



October 28, 2010

Mr. Andrew Richmond  
East Resources Management, LLC.  
370 Interlocken Blvd., Suite 550  
Broomfield, CO 80021

RE: Second Quarter 2010 Monitoring Report  
WT Durham #4 Flowline Release  
Moffat County, Colorado

Dear Mr. Richmond:

LT Environmental, Inc. (LTE) was retained by East Resources Management, LLC. (ERM) to install post-remediation groundwater monitoring wells and to conduct sampling activities at the WT Durham #4 Flowline Release (Site). LTE also conducted two slug tests, surveyed the groundwater monitoring wells, and collected groundwater quality parameters prior to sampling. LTE utilized all of the data to evaluate monitored natural attenuation (MNA) as a remedial method at the Site.

Monitoring well installation activities and groundwater sampling occurred on September 15, 2010, and September 16, 2010, respectively. Site history and remediation activities were described in the Form 27 Site Investigation and Remediation Workplan submitted to the Colorado Oil and Gas Conservation Commission (COGCC) on June 17, 2010. This well installation and groundwater monitoring event constitutes the second post remediation performance monitoring event. A Site Location Map is provided as Figure 1.

## **MONITORING WELL INSTALLATION**

LTE personnel installed four additional monitoring wells (MW08, MW09, MW10, and MW11) on September 15, 2010, to further define the extent of groundwater impacts. A Site Map is provided as Figure 2. The monitoring wells were installed using a hand auger equipped with a 4 inch bucket. Each of the monitoring wells was advanced to total depths between 7.5 feet (ft) and 8 ft below ground surface (bgs). Monitoring wells were constructed of 2-inch diameter, 0.010-inch slotted screen and schedule 40, poly vinyl chloride (PVC) casing. Boreholes were filled with 10-20 silica sand from total depth to one foot above the screened interval. Bentonite chips were then placed from the top of the sand pack to ground surface and hydrated. Well logs are provided as Attachment 1.

In order to develop the wells, ten casing volumes of groundwater were purged from the well to remove fine grain sediments from the vicinity of the well screens. LTE utilized this procedure to promote water to flow freely into the wells from the formation.



## **SURVEYING GROUNDWATER MONITORING WELLS**

The depth to groundwater was measured in wells MW01 through MW07 on September 16, 2010, and recorded to calculate potentiometric surfaces and purge volumes. During the September 2010 sampling event, the depths to static groundwater level ranged from 3.95 feet below top of casing (BTOC) in MW05 to 5.81 feet BTOC in wells MW08 and MW10 (Table 1).

LTE surveyed the top of casing elevations for each well on September 16, 2010. Calculating the difference in top of casing and depth to groundwater, LTE determined the groundwater elevation in each well and created a groundwater elevation map (Figure 3). Based on the groundwater elevation map and surrounding areas groundwater is flowing northeast towards Waddle Creek under an average hydraulic gradient of 0.003 feet per foot.

## **GROUNDWATER SAMPLING PROCEDURES**

Each well was purged of three casing volumes prior to collection of groundwater samples. Groundwater samples were collected from the well utilizing disposable 1.6-inch diameter polyethylene bailers to collect the groundwater samples prior to placement into laboratory prepared sample bottles. Groundwater samples were collected in 40-milliliter vials, placed on ice, and delivered under chain-of-custody (COC) protocol to Origins Laboratory located in Denver, Colorado. Samples were analyzed for benzene, toluene, ethylbenzene, and total xylenes (BTEX) by Environmental Protection Agency Method 8260B.

Prior to sampling LTE also conducted field screening of pH, temperature, conductivity, dissolved oxygen (DO), total dissolved solids (TDS), and oxygen reduction potential (ORP). General water quality parameters are summarized in Table 2.

In addition to BTEX, monitoring wells MW02, MW06 and MW11 were sampled for geochemical indicators. Samples were analyzed for dissolved manganese and ferrous iron by EPA Method 6010B and sulfate and nitrate by EPA method 300. All of the samples (except for ferrous iron) were collected from the wells utilizing 1.6-inch diameter polyethylene bailers.

Groundwater samples were collected for total iron by advancing disposable 3/16-inch diameter polyethylene tubing below the groundwater table inside the 2-inch diameter PVC well casing. LTE utilized a peristaltic pump to collect the groundwater samples. Laboratory analysis for total iron measures dissolved iron rather than ferrous iron, with the assumption that soluble ferric iron is negligible in the groundwater. At neutral pH and with exposure to air, almost all soluble ferrous iron will precipitate out of solution within 1 minute or less. Therefore, LTE filtered the iron samples with a 0.45 micron cartridge-style filter prior to placement into the laboratory prepared jars.



## **SLUG TESTS**

LTE also performed two slug tests at the Site on September 15, 2010 in wells MW03 and MW05. The test was performed by purging 5 gallons of water from each well using a utilizing disposable 1.6-inch diameter polyethylene bailer. LTE initiated the slug tests by placing a pressure transducer equipped with a data logger below the groundwater table inside the 2-inch diameter PVC well casing following purging. The data logger measured the increase in water level as the aquifer recharged over a sufficient time period.

LTE generated site-specific hydraulic conductivity data for the Site from the slug tests. The hydraulic conductivity for wells MW03 and MW05 were  $7.4 \times 10^{-5}$  centimeters per second (cm/sec) and  $5.15 \times 10^{-5}$  cm/sec. The soil type encountered in each of the borings consisted of mostly clay, some silt, and organics. However, the hydraulic conductivities were consistent with published values ( $10^{-6}$ -  $10^{-4}$ ) for unconsolidated sediments that include silt, sandy silts, clayey sands, and till (Applied Hydrogeology - Third Edition, C.W. Fetter). LTE believes the actual values obtained from the slug tests are representative of Site-specific conditions and the topographic location of the Site, more so than the site wide soil type. Graphs of the slug test data for the Site are provided in Attachment 2.

## **GROUNDWATER ANALYTICAL RESULTS**

The Colorado Department of Public Health and Environmental (CDPHE) Water Quality Control Commission (WQCC) has established Regulation 41 - The Basic Standards for Groundwater for BTEX of 5.0 micrograms per liter (ug/L) for benzene, 560 ug/L for toluene, 700 ug/L for ethylbenzene, and 1,400 ug/L for total xylenes. Table 1 summarizes groundwater analytical results for samples collected during all monitoring events. The laboratory analytical report, laboratory quality assurance/quality control data, and COC documentation are provided in Attachment 3.

Eleven groundwater samples were collected and submitted to Origins Laboratory for BTEX analysis during the September 2010 sampling event. Groundwater analytical results indicated that benzene was detected above the CDPHE-WQCC Regulation 41 standard in monitoring wells MW01 and MW06 at concentrations of 10.1 ug/L and 354 ug/L, respectively. BTEX compounds were not detected above the laboratory method detection limits or were in compliance with CDPHE-WQCC Reg. 41 in the remaining samples. Groundwater analytical results for the September 2010 sampling event are summarized in Table 1.

During initial assessment activities in May 2010, a surface water sample was collected from a tributary to Waddle Creek and submitted for laboratory analysis of BTEX. Analytical results indicate BTEX concentrations in the surface water sample were in compliance with Reg. 41 standards and the CDPHE-WQCC Regulation 31 standards (The Basic Standards and Methodologies for Surface Water). Surface water analytical results are summarized in Table 2.



## **MNA EVALUATION**

LTE utilized groundwater quality parameters, geochemical indicators, and modeling to determine if natural attenuation of groundwater impacts is occurring, whether MNA is an effective remedial method to achieve Site cleanup goals, and what subsurface biological processes are occurring.

### **Groundwater Quality Parameter Results**

LTE personnel collected general water quality parameters during sampling activities to establish whether the appropriate Site conditions existed for biodegradation. Initial field screening results indicated temperature and pH readings were within a range for optimal biodegradation. Dissolved oxygen (DO) concentrations within the plume are lower than those outside of the plume, indicating biodegradation is also occurring. Additionally, all of the DO concentrations were greater than 1 milligram per liter (mg/L) which indicates that oxygen is available to a degree, and being utilized within the plume to promote biodegradation and natural attenuation. However, the data also indicate that DO is repressed inside the plume, relative to upgradient, downgradient, or crossgradient results. This indicates that the available oxygen is generally being utilized. The oxygen reduction potential (ORP) values within the plume indicated the groundwater is chemically reducing, which is to be expected considering the dissolved hydrocarbon concentrations (electron donors), and the reduced concentrations of DO inside the groundwater plume. LTE believes general water quality parameters have established that biodegradation is occurring, and will continue to occur at the Site. General water quality data is summarized in Table 3.

Inorganics that include total dissolved solids (TDS) are regulated by the COGCC in groundwater. Initial field screening results indicate the TDS concentrations in MW06 was 2.4 grams per liter (g/L). The TDS concentrations for wells MW02 through MW05 and MW07 through MW11 ranged from 1.246 g/L to 2.4 g/L. LTE believes the TDS concentrations observed at the Site are representative of background conditions.

### **Geochemical Indicators**

In order to further establish baseline Site conditions and evaluate secondary lines of evidence to detail subsurface biodegradation processes, LTE collected groundwater samples for geochemical indicators that included nitrate, manganese, total iron (representative of ferrous iron), and sulfate. In the absence or near absence of DO, microorganism metabolize petroleum contaminants through the use of these alternate electron acceptors. Geochemical data is summarized in Table 4.

As shown on Table 4, monitoring wells MW11, MW06, and MW02 were sampled for these electron acceptors as upgradient, in-plume, and downgradient locations, respectively. The data indicate nitrate, manganese, and iron are currently being utilized by subsurface microbes to promote biologically mediated anaerobic hydrocarbon oxidation of petroleum hydrocarbons. The sulfate data indicate sulfate reduction is not currently occurring in the subsurface. Nitrate data indicate that the upgradient well (MW11) exhibited greater concentrations than both the in-plume and downgradient well, showing that microbes have utilized the available nitrate to biodegrade



hydrocarbons. Both the dissolved manganese and ferrous iron tests analyze for the reduced species of the metal ( $\text{Mn}^{+2}$  or  $\text{Fe}^{+2}$ ). Data collected from the site indicates both reduced metals are observed in lower concentrations upgradient, as they are being produced inside the plume, and are not re-oxidized downgradient. Finally, the sulfate data do not indicate any appreciable difference in concentrations.

