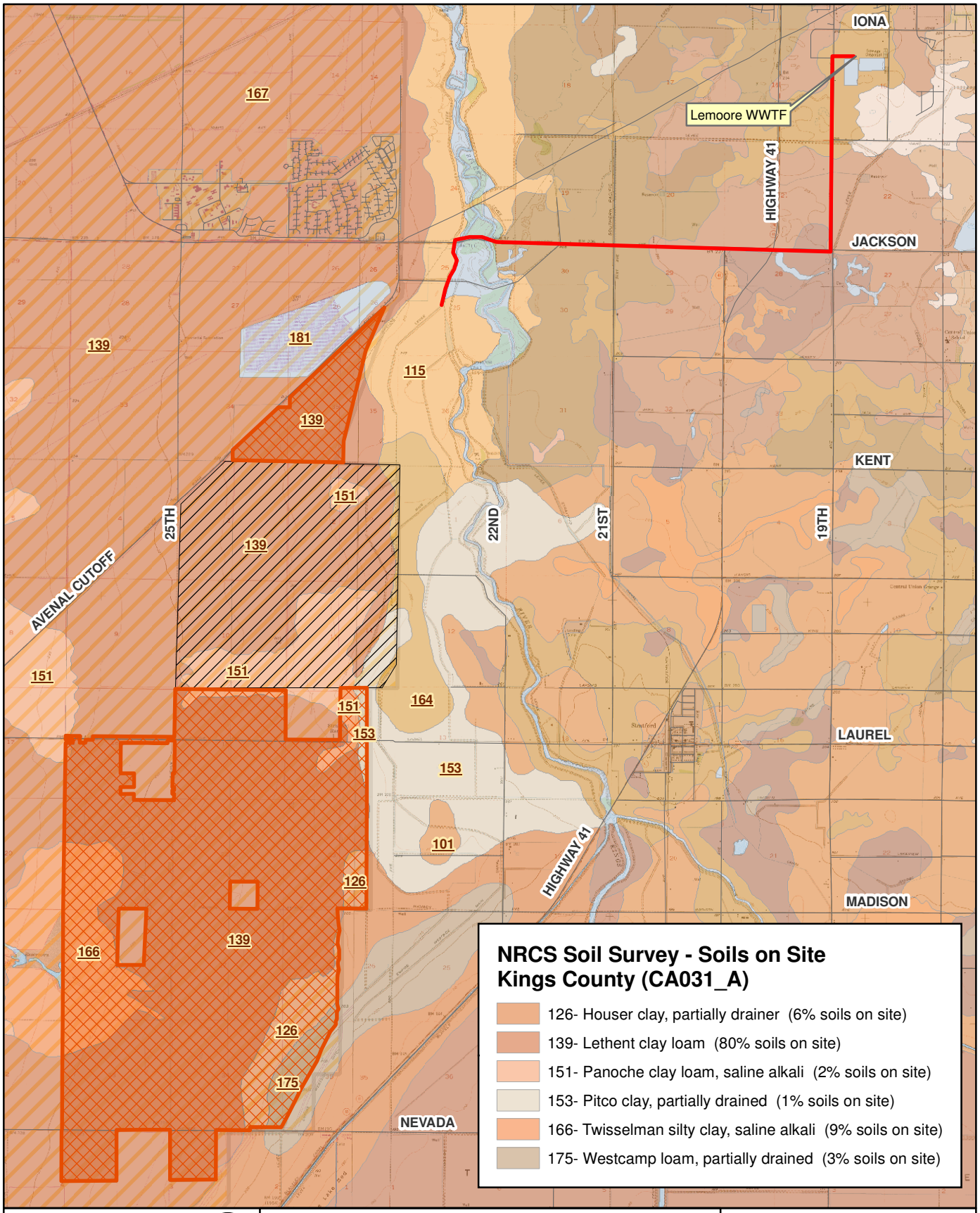
USGS Quadrangles
- Lemoore
- Stratford
- Vanguard
- Westhaven

FIRM Panel Nos.
06031C0300C & 06031C0325C

Exhibit 4.4

Westlands Water District
FEMA Flood Map

V:\Clients\Lemoore_City of-1059-GIS\Map\2011-0104 WWTP Exh 5-3_4-4.mxd



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Legend

- Westlands WD Study Area
- Westlands Water District
- Olam West Coast Reclamation Area
- 30" WWTF Pipeline

Exhibit 4.5

Westlands Water District
Soils Map

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5

STUDY AREA 2
NAVAL AIR STATION LEMOORE

5.1 BACKGROUND

5.1.1 Wastewater Reclamation Study Area 2 is owned by the United States military and is located within the boundary of the Naval Air Station Lemoore. Irrigated agriculture benefits the NASL by creating a controlled buffer around the military facilities, provides dust suppression and animal control, and is a source of revenue.

5.1.2 Currently, 60 parcels of the agricultural lands are leased to numerous farming entities for five year terms. There are at times as many as 40 different entities leasing parcels for agricultural crop production.

5.1.3 Study Area 2 of the Reuse Study consists of approximately 11,700 acres of farmland located within the boundary of the NASL which totals approximately 31 square miles of land and is approximately six (6) miles west of the City of Lemoore. NASL is comprised of sections 12, 13, 24, 25, and 36 of Township 18S, Range 18E; section 1 of Township 19S, Range 18E; sections 8, 16, 17, 18, 19, 20, 21, 28, 29, 30, 31, 32, and 33; sections 4, 5, 6, 7, 8, 9, 16, 17, 20, and 21; all on the Mount Diablo Base and Meridian.

5.1.4 WWD is the primary source of irrigation water to this area but the City of Lemoore effluent could be a significant source of irrigation water due to drastic reductions in the WWD supply.

5.1.5 It is anticipated that the southern portion of the agricultural area would need to be dedicated to effluent reuse (with crop limitations) and the northern area could be dedicated to growing higher value food crops. Lease arrangements would have to be renegotiated for compatibility with the growers, NASL and the City.

5.2 SITE CONDITIONS

5.2.1 Aerial photography (flight date 2008) of the study area was used to help identify land use and to provide a visual bearing of the site. The aerial photo for Study Area 2 is included as **Exhibit 5.1**.

5.2.2 The crop data for the years 2007 and 2008 was provided by the NASL and are included as **Exhibits 5.2 and 5.3**. Crop and open ground planting history was used to evaluate the proposed effluent reclamation area layout. A wide variety of crops are grown in the area with the primary crops consisting of cotton, alfalfa and feed grains. A number of vegetable crops such as melons, lettuce, peppers, tomatoes and beans are also grown, but cannot be irrigated with the Lemoore effluent due to its level of treatment quality.

5.2.3 There are certain NASL crop restrictions in place, such as no vineyards or orchards. Military aircraft and permanent plantings are not compatible. Berries are also not allowed due to their tendency to attract wildlife. Parcels 4A61 and 4A62 along the east and west edges of the airfield are restricted to nothing other than alfalfa and cotton, unless permitted in writing. All other parcels are allowed to grow any of the other acceptable crops.

5.2.4 Topographic information is important for the analysis and determination of land preparation needs and irrigation system selection and performance. USGS 7.5-minute topographic data was used in this WRS. The resulting topographic map for Study Area 2 is included as **Exhibit 5.4**. The general slope is from west to the northeast, with an elevation drop of approximately 10 feet per linear mile. The design of the system will require precise engineering to compensate for elevation differences. Runoff from the reclamation area must be contained on-site to avoid runoff outside of the reclamation area.

5.2.5 The FEMA Flood Insurance Rate Maps were the source for flood zone data. This data was modified, formatted, and merged into the standard basemap used in this WRS. The FEMA flood zone map for Study Area 2 is included as **Exhibit 5.5**. The southern portion of Study Area 2 is located in Zone X, outside the 500 year flood zone, and therefore flooding should not be a concern.

5.3 SOILS

5.3.1 The USDA Natural Resources Conservation Service soil survey data for Study Area 2 is included as **Exhibit 5.6**.

5.3.2 According to the soil survey, soils in the southern part of Study Area 2 consist predominantly of Lethent clay loam. Detailed descriptions can be found in the published survey.

5.3.3 Pertinent soil characteristics from the **USDA Soil Survey** of surface soils are presented in **Table 5 - 1.**

Table 5 - 1
USDA Soil Characteristics

Soil Name	Depth from Surface (inches)	Dominant USDA Texture	Permeability (inches/hour)	Water Holding Capacity (in/in of soil)
Lethent	0 - 60	Clay Loam	0.06 – 0.20	0.02 – 0.15
Panoche	0 - 60	Clay Loam	0.20 – 0.60	0.05 – 0.16

5.4 GROUNDWATER CHARACTERISTICS

5.4.1 Groundwater conditions are generally similar to those in Study Area 1, although salinity and subsurface drainage issues are not as severe. Well drillers logs were requested but not received for this Study Area.

5.4.2 There are areas of perched groundwater in Study Area 2, with uncertain depths and EC levels. A majority of the groundwater is unusable due to high EC.

5.5 IRRIGATION WATER SUPPLY

5.5.1 There are a limited number of groundwater wells (about six) in the NASL area but they may not produce a reliable volume or an acceptable quality of irrigation water.

5.5.2 Westlands Water District infrastructure can service approximately 80% of the NASL agricultural cropland area. Water from Westlands Water District will continue to be used as the primary source of irrigation water for the Study Area 2 reclamation area.

5.5.3 The availability of WWD water supplies has diminished due to regulatory, environmental and weather-related cutbacks. The ability to grow a sustained acreage of crops surrounding the NASL operations has diminished due to these reductions. For instance, the growers typically need 24,000 acre-feet of water per year but only received 10% of that for the 2009 crop year. The addition of Lemoore effluent would provide a reliable long-term supplemental supply.

5.5.4 The WWD water can be blended with the WWD surface water supply to meet irrigation water quality standards and salt loading limitations, and could also serve as the primary supply during high irrigation demand summer months.

5.5.5 There are approximately 84 WWD turnouts throughout the available agricultural land, with some tail-water return systems in place.

5.5.6 Again because of its lesser quality, WWD will not allow Lemoore effluent to directly mix within the WWD delivery system and therefore a separate effluent delivery

system would be required to convey the effluent to the various fields. This would be a significant cost borne by the growers or the City. Additionally, backflow prevention will be needed at the various connection points to prevent cross contamination of the WWD supply or groundwater wells.

