2.0 FACILITY DESCRIPTION

This section includes a detailed description of the existing Lodi Water Pollution Control Facility (WPCF) and associating reuse system. The major topics addressed include:

2.1 FACILITY LOCATION, HISTORY AND OVERVIEW

The City of Lodi is located in San Joaquin County along the Interstate-5 (I-5)/Highway 99 corridor between Sacramento and Stockton. The WPCF is located southwest of the City at a location along the west side of I-5 about two miles south of the Highway 12 interchange. The location of the WPCF is depicted on Figure 2-1.

The City has been providing wastewater service for the Lodi community since 1923. Originally, wastewater was treated at a facility located within the City limits. In the 1940's the City purchased a portion of the existing 1,040-acre WPCF site, constructed a pipeline from the wastewater treatment plant to the site, and began practicing agricultural reuse shortly thereafter.

The initial components of the existing WPCF were originally constructed in 1966. Since that time, several treatment upgrade and capacity expansion projects have been completed. Today, the WPCF treats approximately 6.3 millions gallon per day (mgd) (annual average) of municipal wastewater from the City.

A total of 880 acres of the existing 1,040-acre City property is used for agricultural production. During the summer months, 790-acres of this area are used for beneficial reuse of industrial process wastewater (primarily from a large cannery) and Class B biosolids. WPCF treated municipal effluent is also used to satisfy the remaining irrigation demands (and to some extent the nutrient demands) within this area. An additional 90 acres of the City-owned agricultural property is currently irrigated with groundwater.

Municipal effluent not needed to satisfy the irrigation demands on the 790-acre agricultural area are discharge to Dredger Cut, a dead end slough of the Sacramento-San Joaquin Delta (Delta). From approximately September through April, all of the WPCF effluent is discharged to Dredger Cut.

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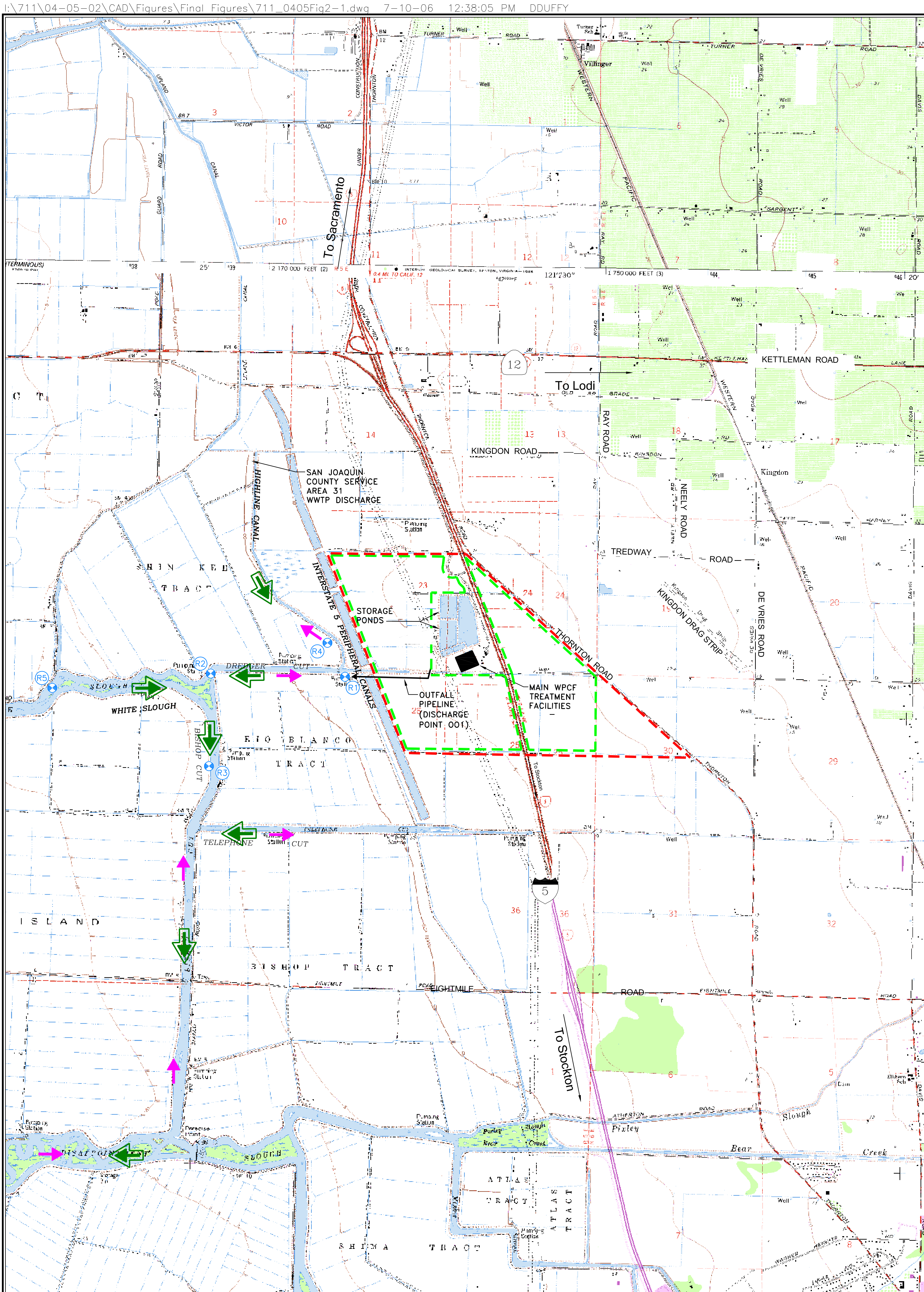

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- Boundary of City–Owned Land
- Boundary of Existing Effluent Irrigation & Biosolids Land Application Areas
- Receiving Water Flow During Outgoing Tide
- Receiving Water Flow During Incoming Tide
- R1 Receiving Water Monitoring Locations

N

0 2000 4000
SCALE IN FEET

Figure 2-1
City of Lodi
White Slough WPCF
Groundwater Investigation
LOCATION MAP

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2.2 EXISTING TREATMENT PROCESSES

The three treatment processes at the WPCF include the following:

- Municipal wastewater treatment process
- Solids treatment process
- Industrial wastewater treatment process

2.2.1 Municipal Wastewater Treatment Process

A flow schematic of the City's existing municipal wastewater treatment facilities is provided on Figure 2-2. The existing municipal treatment process train consists of comminutors, grit removal, primary sedimentation, activated sludge treatment, secondary clarification, and effluent filtration and associated chemical feed facilities and UV disinfection facilities. Flow discharged to Dredger Cut under the NPDES program are filtered and disinfected to State of California Title 22 recycled water tertiary standards. Domestic municipal wastewater flows discharged to the land application areas are treated to undisinfected secondary standards.

2.2.2 Solids Treatment Process

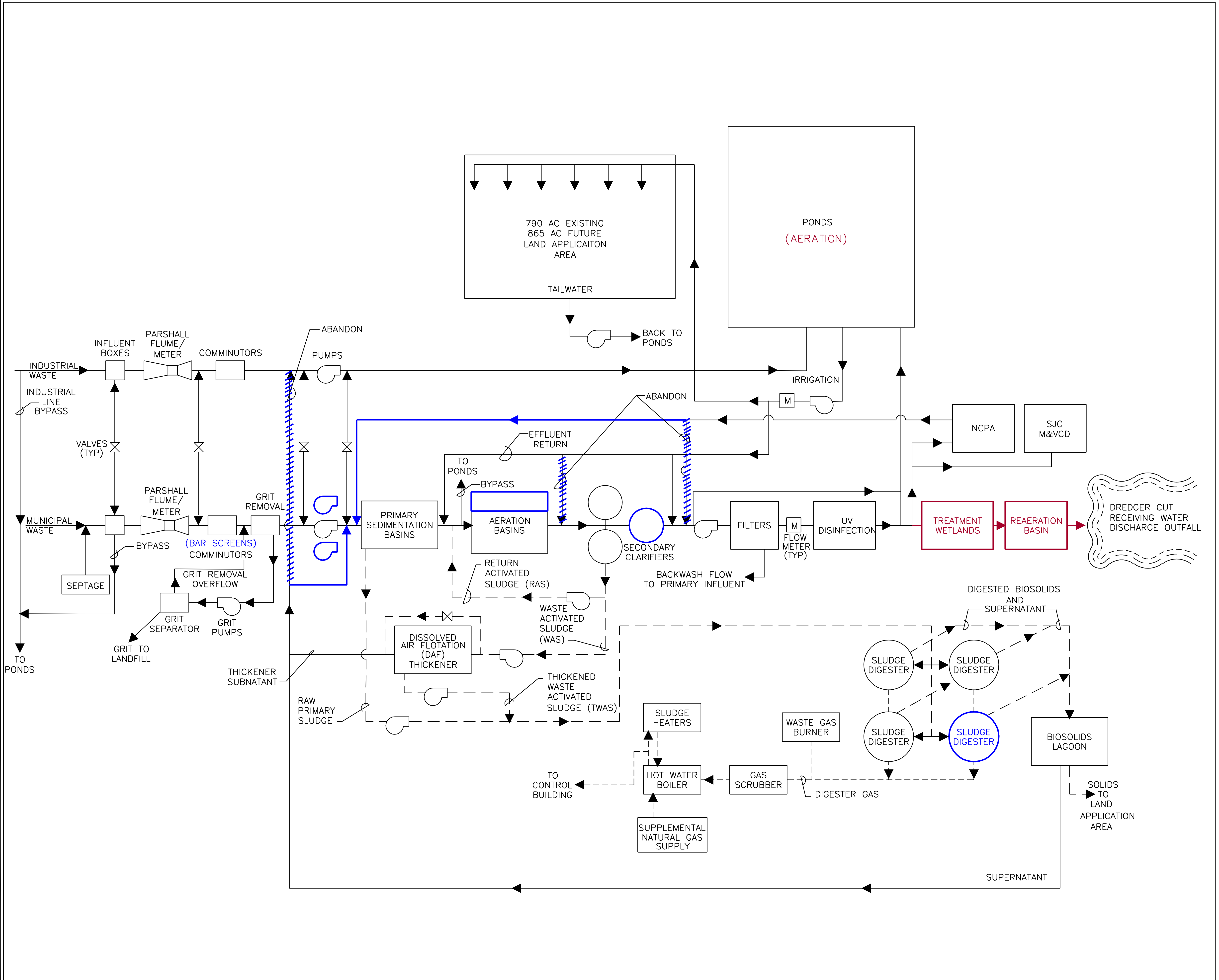
The treatment facility flow schematic depicted on Figure 2-2 also includes the City's biosolids treatment facilities. The primary flows shown on this figure include:

- Solids from the primary basin that are digested anaerobically in onsite digesters prior to concrete lagoon stabilization and land disposal on City-owned properties.
- Waste activated sludge from the secondary treatment process that is first thickened in a dissolved air flotation (DAF) thickener before being digested anaerobically, stabilized in the onsite lagoon, and land applied.
- The DAF thickener subnatant, the liquid remaining beneath the surface of the floating solids, that is directed to the industrial influent line downstream of the headworks facilities.
- The biosolids lagoon supernatant, the liquid remaining above the surface of the floating solids in the lagoon, that is directed to the industrial influent line downstream of the headworks facilities.