Geochemical data indicate subsurface anerobic processes are robust and continuing to occur. It is expected that sulfate reducing microbes will eventually proliferate, as the iron reducers start to decline.

### **Groundwater Modeling**

LTE conducted fate and transport modeling (BP RISC) to determine whether sensitive receptors could potentially be impacted by benzene in groundwater remaining at the Site. LTE utilized well MW06 as a source to calculate whether a receptor 98 ft downgradient could potentially be affected by benzene concentrations groundwater. The parameters used to process the model included an average of total organic carbon (TOC) from laboratory analyses, hydraulic conductivities, and several other aquifer properties. The results of the model indicate after a 100 year time period, a receptor 98 ft downgradient of well MW06 would not be impacted. Groundwater modeling parameters and results are provided as Attachment 4.

In addition to BP RISC, LTE conducted decay rate modeling utilizing two quarters of benzene data collected from well MW06. LTE was unable to model a decay rate for MW01 since the data was not a good fit for the regression analysis. The decay rate model calculates the benzene concentrations versus time, but does not take into account changing site conditions. Based on the current decreasing trend in benzene concentrations, the decay rate modeling indicates only a half a year or 184 days until the groundwater concentration in well MW06 is in compliance with the Reg. 41 Standard. Additional data is needed to determine whether the trend in decaying groundwater concentrations in well MW06 is representative. The results for decay rate calculations are provided in Attachment 4.

### **SUMMARY AND CONCLUSIONS**

As seen on Table 1, the benzene concentrations in wells MW01 and MW06 exceed the CDPHE-WQCC Regulation 41 standards. Since the July sampling event the benzene concentration in well MW06 has decreased from 1,520  $\mu\text{g/L}$  to 345  $\mu\text{g/L}$ . The benzene concentration in well MW01 is relatively unchanged from the July sampling event.

The groundwater data indicates the extent of impact has been defined to the west, east, and south of the release location by newly installed wells MW08, MW09, MW10, and MW11. LTE surveyed the top of casing elevations for each groundwater monitoring well and created a groundwater elevation map. Based on the groundwater elevation map and surrounding areas, groundwater is flowing northeast towards Waddle Creek. LTE also performed two slug tests at the Site in wells MW03 and MW05 to generate site-specific hydraulic conductivity data. LTE does not believe the hydraulic



conductivities were consistent with published values, but are representative of Site specific conditions and the topographic location of the Site.

LTE utilized groundwater quality parameters, geochemical indicators, and modeling to determine if biodegradation of groundwater concentrations is occurring and whether MNA is an effective remedial method to achieve Site cleanup goals. Based on general water quality data, biodegradation of benzene in groundwater is occurring and anaerobic hydrocarbon oxidation conditions are predominant at the Site. LTE conducted fate and transport modeling to determine whether sensitive receptors could potentially be affected by benzene in groundwater remaining at the Site. The results from the model indicate groundwater concentrations are stable and do not have the potential to migrate more than 30 ft downgradient of MW06.

The benzene concentration in well MW01 remained consistent between the July and September sampling event. Benzene concentrations in well MW06 have been reduced by an order of magnitude from the July to September sampling event. Based on decay models for MW01 and MW06 results indicate it will take between 0.5 and 1.1 years to degrade benzene concentrations until they are in compliance with the Reg. 41 standard. At this time, MNA appears to be an appropriate remedial method to achieve Site cleanup goals.

LTE appreciates the opportunity to provide environmental services to ERM. Please call us at 970-285-9985 if you have any questions or comments regarding this report.

Sincerely,

LT ENVIRONMENTAL, INC.

A handwritten signature in black ink, appearing to read "Asher Weinberg".

Asher Weinberg  
Staff Environmental Scientist

A handwritten signature in black ink, appearing to read "John D. Peterson".

John D. Peterson, P.G.  
Principal/Senior Geologist



## Attachments

Table 1 Groundwater Analytical Data  
Table 2 Surface Water Analytical Data  
Table 3 General Water Quality Data  
Table 4 Geochemical Data  
Figure 1 Site Location Map  
Figure 2 Site Map  
Figure 3 Groundwater Elevation Map  
Attachment 1 Well Logs  
Attachment 2 Slug Test Data Graphs  
Attachment 3 Laboratory Analytical Report  
Attachment 4 Groundwater Modeling Results

## TABLES



**TABLE 1**  
**GROUNDWATER ANALYTICAL DATA**  
**WT DURHAM #4**  
**MOFFAT COUNTY, COLORADO**  
**EAST RESOURCES MANAGEMENT, LLC.**

Well ID	Date	Depth to Water (ft btoc)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
MW01	5/4/10	3.52	3.1	<2	<2	<2
	7/14/10	4.21	<b>9</b>	<1	<1	<3
	9/16/10	9.15	<b>10.1</b>	<1	<1	<3
MW02	5/4/10	2.86	<2	<2	<2	<2
	7/14/10	3.65	<1	<1	<1	<3
	9/16/10	9.81	<1	<1	<1	<3
MW03	5/4/10	3.30	<2	2	<2	3.3
	7/14/10	3.66	<1	<1	<1	<3
	9/16/10	9.81	<1	<1	<1	<3
MW04	5/4/10	2.69	<2	2.4	<2	<2
	7/14/10	3.16	1.12	1.71	<1	<3
	9/16/10	9.83	<1	<1	<1	<3
MW05	7/14/10	2.70	<1	<1	<1	<3
	9/16/10	10.01	<1	<1	<1	<3
MW06	7/14/10	3.61	<b>1,520</b>	78.1	88.1	198.1
	9/16/10	9.96	<b>354</b>	<1	44.4	16.3
MW07	7/14/10	3.99	<b>58.7</b>	<1	1.52	8.16
	9/16/10	9.73	<1	<1	<1	<3
MW08	9/16/10	10.13	<1	<1	<1	<3
MW09	9/16/10	10.30	<1	<1	<1	<3
MW10	9/16/10	9.93	<1	<1	<1	<3
MW11	9/16/10	10.05	<1	<1	<1	<3
GW01	5/11/10	-	<b>1,370</b>	<b>1,730</b>	72.3	752
GW02	5/18/10	-	<b>332</b>	319	12.8	258
CDPHE WQCC Reg 41			<b>5</b>	<b>560</b>	<b>700</b>	<b>1,400</b>

ug/L - micrograms per liter

< - indicates result is less than the stated laboratory method reporting limit

ft btoc - feet below top of well casing

**BOLD** - indicates result is above the applicable standard

Benzene, toluene, ethylbenzene, total xylenes analyzed by EPA Method 8260B

CDPHE WQCC Reg 41 - Colorado Department of Public Health and Environment - Water Quality

Control Commission Regulation 41 covering Basic Standards for Groundwater



**TABLE 2**  
**SURFACE WATER ANALYTICAL DATA**  
**WT DURHAM #4**  
**MOFFAT COUNTY, COLORADO**  
**EAST RESOURCES, INC.**

Well ID	Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
SW01	5/4/2010	<2*	3.6	<2	7.5
Human Health Based	Water Supply	1	1,000	680	10,000
	Water + Fish	1	1,000	680	-
Aquatic Life Based	Acute	5,300	17,500	32,000	-
	Chronic	-	-	-	-

**NOTES:**

ug/L - micrograms per liter

< - indicates result is less than the stated laboratory method reporting limit

Benzene, toluene, ethylbenzene, total xylenes analyzed by EPA Method 8260B

Human health and aquatic based standards taken from CDPHE WQCC Reg 31- Colorado

Department of Public Health and Environmental - Water Quality Control Commission

Regulation 31 The Basic Standards and Methodologies for Surface Water

\* Lowest detection level for instrument used to analyze sample



**TABLE 3**  
**GENERAL WATER QUALITY DATA**  
**WT DURHAM #4**  
**MOFFAT COUNTY, COLORADO**  
**EAST RESOURCES MANAGEMNET, LLC.**

Well ID	Date	pH	Temp (C°)	Conductivity (u-S)	DO (mg/L)	ORP (mV)	TDS (g/L)
MW01	9/16/10	6.93	13.30	2,331	2.80	-49.6	1.515
MW02	9/16/10	7.17	12.48	2,126	2.04	-89.4	2.4
MW03	9/16/10	6.42	13.88	3,341	2.41	-84.8	2.171
MW04	9/16/10	6.55	12.75	2,058	2.17	-75.5	1.338
MW05	9/16/10	6.56	15.70	2,581	1.56	-107.5	1.677
MW06	9/16/10	7.15	16.79	2,711	1.38	-102.3	2.4
MW07	9/16/10	6.42	13.22	2,456	1.34	-53.5	1.596
MW08	9/16/10	6.53	13.28	1,916	2.40	6.9	1.246
MW09	9/16/10	6.50	14.55	2,566	3.26	-49.0	1.668
MW10	9/16/10	6.56	12.85	2,017	1.90	38.6	1.311
MW11	9/16/10	6.99	13.29	2,488	2.2	7.3	1.618
CDPHE WQCC Reg 41		NA	NA	NA	NA	NA	<1.25 x background

NOTES:

C° - degrees celcius

u - S - micro siemens

DO - dissolved Oxygen

mg/L - milligrams per liter

NA - not applicable

ORP - oxygen reduction potential

mV - milli volts

TDS - total dissolved solids

g/L - grams per liter

CDPHE WQCC Reg 41 - Colorado Department of Public Health and Environment - Water Quality

Control Commission Regulation 41 covering Basic Standards for Groundwater



**TABLE 4**  
**GEOCHEMICAL DATA**  
**WT DURHAM #4**  
**MOFFAT COUNTY, COLORADO**  
**EAST RESOURCES MANAGEMNET, LLC.**

Well ID	Date	Manganese (µg/l)	Total Iron (µg/l)	Nitrate (mg/L)	Sulfate (mg/L)
MW02	9/16/10	356	3,310	<0.05	292
MW06	9/16/10	829	3,560	<0.05	465
MW11	9/16/10	<200	317	0.119	376