5.6 EFFLUENT CONVEYANCE SYSTEM

5.6.1 As previously described, an existing 30-inch C-905 PVC gravity pipeline conveys the wastewater effluent from the City of Lemoore WWTF approximately 6 miles to the Westlake Canal where it discharges. A pipeline extension of 5.9 miles could be constructed west then north into the proposed southern portion of the Study Area. See **Exhibit 5.7.**

5.6.2 The gravity flow capacity of the existing pipeline is 5.5 mgd, which will be sufficient through approximately 2012. Approximately 35 hp of pumping would be required to get the effluent flow from the WWTF up-gradient to the various points of connection in the WWD reclamation area at NASL. The required horsepower is projected to increase to 100 hp in 2030 and to 313 hp by 2057. The existing 100-psi pipeline would be adequate to handle the pressure induced by the pumps to meet the 2057 flow rate.

5.7 WATER BALANCE

5.7.1 A water balance calculation was performed for three years 2010, 2030, and 2057 using the wastewater effluent projections from **Table 2 - 2**. The purpose of the water balance is to determine the amount of wastewater and irrigation water needed to grow various crops, the reclamation crop acreage needed, and the loading rates of BOD_5, Nitrogen, and salts. Additionally, the amount of water percolating through the rootzone and the winter storage pond size needed are calculated.

5.7.2 The reclamation area is designed to utilize the applied nutrients from the wastewater by growing a crop. An assumed cropping pattern of alfalfa, cotton and feed grain crops was used in the water balance calculations.

5.7.3 The AWHC of the area soils is the composite of the individual soil types' AWHCs multiplied by the percentage of that soil found in the area. It was determined that the composite AWHC for Study Area 2 is 0.09 inches per inch.

5.7.4 Using the existing wastewater effluent characteristics and future flow projections, the future effluent characteristics were calculated. The calculation assumed that the municipal and industrial effluent characteristics would remain consistent over time. Because salt concentrations are lower in the municipal effluent, as the projected effluent flow rates increase over time, and the ratio of municipal flow rate to industrial flow rate increases, the overall salt concentration of the combined stream

will decrease. The specific constituents of concern are the inorganic salts, comprised of calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates. The combined concentration of these constituents, expressed as inorganic total dissolved solids (**IDS**) for the 2010, 2030, and 2057 years, are 1,159 mg/l, 1,129 mg/l, and 980 mg/l. These IDS concentrations are used in the corresponding water balances to determine the inorganic salt loading on the reclamation area.

5.7.5 The salt loading will be the limiting factor in the application of wastewater to the fields. The reclamation area has been sized to limit the salt loading to a maximum of 6,000 lbs/ac/yr. By planting salt tolerant crops and using a leaching fraction of lower-EC water to flush the salts out of the rootzone, this relatively high salt loading could be accommodated. Ultimately a subsurface drainage system will need to be installed. Doing so will require a final disposal site for the drainage water in addition to the reclamation acreage.

5.7.6 A summary of the normal rainfall year water balance calculations are shown in **Table 5-2.** The water balance calculations are available upon request.

Table 5 – 2
NASL Water Balance Summary

Year	Effluent Flow Rate (mgd)	Reclamation Area Needed (ac)	BOD Loading (lbs/ac/day)	N Loading (lb/acre/yr)	Salt Loading (lbs/ac/yr)	Pond Storage Needed (ac-ft)	Pond Area Needed (ac)
2010	4.15	2,245	0.28	153	5,858	1,198	71
2030	7.12	3,961	0.28	153	5,761	1,952	114
2057	11.60	5,363	0.34	184	6,000	3,348	193

5.8 STORAGE NEEDS & LOCATIONS

5.8.1 Calculations assume that wastewater will not be applied to the reclamation area during the months of October, November, and December. Thus storage is necessary for the 90 days each year that the effluent is being produced but not used. The storage pond would be managed such that the ponds would be empty by the end of September of each year. Managing the pond in this manner minimizes the required storage volume.

5.8.2 The corresponding reclamation acreages for the 2010, 2030, and 2057 projected effluent flow rates are 71 acres, 114 acres, and 193 acres respectively. The ponds were assumed to be square in shape and 20 feet deep. Should this depth prove to be greater than what is practical, proportionally more acreage will be needed.

5.8.3 These new ponds could be located near the existing NASL domestic wastewater treatment ponds.

5.9 COST ANALYSIS

5.9.1 For each of the three years studied a preliminary cost analysis was performed. The analysis considered the construction of the storage ponds, the construction of the conveyance system, and other miscellaneous items.

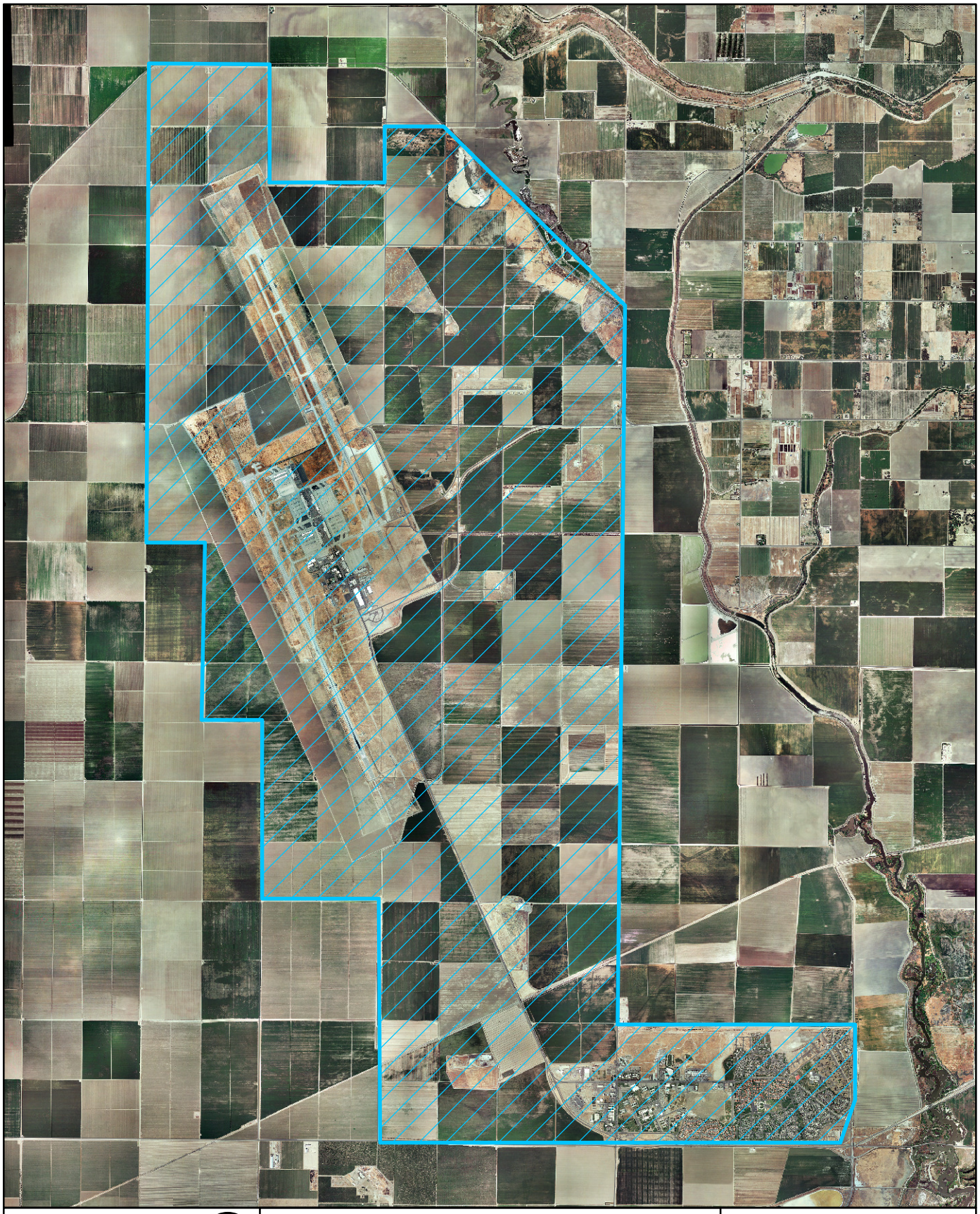
5.9.2 The preliminary cost estimates for Study Area 2 using the information from the 2010 (4.15 mgd), 2030 (7.12 mgd), and 2057 (11.60 mgd) flow rates is approximately $17,000,000, $21,400,000, and $29,700,000 respectively. All estimates are in present cost dollars and are for total costs as if the entire flow rate required project was built today.

5.10 CONSIDERATIONS

5.10.1 NASL personnel met with the project team and the City during preparation of this WRS to discuss the possibility of utilizing Lemoore effluent with their lessee growers, and also met with the growers to discuss the idea. The growers were hesitant to purchase Lemoore effluent, which they perceived could restrict what crops they could grow, would always have a high salt content and likely would not provide them significant cost savings. Because of this, NASL chose to not pursue further discussions with the City of Lemoore at this time.

5.10.2 In a follow-up discussion with NASL personnel, it was made more clear that the Lemoore effluent could be sold to the growers at a significantly lower price (possibly $1.50/acre-foot) than the approximately $65/acre-foot they currently pay for WWD water. While that lower cost may affect the grower's decisions in time, none have yet indicated a willingness to use the City effluent.

5.10.3 The City and NASL plan to continue discussing the possibility of a reclamation project. There may be other incentives for NASL such as the potential future need to recycle their domestic wastewater.



