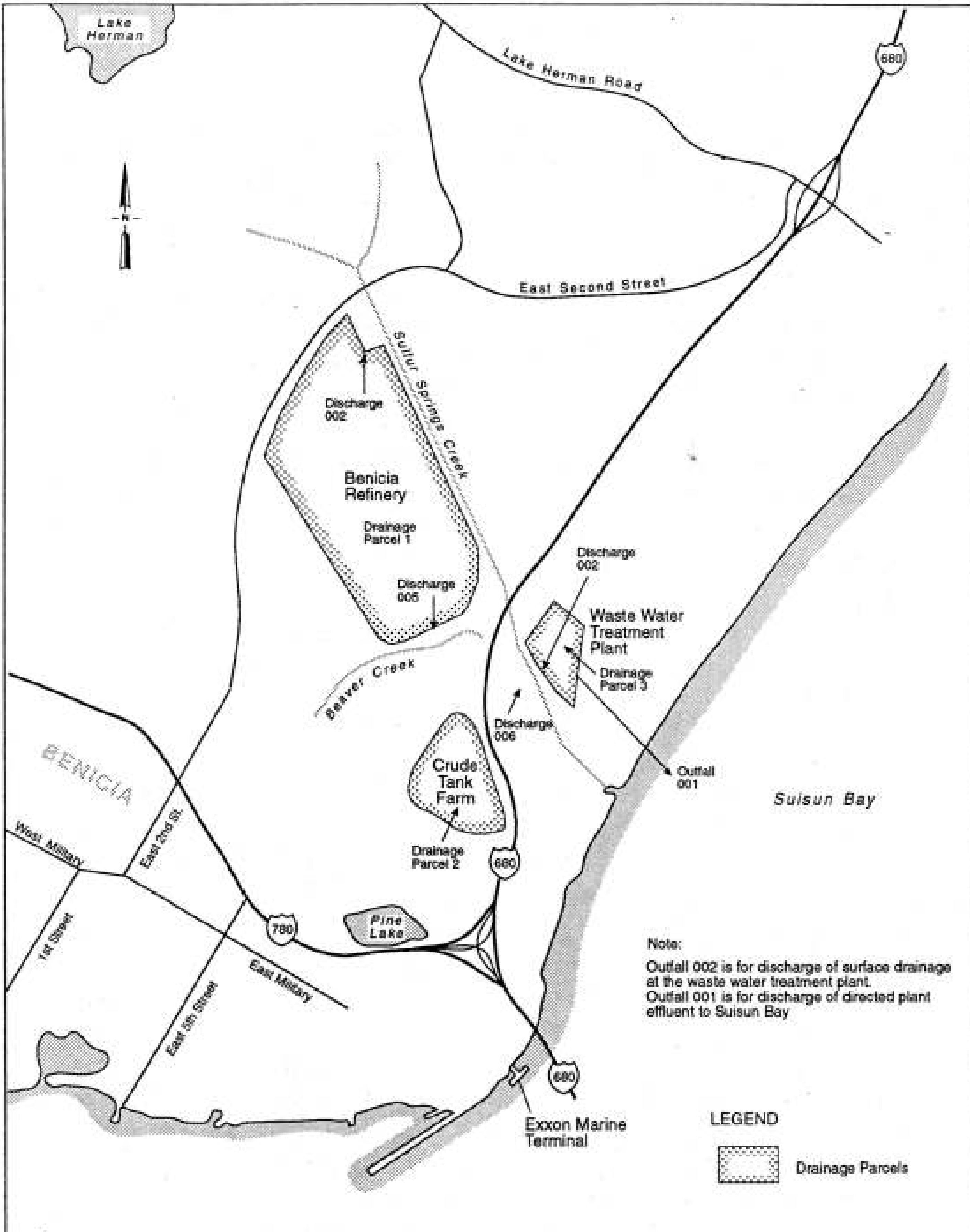
4.7 SURFACE WATER HYDROLOGY AND QUALITY

4.7.1 Environmental Setting

The Exxon Benicia Refinery is situated within rolling, low-elevation hills (ranging up to 200 to 300 feet) above Suisun Bay. Several small drainage catchments are located in the area. The largest of these is the Lake Herman/Sulphur Springs Creek watershed. Sulphur Springs Creek is impounded by Lake Herman Reservoir located to the north of the refinery. Below the reservoir, the creek eventually discharges to Suisun Bay (Figure 4.7-1). Along the eastern border of the refinery, the creek is channelized where it passes through the Benicia Industrial Park. Other small ephemeral tributaries to Sulphur Springs Creek flow from west to east near the refinery property. These include Beaver Creek, a drainage located along the southern boundary of the refinery.

<u>Existing Storm Water Drainage System at the Exxon Benicia Refinery</u>

As is common of most refineries, the majority of the surfaces within the Benicia Refinery are covered with impervious materials and storm water runoff is generally rapid. The storm drainage system at the refinery is divided into three major drainage parcels: Parcel 1 is the main refinery area, administration building, and product tank farm, Parcel 2 contains the crude oil tank farm, and Parcel 3 drains the area surrounding the waste water treatment plant (Figure 4.7-1). Within each of the drainage parcels, stormwater may be handled three different ways. First, some specific areas are diked or otherwise contained such that stormwater flows are collected and may be detained before they are released to the waste water treatment plant. This controlled system allows the refinery to regulate the volume of storm water flow that enters the waste water treatment plant at any given time. Second, there are areas where storm-water runoff is not collected or detained, and drains directly into a collection system that transports the flows to the waste water treatment plant. Finally, there are areas (primarily undeveloped) where storm water drains to a system of outfalls that are permitted under the National Pollutant Discharge Elimination System (NPDES), which eventually drain to Suisun Bay. The refinery's storm-water system for each of the major drainage parcels is described below.



Project No. 93C0336A	Exxon Clean Fuels Project	LOCATION OF DRAINAGE PARCELS AND STORMWATER OUT FALLS	Figure 4.7-1
Woodward-Clyde Consultants			

93C0336A-0600/083193

Parcel 1, the main refinery area, covers approximately 197 acres. Except for a 1-acre undeveloped area between the administration building and main process block, runoff from Parcel 1 flows to the waste water treatment plant through the storm-water drainage system. Dikes enclose approximately 61 acres of this drainage area. Drainage from the diked areas is controlled (detained) by manually operated valves so storm water that flows into the areas can be stored and drained to the treatment plant after the storm ends. Runoff from the remaining 137 acres is not controlled and flows directly to the treatment plant (Dames and Moore 1990).

Storm-water runoff is transported to the treatment plant through a 72-inch-diameter pipe. This water is treated at the plant as discussed in Section 2.6 and discharged to San Francisco Bay via an NPDES-permitted outfall 001 (Figure 4.7-1). Storm water falling in the 1-acre undeveloped area between the administration building and main processing block is discharged directly to receiving waters via NPDES discharge points 005 and 002 (Figure 4.7-1).

Parcel 2 drains about 123 acres and encompasses the crude oil tank farm. This area is located to the south of the main refinery and is geographically separated from it (Figure 4.7-1). Approximately 37 acres of Parcel 2 are diked to contain the crude oil tanks. Runoff from these areas can be stored and released to the treatment plant via the storm drain system after the storm ends. Runoff from the remaining 86 acres outside of the diked areas would not come into contact with crude oil; therefore, it is collected and discharged to Sulphur Springs Creek (and ultimately to Suisun Bay) through NPDES-permitted discharge point 006. Since 70 percent of the runoff in this parcel drains directly to the Bay, and the remaining amount can be released to the treatment plant in a controlled manner, runoff from this parcel does not contribute to peak flows or impact the treatment plant during a storm event.

Parcel 3 is the area surrounding the waste water treatment plant. This drainage area covers approximately 20 acres, all of which is diked (Dames and Moore 1990). Approximately half of this drainage area is covered by three surface water impoundments: an equalization pond, a retention pond, and a final pond. The equalization and retention ponds had historically been used for waste water storage prior to processing through the biological oxidation unit.

These ponds have been modified so that currently only storm-water runoff in excess of the treatment plant processing rate (2,500 gallons per minute [gpm]) is diverted into them. Exxon is currently expanding the capacity of the retention pond. The final pond is downstream of the treatment plant and receives treated effluent prior to discharge to San Francisco Bay. Storm water that falls on the 10 acres of Parcel 3 that is outside of the three ponds is collected and pumped to the retention pond for later processing at the treatment plant.

The process equipment for the Clean Fuels project is located in an undiked drainage area of Parcel 1. About half of the 2.75 acres that would be occupied by project equipment and tanks is currently paved. The remaining area is graded and graveled. The area is now used for truck parking and equipment storage. Three hydrocarbon tanks will be added to a controlled drainage area of Parcel 1. Drainage Parcels 2 and 3 would not be altered by the Clean Fuels project.

An additional area, located near the Gate 5 parking lot (Figure 2-2) would be graded and used for equipment fabrication. This area is not within any of the drainage parcels described above. Runoff from this area flows overland to an unnamed drainage and then into Sulphur Springs Creek.