NOTES:

ug/L - micrograms per liter

mg/L - milligrams per liter

< - indicates result is less than the stated laboratory method reporting limit



## FIGURES



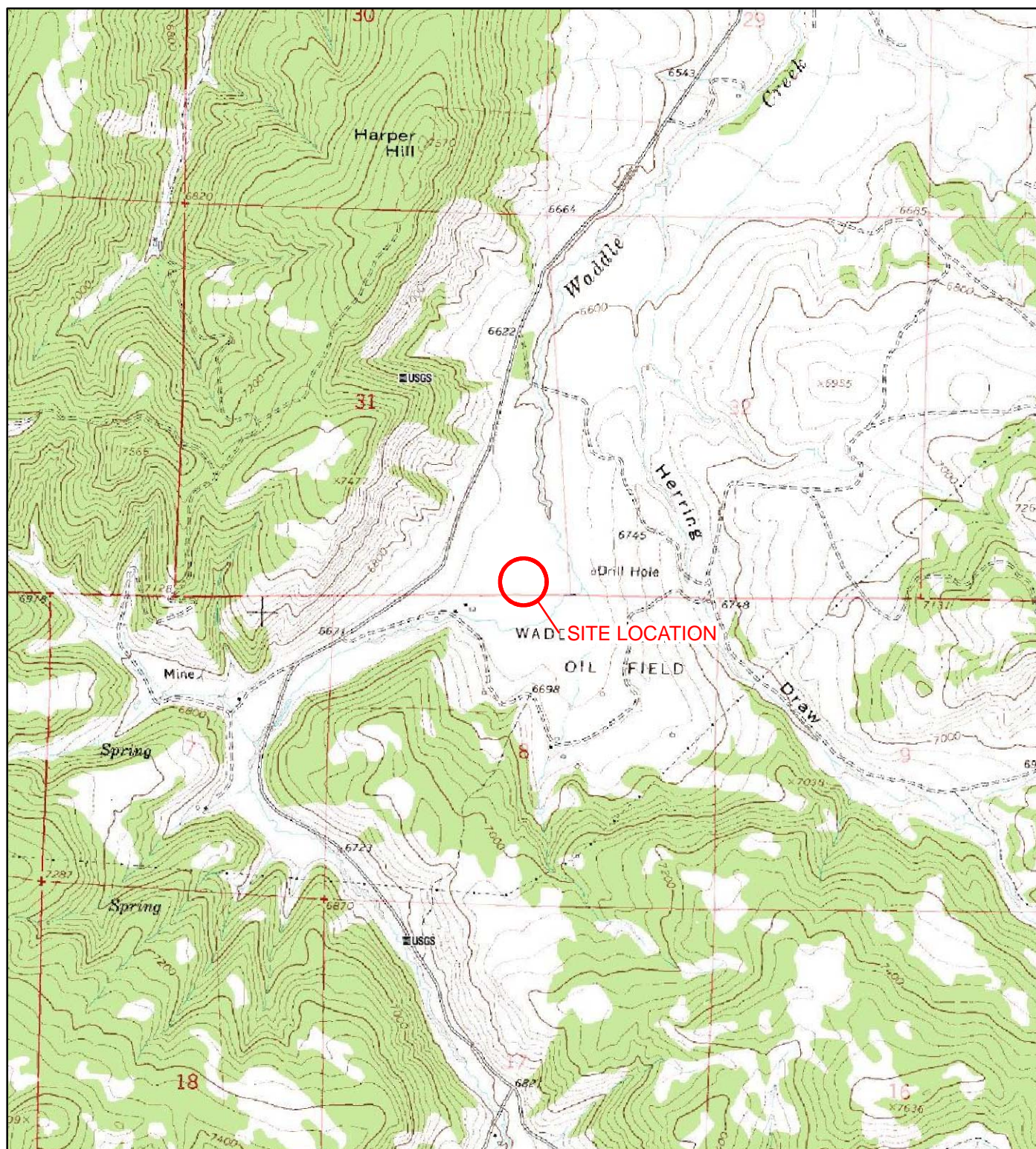
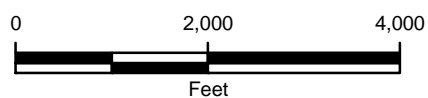


