Whitenton Group, Inc.
ENVIRONMENTAL CONSULTANTS

1 August 2012

Aimee Wilson
Air Permits Section (6PD-R)
US EPA Region 6
1445 Ross Avenue
Dallas, TX 75202

RE: BFLP Ethylene Cracker Expansion Project
PSD GHG Permit Application

Ms. Wilson:

BASF FINA Petrochemicals LP (BFLP) submitted a GHG PSD Permit Application for the BFLP Ethylene Cracker Expansion Project on 17 March 2011. Whitenton Group, Inc. (WGI) Environmental Consultants originally submitted a Biological Assessment in support of the PSD GHG Permit Application to the United States (US) Environmental Protection Agency (EPA) in November of 2011. The finalized BA was submitted to the USEPA in January of 2012.

An addendum to the Biological Assessment for the BFLP Ethylene Cracker Expansion Project has been completed. The addendum package is enclosed for your review. We will also send you a hardcopy of the addendum package.

The addendum includes final dispersion modeling, supplemental wastewater information, deposition modeling, and additional analysis of potential effects to federally protected species based on this information and applicable scientific research.

All wastewater information was provided by BFLP and RPS. All technical information regarding air modeling was provided by RPS. The final dispersion modeling provided in the addendum was approved by the Texas Commission on Environmental Quality in April of 2012. The dispersion modeling provided in the addendum was completed in accordance with USEPA approved methodology. Although there is not a standard protocol for calculating pH change and increase in nitrate and ammonia concentrations in a waterbody due to NO_x and SO_x deposition, RPS has provided conservative chemical

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calculations based on best known water quality parameters of Sabine Lake and modeled deposition rates.

The analyses included in the addendum were completed in accordance with the protocol established by the US Fish and Wildlife Service for the purposes of preparing Biological Assessments and Biological Evaluations. The addendum was completed in cooperation with the US Environmental Protection Agency (EPA), the National Oceanic and Atmospheric Administration (NOAA), BFLP, and RPS. The results of the additional analyses support a "no effect" determination for the piping plover and the five listed sea turtles.

The addendum also includes the additional information requested by NOAA in the letter to EPA Region 6 dated June 22, 2012. A draft of this addendum was reviewed by Nicole Bailey at NOAA. Ms. Bailey copied AC Dumaual in her email response. In summary, Ms. Bailey's response stated that the assessment looked reasonable and if EPA continues to pursue the request for concurrence from NOAA, it will be difficult to show a route of effect to the sea turtle species, based on the provided information. The attached final addendum is unchanged from the draft version that Nicole Bailey reviewed.

On behalf of BFLP, we request that the USEPA consider the provided documentation and analyses as sufficient proof that the proposed project will have no effect on the piping plover and green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. We further request that the USEPA consider withdrawing the request for concurrence from both NOAA and the USFWS based on the documentation provided in the addendum and Biological Assessment, the response from Nicole Bailey at NOAA, and our understanding of feedback from the USFWS.

BFLP is anxious to see this project to completion and would appreciate review of the addendum at your earliest convenience.

Thank you for reviewing the project information. Please contact me at 512.353.3344, 512.627.0150, or jshiner@whitentongroup.com, if you have any questions.

Whitenton Group, Inc.
ENVIRONMENTAL CONSULTANTS

Sincerely,

Jayme A. Shiner PWS
Ecologist

Enclosures (1)

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Whitenton Group, Inc.
ENVIRONMENTAL CONSULTANTS

Addendum to the Biological Assessment

BFLP Ethylene Cracker Expansion Project
Jefferson County, Texas

Prepared for

BASF FINA Petrochemicals, L.P.

Prepared by

Whitenton Group, Inc.

July 2012

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Addendum to the Biological Assessment
BFLP Ethylene Cracker Expansion Project
Jefferson County, Texas

Prepared for

BASF FINA Petrochemicals, L.P.
Port Arthur, Texas

Prepared by

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San Marcos, Texas 78666

WGI Project No. 1125

July 2012

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ACRONYMS AND ABBREVIATIONS

AERMET	AERMOD Meteorological Preprocessor
NH_3	Ammonia
AERMOD	AMS/EPA Regulatory Model
AOI	Area of Impact
BFLP	BASF FINA Petrochemicals LP
BA	Biological Assessment
EPA	Environmental Protection Agency
gpm	Gallons Per minute
kg/yr	Killograms Per Year
mg/l	Milligrams Per Liter
mgd	Million Gallons Per Day
NED	National Elevation Dataset
NSR	New Sources Review
HNO_3	Nitric Acid
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PSD	Prevention of Significant Deterioration
SIL	Significant Impact Level
SO_2	Sulfur Dioxide
H_2SO_4	Sulfuric Acid
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollutant Discharge Elimination System
tpy	Tons Per Year
US	United States
USGS	US Geological Survey

1.0 INTRODUCTION

This document is an addendum to the Biological Assessment (BA) submitted on behalf of BASF FINA Petrochemicals LP (BFLP)[1]. This addendum includes final dispersion modeling, supplemental wastewater information, deposition modeling, and additional analysis of potential effects to federally protected species based on final dispersion modeling, supplemental wastewater information, and deposition modeling.

Construction of the BFLP facility began in November 1998, and operations began in December 2001. The expected life of the tenth furnace addition is 25 years.