Receiving Waters and Beneficial Uses

Discharges from the Benicia Refinery ultimately drain into Suisun Bay and the Carquinez Strait, the channel between Suisun Bay and San Pablo Bay of the San Francisco Delta system. In the Basin Plan (RWQCB 1991), the San Francisco Regional Water Quality Control Board identifies a number of beneficial uses of Suisun Bay and the Carquinez Strait that must be protected. The beneficial uses include:

- Water contact recreation
- Non-contact water recreation
- Navigation
- Ocean commercial and sport fishing
- Wildlife habitat

- Estuarine habitat
- Fish spawning and migration

The State Water Resources Control Board's Water Quality Assessment indicates that San Pablo and Suisun bays have elevated levels of mercury and selenium and have recently experienced fish declines. Selenium is of particular concern because it is known to bioaccumulate in tissues of aquatic organisms. Data on selenium concentrations in marine organisms indicate that food chains in Suisun Bay, Carquinez Strait, eastern San Pablo Bay, and the South Bay have elevated concentrations of this element (SFEP 1992).

Waste Water Treatment

A description of the components of the waste water treatment plant is provided in Section 2.6.7. Treatment capacity is discussed below.

Flows and Hydraulic Capacity. Process waste water and oil-free utilities waste water (i.e., filter backwash, boiler and cooling system blowdown) discharge to the treatment plant at an average rate of 1177 gpm (Dames and Moore 1990). Stripped sour water[1] flows to the treatment plant at an average rate of 300 gpm with a maximum rate of 400 gpm. The hydraulic capacity of the plant is limited by the capacity of the activated sludge clarifiers to a maximum of 2,500 gpm. The average process and utility waste water flow of 1177 gpm, combined with the average sour water flow of 300 gpm, uses approximately 60 percent of the hydraulic capacity of the treatment plant. The remaining 40 percent of capacity (or 1,023 gpm of flow) is available for treating stormwater runoff.

Peak Flows and Runoff Volumes. Dames and Moore (1993) performed stormwater runoff computations for the 5, 10, and 20-year, 24-hour storm events from the refinery. These storm events would result in runoff volumes from the overall refinery of approximately 26, 34, and 39 acre-feet, respectively. The runoff computations indicated that the existing drainage system has the capacity to easily convey runoff from the refinery's undiked areas during a 20-year storm event. The analyses also indicate that the existing drainage system, waste

[1] Sour water is water containing ammonia and hydrogen sulfide generated during the refining process.

water treatment capabilities, and impoundment volumes, including the expanded stormwater retention pond, are capable of handling the 5-, 10-, and 20-year, 24-hour storm events provided that the impoundment basins are dry prior to the storm, drainage into diked areas of the refinery can be retained and released after the storm event, and the treatment plant is operating at the design capacity of 2,500 gpm. If several storms occur over a period of several days, the storm-water storage and treatment capacity can be exceeded. That is, the refinery's containment (impoundment) areas that are designed to store and temporarily detain storm-water flows may become partially or entirely filled from a series of successive storms, thereby reducing available capacity for storm-water detention in the event of additional successive storms. When this occurs, excess storm water and process effluent bypass the treatment plant and are discharged directly to the Bay. As an example, a bypass of a mixture of storm water and process water occurred during mid-January 1993 when a large storm (approximately 2.5 inches in 24 hours) was preceded by several days of rain. Exxon is expanding the stormwater retention pond, in part, to reduce the frequency of such events.

Treated waste water is discharged into Carquinez Strait at a depth of 18 feet via a 12-inch pipe. The diffuser at the end of the pipe provides a minimum dilution ratio of 15:10.

NPDES Discharge Limitations and History of Compliance

Discharges from the Benicia Refinery are controlled under a NPDES permit Order No. 90-096 (NPDES No. CA0005550), which is regulated by the San Francisco Regional Water Quality Control Board (RWQCB). This permit covers the discharge of process waste waters from the waste water treatment plant and storm water. Routine water quality monitoring is conducted on outflows from one outfall (Waste 001) into the Carquinez Strait, and from four outfalls (002, 003, 005, 006) into the Sulphur Springs Creek.

Treatment Plant Discharges. The discharge limitations in the NPDES permit for the treatment plant are summarized for mass effluent in Table 4.7-1 and for concentration limits in Table 4.7-2. Toxicity bioassays are required for these discharges. These bioassays consist of placing three-spine stickleback and fathead minnow (or rainbow trout) in undiluted treatment plant effluent and evaluating their survival over a 96-hour period. The permit limitation on the toxicity tests requires a survival rate of not less than 50 percent. Discharge

TABLE 4.7-1

MASS EFFLUENT LIMITATIONS FOR DISCHARGE POINT, WASTE 001

Constituent	Units	Monthly Average	Maximum Daily
BOD (5-day @ 20C)	lbs/day	1416.	2549.
	kg/day	643.6	1159.
TSS	lbs/day	1133.	1777.
	kg/day	515.	808.7
COD	lbs/day	9888.	19060.
	kg/day	4495.	8664.
Oil and Grease	lbs/day	412.	772.5
	kg/day	187.3	351.1
	mg/l	8.	15.
Phenolic Compounds	lbs/day	5.42	19.06
	kg/day	2.46	8.66
Ammonia as N	lbs/day	772.5	1700.
	kg/day	351.1	772.7
Sulfides	lbs/day	7.47	16.7
	kg/day	3.4	7.59
Total Chromium	lbs/day	6.36	18.25
	kg/day	2.89	8.30
Hexavalent Chromium	lbs/day	0.52	1.16
	kg/day	0.24	0.53
Settleable Solids	ml/l/hr	0.1	0.2

Source: NPDES Permit Order No. 90-096. California Regional Water Quality Control Board. San Francisco Bay Region.

BOD - Biochemical Oxygen Demand
TSS - Total Suspended Solids
COD - Chemical Oxygen Demand

TABLE 4.7-2

CONCENTRATION LIMITS FOR DISCHARGE POINT, WASTE 001

Constituent	Daily Average (μg/l)
Arsenic	200
Cadmium	30
Chromium VI*	110
Copper	200
Cyanide	25
Lead	56
Mercury	1
Nickel	71
Silver	23
Zinc	580
Phenols	500
PAHs	150

Source: NPDES Permit Order No. 90-096. California Regional Water Quality Control Board. San Francisco Bay Region.

* This limit can be met as total chromium.

from Waste 001 is also subject to the following receiving water limitations:

- No floating, suspended, or deposited macroscopic particulate matter or foam
- No bottom deposits or aquatic growth
- No alteration of turbidity or apparent color beyond present natural background levels
- No visible, floating, suspended, or deposited oil or other products of petroleum origin
- No toxic or other deleterious substances to be present in concentrations or quantities which will cause deleterious effects on aquatic biota, wildlife, or waterfowl, or which render any of these unfit for human consumption either at levels created in the receiving waters or as a result of biological concentrations.

Monitoring of the discharge from the treatment plant to the Bay is required under the self-monitoring program to confirm compliance with NPDES permit stipulations, and is reported monthly to the RWQCB. These reports were obtained and reviewed for this EIR (Exxon 1991-1993). For the period between January 1991 through June 1993, all constituents were reported to be in compliance except for toxicity.

Toxicity of the refinery effluent (discharge point Waste 001) exceeded permit limitations 11 times in 1991, and 4 times in 1992. Most of these fish bioassay failures were related to insufficient nitrification thereby creating high nitrite levels in the water. Changes have been made by Exxon to improve performance of the bio-oxidation system and general treatment plant operations to increase nitrification. For a recent 6-month period (November 1992 through June 1993), there were no fish bioassay failures.

Selenium discharge limitations are expressed as a 12-month rolling mass average based on historical performance. The weekly mass estimate is calculated from the weekly concentration measurement and the average weekly flow rates. The 12-month rolling average is calculated as the average of the previous 52 weekly mass estimates. Exxon has not violated the selenium 12-month rolling average of 2.07 lb/day. The refinery's 1992 average mass was 1.89 lb/day.

In addition to the numeric indicator, the permit limits any selenium discharge increase by stating:

> These limits are intended to be a cap on current performance, and any enforcement action by the Board will be based on violation of that narrative standard as well as violation of the explicit numeric limits listed below.

Additionally, Regional Water Quality Control Board Order No. 91-026 (February 20, 1991) will require that the Exxon Refinery reduce discharges to a maximum daily selenium effluent limit of 50 parts per billion by December 1993 and a mass emission rate calculated on a running annual average of 0.97 lb/day.

Storm Water Discharges. Discharge points for the refinery's storm water runoff are from Outfalls 002, 003, 005, and 006 (Figure 4.7-1). Discharge limitations for untreated storm water are outlined in Table 4.7-3. Storm water runoff from the Clean Fuels process equipment area and tanks (to be located in Drainage Parcel 1) would flow to the treatment plant for processing. Storm water runoff for the proposed equipment fabrication and storage area adjacent to the Gate 5 parking area would flow to an unnamed drainage; this area is not within a drainage parcel.

4.7.2 Impacts And Mitigation

Significance Criteria

The CEQA guidelines list a series of conditions which could result in significant water quality and hydrology-related environmental impacts. According to CEQA, a project could have hydrology-related impacts if 1) the project results in changes in surface absorption rates, drainage patterns, or the rate and amount of runoff, and 2) exposes people or property to water-related hazards such as flooding. Based on this, the following significance criteria were used in evaluating hydrological impacts from the project:

TABLE 4.7-3

STORMWATER RUNOFF LIMITATIONS

Constituent	Monthly Average (mg/l)	Maximum Daily (mg/l)
BOD (5-day @ 20)	26.	48.
TSS	21.	33.
COD	180.	360.
Oil and grease	8.	15.
Phenolic Compounds	0.17	0.35
Total Chromium	0.21	0.60
Hexavalent Chromium	0.028	0.062

Source: NPDES Permit Order No. 90-096 California Regional Water Quality Control Board. San Francisco Bay Region.

