RECLAMATION
Managing Water in the West

5-Year Groundwater Acquisitions for South of Delta Central Valley Project Improvement Act Refuges

Water Quality Monitoring Plan

U.S. Bureau of Reclamation, Mid-Pacific Region
Environmental Monitoring Branch, MP-157

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U.S. Department of the Interior
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Mid-Pacific Region

5-Year Groundwater Acquisitions for South of Delta Central Valley Project Improvement Act Refuges

Water Quality Monitoring Plan

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I. Project/Task Description

This Water Quality Monitoring Plan (Plan) is prepared in support of the Environmental Assessment (EA) that has been prepared by the Bureau of Reclamation (Reclamation) to evaluate and disclose any potential environmental impacts associated with Reclamation's acquisition of up to 29,000 acre-feet (AF) of groundwater annually from South of the Delta Parties (Parties) to meet the Incremental Level 4 refuge water supply needs of Central Valley Project Improvement Act (CVPIA) South of Delta (SOD) refuges. The Parties are defined as those entities that are facilitating the acquisition or exchange of groundwater. The proposed project is authorized under Section 3406(d)(2) and 3406(b)(3) of the CVPIA.

The overall goal of this Plan is to monitor the quality of well water and the water quality changes to the conveyance system each specific well discharges to. General tasks for this Plan are listed below:

1. Collect water samples from the wells and surface water locations
2. Measure and record the specific conductivity (EC), temperature and pH of surface water and well water at times of sample collection
3. Analyze chemical characteristics of field and quality assurance samples via contract laboratories
4. Validate analytical data and outlier assessments
5. Review verified analytical results and compare them to the water quality standards
6. Write a data assessment

II. Quality Objectives and Criteria

Table 1 - Water Quality Goals and Reporting Limits

Constituent	Water Quality Goal	Minimum Desired RL	Method RL
Boron (mg/L)	4 in conveyance	1	.05
Selenium (µg/L)	5 at well head 2 in conveyance	0.5	0.04 µg/L
Total Dissolved Solids (mg/L)	<200 increase in conveyance from upstream to downstream	10	10

Table 2 – Data Quality Objectives for Field Instruments

Parameter	Method/range	Units	Detection Limit	Sensitivity	Precision	Accuracy	Completeness
pH	pH meter	pH units	2.0	0.1 unit	± 0.2 units	± 0.2 units	80%
Conductivity	conductivity meter	µS/cm	10	10 µS/cm	± 10%	± 10%	80%
Temperature	thermistor	º F			± 0.15º C	± 0.15º C	

Method Sensitivity

Where practicable, the reporting limit should be 3-5 times less than the action limit to ensure accuracy of low level results.

Comparability

Comparability is achieved by collecting the samples in the same manner at the same sites over the life of the project. Furthermore, comparable methods will be used by the laboratories chosen to analyze the samples.

Historical Outliers

A result is considered to be an outlier if it is greater than three standard deviations from the average.

III. Documentation and Records

Field Logbook

Field logbooks are carried in the field and entries are made by field personnel at the time of sample collection. Logbook entries document the following information:

- Project name
- Site name
- Sample collection date
- Start and end times for sample collection
- Weather/sampling conditions
- Sample identification (IDs)
- Sampling methods
- Decontamination
- Parameters and matrices collected
- Field measurements
- Water clarity
- Unusual conditions that might affect the samples

After entering the required information, logbook entries are signed by all field personnel. The logbook will be securely stored between sampling events.

Field Sheet

Field sheets provide duplicate documentation of essential sampling information; field sheets are generated from the entry in the field logbook. Field sheets document the following information:

- Project name
- Sampler name
- Sample IDs
- Sample collection date
- Site name
- Field measurements
- Parameters and matrices collected

Instrument Calibration Sheet

The instrument calibration sheet documents the information from an initial calibration, performed prior to instrument use, and information from a verification check, performed after all sampling for that day is completed. Information documented on the instrument calibration sheet should include:

- Project name(s)
- Date
- Time(s)
- Field sampler's name
- Instrument type
- Instrument number
- Standard value
- Initial value
- Adjusted value
- Post value

Chain of Custody

Chain of Custody forms (COCs) document the custody of samples from the time samples are collected to the time they are delivered to the laboratory. Personnel shall initiate COC documentation while in the field. Information recorded on the COC includes:

- Project name
- Project manager
- Title and signature of sample collector
- Name of the designated analytical laboratory
- List of sample IDs
- Date and time samples were collected
- Sample matrix type
- Number of containers per sample ID

- Analyses requested
- Point of contact phone number
- Date, time, and signatures of all parties responsible for receiving and relinquishing the samples from the time of collection to the time of delivery to the laboratory

Signed COCs accompany all samples to the laboratory. Copies of the COC shall be filed with the field sheets.

Analytical Report

The laboratory generates the analytical report. The analytical report documents the analytical results for each parameter analyzed on each sample submitted. The analytical report generally includes the case narrative, analytical results, reporting limits for parameters, methods used to analyze the sample, dates samples were collected, prepared, and analyzed, and the laboratory's quality control (QC) results.

