CHAPTER 2

PROJECT DESCRIPTION

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2.0 PROJECT DESCRIPTION

2.1 INTRODUCTION

Tesoro is proposing the Los Angeles Refinery Integration and Compliance Project. In June 2013, Tesoro purchased the adjacent BP Carson Refinery, which, as part of the proposed project will be more fully integrated with the Tesoro Los Angeles Refinery – Wilmington Operations to form the Tesoro Los Angeles Refinery. The Refinery includes: (1) the Wilmington Operations located at 2101 East Pacific Coast Highway in the Wilmington District of the City of Los Angeles; and (2) the Carson Operations, which is the former BP Carson Refinery located at 2350 East 223rd Street in the City of Carson. The proposed project will be designed to better integrate the Wilmington Operations and Carson Operations.

As a matter of course, federal and state agencies typically review mergers and acquisitions of a certain size prior to closing to ensure compliance with antitrust statutes. On May 17, 2013, the Federal Trade Commission and the California Attorney General's office each announced that they had concluded a nine month investigation and had resolved any potential antitrust concerns with Tesoro Corporation's proposed acquisition of BP's southern California refining and marketing assets, including BP's Carson Refinery near Los Angeles.

The Attorney General explained that the investigation involved close cooperation with the California Energy Commission and that, "over the course of the investigation, the agencies and various third parties combined to produce millions of pages of documents and voluminous amounts of data." The agencies "reviewed these documents and data, subpoenaed the parties and numerous third parties for testimony, and secured a leading economist in the field of oil and gas to conduct various analyses of the markets at issue." After a thorough investigation and review of the evidence, many of the agencies' concerns were addressed, and they concluded that any remaining consumer, environmental and job security issues were appropriately addressed through a letter agreement with Tesoro, stating "… we believe that these commitments will help ensure that California's oil and gas markets remain competitive for years to come, help to reduce greenhouse gases and emissions, and protect jobs for potentially thousands of Californians." (California Attorney General, 2013)

In its statement, the Federal Trade Commission said it concluded from the qualitative and quantitative evidence that "the proposed acquisition is not likely to lessen competition substantially in violation of Section 7 of the Clayton Act or Section 5 of the FTC Act. … Although the specific facts associated with this transaction do not warrant Commission action at this time, the Commission is fully committed to using all the tools at its disposal to protect competition and consumers in this important economic sector." (Federal Trade Commission, 2013)

Currently, there are some pipeline connections between the Wilmington and Carson Operations that allow limited transfer of crude oil, feedstocks, and refined products between the two Operations. The proposed project would greatly enhance the integration of overall Refinery operations through process modifications that enable shutting down the Fluid Catalytic Cracking

Unit (FCCU) at the Wilmington Operations and relying on the remaining Carson Operations FCCU for production of FCCU gasoline at both Operations, installation of new pipeline connections between the Wilmington and Carson Operations, and the installation of transmission lines from the Carson Operations Watson Cogeneration (Cogen) Facility to Wilmington Operations. The new pipeline connections will allow efficient transfer of intermediate feedstocks between the facilities to allow gasoline blending optimization, gas oil balancing and maintaining transportation fuels production capability. The installation of new electricity transmission lines will allow electricity generated at the Carson Operations to be used at the Wilmington Operations. These electricity transmission lines will allow the increased electricity demand from the proposed project to be supplied entirely from existing on-site electricity generation.

In addition to furthering Refinery integration, the proposed project will be designed to comply with the federally mandated Tier 3 gasoline specifications and with State and local regulations mandating emission reductions. Federal Tier 3 gasoline specifications require that refining companies meet an annual average of 10 ppm sulfur in gasoline produced from their refineries in the United States by January 1, 2017. The Los Angeles Refinery Integration and Compliance Project is designed to meet Tier 3 gasoline sulfur standards and is expected to substantially reduce GHG, SOx, NOx, and CO emissions. These emission reductions will be accomplished by recovering diesel and jet boiling range materials from the gas oil that is currently fed to both Wilmington and Carson Operations FCCUs so that the remaining gas oil feed from the Wilmington Operation FCCU can be diverted to the Carson Operations FCCU, while maintaining the same overall level of transportation fuels production. Reconfiguring the combined Refinery complex is expected to improve the gasoline to distillate production ratio from the integrated Refinery and to allow more expeditious response and adjustments to ongoing changes in market demand for various types of petroleum products. Additionally, heat recovery will be optimized by installing new heat exchangers and modifying specified units to further minimize GHG and other emissions. All new and modified sources will be required to comply with Best Available Control Technology (BACT) requirements in SCAQMD Rule 1303. The proposed process modifications will improve efficiency, enabling Tesoro to shut down the Wilmington Operations FCCU and reduce carbon intensity per unit volume of product output.

The proposed project will have a small impact on crude oil and feedstock throughput capacity. The crude oil and feedstock processing capability at the integrated Refinery will increase approximately two percent or 6,000 barrels per day (bbl/day) as a result of the proposed project. In spite of this increase in feedstock throughput capacity, the proposed project is still expected to result in overall Refinery emission reductions. Further, the modifications will be designed so that the combined Refinery operates within the existing capacity of the Sulfur Recovery Plants (SRPs), so no SRP permit modifications are required. The type of crude oil and feedstocks will not change as part of the proposed project. Crude oil and oil feedstocks are currently obtained from a variety of sources based on factors such as product availability and market conditions. Feedstocks include, but are not limited to: intermediate gas oil, transmix (a mixture of pipeline products; such as gasoline, jet and diesel) and internally recycled oil. Modifications will be made to recover diesel and jet fuel boiling point range material, also known as distillate, from gas oil that is currently fed to the FCCUs at both Wilmington and Carson Operations. In addition, facilities will be added to remove impurities such as sulfur, nitrogen compounds, and organic acids from distillates. There will be no modifications at any of the marine terminals associated with the Tesoro Los Angeles Refinery.

On April 23, 2014, the SCAQMD released a Notice of Intent to adopt a Draft Negative Declaration for the Tesoro Storage Tank Replacement and Modification project. The Tank Replacement and Modification Project was considered to be a separate project from the Tesoro Refinery Integration and Compliance Project because it could go forward with or without the currently proposed project; that is, neither project relies on the other project to be implemented and each project has independent utility. However, because of the timing of construction and implementation of the two projects, it was decided to incorporate the Tesoro Storage Tank Replacement and Modification project into the currently proposed project to provide a cohesive analysis of all environmental impacts from the two projects. As a result, the Negative Declaration for the Tesoro Storage Tank Replacement and Modification project has been withdrawn and the impacts are analyzed as part of the currently proposed project (see Subsection 2.7.1.9).

2.2 PROJECT OBJECTIVES

Tesoro is proposing the Los Angeles Refinery Integration and Compliance Project to further integrate its Los Angeles Refinery Carson and Wilmington Operations. Because the Carson and Wilmington Operations are located adjacent to each other, there are opportunities for reducing emissions and improving operational efficiencies at and between the two sites if they can be more fully integrated.

There are multiple objectives for the proposed project that include the following:

- Improving process efficiency through integration while maintaining the overall production capability of transportation fuels. Making process modifications that improve efficiency and enable shutdown of the Wilmington Operations FCCU prior to the next scheduled FCCU turnaround, currently anticipated to occur in 2017, providing substantial emission reductions on-site and reducing carbon intensity.

- Recovering and upgrading distillate range material from FCCU feeds. Tesoro proposes to achieve this objective by modifying 51 Vacuum Unit, and the Hydrocracker Unit (HCU) at Carson Operations, and the Hydrotreater Unit 4 (HTU-4) and HCU modifications at Wilmington Operations. Recovering distillate from FCCU feed enables shut down of the Wilmington Operations FCCU since the Carson Operations FCCU has sufficient capacity to process the FCCU feed that remains after distillate recovery.

- Complying with federal, state, and local rules and regulations. Tesoro proposes to achieve this objective by: (1) meeting the U.S. EPA Tier 3 gasoline specifications; and (2) reducing Refinery NOx, SOx, and GHG emissions through proposed process modifications that improve efficiency, enable shutdown of the Wilmington Operations FCCU, and lower carbon intensity.

- Improving financial viability for the newly integrated Tesoro Los Angeles Refinery and the local community. Tesoro proposes to achieve this objective by: (1) reducing future operating, capital, turnaround, and environmental compliance costs, primarily by shutting down the Wilmington Operations FCCU; (2) improving electrical supply reliability; (3) improving integrated Refinery transportation fuel production flexibility between gasoline and distillate products to respond to changes in market demand, including the capability to produce 100 percent of the refinery gasoline production as CARB compliant gasoline; and (4) providing sustainable local jobs and tax revenue for the community.

- Integrating Carson and Wilmington Operations. Tesoro proposes to achieve this objective by installing the Interconnecting Pipelines to allow efficient transfer of hydrocarbons between the facilities to allow gasoline blending optimization, process unit feedstock optimization, and increased diesel production.

- Increasing overall Refinery processing efficiency. Tesoro proposes to achieve this objective by: (1) adding a Sulfuric Acid Regeneration Plant at the Wilmington Operations to regenerate sulfuric acid on-site; (2) adding a Wet Jet Treater to improve jet fuel quality; (3) upgrading and adding facilities to recover and treat propane for commercial sales; and (4) upgrading existing LPG rail facilities to enable fast unloading of railcars.

- Improving efficiency of water-borne crude oil receipt and marine vessel unloading. Unloading crude oil from marine vessels without delay will reduce vessel emissions at the Port of Long Beach. Tesoro proposes to achieve this objective by constructing six new 500,000 barrel tanks at the Carson Crude Terminal and replacing two existing 80,000 barrel crude oil tanks at the Wilmington Operations with two 300,000 barrel tanks. Piping within the Carson Crude Terminal will be installed to connect the six new 500,000 barrel tanks to existing pipelines to the Carson Operations and Marine Terminal 1. The two new 300,000 barrel tanks will be connected to existing pipelines from the Wilmington Long Beach Terminal. Within the confines of the Wilmington Operations, the existing 12-inch diameter piping will be replaced with 24-inch diameter piping to connect the replacement tanks to the Wilmington Operations.

2.3 PROJECT LOCATION

The proposed project will occur at both the Wilmington and Carson Operations of the Tesoro Los Angeles Refinery. Tesoro will more fully integrate the recently purchased adjacent BP Carson Refinery (referred to as the Carson Operations) with the existing Wilmington Operations, to become a more efficient single entity owned and operated by Tesoro. The Refinery will be comprised of approximately 950 contiguous acres in size and operate within the Cities of Los Angeles (Wilmington District) and Carson, California.

The Wilmington Operations are located within Wilmington, a community under the jurisdiction of the City of Los Angeles, at 2101 East Pacific Coast Highway, Wilmington, Los Angeles County, California 90744. The Carson Operations are located at 2350 East 223rd Street, Carson, California, 90810. Although the SRP is considered to be a portion of the Wilmington

Operations, it is located at 23208 South Alameda Street in the City of Carson. Figure 2-1 depicts the regional location of the Refinery and Figure 2-2 provides a detailed Site Location Map. The proposed project would include installing pipelines within the Refinery as well as under Alameda Street and Sepulveda Boulevard adjacent to the Refinery to connect pipelines between the Wilmington and Carson Operations. Both new and modified equipment, as well as connecting pipelines, will be located within portions of the Refinery under both the City of Carson jurisdiction and the City of Los Angeles jurisdiction.

2.4 LAND USE AND ZONING

Implementation of the proposed project at the Wilmington and Carson Operations of the Tesoro Los Angeles Refinery will occur primarily within existing property boundaries. Land uses in the vicinity of the Refinery include oil production facilities, refineries, hydrogen plants, coke handling facilities, automobile wrecking/dismantling facilities, and other industrial operations.

2.4.1 WILMINGTON OPERATIONS

The Wilmington Operations are bounded to the north by Sepulveda Boulevard (as well as other tank farms and refinery activities), to the west by Alameda Street (as well as the Alameda Corridor and other tank farms), to the south by railroad tracks (as well as tank farms and metal recycling/scrap yards), and to the east by the Dominguez Channel (as well as other tank farms and rail yard activities) (see Figure 2-2). The Wilmington Operations are bisected by Pacific Coast Highway, with the larger portion of the Wilmington Operations to the north of Pacific Coast Highway and the smaller portion to the south. The closest residential area to the Wilmington Operations is about 200 feet west of the Truck Loading Rack (see Figure 2-2).

The main operating portions of the Wilmington Operations are located within the Wilmington-Harbor City Planning Area (City of Los Angeles), which permits heavy industrial uses including petroleum refining on the Tesoro property (City of Los Angeles, 1999). The Wilmington-Harbor City Plan places no additional restrictions on refineries, and specifically allows for construction without regard to height limitations. The Refinery and all adjacent areas are zoned for heavy industrial use (M3-1).

2.4.2 CARSON OPERATIONS

The Carson Operations are bounded by Wilmington Avenue to the west, 223rd Avenue to the north, Alameda Street and the Dominguez Channel to the east, and Sepulveda Boulevard to the south. The Dominguez Channel flows through the Carson Operations, dividing the property into two sections: Northeastern and Southern. Several industrial/commercial facilities and the 405 Freeway border the Carson Operations to the north. The Alameda Corridor, a major port access arterial, and other industrial facilities, including the Carson Operations Coke Barn, the Air Products Hydrogen Plant, the Wilmington Operations SRP, wrecking yards, and the ICTF are located to the east of the Refinery. Land to the east of the ICTF is in the City of Long Beach and includes a residential neighborhood and light manufacturing facilities.

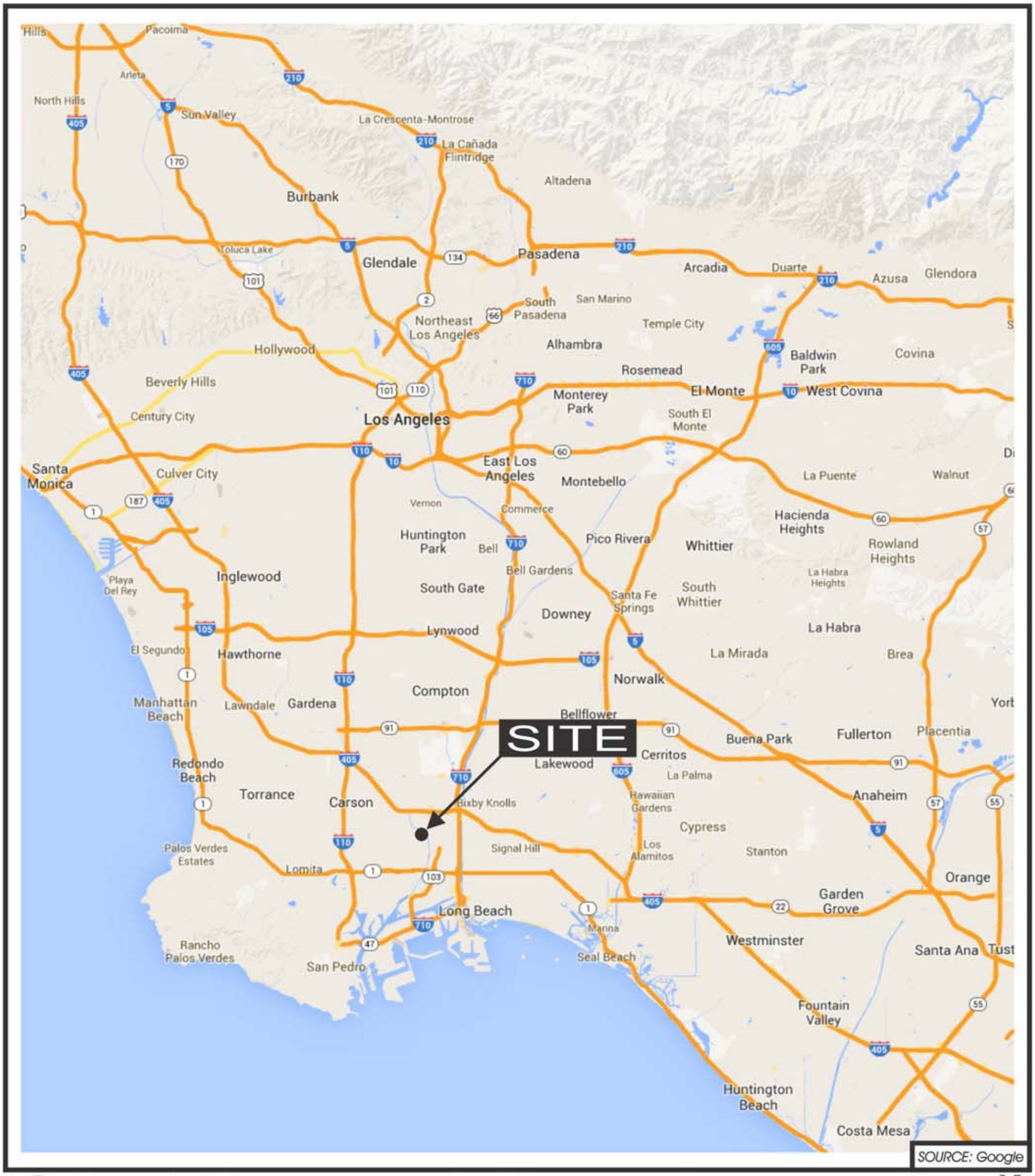

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FIGURE 2-1
REGIONAL MAP
TESORO LOS ANGELES REFINERY

Project No. 2844
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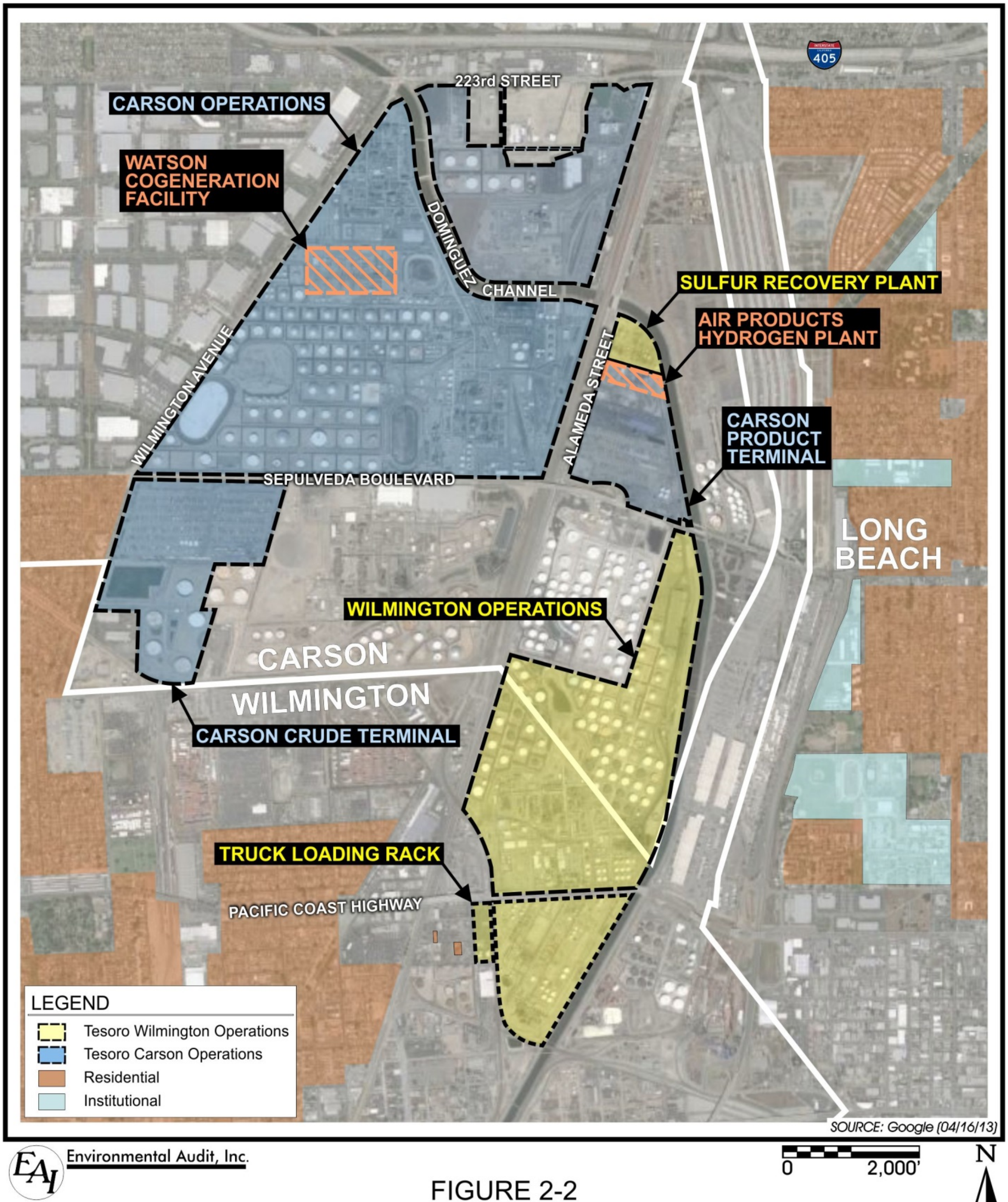

FIGURE 2-2
SITE LOCATION MAP
TESORO LOS ANGELES REFINERY

Project No. 2844

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To the west of the Carson Operations is Wilmington Avenue. The land adjacent to Wilmington Avenue on the west is occupied by the Watson Industrial Park, a development of manufacturing and warehouse-type structures. The land to the west of Wilmington Avenue and south of Sepulveda Boulevard, immediately west of Carson Operation's southwest tank farm, known as the Carson Crude Terminal, is a residential neighborhood and represents the closest residences (about 100 feet from the Carson Crude Terminal property boundary and 1,300 feet from the proposed crude oil tanks location). South of the Carson Operations is Sepulveda Boulevard and the ConocoPhillips Carson Plant and a cold storage warehouse facility. This area is dominated by storage tanks, refinery equipment and a large warehouse.

