Resource Report 10 – Alternatives
AES Sparrows Point LNG Terminal & Mid-Atlantic Express Pipeline

SUMMARY OF REQUIRED FERC REPORT INFORMATION		
TOPIC	**FERC Reference**	**Report Reference or Not Applicable**
1. Address the "no action" alternative. • Discuss the costs and benefits associated with the alternative.	§ 380.12(l)(1)	Section 10.3
2. For large Projects, address the effect of energy conservation or energy alternatives to the Project.	§ 380.12(l)(1)	Section 10.3.1 and 10.3.2, respectively
3. Identify system alternatives considered during the identification of the Project and provide the rationale for rejecting each alternative. • Discuss the costs and benefits associated with each alternative	§ 380.12(l)(1)	Section 10.4 and 10.5
4. Identify major and minor route alternatives considered to avoid impact on sensitive environmental areas (e.g., wetlands, parks, or residences) and provide sufficient comparative data to justify the selection of the proposed route. • For onshore projects near to offshore areas, be sure to address alternatives using offshore routings.	§ 380.12(l)(3)	Section 10.6
5. Identify alternative sites considered for the location of major new aboveground facilities and provide sufficient comparative data to justify the selection of the proposed site.	§ 380.12(l)(3)	Section 10.5

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Term	Description
"	inches
°F	degree Fahrenheit
bbl	barrels
bbl/h	barrels per hour
AMSC	Area Maritime Security Committee
ANSI	American National Standards Institute
AOR	Area of Responsibility
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ATWS	Additional Temporary Workspace
BIA	Bureau of Indian Affairs
BIBI	Benthetic index of biotic integrity
BMP	Best Management Practice
BMS	Burner Management System
BOG	boiloff gas
Bscfd / bscfd	billion standard cubic feet per day
Btu	British thermal unit
Btu/(ft^2hr)	British thermal unit per feet squared per hour
C5 plus	pentane plus
CCTV	closed circuit television
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
COE	U.S. Army Corps of Engineers
COMAR	Code of Maryland Regulations
COTP	Coast Guard Captains of the Port
CROW	Construction right-of-way
CWA	Clean Water Act
cy	cubic yard
CZMA	Coastal Zone Management Act of 1972
DB&B	double block and bleed
DCS	distributed control system
DMRF	Dredge Material Recycling Facility
Dth/day	Dekatherms per day
EA	Environmental Assessment
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EPC	Engineering, Procurement and Construction
ER	Environmental Report

Term	Description
ERC	emergency release coupling
ESA	Endangered Species Act of 1973
ESD	emergency shutdown
ESD-1	Pier Emergency Shutdown
ESD-1-1	Activation of the unloading arm/vapor return arm ERCs on Berth 1 and Berth 2
ESD-2	Total Terminal Emergency Shutdown
FAA	Federal Aviation Administration
FBE	Fusion-Bonded Epoxy
FEED	Front End Engineering Design
FERC	Federal Energy Regulatory Commission
FERC's Plan	FERC's Upland Erosion Control, Revegetation, and Maintenance Plan
FERC's Procedures	FERC's Wetland and Waterbody Construction and Mitigation Procedures
FM	Factory Mutual
fps	feet per second
ft	feet
gpm	gallons per minute
h	hour(s)
H&MB	heat and material balance
HAZID	Hazard Identification
HAZOP	Hazard And Operability
HDD	Horizontal Direction Drilling
HDMS	Hazard Detection and Mitigation System
HHV	higher heating value
HID	High Intensity Discharge
HIPPS	High Integrity Pipeline Protection System
Hp / hp	horsepower
HP	high pressure
HTF	heat transfer fluid
IESNA	Illuminating Engineering Society of North America
in	inch
inches H_2O	inches of water
inches Hg	inches of mercury
inches Hg/h	inches of mercury per hour
IP	intermediate pressure
ISO	International Organization for Standardization
Kts	knots
kV	kilovolt
kVA	kilovolt Ampere (one thousand Volt Amperes)

