DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
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SAN DIEGO, CA 92132-5190

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Ser JE30.MQ.0555
August 18, 2011

Ms. Alison Oakley
DoD Branch Supervisor
Bureau of Corrective Actions
Nevada Division of Environmental Protection
901 S. Stewart Street, Suite 4001
Carson City, NV 89701-5249

Dear Ms. Oakley,

SUBJECT: REMEDIAL PROJECT MANAGER FINAL MEETING MINUTES, NAVAL AIR STATION FALLON, FALLON, NV

Enclosed is one copy of the final meeting minutes from the May 26, 2011 Remedial Project Manager Meeting for the Installation Restoration Program Site 16 at Naval Air Station (NAS) Fallon, Fallon, NV.

Please call me at (619)-532-4176 if you have any questions regarding this submittal.

Sincerely,

R. MICHAEL QUESADA
Lead Remedial Project Manager
By direction of the
Commanding Officer

Enclosure: Final Remedial Project Manager Meeting Minutes, Naval Air Station Fallon, Fallon, NV dated May 2011.

Copy to:
Debora Waxer, NAS Fallon
Becky Kurtz, NAS Fallon
Barbara DeAngelis, Tetra Tech EM Inc.
Scott Smale, Nevada Division of Environmental Protection
Ben Latham, Tetra Tech EM Inc.
David Berestka, Tetra Tech EM Inc.
NAVFAC Southwest, Admin Record

REMEDIAL PROJECT MANAGER MEETING

FINAL MEETING MINUTES

NAVAL AIR STATION FALLON

MAY 26, 2011

Attendees	**Affiliation**
Mike Quesada	Naval Facilities Engineering Command, Southwest (NAVFAC SW)
Scott Smale	Nevada Division of Environmental Protection (NDEP)
Debora Waxer	Naval Air Station (NAS) Fallon
Becky Kurtz	NAS Fallon
Michael Klapec	NAS Fallon
David Berestka	Tetra Tech Inc. (Tetra Tech)
Ben Latham	Tetra Tech

MEETING SUMMARY

A remedial project manager (RPM) meeting for NAS Fallon was held at the office of the Nevada Division of Environmental Protection (NDEP), Bureau of Corrective Actions, in Carson City, Nevada, on Thursday May 26, 2011. The purpose of the meeting was to discuss the proposed methodology for the Time Critical Removal Action (TCRA) at Installation Restoration (IR) Site 16.

The following presentation materials are included in an attachment:

- PowerPoint slide presentation titled "Naval Air Station Fallon Site 16 Time Critical Removal Action Remedial Project Managers Meeting"

Mr. Mike Quesada began the meeting with introductions and a general overview of the proposed TCRA as seen in slides 1 through 5 of the attached presentation.

The proposed TCRA consists of a two phased approach that consists of 1) partially filling a portion of the E4X drain and 2) injection of ozone-hydrogen peroxide to remediate PCE and TCE. Mr. Quesada noted that the chlorinated solvent plume consists of two plumes. The larger, low concentration northwest plume is west of the E4X drain and the smaller, but more concentrated southeast plume is immediately east and adjacent to the E4X drain. The Navy has been collecting surface water samples for fifteen years from the E4X Drain and the Lower Diagonal Drain and no chlorinated solvents have been detected.

Mr. Quesada noted that the calculated volume of the chlorinated solvent is approximately 2.5 gallons with the majority of the contaminant confined to a small area adjacent to the E4X drain in the southeast plume.

There appears to be slow natural degradation occurring in both the plumes, and the goal of the TCRA is to target and remediate the highest PCE and TCE concentrations in groundwater adjacent to the E4X drain to reduce the potential for migration of contaminated groundwater to surface water. Remaining low-concentrations of chlorinated solvents that may remain after treatment in both the northwest and southeast plumes would be addressed via monitored natural attenuation.

Mr. Berestka discussed the groundwater treatment by ozone-peroxide injection as seen in slides 6 through 12 of the attached presentation.

A variety of potential remedial alternatives for the treatment of the solvents in groundwater were investigated and treatment by ozone-peroxide injection was selected because it can more efficiently treat the groundwater contaminant concentrations and is a more cost effective approach.

Mr. Berestka explained the ozone-peroxide treatment technology and process and the chemical reactions that will occur and oxidize the solvents present. The specifics of the system implementation at Site 16 was presented including further plume delineation and baseline sampling as part of the well drilling activities to more definitively establish the perimeter of the plume and the treatment area. The estimation of the radius of influence (ROI) for the ozone-peroxide system was discussed and is based on the air sparge (AS)/soil vapor extraction (SVE) pilot test conducted in October 2009 and discussions with ozone-peroxide injection system vendors. Field operation and system operation monitoring was also presented along with system shutdown criteria, which will occur when concentrations of chlorinated solvents are reduced to regulatory level (such as MCLs) or when contaminant mass removal reaches an asymptotic rate and operation is no longer cost effective.

Mr. Smale asked why the Navy is using contaminant mass calculations and asymptotic conditions for cleanup endpoints, whereas NDEP uses groundwater concentrations as its regulatory standard. Mr. Berestka responded that contaminant mass was calculated to (1) help ascertain a possible initial release mechanism (i.e. the volume of PCE is small enough that the initial release was likely a single point source), and (2) demonstrate that the majority (approximately 85 percent) of the contaminants are in the southeastern plume. For remedial goals, Mr. Berestka stated that while meeting MCLs would be ideal and may be achievable, it is not the goal of the TCRA, but that the goal of the TCRA is removal of contaminant mass and reduction in concentration to levels where MNA is feasible.

Mr. Smale asked if there was a collocated petroleum hydrocarbon plume. Mr. Berestka stated that there is no known hydrocarbon plume co-located with the chlorinated solvent plume. The hydrocarbon plume is 400 feet west and sidegradient of the chlorinated solvent plume. Mr. Smale requested that a brief explanation of the hydrocarbon plume at IR Site 16 be included in the Action Memo. Mr. Quesada agreed that a brief discussion can be added to the Action Memo discussing the location of the hydrocarbon plume to the Action Memo. Mr. Berestka reiterated that the existing hydrocarbon plume is sidegradient of the delineated chlorinated solvent plume and the designed system will not have an effect. However, since this system is injecting a strong oxidant that if some residual petroleum was in the vicinity, the hydrocarbon would be oxidized and remediated as well.

Mr. Smale asked if the injection of the oxidants will affect the naturally occurring organics that are prevalent throughout the region. Mr. Berestka stated that f_{oc} samples from Site 16 were collected and are quite low (TT16-SB11 had an f_{oc} of 0.00039 gr/gr), but there will be naturally occurring soil oxidant demand, both from organic and inorganic compounds. Ozone/peroxide injection systems are well-suited to addressing this potential problem as the system continuously injects oxidant throughout the remediation to overcome the soil oxidant demand. In direct push oxidant injections, such as sodium

permanganate, potassium permanganate, and persulfate, much of the oxidant is consumed by the soil oxidant demand, often required subsequent mobilizations and injections.

Mr. Latham discussed the raising of the channel bed of the E4X Drain as seen in slides 13 through 21, which will occur before operation of the ozone-peroxide groundwater injection system. The purpose of the E4X drain modification is to eliminate the groundwater to surface water migration pathway. The E4X drain modification will be conducted before the groundwater remediation to reduce the remote possibility of migration of contaminants or oxidants to E4X Drain surface water during remediation.

