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& associates, inc

January 13, 2012

Catherine Kuhlman, Executive Officer
c/o Ms. Janice Goebel
California Regional Water Quality Control Board
North Coast Region
5550 Skylane Blvd., Suite A
Santa Rosa, California 95403

Subject: Work Plan for In-Situ Remediation of VOCs in Shallow Groundwater Former Remco Hydraulics Facility, Willits, California

Dear Ms. Kuhlman:

Jacobson James and Associates, Inc., (JJ&A) and Farr Associates submit this Work Plan for In-Situ Treatment of VOCs in Shallow Groundwater at the Former Remco Hydraulics Facility in Willits California ("Work Plan") on behalf of the Willits Environmental Remediation Trust ("Willits Trust"). This Work Plan proposes to conduct subsurface injections of reductive solutions to enhance *in-situ* reductive remediation of volatile organic compounds (VOCs) in shallow groundwater at the Remco Facility ("the Facility," Figure 1). This planned interim remedial action (IRA) involves the injection of dilute molasses and calcium polysulfide (CaS_x) to enhance *in-situ* remediation. Background information on previous IRAs conducted at the Facility is presented in the *Summary Report on In-Situ Treatment of Volatile Organic Compounds (VOCs) and Hexavalent Chromium* prepared by Farr Associates and Jacobson James & Associates, Inc., May 12, 2011.

This IRA will be governed by and conducted in accordance with the Waste Discharge Requirements (WDRs) Order No. R1-2009-001 ("WDR Order"), as authorized by the Regional Water Quality Control Board, North Coast Region (RWQCB). The WDR Order approved implementation of in-situ reductive remediation of VOCs in groundwater, such as proposed for the subject IRA. The planned IRA is designed to reduce concentrations of VOCs in groundwater at the Facility. This Work Plan is intended to fulfill the requirements in Section B, paragraph 2 of the WDR Order, which requires a work plan be prepared and submitted to the RWQCB for the planned injections.

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Target Area and Technical Basis for In-Situ Remediation Plan

The planned IRA will involve direct-push injections in an area surrounding the MLW-9 monitoring-well cluster, in the former paint room in the western end of the Remco main building (Figure 2). Although effective enhanced reductive remediation of PCE, TCE and 1,2-DCE has been observed in this area following previous direct-push injections, the remedial effectiveness has been relatively poor for the 1,1,1-TCA, 1,1-DCA, and 1,1-DCE present in this area. This area is also being targeted for additional reductive remediation because the oxidation-reduction potential (ORP) has remained higher than ideal in this area despite the previous injection of microbial food substrates (i.e., emulsified soybean oil and molasses). It is possible that the ORP has remained higher in this area (compared to surrounding areas that received previous remedial injections) due to the presence of elevated concentrations of 1,4-dioxane. 1,4-dioxane is a highly oxygenated compound that is very stable and difficult to breakdown by microbial action in the presence of supplemental food substrate, as attempted with previous IRA injections. The IRA plan presented herein includes the direct injection of calcium polysulfide, a strong reducing agent, to more effectively lower the ORP and create sufficiently reduced subsurface conditions for the enhanced degradation of 1,1,1-TCA, 1,2-DCA, and 1,1-DCE to occur.

Scope of Work

A direct-push rig with a 1-ft screened injection tool will be used to inject a remedial solution comprised of approximately 11% CaS_X and 8% molasses (by volume) over 13 separate depth intervals at 14 injection locations surrounding the MLW-9 well cluster, as shown on Figure 2. Target volumes of 20 to 30 gallons of treatment solution will be injected (or attempted to be injected) at each depth interval. The treatment solution will include a pH buffer[1] and vitamin B12. The preparation of remedial solutions (ingredients, procedures, and handling) will be the same as utilized for the previous IRA injections conducted in spring of 2009 and winters of 2010 and 2011 (*Summary Report on In-Situ Treatment of Volatile Organic Compounds (VOCs) and Hexavalent Chromium*, Farr Associates and Jacobson James & Associates, Inc., May 12, 2011). The scope of work is expected to be completed in approximately one week, assuming the completion of three to five injection locations per day.

[1] Similar to prior remedial solutions, a pH buffer (sodium bicarbonate) will be added to the remedial solution to ensure the pH is kept at optimal levels for remedial effectiveness.

