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APPENDIX E-2

LIQUID PETROLEUM PIPELINE RISK AND CALIFORNIA AQUEDUCT FLOOD RISK FOR THE PROPOSED TRACY HILLS SCHOOL SITE, JEFFERSON SCHOOL DISTRICT, CITY OF TRACY, SAN JOAQUIN COUNTY, CALIFORNIA PREPARED BY WILSON GEOSCIENCES INC., DATED APRIL 2013 AND REVISED MAY 2013

LIQUID PETROLEUM PIPELINE RISK AND CALIFORNIA AQUEDUCT FLOOD RISK FOR THE PROPOSED TRACY HILLS SCHOOL SITE, JEFFERSON SCHOOL DISTRICT, CITY OF TRACY, SAN JOAQUIN COUNTY, CALIFORNIA

SUMMARY REPORT: Analysis of 2007 California Department of Education Protocol Parameters

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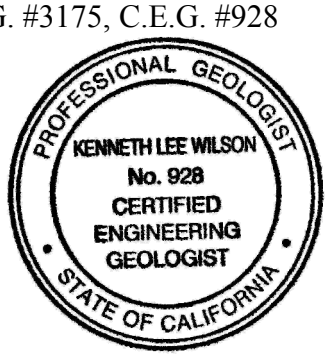

April 2013 [Revised May 15, 2013]

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1. INTRODUCTION

1.1 PURPOSE AND BACKGROUND

As proposed (February 25, 2013), Wilson Geosciences Inc. (WGI) is providing an analysis of the important parameters affecting possible (1) future liquid petroleum pipeline risk and (2) California aqueduct flooding risk assessments for the subject Tracy Hills school site (Site). We have prepared risk studies for these conditions at other sites and have reviewed other similar studies provided by the California Department of Education (CDE) for other sites with similar pipelines. The purpose of this report is to provide a professional opinion regarding the likelihood that failures of the Conoco 16-inch diameter crude oil pipeline, the Shell 20-inch diameter crude oil pipeline, or the California Aqueduct create risks that would preclude construction of a school site within the boundaries of the proposed Site as defined. *As such, this report is not intended to be a full and complete school site analysis as required by the 2007 California Department of Education Protocol.* Although future liquid pipeline and flood risk assessments may be required, in our professional opinion the purpose as stated above is satisfied.

As a part of the ongoing process to update the EIR for the proposed Tracy Hills Project which includes the proposed school site, it may be necessary to prepare a full risk assessment in accordance with the 2007 California Department of Education (CDE) published *"Guidance Protocol for School Site Pipeline Risk Analysis."* CDE regulations (Title 5, California Code of Regulations, Division 1, Chapter 13, Subchapter 1, School Facilities Construction, Article 2-School Sites, § 14010, Standards for School Site Selection) that took affect in late 2000 require that:

"h. The site shall not be located near an above-ground fuel or water storage tank or within 1500 feet of the easement of an above-ground or underground pipeline that can pose a safety hazard as determined by a risk analysis study, conducted by a competent professional, which may include certification from a local public utility commission."

The 2007 CDE Protocol (Protocol) was updated in part in 2009 and uses a multi-stage approach consisting of Stages 1, 2, and 3. Stage 1 is the Risk Screening Analysis, whereby in certain situations (CDE, 2007, page 4-7) analysis has revealed combinations of pipe size, pressure, product, and distance from the school campus property line that will result in an individual risk (IR) value that will meet the CDE IR criterion of 1×10^{-6} probability of fatality of an exposed individual at a specified receptor location. The subject site would not pass the Stage 1 analysis tests because a) the single pipeline within the 1,500-feet zone has a segment length greater than 1000 feet, b) the terrain is sloping and there is a significant potential for drainage toward the school campus site that would result in product within 600 feet of the nearest property line, and c) the line and/or potential pool areas are not wholly downwind from the campus site. Therefore, at a minimum a Stage 2 Probabilistic Risk analysis would be required. Stage 3, a more detailed probabilistic analysis, is available if a Stage 2 analysis would not adequately assess the IR criterion or would otherwise be unsatisfactory to the CDE.

1.2 SCHOOL SITE LOCATION

The Site is located north of Interstate Highway 580 (I-580), west of Corral Hollow Road, and immediately south of the California Aqueduct (Figure 1) within what is understood to be the city limits of the City of Tracy. The Site is within the Phase I portion of a larger proposed development with boundaries extending farther west and south.

The features of interest in this analysis are the California Department of Water Resources (CDWR) California Aqueduct and two liquid petroleum (crude oil) pipelines. The Aqueduct lies 100-feet northeast of the Site and the pipelines trend northwest-to-southeast and lie southwest of the Site. The 16-inch diameter Conoco Phillips 66 Pipeline LLC (herein, Conoco or PPL) pipeline is approximately 700-feet from the southern edge of the Site and the 20-inch diameter Shell Oil Company (Shell) pipeline is approximately 2,250-feet from the southern edge of the Site. Although the Shell pipeline is outside the 1,500-feet distance specified in Title 5, there is at least some potential for a pipeline break to allow crude oil to flow northerly toward the Site.

1.3 GENERAL 2007 CALIFORNIA DEPARTMENT OF EDUCATION PROTOCOL METHODOLOGIES

As discussed above, the Protocol specifies methodologies to assess the risk to school sites posed by liquid petroleum and water pipelines/aqueducts. This study recognizes the elements of these methodologies and applies them generally to reach opinions regarding the potential for the Site to be suitable for a school considering the presence of the liquid petroleum pipelines and California Aqueduct as described above. The following subsections summarize the basic elements of the Protocol analysis for liquid petroleum pipelines and water pipelines (includes aqueducts) used herein.

Liquid Petroleum Pipelines – The Protocol analysis considers the impact on school occupants of heat and explosive over-pressure emanating from the location of a pipeline failure (considered to be a full pipeline rupture for purposes of this report) or from a location where the petroleum product would collect in a "pool" after flowing down slope from a more distant pipeline location. Heat and explosion impacts to school occupants decrease at increasing distance of the occupants (termed receptor location) from the location of a fire or explosion. Flash fire, pool fire, and vapor cloud explosion are the three liquid petroleum consequences analyzed for the Protocol. These consequences are discussed more fully below.

California Aqueduct – Flooding is the primary concern addressed in the Protocol for water pipelines and the aqueduct; erosion, flowing water, and subterranean saturation are also considered. For an aqueduct, breach size in the levee wall, water flow rate, and breach direction must be determined in order to approximate the flow direction and flooding pool size. The flood height and water velocity, though not specified, should also be considered. Flooding consequences are discussed more fully below.

1.4 GEOLOGIC AND NATURAL HAZARDS AFFECTING THE SITE

Several geologic reports (TERRASEARCH, INC., 1990; Kleinfelder, 2000; T. Makdissy Consulting, Inc., 2012) have been prepared for some or all of the overall development site. No specific study evaluated the proposed school

Site. The Tracy Hills Draft EIR (1997) Geology and Soils (Section 4.7), and Surface Water Hydrology, Groundwater, and Water Quality (Section 4.9) sections address the relevant issues for the proposed specific plan development as a whole.

The 1997 Draft EIR indicated that geology, soils, and flooding impacts can be mitigated for the Tracy Hills development, but does not address liquid petroleum pipeline hazards or aqueduct flooding specifically. The 2012 Makdissy report was a geologic and geotechnical feasibility evaluation to assess geologic, geotechnical, and seismic hazards; it very generally describes the geologic units, faulting, groundwater occurrence, liquefaction, seismic conditions, and geotechnical considerations. They determined that the overall development is feasible and did not identify geologic or geotechnical conditions that would be detrimental to the performance of the liquid petroleum pipelines or the California Aqueduct. Neither the 1990 or 2000 geotechnical reports appear to contain information that contradicts this conclusion or identifies conditions that would negatively impact the pipelines or aqueduct.