The historical background of the E4X Drain was presented along with the alternatives that were investigated for preventing groundwater contamination from entering the drain. Raising the channel bed by partial filling along the drain was selected because it is relatively easily implemented and more cost effective over time compared to the other available alternatives. Additionally, other alternatives have significant risks associated with standing water, including flooding of runway and taxiways and the habitat created by standing water, which increases bird air strike hazard (BASH) risks associated with the planes use of nearby runways.

Mr. Latham summarized the intent and implementation of the drain modification. The intent of the drain modification is to raise the base of the E4X Drain in the vicinity of the groundwater plume to an elevation where the drain will be dry except during storm events. The base of the drain will be raised above the high groundwater elevation thus preventing groundwater from entering the drain. Additionally, the modified elevation of the drain will prevent waste water treatment plant (WWTP) discharge and Lower Diagonal Drain water from filling the portion of the channel in the vicinity of the groundwater solvent plume.

Analysis completed to demonstrate that the modified channel conditions would not result in flooding was explained. The analysis completed included assessment of the peak water levels anticipated in the drain resulting from a 25-year, 24-hour storm event. During this storm event the peak water height anticipated in the drain would be about 1.2 feet and about 2-feet of excess capacity would remain in the drain. Analysis of headwater flooding at the culvert was also summarized, which is not anticipated to be a risk.

Mr. Quesada presented the anticipated schedule for project implementation (slide 22) and treatment system operation, which concluded the presentation.

Mr. Smale asked if there any evidence of the culvert having flooding problems. Mr. Latham responded that there is no evidence of overtopping the banks upgradient of the culvert. It was further noted that the height of the banks in the vicinity of the culvert are the same as the other portions of the drain, and if water were to back up behind the culvert it would not likely overtop the banks. NAS Fallon representatives, Mr. Klapec in particular, stated that they are not aware of any flooding issues associated with the culvert and that they will inquire with other NAS Fallon personnel familiar with the culvert and confirm that flooding has not occurred.

Mr. Smale asked if the partial filling of the drain will affect the current stormwater permit. Mr. Klapec responded that the minor modification of the drain proposed would not impact the conditions of the permit, which is a base-wide permit. The conditions of the stormwater permit will be reviewed in the subsequent weeks as part of the ongoing communications with the Bureau of Reclamation (BOR) in relation to future use and management of the drain.

Mr. Smale stated that the Underground Injection Control Program (UIC) will need to be notified of the proposed project to inject ozone-peroxide. The UIC requires proper permitting for injection into

groundwater. Mr. Quesada stated that under CERCLA the Navy is exempt from obtaining permits, however, the Navy can draft a letter stating the intent of the project as the Navy did with Nevada Bureau of Air pollution Control for the Site 16 soil vapor extraction pilot test. Mr. Smale agreed that coordination with the UIC will be required and the NDEP will help coordinate with the UIC.

After the presentation for the Site 16 TCRA, Mr. Quesada stated that due to the delay in budget this year the Restoration Advisory Board Meeting will have to be postponed to the late Summer/early Fall.

Mr. Smale stated that a new NDEP project manager has been selected and will be available in late June. Mr. Quesada suggested a RPM meeting in mid July to familiarize the new NDEP project manager with all the IR sites.

ATTACHMENT 1
PRESENTATION SLIDES

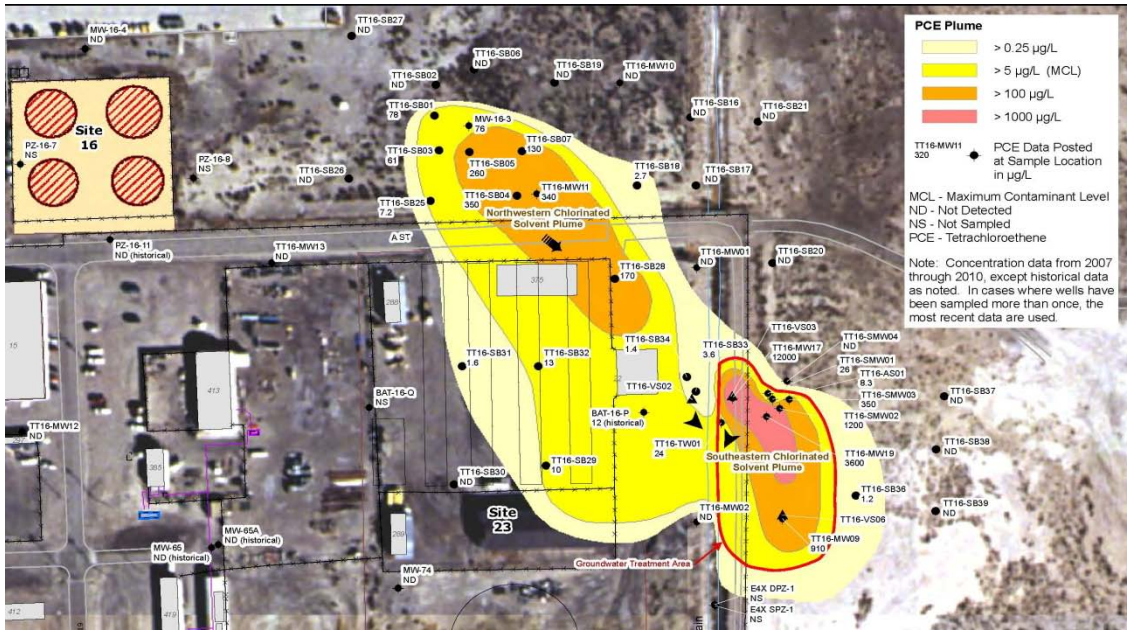
Naval Air Station Fallon
Site 16 Time Critical Removal Action
Remedial Project Managers Meeting

May 26, 2011

Mike Quesada
Remedial Project Manager
Naval Facilities Engineering Command, Southwest

Site 16 Time Critical Removal Action (TCRA)

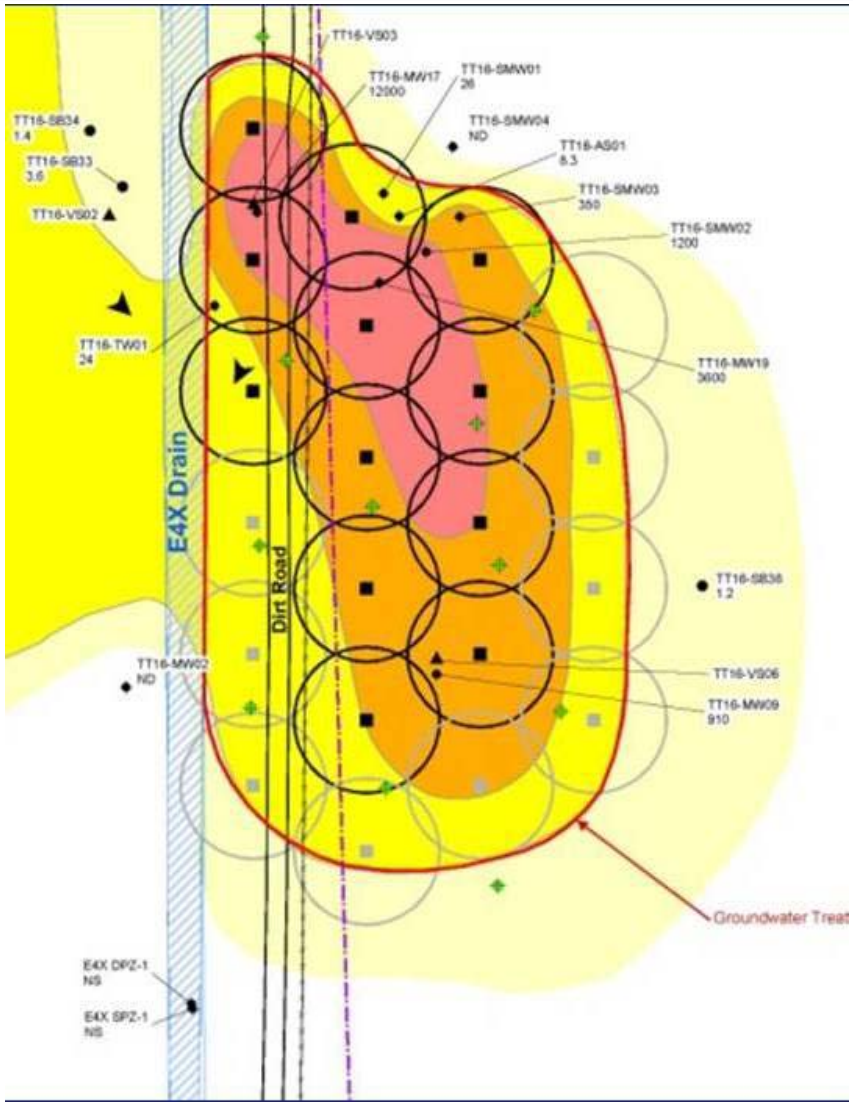
- **Installation Restoration Site 16**
  - –Old Fuel Farm
  - –Study area expanded; includes chlorinated solvent plumes
- **Very low volume estimate**
  - –2.5 gal PCE; 0.4 gal TCE
  - –No chlorinated solvents detected in surface water over 15 years of sampling



