NAS7.10395
NASA-JPL
SSIC No. 9661

National Aeronautics and
Space Administration
Science Mission Directorate

NASA Management Office

180-801
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109-8099

Gary Takara
Pasadena Water and Power
150 South Los Robles Avenue, Suite 200
Pasadena, CA 91101

December 1, 2005

Dear Gary,

Per our discussions and in support of the pending Monk Hill Treatment System Agreement, NASA has prepared the attached pre-development plan and draft CEQA Initial Study. These documents are provided to help support the City's approval processes.

This is a project partnership between NASA and the City of Pasadena, with funding by NASA as a part of fulfilling its responsibilities under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). NASA will conduct its CERCLA processes in parallel with the City of Pasadena permitting processes. These processes include preparation of a Proposed Plan and public participation leading to an interim Record of Decision. We will work with you to integrate these processes with City requirements. The final decision to proceed will be made at the close of this CERCLA process.

I look forward to working with the City on this project. You may call me at (818) 393-6683 or Nick Amini and (818) 393-2808.

Sincerely,

Steve Slaten
NASA/JPL Remedial Project Manager
Cc w/o encl Phyllis Currie

Technical Memorandum

Date: December 1, 2005

From: NASA/Battelle

To: City of Pasadena
Subject: Pre-development Plan for Construction of a Groundwater Treatment System at Windsor Reservoir Site

1.0 BACKGROUND

In the early 1980s, analyses of groundwater from four Pasadena Water and Power (PWP) water-supply wells, Arroyo Well, Well 52, Ventura Well, and Windsor Well (collectively known as the Monk Hill Wells in reference to the aquifer, Monk Hill Basin, the wells pump from), revealed the presence of volatile organic compounds (VOCs). As a result of continued monitoring, the Monk Hill Wells, located in northwest Pasadena, were shutdown in the mid to late 1980s by the California Department of Health Services (DHS). In 1990, the National Aeronautics and Space Administration (NASA) funded the installation of an air stripping system to remove the VOCs so that the four Monk Hill Wells could resume supplying water. The air stripping system is located on the eastern edge of the Devil's Gate Reservoir, and the treated water was pumped from the air stripping system to the Windsor Reservoir, from which water is distributed to customers within the City of Pasadena. However, due to levels of perchlorate in excess of the DHS action level (4 ppb at the time), pumping of Arroyo Well was discontinued in 1997, and pumping of the remaining three wells was discontinued in 2002. The four Monk Hill wells remain closed at this time due to the elevated perchlorate concentrations. Additional treatment is necessary to restore use of these production wells to meet potable water demands for the City of Pasadena.

PWP and NASA are currently working together to install a treatment system to remove perchlorate from groundwater so that the four Monk Hill Wells can begin pumping again from the Monk Hill Basin. The wells will be rehabilitated to produce a combined flow rate of 7,000 gallons per minute (gpm). Groundwater extracted from these four wells will be treated using a DHS approved treatment system consisting of an ion exchange to remove perchlorate and air stripping and/or liquid-phase granular activated carbon (LGAC) treatment units to remove VOCs. The determination regarding the use of one or both of these technologies for VOC removal will be made during the design phase of work. Treated water will then be chlorinated and stored in the Windsor Reservoir. The treatment system will have a maximum capacity of 7,000 gpm, and the new ion exchange and LGAC treatment units are proposed to be installed at 2696 Windsor Avenue which is a City of Pasadena owned land (see Figure 1). The parcel and existing facilities residing on the proposed project site are owned, operated, and maintained by PWP. The existing facilities include a 4,750,000 gallon reservoir, Windsor Well, numerous power transformer banks, and three storage buildings storing electrical and water equipment. The parcel boundary is adjacent to the county unincorporated area of Altadena. The proposed location was selected due to: (1) The existing road access that will be necessary for constructing the proposed treatment system, and operating and maintaining the system; (2) It is ideal to have the treatment system as close to the affected wells and Windsor Reservoir which will serve as the receiving tank for the treated water; (3) The site is enclosed and secured from trespassers and potential intruders; (4) The location is centralized for most of Pasadena's Monk Hill water facilities.

The purpose of this pre-development plan is to provide sufficient technical information to initiate the Predevelopment Plan Review process with the City. For purposes of this review the envelope approach is applied and the worst case is assumed whereby perchlorate and VOC treatments via ion exchange and LGAC, respectively, are needed and described in this document. Following this review process, a Pre-Application Conference will be scheduled to discuss any design or permitting requirements from the City. Based on the Pre-Application Conference, all necessary permit applications for construction of the groundwater treatment system will be submitted to the City.

2.0 TREATMENT SYSTEM DESCRIPTION

A general description of the new treatment train is given in this section. The treatment train includes two stages of chemical removal: perchlorate removal using ion exchange and VOC removal using air stripping and/or LGAC treatment. The new stages (ion exchange and LGAC) along with the concrete pad, on which all the equipment will be installed, and the associated piping are described under this section.

2.1 Ion Exchange System

The ion exchange treatment system will be used to remove perchlorate from the extracted groundwater. The general requirements of such a system are as follows:

- The ion exchange plant will remove perchlorate from the Monk Hill Wells at maximum flow rate of 7,000 gpm. The minimum design flow rate is between 1,400 to 2,200 gpm.

- The system will accommodate perchlorate removal from a minimum of 4,500 acre-feet of groundwater annually. One acre-feet is equivalent to 325,828 gallons.
- The existing 16-inch steel pipeline will be used to transport the water from three of the wells (Arroyo, Well 52 and Ventura) to the proposed site.
- The treatment system will have the ability to operate at least 95 percent of normal operations (i.e., downtime due to mechanical failures will not exceed 5 percent).
- The ion exchange system will include SCADA system outputs for remote monitoring capabilities.
- All chemicals or substances to be added to, or to be in contact with the water during this stage of treatment will be DHS accepted, or are certified to meet the criteria of American Water Works Association (AWWA), American National Standards Institute (ANSI)/National Science Foundation (NSF) 61, NSF, or Food Chemical Code publications.
- Groundwater is part of a CERCLA operable unit. Therefore, the spent (used) ion exchange media must be handled in accordance with the Off-Site Rule (40 CFR 300.440).
- The ion exchange system will be designed to meet treatment objectives for the anticipated influent contaminant concentrations defined in Table 1.