Mapping by Dibblee and Minch (2006; Figure 2) indicates that the pipelines are located within the older (Pleistocene age) surficial sediments (map symbols Qoa and Qoa_2) and the proposed school Site and aqueduct are located within the more recent (Holocene) surficial sediments (Qa). None of these formations is susceptible to landslides and the Qoa and Qoa_2 are not susceptible to liquefaction. Qa may have a very low liquefaction potential that could affect the aqueduct. No faults cross the pipelines or aqueduct within at least one mile of the proposed Site.

Comments by the CDWR on the 1997 DEIR indicated that they believe seismic events from local and regional faults (e.g., the Greenville fault approximately 7 miles west and the Calaveras and Hayward faults approximately 13 and 21 miles west, respectively) could cause a failure of the aqueduct (this cannot be precluded). The California Geological Survey (CGS; 2010) and the Tracy General Plan Draft EIR (2005) also identify the San Joaquin fault that borders the west side of much of the Central Valley as potentially active. The San Joaquin fault extends southward from the Black Butte fault that is present just west of the I-580 adjacent to the site area. CDWR indicates such a failure could generate a maximum flow from the California Aqueduct at this location of 10,300 cubic feet per second (cfs) with an initial surge equaling almost 25,000 cfs, posing a threat to persons and property situated down slope (north) of the Aqueduct. It is believed that severe seismic shaking would be the primary natural hazard that would impact the liquid petroleum pipelines as well.

1.5 SITE AREA TOPOGRAPHY, DRAINAGE, AND WIND DIRECTION

Figure 3 shows the topography surrounding the entire proposed project, the Phase I area and the proposed Site. Both 1981 U. S. Geological Survey topographic map contours (20-foot contour interval—in black) and detailed project-specific one-foot contours (white) are shown representing the present condition for the Phase I area including the proposed Site. In general, topography slopes downhill from I-580 on the southwest (approximate elevation 290-feet) toward the Site (elevation 247-feet to 260-feet), the edge of the California Aqueduct (elevation 245-feet), and the adjacent portion of the Central Valley and the City of Tracy. This slope gradient is approximately one to two percent. The slope is not uniformly flat in that a subtle, similarly low gradient broad ridge-feature occupies the

southeastern two-thirds of the Phase I area. A secondary drainage borders the school Site on the northwest. Natural topography is interrupted by the California Aqueduct that forms a barrier to flow immediately north and west of the project Site area. Drainage across the Phase I area is directed to two artificial drainage features (culverts) that cross the aqueduct above the water level existing at this time. To the east of the Site and Corral Hollow Road topography slopes easterly toward the wide drainage feature emanating from the Corral Hollow canyon to the south; a large culvert beneath the aqueduct well east of Corral Hollow Road is shown on CDRW plans.

Surface runoff is primarily by overland flow across the project area toward the aqueduct, and toward the secondary drainage (on the west) and Corral Hollow Road (on the east; Figure 3). Ground surfaces are not highly eroded or dissected due to current land uses, as well as to the presence of I-580 interrupting natural runoff from the west and channeling the runoff through culverts under I-580. At the aqueduct within the Phase I area this reduced drainage flow volume is accommodated by the two culverts mentioned above. It appears from Google Earth images and the field reconnaissance that sediment deposition is occurring at the westernmost drainage feature adjacent to the aqueduct (Figure 3).

Wind can carry liquid petroleum vapors to ignition sources away from a release location or toward a school site. Daytime winds at the nearby airport generally blow northwest to southeast, southwest to northeast, and to a lesser degree at compass points in between, at 1.3 to 13 miles per hour (mph) and less commonly up to 25 mph (Western Regional Climate Center, 2013). The predominant daytime directions are sub-parallel to the pipeline orientations.

2. LIQUID PETROLEUM PIPELINE ASSESSMENT

2.1 PIPELINE LOCATION, CHARACTERISTICS, AND OPERATIONAL DATA

The pipeline characteristics for the PPL and Shell pipelines are presented in Table 1 and the pipeline locations are shown on Figures 1 and 3.

Table 1 – Conoco and Shell Pipeline Characteristics near the Proposed Tracy Hills School Site [1]

PIPELINE CHARACTERISTICS	**CONOCO** (Phillips 66 Pipeline LLC (PPL)) **(Oleum Line No. 200)**	**SHELL** (Shell Oil Company) **(Coalinga-Avon Line)**
Closest distance to the Site	~700-feet (site plan and field observation)	~2,250-feet (site plan and field observation)
General characteristics	Typically 3.5- to 4.5-feet of cover	Typically 4- to 5-feet deep
Product transported	Elk Hills crude oil, gas oil, pressure distillate, and heavy distillate	Crude oil
Diameter	16-inches	20-inches
Operating pressure	1,130 psig	Proprietary (test pressure 1,425)
Product flow rate	4,000 - 4,200 barrels per hour (bbl/hr) with flow to the northwest	Proprietary (assumed to be 6,000 bbl/hr) with flow to the northwest
Pipeline materials and date of construction	Carbon steel, wall thickness 0.25", grade API-5LX 52000, installed 1957	Carbon steel, wall thickness 0.25", grade X-52, installed 1967
Locations of, and distances to, shutoff valves, block valves, pump stations, and manned operations facilities	To the north = ~12 miles 16" motor operated block valve C-22. To the south = ~640 feet 16" manual block valve C-21.	To the north = Patterson Pass Road (~5.25 miles). To the south = 4.38 miles south of Corral Hollow Road;

PIPELINE CHARACTERISTICS	**CONOCO** (Phillips 66 Pipeline LLC (PPL)) **(Oleum Line No. 200)**	**SHELL** (Shell Oil Company) **(Coalinga-Avon Line)**
Valve operation (e.g., manually or remotely operated)	A Pipeline Monitoring system constantly measures pipeline pressures and flow rates. Pumping pressure can be shut off immediately from the Bartlesville control center; response time to manually close the two valves can range from 30 minutes to 2 hours.	Not provided by Shell, however, the oil pipelines are continuously monitored by computers, which can detect high and low thresholds of leakages by a loss in pressure. If any decrease in pressure is detected, the system is automatically shut down. (City of Tracy, 1997)
Operating history information (e.g., inspections, repair history, previous accidental releases) --- **CONOCO** **(**Phillips 66 Pipeline LLC (PPL)**)** **(Oleum Line No. 200)** PPL indicates: • Historic pipeline releases - There are no known pipeline releases within the past 15 years. • Repair History - There are no known repairs on Line 200 within the proposed Tracy Hills development except for the installation of cathodic test leads and marker plates. • Other PPL activities to monitor, inspect, and maintain the safety and integrity of Line 200: • PPL has marked the route of Line 200 across the proposed Tracy Hills Project development. • Air patrol flies the pipeline 200 route twice a week to monitor surface activity near Line 200. • PPL is a member of Underground Service Alert (USA). PPL marks its pipelines prior to third-parties excavating near its facilities when it receives a USA notification. • PPL sends inspection tools through Line 200 every five years to detect anomalies in the pipeline wall and prepares a program to maintain the pipeline based on the report the tool generates. • A Pipeline Monitoring system constantly measures pipeline pressures and flow rates.	• The California State Fire Marshal audits our pipeline records to confirm that PPL complies with the DOT standards. • PPL has an approved spill response plan that covers our emergency notifications and management of a pipeline release. PPL personnel are trained in the Incident Command Structure to team with local agencies to manage the response. PPL can mobilize and deploy an Incident Management Assist Team to aid in the response. • Property owners have been made aware of the presence of a pipeline on their property through our public awareness program. PPL reaches out to law enforcement agencies, fire departments, and other agencies that protect the public. • PPL reviews utility notices from private developers and public agencies to determine if proposed improvements will impact the operation and/or maintenance of Line 200.	The pipeline is designed, operated, maintained, and repaired in compliance with State and Federal Regulations. The pipeline is inspected annually using an internal inspection tool. There was a release at Bird Road (approximately ½-mile southeast of Corral Hollow Road) in 2007 due to unknown accelerated corrosion activity.

