**IN THE UNITED STATES DISTRICT COURT**
**FOR THE EASTERN DISTRICT OF LOUISIANA**

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| **In Re: Oil Spill by the Oil Rig "Deepwater Horizon" in the Gulf of Mexico, on April 20, 2010** | * | **MDL NO. 2179** |
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| | * | **SECTION J** |
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| | * | **HONORABLE CARL J. BARBIER** |
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| | * | **MAGISTRATE JUDGE SHUSHAN** |
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# REBUTTAL REPORT OF ELLIOTT TAYLOR, PH.D.

**September 12, 2014**

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## I. PURPOSE OF THE REPORT

1. My name is Elliott Taylor. On August 15, 2014, I filed an opening report in which I evaluated (1) the nature, extent, and degree of effectiveness of efforts to assess and treat shoreline oiling, and (2) the impact to and recovery of the oiled shoreline, including beaches and marshes. My qualifications and resume are included in my opening report.

2. Subsequent to filing a report on August 15, 2014, I was asked to review and consider the report filed by Dr. Donald F. Boesch on behalf of the United States. The report prepared by Dr. Boesch does not change the conclusions I reached in my August 15, 2014 report. This rebuttal report presents my opinions concerning some of the issues raised in Dr. Boesch's report.

## II. SHORELINE OILING ESTIMATES CORRECTLY OMIT TEXAS AND, IF ANYTHING, EXCEED THE ACTUAL LENGTH OF IMPACTED SHORELINE.

3. Dr. Boesch opines about the extent of shoreline oiling and asserts that U.S. government and BP responders determined that oil stranded on 1,773 kilometers (1,102 miles) of shoreline in Louisiana, Mississippi, Alabama and Florida during 2010.[1] Dr. Boesch also asserts that trace oiling was found along 58 kilometers (36 miles) of the Texas coast during less frequent surveys.[2] He then adds the 36 miles to the cumulative miles of shoreline oiled for a total of at least 1,138 miles of oiled shoreline.[3]

4. Contrary to Dr. Boesch's assertion, the 36 miles of Texas shoreline that purportedly had trace oiling should not be included in the total extent of shoreline oiled. Those miles have never been included in the official tally of shoreline oiling. This is because the shoreline visits and data collection conducted in Texas lacked the rigor, repeatability, and comprehensiveness of a Shoreline Cleanup Assessment Technique ("SCAT") survey. During the early days of the Response, an Incident Command Post was established in Texas in the event that oil stranded on the shoreline. The Coast Guard and the Texas General Land Office ("TGLO") deployed teams to determine if and where oil from the spill stranded on the shoreline. These teams did not include BP representatives.[4] The Texas teams partially filled out a few Shoreline Oiling Summary forms and made a few field sketches, but there was insufficient information on these forms and sketches to enter the required data into the SCAT database. As Dr. Jacqui Michel, the SCAT Coordinator for the U.S.'s National Oceanic and Atmospheric Administration ("NOAA"), has acknowledged, this information was insufficient to calculate

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1 Of the shorelines with *any* documented oiling, 60.6% were in Louisiana, 16.1% were in Florida, 14.6% in Mississippi, and 8.7% in Alabama. Michel, Owens, et al., *Extent and Degree of Shoreline Oiling*, p. 4 (June 2013) (Exhibit 12199).

2 Expert Report of Dr. Donald Boesch, p. 12 (Aug. 15, 2014) ("Boesch Opening Report") (referencing Michel, Owens, et al., *Extent and Degree of Shoreline Oiling*, p. 6 (June 2013) (Exhibit 12199)).

3 Boesch Opening Report, pp. 12-13.

4 Email from Michel to Debosier (May 24, 2014) (BP-HZN-2179MDL09216014).

the miles of shoreline oiling and the degree of oiling in Texas.[5] Therefore, this information does not serve as a reliable basis for estimating the extent of shoreline oiling in Texas.

5. Moreover, although BP undertook efforts to establish a SCAT team in Texas in response to reports of oiling, the project was ultimately terminated by the federal government and SCAT teams never conducted surveys in Texas. Specifically, NOAA's Scientific Support Coordinator said that he "did not see a need of a NOAA presence for TX SCAT" in early July 2010.[6] BP also mobilized personnel to westernmost Louisiana with the intent to staff a SCAT Branch in that area for possible surveys into Texas and to support efforts in the western parishes of Louisiana. The personnel were recalled, however, after surveys showed no evidence of oil in western Louisiana and in response to a request from Unified Command. The Incident Command Post in Texas was stood down for similar reasons on September 13, 2010[7] — nearly three years before active shoreline cleanup operations ended in Florida, Alabama, and Mississippi, and approximately three and a half years before active operations ended in neighboring Louisiana.