Following QA review and entry of the analytical results into the database, reports are stored with the field sheets and COCs.

Data Generation and Acquisition

IV. Sampling Process Design

The design for this project is intended to obtain a representative sample of groundwater at each pump/well and at surface water sites above and below (where applicable) the delivery point to the associated conveyance system of that well. Analysis of these samples will determine whether or not the ground water is of sufficient quality to support the water quality goals presented in table 1.

To minimize ambient surface water quality degradation associated with the development of groundwater in the project area to supplement surface water supply, water quality monitoring will consist of both surface and groundwater monitoring.

Surface water quality monitoring will consist of both continuous and instantaneous sampling. Monitoring will include sampling upstream of well discharge locations, downstream of well discharge locations, and at each wellhead. Continuous surface water quality monitoring will be accomplished in part through the GWD's Real Time Water Quality Monitoring Network, characterizing electroconductivity (EC, as µS/cm), temperature, pH, and flow (cubic-feet per second and AF). Additionally, flow meters at each wellhead will characterize wellhead production in cubic-feet per second (cfs) and AF. Data will be recorded and included in monthly reports to the Reclamation in conjunction with monthly invoices from the Parties.

Grab samples will be collected at each wellhead at the beginning of each pumping period and analyzed for selenium, boron, and Total Dissolved Solids (TDS) by a Reclamation-approved laboratory. For wells with selenium concentrations greater than 2.0 micrograms per liter (µg/L), monthly grab samples at the wellhead and downstream of the well discharge will be collected and analyzed for selenium concentration. The laboratory used to analyze selenium will provide a reporting limit (RL) of 0.4 µg/L. Boron analysis requires a RL of 100 milligrams per liter (mg/L), and TDS analysis a RL of 10 mg/L. As soon as practical, generally within 7 days of the Parties' receipt of information from the water quality testing laboratory, the Parties will ensure that Reclamation receives electronic copies of the complete data reports submitted by the laboratory. All data will also be recorded and included in annual reports to Reclamation for review.

Weekly water quality monitoring will be accomplished through grab sample analysis of the surface water quality upstream and downstream of the wellhead discharge as well as the groundwater quality at the wellhead. The upstream, downstream and wellhead water will be sampled and analyzed (EC, pH, and temperature) by the Parties on a weekly basis during the Project pumping period utilizing YSI 600XL multi-parametric SONDE water quality sensors, and recorded in a weekly log.

If the Monitoring Plan data indicates that the introduction of groundwater into the Parties conveyance system may adversely impact water quality, the protection measures described in the next section will be implemented. If groundwater is found to contain constituent concentrations above the surface water quality objectives presented below, groundwater will be blended with additional CVP water upon discharge into flowing conveyance channels, effectively reducing concentrations below the water quality objectives, or wellhead operations will be modified until flow conditions improve and water quality objectives are again met. The protection measures discussed below will ensure that the groundwater supply developed as part of the Project will not adversely impact water quality. If the monitoring indicates that water quality objectives are exceeded, protection measures will be implemented within 24 hours of identifying an exceedance.

The Parties should quantified flow conditions required to meet downstream water quality objectives for each of the wells based on individual wellhead water quality sampling data. Accordingly, the Parties will immediately modify pumping or flow conditions if inadequate flow conditions are observed prior to receiving laboratory confirmation of an exceedance.

Monitoring of downstream locations will determine the combined flow and chemistry of the operation. The sites are located to assure adequate blending of groundwater for surface water sample collection.

Groundwater samples will initially be collected, for chemical analysis, monthly for six months. Once this baseline is established groundwater will be tested quarterly for one year until reviewed. After review this frequency may change based on findings.

Location	Sample Frequency				
	EC	**Flow**	**Selenium**	**Boron**	**TDS**
Upstream	weekly	continuous	monthly	monthly	monthly
Wellhead	weekly	continuous	At beginning of pumping period	At beginning of pumping period	At beginning of pumping period
Downstream	weekly	continuous	monthly (wells >2.0 µg/L Se)	monthly	monthly
Conveyance	continuous	continuous			

Water Quality Protection Measures

The Parties will not accept water from any well if the water exceeds the following values:

- 5.0 µg/L for selenium

The Parties will modify wellhead operations until flow conditions improve if any of the following downstream water quality objectives in the conveyance are exceeded:

- 2.0 µg/L for selenium
- 4.0 mg/L boron

V. Sampling Methods

At each pump/well, samples are collected from the closest discharge point from the well head. The well is to be turned on and allowed to run until three well casing volumes are discharged; the sample is then collected directly into the sample bottles or into a precleaned churn splitter. In addition, the churn splitter must be rinsed three times with DI water after use at a site. After collection, the samples are placed on (blue) ice in a cooler and transported to the collecting agency facility or shipped directly from the field to the contract laboratory (short hold time constituents). Samples not shipped directly to the contract labs shall be stored at 2º C to 6º C.

Physical measurements will be collected in the field. Physical measurements will include pH and EC.

VI. Sample Handling and Custody

Sampling personnel shall collect samples into appropriate, pre-preserved containers (Table 5). Samples are placed on blue ice and stored in coolers during collection and while in transit. If not shipped immediately samples will be refrigerated until shipped.