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Naval Air Station Lemoore

Exhibit 5.1

Naval Air Station Lemoore
Aerial

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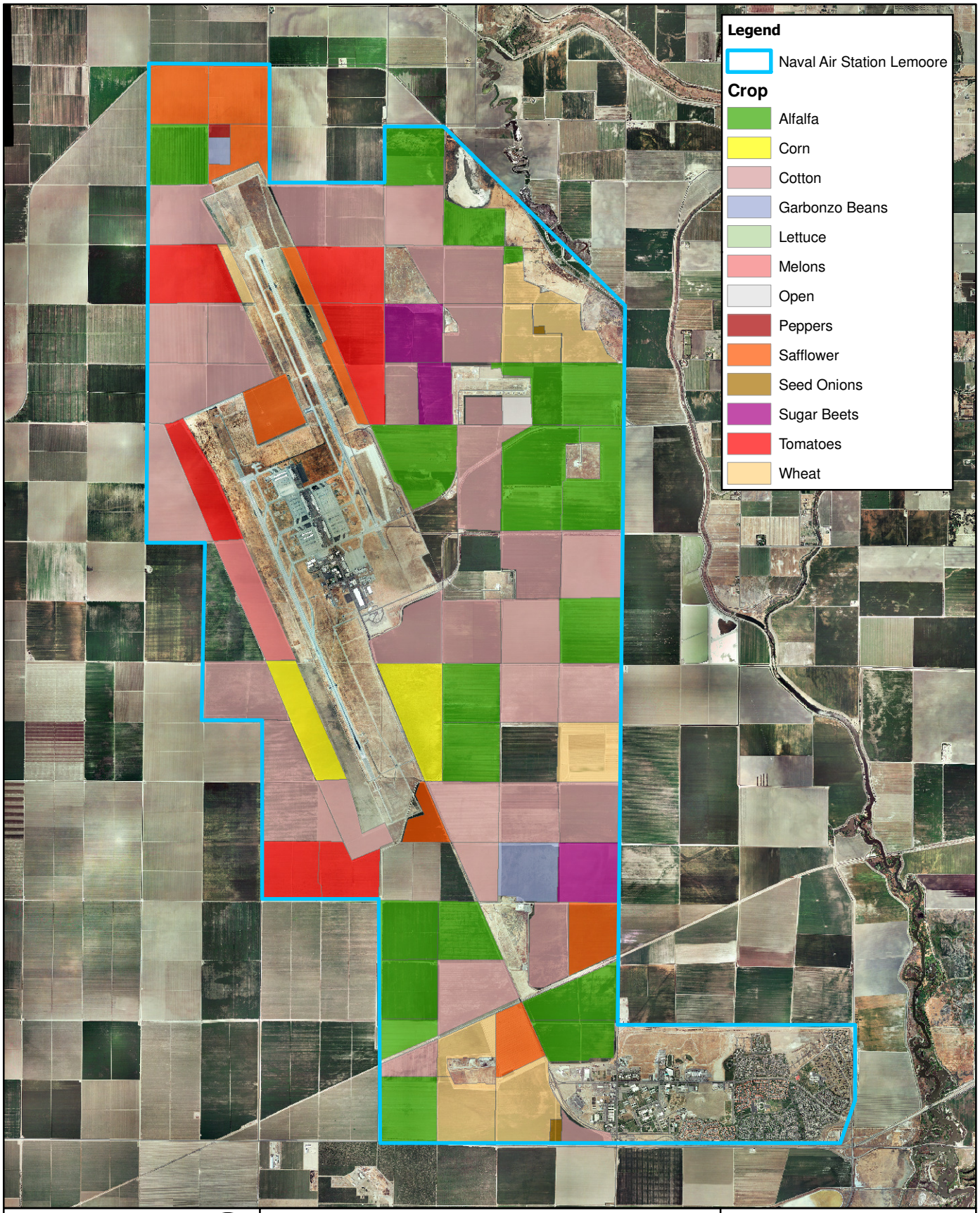

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Exhibit 5.2

Naval Air Station Lemoore
2007 Ag Crops

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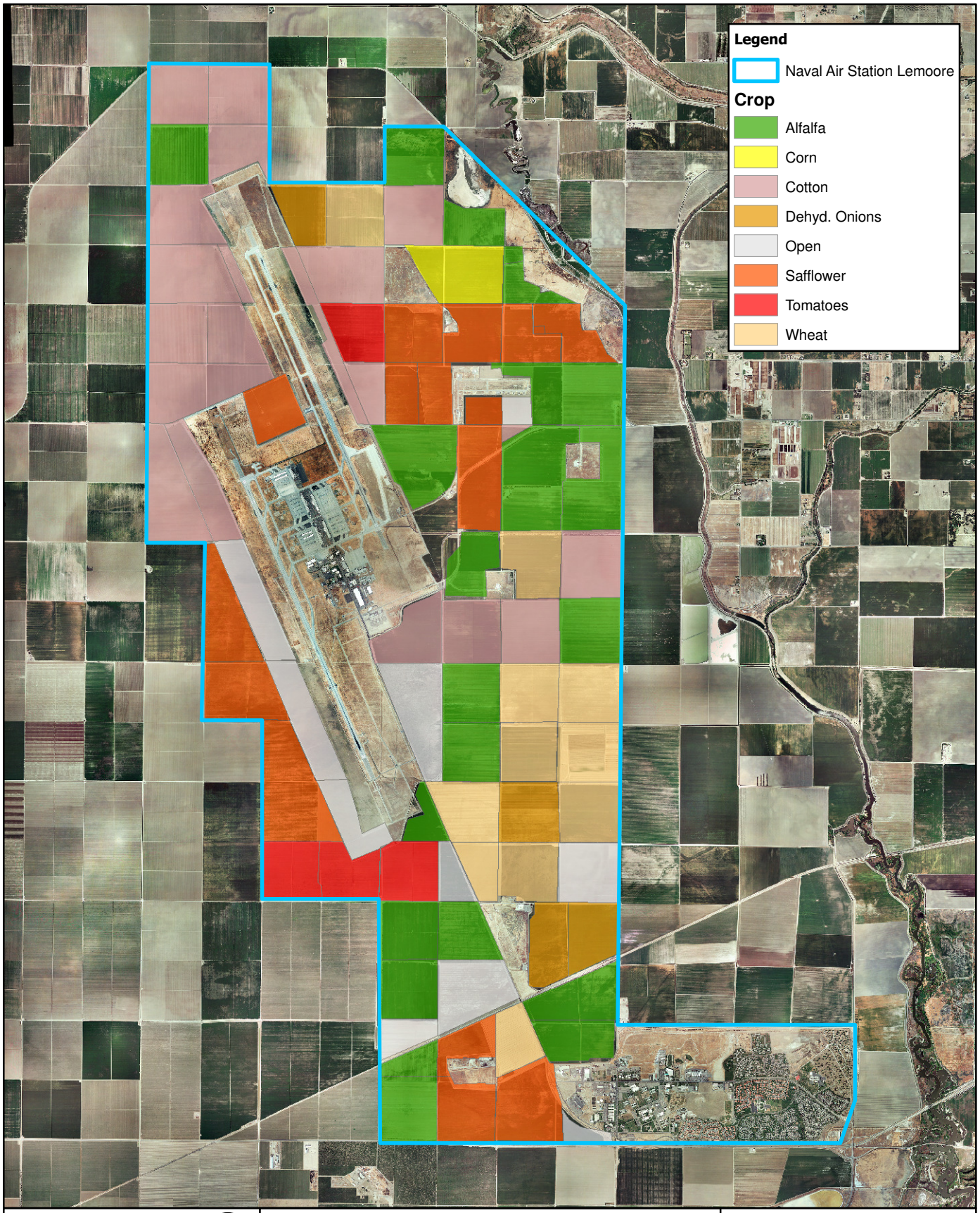

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Exhibit 5.3

Naval Air Station Lemoore
2008 Ag Crops

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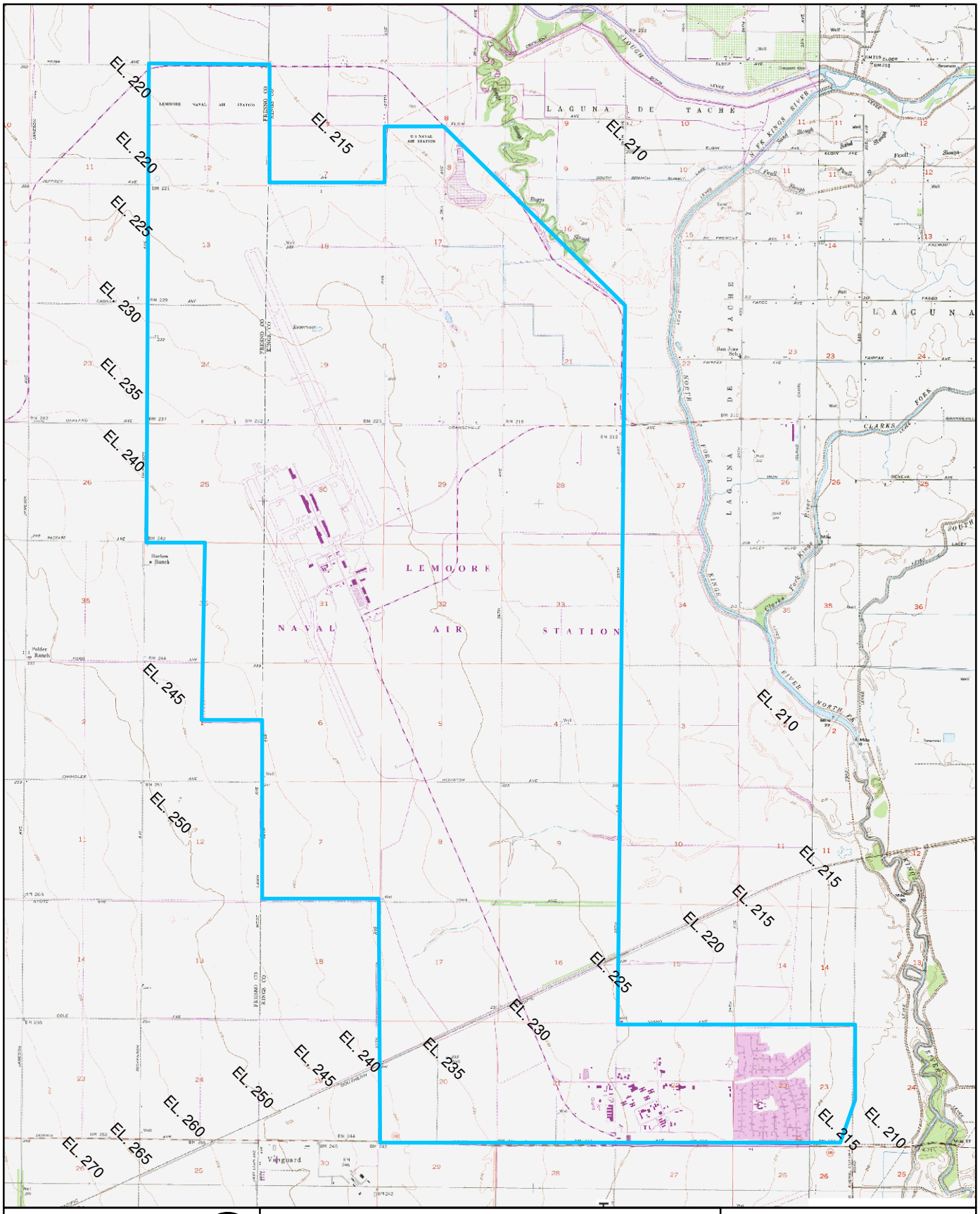

