OCS Report
MMS 2008-056

Investigation of Pipeline Leak
Pipeline Segment No. 4582
Main Pass Area Block 288
23 June 2007

Gulf of Mexico
Off the Louisiana Coast

U.S. Department of the Interior
Minerals Management Service
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Executive Summary

Several pollution events were reported in the Main Pass Block 288 area over a three-week time period beginning *31 May 2007*. On *31 May 2007*, the National Response Center (NRC) received a report (No. 837010) that indicated a 350-foot by 100-foot oil slick had been sighted in the Main Pass Block 288 area. In the following three weeks, four additional oil slicks of various sizes, color, and consistency were reported in the same area. On *23 June 2007,* a major spill (the Spill) was reported to NRC in a subsequent report (No. 839690). The Spill covered an area 30 miles in length by 6 miles wide and was later estimated to be comprised of 187 barrels (bbls) of oil.

The investigation by Minerals Management Service (MMS) was conducted in conjunction with the U.S. Coast Guard (USCG). The investigation found that a pipeline transporting crude oil from Main Pass Block 288, Platform A, to Main Pass Block 289, Platform B, developed corrosion that created several holes. The pollution event of *23 June 2007,* resulted from these holes.

The investigation found that the lease operator had not performed the required annual cathodic protection (CP) inspection nor submitted the results of the inspection to the MMS and had allowed the CP of the pipeline to fall below standards of both MMS and National Association of Corrosion Engineers (NACE). The failure to maintain adequate CP led directly to the pipeline corrosion, which caused the pipeline holes, and resulted in the pollution event.

Introduction

Authority

A significant pollution event occurred on *23 June 2007,* on Lease OCS-G 1665, Block 288, Main Pass Area (MP-288), in the Gulf of Mexico, offshore the State of Louisiana.

Pursuant to Section 208, Subsection 22 (d), (e), and (f), of the Outer Continental Shelf (OCS) Lands Act, as amended in 1978, and Department of the Interior (DOI) regulations at 30 CFR 250, Minerals Management Service (MMS) is required to investigate and prepare a public Report of this Accident (the Investigation). By memorandum dated *10 July 2007,* the following MMS personnel were named to the investigative panel (the Panel):

Angie D. Gobert, Chairperson – Pipeline Section, Field Operations, Gulf of Mexico OCS Region
Frank Patton – New Orleans District, Field Operations, Gulf of Mexico OCS Region
Jack Williams – Office of Safety Management, Field Operations, Gulf of Mexico OCS Region

Background

Description of Pipeline Segment No. 4582

Pipeline Segment No. 4582 (PSN 4582) is located in the Gulf of Mexico (GOM) off the Louisiana coast. It is a 4.5-inch outer diameter (OD), Schedule 80, A-106, Grade B-35,000 pounds per square inch (psi), 16,000-foot lease term pipeline originating at Platform A located in Lease OCS-G 1665, Block 288, Main Pass Area; and terminating at Platform B, located in Lease OCS-G 1666, Block 289, Main Pass Area. It parallels lease term Pipeline Segment No. 4581 (PSN 4581). *(See Attachments Nos. 1 and 2)* The water depth range along the route of the pipeline is from 301 feet to 394 feet.

PSN 4582 has been used to transport bulk oil. It was assigned a maximum allowable operating pressure of 1,440 psi and was designed for a throughput capacity of 8,000 barrels of oil per day (BOPD). It was coated with Cook's "Pipeclad." Field joints were protected with "Thermofit" heat shrink sleeves. Originally, corrosion protection was composed of zinc sacrificial anodes weighing 56 pounds and installed at approximately 500-foot intervals.

History of Pipeline Segment No. 4582

In *May 1977*, both PSN's 4582 and 4581 were installed by Conoco Inc., who was the operator of the Lease.