Samples will be relinquished to the laboratories using the COC, Samples are packed on blue ice in cooler(s), and then shipped with the COC in the cooler(s) to the project laboratories. The laboratories then document receiving the samples on the COC with the date of receipt and a signature. If required, the laboratories store the samples in refrigerators; refrigeration keeps the samples between 2º C and 6º C to prevent degradation.

Samples are collected, processed, and shipped to the laboratories in a timely manner to ensure all holding times are met (Table 3). The laboratories must have adequate time to prepare and analyze the samples within the parameter's holding time.

Table 3 - Required Bottle Sizes, Sample Preservation, and Sample Hold Times

Constituent	Bottle / Preservative	Hold Time
Boron	HDPE 500 ml / HNO3 to pH<2	6 months
TDS	HDPE 500 ml / none	7 days
Selenium	HDPE 125 ml / HNO3 to pH <2	6 months

VII. Analytical Methods

The laboratories follow the protocols for preparation, analysis, and corrective actions stated in the analytical methods and the laboratory Standard Operating Procedures (SOP). Approximate turn-around time for analysis is 3 weeks. The following analytical methods will be used:

Table 4 – Analytical Methods

Parameter	Method
Boron	EPA 200.7
TDS	SM 2540 C,E
Selenium	Fluorometric

VIII. Quality Control

Laboratory Quality Control Samples

The laboratory incorporates QC samples at the frequencies specified in the analytical method and the laboratory SOP for the method. The results of the QC samples are assessed based on the acceptance criteria in the analytical method and the laboratory SOP for the method. If any laboratory QC samples do not meet the established acceptance criteria, the laboratory follows the corrective action protocols detailed in the analytical method or the laboratory SOP for the method.

Holding Times

The date of the sample preparation/analysis is compared to the date the sample was collected to ensure the sample was prepared and analyzed within the holding time. If the holding times are exceeded, the Program Manager determines if re-sampling is required. If re-sampling is not required, the QA specialist qualifies the data as necessary. Applicable hold times are listed in Table 5.

Field Quality Assurance Checks

Reclamation will add periodic QA checks by collecting field samples concurrently with staff from the Parties. Samples collected by Reclamation would be sent separately to the same contract laboratory for an independent quality assurance check.

IX. Instrument/Equipment Testing, Calibration, Inspection, and Maintenance

Field

Portable (hand held) instruments are calibrated according to manufacturer's protocol. For each grab sampling episode (whether taking place in one day, or over a number of days), instruments are calibrated every day and within four hours of taking the first measurement. Calibrations are verified with calibration standards within four hours of recording the last measurement of the day. All calibration information is recorded on a calibration sheet.

Laboratory

Maintenance procedures for instruments used by the contract laboratories for this project are detailed in the contract laboratory's QA manual. All instrument maintenance is documented in logbooks. Instrument calibration procedures are specified in the analytical methods or laboratory SOPs for each parameter.

X. Inspection/Acceptance for Supplies and Consumables

Pre-preserved, certified clean bottles (sample collection), certified calibration standards (preparation of project-specific spike solutions and field instrument calibration), and certified reference materials are ordered from outside vendors. All bottles and reagents are inspected prior to use. If any damage or contamination is suspected, packages are not accepted.

Field calibration standards will have certified values from the vendors.

XI. Data Management

All water quality data will be kept at the each Parties office. As previously stated, the Parties will ensure that Reclamation receives electronic copies of the complete data reports submitted by the laboratory as soon as practical (generally within 7 days of the Parties receipt of information from the water quality testing laboratory). The Parties will also provide a monthly water quality summary report, including volumetric data on wellhead production, within 60 days of sample collection. Water quality data and reports will also be provided to the Central Valley Regional Water Quality Control Board.

Field sheets, instrument calibration sheets, and COC's are generated, inspected and signed by the field sampler.

Laboratory data reports are received by Reclamations QA specialist; the QA specialist validates the data and documents the QA metadata. After the laboratory data reports are validated by the QA specialist, the data reports are signed and sent to Reclamations Data Management Team (DMT) for review. The DMT enters the analytical results and the QA metadata in the database; the laboratory data reports are filed in the project binder.

All data entered into the database follows the protocols in the DMT SOP. As a QC check, all data entered will be secondarily reviewed by an additional DMT member; the secondary review is documented with initials and the date. After all data has been entered into the database, the data is signed, dated, and filed in project binders.

Field logbooks and project binders are locked in a file cabinet in the EMB office and must be signed out for use.

Assessment and Oversight

XII. Assessments and Response Actions

Reclamations EMB's Quality Assurance Team (QAT) will perform laboratory documentation audits.

Laboratory

The three-tier audit consists of reviewing the laboratory's QA Manual, reviewing the laboratory's performance evaluation (PE) sample results, and conducting an intensive, on-site, system audit of the laboratory. The laboratory's expertise in conducting analyses, their capability of generating valid data, their ability to effectively support the data, and the integrity of their QA/QC practices are assessed during the on-site audit. Laboratory audits are conducted every three years. The audit reports are issued to the laboratory. The laboratory then issues a response with corrective actions to the EMB. At that time, the QAT determines whether or not to approve the laboratory for use and contacts the laboratory with their decision.

