EXECUTIVE SUMMARY

TERRAIN SOLUTIONS, INC.

CITY OF HOUSTON

PUBLIC WORKS AND ENGINEERING
PLANNING & DEVELOPMENT DIVISON

Executive Summary

The subject site for which we are submitting this MSD application is known as Kwik Wash, located at 1436 Studewood Street at LeGreen Street in Houston, Texas 77008. The subject property is a rectangular tract that is a 0.11 acre tract of land with a 2,000 square foot single story building located southeast of the intersection. The building is surrounded by a paved strip of paved parking spaces to the north. The surrounding area is predominantly residential.

The subject property was used for residential purposes until the 1970s. The residential structure was removed and a laundromat was built in 1974. Kwik Wash operated the laundromat and used standard washing machines along with three small individual- load coin-operated dry cleaning machines that used chlorinated solvents. It is thought that the small individual load dry cleaning machines were installed between the mid-1970s and the early 1980s. These machines were removed by the late 1980s and no later than 1991. The building was subsequently renovated and the current use of the site is a women's exercise facility.

Based on the drilling of borings, installation of five monitoring wells, and the chemical testing of soils and groundwater samples, the COCs identified on the subject property consisted of chlorinated solvents, primarily in the groundwater. The contaminant 1,2,3-Trichloropropane (KB-7= 0.02 mg/Kg) was detected in one soil sample at 5 feet below ground surface above the residential PCLs below the southwest corner of the building. Other elevated COCs, Tetrachloroethylene (KMW-1 = 0.183, KMW-2= 4.58 mg/Kg) Cis-1,2-Dichloroethylene (KMW-2= 2.55 mg/Kg) and Trichloroethylene (KMW-2 = 0.198 mg/Kg) were below 20 ft under the ground surface.

Five permanent monitoring wells were placed on and downgradient of the subject site to confirm the presence or absence of chlorinated solvents in the groundwater. Monitor well KMW-1 was placed on the western side of the property in the vicinity of where loading and offloading of dry cleaning chemicals

were identified to have occurred. Monitor Well KMW-2 was placed adjacent to the concrete lint trap where waste water was conveyed. Both wells encountered groundwater at a depth of approximately 30 feet below ground surface. Monitor Well MW-3 was drilled to approximately 20 feet below grade on the western side of the building to assess a thin water-bearing seam that had been impacted by the contaminant rerelease but did not meet the characteristics of an aquifer due to low water-yield. A fourth monitor well, KMW-4, was installed on the subject property to provide a reference for groundwater direction. A fifth well, KMW-5 was installed approximately 65 feet downgradient of the source area in Le Green Street.

In each of these wells, the presence of COCs associated chlorinated solvents (tetrachloroethylene, trichloroethylene, cis 1,2- dichloroethylene, and vinyl chloride) were confirmed, and in some instances were found to be above the Tier One Residential PCLs. Four off-site temporary wells were installed to examine the extent of off-site migration. No COC exceeding the PCLs were found in the groundwater samples collected from wells KT-10 and KT-12 located north and southwest, respectively, of the site. Temporary monitoring well KT-11, located to the northeast of the subject site, had COCs above the Tier One PCLs. Temporary monitoring well KT-13 was placed approximately 75 feet further to the northeast, and no COCs exceeding the TCEQ PCLs were found. Mr. Charles Brigance of the TCEQ VCP section has indicated the COCs associated with the chlorinated solvents release have been sufficiently delineated.

An additional monitoring well, KMW-5 was placed approximately 40 feet northeast near KT-11 to further assessment the contaminant plume concentration down-gradient of the site. The dissolved COCs were generally found to be lower in concentration at that location

As part of the risk assessment, TSI conducted a receptor survey. Two locatable water well records were identified within the ½ mile radius. Of these two wells, none were in the 500 foot radius of the subject property. None of the water wells were visually verified during field reconnaissance. Water meters were noted in front of the businesses and residences in the area that were owned and maintained by the City of Houston. Therefore, no existing ingestion receptors are threatened by the release.

Findings and Conclusions

- Based on six groundwater sampling events, the COCs have not shown large increases in concentrations. Statistical modeling (Mann Kendall) does not indicate significant concentration increases and suggests evidence of contaminate stability. The original dry cleaning solvent compound, tetrachloroethylene, has shown a general decreasing trend. The presence of the degradation products is consistent with natural attenuation. When a COC such as cis 1,2-dichloroethylene is detected with a slight increase in concentration over time, it is probably the result of the degradation typically associated with chlorinated solvents. Additionally, when the site is granted an MSD thereby eliminating groundwater ingestion as a potential pathway of exposure, the groundwater inhalation PCL can be applied. All COCs in samples collected from the wells are below the groundwater inhalation PCL.
- No COCs in the subsurface soils have been found to exceed health related PCLs.
- The primary source of the release, a concrete lint trap located in the northeast section of the site has been removed. The lint trap was removed on July 10, 2014.
- Mr. Charles Brigance of the TCEQ VCP section has indicated the COCs associated with the chlorinated solvents release have been sufficiently delineated. (See the TCEQ letter in the Appendix).
- No existing ingestion receptors, such as water wells, are threatened by the release. With the issuance of the MSD by the City of Houston which would restrict access to the shallow impacted groundwater-bearing zone, the ingestion exposure pathway would effectively be eliminated as a potential threat to human health.

Therefore, the Kwik Wash site is a good candidate for the MSD designation based on soil and groundwater conditions.

Appendix A
Legal Description

Kwik Wash
Lot 2, Block 112 of the North Norhill, Volume 6, Page 28 of the Harris County, Texas Records.

TERRAIN SOLUTIONS, INC.

RETURN TO:
STEWART TITLE FORT BEND
14100 SOUTHWEST FREEWAY #200
SUGAR LAND, TEXAS 77478
06100797-LG-TO

WD

Z389310
06/20/06 201178842 $20.00

SPECIAL WARRANTY DEED

NOTICE OF CONFIDENTIALITY RIGHTS: IF YOU ARE A NATURAL PERSON, YOU MAY REMOVE OR STRIKE ANY OR ALL OF THE FOLLOWING INFORMATION FROM THIS INSTRUMENT BEFORE IT IS FILED FOR RECORD IN THE PUBLIC RECORDS: YOUR SOCIAL SECURITY NUMBER OR YOUR DRIVER'S LICENSE NUMBER

THE STATE OF TEXAS §
§ KNOW ALL MEN BY THESE PRESENTS:
COUNTY OF HARRIS §

THAT ALICE S. BURROUGHS, Individually and as Independent Executrix of the Estate of Ralph S. Burroughs, Deceased, hereinafter called "Grantor" (and referred to in the singular, whether one or more), for and in consideration of the sum of Ten and No/100 DOLLARS ($10.00) cash and other good and valuable consideration in hand paid by ELP INVESTMENTS, LLC, hereinafter called "Grantee", the receipt of which is hereby acknowledged; has GRANTED, SOLD and CONVEYED, and by these presents does GRANT, SELL and CONVEY unto Grantee all that certain lot, tract or parcel of land together with all improvements thereon, lying and being situated in Harris County, Texas, described as follows, to-wit:

> Lot Two (2), in Block One Hundred Twelve (112), of NORTH NORHILL, an addition in Harris County, Texas, according to the map or plat thereof recorded in Volume 6, Page 28 of the Map Records of Harris County, Texas.

This conveyance is made subject to any and all easements, rights of way, valid restrictions, mineral reservations of any kind, maintenance charges, building set back lines, and governmental regulations, if any, to the extent, but only to the extent that they are reflected by the records of the Office of the County Clerk of the above mentioned County and State.

TO HAVE AND TO HOLD the above described premises, together with all and singular the rights and appurtenances thereto in any wise belonging, unto Grantee, his heirs and assigns forever; and, Grantor does hereby bind himself, his heirs, executors and administrators, to WARRANT and FOREVER DEFEND, all and singular the said premises unto Grantee, his heirs and assigns, against every person whomsoever lawfully claiming, or to claim the same, or any part thereof, by, through, or under the undersigned, but not otherwise.

When Grantor and/or Grantee are more than one entity, the pertinent nouns, verbs and pronouns shall be construed to correspond. When Grantor and/or Grantee are a corporation, a trustee or other legal entity that is not a natural person, the pertinent words "heirs, executors and administrators" and/or "heirs and assigns" shall be construed to mean "successors and assigns," respectively. Reference to any gender shall include either gender and, in the case of a legal entity that is not a natural person, shall include the neuter gender, all as the case may be.

EXECUTED this the 8 day of June, A.D. 2006.

FILED
2006 JUN 20 PM 12:33
COUNTY CLERK
HARRIS COUNTY, TEXAS

Alice S. Burroughs
ALICE S. BURROUGHS, Individually and as Independent Executrix of the Estate of Ralph S. Burroughs, Deceased

THE STATE OF TEXAS

THE COUNTY OF HARRIS

This instrument was acknowledged before me on this the 8 day of June, A.D. 2006, by ALICE S. BURROUGHS, Individually and as Independent Executrix of the Estate of Ralph S. Burroughs, Deceased.

KATHERINE A. VALLET
Notary Public, State of Texas
My Commission Expires 11-29-2009

Katherine A. Vallet
NOTARY PUBLIC, STATE OF TEXAS

ANY PROVISION HEREIN WHICH RESTRICTS THE SALE, RENTAL, OR USE OF THE DESCRIBED REAL PROPERTY BECAUSE OF COLOR OR RACE IS INVALID AND UNENFORCEABLE UNDER FEDERAL LAW
THE STATE OF TEXAS
COUNTY OF HARRIS
I hereby certify that this instrument was FILED in file number Sequence on the date and at the time stamped hereon by me; and was duly RECORDED, in the Official Public Records of Real Property of Harris County Texas on

JUN 20 2006

COUNTY OF HARRIS COUNTY, TEXAS

Beverly B. Kaufman
COUNTY CLERK
HARRIS COUNTY, TEXAS

GRANTEE'S MAILING ADDRESS:

_____

_____

AFTER RECORDING, RETURN TO:

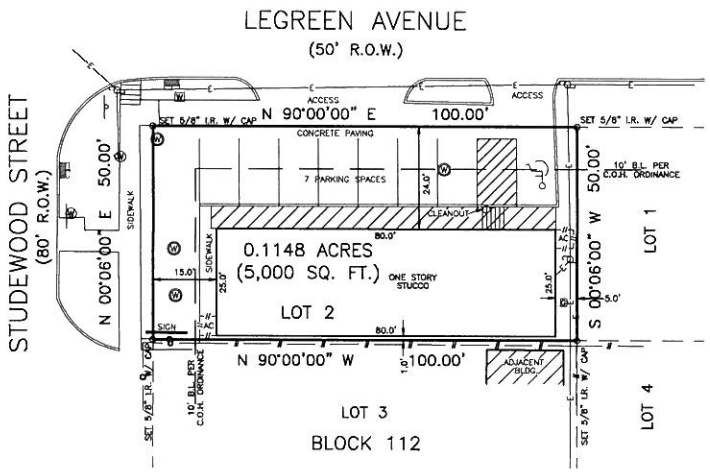
PREPARED IN THE LAW OFFICE OF
MORRIS, LENDAIS, HOLLRAH & SNOWDEN
1980 Post Oak Boulevard, Suite 700
Houston, Texas 77056
fi\conv\sfc\06100797.gwd.wpd.RS
6/8/06

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

LEGEND:
AE – AERIAL EASEMENT
BL – BUILDING LINE
BLDG – BUILDING
ESMT – EASEMENT
FND – FOUND
HL&P – HOUSTON LIGHTING & POWER
IP – IRON PIPE
IR – IRON ROD
HCCF – HARRIS COUNTY CLERKS FILE
HCDR – HARRIS COUNTY DEED RECORDS
HCMR – HARRIS COUNTY MAP RECORDS
POB – POINT OF BEGINNING
POC – POINT OF COMMENCING
PS – PARKING SPACES
ROW – RIGHT OF WAY
SQ. FT. – SQUARE FEET
UE – UTILITY EASEMENT
—x— BARBED WIRE FENCE
—o— CHAIN LINK FENCE
CONCRETE
COVERED CONCRETE
—E— OVERHEAD ELECTRIC LINES
—x— WOOD FENCE
—/— WROUGHT IRON FENCE
GUY WIRE
– CATCH BASIN
– CABLE BOX
– ELECTRIC BOX
– ELECTRIC MH
– FIRE HYDRANT
– FIBER OPTIC MARKER
– FLAG POLE
– GAS METER
– GAS VALVE
– CURB INLET
– LIGHT POLE
– MANHOLE
– MONITORING WELL
– PIPELINE MARKER
– POWER POLE
– SERVICE POLE
– SANITARY MANHOLE
– STORM MANHOLE
– TELEPHONE PEDESTAL
– TRANSFORMER
– TRAFFIC SIGNAL BOX
– TRAFFIC SIGNAL POLE
– UNDERGROUND CABLE MARKER
– WATER WELL
– WATER METER
– WATER VALVE
– BENCHMARK
– SIGN



NOTES:
1. ALL BEARINGS AND STREET RIGHT OF WAYS ARE BASED ON RECORDED PLAT.
2. SURVEYOR DID NOT ABSTRACT PROPERTY. SURVEY BASED ON LEGAL DESCRIPTIONS SUPPLIED BY THE CLIENT.
3. NOTHING IN THIS SURVEY IS INTENDED TO EXPRESS AN OPINION REGARDING OWNERSHIP OR TITLE.
4. THE WORD CERTIFY IS UNDERSTOOD TO BE AN EXPRESSION OF PROFESSIONAL JUDGMENT BY THE SURVEYOR, WHICH IS BASED ON HIS BEST KNOWLEDGE, INFORMATION AND BELIEF.
5. SURVEY IS CERTIFIED FOR THIS TRANSACTION ONLY.
6. THE FINDINGS AND OPINIONS OF SOUTH TEXAS SURVEYING ASSOCIATES, INC. REFLECTED HEREON ARE PRIVILEGED, CONFIDENTIAL AND INTENDED FOR THE USE OF THE INDIVIDUAL OR ENTITY FOR WHOM THIS WORK WAS PREPARED, IT IS UNDERSTOOD THAT THE USE OF, RELIANCE ON, OR REPRODUCTION OF SAME, IN WHOLE OR IN PART, BY OTHERS WITHOUT THE EXPRESS WRITTEN CONSENT OF SOUTH TEXAS SURVEYING ASSOCIATES, INC. IS PROHIBITED AND WITHOUT WARRANTY, EXPRESS OR IMPLIED. SOUTH TEXAS SURVEYING ASSOCIATES, INC. SHALL BE HELD HARMLESS AGAINST DAMAGES OR EXPENSES RESULTING FROM SUCH UNAUTHORIZED USE, RELIANCE OR REPRODUCTION. COPYRIGHT 2015. ALL RIGHTS RESERVED.
7. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A TITLE REPORT. CERTAIN EASEMENTS AND/OR BUILDING LINES MAY HAVE BEEN GRANTED WHICH ARE NOT REFLECTED HEREON. THIS SURVEY IS SUBJECT TO ANY FACTS THAT MAY BE DISCLOSED BY A FULL AND ACCURATE TITLE SEARCH. THIS SURVEY WAS DONE WITHOUT BENEFIT OF DEED. OWNER SHOULD OBTAIN A TITLE COMMITMENT BEFORE DESIGN OR CONSTRUCTION COMMENCES.

PROPERTY LIES WITHIN FLOOD ZONE "X", ACCORDING TO F.I.R.M. MAP NO. 48201C 0670M, DATE 06-09-14, BY GRAPHING PLOTTING ONLY, WE DO NOT ASSUME RESPONSIBILITY FOR EXACT DETERMINATION.
BEFORE ANY DEVELOPMENT PLANNING, DESIGN, OR CONSTRUCTION IS STARTED, THE COMMUNITY, CITY AND COUNTY IN WHICH SUBJECT TRACT EXISTS SHOULD BE CONTACTED. SAID ENTITIES MAY IMPOSE LARGER FLOOD PLAIN AND FLOODWAY AREAS THAN SHOWN BY F.I.R.M. MAPS THAT WILL AFFECT DEVELOPMENT.

SURVEYOR'S CERTIFICATION
PROPERTY SUBJECT TO CITY ORDINANCES AND SUBDIVISION COVENANTS, CONDITIONS AND RESTRICTIONS.
I hereby certify that this survey was made on the ground and that this plat correctly represents the facts found at the time of survey showing any improvements, from legal descriptions supplied by client. There are no encroachments apparent on the ground, except as shown. This survey is only certified for boundary and this transaction only. Surveyor did not abstract property. Easements, building lines, etc. shown are as identified by:

GF N/A of N/A

Fred W. Lawton, Registered Professional Land Surveyor No. 2321

STATE OF TEXAS REGISTERED FRED W. LAWTON 2321 PROFESSIONAL LAND SURVEYOR

SURVEY OF

LOT 2 IN BLOCK 112 OF NORTH NORHILL, AN ADDITION IN HARRIS COUNTY, TEXAS, ACCORDING TO THE MAP OR PLAT THEREOF RECORDED IN VOLUME 6, PAGE 28 OF THE MAP RECORDS OF HARRIS COUNTY, TEXAS.

ADDRESS: 1436 STUDEWOOD STREET
HOUSTON, TEXAS 77008

JOB NO.: 431-15 SCALE: 1" = 20' DATE: 04-06-15

SOUTH TEXAS SURVEYING ASSOCIATES, INC.
11281 Richmond Ave. Bldg J, Suite 101, Houston, Texas 77082
TEL. 281-556-6918 FAX 281-556-9331
Firm Number: 10045400

COPYRIGHT 2015

K:\DOMRES 2015\431-15.DWG (EO)

JOB NO: 431-15

Appendix B
Property Use and 500-foot Property Use

The subject site was occupied by the Kwik Wash operating in a single-story 2,000 SF building. The building has been redeveloped in 2014 as a women's exercise business. The surrounding properties within a 500-foot radius are predominantly single family dwellings. There is no anticipated change in development in the area.

N
W E
S

Scale

1 inch equals 200 feet

0 100 200 400 Feet

STATE OF TEXAS
Glenn R. Lowenstein
Geology
28
LICENSED
PROFESSIONAL GEOSCIENTIST

Figure B-1
Property and
500 Foot Property Use Map

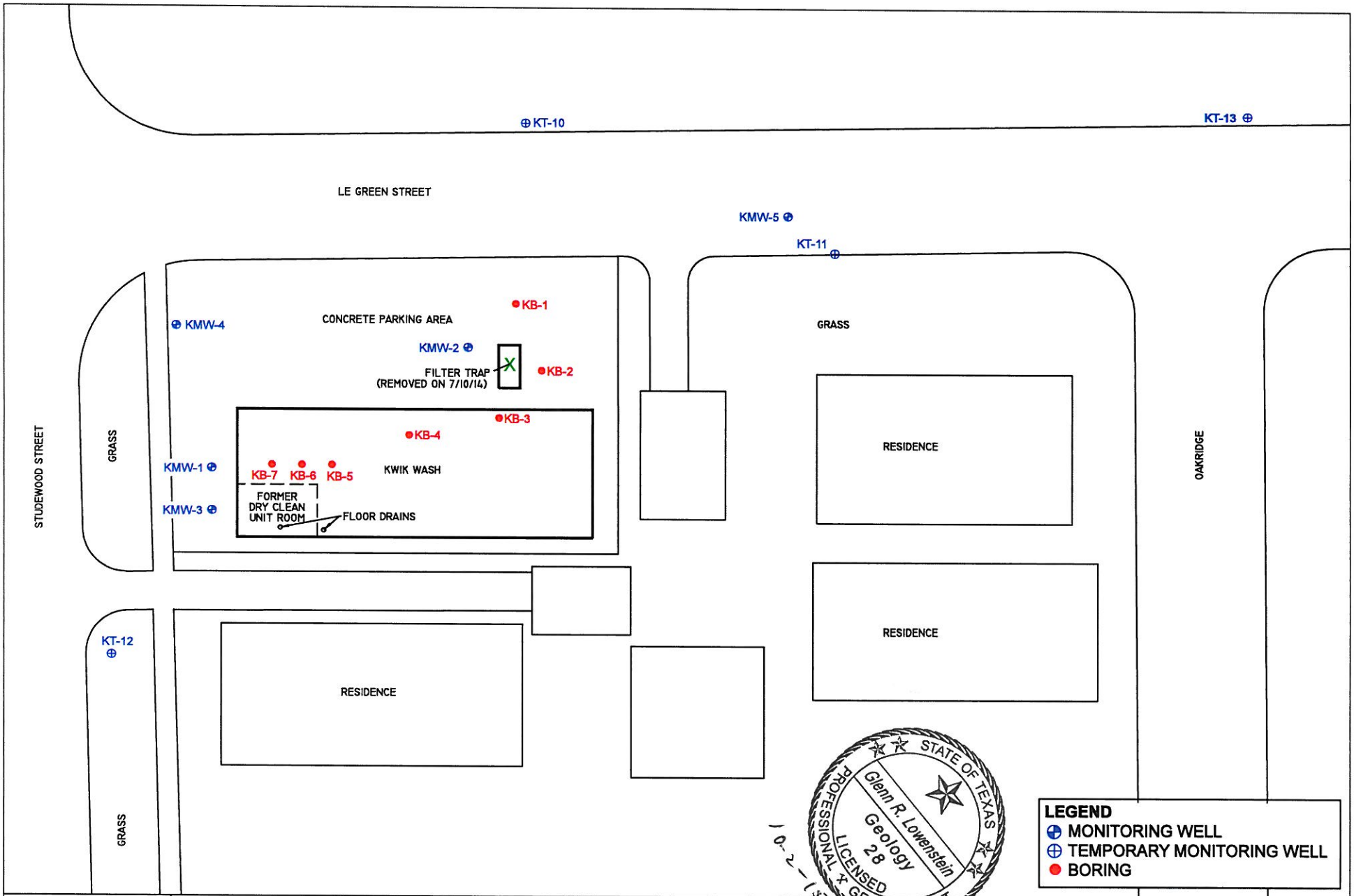
Kwik Wash VCP# 2663
1436 Studewood
Houston, TX 77008

PROJECT #: 1312Z-89	DATE: 12-20-14

TERRAIN SOLUTIONS INC.
10103 Fondren Suite 426
Houston, TX 77096
713-467-2900

SOURCE: Texas Natural Resource and Information Systms
Base Map: 2008 TOP 0.5 meter - SE Houston Heights Quad

Appendix C
Site Map

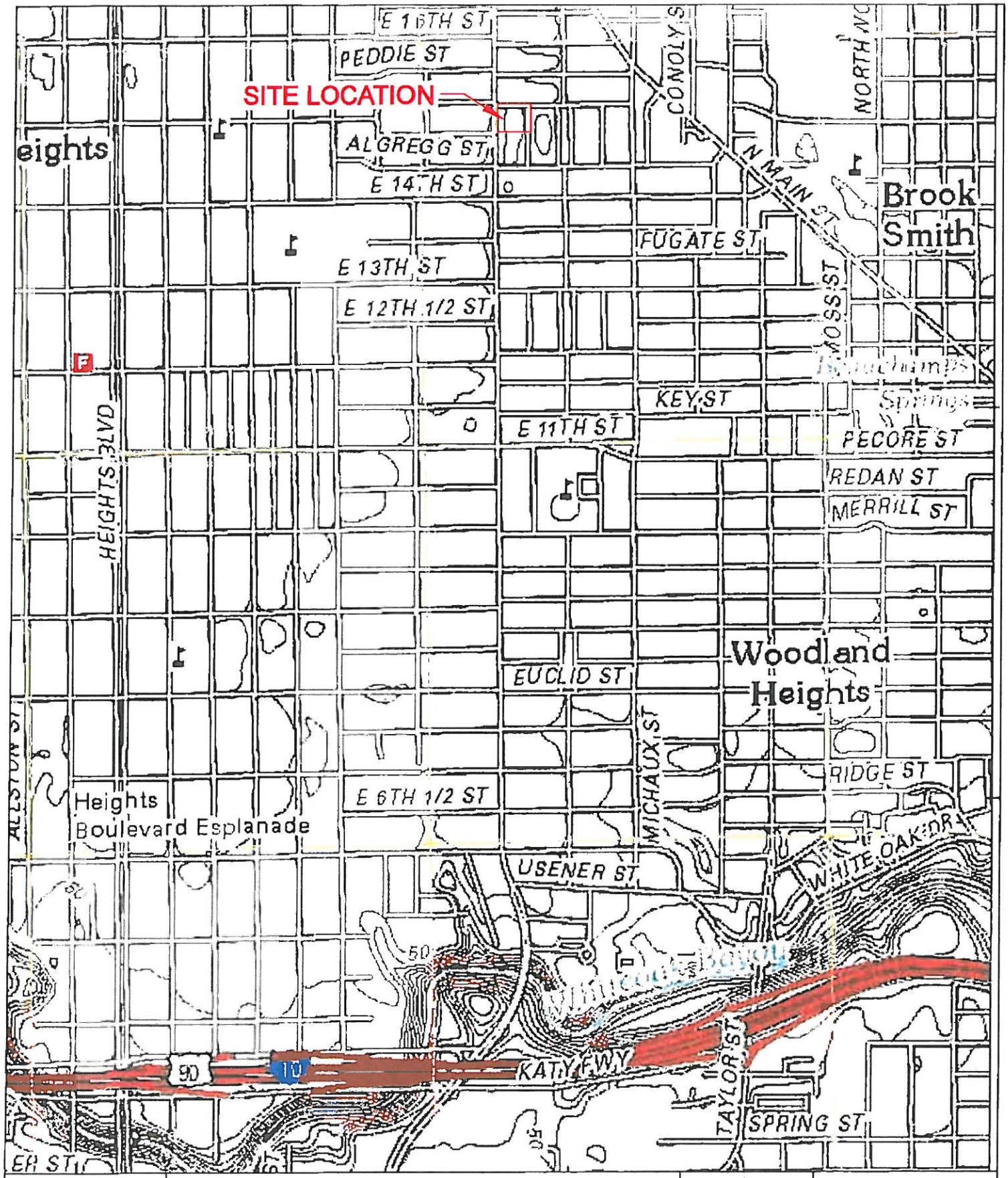


Terrain Solutions, Inc.

Site Map

Kwik Wash (MSD# 2015-081-KWL)
1436 Studewood Street
Houston, Texas 77008
TSI Project No. 1507T-47 (REV 1312Z-89)

Approximate Scale:
1 inch = 30 feet
0 Ft. 15 Ft. 30 Ft.