In *June 1977,* both PSN's 4582 and 4581 were placed in service. (As originally configured, PSN 4581, the 3.5-in OD pipeline, transported natural gas, and PSN 4582, the 4.5-in OD pipeline, transported crude oil. All hydrocarbon products transported by PSN's 4582 and 4581 have been lease production.)

In *December 2001,* Stone Energy Corporation (Stone) became the designated operator of Lease OCS-G 1665, including PSN's 4582 and 4581.

In *December 2002*, Stone became the sole lessee of Lease OCS-G 1665.

On *10 February 2004*, Stone proposed to switch the use of the two segments. Stone desired to convert PSN 4582, the 4.5-inch pipeline, to transport natural gas, and PSN 4581, the 3.5-inch pipeline, to transport oil. This was proposed in response to changes in the comparative composition of field production and line throughput, being that gas well production now exceeded the capacity of the 3.5-inch pipeline. This change was approved by MMS on 13 *February 2004.*

On *13 December 2004* following a drilling program, Stone requested switching the service of the two pipelines again, changing the 4.5-inch gas pipeline to handle oil production and the 3.5-inch oil pipeline to transport natural gas. This change was approved by MMS on *4 January 2005.*

Cathodic Protection Requirements

Cathodic protection (CP) requirements for DOI offshore pipelines are covered in DOI regulations. These regulations have provisions to ensure that pipelines are constructed, operated, *maintained*, and decommissioned to provide safe and pollution-free transportation of fluids.

- The regulations at 30 CFR 250.1005(b) state, "When pipelines are protected by rectifiers or anodes for which the initial life expectancy of the CP system either cannot be

calculated or calculations indicate a life expectancy of less than 20 years, such pipelines shall be inspected annually by taking measurements of pipe-to-electrolyte potential."

- The regulations at 30 CFR 250.1008(h) state, "The results and conclusions of measurements of pipe-to-electrolyte potential measurements taken annually on DOI pipelines in accordance with §250.1005(b) of this part shall be submitted to the Regional Supervisor by the lessee before March of each year."

Findings

Chronology of Events

Operations Prior to Spill

In the year prior to the Spill, throughput in the 4.5-inch oil pipeline averaged about 2,000 BOPD. No unusual operational problems were reported by the Operator, and no indications were received of any abnormal operating problems or deficiencies in the pipeline segment. It operated without a major reported incident.

However, beginning on *31 May 2007,* a number of pollution events of unknown origin were reported in the area as follows:

- *May 31*, NRC report No. 837010, MP-288, 350 feet x 100 feet, unknown color.
- *June 7,* NRC report No. 837842, MP-287, 1.5 miles x 200 yards, dark brown.
- *June 7,* NRC report No. 837874, MP-288, 800 yards x 200 yards, brown, reported as 20 barrels (bbls).
- *June 17,* NRC report No. 838922, MP 288, 2 miles x 2 meters, silvery sheen.
- *June 19*, NRC report No. 839058, MP-288, 1 mile x 1 mile, rainbow sheen.

MMS inspectors were unable to identify positively the source of these slicks. However, MMS inspectors reported that personnel for other operators in the area indicated that they suspected the possibility of a connection between the mystery slicks and the 4.5-inch oil pipeline, PSN 4582.

The Spill and Immediate Response

On *23 June 2007*, the Spill occurred. An oil slick, 30 miles in length by 6 miles wide, of unknown origin was reported near the Platform (NRC Report No. 839690). An overflight by MMS personnel confirmed the presence of the slick, but its origin could not be determined from aerial reconnaissance. (*See Attachment No. 3)*

The volume of the spill was estimated to be 187 bbls based on slick size and sheen appearance. Estimates that up to 214 bbls were lost in the two weeks preceding the Spill were later amended by the Operator. Stone personnel stated that they did not believe the previous reports of sheens in the area originated from the Pipeline. It was reported that there was no metering at the departure point for the 4.5-inch OD oil pipeline (PSN 4582) from the MP-288 "A" Platform. At the time of the Spill, the pipeline was averaging a throughput of approximately 2,600 BOPD and either was

operating between 500 and 800 psig with the pipeline pumps on or between 50 and 100 psig when the pumps were not running.