1. Provided by Ruggeri~Jensen~Azar, March and April 2013 (as provided by Conoco and Shell).

This (and other) information is required in order to perform a full Protocol pipeline risk assessment. For this report these characteristics provide information useful in determining the relative likelihood of a pipeline failure, the approximate amount of liquid product released, and the logistics involved for the operators to deal with a full pipeline rupture.

2.2 POTENTIAL CONSEQUENCES OF LIQUID PETROLEUM PIPELINE FAILURES

For liquid petroleum/hydrocarbon releases, the Protocol requires the evaluation of three potential scenarios, flash fire, liquid pool fire, and vapor cloud explosion. The dispersion and flammability properties used in these analyses in accordance with the Protocol manual are based on those of hexane, which is used as a surrogate for gasoline. Hexane is considered a worst-case scenario at the Site because gasoline is more volatile and flammable than crude oil, which is the product transported in the Conoco and Shell pipelines. Therefore, the impacts of a gasoline release could result in greater impact distances and consequences than the release of crude oil. The Protocol assumes a default time of 15 minutes to shut-off of a pipeline after a failure.

For crude oil in the Conoco and Shell pipelines near the Site, impact distances can be estimated as 71% of the distance shown in the impact figures shown in this report, although this hazard reduction factor has not been considered in risk discussion in this report. For liquid pipelines, there must be consideration that the hazard source may be located away from pipeline right-of-way because the liquid petroleum product can flow down slopes or along roadways. Therefore, the ignition that could lead to a flash fire, a pool fire, or a vapor cloud explosion may be at some distance from the release point at the pipeline. For relatively flat terrain, the Protocol analysis assumes that a circular pool will form at the pipeline point of release. Non-circular pools (e.g., rectangular, triangular, or irregular) can also be analyzed, if a simplifying assumption of a circular pool is not reasonable. In sloping terrain, including drainage channels or roadways, a Stage 3 analysis may be required at the discretion of the CDE.

While it is not the purpose of this report to provide a full quantitative analysis in accordance with the Protocol manual, there are studies of similar pipelines with similar terrain characteristics prepared in accordance with the Protocol that provide examples of expected outcomes for the liquid petroleum pipeline risk factors considered herein for the subject Site. Two such reports (The Planning Center, 2012 and 2008, respectively) were reviewed; the first is for a site in Banning adjacent to a 20-inch diameter liquid petroleum pipeline located some 20-feet from the subject proposed school site and the second is for a site in San Juan Capistrano adjacent to a 16-inch diameter liquid petroleum pipeline located some 720-feet from the subject school site. Pipeline flow characteristics are similar to the pipelines evaluated herein. The Protocol analyses include heat impacts from a lower flammability limit (LFL) flash fire and a pool fire, as well as over-pressure affects from a semi-confined vapor explosion in a storm drain, conditions that could potentially result from a liquid petroleum pipeline rupture near the proposed Tracy Hills Site. In both cases, the sites were found to have less than significant impacts from the subject pipelines.

2.3 RISK ANALYSIS

This subsection presents the estimated likely impacts at the proposed school Site due to a full pipeline break along

the Conoco and Shell pipelines at locations immediately upstream of (and the closest point to) the proposed Site. Estimates are based on the pipeline characteristics shown in Table 1 and the Protocol analysis process, although as explained, the full Protocol analysis was not performed. As mentioned above, flash fire, liquid pool fire, and unconfined vapor cloud explosion are the liquid petroleum hazards evaluated by the Protocol methodology. As pointed out in the Protocol, for crude oil in the Conoco and Shell pipelines near the Site impact distances can be estimated as 71% of the distances on the impact figures (Figures 4 and 5) shown later in this report. These reductions have not been applied in this discussion.

The risk discussions for the two pipelines presented below do not include unconfined vapor cloud explosion because it has such a remote chance of occurrence and confined conditions are unlikely considering the Site, pipeline distances, and typical wind conditions. This is summarized in the Protocol (page 4-53) as follows:

> *"Flammable vapors have the potential to ignite as an unconfined vapor cloud explosion (UCVE) special circumstances. These events are rare (Lees 1996). Similar comments apply here as in the discussion for gas cloud explosions. For the conditions modeled, ALOHA yielded no explosion overpressures for unconfined conditions."*

It is possible that cases may exist where there could be partial confinement from groupings of off-site residential buildings near the campus. However, due to the relatively low volatility of crude oil compared to gasoline and the prevalence of daytime winds blowing generally parallel to the pipelines, we believe the likelihood of a vapor cloud explosion is remote. However, a semi-confined underground vapor cloud explosion in future storm drain structures is discussed.

Conoco Pipeline - The Conoco pipeline is located approximately 680- to 700-feet southwest of the proposed school Site boundary (Figures 1 and 3). For purposes of this discussion, we assume that a full pipeline rupture would occur adjacent to the residential development area. In order to illustrate several possible resulting "pools" of crude oil, we have considered hypothetical flow paths across existing topography. It is important to recognize throughout the report and on Figure 3 that the hypothetical flow paths and pool locations do not consider future development mitigations that are discussed at the end of the report. Three 500-feet diameter circles (A, B, and C) and an isosceles triangle (D) are shown on Figure 3, with conservative surface areas representing 15 minutes of product flow (the CDE 2007 Protocol default time) and an elapsed time of 1.25 hours (an average time derived from PPL in Table 1) before valve closure with an resultant oil depth of 3-inches (it would be deeper for A, B, and C given the sloping topography and containment against the aqueduct). Only Pool E does not represent an existing condition, but rather a worst-case crude oil pool configuration along the planned main roadway extending to Corral Hollow Road on the east and the aqueduct on the north, as discussed in a later section. The distances from the centers of the pools to the center of the Site (the receptor location in a Protocol Stage 2 analysis) are shown in Table 2 below.

Currently, based on the pipeline location crossing natural topography, these flow paths are considered reasonable forming a fan-shape down gradient (north) toward the Site (Pool D), and circular pools west toward the natural

drainages (Pools A and B), and east toward Corral Hollow Road (Pool C); as mentioned, Pool E is not an existing condition. We estimate that approximately 5,895 cubic feet (approximately 44,100 gallons) of crude oil would be released in the default 15-minute period before shutdown assumed in the Protocol. Using the Hazen-Williams formula for gravity-fed full pipe flow,[1] we estimate, conservatively, approximately 20 miles of pipeline liquid could drain back toward the Site from the high elevation (700 feet) on the north after shutdown (estimated 350 cubic feet per minute [cfm]), but before valve closure (60 additional minutes based on one-half of the PPL range in Table 1). This would add approximately 21,000 cubic feet (157,100 gallons) for a total of approximately 26,895 cubic feet (201,200 gallons) of liquid product in the default 15-minute release period and assumed 60-minute drain-down period. (As a comparison, a 20-feet wide by 40-feet long by 5-feet deep (average depth) swimming pool holds approximately 4000 cubic feet of water.) At 3-inches deep on a horizontal surface, this would form a circular pool approximately 370 feet in diameter[2].