IMAGE COURTESY OF [WWW.TERRASERVER.COM/USGS](http://WWW.TERRASERVER.COM/USGS), 1966

## LEGEND



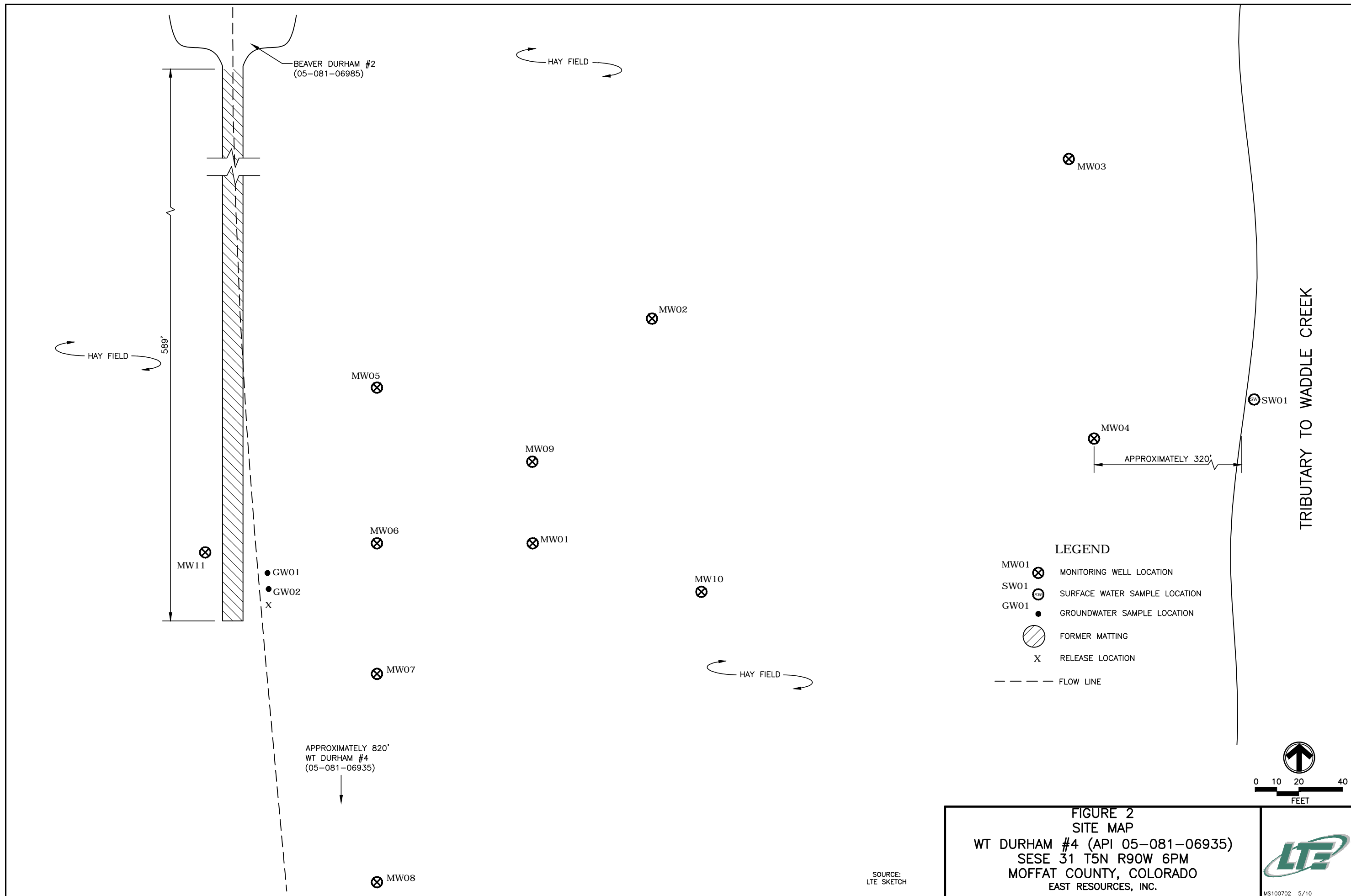
## SITE LOCATION

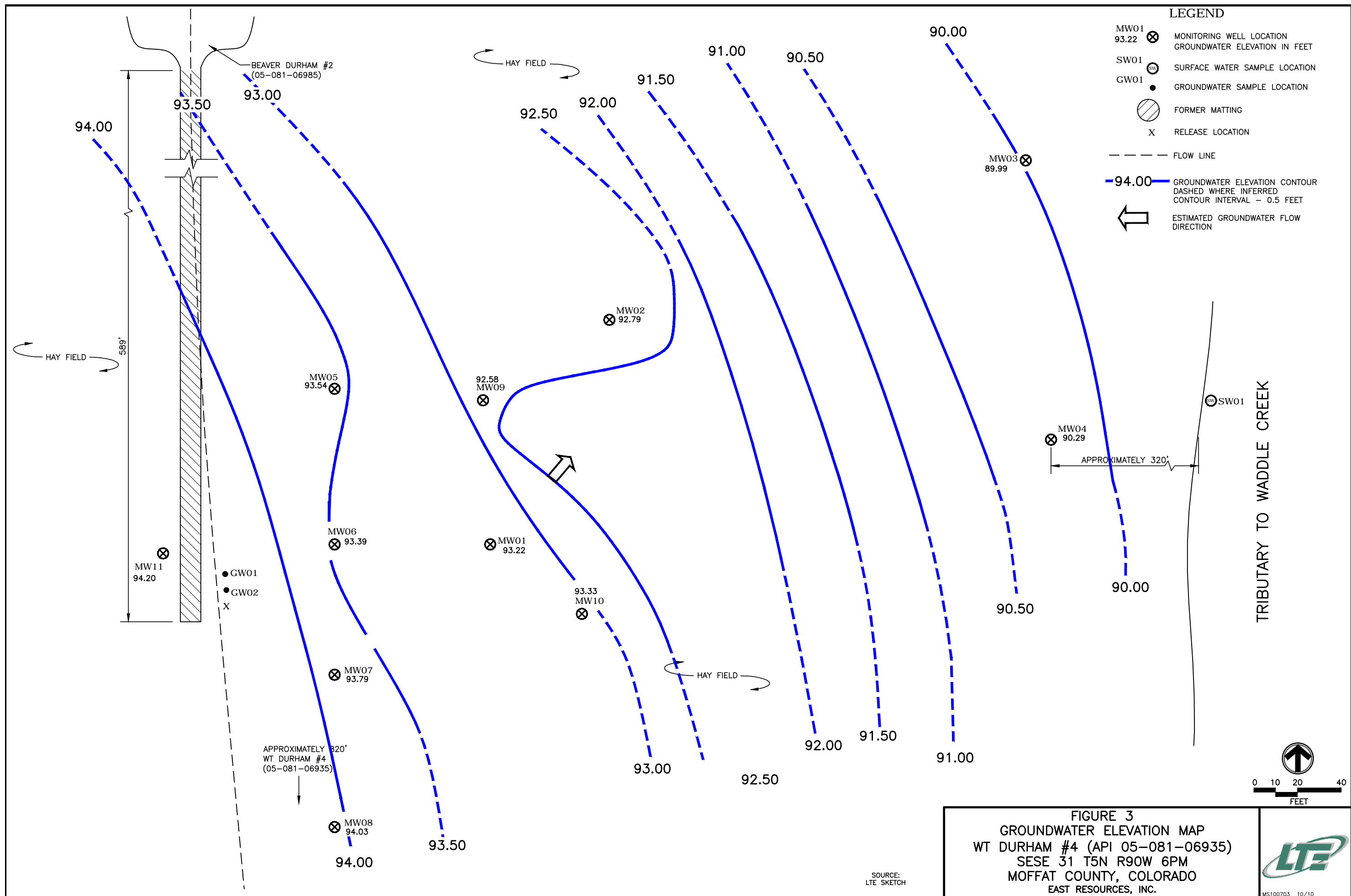


**FIGURE 1**  
**SITE LOCATION MAP**  
**WT DURHAM #4 (API 05-081-06935)**  
**SESE SEC 31 T5N R90W 6PM**  
**MOFFAT COUNTY, CO**  
**EAST RESOURCES, INC.**











**ATTACHMENT 1**

**WELL LOGS**



Location Map:

1N



**Compliance <sub>LL</sub> Engineering <sub>LL</sub> Remediation**  
**LT Environmental, Inc.**  
 4600 W. 60th Avenue  
 Arvada, Colorado 80003

## BORING LOG/MONITORING WELL COMPLETION DIAGRAM

Boring/Well Number:

MW08

Project:

WT Durham #4

Date:

9/15/10

Project Number:

MS1007

Logged By:

AW

Drilled By:

JJ

Drilling Method:

Hand Auger

Sampling Method:

Not Sampled

Elevation:

-

Detector:

-

Gravel Pack:

10-20 silica sand

Seal:

Bentonite Chips

Grout:

-

Casing Type:

Schedule 40 PUC

Diameter:

2"

Length:

5'

Hole Diameter:

4"

Depth to Liquid:

-

Screen Type:

PUC

Slot:

0.010"

Diameter:

2"

Length:

5'

Total Depth:

8'

Depth to Water:

~3.5'

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Soil/Rock Type	Lithology/Remarks	Well Completion
	Dry	-	none	-	0		OH	Organic clay, Dark Brown to Dark grey medium plasticity some silt	
					2				
					4	NS	CH	Inorganic clay, medium plasticity Dark Brown, saturated water at ~3.5'	
	Wet ~35%	-	none	-	6		CH	Same, saturated, color not noted	
	Wet	-	none	-	8		CH	Same, water some more organics	
					10			Well set at 8' screen to 3' sand to 8' bentonite to surface hydrated in lifts	

Location Map:



Compliance ■ Engineering ■ Remediation  
 LT Environmental, Inc.  
 4600 W. 60th Avenue  
 Arvada, Colorado 80003

## BORING LOG/MONITORING WELL COMPLETION DIAGRAM

Boring/Well Number:

MW09

Project:

WT Durham #4

Date:

9/5/10

Project Number:

MS1009

Logged By:

AW

Drilled By:

JJ

Elevation:

Detector:

Drilling Method:

Hand Auger

Sampling Method:

Not Sampled

Gravel Pack:

10-20 Silica Sand

Seal:

Bentonite Chips

Grout:

—

Casing Type:

Schedule 40 PUC

Diameter:

8"

Length:

3'

Hole Diameter:

4"

Depth to Liquid:

—

Screen Type:

PUC

Slot:

0.010"

Diameter:

2"

Length:

3'

Total Depth:

8'

Depth to Water:

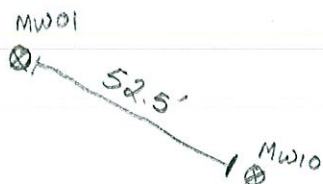
~4'

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Soil/Rock Type	Lithology/Remarks	Well Completion
	Dry	—	none	—	0		CH	Inorganic, fat clay, high plasticity, some organics Medium to Dark Brown	
	Dry	—	none	—	2		CH	Same more organics light grey saturated / water at ~4'	
	Wet ~4'	—	none	—	4	NS	CH	Same	
					6		CH	Same	
					8		CH	Same	
					10			Well set at 8' screen to 3' sand to 2' bentonite to surface hydrated in lifts	



Location Map:

1N



Compliance <sub>m</sub> Engineering <sub>m</sub> Remediation  
 LT Environmental, Inc.  
 4600 W. 60th Avenue  
 Arvada, Colorado 80003

## BORING LOG/MONITORING WELL COMPLETION DIAGRAM

Boring/Well Number:

MW10

Project:

WT Durham #4

Date:

9/5/10

Project Number:

MS1007

Logged By:

AW

Drilled By:

JJ

Drilling Method:

Hand Auger

Sampling Method:

Not Sampled

Elevation:

Detector:

Gravel Pack:

10-20 Silica Sand

Seal:

Bentonite Chips

Grout:

Casing Type:

Schedule 40 PUC

Diameter:

2"

Length:

5'

Hole Diameter:

4"

Depth to Liquid:

Screen Type:

PUC

Slot:

0.010"

Diameter:

2"

Length:

5'

Total Depth:

8'

Depth to Water:

~3.5

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Soil/Rock Type	Lithology/Remarks	Well Completion
	Dry	—	none	—	0		CH	Inorganic clay light Brown to Dark Brown, some organics & silt, medium plasticity	
	Wet 3.5'	—	none	—	2		OH	Organic clay Dark Brown to Dark grey medium plasticity saturated water at ~3.5'	
	Wet	—	none	—	4	NS	CH	Same some organics	
					6		CH	Same	
					8		CH	Same	
					10			Well set at 8' screen to 3' sand to 2' bentonite to surface, hydrated in lifts	

Location Map:

1N

MW11 72' MW006



Compliance <sup>M</sup> Engineering <sup>M</sup> Remediation  
 LT Environmental, Inc.  
 4600 W. 60th Avenue  
 Arvada, Colorado 80003

## BORING LOG/MONITORING WELL COMPLETION DIAGRAM

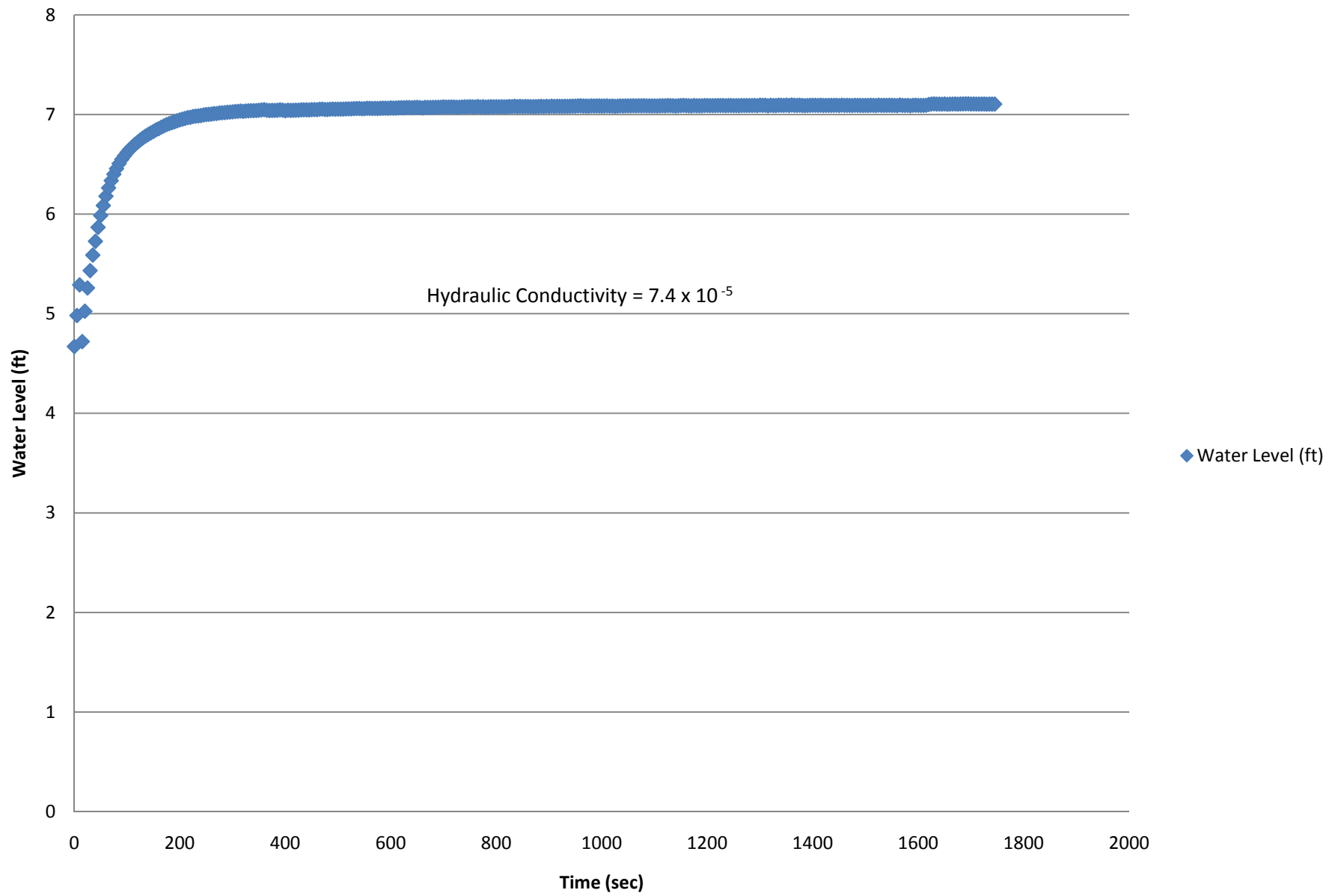
Boring/Well Number: MW11	Project: WT Durham #4
Date: 9/15/10	Project Number: MS1007
Logged By: AW	Drilled By: JJ
Drilling Method: Hand Auger	Sampling Method: Grab
Gravel Pack: 10-20 Silica Sand	Seal: Bentonite Chips
Casing Type: Schedule 40 PUC	Diameter: 2"
Screen Type: PUC	Slot: 0.010"
	Length: 5'
	Hole Diameter: 4"
	Depth to Liquid: —
	Total Depth: 7.5'
	Depth to Water: ~3