Table 1. Estimated Influent Water Quality to Ion Exchange System

Chemical	Concentration	Treatment Objective	
Perchlorate	59 µg/L	< 4 µg/L	DHS Detection Limit for Reporting
Nitrate (as NO_3)	44 mg/L	36 mg/L	CA Primary MCL
Chloride	55 mg/L	250 mg/L	CA Secondary MCL
Sulfate	75 mg/L	250 mg/L	CA Secondary MCL
Total Dissolved Solids (TDS)	400 mg/L	500 mg/L	CA Secondary MCL

MCL: Maximum contaminant level
All MCLs are established by California DHS

2.2 Liquid Phase Granular Activated Carbon

It may be necessary to also install an LGAC treatment system for removal of VOCs from the extracted groundwater. However, the determination regarding the use air stripping and/or LGAC for VOC removal will be made during the design phase of work. If LGAC is used, the effluent (i.e. treated water) from the ion exchange vessels will be directed through steel piping network to the LGAC system. The VOC-removal capacity of the LGAC system will be designed based on the assumption that the existing VOC treatment system unintentionally shuts down due to mechanical failure and will not be treating the extracted groundwater for VOCs. The general requirements of such a system are as follows:

- The LGAC system will treat four wells at maximum flow rate of 7,000 gpm. The minimum design flow rate is between 1,400 to 2,200 gpm.
- The LGAC system will include SCADA system outputs for remote monitoring capabilities.
- Groundwater is part of a CERCLA operable unit. Therefore, the spent (used) carbon will be handled in accordance with the Off-Site Rule (40 CFR 300.440).
- The LGAC system will be designed to meet treatment objective for the anticipated influent contaminant concentrations defined in Table 2.

Table 2. Estimated Influent Water Quality to LGAC System

Chemical	Concentration	Treatment Objective	
Trichloroethene	20 µg/L	5 µg/L	CA Primary MCL
Tetrachloroethene	8 µg/L	5 µg/L	CA Primary MCL
1,2-Dichloroethane	2.5 µg/L	0.5 µg/L	CA Primary MCL
Carbon Tetrachloride	20 µg/L	0.5 µg/L	CA Primary MCL
1,2,3-Trichloropropane	0.014 µg/L	0.005 µg/L	DHS Action Level
Methylene Chloride	13 µg/L	5 µg/L	CA Primary MCL

MCL: Maximum contaminant level
All MCLs are established by California DHS

2.3 Treatment System Pad and Piping

At this point, three different conceptual designs for the treatment system have been proposed by three treatment vendors; however, NASA and PWP have not yet selected a final vendor. The City will eventually solicit proposals from treatment vendors after which PWP and NASA will make a final selection. Three of the proposed conceptual design drawings are provided in Appendix 1. The following is a general description of the treatment system which provides information on the elements that the three proposed designs have in common.

The ion exchange and LGAC treatment train will be placed on a new concrete pad with maximum dimensions of 150-feet by 200-feet. The dimensions of the pad may change based on the actual treatment system selected. This pad will be located in the south central portion of the proposed site (2696 Windsor Avenue). This location is being proposed based on its proximity to the Monk Hill Wells and Windsor Reservoir, the accessibility of the location for routine maintenance needs, as well as the results of topographical and geophysical surveys, and a geotechnical study that was conducted at the site. Figure 1 provides a conceptual depiction of the proposed location of the pad within the site and the simplified piping network for groundwater transportation to and from the treatment pad.

Construction of the pad will take into account the seismic conditions of the area. If the air stripping system is used for VOC treatment, then the existing (pressurized) 16-inch steel pipe will be used to deliver the treated water from the air stripper to the proposed site. If the air stripping system is not used, then the existing 16-inch steel pipe will be used to deliver water from Arroyo Well, Well 52, and Ventura Well to the site location. The groundwater from this line will then join the groundwater from Windsor Well, transported via an existing (pressurized) 12-inch steel line (which currently connects the Windsor well to the air stripper unit), at a point located in the northern portion of the site. The combined flow will then be directed toward the treatment system (heading south) through a new 24-inch steel pipeline. A general description of the treatment system is provided in the following sections.

2.3.1 Calgon/US Filter Ion Exchange Systems

The first type of the ion exchange system is available through vendors such as U.S. Filter and Calgon Carbon Corporation. After reaching the inlet of the treatment system, the groundwater will first be introduced to the ion exchange vessels using a piping manifold equipped with flow control valves to evenly distribute water into each of the lead ion exchange vessels. Depending on the system chosen, either 3 or 5 pairs of ion exchange steel vessels may be installed. Each vessel may be up to 12-feet in diameter and 15-feet 4-inches tall. Each pair of vessels will operate in lead-lag mode, meaning that water will flow through each of the first, or lead, vessels and then through the second, or lag, vessel of each pair. Each ion exchange vessel will be equipped with isolation valves at the inlet and outlet connections, and sample ports will be installed so that samples can be collected from the influent water, after each lead vessel, and also after each lag vessel, to determine treatment efficiency. When the ion exchange resin in a lead vessel becomes spent, the vessel is taken off-line while the water continues to flow using the valves so that the lag vessel now becomes the lead vessel in that pair. The spent resin is then replaced, and the vessel is brought back on-line as the lag vessel in that pair. The spent resin is not expected to be classified as hazardous waste. It will be pumped out of the vessels to trailer tankers which will transport the resin for off site disposal at a licensed disposal facility.

The flowrate, pressure, temperature and pH of water will be measured at the inlet of the vessels using appropriate gauges. The inlet line will also be equipped with transmitter units which convert the measured parameters to electrical current (4-20 mA) and send electrical signals to the appropriate monitoring equipment at a control center designated by PWP. The data can then be converted back to meaningful parameters for observation and recording.

Other vendors such as General Electric Infrastructures and Layne Christensen also solicit perchlorate treatment systems. These systems are very similar in design and concept to the Calgon and U.S. Filter systems.

2.3.2 Basin Water Ion Exchange System

The second type of ion exchange system is provided by Basin Water and is different from the Calgon and US Filter systems in that several small vessels are used instead of a series of two larger vessels in pairs. The Basin Water ion exchange system, if selected, would consist of 7 pre-assembled ion exchange units. Flow will be distributed by inlet control valves located at each unit. Each unit includes up to 18 small ion exchange vessels (36-inch diameter) and automatic controls enclosed in a 10-foot by 10-foot by 35-foot steel containers (i.e. remodeled shipping cargo containers). Flow is automatically controlled through up to 12 of the18 ion exchange vessels in each unit, and each vessel is equipped with two automatically controlled valves that allow the control system to cycle each bed into and out of service in a staggered schedule. Similar to the Calgon and US Filter systems, when system monitoring and sampling indicates that the ion exchange resin becomes spent, the vessel is taken out of service and the spent resin is replaced. Additional standby vessels are brought on-line in the unit during the resin change out process. Similar to the U.S. filter and Calgon ion exchange systems, the spent media is transported offsite for disposal.