2.2.3 Industrial Wastewater Treatment Process

The flow schematic for the City's industrial process is also shown on Figure 2-2. Industrial wastewater collected in the City's industrial sewer line is screened and directed to the City's agricultural reuse facilities. During the summer months, these flows are blended with flows stored in the City's onsite storage ponds, and directed to the City's fields for agricultural reuse. During the remainder of the year, industrial flows are directed to the onsite storage ponds, where they are blended with other flows and stored until being land applied in the following year. Additional information regarding operation of the City' storage and land application facilities are provided in Section 2.4.

Figure 2-2
City of Lodi
White Slough WPCF
Groundwater Investigation
WPCF PROCESS FLOW DIAGRAM



LEGEND

EXISTING

IMPROVEMENTS PROJECT 2007

POTENTIAL FUTURE IMPROVEMENT PROJECT

NOTES

1. SOLID LINE INDICATES LIQUID FLOW.
2. DASHED LINE INDICATES SOLIDS FLOW.
3. SMALL DASHED LINE INDICATES GAS FLOW.

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Flows to the City's industrial sewer line can be characterized as follows:

- Approximately 90 percent of the industrial system flow comes from Pacific Coast Producers (PCP), a large fruit canning facility; and approximately 95 percent of all these flows are received between the months of June and September (metered).
- The remainder of the waste flow is from Holz Rubber Company, Valley Industries, M&R Packing, Lodi Iron Works, a groundwater remediation project operated by Chevron (estimated from water supply data), and Van Ruiten Winery (metered).
- Stormwater captured from a few industrial areas (primarily from the industries that discharge process wastewater to the industrial system) within the City is also discharged to the City's industrial sewer system (not metered).
- Runoff and stormwater flows from approximately 118 acres of the City-owned agricultural reuse area and from the agricultural area located east of the City's properties are also discharged to the industrial sewer system via a manhole located on the City's property (not metered).

The average industrial line flows and associated loads that were observed between 2002 and 2005 are shown graphically on Figure 2-3 (a) through (d).

Note that prior to 2002, the PCP cannery typically processed tomatoes (in comparison to the peaches and nectarines that were processed during 2002 through 2005). As a result, PCP historically discharged approximately twice the flow and loads that are shown on Figure 2-3 as being typical during the 2002 through 2005 period. Nevertheless, PCP is not anticipated at this time to revert to tomato processing. The cannery operates under the terms of a City discharge permit, which limits their annual flow to 121 million gallons per year and annual BOD loads to 2.61 million pounds per year. Therefore, the flows and loads received prior to 2002 are not to be considered as typical of future operations. (The previous PCP discharge permit allowed up to 356 million gallons per year of flow and 5.05 million pounds per year of BOD.) Nevertheless, other potential additions to the industrial flow and loads are being considered by the City and are discussed in Section 2.3.3.

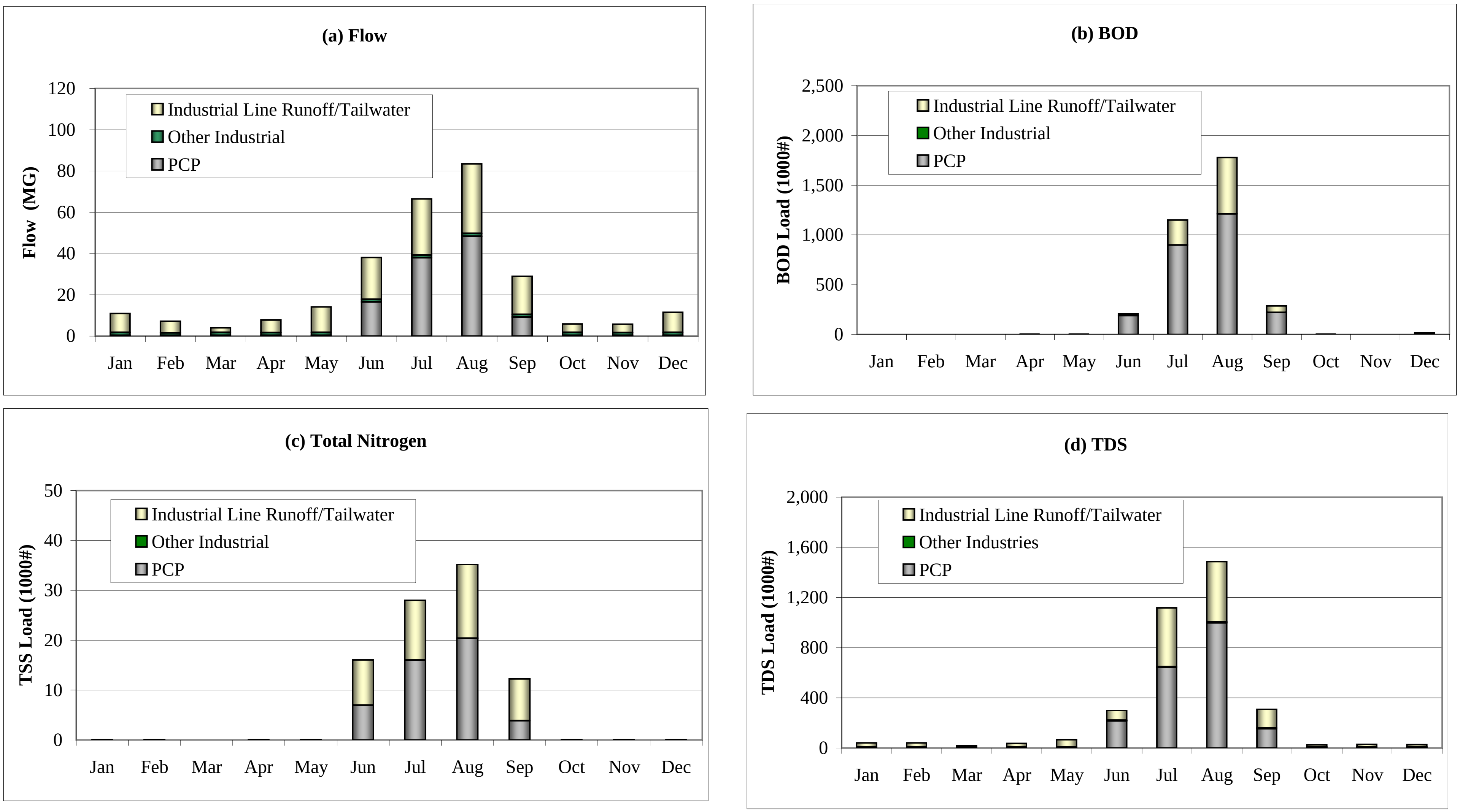
2.3 PLANNED TREATMENT PROCESS MODIFICATIONS

The City is currently implementing (or has proposed to implement) modifications to the following processes at the WPCF:

- Municipal wastewater treatment process
- Biosolids treatment process
- Industrial wastewater treatment process

Brief descriptions of the modifications are provided below.

Figure 2-3. Typical WPCF Industrial System Flow and Loads (2002 - 2005)



2.3.1 Municipal Wastewater Treatment Process Modifications

The White Slough Water Pollution Control Facility Phase 3 Improvements Project 2007 (Improvements Project 2007) is currently underway. The purpose of this project is to increase the available dry weather treatment capacity to 8.5 mgd, and to improve the City's municipal wastewater treatment facilities to meet future NPDES permit limits and long-term land management needs. The planned municipal facility improvements under the Improvements Project 2007 consist of the following:

- Installation of two new influent screens, screenings washers, and two new influent pumps
- Installation of new diffusers in Aerations Basins 1 and 2
- Installation of flow modifications to the aeration basins to achieve improved de-nitrification
- Construction of Aeration Basins 5 and 6, with de-nitrification
- Construction of Secondary Clarifier 3

These planned modifications are shown in the flow schematic depicted on Figure 2-2. The layout of these planned improvements is shown on Figure 2-4. Following these upgrades, the WPCF will be capable of providing oxidized, de-nitrified (to an average of less than 5 milligrams per liter (mg/L) of NO_3-N), filtered, and disinfected effluent for up to of 8.5 mgd of average dry weather flows.

In addition to the upgrades included in the Improvements Project 2007, the City is considering the addition of aeration to the storage ponds to reduce the potential for odors and a constructed treatment wetland with final effluent reaeration to polish the filtered, disinfected effluent from the WPCF prior to discharge to Dredger Cut. The constructed treatment wetland would be located on a portion of the existing agricultural reuse area, just west of the existing storage ponds. The purposes for the constructed wetlands would be to:

- Remove additional nitrate-nitrogen
- Reduce trace heavy metals and organic compounds
- Buffer "spikes" from upstream processes
- Reduce effluent temperatures

However, the following concerns have been identified with treatment wetlands:

- Potential for increases in constituents of concern that could cause discharge violations
- Potential for groundwater impacts
- Loss of land disposal area
- Operation and maintenance requirements, particularly related to mosquito control

Therefore, a pilot treatment wetland would be constructed to evaluate both the benefits and potential impacts associated with such a facility before a full-scale facility would be considered.

