Table RMM-4: Evaluation of Potential for Damage to Active SYU Components from Dropped Cable [OPSR-A]

(Evaluation assumes worst case where cable can fall within an area formed by a cone with an apex angle of 90 deg at water surface.)

Activity	Location	Water Depth (ft)	Potential ImpactZone (ft^2)	Active P/L & PC Within Zone	Distance To P/L and PC (ft)	Potential For Impact	Plausible Damage Mode (Note 1)	Probability (Note 2 & 3)
OPSR-A Project Cable C1 and D1 Installation								
Cable Installation (Cable C1)	Conduit Terminus	25	1,965	Cable A	10	Yes	None (Buried)	Zero
				Cable B	5	Yes	None (Buried)	Zero
				POPCO P/L	70	No	N/A	
				HA Emulsion P/L	55	No	N/A	
				Treated Water P/L	50	No	N/A	
Cable Installation (Cable C1)	Platform Heritage Remove Cable C from J-Tube	1100	3,801,340	Cable E	300	Yes	SP w/C & PS	1.95×10^{-7}
				HE Gas P/L	645	Yes	PS	3.28×10^{-7}
				HE Emulsion P/L	1,015	Yes	None (Beyond PS Impact Zone)	Zero
Cable Installation (Cable C1)	Platform Heritage Cable C1 J-Tube Pull-In	1090	3,732,535	Cable E	30	Yes	SP w/C	1.80×10^{-7}
				HE Gas P/L	385	Yes	None (Cable Swinging Not Falling)	Zero
				HE Emulsion P/L	710	Yes	None (Cable Swinging Not Falling)	Zero
Cable Installation (Cable D1)	Platform Hondo Remove OS&T Cable from J-Tube	790	1,960,670	Cable A	690	Yes	SP w/C	1.99×10^{-7}
				Cable B	765	Yes	SP w/C	9.69×10^{-8}
				POPCO Gas P/L	360	Yes	PS	6.43×10^{-7}
				HA Gas P/L	805	No	N/A	
				HO Emulsion P/L	740	Yes	None (Beyond PS Impact Zone)	Zero
				HA Emulsion P/L	1,320	No	N/A	
				Treated Water P/L	1,245	No	N/A	

Table RMM-4 Continued

Activity	Location	Water Depth (ft)	Potential ImpactZone (ft^2)	Active P/L & PC Within Zone	Distance To P/LAnd PC (ft)	Potential For Impact	Plausible Damage Mode (Note 1)	
Cable Installation (Cable D1)	Platform Harmony Cable D1 J-Tube Pull-In	1195	4,486,285	Cable E	60	Yes	SP w/C	1.76×10^{-7}
				HE Gas P/L	330	Yes	None (Cable Swinging Not Falling)	Zero
				HE Emulsion P/L	430	Yes	None (Cable Swinging Not Falling)	Zero
				HA Emulsion P/L	575	Yes	None (Cable Swinging Not Falling)	Zero
Cable Installation (Cable D1)	Platform Hondo Cable D1 J-Tube Pull-In (Dwg. No. 8783-9)	800	2,010,625	Cable A	710	Yes	SP w/C	2.04×10^{-7}
				Cable B	805	No	N/A	
				POPCO Gas P/L	330	Yes	None (Cable Swinging Not Falling)	Zero
				HA Gas P/L	535	Yes	None (Cable Swinging Not Falling)	Zero
				HO Emulsion P/L	480	Yes	None (Cable Swinging Not Falling)	Zero
				HA Emulsion P/L	1,260	No	N/A	
				Treated Water P/L	1,165	No	N/A	

Note 1: SP w/C-Spaghetti Pile with Clamp; PS-Plunging Stalk; SP w/C & PS-Spaghetti Pile with Clamp & Plunging Stalk; N/A-Not Applicable
Note 2: Assumption: 1 time out of a 1000 cable will be dropped (no data available) Calculation: (Area of each P/L or PC in potential impact zone / Area of impact zone)
Note 3: E-7 equal to 1 / 10,000,000

Potential Upset Event 6 - Accidental Damage to Pipelines/Cables in the Onshore Tunnel

Removal and installation of cables in the conduit tunnel could cause damage to the existing cables or to the pipelines in the tunnel; however it would be highly unlikely for the reasons described below. The cable removal and installation operations would be conducted by winching the cables through the tunnel on a specially designed tray equipped with rollers for easy movement. The three power cables located in the tunnel are located on a tray above the emulsion pipeline. A treated water pipeline is also located in the tunnel. The POPCO gas pipeline is separated by a walkway and a handrail from the other pipelines and cables. This arrangement provides for protective spacing between the cables and the pipelines. Therefore, abrasion of the cable against existing pipelines is not possible. In addition, the tension and alignment of the cable during retrieval and installation would be continuously monitored through the tunnel and controlled on both ends. Consequently, it would be very unlikely that a pipeline or cable could be damaged by abrasion during cable removal and installation operations. ExxonMobil will prepare detailed execution procedures for cable installation and retrieval in the tunnel that will be available for review by any of the agencies to ensure appropriate safety measures are incorporated. The potential for a more severe accident resulting in a rupture of an oil, gas or treated water line is considered highly improbable (such events have never occurred but conceivably could). Absent execution of proper engineering and safety practices, SBC would consider this impact to be potentially significant but mitigable. Under NEPA, the impact would be considered insignificant due to the remote probability of occurrence. The mitigation measures in section 1.16.3 will be implemented to minimize risk.

Damage to one of the other cables could cause operational problems by partially or totally shutting down the platforms. In addition, damage to one of the other cables could require the replacement of the damaged cable, which would be a project similar to the one being evaluated in this document. This impact is considered to be insignificant. In addition, as discussed in Section 1.13 (Fire Protection), because of the classification of the tunnel (Class 1, Division 2), all work in the tunnel must comply with API RP 500 and NEC 70.

Conclusions – Proposed Project

Table RMM-5 presents the upset events, probabilities, impact classifications, mitigation measures, and residual impacts with mitigation measures for the upset events that were assessed for the previous similar OPSR-A project. The classification of impacts as potentially significant for Upset Events 1 and 2 is based on SBC's environmental impact significance criteria (any reportable oil spill is considered potentially significant). The BSEE would be expected to consider potential impacts from the incidental spillage of petroleum hydrocarbons from the DP and support vessel or incidental fuel oil spills to be insignificant. With proper planning, procedures, and safety plans, as well as good vessel housekeeping operations, all potentially significant impacts can be mitigated to insignificant levels.

Table RMM-5: Probability, Potential Impact, Mitigation, and Residual Impact for Potential Upset Events

(This information is required by the California Environmental Quality Act.)

Upset Event	Probability of Upset Event	Impact Classification*	Mitigation Measure	Residual Impact
1. Incidental spillage of petroleum hydrocarbons from the DP and support vessel.	Unlikely	CEQA: Potentially significant NEPA: Insignificant	RMM-1 through 4	Insignificant with mitigation (Class II)
2. Incidental fuel oil spills.	Unlikely	CEQA: Potentially significant NEPA: Insignificant	RMM-5	Insignificant with mitigation (Class II)
3. Anchoring accidents.	Unlikely	CEQA: Potentially significant NEPA: Insignificant	RMM-6 and 7	Insignificant with mitigation (Class II)
4. Accidental release of cable with plausible damage to pipeline.	Highly Improbable	CEQA: Potentially significant NEPA: Insignificant	RMM-8 and 9	Insignificant with mitigation (Class II)
5. Impact by the DP vessel with a platform	Rare	Insignificant	None	Insignificant (Class III)
6. Potential damage to existing pipelines or power cables during removal and installation of cable in tunnel.	Highly Improbable	CEQA: Potentially significant NEPA: Insignificant	RMM-10 through 12	Insignificant with mitigation (Class II)

* The classification impact levels differ under CEQA vs. NEPA due to differences in agency significance criteria.

1.16.3 Mitigation Measures

Mitigation Measures for Potential Upset Event 1 – Incidental Spills of Lubricating Oils, Hydraulic Fluids, and Waste Oils

RMM-1: ExxonMobil shall ensure that all installation contractors maintain good housekeeping practices to avoid washing of lubricants or other hydrocarbons from deck into the ocean or dropping of debris overboard. All lubricating oils, hydraulic fluids, waste oils and related materials shall be stored in contained areas.
Expected Enforcement Agency: BSEE, SLC.

RMM-2: ExxonMobil shall ensure that all materials related to cable retrieval and installation operations are loaded on the DP vessel at applicable port locations and transfer of materials at sea should be avoided to the extent feasible. No crane lifts of materials and equipment shall be made over operating pipelines and power cables.
Expected Enforcement Agency: BSEE, SLC, SBC

RMM-3: ExxonMobil shall prepare a project-specific addendum to the SYU Oil Spill Response Plan (OSRP) that clearly identifies responsibilities of contractor and ExxonMobil personnel. The plan shall list and identify the location of oil spill response equipment and response times for

deployment. The addendum shall be submitted to the BSEE, SLC and SBC prior to commencement of cable installation and retrieval operations.
Expected Enforcement Agency: BSEE, SLC, SBC.

RMM-4: ExxonMobil shall provide OSPR training to primary contractors and sub-contractors to ensure clear understanding of responsibilities and prompt oil spill response procedures. If any contractors are to be responsible for boom deployment, ExxonMobil shall conduct a boom deployment drill prior to commencement of power cable removal and installation operations. ExxonMobil shall notify BSEE at least 72 hours before the drill so BSEE can witness boom deployment operations.
Expected Enforcement Agency: BSEE, SLC, SBC.

Mitigation Measure for Potential Upset Event 2 - Incidental Fuel Oil Spills

RMM-5: ExxonMobil shall refuel all vessels involved in the project at onshore facilities (ports/piers) or in accordance to a Fueling Plan. ExxonMobil shall submit the Fueling Plan to BSEE, SLC, and SBC prior to commencement of cable installation and retrieval operations. There shall be no boat-to-boat fuel transfers, with the exception of skiffs on the DP Lay vessel, which are only fueled when on the vessel.
Expected Enforcement Agency: BSEE, SLC, SBC.

Risk Mitigation Measures for Potential Upset Event 3 – Anchoring Accidents

RMM-6: ExxonMobil shall set all anchors a minimum of 250 feet (75 meters) from active pipelines and power cables.
Expected Enforcement Agency: SLC, BSEE.

RMM-7: ExxonMobil shall submit an Anchoring Plan to SBC, SLC and BSEE prior to commencement of cable installation and retrieval operations. The plan shall list all of the vessels that will anchor during the project and the number and size of anchors to be set. The plan shall include detailed maps showing anchoring sites identified during the pre-installation biological surveys, including re-positioning of anchors to ensure that they are at least 40 feet (12 m) from rocky habitat. The plan shall also describe the navigation equipment that would be used to ensure anchors are accurately set and anchor handling procedures that would be followed to prevent or minimize anchor dragging.
Expected Enforcement Agency: BSEE, SLC, SBC.

Mitigation Measures for Potential Upset Event 4 – Accidental Release of the Cable and Damage to Nearby Structures

RMM-8: ExxonMobil shall prepare a Critical Operations and Curtailment Plan for offshore cable installation and retrieval operations that describes weather and sea conditions that would require curtailment of operations. The plan shall be submitted to BSEE, SLC, and SBC prior to commencement of the cable installation and retrieval operations.
Expected Enforcement Agency: BSEE, SLC, SBC.

RMM-9: ExxonMobil shall prepare and submit a Cable Release Prevention Plan which details the specific measures to be taken at all locations where a cable is suspended and could fail and fall to the ocean floor. The plan shall detail design measures, engineering measures, safety

measures, and redundancy in safety equipment. The plan shall be submitted to BSEE and SLC prior to commencement of the cable installation and retrieval operations.
Expected Enforcement Agency: BSEE, SLC, SBC.

Mitigation Measure for Potential Upset Event 6 – Accidental Damage to Pipelines/Cables in the Onshore Tunnel

RMM-10: ExxonMobil shall prepare a Safety Plan for Tunnel Cable Installation and Removal Operations that describes procedures that will followed and safety measures that will be taken to ensure damage to other cables and pipelines does not occur. The plan shall include the method proposed to enable continuous monitoring of cable pull activities in the tunnel. The procedures shall identify activities during which SYU operations will be shutdown. The plan shall include a hazards study evaluation of cable installation and removal operations in the tunnel using an appropriate method (e.g., "What-If" or "Checklist"). The study shall identify potential failure modes, protection devices or systems, safety procedures and redundant safety equipment or measures (levels of protection). Procedures and safety plan shall be submitted to SBC prior to commencement of the cable installation and retrieval operations and to the Santa Barbara County System Safety Reliability Review Committee (SSRRC).
Expected Enforcement Agency: SBC.

RMM-11: ExxonMobil shall prepare an Execution Plan describing cable removal and installation procedures in the onshore tunnel. The plan shall describe measures that will be taken to minimizing the tension/stress that will be placed on cables during cable pulling operations. Detailed plans shall be submitted to SLC and SBC prior to commencement of cable removal and installation operations and to the Santa Barbara County System Safety Reliability Review Committee (SSRRC).
Expected Enforcement Agency: SBC, SLC.

RMM-12: ExxonMobil shall de-energize the cables and shutdown the oil and gas pipelines in the tunnel during cable pulling operations in the tunnel, unless ExxonMobil can clearly demonstrate to SBC and SLC that cable pulling operations can be performed safely while the cables and pipelines in the tunnel are operating.
Expected Enforcement Agency: SBC, SLC.

See also mitigation measure FIRE-2.

Residual impacts would be expected to be insignificant.

1.16.4 Cumulative Impacts

The proposed project is not expected to significantly contribute to risk of upset conditions on a cumulative basis based on similarity to OPSR-A analysis. Risks associated with the cable installation and retrieval operation in conjunction with ongoing SYU operations are described in Section 1.16.2. There are no other significant offshore operations expected to take place during the cable retrieval and installation operations in this area.

1.17 Historic Resources

1.17.1 Environmental and Regulatory Setting:

Two historic structures are located near the mouth of Corral Canyon north of U.S. Highway 101 (Exxon EIR, 83-EIR-22). The structures are believed to have been built in the 1870s by Bruno Orella, a local cattle rancher (Heff, 1983). Both buildings are listed in the California Inventory of Historic Resources and are considered historically significant. One of the structures was reconstructed prior to construction of the original Exxon project. The adobes were rehabilitated and given landmark status by Resolution 94-436 adopted by the Board of Supervisors in August 1993 as mitigation for original construction of the Exxon project.

1.17.2 Project Impact Assessment

Onshore: Excavation work would be located approximately ½-mile south of the Orella Adobes and therefore there would be no foreseeable impacts from the proposed project. The applicant does not propose to use the structures for offices or any other function associated with the project.

Offshore: Not applicable.

1.17.3 Mitigation Measures

No mitigation would be required and no residual impacts would result from the proposed project.

1.17.4 Cumulative Impacts

There would be no cumulative impacts associated with the proposed project.

1.18 Land Use

1.18.1 Environmental and Regulatory Setting

The onshore and coastal land use plans/policies that govern the SYU project are contained within the California Coastal Act, Santa Barbara County Comprehensive Plan and implementing Article III Zoning Ordinance and the Local Coastal Plan and implementing Article II Coastal Zoning Ordinance. While the majority of ExxonMobil's onshore processing facilities are located on the inland side of the coastal zone boundary, the onshore portion of the proposed project lies within the coastal zone.

The CCC concurred with the consistency certification made by ExxonMobil for the offshore portion of the original project. The CCC found that while the proposed development adversely affected the coastal zone, it met the policies of the California Coastal Management Plan and was therefore found to be generally consistent with the CCMP and the policy requirements of Chapter 3 of the Coastal Act.

Onshore: The Las Flores Canyon property is a parcel comprised of approximately 1500 acres owned by ExxonMobil. Thirty four acres are developed with the ExxonMobil and former Pacific Offshore Pipeline Company (POPCO) oil and gas processing facilities. The surrounding parcel is zoned AG-II-100, Agriculture, 100-acre minimum parcel size and both facilities are located on property zoned M-CR, Coastal-Related Industry. The Comprehensive Plan land use designation is

AG-II-100, 100-acre minimum parcel size with a Petroleum Resource Industry Overlay. Historic land use was agricultural and oil and gas development.

The project site is located within the South Coast Consolidation Planning Area and is one of two designated consolidated oil and gas processing sites on the Santa Barbara County South Coast (Exxon Final EIR/S, 83-EIR-22). Continued oil and gas processing is allowed, and any new processing would be encouraged to occur, in Las Flores Canyon.

The County is finalizing Oil and Gas Abandonment Policies that would put into effect standards for on and offshore decommissioning and abandonment of oil and gas processing facilities in Santa Barbara County. While there are no officially adopted County policies to-date, the practice has been to require removal of abandoned structures located in dynamic environments, especially stream crossings, surf zone areas, etc. unless there are significant and compelling environmental reasons to allow them to remain.

Offshore: The existing pipelines and cables are located within a State Lands lease to the OCS boundary (3 nautical miles offshore). The pipelines and cables continue into OCS waters under existing OCS oil and gas leases with the BSEE (formerly MMS). The California Coastal Commission issued a permit for the onshore and State Waters portion of the original project and has consistency review authority over federal action(s) taken on the project under the Coastal Act. The CCC found the original project consistent with the California Coastal Act as part of the State's obligation to determine federal consistency with projects located in federal jurisdiction that may affect state waters.

Condition #3 of the applicant's CCC permit addresses the abandonment of project facilities as follows:

> *Prior to termination of the operation of any of the facilities authorized by this permit, Exxon shall apply for a coastal permit for the abandonment of the subject facilities. A permit application for facility abandonment shall include plans for site restoration.*

ExxonMobil proposes to meet this condition by submitting a plan for retrieval of the out-of-service cables from the nearshore area to just beyond the State-Federal Boundary as part of this project with the remaining cables removed at the end of the SYU project life.

1.18.2 Project Impact Assessment

A project could be expected to have the potential for significant land use impacts if it conflicts with existing regulations, policies or requirements or if the proposed project introduces structures incompatible with surrounding land uses.

Onshore: As currently proposed, the project would not introduce any land uses incompatible with existing land uses nor would it involve the installation of any incompatible structures. The proposed project involves the retrieval and replacement of the out-of-service power cables and the installation of a fiber optic cable to the facilities located at the upper canyon facilities. The power cables would be installed in the same conduit as the out-of-service cables. The fiber optic cable would be installed within existing or new facilities; no significant structural modifications would be required. The proposed project is consistent with all local land use plans, policies and existing project conditions.

Offshore: The proposed project would not result in incompatible land uses beyond those evaluated in the original project EIR (SAIC, 1984) for installation and operation of all the SYU facilities (platforms, pipelines and power cables). Potential conflicts with fishing activities – commercial and sport – were addressed in previous environmental analyses as discussed in Section 1.6 (Commercial Fishing) of this document.

As proposed, the project would not result in conflicts with existing land use regulations, policies or requirements currently in place. The project would result in the installation of two approximately 5 mile lengths of armored cables in state waters within the existing pipeline/power cable corridor leased from the State Lands Commission. An equal amount of cables (out-of-service Cables A or B and C1) would be retrieved from state waters.

In federal waters, approximately 19 miles (31 km) of replacement cable would be installed (Cables A2 (or B2), and F2 from shore to Platform Harmony and G2 from Platforms Harmony to Platform Heritage) and 11 to 16 miles (18-26 km) of power cable (out-of-service Cable A and C1) would remain on the OCS sea floor until the end of the SYU project life. The portion of the replacement cable on the OCS would be installed within the identified surveyed corridors (reference OPSRB Project Description). With the installation of the three replacement cables and without removal of the OCS portion of the out-of-service cables, the project would result in an increase of approximately 0.1-0.2 acres of oil and gas infrastructure on the seafloor until the end of the life of SYU operations.