XIII. Reports to Management

Qualified sample results will be issued by the EMT to the Project Manager for inclusion in data assessment reports. Only data that has passed quality assurance requirements will be included in data assessments.

Data Validation and Usability

XIV. Data Review, Verification, and Validation

If all laboratory QC samples meet the acceptance criteria and all samples are analyzed within the holding time, all data is accepted as valid.

If a result is confirmed after reanalysis, the result is accepted as valid.

Data may be qualified if results demonstrate unacceptable QA, if the laboratory QC sample results are unacceptable, or if the holding times were exceeded.

Based on the qualification, the data assessor (Project Manager) determines the usability of the data.

XV. Verification and Validation Methods

The QA Officer validates the data by following the guidelines in the EMB's *SOPs for Quality Assurance* document, dated May 2009. Validation consists of reviewing the results of the laboratory quality control results. Holding times and will also be assessed.

XVI. Reconciliation with User Requirements

Any qualified results will be identified to the DMT by completing the Qualified Results form per EMB protocol. Additionally, if results are qualified, the result will be marked with a footnote on the data table submitted to the data assessor (Project Manager); the footnote will detail the qualification.

Appendices

Well Information

Table 2 - Well Information

New Well No.	Current Well Designation	Well Production			Discharge Location	GPS Coordinates
		CFS	AF Per Day	Maximum AF/Agreement #		
1	1	5.1	10.1	10,000/ #08-WC-20-3748	Santa Fe Canal	37°06’21.45"N 120°50’9.74W
2	2	1.1	2.2		Santa Fe Canal	37° 06’34.71"N 120°50’21.67"W
3	3	1.1	2.2		Santa Fe Canal	37° 06’51.37"N 120°50’38.43"W
4	5	4.0	7.9		Almond Drive/Habitat Direct	36°59’53.48"N 120°48’0.04"W
5	4	3.0	5.9		Almond Drive/Habitat Direct	37° 00’37.83"N 120°47’59.91"W
6	1	1.0	2.0	3,500/#14-WC-20-4640	Santa Fe Canal	37°06’14.74" N 120°50’01.76"W
7	2	1.0	2.0		Santa Fe Canal	37°06’12.47"N 120°50’00.03"W
8	4	4.5	8.9		Standard Ditch	37°07’35.69"N 120°49’24.53"W
9	7	4.0	7.9	*Wells J & K - Maximum AF is included in 10,000 AF total listed for Wells A-E.	Habitat Direct	37°15’13.34"N 120°56’24.56"W
10	6	2.6	5.1		San Luis Canal	37° 02’18.98"N 120°49’0.68"W
11	R10	8.2	16.3	4,000/ #14-WC-20-4655	San Luis Canal	37°02’06.28"N 120°48’29.93"W
12	R4	5.5	10.9		San Luis Canal	37°04’17.07"N 120°49’33.73"W
13	R3	5.1	10.1		San Luis Canal	37°05’07.36"N 120°50’26.67"W
14	R1	4.2	8.3		San Luis Canal	37°05"23.76"N 120°49’53.90"W
15	G-5(OR-5)*	4.5	8.9	10,000/#08-WC-20-3748 2,000/#14-WC-20-4636	Standard Ditch	37°07’50.02"N 120°49’52.96"W
16	G-4(8.04)*	3.4	6.7		Santa Fe Canal/Habitat Direct	37°07’25.83"N 120°51’11.98"W

17	G-3(8.03)	3.6	7.1	2,000/#14-WC-20-4636	Santa Fe Canal/Habitat Direct	37°08’36.61"N 120°52’20.30"W
18	OR-6	3.6	7.1		Santa Fe Canal	37°06’12.56"N 120°49’59.40"W
Total				19,500		

Table 2 – Well Information (continued)

Well	Current Well Designation	Well Production			Discharge Location	GPS Coordinates
		CFS	AF Per Day	Maximum AF/Agreement #		
19	N/A	Not available	N/A	Not available	San Luis Canal	37°02’11.68"N 120°48’29.51"W
20	N/A	Not available	N/A	Not available	San Luis Canal	37°02’18.94"N 120°48’32.36"W
21	N/A	Not available	N/A	Not available	San Luis Canal	37°05’29.11"N 120°50’8.89"W
22	N/A	Not available	N/A	Not available	San Luis Canal	37°05’35.86"N 120°50’23.17"W
23	N/A	3.0	5.94	Not available	Santa Fe Canal	37°14’0.59"N 120°54’21.10"W