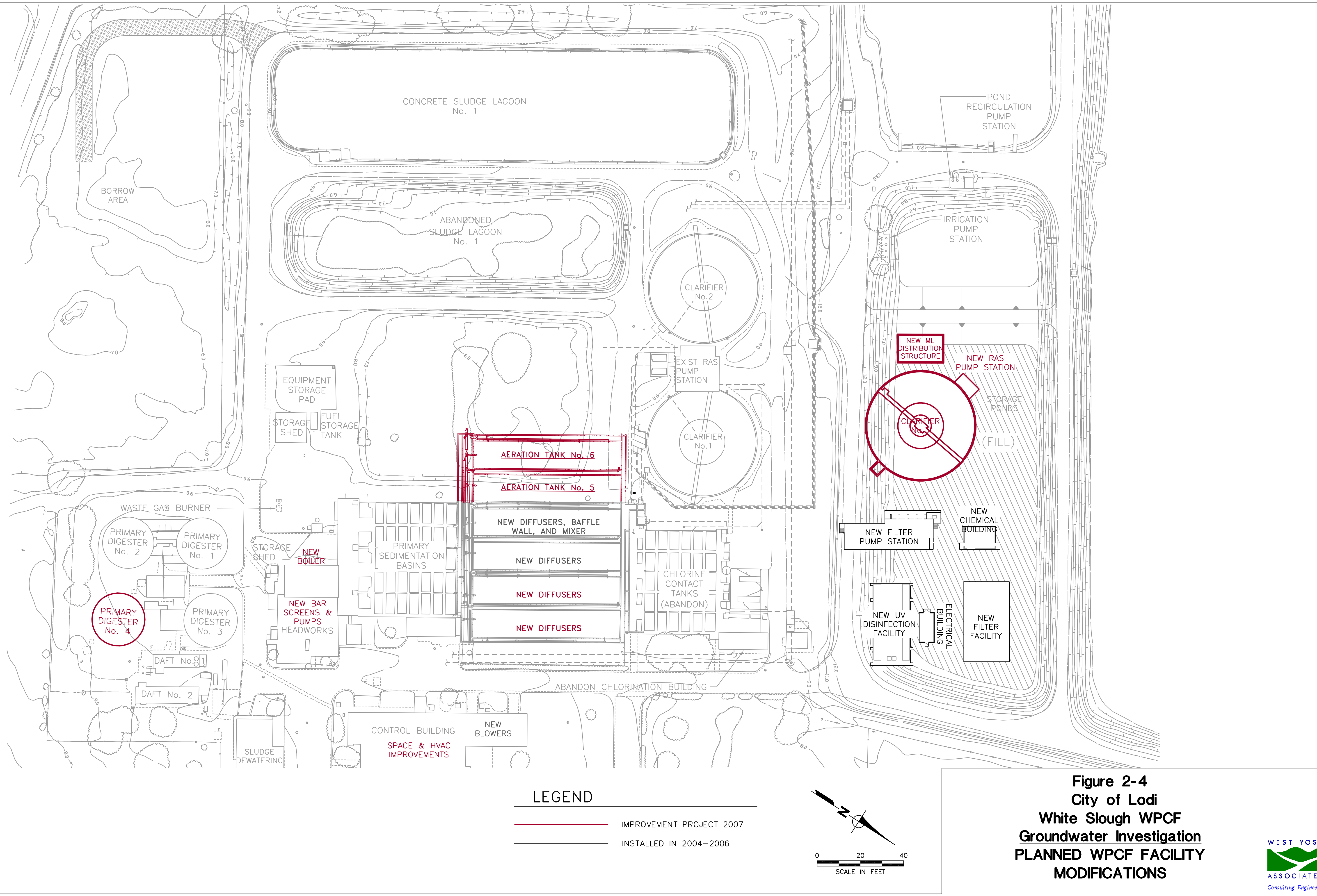


Figure 2-4
City of Lodi
White Slough WPCF
Groundwater Investigation
PLANNED WPCF FACILITY MODIFICATIONS

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2.3.2 Biosolids Treatment Process Modifications

In conjunction with Improvements Project 2007, the City is also planning to construct a new return activated sludge (RAS) pump station and a fourth anaerobic digester. Additionally, the City is planning to redirect the biosolids lagoon supernatant flows to a location upstream of the municipal treatment system aerations basins. This modification would result in nitrogen removal from the supernatant flows and result in a reduction in the nitrogen load applied to the existing irrigation reuse facilities.

2.3.3 Industrial Process Modifications

The City is currently considering requests for additional discharges to the industrial sewer line. The following loading scenarios are currently being evaluated with respect to available storage capacity, additional treatment requirements, and impacts to irrigation water quality:

1. Current base case flows/loadings + 10 wineries each with flows equivalent to the existing discharge from the Van Ruiten Winery (1.1 million gallons per year).
2. Current base case flows/loadings + additional 60,000 gallons per day (gpd) from PCP during the non-irrigation season (November through March).
3. Current base case flows/loadings + doubling the flows from the PCP during the irrigation season (current PCP summer flows are approximately 100 million gallons per year).
4. Current base case flows/loadings + additional 60,000 gallons per day (gpd) from PCP during the non-irrigation season (November through March) + doubling the flows from the PCP during the irrigation season.

To accommodate such loads, the City is evaluating the benefits of constructing an aeration basin that would provide treatment for a portion of the increased loads. This facility would also likely need to be lined with geomembrane liner such as to avoid the potential for these high strength flows to cause groundwater degradation.

The PCP cannery currently uses sodium hydroxide in their canning process as a caustic material for peeling fruit. This practice is of concern for land application on the City's property due to the undesirable sodium content in the land-applied wastewater (high sodium content can be toxic to certain plants and disrupt the calcium nutrition of the plant). Therefore, the PCP cannery is planning to change their existing process to use potassium hydroxide in lieu of sodium hydroxide. Potassium hydroxide would be considered an environmentally superior source of caustic since the wastewater would add an essential plant nutrient to the cropland.

2.4 AGRICULTURAL REUSE SYSTEM

The City's agricultural reuse facilities consist of the following major components:

- Stormwater and Agricultural Runoff Collection
- Storage
- Irrigation

The layout of these facilities is shown on Figure 2-5 and described in detail below. Note that this section describes the existing facilities and the planned changes to the reuse system are described in Section 2.6.

2.4.1 Stormwater and Agricultural Runoff Collection

As shown on Figure 2-5, the City operates an extensive tailwater return and runoff control system for the properties surrounding the WPCF. These facilities are used year-round to control and prevent runoff of the irrigation tailwater and stormwater runoff.

Runoff and tailwater flows are returned to the storage pond and/or irrigation system via two primary pathways. Flows originating on 762-acres of the City's property (primarily the western and southeastern portions) are directed to a collection point in the western portion of the City's property. From here, these flows are conveyed via a gravity flow pipeline to the tailwater pump station, where they are pumped into the storage pond number 1.

Flows that originate in 118 acres of the 130-acre northeastern portion of the City's property are directed into the industrial influent pipeline at a manhole located in the southern portion of Field 4E (note that flows from Field 4A are directed to the western collection point). These flows are then conveyed along with the other industrial line flows to either to the storage ponds (during the non-irrigation season) or to the City's agricultural reuse areas (during the irrigation season).

In addition to the runoff flows that originate on the City's properties, runoff and tailwater flows that originate off the City-owned site are also captured for return to the City's storage facilities via the industrial line. These offsite areas include the following:

- Stormwater generated from a few industrial areas within the City, which is discharged to the industrial line along with the other industrial waste flows.
- Agricultural runoff and stormwater generated from the properties located to the east of the WPCF, which are conveyed to the City's property via an irrigation ditch and are directed to the industrial line via the manhole located on the eastern side of the City's property. As discussed in Section 2.6.3, the City plans to construct facilities in the near future to allow for the bypass of these flows.