As discussed in the OPSRB Project Description, all of the remaining sections of the out-of-service Cables C1 and A (or B) in the OCS would be removed consistent with a plan which calls for removal of the these cable simultaneous with the removal of other facilities at the end of SYU project life. Further, ExxonMobil agrees to accept a condition on the OPSRB Project that specifically requires removal of the cables at the end of the SYU project life. The applicant's plan is consistent with its contractual OCS lease instruments with BSEE (formerly MMS) and OCS oil and gas regulations which require that, within one year of the termination of a lease in whole or in part, ExxonMobil must remove all structures, machinery, equipment, tools, and materials from the lease. The requirement to remove all structures and other facilities is the joint and several responsibility of all leases and owners of operating rights under the lease at the time the obligation accrues, and each future lessee or owner of operating rights, until the obligation is satisfied. Thus, if ExxonMobil should decide to sell its interests in SYU before the end of the SYU project life, it would retain full responsibility for removing all structures and facilities should a future lessee not be able to meet its obligations.

To further ensure compliance with OCS lease terms and conditions, BSEE (formerly MMS) uses various financial security instruments (bonds) to ensure compliance with lease and regulatory requirements. The BSEE requires OCS operators to provide a General Lease Surety Bond before it would issue a lease or approve a lease assignment or an operational activity plan. General Surety Bond levels are set at the following levels based on the level of lease activity: $50,000 (no development), $200,000 (exploration) and $500,000 (development and producing) and Areawide Bonds of $300,000, $1,000,000, and $3,000,000. ExxonMobil has a $3,000,000 Areawide Bond for its SYU OCS operations. The BSEE can also require operators to obtain supplemental bonds to insure financial capability to meet the decommissioning and site clearance obligations. If an operator defaults on its decommissioning and site clearance obligations and the existing bond is insufficient to meet remaining its obligations, BSEE can require the previous lessees to cover any decommissioning or site clearance obligations they were responsible for creating.

The proposed deferral of removal of the out-of-service cables in OCS waters differs from the Rigs to Reefs approach in that the applicant does not propose to abandonment the cable in-place past the end of the project life. As stated above, the applicant has agreed to accept a permit condition that requires removal of the remaining out-of-service cables as well as the replacement cables at the end of the SYU project life. It has been the position of the CCC that offshore structures should be promptly removed when no longer in use. The CCC will review this project to determine its consistency with the California Coastal Act.

1.18.3 Mitigation Measures

The following measure is recommended to ensure consistency with land use policies and potential impacts on a project-specific basis:

LUS-1: The applicant shall remove replacement power cables as well as the remaining out-of-service cables in their entirety at the end of the SYU project life. Application for removal shall be submitted to appropriate federal, state, and local agencies within one year of ceased production unless an extension is granted. Full cable removal shall occur within one year of obtaining discretionary permits unless an extension is granted.
Expected Enforcement Agency: BSEE, SLC, CCC, SBC.

Residual impacts would be expected to be less than significant.

1.18.4 Cumulative Analysis

As stated above, the proposed project complies with existing land use regulations and policies. Allowing the out-of-service cables (in OCS waters) to remain in place until the end of the life of the project would add to the total oil and gas-related structures in the Santa Barbara Channel. However, given that these cables are located in the same general area and would be removed along with the existing pipelines and power cables associated with the SYU project at the end of the SYU project life, it would not be considered a significant impact. Existing BSEE regulations could be invoked to require removal of all or portions of the cables in the future if it should conflict with other users of the OCS. Further, a condition of project approval would mandate that the cables be removed in a timely manner at the end of project life.

1.19 Noise

1.19.1 Environmental and Regulatory Setting

Onshore: Current noise in the project area is generated from traffic on U.S. Highway 101 and Calle Real, ranching operations and the ExxonMobil and former POPCO facilities. Sensitive receptors in the general vicinity of the project site are rural residences and recreationalists enjoying Refugio and El Capitan State Beach Parks. The project site is located in an agriculturally and recreationally zoned area with few residences. The closest residence is located approximately one mile southwest of the project site.

The final SEIR (83-EIR-22) prepared for the ExxonMobil SYU project identified short and long term noise impacts ranging from Class I to Class III. A Baseline Noise Survey and Noise Monitoring and Control Plan were prepared in 1987 for the project. Primary sources of noise were identified from construction, highway and railroad traffic, plant operation, crew and supply boats, helicopters and offshore facilities. Impacts were mitigated through the following measures: penalties for unnecessary helicopter noise exposure; restrictions on the hours and travel routes of operation of crew and supply boats; strict adherence to daytime construction hours; and monitoring and reporting of noise levels along property boundaries.

Noise complaints were filed with the county from residents of adjacent canyons. The applicant implemented the LFC Integrated Noise Monitoring and Control Plan in 1997 to mitigate impacts associated with facility noise related to construction and ongoing operations. Equipment modifications were implemented between 1997 and 1998 to address the complaints. In 2001, ExxonMobil requested that the annual noise monitoring requirement be suspended as the compliance goals set forth in the LFC Integrated Noise Monitoring and Control Plan had been met since the implementation of the plan. Further, no noise complaints for operational or construction activities had been received over the last few years. Based on the record of compliance and no complaints, Santa Barbara County suspended the requirement for annual surveys with the understanding that the requirement may be reinstated at any time if any noise complaints are received.

Offshore: As stated above, the Final SEIR (83-EIR-22) identified construction-related noise from crew and supply boats, helicopters and offshore facilities as a Class I impact. Noise generated by crew and supply boats was determined to have a potentially significant but mitigable (Class II) impact on coastal residents. Noise generated by offshore oil activities and the potential impact on the California gray whale was a controversial aspect discussed in the original project EIR. The impacts from the original project were considered insignificant, however, the cumulative impact of noise from all such oil and gas-related projects was considered potentially significant. Changes in migration patterns of the California gray whale were determined to be a potential result of oil and gas production-related noise. However, subsequent studies performed during construction operations concluded that project-related construction did not affect migratory patterns. The proposed project is not anticipated to cause significant impacts on gray whales or other marine mammals. Please see Section 1.7, Marine Mammals, for further discussion of noise impacts related to marine mammals.

1.19.2 Project Impact Assessment

Magnitude of sound involves determining three variables: magnitude, frequency and duration. A proposed project would be considered to have a significant impact on the public if it generated noise levels in excess of 65 dBA and could affect sensitive receptors or outdoor living areas. In addition, noise from grading and construction activity proposed within 1600 feet of sensitive receptors, including schools, residential development, commercial lodging facilities, hospitals or care facilities, would generally result in a potentially significant impact. Significance criteria for offshore work and potential impacts to marine mammals are discussed in the Marine Mammal section.

Onshore: Short term noise impacts would be generated from construction-related activities, including excavation in the lower canyon and work in the tunnel. In addition, while not anticipated to be significant or of lasting duration, access needed to the south end of the tunnel would be on a public bike path. Typical construction equipment noise levels would be expected to be approximately 65 dBA at 1600 feet, thereby only impacting receptors within this range. No sensitive receptors are located within 1600 feet of the project site. El Capitan State Beach and campground is located to the south of the project site and residences are located in adjacent canyons. However, these facilities are all located more than 1600 feet from any construction activity. There would be no long or short-term exposure of people to noise levels exceeding County thresholds; however, campers at El Capitan could consider construction noise at night a nuisance. Long-term ambient noise levels would not change as a result of the proposed project.

Onshore construction activities are expected to occur during daylight hours each day with periods where operations would occur 24 hours a day (cable removal and installation in tunnel). The oil and gas facilities operate continuously, although they are located more remotely, over one mile north of the project site. The duration of the impacts would be expected to last ,at least some of the time, during the duration of the onshore activities, approximately 7-10 months.

Offshore: Due to the limited time that offshore vessels would be near shore, no onshore noise impacts from offshore sources would be anticipated. Please refer to the Marine Mammals section for a discussion of potential noise impacts to marine mammals.

1.19.3 Mitigation Measures

Existing agency permit conditions in place for the SYU facility are adequate to ensure noise impacts associated with the project remain insignificant. No additional mitigation measures are recommended for onshore noise impacts.

Please refer to the Marine Mammal section for a discussion of recommended mitigation measures for offshore noise impacts as they relate to marine mammals.

1.19.4 Cumulative Impacts

The proposed project would temporarily exacerbate cumulative noise impacts, however, such impacts are temporary in nature would be considered insignificant.

1.20 Public Facilities

1.20.1 Environmental and Regulatory Setting

This section focuses on solid waste disposal as the only public facility that could potentially be impacted by the proposed project is landfill capacity and/or that of a recycling center(s).

Demand for public facilities was reviewed extensively in previous environmental documents prepared for the SYU onshore and offshore facilities (FEIR and SEIR, 83-EIR-22). Demands for wastewater treatment and solid waste disposal were anticipated to increase as a result of the original project; however, the impact was ultimately determined to be adverse but not significant.

The closest landfill to the project site is Tajiguas Landfill located along the Gaviota coast in Santa Barbara County. ExxonMobil routinely uses the privately-owned and operated Buttonwillow Landfill in Kern County to dispose of its SYU non-hazardous wastes.

1.20.2 Project Impact Assessment

A project is considered to have a significant impact on public facilities if it would generate such substantial amount of waste as to exceed established national standards or thresholds for waste generation or exceed existing landfill capacity. The County of Santa Barbara Solid Waste Thresholds includes information provided through the adopted Source Reduction and Recycling Element (County of Santa Barbara, 1996). A project is considered to result in significant impacts to landfill capacity if it would generate 196 tons per year of solid waste. The County Thresholds also mandate consideration of recycling efforts when evaluating waste impacts from new projects in the county. Kern County has no established waste disposal thresholds of significance (personal Communication, D. Ferguson, Kern County Waste Management Department, July 2002).

The primary source of solid waste generated from the proposed project would be from recycling of the retrieved cables from shore to the shelf break (approximately 10 miles or 16 km) and adjacent to Platform Harmony and Heritage (approximately 2-8 miles or 12-13 km). Private recycling facilities have been identified that would recover all usable components and send the remaining waste material to an approved disposal facility. At this time there is not an accurate estimate of the amount of material that would be sent to a disposal site.

With the exception of the waste components remaining from the recycling of the out-of-service cables, waste generated during construction would not be anticipated to be different from or significantly more than current operational wastes.

Currently there are 60 miles of subsea power cable associated with the SYU project. The proposed project would result in a net increase of about 11-17 miles of cable (29 miles for replacement Cables A2 (or B2), F2 and G2; 12-18 miles of out-of-service Cable A (or B) and C1 removed). The proposed project would therefore increase the amount of power cable ultimately requiring removal and landfilling or recycling by 18-28%. This could present a potentially significant impact; however the options for recycling and disposal would be fully evaluated at the end of the SYU project life.

Consistent with County policies and practice, the County of Santa Barbara is expected to request that the applicant recycle the retrieved cable to the extent feasible. ExxonMobil has required the bidders to evaluate this option. At this time several private recycle companies in the area have indicated that they have the equipment to recycle the out-of-service cables. ExxonMobil will require the successful bidder to send the out-of-service retrieved cable to one of the recycle companies.

1.20.3 Mitigation Measures

The following mitigation measure is recommended to mitigate impacts to the maximum extent feasible:

PUB-1: Require contractor to recycle the out-of-service cables to the extent feasible. Contractor to conduct tests of cable recycling at selected recycle company and determine any conditions and/or limitations to recycling.
Expected Enforcement Agency: SBC.

PUB-2: ExxonMobil shall submit a Recycling Feasibility Analysis for agency review and approval for the replacemently installed cable in state waters and onshore as part of its facility-wide abandonment application at the end of the SYU life.
Expected Enforcement Agency: SLC, SBC.

Residual impacts would be expected to be insignificant.

1.20.4 Cumulative Analysis

The proposed project would add a net 11-17 miles (18-27 km) of power cable to the approximately 60 miles (96 km) of existing cable offshore which would ultimately need to be properly removed and disposed of at the end of the project life. The cumulative impacts associated with the proposed project involve the capacity of local companies to recycle the retrieved cable. Recycling of unused equipment would be an even greater concern at the end of the SYU project life when tens of miles of pipelines, power cables, as well as other equipment from platforms and the onshore plant will need to be removed. As indicated above, recycling of the retrieved appears to be feasible with local companies. On a cumulative basis, the project's contribution of up to 17 miles (27 km) of cable is not considered a significant impact compared to other oil and gas infrastructure present on the Santa Barbara Channel seafloor that will need to be removed at some point in the future.

1.21 Recreation

1.21.1 Environmental and Regulatory Setting

Construction of the original SYU project led to a finding of Class I (adverse and unavoidable) and Class II (adverse but mitigable) socioeconomic impacts. These findings were in part due to the closure and potential damage to the coastal bikeway during project construction (Santa Barbara County *Findings of Approval*, September 15, 1987). As mitigation, Santa Barbara County permit condition (IV.e.7) required that ExxonMobil reconstruct a total of 1.6 miles of coastal bikeway after the completion of nearshore SYU construction (1990) and abandonment of the El Capitan Marine Terminal facilities (1991). In 1993, Santa Barbara County Parks and Recreation Department indicated that ExxonMobil had satisfied this condition (letter to Santa Barbara County Planning and Development from Santa Barbara County Parks and Recreation Department, April 23, 1993).

In addition, Class II recreational impacts were identified in the original project EIR (83-EIR-22) (overcrowding of campgrounds by temporary workers) and were fully mitigated. Class III impacts were identified in relation to potential impacts to recreational fishing. These impacts were determined to be insignificant.

1.21.2 Project Impact Assessment

A project would be determined to have the potential for significant impacts to recreation if it could have a substantial impact on the quality or quantity of existing recreational opportunities, conflict with established recreational uses of an area or conflict with biking, hiking or equestrian trails on a long-term basis.

The majority of the onshore work is located on private property zoned M-CR, coastal-related industry and would therefore not impact adjacent recreational areas (El Capitan State Beach and campground). Onshore work off of private property would be limited to accessing the tunnel via a manhole on the south side of US Highway 101. Access to the manhole would be by way of the county bike path, which runs along the bluff above the beach. Based on the current estimates, the tunnel manhole would be open for approximately 20-25 days. Equipment to be brought along the bike path would include an ATV, generator, air blower, safety equipment and proofing equipment. There is an existing vehicle turn around area at the southern tunnel access point; therefore, none of the necessary equipment and vehicles needed to access the manhole would block the bike path.

It is anticipated that a State Parks Temporary Use Permit (TUP) would be required to utilize the bike path. Impacts would be expected to be greater if the project is conducted during summer months, when there is significantly more recreational traffic along the bike path, however, with mitigation, the impacts are not expected to be significant. Currently the bike path is closed from just east of the manhole on the south side of the tunnel to El Capitan State Beach.

The offshore portion of the project has the potential to temporarily impact recreational boating activities as well as temporarily impacting the quality of existing recreational activities (El Capitan State Beach) due to the presence of increased construction and supply vessels. Nearshore work would require several months to complete. Based on the temporary nature of the project, impacts would not be considered significant.

1.21.3 Mitigation Measures

The following mitigation measures are recommended to mitigate impacts to recreational resources to the maximum extent feasible:

REC-1: The applicant shall obtain and comply with all conditions of approval set forth in its State Parks TUP. The permit shall be obtained and a copy submitted to the County of Santa Barbara Planning & Development prior to onshore construction work.
Expected Enforcement Agency: State Parks, SBC.

REC-2: During any time that the south tunnel access manhole is open, safety barriers shall be erected in the immediate area to ensure public safety. In addition, speed limits for vehicle traffic along the bike path shall be adhered to pursuant to State Parks rules implemented for public safety. The County EQAP monitor shall verify compliance in the field.
Expected Enforcement Agency: State Parks, SBC.

REC-3: In order to ensure public safety, signs shall be posted alerting cyclists and pedestrians to project-related work being conducted along the bike path when access to the tunnel is required. Notices shall be posted at least 24 hours prior to any vehicle access. The County EQAP monitor shall verify compliance in the field.
Expected Enforcement Agency: State Parks, SBC.

REC-4: The applicant shall submit photo-documentation of the physical condition of the bike path at the work area before and after access to the south manhole tunnel. ExxonMobil shall be responsible for any maintenance or repair work necessary, if there is evidence of damage during construction. The applicant shall coordinate with El Capitan and Refugio State Parks for pre and post-construction inspections.
Expected Enforcement Agency: State Parks, SBC.

Residual impacts would be expected to be insignificant.

1.21.4 Cumulative Impacts

Impacts from the proposed project would be temporary and localized. While there may be other projects along the Gaviota coast that would occur contemporaneously, impacts associated with this project would not substantially contribute to adverse impacts to recreational resources.

1.22 Transportation/Circulation

1.22.1 Environmental and Regulatory Setting

Access to the project site and the main roadways in the vicinity include US Highway 101 and Calle Real. Highway 101 handles most traffic to and from the site, Calle Real, a frontage road, is used to access the facility within several miles east and west of the site. The applicant has an agreement with the County of Santa Barbara to upgrade Calle Real to meet current design specifications regarding roadway safety.

As identified in the project EIR (83-EIR-22), transportation impacts were identified related to parking during peak construction periods. Mitigation resulting from this impact was the Parking and Transportation Plan (1987 and Revised TSMP, 1990), which identified appropriate ridesharing and/or shuttle services for offsite parking. The TSMP also included development of a new parking lot (referred to as the Goleta Parking Lot) at the West End of Hollister Avenue in Goleta. The Goleta lot was intended to supplement an existing lot to accommodate both onshore and offshore workers during peak construction periods. The Goleta Parking Lot required a separate County Final Development Plan (88-FDP-017) and preparation of a Supplemental EIR (89-SD-01). Additional mitigation was developed during the Planning Commission's review of the parking lot, including the revised TSMP to reduce traffic and associate short term air quality impacts. After use during project construction, ExxonMobil relinquished its lease on the Goleta Parking Lot in 1999.

1.22.2 Project Impact Assessment

A project will ordinarily have a significant effect on transportation/circulation if it will cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system. The need for private or public road maintenance or the need for new roads would also cause a potentially significant effect on the environment. In addition, effects on existing parking facilities or the demand for new parking could result in a potentially significant impact.

The largest traffic-related impacts of oil-related projects are due to the temporary effects of construction, start up and drilling compared with long term impacts associated with operations (83-EIR-22). The onshore construction workforce would average 10-20 additional workers (round trips) per day during average construction periods. The peak increase would be approximately 25 additional workers per day. During onshore work, trucks delivering materials and equipment and removing construction debris and equipment would be expected to generate an additional 0 to 5 truck trips per day over current levels. These numbers are well below those evaluated and mitigated for during original SYU project construction. The increase would be temporary and there would be no permanent increase in employees working onsite or truck trips. The additional traffic on Highway 101 and Calle Real would not be considered significant.

The proposed project would not result in the need for private or public road maintenance or construction nor would the proposed project affect existing parking facilities or create the demand for new facilities. As previously mentioned, the existing roadways are adequate for the temporary increase in vehicular traffic and parking for onshore and offshore work could be adequately handled through existing parking facilities. No transit systems (including rail) would be impacted as a result of the proposed project as no public roadways would be closed.

Temporary impacts to waterborne traffic may be expected as vessels may be required to modify routes to accommodate project construction vessels. No increase in helicopter trips would be anticipated. However, these impacts would be considered temporary and insignificant.

During work necessary to access the manhole tunnel on the south side of US Highway 101, small recreation vehicles would need to travel on a county bike path. This is not expected to limit recreational access or travel along the bike path (see Recreation section). However, impacts to the bikeway could occur, as they did during project construction in 1993. As discussed in Section 1.22, this was mitigated through a condition requiring that ExxonMobil fund and repair any damage caused to the bikeway from construction-related activities. A similar requirement for this project would ensure no permanent damage to the bikeway (See Mitigation Measure REC-4).

1.22.3 Mitigation Measures

The project would not result in any significant impacts to traffic or circulation. No mitigation measures are required.