- **Interim Removal Action or TCRA:**
  - –The Navy has elected to implement a proactive interim removal action (TCRA)
  - –Target “hot spot” to complement natural degradation of lower concentrations
  - –Removal action begins within 6 months of planning

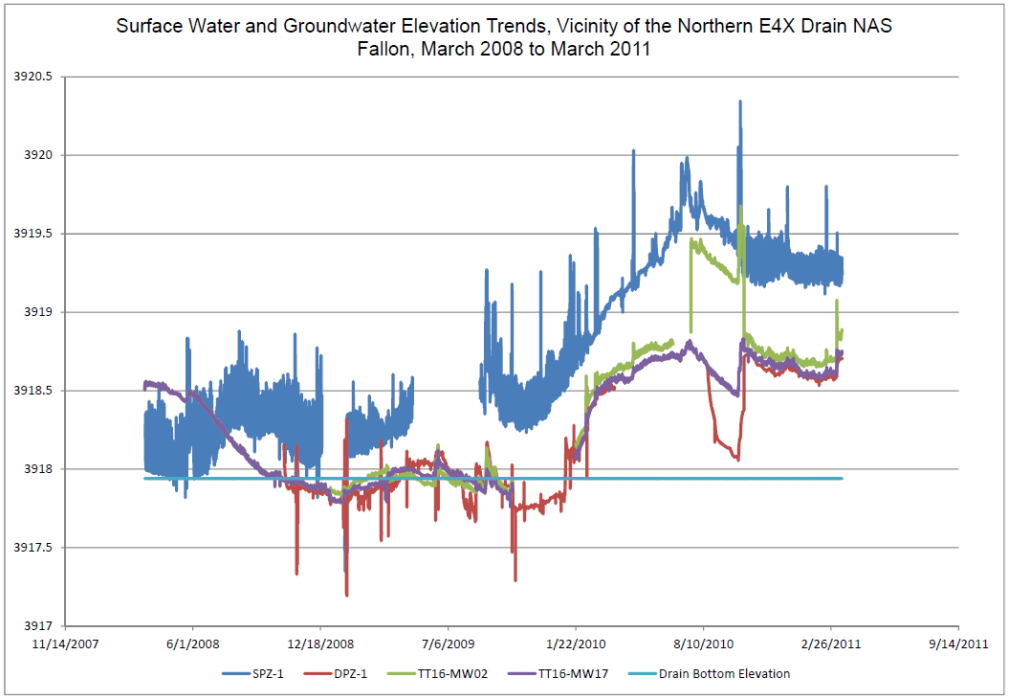
Chlorinated Solvent Plume Adjacent to the E4X Drain

- **Highest concentrations (red and orange areas) are downgradient of the E4X Drain.**
- **Partially fill the E4X Drain to prevent groundwater contamination from potentially entering.**
- **Remove highest concentration of chlorinated solvents using ozone-peroxide treatment to prevent all future risk of contamination from entering.**



Groundwater/Surface Water Interaction in E4X Drain

- **E4X Drain receives treated discharge from the WWTP.**
  - Average 225,000 gpd with maximum of 464,000 gpd
  - Permit allows for 750,000 gpd
- **Groundwater and surface water in the drain interact differently over different periods.**
  - Surface water presence from WWTP discharge and precipitation
  - Groundwater relative to drain bed elevation
  - Always losing under conditions



