Groundwater Classification - Former Exide Technologies Facility, Frisco, Texas

COMMENTS ON APPENDIX 7 OF *AFFECTED PROPERTY ASSESSMENT REPORT, FORMER OPERATING PLANT, FRISCO RECYCLING CENTER, FRISCO, COLLIN COUNTY, TEXAS (AGREED ORDER DOCKET NO. 2011-1712-IHW-E)*, PASTOR, BEHLING & WHEELER LLC, DATED 7/10/2013

12 SEPTEMBER 2013

Prepared for:

Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

and

The City of Frisco
6101 Frisco Square Blvd. 5th Floor
Frisco, Texas 75034

Prepared by:

and

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
816 WEST ELEVENTH
AUSTIN, TEXAS 78701-2000
(512) 474-2097 FAX (512) 474-2483

Southwest GEOSCIENCE

STATE OF TEXAS
WADE M. WHEATLEY
76710
LICENSED
PROFESSIONAL ENGINEER

Wade Wheatley, PE# 76710
9/12/13

STATE OF TEXAS
RICHARD D. VARNELL
GEOLOGY
No. 4992
LICENSED
PROFESSIONAL GEOSCIENTIST

Richard Varnell, PG# 4992

STATE OF TEXAS
RUSTY SIMPSON
GEOLOGY
LIC. #218
LICENSED
PROFESSIONAL GEOSCIENTIST

Rusty Simpson, PG# 218

Attachment D

INTRODUCTION

Cook-Joyce, Inc. (CJI) and Southwest Geoscience (collectively referred to as City Consultants) have prepared this document on behalf of the City of Frisco (City). The purpose of this document is to relay the City's concerns regarding the Class 3 groundwater designation that Exide Technologies, Inc. (Exide) is pursuing at their Former Recycling Facility in Frisco, Texas. The City and the City Consultants have concluded that there are multiple technical inconsistencies in Exide's Class 3 groundwater request. Based on our review of the available information, we have concluded that:

1) The area Exide has described as Class 3 groundwater appears to be Class 2 groundwater;

2) Shallow groundwater does not occur in isolated "pockets" at the site; instead, there is a contiguous stratum of alluvial deposits that is continuously saturated across an area that is approximately 100 acres in size (including most of the "Bowtie" property[1], the Class 2 Landfill area, and the M Tract[2]); and

3) Exide appears to be precluded by rule from downgrading Class 2 groundwater to Class 3 groundwater.

The bases for those conclusions and the City's interest in the Exide-related projects in Frisco, Texas, are discussed below.

CITY OF FRISCO'S INTEREST IN EXIDE PROPERTY AND PROJECTS

The City's interest in the groundwater classification at the site is based on the following:

- First and foremost, the City is focused on the well-being of its citizens and the environment in which they live.

- In an effort to protect its citizens and environment the City entered into an agreement with Exide to purchase "buffer property" from Exide. The buffer property is adjacent to Exide's Frisco Recycling Facility. The purchase price for that land (known as the "J Parcel" and, potentially, the "Lake Parcel") was negotiated in part to provide Exide with the necessary funds to appropriately address the endemic contamination present at their facility.

- The groundwater classification at the former Exide facility directly impacts the size and scope of any response action that is undertaken. The City's desire is that Exide's groundwater classification be interpreted in strict accordance with TCEQ rules and guidance and that contamination present at the former Exide facility be removed or controlled in a manner that will prevent exposure to the contaminants and their off-site migration.

[1] The Bowtie property (named such because its shape resembles a bowtie) represents Exide's Resource Conservation and Recovery Act (RCRA)-Permitted area. It contains the former recycling facility, the "Lake Parcel" (an undeveloped tract of land located west of the former recycling facility), and areas immediately south and immediately north of the Exide facility.

[2] The M Tract is a tract of land currently owned by Exide that is located west of the Class 2 landfill and north of the Bowtie property.

Based on the factors listed above, the City has an ethical and fiduciary responsibility to ensure that the investigation, response action, and eventual closure of Exide's Former Recycling Facility is thorough and based on solid scientific and technical principles.

GROUNDWATER RESOURCE CLASSIFICATION EVALUATION

A document entitled *Updated Groundwater Resource Classification Evaluation, Exide Frisco Recycling Center, Frisco, Texas*, by Pastor, Behling & Wheeler LLC (PBW), dated July 9, 2013 (Groundwater Memo) was submitted as Appendix 7 of the APAR[3] for Exide's Former Recycling Facility. This document is an updated version of similar documents that were submitted to the Texas Commission on Environmental Quality (TCEQ) on November 29, 2012 and on May 22, 2013. The City provided comments from its technical consultants regarding both of those previous documents directly to Exide after learning of each submittal to the TCEQ. The City and its consultants have also informed the TCEQ of their concerns during monthly meetings held regarding the Exide site. In addition, these comments and their technical bases were discussed with Exide, their attorneys (Baker Botts LLP), and their technical consultants (PBW) during a June 6, 2013 meeting held specifically on this subject.

The Groundwater Memo provides data that indicate that the predicted yield of shallow groundwater at the site[4] varies from levels consistent with a saturated soil to levels consistent with a Class 2 groundwater, with Class 3 groundwater being an intermediate point between those two bounding conditions. With a few exceptions, the Exide data indicate saturated soils are typically found to the south of Stewart Creek and to the east of 5th street. The Exide data also identify yields that are consistent with Class 2 or Class 3 groundwater within the former plant area, north of Stewart Creek, and west of 5th Street. In these areas, Exide states that Class 2 groundwater yields are typically found in areas with "lenses" of gravel and/or sand and Class 3 groundwater yields are typically present in areas without those lenses.

Although the Groundwater Memo notes that the yield and quality of the groundwater meets Class 2 criteria in some areas of the site, it concludes that, due to their limited hydrogeologic extent[5], the more transmissive gravels and sands "appear incapable of sustaining a long-term daily withdrawal rate that would satisfy the Class 2 criteria; therefore, it is appropriate to downgrade the gravels and sands to a Class 3 designation in accordance with TRRP-8."

The City disagrees with this conclusion and the following section outlines additional lines of evidence supporting the classification of the groundwater bearing unit as a Class 2 groundwater resource.

Apparent Extent of Class 2 Sands and Gravels

Exide maintains that groundwater at Bowtie/J Parcel is Class 3 because of the limited areal extent of sand and gravel lenses that produce most of the groundwater. TCEQ regulatory guidance (RG-366/TRRP-8, *Groundwater Classification*, revised March 2010) addressed the

[3] *Affected Property Assessment Report, Former Operating Plant, Frisco Recycling Center, Frisco, Collin County, Texas (Agreed Order Docket No. 2011-1712-IHW-E)*, Pastor, Behling & Wheeler LLC, dated 7/10/2013.

[4] The shallow groundwater at the site is found within a few feet of the ground surface and extends down to the surface of the Eagle Ford Shale (between ~10 to ~30 feet below grade depending the location within the site).

[5] More information regarding Class 2 groundwater, Class 3 groundwater, and Exide's limited hydrogeologic extent conclusion is provided in Attachment A of this document.

burden of proof to be met in making a Class 3 groundwater determination on this basis, identifying the need to perform a "rigorous geological analysis" to support such a determination. The City Consultants believe that a rigorous geological investigation has been performed. However, we believe that the data gathered during the geological investigation supports a Class 2 groundwater designation, not a Class 3 groundwater designation. For example, the Groundwater Memo indicates that the shallow geology at the former Exide facility consists of 3 distinct units:

1) A clay with no or very limited gravel (saturated soils);

2) Clayey gravels that meet the definition of a Class 3 resource based on calculated yield values; and

3) Gravels and sands that are laterally discontinuous and therefore should be downgraded from a Class 2 to a Class 3 designation.

PBW includes cross-sections with the Groundwater Memo to illustrate the basis for their conclusions.

The City concurs that saturated soils appear to be present to the east of 5th Street (with some minor exceptions, such as the area near VCP-MW-8) and to the south of Stewart Creek and the former Exide operating facility. However, the City and our technical consultants believe that the "clayey gravels" and "gravels and sands" (units 2 and 3 as identified by PBW) are actually one unit that represents "alluvial deposits". The alluvial deposits originate from Stewart Creek, which borders Exide's former operating facility to the south, and its northern tributary, which is located to the north of the operating facility. Generally the alluvial deposits appear to extend from the Class 2 landfill to the north to Stewart Creek to the south, and from Eagan Way to the east to the Museum of the American Railroad property to the west.

These alluvial deposits consist of unconsolidated soils with grain sizes ranging from silty clays to sandy gravels. This unit is present and is continuously saturated across the northern and eastern portions of the site. Figure 1 (attached) provides a map of the apparent extent of this unit based on an overlay of the extent of the clayey gravels and extent of the gravels and sands as mapped by PBW. Figure 2 documents the saturated thickness of the unit in and around the former Exide operating facility.

The cross sections that were included with the Groundwater Memo (Sections A-A' through F-F') have been revised to illustrate the interpretation of the City's consultants that connectivity exists between transmissive strata at the site and are attached to this document.

Based on review of the lithologic data presented by PBW, a historic stream channel (a paleochannel) appears to be present within the alluvial deposits at the site. This feature lies immediately to the south of the Class 2 landfill in a roughly east-west orientation, and appears to cross beneath the southeast corner of the Class 2 landfill. The paleochannel contains transmissive soils and, based on a previous groundwater pump test (described below), can produce prodigious amounts of groundwater. However, the apparent paleochannel is not addressed by PBW in its geological and hydrogeological characterization of the site, and the cross sections prepared by Exide for the Groundwater Memo and the APAR to which it is attached did not include a cross section along the paleochannel.

Therefore, a new cross section that generally aligns longitudinally along the paleochannel (Section G-G') has been prepared to depict this feature and is attached to this document. There is a higher percentage of gravel and sand in the paleochannel than in the alluvial deposits outside of the channel.

Fill Material

In addition to the clay and alluvial deposits, the City believes that there is a third distinct unit present in the shallow soils at the site: fill material. Based on the observations noted on the boring logs included in the APAR, the fill material consists of reworked soils native to the area, slag, battery chips, municipal solid waste, and potentially other types of debris.

Because the Exide facility extends over the former channel of Stewart Creek and its northern tributary (the Slag Landfill and North Disposal Area extend over the northern tributary's former channel as well), a large percentage of the central and western portions of the operating facility is situated on fill. In some areas the fill is relatively deep and is saturated. For example, MW-30 was installed through (or very close to) the former Stewart Creek channel. The boring log for MW-30 reports slag and lead were found at a depth of 28 feet below grade at that location. Figure 3 depicts the possible extent of fill at the former operating facility. The former stream channels are also depicted on Figures 1-3, and an overlay of the Exide facility on a 1942 aerial photograph is provided as Figure 4.

Groundwater flow characteristics in unconsolidated fill will be highly variable and some areas could yield large amounts of groundwater. While the City is not suggesting that groundwater will be produced from filled areas, groundwater yield is one of the two defining characteristics in groundwater classification; therefore the yields from those areas should be considered in this evaluation. In addition, another purpose of groundwater classification is to evaluate potential groundwater transport pathways. The saturated fill likely represents a different transport pathway and requires evaluation; especially since waste is present within the saturated fill.