Injection Methodology

Injections are planned to be completed on a triangular grid with 10-ft center-to-center spacing in the approximate north-south direction (aligned with the building walls) and 12.5-ft center-to-center spacing in the approximate east-west direction (Figure 2). The injection intervals at each location will range in depth from 2 to 21 ft-bgs with a spacing of 0.5 feet in between injection intervals. Each injection interval will receive 20 to 30 gallons, for a total of 355 gallons/location. The injection intervals between 5 and 16.5 ft bgs will receive the highest volume of remedial solutions (e.g., 30 gallons) to coincide with the higher concentrations of VOCs detected within this depth interval (based on analytical testing of groundwater samples collected from the MLW-9-cluster wells). The injection depth intervals and planned injection volumes are provided below:

Target Injection Interval (ft-bgs)	**Approx. Injection Volume/Interval (gals)**
2 – 3	20
3.5 – 4.5	25
5 – 6	30
6.5 – 7.5	30
8 – 9	30
9.5 – 10.5	30
11 – 12	30
12.5 – 13.5	30
14 – 15	30
15.5 – 16.5	30
17 – 18	25
18.5 – 19.5	25
20 –21	20
Approx. Total Volume per Location	355

A total of approximately 4970 gallons of dilute reductive remedial solution, containing approximately 547 gallons of CaS_x, 398 gallons of molasses, 300 pounds of sodium bicarbonate, and 64 ounces of vitamin B12 will be injected through the 14 direct-push locations.

Monitoring and Reporting Program

A groundwater monitoring and sampling program has been designed to evaluate the performance and effectiveness of the IRA and to monitor potential deleterious by-products of the remedial action. Based on extensive experience with previous direct injections of the proposed remedial solutions at the Facility, any potentially adverse water-quality effects will be localized, of relatively short-term duration, and will not affect existing or potential beneficial uses of groundwater beyond the Facility treatment area. The monitoring program described below is consistent with Monitoring and Reporting Program R1-2010-0004 (MRP), and will monitor for remedial effectiveness and to ensure no long-term adverse affects to beneficial uses of groundwater, the environment, or human health and safety.

Groundwater monitoring will be conducted in IRA monitoring wells located in the immediate vicinity of the injection area (primary IRA performance well), just outside the injection area (secondary IRA performance well), and further down gradient of the injection area (down-gradient IRA monitoring wells). The IRA performance monitoring wells are as follows:

- Primary IRA performance monitoring wells: MLW-9-1, MLW-9-2 and MLW9-3
- Secondary IRA performance monitoring well: IMW-01.

Subsequent to the injection event, the Trust proposes to conduct a minimum of four quarterly (i.e., 1-year) of groundwater sampling events at these 4 IRA monitoring wells to assess the performance and effectiveness of the IRA. In addition, semi-annual monitoring will be conducted at down-gradient monitoring wells IMW-03 and IMW-04 for a minimum of 1-year. The IRA wells are indicated on Figure 2. The Trust will analyze the IRA monitoring-well samples for VOCs, dissolved arsenic and sulfate, in addition to physical parameters (*e.g.*, temperature, pH, and ORP) measured in the field. The sampling will be conducted in conjunction with the routine Remco groundwater monitoring and sampling events to allow for a comprehensive assessment of Facility conditions.

Contingency Plan

The Willits Trust will continue to extract groundwater from the existing extraction wells along the northern Trust-Owned Property boundary (downgradient of the IRA injection treatment area) to contain and treat A-Zone groundwater from the Facility. The potentiometric surface map constructed from the October 2011 water level monitoring round is presented as Figure 3. The potentiometric surface data indicates that the current groundwater extraction system is effective at controlling groundwater on the down-gradient edge of the Trust-Owned Property, and therefore the existing groundwater extraction and treatment system will ensure that the proposed IRA will have no long-term adverse affects to beneficial uses of groundwater, the environment, or human health and safety.

Reporting

The implementation of the IRA injections will be summarized in a report submitted to the RWQCB within 45-days of completion of the injection event. All monitoring data will be submitted with the comprehensive groundwater and surface water monitoring and sampling reports required under the RWQCB's Monitoring and Reporting Program R1-2011-0055.

Summary and Schedule

JJ&A respectfully submits this *VOC IRA Work Plan* on behalf of the Willits Trust. The proposed injections and sampling plan, as described herein, will allow the Trust to efficiently implement the IRA, assess remedial effectiveness, and monitor any potentially deleterious by-products of the remedial action. It is understood that, if the RWQCB Executive Officer finds no significant changes in discharge, impacts or issues, and concurs with the injection proposal contained herein, the RWQCB will issue this Work Plan to the public and interested parties for a 30-day comment period (as required by the WDR Order). Assuming that the RWQCB approves the work to be conducted, the Trust anticipates implementing the additional injections in March 2012.

Please feel free to call Terry James at (916) 367-5111, or John Farr at (916) 781-9327, if you have any questions or would like to discuss the contents of this letter.