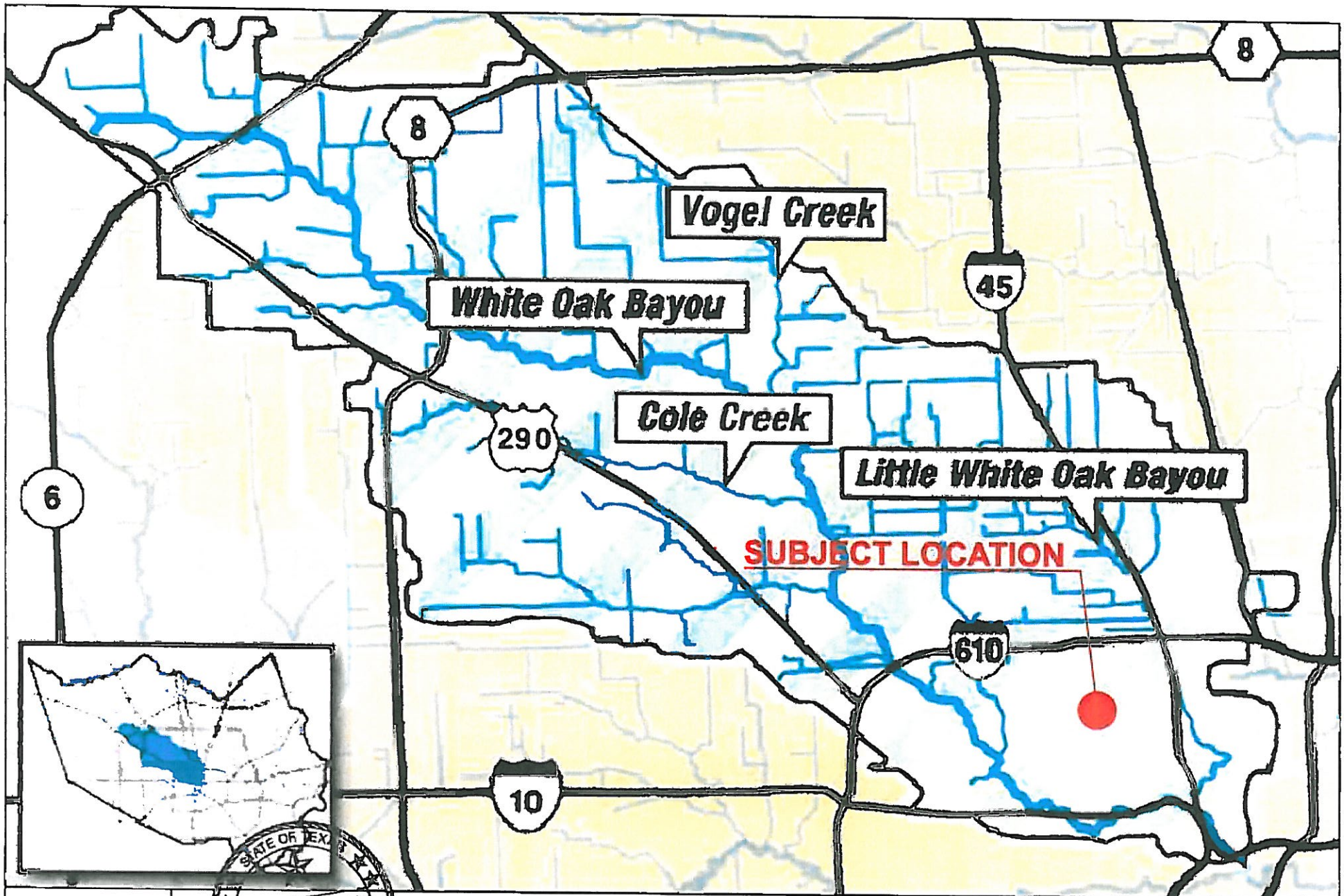
Terrain Solutions, Inc.

Topographic Map

Kwik Wash Laundry Site (VCP# 2663)
1436 Studewood Street
Houston, Texas 77008
TSI Project No.1312Z-89

Approximate Scale:
1" = 1000'

7.5 Minute Quadrangle
Houston Heights, TX
2013



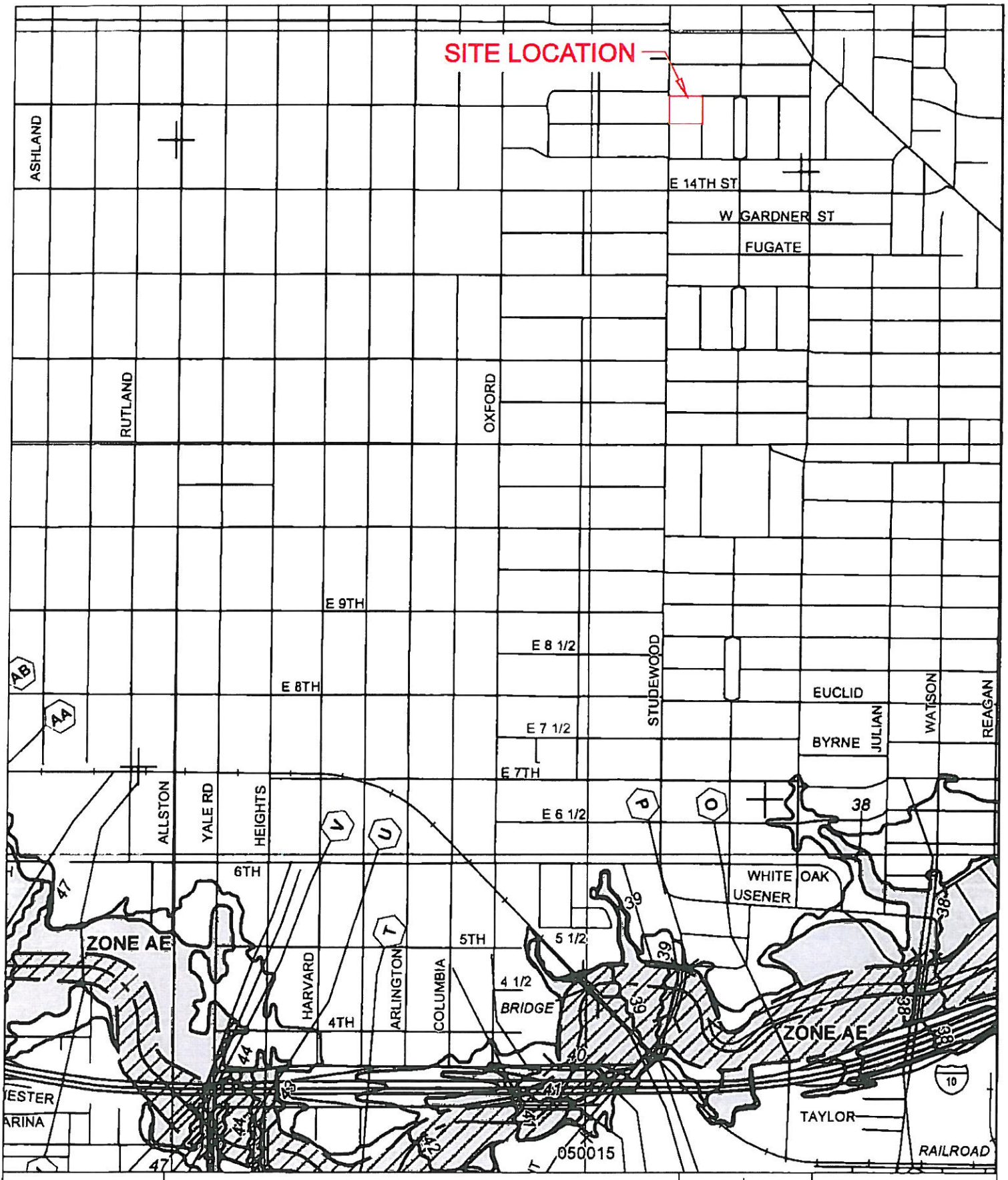
Terrain Solutions, Inc.

Glenn R. Lowenstein
Geology
28
LICENSED
PROFESSIONAL GEOSCIENTIST
STATE OF TEXAS

Fig. 3b2 - Watershed Map

Kwik Wash (VCP# 2663)
1436 Studewood Street
Houston, Texas 77008
TSI Project No.1312Z-89

Approximate Scale:
N.T.S.



Terrain Solutions, Inc.

FEMA Map

Kwik Wash Laundry Site (VCP# 2663)
1436 Studewood Street
Houston, Texas 77008
TSI Project No.1312Z-89

Approximate Scale:
1" = 1000'

FIRM Map#:
48201C0670M
Revised: June 9, 2014

Site Chronology
Kwik Wash, 1436 Studewood Street,
Houston, Harris County, Texas 77008

- **1974 – Late 1980s/Early 1990s** - Kwik Wash opens in 1974. Subsequently, three coin-operated dry cleaning machines were installed in the southwestern corner of the building that used chlorinated hydrocarbons. These machines were removed by the late 1980s and no later than 1991.

- **November 2012** - Live Oak Environmental Consultants (Project No. 12-01087-1). A total of two soil borings were advanced on the subject site. The subsurface soils were predominantly hard/firm, dense clays with a wet zone in the clay from 32-32.5 feet BGL followed by a relatively thin zone (32.5-32.8) feet BGL. One soil sample and one groundwater sample were collected from each of the borings and were subjected to chemical analysis. For the presence of volatile organic compounds (VOCs). The presence of VOCs, typical dry cleaning solvent constituents, was confirmed in the samples. The soil results were compared to the concentrations listed in the TCEQ May 24, 2011 Tier I Residential Soil PCLs for a 0.5 acre source area. Only tetrachloroethylene in soil exceeded the Protective Concentration Level (PCLs). The groundwater samples collected from B-1 & B-2 exceeded the PCLs for tertachloroethylene, trichloroethylene, 1,1-dichloroethylene, trans-1,2-Dichloroethylene, vinyl chloride.

- **May 2013 -** TSI installed two permanent monitoring wells (KMW-1 and KMW-2) on the subject site. Soil and groundwater samples were collected for chemical analysis. High concentrations of tetrachloroethylene (4.58 mg/L), cis-1,2-dichloroethylene (2.55 mg/l) and trichloroethylene (0.198) were detected in the soil samples collected. Elevated concentrations of tetrachloroethylene (3.05 mg/L) and cis-1,2-dichloroethylene (1.54 mg/l) were detected in the groundwater samples collected. The findings of the assessment indicate the presence of two shallow water bearing units within the interval investigated: one at twenty-two feet below grade within a thin silty seam and one near thirty-five feet below grade in a sand. Both water-bearing units have been impacted by the chlorinated solvent release. One of the source areas for the solvent release appears to be near the lint trap near the northeast corner of the Subject Site. **A ½-mile water drinking water well survey confirmed that there are no active water wells within one mile of the site.**

- **July 2013 –** Drilled two borings (KB-1 and KB-2) to assess evidence of a chlorinated solvent release from the on-site lint trap. Drilled several interior borings (KB-3 through KB-7) to assess potential source areas near the former location of the dry cleaning machines and the drain lines. No significant soil impacts were encounter. Installed a third monitoring well (KMW-4) and determined groundwater flow was generally to the east.

- **August 2013** - Installed three temporary monitoring wells located to the east, southwest, and north of the subject site (KT-10, KT-11, and KT-12). Chemical Analyses indicated no VOC impact to the east and southwest and an elevated concentration of chlorinated compounds to the north.

- **April 2014** – Established a groundwater monitoring program of monitoring wells KMW-1, KMW-2 and KMW-4.

- **June 2014** – Installed a temporary monitoring well located east of the subject site (KT-13). Chemical analysis indicated no VOC impact.

- **July 2014** – Removed concrete lint trap in front of Kwik Wash facility. Sampled/analyzed groundwater samples collected from KMW-1, KMW-2, and KMW-4.

- **October 2014 -** Sampled/analyzed groundwater samples collected from KMW-1, KMW-2, and KMW-4.

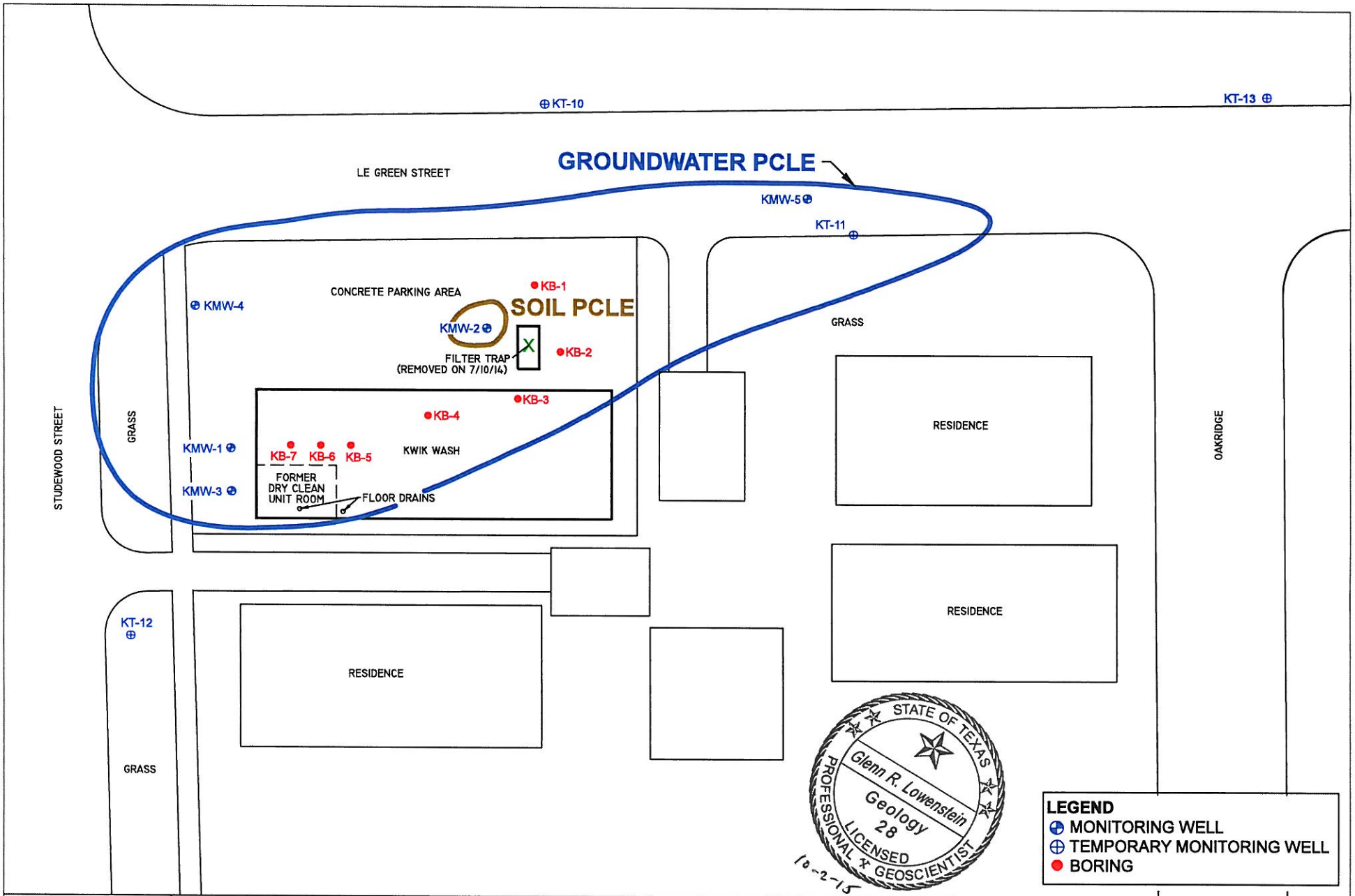
- **February 2015 -** Sampled/analyzed groundwater samples collected from KMW-1, KMW-2, and KMW-4.

- **March 2015 - Submission** of MSD application to the City of Houston.

- **May 2015 - Administrative** review of MSD completed. Assigned MSD # 2015-081-KWL.

- **July – August 2015 -** Install KMW-5 downgradient of former lint trap and re-sample existing monitoring wells for chemical analysis.

- **November 2016** - Resample KMW-5 to reassess COC stability at that location as directed by the City of Houston.



Terrain Solutions, Inc.

Figure 3 c, d - Affected Property Map

Kwik Wash (MSD# 2015-081-KWL)

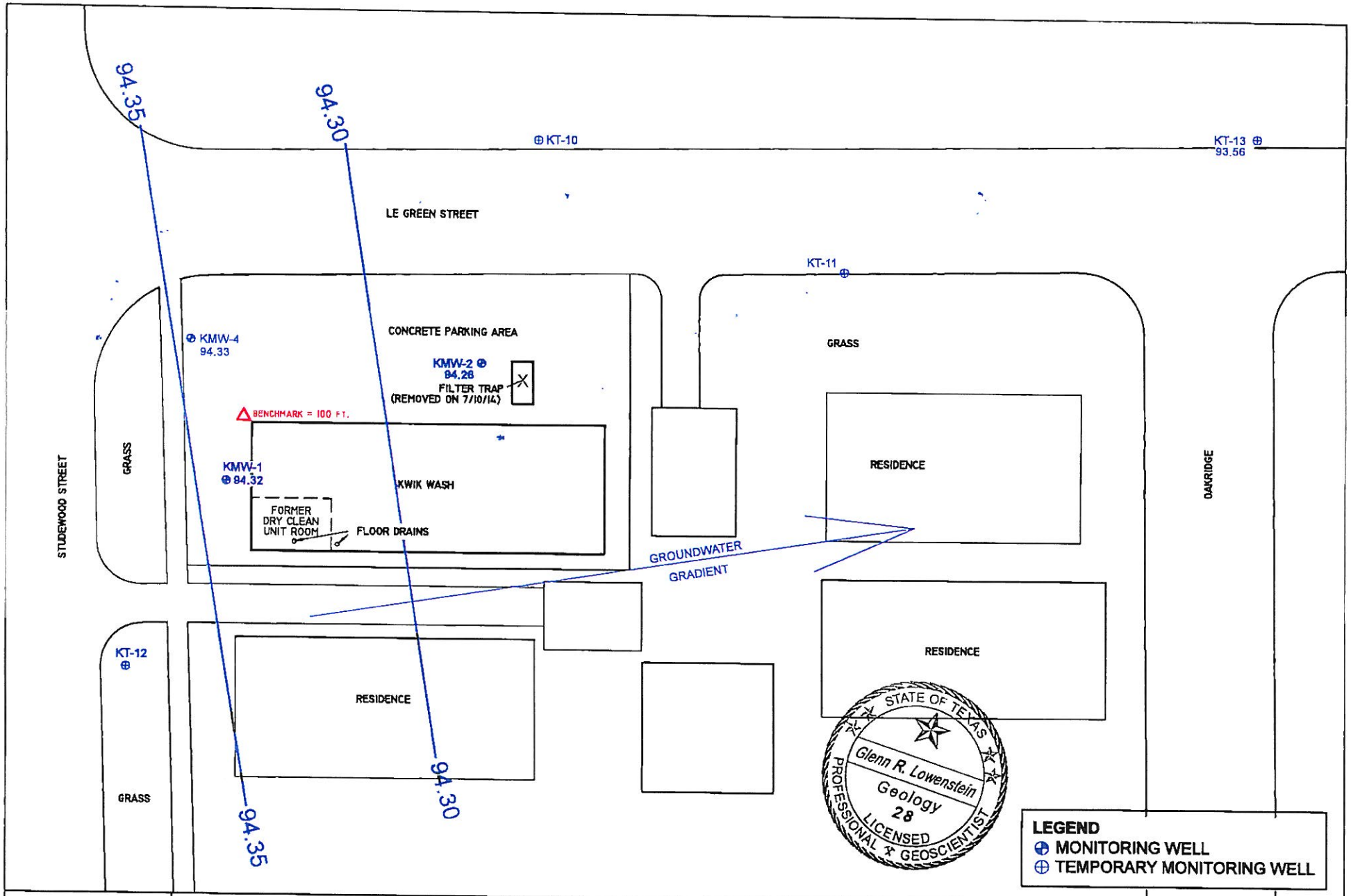
MSD Application

1436 Studewood Street | Houston, Texas 77008

TSI Project No. 1507T-47 (REV 1312Z-89)

Approximate Scale:
1 inch = 30 feet

0 Ft. 15 Ft. 30 Ft.

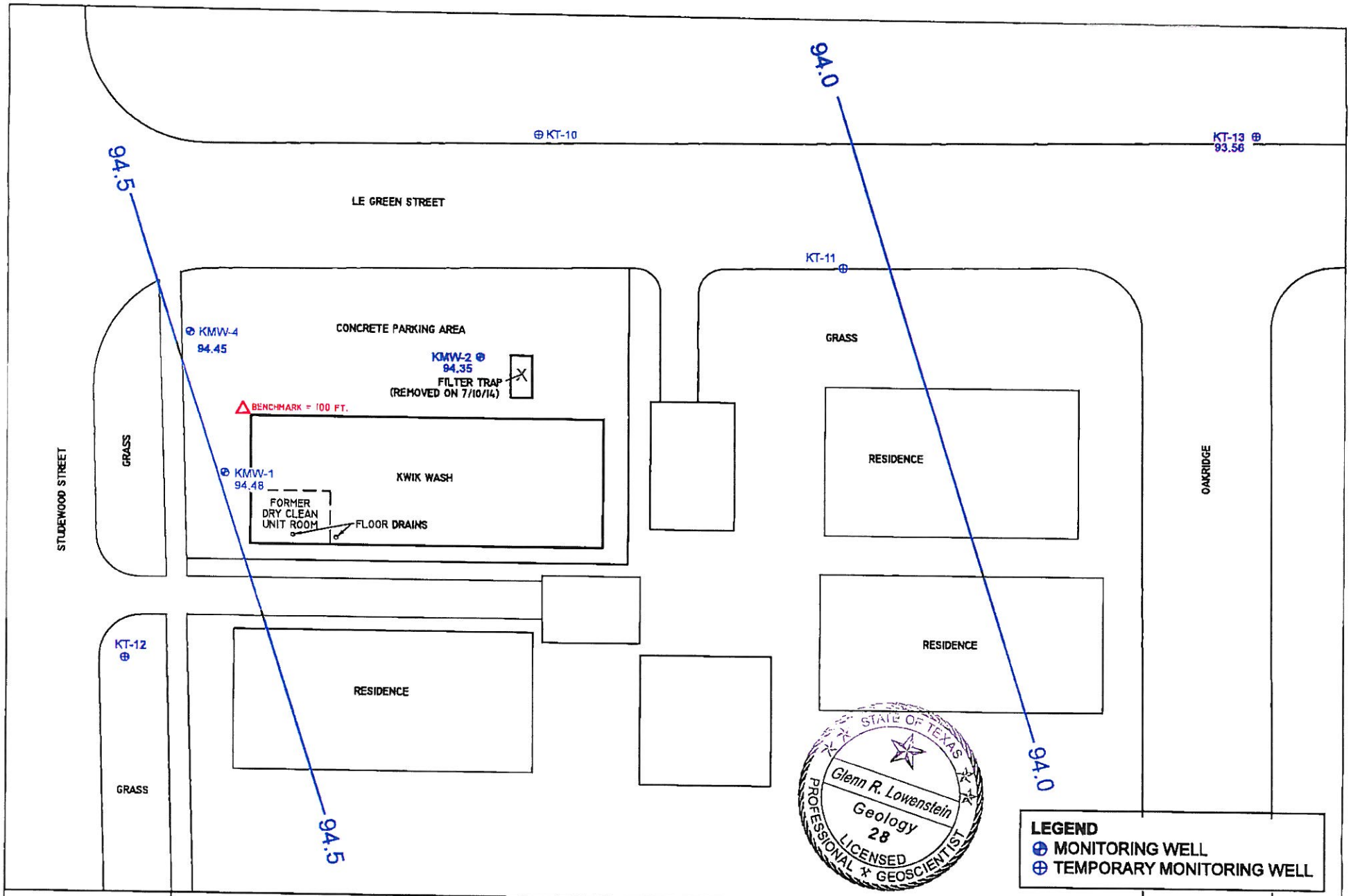


Terrain Solutions, Inc.

Fig. 3e1 - Groundwater Gradient Map (10/15/14)

Kwik Wash (VCP# 2663)
MSD Application
1436 Studewood Street | Houston, Texas 77008
TSI Project No.1312Z-89

Approximate Scale:
1 inch = 30 feet
0 Ft. 15 Ft. 30 Ft.

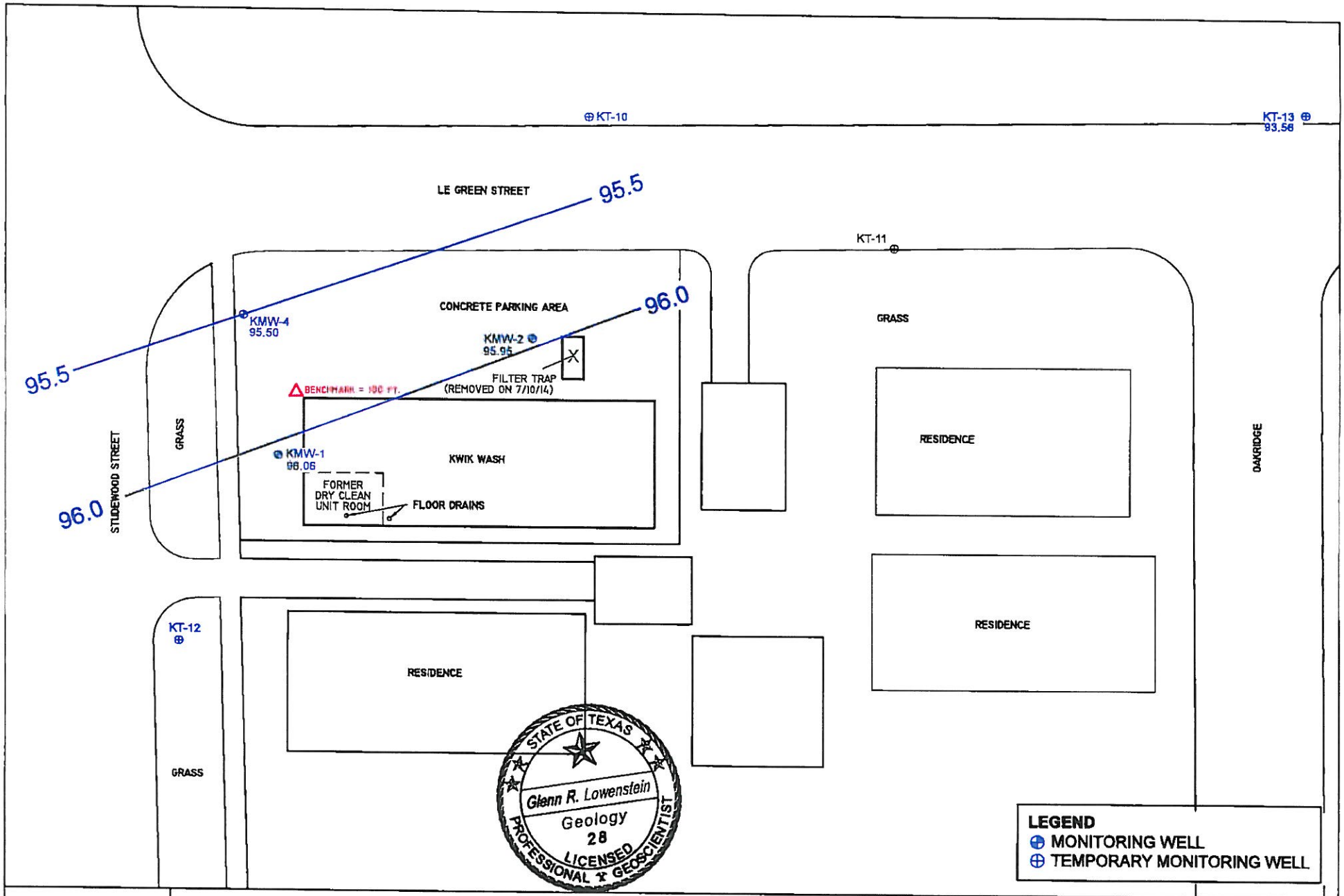


Terrain Solutions, Inc.