6. Therefore, given the lack of rigor in assessments, it is my opinion that the 36 miles of Texas shoreline that purportedly had trace oiling should not be added to the SCAT data on the extent of shoreline oiling for the Eastern States and Louisiana. This is consistent with the approach taken by the United States in official reports concerning the extent of shoreline oiling, including the Federal On-Scene Coordinator Report ("FOSC Report"), the official summary of the *Deepwater Horizon* Response that the U.S. Coast Guard prepared and published in September 2011. The FOSC Report notes that Texas's highest single-day quantity of light to trace oiled shoreline totaled a single mile,[8] and omits Texas entirely from a table discussing shoreline oiling estimates.[9]

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5 Email from Michel to Debosier (May 24, 2014) (BP-HZN-2179MDL09216014-015) (contrasting SCAT surveys, which featured Shoreline Oiling Summary forms, GPS tracking, photographs, and team recommendations, with surveys conducted in Texas, and concluding that "[t]here was not enough information on these [Texas] forms and sketches to enter the required data into the SCAT database and to calculate the miles of shoreline oiling and the degree of oiling"); *see also* Detailed Breakdown of Surface Oiling Conditions – Maximum Oiling as of 29 March 2014 (BP-HZN-2179MDL09281530) (explaining that the Texas oiling observed was "sporadic and not contiguous," and that "the oiled miles are much less than the approximate 32 miles but ultimately unknown because there were no formal SCAT surveys for Texas shorelines"); Email from Stong to Owens, Santner, et al. (July 6, 2010) (N9G041-003599) (explaining that shoreline surveyors from the Texas General Land Office "have not been SCAT-documenting, but they could…We probably want to send someone over to work with the TGLO guys to SCAT and capture the documentation"); Email from Stong to Graham, Zengel, et al. (July 6, 2010) (N9G041-003479) (noting that she told TGLO representative "that my call is specific to get someone from the TGLO plugged into our SCAT process").

6 Email from Callahan to Helton and Michel (July 6, 2010) (N4M026-000529).

7 *See* Memorandum from RADM Zukunft to Capt. Woodring (Sept. 13, 2010) (BP-HZN-2179MDL09281535) (stating that the ICP was being disestablished due to "minimal impact on the waters and shoreline of the Sector Houston-Galveston Area of Operating Responsibility").

8 FOSC Report at TREX 9105.0233 (TREX 9105).

9 *See* FOSC Report at TREX 9105.0088 (TREX 9105) (discussing Louisiana, Mississippi, Alabama, and Florida).

7. Dr. Boesch also opines that estimates of the length of impacted shoreline would be larger if every "nook and cranny" that had oil were individually measured.[10] This is incorrect for a number of reasons.

8. First, Dr. Boesch's opinion disregards the fact that the reported miles of oiled shoreline is a very conservative figure that likely overestimates the amount of shoreline oiled. In fact, the number of miles of Gulf shoreline that had any observable oil during peak shoreline oiling (June-July 2010) is actually less than the well-recognized figure of 1,773 kilometers (1,102 miles).[11] This is the result of the SCAT method of documenting oiling in which SCAT database mapping and summaries used a very conservative approach. If a given shoreline segment had observable oil on a length of it — for example, a single surface residue ball ("SRB") every 100 meters along a shoreline segment that was 1 kilometer long — the SCAT team could record that information in one of two ways: (1) assign a specific zone to each SRB to indicate oiling within that zone of the segment (say 1 SRB in a 10-meter zone), which would result in that zone being added to the tally of oiled shoreline; or (2) characterize the segment as having 1 SRB per 100 meters along the length of the segment. In this latter example, the SCAT database would record the ***entire*** 1 kilometer of shoreline as oiled even though only several meters in that segment actually had observable oil. As a result, the total amount of shoreline reported as oiled during peak oiling includes miles of shoreline that may have had no oil or only partial or scattered oiling, and thus does not indicate that 1,773 kilometers (1,102 miles) of shoreline were in fact contiguously oiled. Put simply, the SCAT data indicates that 1,102 miles of shoreline received some level of oiling, not that 1,102 miles of shoreline were contiguously oiled.

9. Second, the shoreline mileage estimates do in fact reflect various nooks and crannies along the Gulf shoreline. Dr. Boesch's assertions disregard the extensive efforts of BP and the U.S. government to estimate the length of impacted shoreline (including its numerous nooks and crannies) and to do so as accurately and with as much granularity as possible. The BP SCAT data group used combinations of high-resolution imagery to define the Gulf shoreline and separate it into discrete segments for SCAT teams to survey and for Operations teams to apply the appropriate treatment (as identified by SCAT and agreed upon by Unified Command). Specifically, the program used satellite imagery from 2008, separate satellite imagery that became available in July 2010, and aerial photo imagery produced by the U.S. Geological Survey (Digital Orthophoto Quarter Quads, or "DOQQs"). In Louisiana, most of the shoreline was automatically processed using a program that differentiated between the shore and water and that digitized the line, based on the 2008 imagery. In the Eastern States, the shoreline was manually digitized based on ESRI satellite imagery and DOQQs. In some locations, the lines defined in May 2010 were updated manually based on the evident shoreline changes captured in the July 2010 imagery and/or SCAT team GPS track lines. BP's SCAT contractors completed the GIS-based shoreline for segments and then provided it to NOAA. The resulting shoreline maps that the SCAT program created provided a higher

[10] Boesch Opening Report, pp. 12-13.