The BFLP BA[1] was originally submitted to the United States (US) Environmental Protection Agency (EPA) in November of 2011. The finalized BA[1] was submitted to the USEPA in January of 2012. At that time, only preliminary dispersion modeling was available. The action area identified in the BA[1] and the subsequent analysis of potential effects was based on the preliminary dispersion modeling. Dispersion modeling was submitted to the Texas Commission on Environmental Quality (TCEQ) in February of 2012 in support of the New Sources Review (NSR) and Prevention of Significant Deterioration (PSD) permit application for the BFLP project. TCEQ final approval was not obtained for the dispersion modeling until April of 2012. During the period between submittal of the BA[1] and final modeling approval for the TCEQ permit, several changes were made to the modeling protocol and the subsequent modeling analysis. As a result of those changes, the predicted pollutant concentration increases and significant impact areas have decreased for some of the criteria pollutants compared to the preliminary results upon which the BA[1] was originally based. Since the action area is based on the extent of project impacts including but not limited to dispersion modeling, the action area for the BFLP project would decrease in size to reflect finalized, agency-approved dispersion modeling. The action area would also include any potential impact areas resulting from wastewater outfall locations and construction areas. More specific modeling information and effects analysis is included in Section 2.0.

Supplemental wastewater information and effects analysis is included in Section 3.0.

In addition to the finalized dispersion modeling, deposition modeling information and analysis of potential effects to federally protected sea turtle species is included in Section 4.0.

2.0 FINAL DISPERSION MODELING

2.1 FINAL DISPERSION MODELING INFORMATION

The BFLP BA[1] was based on preliminary dispersion modeling, which showed project impacts above the significant impact levels (SIL)s for 1-hour and annual nitrogen dioxide (NO_2). The significant areas of impact (AOI)s located the farthest distance from the source in all directions were plotted to create an action area. The action area had a maximum radius of approximately 2.6 miles, which included portions of Sabine Lake, the Intracoastal Waterway, and the Neches River. The action area is demonstrated in Figure 10 (Appendix A) of the BFLP BA[1] and a copy of this figure is included in Appendix A of this addendum.

The final modeling analysis approved by TCEQ shows that the project will not have a significant impact for annual NO_2. Additionally, the maximum area where concentration increases are above the 1-hour NO_2 SIL has been reduced in size compared to the preliminary dispersion modeling results. The changes to the modeling that reduced the NO_2 concentrations and impact area resulted primarily from corrections to the downwash structure analysis. In the final modeling, the analysis was refined to more accurately follow TCEQ criteria, which resulted in redefining some plant equipment as "non-interfering" to airflow. Initial assessments of interference had conservatively included more equipment than appropriate for accurate modeling.

The significant AOIs located the farthest distance from the source in all directions were plotted based on the final dispersion modeling to create a revised action area. The revised action area has a maximum radius of approximately 2.2 miles, which no longer includes Sabine Lake, the Intracoastal Waterway, or the Neches River. The revised action area is demonstrated in Figure 11 (Appendix A). Figure 1 – 1-Hour NO_2 Receptors (Appendix B) shows the locations where project emission increases are predicted to exceed the 1-hour NO_2 SIL. One receptor is located immediately adjacent to the shoreline of an inlet to Sabine Lake.

Table 1 compares the project impacts that were included in the BA[1], the revised impacts, and the applicable SILs for all criteria pollutants. The final modeling results show that concentrations for all pollutants and averaging periods have either gone down or remained the same and are all below the applicable SIL.

Table 1. Final Criteria Pollutant Dispersion Modeling Results

Pollutant	Averaging Period	Project GLCmax[1] (ug/m³)		SIL[2] (ug/m³)	Less Than SIL?
		Preliminary	Final		
NO_2	1-hour	29.6	15.6	7.5	No
	Annual	1.1	0.5	1	Yes
CO	1-hour	1143.6	1143.6	2000	Yes
	8-hour	196.9	196.9	500	Yes
PM_{10}	24-hour	1.3	0.5	5	Yes
	Annual	0.3	0.2	1	Yes
$PM_{2.5}$	24-hour	1.17	0.5	1.20	Yes
	Annual	0.29	0.2	0.30	Yes
SO_2	1-hour	4.6	1.6	7.8	Yes
	3-hour	4.3	1.5	25	Yes
	24-hour	2.3	1	5	Yes
	Annual	0.3	0.1	1	Yes

1 - GLCmax is the maximum ground level concentration due to the project as predicted by the model.

2 - SIL is the Significant Impact Level set by the EPA, below which the project is considered to have no significant contribution to ambient pollutant concentrations.

2.2 POTENTIAL EFFECTS ANALYSIS

Based on the revised action area, the project has the potential to affect portions of five observed habitat types: drainage canals, marshland, open water, mixed woodland, and pastureland.

All five of these habitats may be utilized by migratory birds. As described in Section 8.0 of the BFLP BA[1], migratory birds would not be impacted by direct or indirect effects resulting from the expansion project. The take of migratory birds is not anticipated as a result of this project.

Bald (*Haliaeetus leucocephalus*) or golden eagles (*Aquila chrysaetos*) have the potential to utilize any of the five habitats; however, they are highly unlikely to occur within the action area for this project. As described in Section 8.0 of the BFLP BA[1], bald or golden eagles would not be impacted by direct or indirect effects resulting from the expansion project. The take of bald or golden eagles is not anticipated as a result of this project.

Marginal foraging and roosting habitat is limited to the shorelines of the Neches River and the shorelines of the northern tip of Pleasure Island within the survey area. The revised action area no longer includes any shorelines with the potential to support the piping plover. According to the final modeling results, one receptor is located on the shoreline of a commercial/industrial inlet to Sabine Lake. This inlet is a commercial shipyard and is subject to vessel traffic. The shorelines of this inlet are lined with rip rap or otherwise disturbed by anchored vessels. No habitat with the potential to support piping plovers was observed at the inlet to Sabine Lake. Based on the revised action area and the information provided in Section 8.0 of the BFLP BA[1], the proposed action will have no effect on the piping plover.