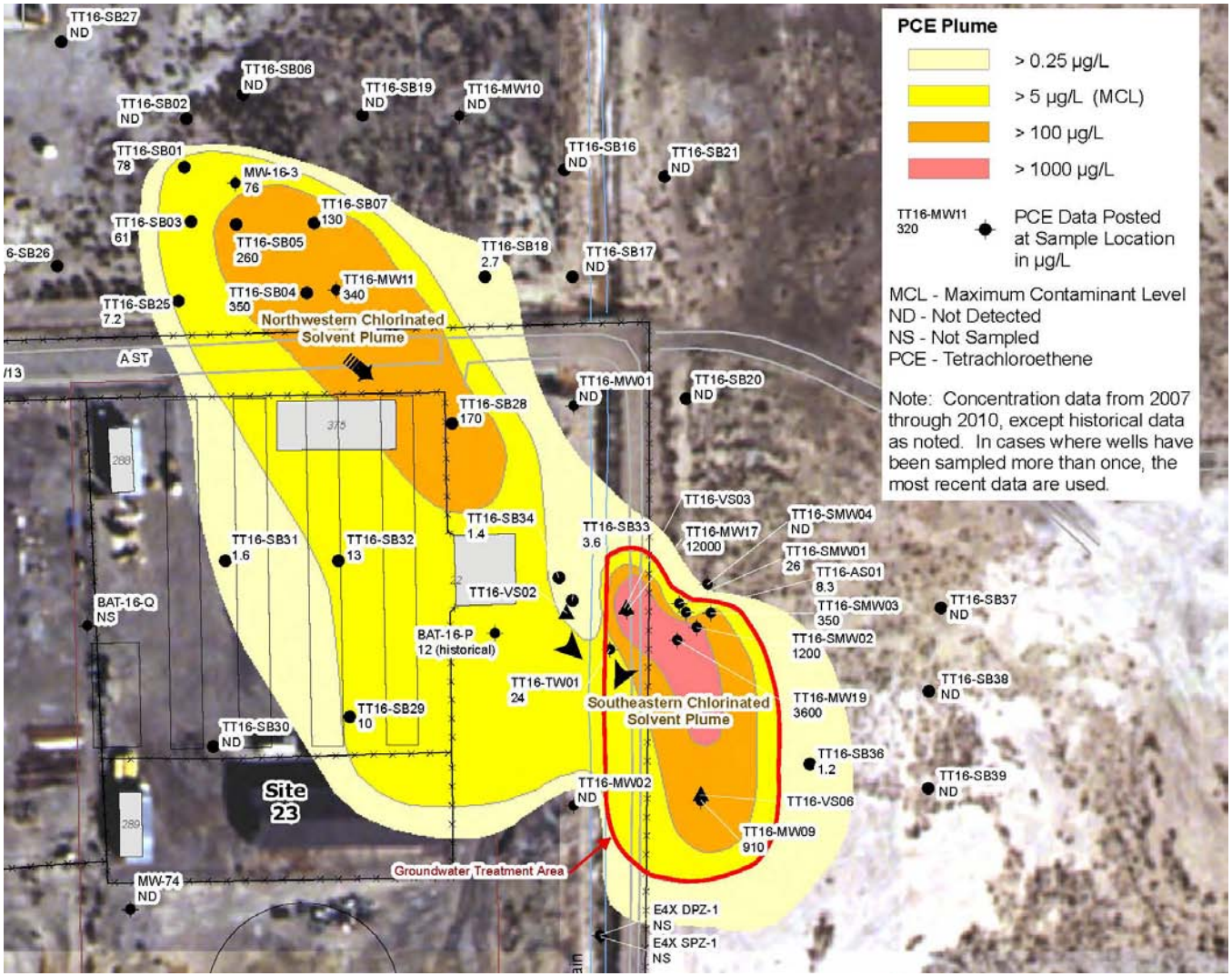
Surface Water Sampling History

- **Surface water in E4X Drain sampled from 1996 to 2003.**
  - –Collected before confluence with Lower Diagonal
  - –No chlorinated solvents detected.
- **Surface water samples collected from Lower Diagonal Drain 2006 to 2011**
  - –Up and downgradient of confluence with E4X Drain
  - –No chlorinated solvents detected.
- **Low probability of the low level GW solvents entering the drain**

E4X Surface Water Sampling

Date	Location	Chlorinated Solvents
Spring 1996	E4X Drain	Not Detected
Spring 1997	E4X Drain	Not Detected
Spring 1998	E4X Drain	Not Detected
Spring 1999	E4X Drain	Not Detected
Spring 2000	E4X Drain	Not Detected
Spring 2001	E4X Drain	Not Detected
Spring 2002	E4X Drain	Not Detected
Spring 2003	E4X Drain	Not Detected
Spring 2006	Lower Diagonal Drain	Not Detected
Spring 2007	Lower Diagonal Drain	Not Detected
Spring 2008	Lower Diagonal Drain	Not Detected
March 2009	Lower Diagonal Drain	Not Detected
October 2009	Lower Diagonal Drain	Not Detected
March 2010	Lower Diagonal Drain	Not Detected
June 2010	Lower Diagonal Drain	Not Detected
July 2010	Lower Diagonal Drain	Not Detected
August 2010	Lower Diagonal Drain	Not Detected
September 2010	Lower Diagonal Drain	Not Detected
October 2010	Lower Diagonal Drain	Not Detected
November 2010	Lower Diagonal Drain	Not Detected
December 2010	Lower Diagonal Drain	Not Detected
January 2011	Lower Diagonal Drain	Not Detected
February 2011	Lower Diagonal Drain	Not Detected
March 2011	Lower Diagonal Drain	Not Detected

Groundwater Treatment – PCE Plume



Groundwater Treatment Alternatives

- **Alternative 1: Ozone-Peroxide Injection**
  - Better distribution of oxidants in subsurface
  - Cost-effective

- **Alternative 2: Air Sparging/Soil Vapor Extraction**
  - Pilot test in 2009
  - SVE not effective; small radius of influence (ROI) and extraction of groundwater

- **Alternative 3: Zero-valent Iron (ZVI) Injection**
  - Distribution of ZVI may be difficult
  - Not as cost-effective

- **Alternative 4: Electrical Resistance Heating**
  - Expensive
  - Uses SVE to collect vapors; not effective

- **Anaerobic degradation (HRC) was not considered because of failed HRC pilot at Site 1 due to high sulfate concentrations.**

Ozone-Peroxide Injection

- **Ozone generated on-site**
- **Ozone and hydrogen peroxide injected into subsurface separately**
- **Ozone and hydrogen peroxide combine to create hydroxyl radicals:**

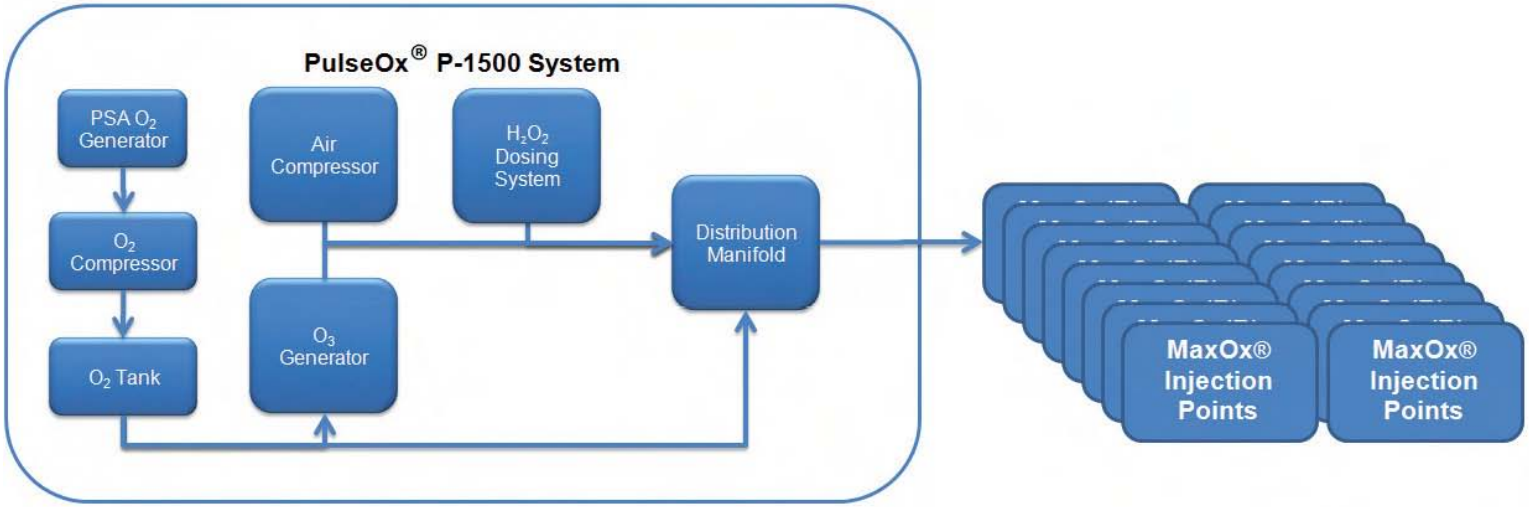
$$H_2O_2 + H_2O \longrightarrow HO_2^- + H_3O^+$$