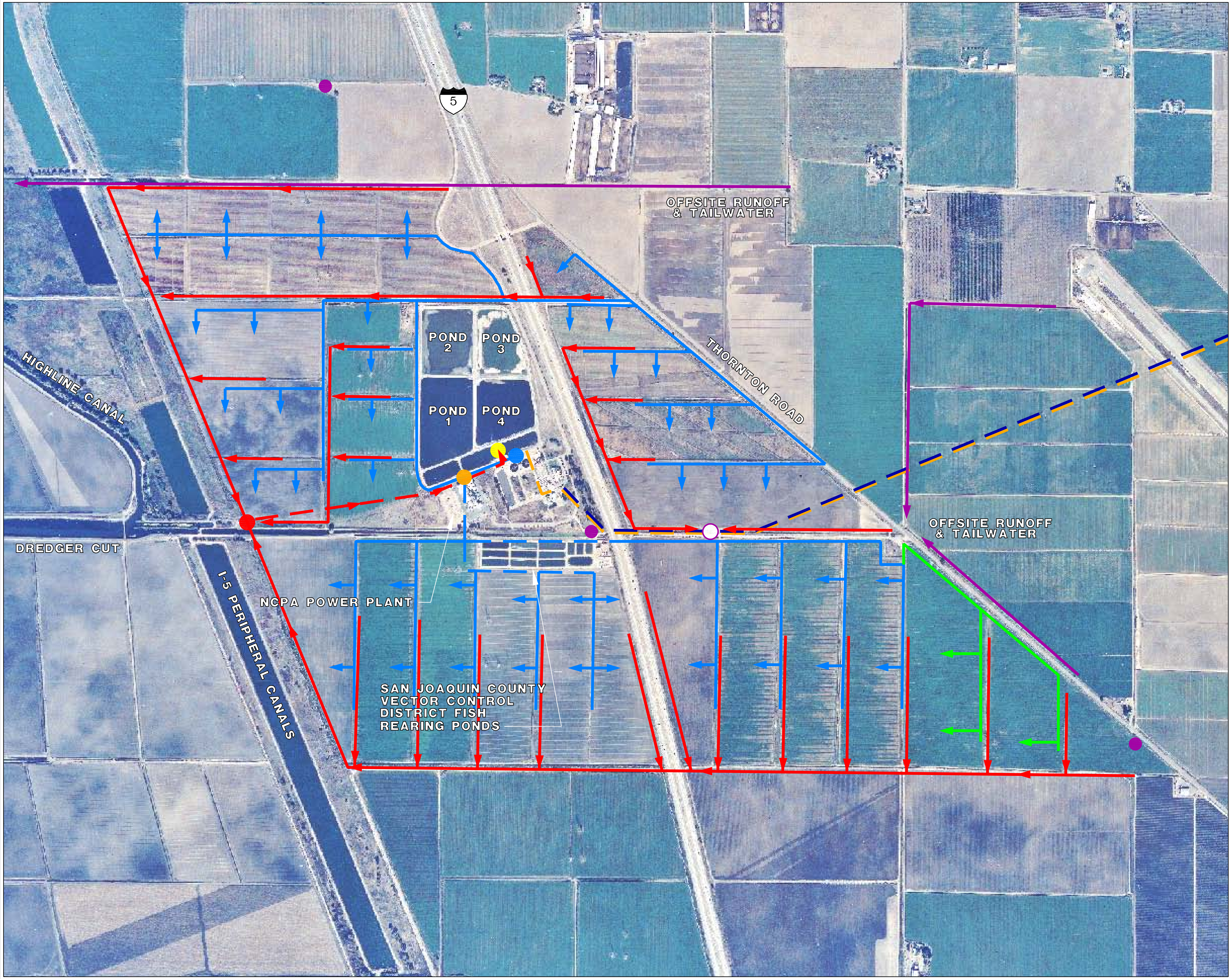

Figure 2-5
City of Lodi
White Slough WPCF
Groundwater Investigation
REUSE FACILITIES
SCHEMATIC

LEGEND:
INDUSTRIAL INFLUENT LINE
MUNICIPAL INFLUENT LINE
IRRIGATION DISTRIBUTION FACILITIES
PLANNED IRRIGATION DISTRIBUTION FACILITIES
RUNOFF & TAILWATER RETURN FACILITIES
IRRIGATION PUMP STATION
INDUSTRIAL INFLUENT/ RUNOFF COMBINED MANHOLE
RETURN FLOW COLLECTION MANHOLE
TAILWATER PUMP STATION
IRRIGATION FLOW TRANSFER STRUCTURE
AGRICULTURAL WATER SUPPLY WELL

NOTE:
DASHED LINES INDICATE SUBSURFACE FACILITIES

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NOT TO SCALE

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2.4.2 Storage

The following topics are discussed below with respect to the City's existing agricultural reuse system storage facilities:

- Configuration and Sizing
- Typical Winter Operations
- Typical Summer Operations
- Typical Operational Storage Volumes
- Estimated Percolation

2.4.2.1 Configuration and Sizing

As shown on Figure 2-5, the storage facilities associated with the WPCF agricultural reuse system include four storage ponds and three equalization (EQ) ponds. The four onsite storage ponds were originally designed to have a capacity of 110 million gallons, with a working depth ranging from 7 to 9 feet. However, material is expected to have accumulated in each of the ponds over the years of operation since they have been constructed. Therefore, the actual storage volume available today is likely less than 110 million gallons. Note that the pond storage volume is reported in the City's monthly monitoring reports, and that these reports indicate that approximately 97 million gallons of volume is stored when the four ponds are full.

2.4.2.2 Typical Winter Operations

During the winter months (typically November through March), the storage ponds are used to hold the industrial and other captured flows that cannot be discharged to Dredger Cut. A schematic showing the typical winter operations of the onsite storage facilities is provided on Figure 2-6. During typical winter operations, the City directs the following flows to the four onsite storage ponds:

- Stormwater runoff generated from approximately 762 acres of City-owned agricultural property (not metered).
- Industrial Line flows (metered). Includes industrial waste discharges, captured stormwater runoff from a few industrial sites within the City limits, stormwater runoff from approximately 118 acres of City-owned property, and stormwater runoff generated from the agricultural area located east of the City's property (Section 2.2.3).
- Supernatant flows from the onsite biosolids lagoon (not metered).
- Subnatant from the DAF thickener (metered).

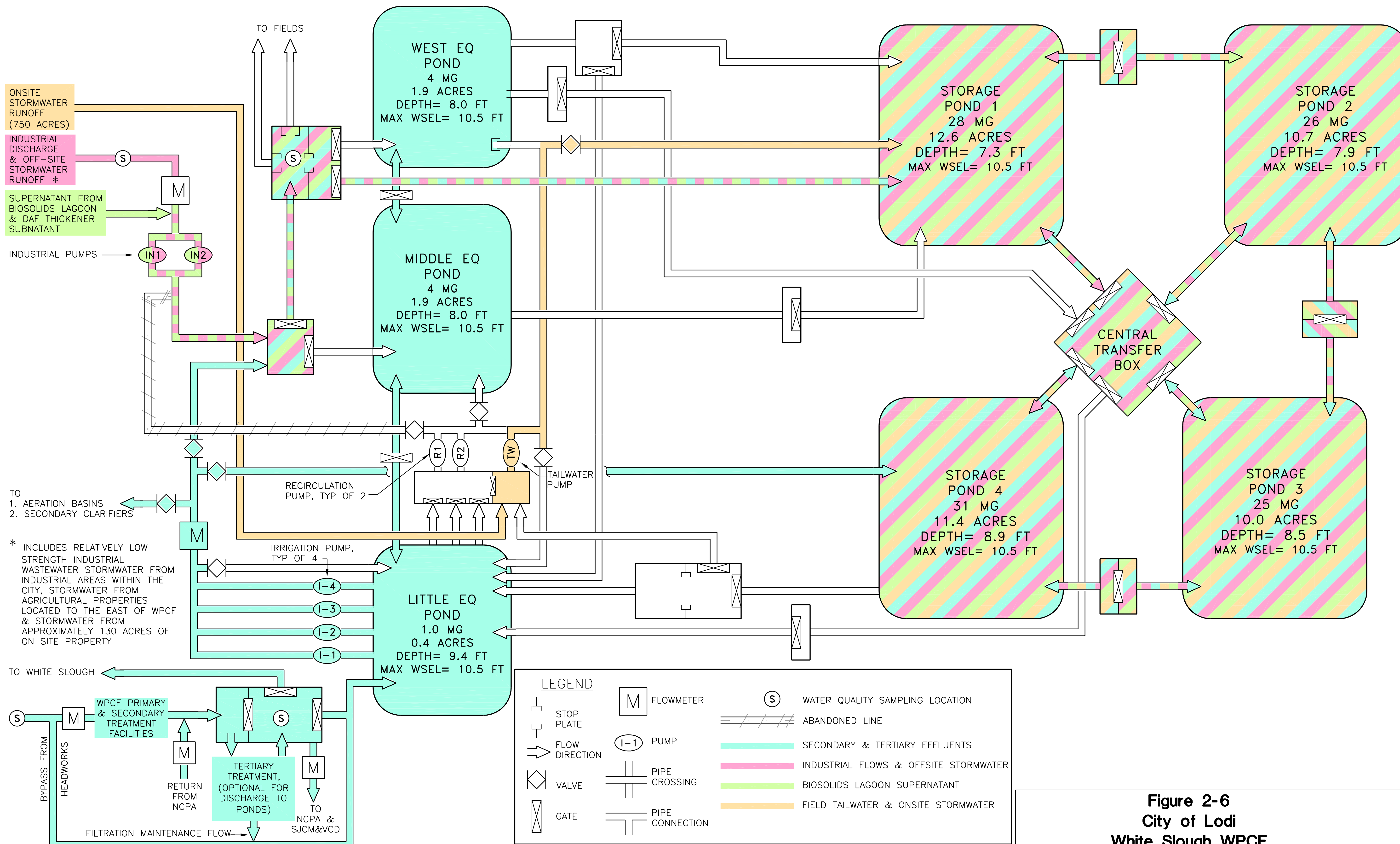

Figure 2-6
City of Lodi
White Slough WPCF
Groundwater Investigation
POND FACILITY SCHEMATIC OF TYPICAL WINTER OPERATIONS

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Consulting Engineers

Additionally, in the event of a plant upset that would preclude the discharge of WPCF treated municipal flows to Dredger Cut, the WPCF municipal effluent flows are directed to the three EQ ponds. These flows are typically disinfected, tertiary treated flows, but do not otherwise meet the City's prescribed effluent standards for surface water discharge. From the EQ ponds, these flows are pumped, as necessary, to either the four onsite storage ponds or back to the municipal treatment facilities for eventual discharge.

The City does not currently meter all of the individual flows sources to the ponds. However, these flows have been estimated and/or calculated for purposes of developing the analyses presented in this report. Details regarding these estimates are as follows:

- Stormwater runoff generated from approximately 762 acres of City-owned agricultural property:

  Total Irrigation Area (762 acres) x Total Rainfall (measured) x 0.2 Estimated Runoff Coefficient (typical)

- Stormwater entering industrial line:

  Total Industrial Line Flow (metered) – PCP flows (metered) – Flows from Other Industrial Discharging to the Industrial Line (estimated)

- Biosolids supernatant flows:

  Thickened Waste Activated Sludge (metered) + Primary Sludge (metered) – Biosolids Applied to Fields (metered) + Captured Rainfall (estimated) – Losses to Evaporation (estimated)

<u>2.4.2.3 Typical Summer Operations</u>

Beginning typically in mid-April and extending through mid-October, the City irrigates the City-owned agricultural reuse areas, using the ponds only for operational storage of the flows that are used for irrigation. However, given weather and crop patterns can result in considerable variation in the irrigation season. Additional information regarding the operations of the agricultural irrigation site is provided in Section 2.4.2.