The flowrate, pressure, temperature and pH of water will be measured at the inlet of the vessels using appropriate gauges. The inlet line will also be equipped with transmitter units which convert the measured parameters to electrical current (4-20 mA) and send electrical signals to the appropriate monitoring equipment at a control center designated by PWP. The data can then be converted back to meaningful parameters for observation and recording.

2.3.3 Layout of the LGAC System

The determination regarding the use of LGAC for VOC removal will be made during the design phase of work. If LGAC is used, then the layout will depend on the particular system chosen, which will include either 5 or 7 pairs of LGAC vessels in the system. Each pair of vessels will operate in lead-lag mode, similar to the ion exchange vessels. The LGAC vessel sizes may be similar to the ion exchange vessels, up to 12-feet in diameter and 15-feet 4-inches tall. Each LGAC vessel will be equipped with isolation valves at the inlet and outlet connections, and sample ports will be installed so that samples can be collected from the influent water, after each lead vessel, and also after each lag vessel, to determine treatment efficiency. When the activated carbon in a lead vessel becomes spent, the vessel is taken off-line while the water continues to flow using valves so that the lag vessel is now the lead vessel in that pair. The spent activated carbon is then replaced, and the vessel is brought back on-line as the lag vessel in that pair. The spent carbon will be classified as non-hazardous waste. It will be pumped out to tanker trailers and will be transported off site for reactivation.

Gauges and transmitters for flowrate, pressure, and temperature will be installed at the individual inlets and outlets for the LGAC vessels. The pressure drop across the individual LGAC vessels will be in the range of 5 to 15 psi, depending on the superficial velocity of water through the vessel bed and the height of the bed. The effluent from the LGAC vessels will be collected through a common header and will be directed to the disinfection system at the site through a new 24-inch ductile iron pipeline.

2.3.4 Treatment System Booster Pumps

The expected pressure drop across the ion exchange vessels is in the range of 10 to 40 psi, depending on the selected type of system. In addition pressure drops across the LGAC vessels and bag filters results in a total loss of pressure in the range of 50 to 80 psi in the treatment plant. To compensate for this pressure loss, booster pump(s) may be installed at some point in the treatment train. One of the potential spots for locating the booster pump(s) is after the outlet of the ion exchange vessels. The water from the booster pump(s) will be distributed to the LGAC system. The method of distribution will depend on the number of the LGAC vessels and their configuration on the treatment pad compared to the ion exchange vessels. These configurations would result in two different scenarios. In the first scenario, the distribution will occur from individual ion exchange vessels directly to individual LGAC vessels using small booster pumps (i.e., 100-1000 gpm) between each pair of ion exchange and LGAC vessels. In the second scenario, the effluent water from the ion exchange units will be directed through a common header to a single large booster pump (i.e., 4000-7000 gpm). The discharge of the booster pump will flow through a main header and the water will be distributed through a piping manifold to each pair of LGAC vessels. Additional electric service will be required to operate the booster pumps. The required power for the booster pumps will be provided from the overhead power line located just outside of the site's north gate. Appropriate sound enclosures will be used to suppress the noise produced by the booster pump(s) and to maintain a low-noise environment for the residential areas that surround the reservoir site.

2.3.5 Concrete Pad

The geophysical study conducted at the site shows that, with the exception of two existing pipelines passing on the west and east side of the proposed concrete pad area, no underground utilities will be impacted by the proposed 150-foot by 200-foot concrete pad in the south central portion of the site. One of the two identified existing pipelines, which will be to the west of the proposed concrete pad, is a 12-inch drinking water pipeline that conveys potable water to nearby residents. This pipeline is located approximately 25 feet to the east of the west border fence line. The second pipeline is a 4-inch steel line, located approximately 160 feet to the east of the west border fence line. This pipeline has been historically used as a sewer line. A secondary plastic line was inserted in the sewer line at a later date, and it has been occasionally used during the recent years.

The specified value of 150 by 200 feet is assumed for the largest commercially available system that can be proposed by a vendor. At this time, it is believed that the concrete pad can fit within the southern portion of the site, without significant impact on the structure, utilities, plants and vegetation at the site. Based on the type of the treatment systems selected for perchlorate removal and depending if there is a need for a LGAC system, the dimensions of the pad may vary (reduce) within a margin of 50 percent of the specified values. An existing monitoring well, MW-19, located in the southern portion of the site will be surrounded by the concrete pad. In order to keep the well functional and protected, the wellhead will be extended using appropriate piping and will be placed in 2×2×2 feet steel vault. The top of the extended casing will be resurveyed to assure accuracy in the future groundwater monitoring events. It is expected that for construction of the concrete pad and any required access road, some areas in the south central portion of the site has to be graded.

Construction of the concrete pad will result in the increase in the run-off water, as a result of precipitation. To direct the produced run-off water, stream channels may have to be constructed which will transfer the water to the nearest storm drain.

In a worst case scenario, the only projected impact on the proposed site plants may be to remove up to 5 trees (two on the west side and 3 on the south side of the pad). The preliminary plans for the described two types of the systems indicate that Shaw-Basin Water system may extend beyond the existing sewer line. See Appendix 1. Photographs that show different areas within the reservoir site, two of the 5 trees with the possibility of being impacted, the adjacent Windsor Avenue, and the residential areas to the north and south of the site are provided in Appendix 2.

The general location of the treatment pad is to accommodate expansion for treatment needs if a new groundwater contaminant is detected in the future.

2.3.6 Water Conveyance Pipelines

The existing 16-inch pipeline that conveys the water from the air stripping system to the Windsor Reservoir will be altered slightly to convey water from Arroyo Well, Well 52, and Ventura Well to the new treatment plant. The existing pipeline will be accessed at the northern portion of the site, and a new section of 16-inch pipe will be laid in a trench which will be excavated starting at the existing pipeline and going to the new treatment plant, passing through the area that is used as a dirt road in the south central portion of the site. No plants, vegetation or structure will be impacted by this trench. The outgoing pipeline from the concrete pad will be placed in a trench adjacent to the influent pipeline. The bottom portion of the trenches will be filled with fine sand to protect the pipelines. The outgoing 24-inch steel line will then be directed toward the disinfection unit and Windsor Reservoir. The 24-inch pipeline will be physically connected into the existing sand box unit, located at the northwest corner of the reservoir. The treated water from the system will be disinfected prior to being introduced into the reservoir.