$$O_3 + HO_2^- \longrightarrow OH\cdot + O_2^- + O_2$$

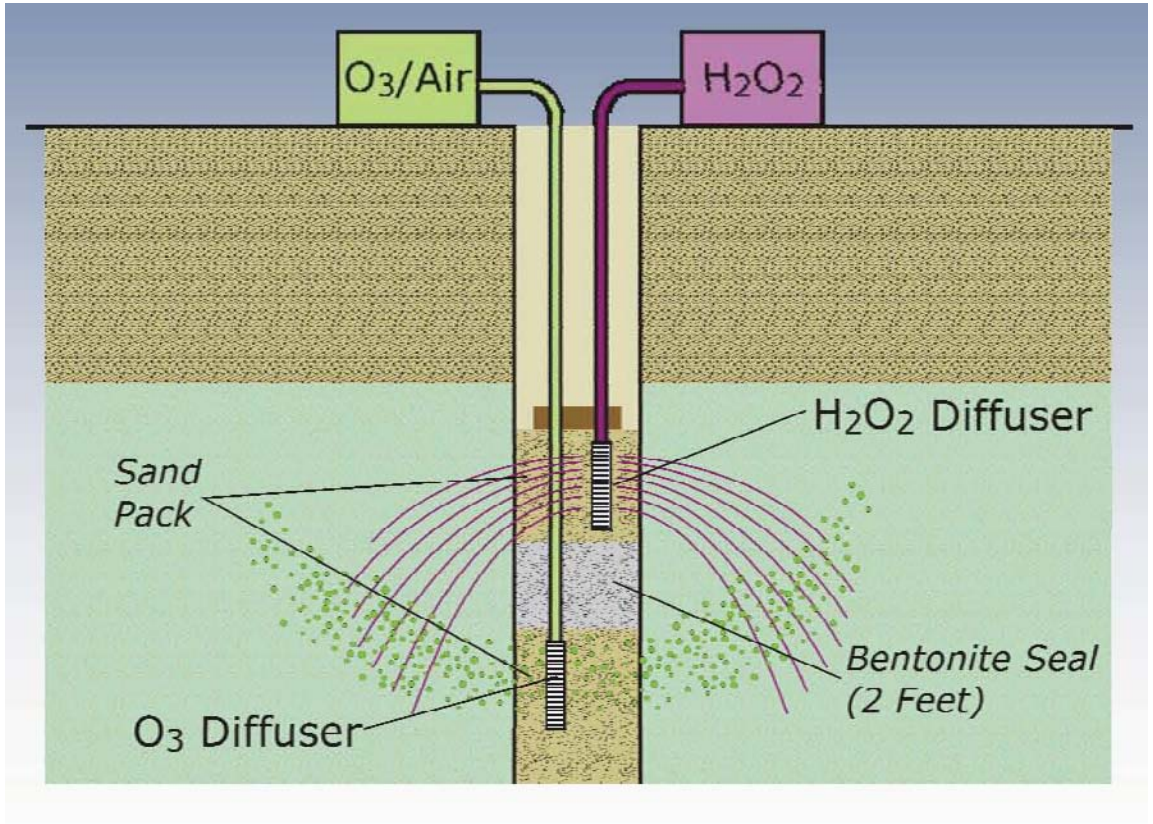
- **Hydroxyl radicals rapidly oxidize PCE, TCE, and other contaminants:**

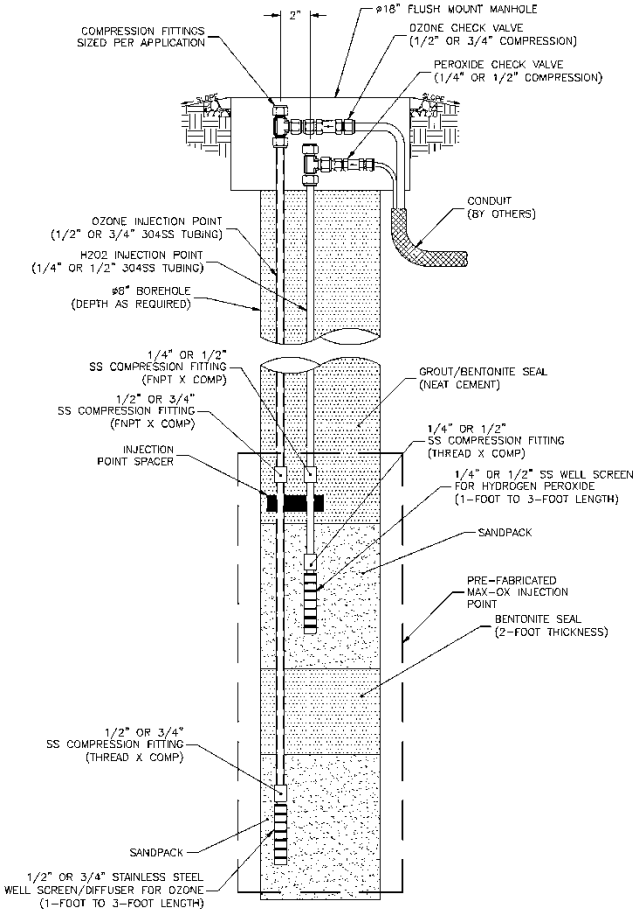
$$\underset{(TCE)}{C_2HCl_3} \xrightarrow[yields]{OH\cdot} CO_2 + H_2O + Cl^- \qquad (simplified)$$