1.22.4 Cumulative Analysis

Impacts from the proposed project would be temporary and localized. There are no other significant projects anticipated to overlap in timing. There is currently ample capacity on Calle Real and Highway 101 in this area to handle truck and construction worker traffic for anticipated activities. The proposed project would not substantially contribute to cumulative adverse impacts on transportation or circulation.

1.23 Water Quality

1.23.1 Environmental and Regulatory Setting

Onshore: The onshore portion of the project would be located within the developed portion of the existing facilities in the lower Las Flores Canyon area. The nearest water body to the onshore portion of the proposed project is Corral Creek, located approximately 500 feet west of the existing pipeline/cable right of way and proposed construction area. Water quality in the creek is monitored regularly by ExxonMobil in accordance with their RWQCB-required Storm Water Pollution

Prevention Plan (SWPPP) and Santa Barbara County-required Surface Water Quality Monitoring Program.

Water used at the facility is obtained from onsite groundwater wells (83-EIR-22); no additional water usage would be required for operation of the installed facilities. Temporary water use will be required for dust control at the onshore construction site.

Offshore: Marine water quality in the project area has been fully described in Dames and Moore (1982); SAI (1984); ADL (1984); Chambers Group (1987a, b), and MMS (2001). The commonly measured chemical oceanographic parameters and their ranges are given in Table WQ.1.

Three agencies provide regulations for water quality issues: the U.S. Environmental Protection Agency (EPA), the U.S. Coast Guard (USCG) and the California State Central Coast Regional Water Quality Control Board (CCRWQCB). The EPA, through the Clean Water Act (as amended), resulting in the National Pollutant Elimination Discharge System (NPDES) regulations, sets limits on specific discharges.

The USCG vessel regulations, via the Federal Water Pollution Control Act, ensure that vessel effluents such as sewage and cooling water do not leave a sheen or other foreign material on navigable waters.

Table WQ-1: Key Water Quality Parameters Typical Units of Measure and Characteristics

Parameter (Units)	Characteristics
Temperature (°C)	Ocean surface temperatures minimums of 12-13 °C in April and maximums of 15-19 °C in July-October
Salinity (°/oo – parts per thousand)	33.2-34.3 °/oo
Dissolved oxygen (DO) (mg/L or ml/L)	5-6 ml/l at the surface, decreasing with depth to about 2 ml/l near 200 m to as low as 1 ml/l below 350 m.
pH (unitless)	7.8 to 8.1.
Nutrients (µg-atoms/l)	Nutrients and micronutrients include nitrogen, phosphorus, and silicon iron (Fe), manganese (Mn), Zn, Cu, cobalt (Co), molybdenum (Mo), vanadium (V), vitamin B12, thiamin and biotin. Concentrations show depletion near the surface, increasing with depth.
Turbidity (mg/L)	Concentrations average near 1 mg/L, but range from 0.93 – 1.5 mg/L in the nearshore, surface waters (BLM, 1978). Levels near the sea floor average 0.4 mg/L and range from 0.1 to 1.4 mg/L; offshore regions average 0.15 mg/L and range from 0.07 – 0.32 mg/L. Periods of highest turbidity correspond to periods of highest upwelling, highest primary production, river runoff, and nearshore current and wave action.
Organic materials (µg/l)	Naturally-occurring organic materials include a variety of molecules ranging from hydrocarbons to biogenic-based substances.

Sources: Dames and Moore (1982); SAI (1984); ADL (1984); Chambers Group (1987a, b).

Sources of marine pollution in the Santa Barbara Channel include publicly owned treatment works (municipal sewage), power plant discharges, and river runoff (MMS, 2001). Very few industrial or power plant outfalls exist in the area.

The nearest municipal discharge to the proposed project area is from the Goleta Municipal Wastewater Treatment Plant. This plant collects and treats wastewater from the cities of Goleta, Santa Barbara, and other outlying communities. The municipality discharges over 5 million gallons per day of wastewater at a mixed primary/secondary level of treatment (Table WQ-2). Specific components (concentrations and mass emissions of metals, hydrocarbons, synthetic organics, etc.) of this and other Santa Barbara Channel outfalls are found in publications by the Southern California Coastal Water Research Project (SCCWRP), in particular see SCCWRP (1996).

Table WQ-2: Publicly-owned Treatment Works Discharging into Santa Barbara Channel

POTW Name	Level of Treatment	Volume (millions gallon/day)	Distance from Project Area (miles)
Goleta	Primary/Secondary	5	1
Santa Barbara	Secondary	8	22
Montecito	Secondary	1	29
Summerland	Tertiary	0.2	30
Carpinteria	Secondary	2	32
Oxnard	Secondary	25	51

Source: SCCWRP (2008 Report for 2005 data)

River runoff could contribute various natural and man-made pollutants ranging from suspended sediments to pesticides. River runoff is difficult to quantify and is seasonally variable. Nevertheless, material from the Santa Ynez River sometimes flows eastward around Point Conception and provides sediment to the project area, particularly during periods of high flow. In addition, the numerous small, intermittent creeks which drain into coastal waters near the SYU area, may also provide a sizeable amount of sediment during periods of high flow (pers. comm. Jon Warrick, August, 2002).

1.23.2 Project Impact Assessment

Onshore: The replacement of the out-of-service cables onshore in the lower canyon would not alter the movement of water in fresh water stream or drainages. All construction activities would occur in the lower canyon parking area, a dirt lot, and would not impact percolation rates, drainage patterns or the rate and amount of surface water runoff. No impacts, including drainage into or out of surface waters (i.e., Corral Creek) would be anticipated as construction activities would be limited in scope and duration and located well outside the 100-foot buffer zone. However, a site-specific Stormwater Pollution Prevention Plan has been prepared for use during construction work. The plan is designed to control erosion from the construction area that could conceivably reach Corral Creek and cause a temporary increase in sediment loading. As discussed in Section 1.4 (Onshore Biological Resources), the creek provides habitat for several protected species. In this instance, erosion control measures should be employed to avoid temporary degradation of water quality in the creek.

Offshore: The impact analysis for water quality in this document adopts the following significance criteria:

- An impact from the proposed project is considered to be significant if it causes in an unreasonable degradation to water quality as measured by contributions to changes in standard, measurable parameters (see Table WQ-1 for water quality parameters);
- Persistent and not reversed by natural dispersive processes within a few days;
- Extend beyond the project area; or
- Cause physiochemical changes that impact the marine ecosystem.

The term "unreasonable degradation" follows EPA's regulations at 40 CFR 125.121(e)(1-3): (1) Significant adverse changes in ecosystem diversity, productivity and stability of the biological community within the area of discharge and surrounding biological communities; (2) Threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms; (3) Loss of esthetic, recreational, scientific or economic values which is unreasonable in relation to the benefit derived from the discharge.

State of California Ocean Plan Water Quality Standards requirements (California State Water Resources Control Board, 2001) are substantively included in this significance criteria. Applicable requirements include physical, chemical and biological characteristics which prohibit such things as discoloration of the ocean surface, reduction of natural light, increases in the deposition of inert solids which result in changes in biological communities, changes in dissolved oxygen and pH, and degradation of marine communities.

Cable Retrieval and Installation Impacts:
As described in the OPSRB Project Description, the project would involve the removal of approximately 12-18 miles (19-29 km) of out-of-service power cable and the installation of 29 miles (47 km) of replacement cable in the general vicinity of the existing SYU facilities. This section analyses impacts to water quality that would be expected to occur as a result of cable retrieval and installation activities. Impacts that would occur from installation of the replacement cables (A2 (or B2), F2 and G2) and the retrieval of the out-of-service cables as well as the removal of all remaining cables at the end of SYU life are analyzed in the following section. Impacts to water quality could also occur from the anchoring of support vessels. The location and timeframe, the type of activity, and the estimated amounts and type of sediment that could be resuspended are estimated in Table WQ-3.

The major sources of impacts to water quality from the project during conduit excavation, and cable retrieval and installation would be:

- Water jetting to expose the ends of the conduit and the cables at the POPCO crossing nearshore and the locations where the cables would be cut and removed offshore;
- Flushing and pigging, if necessary, of the conduits and J-tubes;
- Anchoring of support vessels;
- Removal and cleaning of short segments of cable in conduits in preparation for installation of the replacement cables;
- Installation of the replacement power cables;
- Retrieval of the out-of-service cables from nearshore to the State-Federal Boundary;

- Retrieval of the out-of-service cables adjacent to the platforms.

Water jetting: The applicant proposes to use water jetting to expose the nearshore conduits, approximately 50 feet of cable offshore of the conduits, and the cables at the POPCO crossing. Diver-supported water jets would be used to clear sediment from above and around the end of the conduits and for a distance along the cable route to allow working room. The cables are expected to be buried at the conduit terminus, offshore of the conduits, the POPCO crossing and possibly at the offshore locations where the out-of-service cables will be cut. In addition, the out-of-service cables are partially buried along the route from the shelf break to the conduit terminus. The amounts of sediment which could be suspended in the area of the conduits are estimated to range from 10- to 20 cubic yards (yd^3) depending on buried depth and 1-5 cubic yards at the POPCO crossing. The sediment in this area is sand-sized. In these areas, divers would sidecast the sediment into an adjacent sand channel. Jetting activities would raise this sandy particulate into the water column, but since sand is relatively heavy, it would sink to the sea floor within a few feet from the point of disturbance. In addition, a Sampling and Analysis Plan will be utilized to sample and measure the chemical composition of the sediment in these areas before removal to verify that there are no harmful substances present.

Further offshore, near the shelf break and the platforms, sediments are characterized by finer silt-sized particles with some clay. Most of this clayey silt would be settle within a few tens of feet of the point of disturbance, while the remainder would disperse with the ambient currents. In order to cut the cables prior to retrieval, the ROV would need to clear the area around the cable to allow access for the cutting tool. An estimated less than one cubic yard would be expected to be disturbed at each of the four locations (two at shelf break, one at Platform Harmony and one at Platform Heritage). The sediment would be expected to settle relatively quickly and not degrade water quality.

Flushing and Pigging: Prior to the installation of the replacement cables, the nearshore conduits and the possibly the existing J-tubes that are to be reused may need to be flushed and pigged to remove sediment or other material that could impede the insertion of the replacement cable. It is anticipated that <1 cubic yard of sediment would be displaced from inside each conduit and J-tube to outside and be dissipated by the local currents. Other material inside the conduits and J-tubes might include minor amounts of rust and some organic material. This would also be dissipated by the local currents and not degrade the water quality.

Anchoring: Anchoring by dive-support vessels would also slightly contribute to increased turbidity. At all locations where anchoring is necessary, <1 cubic yard would be resuspended when anchors are placed onto the sea floor and when the anchors are raised. Negligible impacts to water quality would occur due to anchoring activities.

The applicant will use a dynamically positioned (DP) vessel to install and retrieve the power cables; as such, no anchoring will be required. A dive support vessel will be required to be anchored in one or more locations near the conduit terminus and the POPCO crossing.

Cutting, Retrieval and Cleaning of Portions of Out-of-Service Cables Adjacent to Platforms as Part of the Installation Process: Approximately 1-6 miles of out-of-service Cable A (or B) would be removed at Platform Harmony and 1-2 miles of Cable C1 would be removed at

Platform Heritage. The cables are partially to completely buried adjacent to the platforms. This activity would result in the resuspension of approximately 40-180 cubic yards of clayey silt sediments in the immediate vicinity of the cable and is not expected degrade water quality.

Cleaning the cable of marine fouling organisms and sediment would be necessary before it is stored on the cable installation vessel. This process involves pulling the cut end of the cable to the surface, scrapping and water blasting it to remove any adhering sediment and marine growth, and winding it onto a reel for storage. Approximately 5-45 yd^3 of material would be removed from the cable during this part of the project. The cleaning process would result in a turbid cloud around and down current of the cable installation vessel and would be expected to dissipate within a short period of time.

Power Cable Installation: The installation of the replacement power cable from the nearshore conduit to Platform Harmony and from Platform Harmony to Platform Heritage would resuspend approximately $3yd^3$ of sediment from the seafloor. Sediment characteristics would range from sandy in the nearshore area to silty sand on the outer shelf to clayey silt near the platforms. A negligible impact to water quality would occur from this phase of the project.

Cutting, Retrieval and Cleaning of the Out-of-Service Cables to the State-Federal Boundary: This portion of the project involves retrieval of the out-of-service power Cables A (or B) and C1 from the nearshore conduit to just beyond the State-Federal Boundary near the shelf break, a distance of approximately 5 miles (8 km) for each cable. Retrieval of the remaining portion of the power cables would be deferred until the SYU offshore facilities are decommissioned. Cable retrieval operations are expected to take 1-2 weeks.

Activities during this portion of the proposed project that could result in turbidity and impacts to water quality would be:

- Retrieval of the cables from the seafloor;
- Cleaning the exposed cables onboard the cable installation vessel; and
- Covering the remaining ocean bottom cable ends with a concrete mat at the shelf break and adjacent to the platforms.

Retrieval of the State Waters Cables from the Seafloor: About 200-250 yd^3 of sediment would be disturbed over a distance of 10 miles (16 km) as the out-of-service cables are cut and retrieved from the seafloor to the cable installation vessel. The cables are completely buried for approximately the first 2 miles (3.5 km) and embedded in the seafloor the remaining 3 miles (4.5 km), in water depths greater than approximately 200 feet (60 m). Most of the turbidity would occur close to the seafloor, particularly where the sediments are sandy. These would settle within a few feet of the point of disturbance. Further offshore, where the sediments are finer and the proportion of silt increases, the turbid cloud would stay in suspension longer and be dispersed by bottom currents. It is estimated that much of the disturbed sediment would settle to the bottom within a few tens of feet of the point of disturbance while the finer sediments would drift down-current, gradually dispersing. No significant impact to water quality would be anticipated from this turbidity.

Some sediment would adhere to the cable on its way to the surface, leaving a gradually decreasing trail of sediment in the water column. Most of the disturbed sediment would remain close to the sea floor, settling out relatively quickly, as discussed above, while the remainder would be dissipated by the currents throughout the water column. Impacts to the water quality would be negligible.

Cleaning of the State Waters Cables: Once onboard the cable installation vessel, scrapping and water blasting would be used to clean the cable of any remaining sediment and marine organisms that are still adhering to the cable. Approximately 50-60 yd^3 of material would be removed from the cables and onto the sea surface, generating a continuous cloud of turbidity below and around the vessel. However, while the clouds of sediment raised by these operations would be continuous while the activity is occurring, it would be spread over a wide area and be dissipated by local waves and currents. Thus, impacts to water quality would be negligible.

Covering the Ocean Bottom Cable Ends With Concrete mats: A very small amount of sediment would be released (about 2-4 yd^3) during the setting of concrete mats (total of 4) on top of the cut end of the out-of-service cables that will be left on the ocean bottom. Impacts to water quality would be negligible.

Cable Removal and Cleaning Impacts at the End of SYU Life: Estimates of the amounts of sediment disturbed from the removal of the replacement and out-of-service cables at the end of SYU life is difficult to determine, but is expected to be in the range of 300-400 yd^3.

Some sediment would adhere to the cable on its way to the surface, leaving a gradually decreasing trail of sediment in the water column. Impacts to the water quality would be negligible because most of the disturbed sediment would remain close to the sea floor, settling relatively quickly while the remainder will be dissipated by the currents throughout the water column.

Once onboard the cable installation vessel, scrapping and water blasting would be used to clean the cable of any remaining sediment and marine organisms that are still adhering to the cable. An estimated 250-275 yd^3 of material would be removed from the cables and onto the sea surface, generating a continuous cloud of turbidity below and around the cable lay vessel. Expected impacts would be the same as those described for the proposed project. However, while the clouds of sediment raised by these operations would be continuous while the activity is occurring, it would be spread over an estimated 60 miles (97 km) and be dissipated by local waves and currents. Thus, impacts to water quality would be negligible.

1.23.3 Mitigation Measures

WQ-1: If flushing of one of the reused J-tubes is required, provide results of samples taken of the seawater in the J-tubes to EPA and submit other information (such as volume, number of times to discharge, etc.) to EPA in order to receive permission to conduct flushing.
Expected Enforcement Agency: EPA, BSEE.

WQ-2: Work with the CCRWQCB by providing samples of the material within the conduit and, if required by the CCRWQCB, submit a Low Threat Permit in order to receive permission to conduct conduit flushing operations.
Expected Enforcement Agency: CCRWQCB, BSEE, SLC, SBC.

WQ-3: Utilize a site-specific Stormwater Pollution Prevention Plan for use during construction work. The plan has been designed to control erosion from the construction area that could conceivably reach Corral Creek and cause a temporary increase in sediment loading.
Expected Enforcement Agency: RWQCB, SBC.

In addition to these mitigation measures, please refer to the following mitigation measures from other resource sections: BE-1 and BE-2.

Residual impacts would be expected to be insignificant.

Conclusions – Proposed Project
According to the significance criteria established for this document, an impact to marine water quality is considered to be significant if changes in water quality parameters result in unreasonable degradation to the water quality. The only notable impacting agent is turbidity raised from various seafloor-associated activities. No significant impacts to water quality would be expected.

1.23.4 Cumulative Impacts

Onshore: The proposed project could result in temporary and localized impacts to onshore water resources. However, these impacts would be fully mitigated through proper erosion control measures. No other significant projects are expected to occur during the project that would exacerbate adverse impacts to water quality.

Offshore: The draft EIS for Delineation Drilling Activities in Federal Waters Offshore Santa Barbara County, California (MMS, 2001) provides a detailed discussion of cumulative impacts on water quality offshore southern California. The EIS identifies ongoing and proposed oil and gas development and production projects in federal and state waters and various non-oil and gas activities including, municipal and industrial wastewater discharges, river runoff, and other nonpoint sources. While there are no major point-source discharges near the project area, the Santa Ynez River and the small creeks located along the local coastline do contribute nonpoint source material to the project area, especially during winter storms. The relatively small amount of turbidity produced by project activities would be effectively hidden in the large natural sedimentation signal contributed from these natural sources. In conclusion, no significant cumulative impacts to water quality would be expected to occur from the proposed project.

Table WQ-3: Activities from the Proposed Project that Could Result in Turbidity in the Water Column

(OPSRB impacts estimated from an analysis of OPSR-A impacts adjusted for amounts of cable retrieved and installed)

Location/Timeframe	Activity	Amount and Type of Sediment Resuspended*
Nearshore Pre- and Post-construction Biological Surveys	Anchoring of diver-support vessel (2-4 anchors up to 5,000 lb ea.)	<1 yd^3 – Sand
Retrieval and Installation of Cables at Nearshore Conduit Terminus	Exposure of the conduit terminus, approximately 50 feet of cable offshore of conduits and cables at POPCO crossing by water jetting (depends on depth)	10-20 and 1-5 yd^3 – Sand
	Diver-support vessel (4-6 anchors up to 10,000 lb ea.) Three separate events: • Inspection of conduit terminus • Conduit preparation, clearance and cable cutting • Cable retrieval and conduit pigging	4 yd^3 – Sand
	Water flushes of conduit (if necessary)	2 yd^3 – Sand
	Exposure by water jetting of cable segments to be cut and removed	10-20 yd^3 – Sand
	Cleaning of portion of cable removed from conduit; store on CIV	2 yd^3 – Sand
Installation of Cables from Nearshore to Platform Harmony and at Platform Harmony	Cable cutting, retrieval and cleaning of cable adjacent and in J-Tube (1-6 miles); Store on CIV	25-150 yd^3 – Silty/clay (Sediment and organic debris)
	Installation of the two replacement cable from LFC to Platforms Harmony	2 yd^3 – Silty/clay
	Water flushing (if necessary) and pigging J-Tube	<1 yd^3 – Silty/clay (Sediment and organic debris)
Installation of Cable from Platform Harmony to Heritage and at Platform Heritage	Cable cutting, retrieval and cleaning of cable adjacent to and in J-Tube (1-2 miles); Store on CIV	25-50 yd^3 – Silty/clay (Sediment and organic debris)
	Water flushing (if necessary) and pigging J-Tube	<1 yd^3 – Silty/clay (Sediment and organic debris)
	Installation of replacement cable from Platform Harmony to Platform Heritage	1 yd^3 – Silty/clay
		Installation Total: 850-260 yd^3

* The term <1 yd^3 indicates any amount of sediment or other material ranging from 1 to 27 ft^3 (27 ft^3 = 1 yd^3).