The Carson Operations and all adjacent facilities and properties are zoned MH according to the City of Carson's Land Use element of its General Plan. The closest residential area to the Carson Operations is approximately 250 feet southwest of the Refinery on the southwest corner of the Sepulveda Boulevard/Wilmington Avenue intersection (approximately 4,500 feet from proposed project modifications).

As noted previously, the SRP is part of the Wilmington Operations, but is located in the City of Carson. The SRP is zoned MH according to the City of Carson's Land Use element of its General Plan. Adjacent land uses to the SRP also are heavy industrial and include other refineries, a hydrogen plant, undeveloped lots, and container storage areas.

2.5 OVERVIEW OF PETROLEUM REFINING

Crude oil is a mixture of hydrocarbon compounds and relatively small amounts of other materials, such as oxygen, nitrogen, sulfur, salt, sediment, and water. Petroleum refining is a coordinated arrangement of manufacturing processes designed to produce physical and chemical changes in the crude oil to remove most of the non-hydrocarbon substances, break the crude oil into its various components, and blend them into various useful products. The overall refining process uses four kinds of techniques: 1) separation, including distilling hydrocarbon liquids into gases, gasoline, diesel fuel, fuel oil, gas oils, and heavier residual materials; 2) cracking or breaking large hydrocarbon molecules into smaller ones by thermal or catalytic processes; 3) reforming using heat and catalysts to rearrange the chemical structure of a particular oil stream to improve its quality; and, 4) chemically combining two or more hydrocarbons to produce high-grade gasoline.

Crude oil is delivered to the Wilmington and Carson Operations via pipeline from ships at the Marine Terminal and other local pipelines. Crude oil is processed in the Crude Unit where it is heated and distilled into various hydrocarbon components, which are further processed in downstream processing units. The Refinery also receives and transports other refined petroleum products (crude oil not included) to and from the Refinery by ship, truck, and railcar. The Wilmington and Carson Operations produce a variety of products including unleaded gasoline, jet fuel, diesel fuel, petroleum gases, petroleum coke, and sulfur. Elemental sulfur and petroleum coke are produced as by-products of the refining process. Major processing units at the Refinery include the Crude Unit, DCU, hydrotreating units, reforming units, FCCU, Alkylation Unit, Hydrogen Plant, SRP, and the Cogeneration Plants.

Refining processes convert crude oil into petroleum products, which have varying market values. Refineries strive to optimize the volumes or "yields" of higher value products, such as transportation fuels (i.e., gasoline, diesel, and jet fuel) while producing the maximum quantity of saleable products from each barrel of crude oil refined. Each type of crude oil produces different yields of products (ICCT, 2011).

2.5.1 TYPES OF CRUDE OIL

Crude oils are comprised of thousands of different chemical compounds. The majority of these compounds are hydrocarbons, consisting solely of hydrogen (H) and carbon (C) atoms. Crude oils also contain other compounds including small amounts of sulfur, nitrogen, oxygen, and metals.

Hydrocarbons are measured by the number of carbon atoms present in each molecule. Crude oil contains hydrocarbons and other compounds with up to 50 carbon atoms or more (ICCT, 2011). The weight of hydrocarbons increases as the number of carbons increase. The lightest hydrocarbons, for example, are petroleum gases such as methane (CH_4), ethane (C_2H_6), propane (C_3H_8), and butane (C_4H_{10}), where each molecule of these gases contains one to four carbon atoms, respectively. Gasoline is a mixture of heavier hydrocarbon, with anywhere from five to 12 carbon atoms in each molecule.

The different crude oils produced throughout the world vary in weight (i.e., the proportion of light to heavy hydrocarbons), the predominant hydrocarbon type (e.g., paraffins, naphthenes, and aromatics (see Chapter 8 for definitions)), and the amount of other compounds (e.g., sulfur) (Lucas, 2000). Of these, weight and sulfur content are commonly used to describe crude oils. The weight of crude oil is compared to water using an American Petroleum Institute (API) method referred to as API Gravity (Leffler, 2008). Most crude oils have API Gravities between 10 and 70 degrees with lighter crude oils having higher values. (Schlumberger, 2015)

The sulfur content of crude oil generally ranges anywhere from 0.0 to 3.5 percent (Energy Information Association (EIA), 2015). While not definitively set, crude oils with a sulfur content of less than 0.5 percent are known as "sweet" crude oils and crude oils with a sulfur content greater than one percent are known as "sour" crude oils (ICCT, 2011). Crude oils are generally categorized as follows in Table 2.5-1.

Refinery configurations, operating characteristics, and economics are unique to each location. Crude oil selection is based first and foremost on limitations of refinery configuration, and on oil characteristics which optimize production of desired products. Refineries blend crude oil in order to enable operations within the process unit limitations. If a crude oil cannot be blended to meet the crude property limitations of a specific refinery, it will not be purchased. Selection of crude oil blends is made considering the capabilities of all the refinery units, the quality and price of crude oil that is available, the market demand and price of specific products and product specifications (Lucas, 2000).

TABLE 2.5-1

Crude Oil Classes

Crude Oil Class	Property Range	
	Gravity (°API)	Sulfur (wt. %)
Light Sweet	35-60	0-0.5
Light Sour	35-60	>0.5
Medium Medium Sour	26-35	0-1.1
Medium Sour	26-35	>1.1
Heavy Sweet	10-26	0-1.1
Heavy Sour	10-26	>1.1

SOURCE: International Council on Clean Transportation (ICCT), 2011

The crude oils available in the marketplace at any given time provide a wide range of API gravities and sulfur content. Table 2.5-2 presents the spectrum of crude oils processed in the U.S. in 2011 (ICCT, 2013). Light, sweet crude oils are considered the highest quality and therefore are the most expensive (e.g., Brent or West Texas Intermediate). Heavy sour crude oils are the least expensive (e.g., Arab Heavy or Western Canadian Select) (EIA, 2015).

2.5.2 THE REFINING PROCESS

The first step in the refining process is to separate crude oil into components by taking advantage of the differing boiling points of the compounds contained in the crude oil using simple distillation in the crude unit. Compounds that boil within a certain boiling point range or cut point are considered fractions (Leffler, 2008). The lower the boiling point, the lighter the fraction, i.e., compounds that boil at less than 60 ^{o}F are the light gases fraction. Typically, heavy compounds boil between 500 and 1050 ^{o}F are the gas oil fraction. Common fractions include, from lightest to heaviest, light gases, naphthas, kerosene, distillate, gas oils, and residual oil. Different crude oils produce different percentages of the various fractions (see Figure 2-3). Figure 2-3 compares the fractions of a typical light crude oil (35° API) and a typical heavy crude oil (25° API) with the average demand profile for products in developed countries. As shown in Figure 2-3, both light and heavy crude oils produce more heavy oils than heavy oil products the market demands (shown in blue). Therefore, to produce the desired marketable products, additional processing besides simple distillation is needed. A simplified typical refinery process diagram is included in Figure 2-4 (ICCT, 2011).

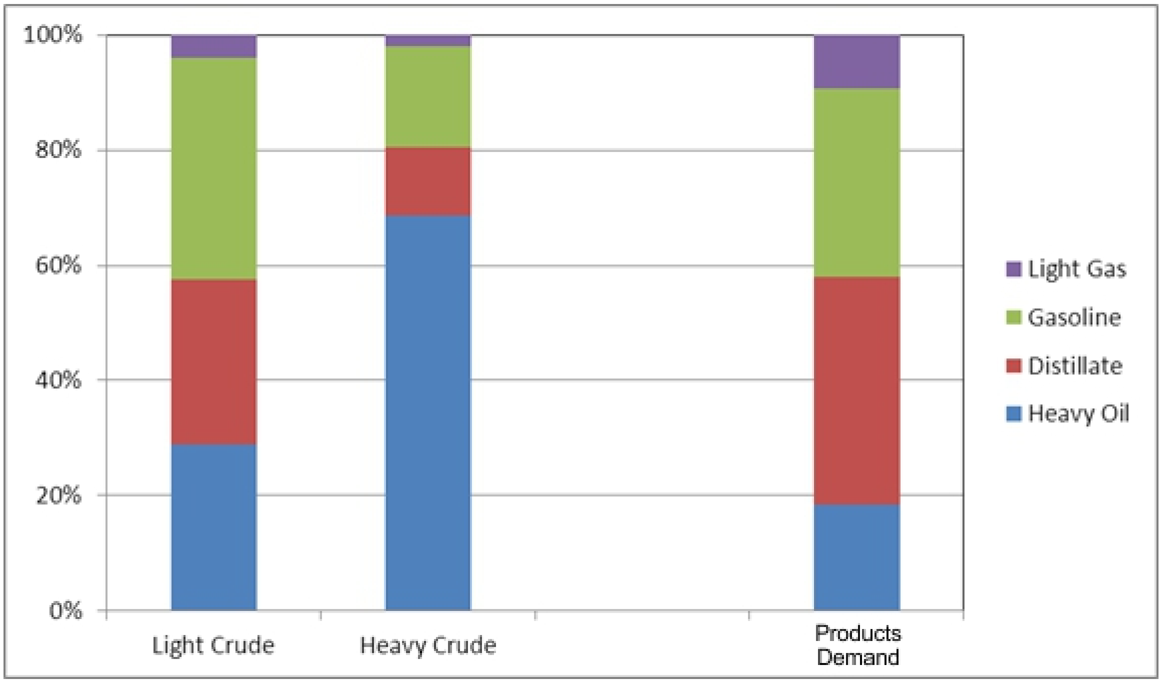
TABLE 2.5-2

U.S. Crude Oil Supply in 2011

Origin and Type of Crude Oil	Volume (1,000 bbl/day)[a]	API Gravity	Sulfur (wt %)
Domestic	5,897	35.0	0.72
Light, Tight Oil	187	47.0	0.11
Alaska	945	32.0	0.90
California	538	17.1	1.47
All Other	4,227	36.9	0.67
Canada	2,202	26.2	2.3
Conventional			
Light & Medium	588	36.1	0.73
Heavy	292	21.3	3.18
Oil Sands			
Light Synthetic	308	33.3	0.21
Heavy	1,014	20.3	3.52
Mexico	1,000	24.8	2.6
Light & Medium	247	37.4	1.05
Heavy	753	21.1	3.38
Atlantic Basin[b]	3,447	26.5	1.2
Light	975	39.9	0.15
Medium	561	30.8	0.32
Heavy	1,911	19.3	1.92
Rest of World	2,261	32.6	1.8
Light	332	39.2	0.65
Medium	1,866	31.9	2.09
Heavy	63	20.1	2.33

SOURCE: ICCT, 2013.
(a) 1,000 bbl/day = thousand barrels per day.
(b) Comprises Latin America, Caribbean, and West Africa, but excludes North Sea.

The crude unit is the "front end" of the refining process. After distillation in the crude unit, the resulting fractions or process streams are further refined and treated in various "process units" for blending into marketable products. To formulate products, some hydrocarbons in the crude oil need to be converted to different chemical compounds. Hydrocracking and fluid catalytic cracking units break or "crack" heavy fractions into lighter compounds. Other compounds require rearranging the molecular structure in units such as catalytic reformers, alkylation units, and isomerization units. Producing lighter fractions from heavier compounds allows a refinery to produce more high value products such as gasoline from heavier gas oils. Coking is a thermal cracking process used on the residual oil to convert the remaining heaviest compounds to lighter compounds (ICCT, 2011).



SOURCE: ICCT, 2011

FIGURE 2-3

TYPICAL NATURAL YIELDS OF LIGHT AND HEAVY CRUDE OIL

To meet product specifications, impurities in the crude oil, such as sulfur and nitrogen compounds and metals, must be removed. Hydrotreating units remove sulfur and nitrogen from process streams; sulfur in the form of hydrogen sulfide, and nitrogen in the form of ammonia, which are then converted into elemental sulfur and nitrogen in sulfur recovery units. Nitrogen, an inert gas, is emitted from the sulfur recovery unit. Metals remain in the residual oil that is fed to the Coker and is converted to coke. Elemental sulfur and coke are removed by the refining process as solid or molten liquid materials. Elemental sulfur and coke are products of refining with economic value that are sold and transported as a heated liquid known as molten sulfur and as solid coke.

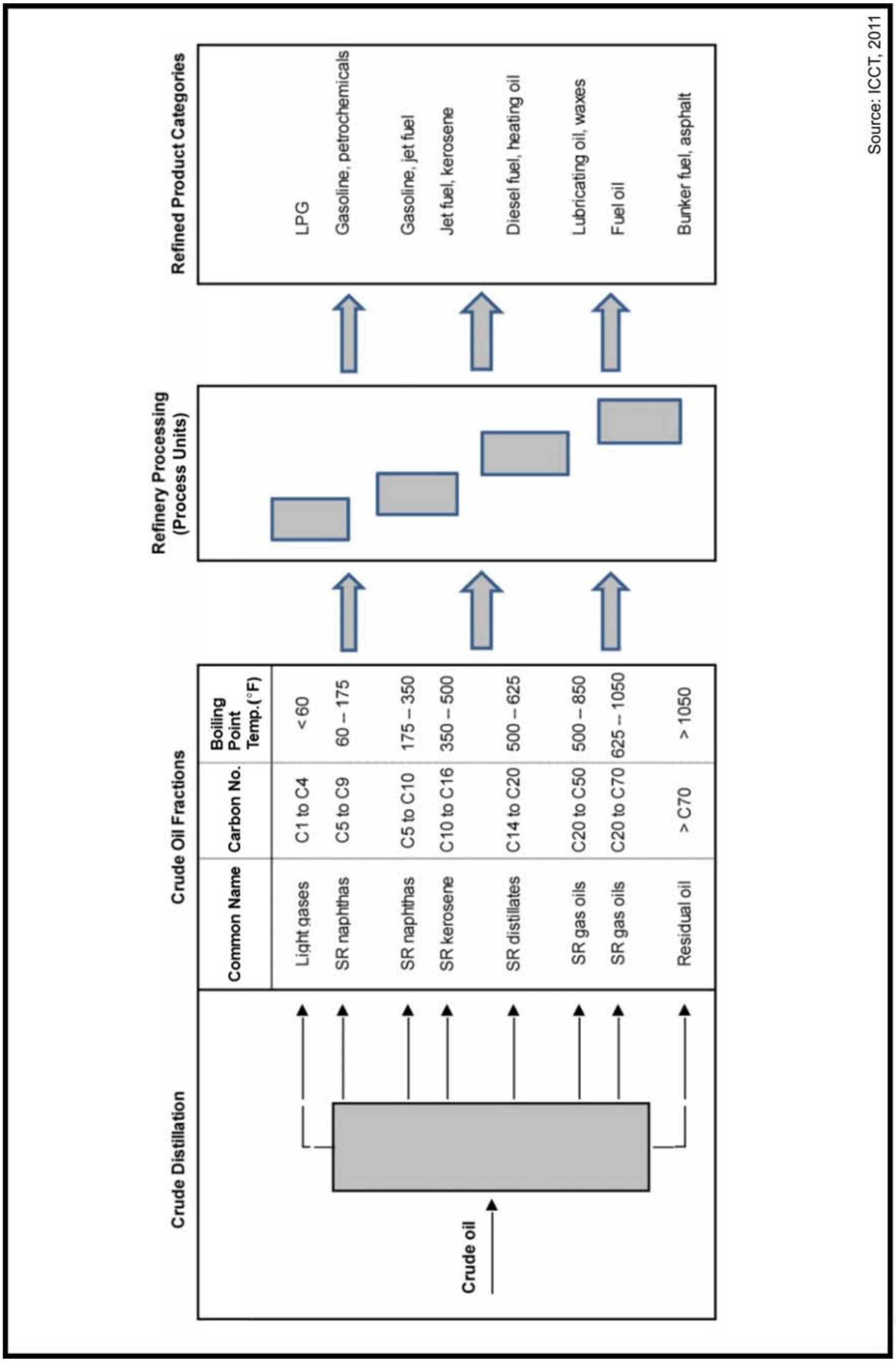


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FIGURE 2-4
SIMPLIFIED DIAGRAM OF THE REFINING PROCESS

Project No. 2844
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2.5.3 REFINERY OPTIMIZATION

The configuration of any refinery is unique, in terms of its overall capacity, the types of units employed, the technical capabilities, and the individual capacity of each unit (Lucas, 2000). The block flow diagram in Figure 2-5 reflects the complexity of a typical refinery. Several aspects of refining operations suggested by Figure 2-5 merit comment. Refineries produce dozens of refined products (ranging from very light, such as LPG, to very heavy, such as residual fuel oil). Operation of the various process units within their design limitations involves numerous decisions to optimize conversion of the selected crude oil blend into products. The operating parameters of the various process units in turn limit the properties of the crude oil blends that can be processed by a particular refinery configuration. These constraints include a limitation on the amount of crude oil that can be processed in any one day, the qualities of the crude oil blend that can be processed, and the combination of products that can be produced.

The complexity of refinery operations is such that they can be fully understood and optimized, in an economic sense, only through the use of refinery-wide mathematical models (ICCT, 2011). Because refinery operations are complex, virtually all refiners use the "linear programming" technique to plan refinery operations. The Linear Program model involves the use of a (proprietary) mathematical model to determine the most profitable or optimal operating strategy for a particular refinery. The model "inputs" include variables such as the configuration and constraints of the refinery in question, the crude oils available, market demand, product prices, and product specifications. The model "outputs" include the crude oils that should be purchased, the product slate that should be produced, the cut points, and the manner in which each intermediate process stream should be treated and blended.

2.5.4 THE TESORO LOS ANGELES REFINERY

The Tesoro Los Angeles Refinery consists of two adjacent operations: one in Carson (the Carson Operations) and the other in Wilmington (the Wilmington Operations) that are integrated to a degree. The Refinery receives its crude oil by pipeline and marine vessels and converts crude oil into finished products; including gasoline, jet fuel, diesel, LPG, petroleum coke, and sulfur. The Refinery produces CARB compliant gasoline and diesel used in California.