Habitat with the potential to support the hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*) sea turtles was not identified and both species are highly unlikely to occur within the original action area identified in the BFLA BA[1]. The portion of Sabine Lake within the original action area does not possess preferred habitat for the green sea turtle (*Chelonia mydas*). The chance exists for the green sea turtle to incidentally occur in this area. The portions of Sabine Lake that are not dredged are potential foraging habitat for the loggerhead (*Caretta caretta*) and Kemp's ridley (*Lepidochelys kempii*) sea turtles. Occurrences of both species within Sabine Lake are infrequent. The revised action area no longer includes any portions of Sabine Lake or the Intracoastal Waterway. Based on the revised action area and the information provided in Section 8.0 of the BFLP BA[1], the proposed action will have no effect on the green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtles.

3.0 WASTEWATER INFORMATION

3.1 SUPPLEMENTAL WASTEWATER INFORMATION

The following wastewater information is intended to supplement the information provided in the BFLP BA[1] in Section 4.4.

3.1.1 STORMWATER INFORMATION

The project construction area is located in the center of a fully developed industrial facility and is currently a concrete slab. The proposed project will not cause an increase in stormwater runoff. The construction area is located within the process area of the facility. The first one inch of precipitation that falls within the process area is gathered and sent to the TOTAL refinery treatment facility with the process water. If the amount of stormwater within the process area exceeds the capacity of the gathering system pumps, the system is designed to overflow into the retention pond onsite. Stormwater that falls outside the process area as well as any potential stormwater overflow from the process area is held in the onsite retention pond before being released into the adjacent drainage system to allow time for sediment release, flow velocity control, and water temperature acclimation.

The majority of any potential pollutants gathered within the process area stormwater resulting from the expansion project would be processed by the TOTAL refinery treatment facility. The majority of any potential pollutants gathered within the process area stormwater that overflows into the retention pond would be contained within the retention pond.

Stormwater processed by the TOTAL refinery treatment facility will meet the conditions of the facility's Texas Pollution Discharge Elimination System (TPDES) Permit No. WQ0000419-000 (EPA ID NO. TX0004201). These permit conditions are described in Section 3.1.2.

Stormwater released from the onsite retention pond is discharged through an outfall structure (Outfall 001) into a drainage canal. The BFLP stormwater follows approximately 2.2 miles of drainage canals, ultimately discharging into the Intracoastal Waterway. Figure 1 – Supplemental Permit Information (Appendix B) demonstrates the discharge route of the stormwater from the BFLP facility retention pond to the Intracoastal Waterway.

3.1.2 TPDES INFORMATION

The BFLP facility wastewater that is generated on site is treated at the adjacent TOTAL Refinery prior to discharge under the TOTAL TPDES Permit. The project is expected to require a 0.5% increase in freshwater usage, which equals an increase of approximately 32 gallons per minute (gpm), annual average basis, over the existing approximate 6,000 gpm. A portion of the water use increase is expected to be recycled within the system or lost to evaporation. There will be a small increase in the flow of process wastewater from BFLP to the TOTAL refinery treatment facility resulting from the expansion project. The expansion project is expected to add approximately 21 gpm (30,240 gallons per day) to the existing TOTAL refinery wastewater discharge. According to the TOTAL TPDES Permit, the daily average discharge is limited to 5 million gallons per day (mgd) and the daily maximum discharge is limited to 8.5 mgd.

It is difficult to accurately estimate total pollutant discharge resulting from the expansion project. Table 2 includes a list of the discharge parameters included in the wastewater agreement between BFLP and TOTAL. The discharge parameters from the expansion project would be significantly less than those listed in Table 2.

Table 2. BFLP Wastewater Discharge Parameters

Condition	Limit
pH	6.0 to 9.0
BOD5	Less than 723 ppm
COD	Less than 1188 ppm
TSS	Less than 88 ppm
Oil and Grease	Less than 130 ppm
Benzene	Less than 28 ppm
Ethylbenzene	Less than 4 ppm
Toluene	Less than 5 ppm
Phenol	Less than 21 ppm
Sulfides	Zero ppm
Chlorine	Zero ppm
Temperature	Ambient
Maximum Flow Rate	600 gpm

The TOTAL TPDES Permit discharge parameters for the same conditions are listed in Table 3 below. Table 3 is an abbreviated list and does not include all conditions of the TOTAL TPDES Permit. Although the units are not comparable, it can be inferred that the expansion project would contribute a small fraction of the water quality conditions of the permitted TOTAL effluent.

Table 3. TOTAL TPDES Permit Discharge Parameters (Abbreviated List)

Condition	TOTAL TPDES Permit Limit (Daily Average)
pH	6.0 to 9.0
BOD5	1350 lbs/day
COD	12732 lbs/day
TSS	1573 lbs/day
Oil and Grease	536 lbs/day
Benzene	0.74 lbs/day
Ethylbenzene	0.64 lbs/day
Toluene	0.52 lbs/day
Phenol	0.30 lbs/day
Sulfides	7.7 lbs/day
Chlorine	N/A
Temperature	Ambient
Maximum Flow Rate	5 mgd

The majority of any potential pollutants included in the wastewater from the expansion project would be processed by the TOTAL refinery treatment facility. As demonstrated above in Tables 2 and 3, the potential pollutants that would contribute to the wastewater from the expansion project would be a small fraction of those authorized by the BFLP facility, which is a small fraction of those authorized by the TOTAL TPDES Permit. The expansion project wastewater will be discharged at ambient temperature and will not contribute to a temperature change in the effluent discharge from the TOTAL refinery.