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Naval Air Station Lemoore

Exhibit 5.4

Naval Air Station Lemoore
Ground Surface Contours

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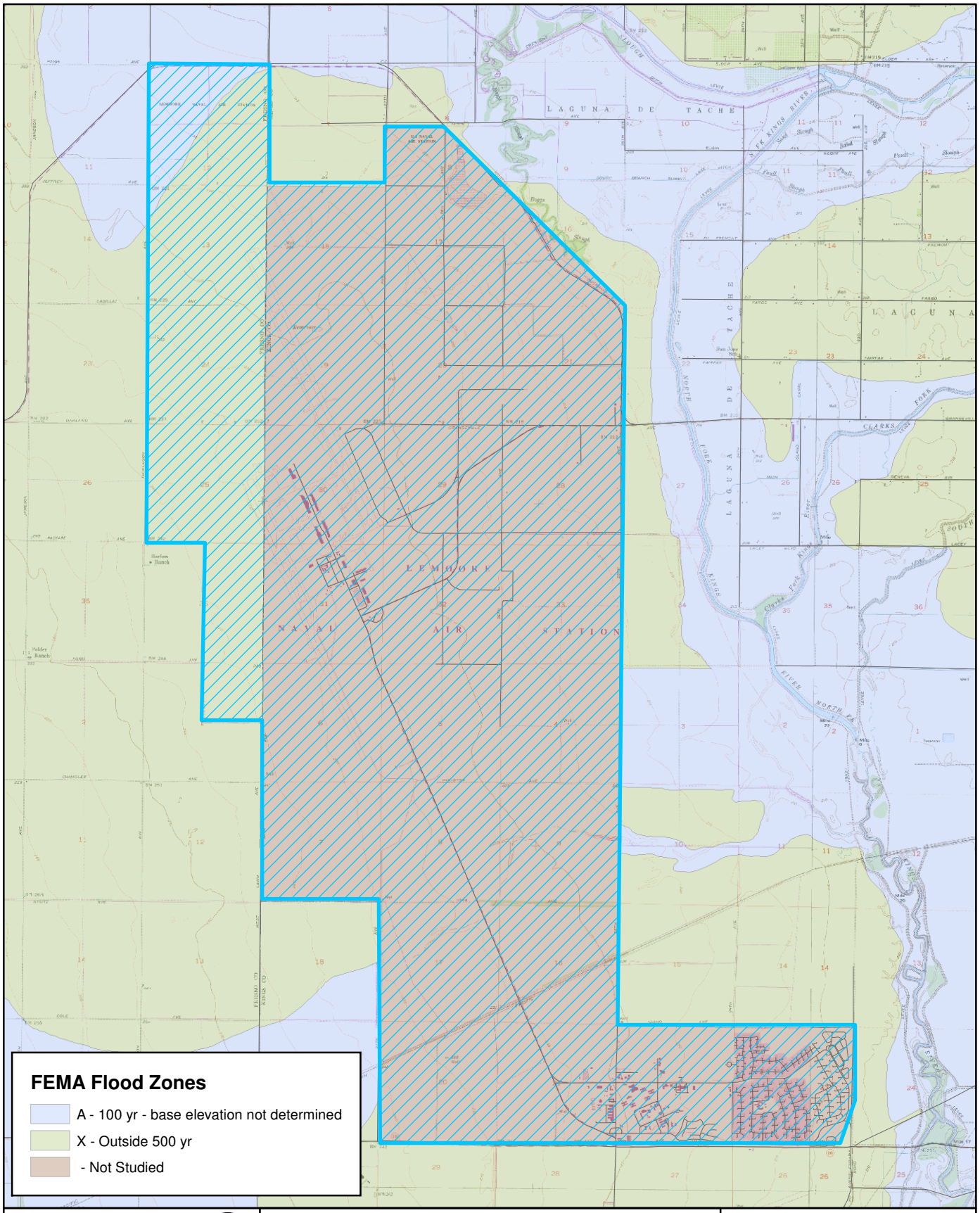

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Naval Air Station Lemoore

USGS Quadrangles
- Lemoore
- Stratford
- Vanguard
- Westhaven

FIRM Panel Nos.
06031C0025C & 06031C0150C

Exhibit 5.5

Naval Air Station Lemoore
FEMA Flood Map

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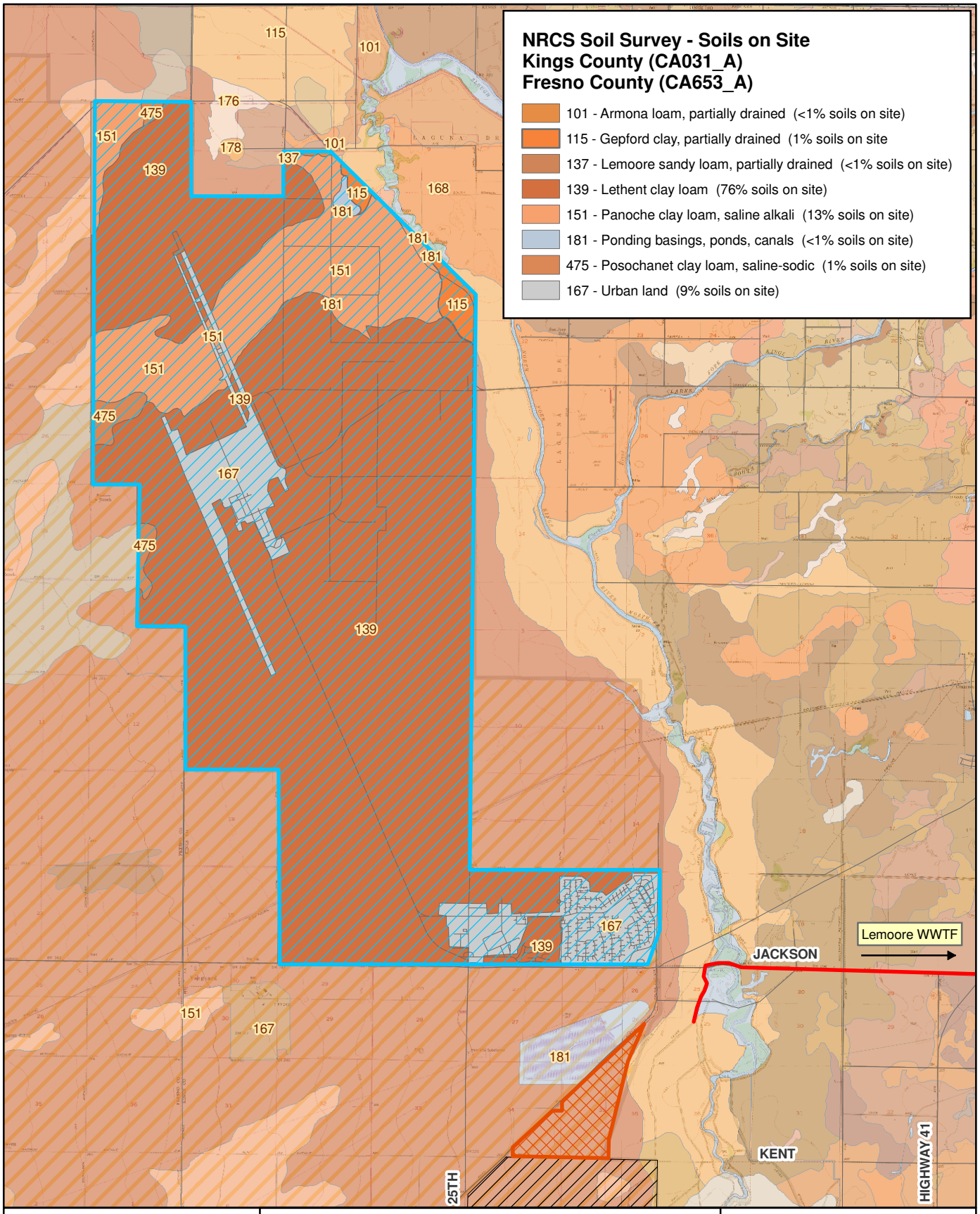

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- Naval Air Station Lemoore
- Westlands WD Study Area
- Westlands Water District
- Olam West Coast Reclamation Area
- 30" WWTF Pipeline