Fig. 3e2 - Groundwater Gradient Map (6/26/14)

Kwik Wash (VCP# 2663)
MSD Application
1436 Studewood Street | Houston, Texas 77008
TSI Project No.1312Z-89

Approximate Scale:
1 inch = 30 feet
0 FL 15 FL 30 FL

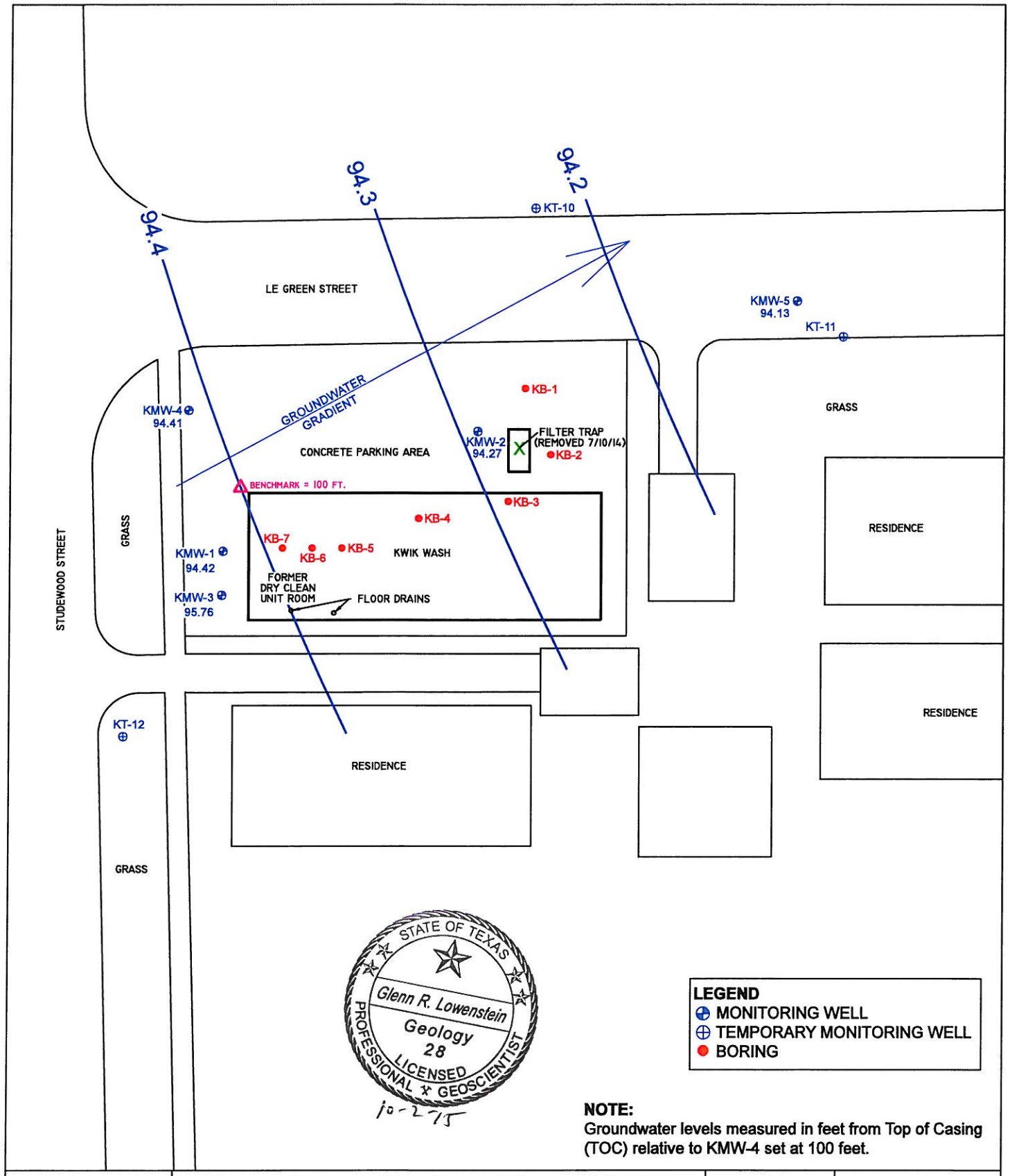


Terrain Solutions, Inc.

Fig. 3e3 - Groundwater Gradient Map (2/10/15)

Kwik Wash (VCP# 2663)
MSD Application
1436 Studewood Street | Houston, Texas 77008
TSI Project No.1312Z-89

Approximate Scale:
1 inch = 30 feet
0 Ft. 15 Ft. 30 Ft.



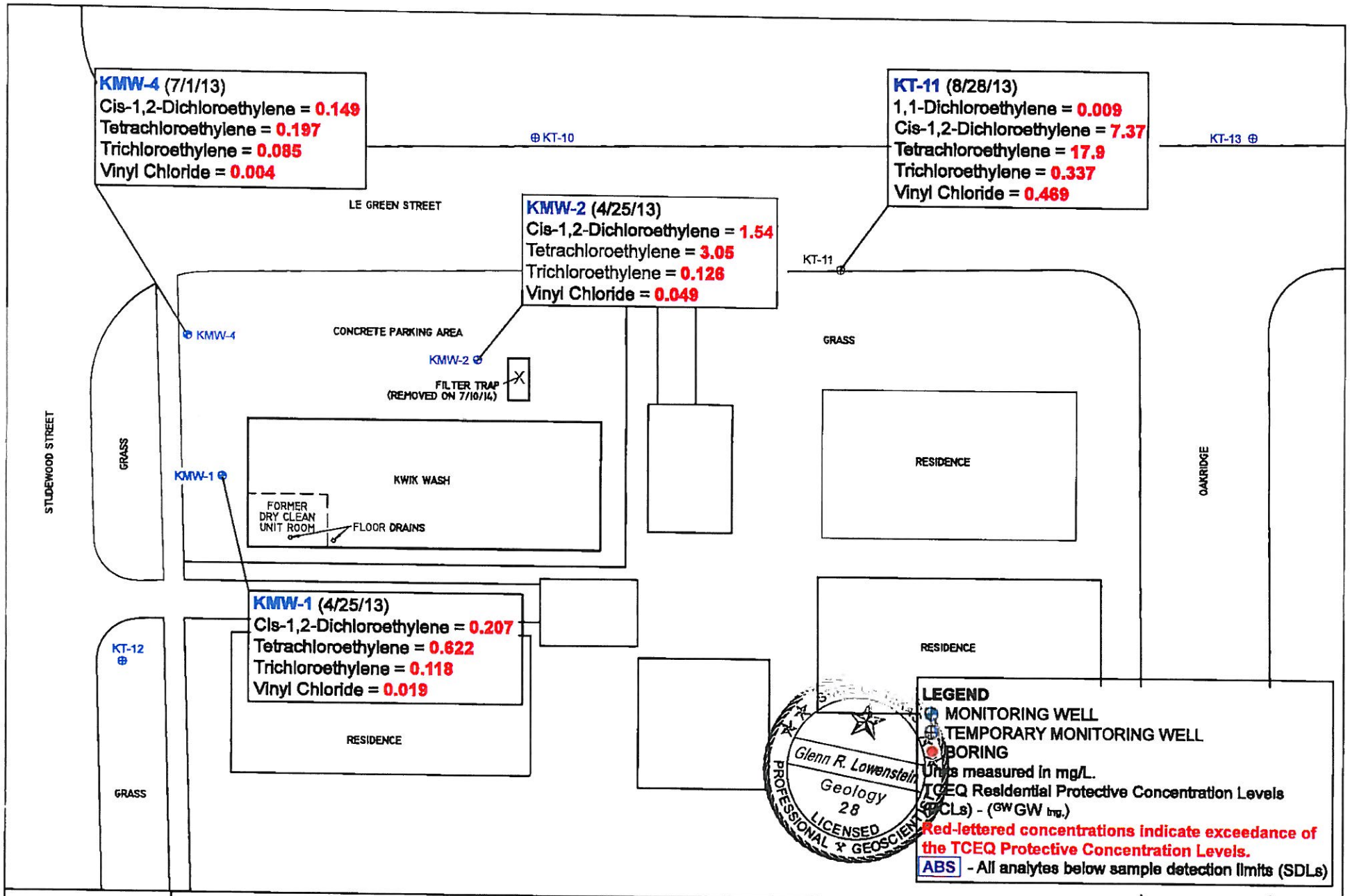
NOTE:
Groundwater levels measured in feet from Top of Casing (TOC) relative to KMW-4 set at 100 feet.

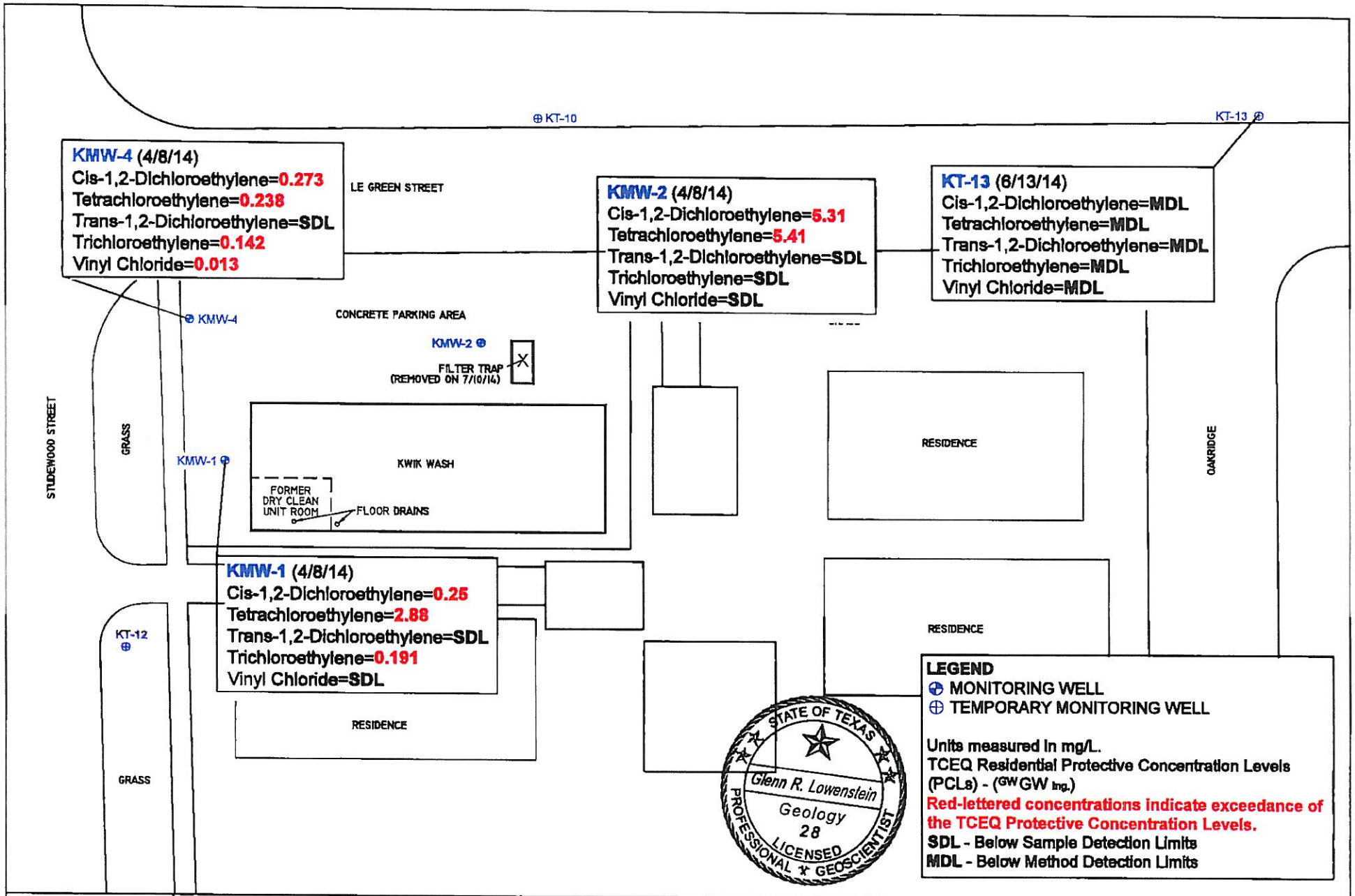
Terrain Solutions, Inc.

Groundwater Gradient Map - 9/02/15

Kwik Wash (MSD# 2015-081-KWL)
1436 Studewood Street
Houston, Texas 77008
TSI Project No. 1507T-47

Approximate Scale:
1 inch = 30 feet
0 Ft. 15 Ft. 30 Ft.


KMW-4 (7/1/13)
Cis-1,2-Dichloroethylene = 0.149
Tetrachloroethylene = 0.197
Trichloroethylene = 0.085
Vinyl Chloride = 0.004
KT-10
KT-11 (8/28/13)
1,1-Dichloroethylene = 0.009
Cis-1,2-Dichloroethylene = 7.37
Tetrachloroethylene = 17.9
Trichloroethylene = 0.337
Vinyl Chloride = 0.469
KT-13
LE GREEN STREET
KMW-2 (4/25/13)
Cis-1,2-Dichloroethylene = 1.54
Tetrachloroethylene = 3.05
Trichloroethylene = 0.126
Vinyl Chloride = 0.049
KT-11
KMW-4
CONCRETE PARKING AREA
KMW-2
FILTER TRAP
(REMOVED ON 7/10/14)
GRASS
STUDEWOOD STREET
GRASS
KMW-1
KWIK WASH
FORMER
DRY CLEAN
UNIT ROOM
FLOOR DRAINS
RESIDENCE
OAKRIDGE
KMW-1 (4/25/13)
Cis-1,2-Dichloroethylene = 0.207
Tetrachloroethylene = 0.622
Trichloroethylene = 0.118
Vinyl Chloride = 0.019
KT-12
RESIDENCE
RESIDENCE
GRASS
Glenn R. Lowenstein
Geology
28
LICENSED
PROFESSIONAL GEOSCIENTIST
LEGEND
MONITORING WELL
TEMPORARY MONITORING WELL
BORING
Units measured in mg/L.
TCEQ Residential Protective Concentration Levels (PCLs) - (GW GW Ing.)
Red-lettered concentrations indicate exceedance of the TCEQ Protective Concentration Levels.
ABS - All analytes below sample detection limits (SDLs)
Terrain Solutions, Inc.
Groundwater COC Concentration Map (7/01/2013, 4/25/2013 & 8/28/2013)
Kwik Wash (VCP# 2663)
1436 Studewood Street
Houston, Texas 77008
TSI Project No.1312Z-89
N
Approximate Scale:
1 inch = 30 feet
0 Ft.
15 Ft.
30 Ft.

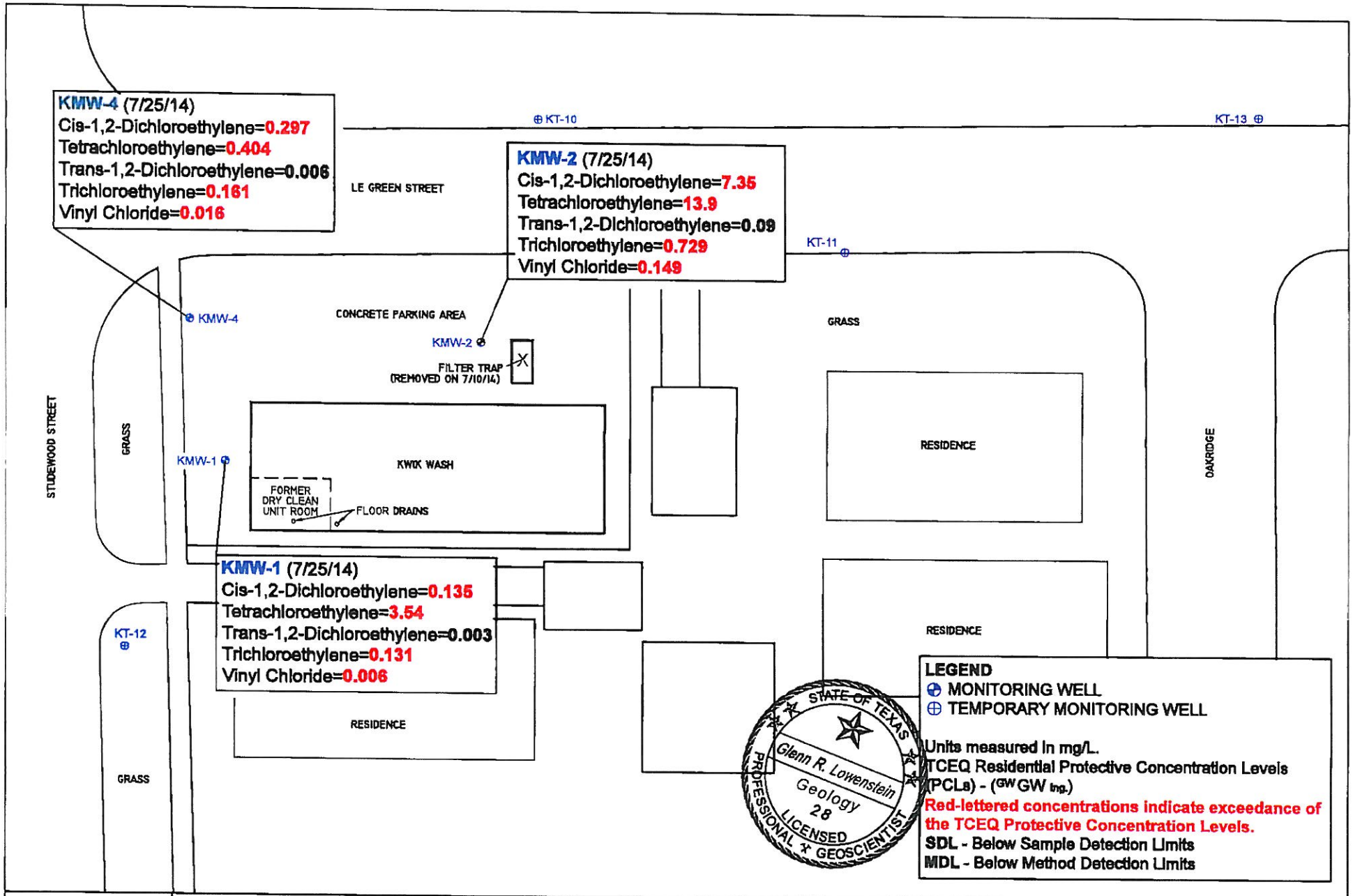


Terrain Solutions, Inc.

Groundwater COC Concentration Map (4/08/2014)

Kwik Wash (VCP# 2663)
1436 Studewood Street
Houston, Texas 77008
TSI Project No.1312Z-89

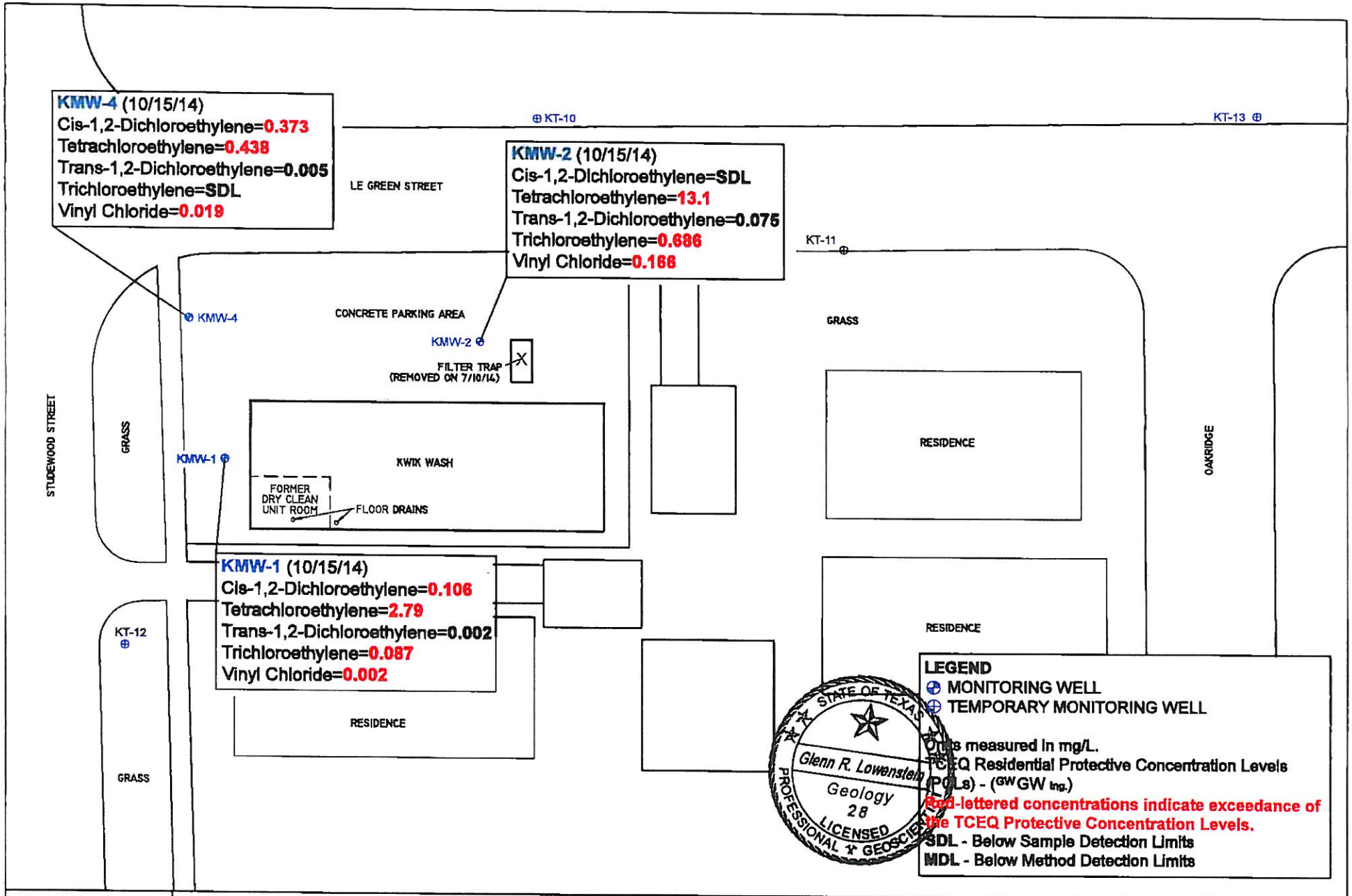
Approximate Scale:
1 inch = 30 feet
0 Ft. 15 Ft. 30 Ft.



Terrain Solutions, Inc.

Groundwater COC Concentration Map (7/25/2014)

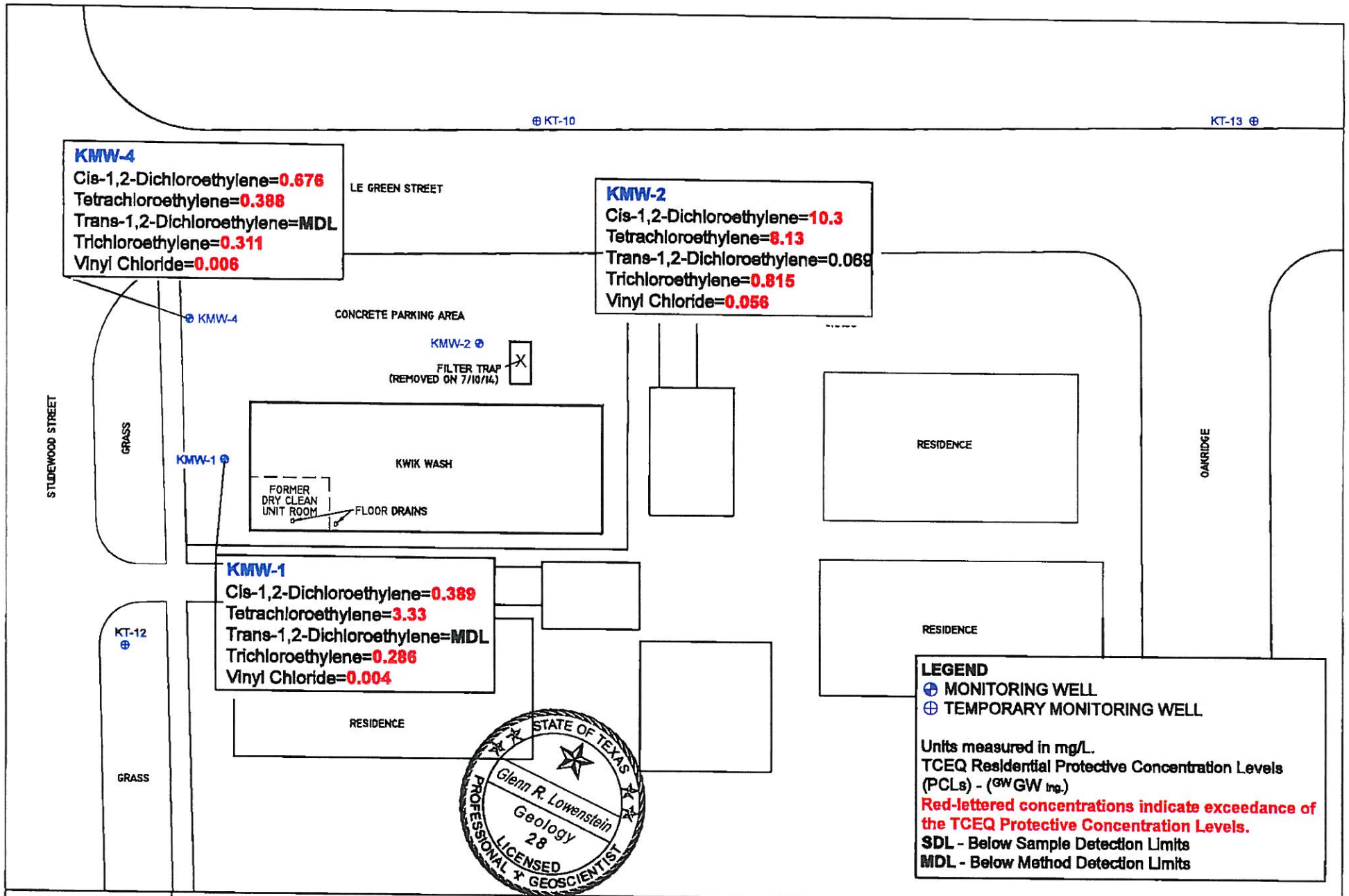
Kwik Wash (VCP# 2663)
1436 Studewood Street
Houston, Texas 77008
TSI Project No.1312Z-89



Terrain Solutions, Inc.