TABLE 2 – Site Distances to Hypothetical Pool Locations

POOL LOCATION	CLOSEST SITE DISTANCE	DISTANCE TO SITE CENTER
A	1600 feet	2200 feet
B	1000 feet	1600 feet
C	1650 feet	2250 feet
D	Zero feet	Zero feet
E	670 feet	875-1065 feet (ave. ~1000 feet)

When reaching the south edge of the aqueduct, some liquid product could flow into drainage structures across the aqueduct (shown by the blue solid arrow symbols on Figure 3), but most would collect in the low area south of the aqueduct and west of the proposed Site. The irregular-shaped area bounded by the thick gold line (Figure 3) is the hypothetical area that could be filled (requiring an extremely unlikely 8 hours of drainage from the pipeline north of the Site) before the liquid petroleum pool surface reached elevation 245- to 250-feet where it could flow into the aqueduct limiting the pool size within the project area. This is shown only for reference since it is such an extreme and unreasonable condition, particularly considering the planned development grading. None of the hypothetical 500-feet diameter circular pools should produce an impact at the Site from flash fire. With regard to triangle D, the crude oil would make its way across the Site as the current topography exists (no mitigation considered) and there would be an impact with the existing condition for flash fire and liquid pool fire.

This conclusion for the 500-feet diameter circular pools is validated using the Protocol analysis tables and graphs from Section 4.6.2 - Flammable Release Consequences. The Protocol Figure 4-19 for flash fire impact (LFL = lower flammability limit) distance versus distance from the pool center is shown below (Figure 4). With current conditions, the proposed Site could be impacted by flash fire only from the Pool D scenario prior to grading. The 500-feet diameter pools have an impact distance for flash fire of approximately 180-feet.

The liquid pool fire would consider the same potential pool configurations for the existing conditions as shown on Figure 3. Figure 5 (Protocol Figure 4-20) below shows the relationship between the size of the liquid petroleum

[1] http://www.calctool.org/CALC/eng/civil/hazen-williams_g
[2] http://www.calculatorsoup.com/calculators/construction/tank.php

Figure 4 - Liquid Pool LFL Impact Distance

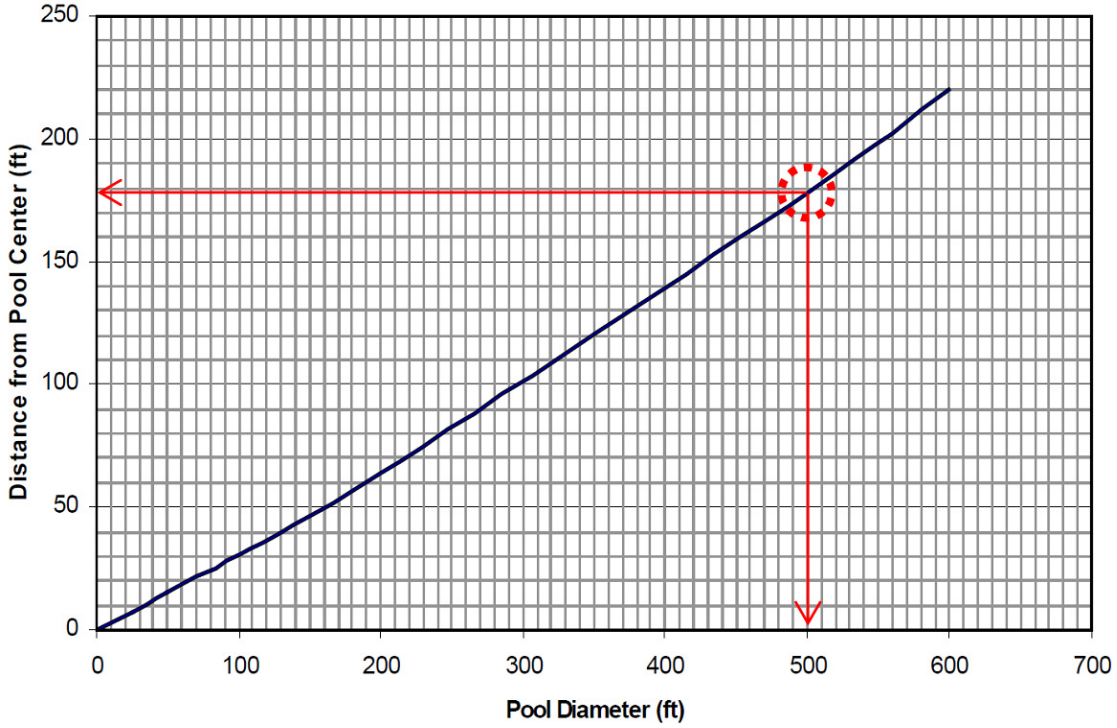
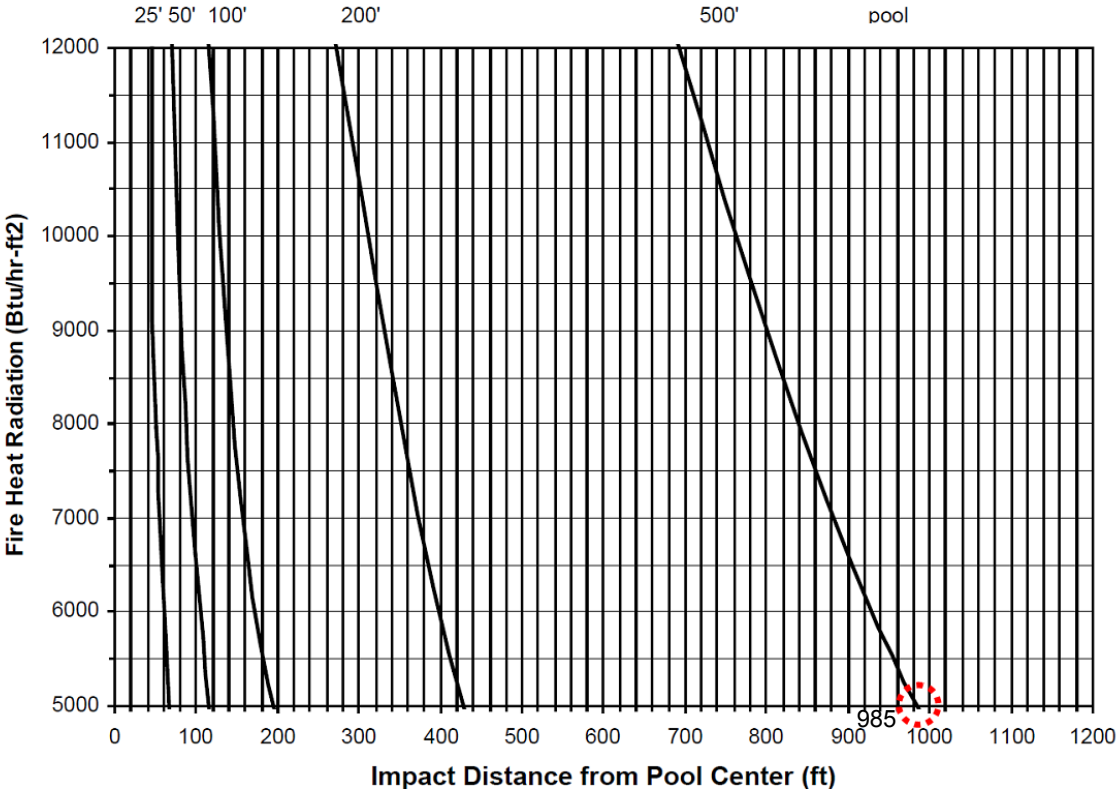