Effluent released from the TOTAL refinery treatment facility is discharged through an outfall structure into the Neches River. Figure 1 – Supplemental Permit Information (Appendix B) demonstrates the location and discharge route of the outfall structure (Outfall 002). The discharge route of the TOTAL refinery effluent is approximately a half mile upstream and downstream of Outfall 002.

3.2 POTENTIAL EFFECTS ANALYSIS

Since the majority of any potential pollutants within the BFLP stormwater from the expansion project will be treated by either the TOTAL refinery treatment facility or the onsite retention pond, there is minimal potential for pollutants resulting from the expansion project to reach protected species habitat. The concentration of pollutants from the expansion project that may reach potential protected species habitat would be below the level of potential effects. Protected species will not be impacted by stormwater flow velocity, temperature change, or pollutants from the BFLP expansion project.

The majority of any potential pollutants included in the wastewater from the expansion project would be processed by the TOTAL refinery treatment facility. The additional amount of pollutants that may result from the expansion project will not exceed those currently authorized by the TOTAL TPDES Permit. The potential contribution of pollutants to the wastewater from the expansion project would be a small fraction of those currently authorized by the TOTAL TPDES Permit. The expansion project wastewater will be at ambient temperature and will not contribute to a temperature change in the effluent discharge from the TOTAL refinery. Protected species will not be impacted by wastewater flow velocity, temperature change, or pollutants from the BFLP expansion project.

Based on the above evidence, the proposed project would have no effect on sea turtle species or their habitat due to wastewater or stormwater discharge.

4.0 DEPOSITION MODELING RESULTS

4.1 DEPOSITION MODELING INFORMATION

4.1.1 DEPOSITION ANALYSIS METHODOLOGY

Deposition modeling was performed using the AMS/EPA Regulatory MODel (AERMOD) (version number 12060) to predict deposition rates of Nitrogen Oxides (NO_x), Sulfur Dioxide (SO_2), and Ammonia (NH_3) emitted by the proposed furnace onto the surface of Sabine Lake. The model employs hourly sequential preprocessed (AERMET) meteorological data to estimate depositional rate values due to both wet and dry mechanisms.

The gas deposition algorithms in AERMOD include land use characteristics and some gas deposition resistance terms based on five seasonal categories and nine land use categories. The seasonal and land use categories used in this model are shown in Tables 4 and 5, respectively. For each pollutant modeled, there are specific source parameters that must be input to the model. The parameters used in this analysis are shown in Table 6. The receptor, source, and building base elevations were determined using data from US Geological Survey (USGS) National Elevation Dataset (NED) files and the AERMAP processing program.

A building wake (downwash) analysis was performed to determine appropriate downwash parameters for the major structures at the facility. Downwash parameters were calculated using the Oris Software's BPIP-PRIME (Dated: 04112) Program. The receptor grid used to determine maximum off-property depositional rates was an array of receptors with spacing of 500 meters placed on Sabine Lake.

Table 4. Seasonal Categories

Month	Seasonal Category
Dec - Feb	3
Mar - May	5
Jun - Aug	1
Sep - Nov	2

Table 5. Land Use Categories

Sector	Land Use Category
1 – 6	9
7 - 15	7
16 – 30	1
31 - 36	9

Table 6. Source Parameters

Pollutant	Diffusivity in Air (cm^2/sec)	Diffusivity in Water (cm^2/sec)	Cuticular Resistance Term (sec/cm)	Henry's Law Coefficient (Pa m^3/mol)
NO_2	0.1361	0.000019	99.99	10132.50
SO_2	0.122	0.0000075	80.00	72.37
NH_3	0.259	0.0000693	2.29	1.61

4.1.2 DEPOSITION ANALYSIS RESULTS

The deposition rates of NO_x, SO_2, and NH_3 due to emissions from the proposed BFLP expansion are summarized in Table 7. The rates shown are the average deposition rates over the entire lake surface calculated as the arithmetic average of the rates calculated by the model at each of the equally spaced (500 meter) receptors.

Table 7. Deposition Rates* (g/m2/yr) of Furnace Emissions to Sabine Lake

Year	NO_x	SO_2	NH_3
2006	0.00060	0.00030	0.00046
2007	0.00044	0.00023	0.00036
2008	0.00052	0.00052	0.00041
2009	0.00056	0.00030	0.00048
2010	0.00061	0.00032	0.00052
Average	**0.00055**	**0.00034**	**0.00045**

4.1.3 ACIDIFICATION

Potential acidification (decrease in average pH) of Sabine Lake was calculated from the annual NO_x and SO_2 deposition rates in Table 7 and published data characterizing Sabine Lake. The complete calculations and results are presented in Table 8 (Appendix B). NO_x and SO_2 were assumed to be deposited on the lake in the form of nitric acid and sulfuric acid, respectively. All associated hydrogen was then assumed to be released as hydrogen ions (H^+) into the water. An annual H^+ concentration increase was calculated by dividing the annual H^+ deposition rate by the lake volume. The H^+ concentration increase was then divided by the annual freshwater inflow to the lake to yield a predicted H^+ concentration increase in mole/liter. The H^+ concentration increase was then added to the estimated existing Sabine Lake H^+ concentration calculated from the estimated average lake pH of 7.5. The resulting H^+ concentration was then converted back to pH. This calculation method resulted in a predicted pH change from 7.5 to 7.495. This change is negligible, would not be detectable, and is well within the expected normal pH range of the lake (7.0 to 8.5).