BOD - Biochemical Oxygen Demand

TSS - Total Suspended Solids

COD - Chemical Oxygen Demand

- Substantial change in the rate and amount of surface runoff. A substantial change is considered to be a change which would cause exceedance of the refinery's treatment plant capacity.
- Changes in runoff or drainage patterns which would result in substantial flooding, erosion, or siltation.

The following significance criteria were used to evaluate the impact of the Clean Fuels project on water quality:

- Substantial change in concentrations and loads of pollutants to the receiving water. A substantial change is considered to be a change which would cause exceedance of the current NPDES effluent limitation.

<u>**Storm Water Runoff Impacts and Mitigation**</u>

The following impacts were identified for storm water runoff.

<u>**Impact No. 1**</u> **Increased storm water runoff would result from the increase in the amount of paved surfaces added by the Clean Fuels project. This impact would not be significant.**

Approximately half of the 2.75-acre project area is currently paved and contributes runoff to the waste water treatment plant. The increase of approximately 1.4 acres of impervious surface caused by the project would slightly increase the amount of runoff flowing to the treatment plant during storm events; this impact is discussed below. No discharge to Sulphur Springs Creek or Beaver Creek occurs from this area so no hydrological impacts (e.g., flooding) to the creeks would occur due to this project. The three new hydrocarbon tanks would be placed in a controlled runoff area (i.e., an impoundment or containment area capable of temporarily detaining storm water flows); therefore, there would be no change in peak storm water runoff flows to the treatment plant.

The proposed Clean Fuels process equipment area (2.75 acres) represents approximately 2 percent of the total undiked drainage area of Parcel 1. Since about half of the Clean Fuels project area is currently covered with impervious material, the impervious surface added by the project (1.4 acres) represents about 1 percent of the total undiked drainage area of Parcel 1. During a 20-year, 24-hour storm event, the currently unpaved portion of the proposed Clean Fuels process area would contribute approximately 0.2 acre-foot[2] (65,165 gallons) of runoff to the treatment plant. With the Clean Fuels process equipment in place, this area would contribute 0.36 acre-foot[3] (117,298 gallons), or about 0.16 acre-foot (52,132 gallons) more than under current conditions.

As discussed in Section 4.7.1, the refinery consists of areas where rainfall is contained and temporarily detained before being released to the waste water treatment plant, and areas where the storm water runoff is not contained, and flows directly to the treatment plant, or in undeveloped areas flows to a permitted NPDES outfall and to Suisun Bay. The additional flow from the new paved areas of the Clean Fuels process area (0.16 acre-foot for a 24-hour, 20-year storm event) would flow directly (not detained) to the treatment plant. This additional flow will utilize a portion of the excess capacity of the treatment plant that is currently available to process storm water runoff. This means that Exxon must withhold additional storm water flows within the contained (diked or otherwise controlled) portions of the refinery to avoid storm water runoff flows that exceed the hydraulic capacity of the treatment plant during a maximum storm event. To evaluate this potential impact, the total runoff from a maximum storm event was added to the existing waste water treatment plant capacity to determine if the project would change the size of the storm events that can be handled by the refinery's storm water storage and treatment system.

Table 4.7-4 lists runoff and waste water flows for a 20-year, 24-hour storm event. This is the maximum storm event used by Exxon to design the capacity of their storage and treatment system. Table 4.7-4 shows that such an event would currently result in 34 acre-feet

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[2] Calculated based on U.S. Soil Conservation Service (1986) runoff curve number of 77 and precipitation of 3.8 inches over 24 hours (see Dames and Moore 1990).

[3] Calculated based on U.S. Soil Conservation Service (1986) runoff curve number of 94 and precipitation of 3.8 inches over 24 hours (see Dames and Moore 1990).

TABLE 4.7-4

COMPARISON OF RUNOFF AND PROCESS WASTEWATER FLOWS, TREATMENT CAPACITY, AND STORAGE VOLUMES FOR A 20-YEAR, 24-HOUR STORM EVENT

	CURRENT CONDITIONS*			POST-PROJECT CONDITIONS		
	acre-feet	gallons	GPM	acre-feet	gallons	GPM
FLOWS TO TREATMENT PLANT						
STORMWATER RUNOFF 24 HOURS (PARCELS 1 AND 3)	42.75	13,929,181	9,682	42.91	13,981,314[b]	9,717[b]
PROCESS/UTILITIES[a] WASTEWATER	5.56	1,811,608	1,259	5.8	1,889,807	1,313[c]
STRIPPED SOUR WATER	1.46	475,710	331	1.46	475,710	332
TOTAL FLOW TO TREATMENT PLANT	49.77	16,216,499	11,272	50.17	16,346,831	11,362
TREATMENT PLANT PROCESSING RATE	11.05	3,600,000	2,500	11.05	3,600,000	2,500
STORM WATER STORAGE VOLUMES						
REQUIRED STORAGE VOLUME (total flow to treatment plant minus processing rate)	38.72	12,616,091	--	39.12	12,746,831	--
AVAILABLE STORAGE VOLUME	39.44	12,850,688	--	39.44	12,850,688	--
EXCESS STORAGE CAPACITY (available volume minus required volume)	0.72	234,597	--	0.32	103,857	--

* Includes modifications resulting from in-progress MTBE project.
[a] Utilities wastewater refers to water from filter backwash and boiler and cooling system blowdown.
[b] These volumes equal current flows plus the increase in runoff with the project.
[c] These volumes equal current flows plus the additional 56-gpm Clean Fuels wastewater flow.

of runoff, which would increase by 0.16 acre-foot to about 34.2 acre-feet (rounded) with the project in place. The treatment plant currently processes approximately 5.56 acre-feet over a 24-hour period, which would increase by 56 gpm (about 0.2 acre-foot per 24 hours) due to additional process flows coming from the Clean Fuels equipment, for a total of 5.8 acre-feet per day. When combined with stripped sour water flows, the total quantity of water that would need to be processed by the treatment plant from a 24-hour, 20-year storm combined with process flows would be 49.77 acre-feet currently, increasing to 50.17 acre-feet with the project. Because the treatment plant can process 11 acre-feet of flow per day, the refinery must be capable of temporarily storing 38.72 acre-feet of rainfall currently, and 39.12 acre-feet with the Clean Fuels project, in order to sufficiently handle a 20-year, 24-hour design storm event without having excess flow bypass the treatment plant. As shown in Table 4.7-4, the available storm water storage capacity is 39.4 acre-feet, which provides 0.72 acre-feet excess storage capacity currently, and 0.32 acre-feet with the project. This means that the Clean Fuels project would reduce the available storm water storage capacity of the refinery by 0.4 acre-foot, but that a design 20-year, 24-hour storm event could still be handled without exceeding the capacity of the system.

It should be noted, however, that the storm water storage capacity of the refinery has been exceeded in the past when multiple large storms occur over a short period of time (e.g., several days). This can happen if the storm water storage basins are partially or entirely filled as a result of consecutive storms, followed by a major storm event. Closely spaced major storms will occur in the future, and exceedances of the refinery's capacity can occur, with or without the project. The increased runoff associated with the proposed project would increase the frequency of such an event by 1 percent or less; therefore, this impact is not considered significant.

Runoff from the proposed equipment storage/fabrication area near the Gate 5 parking lot would not change appreciably with the project. The area is currently relatively level and unpaved, and does not contribute runoff to the waste water treatment system. Best management practices, according to the RWQCB's BMP guidelines for industrial storm water pollution prevention, would be implemented during equipment fabrication to prevent pollutants from entering the storm drains. After project modifications the area would be graded and would remain unpaved. No significant storm water runoff impacts are predicted for this element of the project.

Mitigation Measure No. 1

The increase in storm water runoff from the Clean Fuels project is not considered significant and no mitigation is required.