Sincerely,

JJ&A

Terry James, P.G.

Farr Associates

John M. Farr, Ph.D., P.E.

Enclosures

Figure 1: Facility Location Map
Figure 2: Proposed IRA Injection Area
Figure 3: A-Zone Potentiometric Surface Map (October 2011)

cc: Anne Farr, Ph. D., Willits Environmental Remediation Trust
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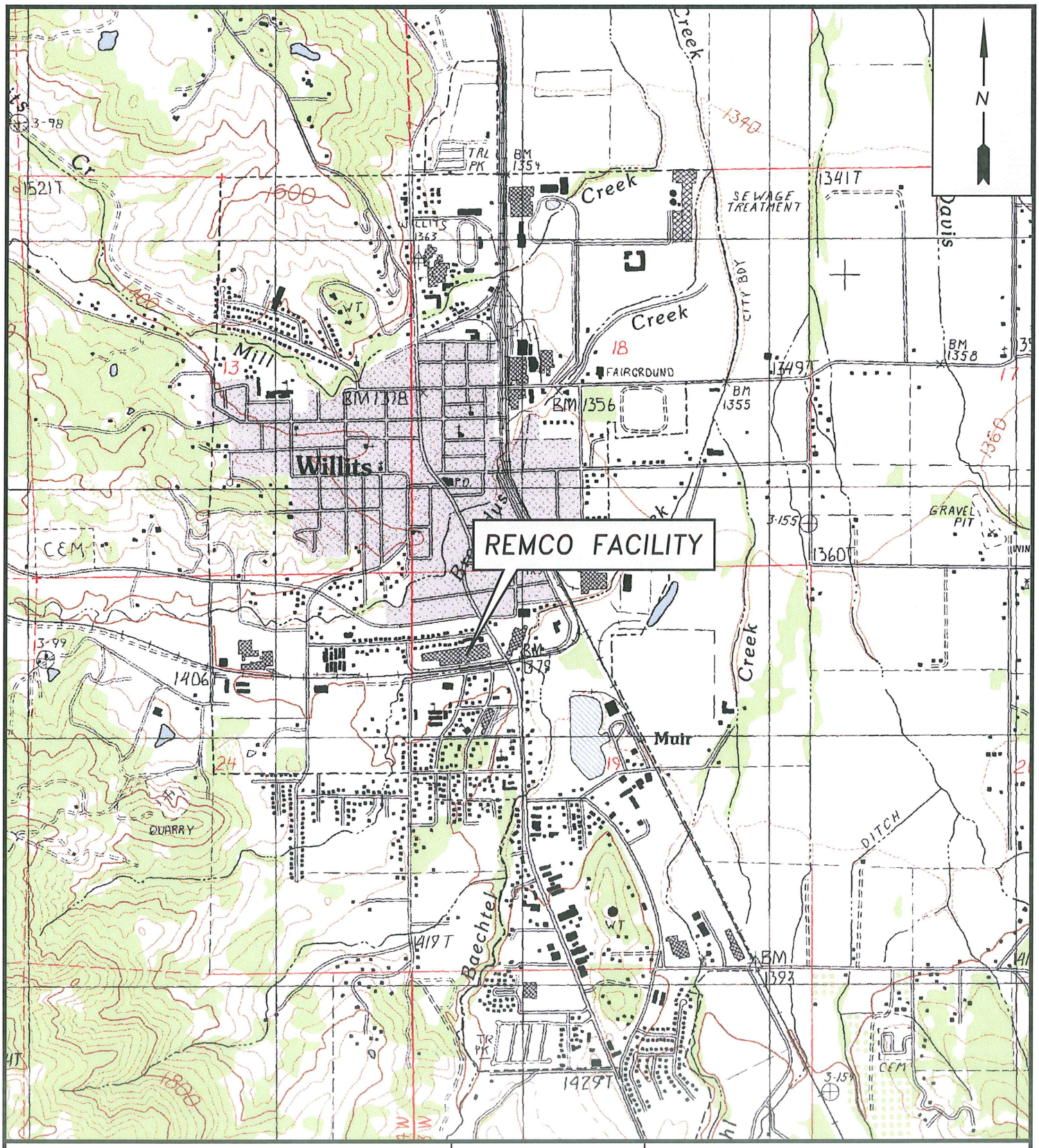
P. Cayler, City of Willits
Earl D. James, EKI
Stuart Block, Esq., Cox, Castle and Nicholson, LLP
H. James Lance, Esq., City of Willits
Thomas Larson, Esq., Briggs & Morgan, PA
Former Remco Facility Document Depository
David Patrick, Pepsi Beverages Company