4.1.4 EUTROPHICATION

The increases in nitrate and NH_3 concentration in Sabine Lake due to deposition of NO_x (as nitrate) and NH_3 from the proposed furnace were calculated from the deposition rates shown in Table 7. The complete calculations and results are presented in Table 8 (Appendix B). The total deposition and concentration increases of nitrates and NH_3 in the lake were calculated in the same manner described above for acidity (H+ concentration increase). Total nitrate and NH_3 loading to the lake resulting from furnace emissions were calculated to be 199 kilograms per year (kg/yr) and 115 kg/yr, respectively.

4.2 POTENTIAL EFFECTS ANALYSIS

4.2.1 BACKGROUND INFORMATION

The potential effects of airborne NO_2 on aquatic ecosystems include acidification and eutrophication. Estuaries, such as Sabine Lake, are generally less impaired by acid deposition than other aquatic ecosystems[5]. However, they are subject to eutrophication.

Acidification

The effects of acidification on water quality include increased acidity, reduced acid neutralization capacity, hypoxia, and mobilization of aluminum[2]. Acidification can be chronic or episodic and both can be damaging. In general, larger aquatic ecosystems, such as Sabine Lake with a volume of 300,000 acre feet, have a greater buffering capacity than smaller systems. According to the USEPA, most unimpaired waterbodies have a pH range of 6.0 to 8.0[3]. The majority of aquatic fauna prefer a pH range of 6.5 to 8.0. With the exception of the extremely sensitive species, fauna function normally within this range[4]. Fluctuations in pH beyond this range can cause stress on aquatic fauna, such as impaired reproduction and respiration[5].

Select fish and aquatic macroinvertebrate species have been studied for tolerance of rapid pH changes. These studies concluded that neither mortality nor chronic effects resulted from rapid pH changes within the tolerance pH range of 6.5 to 8.5[5].

As pH of an aquatic ecosystem decreases, aluminum is released from the soil into the water column. Increased aluminum levels can be toxic to aquatic organisms or can contribute to chronic stress, leading to sublethal effects. Aluminum levels do not typically reach toxic levels within the pH range tolerated by aquatic fauna[5].

According to a study published in 1997, which included water quality data in three regions of Sabine Lake, the pH of Sabine Lake ranged between 6.4 and 8.9[6]. The pH of aquatic ecosystems, especially tidal estuaries, can fluctuate daily in response to freshwater and tidal influx as well as photosynthetic activity. Lake acidity can fluctuate by as much as 2 pH units[5].

<u>Eutrophication</u>

Eutrophication is the over enrichment of nutrients (i.e. nitrogen and phosphorous) in an aquatic system, which can result in excess algal growth. The decomposition of excess algae can result in a decrease in dissolved oxygen, which can be harmful to fish and other aquatic organisms. In estuaries and marine systems, nitrogen is the most frequent contributor to eutrophication. Nitrogen is a naturally occurring element in nature and the nitrogen cycle is a vital nutrient cycle in ecosystems. Nitrate, for example, is vital for plant growth. Nitrate and NH_3 are naturally occurring compounds in aquatic ecosystems and are not harmful to animals unless in extremely high concentrations. Nitrogen causes harm to an ecosystem when more nitrogen is put into a system than the system can utilize or cycle out, which is known as nitrogen accumulation[7].

According to the USEPA, the primary sources of excess nitrogen in aquatic ecosystems are fertilizer and animal waste. Secondary sources of excess nitrogen include atmospheric deposition and septic system leaching[4]. The Neches and Sabine River basins are subject to significant nitrogen sources including fertilizers and animal waste. Sabine Lake is also subject to multiple sources of atmospheric deposition.

Eutrophication caused by atmospheric deposition, especially over a significant body of water, would require large sources of emissions of these pollutants, such as coal-fired utility boilers. Older coal-fired utility boilers without emissions controls can emit as much as 10,000 tons per year (tpy) of NO_x and 30,000 tpy of SO_2. Even a modern, well-controlled coal-fired utility boiler has the potential to emit over 1,000 tpy of NO_x and over 2,000 tpy of SO_2.

In a study performed by Lamar University (2000), nitrate and ammonia loading from two bayous (Johnson and Black Bayous) that drain into Sabine Lake were estimated to be between 188,000 kg/yr and 321,000 kg/yr of nitrates and between 394,000 kg/yr and 660,000 kg/yr of ammonia[8]. Based on the flow rates in this study, these two bayous combined account for a maximum of 4% of the freshwater inflow to Sabine Lake.

According to Batley and Simpson (2009), ammonia concentrations at 460 micrograms total ammonia per liter (μg total NH3–N/L) represent a low risk of acute or chronic toxic effects on aquatic wildlife in slightly to moderately disturbed aquatic systems and are recommended guideline values that should protect 95% of species[9]. Ammonia concentrations resulting from emissions from the proposed expansion project are anticipated to be 0.31 μg total NH3–N/L, a value far below recommended guidelines.

Although a nitrate concentration limit for tidal estuaries was not found, the USEPA indicated that nitrate concentrations greater than or equal to 0.2 mg/l can accelerate eutrophication in freshwater streams[11].

4.2.2 ACIDIFICATION

The pollutants that will be emitted by the proposed furnace at the BFLP plant that have the potential for causing acidification are NO_x and SO_2, which can convert to nitric acid (HNO_3) and sulfuric acid (H_2SO_4), respectively, when combined with water. According to the data presented in Section 4.1.3, the calculation method resulted in a predicted pH change from 7.5 to 7.495, which would not constitute acidification. According to the research presented in Section 4.2.1, studies have shown that aquatic fauna can tolerate both rapid and chronic pH changes within their pH tolerance range. A pH change of 0.005 would not cause pH change beyond the tolerance range of most aquatic species. Further, Sabine Lake naturally fluctuates between a pH of 6.4 and 8.9[6]. A decrease of 0.005 pH units is insignificant compared to the existing pH fluctuation. Finally, a pH change of 0.005 would not cause toxic aluminum levels.