2.5.4.1 Crude Oil Processing

The Refinery consists of a variety of equipment, including: distillation columns, reactors, heaters, boilers, vessels, pumps, compressors, storage tanks and other ancillary equipment. Tesoro also operates Cogeneration Plants located within the Refinery property (Watson Cogen Facility at the Carson Operations and the Cogen Unit at the Wilmington Operations), and under separate permits, a Coke Calcining Plant in the Port of Long Beach, Marine Terminals within the Port of Long Beach and pipelines and other product distribution terminals within southern

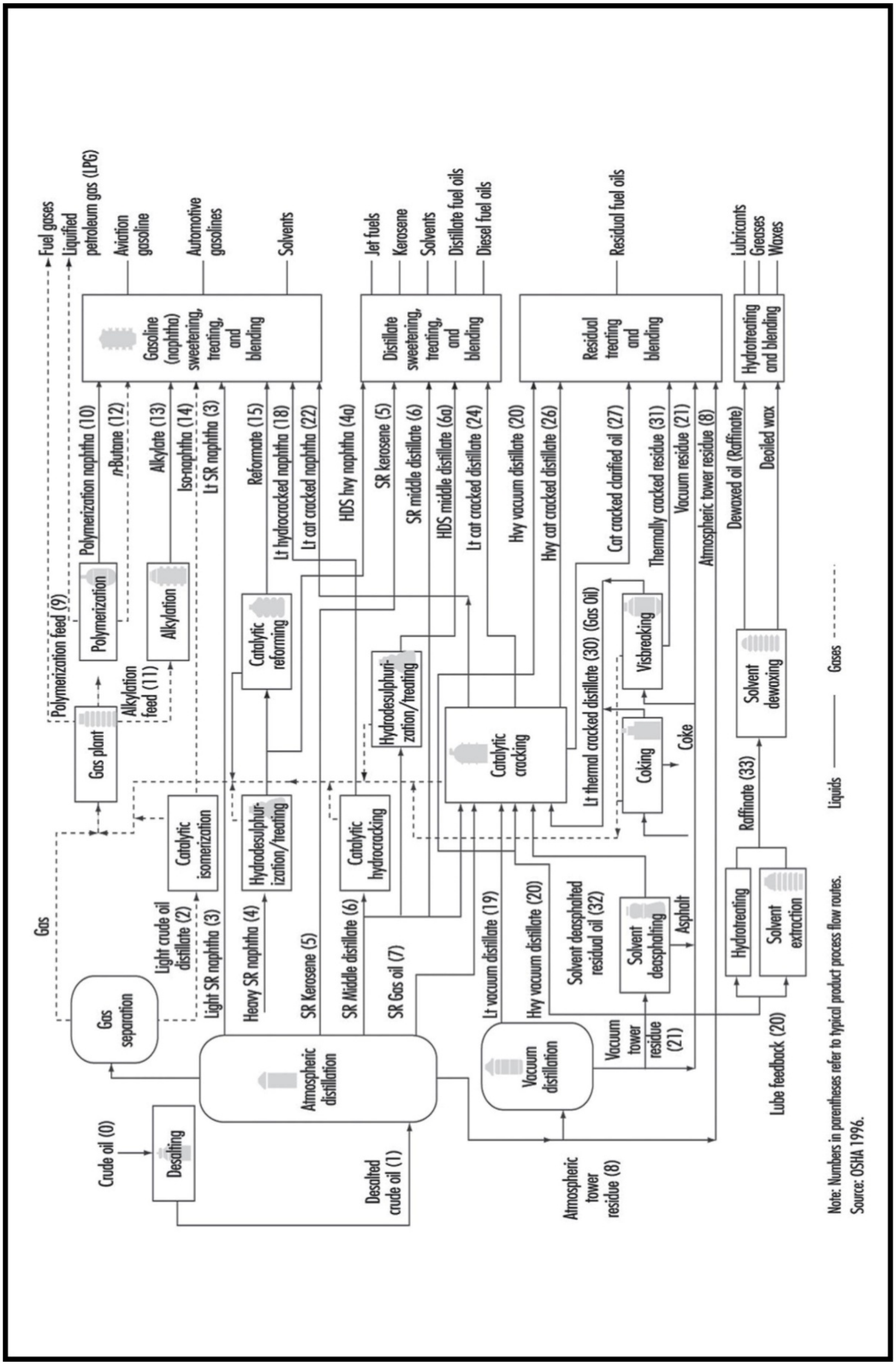

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FIGURE 2-5
EXAMPLE OF TYPICAL REFINERY FLOW DIAGRAM

Project No. 2844
N:\2844\Typical Operations (rev.1).cdr

California. The Refinery receives crude oil, intermediate feedstocks, and blending components via pipelines; many deliveries are brought into southern California via marine vessels. Pipelines are used to export the majority of the Refinery products: gasoline, jet fuel, and diesel. The Refinery uses rail transport to export and import LPG using an SCAQMD-permitted LPG loading/unloading rack. The Refinery uses truck transport to export gasoline, diesel, petroleum coke, sulfur, and LPG using SCAQMD-permitted truck racks.

Crude oils delivered to the Refinery are transferred into storage tanks within the Refinery that are either floating roof tanks or fixed roof/blanketed tanks venting to vapor recovery systems as required by U.S. EPA and SCAQMD rules. Crude oils are pumped or gravity fed to the Refinery processing units. Intermediate feedstocks are pumped to other Refinery processing units for further treating including “cracking" and "reforming.”

The Los Angeles Refinery currently purchases crude oil from all over the world. Crude oil is selected through Linear Program modeling and based on its suitability for processing in the Refinery. There are limitations on the types of crude oil that can be processed in the Refinery due to the design limitations and capacities of the processing units. The crude oil characteristics considered include sulfur and nitrogen content, gravity (or density), organic acid content, total acid number (TAN), the content of metals and other impurities, and cost. In 2014, the Los Angeles Refinery processed over 30 different types of crude oil from various regions worldwide including North and South America, the Middle East, and Africa. Crude oil that is purchased is blended to meet criteria specific to Carson or Wilmington Operations. Crude oil blends are selected to complement specific refinery configurations. For example, the Carson Operations have been designed to run primarily Alaska North Slope (ANS) crude oil, which is no longer readily available. Therefore, the Carson Operations blend crude oils to have properties similar to ANS crude oil.

The basic crude oil operating envelope, or acceptable ranges of several properties, for the Carson Operations is an API gravity range of 28 degrees to 35 degrees and sulfur content of 0.6 to 3.5 weight percent sulfur. The basic crude oil operating envelope for the Wilmington Operations Crude Unit is an API gravity range of 19 degrees to 37 degrees and sulfur content of 0.0 to 2.5 weight percent sulfur. The feed operating envelope for the Delayed Coker Unit is an API gravity of 9 degrees to 23 degrees and sulfur content of 0.8 to 3.5 weight percent sulfur (the feed to the Delayed Coker is a blend of crude oils and resid from processing units).

The first major unit in which crude oil is processed is the Crude Unit that separates the crude oil into different fractions. The Carson and Wilmington Operations each have a Crude Unit, FCCU and a Hydrocracker Unit that process heavier streams and convert them to lighter hydrocarbon streams. Hydrotreaters and Sulfur Recovery Units remove sulfur from process streams and convert the removed sulfur into elemental sulfur. Delayed Coker Units at both sites convert residual oil into petroleum coke and lighter process streams. The Alkylation, Reforming, and Isomerization Units change the shape of the hydrocarbon molecules in the gasoline range streams that are blended into gasoline.

The total crude oil rate capacity for the Los Angeles Refinery is 363,000 bbl/day. The crude oil rate for Wilmington Operations is primarily constrained by Crude Unit and Coker feed heater duty conditions described in the existing SCAQMD permit. Therefore, the Wilmington Operations is heat limited in its ability to process additional crude oil, which will be modified by the revision to the Heater H-100 permit. The Carson Operations crude rate is constrained by physical limitations of the equipment, including heater duty and pump/piping capacity limitations. In order to increase crude oil processing rate at Carson Operations, physical modifications to the heaters, pumps and piping would have to be made and the appropriate SCAQMD permits would need to be obtained. No such modifications are included as part of the proposed project.

The sulfur contained in crude oil that comes into the Refinery must also leave the Refinery, it cannot accumulate. There are limited possibilities for removing this sulfur from the Refinery. Most of the sulfur is removed in the form of elemental or liquid sulfur solution that has been recovered. Small amounts of sulfur remain in the refined products and coke that is produced and it can be emitted in the form of sulfur dioxide that is a by-product of burning small quantities of sulfur compounds in refinery fuel gas or sulfur plant tail gas. All of these removal outlets have limits defined by the following:

- The physical capacity of the sulfur plant and tail gas units;
- Regulatory sulfur limits on the refined products; and,
- Regulatory sulfur limits on the refinery fuel gas and sulfur plant tail gas. (Note: Refinery fuel gas is a blend of refinery gas used for fuel in refinery heaters and boilers and generated from the process units, LPG and natural gas. Sulfur plant tail gas is the residual gaseous effluent from the Claus sulfur recovery process that is further treated for sulfur removal in a tail gas treating unit and/or incinerator in order to meet stringent sulfur limits.)

Virtually all the sulfur that is contained in crude oil is removed from the Refinery via one of the above described outlets. Because there are strict regulatory limits or physical capacity limitations on downstream units, the range of sulfur in crude oil that can be processed by the Refinery is limited. The Refinery operates at or near these limits today, and there is limited capability for processing higher sulfur crude oil.

The gravity or heaviness of the crude oils that can be processed is set by equipment limits in the Crude Unit itself. There are limitations to how light or how heavy the crude oil slate can be for a given crude unit design.

If either the Carson Operations or Wilmington Operations attempted to run a lighter crude oil slate, it would be restricted by hydraulic limits or “lift” in the Crude Unit. The design of the Crude Unit distillation columns or towers has a limit on its capacity to “lift” the lighter portion of the crude oil. If the limit is exceeded, there is a phenomenon known as “flooding” that occurs due to high vapor velocities inside the tower. When flooding occurs, the ability of the tower to separate components, which is the primary function of the tower, is dramatically compromised. The operating limits on the Refinery's Crude towers are provided in Table 2.5-3.

TABLE 2.5-3

Tesoro Los Angeles Refinery Crude Unit Limitations

Unit	Tower Lift Limit (barrels per hour)	Comments
Carson No.1 Crude Unit	90,000	Carson has reached this limit when running light crude oils.
Carson No. 2 Crude Unit	37,000	No. 2 Crude Unit operates at its feed heater limit of 33,000 barrels per hour because the tower runs a heavier crude oil slate.
Carson No. 4 Crude Unit	20,000	Carson has reached this limit when running light crude oils.
Wilmington Crude Unit	16,000	Wilmington has reached this limit when running light crude oils.

Relieving these constraints would require modifications to the Crude tower internals, or replacement of the Crude towers themselves. If new Crude towers were to be installed, the entire overhead system of pipes, heat exchangers, accumulator vessels and naphtha pumps would also have to be replaced. Equipment modifications of this nature would require Tesoro to submit applications to modify the Refinery Title V operating permit with the SCAQMD. No such modifications to the Crude Unit are included as part of the proposed project.

If the Carson or Wilmington Operations were to run heavier crude oils, the amount of crude oil that could be processed at both Operations would be limited by the downstream Coker Units. The heavy material from the Crude/Vacuum process, called residuum or resid, leaves the Vacuum tower bottom and is fed to the Coker Unit. The Coker Unit is a semi batch process where the resid is heated and fed to coke drums. Some of the heated resid cracks and evolves lighter material while in the drum; the material that does not crack remains in the drum as coke. The drum eventually gets filled up with petroleum coke and the feed is diverted to a second drum. The first drum is cooled, depressured, emptied, and is then ready for the next cycle. The limit in the Coker Unit is a combination of the coke drum size and the cycle time. The "heaviness" of the crude oil the Refinery can process is set by the capacity of the Coker Unit. To run a heavier crude oil blend than is currently run at the Refinery either the Coker Unit cycle time would have to be reduced or new equipment (i.e. coke drums) would have to be built. As cycle time is reduced, resid feed rates must also be reduced, this results in a heaviness limit for the crude oil slate. The Carson Coker Unit (Cokers Nos. 1 and 2 combined) has achieved a peak capacity of approximately 67,230 bbl/day and currently operates near this rate on a peak day. The Wilmington Coker Unit has achieved a peak capacity of approximately 44,000 bbl/day and currently operates near this rate on a peak day. The 2012-2013 annual average rates through the Coker Units were 44,700 bbl/day for Carson Operations and 36,950 bbl/day for Wilmington

Operations. There is a limit to the amount of coke that can be processed within the current cycle time. Both Carson and Wilmington Operations modifications to relieve these limits would require new larger coke drums. Equipment modifications of this nature would require Tesoro to submit applications to modify the Refinery Title V operating permit with the SCAQMD. No such modifications to the coke drums at the Coker Units are included as part of the proposed project.

The Coker Unit at Carson includes one train that produces fuel grade coke and another that produces anode grade coke. The limits on the fuel grade side include coke drum capacity and limits on the Coker Unit blowdown system. Relieving these constraints would involve building new coke drums and replacing air coolers, condensers and pressure relief devices. Equipment modifications of this nature would require Tesoro to submit applications to modify the Refinery Title V operating permit with the SCAQMD. No such modifications to the Coker Units are included as part of the proposed project.

As described above, Tesoro has a number of limitations on the sulfur content and API gravity on the crude oil blend that the Refinery can process. For example, a heavy Canadian crude oil, like Cold Lake, exceeds the sulfur content and API gravity of a crude oil that can be run at the Tesoro Los Angeles Refinery. Cold Lake crude oil contains approximately 3.7 percent (by weight) sulfur. In order to run Cold Lake crude oil, it must be blended with other crude oils. Further, Cold Lake crude oil has a high TAN. The Refinery would exceed metallurgy limits (i.e. exceed industry practice for acceptable corrosion rates) if it were to run too high a percentage of Cold Lake crude oil due to its high TAN. Thus, the Refinery is limited in how much heavy and sour crude oils, such as Cold Lake, can be used in the blend. The Refinery would continue to be subject to these same constraints if the proposed project is approved and implemented.

2.5.4.2 Crude Oil Feedstocks

Tesoro can choose from a variety of available crude oils within acceptable sulfur content and API gravity parameters at any given time for the Carson Operations and the Wilmington Operations. In the last several years, Tesoro has purchased a variety of crude oils ranging from light sweet to heavy sour. Tesoro’s crude oil selection is guided by analysis performed utilizing a proprietary Refinery Linear Program model. The Linear Program model analysis takes into account many factors including the configuration of the Refinery, quality of the available crude oils that can be blended to complement the Refinery’s configuration, prices for each crude oil, estimated demand and prices for specific products, and specifications of the products to be produced. Some of these factors are constantly changing, therefore Tesoro’s crude oil and feedstock charge changes as well.

Figure 2-6 shows the optimal crude oil slates selected monthly by the Linear Program Model for 2012 – 2014 for the Wilmington Operations. Figure 2-7 shows the optimal crude oil slates selected monthly by the Linear Program Model for 2012 – 2014 for the Carson Operation. In selecting the monthly optimal crude oil slates, the Linear Program Model considers market forces, such as crude oil prices and availabilities, and processing constraints, such as unit turnarounds. There is also an economic balance that must be achieved. While certain heavier crude oils may be less expensive to purchase, they would produce more residuals, or low value coke, and less light, higher value products. As explained above, the Refinery is already operating the coker units at capacity.

Tesoro does not process all the crude oils individually as they are delivered to the Refinery. Based on the Refinery's unique configuration, Tesoro must blend different crude oils into a specific range of API gravity and sulfur content before they can be processed. Tesoro uses the proprietary Linear Program model to determine whether the crude oil can be processed by itself or blended with other available crude oil run. Ultimately, the Linear Program model will determine whether a crude oil can be processed individually or when blended with other available crudes. If a specific crude oil cannot be run by itself or within a blend, it will not be purchased.

2.5.4.3 Refinery Expert Independent Evaluation of the Proposed Project

The District retained refinery expert, Dr. Stephen McGovern, PE, to independently review the proposed project, including the crude oil processing capabilities of the refinery. Dr. McGovern provided an independent review of the information related to crude oil processing and verified the operating limitations described in Sections 2.5.4.1 and 2.5.4.2. The conclusions presented in Dr. McGovern's report are summarized as follows:

1. The LARIC project [proposed project] will not change the modes by which Tesoro receives crude oil into the refinery complex. As such, the LARIC project [proposed project] will not allow Tesoro to access crudes that are not currently available to the refinery. . . .

2. Certain aspects of the Tesoro Los Angeles Refinery's processing configuration limit the instantaneous quality of the crude mix that can be processed. These aspects of the refinery processing configuration will not be changed significantly by this project. . . .

3. Although some of the units in the Tesoro Los Angeles Refinery are being modified and new units are being added, the slate of crude oils available to the refinery will not change and the minor changes in average crude oil quality that might result would not cause an increase in operating emissions of criteria air pollutants, toxic air contaminants or GHG emissions after the mitigation methods that are part of the LARIC [proposed project] are applied.

4. The changes being made as a result of this project will not allow the refinery to process a different slate of crude oil. As such, there will be no crude oil changes that make the refinery more prone to upset or potential leaks of hazardous or toxic substances. . . .

The completed Dr. McGovern report is provided in Appendix F.