[11] Michel, Owens, et al., *Extent and Degree of Shoreline Oiling*, p. 6 (June 2013) (Exhibit 12199); SCAT Database.

resolution of the shoreline relative to the NOAA charts or Environmental Sensitivity Index ("ESI") maps that were available at the time the spill occurred, and became the official basis for shoreline oiling reports by Unified Command and by NOAA — in particular, by the Emergency Response Management Application ("ERMA"), NOAA's online shoreline mapping tool.[12]

10. Third, SCAT teams surveyed entire shoreline areas (across-shore and along-shore) throughout the Area of Responsibility ("AOR") and on a repeated basis. Teams typically surveyed from the backshore to the lower intertidal areas of shorelines unless access or sensitivity to foot traffic were concerns. That means teams covered miles of shoreline that are not captured in the miles reported as surveyed, given that survey results are reported as the segment line only (waterline). Importantly, the thoroughness of SCAT surveys included nooks and crannies.[13]

11. In addition, Dr. Boesch shows satellite imagery of the Gulf of Mexico in Figure 3 of his report, presumably to demonstrate the extent of shoreline oiling.[14] During the Response, satellite imagery provided valuable information about potential areas for SCAT surveys, cleanup operations, and the movement on the sea surface, but required interpretation and validation from overflights to visually confirm the extent of floating oil.[15] Although the satellite imagery was a valuable tool during the Response, satellite imagery is not as reliable as SCAT survey data for determining the extent of shoreline oiling. This is because satellite imagery identifies sea surface anomalies, including anomalies entirely unrelated to Macondo oil. Various environmental variables (*e.g.*, water depth changes, cloud shadows, waves, and atmospheric conditions including cloud cover and rain),[16] naturally occurring substances (*e.g.*, kelp beds, jellyfish, red tide blooms, herring spawn, sargassum, and natural seeps),[17] and substances introduced to the environment by human activity (*e.g.*, pollution from ships)[18] can lead to "false positive" identifications of sea surface oiling when relying on satellite

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12 *See* Taylor Opening Report, ¶ 40 n.74; Fla. Dep't of Envtl. Prot., *NOAA Gulf Response Mapping (NOAA)*, http://www.dep.state.fl.us/deepwaterhorizon/erma.htm (last visited Sept. 2, 2014); *see generally* NOAA, ERMA Deepwater Gulf Response, http://gomex.erma.noaa.gov/erma.html (last visited Sept. 2, 2014).

13 *See* NOAA, Shoreline Assessment Manual, p. 31 (3d ed., Aug. 2000) (HCF080-002198) (listing the recommended shoreline survey methods, including "[c]onfirm segment boundaries," "[d]escribe the shoreline characteristics," and "[s]ketch the segment"). The SCAT data forms and methodology called for oiling conditions to be noted for the lower to supratidal zones, so by default teams had to survey the cross-shore as well as alongshore. *See, e.g., id.* at pp. 107-113.

14 Boesch Opening Report, p. 13.

15 Miller Deposition, p. 165 (July 10, 2014).

16 Miller Deposition, pp. 184-186 (July 10, 2014); NOAA, Open Water Oil Identification Job Aid for Aerial Observation, pp. 41-42 (July 2012) (Exhibit 12382); Fingas & Brown, *Oil Spill Remote Sensing: A Review, in* Oil Spill Science and Technology, pp. 113-114, 120, 132 (Fingas, ed. 2011) (Exhibit 12383).

17 Miller Deposition, pp. 180-183, 186-187 (July 10, 2014); NOAA, Open Water Oil Identification Job Aid for Aerial Observation, pp. 37-40 (July 2012) (Exhibit 12382).

18 Miller Deposition, p. 187 (July 10, 2014).

imagery. Oil on water also does not translate to oil on the shoreline, and the satellite imagery of surface oiling was not intended to be used to identify the extent of shoreline oiling. It is my opinion that the SCAT data is the most reliable and comprehensive data on the extent of shoreline oiling.[19]

## III. UNIFIED COMMAND UNDERTOOK EXTENSIVE EFFORTS TO LIMIT THE IMPACT FROM SHORELINE CLEANUP ACTIVITIES.

12. Dr. Boesch asserts that oil removal (*i.e.*, cleanup efforts) produced negative impacts as well as benefits. He acknowledges the benefits of cleanup, including that it reduced the amount of oil on shorelines as well as the potential for oil to be re-transported.[20] While Dr. Boesch contends that the cleanup had negative impacts, he does not attempt to quantify any such impacts nor does he acknowledge the extensive steps that Unified Command took to minimize the impacts associated with cleanup activities.

13. Notably, the Federal On-Scene Coordinator reviewed and approved all shoreline cleanup efforts based on the recommendations of SCAT teams, which included experts from the federal government and BP. In Section V.C of my opening report, I address Unified Command's efforts to minimize the negative impact of cleanup activities through the Shoreline Treatment Recommendation ("STR") process with Best Management Practices ("BMPs") and the success of those efforts.