Penetration Resistance	Moisture Content	Vapor (ppm)	Staining	Sample #	Depth (ft. bgs.)	Sample Run	Soil/Rock Type	Lithology/Remarks	Well Completion
					0				
					1-2'				
	Dry	0.0	none	MW11 Unders	2	X	OH	Organic clay, Dark grey medium plasticity some silt	
					3.5-4.5				
	Wet	—	none	MW11 Saturated	4	X	CH	Inorganic clay, medium plasticity, Dark Brown saturated at ~3'	
					6		CH	Same water	
					8		CH	Same water	
					10			Soil Samples collected for analysis of total organic carbon (TOC)	
								Well Set at 7.5' Screen to 3' sand to 2' bentonite to surface in lifts	

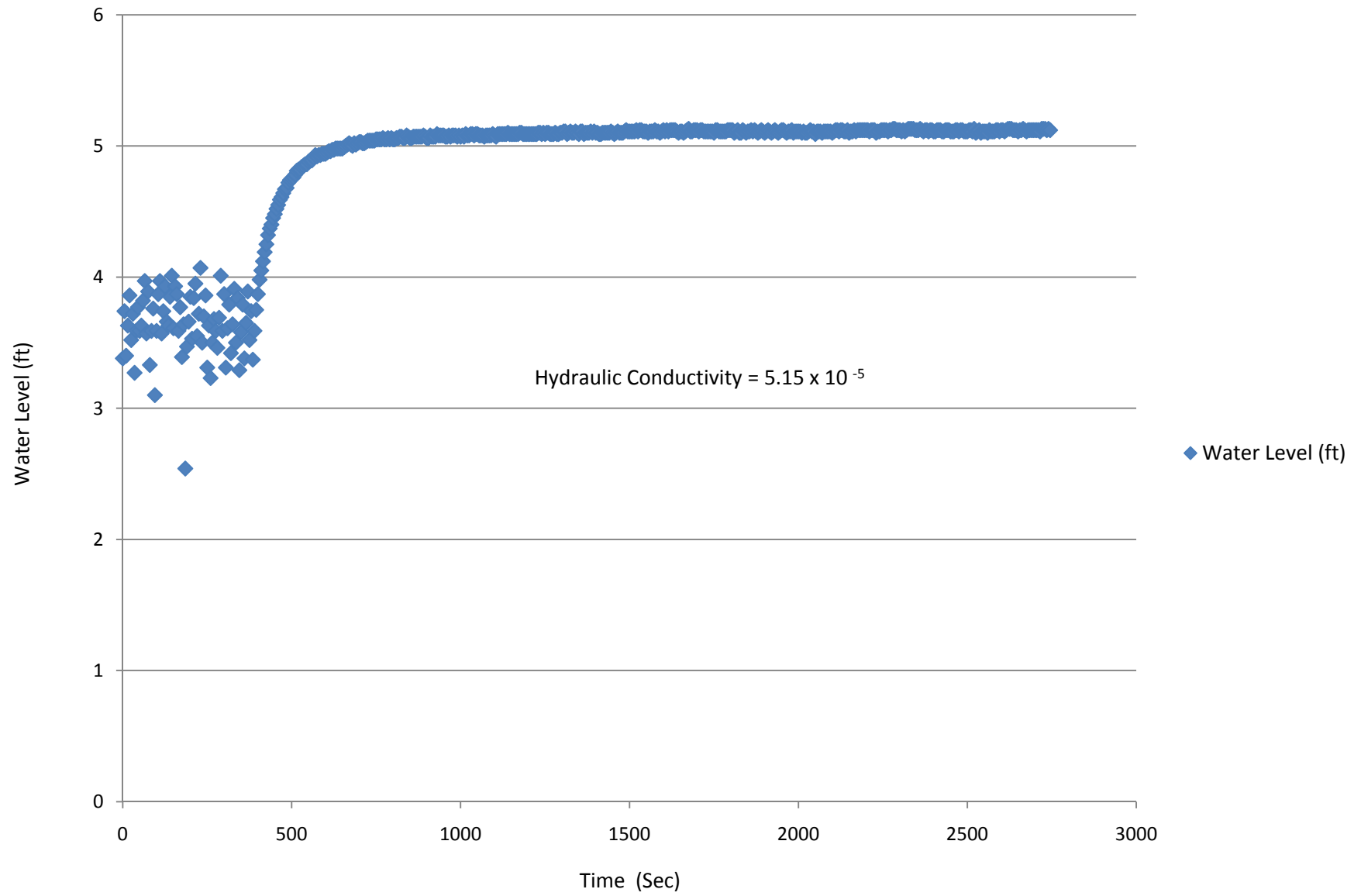
**ATTACHMENT 2**  
**SLUG TEST DATA GRAPHS**



# MW03



# MW05





**ATTACHMENT 3**  
**LABORATORY ANALYTICAL REPORT**



09/28/2010

LT Environmental, Inc.

Asher Weinberg

4600 West 60th Avenue

Arvada

CO

80003

Project Name- WT Durham #4

Project Number- MS1007

Attached are your analytical results for WT Durham #4 received by Origins Laboratory, Inc. September 17, 2010 3:00 pm. This project is associated with Origins project number X009094-01 .

The analytical results in the following report were analyzed under the guidelines of EPA Methods specified in SW-846. The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.

303.433.1322

o-squad@oelabinc.com



LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

**CROSS REFERENCE REPORT**

Sample ID	Laboratory ID	Matrix	Sampled	Date Received
MW05	X009094-01	Water	9/16/2010 9:14:00AM	09/17/2010 15:00
MW11 - Valdese	X009094-02	Soil	9/15/2010 11:45:00AM	09/17/2010 15:00
MW11 - Saturated	X009094-03	Soil	9/15/2010 12:00:00PM	09/17/2010 15:00
MW07	X009094-04	Water	9/16/2010 9:55:00AM	09/17/2010 15:00
MW08	X009094-05	Water	9/16/2010 10:00:00AM	09/17/2010 15:00
MW10	X009094-06	Water	9/16/2010 10:06:00AM	09/17/2010 15:00
MW09	X009094-07	Water	9/16/2010 10:22:00AM	09/17/2010 15:00
MW03	X009094-08	Water	9/16/2010 10:43:00AM	09/17/2010 15:00
MW04	X009094-09	Water	9/16/2010 11:01:00AM	09/17/2010 15:00
MW01	X009094-10	Water	9/16/2010 11:20:00AM	09/17/2010 15:00
MW02	X009094-11	Water	9/16/2010 1:00:00PM	09/17/2010 15:00
MW06	X009094-12	Water	9/16/2010 12:31:00PM	09/17/2010 15:00
MW11	X009094-13	Water	9/16/2010 11:50:00AM	09/17/2010 15:00

Origins Laboratory, Inc.



Noelle E Doyle,

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LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

www.originslaboratory.com

X009094 page 1 of 2

Client: LT Environmental  
Address: 820 Megan Ave Unit B  
Rifle, CO 81650  
Telephone Number: (970) 285-9985  
Email Address: aweinberg@ltenu.com

Project Manager: Asher Weinberg  
Project Name: WT Durham #4  
Project Number: MS1007  
Samples Collected By: JS + AW

Sample ID Description	Date Sampled	Time Sampled	# of Containers	Preservative					Matrix				Analysis					Sample Instructions																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
				Unpreserved	HCl	HNO <sub>3</sub>	Other	Groundwater	Soil	Air Summa #	Other	TOC	Nitrate	Dissolved Phosphorus	Fluoride	Sulfate																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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1725 Elk Place | Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

Origins Laboratory, Inc.

Noelle E Doyle

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LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

**MW05****9/16/2010 9:14:00AM**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.  
X009094-01 (Water)

**BTEX by EPA 8260B**

Benzene	ND	0.00100	mg/L	1	0120003	09/20/2010	09/20/2010
Toluene	ND	0.00100	"	"	"	"	"
Ethylbenzene	ND	0.00100	"	"	"	"	"
m,p-Xylene	ND	0.00200	"	"	"	"	"
o-Xylene	ND	0.00100	"	"	"	"	"

Surrogate: 1,2-Dichloroethane-d4	101 %	73.5-130	"	"	"
Surrogate: Toluene-d8	103 %	79.3-113	"	"	"
Surrogate: 4-Bromofluorobenzene	96.7 %	81.5-117	"	"	"

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Noelle E Doyle,

LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

**MW11 - Valdese****9/15/2010 11:45:00AM**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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**XENCO****X009094-02 (Soil)****Percent Moisture by AD2216A**

Percent Moisture	26.1	1	%	1	823759	09/20/2010	09/20/2010
------------------	------	---	---	---	--------	------------	------------

**Total Organic Carbon (TOC) by SG90.3.1**

Total Organic Carbon	25900	677	mg/kg	1	824877	09/27/2010	09/27/2010
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Origins Laboratory, Inc.