Figure 5 -
Liquid Release Pool Fire Heat Radiation Impact Distance



pool across the top, the distance from the center of the pool to the receptor (school occupants) across the bottom, and the fire heat radiation in BTU per hour on one square foot of surface area (BTU/hr-ft^2). At or below the 5000 BTU/hr-ft^2, the mortality rate is one percent or less and is considered a less than significant impact therefore not a risk to occupants. The 500-feet diagonal line represents the 5000 BTU/hr-ft^2 thresholds at a distance of approximately 980-feet. That is, the school occupants must be at this distance or closer to reach one percent mortality. The Pools A and B distances to the west edge of the Site as shown on Figure 3 are 1000-feet and 1600-feet, respectively. These distances are to the edge of the proposed Site (the radius [Ro] distance in the Protocol Figure 4-21), while the Protocol analysis procedure considers increasingly larger (more distant) radii across the Site further distancing the occupants from the pool centers. From this general analysis of the methodology, we conclude that a full breach of the Conoco pipeline up slope from the proposed Site, or the drainages leading to Pools A, B and C, should produce no impact at the Site from liquid pool fire based on application of the Protocol methodology. For crude oil impact these distances can be estimated as 71% of the distances shown in the impact Figures 4 and 5, which would make the Site less vulnerable.

Shell 20-inch Pipeline – The Shell pipeline is located approximately 2250-feet southwest of the proposed school Site (Figures 1 and 3). Based on the location of the Shell pipeline along the southwest edge of the I-580 and the intervening man-made and natural topography, we conclude that it is very unlikely that liquid petroleum product flowing from a full pipeline break could reach a point within 1500-feet of the proposed Site. At an assumed flow rate of 6000 bbl/hr (561 cfm), if the pipeline were to rupture at its closest approach to the Site it is estimated that 8421 cubic feet (63,000 gallons) could be released in the 15-minute period before shutdown assumed in the Protocol. We estimate approximately 5.25 miles of pipeline liquid could drain back toward the Site after shutdown (assuming the entire pipe volume) adding an additional 60,474 cubic feet (452,405 gallons) for a total of 68,895 cubic feet (515,405 gallons).

Only two possible flow path scenarios are considered reasonable based on the conditions shown on Figure 3. First, if by some means the liquid flowed onto the I-580 and crossed the southbound lanes it would remain within the median and flow to the southeast in a direction and to a location that would present no concern to the Site. In this scenario, an approximately 80-feet wide "rectangular pool" would be formed in the center median area approximately 2150-feet from the Site. It may be possible that some liquid could enter inlets to the Caltrans drains beneath the freeway (discussed below). This should produce no impact from flash fire, liquid pool fire, or vapor cloud explosion at the Site.

Second, the flow could pass through any of the three culverts (shown by the blue dotted arrow symbols) that pass beneath the I-580 just upslope from the Site. Two culverts (marked X and Y on Figure 3) pass beneath I-580 and into the relatively narrow secondary drainages that drain to the north to the California Aqueduct to Pools A and B previously discussed. Assuming all 515,405 gallons could reach either Pool A or B under existing conditions, a 3-inch deep pool 593 feet in diameter could form. Under existing conditions with the shallow ground slope and soils present along the flow path, it is unlikely that 50 percent of the liquid could reach these pool locations; most would

be remain within the narrow drainages (see Figure 3. Potential impacts would therefore be less than those described for the Conoco Phillips pipeline.

If the liquid petroleum passed through culvert Z and under I-580, it would exit onto a broad ridge upslope from the Site and likely form a fan-shaped "pool" as described for triangular Pool D except much broader. Because of the relatively low gradient (gentle slope), it is unlikely that the crude oil would make its way across the area upslope from the Site as the current topography exists and the pool would form adjacent to the I-580 more than 1500 feet away, yielding no impact to the Site area for flash fire, liquid pool fire, or vapor cloud explosion.

2.4 CONCLUSIONS AND POSSIBLE MITIGATIONS

Consideration of the Existing Condition – Together, the pipeline characteristics (location, age, pressure, product type, diameter, and flow rate), the site topography, and the Protocol methodology suggest if the site area were left in an undeveloped state there may be some flash fire and pool fire heat risk within the future school Site from Pool D due to the Conoco Phillips 16-inch diameter crude oil pipeline. We believe, even without a full Stage 2 or 3 analysis that the risk at Pools A, B, and C should be below any significance threshold of concern in the Protocol. This is based on the Protocol technical parameters (specifically the data on Figures 4 and 5 [Figure 4-19 and 4-20 in the Protocol]) considered herein as an advanced screening method for flash fire and pool fire impacts, respectively. Unconfined vapor cloud explosion (UVCE) is considered a rare event by the Protocol, especially for crude oil (Protocol page 4-53), therefore is not considered a credible risk at the proposed school Site.

Consideration of Future Conditions – Figure 3 shows Pool E that would form along the future planned main access road parallel to the southern school boundary and extend into the development along the road to the north toward the aqueduct. That pool would be approximately 2250 feet long and is assumed to be a maximum of 80 feet wide (assumed as approximately the road width). For this analysis it is assumed that the full pipeline rupture would occur at location 4 (Figure 3) and flow would be to the east and north along the access road. Considering currently estimated grades and slopes along the proposed road, we believe this represents a conservative assumption. We have taken a simplified look at the geometry of Pool E with respect to the center of the Site, which is the receptor location based on the Protocol definition (Volume 1 page 4-4). A full Stage 2 analysis of the rectangular pool would entail a summation of heat output from a series of 80-feet by 80-feet pools along the 2250 feet length. The distances to the north and east ends, and the center of the pool (Table 2) are 875 to 1065 feet from the receptor location; overall Pool E distances average about 1,000-feet away. By assuming the total area (180,000 square feet) regardless of liquid depth, one could assume a 478-feet diameter circular pool at the average distance as a worst-case scenario. At approximately 1000-feet away from the receptor location, the pool fire impact would be less than 5000 Btu/hr-ft^2 and therefore less than the threshold of concern in the Protocol.

As indicated in the previous subsection, even though the Shell pipeline is at a significant distance from the Site (2250-feet), the main risk issue is the surface flow of crude oil could enter existing drainage culverts. It is understood that in the future condition these drainage culverts would be connected to the development surface

drainage (streets) or underground drainage (sub-drains). Flow of liquid product under I-580 onto surface streets is unlikely, but could result in product flow north to the main access road where it could conceivably form Pool E (future condition) with the results described above. If the liquid product were to flow into the underground sub-drain system (confined spaces), an explosion event would be possible. Impacts from such a confined explosion should be relatively small at the ground surface. This was demonstrated in a Protocol analysis for San Juan Hills High School in San Juan Capistrano (The Planning Center, 2008). This analysis indicates that for a storm drain 1430-feet long, 3-feet in diameter, and 130-feet from the school no significant impact would occur at the Site.

Possible Mitigations - Given these factors controlling the degree of risk at the Site, there are grading and drainage mitigations that would minimize the potential for a full pipeline rupture of either the Conoco Phillips or the Shell pipelines to impact the Site. These are discussed below.