14. Dr. Boesch fails to reference the STR development process, which involved collaboration among BP, the U.S. Coast Guard, NOAA, National Marine Fisheries Service, Fish and Wildlife Service, and state-specific agencies.[21] STR drafters considered and weighed the risks and potential consequences of cleanup activities against the benefits through a thorough Net Environmental Benefit Assessment ("NEBA") process.[22] The recommended treatment techniques and cleanup endpoints were developed by Technical and Core Working Groups, which provided guidance regarding "habitat-specific guidelines on cleanup methods and end points" and helped "ensure further damage was not caused by the cleanup techniques."[23]

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19 *See* Michel Deposition, pp. 81-83 (Aug. 1, 2014) (NOAA SCAT Coordinator testifying that the data the SCAT teams collected was "the most important data collected to support the cleanup effort"); Miller Deposition, pp. 188-189 (July 10, 2014) (testifying that "there is uncertainty associated with the analysis technique that [NOAA's National Environmental Satellite Data and Information Service] would use to identify surface anomalies"); Hein Deposition, pp. 57-58, 67, 120-124 (July 9, 2014) (explaining that various SCAT personnel undertook snorkel SCATing by wading into coastal waters to determine whether submerged oil mats existed).

20 Boesch Opening Report, p. 31.

21 Taylor Opening Report, ¶ 48.

22 Taylor Opening Report, ¶ 46; *see also, e.g.*, Owens, Santner, et al., *Shoreline Treatment during the Deepwater Horizon-Macondo Response*, p. 6 (Feb. 4, 2011) (Exhibit 13006); *see also* Michel Deposition, pp. 183-184 (Aug. 1, 2014); Hein Deposition, pp. 184-186 (July 9, 2014); Deepwater Horizon 2011 Shoreline Plan for Louisiana, p. 6 (Ex. 13014); OSAT-2, Summary Report for Fate and Effects of Remnant Oil in the Beach Environment, pp. 32-33 (Feb. 10, 2011) (Exhibit 12238).

23 Taylor Opening Report, ¶ 72; Michel Dep. at 64-65, 103-104, 184 (Aug. 1, 2014); FOSC Report at TREX 009105.0085 (TREX 9105); *see also* MC 252 Stage III, SCAT-Shoreline Treatment Implementation

Each segment-specific STR also was submitted for approval to Unified Command. Once Unified Command approved an STR, Operations teams conducted shoreline treatment operations in accordance with the STR.

15. Dr. Boesch does not acknowledge any of the numerous measures that were utilized to minimize the impact of cleanup activities, consistent with the STRs. BMP checklists, for example, were attached to STRs "to protect the endangered and threatened species, and critical habitats located in those segments contained in that particular STR."[24] Natural and Cultural Resource Advisors helped ensure that SCAT and Operations teams "did not do any damage to endangered species or the environment," and assisted Operations teams in "minimizing potential injury to natural resources" and "cultural resources like archaeological sites."[25] In addition, cleanup operations were directed through access routes to minimize possible impacts from ingress/egress to work sites. In a number of instances, cleanup and access to sensitive areas were placed on environmental holds such as in select areas during turtle or bird nesting activity.[26]

16. Moreover, as I explain in my opening report, efforts to minimize the impact of the oil spill on the Gulf shoreline were successful and efficacious.[27] Shoreline response and cleanup activities minimized the effect of the spill on amenity beaches (all of which were open in time for the spring 2011 tourist season),[28] wildlife,[29] and cultural resources.[30] Two years

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Framework for Louisiana, Appendices C, D, and E (Dec. 20, 2010) (Exhibit 13013) (containing Technical Working Group draft reports regarding three types of shoreline: sand beaches, coastal marshes and mangroves, and riprap/man-made structures).

24 FOSC Report at TREX 009105.0087 (TREX 9105); *see also, e.g.*, Taylor Opening Report, ¶¶ 47, 54-55; Owens, Santner, et al., *Shoreline Treatment during the Deepwater Horizon-Macondo Response*, pp. 6-7 (Feb. 4, 2011) (Exhibit 13006); Michel Deposition, pp. 188-193 (Aug. 1, 2014); Hein Deposition, pp. 61-63 (July 9, 2014); MC 252 DWH Sec 7 Authorized Best Management Practices for Louisiana: Applicable BMP Checklist for Individual Shoreline Treatment Recommendations (Mar. 9, 2011) (Exhibit 13011).

25 Hein Deposition, pp. 72-76 (July 9, 2014); *see also, e.g.*, Taylor Opening Report, ¶¶ 54-55; *see also, e.g.*, Owens, Santner, et al., *Shoreline Treatment during the Deepwater Horizon-Macondo Response*, pp. 4, 7 (Feb. 4, 2011) (Exhibit 13006); *see also* Michel Deposition, pp. 193-198 (Aug. 1, 2014); FOSC Report at TREX 009105.0087 (TREX 9105).