Groundwater COC Concentration Map (10/15/2014)

Kwik Wash (VCP# 2663)
1436 Studewood Street
Houston, Texas 77008
TSI Project No.1312Z-89

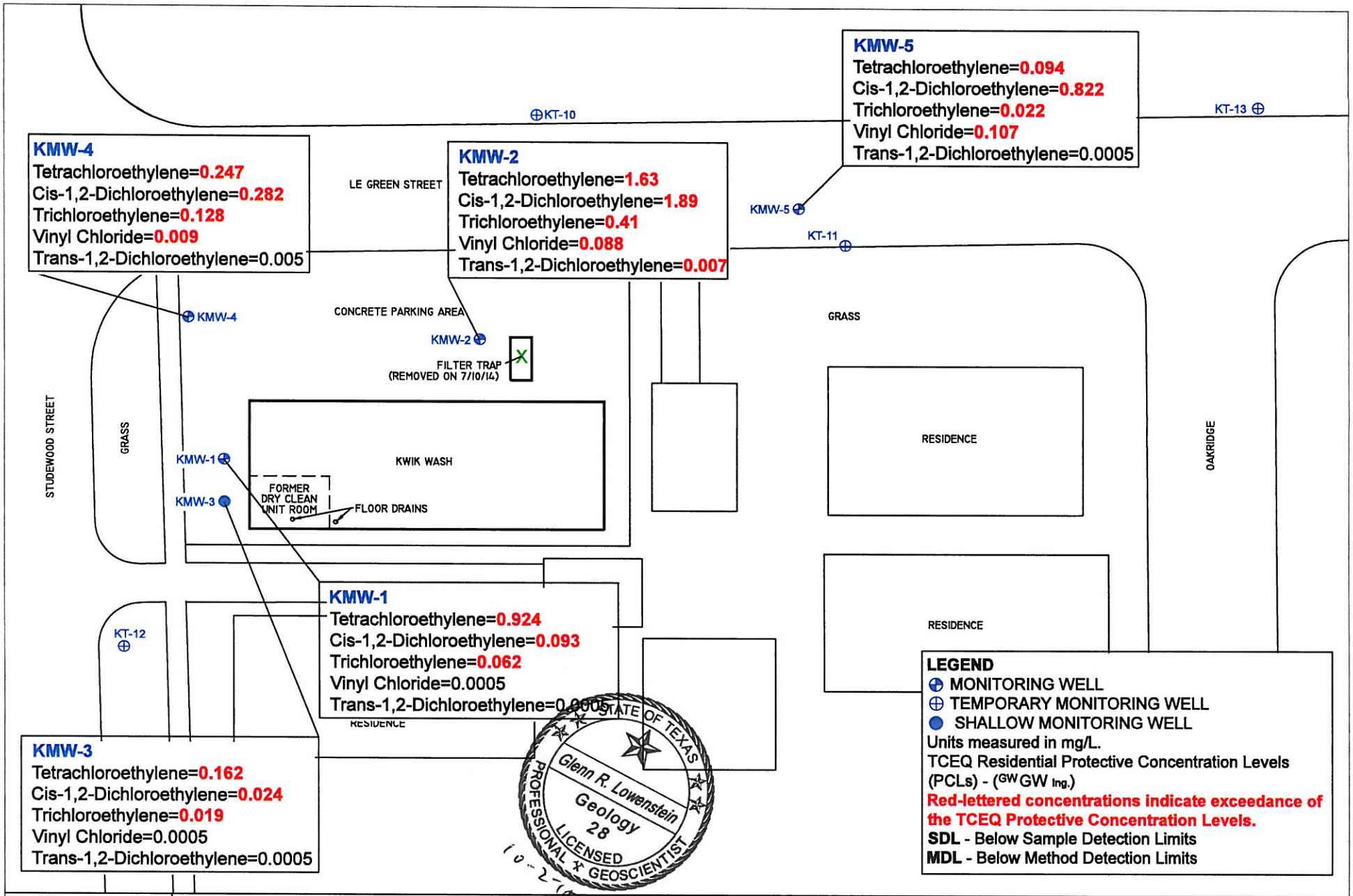


Terrain Solutions, Inc.

Groundwater COC Concentration Map (2/10/2015)

Kwik Wash (VCP# 2663)
1436 Studewood Street
Houston, Texas 77008
TSI Project No.1312Z-89

Approximate Scale:
1 inch = 30 feet
0 Ft. 15 Ft. 30 Ft.


KMW-5
Tetrachloroethylene=0.094
Cis-1,2-Dichloroethylene=0.822
Trichloroethylene=0.022
Vinyl Chloride=0.107
Trans-1,2-Dichloroethylene=0.0005
KMW-4
Tetrachloroethylene=0.247
Cis-1,2-Dichloroethylene=0.282
Trichloroethylene=0.128
Vinyl Chloride=0.009
Trans-1,2-Dichloroethylene=0.005
KMW-2
Tetrachloroethylene=1.63
Cis-1,2-Dichloroethylene=1.89
Trichloroethylene=0.41
Vinyl Chloride=0.088
Trans-1,2-Dichloroethylene=0.007
KMW-1
Tetrachloroethylene=0.924
Cis-1,2-Dichloroethylene=0.093
Trichloroethylene=0.062
Vinyl Chloride=0.0005
Trans-1,2-Dichloroethylene=0.0005
KMW-3
Tetrachloroethylene=0.162
Cis-1,2-Dichloroethylene=0.024
Trichloroethylene=0.019
Vinyl Chloride=0.0005
Trans-1,2-Dichloroethylene=0.0005
KT-10
KT-11
KT-12
KT-13
KMW-5
KMW-4
KMW-2
KMW-1
KMW-3
LE GREEN STREET
CONCRETE PARKING AREA
FILTER TRAP
(REMOVED ON 7/10/14)
KWIK WASH
FORMER
DRY CLEAN
UNIT ROOM
FLOOR DRAINS
STUDEWOOD STREET
GRASS
GRASS
RESIDENCE
RESIDENCE
RESIDENCE
OAKRIDGE
STATE OF TEXAS
Glenn R. Lowenstein
Geology
28
LICENSED
PROFESSIONAL GEOSCIENTIST
10-2-16
LEGEND
MONITORING WELL
TEMPORARY MONITORING WELL
SHALLOW MONITORING WELL
Units measured in mg/L.
TCEQ Residential Protective Concentration Levels
(PCLs) - (GW GW Ing.)
Red-lettered concentrations indicate exceedance of the TCEQ Protective Concentration Levels.
SDL - Below Sample Detection Limits
MDL - Below Method Detection Limits
Terrain Solutions, Inc.
Groundwater COC Concentration Map (8/12/2015)
Kwik Wash (MSD# 2015-081-KWL)
1436 Studewood Street
Houston, Texas 77008
TSI Project No. 1507T-47 (REV 1312Z-89)
N
Approximate Scale:
1 inch = 30 feet
0 Ft.
15 Ft.
30 Ft.

Appendix D
Provide for each contaminant of concern within designated groundwater

A comparison of the latest groundwater sampling results (February 2015) to the applicable Texas Risk Reduction Program (TRRP) Tier 1 Residential groundwater ingestion Protective Concentration Levels (PCLs) ($^{GW}GW_{Ing}$) indicates that the COCs in the groundwater plume exceed the PCLs for tetrachloroethylene (PCE), trichloroethylene (TCE), Cis 1,2-dichloroethylene (DCE), and vinyl chloride (VC). However, when compared to the $^{Air}GW_{Inh-V}$ PCLs (Non-Ingestion PCL), as is justified when the MSD is applied, there are no exceedances in the groundwater samples.

The COCs in the shallow groundwater consist of the chlorinated solvents identified above and originate in limited areas between the southwestern corner of the site where the dry cleaning machines historically operated and the concrete lint trap on the eastern boundary and extend northeastward in the direction of groundwater gradient a total distance of approximately 200 feet. The COC plume terminates north and adjacent to the residence located southwest of the intersection of Oakridge and Le Green. The width of the PCLE plume is estimated at 30 feet underlying the western section of the Kwik Wash site.

The Protective Concentration Level Exceedance Zone (PCLEZ) groundwater plume is approximately 8,000 square feet (SF). Each of the COCs is found exceeding their respective Tier 1 Residential $^{GW}GW_{ing}$. Ingestion PCLs within the PCLEZ (PCE = 0.005 mg/l; TCE= 0.005 mg/l; DCE= 0.07 mg/l; VC= 0.002 mg/l. The COCs do not exceed their respective Tier 1 Residential $^{Air}GW_{inh-V}$. Non- Ingestion PCLs within the PCLEZ (PCE = 500 mg/l; TCE= 24 mg/l; DCE= 1,200 mg/l; VC= 3.8 mg/l). The minimum depth to the impacted groundwater is approximately 16 feet below ground surface (bgs) and the maximum is 36 feet bgs representing a thin water-bearing upper zone that is not defined as an aquifer, and a lower aquifer.

Chemical of Concern (COC) (contaminant)	Maximum Concentration in Groundwater (mg/L)	Date sampled	Vertical (feet) and Horizontal Extent (Square feet) of PCL exceedance	Tier 1 PCL Residential ingestion concentration – ${}^{GW}GW_{Ing}$ (mg/L)	Tier 1 PCL Residential non-ingestion concentration – ${}^{Air}GW_{Inh-V}$ (mg/L)	Geochemical and Physical Properties of COC
Cis-1,2-Dichloroethylene	10.3	02/14/2015	30 feet 7,000 SF	0.070	1,200	Molecular weight = 96.9 Specific Gravity = 1.28 Solubility in water =4,930 mg/l
Methylene chloride	0.012	5/07/2013	N/A	0.005	21,000	Molecular weight = 84.9 Specific Gravity = 1.32 Solubility in water =15,400 mg/l
Tetrachloroethylene	17.9	8/28/2013	30 feet 7,000 SF	0.005	500	Molecular weight = 166 Specific Gravity = 1.623 Solubility in water =200 mg/l
Trichloroethylene	0.815	2/14/2015	30 feet 7,000 SF	0.005	24	Molecular weight = 131.39 Specific Gravity = 1.46 Solubility in water =1,100 mg/l
1,1-Dichloroethylene	0.01	02/14/2015	30 feet 7,000 SF	0.007	1,700	Molecular weight = 96.94 Specific Gravity = 1.213 Solubility in water = 2,400 mg/l
Vinyl Chloride	0.469	8/28/2013	30 feet 7,000 SF	0.002	3.8	Molecular weight = 62.5 Specific Gravity = 0.91 Solubility in water =2,760 mg/l

Appendix E
A table for each contaminant of concern

Surface Soil Residential Assessment Levels for Human Health Exposure Pathways

COC	Source area size (acres)	$^{Tot}Soil_{Comb}$ PCL (mg/kg)	$^{Air}Soil_{Inh-V}$ PCL (mg/kg) (Non-Ingestion PCL)	$^{GW}Soil_{ING}$ PCL (mg/kg)	Maximum concentration (mg/kg)			
					Sample ID	Sample depth	Sample date	Conc (mg/kg)
1,2,3-Trichloropropane	<0.5	0.2	14.0	0.00053	KB-7 (0-2.5)	0-2.5	6/27/13	0.02

Yellow Highlight = exceedance of only $^{GW}Soil_{Ing}$ (Non-ingestion PCL was not exceeded)

Subsurface Soil Residential Assessment Levels

COC	Source area size (acres)	$^{Tot}Soil_{Comb}$ PCL (mg/kg)	$^{Air}Soil_{Inh-V}$ PCL (mg/kg) (Non-Ingestion PCL)	$^{GW}Soil_{Ing.}$ PCL (mg/kg)	Maximum concentration (mg/kg)			
					Sample ID	Sample depth	Sample date	Maximum Concentration (mg/kg)
Cis-1,2-Dichloroethylene	<0.5	140	920	0.25	KMW-2 (20-22.5)	20-22.5	4/24/2013	2.55
Tetrachloroethylene	<0.5	710	940	0.05	KMW-2 (20-22.5)	20-22.5	4/24/2013	4.58
Trichlorethylene	<0.5	18	31	0.034	KMW-2 (20-22.5)	20-22.5	4/24/2013	0.198

Yellow Highlight = exceedance of only $^{GW}Soil_{Ing}$ (Non-ingestion PCL was not exceeded)

Groundwater Residential Assessment Levels

Groundwater COC	$^{GW}GW_{Ing}$ (mg/L)	$^{Air}GW_{Inh-V}$ (Non-Ingestion PCL)		Maximum concentration			
		(mg/L)	TRRP Tier	Sample ID	Well depth (ft)	Sample date	Maximum Concentration (mg/L)
Cis-1,2-Dichloroethylene	0.07	1,200	1	KMW-2	35	02/14/2015	10.2
Methylene chloride	0.005	21,000	1	KW-1A*	20	5/07/13	0.012
Tetrachloroethylene	0.005	500	1	KT-11	35	8/28/2013	17.9
Trichloroethylene	0.005	24.0	1	KMW-2	35	2/14/2015	0.815
1,1-Dichloroethylene	0.007	1,700	1	KMW-2	35	02/14/2015	0.01
Vinyl Chloride	0.002	3.8	1	KT-11	35	8/28/2013	0.469
Yellow Highlight = exceedance of only $^{GW}GW_{Ing}$ (Non-ingestion PCL was not exceeded)							

Appendix F
List owners of additional property if plume extends beyond property line

Potentially Impacted Property Owner Name	Potentially Impacted Property Owner address	Contact
Mary E Sweetin and Lois R Farris	4635 Oak Ridge Street, Houston, Texas 77009-4422	See below

Interview with down-gradient property owners

A meeting with the property neighbor was held on December 16, 2014. The discussion involved regarding the history of the spill, the likelihood of her property being impacted with chlorinated solvents, the need for a water well restriction, and a brief preview of the MSD process. A request was made that they consider executing a deed restriction forbidding the installation of a drinking water well on their property. Several follow-up contact attempts have been made.

Appendix G
Stability of plume contamination

Groundwater samples collected from the five groundwater monitoring wells in the subject area intersecting the aquifer underlying the subject site have been sampled/chemically analyzed six times between April 2013 – August 2015. There appears to be a single contaminant plume located underlying the subject site and primarily trending north -northeast following groundwater gradient. The contaminant plume is composed of four primary COCs namely, tetrachloroethylene, trichloroethylene, cis 1,2-dichloroethylene, and vinyl chloride. During this time period, the COC concentrations have shown the following trends:

COC	**Concentration Trend – Mann Kendall Analysis**
Tetrachloroethylene (PERC) Trichloroethylene Cis 1,2-Dichloroethylene	Fluctuating but stable concentration. Decreasing as of the last sample event.
1,1 Dichloroethylene	Stable
Vinyl Chloride	Fluctuating but stable concentration.

There were no significant increases in COC concentrations from 2013-2015 (Appendix E). Groundwater monitoring downgradient of the former source area (KT-11 and KMW-5) from August 2013 through October 2015 indicated a general decrease in COC concentrations. Fluctuations in COCs are typically due to groundwater level changes from seasonal or flooding events. Concentration increases of degradation products like vinyl chloride can be expected over time due to the natural attenuation of the original solvent, tetrachloroethylene. When the COC concentrations were compared to the Air-GW-Inh-V PCLs, the COC concentrations were over two hundred times lower. The contaminant plume has been delineated by groundwater sample collection the permanent and temporary wells installed on and adjacent to the property.

SOIL SAMPLE RESULTS
KWIK WASH LAUNDRY VCP# 2663, 1436 STUDEWOOD, HOUSTON, TX 77008
TSI PROJECT NO. 1312Z-89

Sample ID/ (Depth In Feet)	Sample Collection Date	Volatile Organic Compounds (mg/Kg) Method 8260
KMW-1 (20-22.5)	04/24/2013	All analytes are below SDLs except: Cis-1,2-Dichloroethylene = 0.106 Tetrachloroethylene = **0.183** Trichloroethylene = 0.03
KMW-2 (20-22.5)	04/24/2013	All analytes are below SDLs except: Cis-1,2-Dichloroethylene = **2.55** Tetrachloroethylene = **4.58** Trans-1,2-Dichloroethylene = 0.017 Trichloroethylene = **0.198**
KB-1 (2 ½-5)	06/27/2013	All analytes are below SDLs except: Cis-1,2-Dichloroethylene = 0.006
KB-2 (0-2 ½)	06/27/2013	All analytes are below SDLs
KB-3 (0-2 ½)	06/27/2013	All analytes are below SDLs
KB-4 (2 ½-5)	06/27/2013	All analytes are below SDLs
KB-5 (2 ½-5)	06/27/2013	All analytes are below SDLs except: 4-Isopropyltoluene = 0.042 MEK = 0.015
KB-6 (2 ½-5)	06/27/2013	All analytes are below SDLs except: MEK = 0.007
KB-7 (0-2 ½)	06/27/2013	All analytes are below SDLs except: 1,2,3-Trichloropropane = **0.02** Cis-1,2-Dichloroethylene = 0.005 MEK = 0.01 Tetrachloroethylene = 0.035 Trichlorethylene = 0.022
KT-10 (6-8)	08/28/2013	All analytes are below SDLs
KT-10 (24-28)	08/28/2013	All analytes are below SDLs

SOIL SAMPLE RESULTS
KWIK WASH LAUNDRY VCP# 2663, 1436 STUDEWOOD, HOUSTON, TX 77008
TSI PROJECT NO. 1312Z-89

KT-11 (6-8)	**08/28/2013**	All analytes are below SDLs
KT-11 (12-16)	**08/28/2013**	All analytes are below SDLs
KT-12 (8-12)	**08/28/2013**	All analytes are below SDLs
KT-12 (24-28)	**08/28/2013**	All analytes are below SDLs

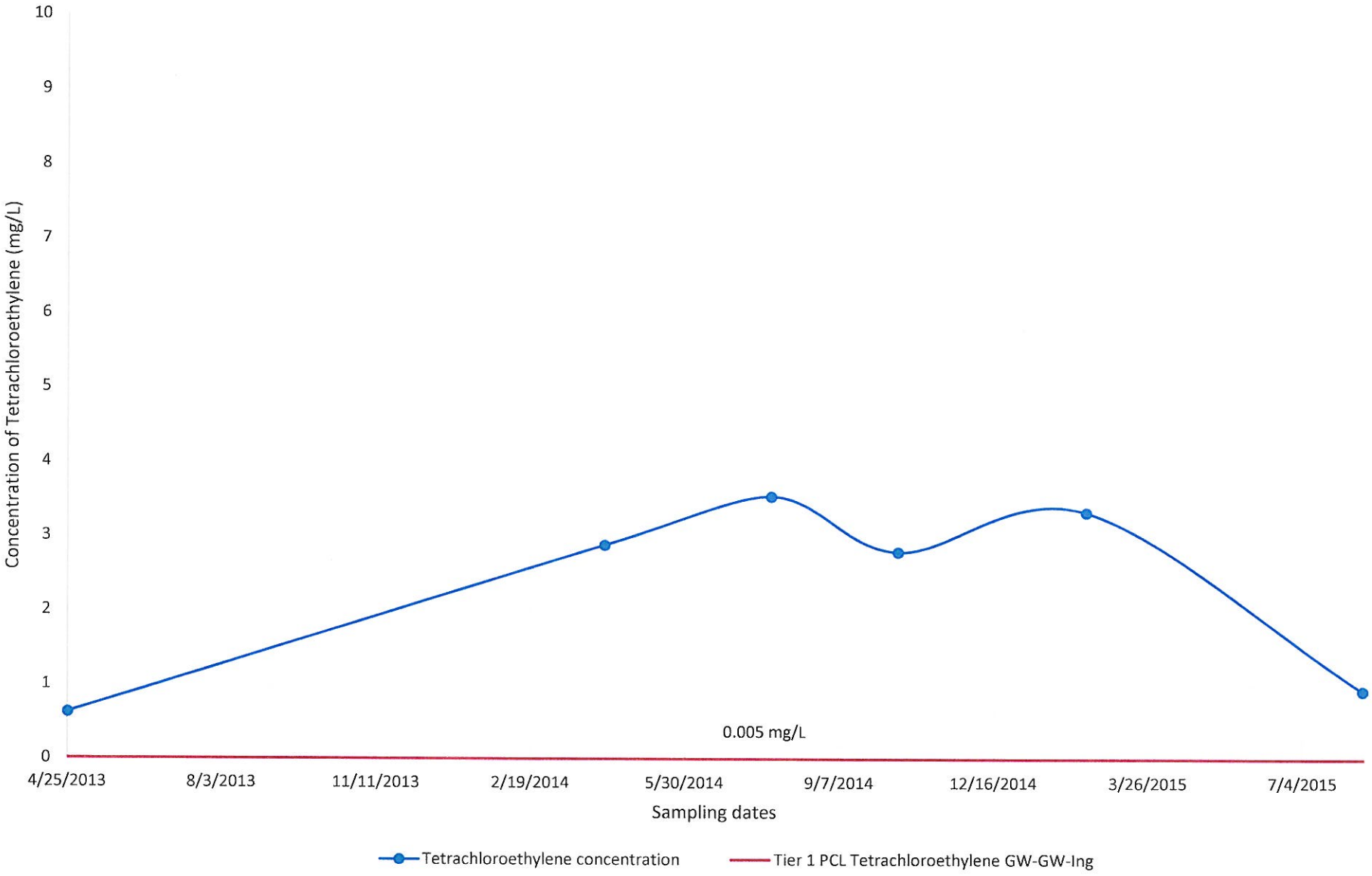
Red-lettered concentrations indicate exceedance of the TCEQ Protective Concentration Levels
SDLs=Sample Detection Limits

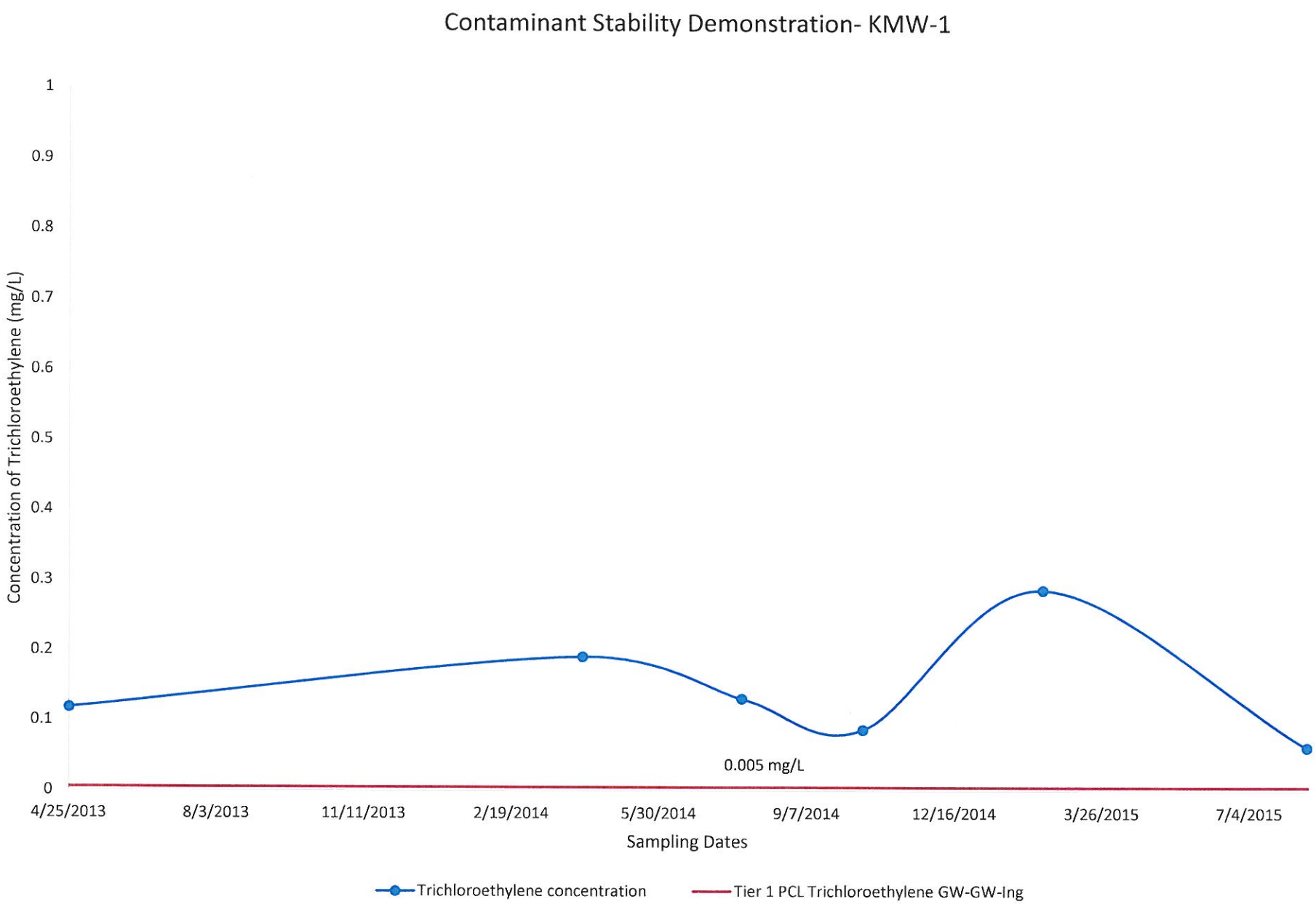
TCEQ Residential Protective Concentration Levels (PCLs) 0.5-Acre Source Area (^{Tot}Soil $_{Ing}$ / ^{GW}Soil $_{Ing}$) – Updated June 29, 2012	**Cis-1,2-Dichloroethylene = 140 / 0.25** **Tetrachloroethylene = 450 / 0.05** **Trichlorethylene = 18 / 0.034** **4-Isopropyltoluene = 8,200 / 230** **1,2,3-Trichloropropane = 0.2 / 0.00053** **MEK = 40,000 / 29**