Well Development

As documented in literature, the development of groundwater monitoring wells is a critical step in any program designed to measure the hydraulic conductivity of a groundwater bearing unit. Well development procedures for each of the monitoring wells that are used in PBWs groundwater classification memo to demonstrate hydraulic conductivity are not included in the appendices, nor are they included in the Bowtie APAR, so direct correlation of well development procedures to hydraulic conductivity measurements is not possible in each case. However, based on SWG observations of the well development procedures initially proposed by PBW during the J-Parcel APAR investigation, well development is a factor in a low biased estimation of hydraulic conductivity.

During the J-Parcel APAR investigation, SWG had discussions with PBW personnel regarding the method of well development that was planned for the new wells on the J-Parcel which included purging with a downhole electric submersible pump. During the drilling process, saturated sand, gravel, clayey gravel and saturated clay lithologies were observed. Clays have the likelihood of creating skin effects in the borehole; therefore, SWG strongly suggested the initial use of a heavy, PVC bailer or surge block device to surge the wells prior to the completion of removing fines with a downhole submersible pump. The purpose of this recommendation was to increase the energy applied to the development procedure, resulting in a more effective well development. Based on a review of the well development records provided for wells on the

Bowtie parcel that SWG was not present to observe, it appears that surging with a surge block or PVC bailer was not performed during well development outside of the new wells on the J-Parcel.

An analysis of well development and purging records for the new monitoring wells on the J-Parcel and the wells on the Bowtie parcel, indicates that an improved well condition is apparent for the monitoring wells that underwent a more aggressive and sustained well development program (surging with a PVC bailer over multiple events). VCP-MW-3 was the only newly installed well that did not respond to the more aggressive development program, most likely due to localized conditions of lower hydraulic conductivity. The other new monitoring wells on the J-Parcel had turbidity readings at sampling that were lower than 10 Nephelometric Turbidity Units (NTUs), and were not subject to filtration during total metals sampling. In general, wells on the Bowtie Parcel exhibited turbidity readings at the time of sample collection that were greater than 10 NTUs, and some as high as 176 NTUs.

It is SWG's opinion that a more aggressive well development program resulted in better groundwater clarity and improved turbidity readings at most of the new wells on the J-Parcel. In addition, more well development may be needed prior to additional measurements of hydraulic conductivity to further evaluate the actual production of the formation as it is likely biased low given the higher turbidity readings observed on the Bowtie Parcel.

Yield Testing

In their Groundwater Memo, Exide acknowledges that certain monitoring wells will likely yield enough groundwater on a daily basis to qualify as a Class 2 groundwater resource. However, they then attempt to discount their own data and the data from another Exide consultant. On page 7 of their memo, PBW states,

> "Short-term tests on most of the wells completed in gravels or sands will likely exceed the Class 3 yield criterion of 150 gpd [gallons per day]. For example, well B5N maintained a pumping rate of 0.1 gpm [gallons per minute] during a 48-hour pump test in March 2012. Given the surrounding boundary conditions, the well would likely have gone dry had it been pumped at a higher rate or for a longer period."

Although PBW mentions this test, they do not provide the data associated with the pump test in their memo. However, PBW did provide a draft version of some of those data to the City. That table is provided as Attachment B to this document. As shown in the table, PBW continuously pumped well B5N at an approximate rate of 0.1 gpm. Over the 48 hour period shown in the table 288 gallons of water were produced. At the end of the test, the groundwater elevation had dropped approximately 2.64 inches from the elevation measured immediately before the test began.

In addition to the yield test performed on B5N, a previous Exide consultant performed a pump test on Monitoring Well LMW-17 in 1995. Those data are also discussed in the Groundwater Memo, but with the focus being on an apparent boundary condition that the data might indicate is present. The City does not know if the data indicate that a boundary condition is present, because there could be multiple reasons that the drawdown at that phase of the test could have increased. Instead, the City focuses on the results of the pump test, during which LMW-17 reportedly produced groundwater at a rate of 8 gpm for approximately 500 minutes (approximately 8 hours). At that rate the well would have produced approximately 4,000 gallons of groundwater during that test. The final drawdown in the well was approximately 1.07 feet.

Because the groundwater yield at monitoring well LMW-17 was so prolific during the pump test, Exide's consultant Jones & Neuse, Inc. (J&N) recommended the use of two dewatering wells during the construction and filling of Cell 1 in the Class 2 Landfill, which is located just to the north of LMW-17.

PBW also attempts to discount the pumping test results from the 1995 test on LMW-17 by comparing recent low flow sampling efforts on monitoring wells in the vicinity of LMW-17. PBW notes that monitoring wells LMW-8, LMW-22 and LMW-5 each went dry at a purge rate of less than 0.2 gpm. LMW-8 is the only well that PBW categorizes as "gravel/sand lens present", and this well has approximately one foot of sand present. In addition, LMW-22 is classified as "no gravel/sand lens present", and LMW-5 is classified as "clayey gravel present". Monitoring wells LMW-21, PMW-20R, VCP-MW-6 are classified as "gravel/sand lens present", and appear to occur within the paleochannel discussed previously. These monitoring wells did not go dry during recent purging events. No discussion is included in PBW's document about the drought conditions prevalent in the North Texas region. It should be noted that the difference in groundwater elevations from the 1995 groundwater level measurements to the 2013 data collected indicate a drop in groundwater elevation of over seven feet in LMW-5 and over two to four feet in other locations across the site. This drop in groundwater elevation could result in a temporarily reduced saturated thickness that is not representative of the long term condition of the groundwater bearing unit.

Finally, in their Groundwater Memo, Exide contends that additional yield testing should not be performed in "clayey gravels" based on the results of a comparison made in accordance with the TCEQ's current guidance document on groundwater classification[6]. The Memo specifically states that:

> "It is instructive to review Figure 9 from TRRP-8 (included as Attachment F of this appendix) when evaluating the groundwater yield of the clayey gravels. Figure 9 graphically illustrates the relationship between saturated thickness (b), hydraulic conductivity (K) values, and well yields (Q). According to TRPP [sic] Section 2.7.1 (Method 1), direct measurement of well yield is not required unless the calculated yield of the groundwater-bearing unit is within 20 percent of the Class 2/3 boundary (the area shaded gray on Figure 9). At the Site, the average thickness of the clayey gravels is about 2 feet, with an average K value of 1.7 X 10^{-3} cm/sec. When these values are plotted on Figure 9 (Attachment F), the chart shows that the clayey gravel is "Low Yield" only capable of yielding about 80 gpd [gallons per day], well below the Class 2/3 boundary; thus according to Note 2 on Figure 9, direct well yield tests are not required to confirm proper groundwater classification."

The City agrees that it is instructive to review Figure 9 from TRRP-8. However, in doing so it appears that PBW has performed that comparison incorrectly. In their evaluation, PBW used the average thickness of the "clayey gravels", which would be correct if those "clayey gravels" were considered a confined unit. But the saturated stratum being tested is unconfined. Therefore, PBW should have used the saturated thickness of the groundwater bearing unit being tested, which is clearly spelled out in the instructions for Figure 9 and on page 17 of TRRP-8, which defines saturated thickness as, "For unconfined GWBUs [Groundwater Bearing Units], the saturated thickness (b) at each location is the vertical distance from the static water level elevation to the base of the saturated unit".

[6] RG366/TRRP-8, *Groundwater Classification*, revised March 2010.

PBW also appears to have made a similar error when calculating well yields for wells in "clayey gravel" and "gravel and sand". In both cases they used the thickness of the stratum they felt was producing the groundwater from those wells, versus the measured saturated thickness at those wells. What is unusual is that their error was not carried through with the yield tests performed on monitoring wells installed in clays ("saturated soils"), where yields were calculated using what appear to be the correct saturated thicknesses.

Based on this discrepancy, the City reviewed the saturated thickness in all of the available monitoring wells that had been described by Exide as being locations where "clayey gravel" yielded most of the groundwater (and therefore the groundwater was Class 3 per their definition). The following table provides the well number, the elevation of the underlying shale (which is assumed to be the base of the saturated thickness), the groundwater elevation (as measured in April 2013), and the "saturated thickness" reported by PBW in the Groundwater Memo.

Well ID	Shale Elevation (ft amsl)	Groundwater Elevation (ft amsl)	Saturated Thickness (Groundwater Elevation – Shale Elevation) (ft)	Saturated Thickness Reported in Groundwater Memo
LMW-1	617.90	629.60	11.7	
LMW-3	622.76	627.70	4.94	
LMW-5	623.27	625.98	2.71	4.0
LMW-8	625.57	638.34	12.77	2.0
MW-16S	608.93	618.87	9.94	2.0
VCP-MW-4	621.48	628.52	7.04	
VCP-MW-9	646.31	653.14	6.83	
P-1	628.95	633.52	4.57	
B5N	610.97	621.39	10.42	4.0
B9N	622.52	631.63	9.11	2.0
MW-11	611.58	617.41	5.83	
MW-18	617.34	629.81	12.47	
Average			8.19	2.0

Notes: Shale elevation interpolated from known ground elevations and review of boring logs.
Groundwater elevations measurements made on April 29, 2013

When completing Figure 9 from TRRP-8 using the hydraulic conductivity (k) value calculated by Exide for the Bowtie APAR and a saturated thickness of 8.19 instead of 2.0, the City has determined that Exide's conclusion that the projected yield of these wells falls within the Class 3 boundary is incorrect. Per Figure 9 those wells clearly represent a Class 2 resource and should be treated as such until or unless yield testing performed on them suggests otherwise. The Figure 9 interpretation completed by the City is provided as Attachment C to this document.

General Discussion on Groundwater Classification

Although the City questions the Class 3 designation applied to portions of the uppermost GWBU at the site, it accepts that yield testing might document that some of those locations represent Class 3 groundwater, with the remainder being Class 2 groundwater. However, per 30 TAC §350.52, "If a GWBU meets the criteria for more than one groundwater classification, then the

GWBU shall be assigned the higher (quality) classification." Therefore, downgrading Class 2 groundwater to Class 3 appears to be precluded by rule.

Finally, it appears that Stewart Creek can act as a gaining stream or as a losing stream based on the current conditions in the area. In the event that Stewart Creek acts as a gaining stream at the site groundwater will enter the creek. That represents a potential human and ecological exposure pathway as soon as it reaches the stream area in the vicinity of Exide's property. By definition, groundwater from a Class 3 GWBU cannot be used within 0.5 miles in a manner resulting in human or ecological exposure.