No data has been found indicating the specific pH tolerance of sea turtles. However, it can be inferred that species that occur within an ecosystem must be able to tolerate that ecosystem's natural environmental conditions. Since the calculated pH change falls within the natural fluctuation range of Sabine Lake, sea turtles will not be directly affected and food sources for sea turtles will not be affected by deposition of NO_x and SO_x from the proposed project.

Based on the above evidence, the proposed project would have no effect on sea turtle species or their habitat due to acidification.

4.2.3 EUTROPHICATION

The pollutants that will be emitted by the proposed furnace at the BFLP plant that have the potential for causing eutrophication are NO_x, which can convert to nitrate (NO_{3-}), and NH_3.

According to the data present in Section 4.1.4 and 4.2.1, the total nitrate and ammonia loading to the lake resulting from furnace emissions (199 kg/yr and 115 kg/yr, respectively) are insignificant compared to the existing atmospheric emissions in the Port Arthur area and the measured concentrations of these compounds inflowing from Johnson and Black Bayous[8]. In general, eutrophication of Sabine Lake is more likely to be caused by fertilizers and animal waste than atmospheric deposition.

A modern coal-fired utility boiler has the potential to emit over 1,000 tpy of NO_x and over 2,000 tpy of SO_2. By comparison, the BFLP furnace will emit less than 22 tpy of NO_x and less than 9 tpy of SO_2. Emissions rates of this magnitude have a negligible contribution to the influx of these pollutants compared to already existing sources and mechanisms.

The total loading of nitrates and ammonia from Johnson and Black Bayous into Sabine Lake alone is at least 2000 times the calculated loading from the furnace emissions[8].

Nitrate and NH_3 concentrations in Sabine Lake were conservatively calculated to increase by 1.24×10^{-5} milligrams per liter (mg/l), and 7.21×10^{-6} mg/l, respectively, due to deposition of furnace emissions, compared to concentrations of around 0.5 mg/l of nitrates and 0.9 mg/l of NH_3 in the inflow from Johnson and Black Bayous[8]. These concentration increases are two to three orders of magnitude below the detection limits reported in the Lamar University study for these compounds[8]. Further, the calculated concentration of nitrate is far below the recommended limit (0.2 mg/l) that can accelerate eutrophication in freshwater streams[11].

Ammonia concentration resulting from emissions from the proposed expansion project is anticipated to be 0.31 μg total NH3–N/L, a value far below recommended guidelines (460 μg total NH3–N/L) that represents a low risk of acute or chronic toxic effects on aquatic wildlife[9].

Based on the above evidence, the proposed project would have no effect on sea turtle species or their habitat due to eutrophication.

5.0 REFERENCES

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Whitenton Group, Inc.
ENVIRONMENTAL CONSULTANTS

APPENDIX A

FIGURES

Figure 10
Survey Area - 2010 Aerial Photograph
BFLP Ethylene Cracker Expansion Project
Action Area
Jefferson County, Texas

Highway	Riverine Habitat	Open Water Habitat
Major Road	Drainage Canals Habitat	Mixed Woodland Habitat
Construction Area (40 Feet X 76 Feet)	Marshland Habitat	Pastureland Habitat
Action Area Boundary (Maximum Radius ~2.6 Miles)		

Background Resources: USGS 1 Meter DOQQ (2010) Port Arthur North (NE, SE) West of Greens Bayou (NW, SW) ESRI StreetMap USA (2006)	Surveyor(s): Jayme Shiner PWS	Project Number and Information: 1125 BFLP Ethylene Cracker Expansion Biological Assessment	Whitenton Group, Inc. ENVIRONMENTAL CONSULTANTS 3413 Hunter Road San Marcos Texas 78666
GPS and Coordinate Type: Trimble Geo XT UTM NAD 1983 Zone 15 North	Map Created: 8/23/2011 by Jayme Shiner		0 0.5 1 Miles

Figure 11 - Addendum
2010 Aerial Photograph
BFLP Ethylene Cracker Expansion Project
Revised Action Area
Jefferson County, Texas

- Construction Area (40 Feet X 76 Feet)
- Revised Action Area Boundary (Maximum Radius ~2.2 Miles)
- Riverine Habitat
- Drainage Canals Habitat
- Marshland Habitat
- Open Water Habitat
- Mixed Woodland Habitat
- Pastureland Habitat

Background Resources:
USGS 1 Meter DOQQ (2010)
Port Arthur North (NE, SE)
West of Greens Bayou (NW, SW)
ESRI StreetMap USA (2006)

Surveyor(s):
Jayme Shiner PWS

Project Number and Information:
1125
BFLP Ethylene Cracker Expansion
Biological Assessment

Whitenton Group, Inc.
ENVIRONMENTAL CONSULTANTS
3413 Hunter Road San Marcos Texas 78666