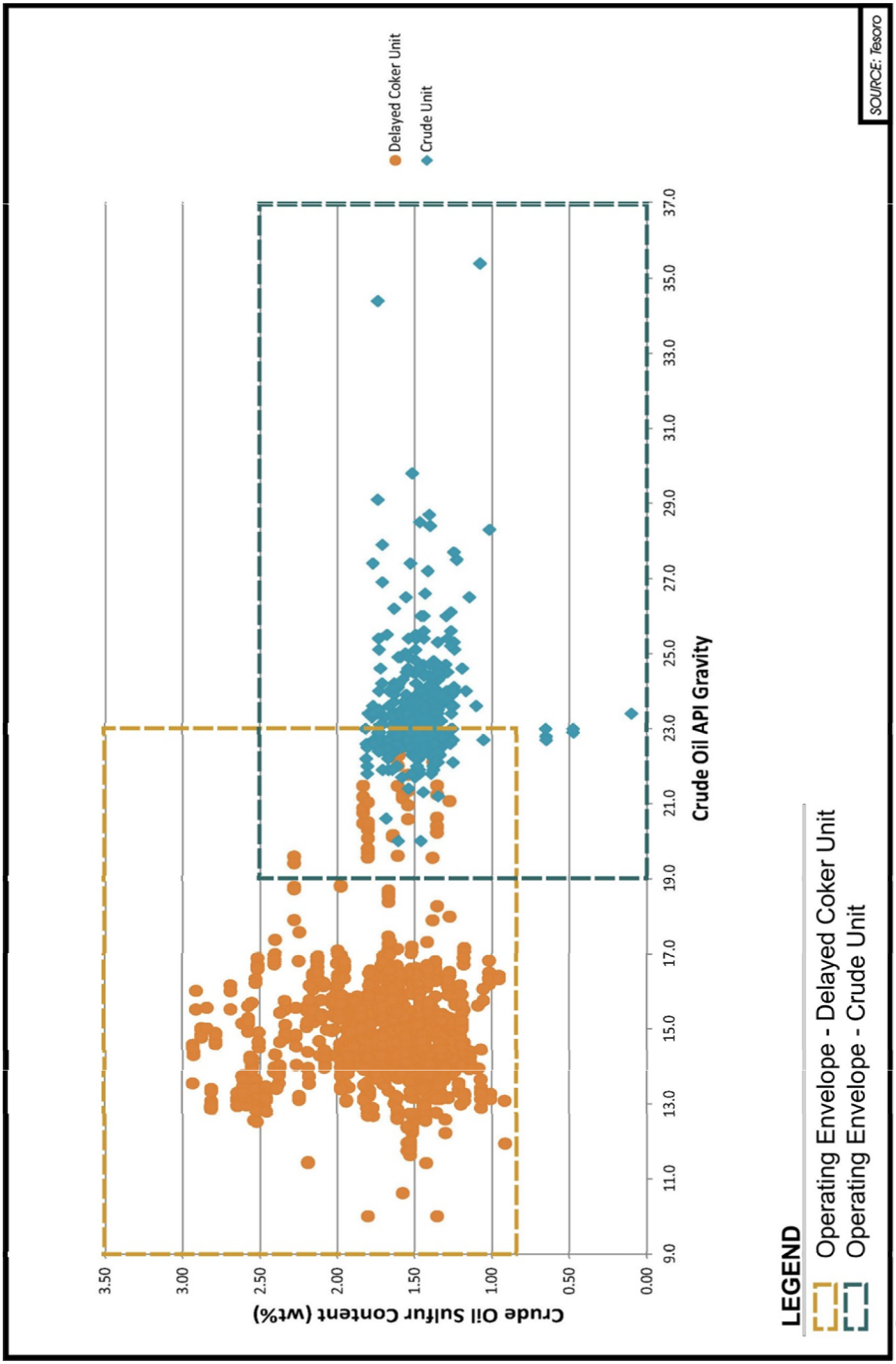

FIGURE 2-6
OPTIMAL CRUDE OIL SLATES
WILMINGTON OPERATIONS
TESORO LOS ANGELES REFINERY

Project No. 2844
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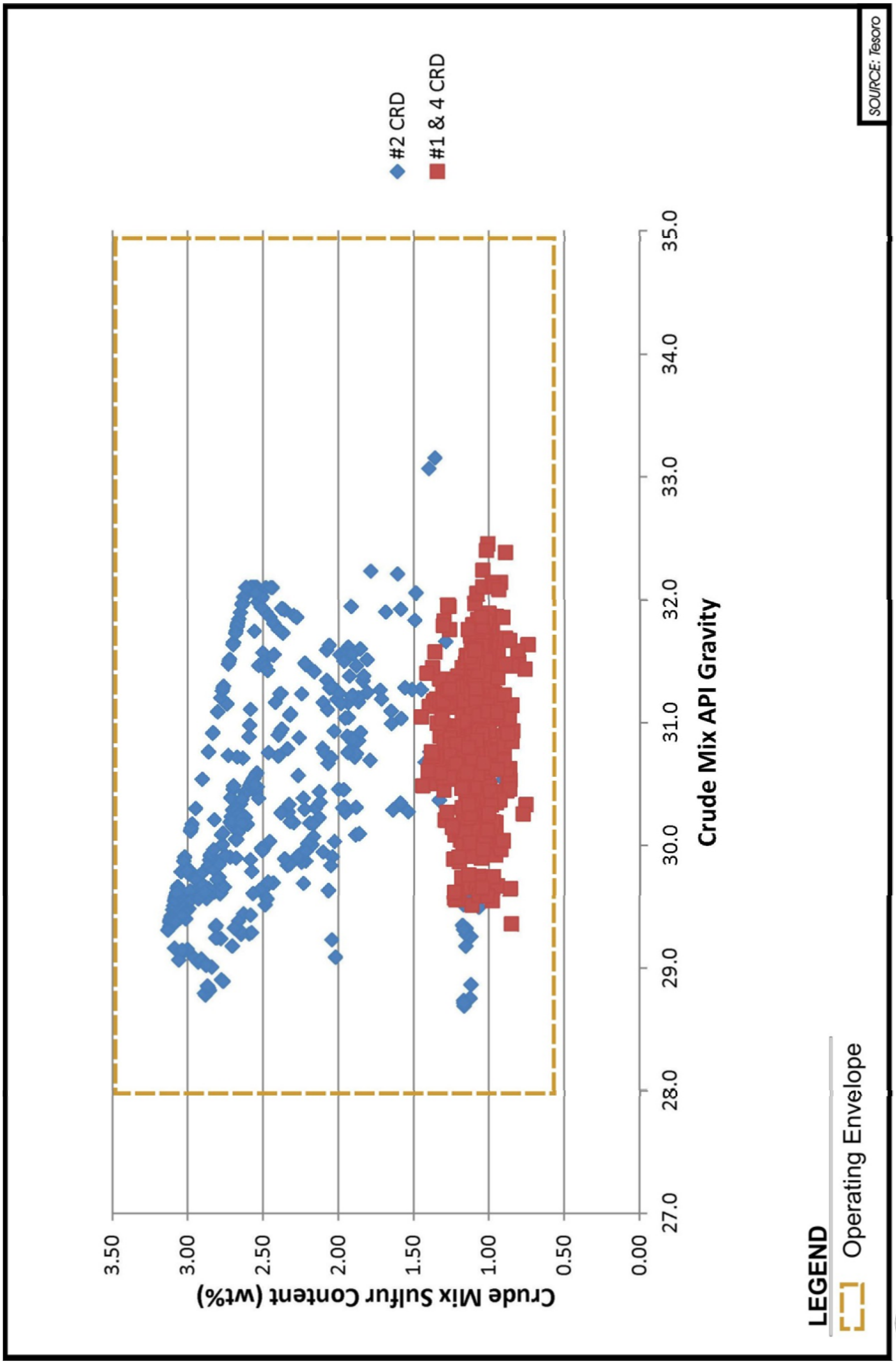

FIGURE 2-7
OPTIMAL CRUDE OIL SLATES
CARSON OPERATIONS
TESORO LOS ANGELES REFINERY

Project No. 2844
N:\2844\Crude Mix Carson (rev.2).cdr

2.6 TESORO REFINERY EXISTING OPERATIONS

Currently, the Wilmington and Carson Operations function as two separate and distinct facilities with some limited integration. Figure 2-8 provides a simplified block flow diagram showing the major processing units for the existing Carson and Wilmington Operations.

2.6.1 WILMINGTON OPERATIONS

Petroleum operations began at the Wilmington Operations in 1923. Tesoro acquired the Wilmington Operations in 2007. Crude oil for the Wilmington Operations is delivered via ship using the pipeline from the Tesoro Marine Terminal at the Port of Long Beach Berths 84A and 86. Crude oil, including California crude oils, can also be delivered via pipeline from other onshore locations. No crude oil is transported to the Wilmington Operations via rail and there are no facilities to receive crude oil deliveries by railcar. The Wilmington Operations currently utilize 20 storage tanks to store crude oil and other heavy petroleum liquids (18 have a capacity of 80,000 bbl and two have a capacity of 125,000 bbl). Crude oil is processed in the Crude Unit where it is heated and distilled into various hydrocarbon components, which are further processed in downstream Wilmington Operations units. The Wilmington Operations also receive, process, and transport other refined petroleum products (crude oil not included) to and from the Wilmington Operations by ship, truck, and railcar. These petroleum products include residuum, gas oil, diesel, gasoline, naphtha, transmix, and LPG.

2.6.2 CARSON OPERATIONS

Petroleum operations began at the Carson Operations in 1923. Tesoro acquired the Refinery in 2013. Crude oil for Carson Operations is unloaded from tankers at Berth 121 or T-2 Terminals located in the Port of Long Beach and then transferred via pipeline and stored at Port of Long Beach Terminals or the Carson Crude Terminal. No crude oil is transported to the Carson Operations via rail and there are no facilities to receive crude oil deliveries by railcar. Crude oil is sent via pipeline from the marine terminals to Carson Operations for further storage in any of nine Refinery crude oil storage tanks and then processed in the Crude Units. Crude oil, including California crude oil, can also be delivered via pipeline from other onshore locations. The Carson Operations storage tanks that store crude oil range from 80,000 to 460,000 bbl capacity. The crude oil from the Carson Operations storage tanks is then transferred to the Crude Units. Crude oil is processed in Crude Units #1, #2 and #4 where it is heated and distilled into various hydrocarbon components which are further processed in downstream Carson Operations units. The Carson Operations also receive, process, and transport other refined petroleum products (crude oil not included) to and from the Carson Operations by ship, truck, and railcar. These petroleum products include residuum, gas oil, diesel, gasoline, naphtha, and LPG. Additionally, the Carson Operations have the Watson Cogen Facility that currently produces excess power, beyond the Carson Operations' needs, and sells the excess power to Southern California Edison. The Coke Calcining Plant is not involved in the proposed project.

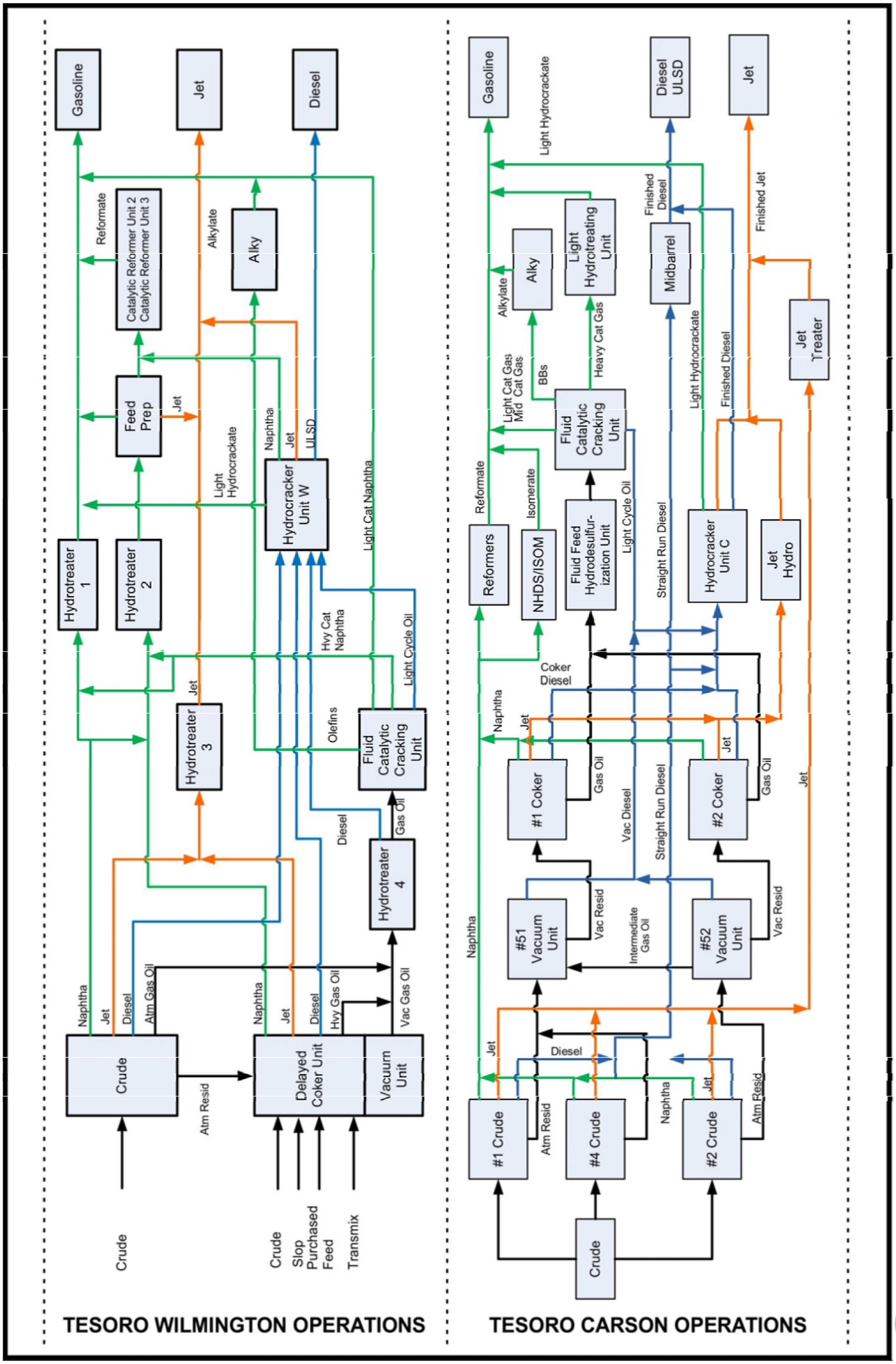

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FIGURE 2-8
EXISTING BLOCK FLOW DIAGRAM
TESORO LOS ANGELES REFINERY

Project No. 2844
N:\2844\Block Flow Diagrams\Existing Block Flow (rev.6).cdr

2.6.3 TESORO LOS ANGELES REFINERY

The Tesoro Los Angeles Refinery consists of two adjacent facilities, Carson Operations and Wilmington Operations, that are managed as one Refinery. The Carson and Wilmington Operations have in the past and continue to produce a variety of products including unleaded gasoline, jet fuel, diesel fuel, fuel oil, petroleum gases, petroleum coke and sulfur. The Carson Operations also produces high purity propylene, used as feedstock to the adjacent Ineos Polypropylene Plant, and calcined coke. Elemental sulfur and petroleum coke are produced as by-products of the refining process at both the Carson and Wilmington Operations. Major processing units at both the Carson and Wilmington Operations include the Crude Units, the Vacuum Units, the Delayed Coker Units, hydrotreating units, reforming units, the FCCUs, the Alkylation Unit, hydrogen plants, the Sulfur Recovery Plants, and the Cogeneration Plants. The major differences between the Carson and Wilmington Operations are that the Carson Operations is a larger operation with three crude, two vacuum, and two coker units whereas the Wilmington Operations only has one crude, one vacuum, and one coker unit.

2.6.4 CURRENT LOS ANGELES REFINERY INTEGRATION

Currently Carson and Wilmington Operations are connected via Tesoro and third party pipelines that enable the transfer of a limited amount of intermediate and finished products between the two facilities. The Refinery optimizes crude oil and other refinery feedstock processing to produce the mixture of refined products that are marketed from the Tesoro Los Angeles Refinery. Unit turnarounds are aligned between the Carson and Wilmington Operations to minimize economic and local area impacts from process unit shutdowns and reduced production during turnarounds. For example, if Carson Operations is planning a major crude, vacuum, coker unit turnaround, the plan would ensure that Wilmington Operations does not plan a turnaround of those same units simultaneously. Hydrogen use is balanced and managed across the Los Angeles Refinery for hydrotreating purposes and output of clean fuel products. Crude oil, intermediate feedstocks and products are transferred between Carson and Wilmington Operations via pipeline, as necessary, to optimize Refinery production to meet market demand. The staffs of the Carson and Wilmington Operations have been merged and contractors' staff has been integrated to serve the combined operations.

2.6.5 MARINE TERMINALS ASSOCIATED WITH LOS ANGELES REFINERY

The Refinery receives crude oil from ships which unload at three marine terminals operated by Tesoro Logistics Operations, LLC (Tesoro Logistics) in the Port of Long Beach (POLB). The crude oil unloaded at the marine terminals is then piped to the Refinery for processing. The three marine oil terminals are: Marine Terminal 2 (T2) located at 1300 Pier B Street and includes Berths 76-78; the Long Beach Terminal, located at 820 Carrack Avenue and includes Berths 84-87; and Berth 121 (also known as Marine Terminal 1) located at 620 Pier T Avenue (see Figure 2-9).

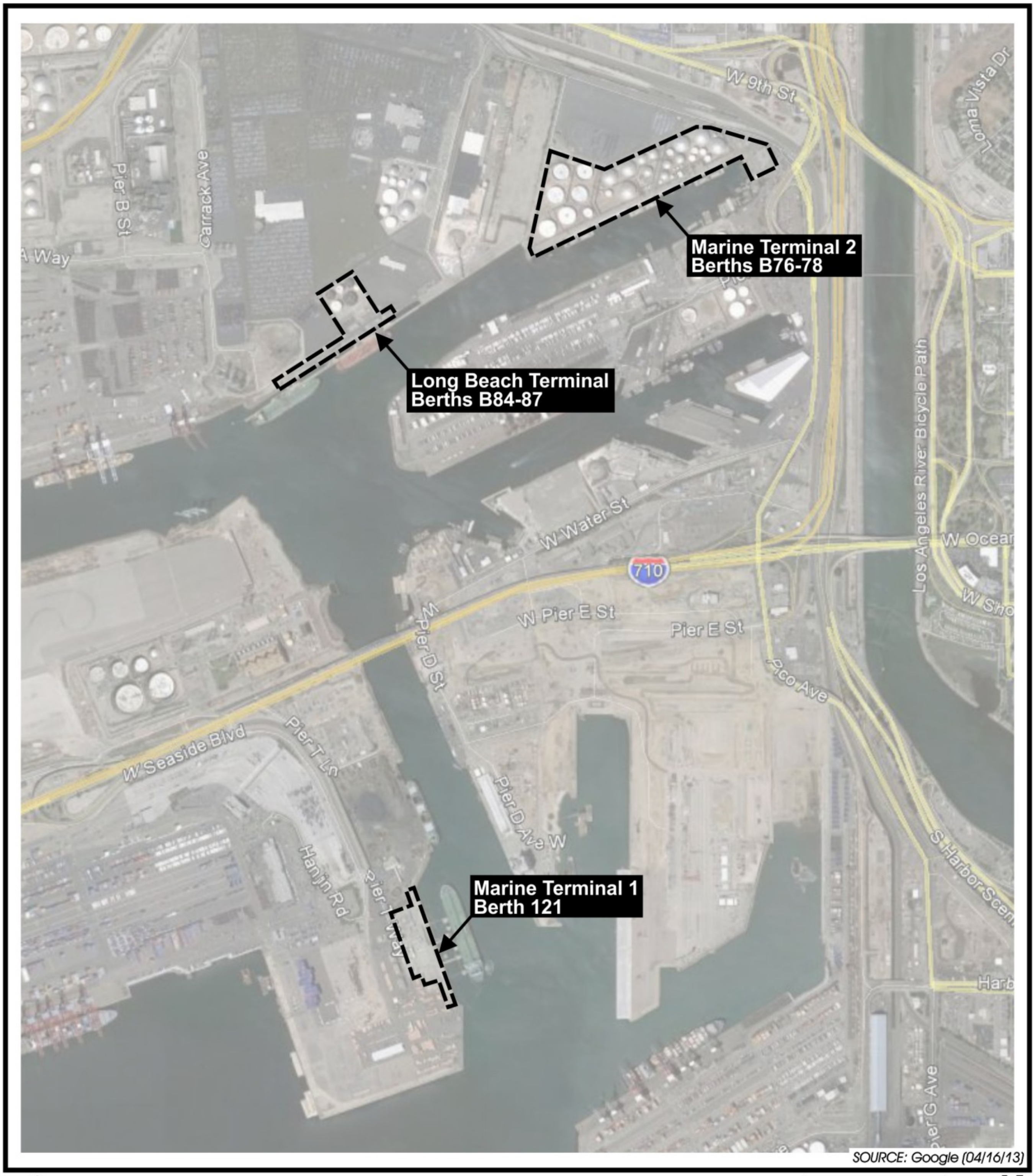

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FIGURE 2-9
MARINE TERMINALS ASSOCIATED WITH
TESORO LOS ANGELES REFINERY

Project No. 2844

N:\2844\Harbor Berth Map\Harbor Berth Map (rev.1).cdr

Marine Terminal 2 encompasses 18 acres, with a berth length of 2,200 feet. The wharf height at this berth is 14.4 feet, with a design water depth of 46 feet. The marine terminal includes a tank farm containing 34 above ground storage tanks with a total storage capacity of 1,800,000 barrels and has several pipeline connections, with loading arms capable of loading rates between 10,000 to 15,000 barrels per hour of various petroleum products and crude oils. Three vessels can be loaded or discharged simultaneously.

The Long Beach Terminal encompasses 11 acres, with a berth length of 1,980 feet. The wharf height at this berth is 16.8 feet, with a design water depth of 52 feet. The marine terminal includes a tank farm containing six above ground storage tanks with a total storage capacity of 245,000 barrels. Products unloaded at this terminal include crude oil, petroleum products and bunker fuel. The terminal has a 24-inch pipeline that connects into storage tanks at the Wilmington Refinery with a discharge capacity of 32,000 barrels per hour. Two vessels can be loaded or discharged simultaneously.

Marine Terminal 1 encompasses six acres, with a berth length of 1,140 feet. The wharf height at this berth is 22.4 feet, with a design water depth of 76 feet. The terminal has 42-inch and 24-inch pipelines, but does not contain any on-site storage capability. Only crude oil is unloaded at this terminal and, because there is no on-site storage, the crude oil is piped directly to the Carson Crude Terminal located near the Carson Operations. The terminal also connects to other storage facilities in the vicinity including Terminal 2. The terminal can accommodate very large crude carriers (VLCCs) that can carry up to two million barrels of crude oil. Only one vessel can be unloaded at a time and discharge rates can be up to 80,000 barrels per hour.

The proposed project does not include any physical or operational changes to the existing marine terminals. Additionally, no changes to the pipelines connecting the marine terminal to the Refinery are planned as a result of the proposed project.

2.7 PROPOSED PROJECT

The crude oil and feedstock processing capability at the integrated Refinery will increase approximately two percent or 6,000 bbl/day as a result of the proposed project due to a revision of the described duty of the Wilmington Operations Coker fresh feed heater (Heater H-100) in the existing permit to conform with SCAQMD and industry standards. Please see Section 2.7.1.3 for more information. Crude oil throughput of the Refinery can only increase by a relatively small amount unless other modifications are made to the units that initially process the crude oil, such as the Crude Units or the Delayed Coker Unit as described above in Section 2.5.4.1. Except for the above-described permit revision, no other modifications to the Crude Units or Delayed Coker Units to increase throughput capacity are included as part of the proposed project; therefore, no other increase in crude capacity will occur.

The Carson and Wilmington Operations currently obtain crude oil and feedstock from a variety of world-wide sources; in general, these sources are not expected to change as a result of the proposed project. Feedstocks include, but are not limited to, intermediate gas oil, transmix (a mixture of pipeline products; such as gasoline, jet, and diesel) and internally recycled oil.