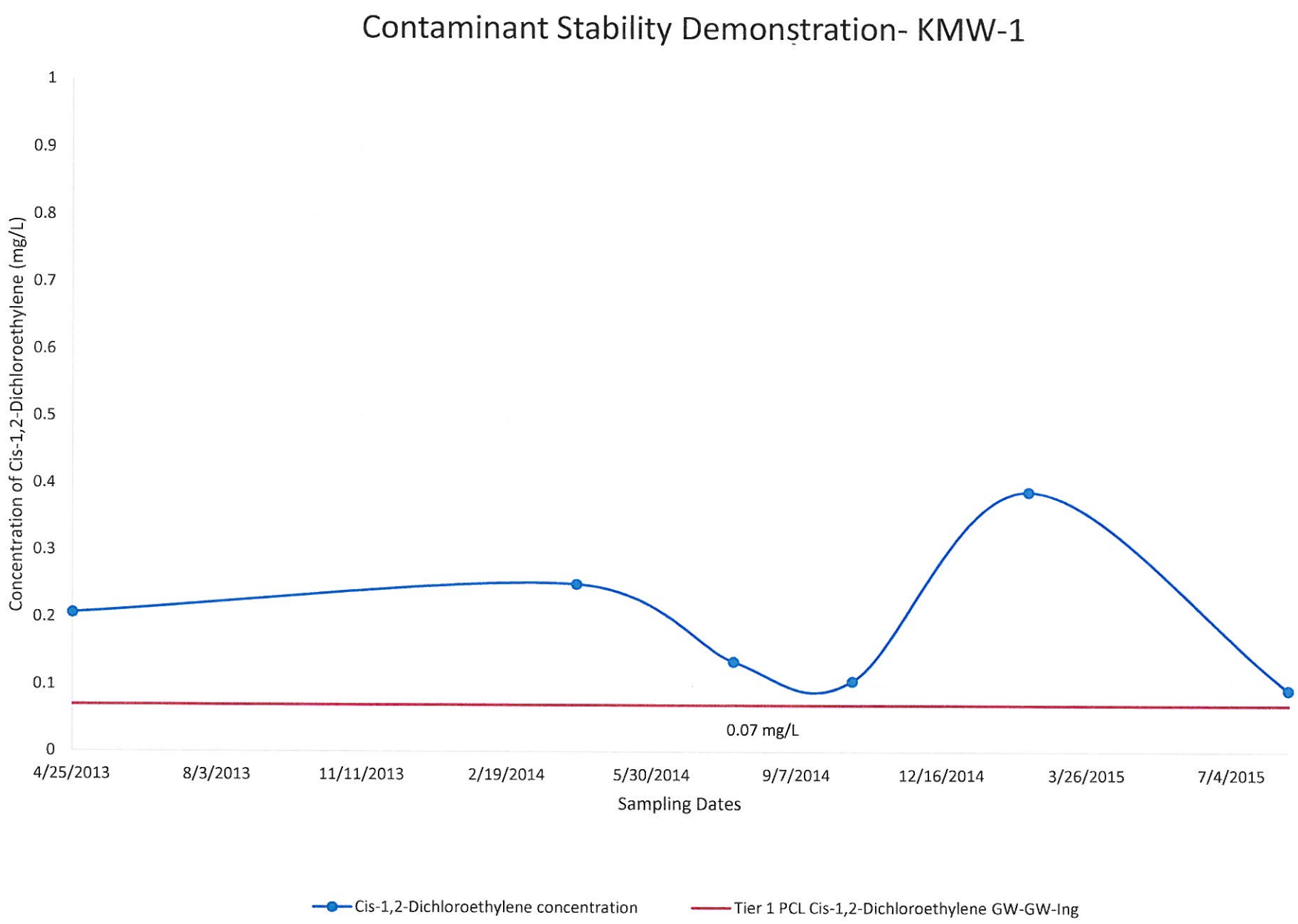
GROUNDWATER SAMPLE RESULTS AND PLUME STABILITY ANALYSIS
KWIK WASH (MSD APPLICATION #2015-081-KWL), 1436 STUDEWOOD ST., HOUSTON, TEXAS 77008
TSI PROJECT NO. 1507T-47

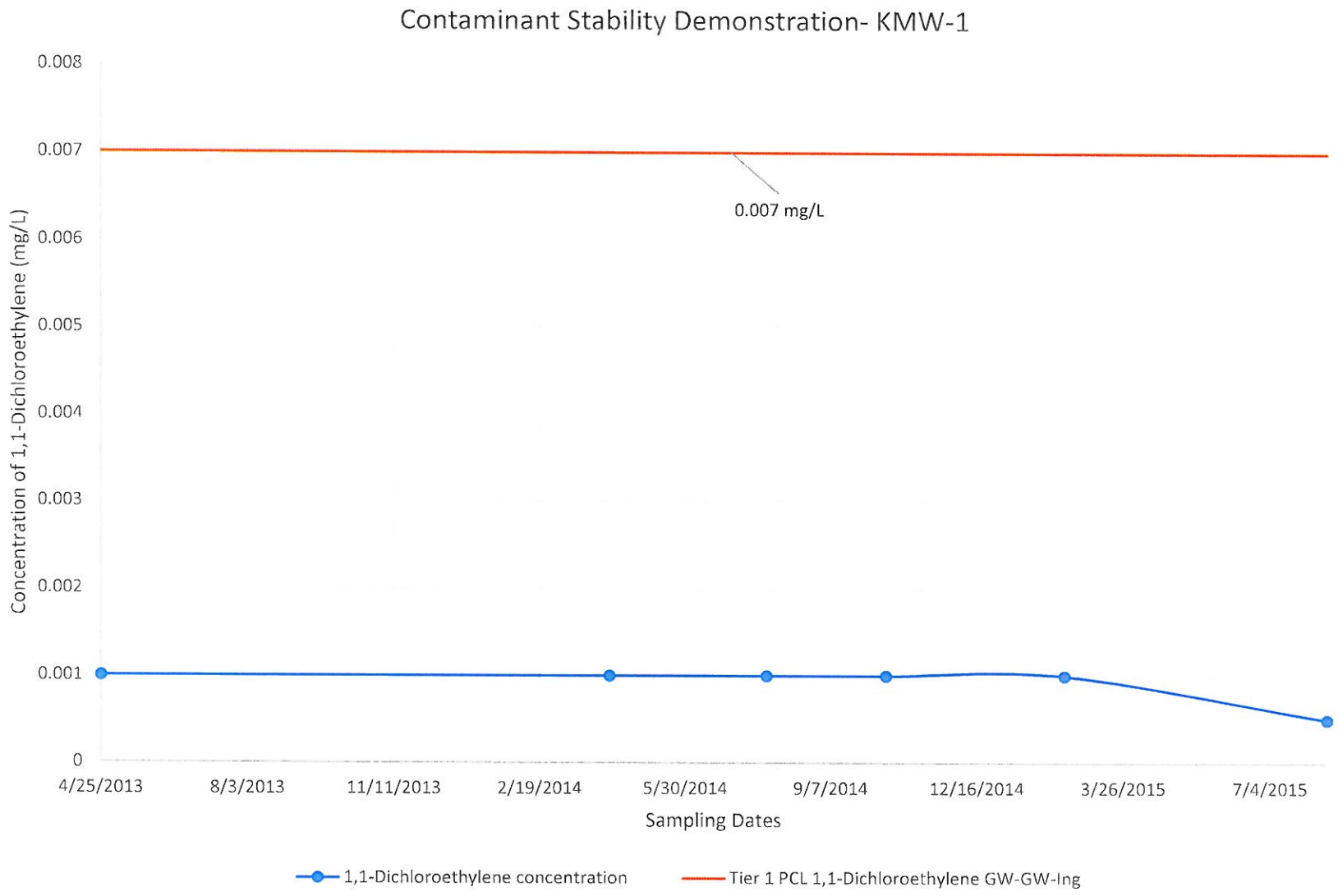
MONITOR WELL	DATE	Tetrachloroethylene (mg/L) Method 8260C	Cis-1,2-Dichloroethylene (mg/L) Method 8260C	Trichloroethylene (mg/L) Method 8260C	Vinyl Chloride (mg/L) Method 8260C	1,1-Dichloroethylene (mg/L) Method 8260C
TCEQ Residential Protective Concentrations Levels (PCLs) - (GW GW Ing.)		0.005	0.07	0.005	0.002	0.007
KMW-1	4/25/2013	0.622	0.207	0.118	0.019	0.001
	4/8/2014	2.88	0.25	0.191	0.001	0.001
	7/25/2014	3.54	0.135	0.131	0.006	0.001
	10/15/2014	2.79	0.106	0.087	0.002	0.001
	2/14/2015	3.33	0.389	0.286	0.004	0.001
	8/12/2015	0.924	0.093	0.062	0.0005	0.0005
KMW-2	4/25/2013	3.05	1.54	0.126	0.049	0.002
	4/8/2014	5.41	5.31	0.001	0.001	0.001
	7/25/2014	13.9	7.35	0.729	0.149	0.009
	10/15/2014	13.1	0.001	0.686	0.166	0.01
	2/14/2015	8.13	10.3	0.815	0.056	0.01
	8/12/2015	1.63	1.89	0.41	0.088	0.007
KMW-3	8/12/2015	0.162	0.024	0.019	0.0005	0.0005
KMW-4	7/1/2013	0.197	0.149	0.085	0.004	0.001
	4/8/2014	0.238	0.273	0.142	0.013	0.001
	7/25/2014	0.404	0.297	0.181	0.016	0.001
	10/15/2014	0.438	0.373	0.001	0.019	0.001
	2/14/2015	0.388	0.676	0.311	0.006	0.001
	8/12/2015	0.247	0.282	0.128	0.009	0.0005
KT-10	8/28/2013	0.001	0.001	0.001	0.001	0.0005
KT-11	8/28/2013	17.9	7.37	0.337	0.469	0.009
KMW-5	8/12/2015	0.094	0.822	0.022	0.107	0.0005
	10/29/2015	0.117	1.23	0.025	0.240	0.001
KT-12	8/28/2013	0.001	0.001	0.001	0.001	0.001
KT-13	6/13/2014	0.001	0.001	0.001	0.001	0.001

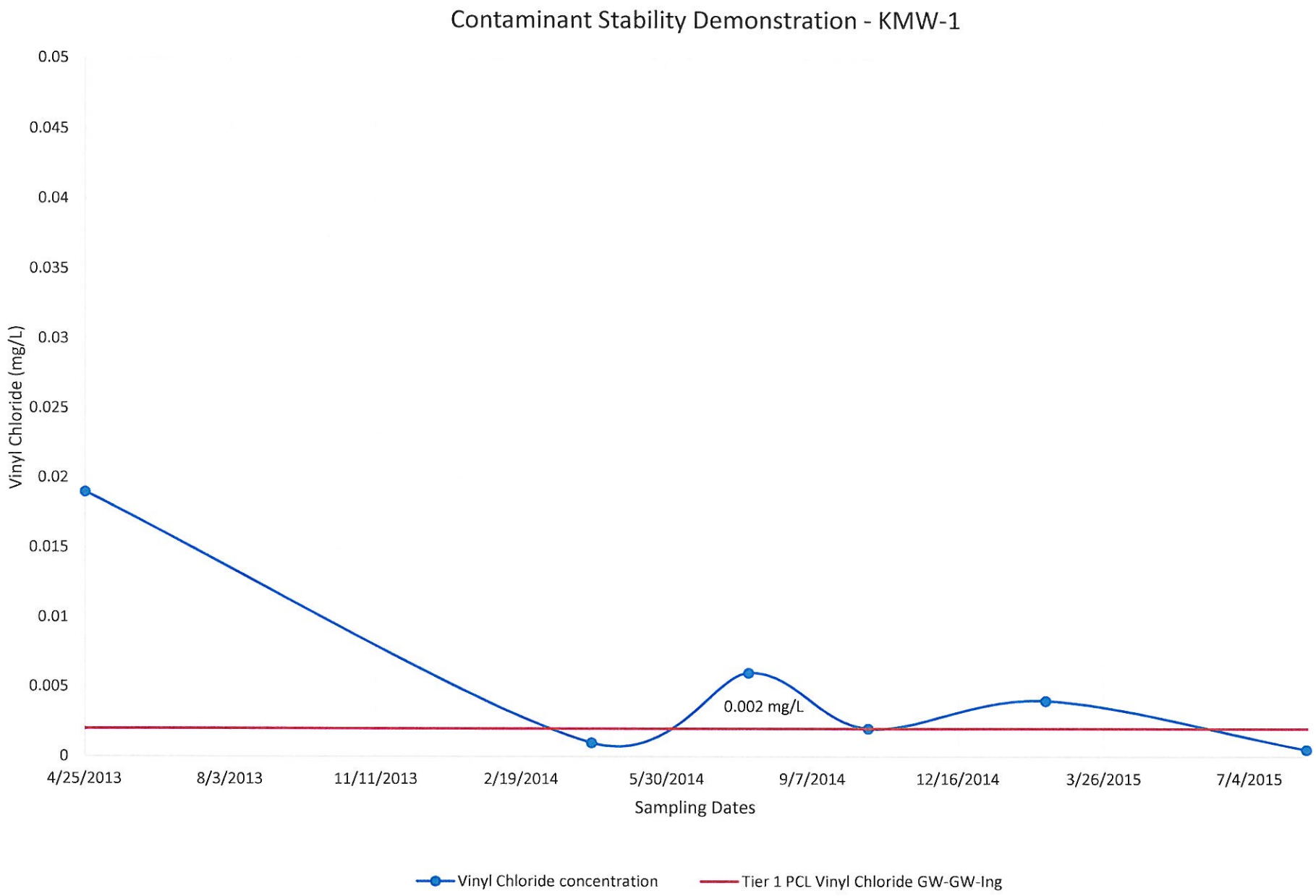
Contaminant Stability Demonstration- KMW-1

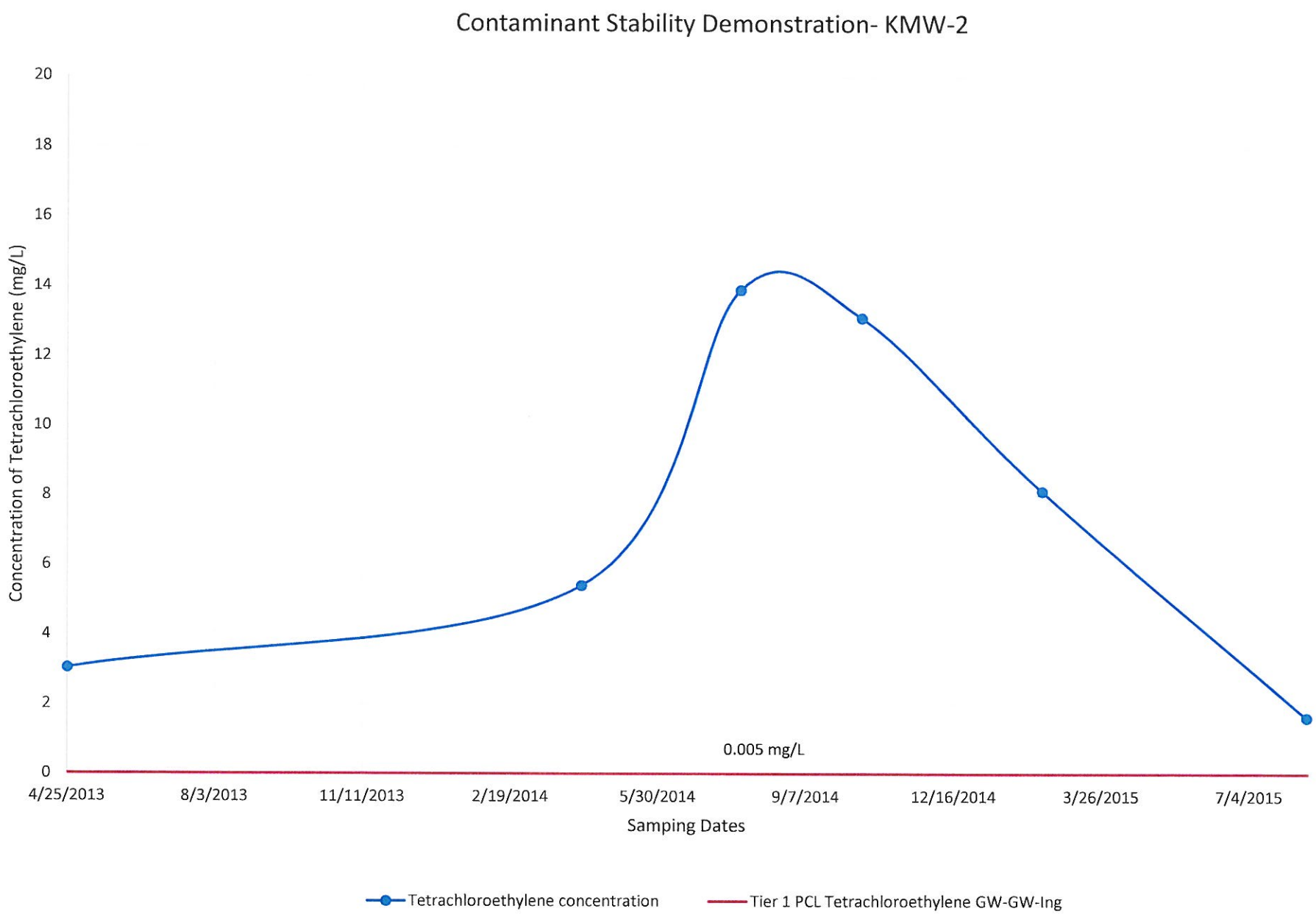


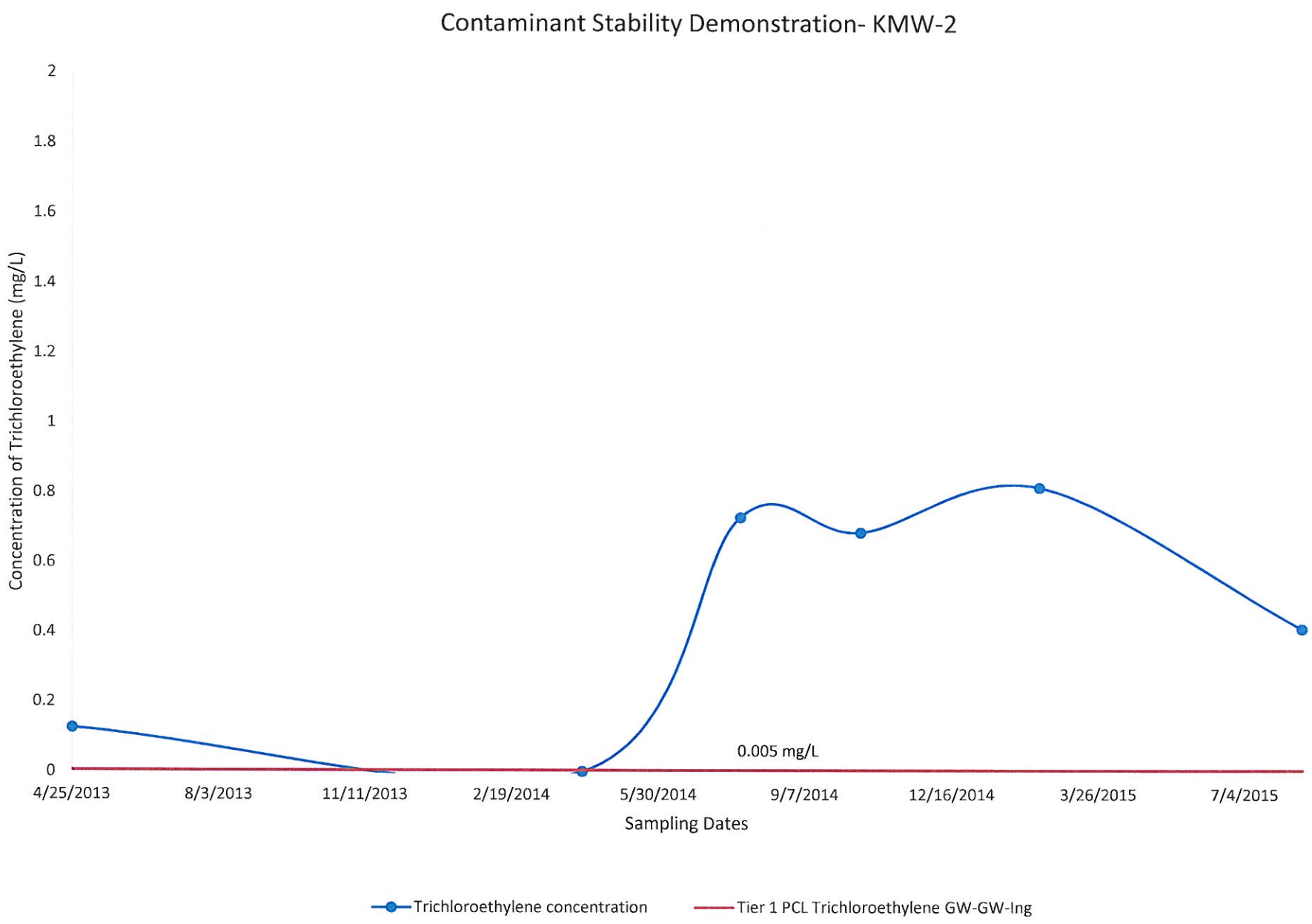

Contaminant Stability Demonstration- KMW-1
Concentration of Trichloroethylene (mg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.005 mg/L
4/25/2013
8/3/2013
11/11/2013
2/19/2014
5/30/2014
9/7/2014
12/16/2014
3/26/2015
7/4/2015
Sampling Dates
Trichloroethylene concentration
Tier 1 PCL Trichloroethylene GW-GW-Ing

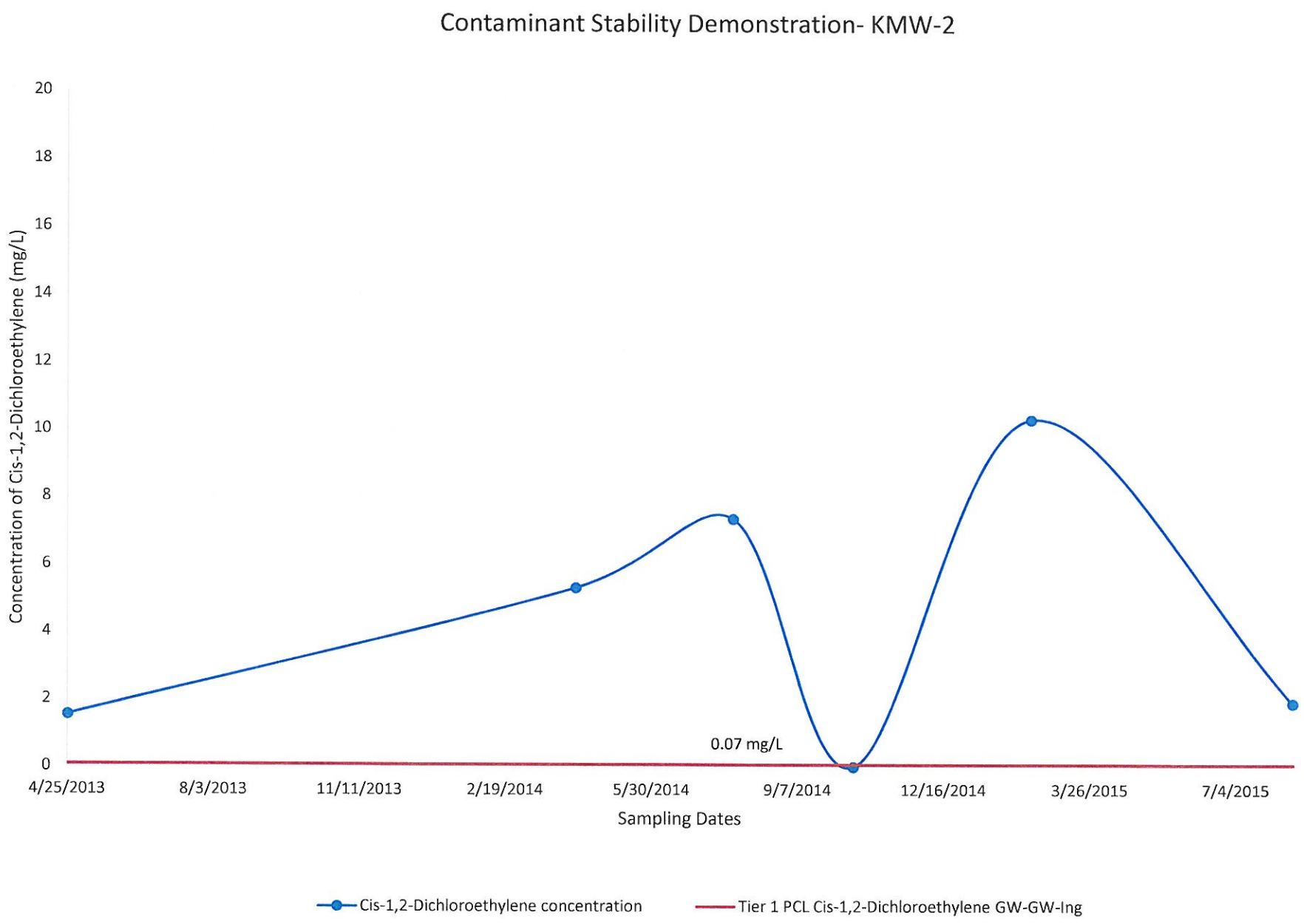

Contaminant Stability Demonstration- KMW-1
Concentration of Cis-1,2-Dichloroethylene (mg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.07 mg/L
4/25/2013
8/3/2013
11/11/2013
2/19/2014
5/30/2014
9/7/2014
12/16/2014
3/26/2015
7/4/2015
Sampling Dates
Cis-1,2-Dichloroethylene concentration
Tier 1 PCL Cis-1,2-Dichloroethylene GW-GW-Ing