26 Michel, Nixon, et al., *Three Years of Shoreline Cleanup Assessment Technique (SCAT) for the* Deepwater Horizon *Oil Spill, Gulf of Mexico, USA*, 2014 Int'l Oil Spill Conference, p. 1255 (May 2014), *available at* http://ioscproceedings.org/doi/pdf/10.7901/2169-3358-2014.1.1251.

27 Taylor Opening Report, ¶¶ 94-113.

28 *See, e.g.*, Allen, *A Year After Gulf Oil Spill, Florida Sees a Comeback*, NPR (Apr. 18, 2011), *available at* http://www.npr.org/2011/04/18/135326540/a-year-after-deepwater-florida-sees-a-comeback (discussing Florida beaches); Hayworth, Clement, et al., *Deepwater Horizon* Oil Spill Impacts on Alabama Beaches, p. 3641 (Dec. 1, 2011), *available at* http://www.hydrol-earth-syst-sci.net/15/3639/2011/hess-15-3639-2011.pdf (discussing Alabama beaches); La. Dep't of Culture, Recreation & Tourism, *2012 Sunset Report*, pp. 35-36 (Mar. 2012), *available at* http://www.crt.state.la.us/Assets/documentarchive/sunset2012.pdf (discussing Louisiana beaches).

29 *See, e.g.*, Boesch Opening Report, p. 34 (acknowledging that populations of certain terrestrial arthropods "largely recovered" approximately one year after the incident); McCall & Pennings, *Disturbance and Recovery of Salt Marsh Arthropod Communities Following BP Deepwater Horizon Spill* (Mar. 7, 2012) *available at*

after the incident, the number of shoreline miles in which any MC252 oiling was documented had decreased from a maximum of 1,100 miles to less than 430, and most of the remaining oil was at trace levels and located in areas where additional cleanup would not provide a net environmental benefit or where endpoints had been achieved.[31] Three years after the incident, less than 400 miles contained documented oiling.[32] And for oiled shorelines that Unified Command subsequently determined would benefit from cleanup, BP quickly deployed response resources accordingly.[33]

17. Due in large part to these and other efforts by BP and Unified Command to quickly and aggressively remove oil from the Gulf shoreline, active shoreline cleanup operations ended in Florida, Alabama, and Mississippi in June 2013, and in Louisiana in April 2014.[34]

## IV. MARSH EROSION DID NOT OCCUR IN LIGHTLY OR MODERATELY OILED SITES, AND WAS LIMITED IN EXTENT AND DURATION IN CERTAIN HEAVILY OILED SITES.

18. Dr. Boesch asserts that, based on studies of other spills, recovery of wetland plants and animals can take 8 to 40 years.[35] Although that may have been the case for certain spill responses that utilized intrusive and damaging marsh cleanup techniques, the timeline for recovery can be much shorter. As Dr. Jacqui Michel, NOAA's SCAT Coordinator, has acknowledged, "marshes most often recover on their own within 1 year for light to moderate oiling."[36] Fortunately, there are various factors that are favorable for accelerated recovery of

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http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0032735 (same); Lubchenco, *Oil Spill Clarifies Road Map for Sea Turtle Recovery*, p. 1 (Ex. 12080) (NOAA Administrator noting that response personnel moved more than 25,000 sea turtle eggs from the Gulf shoreline to the Atlantic coast of Florida).

30 *See* FOSC Report at TREX 9105.0084-086 (TREX 9105) (noting that SCAT personnel helped survey hundreds of archeological, cultural, and historic sites along the Gulf, documented the corresponding shoreline oiling conditions, and crafted STRs to ensure that any cleanup activities would be conducted so as to minimize harms to these sensitive areas).

31 Taylor Opening Report, ¶¶ 96-97.

32 Taylor Opening Report, Appendix G; Michel, Nixon, et al., *Three Years of Shoreline Cleanup Assessment Technique (SCAT) for the* Deepwater Horizon *Oil Spill, Gulf of Mexico, USA*, 2014 Int'l Oil Spill Conference, p. 1253 (May 2014), *available at* http://ioscproceedings.org/doi/pdf/10.7901/2169-3358-2014.1.1251.

33 *See* NOAA, *Net Environmental Benefit Analysis for Louisiana: Set-Aside Sites*, p. 2 (May 2, 2012) (US_PP_NOAA079473) (suggesting that cleanup activities not commence in certain set-aside areas in northern Barataria Bay until the end of 2012); BP, *Q&As for Advocate Interview*, p. 2 (Aug. 13, 2013) (BP-HZN-2179MDL08983247) (noting that BP received permission in early 2013 to treat the set-aside areas).

34 BP Press Release, *Active Shoreline Cleanup Operations from Deepwater Horizon Accident End* (Apr. 15, 2014) (BP-HZN-2179MDL08964317).