Modifications to various units at the Carson and Wilmington Operations will be made to recover diesel and jet fuel boiling point range material, also known as distillate, from gas oil that is currently fed to the FCCUs at both Wilmington and Carson Operations. This will enable the remaining heavier gas oil feed from the Wilmington Operations FCCU to be diverted to the Carson Operations FCCU, while maintaining the same overall level of transportation fuels production. In addition, facilities will be added to remove impurities such as sulfur, nitrogen compounds, and organic acids from distillates in order to make on-specification products. The various Refinery modifications will be designed so that the combined Refinery operates within the existing capacity of the SRPs. Following project completion, when the diesel and jet range material are recovered and the remaining gas oil feed is diverted to the Carson Operations FCCU, the FCCU at Wilmington Operations will be shut down and the Refinery will be integrated as one operating Refinery. Figure 2-10 shows a block flow diagram of the integrated Refinery operations following the proposed project. Simplified block flow diagrams highlighting the production of diesel fuel, jet fuel, and gasoline are shown in Figures 2-11, 2-12, and 2-13, respectively. Figures 2-11 through 2-13 show additional detail on how diesel, jet and gasoline streams will be affected by the proposed-project. In order to maintain the same overall levels of transportation fuels production from the Refinery, the following general categories of Refinery modifications are planned: (1) Distillate recovery and upgrade; (2) Tier 3 gasoline compliance; and, (3) Gasoline production flexibility (e.g., maintain gasoline production capability following shutdown of the Wilmington Operations FCCU). Sections 2.7.1 and 2.7.2 below describe in more detail the various project elements that will be implemented to achieve these and the other project objectives. The following subsections describe in more detail proposed project modifications and new equipment at both the Wilmington and Carson Operations.

2.7.1 WILMINGTON OPERATIONS

The proposed project includes several process modifications to improve efficiency and achieve integration that are essential to enable shutting down the Wilmington Operations FCCU, which is expected to substantially reduce emissions at the integrated Refinery. Reconfiguring the combined Refinery complex is expected to improve the gasoline to distillate production ratio and is anticipated to result in minor increases in air pollutant emissions from some units. However, the net effect on overall emissions from the proposed project is expected to be overall Refinery emissions reductions, primarily associated with process modifications to improved efficiency and integration, enabling the shutdown of the Wilmington Operations FCCU, as well as shutdown or reduced operations of other equipment at the Refinery. Additionally, equipment production efficiency and heat recovery will be optimized for new and modified units, as specified in the following discussions, to further reduce overall Refinery emissions and optimize energy utilization. Proposed new equipment and modifications to existing equipment for the Wilmington Operations are shown in Figure 2-14 and are described further in the following subsections.

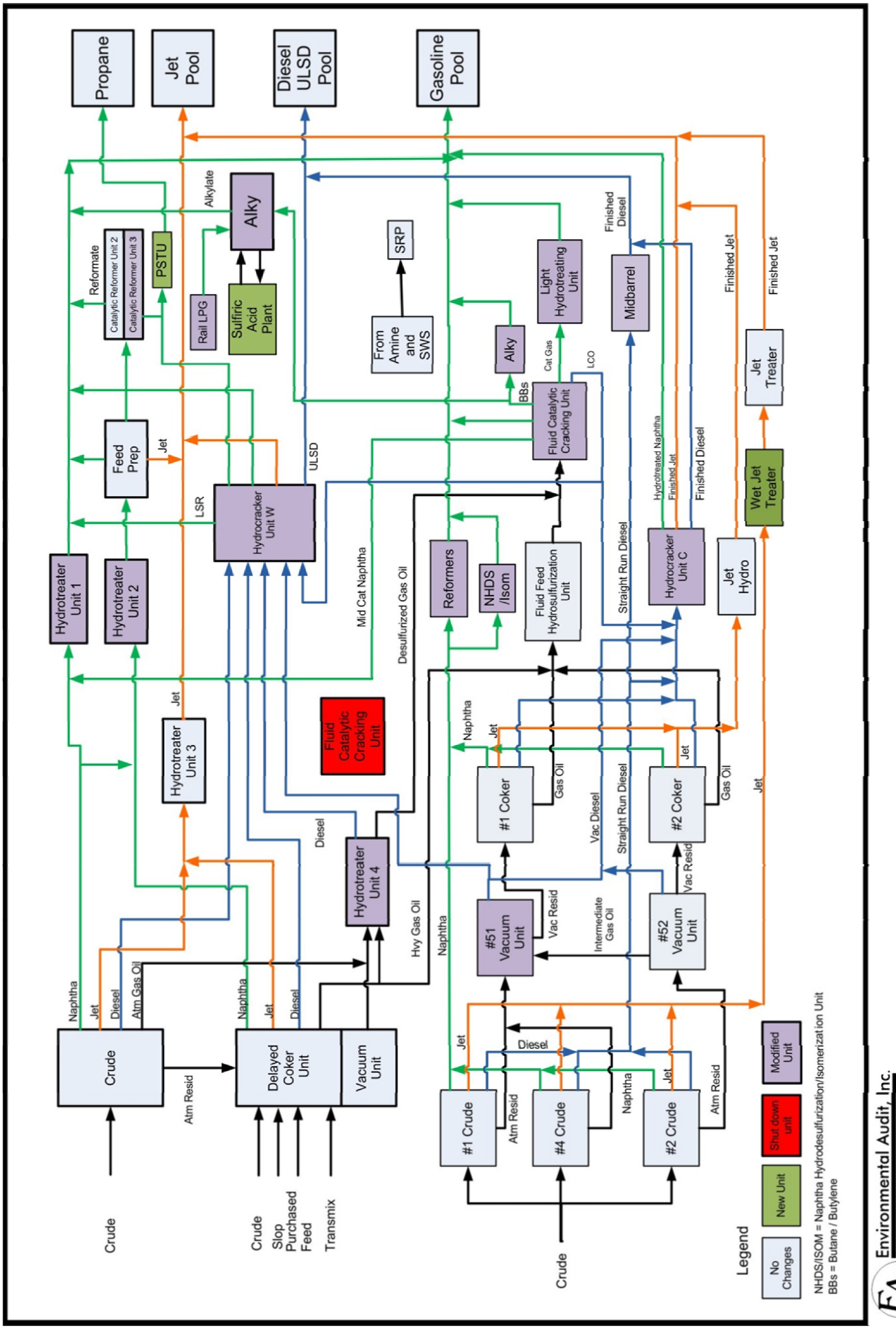

FIGURE 2-10
PROPOSED BLOCK FLOW DIAGRAM
TESORO LOS ANGELES REFINERY

Project No. 2844
N:\2844\Block Flow Diagrams\Proposed Block Flow (rev.11).cdr

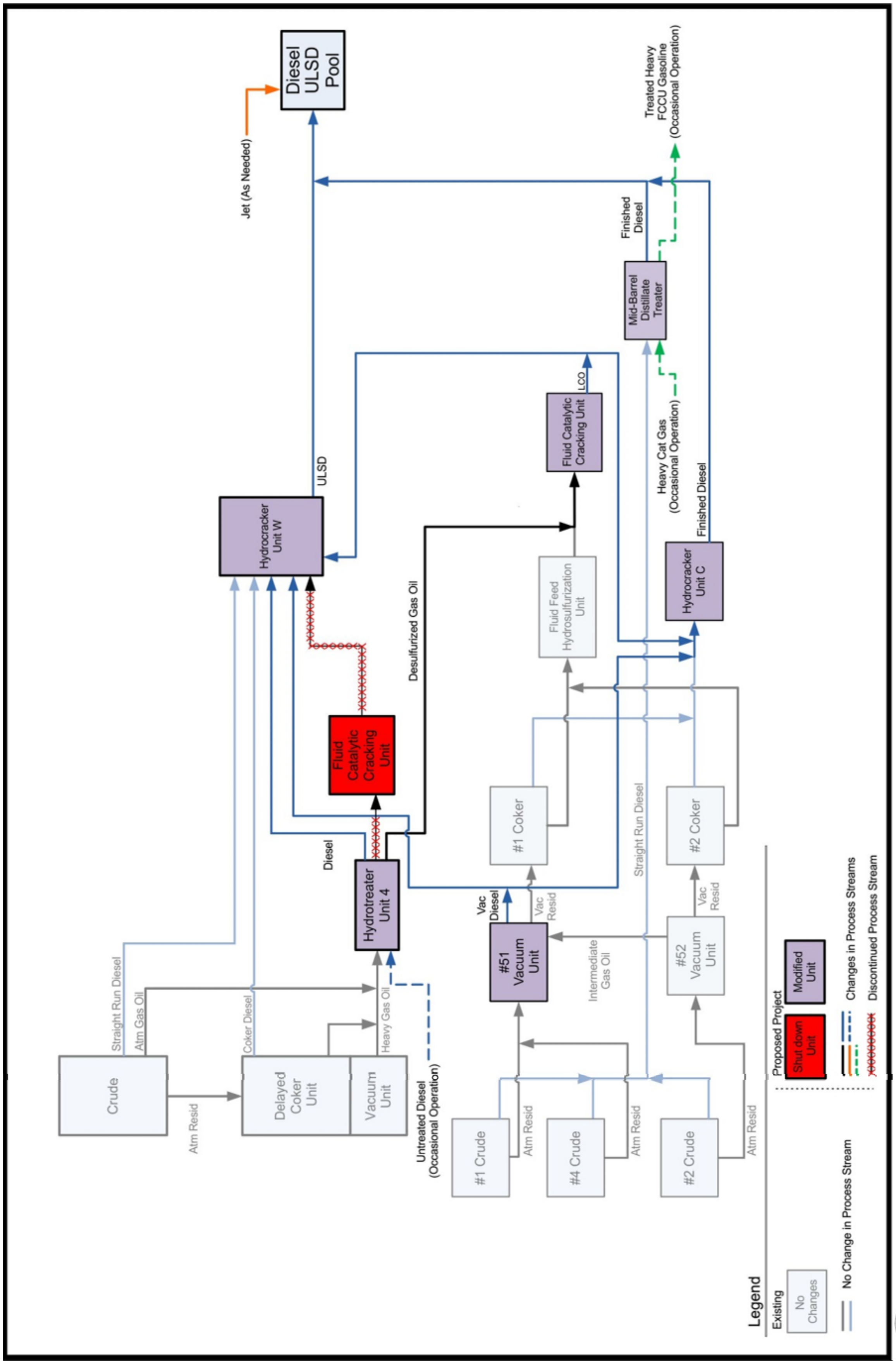

FIGURE 2-11
SIMPLIFIED DIESEL FUEL PRODUCTION BLOCK FLOW DIAGRAM
WITH PROPOSED PROJECT EFFECTS DEPICTED
TESORO LOS ANGELES REFINERY

Project No. 2844
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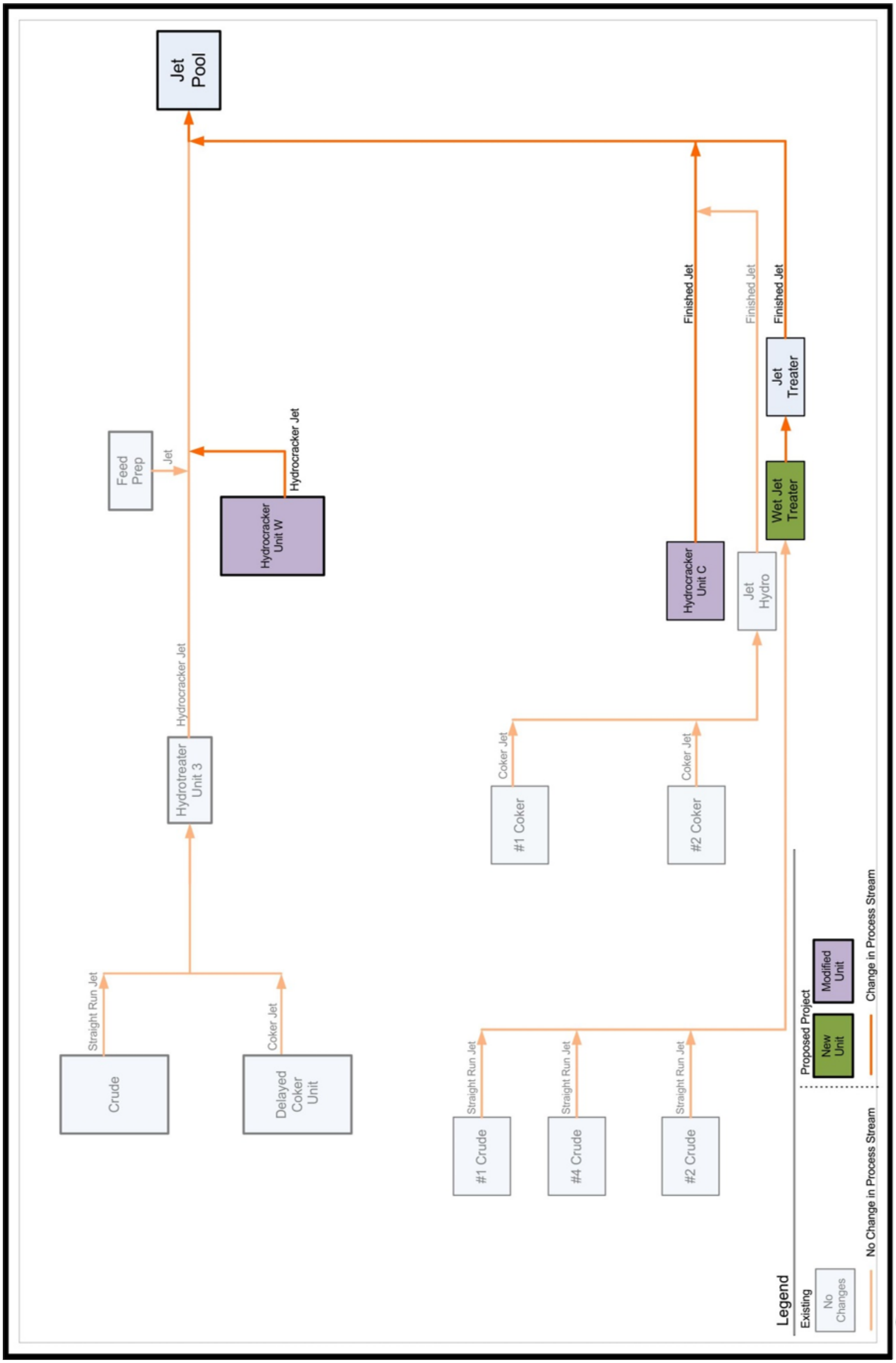

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FIGURE 2-12
SIMPLIFIED JET FUEL PRODUCTION BLOCK FLOW DIAGRAM
WITH PROPOSED PROJECT EFFECTS DEPICTED
TESORO LOS ANGELES REFINERY

Project No. 2844
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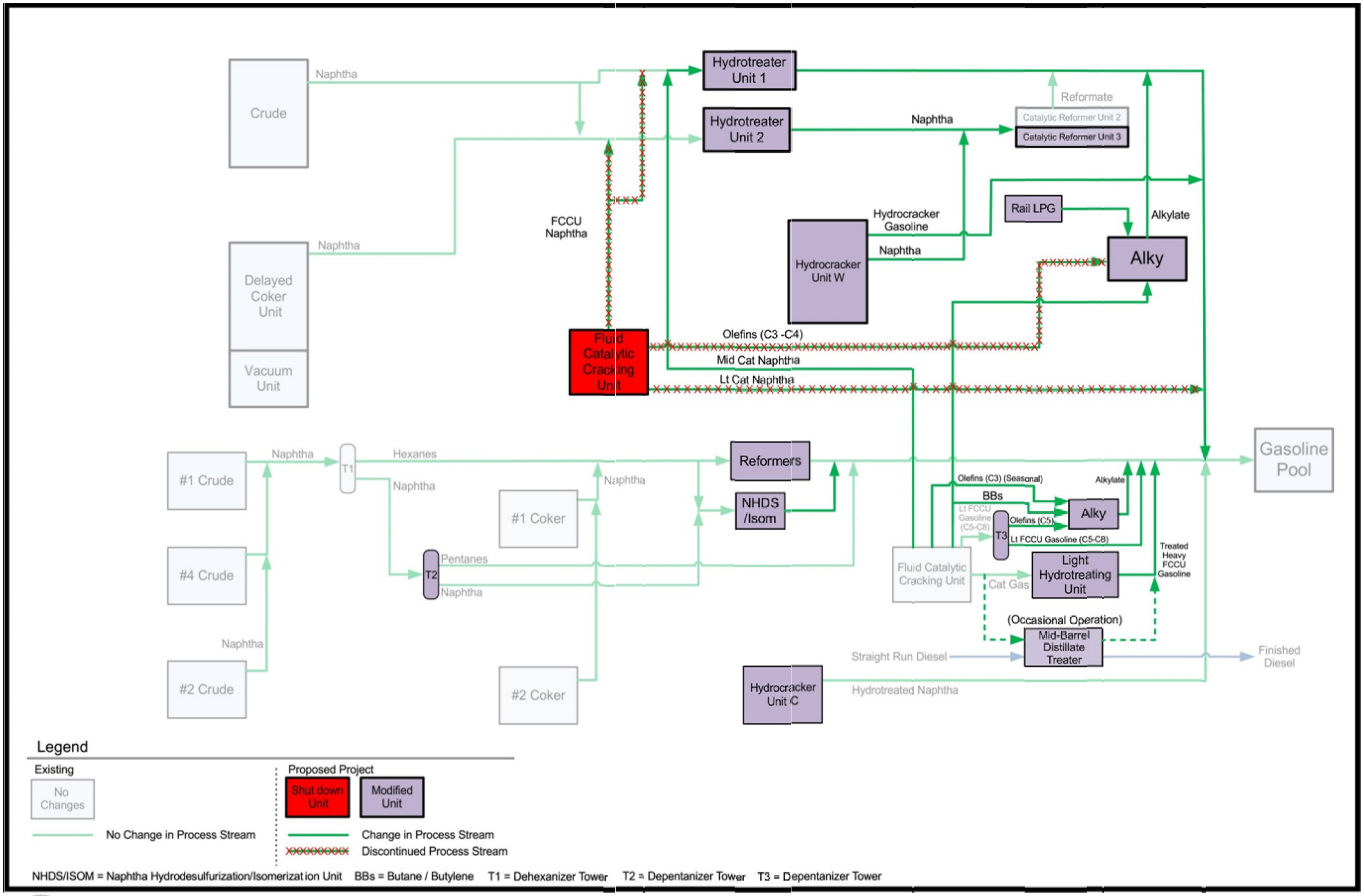

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FIGURE 2-13
SIMPLIFIED GASOLINE PRODUCTION BLOCK FLOW DIAGRAM
WITH PROPOSED PROJECT EFFECTS DEPICTED
TESORO LOS ANGELES REFINERY

Project No. 2844

N:\2844\Block Flow Diagrams\Proposed Simplified Gasoline Block Flow (rev.2).cdr

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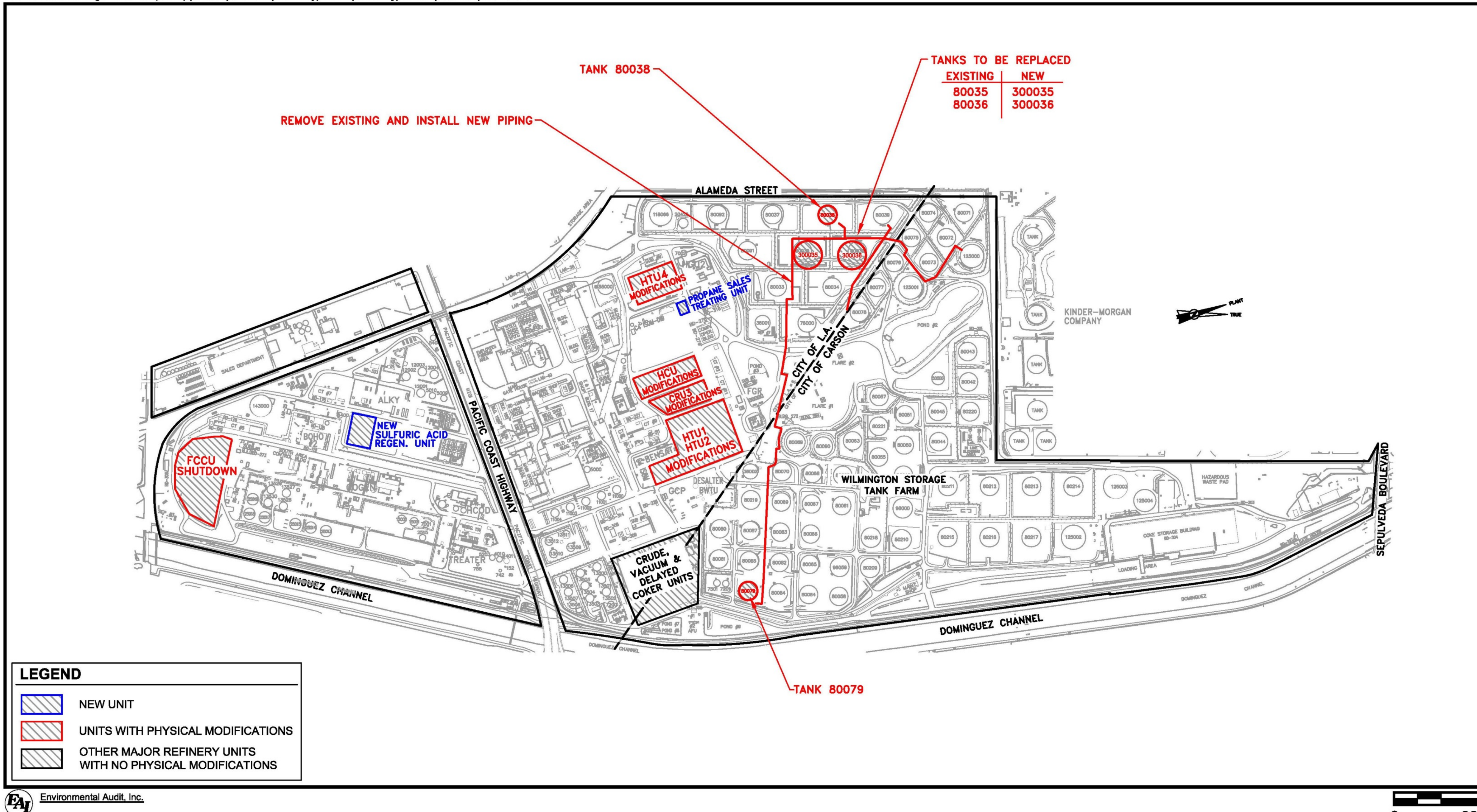

FIGURE 2-14
TESORO LOS ANGELES REFINERY
WILMINGTON OPERATIONS MODIFICATIONS

Project No. 2844

ORIGINAL IN COLOR

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In the Notice of Preparation/Initial Study (NOP/IS) for the proposed project (see Appendix A) the project description for the Wilmington Operations included the construction of a New Ammonium Thiosulfate (ATS) Plant. The ATS Plant scope has been eliminated from the proposed project and will not be built; therefore, no impacts associated with the ATS Plant will be analyzed in this EIR.