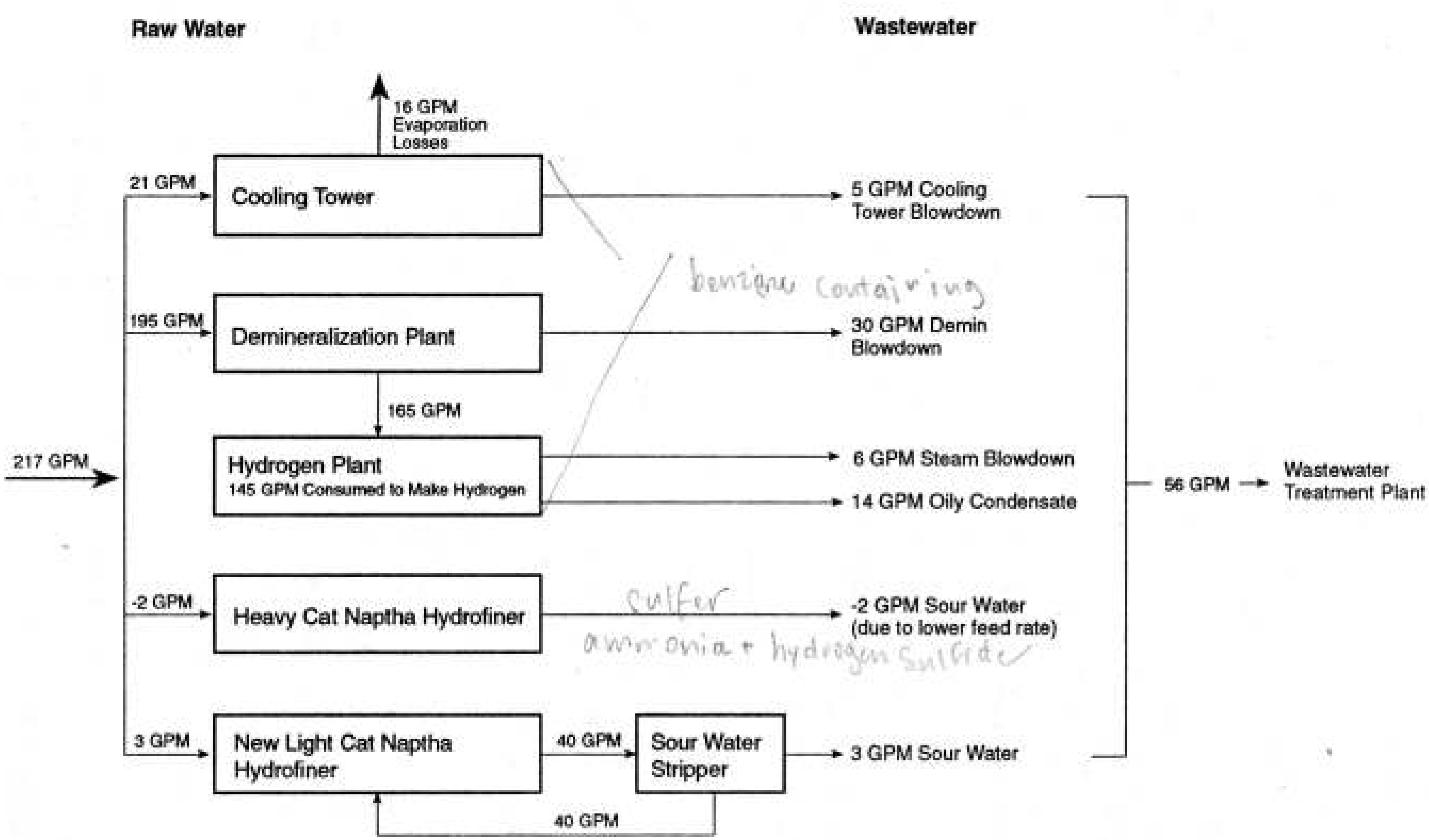
Water Quality Impacts and Mitigation

The proposed project would use an additional 217 gpm of raw water, of which 56 gpm would end up as additional waste water discharged to the treatment plant. Figure 4.7-2 shows the water balance for the additional 217 gpm of water that would be used for the project. The 56 gpm of waste water consists of several blowdown streams as well as some process waste water. The following is a discussion of the impacts to water quality of this additional waste water flow.

Impact No. 2 **The Clean Fuels project would result in an increase of 0.04 lb/day of selenium discharged to Suisun Bay. This impact is not significant.**

Selenium discharges are expected to increase slightly as a result of the Clean Fuels project. Table 4.7-5 presents an estimate of the increase in selenium as a result of the refinery modification project. Selenium is expected to increase by a total of 0.04 lb/day (2.1 percent of 1992 average) based on available data. If this increase is added to the 1992 average of 1.89 lb/day, the projected total mass discharge is 1.93 lb/day, which is below the current limit of 2.07 lb/day. Therefore, the project is not expected to exceed the current mass limit of the refinery's NPDES permit.

An additional dimension to the selenium issue is the previously mentioned RWQCB Order No. 91-026, which will require that the Benicia Refinery comply with a maximum daily selenium effluent limit of 50 parts per billion by December 1993 and a mass loading rate calculated on a running annual average of 0.97 lb/day. While operations at the Exxon Refinery do not result in exceedances of the current permitted discharge limit for selenium



Project No. 93C0336A	Exxon Clean Fuels Project	CLEAN FUELS PROJECT WATER BALANCE	Figure 4.7-2
Woodward-Clyde Consultants			

93C0336A-0600/083193

TABLE 4.7-5

**EXXON CLEAN FUELS PROJECT
POTENTIAL SELENIUM DISCHARGE**

Selenium in Raw Water

Basis: Raw Water Contains 6.6 ppb Selenium
Raw Water Consumption = 217 gpm
Selenium Reduction at Biotreater = 30% (observed)

Discharge = $217 \times 1440 \times 8.34 \times 6.6 \times 10^{-9} \times 0.7$
= 0.01 lb/day

Selenium Discharge in Raw Water = 0.01 lb/day

Selenium from New Light Cat Naphtha Hydrofiner

Basis: LCN contains 20 ppb, 19 kBD, 6.01 lb/gal
Selenium Removal 50%, Same as Existing HCN Hydrofiner
Selenium Reduction at Biotreater = 30% (observed)

Discharge = $19{,}000 \times 42 \times 6.01 \times 20 \times 10^{-9} \times 0.5 \times 0.7$
= 0.03 lb/day

Selenium Discharge from New Hydrofiner = 0.03 lb/day

Total Selenium Discharge 0.04 lb/day

(2.07 lb/day), present discharge levels do exceed the new limits (0.97 lb/day) set to become effective in December 1993.

Selenium control is currently addressed by several provisions in the NPDES permit. Previous studies have involved assessment of selenium sources and treatment options. Results of the studies are summarized below.

Selenium Sources and Evaluation. The main source of selenium entering the refinery is crude oil. Other minor sources include other purchased feed stock, purchased chemicals and even raw water. Within the refinery, the selenium is transferred to waste water by several processes such as the fluid coker, fluid catalytic cracker, and the hydrofiners for heavy hydrocarbon fractions. Selenium behaves chemically similar to sulfur in these processes. The sulfur is present as hydrogen sulfide and the selenium is present as hydrogen selenide in "sour gases." These compounds are condensed simultaneously with steam to form "sour condensates," and join with refinery wash waters to form sour water. To remove hydrogen sulfide and ammonia, sour gas and sour water streams are collected from all refinery operations and stripped prior to discharge to the sewer system and waste water treatment. Stripping is a chemical process to separate light components, usually gaseous, from heavier liquids. All sour water is treated in sour water strippers where the sulfur is removed and eventually recovered in catalytic reactors. Not all selenium is stripped out and some stays with the stripped water. Although there is some recycling and reuse of stripped sour water within the refinery, the majority of the selenium eventually reaches the waste water treatment plant.

Selenium Removal. A number of processes have been studied for selenium removal from refinery waste water, including biological treatment, evaporation, precipitation, adsorption, and ion exchange. The processes provide varying degrees of removal. Extensive bench-scale tests were conducted for Exxon by a consultant on the different selenium-containing waste water streams at the refinery. Iron absorption/coprecipitation was effective in treating the waste water effluent sufficiently to meet the future lower selenium NPDES limit. However, considerable amounts of waste sludge are produced containing primarily the iron used to coprecipitate the selenium. Under normal dry weather flow conditions, 8 to 10 tons per day of sludge would be produced to remove roughly one pound per day of selenium. The sludge would be classified as a California hazardous waste due to high selenium and vanadium levels. Further studies are underway by Exxon and also in a joint effort by all Bay Area refineries through the Western States Petroleum Association. It is anticipated that these research efforts will provide significant improvement to existing technologies, such as iron coprecipitation.

Impact of the Clean Fuels Project. As discussed previously, Exxon's Clean Fuels project would increase selenium slightly (by 0.04 lb/day), which would not increase the refinery's selenium discharge above the current regulated limit. Current refinery discharges exceed the future limit (effective December, 1993), and it is anticipated that the refinery will exceed the new limit after December, 1993. However, the Clean Fuels project will not be in operation until late 1995/early 1996. Exxon must meet RWQCB's order (No. 91-026) limiting total selenium discharges to 0.97 lb/day. Exxon must achieve this limitation through new treatment technology or other changes at the refinery that reduce or remove selenium from the waste water stream. The addition of 0.04 lb/day would not affect the choice of selenium treatment technology or its applicability to the waste stream. Based on the RWQCB order regarding selenium discharge limits, Exxon will have to bring the entire refinery into compliance by the time the Clean Fuels project is ready to start up. The treatment or removal processes carried out by Exxon will have to achieve a greater margin of selenium removal than the future limitation, due to the fact that discharge loadings fluctuate with normal variations in refinery operations. A 0.04 lb/day change in selenium would therefore not impact the ability of the refinery to meet the future limits. Since the conclusion that this is not a significant impact is predicated on the fact that Exxon must comply with the selenium discharge limitation imposed by the RWQCB, Exxon should report on compliance actions to the City of Benicia to demonstrate that the refinery will comply with the waste discharge order by the time that the Clean Fuels project is ready for operation, and that the addition of 0.04 lb/day would not adversely affect Exxon's compliance measures.

Mitigation Measure No. 2

Exxon should report to the City as to its compliance with the applicable cap on selenium discharge set by the RWQCB.