Maps

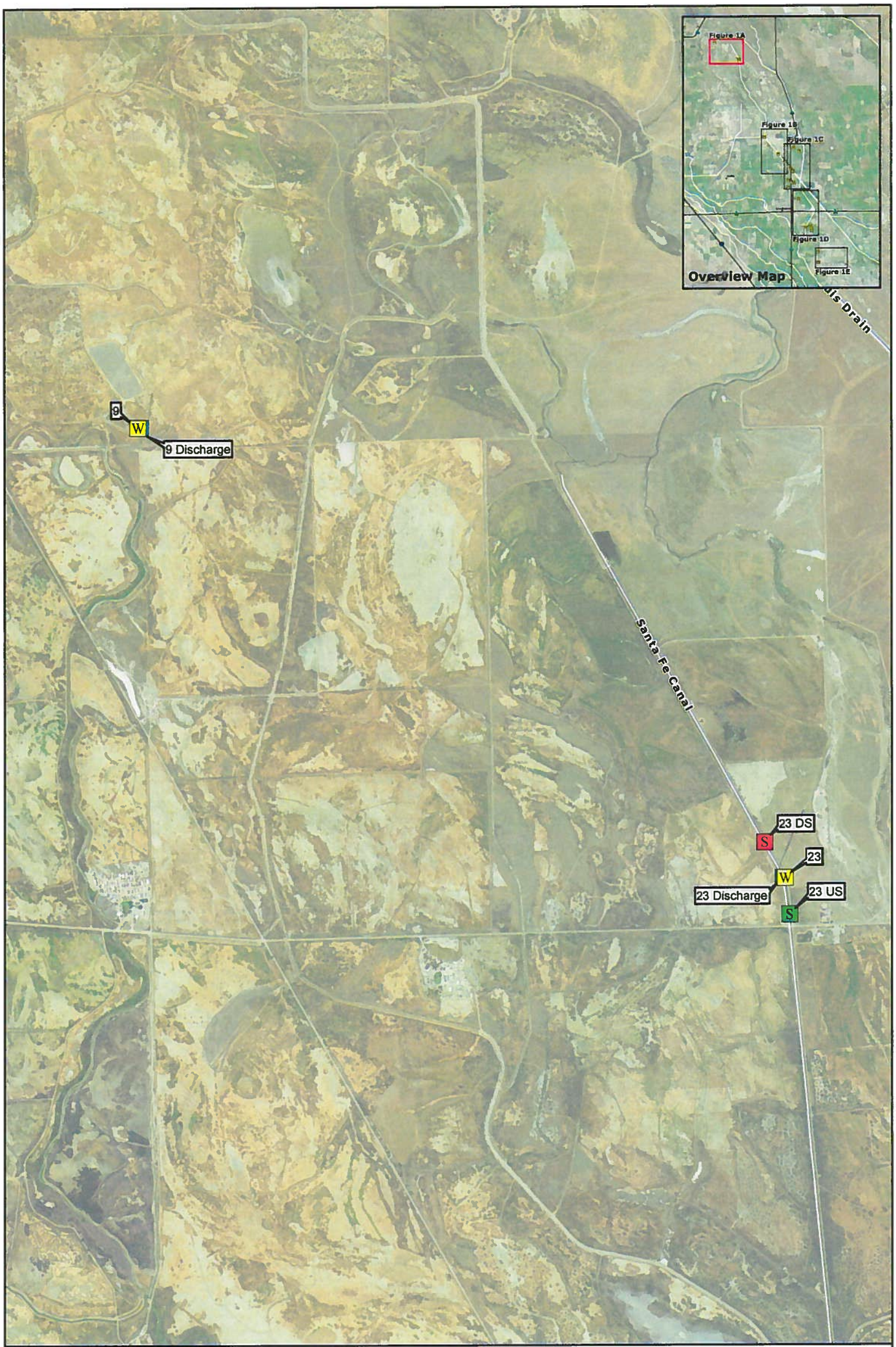

FIGURE 1A
Location Map: 1 of 5

5-Year Groundwater Acquisitions for
South of Delta Central Valley Project Improvement Act Refuges

W Well
S Downstream Sampling Site
D Discharge
S Upstream Sampling Site
S Upstream and Downstream Sampling Site