Term	Description
LDC	Local Distribution Company
LFL	lower flammability limit
LHV	lower heating value
LNG	Liquefied Natural Gas
LNG Terminal	Sparrows Point LNG Import Terminal
LOI	Letter of Intent
LP	low pressure
LTD	Level, Temperature, Density
M&R	Metering and Regulator
m^3	cubic meters
m^3/hour	cubic meters per hour
MAOP	Maximum Allowable Operating Pressure
mbar	millibar
mbar/hour	millibar per hour
MCC	Motor Control Center
mcf	million cubic feet
MCMERG	Mid-Chesapeake Marine Emergency Response Group
MCR	Main Control Room
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
Mg/l	Microgram per Liter
MIS	Management Information System
MLLW	mean low low water
MLV	Mainline valve
MMBtu/hr	million British thermal units per hour
MMcf/day	million cubic feet per day
MMscfd	million standard cubic feet per day
MP	Milepost
mph	miles per hour
MW	megawatt
N/A	not applicable
NAS Pax River	Naval Air Station Patuxent River
NAVD	North American Vertical Datum
NDE / NDT	Nondestructive Examination / Nondestructive Testing
NEC	National Electrical Code
NEPA	National Environmental policy Act of 1969
NFPA	National Fire Protection Association
NGA / NGPA	Natural Gas Act / Natural Gas Policy Act
NHPA	National Historic Preservation Act of 1969
NMFS	National Marine Fisheries Service

Term	Description
NOI	Notice of Intent
No. ins	number of inches
NOAA	National Oceanic and Atmospheric Administration
NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	Noise Sensitive Area
NWI	National Wetland Inventory
NVIC	Navigation and marine traffic Inspection Circular
O&M	Operations And Maintenance
OBE	Operating Basis Earthquake
OD	Outside Diameter
OSHA	Occupational Safety and Health Administration
P&ID	piping and instrumentation diagram
PAH	Poly Aromatic Hydrocarbon
PCB	Polychlorinated Biphyenyls
PCMS	Plant Control and Monitoring System
PCR	Platform Control Room
PDEP	Pennsylvania Department of Environmental Protection
PDM	Processed Dredged Material
PIANC	Permanent International Association Navigation Congress
PM	particulate matter
POTW	Publicly-owned Treatment Works
PPB / ppb	parts per billion
PPM / ppm	parts per million
PPT / ppt	Parts per trillion
psf	pounds per square foot
psig	pounds per square inch gauge
PWSA	Preliminary water way suitability assessment
PVC	Poly Vinyl Chloride
QA	Quality Assurance
QC	Quality Control
RGS	Rigid Galvanized Steel (conduit)
ROW	Right-of-Way
RR	Resource Report
RTD	resistance temperature detector
RTU	remote terminal unit

Term	Description
RUSLE	Revised Universal Soil Loss Equation
SAV	Aquatic vegetation
SCADA	Supervisory Control and Data Acquisition
scfh	standard cubic foot (feet) per hour
scfm	standard cubic foot (feet) per minute
SCUBA	Self-contained Underwater Breathing Apparatus
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SIS	Safety Instrumented System
SPCC	Spill Prevention, Control, and Countermeasure
SSE	Safe Shutdown Earthquake
SSURGO	Soil Survey Geographic
STATSCO	State Soil Geographic
SWPPP	Storm Water Pollution Prevention Plan
Tcf	Trillion Cubic Feet
TCP/IP	Transmission Control Protocol/Internet Protocol,
THPO	Tribal Historic Preservation Office
TMDL	Total Maximum Daily Load
TOC	Total organic carbon
Trap	Pig Launcher Receiver Facility
UL	Underwriters Laboratories
UPS	Uninterruptible Power Supply
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USDOE	United States Department of Energy
USDOT	United States Department of Transportation
USEPA / EPA	United States Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
usg	United States gallons
usgpm	United States gallons per minute
V	voltage
VOC	volatile organic compound
WSA	Water way suitability assessment
WWTP	Waste Water Treatment Plant
§	Section