Exhibit 5.6

Naval Air Station Lemoore
Soils Map

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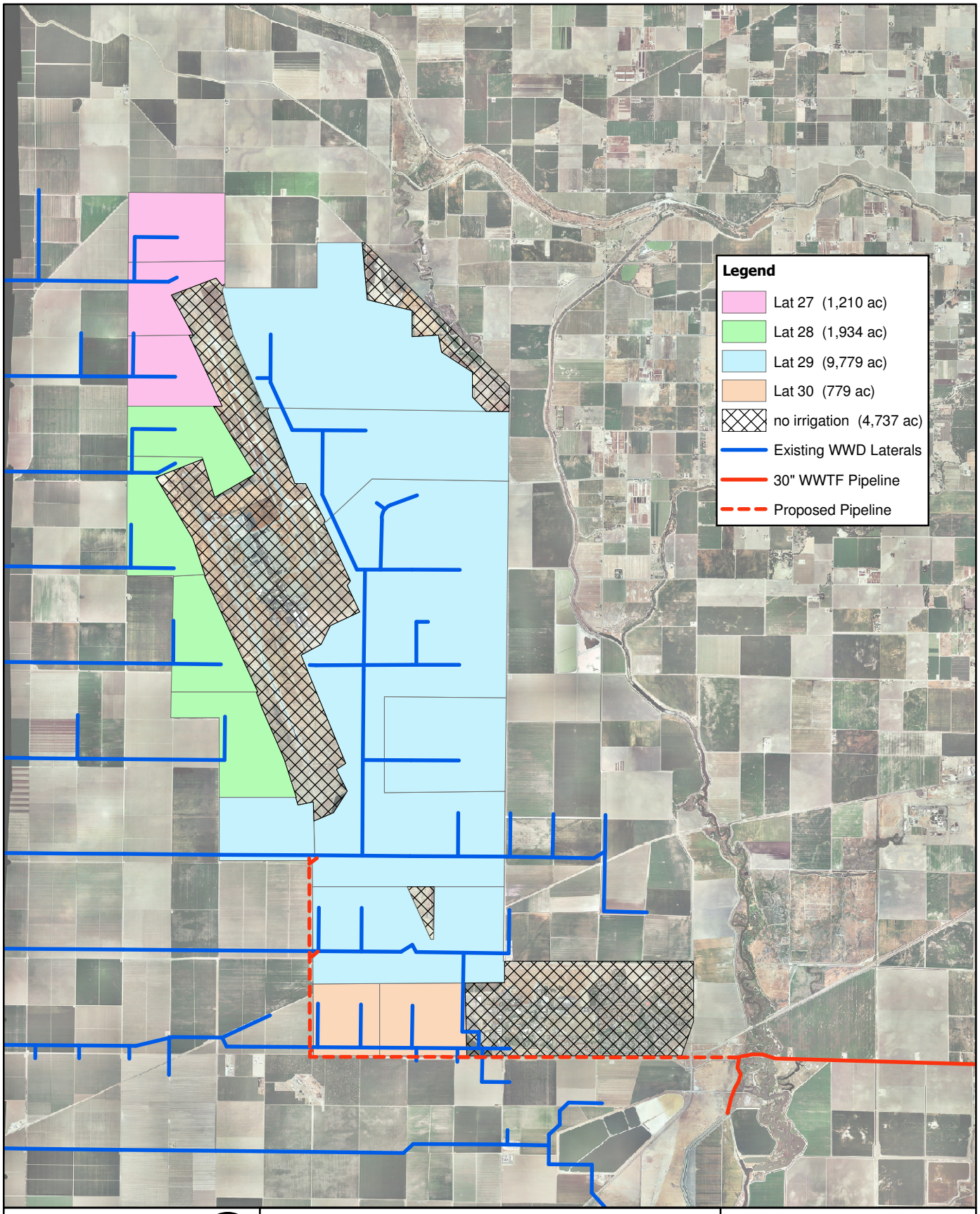

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Exhibit 5.7

Naval Air Station Lemoore
Proposed Effluent Pipeline

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6

STUDY AREA 3
WESTLAKE FARMS

6.1 BACKGROUND

6.1.1 Study Area 3 consists primarily of lands owned by Westlake Farms and adjacent landowners south of the City of Lemoore. Although Westlake Farms currently accepts all of the wastewater from the City of Lemoore onto its own lands, this option considers the purchase of parcels owned by Westlake and others nearest to the City for use as a dedicated reclamation area. Ownership by the City would provide long-term security and control. For reference purposes only, Study Area 3 is identified as Westlake Farms.

6.1.2 Study Area 3 consists of land located approximately 1 miles west of the town of Stratford, and southwest of the City of Lemoore. It is comprised of Sections 25, 26, 35 and 36 of Township 19S, Range 19E; Sections 29, 30 31, and 32 of Township 19S, Range 20E; Section 1, 12, 13, and 14 of Township 20S, Range 19E; and Section 5, 6, 7, and 18 of Township 20S, Range 20E in the Mount Diablo Base and Meridian.

6.1.3 This Study Area consists of approximately 7,900 acres with 3,900 acres owned by Westlake Farms and is sufficient for flows to the year 2057.

6.2 SITE CONDITIONS

6.2.1 Aerial photography (flight date 2008) of the study area was used to help identify land use and to provide a visual bearing of the site. The aerial photo for Study Area 3 is included as **Exhibit 6.1**. The Kings River bisects the parcels and complicates the ability to irrigate with the City's effluent by requiring transport to higher lands on both sides of the river.

6.2.2 Alfalfa, cotton and feed grains, the crops most typically grown in the area, were each evaluated to determine the future effluent reclamation area layout and use.

6.2.3 Topographic data was modified per United States Geological Survey (**USGS**) 7.5-minute quadrangle maps, formatted with five (5) foot contour lines and merged into the standard base map used in this WRS. The resulting topographic map for Study Area 3 is included as **Exhibit 6.3**. In general, elevations increase to both east and west as distance from the Kings River increases. Elevations of the proposed

reclamation area range from 210 feet at the east and west boundaries to 205 feet along the Kings River.

6.2.4 The Federal Emergency Management Agency (**FEMA**) Flood Insurance Rate Maps were the source for flood zone data. This data was modified, formatted, and merged into the standard base map used in this WRS. The FEMA flood zone map for Study Area 3 is included as **Exhibit 6.4**. This Study Area is located in Special Flood Hazard Zone A, the 100 year Flood Zone, along the Kings River, and in Zone X, outside the 500 year flood zone, in areas away from the Kings River. The Zone A designation may affect use of these lands for effluent reclamation. At minimum, the winter storage pond would need to be located outside of the Zone A boundary.

6.3 SOILS

6.3.1 Natural Resources Conservation Service (**NRCS**) soil survey data for Study Area 3 was compiled and formatted to the standard base map for use in this WRS. It is included as **Exhibit 6.5**.

6.3.2 Soils in the USDA soil survey for the Westlake Farms area are predominately of the Pitco clay, Armona loam, Lakeside loam, and Gepford clay. Pertinent soil characteristics from the USDA Soil Survey of surface soils are presented in **Table 6-3.**

Table 6 - 3
USDA Soil Characteristics

Soil Name	Depth from Surface (inches)	Dominant USDA Texture	Permeability (inches/hour)	Water Holding Capacity (in/in of soil)
Pitco	0 - 60	Clay	<0.06	0.02 – 0.12
Armona	0 – 60	Loam	0.20 – 20.00	0.02 – 0.14
Lakeside	0 - 60	Loam	0.20 – 0.60	0.08 - 0.15
Gepford	0 - 60	Clay	<0.06 – 0.60	0.08 – 0.16

6.4 GROUNDWATER CHARACTERISTICS

6.4.1 Groundwater characteristics for this Study Area are similar to the other areas and are described in the other sections of this Study.

6.5 SUPPLEMENTAL WATER

6.5.1 Surface water from Empire Westside Main Canal and Stratford Canal, along with well water, could be used as supplemental irrigation water for the effluent reuse area.

Surface water would be used both for blending to meet crop salt loading limitations and as a supplemental supply during high irrigation demand (summer) months.

6.6 EFFLUENT CONVEYANCE SYSTEM

6.6.1 Currently, a 30-inch C-905 PVC gravity pipeline conveys the City's effluent from the WWTF to a discharge at the Westlake Canal. From the WWTF the pipeline runs south along 19th Avenue to Jackson Avenue, then west along Jackson Avenue where it passes over the Kings River, attached to a bridge, and turns south to meet the Westlake Canal.

6.6.2 The gravity flow capacity of the existing pipeline is 5.5 mgd. This will be sufficient until approximately 2012, after which pumping will be needed. The pressure rating of the pipe is adequate to convey all effluent projected to the year 2057 and beyond.

6.6.3 The Westlake Farms property is ideally located for reclamation purposes because the existing pipeline alignment is along the northern border of the Study Area. The existing pipeline runs along the north side of parcels 024-10-003 and -015 and the discharge to the Westlake Canal is next to parcel 024-19-008. **Exhibit 6.1** shows the alignment of the existing pipeline and the 5.1 miles of proposed pipeline which would be used to convey wastewater to Study Area 3.

6.6.4 Using the projected flow rates for 2010, 2030, and 2057 along with the topography from **Exhibit 6.3** and size of the existing pipeline the approximate size of pumps were calculated. The assumption was that the pump(s) would need to produce the projected flow with enough head to get it to the existing discharge point. Due to favorable down gradient conditions no pumping pressure is needed in year 2010. 2030 it is calculated that 12 hp of pumping capacity will be needed to produce the pressure needed to meet the projected flow rate. In 2057 it is anticipated that 134 hp of pumping capacity will be needed.

6.7 WATER BALANCE

6.7.1 A water balance calculation was performed for the years 2010, 2030, and 2057, using the wastewater effluent projections from **Table 2 - 2**. The purpose of a water balance is to determine the amount of water percolating or leaching below the crop root zone and the loading rates of BOD_5, Nitrogen, and Salts. Additionally, the amount of fresh irrigation applied to the area, the reclamation crop acreage and winter storage pond size are calculated.

6.7.2 The purpose of a reclamation area is to reclaim the nutrients applied to the area through the wastewater; which is typically done by growing a crop. A double crop rotation of summer Sudan grass and winter barley were used to maximize the

uptake of nutrients. The rootzones for Sudan grass and barley are 4 feet and 3.5 feet, respectively. The assumed crop rootzone used in the water balance calculations is 4 feet.

6.7.3 The reclamation area soils and their respective characteristics were determined using the United States Department of Agriculture Natural Resources Conservation Service's Soil Survey. The soil available water holding capacity (AWHC) of the area is the composite of the individual soil types' AWHCs multiplied by the percentage of each soil found in the area. It was determined that the composite AWHC for Study Area 3 is 0.08 inches per inch. The composite rootzone AWHC is the soil AWHC multiplied by the rootzone depth, or 3.84 inches.

6.7.4 Using the current wastewater effluent characteristics and flow projections, the future effluent characteristics were calculated. The calculation assumed the municipal and industrial effluent characteristics would remain constant over time. Since the municipal effluent has a lower salt concentration, the overall salt loading will decrease as the projected effluent flow rates increase over time, and the ratio of municipal flow rate to industrial flow rate increases. The specific constituents of concern are inorganic salts, including calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates. The combined concentration of these constituents, expressed as inorganic total dissolved solids (**IDS**) for the 2010, 2030, and 2057 years, are 1,159 mg/l, 1,129 mg/l, and 980 mg/l. These IDS concentrations are used in the corresponding water balances to determine the inorganic salt loading on the reclamation area.