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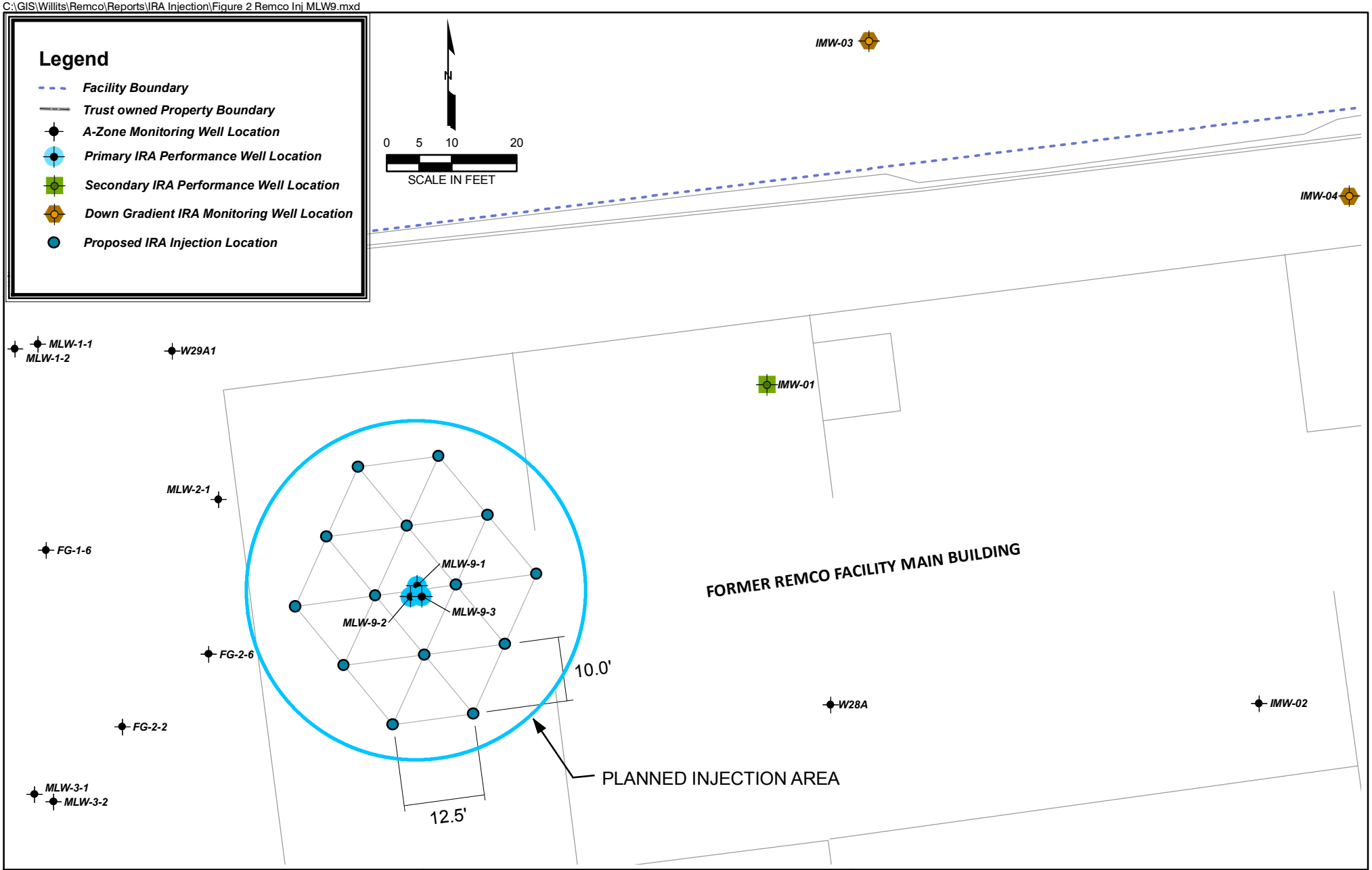
SOURCE: U.S.G.S. 7.5' QUAD SHEET
WILLITS, CALIFORNIA
PHOTOREVISED 1993

SCALE: 0 FEET 2000	TITLE: FACILITY LOCATION MAP
CLIENT: WILLITS ENVIRONMENTAL REMEDIATION TRUST	DATE: 7/24/08
LOCATION: FORMER REMCO HYDRAULICS, INC. WILLITS, CALIFORNIA	FIGURE: 1