2.3.7 Accessibility

The open area around the proposed treatment pad will allow access for trailer trucks to deliver fresh ion exchange resin or activated carbon to the treatment system. The two existing gates located at the south and north ends of the western border fence will allow the delivery trucks to enter from the south gate and exit from the north gate without having to make any sharp or difficult turns. A 16-foot wide paved utility driveway will be constructed for accessing the system. The driveway will start at the southern gate, will circle around the concrete pad and will end at the road which leads to the northern gate.

Windsor Avenue is easily accessible from freeway 210 and the site is located only about one mile to the east of the freeway. The site is located at approximately 2 miles from the NASA management office at JPL and it is only 4.5 miles away from the PWP office on Los Robles Avenue in Pasadena.

2.3.8 Disinfection by Chloramination

Currently, PWP disinfects its water from the Monk Hill Wells with gaseous chlorine. PWP also receives imported water from Metropolitan Water District of Southern California (MWD) which is disinfected by chloramination. The chemical reaction between gaseous chlorine and chloramines do not provide for the ideal disinfection environment. Therefore, PWP is proposing to install a chloramine disinfection system for the Monk Hill Wells and maintain its chlorine disinfection system for emergencies and backup.

The proposed disinfection system will consists of two liquid storage tanks containing liquid chlorine (sodium hypochlorite), which is much safer to handle and store than gaseous chlorine, and liquid ammonia. The liquid chlorine will be injected into the discharge of the treated effluent water from the LGAC system and liquid ammonia will be injected thereafter downstream. To overcome the higher system pressure in the treated effluent water from LGAC system, stand-by metering pumps are utilized for each liquid.

The chlorine tank will be approximately 8 feet in diameter by 13 feet tall storing 5,000 gallons of sodium hypochlorite. The second tank will be approximately 6 feet in diameter by 10 feet tall storing 2,000 gallons of ammonia. The two tanks will be located on the north side of the treatment pad, at the vicinity of the effluent line, and will occupy an area of approximately 30 by 40 feet. Because chlorine degrades with direct sunlight, a protective roof will be constructed above the tank. As a safeguard for the liquid ammonia, the roof will also extend over the liquid ammonia tank. The tanks will be filled by a chemical delivery truck once every two to three weeks. Usage rates will depend on treatment production.

2.4 Production Wells Rehabilitation

As mentioned earlier, the expected total flowrate for the extracted groundwater from the four wells is 7,000 gpm. As a part of the groundwater remediation effort, the wells will be rehabilitated to a condition that can supply the appropriate flowrates. A work plan for this rehabilitation effort will be submitted to the PWP for review. The required permits from the City’s building department and any other departments will be obtained prior to mobilization to the field. The estimated duration for rehabilitation of each well is 30 days. During the rehabilitation activities, the access road to wells 52 and Ventura will not be blocked by the heavy equipment used for this task. A final well development will be conducted just prior to startup of the treatment system.

Wastes will include purge water and sediment recovered from the well cleaning activities (e.g. biofouling and mineral encrustation removed from the well casing); purge water from well development and testing; initial well development is estimated to produce ~150,000 gallons/well of water and final well rehabilitation and testing is estimated to produce ~3 to 3.5M gallons/well. The water from initial development will be stored in the Baker tanks and shipped off site for disposal. The produced water during the well rehabilitation activities will be treated and discharged into the Arroyo-Seco spreading basins. The existing 30-inch pipeline along the Windsor Avenue will be used to transfer the water to the basins.

Heavy equipment will include a crane to remove pump equipment at wells which still have pumps installed and a flatbed trailer to haul pump equipment removed from these same wells (3 days per well); a 5-ton diesel engine truck will be used to clean the wells, this may take two weeks or more with the truck being onsite 4-6 days; a 10-passenger sized van will be onsite several days throughout the process to perform video logging; following pump removal.

3.0 INITIAL STUDY

The Draft Initial Study Report, prepared in compliance with the State of California Environmental Quality Act (CEQA) Guidelines, does not identify any adverse environmental impacts due to construction of this treatment system.