A schematic showing the typical summer operations of the onsite storage facilities is provided on Figure 2-7. As shown, some flows are directed to the storage ponds while other flows are sent directly to the agricultural reuse area. The flows directed to the ponds are as follows:

- Agricultural tailwater generated from approximately 762 acres of City-owned agricultural property (not metered).
- Undisinfected, secondary treated municipal flows (metered). These flows are first discharged to the EQ ponds and then directed to either the four storage ponds or to the agricultural reuse areas depending on irrigation demands.

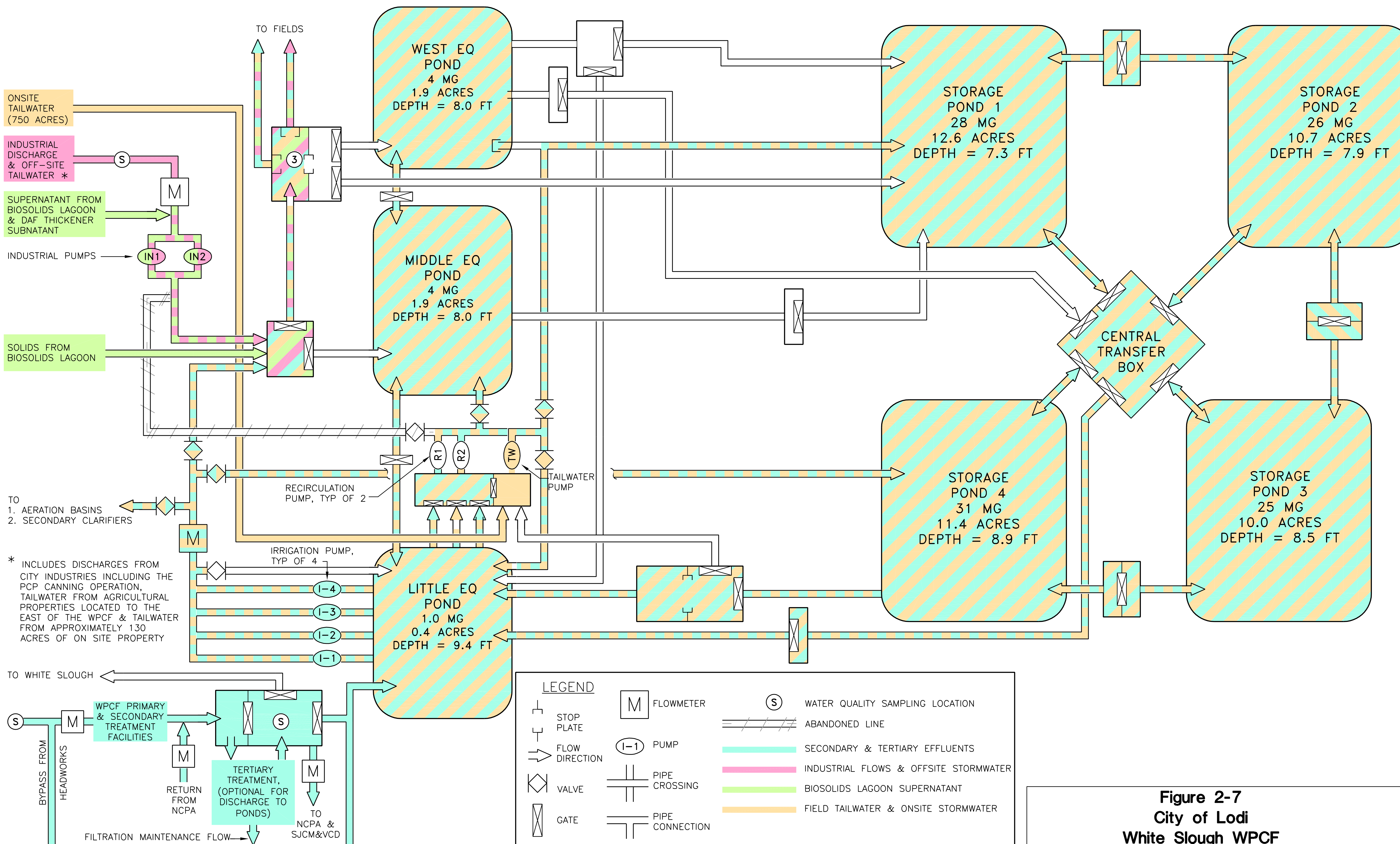

Figure 2-7
City of Lodi
White Slough WPCF
Groundwater Investigation
POND FACILITY SCHEMATIC OF TYPICAL SUMMER OPERATIONS

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All of the industrial line flows are sent directly to the agricultural reuse area (thereby bypassing the pond facilities). During the summer months, the industrial line flows typically consist of the following:

- Discharges from industries (metered). These flows are dominated by discharges from the PCP cannery.
- Captured agricultural tailwater from approximately 118 acres of City-owned property and the tailwater from the agricultural area located east of the City's property (not metered).
- Supernatant flows from the onsite biosolids lagoon (not metered).
- Subnatant from the DAF thickener (metered).

The summer season flows that have been estimated and/or calculated for purposes of developing the analyses presented in this report (which were not already presented) are as follows:

- Agricultural tailwater generated from approximately 762 acres of City-owned agricultural property:

[Total Irrigation Flow (metered) x
Percent of Irrigation Area from Which Flow is Returned to Western Collection Point (672 acres ÷ 790 acres) x
10% Estimated Percent Return Flow] +
[Flow to 90-acre City-Owned Area Not Irrigated with Reclaimed Water (estimated) x 10% Calculated Percent Return Flow]

- Tailwater entering the industrial line:

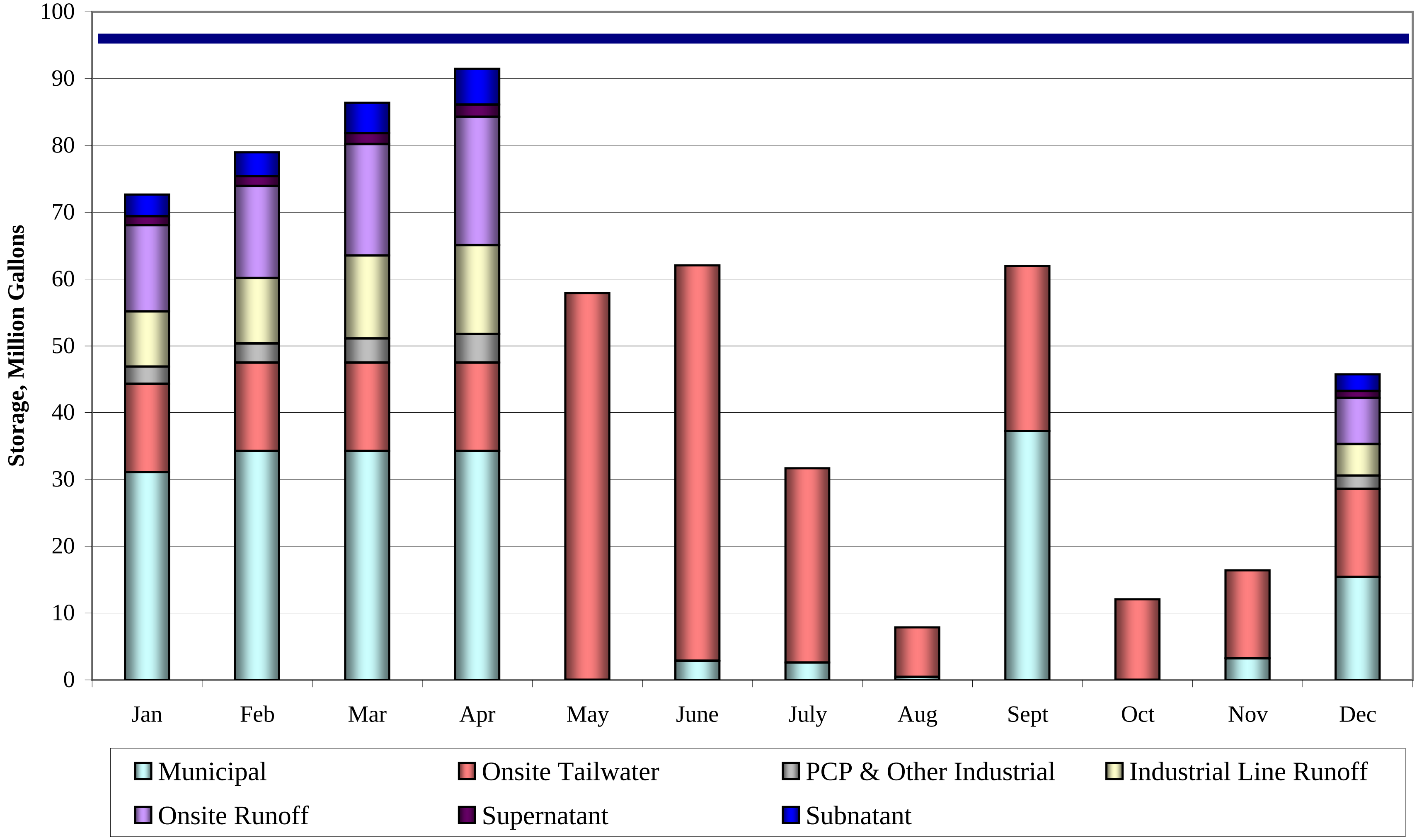
Total Industrial Line Flow (metered) – PCP flows (metered) –
Flows from Other Industries Discharging to the Industrial Line (estimated)

2.4.2.4 Typical Operational Storage Volumes

The typical cumulative storage in the four storage ponds at the beginning of each month (based on data reported by the City between 2002 and 2005) is shown graphically on Figure 2-8. As shown, the storage ponds are typically close to empty at the end of the irrigation season in October. This is so adequate storage capacity will be available to hold winter-month industrial flows, diverted municipal flows, and captured stormwater. As a result of storing these flows through the winter months, the ponds are almost (if not completely) full at the beginning of the irrigation season in April.