2.7.1.1 Wilmington Operations FCCU Shutdown

An FCCU cracks or converts heavy hydrocarbons into lighter, gasoline and distillate range hydrocarbons in the presence of fine particles of catalyst that are circulated throughout the process. The Refinery will modify other units to ensure there will be no loss in overall production due to the FCCU shutdown, prior to taking the FCCU offline. Following completion of elements of the project that enable distillate recovery and other modifications necessary to enable shutdown of the Wilmington Operations FCCU, the Wilmington Operations FCCU will be shut down, the equipment will be permanently removed from service, abandoned in place and Tesoro will relinquish all relevant Wilmington Operations FCCU operating permits to the SCAQMD. Substantial on-site emissions reductions will be realized from shutting down the following emissions sources that constitute the entire Wilmington Operations FCCU, including coke burn from the FCCU and ancillary heaters totaling 687.3 million British Thermal Units per hour (mmBtu/hr):

- FCCU regenerator (FCCU coke burn),
- CO Boiler (300 mmBtu/hr),
- H-2 Steam Superheater (37.4 mmBtu/hr),
- H-3 Fresh Feed Heater (94.7 mmBtu/hr),
- H-4 Hot Oil Loop Reboiler (127.2 mmBtu/hr),
- H-5 Fresh Feed Heater (44 mmBtu/hr),
- B-1 Startup Heater (84 mmBtu/hr), and
- All FCCU fugitive emission components.

2.7.1.2 Hydrocracker (HCU) Modifications

The Wilmington Operations HCU cracks or converts mid-distillate and heavy hydrocarbons to lighter gasoline, jet, and diesel range material in the presence of catalyst, heat, and hydrogen. The process incorporates a hydrotreater which reduces the sulfur content of the diesel. While the Wilmington Operations HCU capacity would be increased approximately 15 percent, this modification will have no impact on the overall integrated Refinery crude throughput capacity. The Wilmington Operations HCU capacity is being increased to accommodate conversion of the distillate material previously routed to the Wilmington Operations FCCU. It will be recovered as HCU feed in order to reduce the amount of gas oil feed produced and to enable the shutdown of the Wilmington Operations FCCU. The reactor and fractionation sections will be modified to increase the production of ultra-low sulfur diesel and gasoline. The Wilmington Operations HCU modification will include adding new nozzles to two existing vessels, modifying the hydrogen recycle compressor internals to accommodate higher unit capacity, installing a small hydrogen booster compressor, installing or modifying as many as three heat exchangers to provide improved heat integration, installing two new electrically driven pumps, and associated piping and instrumentation. Part of the piping associated with unit modifications may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations. The proposed project currently includes increasing the permitted firing duty of two existing heaters, with a common stack and selective catalytic reduction unit (SCR), by a total of 25 mmBtu/hr.

To recover propane for the proposed new Propane Sales Treating Unit (PSTU) described below, the HCU (W) fractionation section will also be modified by installing two new water cooled exchangers, one knockout drum, and associated piping and instrumentation. An existing reflux pump and two heat exchangers in the fractionation section will be removed.

2.7.1.3 Delayed Coker Unit (DCU) Fresh Feed Heater H-100

The Wilmington DCU fresh feed heater H-100 heats DCU charge (a mixture of crude oil, residual from the Crude Unit, slop oil (internally recycled oil and off-specification products) and FCCU main fractionator bottoms that are fed into the unit so they can be fractionated into feedstock streams for other refinery process units. The existing equipment description of the Fresh Feed Heater in the Title V permit will be revised to conform to SCAQMD/Industry standards. The description will be changed from the ‘design heat release’ basis (252 mmBtu/hr) to the industry standard ‘maximum heat release’ basis (302.4 mmBtu/hr). Revising the equipment description to maximum heat release will ensure that operating the heater at maximum heat released conforms with the SCAQMD’s expectation that equipment is operated within the maximum heat release described in the permit. Additional heat is needed at times to either lift more gas oil out of the Coker feed in downstream distillation columns or simply to process more feed through the DCU, to the physical limits of the downstream units. For example, during a Coker shutdown, residuum and crude oil inventory that are normally processed in the unit accumulate. After a shutdown, it is necessary to process feedstocks at a higher rate in order to process the inventory gains of feedstock that accumulated during a shutdown. Alternatively, higher crude rates may be processed in the DCU heater as analyzed herein. No physical modifications are planned to be made to the heater. However, modifications may be required during the permit review process. The maximum heater firing capability will remain unchanged. The number of burners (36) and the maximum heat release (8.4 mmBtu/hr) of each burner in the heater will remain the same. Although the described duty of the heater will increase to 302.4 mmBtu/hr, there will be no increase in emissions as permit conditions will be imposed to limit criteria pollutant emissions. Mass emissions of NOx, SOx, PM10, CO, and VOC will be restricted in the revised permit.

The application to revise the permit description of H-100 heater was submitted in early 2014, independent of the proposed project. As a result, this component of the proposed project was not described in the NOP/IS. Upon further review, it was concluded that this change could create adverse environmental impacts that would likely occur simultaneously with the proposed project. For example, this revision to the heater equipment description has the potential to increase the crude oil throughput to the Refinery by up to two percent (or up to 6,000 bbl/day). While the Refinery could opt to process either a small increase in crude oil throughput or slightly heavier crude oil blend, the processing of additional crude would result in more impacts in numerous units downstream of the DCU, versus an increased coke production for the DCU associated with a heavier crude oil blend. Therefore, for purposes of analyzing the worst-case impacts, this document assesses an increase in crude oil throughput capacity. The increased heat release from the H-100 heater and/or increased crude oil throughput is anticipated to occur once the modified permit is issued. Including the permit revision as part of the proposed project ensures that all impacts from the modification of the Refinery are fully analyzed.

2.7.1.4 Catalytic Reforming Unit No. 3 (CRU-3) Modifications

The Wilmington Operations CRU-3 converts low octane hydrocarbons into higher octane gasoline blending components using catalyst and heat. To enable the Refinery process efficiency improvement to recover and treat propane for sale, the CRU-3 fractionation section will be modified to enable recovery of Hydrocracker propane from the Refinery fuel gas system. The modifications to CRU-3 will include installing one new depropanizer tower that is larger than the existing tower, as many as three heat exchangers, as many as four electrically driven pumps, and associated piping and instrumentation. Part of the piping associated with unit modifications may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations.

2.7.1.5 Propane Sales Treating Unit (PSTU)

A new PSTU will be constructed at the Wilmington Operations to enable the process efficiency improvement to treat propane for sale. A PSTU conditions liquid propane for sale using absorbers and dryers to meet sales specifications. The PSTU will treat up to approximately 2,000 bbl/day of propane and will include eight vessels and four pumps that will be installed to purify recovered propane from the Wilmington Operations HCU and CRU-3. Part of the piping associated with unit may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations. The PSTU will be located east of HTU-4.

2.7.1.6 Hydrotreating Units No. 1 and 2 (HTU-1 and 2) Modifications

The Wilmington Operations HTU-1 and HTU-2 Naphtha Hydrotreaters are process units that reduce impurities such as sulfur from various naphtha product streams and currently hydrotreat FCCU gasoline. The HTU-1 will be modified to hydrotreat an additional 7,000 bbl/day of

FCCU gasoline to comply with the federally mandated Tier 3 gasoline specifications. The modifications to HTU-1 will include modifying or installing as many as five heat exchangers, adding a pump and associated piping and instrumentation. Because the HTU-2 will continue to produce the same types and volumes of feedstock that it currently produces, its feedstock will be separated from HTU-1's feedstock. The HTU-2 feedstock separation modifications will include repurposing an existing diesel salt dryer to be used as a feed surge drum, installing as many as two electrically driven pumps, and associated piping and instrumentation. Part of the piping associated with unit modifications may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations.

The proposed modifications to HTU-1 will also allow it to start hydrotreating jet fuel instead of FCCU gasoline, treating approximately 12,000 bbl/day to remove sulfur impurities. The modifications will include installing one new stripping steam nozzle on the stabilizer, one coalescer, one salt dryer, and condensate pot, and associated piping and instrumentation.

2.7.1.7 Hydrotreating Unit No. 4 (HTU-4) Modifications

The Wilmington Operations Hydrotreater Unit No. 4 (HTU-4) is a process unit that uses catalyst and hydrogen to reduce aromatic compounds and impurities such as sulfur in the FCC feed. HTU-4 will be modified as part of the proposed project to increase distillate yield and must be completed in order to allow for the shutdown of the Wilmington Operations FCCU, and to fully utilize the existing hydrotreating capacity to produce ultra-low sulfur diesel. There will also be modifications to recover jet fuel, and added heat integration equipment to reduce energy consumption by producing steam in heat exchangers, providing process heat to two strippers and preheating boiler feed water. HTU-4 will process either gas oil or high sulfur diesel. The proposed modification to the HTU-4 will allow the Refinery to minimize motor fuels production disruptions during both planned and unplanned outages. Other modifications to HTU-4 include adding new nozzles on the fractionator, modifying the product coolers, installing a new surge drum, a salt dryer, a coalescer, a condensate pot, as many as four new electrically driven pumps and eleven heat exchangers, and associated piping and instrumentation. Part of the piping associated with unit modifications may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations.

2.7.1.8 New Sulfuric Acid Regeneration Plant (SARP)

The proposed new Sulfuric Acid Regeneration Plant (SARP) will be constructed at the Wilmington Operations east of the existing Alkylation Unit and will remove impurities from and recycle the Wilmington and Carson Operations spent sulfuric acid to produce fresh sulfuric acid on-site rather than sending it off-site for treatment. Sulfuric acid is used as a catalyst in the Alkylation Unit to produce alkylate and loses its effectiveness over time. The SARP is sized for an approximate throughput of 400 tons/day of sulfuric acid production and regeneration and will include three tanks, as many as eight electrically driven pumps, a natural gas fired 42 mmBtu/hr Decomposition furnace, a five mmBtu/hr Converter heater, a natural gas fired 20 mmBtu/hr

Process Air Heater, a waste heat steam generator, as many as four blowers, as many as eight heat exchangers, four towers, one reactor, one stripper, three scrubbers, one electrically driven compressor, three drums, and associated piping and instrumentation. Part of the piping associated with the SARP unit may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations. The fresh sulfuric acid will be sent back to the Alkylation Units for reuse. Spent sulfuric acid is currently transported off-site for recycling at the ECO Services Dominguez Carson Sulfuric Acid Plant located at 20720 S. Wilmington Avenue in Carson, California. Installing the Sulfuric Acid Regeneration Plant will eliminate approximately 6,000 acid transport truck miles per month from public roadways compared to current operations. Instead of routing trucks to and from the Wilmington Operations to ECO Services Dominguez Carson, the trucks will be routed to and from the Carson Operations to the Wilmington Operations, a much shorter trip.

2.7.1.9 Wilmington Replacement Crude Oil Tanks and Other Tank Modifications

To improve the efficiency of water-borne crude oil receipt and marine vessel unloading, two new 300,000 bbl internal floating roof storage tanks (Tanks 300035 and 300036) will replace two existing 80,000 bbl fixed-roof storage tanks (Tanks 80035 and 80036) in the north tank area of the Wilmington Operations. The two existing tanks currently store light and heavy crude oils as well as light and heavy gas oils. The two new tanks would store light and heavy crude oils as well as light and heavy gas oils, in support of continued operations. The new larger tanks will allow marine vessels to unload without undue delay, thereby reducing the time vessels are required to wait at anchorage until sufficient tankage is available for vessel discharge. The current 80,000 barrel crude storage tanks have insufficient capacity to completely unload the mid-size marine vessels (with capacities from 300,000 to 700,000 barrels) that deliver crude oil to the Long Beach Marine Terminal that serves Wilmington Operations. Given the large marine vessel capacity and the relatively small available refinery storage tank capacity, marine vessels must either wait at the dock for several days or make several port calls or dock visits in order to unload an entire cargo of crude oil. While the marine vessels are at the dock, in motion, and at anchor they are producing emissions from fuel combustion necessary for vessel operation. Increasing storage tank capacity will increase the amount of crude oil that can be unloaded and stored during a single marine vessel visit, thus, reducing the amount of time that vessels spend within the port. Decreasing the amount of time the vessels spend within the Port and at anchor will reduce annual vessel emissions. This proposed project does not require any modifications to the Wilmington Operations Marine Terminal in the Port of Long Beach. The new tanks will be permitted to store the same types of products as the existing tanks and are not expected to enable the Refinery to bring in a particular type of crude oil that cannot be blended to meet the API gravity and sulfur content parameters of the existing Wilmington and Carson Operations. Refinery crude throughput would increase up to two percent (6,000 bbl/day), but would otherwise be constrained as discussed in Subsection 2.5.4.1 The tanks only affect the ability to offload a marine vessel in less time.

The scope of this part of the proposed project will include demolishing two existing storage tanks, installing two new larger tanks in the same location as the tanks being removed, replacing

5,000 feet of 12-inch diameter piping with 24-inch diameter piping within the confines of the Wilmington Operations to allow the tank loading rate to increase from 5,000 bbl/hr to 15,000 bbl/hr. The scope includes modifying one existing tank (Tank 80038) by connecting it to a vapor recovery system. Existing Tanks 80038, 80060, 80067, and 80079 will require change of service permit modifications and annual throughput increases for each tank.

2.7.2 CARSON OPERATIONS

In addition to the modifications at the Wilmington Operations, the proposed Tesoro Los Angeles Refinery Integration and Compliance Project also includes modifications at the Carson Operations, resulting in a combined Refinery complex and improving the gasoline to distillate production ratio. Additionally, equipment energy efficiency and heat recovery will be optimized for new or modified units, resulting in lower overall emissions. Proposed new equipment and modifications to existing equipment at the Carson Operations are shown in Figure 2-15 and described in the following subsections.

In the NOP/IS the project description for the Carson Operations included modifications to the No. 1 and No. 2 Cokers to comply with SCAQMD Rule 1114 – Petroleum Refinery Coking Operations, which requires recovery of additional vent gases during coke drum deheading operations. Rule 1114 requires that the ejector system be installed at the next scheduled turnaround for each Coker unit. Compliance is required beginning in January 2016 for No. 2 Coker. The impacts of the SCAQMD Rule 1114 compliance projects were analyzed separately in the Environmental Assessment for the Rule 1114 adoption (SCAQMD, 2013). Prior to adoption of Rule 1114, the SCAQMD prepared an Environmental Assessment (EA) (Final Environmental Assessment for Proposed Rule 1114 – Petroleum Refinery Coking Operations; SCAQMD No. 02262013BAR; SCH No. 2013021066; Certified May 3, 2013) pursuant to its Certified Regulatory Program to evaluate potential impacts from implementing Rule 1114. The EA for Rule 1114 provided a comprehensive worst-case analysis of potential adverse impacts from Rule 1114 compliance projects at all of the individual affected refineries. The EA for Rule 1114 concluded that implementing Rule 1114 at all affected refineries would not generate significant adverse impacts to any environmental topic areas identified on the environmental checklist (CEQA Guidelines, Appendix G). Consequently, CEQA requirements for the Rule 1114 component of the proposed project have already been satisfied. As a result, the Rule 1114 compliance component has been removed from the proposed project. However, to the extent that the Rule 1114 compliance project contributes to cumulative impacts of the proposed project, these are evaluated in Chapter 5 of this EIR.

The NOP/IS also included the Nos. 1 and 2 Coker Bottom Head Modifications component. However, because this project component is associated with the Rule 1114 compliance project by improving safety during the coke de-heading process at the end of the coking cycle, it was also removed. Although not analyzed as part of the Rule 1114 EA, it was evaluated as part of the Rule 1114 permit application process and it was concluded that this project component was exempt from permitting, and thus, not subject to CEQA review. Like the Rule 1114 compliance project, to the extent that this project component contributes to cumulative impacts of the proposed project, they are evaluated in Chapter 5 of this EIR.