35 Boesch Opening Report, p. 32.

36 Michel & Rutherford, *Impacts, Recovery Rates, and Treatment Options for Spilled Oil in Marshes*, p. 23 (2014) (BP-HZN-2179MDL09248027).

marshes affected by MC252 oiling: in most of the marshes, the MC252 oil was limited to the marsh fringe and to the surface with little penetration into the marsh soils.[37]

19. For the *Deepwater Horizon* spill, the data indicates that the vast majority of oiled marshes have experienced significant recovery.[38] Natural oiling attenuation was the preferred approach in consideration of net environmental benefit for the vast majority of oiled marshes. Dr. Michel has acknowledged that natural recovery in Louisiana's oiled marshes and wetlands has been "relatively rapid."[39] In addition, my own analysis of data concerning vegetation recovery for oiled marshes has also demonstrated that recovery was relatively rapid at lightly and moderately oiled sites, and even at certain heavily oiled sites.[40] Similar conclusions are noted in the marsh recovery times in two separate publications authored by Dr. Michel and Nicolle Rutherford.[41]

20. Although Dr. Boesch opines on erosion of heavily oiled marshes, he did not perform an independent analysis of the available data that bears on this issue. Instead, he relies on two published studies to offer opinions on erosion of heavily oiled marshes, and overlooks the fact that the two studies reach some conflicting conclusions.[42] In a 2012 study, Silliman et al. — after having examined only three heavily oiled sites — found accelerated erosion at those three sites, but also that the rate of erosion had returned to background rates (*i.e.*, natural, baseline erosion) after 18 months.[43] In contrast, a 2013 study by McClenachan et al. evaluated 10 heavily oiled site groups, and concluded that erosion did not increase at those sites in the first two years following the incident.[44] In addition, the Silliman and McClenachan publications

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37 Michel, Owens, et al., *Extent and Degree of Shoreline Oiling*, p. 8 (June 2013) (Exhibit 12199) (concluding that oil generally remained close to the marsh edge and "spread into the marsh no more than about 10–15 m perpendicular to the shoreline); *see also* Silliman, van de Koppel, et al., *Degradation and Resilience in Louisiana Salt Marshes after the BP–*Deepwater Horizon *Oil Spill*, pp. 11234-37 (July 10, 2012) (observing that interior marsh regions where vegetation was more than 15 meters from the marsh edge were "in tact" free from oil impact); Mendelssohn, Anderson, et al., *Oil Impacts on Coastal Wetlands: Implications for the Mississippi River Delta Ecosystem after the* Deepwater Horizon *Oil Spill*, p. 568 (June 2012), *available at* http://bioscience.oxfordjournals.org/content/62/6/562.full.pdf+html.

38 Taylor Opening Report, ¶¶ 102-103, 111-112.

39 Owens, Santner, et al., *Shoreline Treatment During the Deepwater Horizon-Macondo Response*, p. 5 (Feb. 2011) (Exhibit 13006).

40 Taylor Opening Report, ¶¶ 109-111.

41 *See* Michel & Rutherford, *Oil Spills in Marshes: Planning & Response Considerations* (Sept. 2013), *available at* http://response.restoration.noaa.gov/sites/default/files/Oil_Spills_in_Marshes.pdf; Michel & Rutherford, *Impacts, Recovery Rates, and Treatment Options for Spilled Oil in Marshes* (May 2014), *available at* http://www.researchgate.net/publication/261406689_Impacts_recovery_rates_and_treatment_options_for_spilled_oil_in_marshes.

42 *See* Boesch Opening Report, pp. 33-35.

43 Silliman, van de Koppel, et al., *Degradation and Resilience in Louisiana Salt Marshes After the BP* Deepwater Horizon *Oil Spill* (July 10, 2012), *available at* http://www.pnas.org/content/109/28/11234.full.pdf+html.

44 McClenachan, Turner, et al., *Effects of Oil on the Rate and Trajectory of Louisiana Marsh Shoreline Erosion* (Nov. 13, 2013), *available at* http://iopscience.iop.org/1748-9326/8/4/044030/pdf/1748-9326_8_4_044030.pdf.

concerned only one of the three principal marsh types in the Gulf (Spartina alterniflora, but not Phragmites or mangroves), and involved 3 oiled sites and 10 site groups, respectively — totals that are far too small to yield findings that can be applied broadly across the entire Gulf.

21. In order to form my opinions concerning marsh erosion for this rebuttal report, I have examined three separate datasets: (1) marsh study data that Drs. Irving Mendelssohn (LSU) and Mark Byrnes (Applied Coastal Research and Engineering) collected under the Survey of Impacts from the Deepwater Horizon Oil Spill to Wetland Vegetation and their Recovery in Coastal Louisiana (the "Wetland Vegetation Impact and Recovery Data");[45] (2) data from the Erosion Staking Study collected in 2011 and 2012 (the "Erosion Staking Study");[46] and (3) the shoreline position change data from a cooperative workplan developed by the Natural Resource Damages ("NRD") trustees and BP entitled "Sampling and Monitoring Plan for the Assessment of MC252 Oil Impacts to Coastal Wetlands Vegetation in the Gulf of Mexico" and collected from 2010 through Spring 2013 (the "CWVA").[47] These three studies each collected data on the change in position of the marsh shoreline edge over time at numerous marsh sites, allowing me to compare the data from the oiled sites (including sites observed with heavy, moderate, and light oiling) and data from reference sites, where no oil was observed. Notably, the variability of the data in all three datasets is high: for example, many sites with no oil observed experienced substantial erosion, while some heavily oiled sites did not experience erosion or, in fact, accreted.