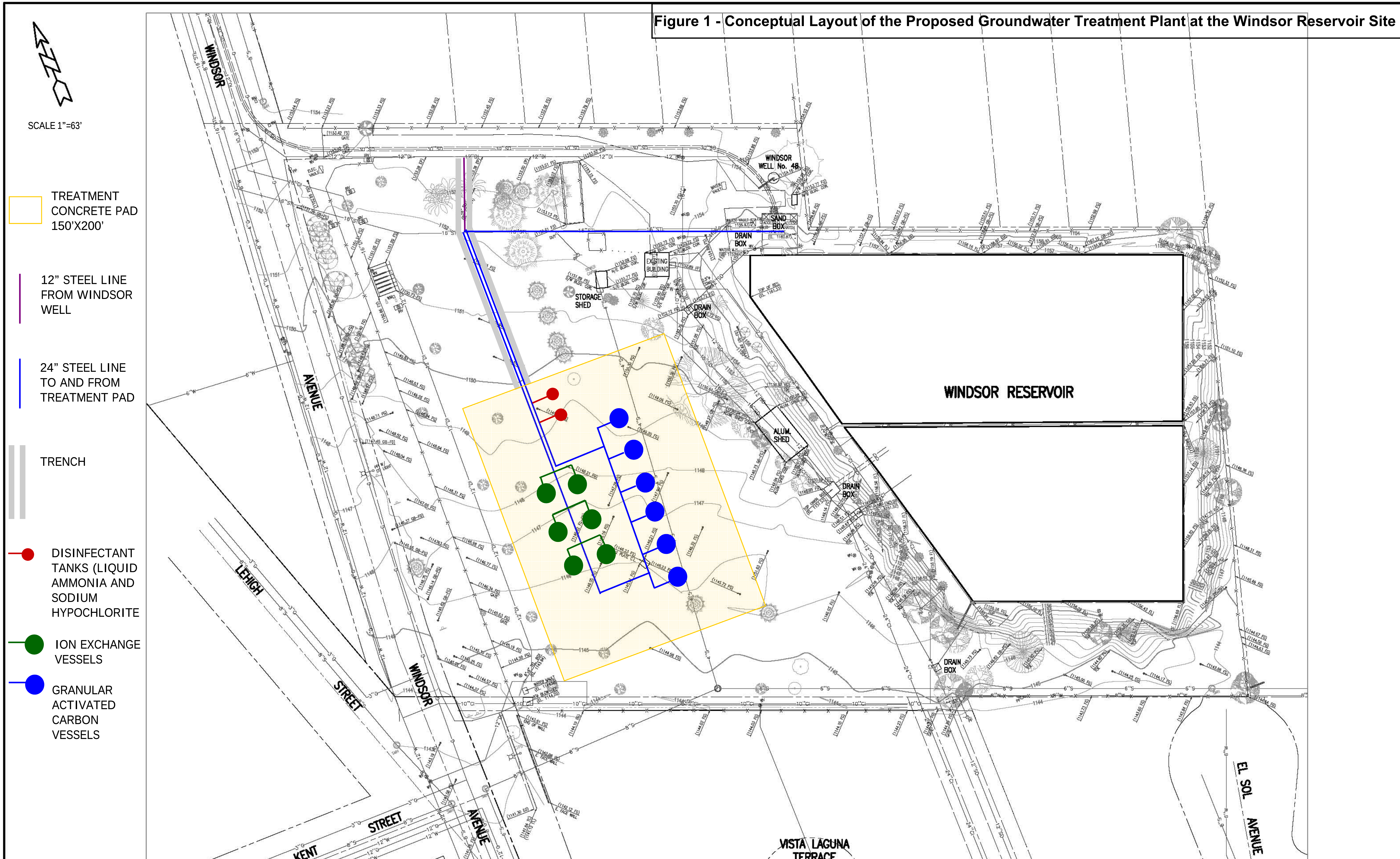


Figure 1 - Conceptual Layout of the Proposed Groundwater Treatment Plant at the Windsor Reservoir Site

1-800-227-2600 UNDERGROUND SERVICE ALERT
DIGALERT
PLAY IT SAFE. DIAL BEFORE YOU DIG! AT LEAST TWO WORKING DAYS PRIOR TO EXCAVATING

REFERENCES

NO.	DESCRIPTION	APP.	DATE	NO.	DESCRIPTION	APP.	DATE

REGISTERED PROFESSIONAL ENGINEER W. DAVID BYRUM No. 43296 Exp. 03/31/06 CIVIL STATE OF CALIFORNIA

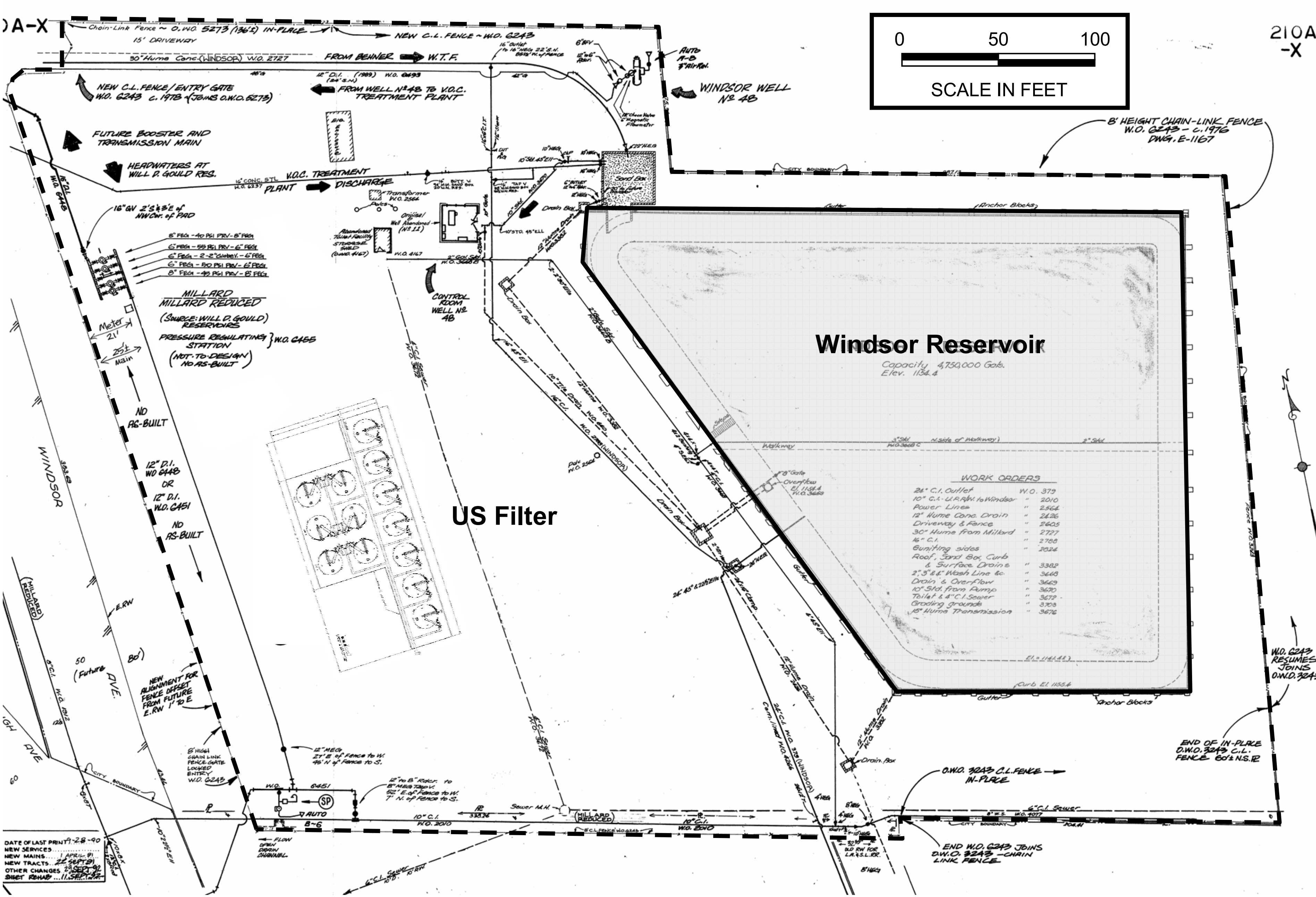
APPROVED BY:
CIVILTEC ENGINEERING, INC. 43296 RCE DATE
APPROVED BY:
(CITY OR AGENCY) DATE