Table WQ-3 (cont') Activities from the Proposed Project that Could Result in Turbidity in the Water Column		
Location/Timeframe	***Activity***	**Amount and Type of Sediment Resuspended***
Retrieval of Cables from Nearshore Conduit Area to Just Beyond state-Federal Boundary	Removal and cleaning of 10 miles (total) of retrieved cable; • Sediment from seafloor • Marine growth • Burying cable end with concrete mat	200-250 yd^3 – Range from sandy nearshore to silty sand offshore 50-60 yd^3 – Sediment plus organic debris from marine growth 2-4 yd^3 – Silty sand **Total Retrieval: 252-314 yd^3**
Nearshore Post-construction biological survey (1-2 days)	Anchoring of diver-support vessel (2-4 anchors up to 5,000 lb ea.)	<1 yd^3 – Sand
Removal of cables at end of SYU life Timeframe: ~20-30 days		**Disturbed Sediment:** – range from sandy nearshore to silty sand offshore plus some organic debris from marine growth from cable cleaning.
Conduit to Platform Harmony	Removal of the replacement Cable A2 (or B2) and F2: 22.5 miles (36 km)	175-200 yd^3
Shelf break to Platform Heritage	Removal of the OCS portion of the Cable A (or B) and C1: 17 miles (27 km)	65-75 yd^3 from current sediment plus an additional 65-75 yd^3 sedimentation in years prior to removal
Between Platforms Harmony and Heritage	Removal of replacement Cable G2: 7.3 miles (12 km)	30-40 yd^3 **Subtotal – 335-390 yd^3** **Marine Growth Removal: - organic debris** 260-270
* The term <1 yd^3 indicates any amount of sediment or other material ranging from 1 to 27 ft^3 (27 ft^3 = 1 yd^3).		

2.0 EXPECTED CEQA MANDATORY FINDINGS OF SIGNIFICANCE

All adverse impacts identified for the proposed ExxonMobil Offshore Power System Reliability-B Project are expected to be found to be fully mitigable with the incorporation of mitigation measures. Cumulative impacts are discussed throughout the document to address CEQA-required elements. Based on the evaluation of potential impacts and mitigation measures discussed in this document, ExxonMobil believes that the state and local agencies will determine that the cumulative impacts will be found to be insignificant.

3.0 EXPECTED NEPA FINDINGS

All adverse impacts identified for the proposed ExxonMobil Offshore Power System Reliability-B Project are expected to be found to be fully mitigable with the incorporation of mitigation measures. Cumulative impacts are discussed throughout the document to address NEPA-required elements. Based on the evaluation of potential impacts and mitigation measures discussed in this document, ExxonMobil believes that the federal agencies will determine that the OPSRB Project does not constitute a major Federal action significantly affecting the quality of the human environment, in the sense of NEPA (Section 102(2)(C)).

4.0 REFERENCES

Allen, S., J. Mortenson, and, S. Webb. 2011. Field Guide to Marine Mammals of the Pacific Coast: Baja, California, Oregon, Washington, British Columbia. University of California Press. Berkeley and Los Angeles, California.

Arthur D. Little, Inc. (ADL). 1984a. Point Arguello Field and Gaviota Processing Facility Area Study and Chevron/Texaco Development Plans EIR/EIS. Prepared for: County of Santa Barbara, Minerals Management Service California State Lands Commission, California Coastal Commission, California Secretary of Environmental Affairs.

Arthur D. Little, Inc. (ADL). 1984b. Point Arguello Field and Gaviota Processing Facility Area Study and Chevron/Texaco Development Plans EIR/EIS. Appendix H. Marine Water Resources. Prepared for: County of Santa Barbara, U.S. Minerals Management Service, California State Lands Commission, California Coastal Commission, California Secretary of Environmental Affairs.

Arthur D. Little, Inc. (ADL). 1986. Exxon Santa Ynez Unit Development Project Supplemental EIR (SBC No. 83-EIR-22). Prepared for Santa Barbara County Resource Management Department.

Baker, C.S., and L.M. Herman. 1989. Behavioral responses of summering humpback whales to vessel traffic: Experimental and opportunistic observations. NPS-NR-TRS-89-01. Rep. from Kewalo Basin Mar. Mamm. Lab., Univ. Hawaii, Honolulu, for Natl. Park Serv., Anchorage, AK. 50 pp. NTIS PB90-198409.

Barlow, J. 1995. The abundance of cetaceans in California waters. Part I: Ship surveys in summer and fall of 1991. Fish. Bull. 93:1-14.

Barlow, J., R.L. Brownell, Jr., D.P. DeMaster, K.A. Forney, M.S. Lowry, S. Osmek, T.J. Ragen, R.R. Reeves, and R.J. Small. 1995. U.S. Pacific Marine Mammal Stock Assessments. NOAA Technical Memorandum NMFS, NOAA-TM-NMFS-SWFSC-219. 162 pp.

Barlow, J., K.A. Forney, J.V. Carretta, M.M. Muto, and J. Baker. 2001. Draft U.S. Pacific Marine Mammal Stock Assessments: 2001. U.S. Department of Commerce, National Oceanographic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center.

Barlow, J., K.A. Forney, P.S. Hill, R.L. Brownell, Jr., J.V. Carretta, D.P. DeMaster, F. Julian, M.S. Lowry, T. Ragen, and R.R. Reeves. 1997. U.S. Pacific Marine Mammal Stock Assessments: 1996. NOAA Technical Memorandum NMFS-SWFSC-248.

Barlow, J., and T. Gerrodette. 1996. Abundance of cetaceans in California waters based on 1991 and 1993 ship surveys. NOAA Tech. Mem. NOAA-TM-NMFS-SWFSC-233.

Bauer, G.B., and L.M. Herman. 1986. Effects of vessel traffic on the behavior of humpback whales in Hawaii. Rep. from Kewalo Basin Mar. Mamm. Lab., Univ. Hawaii, Honolulu, for Natl. Mar. Fish. Serv., Honolulu, HI. 151 pp.

Bonnell, M.L., and M.D. Dailey. 1993. Marine mammals. Pp. 604-681 *in*: M.D. Dailey, D.J. Reish, and J.W. Anderson (eds.), Ecology of the Southern California Bight: A Synthesis and Interpretation. Berkeley, CA: University of California Press.

Bonnell, M.L., B.J. Le Boeuf, M.O. Pierson, D.H. Dettman, G.D. Farrens, and C.B. Heath. 1981. Pinnipeds of the Southern California Bight. Summary Report, 1975-1978, Part I, *In*: Vol. III, Principal Investigator's reports, marine mammal and seabird survey of the Southern California Bight area. NTIS No. PB 81-248-71. 535 pp.

Bonnell, M.L., M.O. Pierson, and G.D. Farrens. 1983. Pinnipeds and sea otters of central and northern California, 1980-1983: status, abundance, and distribution. Final Report to U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region under Contract 14-12-0001-29090. OCS Study MMS 84-0044. 220 pp.

Bornholdt, M.A. and E.M. Lear (comp.). 1995. Outer Continental Shelf Natural Gas and Oil Program: Cumulative Effects 1987-1991. U.S. Department of the Interior, Minerals Management Service, Herndon, VA. OCS Report MMS 95-0007.

Bornholdt, M.A. and E.M. Lear (comp.). 1997. Outer Continental Shelf Oil and Natural Gas Program: Cumulative Effects 1992-1994. U.S. Department of the Interior, Minerals Management Service, Herndon, VA. OCS Report MMS 97-0027.

Braham, H.W. 1984. Distribution and migration of gray whales in Alaska. Pp. 249-266, *in*, M.L. Jones, S.L. Swartz, and S. Leatherwood (eds.), The gray whale. Academic Press, New York.

Bureau of Land Management (BLM). 1978. 1975/1976 Southern California Baseline Study, Final Report, Vol. III, Report 4.1.1. Trace Metals in Sediments. T.J. Chow and J. Earl (authors), Scripps Institution of Oceanography, La Jolla, California. BLM/DOI Contract No. 08550-CT5-52.

Burton, R.K., and J.T. Harvey. 2001. Injured gray whale off Morro Bay. Report to County of San Luis Obispo, California Coastal Commission, and California State Lands Commission. 6 pp.

C&C Technologies. 2010. Letter report: archaeological review of seafloor features, Santa Ynez Unit Heritage Platform OCS P-00182. September 28, 2010, 4 pages.

Calambokidis, J. 1995. Blue whales off California. Whalewatcher 29(1):3-7.

Calambokidis, J., G.H. Steiger, J.C. Cubbage, K.C. Balcomb, C. Ewald, S. Kruse, R. Wells, and R. Sears. 1990. Sightings and movements of blue whales off central California 1986-88 from photo-identification of individuals. Rep. Int. Whal. Commn. Special Issue 12:343-348.

California State Water Resources Control Board (CSWRCB). 2001. California Ocean Plan. Water Quality Control Plan, Ocean Waters of California.

Centaur Associates, Inc. 1984. Mitigation of seafloor conflicts between oil and gas pipelines and commercial trawl fisheries on the California outer continental shelf. MMS 84-0058. 426 pp.

Chambers Group, Inc. 1982. Biological monitoring of pipeline construction through kelp beds located offshore Corral Canyon. Prepared for Pacific Offshore Pipeline Company, Los Angeles, California.

Chambers Group, Inc. 1983. Benthic survey of Exxon=s proposed development sites in the Santa Ynez Unit. EIS/R from Santa Ynez Unit/Las Flores Canyon Development and Production Plan.

Chambers Group, Inc. 1987a. Final Supplemental Environmental Impact Report for the Exxon Santa Ynez Unit Offshore Oil Development Proposal. Prepared for: California State Lands Commission.

Chambers Group, Inc. 1987b. Finalizing Addendum. Final Supplemental Environmental Impact Report of the Exxon Santa Ynez Unit Offshore Oil Development Proposal. Prepared for: California State Lands Commission.

Chambers Group, Inc. 1987c. EIS/EIR Proposed Arco Coal Oil Point Project. Prepared for California State Lands Commission, County of Santa Barbara, and U.S. Army Corps of Engineers, Los Angeles District.

Cox, K.W. 1960. Review of the abalone of California. California Fish and Game Bulletin. 46:381-406.

Dahlheim, M.E., H.D. Fisher, and J.D. Schempp. 1984. Sound production by the gray whale and ambient noise levels in Laguna San Ignacio, Baja California Sur, Mexico. Pp. 511-541 *in*: M.L. Jones, S.L. Swartz, and S. Leatherwood (eds.), The gray whale *Eschrichtius robustus*. Academic Press, Orlando, FL.

Dames and Moore. 1982a. Environmental Report (Production) Santa Ynez Unit Development. Exxon Company U.S.A.

Dames and Moore. 1982b. Environmental Report (Production) Santa Ynez Unit Development. Exxon Company, U.S.A. Unit Operator. Marine Biology Technical Appendix.

Dames and Moore. 1988. Historical Properties Treatment Plan, Santa Ynez Unit, Santa Barbara County, California. Prepared for Exxon Company, U.S.A.

Dames and Moore. 1990. Results of marine mammal monitoring Platforms Heritage and Harmony pile driving construction activities, Santa Barbara Channel, California. Report to Exxon Company, U.S.A., Thousand Oaks, CA. Dames and Moore, Goleta, CA. 5 pp. Plus field log.

Dames and Moore. 1991. Pre-Construction Marine Biological Survey, Santa Ynez Unit Offshore Pipeline and Power Cable. Job No. 08837-479-01. October 1991.

Dames and Moore. 1992. Post-Construction Marine Biological Survey and Comparison of Pre- and Post-Construction Survey Data, Santa Ynez Unit Offshore Pipeline and Power Cable. Job No. 08837-479-01. July 1992.

Davis, G.E., P.I. Haaker, and D.V. Richards. 1996. Status and trends of white abalone at the California Channel Islands. Transactions of the American Fisheries Society 125 (1), 42-48.

DeLong, R.L., and S.R. Melin. 2000. Thirty Years of Pinniped Research at San Miguel Island. Pp. 401-406 *in*: D.R. Browne, K.L. Mitchell, and H.W. Chaney (eds.), Proceedings of the Fifth California Islands Symposium, 29 March to 1 April 1999, Santa Barbara Museum of Natural History, Santa Barbara, CA. Sponsored by the U.S. Minerals Management Service, Pacific OCS Region, 770 Paseo Camarillo, Camarillo, CA 93010. OCS Study No. 99-0038.

DeLong, R.L., B.S. Stewart, and R.D. Hill. 1992. Documenting migrations of northern elephant seals using day length. Marine Mammal Science 8(2):155-159.

De Wit, L.A. 2001. Pre-installation marine biological survey and preliminary impact assessment. Prepared for ExxonMobil. 9 pp. With appendices, photographs, and 1 map.

De Wit, L.A. 2002. Expanded marine biological survey. Tier 1 Area. Santa Ynez Unit Power System Repair Project. Prepared for ExxonMobil. 9 pp. With 4 appendices, photographs, and 4 maps.

De Wit, L.A. 2003. Final technical report post-installation marine biological survey and comparison with pre-installation data. SYU OPSR project. Prepared for ExxonMobil. 11 pp. with figures and map.

Dohl, T.P., R.C. Guess, M.L. Duman, and R.C. Helm. 1983. Cetaceans of central and northern California, 1980-1983: Status, abundance, and distribution. Prepared for U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region. OCS Study MMS 84-0045. 284 pp.

Dohl, T.P., K.S. Norris, R.C. Guess, J.D. Bryant, and M.W. Honig. 1981. Cetacea of the Southern California Bight. Part II of Investigators' reports: Summary of marine mammal and seabird surveys of the Southern California Bight Area, 1975-1978. Prepared for U.S. Department of the Interior, Bureau of Land Management, Pacific OCS Region. NTIS #PB 81-248-189. 414 pp.

Environmental Consulting, Inc. 2001. Marine Mammal and Seabird Computer Database Analysis System: Washington, Oregon, California 1975-1997. Prepared by Environmental Consulting, Inc., Portland, OR, for U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region, Camarillo, CA. Order No: 1435-01-97-PO-14206.

Exxon Company, U.S.A. (Exxon). 1982a. Development and Production Plan. Santa Ynez Unit Development.

Exxon Company, U.S.A. (Exxon). 1982b. Environmental Report (Production). Supporting Technical Data. Volume 1. Project Description. Santa Ynez Unit Development.

Exxon Company, U.S.A. (Exxon). 1985. Santa Ynez Unit Development and Production Plan Update. Submitted to MMS June 1985.

Exxon Company, U.S.A. (Exxon). 1987. Santa Ynez Unit Expansion Project. Development and Production Plan. Summary of Key Project Changes since 1985 DPP Update. September 1987.

ExxonMobil Production Company (ExxonMobil). 2002a. Project Description, Santa Ynez Unit Offshore Power System Repair (OPSR) Project. ExxonMobil Production Company, New Orleans, LA.

ExxonMobil Production Company (ExxonMobil). 2002b. ExxonMobil Santa Ynez Unit Offshore Power System Repair Project, Pre-Lay Cable Route Survey: Platform Heritage to shore including alternate route and Platform Harmony to Platform Hondo. Offshore Santa Barbara, California. Final Report. Performed by Fugro West Inc. Side-scan sonar, sub-bottom profiler, magnetometer, and bathymetric recordings. 33 pp., 6 Appendices, and Survey Charts

ExxonMobil Production Company (ExxonMobil). 2002c. ExxonMobil Santa Ynez Unit Offshore Power System Repair Project ROV Survey Report. Performed by Dominion Diving limited. 50+ pp., 1 Appendices, and 8 Videotapes.

Fish and Wildlife Service (FWS). 2000. Draft Revised Recovery Plan for the Southern Sea Otter (*Enhydra lutris*). Portland, Oregon. 64 pp. + app.

Fish and Wildlife Service (FWS). 2012. Southern sea otter information. U.S. Fish & Wildlife Service website accessed November 19, 2012: http://www.fws.gov/ventura/species_information/so_sea_otter/index.html

Forney, K.A., J. Barlow, M.M. Muto, M. Lowry, J. Baker, G. Cameron, J. Mobley, C. Stinchcomb, and J.V. Carretta. 2000. U.S. Pacific marine mammal stock assessments: 2000. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-300. 276 pp.

Fugro Consultants. 2011. SYU OPSRB pre-project geophysical and archaeological survey report. December 2011.

Fusaro, C., D. Gregorio, and M. Bell (eds.). 1986. A manual for geophysical operations in fishing areas of south/central California. Joint Oil/Fisheries Liaison Office, Santa Barbara, CA. 129pp.

Gales, R.S. 1982. Effects of noise of offshore oil and gas operations on marine mammals: An introductory assessment. Vols. I and II. Technical Report 844. Prepared for USDOI/MMS. Naval Ocean Systems Center, San Diego, CA.

Garcia and Associates. 2002. 2002 Survey Final Report: Ninth Annual Survey. August 2002

Garshelis, D.L., and J.A. Garshelis. 1984. Movement and management of sea otters in Alaska. J. Wildl. Manage. 48:665-678.

Geraci, J.R., and D.J. St. Aubin. 1980. Offshore petroleum resource development and marine mammals: a review and research recommendations. Marine Fisheries Review 42:1-12.

Geraci, J.R., and D.J. St. Aubin. 1985. Effects of offshore oil and gas development on marine mammals and turtles. Chapter 12, in, D.F. Boesch and N.N. Rabalais (eds.), The Long-term Effects of Offshore Oil and Gas Development: An Assessment and a Research Strategy. Final Report to NOAA, Natl. Mar. Pollut. Program Off., for Interagency Committee on Develop., and Monit. Louisiana Indust. Mar. Consort., Chauvin, Louisiana.

Gosho, M.E., D.W. Rice, and J.M. Breiwick. 1984. The sperm whale, *Physeter macrocephalus*. In, J.M. Breiwick and H.W. Braham (eds.), The status of endangered whales. Mar. Fish. Rev. 46:54-64.

Hanan, D.A., L.M. Jones, and M.J. Beeson. 1992. Harbor seal, *Phoca vitulina richardsi*, census in California, May-June 1991. Final Report submitted to NOAA Fisheries/National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, California. Administrative Report LJ-92-03. 67 pp.

Herzing, D.L., and B.R. Mate. 1984. Gray whale migrations along the Oregon coast, 1978-1981. Pp. 289-307, *in*: M.L. Jones, S.L. Swartz, and S. Leatherwood (eds.), The gray whale. Academic Press, New York.

Hobday, A.J., and M.J. Tegner. 2000. Status review of white abalone (*Haliotis sorenseni*) throughout its range in California and Mexico. NOAA Technical Memorandum NMFS. US Department of Commerce, NOAA-TM-NMFS-SWR-035. 90 pp.

Jones, M.L., and S.L. Swartz. 1984. Demography and phenology of gray whales and evaluation of whale-watching activities in Laguna San Ignacio, Baja California Sur, Mexico. Pp. 309-372, *in*: M.L. Jones, S.L. Swartz, and S. Leatherwood (eds.), The gray whale. Academic Press, New York.

Koski, W.R., J.W. Lawson, D.H. Thomson, and W.J. Richardson. 1998. Point Mugu Sea Range marine mammal technical report. LGL Limited, environmental research associates, King City, Ontario, Canada, in association with Ogden Environmental and Energy Services, Santa Barbara, CA, for Naval Air Warfare Center, Weapons Division, Point Mugu, CA, and Southwest Division, Naval Facilities Engineering Command, San Diego, CA. 281 pp. + app.