The cumulative stored volumes shown on Figure 2-8 are delineated to show the estimated percentage of stored volume associated with each source of stored flow. Because the City diverts municipal effluent flows from the little equalization pond to the irrigation areas during the summer months, a large portion of the treated municipal flows are not directed to the four storage ponds. Therefore, as shown on Figure 2-8, onsite and offsite stormwater runoff and onsite tailwater are a major source of flow to the four storage ponds.

Figure 2-8. Average Cumulative Volumes Stored in WPCF Ponds, Designated by Source (2002 - 2005)



Note: Typical storage are based on an assumed total available storage volume of 97 million gallons, as reported by the City.

The City does increase the municipal flow to the storage ponds in August (as reflected by the increased storage volume shown on Figure 2-8 in the month of September) instead of directly applying these flows to the field areas. The City typically begins discharging treated municipal flows to Dredger Cut in September.

2.4.2.5 Estimated Percolation

The storage ponds were originally constructed in the 1960's in conjunction with the WPCF municipal treatment facilities. A liner was not provided as part of this construction. As such, there is likely some percolation of stored water to underlying groundwater.

The City has recently completed an assessment of the percolation from these ponds. Pond Number 4 was filled to a depth of approximately 2 feet and water surface elevations were measured for a period of eight weeks. Accounting for evaporative losses and rainfall, the estimated percolation rate during this period was 0.14 inches per day.

The available data was used to develop a model of the City's ponds to determine the percolation rate that would occur when the ponds were full. Based on this analysis, the average annual percolation rate is estimated to be approximately 0.3 inches per day. This would translate to losses of 104 inches per year. Over the entire 49-acre pond area, approximately 109 million gallons of stored water would be lost to percolation per year.

2.4.3 Irrigation

The following topics are discussed below with respect to these irrigation facilities:

- Crops and Nutrient Uptake
- Field Areas
- Sources of Irrigation Flow
- Distribution Facilities and Flow Metering
- Irrigation Requirements

2.4.3.1 Crops and Nutrient Uptake

The City's irrigation area is leased by two local farmers that grow fodder crops primarily for dairy cattle. A summary of the crops that have historically been grown within the City's individual field areas is shown in Table 2-1. As shown, these crops are corn, wheat and alfalfa. Also shown in Table 2-1 are the estimated nitrogen uptake rates associated with the crops grown on the City's properties (Western Fertilizer Handbook, 1985).

Although the farmers that lease the City's property are responsible for day-to-day management of the irrigation areas, the application practices are monitored by City staff and controlled on a seasonal basis such as to avoid exceedances of the estimated nitrogen uptake rates shown in Table 2-1. As such, the City's agricultural reuse project is intended to provide beneficial reuse of the applied recycled water flows and biosolids.

Table 2-1. Field Crops and Nominal Nitrogen Uptake Rates

	North West Quadrant (257 acres)											North East Quadrant (130 acres)				
Field No.:	1A	1B	1C	1D	2A	2B	2C	3A	3B	3C	3D	4A	4B	4C	4D	4E
2000	W/C	W/C	W/C	W/C	A	A	A	A	A	A	A	A	A	A	A	A
2001	C	C	C	C	C	C	C	A	A	A	A	F	C	C	F	C
2002	A	A	A	A	A	A	A	A	A	A	A	C	C	C	F	C
2003	W/C	W/C	W/C	W/C	A	A	A	W/C	W/C	W/C	W/C	W/C	W/C	W/C	W/C	A
2004	W/C	W/C	W/C	W/C	A	A	A	A	A	A	A	A	A	A	A	A
2005	W/C	W/C	W/C	W/C	A	A	A	A	A	A	A	A	A	A	A	A

	South West Quadrant (223 acres)						South East Quadrant (180 acres)				No Land Application		
Field No.:	5A	5B	5C	5D	5E	5F	6A	6B	6C	6D	6E	6F	6G
2000	C	A	C	A	C	C	A	A	A	A	A	A	A
2001	W/C	A	A	C	C	C	W/C	A	A	A	A	A	A
2002	W/C	A	A	A	A	A	W/C	A	A	A	F	F	F
2003	W/C	W/C	A	A	A	A	A	A	A	A	F	F	F
2004	W/C	A	W/C	A	A	A	A	W/C	W/C	W/C	F	F	F
2005	A	A	W/C	A	W/C	W/C	A	C	C	C	A	A	A

Symbol	Name	Nominal Nitrogen Uptake pounds N/acre
A	Alfalfa	480
C	Corn	240
F	Fallow	0
W/C	Winter Wheat/Summer Corn	425

The field nitrogen loading rates are assumed to be equal to the sum of the total nitrogen in the applied irrigation water and the biosolids plant available nitrogen (PAN). Per the land application guidelines promulgated by the United States Environmental Protection Agency (EPA), the WPCF biosolids PAN is calculated as follows:

Nitrate Nitrogen + 50% of Ammonia Nitrogen + 20% of Organic Nitrogen + Estimated Mineralized Organic Nitrogen from Previous Three Years of Biosolids Applications

Additional information regarding the historic field nitrogen loadings are provided in Section 6.

2.4.3.2 Field Areas

The City-owned agricultural fields and their associated field number and acreages are shown on Figure 2-9. As shown, the City's irrigation area consists of 29 separate fields ranging in size from 9 to 55 acres (average field size is 30 acres). Also shown on Figure 2-9 are the locations of the City's 19 shallow groundwater monitoring wells. Additional discussion regarding these wells is provided in the following sections of this report.

Agricultural reuse and biosolids application currently occurs on approximately 790 acres of the available 880-acre City-owned irrigated agricultural property. Fields 6E, 6F, and 6G are not used for agricultural reuse, but are instead irrigated with groundwater. Also note that the application of biosolids is limited to areas where a corn crop is planted due to the 30-day limitation of no harvesting after the biosolids have been applied and the fact that alfalfa must be harvested throughout the growing season. For this reason, the City requires that the farmers that least the WPCF properties maintain a corn crop on at least 200 acres of the irrigation area.

For purposes of discussion this report, the City's property can be divided into four major quadrants. The eastern and western halves of the property are separated by I-5. The northern and southern halves are separated by the unnamed channels that extend from Dredger Cut eastward across the City's property. Note that the unnamed channel on the western side of the property is connected to Dredger Cut, which is its primary source of flow. The channel on the eastern side of the City's property is only used to convey stormwater and agricultural runoff to the City's industrial influent line as discussed in Section 2.4.1.

2.4.3.3 Sources of Irrigation Flow

The irrigation flows consist of the following sources:

- Treated municipal flows
- Discharges from industries (primarily PCP cannery), including winter stormwater runoff
- Captured agricultural tailwater and stormwater runoff from the City-owned property
- Captured agricultural tailwater and stormwater runoff from the agricultural area located east of the City's property
- Supernatant flows from the onsite biosolids lagoon
- Subnatant from the DAF thickener

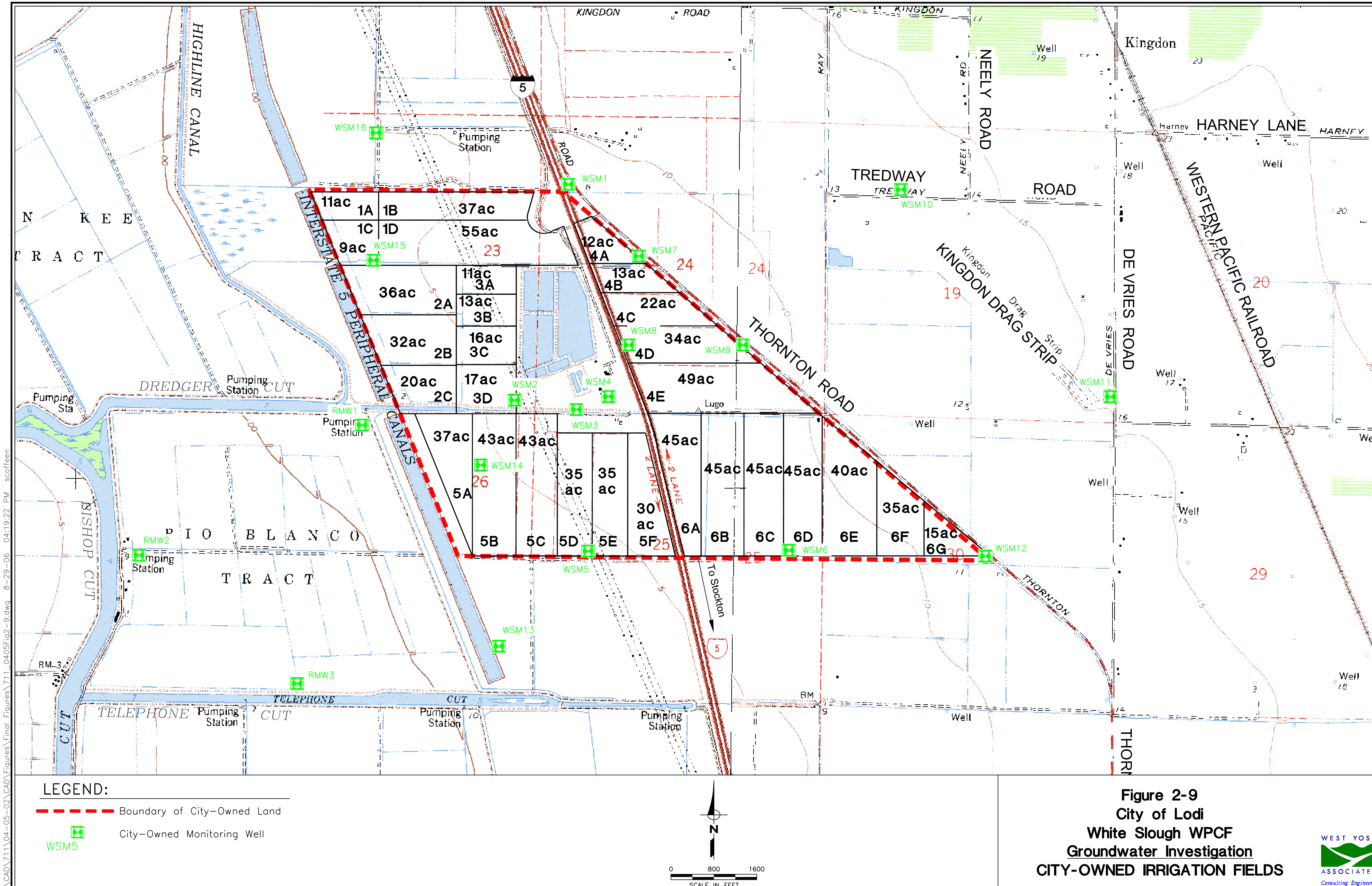


Figure 2-9
City of Lodi
White Slough WPCF
Groundwater Investigation
CITY-OWNED IRRIGATION FIELDS

The average monthly flow discharged to the agricultural fields between 2002 and 2005 from these different sources is shown graphically on Figure 2-10. A portion of the applied irrigation flow comes from the storage ponds and the composition of this flow can vary throughout the year as shown on Figures 2-6 and 2-7.