Noelle E Doyle,

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LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

**MW11 - Saturated**  
**9/15/2010 12:00:00PM**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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**XENCO**  
**X009094-03 (Soil)**

**Percent Moisture by AD2216A**

Percent Moisture	23.4	1	%	1	823759	09/20/2010	09/20/2010
------------------	------	---	---	---	--------	------------	------------

**Total Organic Carbon (TOC) by SG90.3.1**

Total Organic Carbon	24800	653	mg/kg	1	824877	09/27/2010	09/27/2010
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LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

**MW07**

9/16/2010 9:55:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.  
X009094-04 (Water)

**BTEX by EPA 8260B**

Benzene	ND	0.00100	mg/L	1	0120003	09/20/2010	09/20/2010
Toluene	ND	0.00100	"	"	"	"	"
Ethylbenzene	ND	0.00100	"	"	"	"	"
m,p-Xylene	ND	0.00200	"	"	"	"	"
o-Xylene	ND	0.00100	"	"	"	"	"

Surrogate: 1,2-Dichloroethane-d4	101 %	73.5-130	"	"	"
Surrogate: Toluene-d8	105 %	79.3-113	"	"	"
Surrogate: 4-Bromofluorobenzene	96.1 %	81.5-117	"	"	"

Origins Laboratory, Inc.



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Noelle E Doyle,

LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

## MW08

9/16/2010 10:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.  
X009094-05 (Water)

### BTEX by EPA 8260B

Benzene	ND	0.00100	mg/L	1	0120003	09/20/2010	09/20/2010	
Toluene	ND	0.00100	"	"	"	"	"	
Ethylbenzene	ND	0.00100	"	"	"	"	"	
m,p-Xylene	ND	0.00200	"	"	"	"	"	
o-Xylene	ND	0.00100	"	"	"	"	"	

Surrogate: 1,2-Dichloroethane-d4	101 %	73.5-130	"	"	"	"	"	
Surrogate: Toluene-d8	106 %	79.3-113	"	"	"	"	"	
Surrogate: 4-Bromofluorobenzene	96.2 %	81.5-117	"	"	"	"	"	

Origins Laboratory, Inc.



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Noelle E Doyle,

LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

## MW10

9/16/2010 10:06:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.  
X009094-06 (Water)

### BTEX by EPA 8260B

Benzene	ND	0.00100	mg/L	1	0120003	09/20/2010	09/20/2010
Toluene	ND	0.00100	"	"	"	"	"
Ethylbenzene	ND	0.00100	"	"	"	"	"
m,p-Xylene	ND	0.00200	"	"	"	"	"
o-Xylene	ND	0.00100	"	"	"	"	"

Surrogate: 1,2-Dichloroethane-d4	102 %	73.5-130	"	"	"
Surrogate: Toluene-d8	105 %	79.3-113	"	"	"
Surrogate: 4-Bromofluorobenzene	96.1 %	81.5-117	"	"	"

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LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

## MW09

9/16/2010 10:22:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.  
X009094-07 (Water)

### BTEX by EPA 8260B

Benzene	ND	0.00100	mg/L	1	0120003	09/20/2010	09/20/2010	
Toluene	ND	0.00100	"	"	"	"	"	
Ethylbenzene	ND	0.00100	"	"	"	"	"	
m,p-Xylene	ND	0.00200	"	"	"	"	"	
o-Xylene	ND	0.00100	"	"	"	"	"	

Surrogate: 1,2-Dichloroethane-d4	102 %	73.5-130			"	"	"	
Surrogate: Toluene-d8	104 %	79.3-113			"	"	"	
Surrogate: 4-Bromofluorobenzene	95.9 %	81.5-117			"	"	"	

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LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

## MW03

9/16/2010 10:43:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.  
X009094-08 (Water)

### BTEX by EPA 8260B

Benzene	ND	0.00100	mg/L	1	0120003	09/20/2010	09/20/2010
Toluene	ND	0.00100	"	"	"	"	"
Ethylbenzene	ND	0.00100	"	"	"	"	"
m,p-Xylene	ND	0.00200	"	"	"	"	"
o-Xylene	ND	0.00100	"	"	"	"	"

Surrogate: 1,2-Dichloroethane-d4	102 %	73.5-130	"	"	"
Surrogate: Toluene-d8	103 %	79.3-113	"	"	"
Surrogate: 4-Bromofluorobenzene	96.2 %	81.5-117	"	"	"

Origins Laboratory, Inc.



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Noelle E Doyle,

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4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

## MW04

9/16/2010 11:01:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.  
X009094-09 (Water)

### BTEX by EPA 8260B

Benzene	ND	0.00100	mg/L	1	0120003	09/20/2010	09/20/2010
Toluene	ND	0.00100	"	"	"	"	"
Ethylbenzene	ND	0.00100	"	"	"	"	"
m,p-Xylene	ND	0.00200	"	"	"	"	"
o-Xylene	ND	0.00100	"	"	"	"	"

Surrogate: 1,2-Dichloroethane-d4	102 %	73.5-130	"	"	"
Surrogate: Toluene-d8	103 %	79.3-113	"	"	"
Surrogate: 4-Bromofluorobenzene	96.1 %	81.5-117	"	"	"

Origins Laboratory, Inc.



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Noelle E Doyle,

LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

## MW01

9/16/2010 11:20:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.  
X009094-10 (Water)

### BTEX by EPA 8260B

Benzene	0.0101	0.00100	mg/L	1	0120003	09/20/2010	09/20/2010	
Toluene	ND	0.00100	"	"	"	"	"	
Ethylbenzene	ND	0.00100	"	"	"	"	"	
m,p-Xylene	ND	0.00200	"	"	"	"	"	
o-Xylene	ND	0.00100	"	"	"	"	"	

Surrogate: 1,2-Dichloroethane-d4	102 %	73.5-130			"	"	"	
Surrogate: Toluene-d8	103 %	79.3-113			"	"	"	
Surrogate: 4-Bromofluorobenzene	96.4 %	81.5-117			"	"	"	

Origins Laboratory, Inc.



Noelle E Doyle,

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LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

## MW02

9/16/2010 1:00:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.  
X009094-11 (Water)

### BTEX by EPA 8260B

Benzene	ND	0.00100	mg/L	1	0120003	09/20/2010	09/20/2010	
Toluene	ND	0.00100	"	"	"	"	"	
Ethylbenzene	ND	0.00100	"	"	"	"	"	
m,p-Xylene	ND	0.00200	"	"	"	"	"	
o-Xylene	ND	0.00100	"	"	"	"	"	

Surrogate: 1,2-Dichloroethane-d4	102 %	73.5-130			"	"	"	
Surrogate: Toluene-d8	103 %	79.3-113			"	"	"	
Surrogate: 4-Bromofluorobenzene	96.5 %	81.5-117			"	"	"	

### Dissolved Metals by SW6010B

Manganese	356	20	ug/L	1	824710	09/23/2010	09/25/2010	
Iron	3310	200	"	"	"	"	09/25/2010	

### Nitrate by EPA 300

Nitrate as N	ND	0.05	mg/L	1	824002	09/18/2010	09/18/2010	
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### Sulfate by EPA 300

Sulfate	292	0.5	mg/L	1	824002	"	09/18/2010	J
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Origins Laboratory, Inc.



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Noelle E Doyle,



LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

## MW06

9/16/2010 12:31:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.  
X009094-12 (Water)

### BTEX by EPA 8260B

Benzene	0.354	0.0100	mg/L	10	0120003	09/20/2010	09/20/2010	
Toluene	ND	0.00100	"	1	"	"	09/21/2010	
Ethylbenzene	0.0444	0.00100	"	"	"	"	"	
m,p-Xylene	0.0613	0.00200	"	"	"	"	"	
o-Xylene	ND	0.00100	"	"	"	"	"	

Surrogate: 1,2-Dichloroethane-d4	102 %	73.5-130			"	"	09/20/2010	
Surrogate: Toluene-d8	104 %	79.3-113			"	"	"	
Surrogate: 4-Bromofluorobenzene	96.4 %	81.5-117			"	"	"	

### Dissolved Metals by SW6010B

Manganese	829	20	ug/L	1	824710	09/23/2010	09/25/2010	
Iron	3560	200	"	"	"	"	09/25/2010	

### Nitrate by EPA 300

Nitrate as N	ND	0.05	mg/L	1	824002	09/18/2010	09/18/2010	
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### Sulfate by EPA 300

Sulfate	465	0.5	mg/L	1	824002	"	09/18/2010	
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Origins Laboratory, Inc.