Kronman, M. 1995. Commercial fishing organizations and the management of south-central California's marine resources: A political history. 126pp.

Lafferty, K. 2001. Restoration of the white abalone in southern California: Population assessment, brood stock collection, and development of husbandry technology. NMFS Number: 99-SWR-004. 14pp. http://www.nmfs.noaa.gov/sfweb/sk/saltonstallken/husbandry.htm

Leatherwood, S. 1974. Aerial observations of migrating gray whales, Eschrichtius robustus, off southern California, 1969-1972. Marine Fisheries Review 36:45-49.

Leatherwood, S., B.S. Stewart, and P.A. Folkins. 1987. Cetaceans of the Channel Islands National Marine Sanctuary. NOAA, Channel Islands National Marine Sanctuary and NMFS. 66 pp.

Le Boeuf, B.J., D.E. Crocker, D.P. Costa, S.B. Blackwell, P.M. Webb, and D.S. Houser. 2000. Foraging ecology of northern elephant seals. Ecological Monographs 70(3):353-382.

Le Boeuf, B.J., Y. Naito , A.C. Huntley, and T. Asaga. 1989. Prolonged, continuous, deep diving by northern elephant seals. Canadian Journal of Zoology 67:2514-2519.

Leet, W.S., C.M. Dewees, and C. Haugen (eds). 1992. California's living marine resources: A status report. Sea Grant Extension, University of California at Davis. For the California Department of Fish and Game Resources Agency, California Department of Fish and Game (CDFG). 252 pp.

Leet, W.S., C.M. Dewees, R. Klingbeil, and E.J. Larson (eds). 2001. California's living marine resources: A status report. Agricultural and Natural Resources, University of California at Davis. For the California Department of Fish and Game Resources Agency. 592 pp.

Leighton. D.L. 1972. Laboratory observations on the early growth of the abalone. *Haliotis sorenseni*, and the effect of temperature on larval development and settling success. Fishery Bulletin 70(2):373-380.

Love, M.S. 1996. Probably more than you ever wanted to know about the fishes of the Pacific Coast. Really Big Press, Santa Barbara, CA. 381 pp.

Love, M.S., M. Nishimoto, D. Schroeder, and J. Caselle. 1999. The ecological role of natural reefs and oil and gas production platforms on rocky reef fishes in southern California: Final interim report. U. S. Geological Survey, Biological Resources Division, USGS/BRD/CR-1999-007. 208pp.

Macfarlane, H. 1982. Marine Cultural Resources Assessment, Santa Ynez Unit Development, Offshore Santa Barbara County, Exxon Company, U.S.A. Dames & Moore, Santa Barbara, California.

Malme, C.I., P.R. Miles, G.W. Miller, W.J. Richardson, D.G. Roseneau, D.H Thomson, and C.R. Greene, Jr. 1989. Analysis and ranking of the acoustic disturbance potential of petroleum industry activities and other sources of noise in the environment of marine mammals in Alaska. Report No. 6945 prepared by BBN Systems and Technologies Corp. for Minerals Management Service, Anchorage Alaska. Contract No. 14-12-0001-30365. OCS Study MMS 89-0006.

Marine Mammal Consulting Group (MMCG). 2003. Marine mammal mitigation report for ExxonMobil offshore power system repair project:amended. November 2003, 13 pages.

Mate, B.R., B.A. Lagerquist, and J. Calambokidis. 1999. Movements of North Pacific blue whales during the feeding season off southern California and their southern fall migration. Marine Mammal Science 15(4):1246-1257.

MBC Applied Environmental Sciences. 1986. Ecology of important fisheries species offshore California. U.S. Department of the Interior, Minerals Management Service. MMS 86-0093.

Minerals Management Service (MMS). 1988. Environmental Assessment for Santa Ynez Unit Development Project Modifications, Exxon Company, U.S.A. U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region, Los Angeles, CA.

Minerals Management Service (MMS). 1991. Environmental Assessment for Santa Ynez Unit Development and Production Plan Modifications, Exxon Company, U.S.A. U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region, Camarillo, CA.

Minerals Management Service (MMS). 1992. Proposed comprehensive Outer Continental Shelf natural gas and oil resource management program for 1992-1997. Environmental Impact Statement. MMS 92-0004.

Minerals Management Service (MMS). 1994. Environmental Assessment for OS&T Abandonment Plan, Santa Ynez Unit, Exxon Company, U.S.A. U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region, Camarillo, CA.

Minerals Management Service (MMS). 1995. Environmental Assessment for Santa Ynez Unit 3-Dimensional Seismic Survey, Exxon Company, U.S.A. U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region, Camarillo, CA. 84 pp. + app.

Minerals Management Service. 1996. Outer Continental Shelf Offshore Oil and Gas Leasing Program: 1997–2002. Final Environmental Impact Statement. August 1996. 2 Vols.

Minerals Management Service (MMS). 1997. Environmental Assessment for Platform Heritage to Platform Harmony Gas Pipeline, Santa Ynez Unit, Exxon Company, U.S.A. U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region, Camarillo, CA. 60 pp. + app.

Minerals Management Service (MMS). 2000. Biological evaluation of threatened and endangered species: Proposed oil and gas development activities in the Rocky Point Unit off Point Conception, California. Prepared for the National Marine Fisheries Service and U.S. Fish and Wildlife Service in accordance with Section 7© of the Endangered Species Act of 1973, as amended. Minerals Management Service, Pacific OCS Region, Camarillo, CA. 115 pp. + app.

Minerals Management Service (MMS). 2001. Draft Environmental Impact Statement for Delineation Drilling Activities in Federal Waters Offshore Santa Barbara County, California. U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region, Camarillo, CA.

National Marine Fisheries Service (NMFS). 1992. Biological analysis of the impacts on the eastern North Pacific gray whales by outer continental shelf activities in the Pacific and Arctic regions. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Spring, MD. 20 pp.

National Marine Fisheries Service (NMFS). 1998a. Essential Fish Habitat, West Coast Groundfish. http://swr.ucsd.edu/hcd/grndfish.pdf. 45pp.

National Marine Fisheries Service (NMFS). 1998b. Essential Fish Habitat, Coastal Pelagic Species. http://swr.ucsd.edu/hcd/cpsefh.pdf. 39pp.

National Marine Fisheries Service (NMFS). 2001. Endangered and Threatened Species; Endangered Status for White Abalone. 50 CFR Part 224, Federal Register, Vol. 66, No. 103. May 29, 2001.

National Marine Fisheries Service (NMFS). 2002. Description of white abalone (*Haliotis sorenseni*) and its status as a protected species. http://www.nmfs.noaa.gov/prot_res/species/inverts/White_AB.html.

National Marine Fisheries Service. 2008. White Abalone Recovery Plan (*Haliotis sorenseni*). National Marine Fisheries Service, Long Beach, CA.

National Marine Fisheries Service. 2011. Endangered and Threatened Wildlife and Plants: Final Rulemaking To Designate Critical Habitat for Black Abalone. 50 CFR Part 226, Federal Register, Vol. 76, No. 208. October 27, 2011.

National Oceanic and Atmospheric Administration (NOAA). 2012. Habitat areas of particular concern. NOAA website: http://www.swr.noaa.gov/hcd/HCD_webContent/socal/hapc.htm

Orr, J.W., M.A. Brown, and D.C. Baker. 1998. Guide to Rockfishes (Scorpaenidae) of the Genera *Sebastes*, *Sebastolobus*, and *Adelosebastes* of the Northeast Pacific Ocean. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-95. 46 pp.

Padre Associates, Inc. 2011a. Final technical report pre-project nearshore marine biological survey, OPSR-B project. Prepared for ExxonMobil. Padre job number 1102-0961. December 2011.

Padre Associates, Inc. 2011b. Marine wildlife monitoring report for ExxonMobil SYU offshore power system reliability project:B, pre-project geophysical/archaeology survey. Padre job number 1102-1151. October 2011.

Padre Associates, Inc. 2012a. Final technical report cable crossing locations diver survey, OPSR-B project. Prepared for ExxonMobil. Padre job number 1202-0051. May 2012

Padre Associates, Inc. 2012b. Marine wildlife monitoring report for ExxonMobil SYU offshore power system reliability project:B, pre-project geophysical/archaeology survey. Padre job number 1202-0301. April 2012.

Payne, R., O. Brazier, E.M. Dorsey, J.S. Perkins, V.J. Rountree, and A. Titus. 1983. External features in southern right whales (Eubalaena australis) and their use in identifying individuals. Pp. 371-445 in: R. Payne (ed.), Communication and behavior of whales. AAAS Sel. Symp. 76. Westview Press, Boulder, CO.

Poole, M.M. 1984. Migration corridors of gray whales along the central California coast, 1980-1982. Pp. 389-407, *in*: M.L. Jones, S.L. Swartz, and S. Leatherwood (eds.), The gray whale. Academic Press, New York.

Reeves, R.R. 1992. Whale responses to anthropogenic sounds: A literature review. Sci. & Res. Ser. 47, New Zealand Dept. Conserv., Wellington. 47 pp.

Reeves, R.R., P.J. Clapham, R.L. Brownell, Jr., and G.K. Silber. 1998. Recovery plan for the blue whale (*Balaenoptera musculus*). Office of Protected Resources, National Marine Fisheries Service, NOAA, Silver Spring, MD. 42 pp.

Richardson, W.J., C.R. Greene, Jr., W.R. Koski, and M.A. Smultea, with G. Cameron, C. Holdsworth, G. Miller, T. Woodley, and B. Würsig. 1991. Acoustic effects of oil production activities on bowhead and white whales visible during spring migration near Pt. Barrow, Alaska—1990 phase. OCS Study MMS 91-0037. Rep. from LGL, Ltd., King City, Ont., for U.S. Minerals Manage. Serv., Herndon, VA. 311 pp. NTIS PB92-170430.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme, and D.H. Thompson. 1995. Marine mammals and noise. Academic Press, Inc., San Diego, CA. 576 pp.

Richardson, W.J., and C.I. Malme. 1993. Man-made noise and behavioral responses. Pp. 631-700 *in*: J.J. Burns, J.J. Montague, and C.J. Cowles (eds.), The bowhead whale. Special Publication Number 2, The Society for Marine Mammalogy.

Riedman, M.L., and J.A. Estes. 1990. The sea otter (*Enhydra lutris*): behavior, ecology, and natural history. Washington, D.C.: U.S. Department of the Interior, Fish and Wildlife Service. Biological Report 90(14). 126 pp.

Robinson, N.H. 1979. Recent records of southern right whales in New South Wales. Victorian Nat. 96:168-169.

Rugh, D.J., M.M. Muto, S.E. Moore, and D.P. DeMaster. 1999. Status review of the eastern North Pacific stock of gray whales. NOAA/National Marine Fisheries Service, Alaska Fisheries Science Center, National Marine Mammal Laboratory, Seattle, WA. 96 pp.

Santa Barbara County Air Pollution Control District (SBCAPCD). 1987. Final Decision Document: Authority to Construct Permit Number 5651. Installation and Operation Santa Ynez Unit/Las Flores Canyon Oil and Stripping Gas Treating Facility and Transportation Terminal. Issued to Exxon Company, U.S.A. November 19, 1987.

Santa Barbara County Air Pollution Control District (SBCAPCD). 1991. Draft 1991 Air Quality Attainment Plan. Santa Barbara County Air Pollution Control District, November 1991.

Santa Barbara County Air Pollution Control District (SBCAPCD). 2000. Environmental Review Guidelines for the Santa Barbara County Air Pollution Control District. Adopted October 1995, revised November 2000.

Santa Barbara County Air Pollution Control District (SBCAPCD). 2001. 2001 Clean Air Plan. Santa Barbara County Air Pollution Control District, November 2001.

Santa Barbara County Planning & Development Department. 1994. Condition Effectiveness Study (Permit Condition II-2 Review): Exxon Santa Ynez Unit Project, June 1994.

Santa Barbara County. 1999. Coastal Zoning Ordinance, Article II of Chapter 35, Zoning of the Santa Barbara County Code. Republished 1997, updated 1999.

Santa Barbara County. 1995. Santa Barbara County Coastal Plan. January 1982, updated 1995.

Santa Barbara Museum of Natural History (SBMNH). 1992. Exxon SYU Expansion Project, Marine Mammal Monitoring Program. Final report to Exxon, U.S.A., Thousand Oaks, California. C.D. Woodhouse and P.C. Howorth, Project Managers. Contract No. TR-91/1181. 25 pP. plus appendix.

Science Applications, Inc. (SAI). 1994. Exxon SYU Las Flores Canyon Revegetation 1994 Monitoring Report.

Science Applications, Inc. (SAI). 1984a. Final Environmental Impact Statement/Report for Santa Ynez Unit/Las Flores Canyon Development and Production Plan. Exxon, U.S.A. Prepared for U.S. Minerals Management Service, California State Lands Commission, and County of Santa Barbara.

Science Applications, Inc. (SAI). 1984b. Final Environmental Impact Statement/Report. Technical Appendix 1 and 2, Air Quality and Meteorology for Santa Ynez Unit/Las Flores Canyon Development and Production Plan. Exxon, U.S.A. Prepared for U.S. Minerals Management Service, California State Lands Commission, and County of Santa Barbara.

Science Applications, Inc. (SAI). 1984c. Final Environmental Impact Statement/Report. Technical Appendix 8, Marine Biology for Santa Ynez Unit/Las Flores Canyon Development and Production Plan. Exxon, U.S.A. Prepared for U.S. Minerals Management Service, California State Lands Commission, and County of Santa Barbara.

Science Applications, Inc. (SAI). 1984d. Final Environmental Impact Statement/Report. Technical Appendix 12: Marine Water Quality for the Santa Ynez Unit/Las Flores Canyon Development and Production Plan. Exxon, U.S.A. Prepared for U.S. Minerals Management Service, California State Lands Commission, and County of Santa Barbara.

Science Applications International Corporation (SAIC). 1986. Assessment of long-term changes in biological communities in the Santa Maria Basin and western Santa Barbara Channel. Final Report to the U.S. Department of the Interior, Minerals Management Service under Contract No. 14-12-0001-30032.

Schroeder, D.M. 1999a. Spatial and temporal patterns of temperate reef fish communities associated with natural reefs, oil/gas production platforms and other artificial reef structures. Pp. 4A-1–4B-19 *in*: M.S. Love, M. Nishimoto, D. Schroeder, and J. Caselle, (eds.), The ecological role of natural reefs and oil and gas production platforms on rocky reef fishes in southern California: Final interim report. U. S. Department Interior, U. S. Geological Survey, Biological Resources Division, USGS/BRD/CR-1999-007. 208 pp.

Schroeder, D.M. 1999b. Relative habitat value of oil and gas production platforms and natural reefs to shallow water fish assemblages in the Santa Maria Basin and Santa Barbara channel, California. Pp. 4C-1–4C-8 *in*: M.S. Love, M. Nishimoto, D. Schroeder, and J. Caselle (eds.), The ecological role of natural reefs and oil and gas production platforms on rocky reef fishes in southern California: Final interim report. U. S. Department Interior, U. S. Geological Survey, Biological Resources Division, USGS/BRD/CR-1999-007. 208pp.

Southern California Coastal Water Research Project (SCCWRP). 1996. Annual Report, 1996.

State Lands Commission (SLC). 1995. Final Environmental Impact Report. Subsea well abandonment and flowline abandonment/removal program. 2 Vols. Prepared by Continental Shelf Associates, Inc.

Stewart, B.S., and P.K. Yochem. 2000. Community ecology of California Channel Islands pinnipeds. Pp. 413-420 *in*: D.R. Browne, K.L. Mitchell, and H.W. Chaney (eds.), Proceedings of the Fifth California Islands Symposium, 29 March to 1 April 1999, Santa Barbara Museum of Natural History, Santa Barbara, CA. Sponsored by the U.S. Minerals Management Service, Pacific OCS Region, 770 Paseo Camarillo, Camarillo, CA 93010. OCS Study No. 99-0038.

Stewart, B.S., P.K. Yochem, R.L. DeLong, and G.A. Antonelis, Jr. 1987. Interactions between Guadalupe fur seals and California sea lions at San Nicolas and San Miguel Islands, California. Pp. 103-106 *in*: J.P. Croxall, and R.L. Gentry (eds.), Status, biology, and ecology of fur seals. Proceedings of an International Symposium and Workshop, Cambridge, England, 23-27 April 1984. NOAA Technical Report NMFS 51.

Terhune, J.M. 1981. Influence of loud vessel noises on marine mammal hearing and vocal communication. Pp. 270-286, *in*: N.M. Peterson (ed.), The question of sound from icebreaker operations: The proceedings of a workshop. Arctic Pilot Project, Petro-Canada, Calgary, Alberta.

Watkins, W.A. 1986. Whale reactions to human activities in Cape Cod waters. Marine Mammal Science 2(4):251-262.Whitehead, H., J. Gordon, E.A. Mathews, and K.R. Richard. 1990. Obtaining skin samples from living sperm whales. Marine Mammal Science 6(4):316-326.

Wyrick, R.F. 1954. Observations on the movements of the Pacific gray whale *Eschrichtius glaucus* (cope.). Journal of Mammalogy 35:596-598.

APPENDIX A

Southern California Eelgrass Mitigation Policy

APPENDIX B

Offshore Power System Repair Project OPSR-A

Cable Retrieval Risk Assessment

(Analysis of Risk of Damage to Existing Components from a Dropped Cable During Retrieval)

September 2002

and Supplement 1: Shallow Water Addendum

October 2002

Prepared by: Petro Marine / BCI Engineering

[Analysis of OPSRB cable-specific analysis under way and will be provided as soon as it is available.]

SOUTHWEST REGIONAL OFFICE

National Marine Fisheries Service

SOUTHERN CALIFORNIA EELGRASS MITIGATION POLICY

(Adopted July 31, 1991)

(From: http://swr.nmfs.noaa.gov/hcd/eelpol.htm)

Eelgrass (Zostera marina) vegetated areas function as important habitat for a variety of fish and other wildlife. In order to standardize and maintain a consistent policy regarding mitigating adverse impacts to eelgrass resources, the following policy has been developed by the Federal and State resource agencies (National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the California Department of Fish and Game). This policy should be cited as the Southern California Eelgrass Mitigation Policy (revision 8).

For clarity, the following definitions apply. "Project" refers to work performed on-site to accomplish the applicant's purpose. "Mitigation" refers to work performed to compensate for any adverse impacts caused by the "project". "Resource agencies" refers to National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the California Department of Fish and Game.

1. **Mitigation Need.** Eelgrass transplants shall be considered only after the normal provisions and policies regarding avoidance and minimization, as addressed in the Section 404 Mitigation Memorandum of Agreement between the Corps of Engineers and Environmental Protection Agency, have been pursued to the fullest extent possible prior to the development of any mitigation program.

2. **Mitigation Map.** The project applicant shall map thoroughly the area, distribution, density and relationship to depth contours of any eelgrass beds likely to be impacted by project construction. This includes areas immediately adjacent to the project site which have the potential to be indirectly or inadvertently impacted as well as areas having the proper depth and substrate requirements for eelgrass but which currently lack vegetation.

Protocol for mapping shall consist of the following format:

1) Coordinates

Horizontal datum - Universal Transverse Mercator (UTM), NAD 83, Zone 11

Vertical datum - Mean Lower Low Water (MLLW), depth in feet.

2) Units

Transects and grids in meters.

Area measurements in square meters/hectares.

All mapping efforts must be completed during the active growth phase for the vegetation (typically March through October) and shall be valid for a period of 120 days with the exception of surveys completed in August - October.

A survey completed in August - October shall be valid until the resumption of active growth (i.e., March 1). After project construction, a post-project survey shall be completed within 30 days. The actual area of impact shall be determined from this survey.

3. **Mitigation Site.** The location of eelgrass transplant mitigation shall be in areas similar to those where the initial impact occurs. Factors such as, distance from project, depth, sediment type, distance from ocean connection, water quality, and currents are among those that should be considered in evaluating potential sites.