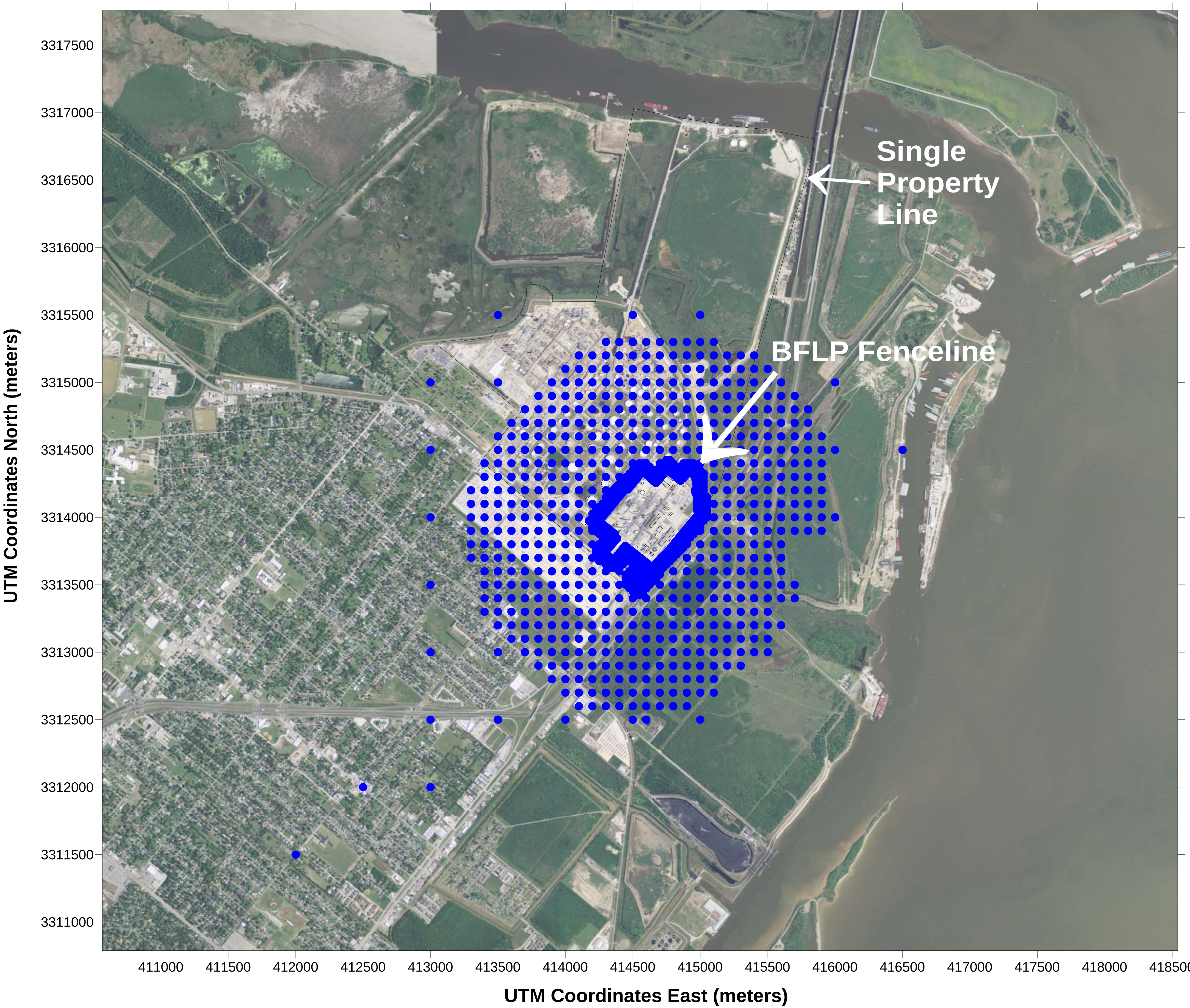
GPS and Coordinate Type:
Trimble Geo XT
UTM NAD 1983
Zone 15 North

Map Created:
7/20/2012 by Jayme Shiner

0 0.5 1 Miles

APPENDIX B

SUPPLEMENTAL DOCUMENTS



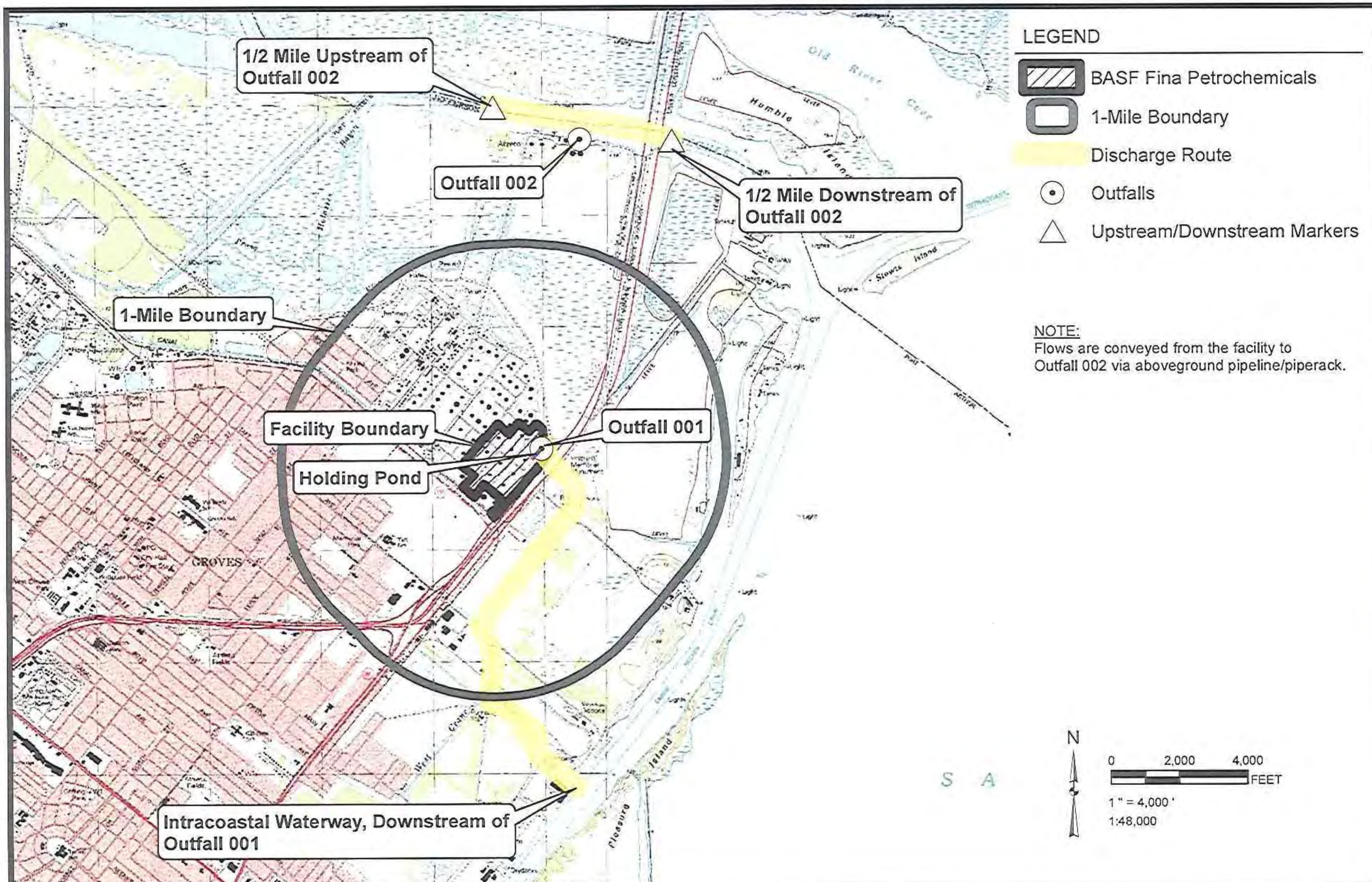
Note : All receptors with modeled concentrations greater than the Significant Impact Level (SIL) are within 3.5 KM of the center of BFLP