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0 0.25 0.5 1 Miles

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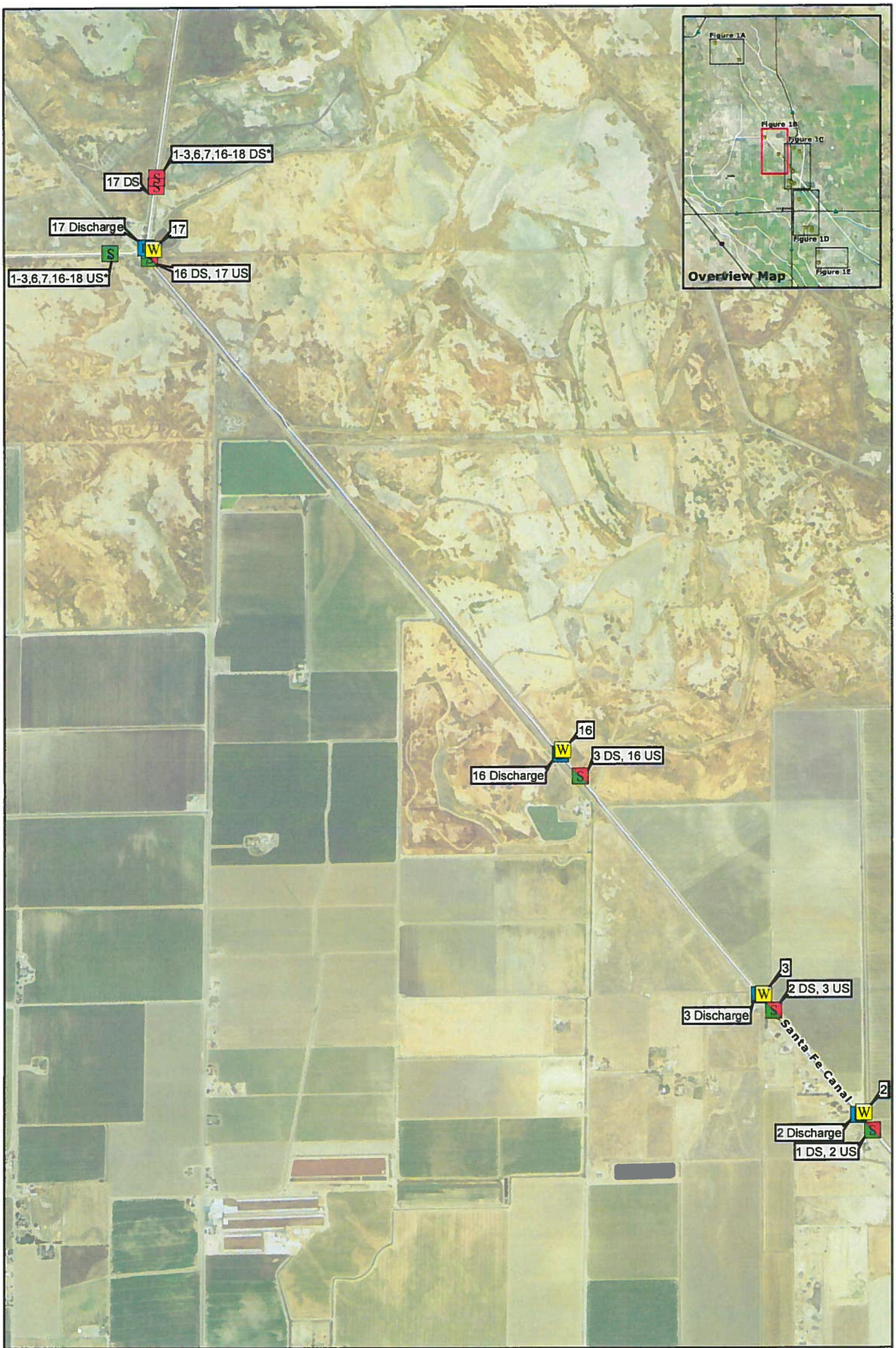

FIGURE 1B
Location Map: 2 of 5

5-Year Groundwater Acquisitions for
South of Delta Central Valley Project Improvement Act Refuges

W Well
S Downstream Sampling Site
D Discharge
S Upstream Sampling Site
S Upstream and Downstream Sampling Site

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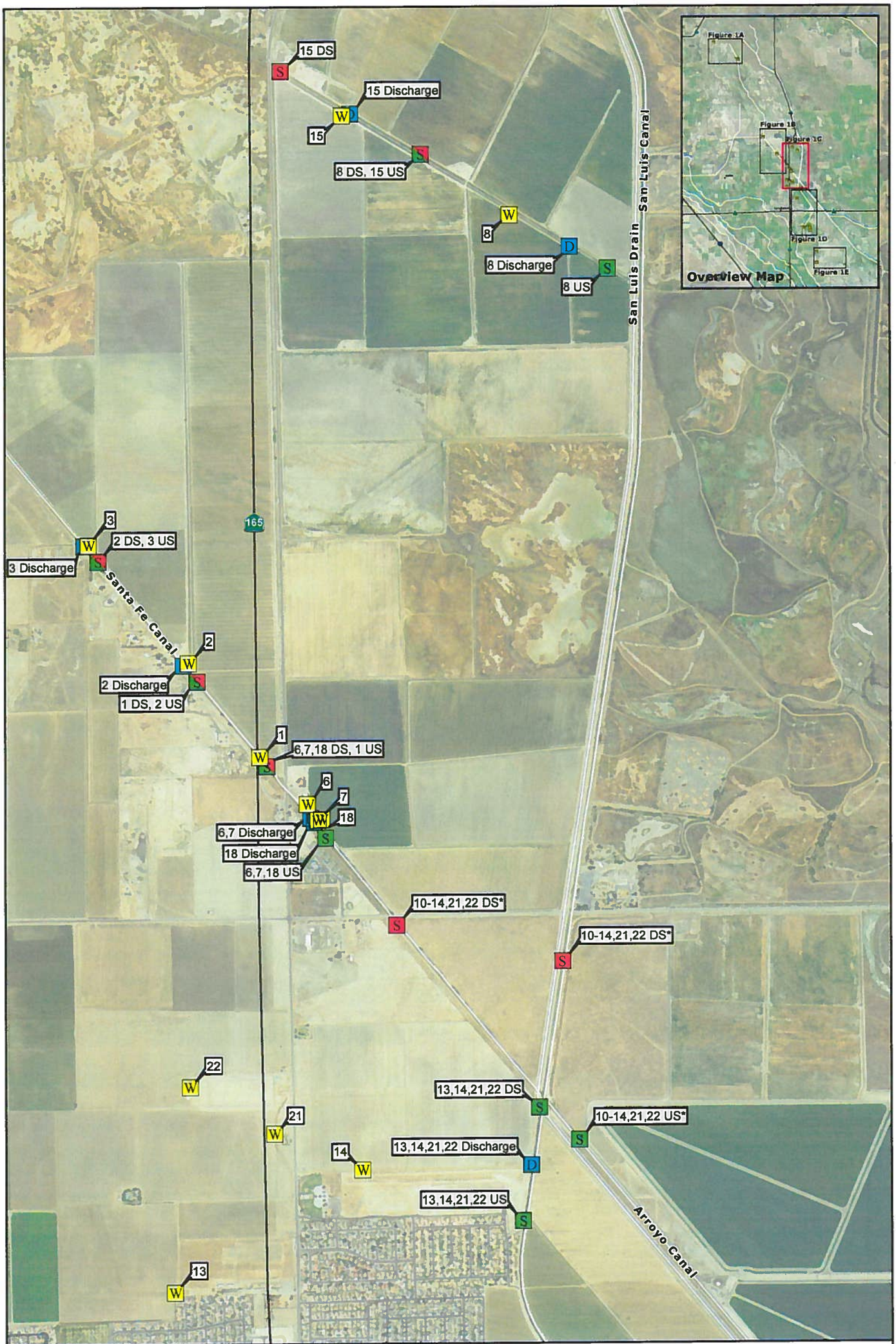