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Noelle E Doyle,

LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

## MW11

9/16/2010 11:50:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.  
X009094-13 (Water)

### BTEX by EPA 8260B

Benzene	ND	0.00100	mg/L	1	0120003	09/20/2010	09/20/2010	
Toluene	ND	0.00100	"	"	"	"	"	
Ethylbenzene	ND	0.00100	"	"	"	"	"	
m,p-Xylene	ND	0.00200	"	"	"	"	"	
o-Xylene	ND	0.00100	"	"	"	"	"	

Surrogate: 1,2-Dichloroethane-d4	102 %	73.5-130			"	"	"	
Surrogate: Toluene-d8	103 %	79.3-113			"	"	"	
Surrogate: 4-Bromofluorobenzene	96.7 %	81.5-117			"	"	"	

### Dissolved Metals by SW6010B

Iron	ND	200	ug/L	1	824710	09/23/2010	09/25/2010	
Manganese	317	20	"	"	"	"	09/25/2010	

### Nitrate by EPA 300

Nitrate as N	0.119	0.05	mg/L	1	824002	09/18/2010	09/18/2010	
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### Sulfate by EPA 300

Sulfate	376	0.5	mg/L	1	824002	"	09/18/2010	
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Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Noelle E Doyle,

LT Environmental, Inc.  
4600 West 60th Avenue  
Arvada CO 80003

Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

## Volatile Organic Compounds by EPA Method 8260B - Quality Control Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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### Batch 0120003 - EPA 5030B

#### Blank (0120003-BLK1)

Prepared: 09/20/2010 Analyzed: 09/20/2010

Benzene	ND	0.001	mg/L							
Toluene	ND	0.001	"							
Ethylbenzene	ND	0.001	"							
m,p-Xylene	ND	0.002	"							
o-Xylene	ND	0.001	"							
Surrogate: 1,2-Dichloroethane-d4	62.0		ug/L	62.5		99.2	73.5-130			
Surrogate: Toluene-d8	66.5		"	62.5		106	79.3-113			
Surrogate: 4-Bromofluorobenzene	60.2		"	62.5		96.3	81.5-117			

#### LCS (0120003-BS1)

Prepared: 09/20/2010 Analyzed: 09/21/2010

Benzene	0.04	0.001	mg/L	0.0500		84.5	77.3-128			
Toluene	0.05	0.001	"	0.0500		99.8	81.7-118			
Surrogate: 1,2-Dichloroethane-d4	64.3		ug/L	62.5		103	73.5-130			
Surrogate: Toluene-d8	66.0		"	62.5		106	79.3-113			
Surrogate: 4-Bromofluorobenzene	60.4		"	62.5		96.6	81.5-117			

#### Matrix Spike (0120003-MS1)

Source: X009094-04

Prepared: 09/20/2010 Analyzed: 09/21/2010

Benzene	0.04	0.001	mg/L	0.0500	ND	88.5	74.5-132			
Toluene	0.05	0.001	"	0.0500	0.0004	105	74.2-116			
Surrogate: 1,2-Dichloroethane-d4	63.9		ug/L	62.5		102	73.5-130			
Surrogate: Toluene-d8	66.8		"	62.5		107	79.3-113			
Surrogate: 4-Bromofluorobenzene	60.9		"	62.5		97.4	81.5-117			

#### Matrix Spike Dup (0120003-MSD1)

Source: X009094-04

Prepared: 09/20/2010 Analyzed: 09/21/2010

Benzene	0.05	0.001	mg/L	0.0500	ND	92.8	74.5-132	4.70	13.1	
Toluene	0.06	0.001	"	0.0500	0.0004	110	74.2-116	4.45	21.2	
Surrogate: 1,2-Dichloroethane-d4	64.0		ug/L	62.5		102	73.5-130			
Surrogate: Toluene-d8	66.4		"	62.5		106	79.3-113			
Surrogate: 4-Bromofluorobenzene	60.6		"	62.5		96.9	81.5-117			

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Asher Weinberg  
Project Number: MS1007  
Project: WT Durham #4

## Dissolved Metals by SW6010B - Quality Control XENCO

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Batch 824710 - SW3010A</b>										
<b>MS (390560-002 S)</b>		Source: 390560-002 S			Prepared: 09/23/2010 Analyzed: 09/25/2010					
Iron	5430	200	ug/L	5000	99.7	107	75-125	0	20	
Manganese	1040	20	"	20.0	±20.0	NR	75-125	0	20	
<b>MSD (390560-002 SD)</b>		Source: 390560-002 SD			Prepared: 09/23/2010 Analyzed: 09/25/2010					
Iron	5570	200	ug/L	5000	99.7	109	75-125	2	20	
Manganese	1070	20	"	20.0	±20.0	NR	75-125	3	20	
<b>LCS (573956-1-BKS)</b>		Source: 573956-1-BKS			Prepared: 09/23/2010 Analyzed: 09/25/2010					
Manganese	1060	20	ug/L	1000	±6.40	106	75-125	0	20	
Iron	5440	200	"	5000	±32.0	109	75-125	0	20	
<b>BLANK (573956-1-BLK)</b>		Source: 573956-1-BLK			Prepared: 09/23/2010 Analyzed: 09/25/2010					
Manganese	ND	20	ug/L	1000			-	0	20	
Iron	ND	200	"	5000			-	0	20	

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## Nitrate by EPA 300 - Quality Control XENCO

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Batch 824002 - E300P</b>										
<b>MS (390437-003 S)</b>		Source: 390437-003 S			Prepared: 09/18/2010 Analyzed: 09/18/2010					
Nitrate as N	2.4	0.05	mg/L	2.26	0.050	106	90-110	0	20	
<b>LCS (573906-1-BKS)</b>		Source: 573906-1-BKS			Prepared: 09/18/2010 Analyzed: 09/18/2010					
Nitrate as N	2.38	0.05	mg/L	2.26	0.007	105	90-110	0	20	
<b>BLANK (573906-1-BLK)</b>		Source: 573906-1-BLK			Prepared: 09/18/2010 Analyzed: 09/18/2010					
Nitrate as N	ND	0.05	mg/L	2.26			-	0	20	

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Project: WT Durham #4

## Percent Moisture by AD2216A - Quality Control XENCO

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch 823759 - NONE

BLANK (823759-1-BLK)

Source: 823759-1-BLK

Prepared: 09/20/2010 Analyzed: 09/20/2010

Percent Moisture	ND	1	%	0.00	-	0	20
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Project: WT Durham #4

**Sulfate by EPA 300 - Quality Control  
XENCO**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Batch 824002 - E300P</b>										
<b>MS (390437-003 S)</b>		Source: 390437-003 S			Prepared: 09/18/2010 Analyzed: 09/18/2010					
Sulfate	286	0.5	mg/L	50.0	292		90-110	0	20	
<b>LCS (573906-1-BKS)</b>		Source: 573906-1-BKS			Prepared: 09/18/2010 Analyzed: 09/18/2010					
Sulfate	54	0.5	mg/L	50.0	40.076	108	90-110	0	20	
<b>BLANK (573906-1-BLK)</b>		Source: 573906-1-BLK			Prepared: 09/18/2010 Analyzed: 09/18/2010					
Sulfate	ND	0.5	mg/L	50.0			-	0	20	

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Project: WT Durham #4

## Total Organic Carbon (TOC) by SG90.3.1 - Quality Control XENCO

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
<b>Batch 824877 - NONE</b>										
<b>LCS (824877-1-BKS)</b>		Source: 824877-1-BKS			Prepared: 09/27/2010 Analyzed: 09/27/2010					
Total Organic Carbon	981	500	mg/kg	1000	+250	98	70-130	0	30	
<b>BLANK (824877-1-BLK)</b>		Source: 824877-1-BLK			Prepared: 09/27/2010 Analyzed: 09/27/2010					
Total Organic Carbon	ND	500	mg/kg	1000			-	0	30	
<b>LCSD (824877-1-BSD)</b>		Source: 824877-1-BSD			Prepared: 09/27/2010 Analyzed: 09/27/2010					
Total Organic Carbon	918	500	mg/kg	1000	+250	92	70-130	6	30	

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Project: WT Durham #4

### Notes and Definitions

J Matrix Spike failed outside method recovery limits. LCS/MSD passed

ND Analyte NOT DETECTED at or above the reporting limit

RPD Relative Percent Difference

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**ATTACHMENT 4**  
**GROUNDWATER MODELING RESULTS**



Title: WT Durham •

Simulation time (years)..... 100

## Saturated Zone Model Source

-----

## Pulse Source:

Length of pulse (yr).....	100.
Total thickness of source (m).....	1.50
Length of source (m).....	19.8
Width of source (m).....	19.8

## Aquifer Properties

-----

Effective porosity (cm <sup>3</sup> /cm <sup>3</sup> ).....	.250
Fraction organic carbon (g oc/g soil)...	1.000E-02
Hydraulic conductivity (m/d).....	9.040E-04
Soil bulk density (g/cm <sup>3</sup> ).....	1.70
Hydraulic gradient (m/m).....	1.000E-03
Longitudinal dispersivity (m).....	code calculated
Transverse dispersivity (m).....	code calculated
Vertical dispersivity (m).....	code calculated

## Receptor Well Location

-----

Distance downgradient (m).....	30.0
Distance cross-gradient (m).....	.000
Depth to top of well screen (m).....	.000
Depth to bottom of well screen(m).....	1.00
Number of points used to calc. conc.....	2

## CHEMICAL DATA INPUT: Benzene

Diffusion coeff. in air (cm <sup>2</sup> /s).....	8.800E-02
Diffusion coeff. in water (cm <sup>2</sup> /s)...	9.800E-06
Solubility (mg/l).....	1.750E+03
KOC (ml/g).....	58.9
Henry's Law Coefficient (-).....	.228
Molecular Weight (g/mol).....	78.0
Density of chemical (g/cm <sup>3</sup> ).....	.877
Degradation rate sat. zone (1/d)....	.000
Degradation rate unsat. zone (1/d)...	.000

## Source Concentrations: Benzene

-----

Source conc. for GW model (mg/l).....	.345
---------------------------------------	------

GROUNDWATER CONCENTRATION AT RECEPTOR WELL  
Benzene  
Averaged Annually

Time (yr)	Concentration at well (mg/l)
1.0	0.00E+00
2.0	0.00E+00
3.0	0.00E+00
4.0	0.00E+00
5.0	0.00E+00
6.0	0.00E+00
7.0	0.00E+00
8.0	0.00E+00
9.0	0.00E+00
10.0	0.00E+00
11.0	0.00E+00
12.0	0.00E+00
13.0	0.00E+00
14.0	0.00E+00
15.0	0.00E+00
16.0	0.00E+00
17.0	0.00E+00
18.0	0.00E+00
19.0	0.00E+00
20.0	0.00E+00
21.0	0.00E+00
22.0	0.00E+00
23.0	0.00E+00
24.0	0.00E+00
25.0	0.00E+00
26.0	0.00E+00
27.0	0.00E+00
28.0	0.00E+00
29.0	0.00E+00
30.0	0.00E+00
31.0	0.00E+00
32.0	0.00E+00
33.0	0.00E+00
34.0	0.00E+00
35.0	0.00E+00
36.0	0.00E+00
37.0	0.00E+00
38.0	0.00E+00
39.0	0.00E+00
40.0	0.00E+00
41.0	0.00E+00
42.0	0.00E+00
43.0	0.00E+00
44.0	0.00E+00
45.0	0.00E+00
46.0	0.00E+00
47.0	0.00E+00
48.0	0.00E+00
49.0	0.00E+00
50.0	0.00E+00
51.0	0.00E+00
52.0	0.00E+00
53.0	0.00E+00
54.0	0.00E+00
55.0	0.00E+00
56.0	0.00E+00
57.0	0.00E+00
58.0	0.00E+00
59.0	0.00E+00
60.0	0.00E+00
61.0	0.00E+00
62.0	0.00E+00
63.0	0.00E+00
64.0	0.00E+00
65.0	0.00E+00
66.0	0.00E+00
67.0	0.00E+00
68.0	0.00E+00
69.0	0.00E+00
70.0	0.00E+00
71.0	0.00E+00