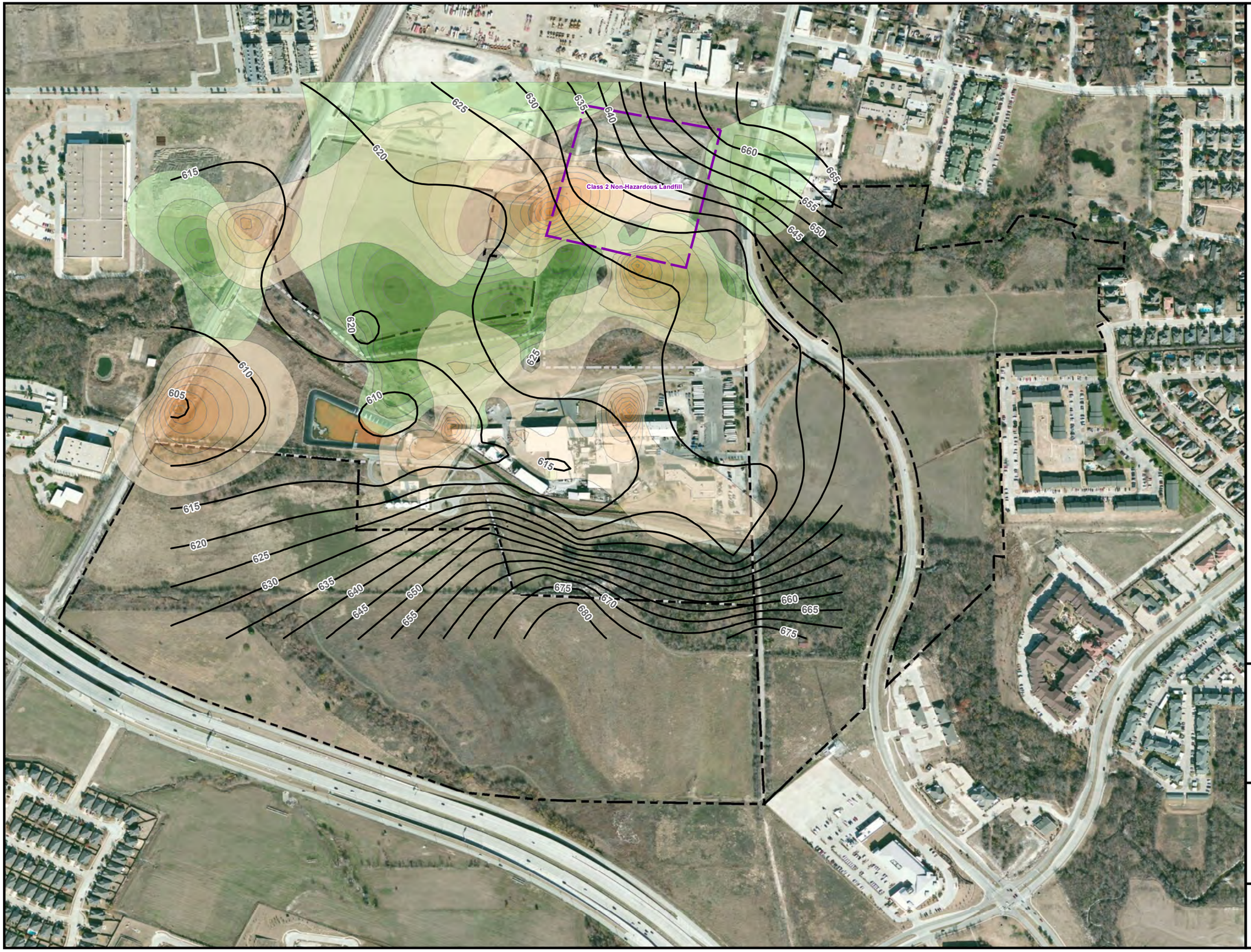
CONCLUSIONS AND CLOSING

In summary, the City has concluded that:

- Exide has inadequately proven that portions of the Site are Class 3 groundwater;
- Exide appears to be precluded by rule from classifying Class 2 groundwater as Class 3 groundwater; and
- Yield tests performed by Exide's consultants prove that Class 2 groundwater is present in an area encompassing the former operating facility, Lake Parcel, Class 2 Landfill area, and the M Tract (a portion of the J Parcel).

The City recommends that the TCEQ thoroughly review and evaluate the information presented in this document prior to making a final ruling on the groundwater classification at the site.

FIGURES



N

STATE OF TEXAS
RUSTY SIMPSON
GEOLOGY
LIC. #218
LICENSED
PROFESSIONAL GEOSCIENTIST

0 200 400
FEET

Clayey Gravel Thickness Contour Interval (Feet)

0.5 1.0 1.5 2.0 2.5 3.0 3.5

Sand/Gravel Thickness Contour Interval (Feet)

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Legend

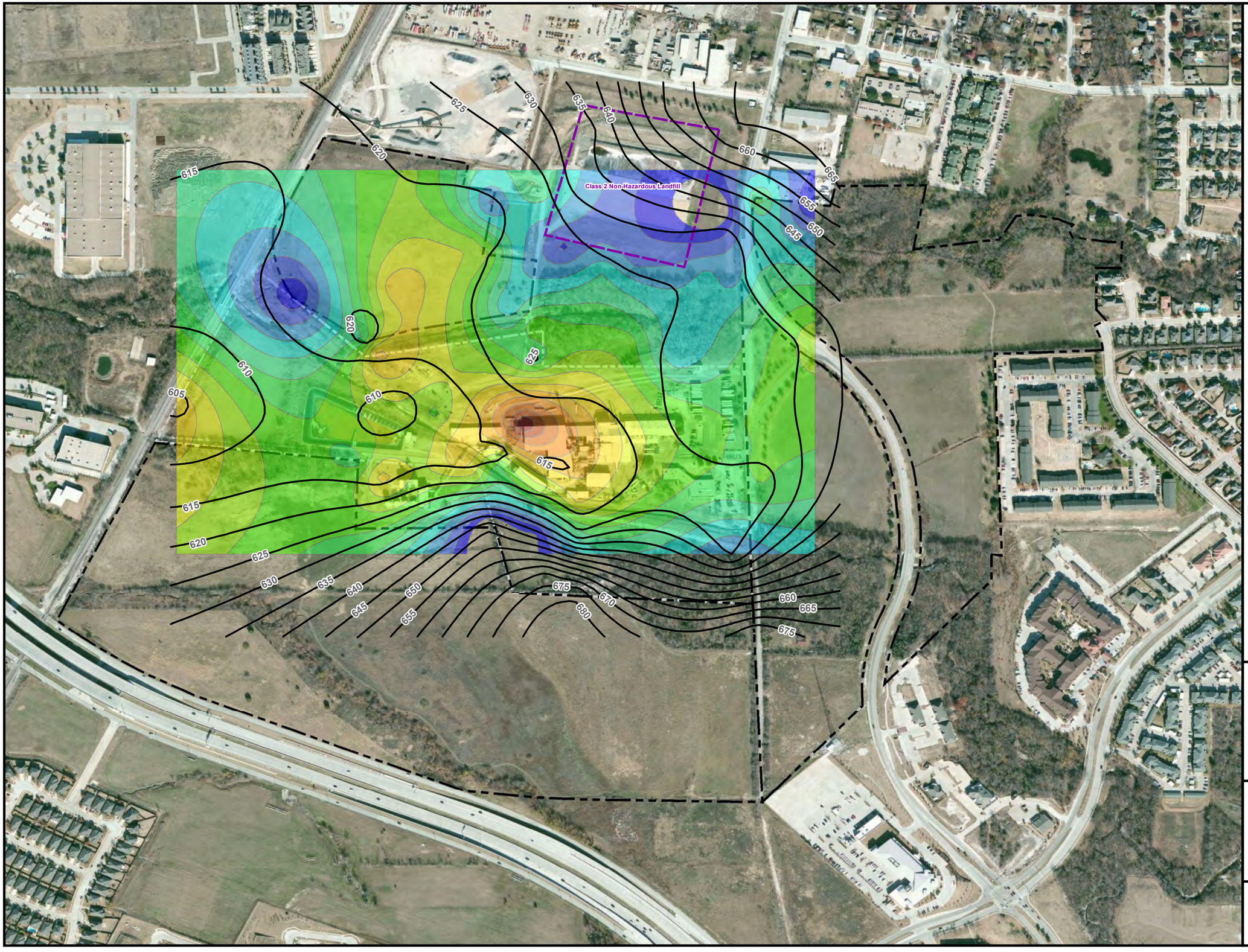
- Bedrock Elevation Contour (Feet)
- J-Parcel Boundary
- RCRA Boundary

Note: Bedrock elevation may vary beneath the Class 2 Non-hazardous Landfill in the model shown based on final grade elevations.

Figure 1
Former Exide Technologies

Clayey Gravel Thickness, Sand/Gravel Thickness & Bedrock Elevation Map

Southwest GEOSCIENCE



N

STATE OF TEXAS
RUSTY SIMPSON
GEOLOGY
LIC. #218
LICENSED
PROFESSIONAL GEOSCIENTIST

0 200 400
FEET

Saturated Thickness Contour Interval (Feet)

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Legend

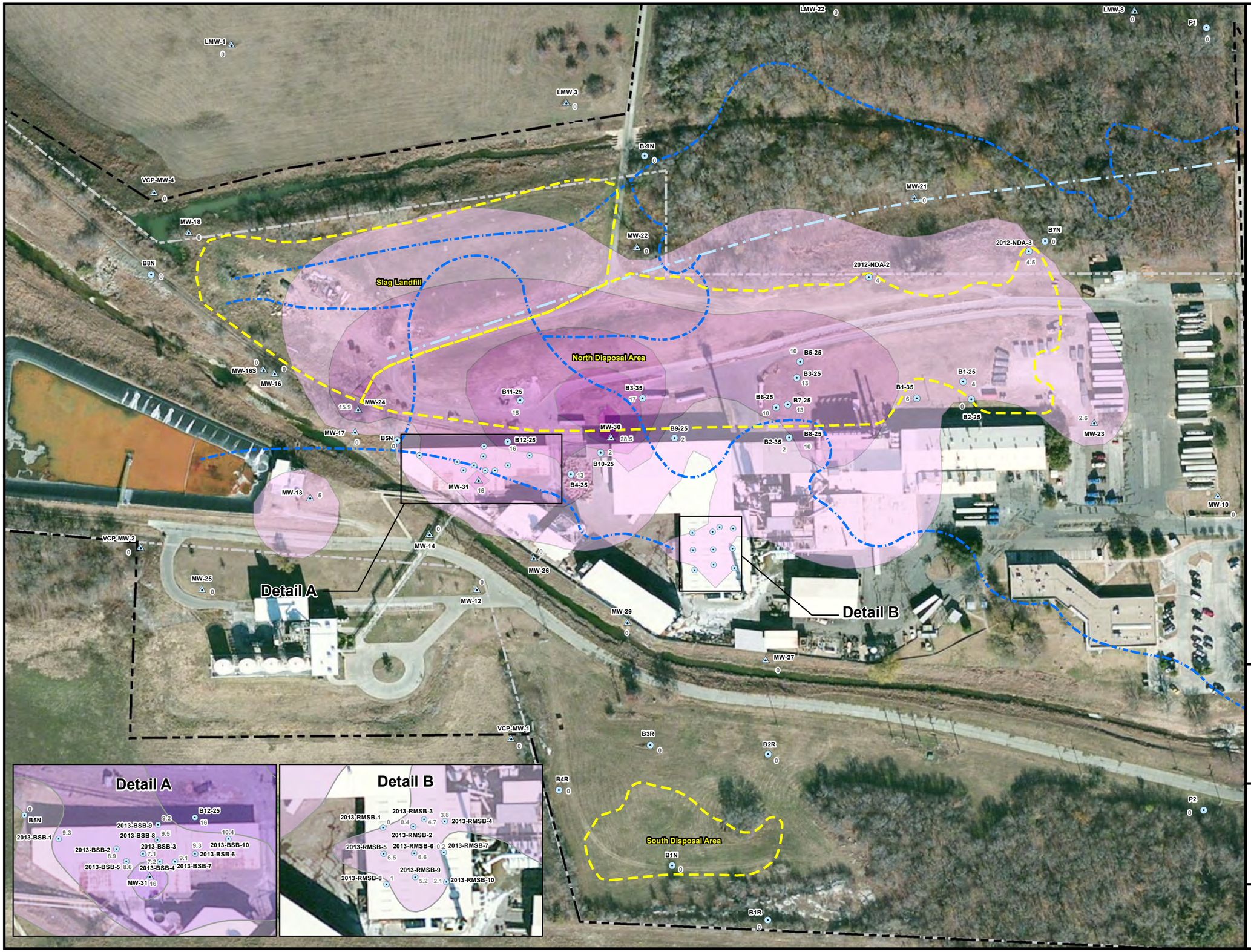
- Bedrock Elevation Contour (Feet)
- J-Parcel Boundary
- RCRA Boundary

Note: Bedrock Elevation may vary beneath the Class 2 Non-Hazardous Landfill in the model shown based on former final grade elevations.