The pressure of the ocean on the Pipeline was approximately 175 psi. Therefore, at average operating pressure with the pumps running, the positive pipeline pressure would have been between 325 and 625 psi. Based on this pressure and the size of the holes found in the pipeline, other methods of estimating the Spill volume would be theoretically available. However, no observable loss of throughput was seen at the receiving platform, MP-289 "B." No noticeable pressure drop was observed in PSN 4582 and the pressure safety low (PSL) sensor did not activate. Therefore, the slick size was used to estimate the Spill volume. According to the Operator, some evaporation was taken into account.

MMS personnel landed on the Platform and discussed the spill event with Operator personnel. The Operator initially questioned the possibility that the PSN 4582 was the source of the Spill. The MMS requested "fingerprint" samples of the oil throughput in PSN 4582 and requested PSN 4582 be shut in and pressure tests performed. On *23 June 2007*, two gas pressure tests performed on the 4.5-inch oil pipeline (PSN 4582) created an additional slick and bubbles, indicating that the pipeline was leaking. The leakage during these tests was of a character and size that recovery was not feasible. PSN 4582 was immediately taken out of service.

Operator Response to Discovery of Pipeline Leakage

On *24 June 2007*, the Operator activated their Spill Management Team in their Lafayette office. Divers were mobilized to the Platform location on board the Motor Vessel (M/V) Agnes Candies, a 220-foot dive support vessel, to determine the damage and make repairs.

Additional support mobilized included a 145-foot crew boat, a 110-foot utility boat, the M/V Mark C, two helicopters, and additional manpower and equipment as needed. The spill management vessels and equipment arrived on location on *25 June 2007*. The Operator initiated overflights to monitor for additional oil slicks and submitted a second NRC report (No. 839843), identifying the source of the previous Spill as being the Pipeline.

The Operator prepared to test PSN 4582 by injecting gas into the 4.5-inch oil pipeline after first blind flanging that segment at its termination point on MP-289 "B." Clean Gulf Associates equipment was placed on standby in case further releases required containment or recovery.

On *26 June 2007,* divers were jumped to examine PSN 4582. It was pressured to 250 psi. Shortly after gas injection was begun, a 200-yard x 10-foot light silvery sheen was detected on the surface. This sheen rapidly dissipated. The divers then patrolled the route of PSN 4582, discovering four holes in a 100-foot segment in the area between 860 feet and 960 feet from the Platform. The divers inspected the pipeline 150 feet beyond the last hole, but found no additional holes. PSN 4582 was then de-pressured, and the inspection halted. The remaining approximately 15,000 feet length of PSN 4582 was not examined.

Divers then cleaned around all four holes and covered them with duct tape after inspecting the pipe for external damage and finding none of critical significance. Hole No. 4 was found to be ⅛-inches x ⅞-inches; Holes Nos. 3 and 2 were both approximately ¼-inch diameter (*see Attachment No. 4*). The divers found some damage to coatings and pipe in several places. They also reported that almost all the anodes they checked on both PSN's 4582 and 4581 were fully depleted.

The Operator's spill response team initiated operations to abate the source by sealing the known leaks using clamps. The Operator contracted a Fast Response Unit (FRU) comprised of a skimming unit, a 100-barrel tank, and four personnel. Overflights were conducted five times daily within a 5-mile radius of the Platform to monitor for any additional sheens. These overflights detected two sheens 2.5 miles southeast of the Platform, one covering an area 5 miles x 50 feet, and the other 300 feet x 300 feet.