PulseOx® Equipment Enclosure

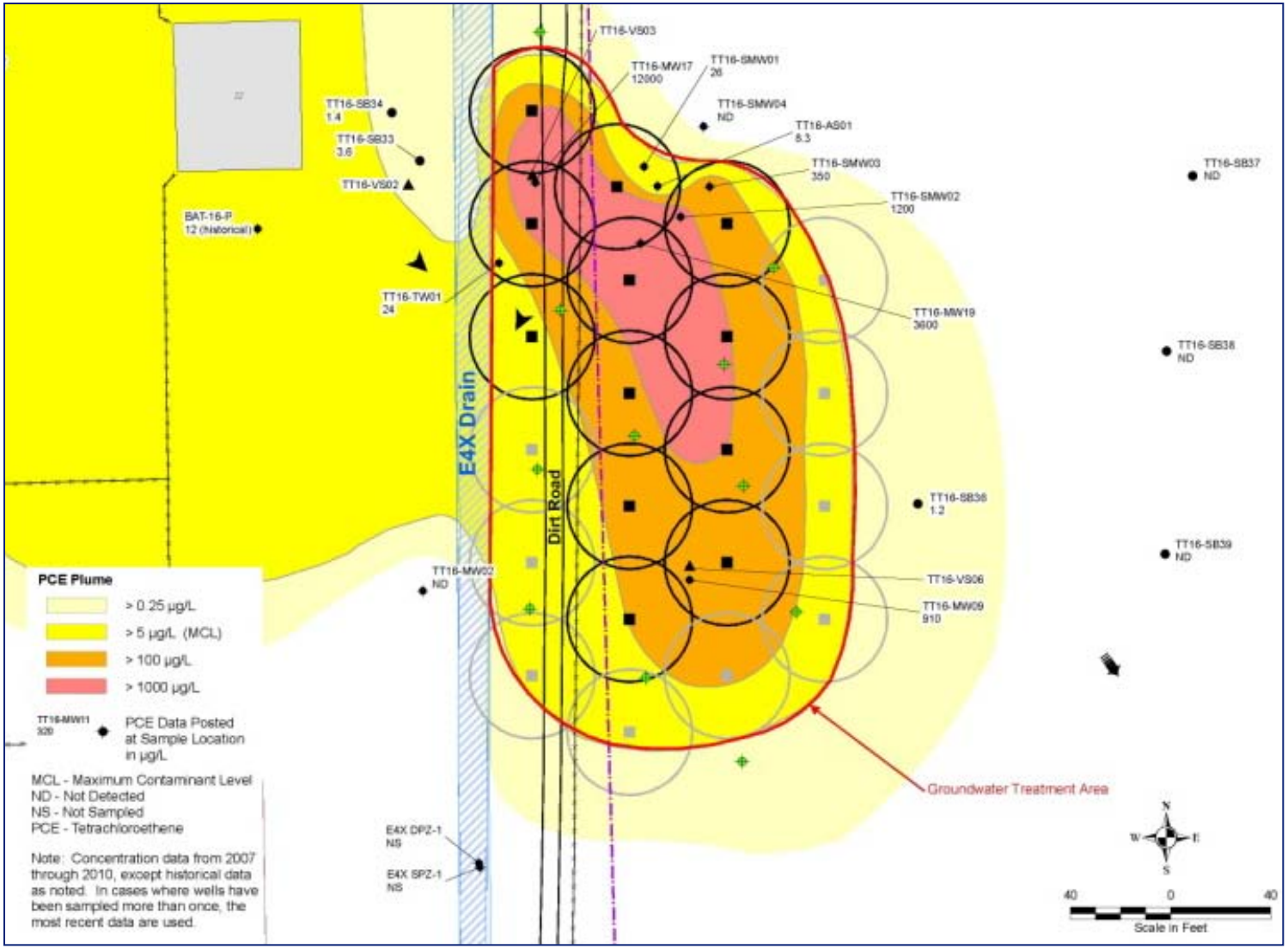


MaxOx® Injection Points





Layout of Injection Wells



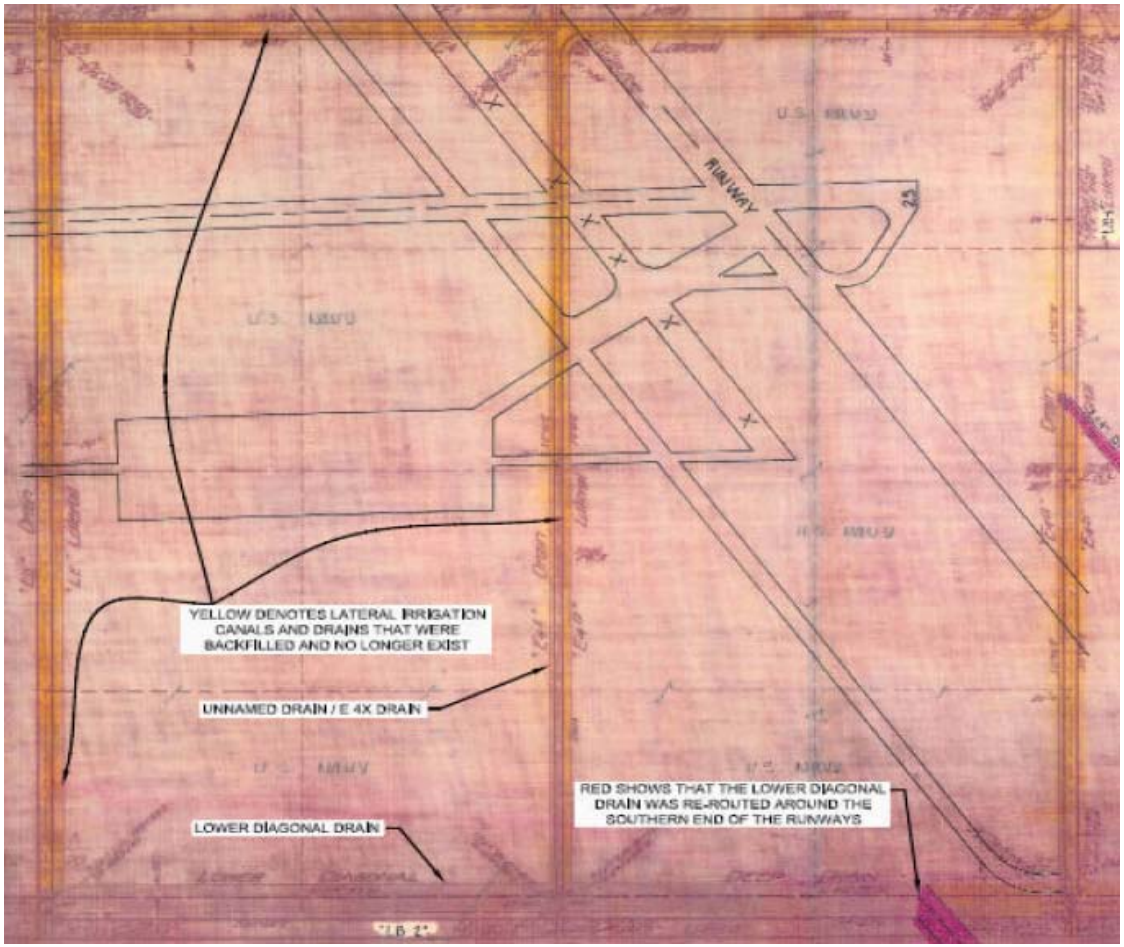
Groundwater Treatment

- **Collect groundwater samples and field parameters to monitor system performance**
  - Baseline sampling; direct installation of injection wells
  - Quarterly groundwater sampling
  - Measure field parameters at least monthly (more frequently at beginning of operation)

- **Expect 12 months of operation**
  - Shutdown if mass removal reaches asymptote
  - Shutdown if not cost-effective or sustainable

NAS Fallon E4X Drain History

- **Constructed as part of the Newlands Reclamation Act in 1926.**
  - E4X was an irrigation return drain.
- **NAS Fallon constructed in the 1940's.**
  - All irrigation water supply canals and many drains were filled
  - E4X Drain partly modified for stormwater drainage



E4X Drain Options

- **Alternative 1: Raise Channel Bed**
  - Prevent groundwater from entering drain
  - Prevent discharge from WWTP
  - Storm water flow unaffected
  - Easily implemented and cost effective

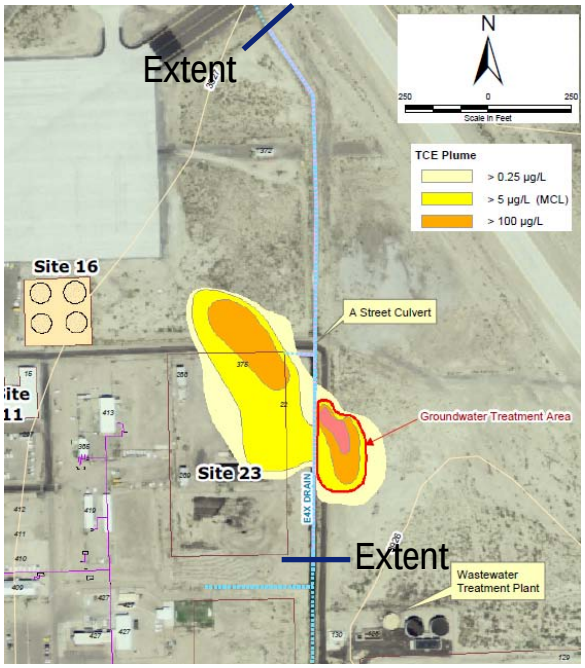
- **Alternative 2: Installation of Constant Head Weirs**
  - Surface water remain in channel at all times/losing stream
  - Easily implemented
  - Bird Airstrike Hazard (BASH)
  - Continual Monitoring
  - If surface water contamination discovered
    - Likely filling in of the drain, or
    - Treatment of surface water before discharge