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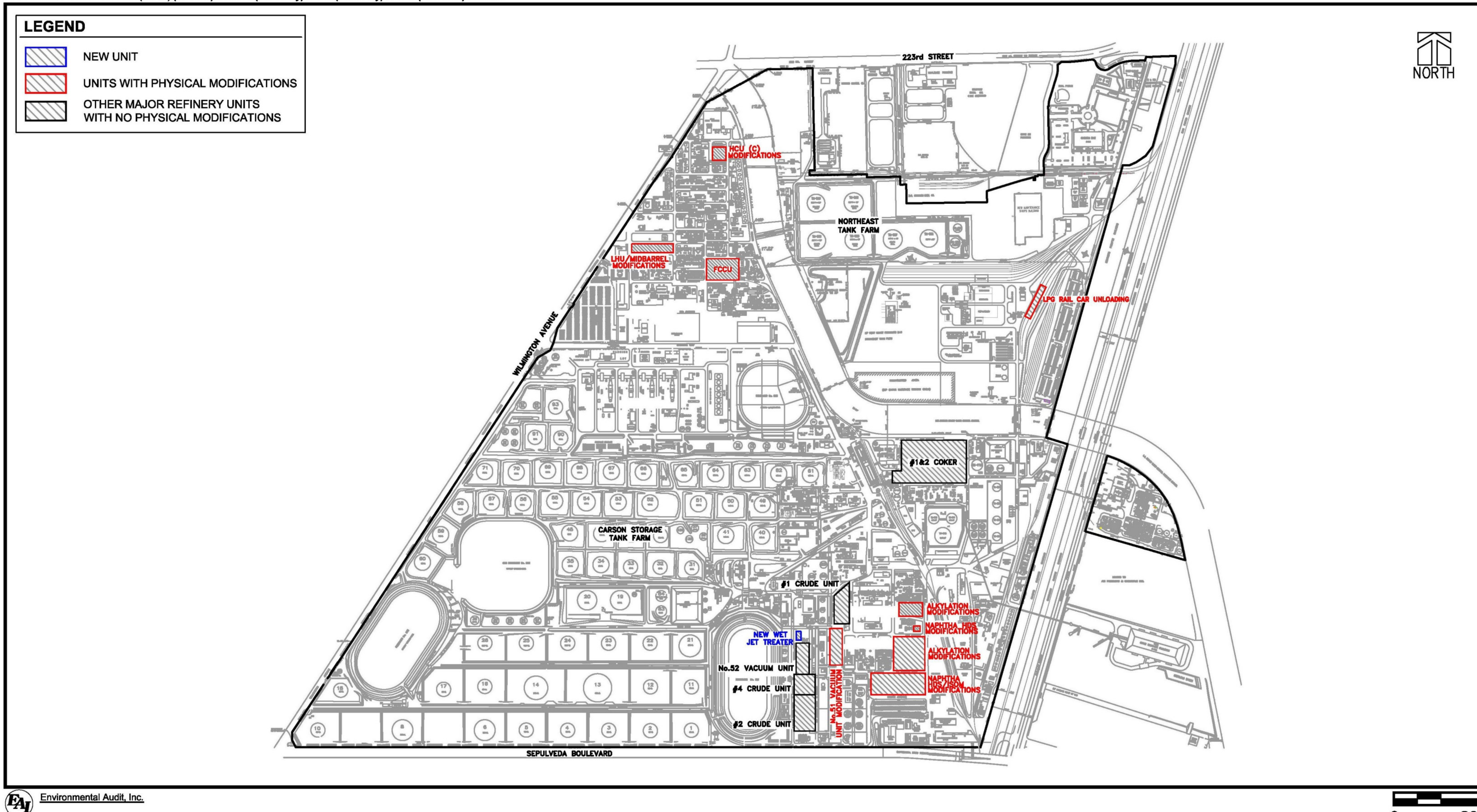

FIGURE 2-15
TESORO LOS ANGELES REFINERY
CARSON OPERATIONS MODIFICATIONS

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ORIGINAL IN COLOR

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2.7.2.1 No. 51 Vacuum Unit Modifications

The Vacuum Unit is a separation process that uses distillation conducted under vacuum (less than atmospheric pressure) to lower the boiling temperature of a liquid and allow removal of light hydrocarbons without thermal cracking. The No. 51 Vacuum Unit will be modified to allow increased distillate yield, or diesel production, which will require reducing vacuum gas oil production by up to 8,000 bbl/day. The No. 51 Vacuum Unit modifications will include modifying the feed heater's Title V permit described duty from 300 to 360 mmBtu/hr, installing one new sixteen-inch nozzle on the vacuum tower, as many as five new exchangers, two strainers, as many as three new electrically driven pumps, and associated piping and instrumentation. Part of the piping associated with unit modifications may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations. No substantial heater modifications are required to achieve a firing rate of 360 mmBtu/hr; however, burner/tips or other modifications may be replaced with a different design. The heater duty increase will enable increased recovery of distillate out of gas oil in the vacuum column. However this will not enable the Refinery to run a lighter crude oil slate since the change will be made in No. 51 Vacuum Unit, which is downstream of the Crude Units. Please see Section 2.5.4.1 for further explanation of the modifications that would need to be completed in order to increase Refinery capacity to refine lighter crude oils.

2.7.2.2 Carson Operations FCCU Modifications

The FCCU cracks or converts heavy hydrocarbons into lighter, gasoline range hydrocarbons in the presence of fine particles of catalyst that are circulated throughout the process. The NOP/IS presented two types of modifications to the Carson Operations FCCU, physical and operational. The physical modifications (i.e., installing a feed surge drum, as many as two pumps and two heat exchangers, and associated piping and instrumentation) have been canceled and removed from the proposed project. However, the proposed process modifications to improve efficiency and achieve integration will still be included. This will enable shutdown of the Wilmington Operations FCCU, and allow the Carson Operations FCCU to accept a portion of the Wilmington Operations gas oil feed. The throughput capability of the Carson Operations FCCU will remain unchanged. New pipelines will be routed between the Wilmington Operations and the Carson Operations FCCU feed tanks. Although physical modifications to the Carson Operations FCCU are no longer proposed, the impacts from the potential increase in utilization of the Carson Operations FCCU have been addressed in Chapter 4.

2.7.2.3 New Wet Jet Treater

One new 50,000 bbl/day Wet Jet Treater will be installed at Carson Operations to treat jet fuel by removing mercaptans and reducing the TAN, or organic acid content, in the jet fuel produced in upstream units. The Wet Jet Treater will increase Refinery operating efficiency. The Wet Jet Treater sweetens jet fuel by converting mercaptans to disulfides, and reacting organic acid with caustic making naphthenic salts which are removed to reduce TAN. The Wet Jet Treater includes one mercaptan removal reactor, one TAN removal reactor, two product separators, one spent caustic loading facility, as many as six associated electrically driven pumps, two salt dryers, two clay filters, and associated piping and instrumentation. Part of the piping associated with unit modifications may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations. Feed and fresh caustic will be routed to the new Wet Jet Treater and spent caustic and treated jet fuel will be routed to existing storage tanks. The spent caustic flow rate is conservatively estimated at approximately 11 gpm. Approximately four additional railcar loads per week of spent caustic will be generated and shipped to the Gulf Coast for recycling.

2.7.2.4 Hydrocracker Unit (HCU) Modifications

The Carson Operations HCU capacity will be increased by approximately 10 percent. The existing Carson Operations HCU cracks or converts mid-distillate and heavy hydrocarbons to lighter gasoline, jet, and diesel range material in the presence of catalyst, heat, and hydrogen. The process incorporates a hydrotreater which reduces the sulfur content. The Carson Operations HCU will be modified as part of the proposed project to increase distillate yield to allow for the shutdown of the Wilmington Operations FCCU by enabling it to process the distillate recovered from the No. 51 Vacuum Unit described above in Subsections 2.7.2.1.

Processing the recovered distillate feed will require increased hydrogen gas usage to allow the modified HCU to comply with existing low sulfur diesel product specifications. The increased hydrogen gas capacity will be provided by increasing the recycle gas compressor speed. This portion of the proposed project will not result in an overall increase in hydrogen demand because hydrogen that is currently used to hydrotreat the Wilmington Operations FCCU products would no longer be required due to the shutdown of the Wilmington Operations FCCU. Therefore, this portion of the proposed project will not require changes to hydrogen generation equipment at the Refinery or by an off-site supplier.

The Carson HCU energy utilization efficiency will be improved by installing a steam generator. The Carson HCU modification will include installing one new steam generator heat exchanger, an air cooler, and associated piping and instrumentation. Part of the piping associated with unit modifications may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations.

2.7.2.5 Light Hydrotreating Unit (LHU) Modifications

The existing Carson Operations Light Hydrotreating Unit (LHU) is a process unit that removes impurities such as sulfur in various naphtha product streams. The LHU will be modified to more effectively remove sulfur from FCCU gasoline to comply with the new federally-mandated Tier 3 gasoline sulfur specifications. The LHU will process a higher sulfur feed material derived from existing fractionation equipment. The proposed modifications will include installing one new stripping steam nozzle on the stabilizer, as many as five new heat exchangers, one coalescer, a condensate pot, and associated piping and instrumentation. Part of the piping associated with unit modifications may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations.

2.7.2.6 Naphtha Hydrodesulfurization Unit (NHDS) Modifications

The existing Carson Operations Naphtha Hydrodesulfurization (NHDS) Unit is a process unit that reduces impurities such as sulfur in various naphtha product streams. The NHDS will be modified with the installation of new equipment to allow removal of contaminants from unit feed and sulfur from pentanes. This enables flexibility for additional gasoline production to partially compensate for lost production from the Wilmington Operations FCCU. The existing Reactor Feed Heater will be retrofitted with new ultra-low NOx burners to reduce emissions. The new burners will not increase the existing heater duty described in the permit. The modifications will include repurposing and modifying the existing Isooctene debutanizer tower to separate isopentane from the Carson Operations NHDS feed. The modifications include the addition of eight new nozzles on the debutanizer tower, installation of a caustic scrubber, two knockout drums, a product coalescer, an air cooler, an accumulator, a condensate pot, as many as 14 new heat exchangers, six electrically driven pumps, and associated piping and instrumentation. Part of the piping associated with unit modifications may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations.

2.7.2.7 Naphtha Isomerization Unit Modifications

The existing Carson Operations Naphtha Isomerization Unit upgrades a pentane/hexane rich stream to make a higher value blending component for gasoline. In order to improve the saleable product yield, the Naphtha Isomerization Unit will be modified to recover propane and heavier material from the Unit off-gas, enabling additional product sales. The Naphtha Isomerization Unit modifications include addition of an off-gas caustic scrubber, two reactor effluent flash drums, up to two heat exchangers, four pumps, and associated piping and instrumentation. Part of the piping associated with unit modifications may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations.

2.7.2.8 Alkylation Modifications

The existing Carson Operations Alkylation Unit is a process unit that converts propylene (C3 olefins), and butylenes (C4 olefins) into gasoline boiling range blendstock. As a project component to increase gasoline production flexibility to partially compensate for lost production from the Wilmington Operations FCCU, amylenes (C5 olefins) will be recovered from FCCU gasoline in an existing fractionation tower and converted to low vapor pressure gasoline in the modified Alkylation Unit. Alkylation Unit capacity will remain unchanged. The modifications to process amylenes will include repurposing the Depentanizer column, replacing one existing four-inch nozzle with an eight-inch nozzle on the olefin feed surge drum, installing as many as six heat exchangers, one filter/coalescer, one truck loading rack, two electrically driven pumps, and associated piping and instrumentation. The modifications to process propylene and butylene will include the installation of a propylene chiller and associated piping and instrumentation. Part of the piping associated with unit modifications may include installation of new pressure relief valves that will tie into the various Refinery flares. The pressure relief valves allow gases to vent to the flares, which are safety equipment, during emergency or over-pressure situations.

2.7.2.9 Mid-Barrel Distillate Treater

The existing Mid-Barrel Distillate Treater incorporates a hydrotreater to remove sulfur from straight run diesel and converts it to ultra-low sulfur diesel. To ensure compliance with new federally-mandated Tier 3 gasoline specifications, the Mid-Barrel Distillate Treater will be modified to enable it to desulfurize heavy FCCU naphtha. Interconnecting pipelines to/from the LHU and Mid Barrel Distillate Treater will be installed. New bypass piping to recycle a portion of the product stream back to the feed system will also be installed.

2.7.2.10 Steam System Balance Modifications

The Carson Operations steam system demand will increase due to compliance with new federally-mandated Tier 3 gasoline specifications and amylene alkylation. The increased steam demand will be met by a combination of: installing waste heat steam generators (heat exchangers at the Wilmington Operations HTU-4 and the Carson Operations Hydrocracker), generating more steam from the existing Watson Cogen Facility, and reducing steam demand from existing steam turbines.

2.7.2.11 New Crude Tankage

To improve the efficiency of water-borne crude oil receipt and marine vessel unloading, up to six new 500,000 barrel floating roof crude oil storage tanks will be constructed adjacent to the Carson Crude Terminal (see Figure 2-16). The new tanks will allow marine vessels to unload crude oil without undue delay, thereby reducing the time vessels are required to wait at anchorage until sufficient tankage is available for vessel discharge.

In the shipping industry, marine vessels have become larger over time. Currently, crude oil marine vessels have the capacity to hold up to 2,000,000 barrels. Given the large marine vessel capacity and the relatively small available refinery storage tank capacity, marine vessels must make several port calls or dock visits in order to unload an entire cargo of crude oil. In between port calls, the marine vessels must leave the dock and anchor until there is available crude storage capacity in refinery tanks and the vessel can return to the dock for additional unloading. While the vessels are at the dock, in motion and at anchor they are producing emissions from fuel combustion necessary for vessel operation. This portion of the project will reduce the amount of time that vessels spend within the port and increase the amount of crude oil that can be unloaded and stored. Decreasing the amount of time the vessels spend within the port and at anchor will substantially reduce annual vessel emissions. The new tanks do not enable the Refinery to bring in a particular type of crude oil. Further, no Refinery equipment modifications will be made that will allow for changes in the existing API gravity or sulfur content

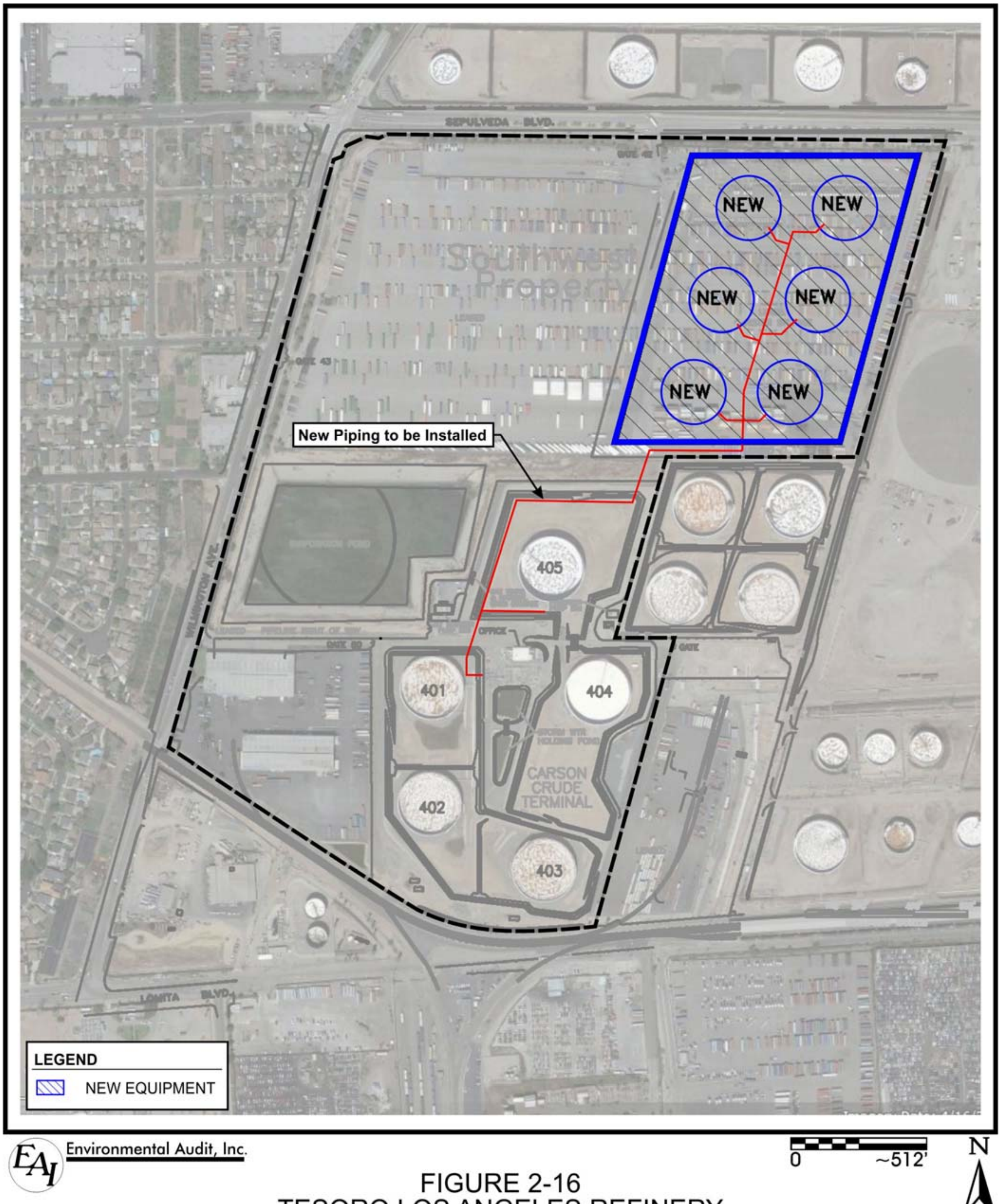

FIGURE 2-16
TESORO LOS ANGELES REFINERY
CARSON CRUDE TERMINAL

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N:\2844\Carson Crude Terminal (rev.2).cdr specifications of the crude oil blend that can be run at the Refinery, and thus, would result in changes of imported crude oils. Refinery crude throughput would increase up to two percent (6,000 bbl/day), but would otherwise be constrained as discussed in Subsection 2.5.4.1. The tanks only affect the ability to offload a marine vessel in fewer port calls rather than the type of crude unloaded.

This element of the project will reduce the amount of time marine vessels spend within the port, but will not increase Refinery crude oil throughput. This portion of the proposed project does not require any modifications to Marine Terminals in the Port of Long Beach. The scope of the work will include installing up to six new tanks, as many as five electrically-driven transfer pumps, and associated piping and instrumentation at the Carson Operations. Piping within the Carson Crude Terminal to connect the six new 500,000 barrel tanks will be installed to connect the tanks to existing pipelines to the Carson Operations and Marine Terminal 1.

2.7.3 MODIFICATIONS TO SUPPORTING EQUIPMENT

2.7.3.1 Interconnecting Pipelines

To more fully integrate the Refinery, this element of the proposed project includes pipelines to transport materials to and from various refinery units, e.g., new units, and storage facilities, as well as pipelines to transport materials between the Carson Operations and Wilmington Operations. The general locations of the proposed new pipelines are shown in Figure 2-17. The pipelines are expected to transport gasoline and gasoline blending components, crude oil, gas oil, butylene, propylene, and liquid petroleum gases. In this EIR, the term “pipelines” refers to all of the proposed pipelines shown in Figure 2-17, primarily pipelines on Tesoro property, but also portions of the pipeline that will be routed in a bundle under the Alameda Corridor and Sepulveda Boulevard. The interconnecting pipelines between the Carson and Wilmington Operations, including the pipeline bundle in the bore, includes approximately 15,000 feet of new 12-inch piping, 30,000 feet of new 10-inch piping and 40,000 feet of new 6-inch and 4-inch piping.

The proposed project would include installing a bundle of pipes under the Alameda Corridor and Sepulveda Boulevard as part of the work that will connect pipelines between the Wilmington and Carson Operations. The pipe “bundle” is where the pipelines come together in one place and go underground to cross adjacent streets. The pipe bundle will require a 54-inch bore using horizontal directional drilling (HDD). HDD would be used to bore underneath (approximately 80 feet in depth) South Alameda Street and East Sepulveda Boulevard (see Figure 2-17). The pipe bundle will be comprised of up to 15 new pipelines ranging in size from four inches to 12 inches in diameter. The pipelines are expected to transport gasoline and gasoline blending components, gas oil, crude oil, butylene, propylene, and LPG. All pipelines within the HDD bundle will be heavy-wall pipe with extra corrosion allowance, cathodic protection will be installed on all lines, and all lines will have a fusion bond epoxy coating with abrasion resistant coating. Isolation valves will be installed on both ends of the lines with flow meters to monitor for flow discrepancies and activate isolation valves if necessary. Pigging stations are proposed

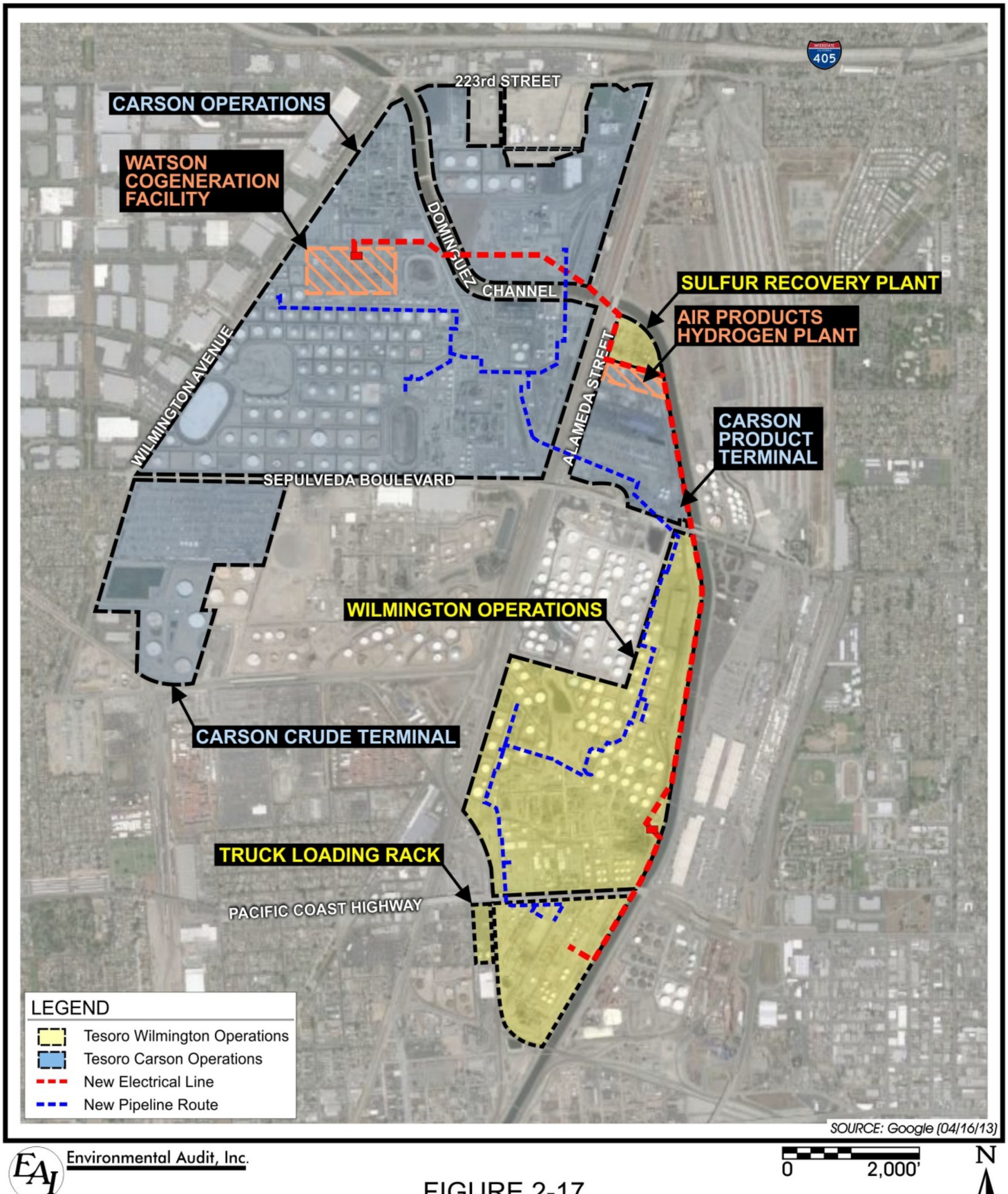

FIGURE 2-17
PROPOSED ELECTRICAL AND PIPELINE ROUTE
TESORO LOS ANGELES REFINERY

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to be installed to enable periodic smart pigging of the lines using instrumented inspection devices allowing early detection of anomalies in the lines.