FIGURE 1C
Location Map: 3 of 5

5-Year Groundwater Acquisitions for
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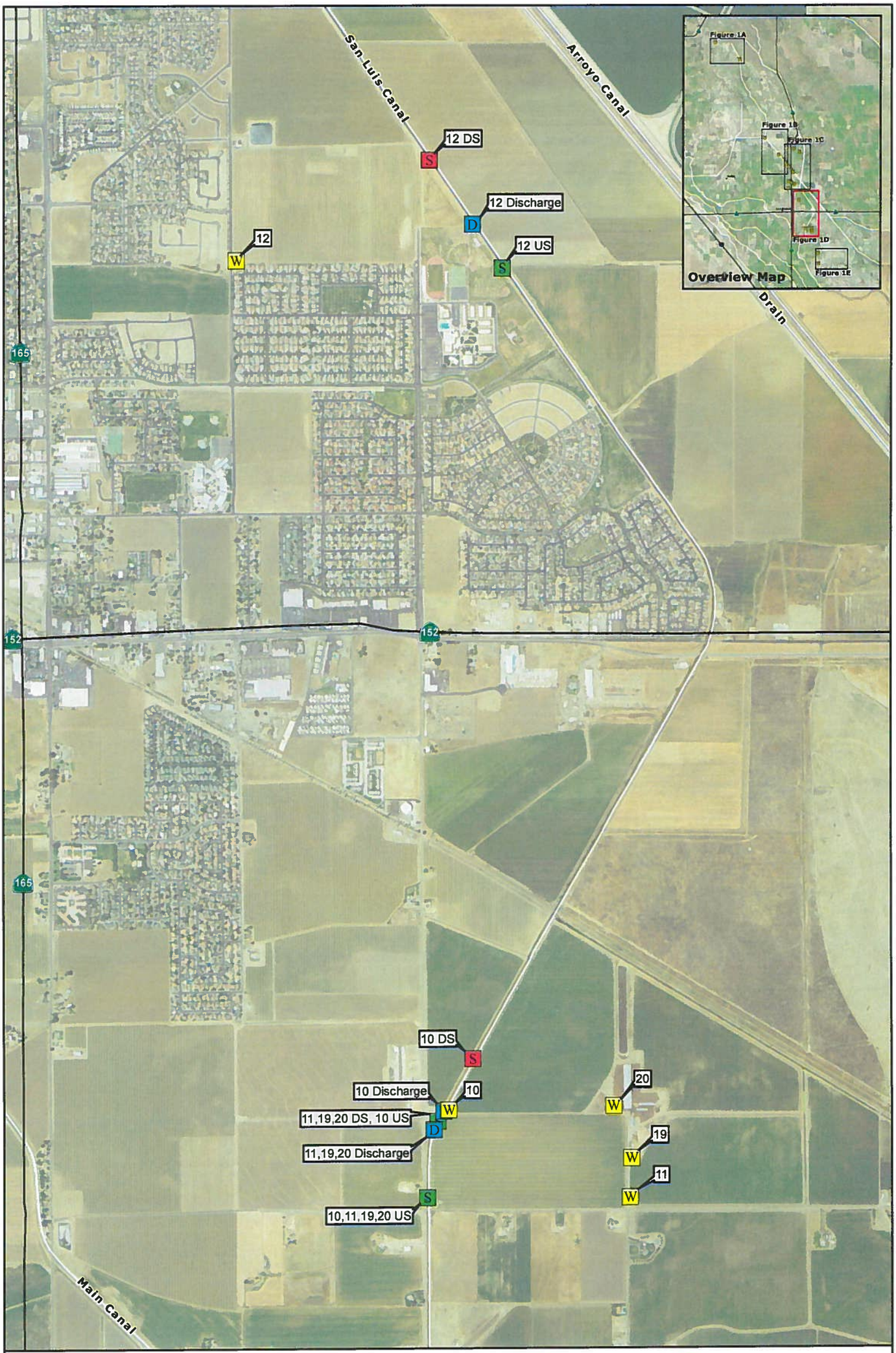