6.7.5 Salt loading will be the limiting factor in the application of wastewater to the fields. The reclamation area has been sized to limit the salt loading to a maximum of 6,000 lbs/ac/yr. A summary of the water balance calculation is shown in **Table 6-4**.

Table 6 – 4
Westlake Farms Water Balance Summary

Year	Effluent Flow Rate (mgd)	Reclamation Area Needed (ac)	BOD Loading (lbs/ac/day)	N Loading (lb/acre/yr)	Salt Loading (lbs/ac/yr)	Pond Storage Needed (ac-ft)	Pond Area Needed (ac)
2010	4.15	2,251	0.29	157	6,000	1,154	68
2030	7.12	3,800	0.30	159	6,000	1,981	116
2057	11.60	5,377	0.34	183	6,000	3,227	186

6.8 STORAGE NEEDS & LOCATIONS

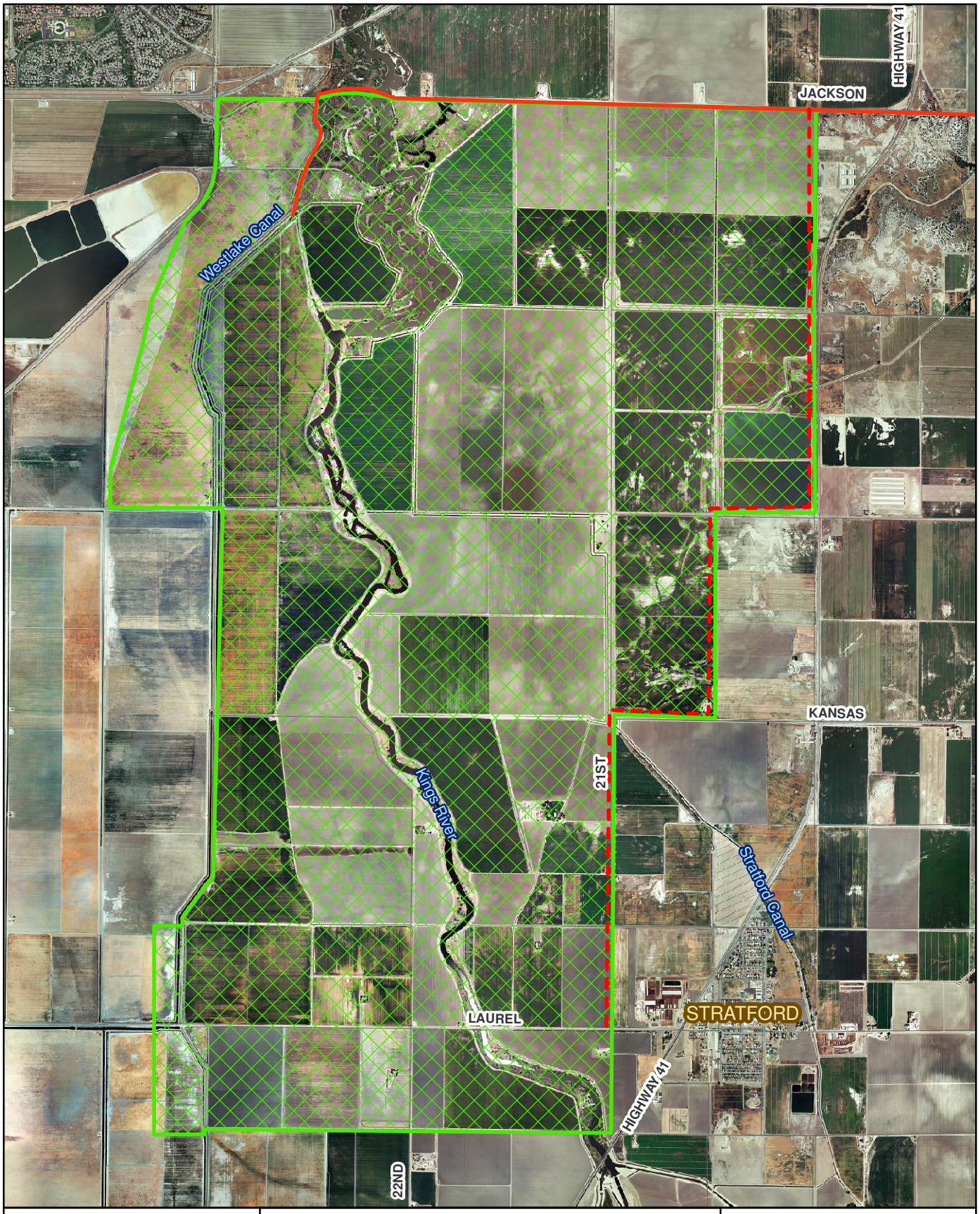
6.8.1 The water balance calculation assumed that wastewater wouldn't be applied to the reclamation area during the months of October, November, and December. Over-winter storage is necessary for the 90 days that the effluent is being produced but not used. The storage pond would be managed such that the pond would be empty by the end of September each year. Managing the ponds in this manner minimizes the required storage volume. The corresponding reclamation acreages for the 2010, 2030, and 2057 projected effluent flow rates are 68 acres, 116 acres, and 186 acres, respectively. The ponds were assumed to be square in shape and 20 feet deep. If this depth proves infeasible due to groundwater issues, proportionally larger, shallower ponds will be required.

6.9 COST ANALYSIS

6.9.1 For each of the three years studied, a preliminary cost analysis was performed. The analysis took into consideration the purchase of the land, construction of the storage pond, construction of the conveyance system, and other miscellaneous items.

6.9.2 The cost per acre of land was assumed to be $864 per acre, based on information about land previously sold by Westlake Farms. The costs associated with the construction of the storage lagoon and other costs are based on recent local experience.

6.9.3 The preliminary cost estimates for Study Area 3 using the information from the 2010 (4.15 mgd), 2030 (7.12 mgd), and 2057 (11.60 mgd) flow rates is approximately $18,200,000, $24,600,000, and $33,600,000 respectively. All estimates are in present cost dollars and are for total costs as if the entire flow rate required project was built today.



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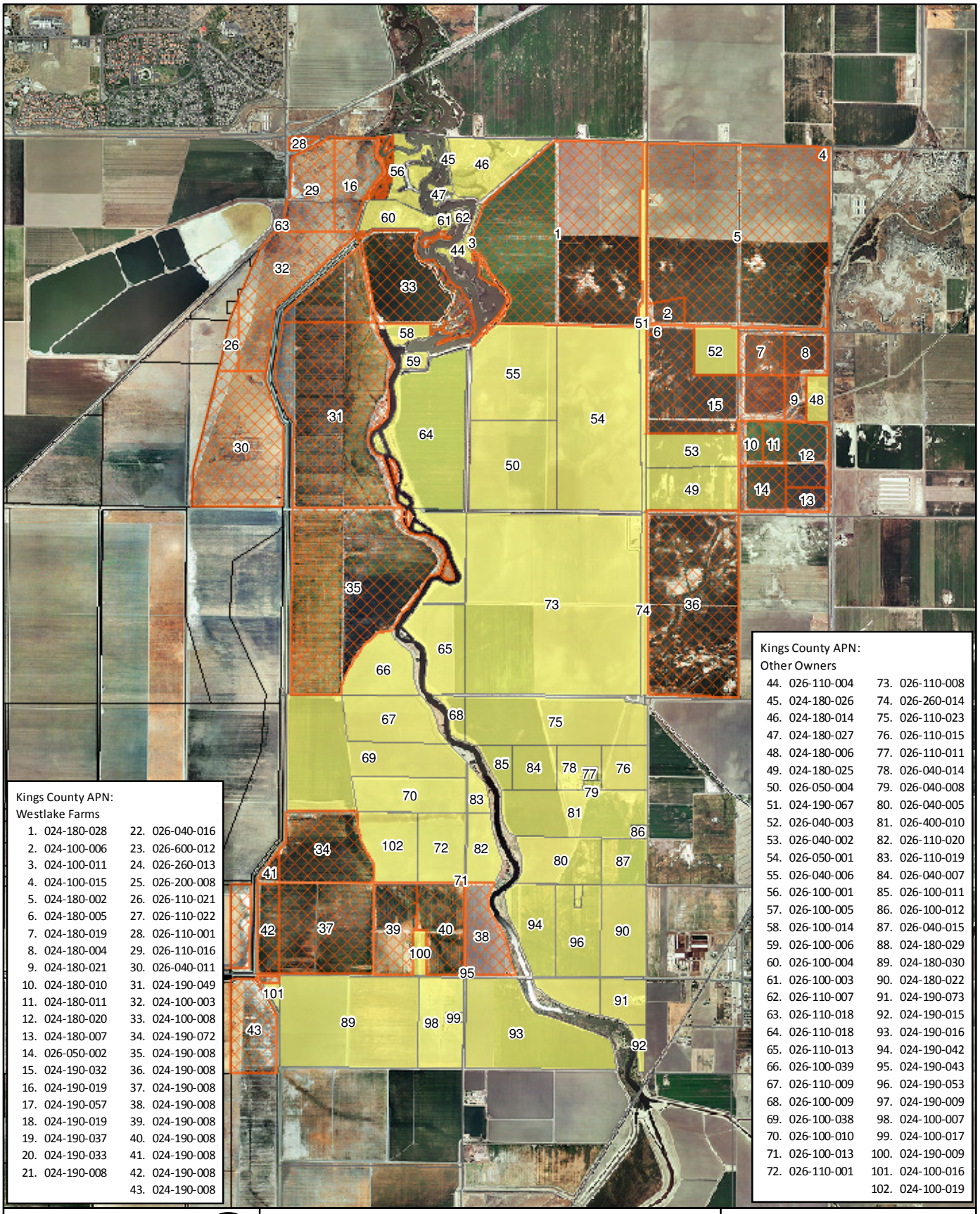
Legend