Figure 2
Former Exide Technologies

Saturated Interval & Bedrock Elevation Map

Southwest GEOSCIENCE



N

STATE OF TEXAS
RUSTY SIMPSON
GEOLOGY
LIC. #218
LICENSED
PROFESSIONAL GEOSCIENTIST

0 70 140
FEET

Fill Thickness Contour Interval (Feet)

2 1 ½ 1 2

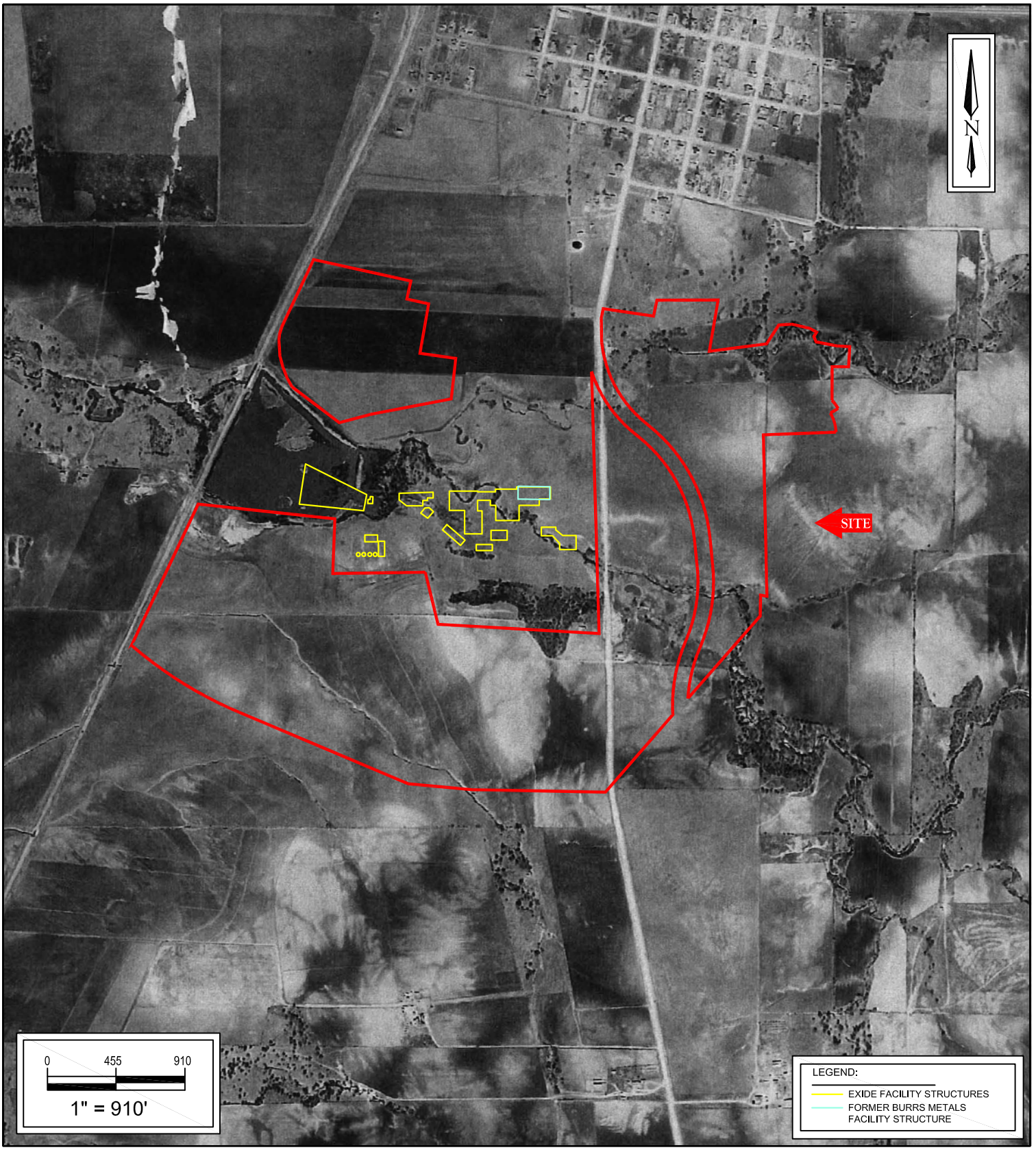
Legend

- Soil Borings
- Monitoring Wells
- 1942 Stewart Creek & Tributaries
- 1972 Stewart Creek Tributary
- J-Parcel Boundary
- RCRA Boundary

Figure 3
Former Exide Technologies

Fill Thickness

Southwest GEOSCIENCE



Environmental Site Assessment
J Parcel
Near Intersection of Eagan Dr. & 5th St.
Frisco, Collin County, Texas