1. We understand that the potential for Shell pipeline liquid petroleum to move through culverts under the I-580 freeway toward the Site cannot be addressed at the southern specific plan area property line due to conservation easement restrictions north of the I-580. With the Caltrans culverts connected to the development sub-drain system, the liquid petroleum could flow through the underground storm drain system beneath the development area to a retention basin location adjacent to the aqueduct several thousand feet northwest of the Site. Any design such as this should keep the affected storm drain at least 150-feet from the proposed school Site.

2. Adjacent to the proposed school Site we understand the Conoco pipeline is to be located along the south edge of a main development access road and through a small pocket park. If a breach were to occur and product flowed at the surface, the roadway gradients should carry the liquid along/within the roadway. Based on the preliminary grading plans liquid product would flow to the northwest past the pocket park, then northerly within the roadway toward the aqueduct and the Phase 2 development. The road surface should be configured (e.g., lowered compared to areas toward the Site, tilted back to the south/west, have sufficiently high curbs/medians and low bordering walls adjacent to sidewalks) to contain flow within the roadway asphalt surface in an area no more than 80-feet wide. Any roadway trending toward the Site from this main development access road should not be allowed to transport product toward the Site or to the area immediately adjacent to the aqueduct.

3. The storm drain/sub-drain systems for the project between the main access road and the proposed school Site should have positive flow away from the school site in order that the liquid petroleum from a pipeline leak or rupture does not flow toward the Site.

4. As described above, graded slopes, sub-surface drainage, and final surface topography must prevent surface flow of liquid petroleum north toward the Site due to a full pipeline rupture. West of the pocket park, flow could be allowed toward the aqueduct (hypothetical Pool A area). It is understood that the City's retention basin sizing requirements are based on very conservative design criteria (i.e., consideration for back-to-back high intensity storm events). We believe that the combined probabilities of the design storms and a simultaneous full pipeline rupture are sufficiently low that the proposed retention basin design west of Pool A should accommodate any of the reasonably anticipated oil flow volumes discussed above.

3. CALIFORNIA AQUEDUCT ASSESSMENT

3.1 AQUEDUCT LOCATION, CHARACTERISTICS, AND OPERATIONAL DATA

The California Aqueduct is located approximately 100-feet north of the proposed school Site (Figure 6 below) and trends roughly parallel to the northern Site boundary. Based on construction plans (CDWR, 1964) the aqueduct is a symmetrical trapezoid shape approximately 100-feet across at the top, 60-feet across at the invert, and 38-feet deep. Two check structures are present along the aqueduct one northwest (Check 1) and one southeast (Check 2) of the proposed Site. Based on the Tracy Hills specific Plan Draft EIR (1997, page 4.7-7):

> *"According to the Department of Conservation, the California Aqueduct has an average freeboard of 8 to 11 feet. However, freeboard is reduced to three feet during the hottest days of the summer season, to minimize heat expansion of the canal's concrete panels. According to the Bureau of Reclamation, the Delta Mendota Canal maintains a freeboard of one to two feet during maximum flow. Water levels are, however, decreased during episodes of fish migration and at time of poor water quality. Both the California Aqueduct and the Delta Mendota Canal are equipped with check structures which monitor massive dewatering and automatically shut off flows."*

Water flow in the aqueduct is approximately 10,300 cubic feet per second (cfs) in this location and the trapezoidal design carries water below adjacent Site grades. This design is more secure than a levee type system, which stands above surrounding topography and, if a breach were to form, erosion and flooding would occur in adjacent areas. CDWR commented on the DEIR (1997; January 26, 1996 comment) that while considering the below grade aqueduct design, due to significant earthquake shaking potential:

> *". . . we believe that in light of the above [earthquake] concerns that the ideal solution would be to designate the lands on both sides of the Aqueduct as open space/greenbelt. This would reduce the need to mitigate the above concerns and further protect the public who would live and work in this planned development."*

3.2 TOPOGRAPHY AND DRAINAGE AFFECTS

As described above, topography slopes downhill from I-580 across the proposed school Site toward the California Aqueduct at a gradient of approximately one to two percent. Pre-aqueduct USGS topographic maps provide an indication of this condition presented graphically in Figure 6 below (approximate original ground). Using this topography we inserted the aqueduct on a cross-section through the Site based on CDWR 1964 drawings (Sheet 82) showing the condition at the Corral Hollow Road crossing (Station 935+12.5). Based on our field inspection (April 2013), we believe that (a) this is a reasonable transposition to approximately Station 928+25 (roughly 700 feet up stream), (b) the surface water elevation should be within one-foot of 241.5-feet elevation during normal flow, and (c) the relationship to original ground is appropriate.

3.3 POTENTIAL CONSEQUENCES OF AQUEDUCT FULL BREACH / RUPTURE

Flooding, rapid water flow and erosion concerns are not believed to be potential risks at locations adjacent to and higher in elevation than the aqueduct. Adjacent to the Site the aqueduct trapezoidal design carries water below adjacent grades as opposed to a levee type system, which stands above surrounding topography. Because the aqueduct water level is roughly elevation 241- to 242-feet adjacent to the Site and the Site pad elevation will likely be approximately elevation 265-feet, these is no reasonable scenario where a breach in the aqueduct can raise flood

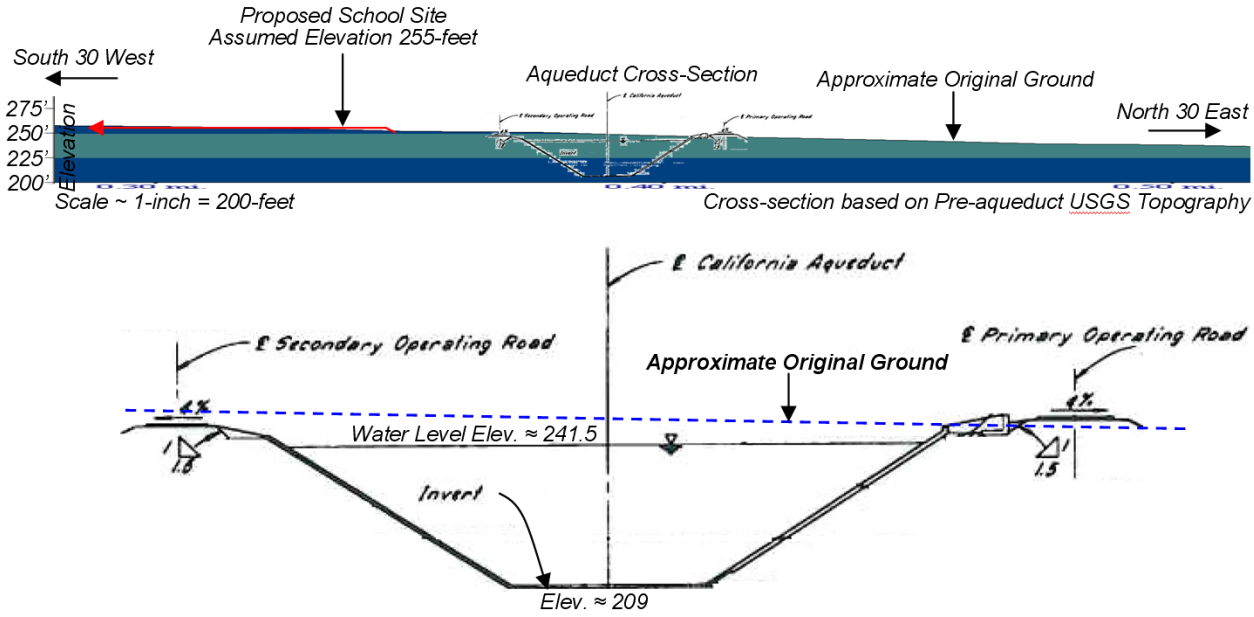


FIGURE 6 - Representative Aqueduct Cross-Section Adjacent to Proposed School Site (CDWR, 1964)

waters to the future pad level. Any erosion would be at lower elevations (less than 242-feet), therefore would not impact the Site. In addition, we see no reasonable pathway in the 100-feet wide easement area by which water from an aqueduct breach to the northwest or southeast away from the Site could flow along the south edge of the aqueduct and reach the Site. This is due to the generally similar or lower elevations of these areas and to the similar below grade construction.