Impact No. 3 **The Clean Fuels process equipment would result in a minor increase in nitrogen and organic pollutant loads to the refinery's waste water treatment plant. The plant is capable of processing these increased pollutant loads. This impact is not significant.**

Out of the 56 gpm of waste water generated by the project, only the stripped sour water (1 gpm) and oily condensate (14 gpm) would contain significant amounts of nitrogen and hydrocarbons, respectively. The additional 1 gpm of sour water would represent less than 0.2 percent additional nitrogen load to the treatment plant. This would have no impact on plant performance or water quality. The additional 14 gpm of oily condensate is from the hydrogen plant. The condensate is expected to contain less than 0.5 percent (by weight) of light hydrocarbon, which would be readily biologically degraded in the treatment plant. No significant impacts to water quality from organic or nitrogen loading is predicted.

Mitigation Measure No. 3

The increase in nitrogen and organic loading is not significant and no mitigation is required.

Impact No. 4 **The Clean Fuels project would increase the total quantity of metals in the waste water discharge, but this increase is below the refinery's effluent discharge limitations. This impact is not significant.**

Total metals in the waste water generated by the project would be from 41 gpm of blowdown waste streams (5 gpm cooling tower, 30 gpm demineralization, and 6 gpm steam) and 14 gpm of oily condensate.

To estimate the increase in metals concentrations and loads, Table 4.7-6 summarizes the contribution of selected metals (copper, lead, nickel, vanadium, and zinc) to the treatment plant, and compares these estimates to the metals limitations in the current NPDES permit. These metals are targeted by the RWQCB in the current NPDES permit for source control.

The estimated concentrations of copper, lead and zinc are significantly lower than the current effluent limitations. The refinery's current NDPES permit is due for renewal in 1995, which roughly coincides with the time that the Clean Fuels modification project is completed. Therefore, it is appropriate to also compare the additional contribution of metals from the

TABLE 4.7-6

ESTIMATE OF CLEAN FUELS WASTEWATER METALS

	Copper	Lead	Nickel	Vanadium	Zinc
A. METALS CONCENTRATION (ppb)					
Current Metals Concentrations in Treatment Plant Effluent (1992 average)[a]	20	6	40	--	28
Estimated Metals Concentrations from Combined Existing and Clean Fuels Project Wastewater	21	6	42	--	30
Current NPDES Effluent Limitations	200	56	71	None	580
1995 NPDES Effluent Limitations[b]	37	53	65	None	580
B. METALS LOAD (pounds/day)					
Estimated Metals Loads from Clean Fuels Project Wastewater (weighted average before treatment)	0.02	0.003	0.03	0.4	0.03
Current Metals Loads in Treatment Plant Effluent (1992 average)	0.3	0.09	0.65	NA	0.45
Clean Fuels Project Wastewater Metals Load Contribution (%)[c]	5.2	3.2	4.4	--	6.3

[a] Average concentrations based on monthly NPDES monitoring data for 1992.
[b] Based on draft documentation provided by Lila Tang of the San Francisco Regional Water Quality Control Board.
[c] Clean Fuels Project wastewater load concentration = [Clean Fuels Project wastewater load(Current WWTP load + Project wastewater load)] x 100.

Clean Fuels project waste water to the proposed 1995 effluent limitations in Table 4.7-6. The comparison shows that, even with the expected lower effluent limitations in 1995, the estimated concentrations of copper, lead, nickel, and zinc from the combined current and project waste water would be well under the proposed limits. For example, the proposed 1995 limit for copper concentrations is 37 ppb. The estimated concentration of copper from combined existing and Clean Fuels effluent is 21 ppb, 16 ppb under the 1995 limit. Therefore the addition of small amounts of metals due to the Clean Fuels project has no significant impact on water quality.

Although there are currently no limits on copper, lead, nickel, and zinc loads in the permit, estimations of the increased loads of these metals from the Clean Fuels project were evaluated. Table 4.7-6 shows that the expected increase in metals loadings from the project range from about 3 percent (lead) to 6 percent (zinc) above current metals loads. This assumes that there is no reduction in metals as the additional waste water from the Clean Fuels project passes through the treatment plant. Because some metals reduction is expected to occur, the estimated increases in metal loadings are likely to be lower.

In the recently proposed waste load allocation for copper (RWQCB 1993a), the RWQCB proposed a load limitation of 0.356 lb copper per day on waste water from the Benicia Refinery. Current copper loads, estimated at 0.310/day, meet the proposed copper load limitation. An estimated increase of about 5 percent from the Clean Fuels project waste water would increase the total copper load to 0.327 lbs. per day, which would remain below the proposed copper load.

Mitigation Measure No. 4

The small increase in metals concentrations and loads from the Clean Fuels Project is not considered significant and no mitigation is required.

4.7.3 Cumulative Impacts

Hydrology

Other projects at the Benicia Refinery include the addition of an MTBE unit, retrofitting to reduce nitrogen oxide emissions, and construction of five storage and fabrication areas. The

MTBE unit would be constructed in an area of the refinery process block that is currently paved with impervious material and would not change current runoff conditions. The storage and fabrication areas would be graded and leveled, as necessary, and used for the storage of equipment and maintenance activities that are currently located on the site of the Clean Fuels project. These areas would not be paved and are not expected to increase runoff at the refinery. Since other projects at the refinery would not change runoff conditions appreciably, no cumulative hydrological impacts are expected.

Water Quality

Discharge of pollutant loads to San Francisco Bay, including organics, metals, and selenium are expected to increase as a result of the following:

- Future modifications to refineries in the Bay region
- Expansion or modifications of other industries contributing waste waters directly to the Bay
- Expansion of regional waste water treatment plants to accommodate regional residential, commercial and industrial growth

The proposed project would not increase the amount of organic material discharged to Suisun Bay. The mass load of metals in the refinery waste water discharge would increase by about 3 to 6 percent with the project. The project would also increase the mass loading of selenium by about 2 percent.

The RWQCB has developed a strategy for improving the quality of San Francisco Bay waters that addresses point (industrial) and nonpoint (municipal storm water) sources that discharge to the Bay. The RWQCB's San Francisco Bay Region have recently promulgated and proposed plans to limit the cumulative discharge of pollutants to the Bay. These plans include the following:

- San Francisco Bay Region Basin Plan (RWQCB 1991)
- Proposed Copper Waste Load Allocation (RWQCB 1993a)
- Proposed Selenium Waste Load Allocation (RWQCB 1993b)

The Basin Plan is a comprehensive plan that sets policies to address all industrial, commercial, and nonpoint source discharges to the Bay. The toxic pollutant control strategy in this plan includes three main components: (1) research (e.g., programs to determine the distribution and effects of toxic pollutants, long-term programs to develop effluent requirements), (2) investigation and monitoring (e.g., identification and monitoring of sensitive areas, requiring the use of more sensitive toxicity tests, and investigation of urban runoff by industries and local agencies), and (3) control of toxic pollutants by establishment of water quality objectives and regulation of dischargers through the National Pollutant Discharge Elimination System (NPDES). Additionally, the RWQCB has proposed two plans (the copper and selenium waste load allocations) to control the amount of copper and selenium into the Bay. In these plans, the RWQCB has proposed an aggressive approach to allocating specific numerical copper and selenium loads to all major discharges to the Bay, including industries (e.g., refineries), waste water treatment plants, and nonpoint discharges. These plans are developed to restrict the cumulative discharge of pollutants to the Bay.

The promulgation of effluent limitations for selenium provides an example of how the regulatory process is designed to protect receiving waters as a whole from cumulative sources. In response to the EPA, the RWQCB began in 1990 to develop more stringent control strategies to address the discharge of selenium to the San Francisco Bay system. Although no federal water quality criteria had been violated, there was concern about selenium because of its high potential for bioaccumulation and adverse impacts. The RWQCB decided to pursue establishing lower selenium limits to prevent potential violations, and address the impacts of bioaccumulation. In establishing these limitations, it was recognized that selenium has a number of natural and man-made sources, but that refineries contributed a large fraction of the total Bay selenium loading (the Delta outflow is considered the other major contributor). It was also recognized that there has been no established link between refinery discharges and elevated levels of selenium in animal tissue (RWQCB 1990). Therefore, the RWQCB focused on establishing limits on selenium concentrations and loadings that would reduce the total selenium input to the San Francisco Bay system. Alternative methods of selenium reduction, such as requiring refineries to change to the use of crude with a lower selenium level was not considered a feasible option by the RWQCB.

To lower cumulative selenium levels, two regulatory limitations were established. First, all Bay Area refineries were ordered to limit selenium concentrations to no more than 50 ppb by December, 1993. This standard was derived from meeting the EPA fresh water criteria of 5 ppb at the edge of dilution of the discharge. This limitation was also consistent with the State Water Resources Control Board's Bay & Estuary Plan water quality objectives. Second, a mass emission rate for each refinery was also established. For Exxon's Benicia Refinery, a mass emission limit of 0.96 lbs/day was calculated based on 50 ppb at their 1990 running annual average waste water treatment flow. This limit is also effective in December, 1993. Similar limitations were established for the Shell, Unocal, Tosco, Pacific, and Chevron refineries. The RWQCB determined that their proposed order would lead to a 50 percent reduction in cumulative selenium discharge from refinery sources to the San Francisco Bay system (RWQCB 1991). These new regulations have elicited comments ranging from concerns that the limitations may be impossible to achieve and are not appropriate, to comments that the limitations are not stringent enough. However, the RWQCB determined that the discharge limitations were the most feasible and achievable means of reducing the levels of selenium in the Bay, and that the cumulative reductions in selenium would have a beneficial effect in terms of reduced bioaccumulation of this constituent.