FIGURE 1D
Location Map: 4 of 5

5-Year Groundwater Acquisitions for
South of Delta Central Valley Project Improvement Act Refuges

W Well
S Downstream Sampling Site
D Discharge
S Upstream Sampling Site
S Upstream and Downstream Sampling Site

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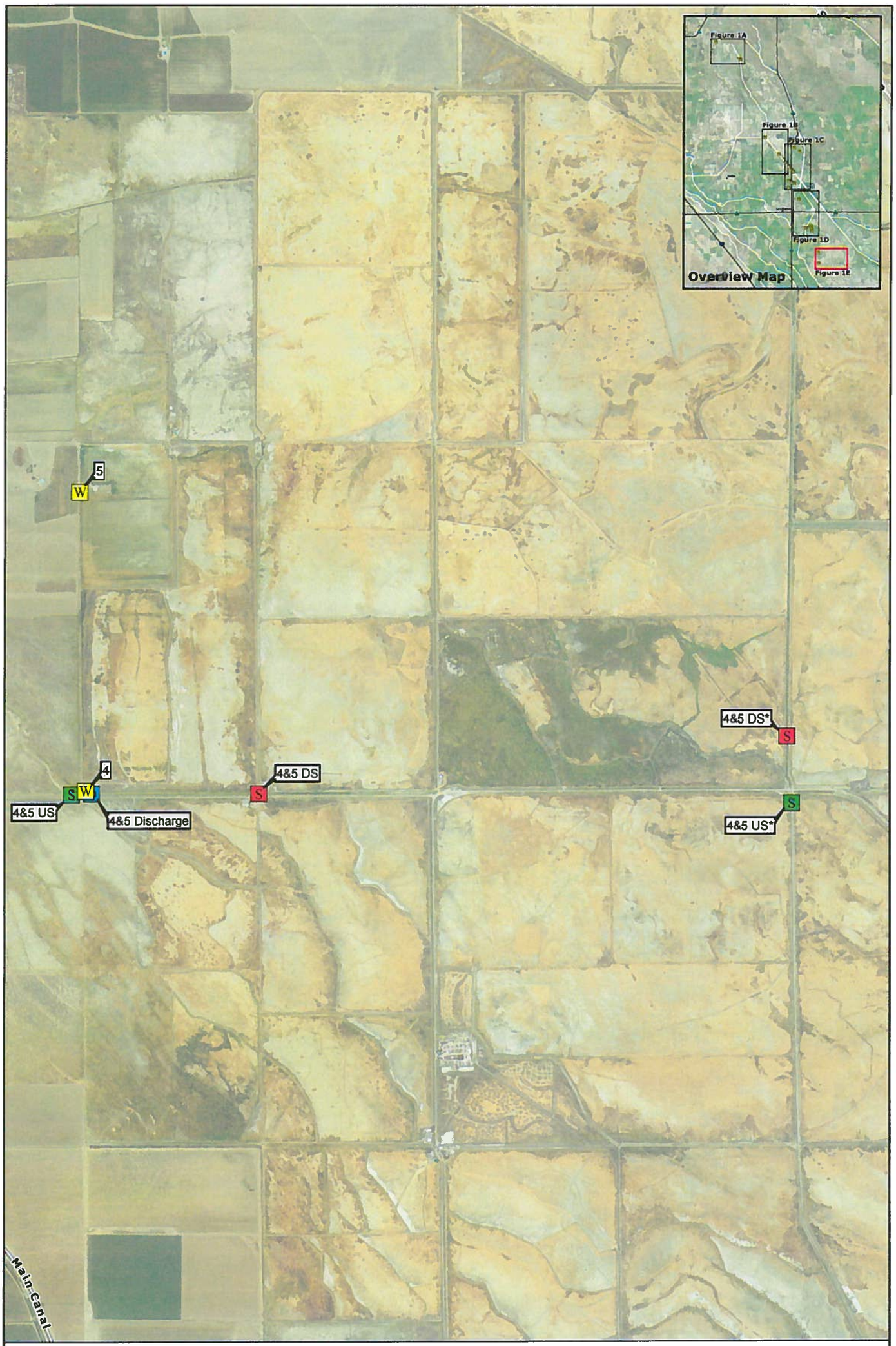

FIGURE 1E
Location Map: 5 of 5

5-Year Groundwater Acquisitions for
South of Delta Central Valley Project Improvement Act Refuges

W Well
S Downstream Sampling Site
D Discharge
S Upstream Sampling Site
S Upstream and Downstream Sampling Site

RECLAMATION
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