Problems were encountered with the dive support boat's thrusters, thereby requiring it to return to port, delaying the source abatement. Over the next five days while repairs were being performed on the dive boat, four additional small sheens were reported in the area. The boat repairs were completed and the dive boat returned to the site and initiated source abatement operations on *1 July 2007*. These operations, including sealing the holes with clamps and pigging and pressure testing the pipeline, were completed by *3 July 2007*. The MMS notified Stone that the pipeline could not be reactivated until repair procedures were submitted and accepted by the MMS Pipeline Section.

On *3 July 2007*, Stone submitted repair procedures for PSN 4582 to MMS for acceptance. However, on *5 July 2007,* MMS determined that the pipeline was no longer fit for purpose.

Therefore, MMS directed Stone to flush and fill immediately PSN 4582 and to submit an application to decommission the subject pipeline.

Subsequently, on *14 January 2008*, the Operator submitted to the MMS Pipeline Section a decommissioning application for PSN 4582. It was approved by the MMS Pipeline Section on *10 March 2008.*

Cathodic Protection

Stone took measurements of the pipe-to-electrolyte potential for PSN's 4581 and 4582 in *June* and *November 2005*. However, 17 months elapsed before Stone took the next required annual measurements in *April 2007*.

On *24 July 2007,* after the pollution event (*23 June 2007*) and on behalf of the Operator, Deepwater Corrosion Services (DwC) reviewed the CP measurements taken in *June* and *November 2005 and April 2007* and provided a report*.* See Table below. The DwC report concluded that the two pipelines (PSN's 4582 and 4581) still had substantial CP at the time of the *November 2005* measurements. By interpolating the pipeline potential decay, DwC concluded the pipelines would have satisfied the -800 mV criterion (established by NACE to indicate the full depletion of anode protection) only until *November/December of 2006.* However, by *April 2007,* the measured CP was found to be below the threshold of effective protection (-800 mV). Before Stone took action to provide adequate CP for the pipelines, the Spill occurred.

The DwC report listed the actual pipeline potentials vs. Ag/AgCl through time as follows:

Date	**PSN 4581**	**PSN 4582**
June 2005	-1001 mV	-1005 mV
November 2005	- 910 mV	- 965 mV
April 2007	- 741 mV	- 748 mV

In *July 2007,* during dive operations to inspect both pipelines, the divers took extensive CP readings and examined the condition of the anodes. The divers found some coating damage and CP current readings below the level encountered when CP first expires and loss of metal thickness begins. Measurement of the OD of the pipelines indicated that loss of thickness had

occurred. The divers also noted that almost all the anodes they checked were 100 percent depleted.

Conclusions

The Spill

After a review of the information obtained during the investigation, it is concluded that on *23 June 2007*, a release of an estimated 187 barrels crude oil occurred while being flowed from MP-288 "A" Platform to MP-289 "B" Platform through PSN 4582. Production through the pipeline at the time of the release was approximately 2,000 BOPD. The spill was reported to NRC and documented as NRC Report No. 839690.