PLANS PREPARED BY: General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying
CIVILTEC engineering inc. 118 West Lime Avenue Monrovia, Ca. 91016 Phone: (626) 357-0588 Fax: (626) 303-7957

DESIGNED BY XX
DRAWN BY XX
CHECKED BY XX

Battelle
Windsor Reservoir Site - Topographic Pla
PASADENA, CALIFORNIA
DATE: 6-28-05 SHEET: 1 OF 1

Appendix 1
Proposed Conceptual Designs by the Vendor



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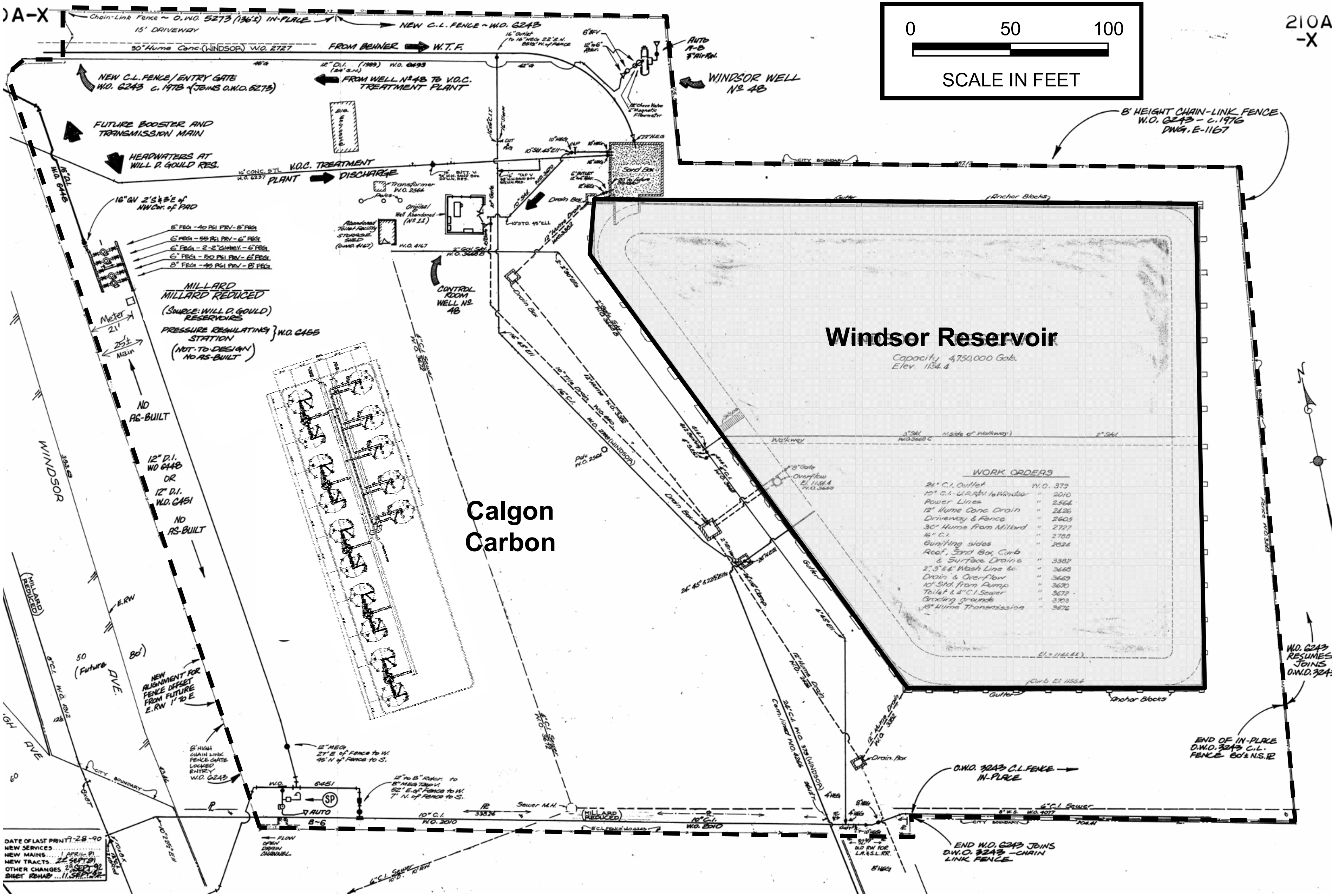
50
100
SCALE IN FEET
Windsor Reservoir
Capacity 4,750,000 Gals.
Elev. 1134.4
US Filter
WINDSOR WELL Nº 48
8' HEIGHT CHAIN-LINK FENCE W.O. 6243 – c.1976 DWG. E-1167
NEW C.L. FENCE ~ W.O. 6243
FROM BEHNER W.T.F.
FROM WELL Nº 48 TO V.O.C. TREATMENT PLANT
NEW C.L. FENCE/ENTRY GATE W.O. 6243 c. 1978 (JOINS O.W.O. 5273)
FUTURE BOOSTER AND TRANSMISSION MAIN
HEADWATERS AT WILL D. GOULD RES.
V.O.C. TREATMENT PLANT DISCHARGE
MILLARD
MILLARD REDUCED
(SOURCE: WILL D. GOULD) RESERVOIRS
PRESSURE REGULATING STATION W.O. 6455
(NOT-TO-DESIGN NO AS-BUILT)
CONTROL ROOM WELL Nº 48
NO AS-BUILT
12" D.I. WO 6448 OR 12" D.I. W.O. 6451
WINDSOR
AVE.
NEW ALIGNMENT FOR FENCE OFFSET FROM FUTURE E.RW 1' TO E
WORK ORDERS
O.W.O. 3243 C.L. FENCE IN-PLACE
END W.O. 6243 JOINS O.W.O. 3243 – CHAIN LINK FENCE
END OF IN-PLACE O.W.O. 3243 C.L. FENCE
W.O. 6243 RESUMES JOINS O.W.O. 3243
DATE OF LAST PRINT 9-28-90