4. **Mitigation Size.** In the case of transplant mitigation activities that occur concurrent to the project that results in damage to the existing eelgrass resource, a ratio of 1.2 to 1 shall apply. That is, for each square meter adversely impacted, 1.2 square meters of new suitable habitat, vegetated with eelgrass, must be created. The rationale for this ratio is based on, 1) the time (i.e., generally three years) necessary for a mitigation site to reach full fishery utilization and 2) the need to offset any productivity losses during this recovery period within five years. An exception to the 1.2 to 1 requirement shall be allowed when the impact is temporary and the total area of impact is less than 100 square meters. Mitigation on a one-for-one basis shall be acceptable for projects that meet these requirements (see section 11 for projects impacting less than 10 square meters).

Transplant mitigation completed three years in advance of the impact (i.e., mitigation banks) will not incur the additional 20% requirement and, therefore, can be constructed on a one-for-one basis. However, all other annual monitoring requirements (see sections 8-9) remain the same irrespective of when the transplant is completed.

Project applicants should consider increasing the size of the required mitigation area by 20-30% to provide greater assurance that the success criteria, as specified in Section 9, will be met. In addition, alternative contingent mitigation must be specified, and included in any required permits, to address situation where performance standards (see section 9) are not met.

5. **Mitigation Technique.** Techniques for the construction and planting of the eelgrass mitigation site shall be consistent with the best available technology at the time of the project. Donor material shall be taken from the area of direct impact whenever possible, but also should include a minimum of two additional distinct sites to better ensure genetic diversity of the donor plants. No more than 10% of an existing bed shall be harvested for transplanting purposes. Plants harvested shall be taken in a manner to thin an existing bed without leaving any noticeable bare areas. Written permission to harvest donor plants must be obtained from the California Department of Fish and Game.

Plantings should consist of bare-root bundles consisting of 8-12 individual turions. Specific spacing of transplant units shall be at the discretion of the project applicant.

However, it is understood that whatever techniques are employed, they must comply with the stated requirements and criteria.

6. **Mitigation Timing.** For off-site mitigation, transplanting should be started prior to or concurrent with the initiation of in-water construction resulting in the impact to the eelgrass bed. Any off-site mitigation project which fails to initiate transplanting work within 135 days following the initiation of the in-water construction resulting in impact to the eelgrass bed will be subject to additional mitigation requirements as specified in section 7. For on-site mitigation, transplanting should be postponed when construction work is likely to impact the mitigation. However, transplanting of on-site mitigation should be started no later than 135 days after initiation of in-water construction activities. A construction schedule which includes specific starting and ending dates for all work including mitigation activities shall be provided to the resource agencies for approval at least 30 days prior to initiating in-water construction.

7. **Mitigation Delay.** If, according to the construction schedule or because of any delays, mitigation cannot be started within 135 days of initiating in-water construction, the eelgrass replacement mitigation obligation shall increase at a rate of seven percent for each month of delay. This increase is necessary to ensure that all productivity losses incurred during this period are sufficiently offset within five years.

8. **Mitigation Monitoring.** Monitoring the success of eelgrass mitigation shall be required for a period of five years for most projects. Monitoring activities shall determine the area of eelgrass and density of plants at the transplant site and shall be conducted at 3, 6, 12, 24, 36, 48, and 60 months after completion of the transplant. All monitoring work must be conducted during the active vegetative growth period and shall avoid the winter months of November through February. Sufficient flexibility in the scheduling of the 3 and 6 month surveys shall be allowed in order to ensure the work is completed during this active growth period. Additional monitoring beyond the 60 month period may be required in those instances where stability of the proposed transplant site is questionable or where other factors may influence the long-term success of transplant.

The monitoring of an adjacent or other acceptable control area (subject to the approval of the resource agencies) to account for any natural changes or fluctuations in bed width or density must be included as an element of the overall program.

A monitoring schedule that indicates when each of the required monitoring events will be completed shall be provided to the resource agencies prior to or concurrent with the initiation of the mitigation.

Monitoring reports shall be provided to the resource agencies within 30 days after the completion of each required monitoring period.

9. **Mitigation Success.** Criteria for determination of transplant success shall be based upon a comparison of vegetation coverage (area) and density (turions per square meter) between the project and mitigation sites. Extent of vegetated cover is defined as that area where eelgrass is present and where gaps in coverage are less than one meter between individual turion clusters. Density of shoots is defined by the number of turions per area

present in representative samples within the control or transplant bed. Specific criteria are as follows:

a. a minimum of 70 percent area of eelgrass bed and 30 percent density after the first year.

b. a minimum of 85 percent area of eelgrass bed and 70 percent density after the second year.

c. a sustained 100 percent area of eelgrass bed and at least 85 percent density for the third, fourth and fifth years.

Should the required eelgrass transplant fail to meet the established criteria, then a Supplementary Transplant Area (STA) shall be constructed, if necessary, and planted. The size of this STA shall be determined by the following formula:

$STA = MTA \times (|A_t + D_t| - |A_c + D_c|)$

MTA = mitigation transplant area.

A_t = transplant deficiency or excess in area of coverage criterion (%).

D_t = transplant deficiency in density criterion (%).

A_c = natural decline in area of control (%).

D_c = natural decline in density of control (%).

Four conditions apply:

1) For years 2-5, an excess of only up to 30% in area of coverage over the stated criterion with a density of at least 60% as compared to the project area may be used to offset any deficiencies in the density criterion.

2) Only excesses in area criterion equal to or less than the deficiencies in density shall be entered into the STA formula.

3) Densities which exceed any of the stated criteria shall not be used to offset any deficiencies in area of coverage.

4) Any required STA must be initiated within 120 days following the monitoring event that identifies a deficiency in meeting the success criteria. Any delays beyond 120 days in the implementation of the STA shall be subject to the penalties as described in Section 7.

10. **Mitigation Bank.** Any mitigation transplant success that, after five years, exceeds the mitigation requirements, as defined in section 9, may be considered as credit in a "mitigation bank". Establishment of any "mitigation bank" and use of any credits accrued from such a bank must be with the approval of the resource agencies and be consistent with the provisions stated in this policy. Monitoring of any approved mitigation bank shall be conducted on an annual basis until all credits are exhausted.

11. **Exclusions.**

1) Placement of a single pipeline, cable, or other similar utility line across an existing eelgrass bed with an impact corridor of no more than ½ meter wide may be excluded from the provisions of this policy with concurrence of the resource agencies. After project construction, a post-project survey shall be completed within 30 days and the results shall be sent to the resource agencies. The actual area of impact shall be determined from this survey. An additional survey shall be completed after 12 months to insure that the project or impacts attributable to the project have not exceeded the allowed ½ meter corridor width. Should the post-project or 12 month survey demonstrate a loss of eelgrass greater than the ½ meter wide corridor, then mitigation pursuant to sections 1-11 of this policy shall be required.

2) Projects impacting less than 10 square meters. For these projects, an exemption may be requested by a project applicant from the mitigation requirements as stated in this policy, provided suitable out-of-kind mitigation is proposed. A case-by-case evaluation and determination regarding the applicability of the requested exemption shall be made by the resource agencies.

(last revised 2/2/99)

ExxonMobil

Santa Ynez Unit

Offshore Power System Repair: Amended Project
OPSR:A

Cable Retrieval Risk Assessment
(Analysis of Risk of Damage to Existing Components from a Dropped Cable During Retrieval)

September 2002

Prepared by:
PMBCI
Gene Pharr, PE

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Study Summary

PMBCI examined the risk of physical damage to the active SYU cables and pipelines from the dropping of the failed "C" cable with or without the recovery tools attached during retrieval from the seabed. The study evaluated two water depths and three locations: 1) seaward of the shelf break in about 450 feet of water depth and 2) at two gas pipeline crossings of the "C" cable west of the Harmony platform each in about 1250 feet of water depth. The study methodology included the following three steps: 1) analysis of the falling cable dynamics; 2) analysis of the collision impact dynamics and 3) estimation of pipeline or cable damage. As a result of the analysis, five cable laydown modes were examined and three were found to be plausible under study conditions.

1) Stiff Catenary Laydown – (Very shallow water only < 50 ft) [Not considered plausible]
2) Hammerhead Laydown – (Does not occur under assumptions used) [Not considered plausible]
3) Spaghetti Pile Without Clamp – (All water depths)
4) Spaghetti Pile With Clamp – (All water depths)
5) Plunging Stalk – (Deep water only > ~400 ft)

The plausible damage to either a pipeline or a power cable was determined using elastic collision impact analysis. The results of this analysis obtained the following conclusions:

a) None of the pipelines or submarine power cables can be damaged by stiff catenary laydown mode.
b) None of the pipelines or submarine power cables can be damaged by the hammerhead laydown mode.
c) None of the pipelines or submarine power cables can be damaged by the spaghetti pile without clamp laydown mode.
d) None of the pipelines can be damaged by the spaghetti pile with clamp laydown mode.
e) All of the submarine power cables can be damaged by the spaghetti pile with clamp laydown mode.
f) All of the pipelines can be damaged by the plunging stalk mode.
g) All of the submarine power cables can be damaged by the plunging stalk mode.

As shown above, a plausible risk to the operating pipelines and power cables exists at each of the study locations, specifically in the deeper water. It should be noted that the spaghetti pile mode would more easily impact a long linear target such as the submarine cable. For the spaghetti pile with clamp or the plunging stalk modes to damage a pipeline or power cable, they would have to have a direct hit on the component. A tabular summary is provided in the report.

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Study Premise

ExxonMobil commissioned PMBCI to examine the risk of damage to the SYU power cables and pipelines if the existing failed "C" cable is dropped during retrieval from the seabed while either the existing cables and pipelines are still in active service or the same operation after all of the cables and pipelines have been decommissioned and removed from service at the end of the SYU field life.

The primary risk examined in this study is that of possible physical damage caused by a dropped object such as the cable being retrieved with or without the recovery tools attached. One phase of this study will be to examine the loading required to cause such a failure. For the situation where the existing power cables or pipelines are still in service, an impact sufficient to cause plastic (e.g. inelastic permanent) deformation of the cable jacket armor wires or the pipeline is defined (for the purposes of this study) as failure. Depending on the actual damage, this type of deformation could require the repair of the cable or pipeline. For the situation where the cables and pipelines have been decommissioned, no repair would be required.

The study assumes, as an obvious conclusion, that the cable being retrieved, and the recovery clamp or end fittings to be employed are not themselves heavy enough to cause damage if they were lowered gently to the sea bottom. The major part of the study will focus on the estimation of the kinetic energy of the falling body. Due to the required calculation assumptions, the unknown physical condition of the cable to be retrieved, and for consistency with common engineering practice for heavy lift marine rigging and salvage operations, a safety factor of at least 3.0 is recommended. Without an adequate safety factor it is not practical to predict that a given scenario avoids damage with consequent risks of loss of service, pollution, and increased risks associated with or arising in additional or corrective work.

Site and Operations

The study evaluates the retrieval of the failed "C" power cable (5.83 inch diameter 35 kv submarine power cable) that has been removed from service and will be replaced as part of the OPSR:A Project. The cable runs between the shore and the Heritage offshore platform passing South of the Hondo and Harmony platforms as shown on the marine survey drawings (reference Pre-Lay Cable Route Survey, September 2001).

The OPSR:A Project purposes to retrieve the portion of the cable from the conduit terminus to the shelf break. The inshore portion of the cable will be retrieved to about 400-450 feet of water to the seaward side of the shelf break in the OCS. As a future operation, the OCS portion of the failed "C" cable could be retrieved from the shelf break to the first gas pipeline crossing west of Harmony platform and then from the second crossing of the gas pipeline to the Heritage platform. Another future operation could be the removal of the entire OCS portion of the failed "C" cable at the end of the SYU field life after the facilities have been shut down.

In the area of the shelf break the purposed approach is for the seaward portion of the "C" cable to be cut at the tension machine on the vessel and lowered to the sea bottom with a nominal 100 pound pulling head attached for future recovery. The cable is nominally parallel and adjacent to the "B" power cable, the "A" power cable, and the 12-inch POPCO pipeline at this location. The first objective of this study is to evaluate if damage could occur to these in-service power cables or pipelines if the "C" cable were dropped at this point.

The future retrieval operation of the OCS portion of the "C" cable would proceed by lifting the inshore end of the cable at the 400-450 water depth and recovering it onto the cable recovery vessel through a traction device. A nominal 3-knot current from approximately West to East will contribute to the cable catenary tension during recovery.

For this analysis the recovery of the cable on the OCS will proceed to a point to the East and slightly South of the Harmony platform. The point will be selected such that the catenary lift-off point remains short of where the "C"

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cable crosses under the 12-inch gas pipeline West of the Harmony platform. The cable will be cut at this point and lowered to the sea bottom with a nominal 100 pound pulling head attached.

The second objective of this study is to determine if this cable were dropped at this point would it damage any of the in-service power cables or pipelines at that location. The cables at that location are the "A", "B", and "D" submarine power cables. The pipelines are the 20-inch oil emulsion pipeline, the 12 inch treated water pipeline, the 14-inch oil emulsion pipeline, and the 12-inch sales gas pipeline.

For this analysis the recovery of the cable on the OCS will continue West of the second crossing of the 12 inch gas pipeline located West of the Harmony platform to the Heritage platform. At this location, the cable will be cut on the sea bottom and lifted with a 200-pound cable clamp.

The third objective of this study is to determine if the cable, with the clamp tool attached, were dropped at this point would it damage any of the in-service cables or pipelines at this location. The "E" power cable, 12-inch gas pipeline, and 20 inch oil emulsion pipelines are at this location.

Study Methodology

The study methodology included the following three steps to address the study objectives:

1.) Falling Cable Dynamics

For each of the three locations, how can the cable fall? How fast will it go? With what kinetic energy will it strike the seafloor or one of the study target cables or pipelines? In simple terms, how hard does it hit?

2.) Collision Impact dynamics

The "C" cable being retrieved and the lifting clamp or end fitting will be falling on the study target bodies with kinetic energies predicted in step 1. The force imparted to the target body will be predicted as a collision of elastic bodies. The work done to bring the falling body to rest is the integral of the force exerted with respect to the falling body deformation. The same amount of work is done by the equal and opposite forces deforming the target body.

3.) Pipeline or Cable Damage Estimate

The pipelines are analyzed by a linear finite element analysis to determine the magnitude of force applied in the anticipated patterns that would result in initiation of a failure if acting alone. As it is not practical to evaluate other actual stresses as may be present, a safety factor of three is recommended to provide rational assurance that damage will not result from combined stresses due to both the predicted impact event and "ambient" stresses from operating and service conditions.

The cables spiral armor will be effective principally in resisting transverse cuts or abrasion. It will not be effective in preventing lateral loads from being transferred to the conductors. The HV Kerite conductor insulation is a material with physical behavior characteristics like a high durometer rubber and a tensile strength of 550 psi. The target cables are primarily subject to damage either by a stabbing type of impact in which the armor wires are pushed aside, perhaps by broken armor wires protruding from the falling cable, or by direct

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crushing forces transmitted through the armor to the conductor core. This high rate impact load can cause a longitudinal splitting and consequent failure if the peak tensile stresses exceed the tensile strength.
A linear finite element analysis of the conductor has been performed to determine the loading that would initiate such a failure. A safety factor of at three is recommended to insure the validity of safe loading predictions. No data is available for the known characteristic of most insulating materials to exhibit reduced dielectric strength under high shear stress loadings therefore the suggested safety factor of three may not be adequate to prevent dielectric breakdown if the cables are energized at the time of impact.

Falling Cable Dynamics

Analyses of the cable catenaries with loading from typical water currents were performed for a wide variety of conditions at 450 and 1250 water depths. These analyses indicated that to avoid exceeding allowable cable tension the horizontal force at the traction (upper) end must be limited. The maximum cable tension without current loading would be at the upper end. Due to the current forces transverse to the cable, both the horizontal and vertical forces are markedly increased and the maximum cable tension will occur in the sag bend rather than the upper end. The profile that must be adopted to prevent excessive tension in the three knot current is steeper at the upper end than might be used for a "no-current" cable laying or recovery operation. The manufacturers suggested maximum cable tension of 21,680 pounds should be observed. As the cable is known to have failed, the possibility of a local physical defect either due to fault currents or galvanic action is considered high. Although the cable is being retrieved without expectation of reuse, higher tension than the manufacturer has recommended could cause a tensile failure at a local physical defect. There is no assurance that such a failure will not occur at an even lower load. All normal precautions to stay clear of highly tensioned multipart lines should be observed. If such an unanticipated tension failure does occur at a tension less than the recommended 21,680 pound limit, the results will be very similar to the cases considered at the previously described three locations.

The cable could be dropped due to a rigging failure or handling error at any of the three study locations. The first analysis is for a 3-knot current loaded catenary in 450 feet of water, within permissible maximum tension limits. Two time steps for a direct integration time-history dynamic analysis are shown in Figure 1. This analysis does not converge to a solution as instabilities develop from the inability of the modeled cable to sustain compressive loads.

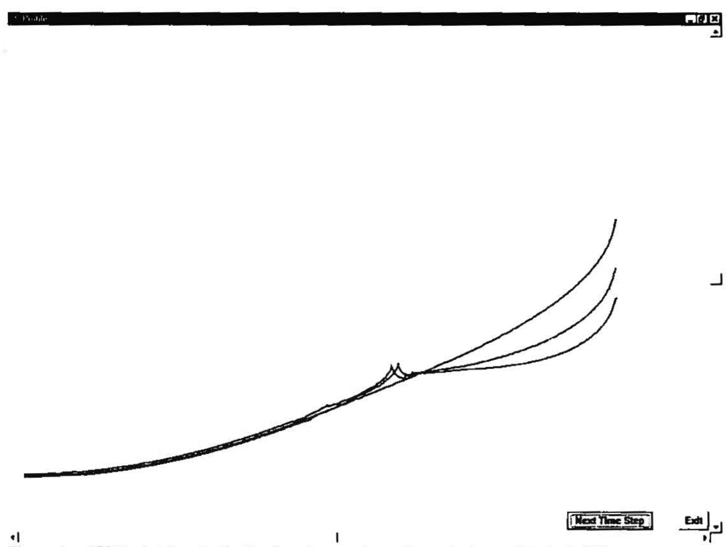

Figure 1 – 450-foot water depth simple catenary dynamic analysis predicts instability

Several useful inferences may be drawn even though a full direct solution fails. These will be discussed further after looking at other examples. The water depth for this case is 450 feet. The lift-off point is 842.28 feet from the able head, which is 11.17 feet above the waterline.

A second analysis using a similar profile for 1250 feet of water follows. This current loaded profile is for minimum tension while retaining control of the lift-off point. The lift-off point is 341.34 feet from the cable head, which is 11.14 feet above the waterline. Note that for this minimum tension case in 1250 feet of water, the cable head is nearly vertical. Five time steps from the cable release are shown in Figure 2. Just as in the 450-foot water depth case, compressive instabilities develop, and the solution fails to converge.

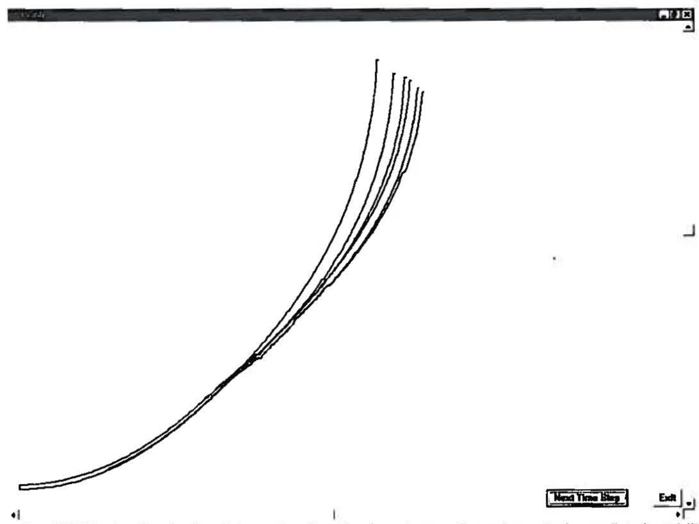

Figure 2 – 1250-foot water depth minimum tension simple catenary dynamic analysis predicts instability

By contrast, the current loaded profile for maximum tension was also evaluated. The lift-off point is 1482.88 feet from the cable head, which is 11.38 feet above the waterline. For this maximum tension case in 1250 feet of water the cable head is still at a high angle. Two time steps from the cable release are shown in Figure 3. Just as in the other cases, compressive instabilities develop, and the solution fails to converge.