22. Based on my review, the available data indicate that lightly, moderately, and the majority of heavily oiled study sites do not differ from unoiled sites with regard to erosion.[48] Moreover, none of the three datasets suggest that any difference in erosion between oiled and non-oiled sites occurred in Phragmites or mangrove marshes.[49] Oiling-related erosion may have occurred in certain predominantly-Spartina areas — and specifically, those few areas that had the heaviest persistent oil with little-to-no vegetation recovery.[50] Of note is that the data collection and analysis from the three studies I evaluated is ongoing, and additional analyses are necessary to more precisely define and quantify any potential erosion that can be attributed to the spill, even at the most heavily oiled sites, and specifically to adequately account for the significant background, or natural, rates of erosion that are a confounding factor in all of the studies.

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45 *See* BP-HZN-2179MDL08421542 - BP-HZN-2179MDL08429376 (hard drive containing "A Survey of Impacts from the Deepwater Horizon Oil Spill to Wetland Vegetation and their Recovery in Coastal Louisiana").

46 *See* BP, *Gulf Science Data*, gulfsciencedata.bp.com (last visited Sept. 11, 2014).

47 *See* BP-HZN-2179MDL08421542 - BP-HZN-2179MDL08429376 (hard drive containing "Sampling and Monitoring Plan for the Assessment of MC252 Oil Impacts to Coastal Wetlands Vegetation in the Gulf of Mexico").

48 Wetland Vegetation Impact and Recovery Data; CWVA.

49 Wetland Vegetation Impact and Recovery Data; Erosion Staking Study; CWVA.

50 Wetland Vegetation Impact and Recovery Data; CWVA.

23. Notably, the data I reviewed suggest that any erosion that may have resulted directly from the *Deepwater Horizon* spill is of very limited spatial extent relative to background erosion rates throughout Louisiana coastal marshes. As I discussed in detail in my opening report and as Dr. Boesch admits, there is a substantial background rate of erosion and subsidence of the marsh shoreline in the Gulf, particularly in Louisiana.[51] The combination of various natural phenomena (*e.g.*, natural subsidence, hurricanes, droughts, sea-level rise, and invasive species) coupled with certain human activities (*e.g.*, subsidence from oil and natural gas extraction, levees, dams, canal channelization, and impoundment) has converted approximately 425 square miles of wetlands to open water since 1935.[52]

24. Although Dr. Boesch makes reference to erosion losses from MC252 oil being "more than simply additive" and compounding background erosion in the Gulf of Mexico, I have not seen credible support for this contention. The CWVA suggests that most of the heavily oiled sites did not experience more erosion between 2011 and 2013 than the unoiled sites, consistent with the Silliman et al. findings that initial increases in erosion at the three heavily oiled study sites were within natural background levels within 18 months. Furthermore, the vegetation recovery at many of the heavily oiled CWVA sites indicates that vegetation is recovering, which is inconsistent with the kind of broader, cascading effect suggested by Dr. Boesch.

25. Dr. Boesch further asserts that it would take large-scale restoration measures to recover the lost marshland.[53] Indeed, BP has funded large-scale restoration efforts of marsh habitat for this very purpose. In April 2011, in cooperation with the federal and state trustees, BP committed one billion dollars to an extraordinary Early Restoration program. This novel program has helped speed recovery by promoting restoration of potentially impacted Gulf habitats and resources years before they would normally have been addressed through the Natural Resource Damage Assessment process.[54] BP has already provided funding for early restoration projects for several shoreline habitats, and restoration efforts are underway.[55]

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51 Taylor Opening Report, ¶ 111; Boesch Opening Report, pp. 34-35.

52 *See, e.g.*, Taylor Opening Report, ¶ 111; Couvillion, Barras, et al., *Land Area Change in Coastal Louisiana from 1932 to 2010*, pp. 1, 6 (2011), *available at* http://pubs.usgs.gov/sim/3164/downloads/SIM3164_Pamphlet.pdf; Mendelssohn, Anderson, et al., *Oil Impacts on Coastal Wetlands: Implications for the Mississippi River Delta Ecosystem After the Deepwater Horizon Oil Spill*, p. 572 (June 2012), *available at* http://bioscience.oxfordjournals.org/content/62/6/562.full.pdf+html.

53 Boesch Opening Report, p. 33.

54 *See, e.g.*, Testimony of Rachel Jacobson, Department of Interior, at June 6, 2013, Senate Commerce Committee Hearing Regarding Gulf Restoration: A Progress Report Three Years after the Deepwater Horizon Disaster at 1, *available at* http://www.commerce.senate.gov/public/?a=Files.Serve&File_id=ce5a0e8b-5dd5-47ba-af98-f0ccbea2b261.