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Chain-Link Fence ~ O.W.O. 5273 (136'±) IN-PLACE
NEW C.L. FENCE ~ W.O. 6243
15' DRIVEWAY
30" Hume Conc. (WINDSOR) W.O. 2727
FROM BEHNER W.T.F.
NEW C.L. FENCE/ENTRY GATE W.O. 6243 c. 1978 (JOINS O.W.O. 5273)
FROM WELL Nº48 TO V.O.C. TREATMENT PLANT
FUTURE BOOSTER AND TRANSMISSION MAIN
HEADWATERS AT WILL D. GOULD RES.
V.O.C. TREATMENT PLANT DISCHARGE
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CONTROL ROOM WELL Nº 48
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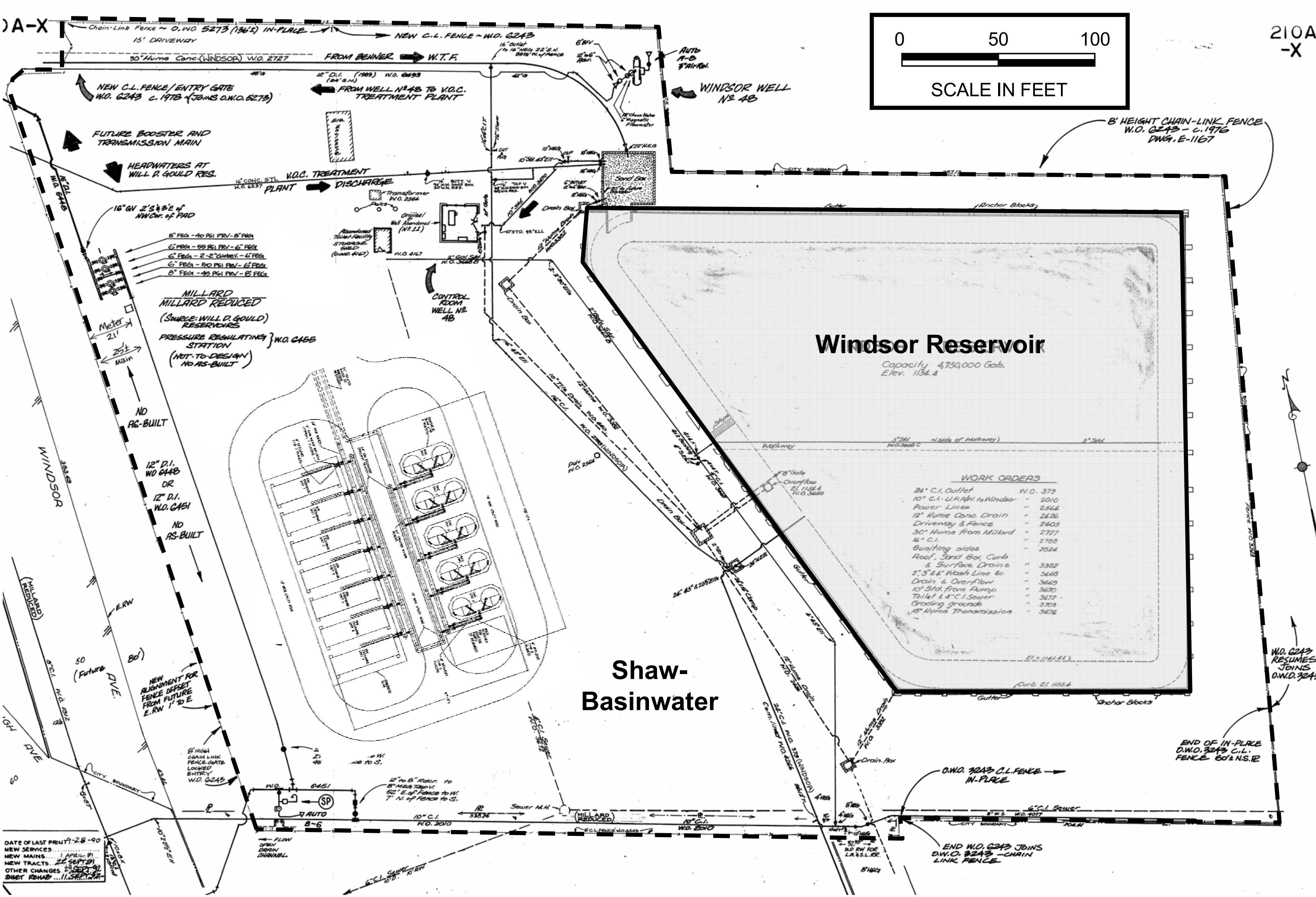
12" D.I. W.O 6448 OR 12" D.I. W.O. 6451
WINDSOR
AVE.
NEW ALIGNMENT FOR FENCE OFFSET FROM FUTURE E.RW 1' TO E
WORK ORDERS
24" C.I. Outlet W.O. 379
10" C.I.-U.P.R/W. to Windsor 2010
Power Lines 2564
12" Hume Conc. Drain 2426
Driveway & Fence 2605
30" Hume from Millard 2727
16" C.I. 2788
Guniting sides 3024
Roof, Sand Box, Curb & Surface Drains 3382
2", 3" & 4" Wash Line &c. 3668
Drain & Overflow 3669
10" Std. from Pump 3670
Toilet & 8" C.I. Sewer 3672
Grading grounds 3708
15" Hume Transmission 3676
Walkway
Gutter
Anchor Blocks
O.W.O. 3243 C.L. FENCE IN-PLACE
END OF IN-PLACE O.W.O. 3243 C.L. FENCE 60'± N.S.R.
END W.O. 6243 JOINS O.W.O. 3243 – CHAIN LINK FENCE
W.O. 6243 RESUMES JOINS O.W.O. 3243
8' HIGH CHAIN LINK FENCE GATE LOCKED ENTRY W.O. 6243
DATE OF LAST PRINT 9-28-90
NEW SERVICES
NEW MAINS 1 APRIL 91
NEW TRACTS 22 SEPT 91
OTHER CHANGES 28 SEPT 92
SHEET REHAB 11 SEPT 92