The maximum tension profile for 1250 feet of water follows.

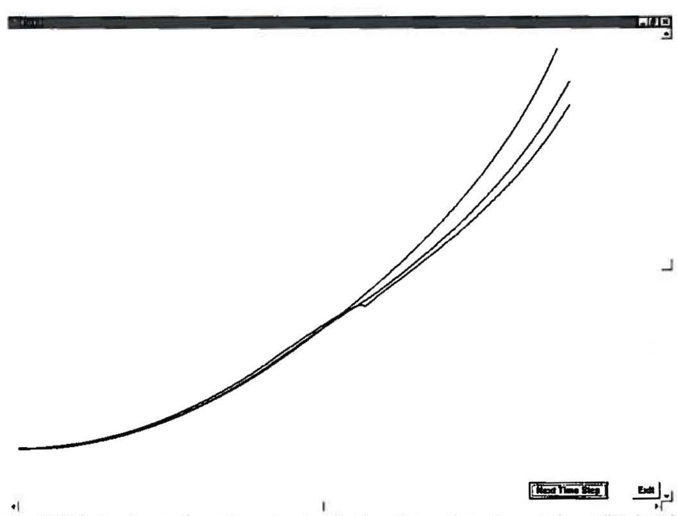

Figure 3 – 1250-foot water depth maximum tension simple catenary dynamic analysis predicts instability

These analyses and others all failed to converge to simple solutions with the cable on bottom and in every case the development of instability due to axial compression was the reason.

The "C" cable has three HV insulated conductors and a single layer of 46 BWG #4 galvanized steel wires coated with 55 mils of high density polyethylene. The coated armor wires are in a single left lay layer with a 39-inch spiral pitch. The armor wires are not contained within a sheath or connected together.

Traditional rational analysis to proceed beyond the above evaluation suggests five specific modes to consider for the manner in which the dropped cable may reach the sea bottom:

1.) Stiff Catenary Laydown Mode

If the cable were able to sustain the compression that arises without significant local buckling or out of plane deformation, it would come down with in-plane lateral motion only. A single touchdown point would move along the seabed from the prior-to-release lift-off point to the cable head.

A number of factors work against development of this case. The single layer spiral armor will cause the slacking cable to spiral and compression will amplify the inherent spiral. This effect will cause out of plane motion to initiate. The spiral armor itself is unable to sustain direct compression and it can open up forming basket(s). At any local defect such as where a basket exists or armor wires are displaced from their normal lay or wires have been broken, corroded, or damaged in any way, a weak spot is formed where compressive force will cause a concentration of p-delta moment amplification effects.

The simple stiff catenary laydown can only occur in very shallow water (perhaps less than 50 feet of water depth). This mode is not expected in the study water depth range. Further analysis of this mode was not pursued as it is not expected to occur.

2.) Hammerhead Laydown Mode

This laydown mode is the same as above except that the cable end fixture acting as a concentrated weight causes the cable end to fall faster such that it hits bottom ahead of the adjacent cable.

This mode is also not expected to develop in the study water depths. The Stiff Catenary Laydown from which this mode would develop does not occur and the cable end fittings employed are not heavy enough to have significant effect.

3.) Spaghetti Pile Mode Without Clamp

As the cable cannot sustain compressive loading without lateral displacement and bending it will curl into a spaghetti pile. As the curling cable falls, there will be multiple touchdown points in unpredictable locations and sequences along and to both sides of the nominal cable path. In all cases the touchdown velocity will be approximately the terminal velocity for lateral motion of the cable. The individual impact points may be very slightly higher than the nominal terminal velocity as adjacent cable segments are inclined with respect to the general motion.

This mode is expected to occur at all the study location water depths. The lateral distribution of the impact points could be higher in the deeper water but remains unpredictable. As the cable reaches its terminal velocity in less than its own diameter there is no other significant difference between the 450 and 1250-foot water depths.

A typical impact point kinetic energy for the spaghetti pile would be approximately:

$$E_k = \frac{m \cdot v^2}{2} = \frac{\left(\frac{200}{32.2}\right) \cdot \left(3.75^2\right)}{2} = 43.7 \ ft \cdot lbf$$

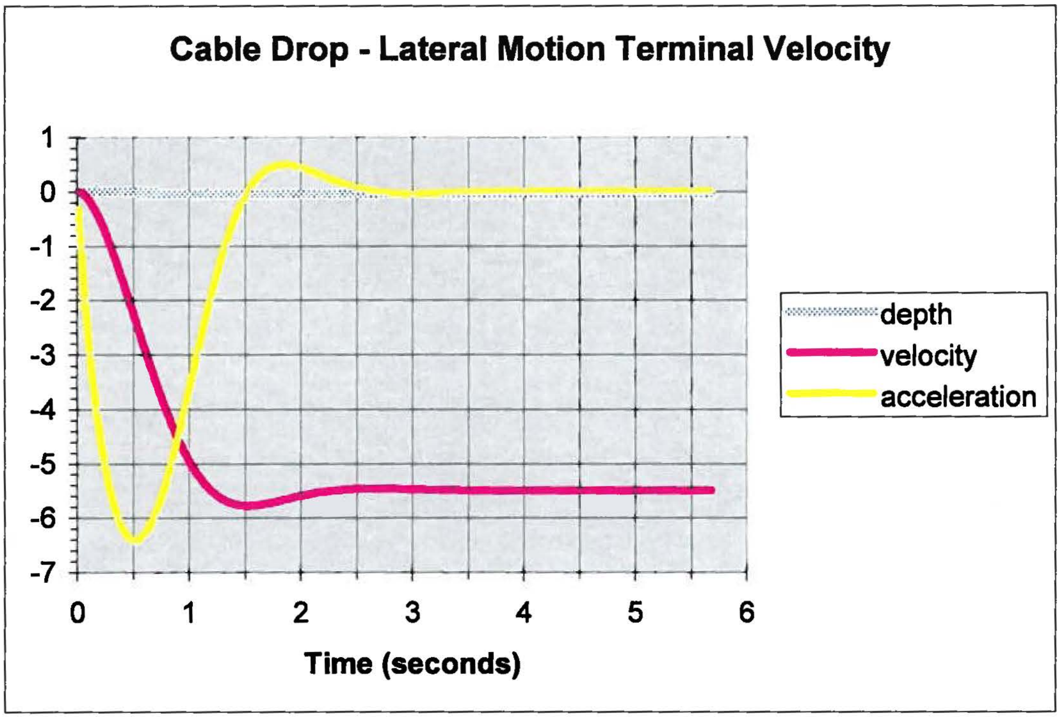

Figure 4 – Dynamic Terminal Velocity Study by Morison's Equation

The terminal velocity for the "C" cable free falling in seawater at 70° F is 5.50 feet per second. The cable diameter is 5.38 inches. The values for Cd and Cm are 0.70 and 1.6.

As can be seen in Figure 4, starting from rest the terminal velocity is reached in about 2.5 seconds and with a lateral motion of less than the cable diameter.

[5.5 feet per second is 3.75 miles per hour; about walking speed.]

4.) Spaghetti Pile Mode With Clamp

This mode is the same as the previous mode except that a 200-pound end clamp is located a few feet from the end of the cable. The edge of this clamp can strike the pipe like a knife-edge and at a slightly higher kinetic energy.

At the end clamp the kinetic energy could be:

$$E_k = \frac{m \cdot v^2}{2} = \frac{\left(\frac{400}{32.2}\right) \cdot \left(4.00^2\right)}{2} = 99.4 \ ft \cdot lbf$$

5.) **Plunging Stalk Mode**

The axial hydrodynamic forces, which are commonly ignored in many cases, are substantially less than the lateral forces described by Morison's Equation. If a segment of cable is falling in the direction of its longitudinal axis then its terminal velocity is governed by the weaker axial flow surface boundary layer effects and it will fall faster and for a much greater distance before reaching terminal velocity.

Figure 5 shows a 400-foot "stalk" falling vertically. It reaches terminal velocity at 67.3 feet per second (45.9 miles per hour) when the drag equals the submerged weight of 3500 pounds after plunging 122 feet. Note this is radically different from the lateral terminal velocity.

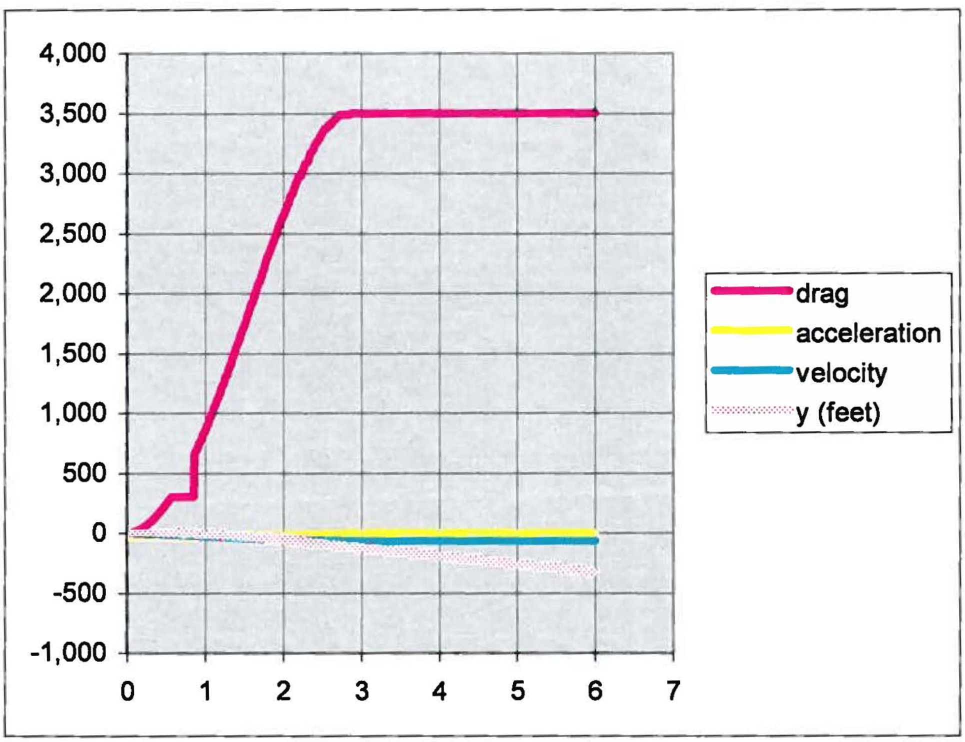

Figure 5 – Axial Flow Terminal Velocity Study

The kinetic energy for a 400-foot stalk at terminal velocity, as could develop in 1250 feet of water, is:

$$E_k = \frac{m \cdot v^2}{2} = \frac{\left(\frac{400 \cdot 18.85}{32.2}\right) \cdot \left(67.3^2\right)}{2} = 530293 \ ft \cdot lbf$$

This is a plausible worst case for the 1250 water depth locations. At the 450-foot water depth the plausible stalk length is more like 150 feet.

$$E_k = \frac{m \cdot v^2}{2} = \frac{\left(\frac{150 \cdot 18.85}{32.2}\right) \cdot \left(39.9^2\right)}{2} = 69898 \ ft \cdot lbf$$

This mode is more plausible in deeper water depths. It is also more likely to be initiating at points of existing cable damage.

Elastic Collision Impact Dynamics

1) 400 foot Plunging Stalk Impact

Weight of impacting object (in force units): $W := 7540\,\text{lbf}$

Velocity of the impacting object: $V := 67.3 \cdot \text{fps}$

Stiffness of object being impacted: $k_1 := 1.5 \cdot \text{kpi}$

Stiffness of the impact object - This value is typically just estimated. As a guide line, some selected values of k_2, and the corresponding combined stiffness k, follows: $k_2 := 150 \cdot \text{kpi}$

for $k_2 = k_1$ $k = 1/2*k_1$ (for equal stiffnesses)
$k_2 = 2*k_1$ $k = 2/3*k_1$
$k_2 = 3*k_1$ $k = 3/4*k_1$
$k_2 = 7*k_1$ $k = 7/8*k_1$
$k_2 = 10^{15}$ $k = k_1$ (for infinitely stiff impact object)

Calculate the kinetic energy at impact as a function of the velocity at impact, V:

$$E_F(V) := \frac{W}{2 \cdot g} \cdot V^2 \qquad E_F(V) = 6368.645 \text{in} \cdot \text{kips}$$

Derive the formula for converting energy of a moving object into an impact force on the body being impacted:

The energy absorbed by the impacted object, as well as the energy absorbed by the impacting object , is equal to the area under each one 's force/deflection curve. Since th e area is a triangle, the energy , $E = \frac{1}{2} \cdot R \cdot y$, where R is the force, which is equal between the two objects, and y is the deflection. The total energy is equal to the sum of the energy absorbed by both.

Therefore $E = \frac{1}{2} \cdot R \cdot y_1 + \frac{1}{2} \cdot R \cdot y_2$ and by substitution $E = \frac{1}{2} \cdot R \cdot \frac{R}{k_1} + \frac{1}{2} \cdot R \cdot \frac{R}{k_2}$

Simplifying $E = \frac{1}{2} \cdot R^2 \cdot \left(\frac{1}{k_1} + \frac{1}{k_2}\right)$ and $R = \sqrt{\frac{2 \cdot E}{\frac{1}{k_1} + \frac{1}{k_2}}}$

And further simplifying $R = \sqrt{2 \cdot \frac{k_1 \cdot k_2}{k_1 + k_2} \cdot E}$

Where the effective stiffness of the two body combination is:

$$k := \frac{k_1 \cdot k_2}{k_1 + k_2} \qquad k = 1.5 \text{kpi}$$

Calculate the impact force as a function of the combined stiffness and the speed of the impacting body:

$$R(k, V) := \sqrt{2 \cdot k \cdot E_F(V)}$$

Therefore for the 400 foot plunging stalk at a 1250 foot water depth:

The resulting impact force between bodies is: $R(k, V) = 137.538 \text{kips}$

2) Similarly, for the 150 foot plunging stalk at a 450 foot water depth:

The resulting impact force between bodies is: $R(k, V) = 49.93 \text{kips}$

3) For the Spaghetti Pile Mode with Clamp Mode:

The resulting impact force between bodies is: $R(k, V) = 1.883 \text{kips}$

4) For the Spaghetti Pile without Clamp Mode:

The resulting impact force between bodies is: $R(k, V) = 1.248 \text{kips}$

Pipeline and Cable Damage Estimates

The most easily damaged pipeline would be the 20-inch diameter pipe with a 0.5-inch wall thickness (oil emulsion line). The force required to yield the pipe is 42,730 pounds. With a safety factor of 3.0, as recommended, this says the applied force should be limited to 14,243 pounds. As shown in Figure 6, this is substantially less than the plunging stalk forces of 137,530 or 49,930-pound forces for the 400 and 150-foot cases, respectively. Damage to the 20-inch pipeline at any of the three study locations is therefore plausible.

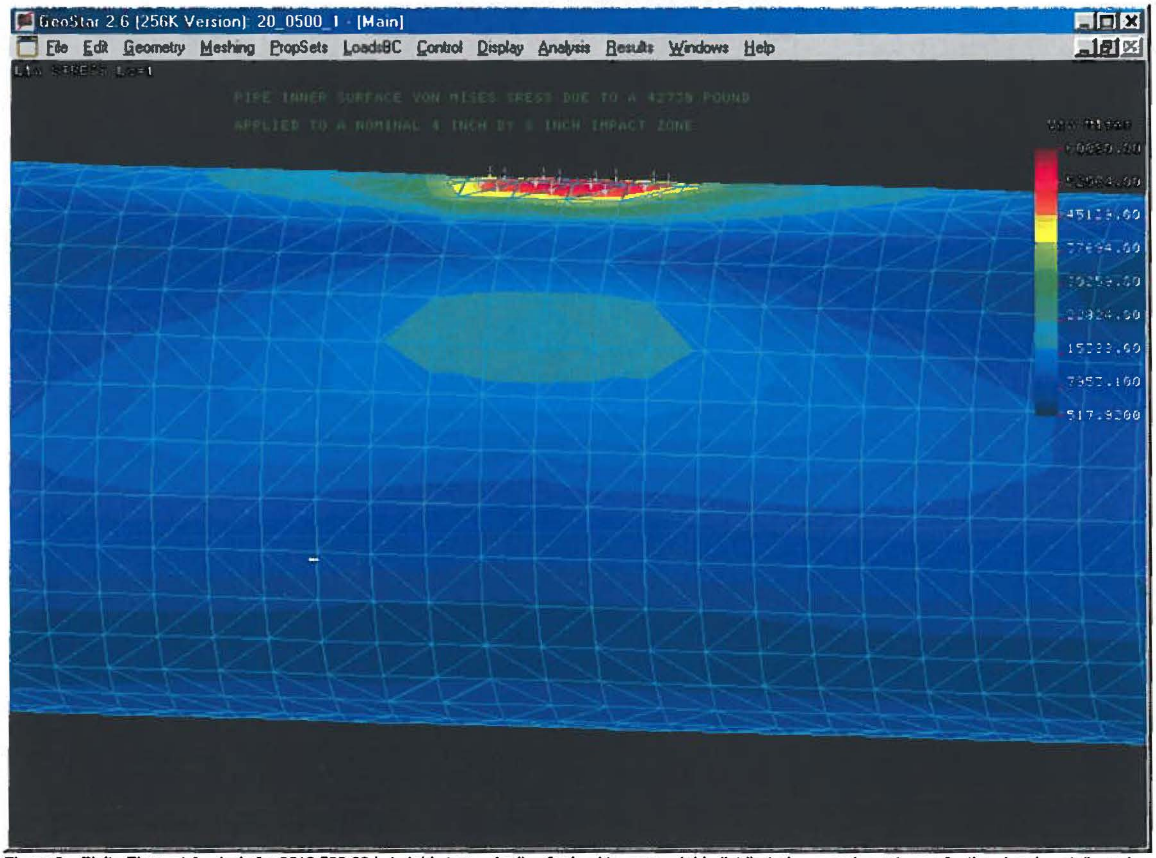

Figure 6 – Finite Element Analysis for 20ϕ0.500 60-ksi-yield stress pipeline for load to cause yield, distributed over an impact zone for the plunging stalk mode

Conversely, for the general case of the spaghetti pile mode, the 1,248 pounds is insufficient to cause damage to the most easily damaged pipeline.

For the spaghetti pile with clamp impact case, the force required to yield the pipe is 31,796 pounds as shown in Figure 7. This force is less than the case shown in Figure 6 since the clamp impact is applied for the finite element analysis as a concentrated line load transversely to the pipe axis rather than spread over a larger impact area. This simulates the knife edge effect of the clamp edge striking the pipe at an angle. With the recommended safety factor of 3.0, the applied load should be limited to 10,599 pounds. As this is substantially more than the 1,883 pounds for the clamp impact in the spaghetti pile with clamp mode, no pipeline damage will occur.