55 Hanzalik Deposition, pp. 261-262 (June 17, 2014); Utsler Deposition, p. 312 (June 27, 2014); BP, *Gulf of Mexico: Four Years of Progress* (Apr. 15, 2014), *available at* https://www.thestateofthegulf.com/media/70884/4-Years-of-Progress-Fact-Sheet-4-15-14.pdf.

26. BP has funded two early restoration projects that are designed to protect and create marsh areas: the Alabama Marsh Island Restoration Project and the Louisiana Lake Hermitage Marsh Project. The Alabama Marsh Island Restoration Project, which is being implemented in Baldwin County, Alabama, will protect 24 acres of existing salt marsh habitat and create 50 acres of additional salt marsh habitat in Portersville Bay.[56] The Louisiana Lake Hermitage Marsh Project will create 104 acres of marsh within the Barataria Hydrologic Basin in Plaquemines Parish.[57]

27. In addition to the projects mentioned above, which have been or are being implemented, there are also numerous ambitious shoreline projects that BP will fund through the early restoration framework.[58] These projects include the Louisiana Outer Coast Restoration project, with an estimated cost of $318 million, involving the restoration of beach, dune, and back-barrier marsh habitats at four barrier island locations in Louisiana (Caillou Lake Headlands, Chenier Ronquille, Shell Island and North Breton Island). The goal of the Louisiana Outer Coast Restoration is to restore beach, dune, and back-barrier marsh habitats, as well as brown pelicans, terns, skimmers, and gulls.[59] Also included in these projects are several "living shoreline" projects in Alabama, Florida, and Mississippi, which involve constructing oyster breakwaters to protect marsh habitat and help prevent coastal erosion.[60] These projects, and other restoration projects that BP is funding, are restoring and enhancing the Gulf shoreline.

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56 NOAA, Early Restoration Projects Atlas, http://www.gulfspillrestoration.noaa.gov/restoration/early-restoration/early-restoration-projects-atlas/?utm_source=Early+Restoration+Atlas&utm_campaign=early+restoration+atlas&utm_medium=email (last visited Aug. 27, 2014).

57 NOAA, Early Restoration Projects Atlas, http://www.gulfspillrestoration.noaa.gov/restoration/early-restoration/early-restoration-projects-atlas/?utm_source=Early+Restoration+Atlas&utm_campaign=early+restoration+atlas&utm_medium=email (last visited Aug. 27, 2014).

58 NOAA, Phase III of Early Restoration, http://www.gulfspillrestoration.noaa.gov/restoration/early-restoration/phase-iii/ (last visited Aug. 27, 2014).

59 NOAA, Phase III Proposed Early Restoration: Louisiana Outer Coast Restoration Project (Winter 2013/2014), *available at* http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/Outer-Coast-Factsheet.finalproof.pdf.

60 NOAA, Phase III Proposed Early Restoration Project: Hancock County Marsh Living Shoreline Project (Winter 2013/2014), *available at* http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/Living_ShoreFINAL12_1_13.pdf; NOAA, Phase III Proposed Early Restoration Project: Swift Tract Living Shoreline Project (Winter 2013/2014), *available at* http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/SwiftTract_FINAL12_2_13.pdf; NOAA, Phase III Proposed Early Restoration Project: Florida – Living Shoreline Projects (Winter 2013/2014), *available at* http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/FL_Living_Shoreline_FS.pdf.

## V. CONCLUSION

This rebuttal report represents my analysis and opinions in response to Dr. Donald F. Boesch's August 15, 2014 report. As I have explained, it is my opinion that Dr. Boesch has erred in his understanding of the total mileage of impacted Gulf shoreline, the impact of oil-removal operations on the shoreline, and the impact of shoreline oiling on marsh recovery and erosion. However, should additional information become available, I reserve the right to supplement and/or revise any of my analysis and opinions. If requested, I can and will competently testify regarding the contents, analysis, and opinions in this rebuttal report.

By: [signature] Date: 12 Sept 2014

| Bates Begin | Bates End | Exhibit Number | Date | Document Title / Description |
|---|---|---|---|---|
| US_PP_NOAA145122 | US_PP_NOAA145130 | Dep Ex 13004 | 06/00/2013 | Michel et al. Extent and Degree of Shoreline Oiling. PLOS, June 2013 |
| N/A | N/A | | 8/1/2014 | Transcript of Deposition of Jacqueline Michel |
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| N/A | N/A | | 8/15/2014 | Expert Report of Donald Boesch |

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| N/A | N/A | | | Website: Phase III of Early Restoration : NOAA Gulf Spill Restoration |
| N/A | N/A | | 3/29/2014 | Detailed Breakdown of Surface Oiling Conditions – Maximum Oiling as of 29 March 2014 |
| N9G041-003599 | N9G041-003602 | | 7/6/2010 | Email from Stong to Owens, Santner, et al. (July 6, 2010) |
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