3.4 RISK ANALYSIS

The previous discussion summarizes the California Aqueduct characteristics and project conditions that indicate there is no reasonable scenario where flooding, water flow, or erosion poses a direct risk to the proposed school Site.

3.5 CONCLUSIONS AND POSSIBLE MITIGATIONS

The California Aqueduct section adjacent to the proposed school Site is a trapezoidal structure in cross-section view and was constructed below the grade of the adjacent ground surface. If a breach were to occur immediately adjacent to the Site, due to its location up slope from the aqueduct it is not reasonable to expect an impact from flooding, water flow, or erosion. Although our analysis was limited to such a local incident, topography up stream to the northwest suggests that flood water from any breach in this area would not have a direct pathway to the proposed school Site.

Currently the proposed school Site boundary adjacent to the aqueduct is separated 100-feet from the easement and approximately 5 to 10-feet in elevation compared to the top edge of the trapezoidal channel. This seems consistent with the CDWR recommendation for an open space/greenbelt along the aqueduct. We believe consideration of grading the Site to an elevation of approximately 265-feet is reasonable and believe the conservation easement

would be capable of moving excessive flow (to be determined by the necessary project-specific hydrology study) eastward to the natural drainage area east of Corral Hollow Road. This should provide sufficient extra protection should any up stream water flow be determined to possibly move toward the proposed school Site along the south edge of the aqueduct.

4. SUMMARY AND LIMITATIONS

The purpose of this report is to provide a professional opinion regarding the likelihood that failures of the Conoco 16-inch diameter crude oil pipeline, the Shell 20-inch diameter crude oil pipeline, or the California Aqueduct would create risks that would preclude construction of a school within the boundaries of the proposed Site as defined (see Figures 1, 2, and 3). This report does not present an analysis that satisfies the 2007 California Department of Education Guidance Protocol for School Site Pipeline Risk Analysis (updated in 2009). However, this report does present a review and a detailed screening analysis of the key parameters of the Protocol that define the risk and concludes that with proper design and construction mitigations similar to those discussed herein the Site is likely to pass a standard Protocol analysis.

Our interpretations and conclusions presented in this report are based on experience conducting similar risk assessments for other schools in California, and reviewing recent reports for similar pipelines at sites with analogous conditions. This analysis was conducted considering the Protocol (as updated in 2009), except as noted, and includes the full implications of the URS Disclaimer in the Protocol (Page ii of Volume 1 – User's Manual). In addition, USGS topographic maps, aerial photographs and the scales determined from the documents provided by Ruggeri~Jensen~Azar (for Integral Communities, 2013), and Google Earth (2013) were used to determine lengths and distances used in this analysis. Calculations of volumes and areas associated with potential liquid pools, and the liquid petroleum pipeline drainage calculations, used available calculators from websites noted in the text. Final development and school Site designs, and decisions to adopt recommendations in this report are the responsibilities of others. The pipeline risk assessment process cannot predict future events or their likelihood and, therefore, this report provides an estimate of the likelihood and magnitude of certain events that may occur. Events can occur that are not foreseen at this time. Wilson Geosciences Inc. makes no warranties either expressed or implied regarding the content of this report.

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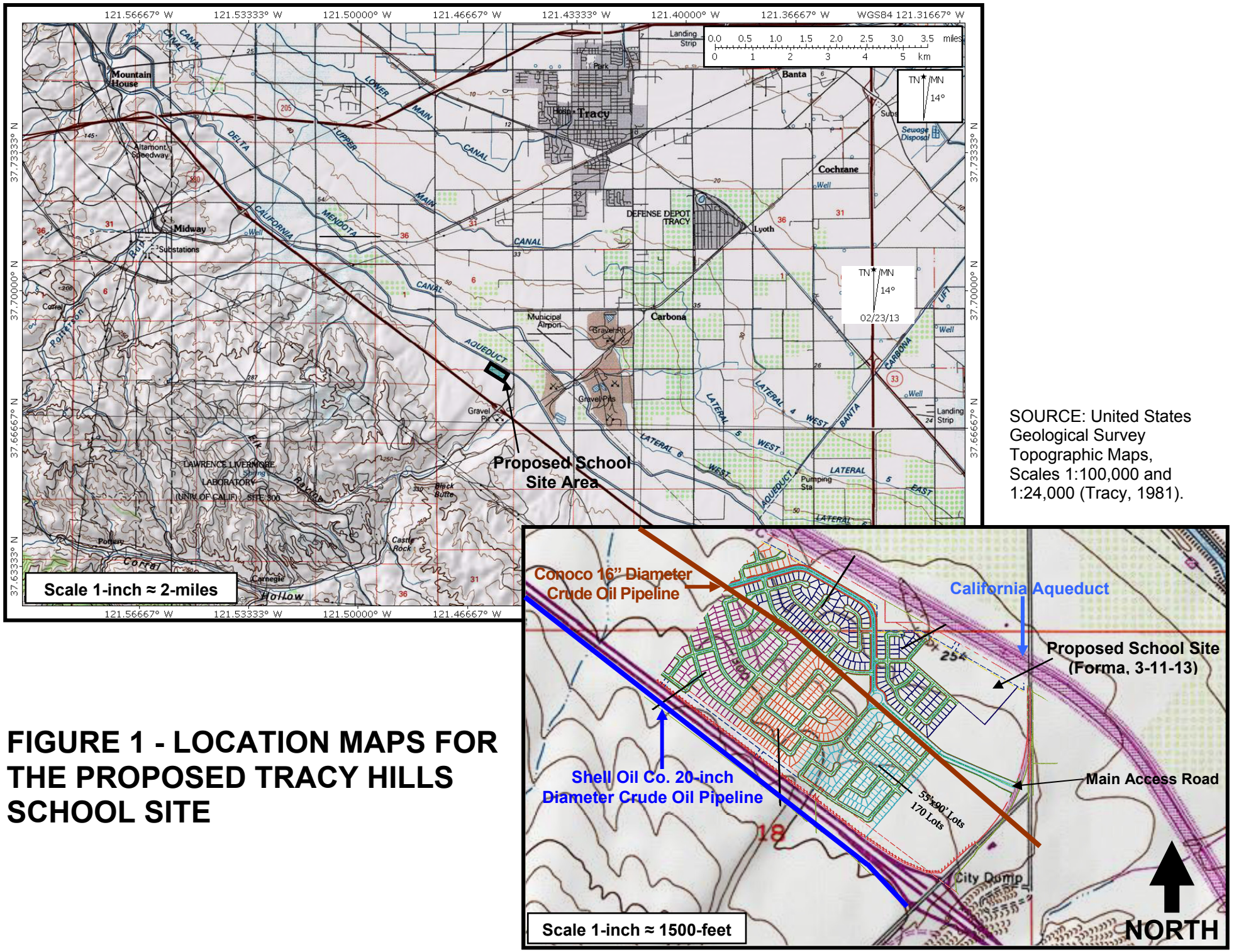
APPENDIX—FIGURES