In addition to these sources of irrigation flow, the City applies Class B biosolids to the field areas by mixing the stabilized solids with irrigation water and applying via the irrigation facilities.

2.4.3.4 Distribution Facilities and Flow Metering

As shown in Figure 2-5, irrigation flows are distributed to the irrigation area via a series of concrete-lined and earthen irrigation ditches and subsurface pipelines. The individual field areas are irrigated via furrow irrigation for row crops (such as corn) and border check (graded basin or flood) irrigation for field crops (such as alfalfa).

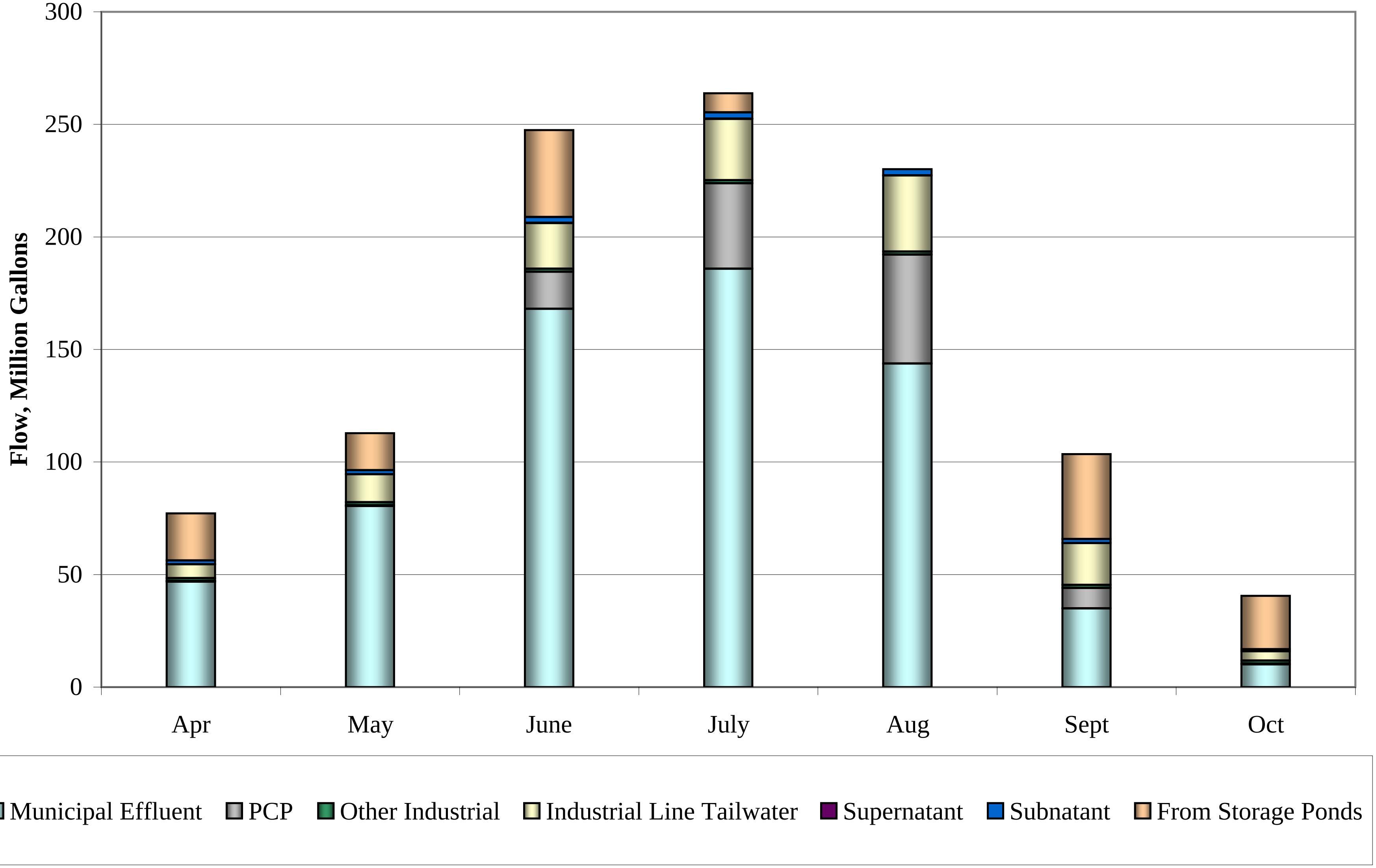
As shown in Figure 2-7, all of the industrial line flows are sent directly to the irrigation distribution facilities during the irrigation season, while the remainder of the irrigation flow is pumped from the storage ponds. The industrial line flows are metered upstream of the biosolids lagoon supernatant and the DAF subnatant inputs. The irrigation flows pumped from the storage ponds are metered downstream from the irrigation pumps. The City calculates the total irrigation volume as the sum of the flows recorded from these two meters. Therefore, the calculated irrigation flows do not include the biosolids lagoon supernatant and the DAF subnatant inputs.

Additionally, the irrigation return flows from the City-owned irrigation areas are actually a portion of the combined recycled water flow that is returned (primarily) to the storage ponds (agricultural runoff from approximately 118 acres is directed to the industrial line and is directly land applied). These flows are metered when they are discharged to the fields from the storage facilities or via the industrial line, but have not historically been metered when returned to the storage facilities (and therefore subtracted from the estimated delivery volume). Therefore, the City staff has historically over-estimating the total volume of flow that is applied to the field areas by double counting these flows. Note that these flows are also not subtracted from the irrigation volume and field loading analyses presented in this report as available data is not adequate to reliably assess the actual volume and loads associated with these flows (including Figure 2-10).

Based on the data that is available (i.e. comparing total flow inputs and losses from the City's reclamation facilities to the reported irrigation volumes), approximately 10 percent of the total applied irrigation flows are estimated to be returned as agricultural runoff. This estimate does account for the lagoon supernatant and the DAF subnatant flows. As such, the City has historically over-estimated the total volume of flow that is applied to the field areas by approximately 10 percent.

The City has recently modified the existing WPCF control system to record the irrigation return flow pump run time and, using a flow rate developed from the pump's rating curve, calculate a daily return flow volume. Once adequate data has been collected, the estimates of the return flow volume presented in this report can be updated.

Figure 2-10. Typical Flows Directed to City-Owned Fields (2002 - 2005)



2.4.3.5 Irrigation Requirements

The City staff relies on evapotranspiration (ET) and rainfall data obtained from the California Irrigation Management Information System (CIMIS) to estimate the crop water demand over a given monthly period. These estimates are used as a means of verifying that the flows applied by the farmers that lease the property are appropriate.

The following equation is used by the City to estimate monthly water demand for a given field area:

$$\frac{\textit{Total Field Area} \times ((\textit{Crop Coefficient} \times (\textit{Monthly ET} - \textit{Monthly Rainfall}))}{\textit{Irrigation Efficiency}}$$

where:

Crop Coefficient = 1

Irrigation Efficiency = 85%

Note that crop coefficients vary by crop, stage of growth of the crop, and by some cultural practices. Therefore, relying on a crop coefficient of 1 could result in an over-estimation of the amount of irrigation water needed, particularly for crops such as corn in the early growing season. However, as discussed in Section 2.4.3.4, the City is also overestimating the amount of water that is actually applied by a factor of approximately 10 percent.

For flood irrigation systems, the time required to ensure that adequate irrigation water reaches the end of the field could greatly exceed the time needed for infiltrating (or irrigating) a desired amount of water based on a given ET requirement. Therefore, more water may be needed than is estimated using the method described above.

2.5 OTHER REUSE FACILITIES

The City also provides recycled municipal wastewater to the following facilities for beneficial reuse:

- Northern California Power Authority (NCPA) Power Plant
- San Joaquin County Mosquito and Vector Control District (SJCM&VCD) Fish Rearing Ponds

As shown on Figure 2-5, both of these facilities are located adjacent to the WPCF treatment plant. Additional information regarding the recycled water use at these facilities is provided below.

2.5.1 NCPA Power Plant

The NCPA operates a 49.9 MW steam injected gas turbine (STIG) power facility adjacent to the WPCF main treatment facilities (Figure 2-5). This facility became operational in April of 1996 and is connected to PG&E's transmission system. The system is primarily run to provide reserve electrical capacity, spinning electricity reserves, and peaking energy.