SWG Project No. 0112079E

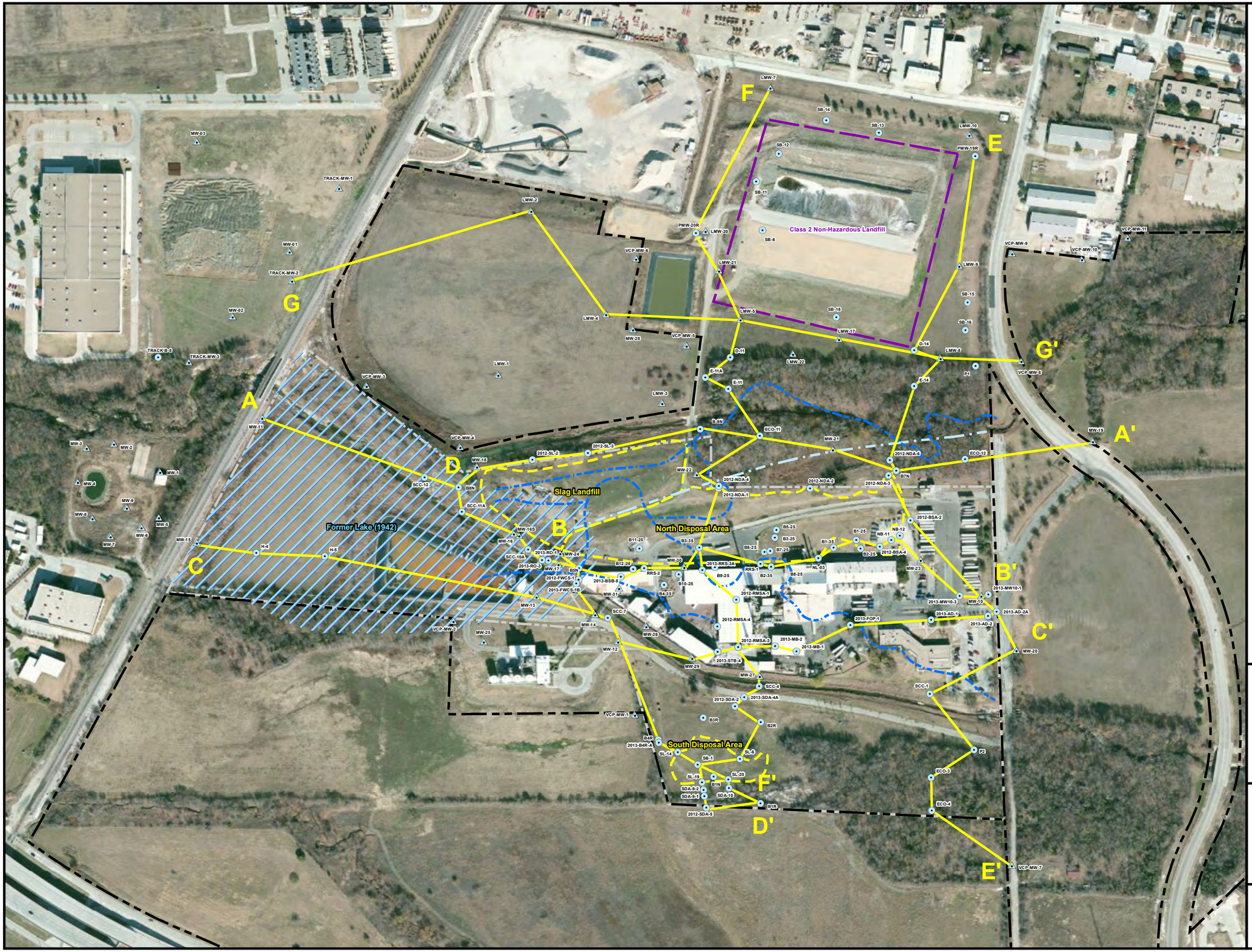
Southwest GEOSCIENCE

Figure 4

Aerial Photograph

1942

CROSS SECTIONS

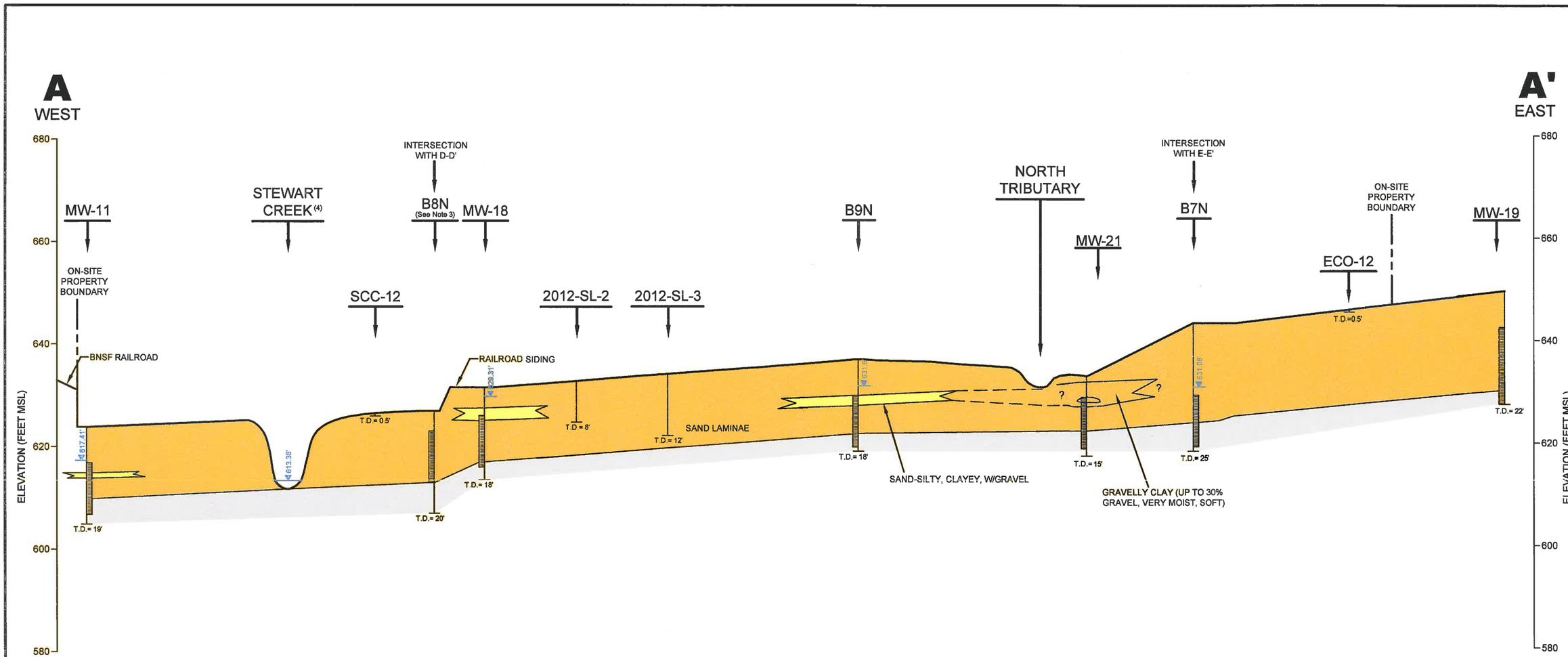


Note: Cross sections A-A' through F-F' are PBW geoscience work that has been reviewed and modified by Cook-Joyce, Inc.

Former Exide Technologies

Cross Section Location Map

Southwest GEOSCIENCE

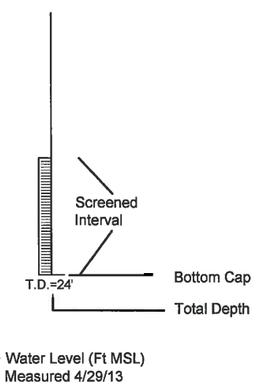


EXPLANATION

GENERALIZED LITHOLOGIC ABBREVIATIONS

- Clay or Silty Clay with Minor Occurrences of Clayey Silt, Clayey Sand, and Gravelly Clay
- Clayey Gravel or Sand
- Eagle Ford Shale

MONITORING WELL CONSTRUCTION

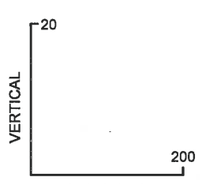


SOURCE: PASTOR, BEHLING & WHEELER, LLC DRAFT 22 MAY 2013 UPDATED GROUNDWATER RESOURCE EVALUATION MEMO.

Notes
1. Ground surface and creek bed topography are estimated. Monitoring well ground surface elevations were surveyed by a licensed surveyor.
2. See attached Figure for cross section location.
3. B8N destroyed.
4. Stewart Creek water elevation inferred from Staff Gauge 2.
5. Depths given in feet below ground surface.
6. MSL = above mean sea level.
7. ? - Boundary Uncertain.

STATE OF TEXAS
RICHARD D. VARNELL
GEOLOGY
No. 9992
LICENSED
PROFESSIONAL GEOSCIENTIST
Richard Varnell
9/12/13

SCALE IN FEET



10x Vertical Exaggeration

REV.	DATE	DESCRIPTION	DR BY	APP BY

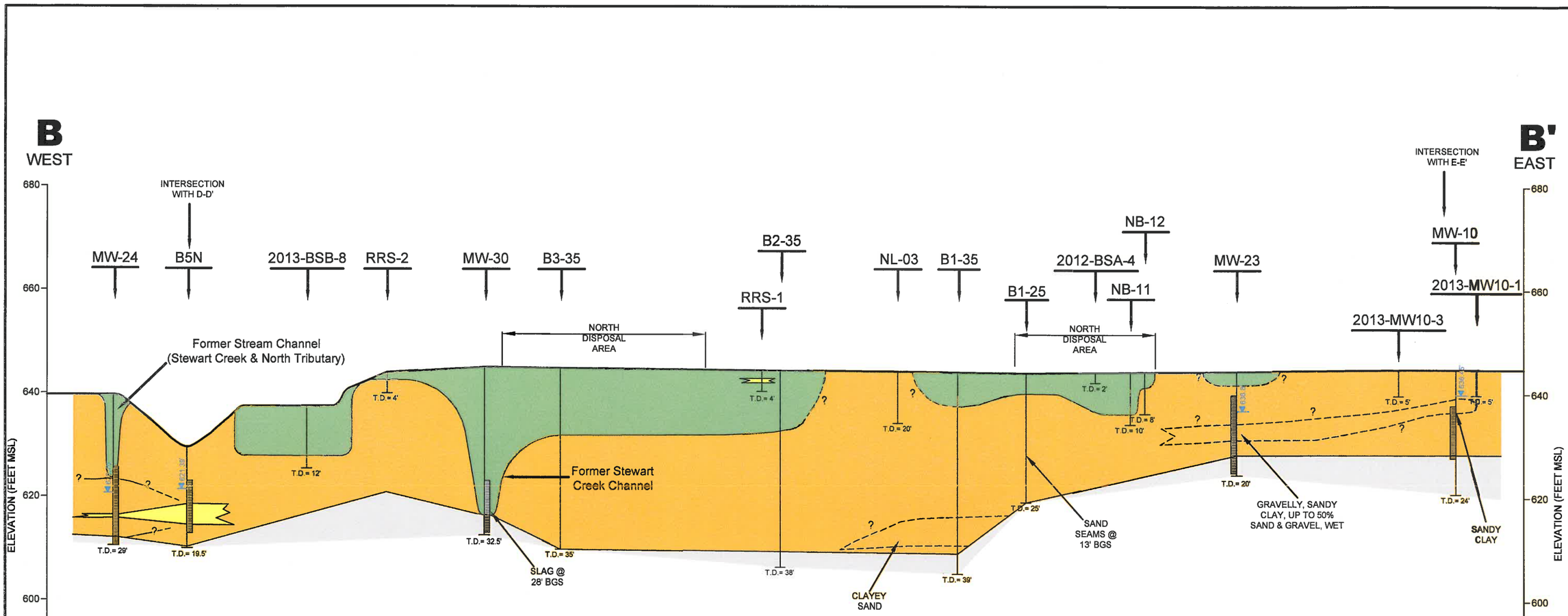
COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH 512-474-9097
AUSTIN, TEXAS 78701
TEXAS REGISTERED ENGINEERING FIRM F-883

PROJECT:
EXIDE FACILITY & ADJACENT PROPERTIES
FRISCO, TEXAS

SHEET TITLE:
GEOLOGIC CROSS SECTION A-A'

DES BY			SCALE: SEE BAR SCALE
DR BY	SDB		PROJECT NO. 12061.01
CHK BY	RDV		CJI NO. 12061003
APP BY	RDV		SHEET 1 OF 1 SHEETS
DATE ISSUED: 09-12-2013			FIGURE NO. NA
PURPOSE: GW CLASSIFICATION			

S:\CAD\City of Frisco\12061\12061003.dwg, 9/12/2013 1:05:27 PM

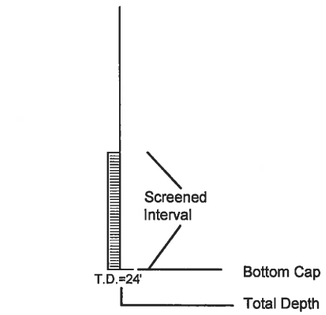


EXPLANATION

GENERALIZED LITHOLOGIC ABBREVIATIONS

- Fill
- Clay or Silty Clay with Minor Occurrences of Clayey Silt, Clayey Sand, and Gravelly Clay
- Clayey Gravel or Sand
- Eagle Ford Shale

MONITORING WELL CONSTRUCTION

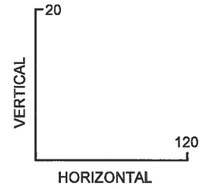


SOURCE: PASTOR, BEHLING & WHEELER, LLC DRAFT 22 MAY 2013 UPDATED GROUNDWATER RESOURCE EVALUATION MEMO.

Notes
1. Ground surface and creek bed topography are estimated. Monitoring well ground surface elevations were surveyed by a licensed surveyor.
2. See attached Figure for cross section location.
3. Depths given in feet below ground surface.
4. MSL = above mean sea level.
5. ? - Boundary Uncertain.