Compliance with water quality effluent limitations established by the NPDES permit for an individual source, such as the Benicia Refinery, are therefore designed to achieve water quality goals established for a water body or system as a whole. Compliance with individual NPDES discharge limitations would minimize the potential for cumulative significant impacts to water quality. As discussed above, the Benicia Refinery with the project is capable of meeting future, more stringent NPDES permit limitations except for selenium. Exxon is currently working on strategies to reduce selenium loads in their waste water, and the additional selenium added by the project would not inhibit these efforts. Because NPDES permit limits have been established to prevent cumulative water quality impacts to the San Francisco Bay system, and because the proposed project would not inhibit compliance with new selenium standards, the project would not result in a significant cumulative water quality impact.

4.8 GROUNDWATER AND HAZARDOUS MATERIALS CONTAMINATION

4.8.1 Environmental Setting

Regional Hydrogeologic Setting

The Benicia Refinery lies in the transition between the low-lying tidelands and foothill areas west of Suisun Bay. This area is within the San Francisco Bay Area Hydrologic Basin and is bounded to the east by the Suisun-Fairfield Valley Groundwater Basin and to the west by the Napa-Sonoma Valley Groundwater Basin (CDWR 1975, 1980). The area has not been designated as a groundwater basin due to the limited occurrence of groundwater. A study of the groundwater development potential classified the area as marginal to adequate for livestock or single family domestic use (Webster 1972).

Regional Groundwater Occurrence. Groundwater occurs in the region in several geologic units. The younger water-bearing units comprise the younger alluvium, older alluvium and the Sonoma volcanic rocks. The older units comprise Tertiary and Cretaceous-age sedimentary rocks (Thomasson et al. 1960). The younger alluvium consists of interfingering fluvial and estuarine silt, clay, and sand deposited by streams (fluvial) and in the tidal marshes (estuarine) of Suisun Bay and the Carquinez Strait. It yields small amounts of water to wells and transmits water readily in the fluvial deposits and less well in the estuarine portions. The older alluvium (Pleistocene age) comprises loose to moderately compacted fluvial silt, clay, gravel, and sands. Its overall ability to transmit water (permeability) varies depending on the thickness and extent of the gravel and sand lenses. The older alluvium comprises most of the sediments which fill the larger valleys and drainages in the region and serves as the principal water-bearing geologic unit (aquifer) in the Fairfield-Suisun area north of the facility. The volcanic-origin rocks (Sonoma volcanics) are also of Pleistocene age and are comprised of interbedded tuff, agglomerate, and flow rock. The volcanic rocks present within a few miles of the facility are mostly flow rocks which cap the northern portion of the Sulfur Springs Mountains northwest of Benicia. The groundwater flow in these rocks can be significant in the fractured portions of the formations, but overall the quantity is less than that of the older alluvium (Thommason et al. 1960).

The Tertiary and Cretaceous-age bedrock aquifer is not considered a significant source of groundwater in the region. Groundwater occurs in limited quantities in the fractured bedrock which comprises the low-lying hills west and northwest of the project site. The permeability of the fractured bedrock may be locally great enough to provide flow to individual wells but regionally is not a significant water-bearing rock formation (Thommason et al. 1960).

Regional Groundwater Flow Direction and Rate. Regional groundwater flow direction (gradient) is generally from the recharge areas in the hills northwest of the refinery toward the tidal marshes of Suisun Bay and the Carquinez Strait. Flow gradient in the older alluvial aquifer has been estimated at 25 to 40 feet per mile (0.004 to 0.007 feet per foot) (Thommasson et al. 1960).

Regional Groundwater Quality. Groundwater quality in the region ranges from generally good in the alluvial sediments to poor in the tidal marsh sediments. The groundwater in the alluvial aquifer may have locally high concentrations of boron, chloride, and iron. The groundwater in the estuarine sediments is brackish to saline (CDWR 1975).

Regional Existing and Potential Groundwater Uses. Groundwater is used in the region for agriculture and to a smaller degree for domestic use. Agricultural use is heavy in the Suisun Valley north of the proposed project site because of the extensive thickness of the older alluvium there, but is very limited in the low lying hills northwest of the refinery because of the limited occurrence of water-bearing formations. Potential future development of groundwater resources is limited by the scarcity of alluvium in the region around and to the northwest of the refinery.

Local Hydrogeologic Setting

Local Groundwater Occurrence. The Benicia Refinery area is underlain by manmade fill, Bay Mud, younger alluvium, older alluvium, and Tertiary and Cretaceous-age sedimentary rock. Groundwater occurs under unconfined or semi-confined conditions in all of the above formations, but is primarily found in the younger and older alluvial material (Dames & Moore 1988). Dames & Moore (1988) defined four water-bearing zones beneath the Exxon Benicia Refinery. These zones include:

- The vadose zone including observed perched water zones
- Uppermost (water table zone)
- Older sediments zone
- Bedrock zone

The shallow soil zone between the surface and the water table (vadose zone) is comprised of organic rich silty clay and clayey silt near Suisun Bay and gravelly clays in the upland areas of the refinery. It ranges in thickness between 0.5 foot near the refinery's waste water treatment ponds along the eastern portion of the site, to 8 to 25 feet near the crude oil tank farm. The vadose zone is also referred to as the unsaturated zone and while not fully saturated with groundwater, localized areas of saturation (perched zones) may occur that are not continuous with the rest of the water table. Perched zones have been identified near the crude oil tank farm in the upland portion of the facility. Clayey gravels and gravelly silty clays overlying less-permeable bedrock appear to have entrapped water at a depth of 8 to 25 feet below the surface. The water table is believed to be in the bedrock and, while not known exactly, is expected to be at a greater depth (Dames & Moore 1988).

The second zone is the upper most water-bearing zone (water table zone) which is comprised of gravelly clay fill and silty clay (Bay Mud) near the waste water treatment ponds to older alluvium and fractured bedrock in the upland portions of the refinery. The thickness of the zone ranges from 4 to 12.5 feet along the bay front to more than 25 feet in the upland areas of the facility.

The third water-bearing zone is the older alluvium which is comprised of silty clay and clayey silt with localized lenses of silty to gravelly sand water-bearing zone. Dames & Moore (1988) reported that these localized lenses occur at the base of the older sediment sequence and believed them to be the principal water-bearing stratum within the deposits. Approximately 24 feet of Bay Mud separates the older alluvium from the surface. Groundwater may be semi-confined in this stratum.

The fourth zone is comprised of the Tertiary and Cretaceous-age bedrock which consists of fractured shales, siltstones, and sandstone of the Panoche Formation. Although no borings have penetrated the bedrock and encountered groundwater at the facility, the interpolated depth to groundwater is estimated to be 30 to 40 feet.

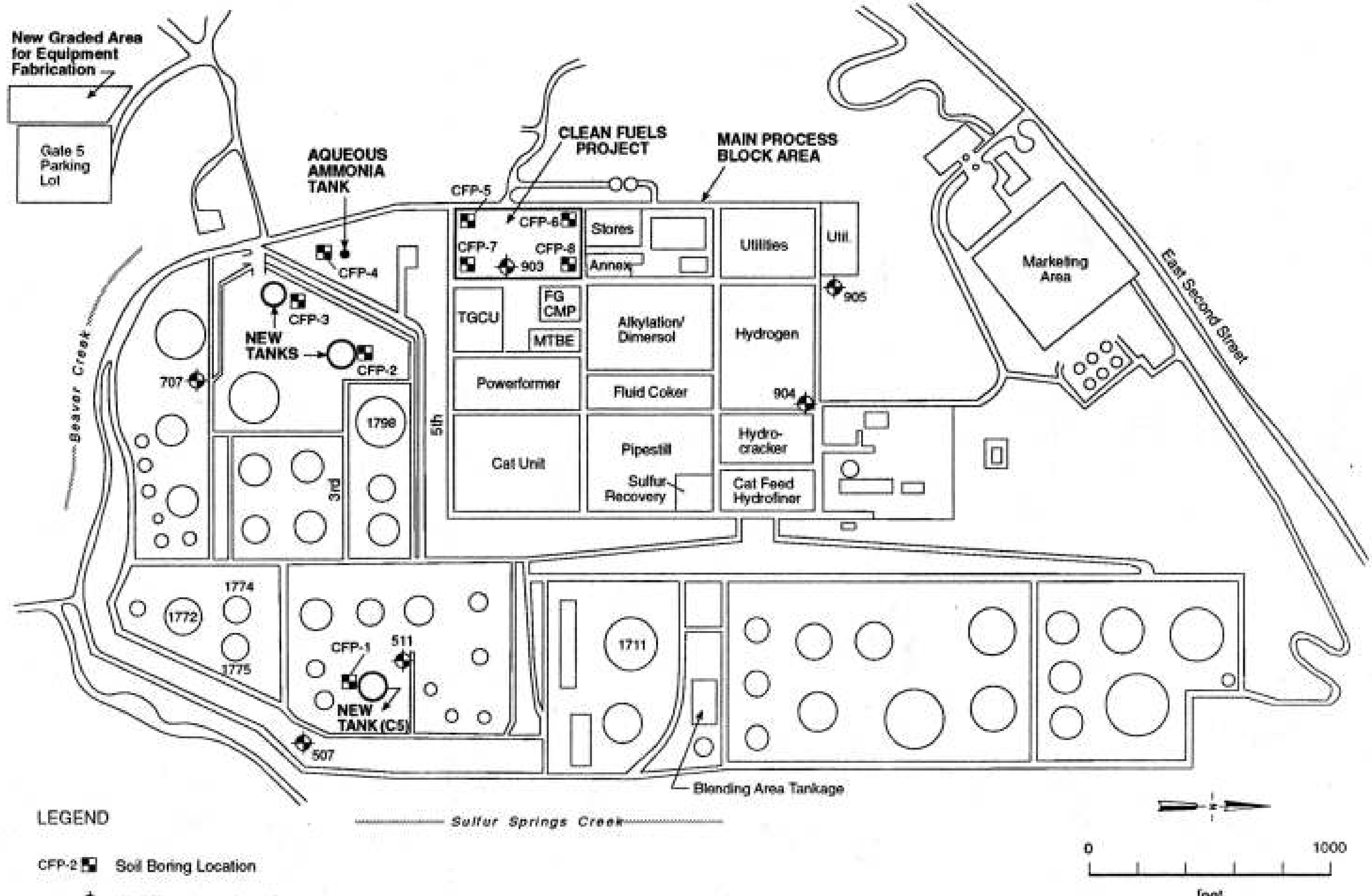
__Local Groundwater Flow Direction and Rate__. Depths to groundwater where project construction would take place range from a minimum of 11 feet to over 35 feet in the upland portions of the facility. Local gradients at the refinery follow the regional pattern but vary slightly in magnitude and direction (Harding Lawson 1993a).