Cause of Spill

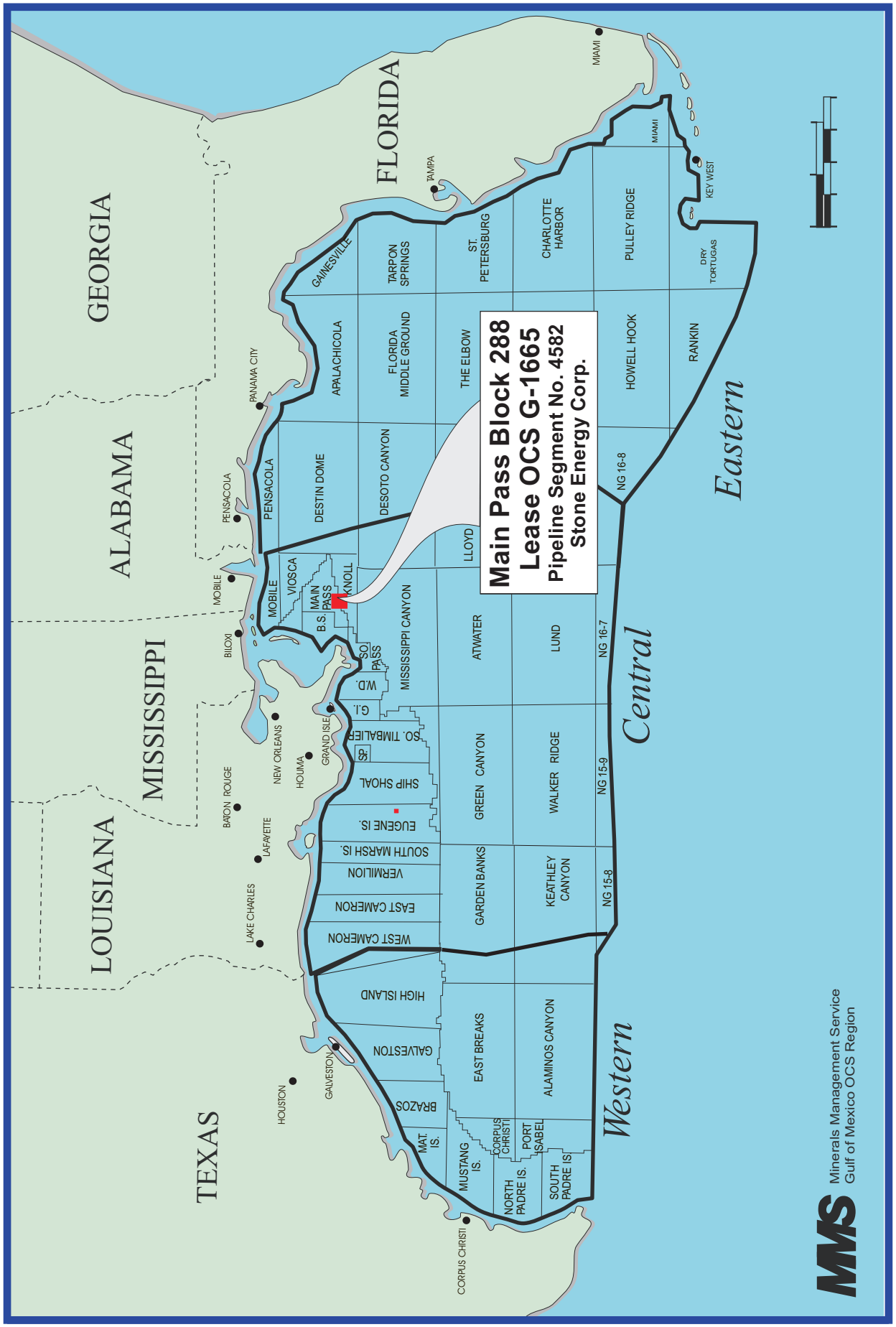
The cause of the pollution incident is as follows:

1. The 4.5-inch oil pipeline PSN 4582 was found to have four holes within a 100-foot long section, which allowed the release of the crude oil. The holes were caused by corrosion.