BASF Fina Petrochemicals, L.P.
Port Arthur, TX

Figure 1
1-Hour NO2 Receptors with Modeled Concentrations Greater Than Significant Impact Level (SIL)

RPS

Cielo Center
1250 S Capital of Tx Hwy
Building Three, Suite 200
Austin, Texas 78746



RPS

BASF FINA PETROCHEMICALS
PORT ARTHUR, TEXAS

FIGURE 1
SUPPLEMENTAL PERMIT INFORMATION FORM

DRAWN BY:	S S WILSON
APPROVED BY:	C STANFORD
PROJECT NO:	PRJ\BASF\TPDES2010
	BASF TPDES2010 SPIF.mxd
	AUGUST 2010

J:\Prj\BASF\TPDES2010\BASF TPDES2010 SPIF.mxd
Printed By: SiteMap on 9/21/2010, 14:14 PM

Table 8 Calculation of Potential Acidification (pH change) and Loading of Nutrients to Sabine Lake

Sabine Lake pH Change Due to Deposition

Lake characterics and parameters (from published sources)

Lake Area:	259	km^2
Lake Area:	2.59E+08	m^2
Lake Volume:	3.70E+11	liters
Freshwater Inflow:	1.60E+10	m^3/yr
Freshwater Inflow:	1.60E+13	liters/yr

Parameter			Calculation Method
	HNO_3	H_2SO_4	
Acid Equivalent (g/m2/yr):	0.00075	0.00052	g/m2/yr of pollutant converted to equivalent grams of acid
Total acid into lake (g/yr):	193,543	133,806	g/m2/yr of acid multiplied by surface area of lake
moles H^+ into lake (mol/yr):	5,803		g/yr of HNO_3 plus H_2SO_4 acid converted to mol/yr of H^+
Annual H^+ conc. change (mol/l/yr):	1.57E-08		mol/hr of H+ divided by lake volume
Annual Lake Turnovers(no./yr):	43		lake volume divided by annual freshwater inflow
H^+ conc. change (mol/l):	3.63E-10		Annual H^+ conc. change divided by annual lake turnovers
Estimated pH of Sabine Lake[1]:	7.500		see note 1 below
H^+ concentration of lake (mol/l):	3.16E-08		Sabine Lake pH converted to H^+ concentration
pH due to deposition:	**7.495**		H^+ concentration converted to pH units

1. pH data for Sabine Lake was not available; however, EPA report (EPA-842-B-06-003) "Voluntary Estuary Monitoring Manual" indicates that estuarine pH generally averages 7.0 to 7.5 in fresher sections and 8.0 to 8.5 in more saline areas. Sabine Lake is a low salinity estuary; therefore, an average pH of about 7.5 is assumed to apply for this analysis.

Sabine Lake Nutrient (Nitrates and Ammonia) Loading Due to Deposition

Nitrate (NO_3^-):

Parameter		Calculation Method
NO_2 deposition rate (g/m2/yr):	0.00055	from AERMOD (see above)
NO_3^- deposition rate (g/m2/yr):	0.00077	Convert NO2 deposition rate to NO_3^- deposition rate
Nitrate (NO_3^-) deposition rate (g/yr):	199,128	Multiply average NO_3^- deposition rate by lake surface area
Annual NO_3^- conc. change (mg/l/yr):	5.38E-04	Convert deposition rate to mg/l/yr and divide by lake volume
Nitrate conc. change (mg/l):	**1.24E-05**	Annual NO_3^- conc. change divided by lake turnovers

Ammonia (NH_3):

Parameter		Calculation Method
NH_3 deposition rate (g/m2/yr):	0.00045	from AERMOD (see above)
NH_3 deposition rate (g/yr):	115,291	Multiply average NH_3 deposition rate by lake surface area
Annual NH_3 conc. change (mg/l/yr):	3.12E-04	Divide annual NH_3 loading rate by lake volume
NH_3 conc. change (mg/l):	**7.21E-06**	Annual NH_3 conc. change divided by lake turnovers