At the refinery, groundwater moves generally toward Sulphur Springs Creek which flows in a channel that parallels the eastern boundary of the refinery (Figure 4.8-1, also Figure 4.7-1 in Section 4.7). The flow rate is estimated to be between 5 and 100 feet per year (Harding Lawson 1993a). Groundwater flow near existing Tank 1798 (located near the proposed hydrocarbon tanks; see Figure 4.8-1) flows southwesterly and away from Sulphur Springs Creek toward a drainage known locally as Beaver Creek. A bedrock ridge which underlies the facility near this tank was cut during original refinery construction activities and the spoil material used to fill the drainage immediately to the southwest (Beaver Creek). The lower permeability bedrock fill may act as a barrier to shallow groundwater flow creating a divide in that portion of the facility. In non-drought years, a spring has been observed to issue from the fill area creating a small amount of surface water flow in Beaver Creek.

Infiltration and migration of groundwater recharge may follow fractures in bedrock and/or other preferential flow pathways. Flow of water through these preferential pathways may be greater than flow through surrounding material.

A study was performed by Dames & Moore (1988) to evaluate the degree of influence of tides in the Carquinez Strait on groundwater in the vicinity of the waste water treatment ponds. Water levels were measured in eight monitoring wells in the vicinity of the ponds to observe whether groundwater levels showed a correlatable response to tides. Five of the wells showed effects of tidal influence of less than 0.2 foot. Tidal effects are measurable in the Suisun Bay side of the facility, but do not extend into the upland portions of the site.

__Local Groundwater Quality__. Groundwater quality in the refinery area ranges from good in the upland areas of the facility to brackish to saline in the areas along Suisun Bay



LEGEND

CFP-2 Soil Boring Location

511 Well/Piezometer Location

Reference: Harding Lawson (1993b)

Project No. 93C0336A	Exxon Clean Fuels Project	SOIL AND GROUNDWATER SAMPLE LOCATIONS FOR PROPOSED CLEAN FUELS FACILITIES	Figure 4.8-1
Woodward-Clyde Consultants			

93C0336A-0600/083093

(Dames & Moore 1988). The saline to brackish water has a chloride content of 510 to 40,000 milligrams per liter (mg/l) and is of such poor quality that it is of limited beneficial use (Harding Lawson 1993b). The fresh water resources in the upland areas while of potentially good quality, occur in small quantities which limits its beneficial use. Free phase liquid hydrocarbons have been observed in monitoring wells at five locations around the facility (Figure 4.8-1) including:

- Tank 1798 (between 3rd and 4th Streets) - 0.6 inches of diesel fuel
- Tanks 1772, 1774 and 1775 (along Sulphur Springs Creek near 2nd Street) - 5 inches of JP-4 jet fuel
- Blending Area Tankage (9th Street) - 5-inches of gasoline
- Tank 1711 (between 7th and 9th Streets) - detectable quantity of reformate
- Waste Water Treatment Plant - (adjacent to Suisun Bay) - undetermined quantity of heavy hydrocarbons

Remediation of the free phase hydrocarbons is in the planning stages and has not been initiated. Exxon is not currently subject to Regional Water Quality Control Board order but has committed to recover free phase hydrocarbons from areas where it has been detected. Remedial activities will include characterization of the nature and extent of contamination and cleanup.

Groundwater quality data collected as a part of a geotechnical and hydrogeological evaluation for the proposed project included soil and groundwater sampling and analysis in the areas to be affected by new construction. Samples were collected from monitoring wells near all proposed project equipment and tanks (Figure 4.8-1). The results are summarized in Table 4.8-1. Petroleum hydrocarbons (as gasoline and diesel) up to 10 mg/l were reported in two wells at the proposed hydrocarbon tank in the southeast tank farm area (Wells 511 and 507). Benzene (2.2 mg/l), toluene (0.62 mg/l), and xylenes (0.32 mg/l) were reported in one well (Well 507) near this tank location. Benzene concentrations of this well exceed the

TABLE 4.8-1

SUMMARY OF CHEMICAL TEST RESULTS FOR GROUNDWATER SAMPLES

Location	Date Sampled	TPHg mg/kg	TPHd mg/kg	TPHo mg/kg	Benzene mg/kg	Toluene mg/kg	Ethyl Benzene mg/kg	Xylenes mg/kg
Clean Fuels Process Block P903	03/10/93	ND (.05)	ND (.05)	ND(.5)	ND (.0005)	ND (.005)	ND (.005)	ND (.005)
Aqueous Ammonia Tank MW-707	07/29/92	ND (.05)	ND (.05)	ND (.5)	ND (.0005)	ND (.005)	ND (.005)	ND (.005)
	10/15/92	ND (.05)	ND (.05)	ND (.5)	ND (.0005)	ND (.005)	ND (.005)	ND (.005)
New Tanks See results for MW-707, above.								
C5 Tank MW-511	03/12/92	ND (.05)	ND (.05)	ND (.5)	ND (.0005)	ND (.005)	ND (.005)	ND (.005)
	05/12/92	ND (.05)	ND (.05)	ND (.5)	ND (.0005)	ND (.005)	ND (.005)	ND (.005)
	07/07/92	ND (.05)	ND (.05)	ND (.5)	ND (.0005)	ND (.005)	ND (.005)	ND (.005)
	10/13/92	ND (.05)	0.057	ND (.5)	ND (.0005)	ND (.005)	ND (.005)	ND (.005)
MW-507	07/07/92	10	2.6	ND (.5)	2.2	0.62	ND (.01)	0.32
	10/13/92	F.P.(1)	--	--	--	--	--	--
	01/18/93	F.P.(1)	--	--	--	--	--	--

Source: Harding Lawson (1993b)
ND = Not detected above reporting limits. Reporting limits listed in parenthesis.
F.P. = Free phase hydrocarbons characterized in jet fuel: approximately 4 inches thick.
TPH = Total petroleum hydrocarbons.
(1) = Proposed C5 Tank site not previously developed. Depth to groundwater is approximately 29 feet below ground surface. See text for discussion.

0.001 mg/l maximum contaminant level (MCL; California Department of Health Services) for drinking water.

<u>**Groundwater Wells**</u>. According to the California Department of Water Resources (CDWR), 98 wells are located within a 1-mile radius of the refinery. Ninety-four of these are monitoring wells associated with the refinery which are discussed in the previous section. The remaining four wells consist of three offsite monitoring wells and one domestic well. The water supply well is located at a residence in the City of Benicia and its use is unknown. Groundwater is generally not used for domestic purposes, as the city system obtains potable water from surface water sources (imports from the Sacramento River via the North Bay Aqueduct, supplemented by water from Lake Herman).

4.8.2 Impacts and Mitigation

Potential impacts to groundwater from the proposed project include (1) effects on water quality from accidental spills or leaks of hazardous materials or petroleum liquids, (2) effects on water quantity due to a reduction in the flow velocity, volume, or water table elevation due to construction activities, such as dewatering or foundation placement, and (3) interference with remediation of existing contamination.

<u>**Significance Criteria**</u>

An impact to groundwater is considered significant if, in the absence of mitigation measures, one or more of the following circumstances might occur:

- Substantial degradation or depletion of groundwater resources
- Substantial interference with groundwater recharge
- Substantial interference with groundwater flow rate or direction (gradient)
- Groundwater discharge that substantially degrades surface water quality

Potential impacts with respect to existing hazardous materials contamination are considered potentially significant if one or more of the following circumstances might occur:

- Potential for the proposed project to result in soil contamination which by itself or in combination with existing soil contamination could have the potential to adversely impact groundwater quality.

- Potential for the project to significantly impact the ability to investigate, control, or remediate existing contamination.

<u>Study Area</u>

The study area for groundwater and hazardous materials impacts evaluation includes the area covered by the existing Exxon Benicia Refinery, Sulphur Springs Creek from the northwestern refinery boundary until the confluence with Sulphur Springs Slough and the entire reach of Sulphur Springs Slough to where it enters Suisun Bay.