72.0	0.00E+00
73.0	0.00E+00
74.0	0.00E+00
75.0	0.00E+00
76.0	0.00E+00
77.0	0.00E+00
78.0	0.00E+00
79.0	0.00E+00
80.0	0.00E+00
81.0	0.00E+00
82.0	0.00E+00
83.0	0.00E+00
84.0	0.00E+00
85.0	0.00E+00
86.0	0.00E+00
87.0	0.00E+00
88.0	0.00E+00
89.0	0.00E+00
90.0	0.00E+00
91.0	0.00E+00
92.0	0.00E+00
93.0	0.00E+00
94.0	0.00E+00
95.0	0.00E+00
96.0	0.00E+00
97.0	0.00E+00
98.0	0.00E+00
99.0	0.00E+00
100.0	0.00E+00

The maximum concentration occurred at the following time:  
.0            0.00E+00

Mass input rate for pulse source in GW (kg/d)... 9.27E-09

Calculated longitudinal dispersivity: 5.56  
Calculated transverse dispersivity: 1.85  
Calculated vertical dispersivity: .213E-01  
Number of integration terms used: 10

GROUNDWATER CONCENTRATION AT WELL (annual average)  
Benzene

Time (yr)	Concentration at well (mg/l)
1.0	0.00E+00
2.0	0.00E+00
3.0	0.00E+00
4.0	0.00E+00
5.0	0.00E+00
6.0	0.00E+00
7.0	0.00E+00
8.0	0.00E+00
9.0	0.00E+00
10.0	0.00E+00
11.0	0.00E+00
12.0	0.00E+00
13.0	0.00E+00
14.0	0.00E+00
15.0	0.00E+00
16.0	0.00E+00
17.0	0.00E+00
18.0	0.00E+00
19.0	0.00E+00
20.0	0.00E+00
21.0	0.00E+00
22.0	0.00E+00
23.0	0.00E+00
24.0	0.00E+00
25.0	0.00E+00
26.0	0.00E+00
27.0	0.00E+00
28.0	0.00E+00
29.0	0.00E+00
30.0	0.00E+00
31.0	0.00E+00
32.0	0.00E+00
33.0	0.00E+00
34.0	0.00E+00
35.0	0.00E+00
36.0	0.00E+00
37.0	0.00E+00
38.0	0.00E+00
39.0	0.00E+00
40.0	0.00E+00
41.0	0.00E+00
42.0	0.00E+00
43.0	0.00E+00
44.0	0.00E+00
45.0	0.00E+00
46.0	0.00E+00
47.0	0.00E+00
48.0	0.00E+00
49.0	0.00E+00
50.0	0.00E+00
51.0	0.00E+00
52.0	0.00E+00
53.0	0.00E+00
54.0	0.00E+00
55.0	0.00E+00
56.0	0.00E+00
57.0	0.00E+00
58.0	0.00E+00
59.0	0.00E+00
60.0	0.00E+00



61.0	0.00E+00
62.0	0.00E+00
63.0	0.00E+00
64.0	0.00E+00
65.0	0.00E+00
66.0	0.00E+00
67.0	0.00E+00
68.0	0.00E+00
69.0	0.00E+00
70.0	0.00E+00
71.0	0.00E+00
72.0	0.00E+00
73.0	0.00E+00
74.0	0.00E+00
75.0	0.00E+00
76.0	0.00E+00
77.0	0.00E+00
78.0	0.00E+00
79.0	0.00E+00
80.0	0.00E+00
81.0	0.00E+00
82.0	0.00E+00
83.0	0.00E+00
84.0	0.00E+00
85.0	0.00E+00
86.0	0.00E+00
87.0	0.00E+00
88.0	0.00E+00
89.0	0.00E+00
90.0	0.00E+00
91.0	0.00E+00
92.0	0.00E+00
93.0	0.00E+00
94.0	0.00E+00
95.0	0.00E+00
96.0	0.00E+00
97.0	0.00E+00
98.0	0.00E+00
99.0	0.00E+00
100.0	0.00E+00

The maximum concentration occurred at the following time:  
.0            0.00E+00

---

MNA - Calculation of Cleanup Time, Cleanup Levels, and Milestones  
Concentration -vs- Time (four consecutive quarters of data available)  
Site Name:

Table 1. Well Data

Date	Days	Benzene (ug/L)		
		Well 1	Well 2	Well 3
		MW06		
7/14/2010	0	1,520		
9/16/2010	64	354		
	#NUM!			
	#NUM!			
	#NUM!			
	#NUM!			
	#NUM!			
	#NUM!			
	#NUM!			
	#NUM!			

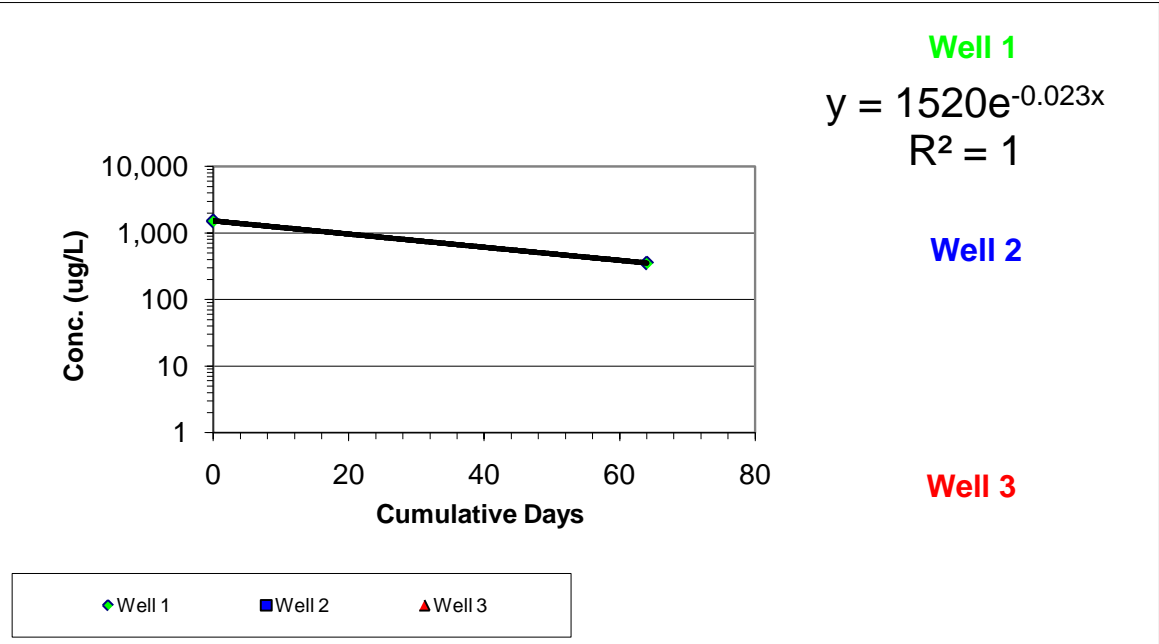


Table 2. Time to cleanup (t) in property boundary well  
(or other downgradient well between the source and a POE other than and inside the property boundary)

Goal Conc. $C_G$ (ug/L)	Current Conc. $C_O$ (ug/L)	Decay Rate* $k$ (day <sup>-1</sup> )	Time to cleanup $t = [-\ln(C_G/C_O)]/k$	
			t (days)	t (years)
5	345	0.023	184	0.5

\*Select most conservative valid decay rate of all wells

Trend line equation:

$$y = be^{-mx} \quad \text{or} \quad C_t = C_0e^{-kt} \quad \text{where} \quad k = \text{bulk decay rate}$$

Typical range for the bulk decay rate ( $k$ ) = 0.001 to 0.01 (0.1 to 1 percent per day).  
If  $R^2$  value < 0.36 = not a good fit; data not usable for regression analysis.  
If  $R^2$  value > 0.64 = data can easily fit a first order regression model.

Table 3. Cleanup Milestones at property boundary well (or downgradient well)

Monitoring Well	Time to Cleanup	Current Conc.	Decay Rate	Cleanup Goal	Milestones					
					$C_{G\%} = C_O - [(C_O - C_G)(\% \text{ of goal}/100)]$			$t_{G\%} = [-\ln(C_{G\%}/C_O)]/k$		
					25% towards Goal		50% towards Goal	75% towards Goal		
					$C_{G20}$ (ug/L)	$t_{G25}$ (days)	$C_{G50}$ (ug/L)	$t_{G50}$ (days)	$C_{G75}$ (ug/L)	$t_{G75}$ (days)
DG Well	184	0	0.023	5	1	#DIV/0!	3	#DIV/0!	4	#DIV/0!

Table 4. Cleanup Levels ( $C_L$ ) and Milestones at in-plume wells

Monitoring Well	Time to Cleanup	Current Conc.	Decay Rate	Cleanup Levels $C_L = C_0e^{-kt}$	Milestones					
					$C_{L\%} = C_O - [(C_O - C_L)(\% \text{ of goal}/100)]$			$t_{L\%} = [-\ln(C_{L\%}/C_O)]/k$		
					25% towards $C_L$		50% towards $C_L$	75% towards $C_L$		
					$C_{L20}$ (ug/L)	$t_{L25}$ (days)	$C_{L50}$ (ug/L)	$t_{L50}$ (days)	$C_{L75}$ (ug/L)	$t_{L75}$ (days)
Source Well	184	0	0.023	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!
In-plume well	184	345	0.023	5	260	12	175	30	90	58