- Westlake Farms Study Area
- 30" WWTF Pipeline
- Proposed Pipeline

Exhibit 6.1

Westlake Farms
Aerial

V:\Clients\Lemoore_City of-1059-GIS\Map\2011-0104 WWTP Exh 6-1.mxd



Kings County APN:
Westlake Farms

1.	024-180-028	22.	026-040-016
2.	024-100-006	23.	026-600-012
3.	024-100-011	24.	026-260-013
4.	024-100-015	25.	026-200-008
5.	024-180-002	26.	026-110-021
6.	024-180-005	27.	026-110-022
7.	024-180-019	28.	026-110-001
8.	024-180-004	29.	026-110-016
9.	024-180-021	30.	026-040-011
10.	024-180-010	31.	024-190-049
11.	024-180-011	32.	024-100-003
12.	024-180-020	33.	024-100-008
13.	024-180-007	34.	024-190-072
14.	026-050-002	35.	024-190-008
15.	024-190-032	36.	024-190-008
16.	024-190-019	37.	024-190-008
17.	024-190-057	38.	024-190-008
18.	024-190-019	39.	024-190-008
19.	024-190-037	40.	024-190-008
20.	024-190-033	41.	024-190-008
21.	024-190-008	42.	024-190-008
		43.	024-190-008

Kings County APN:
Other Owners

44.	026-110-004	73.	026-110-008
45.	024-180-026	74.	026-260-014
46.	024-180-014	75.	026-110-023
47.	024-180-027	76.	026-110-015
48.	024-180-006	77.	026-110-011
49.	024-180-025	78.	026-040-014
50.	026-050-004	79.	026-040-008
51.	024-190-067	80.	026-040-005
52.	026-040-003	81.	026-400-010
53.	026-040-002	82.	026-110-020
54.	026-050-001	83.	026-110-019
55.	026-040-006	84.	026-040-007
56.	026-100-001	85.	026-100-011
57.	026-100-005	86.	026-100-012
58.	026-100-014	87.	026-040-015
59.	026-100-006	88.	024-180-029
60.	026-100-004	89.	024-180-030
61.	026-100-003	90.	024-180-022
62.	026-110-007	91.	024-190-073
63.	026-110-018	92.	024-190-015
64.	026-110-018	93.	024-190-016
65.	026-110-013	94.	024-190-042
66.	026-100-039	95.	024-190-043
67.	026-110-009	96.	024-190-053
68.	026-100-009	97.	024-190-009
69.	026-100-038	98.	024-100-007
70.	026-100-010	99.	024-100-017
71.	026-100-013	100.	024-190-009
72.	026-110-001	101.	024-100-016
		102.	024-100-019

0 0.3 0.6 Miles

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PROVOST & PRITCHARD
CONSULTING GROUP
An Employee Owned Company

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Fresno, CA 93711-6162
(559) 449-2700

Legend

Parcel Ownership

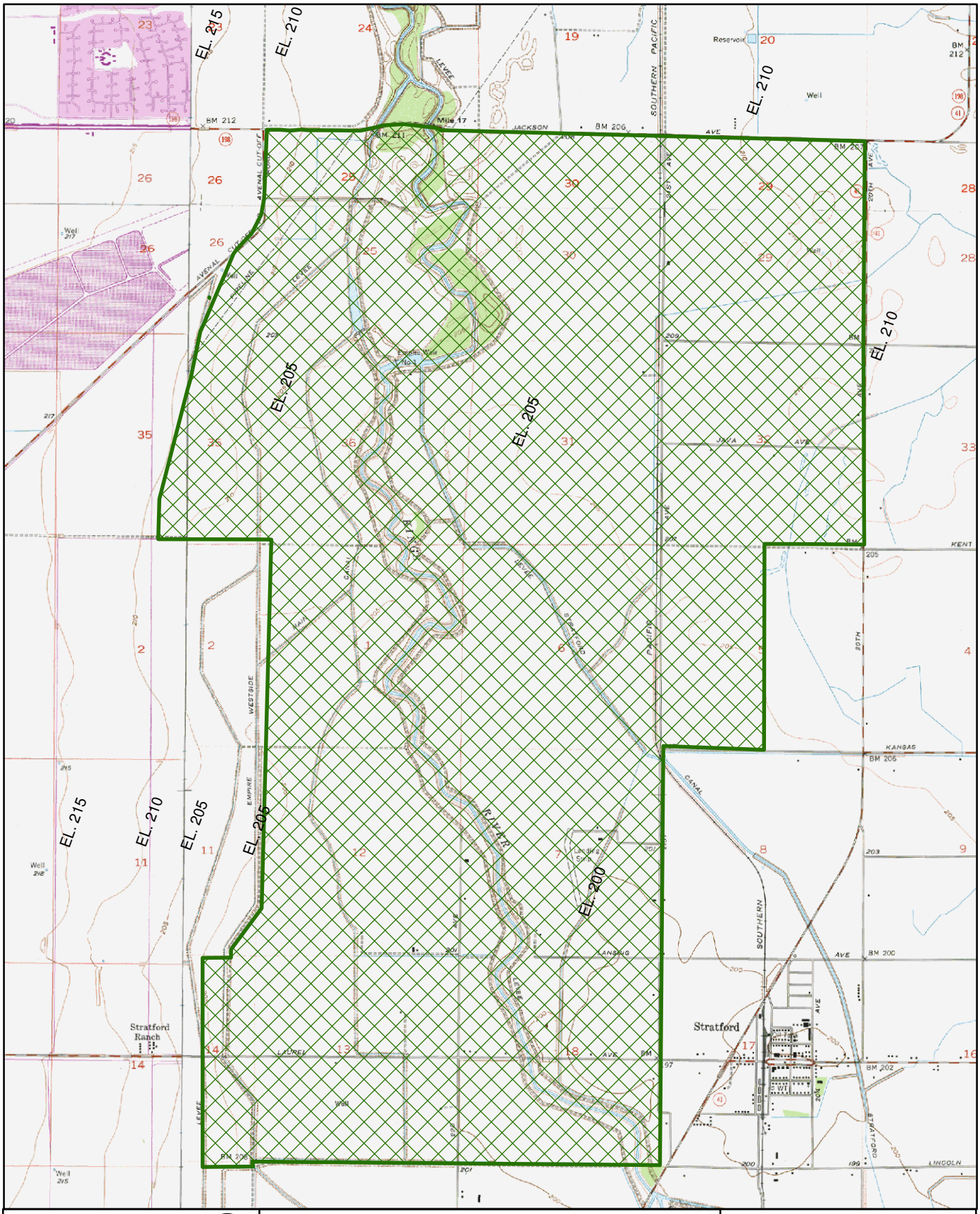
Other Land Owners

Westlake Farms

Exhibit 6.2

Westlake Farms
Aerial - Parcels

2/18/2011 \\goose\vsl_clients\Clients\Lemoore_City of-1059-GIS\Map\2011-0104 WWTP Exh 4-2_6-2.mxd



0 0.3 0.6 Miles

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Legend

Westlake Farms Study Area

Exhibit 6.3

Westlake Farms
Ground Surface Contours

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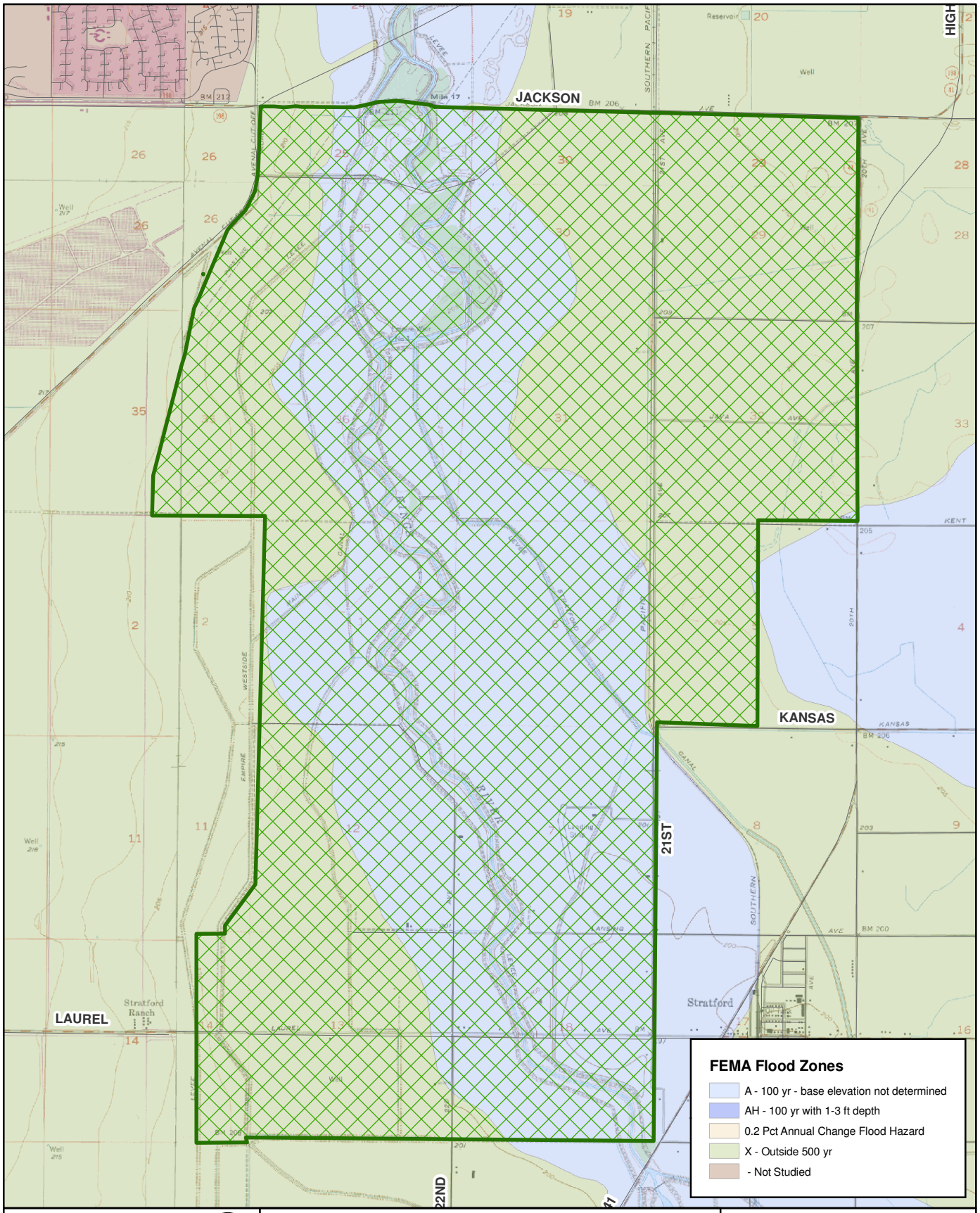