<u>Impact No. 1</u> **Excavation and construction of the project would not measurably impact groundwater quantity, flow or direction. This impact is not significant.**

The proposed project would involve construction of new tankage and process equipment at four major locations within the existing refinery. Construction of the proposed facilities would impede infiltration of precipitation on approximately 2 to 3 acres due to paving and placement of structures. As discussed in Section 4.8.1, there are very limited groundwater resources in the project area. The sites of proposed equipment and tankage are not located in the important recharge areas situated in the upland hills west of the facility. Further, some of the sites of new construction are currently paved so little infiltration if any occurs in these areas. Therefore, the loss of 2 to 3 acres for infiltration of runoff would not measurably affect the quantity of water in the local aquifers. This is not considered a significant impact.

Foundations and excavations for project facilities would not be expected to encounter groundwater, and therefore would not affect groundwater elevations, rate of flow, or flow direction. Based on preliminary plans, the proposed project construction sites are underlain by materials that provide good foundation support, therefore, only shallow spread footing type foundations would be used and pile foundations are not anticipated. Excavations for foundation construction would be limited to the upper few feet of soil and should not encounter the groundwater table. Groundwater level measurements were recorded by Harding Lawson (1993b) in each of the major construction areas (Table 4-8.2). The depths to groundwater below the ground surface ranged from a minimum of 11 feet in the vicinity of the new hydrocarbon tanks to a maximum of 35 feet in the vicinity of the Clean Fuels process area with an average depth of 15 feet. The depth to groundwater in construction areas is sufficient to preclude construction impacts during foundation construction. No groundwater is currently being withdrawn from wells located within the proposed project area. There are no identified impacts to groundwater quantity or flow direction due to new foundation construction.

Mitigation Measure No. 1

No mitigation is required.

Impact No. 2 **Construction and operation of the project would have a low potential to impact groundwater quality. This is not a significant impact.**

Potential contamination of groundwater resources due to accidental spills of chemicals, petroleum, other raw process materials or waste products from the proposed project would be avoided or minimized by the contaminant and detection systems that are part of the proposed facilities. Improvements for the proposed project that store or handle such materials, such as the new hydrocarbon and pentane storage tanks, are designed for secondary containment in the event of accidental release. Tank design calls for the steel tank to be underlain by a liner with a leak detection system placed in between plus a liner covering the entire earthen containment area to prevent accidental spills from infiltrating the ground. The proposed new process areas would be constructed over pavement which would prevent infiltration of spills or releases. These design measures reduce the potential for impacts to groundwater quality to less that significant levels.

The Clean Fuels project would be constructed in areas of the facility where groundwater is found at 11 to 35 feet of depth. In the event of an accidental chemical release to the ground,

TABLE 4.8-2

SOIL AND GROUNDWATER CONDITIONS

Proposed Construction Site	Soil/Rock Depth (feet)	Depth to Groundwater (feet)
Clean Fuels Project Process Area	Rock at surface in north and southwest: up to 30 feet of fill on east side	14 to 35
Aqueous Ammonia Tank	15 feet of fill over colluvium/rock	14
New tanks near the MTBE tank	22 feet of fill over colluvium/rock	11
C5 Tank	Rock at surface	29

Source: Harding Lawson (1993b)

groundwater quality would not be immediately impacted and remedial activities could be implemented before the release reached the water table. The Emergency Response Manual for the Benicia Refinery (Exxon 1989) provides for prevention and cleanup of spills and releases of fuels and chemicals. The purpose of the plan is to provide for responsive control and cleanup of spills or other releases to minimize potential effects to human health and the environment. Implementation of the Emergency Response Manual together with the above design measures would prevent potential impacts to groundwater quality.

<u>Impact No. 3</u> **Contaminated soils are present at the project site. Contamination is below threshold levels for remediation, and removal of contaminated soils due to construction of proposed facilities would be subject to further investigation and proper disposal. This impact is not significant.**

Soil testing has been previously performed by consultants for Exxon to assess the presence of soil contamination in the major construction areas for the proposed project. A total of 12 soil borings (shown on Figure 4.8-1) were advanced in the major process areas for the proposed project (Harding Lawson 1993b). The soil samples were screened using a photoionization detector which qualitatively detects the presence of petroleum hydrocarbons and volatile organic compounds. None of the samples exhibited a response from the detector, so only the uppermost samples collected (2.5 feet of depth) were analyzed. The 12 samples were analyzed for petroleum hydrocarbon quantified as diesel and gasoline by EPA Method 8020 and for benzene, ethyl benzene, toluene and xylenes (common constituents of fuel petroleum) by a modified EPA Method 8015.

The analytical results are summarized on Table 4-8.3. Petroleum hydrocarbons such as diesel were detected in a total of four samples: two collected in the vicinity of the Clean Fuels process equipment site and one each in the aqueous ammonia tank and new petroleum tank areas. Concentrations were less than 2 milligrams per kilogram (mg/kg) (Harding Lawson 1993b). Groundwater quality protection regulatory limits for total petroleum hydrocarbons in soil is 100 mg/kg (RWQCB 1990); therefore, the detected quantities of total petroleum hydrocarbons in soil do not pose a threat to groundwater quality, do not warrant excavation and disposal, and the project would not affect the levels of current contamination. The

TABLE 4.8-3

SUMMARY OF CHEMICAL TEST RESULTS FOR SOIL SAMPLES IN THE PROJECT AREA

Location	Date Sampled	TPHg mg/kg	TPHd mg/kg	TPHo mg/kg	Benzene mg/kg	Toluene mg/kg	Ethyl Benzene mg/kg	Xylenes mg/kg
Clean Fuels Process Block								
CFP-8-02.5	03/12/93	ND (.1)	ND (1)	ND (10)	ND (.005)	ND (.005)	ND (.005)	ND (.005)
CFP-7-02.5	03/12/93	ND (.1)	1.0	ND (10)	ND (.005)	ND (.005)	ND (.005)	ND (.005)
CFP-6-02.5	03/12/93	ND (.1)	ND (1)	ND (10)	ND (.005)	ND (.005)	ND (.005)	ND (.005
CFP-5-02.5	03/12/93	ND (.1)	1.7	ND (10)	ND (.005)	ND (.005)	ND (.005)	ND (.005)
Aqueous Ammonia Tank								
CFP-4-02.0	03/12/93	ND (.1)	1.1	ND (10)	ND (.005)	ND (.005)	ND (.005)	ND (.005)
New Tanks								
CFP-3-02.5	03/12/93	ND (.1)	ND (1)	ND (10)	ND (.005)	ND (.005)	ND (.005)	ND (.005)
CFP-2-02.5	03/12/93	ND (.1)	1.7	ND (10)	ND (.005)	ND (.005)	ND (.005)	ND (.005)
C5 Tank								
CFP-1-02.0	03/12/93	ND (.1)	ND (1)	ND (10)	ND (.005)	ND (.005)	ND (.005)	ND (.005)

Source: Harding Lawson (1993b)

ND = Not detected above reporting limits. Reporting limits listed in parenthesis.
TPH = Total petroleum hydrocarbons.

project design calls for further soil testing during demolition in preparation for foundation construction. If further contaminated soil is discovered, it would be removed and disposed of offsite in accordance with applicable local state and federal laws (Exxon 1993a). Based on these data, potential impacts related to contaminated soils are not expected to be significant.

<u>**Mitigation Measure No. 3**</u>

No mitigation measures are required.

<u>**Impact No. 4**</u> **There would be no effect to groundwater remediation activities due to construction. No impacts would occur.**

As discussed above, groundwater monitoring has shown free liquid phase hydrocarbons at 5 locations across the site. None of the free product has been identified in the areas of new construction for the proposed project. Soil contamination (see Impact No. 4) is below levels requiring remediation of the site. Therefore, the project would not affect the need for groundwater or soil cleanup activities. No impacts are identified.

<u>**Mitigation Measure No. 4**</u>

No mitigation measures are required.

4.8.3 Cumulative Impacts and Mitigation

<u>**Impact No. 5**</u> **The proposed Clean Fuels project and other projects planned at the refinery would have no adverse individual or cumulative impacts to groundwater resources. Other projects in the regional area are too distant to contribute any impacts to groundwater in the Benicia area. No cumulative impacts would occur.**

Other projects at the Exxon Benicia Refinery include the MTBE plant and the NO_x reduction project. Neither of these projects would adversely affect groundwater. The MTBE plant will be constructed in close proximity to the Clean Fuels project area within the refinery's main process block, where groundwater is at least 11 feet or more below grade. Construction of the MTBE project would have no effect on groundwater, as documented in the MTBE Negative Declaration/Initial Study (ENSR 1993a). The NO_x reduction project would involve equipment and modifications at the main process block that are above ground, and would also not affect groundwater resources. There would be no additive or cumulative impacts to groundwater from these projects with the Clean Fuels facilities.

Other related projects identified in Section 3.0 that would be constructed in the region, including reformulated fuels projects at other Bay Area refineries, would be too distant to contribute cumulative impacts to the groundwater resources in the Benicia area. The nearest projects are across the Carquinez Strait, and it is not expected that there would be cross-contaminations of groundwater aquifers that are separated by the Strait.

Mitigation Measure No. 5

No mitigation is required.