C:\GIS\Willits\Remco\Reports\IRA Injection\Figure 2 Remco Inj MLW9.mxd



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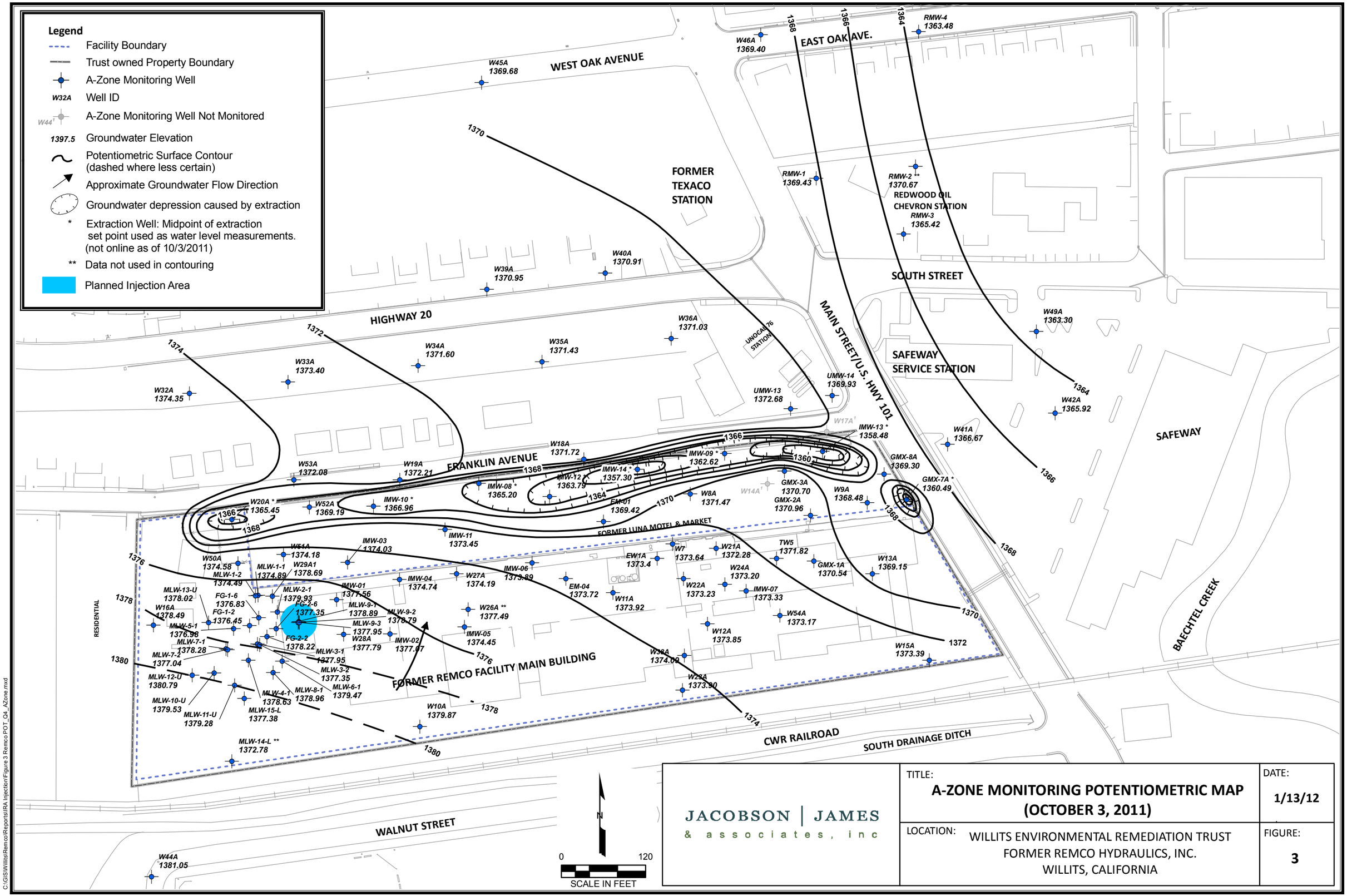
& associates, inc

WILLITS ENVIRONMENTAL REMEDIATION TRUST
FORMER REMCO HYDRAULICS, INC.
WILLITS, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY	APPR. BY
01.WIL.2011	1/13/12	DPG	TJ

FIGURE 2

PROPOSED IRA INJECTION AREA



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TITLE: **A-ZONE MONITORING POTENTIOMETRIC MAP (OCTOBER 3, 2011)**

DATE: 1/13/12

LOCATION: WILLITS ENVIRONMENTAL REMEDIATION TRUST
FORMER REMCO HYDRAULICS, INC.
WILLITS, CALIFORNIA

FIGURE: 3

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