The NCPA facility relies on a heat recovery steam generator (HRSG) to produce steam used by the STIG. The City provides recycled water to the NCPA power plant for steam production and HRSG cooling needs. Untreated water is stored in a 70,000-gallon tank until it is needed. The wastewater is processed to eliminate contaminants before being used in the turbine. The NCPA water treatment processes include multi-media filtration, micro-filtration, ultra-filtration, reverse osmosis, UV sterilization and de-mineralize polishing. Sodium hypochlorite, sodium bisulfite and a silica dispersant are used as part of this treatment process. In addition, several chemicals including, corrosion inhibitors, biocides, anti-foaming agents, and water stabilizers are used to maintain efficiency in the HRSG cooling towers. The facility uses approximately 900 gallons per minute of wastewater to produce 120,000 pounds (14,388 gallons) per hour of steam.

Following its use, the majority of the cooling tower blowdown and the HRSG reject flows are returned to the WPCF downstream of the secondary treatment facilities (Figures 2-6 and 2-7). However, the City is in the process of redirecting these flows to the headworks of the WPCF. Approximately 10 percent of these flows are injected to groundwater via an underground injection well operated by NCPA.

Between 2002 and 2005, approximately 25 million gallons per year of recycled water was delivered to NCPA, and approximately 9 million gallons per year of spent cooling water and HRSG reject water was returned. NCPA peak water use typically occurs during July, August and September. However, at least some WPCF flows are used year-round. On average, NCPA returns approximately 40 percent of the WPCF recycled water flows that are used for cooling. However, on a month by month basis, the return flow percentage can vary between 0 and over 100 percent.

Although NCPA provides additional treatment of the WPCF flow prior to use, the treatment facilities at NCPA are not certified under the State Title 22 recycled water standards. Therefore, the City currently operates the municipal filtration and UV disinfection facilities during the summer months, when flows are being directed to NCPA. Note, however, that the City's filtration and UV disinfection facilities are also currently not certified under the State standards.

2.5.2 SJCV&MCD Fish Rearing Ponds

The City also provides recycled water to the SJCV&MCD as the primary water supply for their rearing ponds for mosquito fish (gambuzia), These facilities are located on a small parcel just to the south of the WPCF main treatment facilities (Figure 2-5) and were constructed in 1995.

Between 2002 and 2005, annual water use at SJCV&MCD facility has been approximately 46 million gallons per year. However, total annual flows have gradually decreased over this period. Daily use has ranged from 0 to 611,000 gallons, and the average monthly water is approximately 3.9 million gallons. Peak monthly use typically occurs in August and minimum monthly use typically occurs in December.

2.6 PLANNED REUSE SYSTEM MODIFICATIONS

The City is currently planning several improvements to the reuse system to increase the available disposal capacity and improve overall operations. Improvements are currently planned for the following facilities:

- Storage Pond Aerators
- Irrigation Area Expansion
- Site-Specific Loading Rates
- Stormwater and Runoff Collection
- NCPA Water Supply and Return Flows

Note that following the completion of this groundwater study and its associated Best Practicable Treatment and Control (BPTC) assessment, additional reuse system modifications may be recommended.

2.6.1 Storage Pond Aerators

In conjunction with the Improvements Project 2007, the City is evaluating the feasibility of installing storage pond aerators to provide treatment of the stored flows and reduce odors at the WPCF. Odors within the storage ponds could be of particular concern if these additional industrial flows discussed in Section 2.3.3 are to be added to the industrial system during the winter months.

2.6.2 Irrigation Area Expansion

The City is in the process of developing improvements to their irrigation and return flow facilities to allow for irrigation of 75 acres of property located in the southeastern corner of the City's parcel area (Fields 6E and 6F). Note that 15 acres will not be irrigated (Field 6G) due to the proximity of water supply wells as shown on Figure 2-5. Once these improvements are completed, the total available agricultural reuse area will be 865 acres.

2.6.3 Site-Specific Loading Rates

As discussed in Section 2.4.3.1, the City currently relies on published values to estimate the nitrogen uptake rates associated with the crops grown on within the WPCF land area. However, these values do not account for the site-specific conditions relevant to the WPCF site. Nor do they account for the month-to-month variability in the crop nutrient demands (i.e. nutrient uptake is much greater earlier in the growing season than it is late in the season). Furthermore, as discussed in Section 2.4.3.5, the City's current method of estimating hydraulic loading rates may also not be appropriate for the type of irrigation system used for the WPCF properties. Therefore, the project team includes a certified agronomist that is currently developing site-specific monthly hydraulic and nutrient loading rates for the WPCF site.

The developed site-specific loading rates will account for soil permeability and other soil properties; depth to groundwater; site-specific crop evapotranspiration rates; historic planting and harvest dates; nitrogen uptake rates based on WPCF land area yield records and NRCS crop nutrient uptake information; and the fraction of applied N removed by denitrification and ammonia volatilization.

2.6.4 Stormwater and Runoff Collection Facilities

The City currently stores all stormwater and tailwater flows collected from the City-owned agricultural reuse areas as well as some stormwater and tailwater flows generated offsite. To increase the available storage during the winter months, the City is designing the facilities needed to bypass the winter runoff flows generated from the offsite agricultural properties located to the east of the WPCF property. Following further investigation, the City may also consider (with regulatory approval) the discharge of winter runoff generated onsite.

2.6.5 NCPA Water Supply and Return Flows

The recycled water that is currently supplied to the NCPA facility during the summer months is tertiary treated, UV disinfected effluent. However, NCPA provides a high level of treatment for the WPCF flows prior to their use. Therefore, NCPA may obtain California Title 22 recycled water certification for these facilities in the future. Once this certification has been provided, the City will no longer operate the filtration and UV disinfection facilities at the WPCF solely to meet the California recycled water standards for the NCPA plant.

Additionally, the Regional Board has raised some concerns regarding the impacts to the WPCF effluent quality resulting from the chemical addition that occurs at the NCPA site. Therefore, the City is in the process of re-routing the NCPA return flows such that they will receive the benefit of secondary treatment and tertiary treatment prior to surface water discharge. This modification would not have an impact on the current operations of the City's reuse system.

2.7 SUMMARY

The City of Lodi WPCF is a state-of-the-art wastewater treatment plant that provides secondary treatment, tertiary filtration and ultraviolet disinfection for approximately 6.3 millions gallon per day (mgd) (annual average) of municipal wastewater from the City. This level of treatment is provided for all municipal flows discharged to surface waters.

The City is currently planning to provide several WPCF improvements to increase the available treatment capacity, improve the City's municipal wastewater treatment facilities to meet future surface water discharge limits, and to help meet long-term land management needs. These upgrades include flow modifications to the aeration basins to achieve improved de-nitrification, which would result in reduced total nitrogen discharges from the municipal wastewater treatment system.

The City also provides treatment and reuse for some of the industrial flows generated within the City. These industrial flows are directed to the WPCF via a separate influent sewer, where they are screened and directed to the City's agricultural facilities for treatment and reuse.

During the summer months, the City operates a somewhat complex reuse system that includes irrigation of fodder crops grown on the City-owned agricultural reuse areas, cooling water supply for the NCPA power plant, and supply water for the SJCV&MCD fish rearing ponds. The City is also currently planning several improvements to the reuse system to increase the available irrigation area, reduce odors generated in the onsite storage ponds, and improve overall operations. Additional improvements may be recommended based on the detailed BPTC assessment that will be developed from the recommendations identified in this report.

The onsite agricultural reuse area provides both beneficial reuse and additional treatment for the following flows and associated loads:

- Secondary treated municipal wastewater;
- Discharges from industries (primarily PCP cannery);
- Captured stormwater runoff from some of the industrial areas located within the City;
- Captured stormwater runoff from the City-owned property;
- Captured stormwater runoff and agricultural tailwater from the agricultural areas located east of the City's property (the City plans to bypass these flows in the future, such that they will be discharged to surface waters);
- Supernatant flows from the onsite biosolids lagoon;
- Subnatant from the DAF thickener;
- Class B biosolids.

The City also captures and re-applies to the irrigation area the agricultural tailwater generated on the City's property.

A summary of the average metered and estimated influent flows and discharges between 2002-2005 are provided in Tables 2-2, 2-3, and 2-4. Table 2-2 provides a summary of the WPCF influent flows. Table 2-3 provides a summary of the WPCF flows that are directed to the storage ponds and/or irrigation reuse facilities. Table 2-4 provides a summary of the fate of the flows discharged from the WPCF.

Table 2-2. Influent Flows to the Lodi WPCF (2002-2005)

Flows	Annual Flow million gallons per year
Domestic Wastewater (metered)	2,252
PCP Wastewater (metered)	115
Other Industrial Wastewater (estimated from water supply data or metered)	16
Stormwater – Onsite (not metered)	46
Stormwater – Offsite[(a)] (not metered)	154
Total Flows	2,583

(a) Includes stormwater from industrial areas in the City; and stormwater and agricultural tailwater captured from offsite agricultural areas.

Table 2-3. Flows Directed to the Storage Ponds and/or Irrigation Reuse Facilities (2002-2005) [a]

Flows	Annual Flow million gallons per year
Secondary Treated Municipal Wastewater (metered)	763
Industrial Wastewater Flows (estimated from water supply data or metered)	131
Captured Stormwater[b] (not metered)	200
Biosolids Lagoon Supernatant (not metered)	3
DAF Subnatant (metered)	30
Total	1,127

(a) These flows will either be applied as irrigation water or lost via percolation and evaporation from the storage ponds.
(b) Includes all captured stormwater and agricultural tailwater from offsite agricultural areas.

Table 2-4. Flows Discharged from the Lodi WPCF (2002-2005)

Flows	Annual Flow million gallons per year
Tertiary Treated Municipal Wastewater Discharge to Dredger Cut (metered)	1,415
SJCM&VCD (metered)	21
NCPA (metered)	
Cooling Water	25
Return Flow	-9
Biosolids Applied to Land (metered)	3.7
Losses in Ponds[a] (estimated)	185
Applied Irrigation Flow (estimated)	942
Total Discharged Flows	2,583

(a) Accounts for rainfall, evaporation and percolation