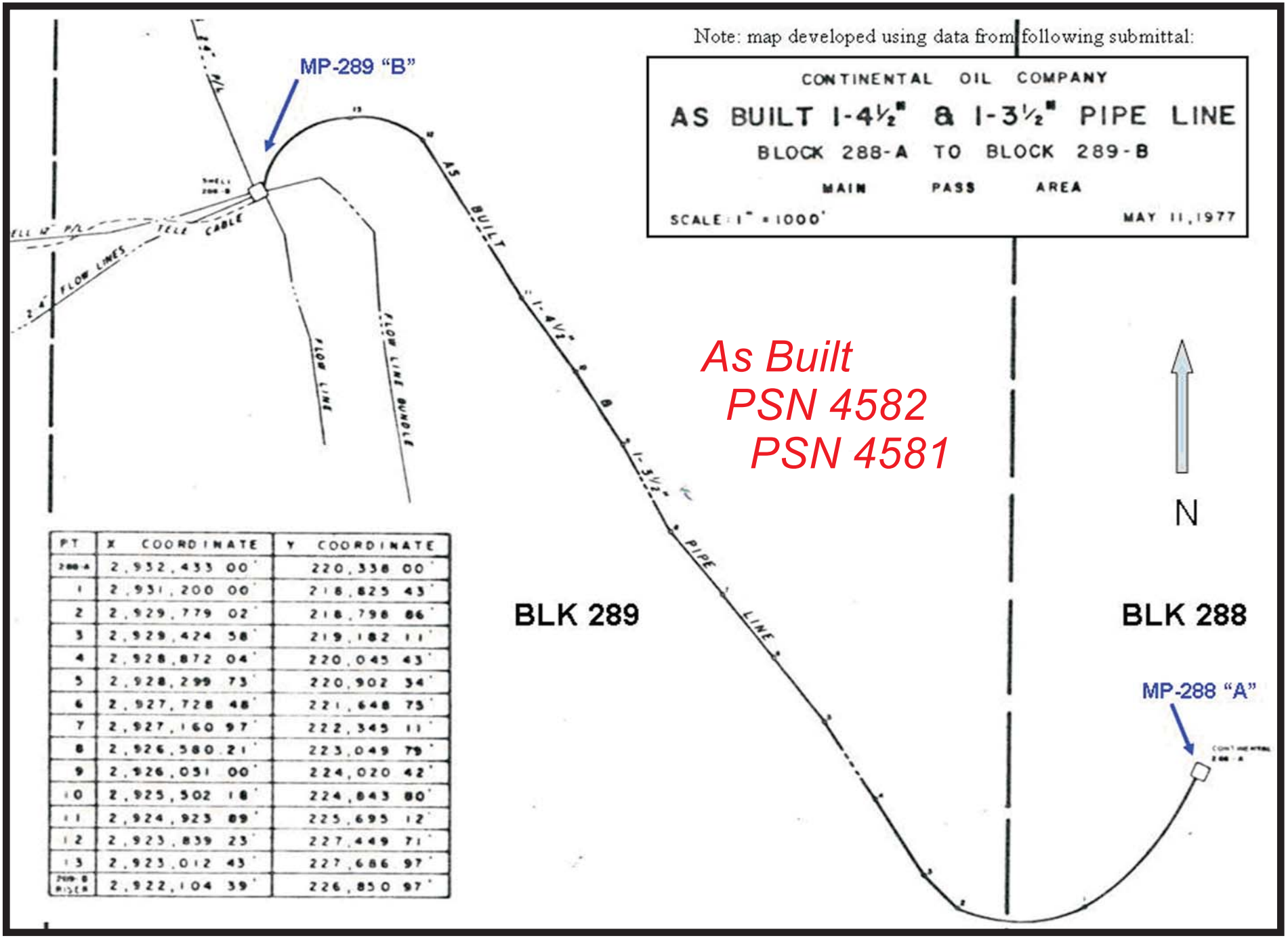
2. The CP prior to the Spill had deteriorated below the minimum level required to protect the pipeline and had remained in that state for at least six months. The failure of the CP was responsible for the corrosion of the pipeline. In April 2007, the level of CP was found to be below minimum acceptable levels for PSN 4582. The Operator failed to take timely action to remedy the deficiency. This allowed the ongoing corrosion to form the holes in PSN 4582.

Recommendation

The Panel recommends that MMS reanalyze its procedures to track and follow up on delinquent industry submittals of annual pipe-to-electrolyte measurements required by 30 CFR 250.1008(h).