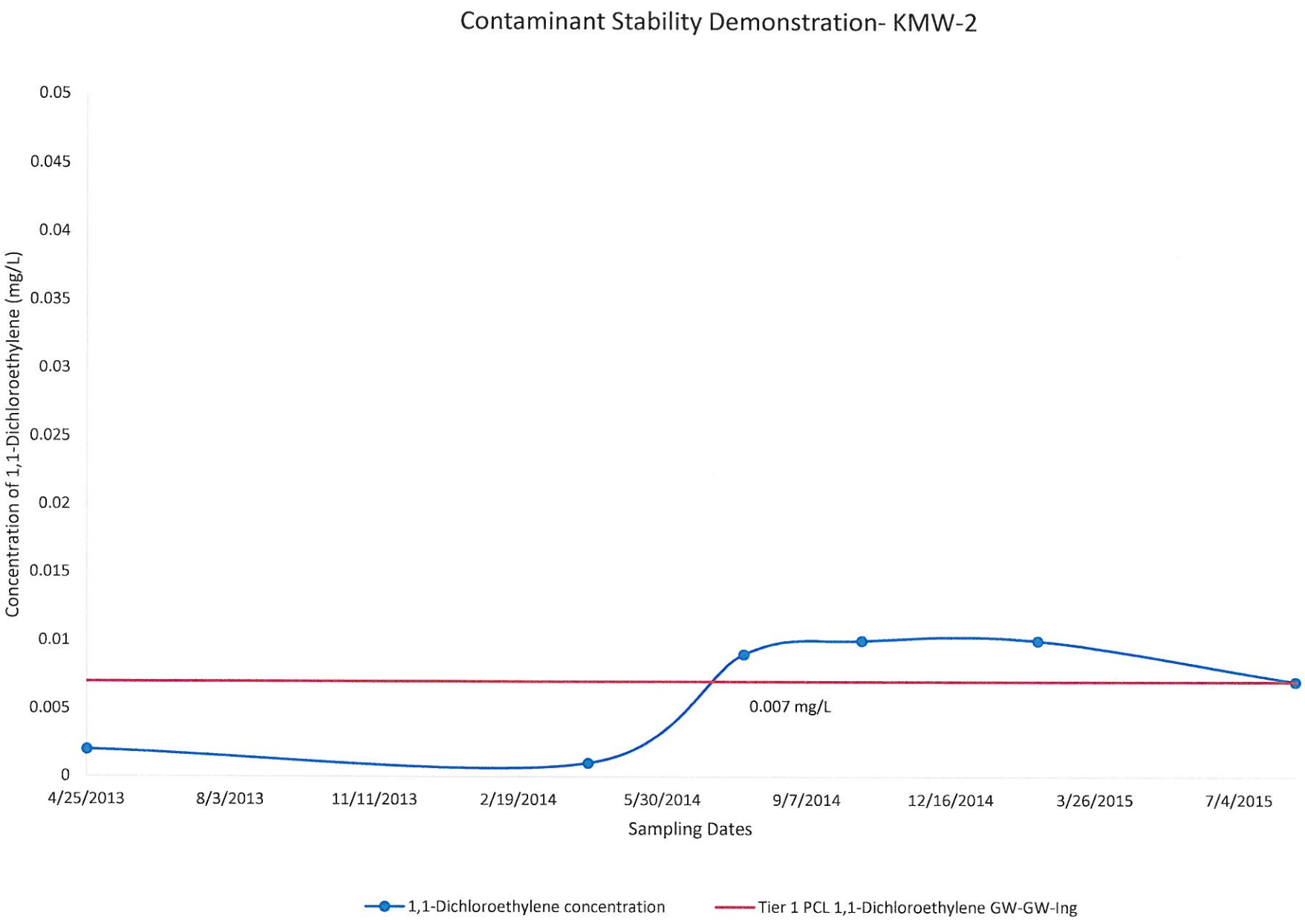

Contaminant Stability Demonstration- KMW-1
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
Concentration of 1,1-Dichloroethylene (mg/L)
0.007 mg/L
4/25/2013
8/3/2013
11/11/2013
2/19/2014
5/30/2014
9/7/2014
12/16/2014
3/26/2015
7/4/2015
Sampling Dates
1,1-Dichloroethylene concentration
Tier 1 PCL 1,1-Dichloroethylene GW-GW-Ing

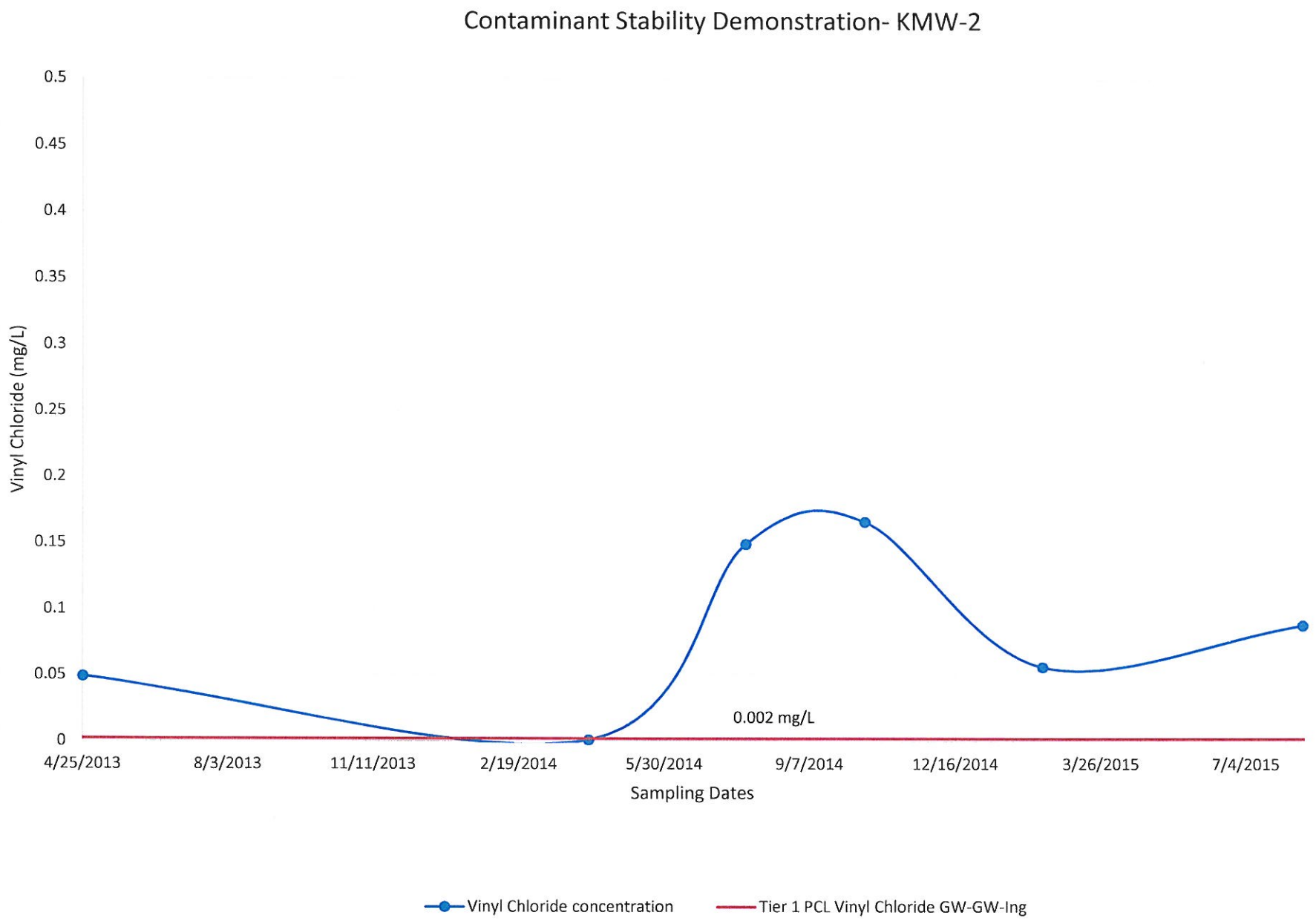

Contaminant Stability Demonstration - KMW-1
Vinyl Chloride (mg/L)
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0.002 mg/L
4/25/2013
8/3/2013
11/11/2013
2/19/2014
5/30/2014
9/7/2014
12/16/2014
3/26/2015
7/4/2015
Sampling Dates
Vinyl Chloride concentration
Tier 1 PCL Vinyl Chloride GW-GW-Ing

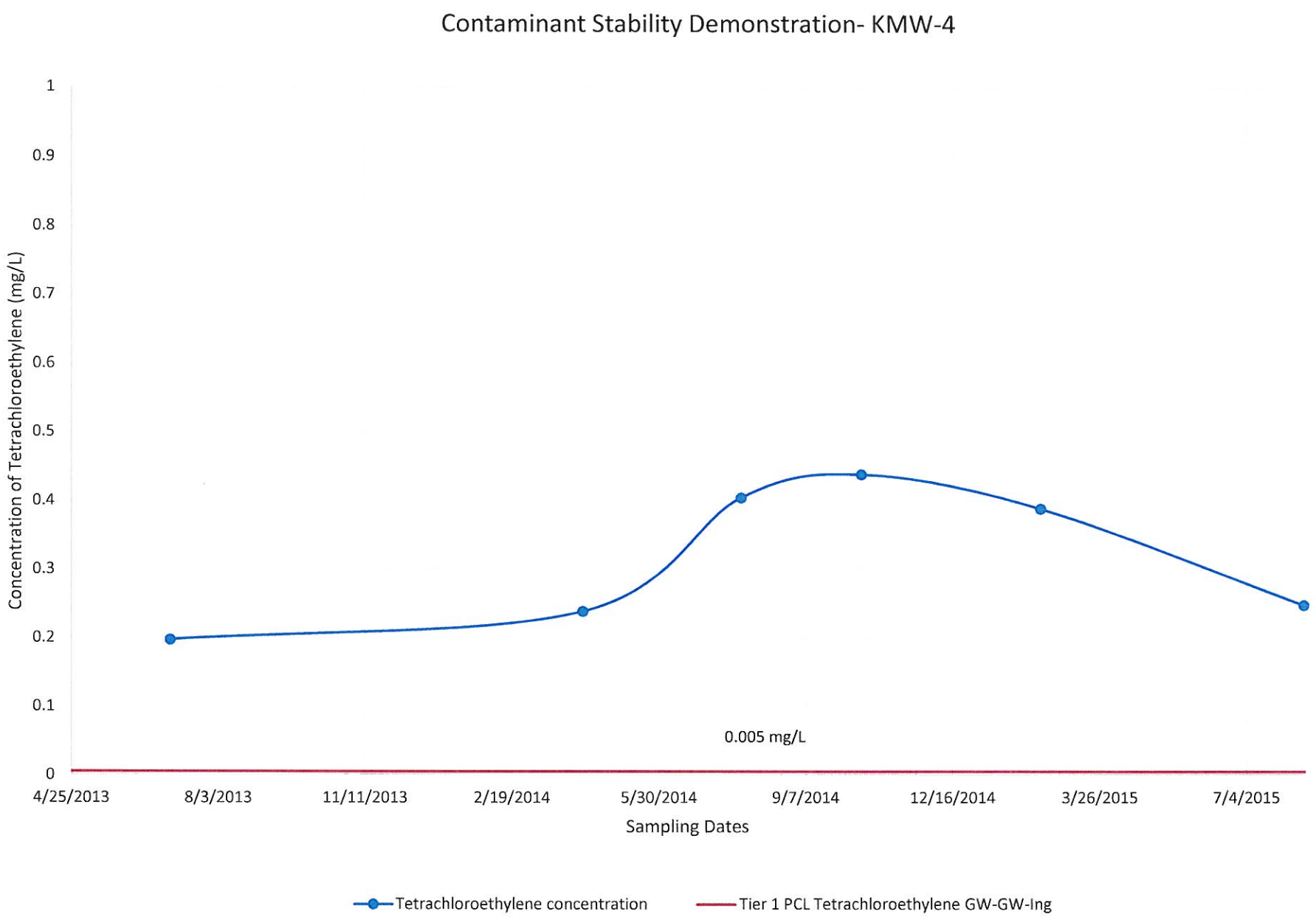

Contaminant Stability Demonstration- KMW-2
Concentration of Tetrachloroethylene (mg/L)
20
18
16
14
12
10
8
6
4
2
0
0.005 mg/L
4/25/2013
8/3/2013
11/11/2013
2/19/2014
5/30/2014
9/7/2014
12/16/2014
3/26/2015
7/4/2015
Samping Dates
Tetrachloroethylene concentration
Tier 1 PCL Tetrachloroethylene GW-GW-Ing

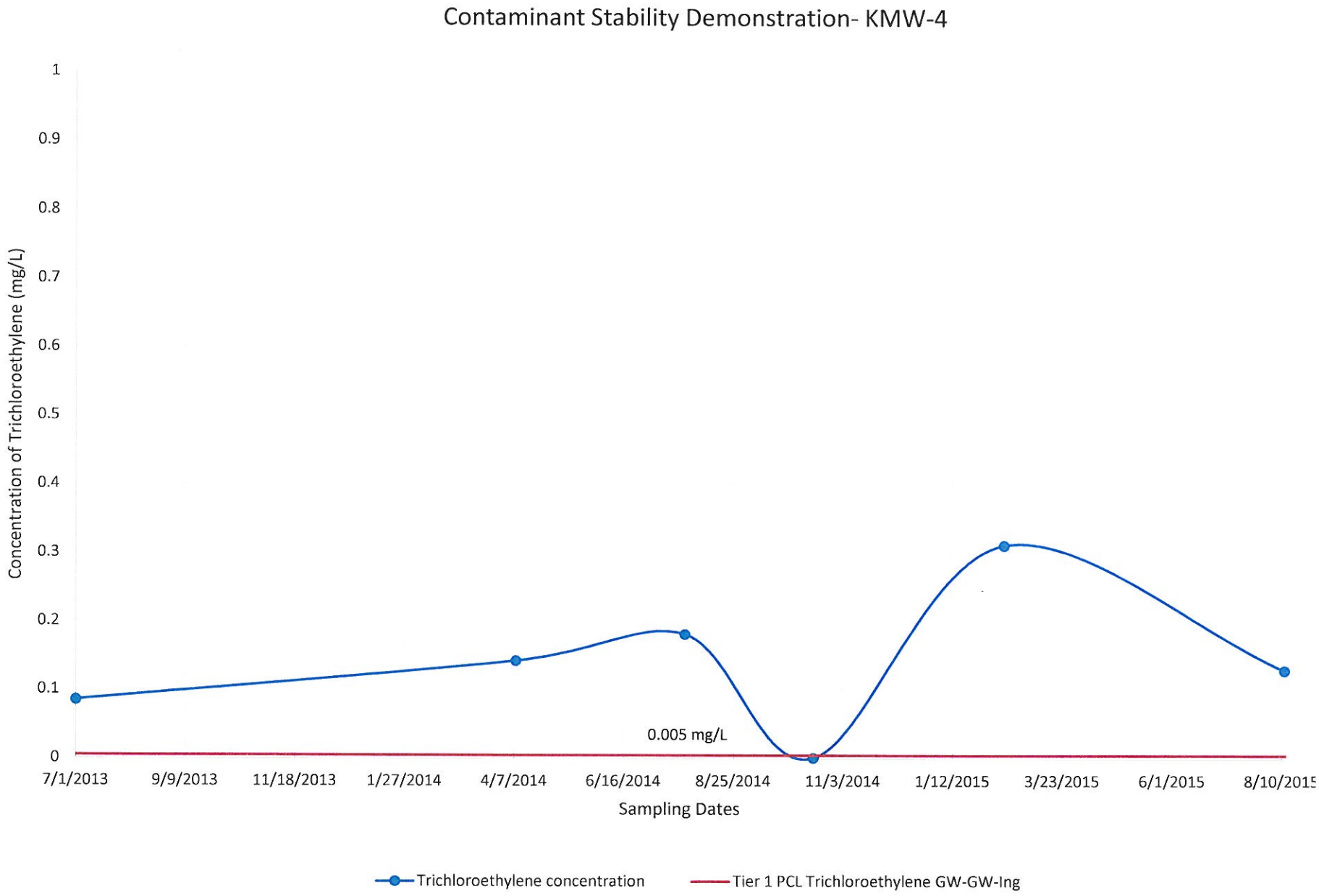

Contaminant Stability Demonstration- KMW-2
Concentration of Trichloroethylene (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.005 mg/L
4/25/2013
8/3/2013
11/11/2013
2/19/2014
5/30/2014
9/7/2014
12/16/2014
3/26/2015
7/4/2015
Sampling Dates
Trichloroethylene concentration
Tier 1 PCL Trichloroethylene GW-GW-Ing

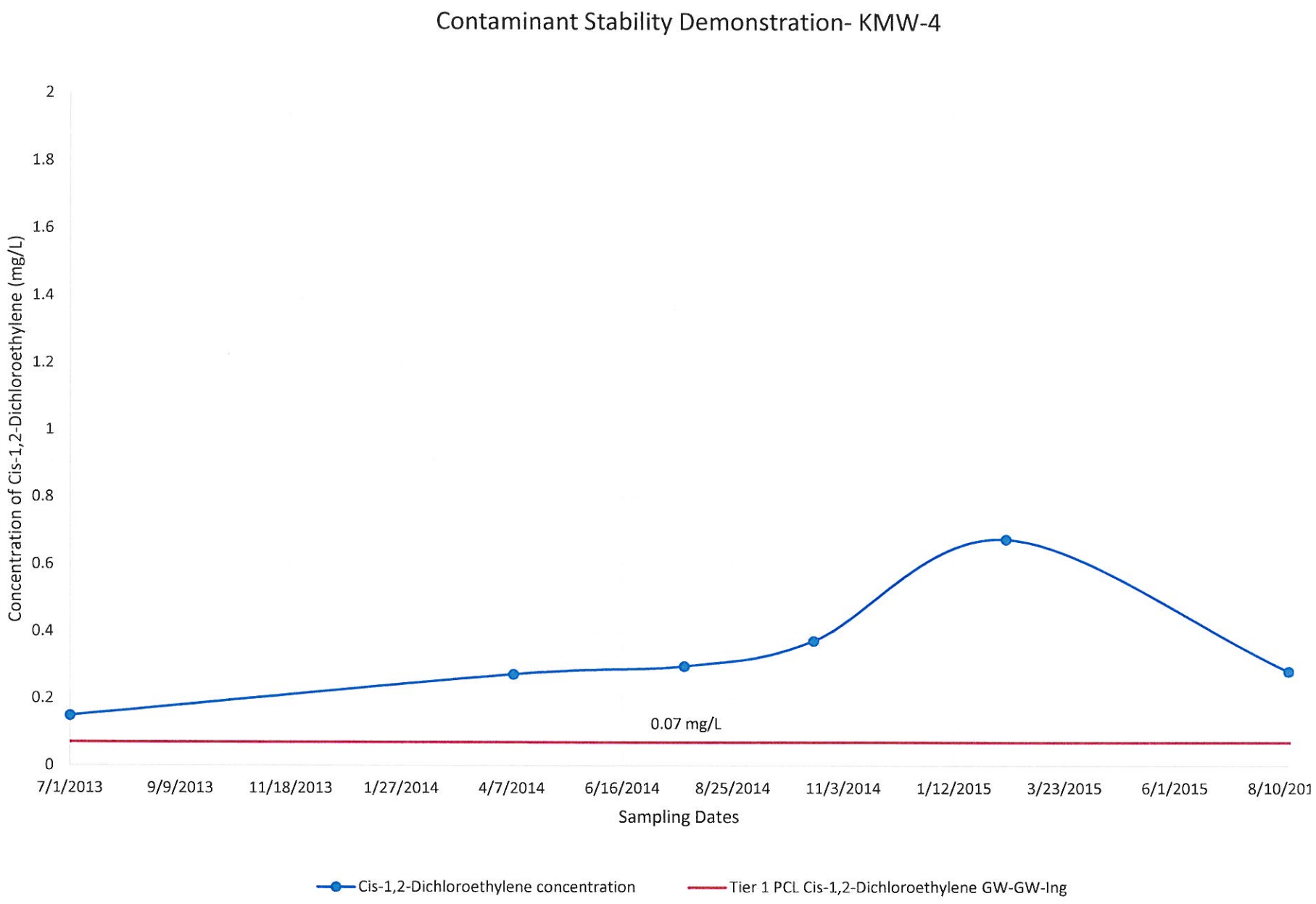

Contaminant Stability Demonstration- KMW-2
Concentration of Cis-1,2-Dichloroethylene (mg/L)
20
18
16
14
12
10
8
6
4
2
0
0.07 mg/L
4/25/2013
8/3/2013
11/11/2013
2/19/2014
5/30/2014
9/7/2014
12/16/2014
3/26/2015
7/4/2015
Sampling Dates
Cis-1,2-Dichloroethylene concentration
Tier 1 PCL Cis-1,2-Dichloroethylene GW-GW-Ing

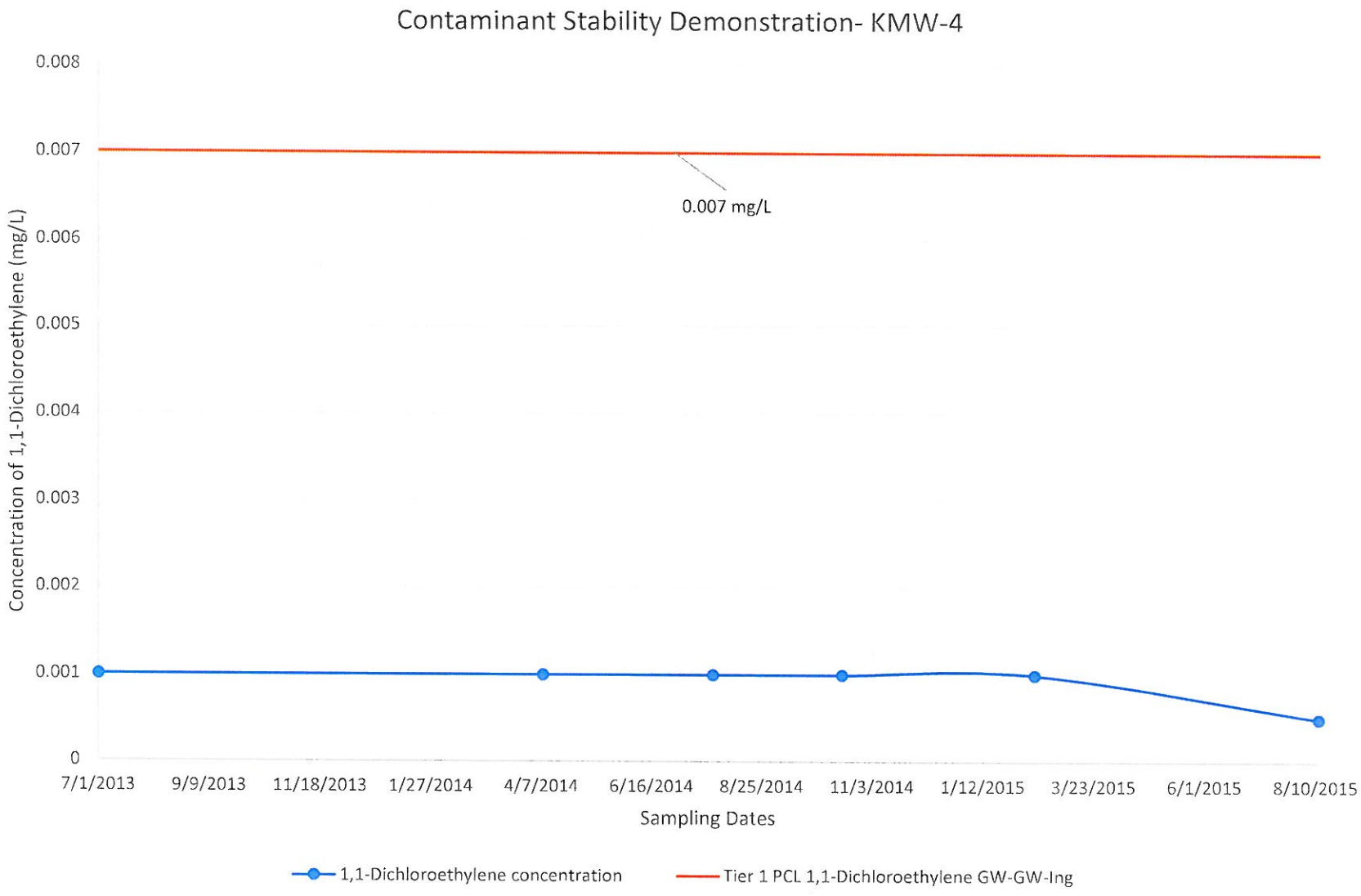

Contaminant Stability Demonstration- KMW-2
Concentration of 1,1-Dichloroethylene (mg/L)
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0.007 mg/L
4/25/2013
8/3/2013
11/11/2013
2/19/2014
5/30/2014
9/7/2014
12/16/2014
3/26/2015
7/4/2015
Sampling Dates
1,1-Dichloroethylene concentration
Tier 1 PCL 1,1-Dichloroethylene GW-GW-Ing