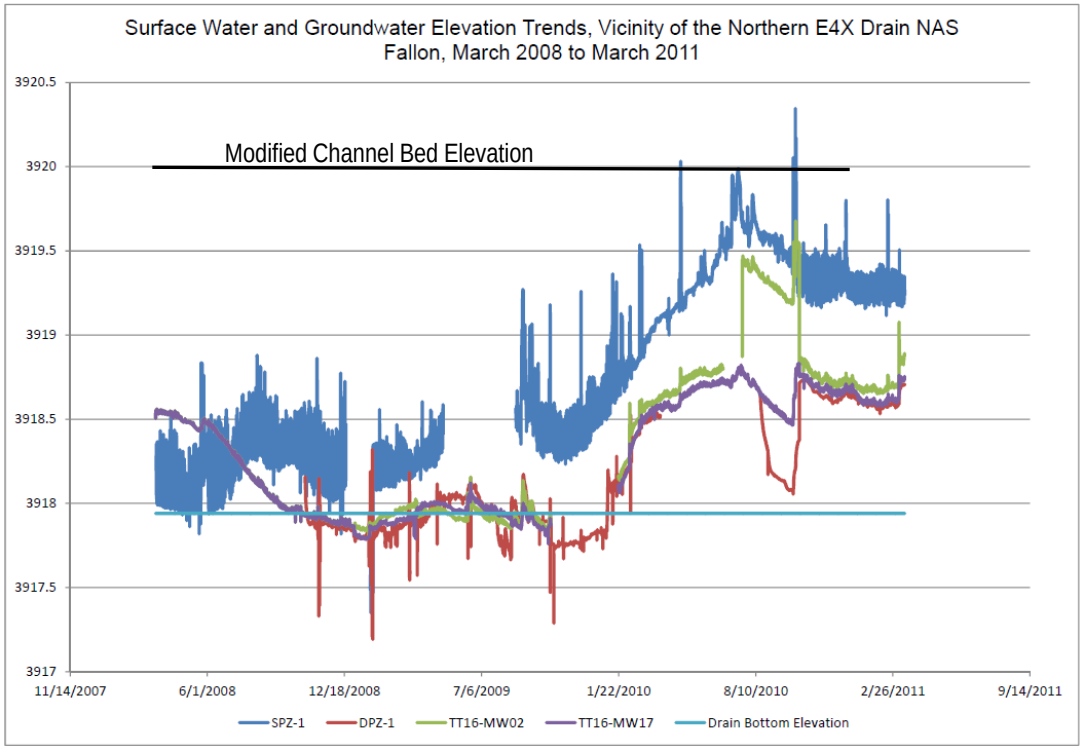
E4X Drain Options (continued)

- **Alternative 3: Complete filling of E4X Drain north of WWTP**
  - Prevents groundwater and stormwater from entering the Lower Diagonal Drain
  - BASH risk
  - No drainage of stormwater from airfield - flooded runways
  - Falls outside of CERCLA response
  - Cultural Resource implications
  - Necessary to construct new drainage or retention structures
  - Not easily implemented and not cost effective
- **Alternative 4: Concrete lining**
  - Continued drainage of storm water
  - Potential for groundwater seepage
  - Potential high O&M related costs over time – cracking, failure, replacement
  - Not easily implemented and not cost effective

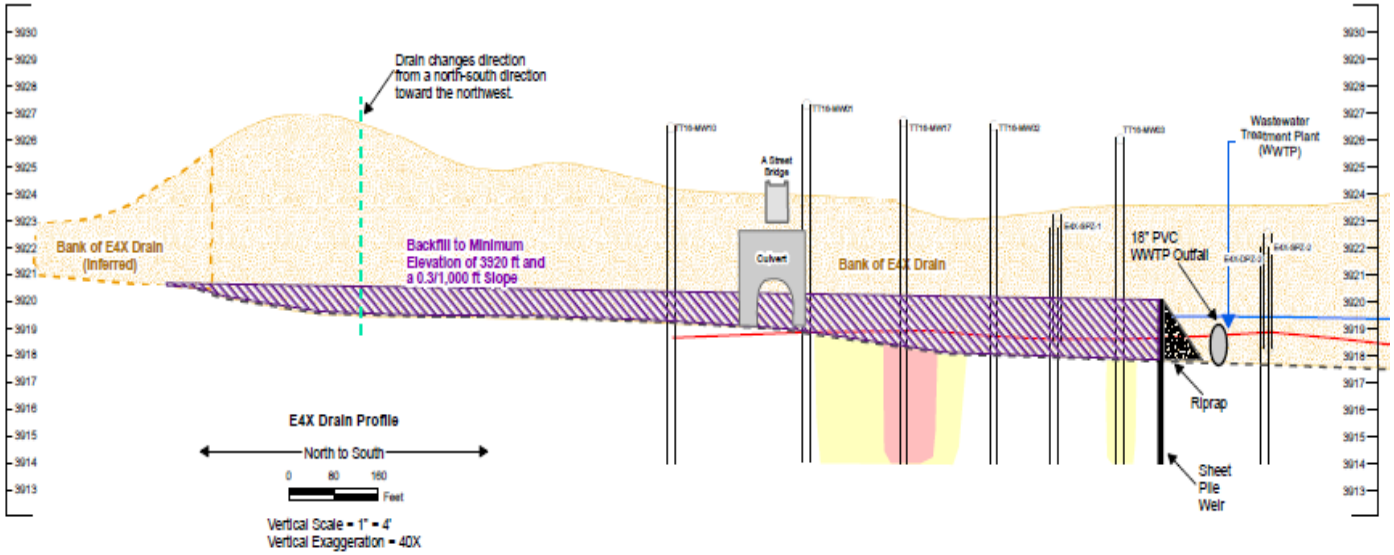
Potential Solvent Inflows to E4X Drain

- **Modifications to the drain will be made to prevent the possibility of solvents entering.**
  - –Channel bed raised





E4X Drain Modifications

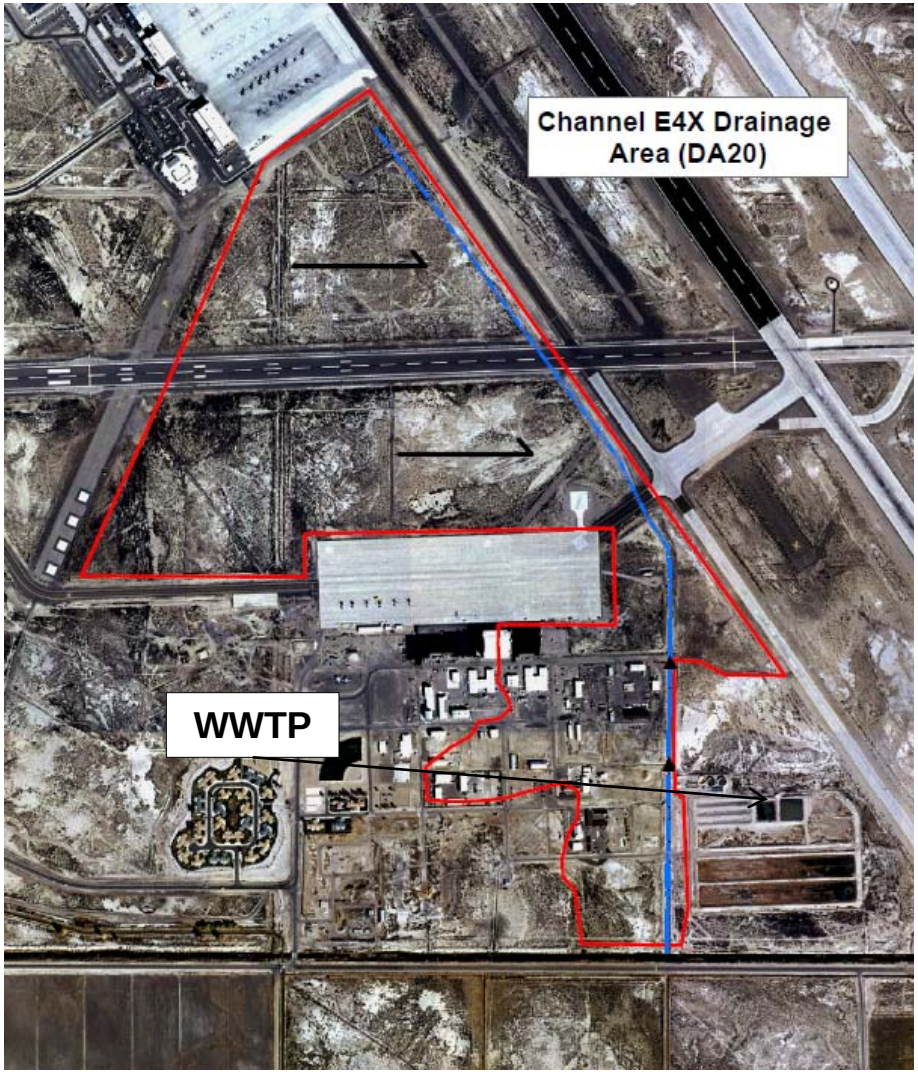


- **Partial backfilling of the drain to raise elevation above groundwater.**
- **Slope to maintain flow and prevent ponding of water.**
- **Weir constructed at downgradient extent to prevent upfilling from WWTP and Lower Diagonal.**
- **Impermeable fill used to eliminate preferential pathways for contamination to migrate along existing channel bed.**