Location of Lease OCS-G 1665, Block 288, Main Pass Area

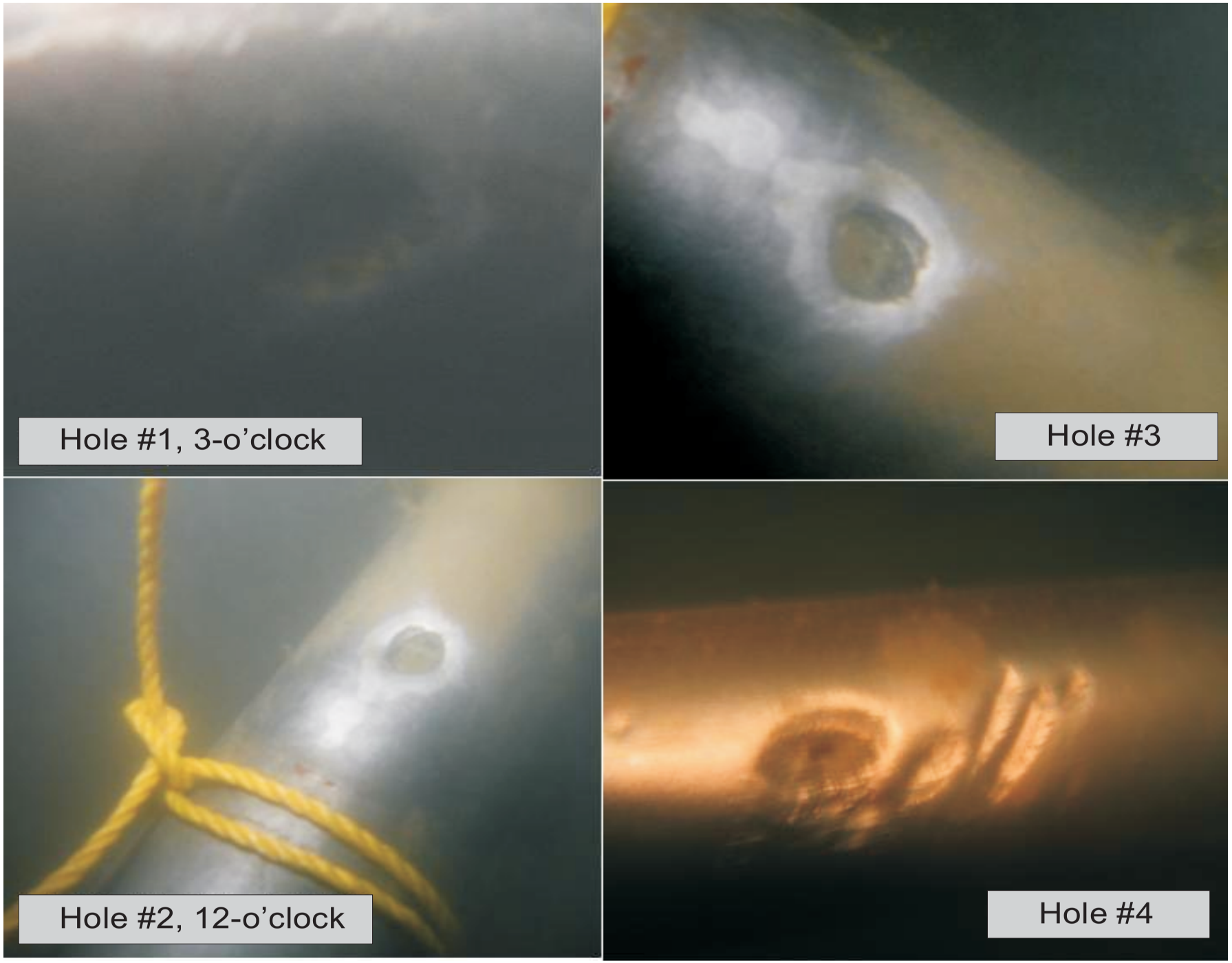


Location and Route of Pipeline Segments Nos. 4582 and 4581

Attachment 2

Photograph of Oil Slick, Block 288 Main Pass Area, June 2007

Attachment 3



Holes found in 4.5 inch oil Pipeline Segment No. 4582

Attachment 4