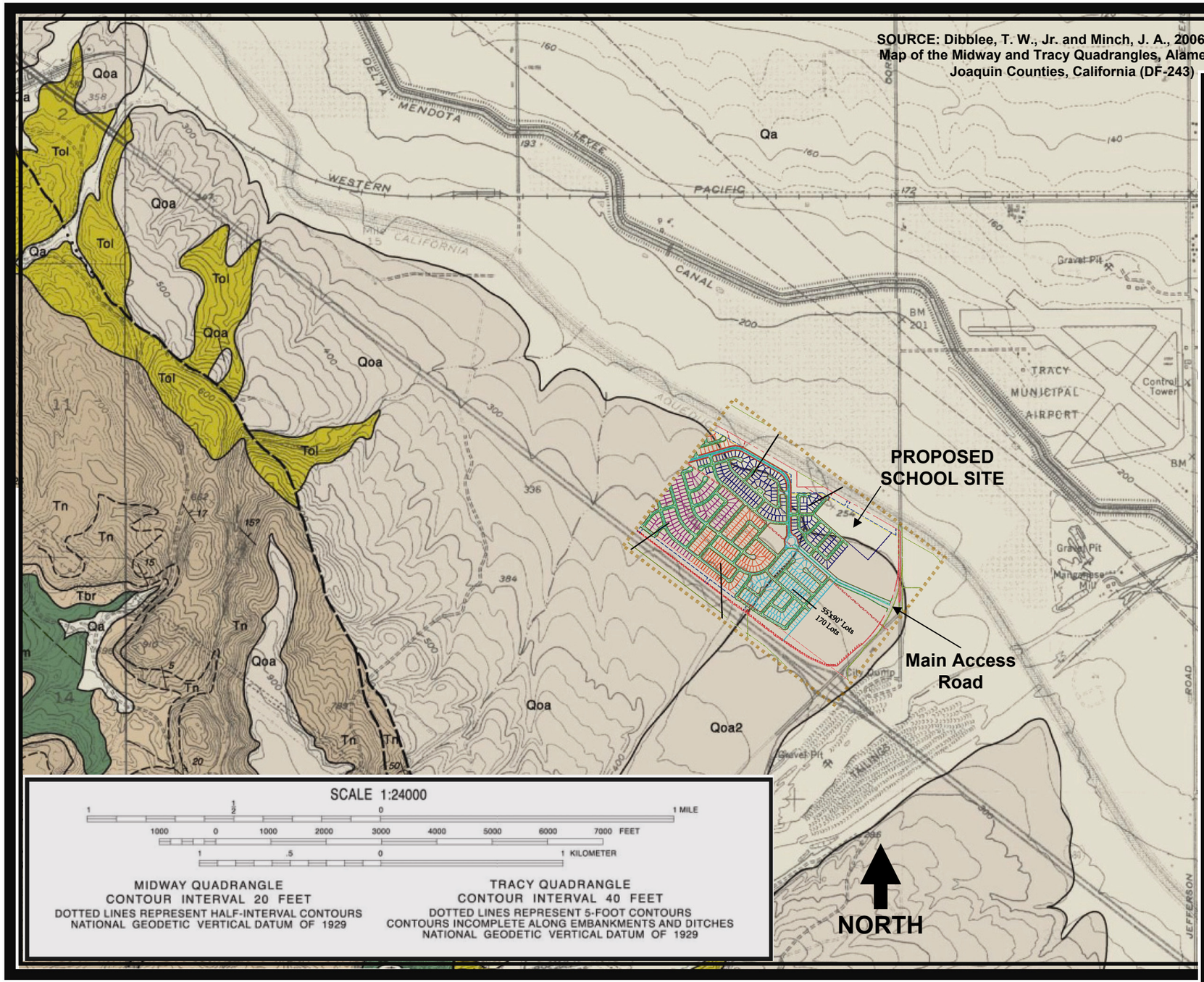
Figure 1 - Location Maps
Figure 2 - Geologic Map
Figure 3 - Liquid Petroleum Pipelines and Potential Impact Areas



SOURCE: United States Geological Survey Topographic Maps, Scales 1:100,000 and 1:24,000 (Tracy, 1981).

FIGURE 1 - LOCATION MAPS FOR THE PROPOSED TRACY HILLS SCHOOL SITE

SOURCE: Dibblee, T. W., Jr. and Minch, J. A., 2006 Geologic Map of the Midway and Tracy Quadrangles, Alameda & San Joaquin Counties, California (DF-243)



MIDWAY AND TRACY MAP (DF-243)

LEGEND

Qa

SURFICIAL SEDIMENTS
Qa *Alluvial gravel, sand and clay of valley areas*

Qls

LANDSLIDE DEBRIS
Qls *Landslide rubble*

Qoa2 / **Qoa**

OLDER SURFICIAL SEDIMENTS
Qoa2 *Younger dissected alluvial fan deposits, undeformed; at lower levels; age, late Pleistocene*
Qoa *Dissected alluvial fan deposits, undeformed; age, late Pleistocene*

UNCONFORMITY

Tor | **Tol** | **Tolc**

ORINDA and ORO LOMA FORMATIONS
Similar to Orinda Formation of Livermore basin, valley sediments, sublithified; age, Pliocene to possibly early Pleistocene
Tor *Pebble conglomerate, sandstone and claystone, interbedded, greenish gray; in western part of map*
Tol *Alluvial pebble conglomerate, sandstone and claystone, interbedded, gray to greenish gray; in eastern part of map*
Tolc *Same as* **Tol**, *but mostly claystone*

Tn
Tbr

NEROLY FORMATION and BRIONES SANDSTONE
Nonmarine and marine clastic, lithified; age, late Miocene
Tn *Upper part, called Neroly Formation in this area because of its distinctive blue color, probably non marine, blue to blue gray, thick bedded, medium grained, locally pebbly*
Tbr *Lower part, called Briones or Cierbo Sandstone in this area, marine to brackish marine, light gray to light tan, thick bedded, medium to coarse grained, locally pebbly, fossiliferous*

UNCONFORMITY

Ttss
Tts

TESLA FORMATION
(of Huey, 1948) Marine clastic, lithified, somewhat similar to Domengine Formation of nearby areas; age, middle to lower Eocene
Ttss *Sandstone, tan, semi friable, bedded, medium grained, locally pebbly, arkosic*
Tts *Sandstone, as above, but includes interbedded gray siltstone and claystone*

Kms
Km
Kps
Kp

GREAT VALLEY SEQUENCE
Marine clastic, lithified; age, late Cretaceous
Kms *Moreno Sandstone, not mapped in the Altamont quadrangle*
Km *Moreno Shale, clay shale or claystone, gray, micaceous, crumbly*
Kps *Panoche Formation, sandstone, light gray to light brown, bedded, fine to medium grained, arkosic, locally contains large dark brown concretions; includes minor interbedded clay shale*
Kp *Panoche Formation, clay shale or claystone, gray to dark gray, micaceous, bedded, crumbly*

Holocene | Pleistocene | Pliocene | Miocene | Eocene | Upper | QUATERNARY | TERTIARY | CRETACEOUS | CENOZOIC

FIGURE 2 - GEOLOGIC MAP FOR THE PROPOSED TRACY HILLS SCHOOL SITE

FIGURE 3 – LIQUID PETROLEUM PIPELINES AND POTENTIAL IMPACT AREAS FOR THE PROPOSED TRACY HILLS SCHOOL SITE