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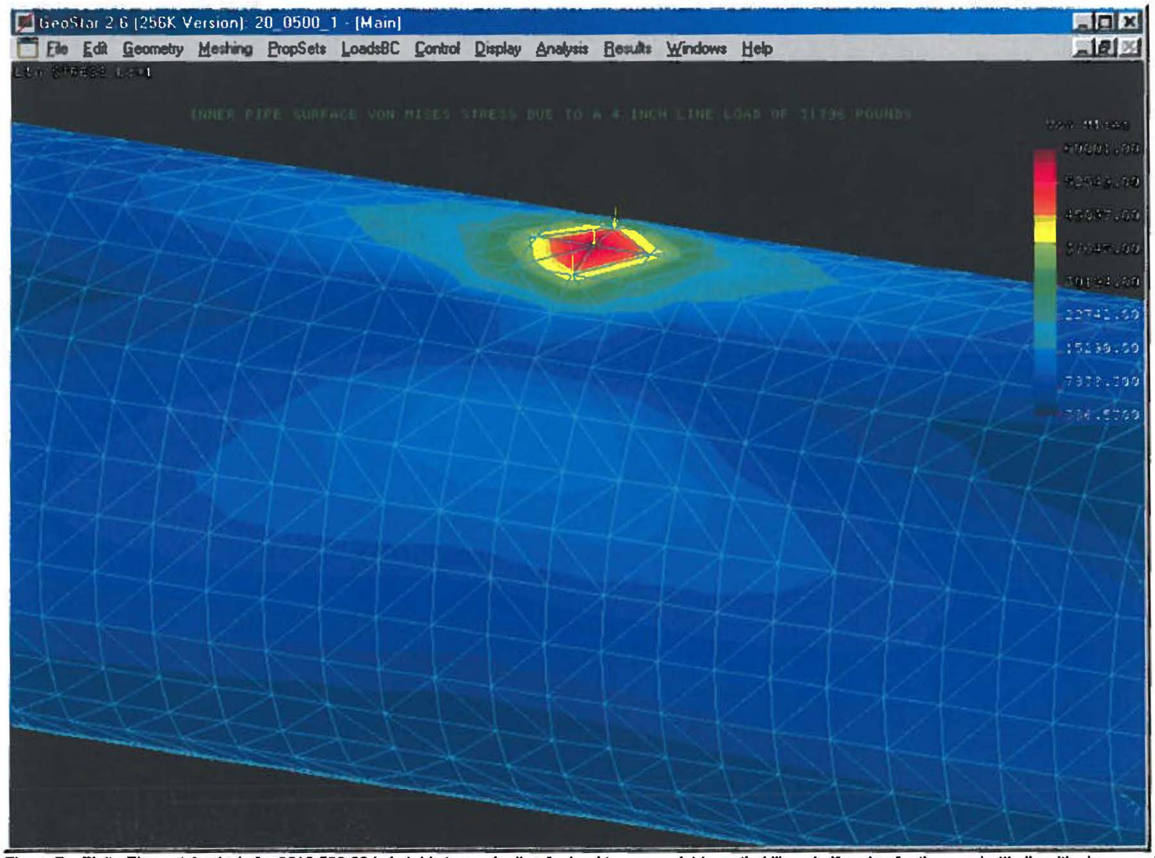

Figure 7 – Finite Element Analysis for 20ϕ0.500 60-ksi-yield stress pipeline for load to cause yield, applied like a knife-edge for the spaghetti pile with clamp mode.

The pipeline most resistant to impact damage would be the nominal 12-inch pipe with a 0.625-inch wall thickness (gas pipeline). The load required to yield the pipe is 107,500 pounds. With the safety factor of 3.0, the load should be limited to 35,833 pounds. The impact pattern assumed on the pipe is shown in Figure 8.

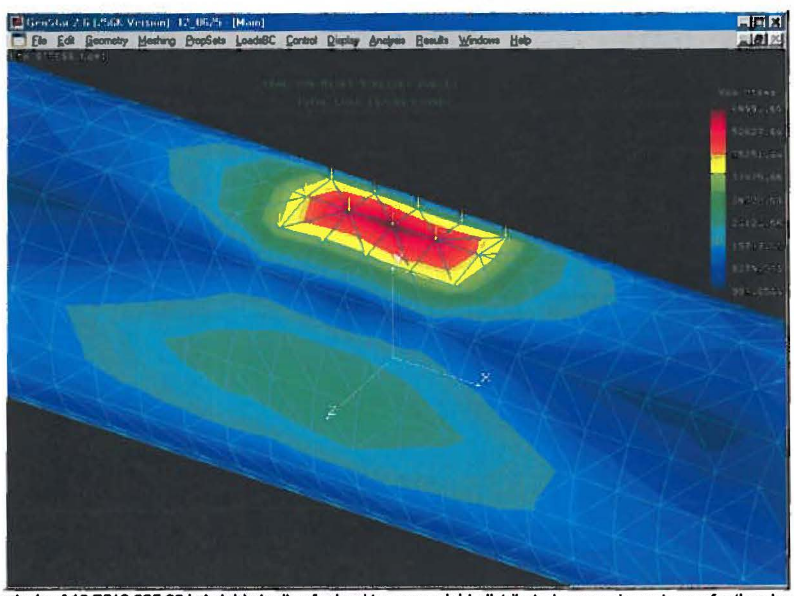

Figure 8 - Finite Element Analysis of 12.75ϕ0.625 60 ksi yield pipeline for load to cause yield, distributed over an impact zone for the plunging stalk mode

The 137,530-pound and 49,930 pound forces from the 400 and 150 foot plunging stalk modes, respectively, both exceed 35,833 pounds. Therefore, any of the pipelines at any of the study locations can plausibly be damaged by an impact in the plunging stalk mode.

Finite element analysis of the cable primary conductor assembly reveals the HV Kerite insulation reaches a 550-psi Von Mises stress with a 5223 pound per inch transverse loading. The spiral armor is deemed to be effective to distribute the knife-edge load for about one inch, or 4 armor wire diameters.

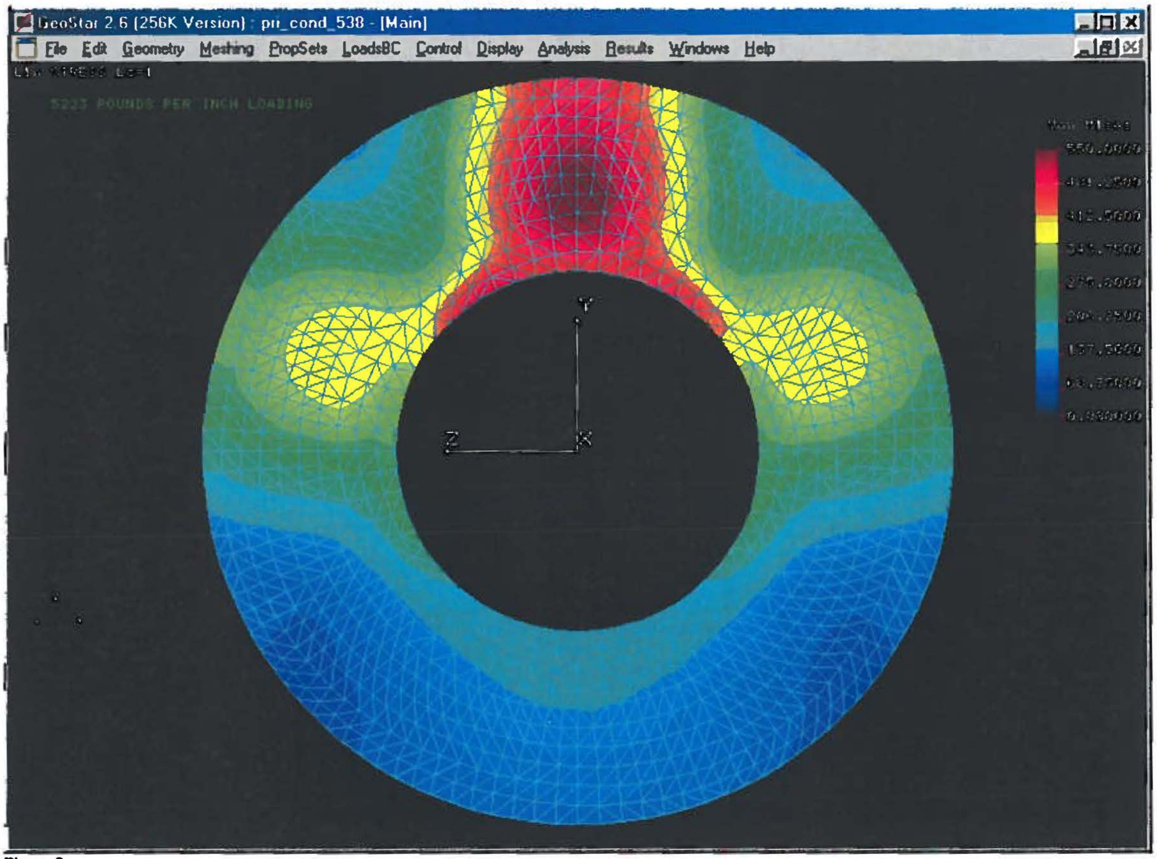

Figure 9 –

The cable analysis stress plot in Figure 9 shows a loading of 5,223 pounds per inch will cause a longitudinal splitting of the HV Kerite insulation layer of the conductors. With a safety factor of 3.0, the loading should be limited to 1,741 pounds. This means that the spaghetti pile with clamp mode impact (1883 pounds) or either plunging stalk mode impact can fail any of the cables.

A summary tabulation of plausible damage is shown in the following table:

location – water depth	Item	Plausible damage during retrieval operation from dropped "C" cable				
		stiff catenary laydown mode (mode 1)	hammerhead laydown mode (mode 2)	spaghetti pile mode without clamp (mode 3)	spaghetti pile mote with clamp (mode 4)	plunging stalk mode (mode 5)
1 - 450	12 inch POPCO	no	no	no	no	yes
1 - 450	"A" cable	no	no	no	yes	yes
1 - 450	"B" cable	no	no	no	yes	yes
2 - 1250	"A" cable	no	no	no	yes	yes
2 - 1250	"B" cable	no	no	no	yes	yes
2 - 1250	"D" cable	no	no	no	yes	yes
2 - 1250	20 inch oil emulsion	no	no	no	no	yes
2 - 1250	12 inch treated water	no	no	no	no	yes
2 - 1250	14 inch oil emulsion	no	no	no	no	yes
2 - 1250	12 inch sales gas	no	no	no	no	yes
3 - 1250	"E" cable	no	no	no	yes	yes
3 - 1250	12 inch gas	no	no	no	no	yes
3 - 1250	20 inch oil emulsion	no	no	no	no	yes

ExxonMobil

Santa Ynez Unit

Offshore Power System Repair: Amended Project
OPSR:A

Cable Retrieval Risk Assessment
(Analysis of Risk of Damage to Existing Components from a Dropped Cable During Retrieval)

Supplement 1: Shallow Water Addendum
(Supplementary findings Italicized)

October 2002

Prepared by:
PMBCI
Gene Pharr, PE

Study Summary

PMBCI examined the risk of physical damage to the active SYU cables and pipelines from the dropping of the failed "C" cable with or without the recovery tools attached during retrieval from the seabed. The study evaluated two water depths and three locations: 1) seaward of the shelf break in about 450 feet of water depth and 2) at two gas pipeline crossings of the "C" cable west of the Harmony platform each in about 1250 feet of water depth. The study methodology included the following three steps: 1) analysis of the falling cable dynamics; 2) analysis of the collision impact dynamics and 3) estimation of pipeline or cable damage. As a result of the analysis, five cable laydown modes were examined and three were found to be plausible under study conditions.

A supplementary examination of damage potential at 300, 150, and 50-foot water depths was performed to consider plausible damage. The same five cable laydown modes were considered with the following summary findings:

1) Stiff Catenary Laydown – (Very shallow water only < 50 ft) [Not considered plausible]

This mode and the Spaghetti Pile Without Clamp mode (mode 3) converge to the same thing when the curl radius of the Spaghetti Pile is very long. In very shallow water this would be the case. The upper bound of kinetic energy for this case may therefore reasonably be taken as the same as mode 3.

2) Hammerhead Laydown – (Does not occur under assumptions used) [Not considered plausible]

This mode and the Spaghetti Pile With Clamp mode (mode 4) converge to the same thing when the curl radius of the Spaghetti Pile is very long. In very shallow water this would be the case. Although considered implausible at the 450 foot and higher water depths considered in the original study, this mode is indistinguishable from mode 4 in very shallow water and would occur. The upper bound of kinetic energy for this case may reasonably be taken as the same as mode 4 thereby eliminating the need for separate consideration.

3) Spaghetti Pile Without Clamp – (All water depths)

This mode, and mode 1 which is identical for very shallow water, will occur at the supplementary study water depths of 300, 150 and 50 feet. The kinetic energy at impact will be the same as for deeper study depths. The impact kinetic energy is the same as the falling cable reaches terminal velocity for transverse motion in a very short distance. The distance to reach terminal velocity is small with respect to even the shallowest supplementary study depth of 50 feet.

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4) Spaghetti Pile With Clamp – (All water depths)

This mode, and mode 1 which is identical for very shallow water, will occur at the supplementary study water depths of 300, 150 and 50 feet. The kinetic energy at impact will be the same as for deeper study depths. The impact kinetic energy is the same as the falling cable reaches terminal velocity for transverse motion in a very short distance. The distance to reach terminal velocity is small with respect to even the shallowest supplementary study depth of 50 feet.

5) Plunging Stalk – (Deep water only > ~400 ft)

For the base study this mode was considered as requiring a water depth of 400 feet or more to develop. The reason for this is best understood by considering the mechanism by which this mode develops. If an arbitrary length of cable is falling at an arbitrary angle, being neither perfectly horizontal nor perfectly vertical, it has a component of motion transverse to the cable and another longitudinal with respect to the cable axis. The longitudinal motion is trivial if the cable is nearly horizontal. The transverse motion becomes trivial as the cable axis approaches vertical. The hydrodynamic forces resisting these two motions are very different in character. The transverse drag forces can be very large and terminal velocity can be reached in less than one foot when cable submerged weight is the only driving force. The longitudinal drag force is very much smaller and a vertical segment may accelerate for approximately 100 feet to reach terminal velocity.

As the falling cable reaches lateral terminal velocity very rapidly, but it requires a considerably longer time (and distance) to reach longitudinal terminal velocity, then the axis of the falling cable will rotate from nearly horizontal to nearly vertical during this acceleration. This mode is also predicated on the assumption that a kink, defect, or point of local damage in the cable exists at the lower end of the developing plunging stalk. Sufficient falling time and falling distance exist for the original study water depths of 450 feet or more.

At the supplementary study depths of 300, 150, and 50 feet these conditions are not met.

At 50 feet the development of a plunging stalk cannot have proceeded significantly. The seabed impact geometry would closely approximate mode 3.

At 150 feet a shorter plunging stalk could develop but there would not be sufficient time and distance for it to reach longitudinal terminal velocity. It is estimated that a stalk of quarter the mass of that considered by the original study could reach one-third the original study velocity. This means that a developing plunging stalk in 150 feet of water might impact a target with approximately one thirty-sixth (2.8%) of the energy of a deep water plunging stalk.

At 300 feet, if the stalk length were one-third that of a deep-water plunging stalk and the impact velocity was two-thirds of terminal velocity then the impact kinetic energy would be 4/27ths (14.8%) of the deep-water plunging stalk.

These reduced kinetic energy impacts were evaluated in the same way as the original deeper water cases and added to the tabulations below.

The plausible damage to either a pipeline or a power cable was determined using elastic collision impact analysis. The results of this analysis obtained the following conclusions:

a) None of the pipelines or submarine power cables can be damaged by stiff catenary laydown mode *at any water depth.*
b) None of the pipelines or submarine power cables can be damaged by the hammerhead laydown mode *at any water depth.*
c) None of the pipelines or submarine power cables can be damaged by the spaghetti pile without clamp laydown mode *at any water depth.*
d) None of the pipelines can be damaged by the spaghetti pile with clamp laydown mode *at any water depth.*
e) All of the submarine power cables can be damaged by the spaghetti pile with clamp laydown mode *at any water depth.*
f) All of the pipelines, *in water depths exceeding 450 feet* can be damaged by the plunging stalk mode. *At the shallow water depths considered by this supplement:*
    a. In 50 feet of water a plunging stalk mode cannot be expected to initiate.
    b. For the partially developed plunging stalk mode in 150 feet of water the force exerted on the target is 8.3 kips. As this is less than the 14.2 kip maximum safe load for the weakest of the pipelines, no pipeline damage from a partially developed plunging stalk mode impact will occur in 150 feet of water.
    c. For the partially developed plunging stalk mode in 300 feet of water the force exerted on the target is 19.2 kips. As this is more than the 14.2 kip maximum safe load for the weakest of the pipelines, but less than the 35.8 kip maximum safe load for the strongest pipeline, some of the pipelines could be damaged by a partially developed plunging stalk mode impact in 300 feet of water.
g) All of the submarine power cables can be damaged by the plunging stalk mode *at any water depth.*

As shown above, a plausible risk to the operating pipelines and power cables exists at each of the study locations, specifically in the deeper water. It should be noted that the spaghetti pile mode would more easily impact a long linear target such as the submarine cable. For the spaghetti pile with clamp or the plunging stalk modes to damage a pipeline or power cable, they would have to have a direct hit on the component. A tabular summary is provided *below to include the supplementary locations at 300, 150, and 50 feet of water.*

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A summary tabulation of plausible damage is shown in the following table:

location – water depth	Item	Plausible damage during retrieval operation from dropped "C" cable				
		stiff catenary laydown mode (mode 1)	hammerhead laydown mode (mode 2)	spaghetti pile mode without clamp (mode 3)	spaghetti pile mote with clamp (mode 4)	plunging stalk mode (mode 5)
1 - 450	12 inch POPCO	no	no	no	no	yes
1 - 450	"A" cable	no	no	no	yes	yes
1 - 450	"B" cable	no	no	no	yes	yes
2 - 1250	"A" cable	no	no	no	yes	yes
2 - 1250	"B" cable	no	no	no	yes	yes
2 - 1250	"D" cable	no	no	no	yes	yes
2 - 1250	20 inch oil emulsion	no	no	no	no	yes
2 - 1250	12 inch treated water	no	no	no	no	yes
2 - 1250	14 inch oil emulsion	no	no	no	no	yes
2 - 1250	12 inch sales gas	no	no	no	no	yes
3 - 1250	"E" cable	no	no	no	yes	yes
3 - 1250	12 inch gas	no	no	no	no	yes
3 - 1250	20 inch oil emulsion	no	no	no	no	yes
4 - 300	*12 inch POPCO*	*no*	*no*	*no*	*no*	*no*
4 - 300	*"A" cable*	*no*	*no*	*no*	*yes*	*yes*
4 - 300	*"B" cable*	*no*	*no*	*no*	*yes*	*yes*
4 - 300	*"C" cable*	*no*	*no*	*no*	*yes*	*yes*
4 - 300	*12 inch treated water*	*no*	*no*	*no*	*no*	*no*
4 - 300	*20 inch oil emulsion*	*no*	*no*	*no*	*no*	*yes*
5 - 150	*12 inch POPCO*	*no*	*no*	*no*	*no*	*no*
5 - 150	*"A" cable*	*no*	*no*	*no*	*yes*	*yes*
5 - 150	*"B" cable*	*no*	*no*	*no*	*yes*	*yes*
5 - 150	*"C" cable*	*no*	*no*	*no*	*yes*	*yes*
5 - 150	*12 inch treated water*	*no*	*no*	*no*	*no*	*no*
5 - 150	*20 inch oil emulsion*	*no*	*no*	*no*	*no*	*no*
6 - 50	*12 inch POPCO*	*no*	*no*	*no*	*no*	*no*
6 – 50	*"A" cable*	*no*	*no*	*no*	*yes*	*no*
6 - 50	*"B" cable*	*no*	*no*	*no*	*yes*	*no*
6 – 50	*"C" cable*	*no*	*no*	*no*	*yes*	*no*
6 - 50	*12 inch treated water*	*no*	*no*	*no*	*no*	*no*
6 – 50	*20 inch oil emulsion*	*no*	*no*	*no*	*no*	*no*

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