0 50 100
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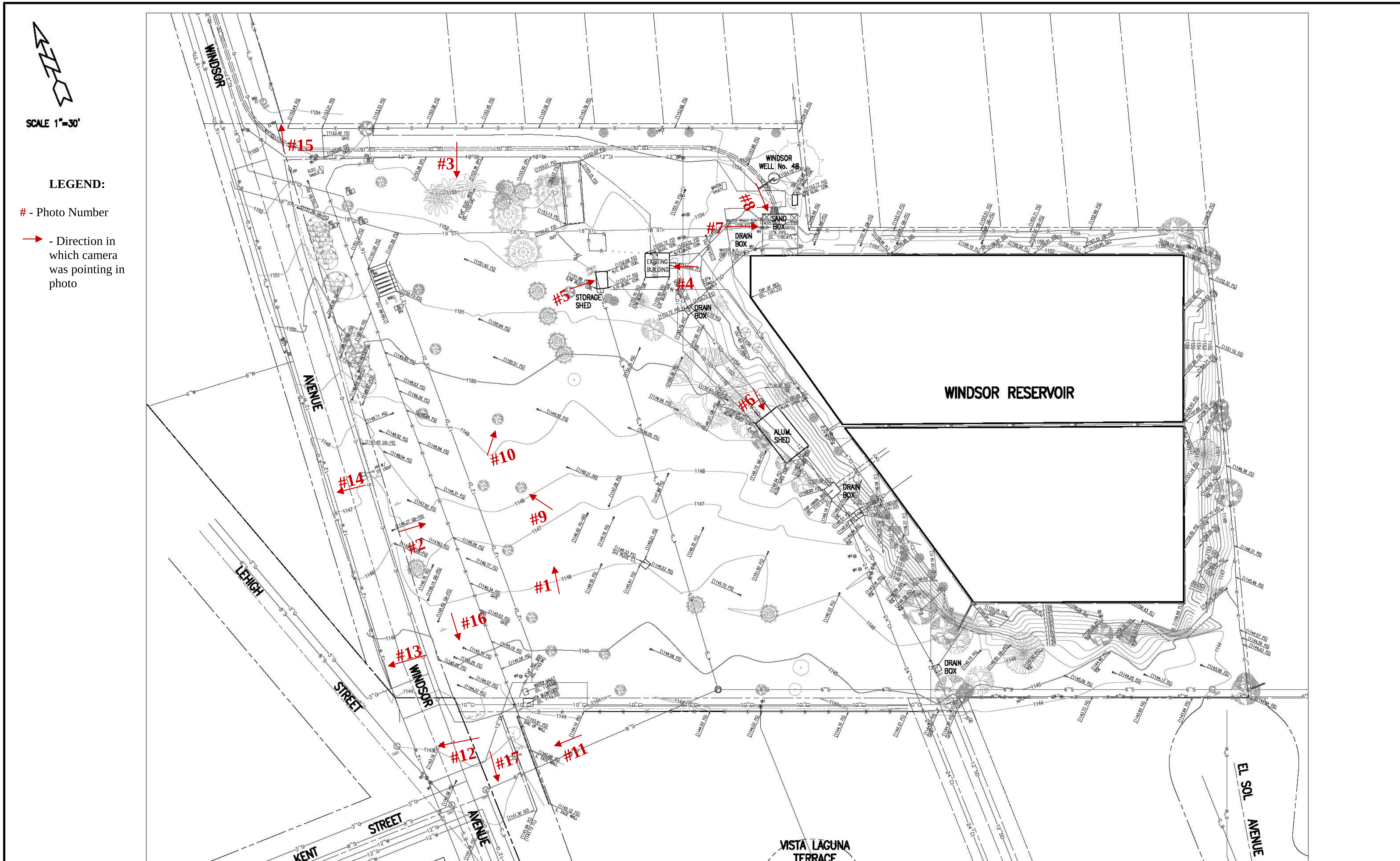
Windsor Reservoir
Capacity 4,750,000 Gals.
Elev. 1134.4
Shaw-
Basinwater
WINDSOR WELL Nº 48
8' HEIGHT CHAIN-LINK FENCE W.O. 6243 – c.1976 DWG. E-1167
NEW C.L. FENCE ~ W.O. 6243
FROM BEHNER W.T.F.
FROM WELL Nº48 TO V.O.C. TREATMENT PLANT
FUTURE BOOSTER AND TRANSMISSION MAIN
HEADWATERS AT WILL D. GOULD RES.
V.O.C. TREATMENT PLANT DISCHARGE
MILLARD REDUCED
PRESSURE REGULATING STATION
CONTROL ROOM WELL Nº 48
NO AS-BUILT
WINDSOR
AVE.
WORK ORDERS
24" C.I. Outlet W.O. 379
10" C.I. U.P.R/W. to Windsor 2010
Power Lines 2564
12" Hume Conc. Drain 2426
Driveway & Fence 2605
30" Hume from Millard 2727
16" C.I. 2788
Guniting sides 3024
Roof, Sand Box, Curb & Surface Drains 3382
2", 3" & 4" Wash Line &c. 3668
Drain & Overflow 3669
10" Std. from Pump 3670
Toilet & 4" C.I. Sewer 3672
Grading grounds 3708
15" Hume Transmission 3676
END OF IN-PLACE O.W.O. 3243 C.L. FENCE
O.W.O. 3243 C.L. FENCE IN-PLACE
END W.O. 6243 JOINS O.W.O. 3243 – CHAIN LINK FENCE
W.O. 6243 RESUMES JOINS O.W.O. 3243

Appendix 2
Site Photographs



1-800-227-2600 UNDERGROUND SERVICE ALERT
DIG ALERT
PLAY IT SAFE ... AT LEAST TWO

REFERENCES							
NO.	DESCRIPTION	APP.	DATE	NO.	DESCRIPTION	APP.	DATE

REGISTERED PROFESSIONAL ENGINEER W. DAVID BYRUM No. 43296 Exp. 03/31/06 CIVIL

APPROVED BY:

CIVILTEC ENGINEERING, INC. 43296 RCE DATE

APPROVED BY:

PLANS PREPARED BY: General Civil, Municipal, Water and Wastewater Engineering, Planning, Construction Management and Surveying

CIVILTEC 118 West Lime Avenue Monrovia, Ca. 91016 Phone (626) 357-0588

DESIGNED BY XX

DRAWN BY XX

CHECKED BY

Battelle

Windsor Reservoir Site - Topographic Pla

PASADENA, CALIFORNIA

1

2

2696 Windsor Avenue, Altadena

3

Looking to south from Driveway #1 of site

4

Building A – Existing Building

5

Building B – Storage Shed

6

Building C – Aluminum Shed

7

8

Building D – Sand Box

9

Tree #1

#10

Tree #2

11

Residential area looking Southwest from the site toward Windsor Avenue

12

13

2600-2700 Block of Windsor Avenue

(across street to the west from site)

14

15

Residential Area to the north of the site

16

Residential Area to
the south of the site

17