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Westlake Farms Study Area

USGS Quadrangles
- Lemoore
- Stratford
- Vanguard
- Westhaven

FIRM Panel Nos.
06031C0300C, 06031C0325C
& 06031C0165C

Exhibit 6.4

Westlake Farms
FEMA Flood Map

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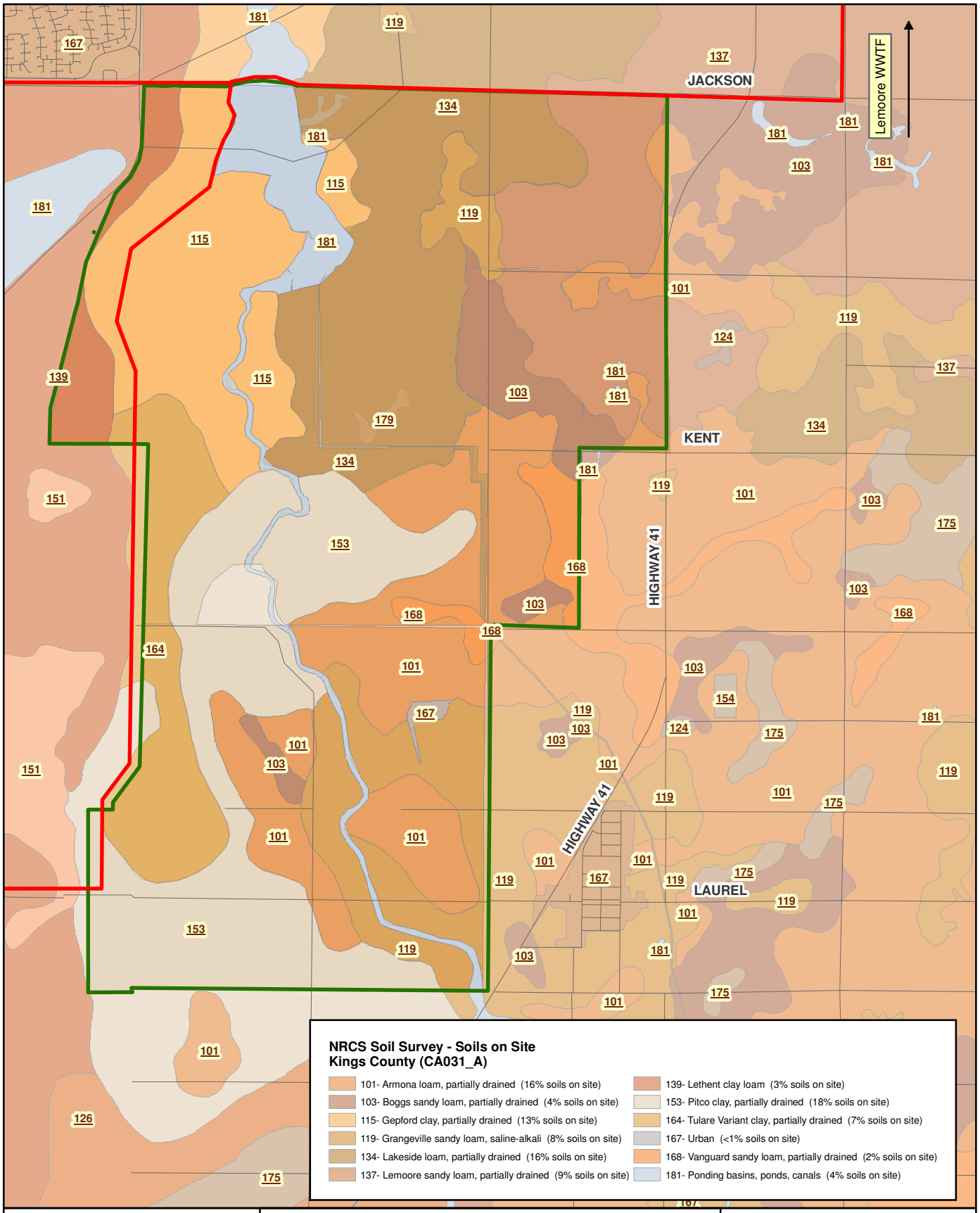

0 0.5 1 Miles

EST. 1968
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Legend

Westlake Farms Study Area

30" WWTF Pipeline

Exhibit 6.5

Westlake Farms
Soils Map

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7

CONSIDERATIONS

7.1 PRELIMINARY COSTS

7.1.1 Once a specific option is selected, an early next step would be to prepare a preliminary estimate of total project cost. This would include land, right of way, conveyance system, irrigation system, over-winter storage, treatment, and other costs. Operating costs would also be included.

7.1.2 Project costs will vary by study area and selected options within each study area. Costs will be highly dependent on industrial salt loading, which may be reduced either through reductions in salt usage within Leprino's facility, pre-treatment of salt loading by Leprino, or other potential options.

7.1.3 Major cost components will include land, supplemental water, and effluent transmission main from the City WWTF to the reuse site. Land will be negotiated when a firm project is selected. This will vary by land owner and current land use, and is difficult to predict. Water costs will vary by source, quality and reliability. The City will be interested in a more reliable, higher quality source, so will be working at the higher end of the water cost spectrum. While high-flow water is often available for less than $25/acre-foot, such a supply would not meet the City's needs for supplemental irrigation through the Summer months of a dry year, for example.

7.1.4 The project would be implemented in phases. A phasing and implementation plan will be developed when a reuse site is selected and negotiations occur regarding reuse acreage, irrigation methods and rates, cropping, and other critical project factors.

7.1.5 Once the City secures the land, an agreement could be made with the former land owner to farm the project site for at period of time. This land lease might range from 10 to 20 years.

7.1.6 Alternatively, the City could retain a farming entity to provide custom farming services on a fee for services arrangement, rather than a straight property lease. This would allow the City to retain control of the operations:

7.1.7 The steps needed to implement the project include:

1. Enter an agreement with the appropriate land owner for modifications to the land.
2. Design the irrigation system. Investigate irrigation methods and control systems including: Automation using telemetry at the farm site; control and program pivot operation from the office or at the pivot point; and monitoring of water pressure, system direction, location in the field, chemigation mode and other information; alarms can be set to notify system failures.
3. Initial setup (ripping, leveling, piping, etc.) These costs are expected to be the responsibility of the City.
4. The project lands would be chiseled as needed by a custom equipment operator or company.
5. The project lands would be leveled or smoothed to the degree needed for the selected irrigation system.
6. Underground pipelines, electrical and booster pump stations installed.
7. Selected irrigation systems installed.
8. Preplant fertilizers and/or pesticides applied.
9. Plant selected crops.
10. Monitor and report results of effluent application volumes and times, crop yields, soil profile testing and groundwater monitoring.

7.2 NECESSARY ENVIRONMENTAL PROCESSES

7.2.1 CEQA and, if required, NEPA, must be completed prior to construction of a new project. The level of environmental review will be selected once the project scope and funding source(s) are known.

7.3 REPORT OF WASTE DISCHARGE

7.3.1 A Report of Waste Discharge application for revising current Waste Discharge Requirements would need to be submitted to the RWQCB in order to implement a new project.

7.3.2 The Report of Waste Discharge will describe the discharge of wastewater to the proposed reuse site. This will include descriptions and analysis of the WWTF (both City and Leprino), including existing and any proposed new treatment components and chemical usage, wastewater characteristics, effluent characteristics, process flow diagram, vicinity map, site map, holding ponds, soils, groundwater, surface water, and source water characteristics, waste management plan, solids handling, monitoring and reporting, contact information, and an antidegradation analysis showing discharge of the effluent will not negatively impact any beneficial uses of the groundwater below the reuse site.

7.3.3 A Report of Water Reclamation (**RWR**) would be prepared and submitted to the California Department of Public Health (**CDPH**). The RWR is a technical report

describing the actual discharge of effluent onto lands for beneficial purpose, in this case for agriculture. The report must demonstrate that application rates are agronomically beneficial; that there will not be an excessive leaching fraction passing through the rootzone to the groundwater. It must also show that the quality of the effluent is appropriate for the crop being grown, and that the chemical makeup of the effluent will not be harmful to the crop. CDPH must approve the report, but does not actually issue a permit. The approved RWR is a necessary part of the application to the Regional Board for a revised discharge permit.

7.4 NECESSARY AGREEMENTS

7.4.1 The City will be required to enter into a reclamation agreement before the land discharge is approved. Currently, the City has a reclamation agreement jointly with Westlake Farms for the Westlake Canal discharge. This would be similar. The Regional Board might also require the City's farm operator or lessee to be party to the reclamation agreement.

7.4.2 An agreement between the City and its farm operator or lessee would be made, where the City would be obligated to provided a minimum and maximum volume and specific quality parameters such as EC, BOD, pH, D.O., etc. of effluent at specified points of connection. The City would be responsible for the monitoring and reporting program, thus alleviating a major item that most farmers are not well equipped to implement. Beyond the points of connection the tenant shall be responsible for taking 100% of the effluent and utilizing it on-site for the specified uses, in a safe manner.

7.4.3 Prior to developing the final design of a proposed project, the City will need to secure an agreement with a water purveyor (in this case likely to be WWD) for a reliable supply of fresh water that can be used to supplement and/or blend with WWTF effluent as needed.

7.5 FUTURE STEPS

7.5.1 This Study provides the necessary background and support information to move forward on a long-term sustainable option for wastewater reclamation. However, proceeding on a preferred site or project is subject to the availability of the reclamation areas identified. While the current option of discharge to Westlake Farms remains the preferred option as long as it is available and feasible, the City is in a good position to use this Study towards the regulatory and permitting needs of a preferred project in the coming years.