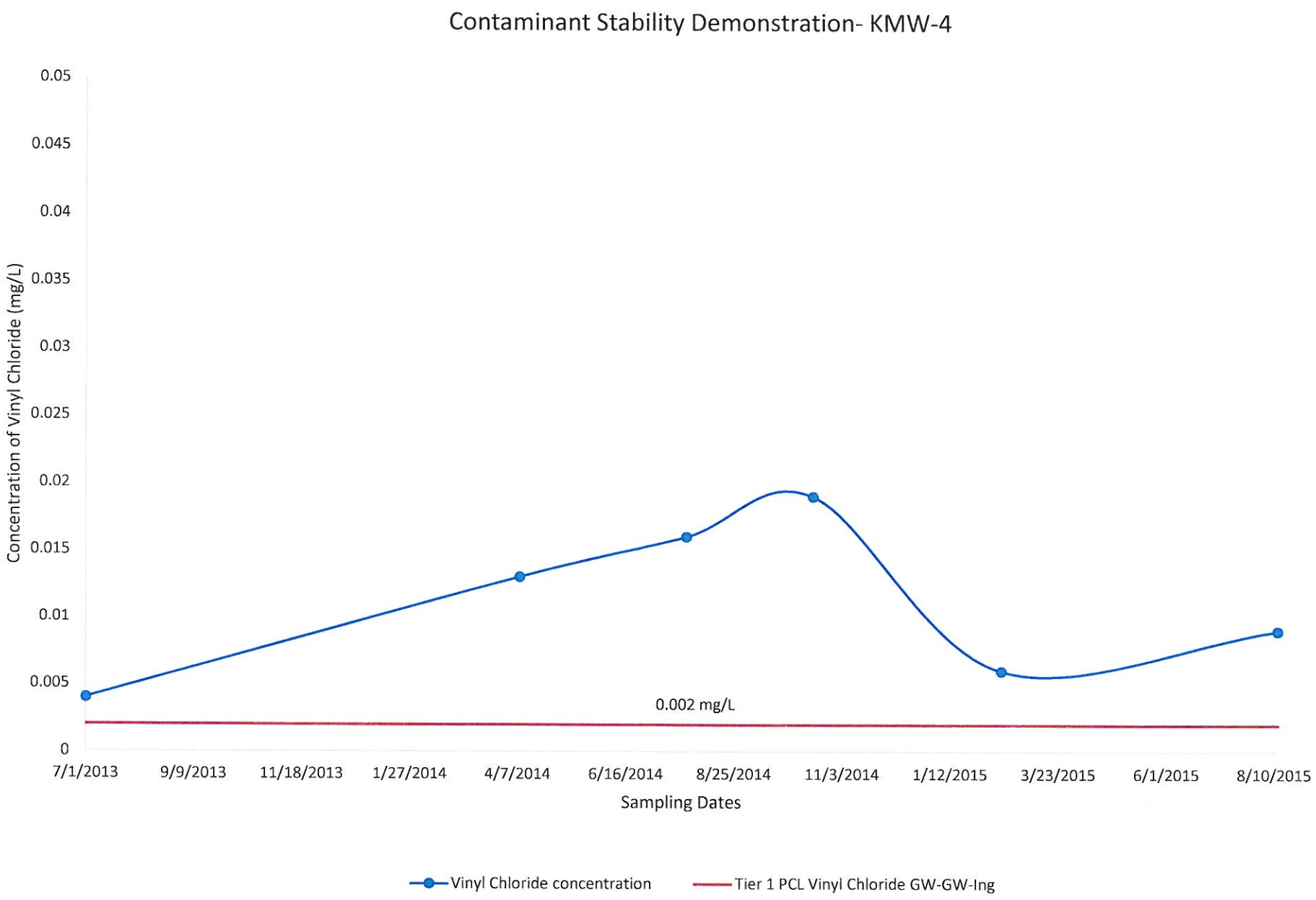

Contaminant Stability Demonstration- KMW-2
Vinyl Chloride (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0.002 mg/L
4/25/2013
8/3/2013
11/11/2013
2/19/2014
5/30/2014
9/7/2014
12/16/2014
3/26/2015
7/4/2015
Sampling Dates
Vinyl Chloride concentration
Tier 1 PCL Vinyl Chloride GW-GW-Ing

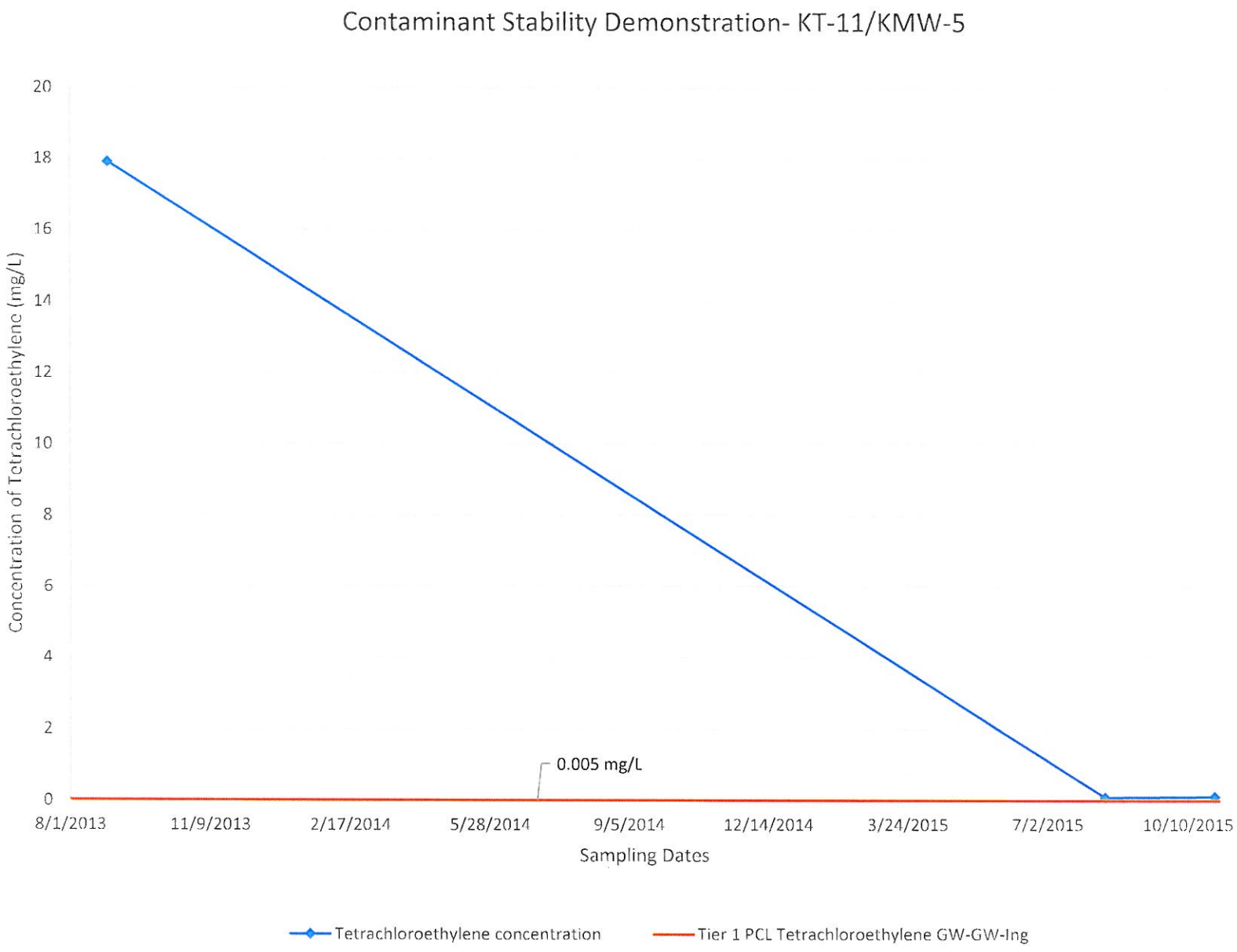

Contaminant Stability Demonstration- KMW-4
Concentration of Tetrachloroethylene (mg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.005 mg/L
4/25/2013
8/3/2013
11/11/2013
2/19/2014
5/30/2014
9/7/2014
12/16/2014
3/26/2015
7/4/2015
Sampling Dates
Tetrachloroethylene concentration
Tier 1 PCL Tetrachloroethylene GW-GW-Ing

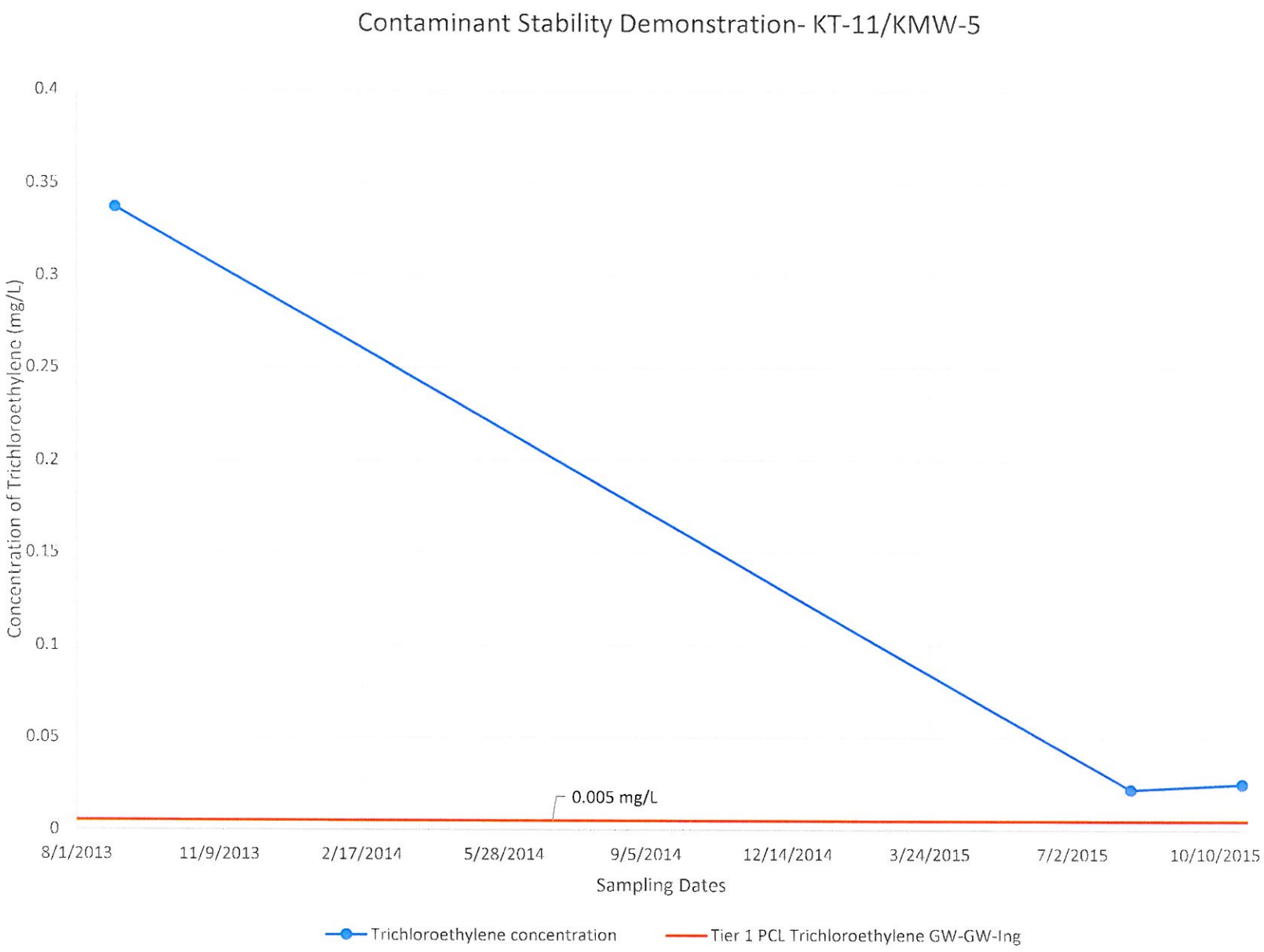

Contaminant Stability Demonstration- KMW-4
Concentration of Trichloroethylene (mg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.005 mg/L
7/1/2013
9/9/2013
11/18/2013
1/27/2014
4/7/2014
6/16/2014
8/25/2014
11/3/2014
1/12/2015
3/23/2015
6/1/2015
8/10/2015
Sampling Dates
Trichloroethylene concentration
Tier 1 PCL Trichloroethylene GW-GW-Ing

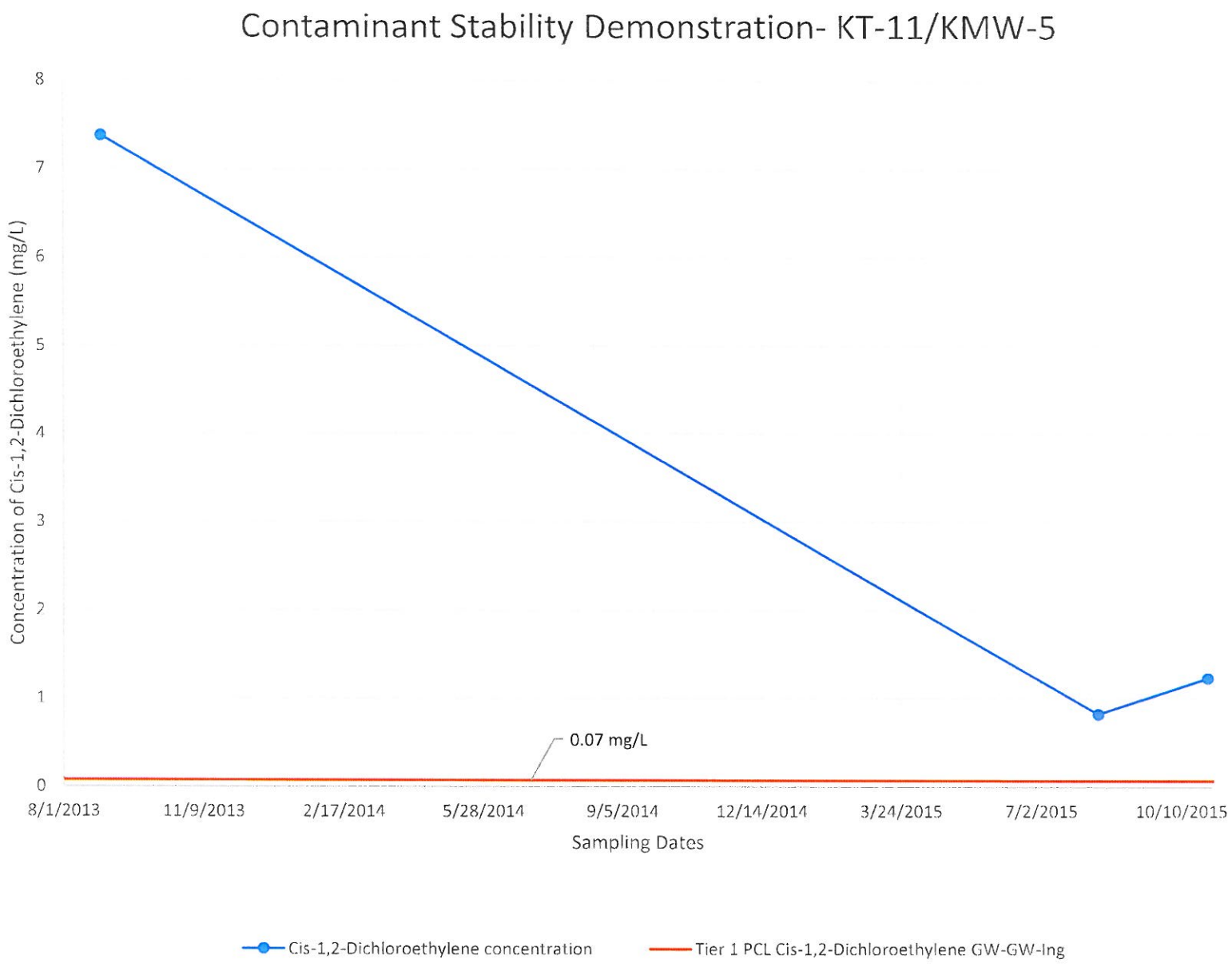

Contaminant Stability Demonstration- KMW-4
Concentration of Cis-1,2-Dichloroethylene (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.07 mg/L
7/1/2013
9/9/2013
11/18/2013
1/27/2014
4/7/2014
6/16/2014
8/25/2014
11/3/2014
1/12/2015
3/23/2015
6/1/2015
8/10/201
Sampling Dates
Cis-1,2-Dichloroethylene concentration
Tier 1 PCL Cis-1,2-Dichloroethylene GW-GW-Ing

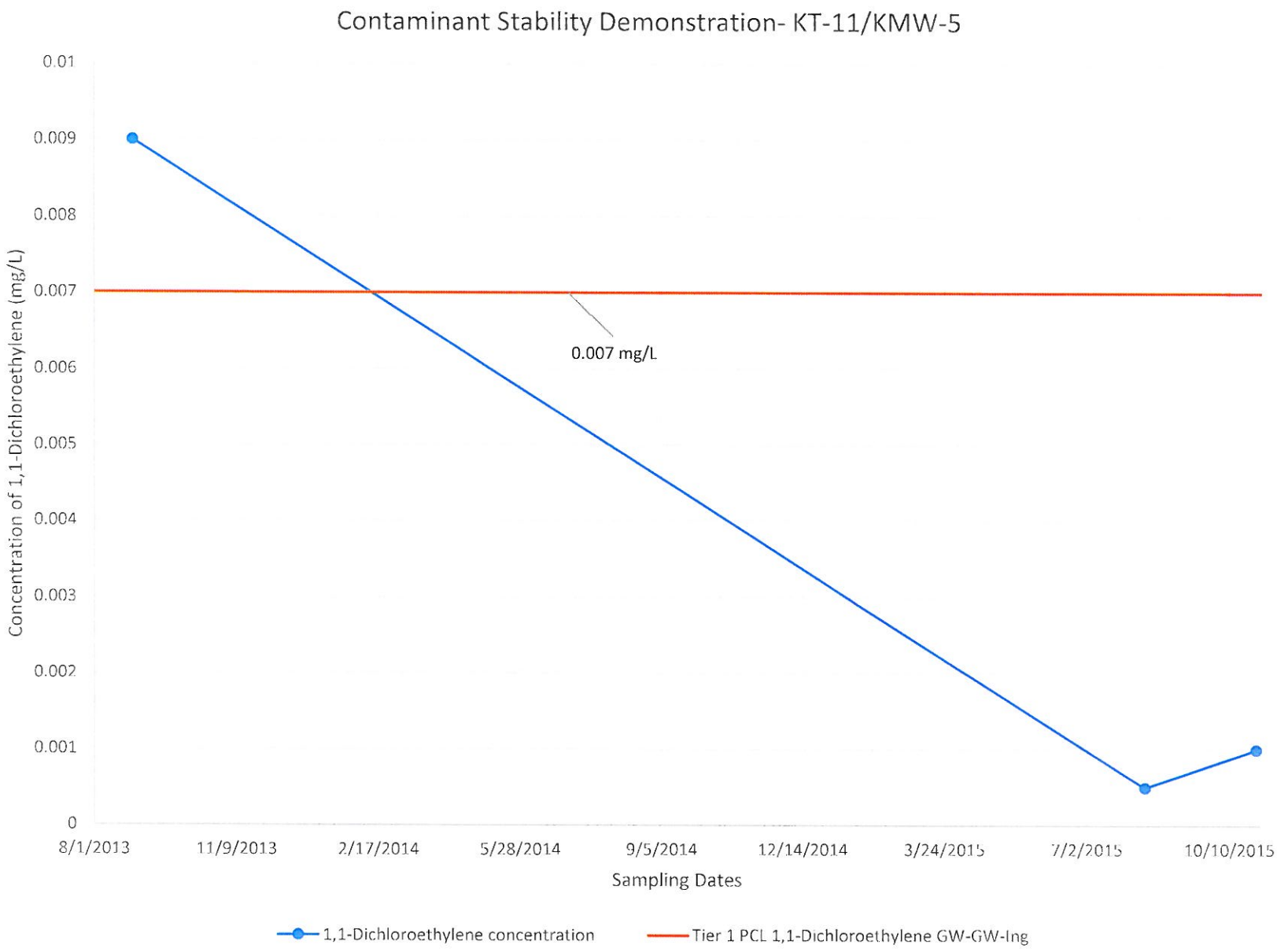

Contaminant Stability Demonstration- KMW-4
Concentration of 1,1-Dichloroethylene (mg/L)
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0.007 mg/L
7/1/2013
9/9/2013
11/18/2013
1/27/2014
4/7/2014
6/16/2014
8/25/2014
11/3/2014
1/12/2015
3/23/2015
6/1/2015
8/10/2015
Sampling Dates
1,1-Dichloroethylene concentration
Tier 1 PCL 1,1-Dichloroethylene GW-GW-Ing

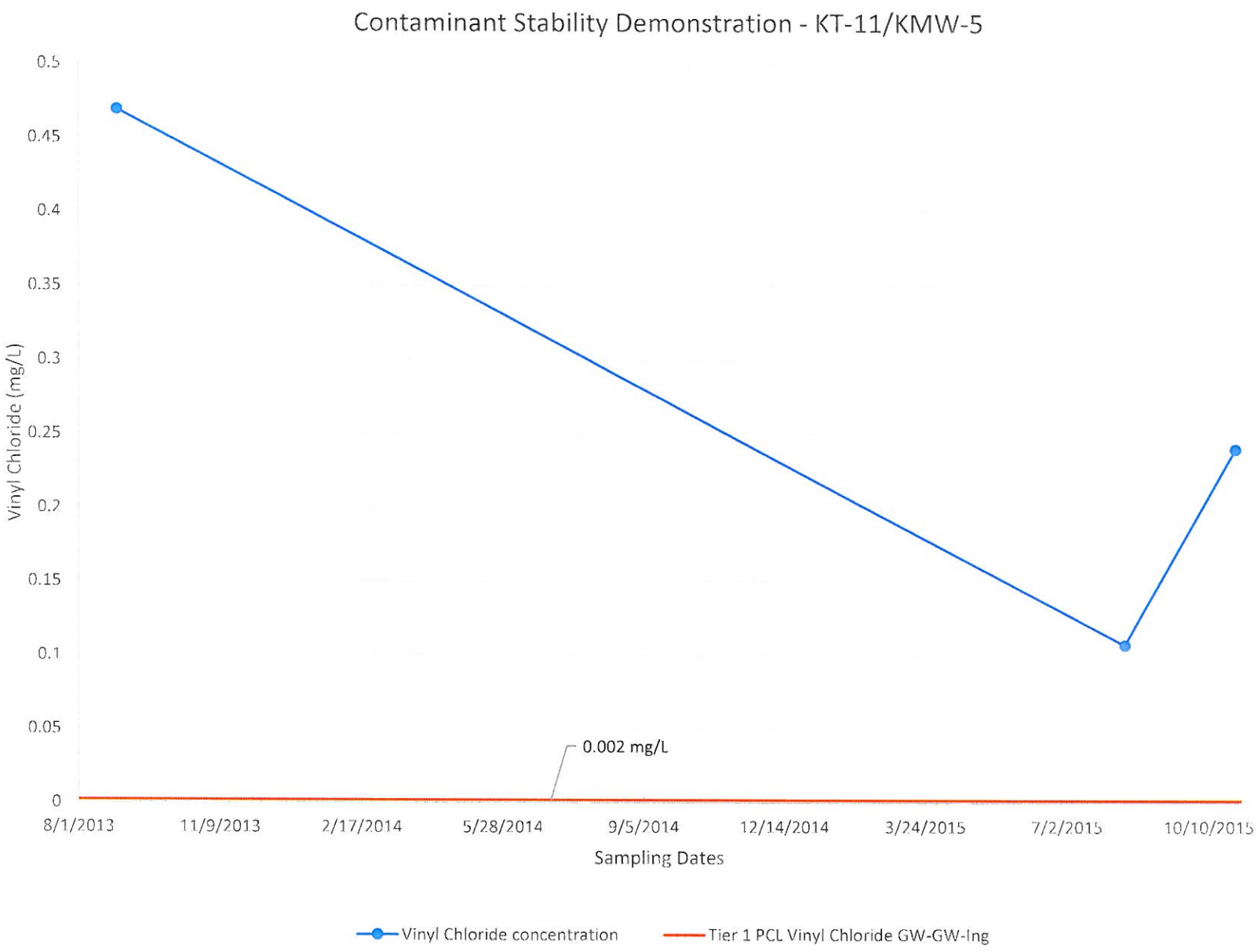

Contaminant Stability Demonstration- KMW-4
Concentration of Vinyl Chloride (mg/L)
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0.002 mg/L
7/1/2013
9/9/2013
11/18/2013
1/27/2014
4/7/2014
6/16/2014
8/25/2014
11/3/2014
1/12/2015
3/23/2015
6/1/2015
8/10/2015
Sampling Dates
Vinyl Chloride concentration
Tier 1 PCL Vinyl Chloride GW-GW-Ing


Contaminant Stability Demonstration- KT-11/KMW-5
Concentration of Tetrachloroethylene (mg/L)
20
18
16
14
12
10
8
6
4
2
0
0.005 mg/L
8/1/2013
11/9/2013
2/17/2014
5/28/2014
9/5/2014
12/14/2014
3/24/2015
7/2/2015
10/10/2015
Sampling Dates
Tetrachloroethylene concentration
Tier 1 PCL Tetrachloroethylene GW-GW-Ing


Contaminant Stability Demonstration- KT-11/KMW-5
Concentration of Trichloroethylene (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0.005 mg/L
8/1/2013
11/9/2013
2/17/2014
5/28/2014
9/5/2014
12/14/2014
3/24/2015
7/2/2015
10/10/2015
Sampling Dates
Trichloroethylene concentration
Tier 1 PCL Trichloroethylene GW-GW-Ing


Contaminant Stability Demonstration- KT-11/KMW-5
Concentration of Cis-1,2-Dichloroethylene (mg/L)
8
7
6
5
4
3
2
1
0
0.07 mg/L
8/1/2013
11/9/2013
2/17/2014
5/28/2014
9/5/2014
12/14/2014
3/24/2015
7/2/2015
10/10/2015
Sampling Dates
Cis-1,2-Dichloroethylene concentration
Tier 1 PCL Cis-1,2-Dichloroethylene GW-GW-Ing