Characteristics of E4X Drain and Drainage Area

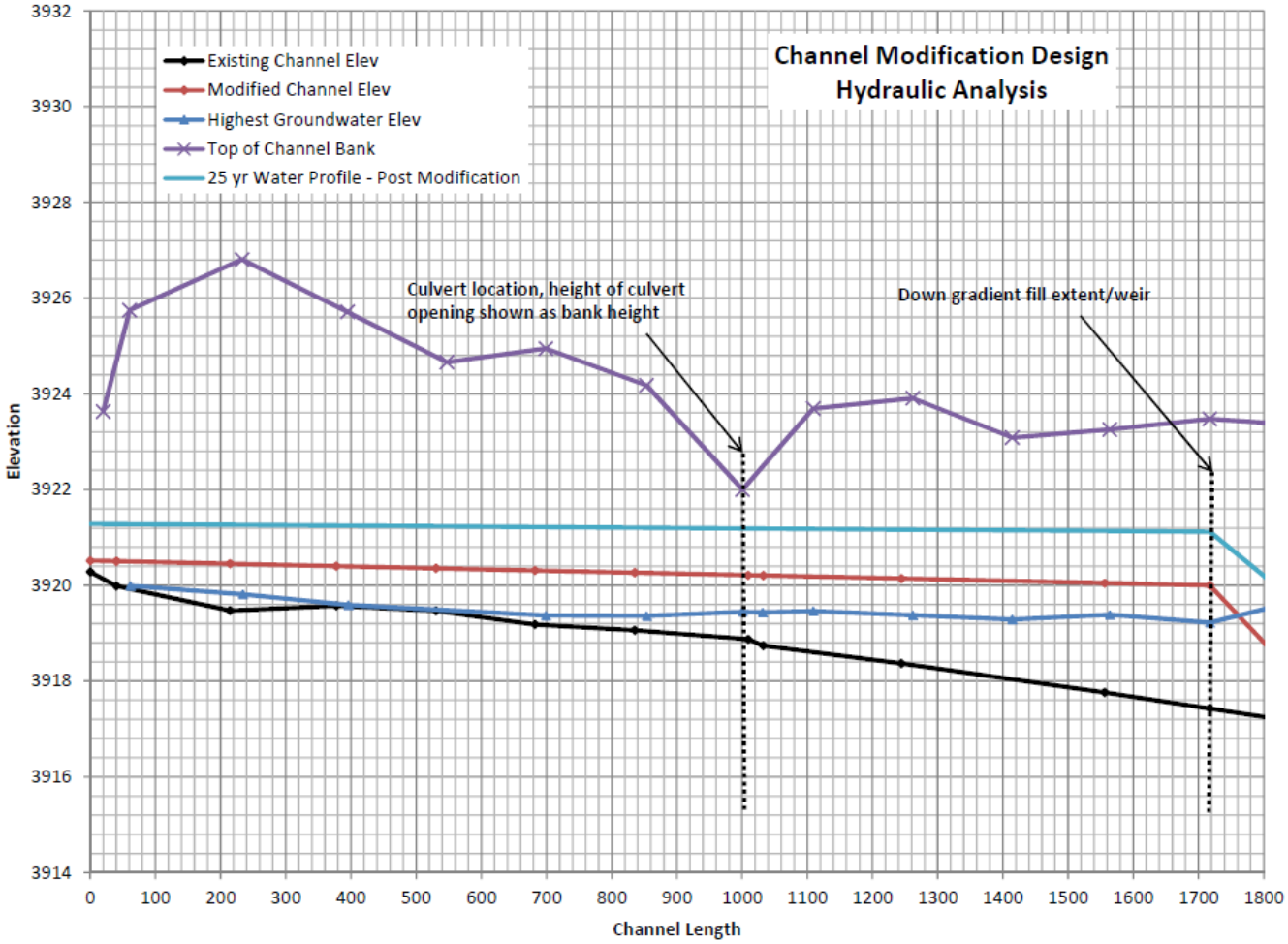
- **E4X drains runoff from western portion of airfield (defined as DA20).**
  - –Approximately 250 acres
  - –18% impervious surfaces

- **Physical characteristics of E4X Drain**
  - –10 to 20 ft bottom width upgradient of the WWTP
  - –5 to 6 ft channel depth
  - –Slope of 1.5 ft/1,000 ft



Modification Analysis and Design

- **Stormwater flow analysis – 25-year, 24-hour storm.**
  - 1.6 inches/24 hrs precipitation.
  - 35 cfs peak flow.
  - Conservative storm
- **Modified channel slope of 0.3/1,000 ft.**
  - Lowest elevation 3920 ft at weir.
- **Peak depth of flow of 1.2 ft.**
- **Greater than 2-feet of excess drain capacity.**



A Street Culvert

- **A Street culvert is the point of greatest potential restriction.**
  - 10 feet width by 3.5 feet in height.
  - Same bank height as up and downgradient.
  - Base of culvert will be raised about 1.5 feet
- **Further analysis was completed to assess headwater conditions during design storm**
- **Design storm will pass freely – headwater and tailwater elevations equal.**

E4X Drain Modifications Conclusions

- **Conservative approach to analysis and design taken.**
  - Solvents have not been detected in surface water.
  - Design storm event exceeds FAA and DoD recommendations for airfields.
- **Drain modifications will raise the channel bed by 2.5 feet or less over about 1,700 foot length of channel.**
  - Prevent inflows of groundwater and potential solvent contaminants.
  - Backfill will prevent preferential groundwater flow and migration.
- **Weir installed at downgradient extent will prevent upfilling of the channel from the WWTP and Lower Diagonal Drain.**
- **Stormwater associated with a 25-year, 24-hour storm event will pass with significant excess capacity.**
  - Actual capacity exceeds what would be necessary for a 100-year storm.
  - Culvert will not restrict flow where water will accumulate upgradient during significant storm events.

Anticipated Schedule

• Draft Action Memorandum	June 2011
• Final Action Memorandum	August 2011
• Draft Work Plan	July 2011
• Final Work Plan	September 2011
• Begin Construction	October 2011
• Operation of Groundwater Treatment System	November 2011-November 2012
• Removal Action Completion Report	TBD

ATTACHMENT 2
RPM MEETING SIGN-IN SHEET

RPM Meeting Sign-in Sheet May 26, 2011			
Name	Affiliation	Phone Number	email
DAVID BERESTKA	Tetra Tech	303 870 5665	david.berestka@tetratech.com
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Michael Klapec	NAS Fallon	775-426-2243	Michael.Klapec@navy.mil
BECKY KURTZ	NAS FALLON ENV	775-426-2242	becky.kurtz@navy.mil
Scott Smale	NDEP	775-687-9384	ssmale@ndep.nv.gov
Mike Quesada	NAVFAC	(619)532-4176	richard.quesada@navy.mil