The Alameda Street crossing bore will be approximately 1,200 feet in length. The entry point of the bore into the ground is located in a container yard south of the Carson Operation Coke Barn on Tesoro-owned property. The proposed exit point of this bore is located near the Carson Operations truck weigh station. The pipelines would then be routed underneath East Sepulveda Boulevard to connect to the Wilmington Operations. This bore of the Sepulveda Boulevard crossing would also be approximately 1,200 feet in length. The proposed entry point of this bore under Sepulveda is located in the container yard south of the Carson Operation Coke Barn on Tesoro-owned property. The proposed exit point of this bore is located between Gate 22V and the Wilmington Operations Coke Barn. With the exception of pipelines that will be routed underground near the Carson and Wilmington Operations Coke Barns, pipelines located outside of the HDD bore, would then be routed above ground on pipe racks or ground level pipeline supports into the respective product and supply manifolds within the Refinery property. Note that the bores for the pipeline bundle will start and end within the boundaries of the Tesoro Los Angeles Refinery.

2.7.3.2 Electrical Connection to Wilmington

To more fully integrate the Refinery, up to six new 69 kV electrical cables and two new 13.8 kV cables will be routed via conduit systems and overhead transmission lines from the Watson Cogen Facility located at the Carson Operations to the SRP (see Figure 2-17) and Wilmington Operations. One new 69 kV substation, and at least two new transformers with associated cabling, are proposed to be installed at the Watson Cogen Facility. One 69 kV substation with two new 13.8 kV main substations with at least four transformers and associated switch gear and wiring will be installed at the Wilmington Operations. Containment dikes will be provided at all transformers within the Refinery. This portion of the proposed project will allow electricity generated at Carson Operations to be used at the Wilmington Operations.

2.7.3.3 LPG Rail Unloading

LPG Rail Car Unloading facilities, which are permitted for LPG only, will be modified at Carson Operations to allow increased deliveries of approximately 4,000 bbl/day of Alkylation Unit feedstocks (LPG including propane, propylene, etc.). LPG Rail Unloading facilities will be used to transfer LPG to the Refinery to replace a portion of the Alkylation Unit feed lost by the closure of the Wilmington Operations FCCU. In addition to producing gasoline and other intermediate feedstocks, the FCCU provides feed to the Alkylation Unit. The Wilmington Operations FCCU produces about ten percent by volume mixed propylene/propane, which are currently fed to the Wilmington Operations Alkylation Unit. Alkylation Unit production is important in the manufacture of CARB compliant gasoline. Therefore, Tesoro will replace a portion of the alkylation feed through delivery of appropriate feedstocks. LPG handling at the Refinery may increase by up to ten railcars per day. Increased production of alkylate is critical for blending clean-burning gasoline due to its properties, such as low benzene and sulfur content and high octane content. The scope of work will include installing a vaporizer a surge drum, a knockout pot as many as four electrically driven transfer pumps, and associated piping and instrumentation. No modification to the onsite LPG storage is proposed because the LPG delivered will be transferred at a rate consistent to keep the Wilmington Operations Alkylation Unit operating within its capacity and existing storage tanks can accommodate the deliveries.

In the NOP/IS the project description included modifications to the LPG Railcar Unloading facilities at either Carson or Wilmington Operations. Tesoro has decided to pursue these modifications at the Carson Operations because it has existing infrastructure, including automated loading and unloading systems, existing LPG pressurized tankage, fire protection and other systems to ensure safe rail operations. Currently, Carson Operations safely unloads up to 11,000 bbl/day of LPG into on-site pressurized tankage for use in the refining process. In the past, during the high Reid Vapor Pressure (RVP) gasoline season, during winter months, October through February, the Refinery has imported up to 11,000 bbl/day of butane. The LPG rail loading modifications will allow the Refinery to import up to about 15,000 bbl/ day of LPG, resulting in the increase of about 4,000 bbl/day or 10 railcars per day at the Refinery. It is expected that these additional railcars would be added onto existing trains that visit the Refinery, i.e., the same train would drop off more railcars with each daily visit. Therefore, no increase in the number of rail trips is expected, but there would be an increase in the number of railcars transferred to/from the Refinery. The impacts of the increased use of rail are evaluated in Chapter 4.

2.8 CONSTRUCTION OF THE PROPOSED PROJECT

Construction activities for the proposed project are expected to begin in the second half of 2016 and are expected to be completed by March 2021, based on preliminary project engineering. As shown in Figure 2-18, the preliminary construction schedule for each component of the proposed project varies. The construction activities for most of the components are expected to overlap from about the third quarter of 2016 to the second quarter 2017. Most construction activities are expected to be completed by the end of 2018. However, the construction activities associated with the crude oil storage tanks are not expected to be completed until March 2021. Construction work shifts are expected to last about ten hours per day during most portions of the construction schedule. During normal construction periods, one work shift per day is expected beginning at 7:00 a.m. and ending at 5:30 p.m. (allowing 30 minutes for lunch) five days per week. During Refinery turnaround periods (when some of the Refinery Units are shutdown), two work shifts are expected and work may be conducted 24 hours per day. Shifts would operate from 6:00 a.m. to 6:00 p.m. and 6:00 p.m. to 6:00 a.m. seven days per week. The preliminary project schedule will be refined as more detailed engineering is completed. Impacts associated with the construction schedule evaluated in Chapter 4 represent a worst-case scenario, i.e., when the greatest number of construction related activities (peak construction phase) are occurring per day.

The proposed project will increase traffic in the local area associated with construction workers, construction equipment, and the delivery of construction materials. The proposed project is expected to require up to about 950 construction workers during the peak construction phase.

Parking during construction activities is expected to require the use of several nearby parking lots to handle the increase in workers. The expected location of parking for construction workers is provided in Figure 2-19. Parking and traffic impacts are evaluated in Section 4.7 of this EIR. Once construction is complete, no increase in permanent workers is expected.

2.9 OPERATION OF THE PROPOSED PROJECT

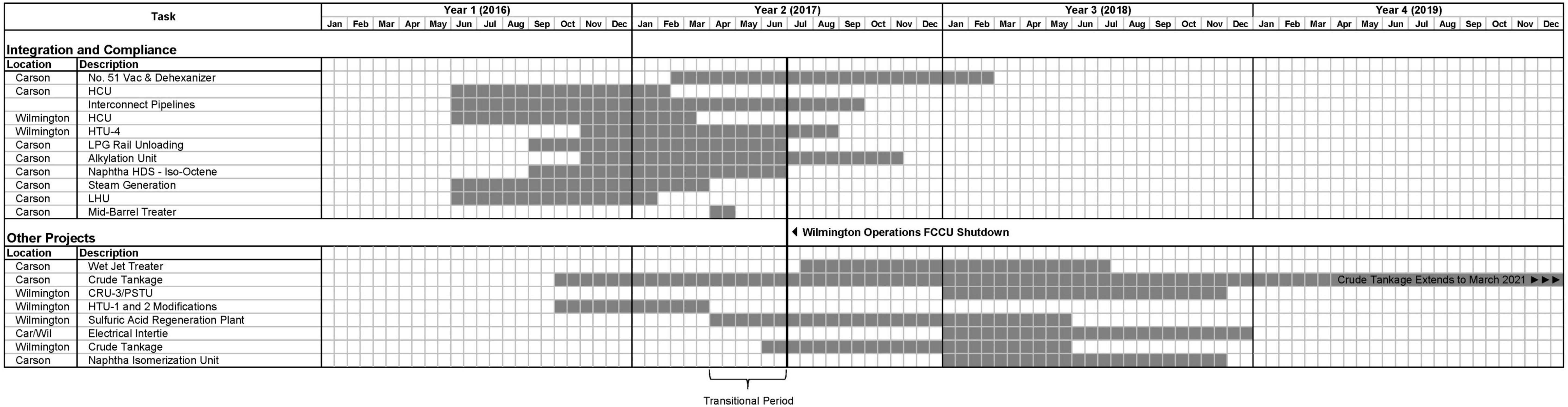
Construction of the project will not affect where the Refinery obtains crude oil. The project is not designed to enable the Refinery to change its feedstock or crude oil blend. The Refinery will continue its practice of seeking cost-effective or advantaged crude oils that can be blended with other crude oils and feedstocks to create the necessary blends suitable for Refinery operations. As discussed in Section 2.5.4.1, even if the Refinery brings in more North American crude oil, which would occur independent of this project, the Refinery crude oil blend properties must remain within the existing operating envelope and therefore will not result in the need for more intensive processing such as additional heat or sulfur removal. Any shifts within the existing operating envelope, for example more or less sulfur, would have negligible impacts on operating emissions because the acceptable crude oil blends already vary, are tailored to complement the existing Refinery configuration, and the Refinery already operates at all ranges within the envelope. Thus peak daily emissions will not change as a result of an unrelated change in crude oil source.

Once construction of the proposed project is completed, the existing work force at the Refinery is not expected to increase or substantially change the volume of traffic. No increase in permanent workers is expected so no increase in worker traffic is expected. Construction of the Sulfuric Acid Regeneration Plant will decrease traffic in the area because spent sulfuric acid is currently transported off-site for recycling. Installing the Sulfuric Acid Regeneration Plant will eliminate approximately 6,000 acid transport truck trip miles per month that are currently used to transport spent and regenerated sulfuric acid to and from Wilmington Operations.

The proposed project is expected to affect rail traffic. Up to ten railcars per day may be used to transport LPG to the Carson Operations. In addition, about four railcars of spent caustic per week are expected to be generated and shipped to the Gulf Coast for recycling.

2.10 PERMITS AND APPROVALS

The proposed project may require approvals from a variety of federal, state, and local agencies. Discretionary permits and approvals are listed in Table 2.10-1. Permits and approvals that are ministerial (i.e., do not require discretion) are summarized in the following subsections and are discussed in the appropriate environmental topic in Chapters 3 and 4.



Note: Wilmington DCU H100 and Carson FCCU Modifications are operational changes only and have no construction schedule.
Transitional Period is the 90-day period prior to the shutdown of the Wilmington Operations FCCU

FIGURE 2-18

CONSTRUCTION SCHEDULE
TESORO LOS ANGELES REFINERY

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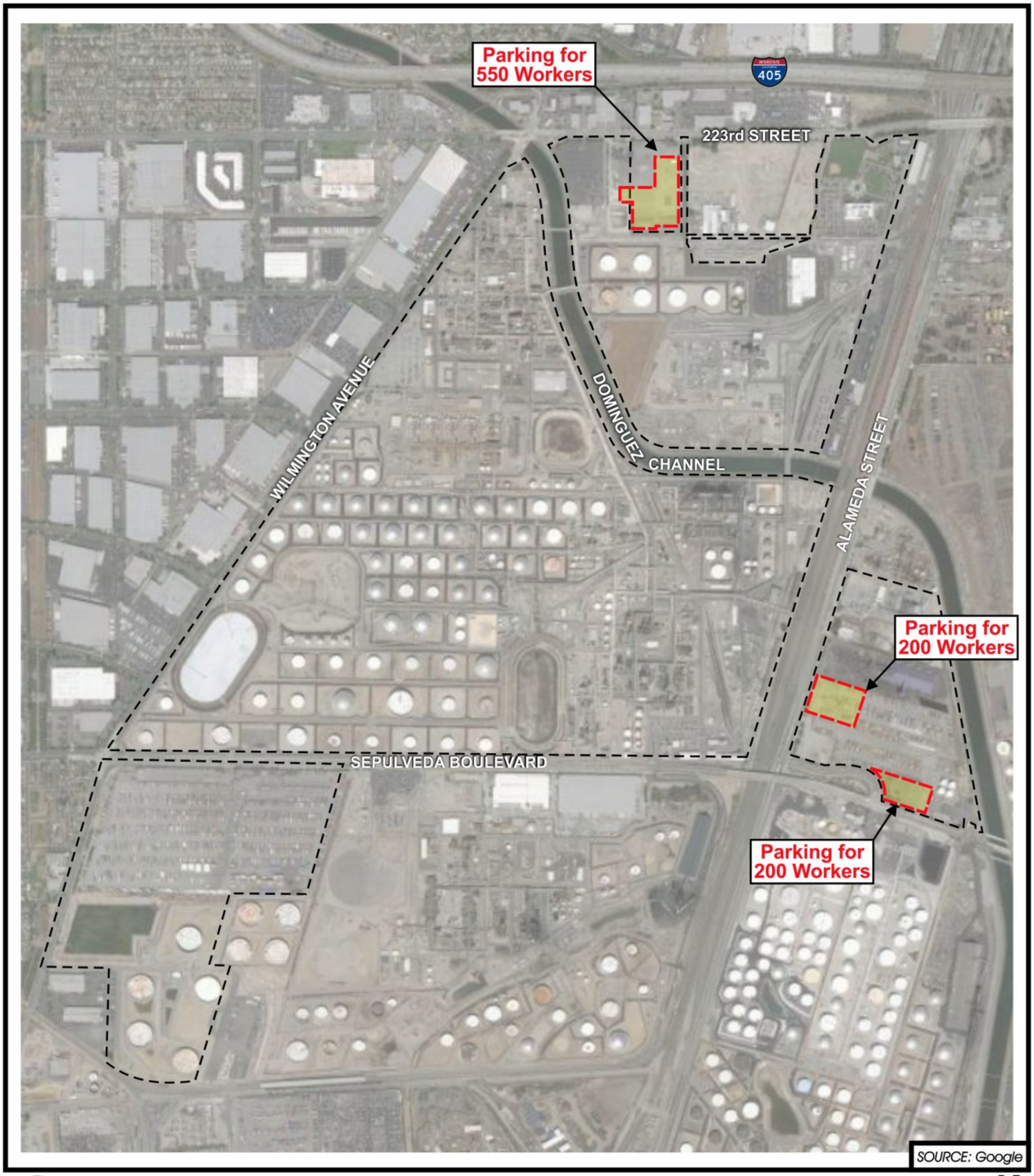

Environmental Audit, Inc.

FIGURE 2-19
PARKING MAP
TESORO LOS ANGELES REFINERY

Project No. 2844

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TABLE 2.10-1

Federal, State and Local Agency Discretionary Actions Needed for the Proposed Project

Agency Permit or Approval	Requirement	Applicability to Project
Federal		
None Required		
State		
None Required		
Local		
South Coast Air Quality Management District (SCAQMD)	Permits to Construct and Title V of the 1990 Clean Air Act.	SCAQMD Rule 201: Permit to Construct and Regulation XXX: Title V Permits. Applications are required to construct, operate or modify air emission sources.
	Permits to Operate	SCAQMD Rule 203: Permit to Operate. Applications are required to operate air emissions sources.
	California Environmental Quality Act (CEQA) Review	The SCAQMD is the lead agency for preparation of the environmental document (Public Resources Code § 21067).
	Standards for Approving Permits	SCAQMD Rule 212: Standards for Approving Permits. Permits cannot be issued if air contaminants create a public nuisance or exceed capacity limits. Also requires public notification of a significant project.
	Soil Contamination	SCAQMD Rule 1166: VOC Emissions from Decontamination of Soil. Requires the control of VOC emissions from soil remediation activities.
City of Carson	Conditional Use Permit	Required for new crude tanks at the Carson Crude Terminal.
	Right-of-Way	Required for new pipelines.
Alameda Corridor Transportation Authority	Right-of-Way	Required for pipelines under Alameda Corridor.

2.10.1 Federal Approvals

No discretionary federal agency approvals for the proposed project are expected to be required. Many of the U.S. Environmental Protection Agency (U.S. EPA) regulations and requirements are implemented by state or local agencies. For example, New Source Performance Standards are implemented by the SCAQMD and hazardous waste regulations are enforced by the California Department of Toxic Substances Control (DTSC). The Spill Prevention Control and Countermeasure (SPCC) Plan may require modifications to assure that all new and modified Refinery units are included in the Plan. The U.S. EPA also has authority over the Prevention of Significant Deterioration (PSD) Program and an applicability analysis to determine if PSD program permitting is required for the proposed modifications has been performed. The preliminary analysis concludes that PSD permitting will not be required for the proposed project.

The Occupational Safety and Health Administration (OSHA) regulates workplace hazards and enforces regulations that protect workers' health and safety. Under federal OSHA, regulations have been promulgated that require the preparation and implementation of a PSM Program (40 CFR Part 1910, Section 119, and Title 8 of the California Code of Regulations, Section 5189). The Refinery will be required to complete a PSM program to evaluate and minimize hazards associated with the proposed project. Finally, the U.S. Department of Transportation regulates the transportation of hazardous substances.

2.10.2 State Approvals

No discretionary state agency approvals for the proposed project are expected to be required. Construction-related permits may be required from the California Occupational Safety and Health Administration (CalOSHA) for demolition, construction, excavation, and tower and crane erection. Any transport of heavy construction equipment, which requires the use of oversized transport vehicles on state highways, will require a Caltrans transportation permit. The proposed project may require a Notice of Intent and preparation of a Stormwater Pollution Prevention Plan (Construction) under the statewide general stormwater NPDES permit from the State Regional Water Quality Control Board. DTSC regulates the generation, transport, treatment and disposal of hazardous wastes. Hazardous wastes generated by the proposed project activities and related to refining activities will be governed by rules and regulations enforced by DTSC. The existing PSM program and hazard communication program may require updating with CalOSHA due to the proposed project revisions.

2.10.3 Local Approvals

The SCAQMD has responsibility as lead agency for the CEQA process and for certification of the EIR because it has primary approval authority over the proposed project (CEQA Guidelines §15051(b)). Discretionary Permits to Construct/Operate for new equipment and modifications to existing units will be required. Certain components of the proposed project would also be subject to existing SCAQMD rules and regulations. Permits or plan approvals also may be required by SCAQMD Rule 1166 for soil remediation activities and demolition activities.

The LACSD and the County of Los Angeles Department of Public Works (LADPW) has responsibility for issuance of industrial wastewater discharge permits which are required for discharges into public sewers. No modifications are expected to be required to the Refinery's existing industrial wastewater discharge permits due to the proposed project.

The County of Los Angeles, Petro/Chemical Division, Fire Planning and Prevention Division is responsible for issuing ministerial permits for storage tanks and for review and approval of Risk Management Plans which will be required as part of the proposed project. The Fire Department also is responsible for assuring that the City fire codes are implemented. Ministerial building and grading permits for the proposed project will be required from the City of Carson and the

City of Los Angeles to assure that the proposed project complies with the Uniform Building Code.

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