STATE OF TEXAS
RICHARD D. VARNELL
GEOLOGY
No. 4992
LICENSED
PROFESSIONAL GEOSCIENTIST
9/12/13

SCALE IN FEET



6x Vertical Exaggeration

REV.	DATE	DESCRIPTION	DR BY	APP BY

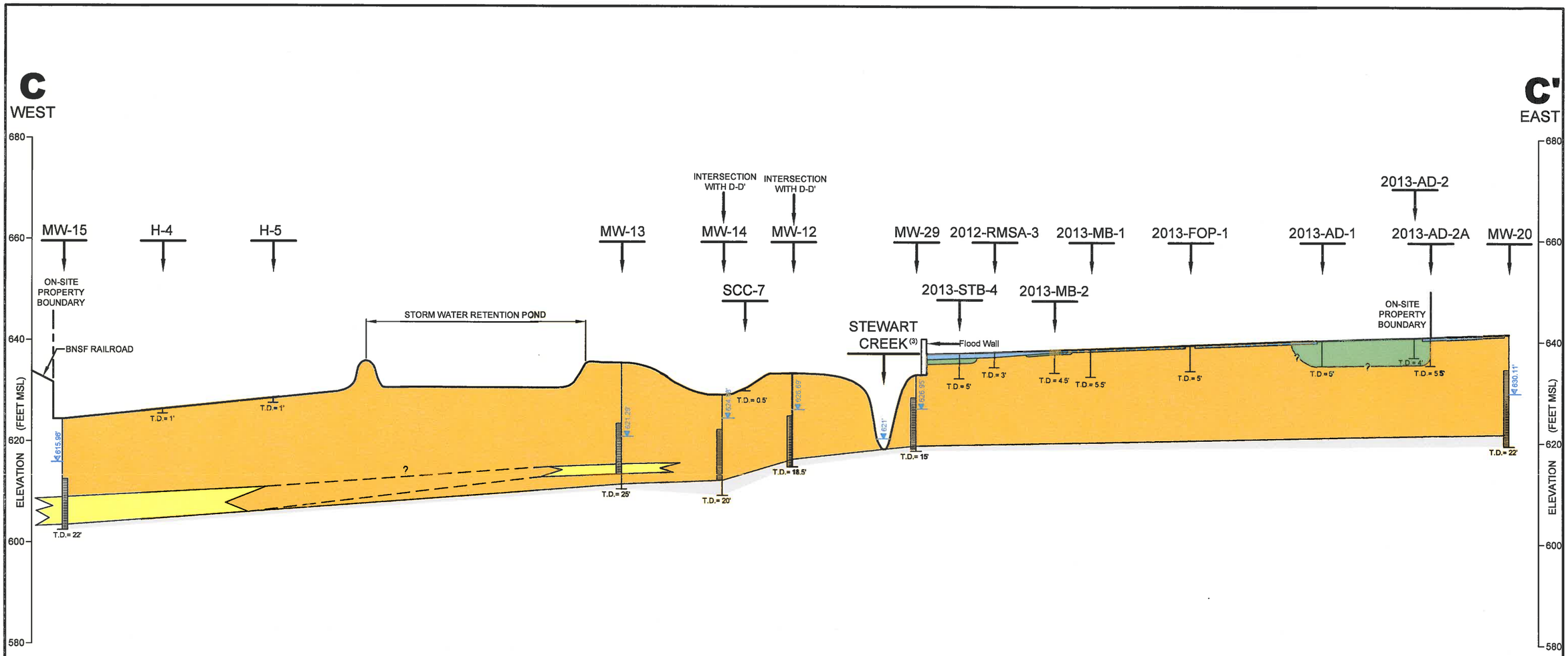
COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH 512-474-9097
AUSTIN, TEXAS 78701
TEXAS REGISTERED ENGINEERING FIRM F-883

PROJECT:
EXIDE FACILITY & ADJACENT PROPERTIES
FRISCO, TEXAS

SHEET TITLE:
GEOLOGIC CROSS SECTION B–B'

DES BY			SCALE: SEE BAR SCALE
DR BY	SDB		PROJECT NO. 12061.01
CHK BY	RDV		CJI NO. 12061006
APP BY	RDV		SHEET 1 OF 1 SHEETS
DATE ISSUED: 09-12-2013			FIGURE NO. NA
PURPOSE: GW CLASSIFICATION			

S:\CAD\City of Frisco\12061\12061006.dwg, 9/12/2013 1:06:21 PM

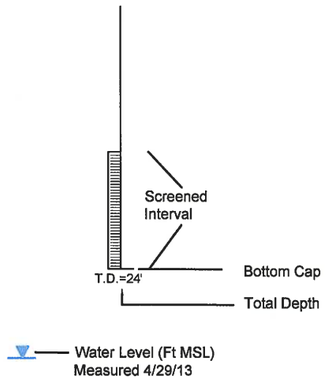


EXPLANATION

GENERALIZED LITHOLOGIC ABBREVIATIONS

- Concrete
- Fill
- Clay or Silty Clay with Minor Occurrences of Clayey Silt, Clayey Sand, and Gravelly Clay
- Clayey Gravel or Sand
- Eagle Ford Shale

MONITORING WELL CONSTRUCTION

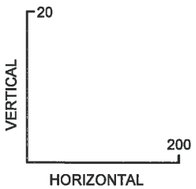


SOURCE: PASTOR, BEHLING & WHEELER, LLC DRAFT 22 MAY 2013 UPDATED GROUNDWATER RESOURCE EVALUATION MEMO.

Notes
1. Ground surface and creek bed topography are estimated. Monitoring well ground surface elevations were surveyed by a licensed surveyor.
2. See attached Figure for cross section location.
3. Stewart Creek water elevation inferred from Staff Gauge 2.
4. Depths given in feet below ground surface.
5. MSL = above mean sea level.
6. ? - Boundary Uncertain.

STATE OF TEXAS
RICHARD D. VARNELL
GEOLOGY
NO. 4992
PROFESSIONAL GEOSCIENTIST
9/12/13

SCALE IN FEET



10x Vertical Exaggeration

REV.	DATE	DESCRIPTION	DR BY	APP BY

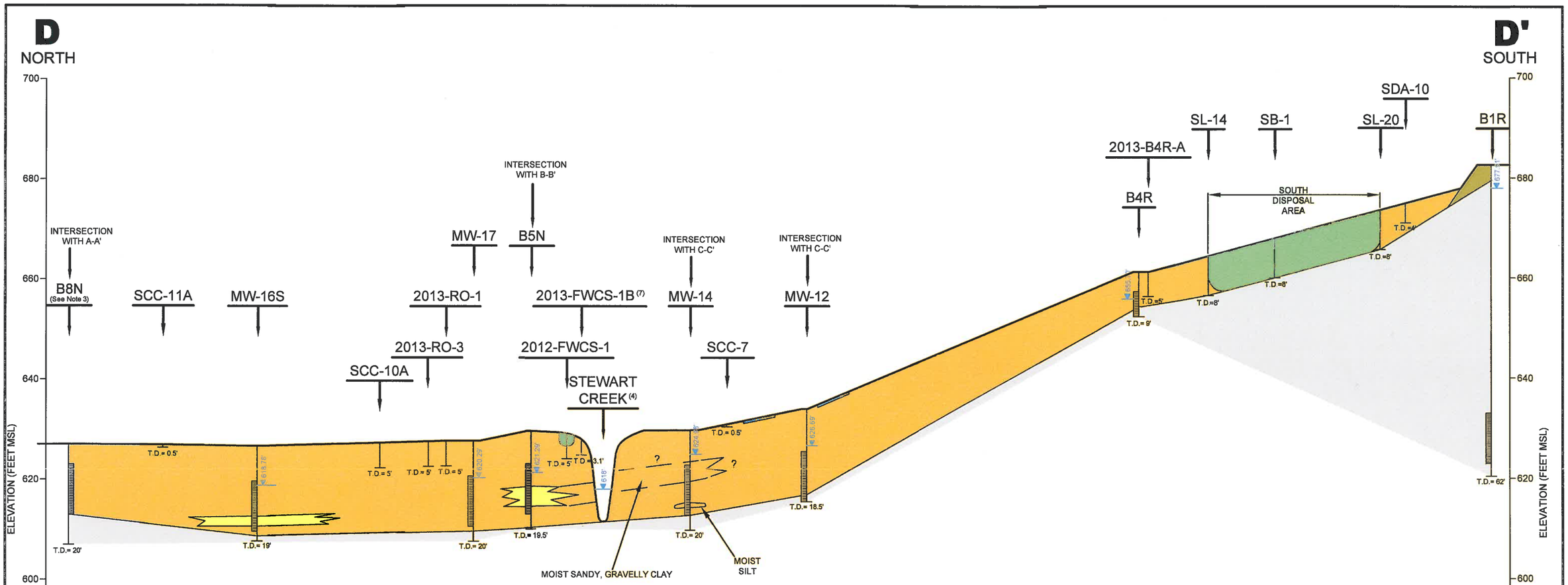
COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH 512-474-9097
AUSTIN, TEXAS 78701
TEXAS REGISTERED ENGINEERING FIRM F-883

PROJECT:
EXIDE FACILITY & ADJACENT PROPERTIES
FRISCO, TEXAS

SHEET TITLE:
GEOLOGIC CROSS SECTION C-C'

DES BY			SCALE: SEE BAR SCALE
DR BY	SDB		PROJECT NO. 12061.01
CHK BY	RDV		CJI NO. 12061007
APP BY	RDV		SHEET 1 OF 1 SHEETS
DATE ISSUED: 09-12-2013			FIGURE NO. NA
PURPOSE: GW CLASSIFICATION			

S:\CAD\City of Frisco\12061\12061007.dwg, 9/12/2013 1:02:51 PM

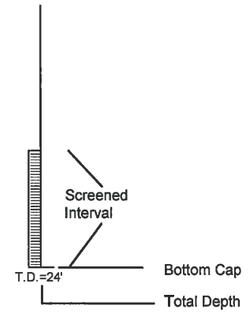


EXPLANATION

GENERALIZED LITHOLOGIC ABBREVIATIONS

- Concrete
- Fill
- Clay or Silty Clay with Minor Occurrences of Clayey Silt, Clayey Sand, and Gravelly Clay
- Clayey Gravel or Sand
- Austin Chalk Limestone
- Eagle Ford Shale

MONITORING WELL CONSTRUCTION

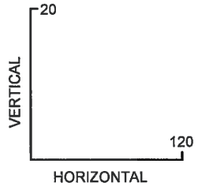


SOURCE: PASTOR, BEHLING & WHEELER, LLC DRAFT 22 MAY 2013 UPDATED GROUNDWATER RESOURCE EVALUATION MEMO.

Notes
1. Ground surface and creek bed topography are estimated. Monitoring well ground surface elevations were surveyed by a licensed surveyor.
2. See attached Figure for cross section location.
3. B8N destroyed.
4. Stewart Creek water elevation inferred from Staff Gauge 1 and Staff Gauge 2 measurements.
5. Depths given in feet below ground surface.
6. MSL = above mean sea level.
7. Gabion basket present at 0 to 1.1 feet below ground surface.
8. ? - Boundary Uncertain.