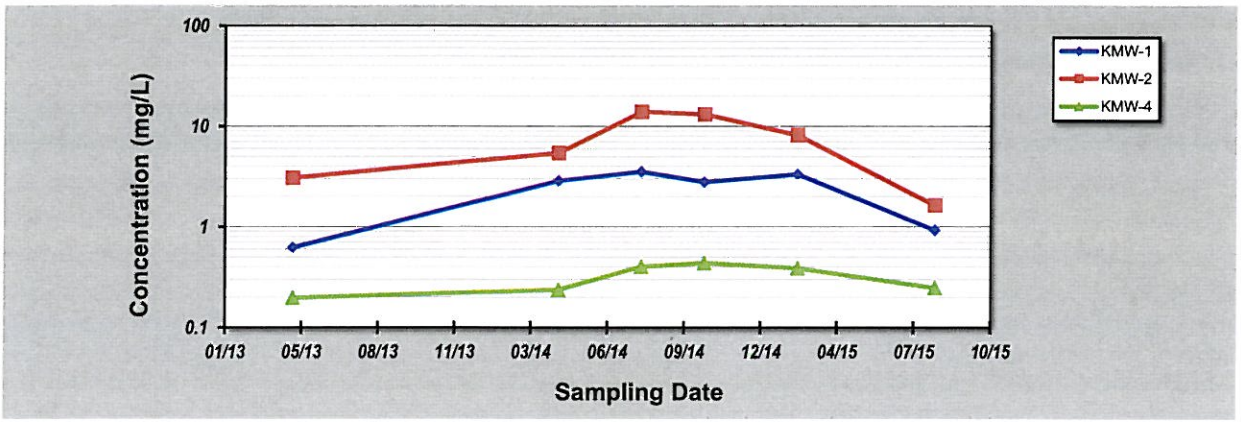

Contaminant Stability Demonstration- KT-11/KMW-5
Concentration of 1,1-Dichloroethylene (mg/L)
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0.007 mg/L
8/1/2013
11/9/2013
2/17/2014
5/28/2014
9/5/2014
12/14/2014
3/24/2015
7/2/2015
10/10/2015
Sampling Dates
1,1-Dichloroethylene concentration
Tier 1 PCL 1,1-Dichloroethylene GW-GW-Ing


Contaminant Stability Demonstration - KT-11/KMW-5
Vinyl Chloride (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0.002 mg/L
8/1/2013
11/9/2013
2/17/2014
5/28/2014
9/5/2014
12/14/2014
3/24/2015
7/2/2015
10/10/2015
Sampling Dates
Vinyl Chloride concentration
Tier 1 PCL Vinyl Chloride GW-GW-Ing

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	12-Aug-15	Job ID:	1507T-47 MSD # 2015-081-KWL
Facility Name:	Kwik Wash, Studewood St., Houston, TX	Constituent:	Tetrachloroethylene
Conducted By:	Glenn Lowenstein, PG	Concentration Units:	mg/L

Sampling Point ID:		KMW-1	KMW-2	KMW-4				
Sampling Event	Sampling Date	TETRACHLOROETHYLENE CONCENTRATION (mg/L)						
1	25-Apr-13	0.622	3.05	0.197				
2	8-Apr-14	2.88	5.41	0.238				
3	25-Jul-14	3.54	13.9	0.404				
4	15-Oct-14	2.79	13.1	0.438				
5	14-Feb-15	3.33	8.13	0.388				
6	12-Aug-15	0.924	1.63	0.247				
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.53	0.68	0.32				
Mann-Kendall Statistic (S):		1	-1	5				
Confidence Factor:		50.0%	50.0%	76.5%				
Concentration Trend:		No Trend	Stable	No Trend				



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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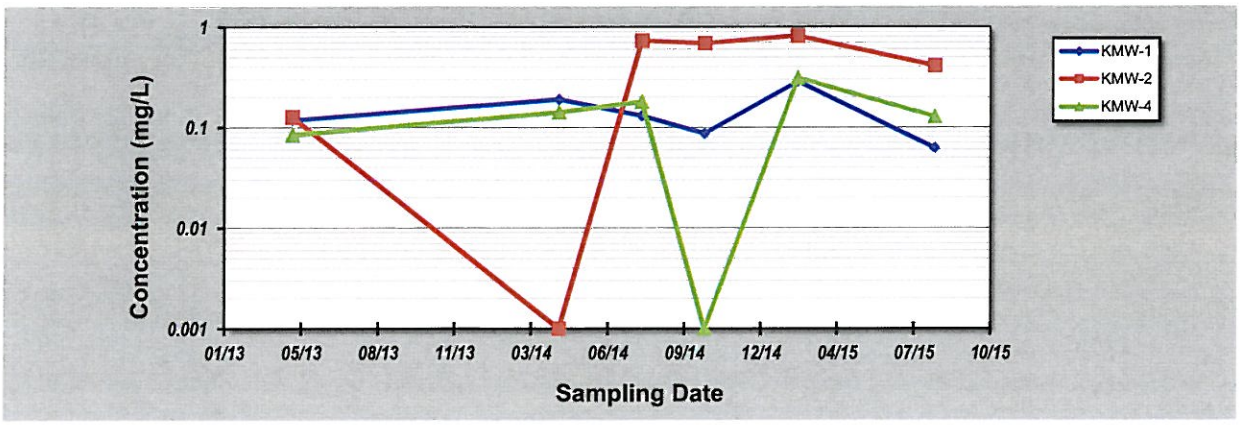
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	12-Aug-15	Job ID:	1507T-47 MSD # 2015-081-KWL
Facility Name:	Kwik Wash, Studewood St., Houston, TX	Constituent:	Trichloroethylene
Conducted By:	Glenn Lowenstein, PG	Concentration Units:	mg/L

Sampling Point ID:		KMW-1	KMW-2	KMW-4				
Sampling Event	Sampling Date	TRICHLOROETHYLENE CONCENTRATION (mg/L)						
1	25-Apr-13	0.118	0.126	0.085				
2	8-Apr-14	0.191	0.001	0.142				
3	25-Jul-14	0.131	0.729	0.181				
4	15-Oct-14	0.087	0.686	0.001				
5	14-Feb-15	0.286	0.815	0.311				
6	12-Aug-15	0.062	0.41	0.128				
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.56	0.73	0.73				
Mann-Kendall Statistic (S):		-3	5	3				
Confidence Factor:		64.0%	76.5%	64.0%				
Concentration Trend:		Stable	No Trend	No Trend				



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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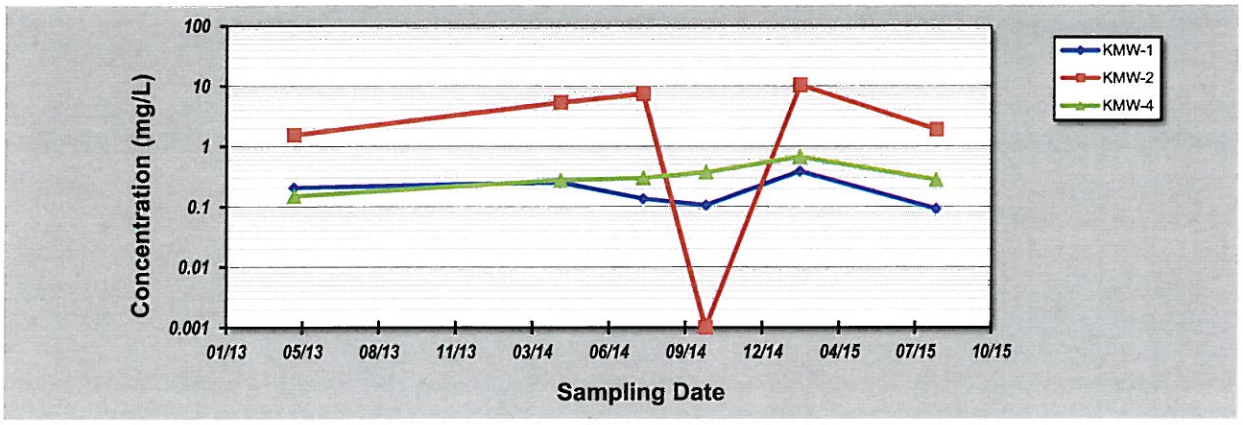
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	12-Aug-15	Job ID:	1507T-47 MSD # 2015-081-KWL
Facility Name:	Kwik Wash, Studewood St., Houston, TX	Constituent:	Cis-1,2-Dichloroethylene
Conducted By:	Glenn Lowenstein, PG	Concentration Units:	mg/L

Sampling Point ID:		KMW-1	KMW-2	KMW-4				
Sampling Event	Sampling Date	CIS-1,2-DICHLOROETHYLENE CONCENTRATION (mg/L)						
1	25-Apr-13	0.207	1.54	0.149				
2	8-Apr-14	0.25	5.31	0.273				
3	25-Jul-14	0.135	7.35	0.297				
4	15-Oct-14	0.106	0.001	0.373				
5	14-Feb-15	0.389	10.3	0.676				
6	12-Aug-15	0.093	1.89	0.282				
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.57	0.90	0.52				
Mann-Kendall Statistic (S):		-5	3	9				
Confidence Factor:		76.5%	64.0%	93.2%				
Concentration Trend:		Stable	No Trend	Prob. Increasing				



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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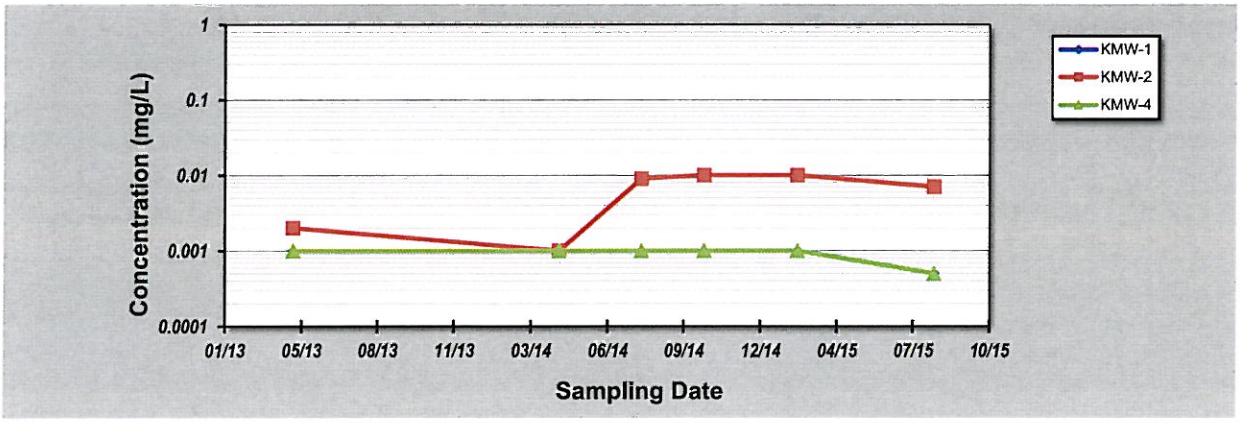
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	12-Aug-15	Job ID:	1507T-47 MSD # 2015-081-KWL
Facility Name:	Kwik Wash, Studewood St., Houston, TX	Constituent:	1,1-Dichloroethylene
Conducted By:	Glenn Lowenstein, PG	Concentration Units:	mg/L

Sampling Point ID:		KMW-1	KMW-2	KMW-4				
Sampling Event	Sampling Date	1,1-DICHLOROETHYLENE CONCENTRATION (mg/L)						
1	25-Apr-13	0.001	0.002	0.001				
2	8-Apr-14	0.001	0.001	0.001				
3	25-Jul-14	0.001	0.009	0.001				
4	15-Oct-14	0.001	0.01	0.001				
5	14-Feb-15	0.001	0.01	0.001				
6	12-Aug-15	0.0005	0.007	0.0005				
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.22	0.62	0.22				
Mann-Kendall Statistic (S):		-5	6	-5				
Confidence Factor:		76.5%	81.5%	76.5%				
Concentration Trend:		Stable	No Trend	Stable				



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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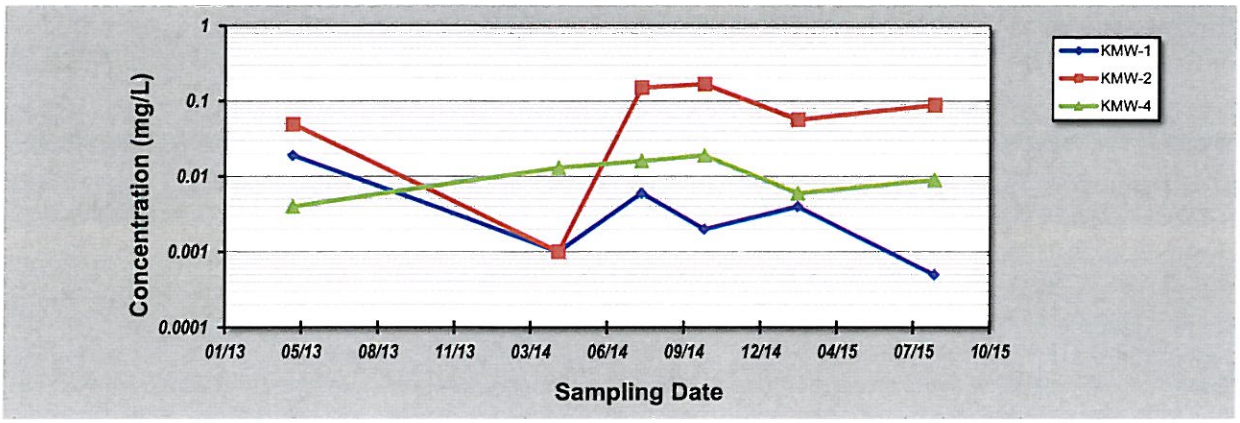
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	12-Aug-15	Job ID:	1507T-47 MSD # 2015-081-KWL
Facility Name:	Kwik Wash, Studewood St., Houston, TX	Constituent:	Vinyl Chloride
Conducted By:	Glenn Lowenstein, PG	Concentration Units:	mg/L

Sampling Point ID:	KMW-1	KMW-2	KMW-4				
Sampling Event	**Sampling Date**	**VINYL CHLORIDE CONCENTRATION (mg/L)**						
1	25-Apr-13	0.019	0.049	0.004				
2	8-Apr-14	0.001	0.001	0.013				
3	25-Jul-14	0.006	0.149	0.016				
4	15-Oct-14	0.002	0.166	0.019				
5	14-Feb-15	0.004	0.056	0.006				
6	12-Aug-15	0.0005	0.088	0.009				
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.28	0.74	0.52				
Mann-Kendall Statistic (S):		-7	5	3				
Confidence Factor:		86.4%	76.5%	64.0%				
Concentration Trend:		No Trend	No Trend	No Trend				



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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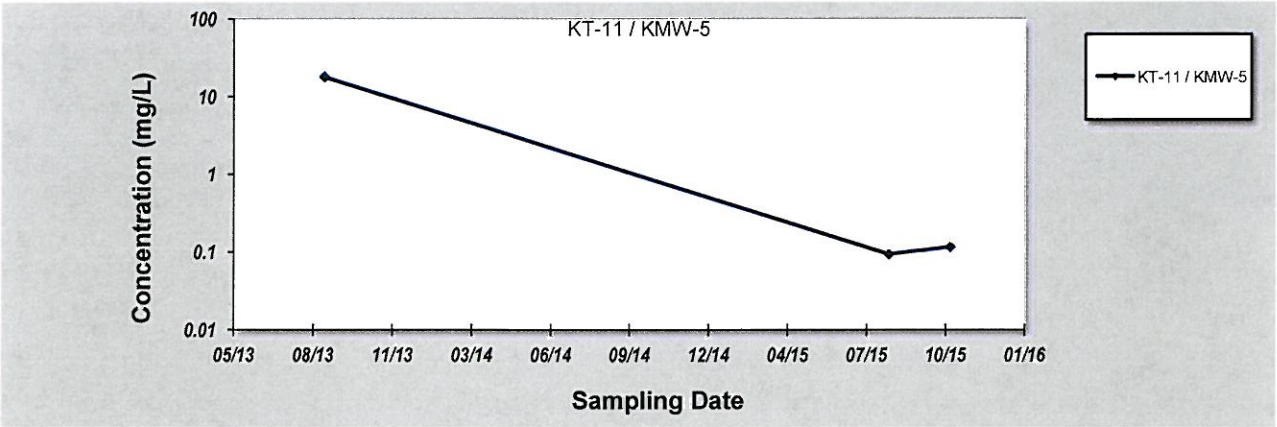
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	12-Aug-15	Job ID:	1507T-47 MSD # 2015-081-KWL
Facility Name:	Kwik Wash, Studewood St., Houston, TX	Constituent:	Tetrachloroethylene
Conducted By:	Glenn Lowenstein, PG	Concentration Units:	mg/L

Sampling Point ID:	KT-11 / KMW-5						
Sampling Event	**Sampling Date**	**TETRACHLOROETHYLENE CONCENTRATION (mg/L)**					
1	28-Aug-13	17.9					
2	12-Aug-15	0.094					
3	29-Oct-15	0.117					
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
Coefficient of Variation:		1.70					
Mann-Kendall Statistic (S):		#NAME?					
Confidence Factor:							
Concentration Trend:							



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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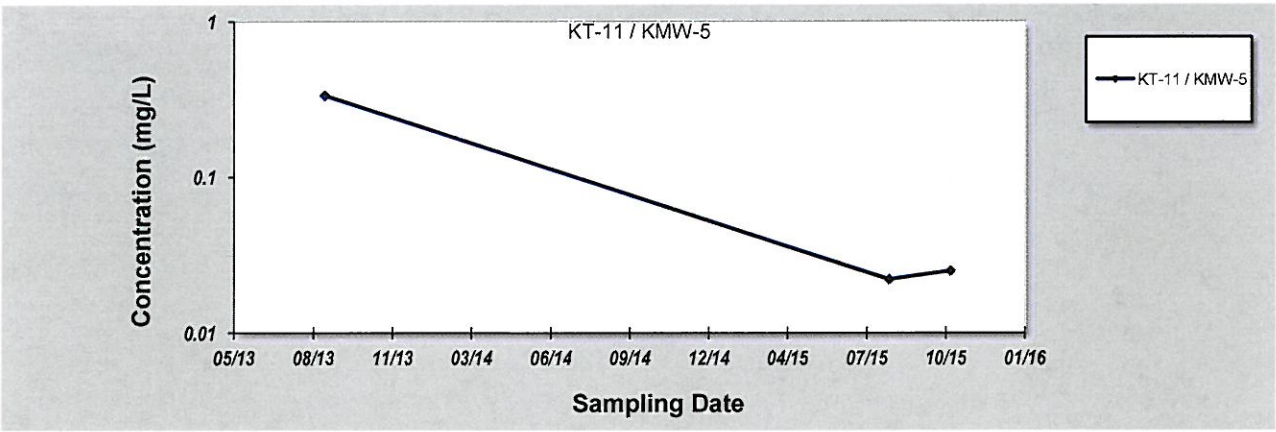
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	12-Aug-15	Job ID:	1507T-47 MSD # 2015-081-KWL
Facility Name:	Kwik Wash, Studewood St., Houston, TX	Constituent:	Trichloroethylene
Conducted By:	Glenn Lowenstein, PG	Concentration Units:	mg/L

Sampling Point ID: KT-11 / KMW-5

Sampling Event	Sampling Date	TRICHLOROETHYLENE CONCENTRATION (mg/L)						
1	28-Aug-13	0.337						
2	12-Aug-15	0.022						
3	29-Oct-15	0.025						
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.41						
Mann-Kendall Statistic (S):		#NAME?						
Confidence Factor:								
Concentration Trend:								



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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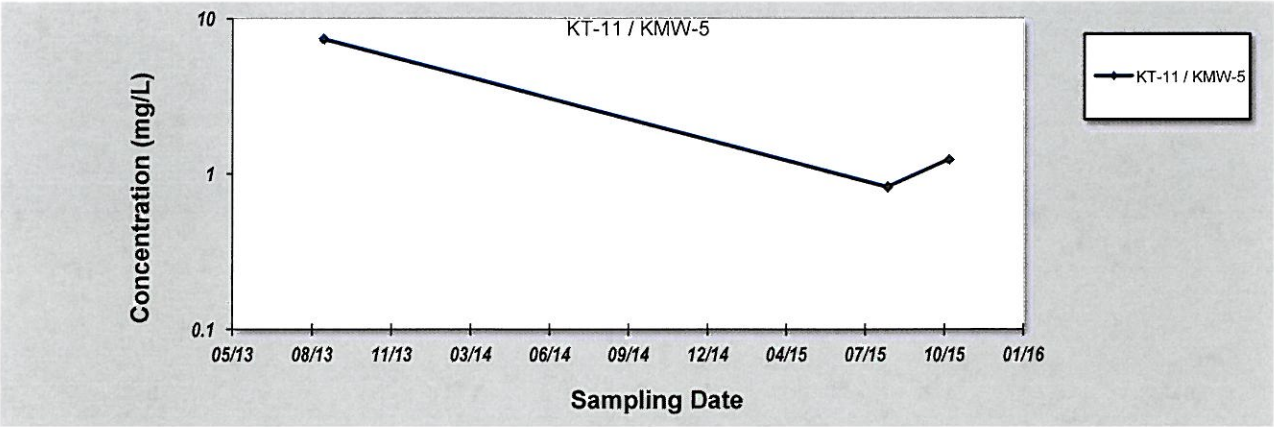
for Constituent Trend Analysis

Evaluation Date:	12-Aug-15	Job ID:	1507T-47 MSD # 2015-081-KWL
Facility Name:	Kwik Wash, Studewood St., Houston, TX	Constituent:	Cis-1,2-Dichloroethlyene
Conducted By:	Glenn Lowenstein, PG	Concentration Units:	mg/L

Sampling Point ID: KT-11 / KMW-5

Sampling Event	Sampling Date	CIS-1,2-DICHLOROETHLYENE CONCENTRATION (mg/L)						
1	28-Aug-13	7.37						
2	12-Aug-15	0.822						
3	29-Oct-15	1.23						
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.17						
Mann-Kendall Statistic (S):		#NAME?						
Confidence Factor:								
Concentration Trend:								



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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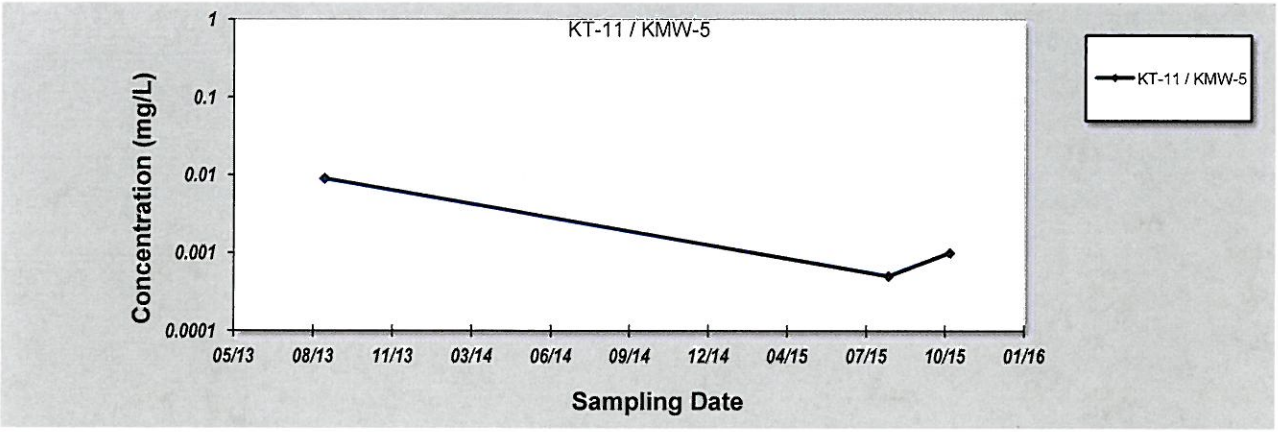
for Constituent Trend Analysis

Evaluation Date:	12-Aug-15	Job ID:	1507T-47 MSD # 2015-081-KWL
Facility Name:	Kwik Wash, Studewood St., Houston, TX	Constituent:	1,1-Dichloroethlyene
Conducted By:	Glenn Lowenstein, PG	Concentration Units:	mg/L

Sampling Point ID: KT-11 / KMW-5

Sampling Event	Sampling Date	1,1-DICHLOROETHLYENE CONCENTRATION (mg/L)						
1	28-Aug-13	0.009						
2	12-Aug-15	0.0005						
3	29-Oct-15	0.001						
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.36						
Mann-Kendall Statistic (S):		#NAME?						
Confidence Factor:								
Concentration Trend:								



Notes:

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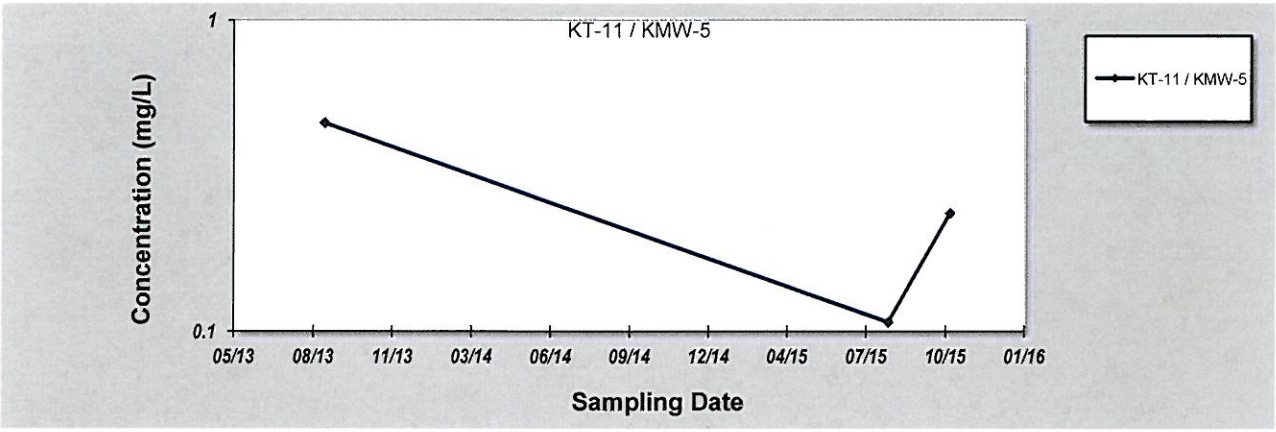
for Constituent Trend Analysis

Evaluation Date:	12-Aug-15	Job ID:	1507T-47 MSD # 2015-081-KWL
Facility Name:	Kwik Wash, Studewood St., Houston, TX	Constituent:	Vinyl Chloride
Conducted By:	Glenn Lowenstein, PG	Concentration Units:	mg/L

Sampling Point ID: KT-11 / KMW-5

Sampling Event	Sampling Date	VINYL CHLORIDE CONCENTRATION (mg/L)						
1	28-Aug-13	0.469						
2	12-Aug-15	0.107						
3	29-Oct-15	0.24						
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.67						
Mann-Kendall Statistic (S):		#NAME?						
Confidence Factor:								
Concentration Trend:								



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