STATE OF TEXAS
RICHARD D. VARNELL
GEOLOGY
No. 4992
LICENSED PROFESSIONAL GEOSCIENTIST
9/12/13

SCALE IN FEET



6x Vertical Exaggeration

REV.	DATE	DESCRIPTION	DR BY	APP BY

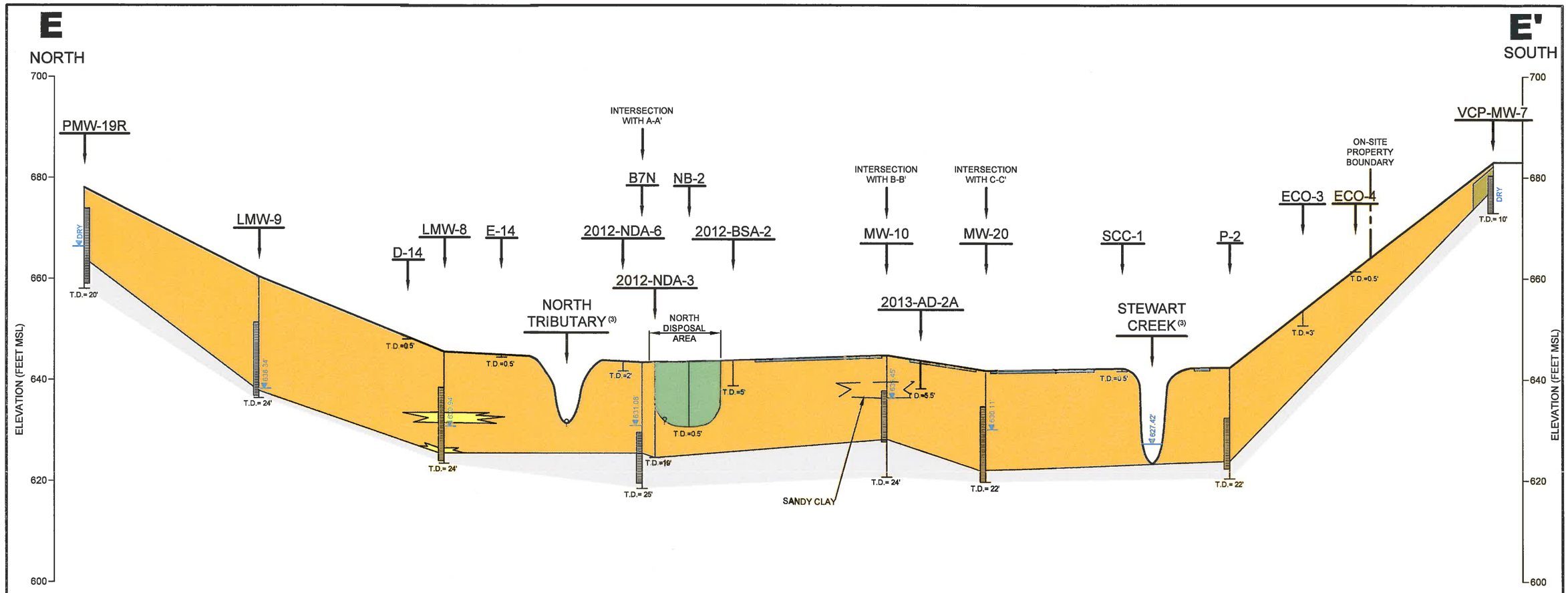
COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH 512-474-9097
AUSTIN, TEXAS 78701
TEXAS REGISTERED ENGINEERING FIRM F-883

PROJECT:
EXIDE FACILITY & ADJACENT PROPERTIES
FRISCO, TEXAS

SHEET TITLE:
GEOLOGIC CROSS SECTION D-D'

DES BY			SCALE: SEE BAR SCALE
DR BY	SDB		PROJECT NO. 12061.01
CHK BY	RDV		CJI NO. 12061004
APP BY	RDV		SHEET 1 OF 1 SHEETS
DATE ISSUED: 09-12-2013			FIGURE NO. NA
PURPOSE: GW CLASSIFICATION			

S:\CAD\City of Frisco\12061\12061004.dwg, 9/12/2013 1:07:14 PM

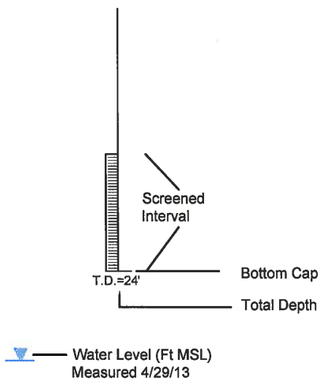


EXPLANATION

GENERALIZED LITHOLOGIC ABBREVIATIONS

- Concrete
- Fill
- Clay or Silty Clay with Minor Occurrences of Clayey Silt, Clayey Sand, and Gravelly Clay
- Clayey Gravel or Sand
- Austin Chalk Limestone
- Eagle Ford Shale

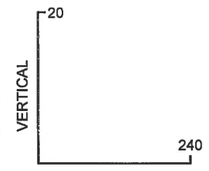
MONITORING WELL CONSTRUCTION



Notes
1. Ground surface and creek bed topography are estimated. Monitoring well ground surface elevations were surveyed by a licensed surveyor.
2. See attached Figure for cross section location.
3. Stewart Creek water elevation inferred from Staff Gauge 1. Water present in North Tributary.
4. Depths given in feet below ground surface.
5. MSL = above mean sea level.
6. ? - Boundary Uncertain.

STATE OF TEXAS
RICHARD D. VARNELL
GEOLOGY
No. 4992
LICENSED
PROFESSIONAL GEOLOGIST
9/12/13

SCALE IN FEET



12x Vertical Exaggeration

SOURCE: PASTOR, BEHLING & WHEELER, LLC DRAFT 22 MAY 2013 UPDATED GROUNDWATER RESOURCE EVALUATION MEMO.

REV.	DATE	DESCRIPTION	DR BY	APP BY

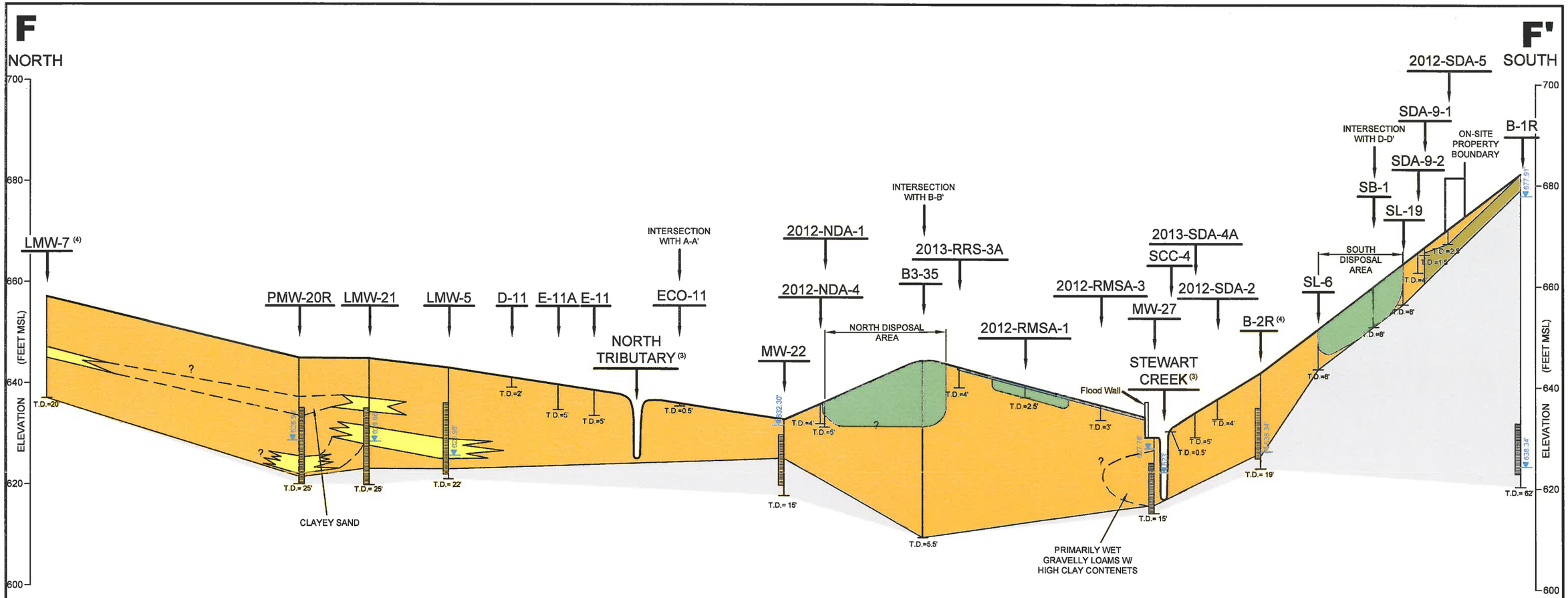
COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH 512-474-9097
AUSTIN, TEXAS 78701
TEXAS REGISTERED ENGINEERING FIRM F-883

PROJECT:
EXIDE FACILITY & ADJACENT PROPERTIES
FRISCO, TEXAS

SHEET TITLE:
GEOLOGIC CROSS SECTION E-E'

DES BY			SCALE: SEE BAR SCALE
DR BY	SDB		PROJECT NO. 12061.01
CHK BY	RDV		CJI NO. 12061005
APP BY	RDV		SHEET 1 OF 1 SHEETS
DATE ISSUED: 09-12-2013			FIGURE NO. NA
PURPOSE: GW CLASSIFICATION			

S:\CAD\City of Frisco\12061\12061005.dwg, 9/12/2013 1:08:23 PM



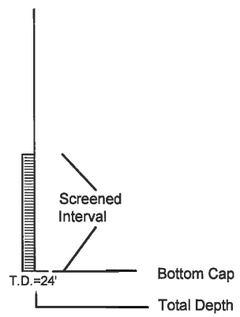
SOURCE: PASTOR, BEHLING & WHEELER, LLC DRAFT 22 MAY 2013 UPDATED GROUNDWATER RESOURCE EVALUATION MEMO.

EXPLANATION

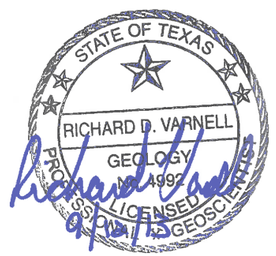
GENERALIZED LITHOLOGIC ABBREVIATIONS

- Concrete
- Fill
- Clay or Silty Clay with Minor Occurrences of Clayey Silt, Clayey Sand, and Gravelly Clay
- Clayey Gravel or Sand
- Austin Chalk Limestone
- Eagle Ford Shale

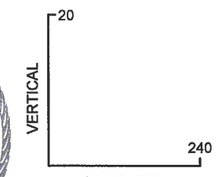
MONITORING WELL CONSTRUCTION



Notes
1. Ground surface and creek bed topography are estimated. Monitoring well ground surface elevations were surveyed by a licensed surveyor.
2. See attached Figure for cross section location.
3. Stewart Creek water elevation inferred from Staff Gauge 1 and Staff Gague 2 measurements.
4. Plugged and adbandoned..
5. Depths given in feet below ground surface.
6. MSL = above mean sea level.
7. ? - Boundary uncertain.



SCALE IN FEET



12x Vertical Exaggeration

REV.	DATE	DESCRIPTION	DR BY	APP BY

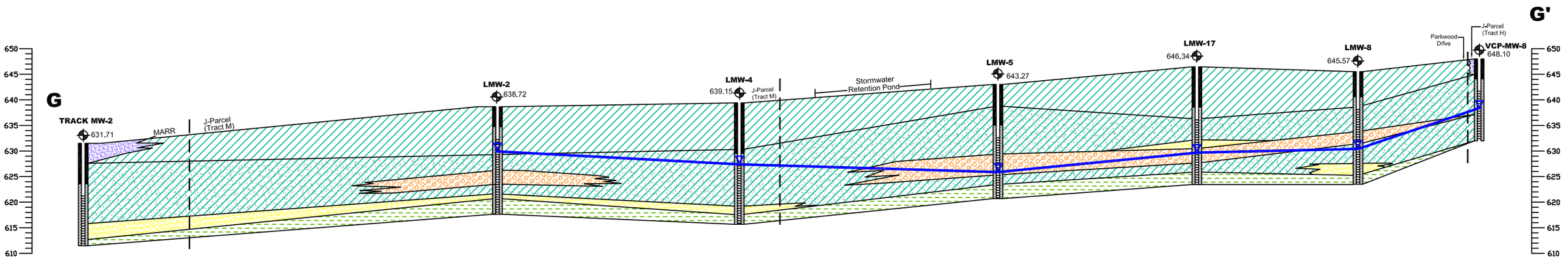
COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH 512-474-9097
AUSTIN, TEXAS 78701
TEXAS REGISTERED ENGINEERING FIRM F-883

PROJECT:
EXIDE FACILITY & ADJACENT PROPERTIES
FRISCO, TEXAS

SHEET TITLE:
GEOLOGIC CROSS SECTION F-F'

DES BY			SCALE: SEE BAR SCALE
DR BY	SDB		PROJECT NO. 12061.01
CHK BY	RDV		CJI NO. 12061008
APP BY	RDV		SHEET 1 OF 1 SHEETS
DATE ISSUED: 09-12-2013			FIGURE NO. NA
PURPOSE: GW CLASSIFICATION			

S:\CAD\City of Frisco\12061\12061008.dwg, 9/12/2013 1:09:19 PM



APPROXIMATE HORIZONTAL SCALE 1" = 220'

APPROXIMATE VERTICAL SCALE 1" = 20'

STATE OF TEXAS
RUSTY SIMPSON
GEOLOGY
LIC. #218
LICENSED
PROFESSIONAL GEOSCIENTIST

NOTE: GROUNDWATER ELEVATION DATE COLLECTED ON APRIL 29, 2013

LEGEND:

- CLAY
- CLAY WITH GRAVEL
- SAND
- SHALE
- CLAYEY GRAVEL
- FILL
- GROUNDWATER ELEVATION

Former Exide Technologies
Frisco, Collin County, Texas

SWG Project No. 0112C079G

Southwest GEOSCIENCE

CROSS SECTION G - G'

ATTACHMENT A – MORE INFORMATION REGARDING CLASS 2 AND CLASS 3 GROUNDWATER

ATTACHMENT A

The TCEQ Texas Risk Reduction Program Rule (30TAC 350.52) provides the following definitions:

> *"(2) Class 2 groundwater resource. Class 2 groundwater resources include:*
> *(A) any groundwater-bearing unit which is a groundwater production zone for an existing well located within 1/2 mile of the affected property and which is used to supply groundwater for human consumption, agricultural purposes or any purpose which could result in exposure to human or ecological receptors; or*
> *(B) any groundwater-bearing unit which is capable of producing waters with a naturally occurring total dissolved solids content of less than 10,000 mg/l and at a sustainable rate greater than 150 gallons per day to a well with a four inch diameter casing or an equivalent sustainable rate in gallons per day to a well with a smaller or larger diameter casing.*
> *(3) Class 3 groundwater resource. Class 3 groundwater resources include any groundwater-bearing unit which produces water with a naturally occurring total dissolved solids content of greater than 10,000 mg/l or at a sustainable rate less than 150 gallons per day to a well with a four inch diameter casing or an equivalent sustainable rate in gallons per day to a well with a smaller or larger diameter casing."*

The information presented in the Memo, and technical discussions contained in this document pertain to Exide's interpretation of the 150 gallon per day threshold value and the sustainability of the groundwater bearing unit. It should be noted that this threshold is a very low production rate; however, it is the indisputable standard set by TCEQ to determine the classification of the groundwater bearing unit. Exide concedes within the Memo that this threshold is exceeded in several locations across the site; however, they present information suggesting that the groundwater bearing unit is "limited" in its hydrogeologic extent and the rate is therefore not sustainable.

Limited Hydrogeologic Extent is a concept introduced by the TRRP-8 Guidance Document "Groundwater Classification". The relevant section of TRRP-8 reads as follows:

> *"Certain GWBUs may be demonstrated to be insufficiently extensive laterally and/or volumetrically and/or to be hydraulically isolated from other GWBUs and other sources of recharge such that the GWBU can not sustain the required long-term daily withdrawal rate to be a Class 1 or a Class 2 groundwater resource. Demonstrations of limited hydrogeologic extent must be based on both site-specific and regional hydrogeology, including detailed hydrostratigraphic analysis. Hydrogeological analysis of a sedimentary GWBU should include placement of the hydrostratigraphic unit within its overall stratigraphic context. The geometry of the hydrostratigraphic unit must be determined on a site-specific basis and the demonstration must rely on the limited extent of that geometry.*
>
> *Examples of qualifying hydrostratigraphic units include lobes of permeable alluvial fans isolated by intercalated impermeable units, perched groundwater zones, and other isolated zones of saturation that are not used as groundwater resources."*

#

Exide's Groundwater Resource Classification document relies entirely on the concept of limited hydrogeologic extent in an attempt to downgrade the groundwater classification at the site from Class 2 to Class 3. The City's position is that Exide's conclusion cannot be technically proven in the absence of long term pumping tests in the vicinity of the wells that are most likely to produce groundwater at 0.1 gallons per minute on a long term daily withdrawal. Until the groundwater

bearing unit is proven to have a boundary condition preventing a sustainable rate of 150 gallons per day, the premise of limited hydrogeologic extent can only be considered a theory in need of supporting site specific evidence. Given the magnitude of the difference in cleanup goals based on the downgrade in groundwater classification, more data is required to support the current theory of limited hydrogeologic extent.

ATTACHMENT B – B5N YIELD TEST DATA

DRAFT

MONITORING WELL B5N
PRELIMINARY CONSTANT DISCHARGE (0.1 gpm) PUMPING TEST READINGS
EXIDE FRISCO RECYCLING CENTER

Date	Time	Cumulative Time (Min)	Cumulative Volume (gal)	Water Level (BTOC)
3/13/2012	9:50	0	0.0	9.47
	9:51	1	0.1	9.60
	9:54	4	0.4	9.60
	9:57	7	0.7	6.94
	10:00	10	1.0	9.58
	10:05	15	1.5	9.58
	10:10	20	2.0	9.58
	10:20	30	3.0	9.57
	10:40	50	5.0	9.58
	11:35	105	10.5	9.61
	12:20	150	15.0	9.61
	13:50	240	24.0	9.61
	14:50	300	30.0	9.59
	15:50	360	36.0	9.57
	16:50	420	42.0	9.57
	17:50	480	48.0	9.59
	18:50	540	54.0	9.58
	19:50	600	60.0	9.59
	20:50	660	66.0	9.60
	21:50	720	72.0	9.61
	22:50	780	78.0	9.62
	23:50	840	84.0	9.62
3/14/2012	0:50	900	90.0	9.62
	2:50	1020	102.0	9.62
	4:50	1140	114.0	9.64
	6:50	1260	126.0	9.65
	7:50	1380	138.0	9.65
	8:50	1500	150.0	9.65
	9:50	1440	144.0	9.65
	10:50	1500	150.0	9.65
	11:50	1560	156.0	9.66
	13:50	1680	168.0	9.66
	15:50	1800	180.0	9.67
	17:50	1920	192.0	9.97
	19:50	2040	204.0	9.67
	21:50	2160	216.0	9.68
	23:50	2280	228.0	9.68
	2:50	2460	246.0	9.68
	5:50	2640	264.0	9.68
	9:50	2880	288.0	9.69

ATTACHMENT C – FIGURE 9 FROM TRRP-8

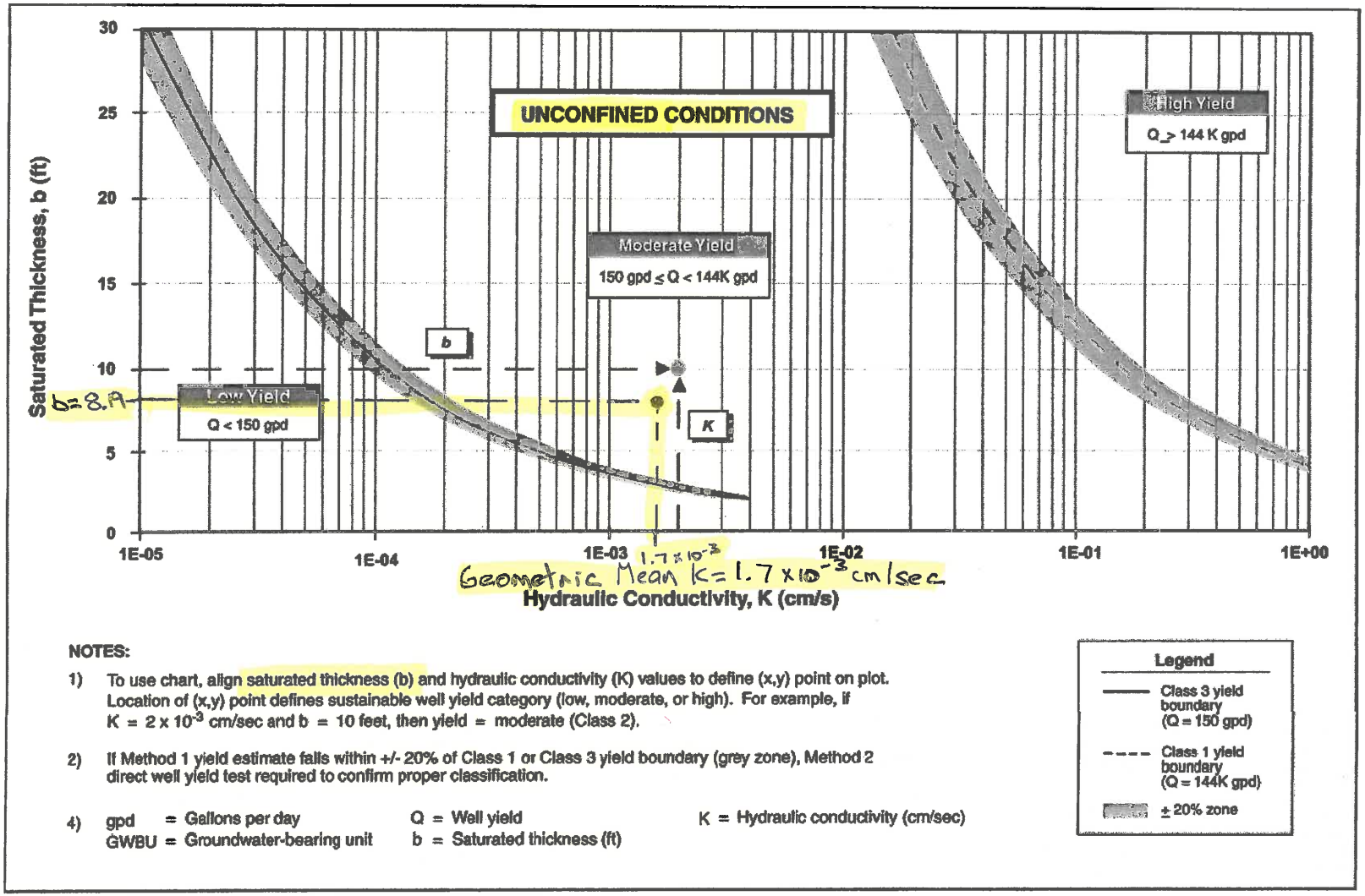


Figure 9. Unconfined Conditions