10. ALTERNATIVES

10.1 Introduction

10.1.1 Project Description

AES Sparrows Point LNG, LLC (Sparrows Point LNG) proposes to construct, own, and operate a new liquefied natural gas (LNG) import, storage, and regasification terminal (LNG Terminal) at the Sparrows Point Industrial Complex situated on the Sparrows Point peninsula east of the Port of Baltimore in Maryland. LNG will be delivered to the LNG Terminal by LNG marine vessels, offloaded from these vessels to shoreside storage tanks, regasified to natural gas on the LNG Terminal site (Terminal Site), and the regasified natural gas transported to consumers by pipeline. The LNG Terminal will have a regasification capacity of 1.5 billion standard cubic feet of natural gas per day (bscfd), with the potential to expand to 2.25 bscfd. Regasified natural gas will be delivered to markets in the Mid-Atlantic Region and northern portions of the South Atlantic Region through an approximately 88-mile, 30-inch outside diameter interstate natural gas pipeline (Pipeline) to be constructed and operated by Mid-Atlantic Express, L.L.C. (Mid-Atlantic Express). The Pipeline will extend from the LNG Terminal to points of interconnection with existing interstate natural gas pipeline systems near Eagle, Pennsylvania. Together the LNG Terminal and Pipeline projects are referred to as the Sparrows Point Project or Project. Both Sparrows Point LNG and Mid-Atlantic Express (hereinafter collectively referred to as AES) are subsidiaries of The AES Corporation.

The Project footprint is located in the counties of Baltimore, Harford, and Cecil in Maryland and the counties of Lancaster and Chester in Pennsylvania. The Terminal Site, which is located entirely within Baltimore County, is a parcel located within a former shipyard. The route proposed for the Pipeline (Pipeline Route), which crosses all of the listed counties, includes industrial, commercial, agricultural, and residential lands. Together, the Terminal Site and the Pipeline Route comprise the Project Area.

As described in Section 1.10 of Resource Report 1, *General Project Description*, The AES Corporation is considering the possibility of building a combined cycle cogeneration power plant (Power Plant) on the Terminal Site. The Power Plant would be configured with one F-Class combustion gas turbine, one steam turbine, and associated auxiliaries. The Power Plant would operate only on natural gas and would produce approximately 300 megawatts (MW) of clean electric power within an area of high energy demand. The Power Plant would be connected to the local utility electric system by an overhead electric power transmission line.

10.1.2 Energy Need

AES is proposing the Project in an effort to introduce a new incremental supply of natural gas into the Mid-Atlantic Region, which includes the Baltimore and Maryland area markets and certain parts of the (northern) portion of the South-Atlantic Region (through displacement rather than direct supply), to help serve the growing demand for energy in those markets in a safe, reliable and economic manner. [1] The new incremental supply will initially be sized at 1.5 bscfd with potential expansion to 2.25 bscfd. The Project will provide U.S. gas customers with access to natural gas production centers throughout the world without the need to construct new long-haul pipelines or expand the existing long-haul interstate pipeline systems that currently serve the Mid-Atlantic Region. [2] The Project will also introduce new natural gas storage facilities into the Mid-Atlantic Region.

Energy demand in the United States continues to grow at a relatively constant pace. According to the U.S. Energy Information Administration (EIA 2006), total energy consumption in the United States is projected to increase by 27 percent by the year 2025 (1.2 percent annually), from 100 quadrillion British thermal units (Btu)/year in 2004 to 127 quadrillion Btu/year in 2025. The EIA predicts that the projected growth in energy demand (from present to 2025) will vary by fuel type. Demand for coal

[1] More specific information on the markets to be served and energy needs of the region may be found below and in Resource Report 1 – *General Project Description*.

[2] Access to natural gas reserves from production areas outside of North America by conventional pipeline is not practical. The nearest non-North American production areas are thousands of miles from the Mid-Atlantic Region and are separated from North America by large bodies of water.

and petroleum is expected to increase, with coal projected to increase steeply in the years beyond 2020. Demand for natural gas is projected to continue with strong growth through to 2020, after which it is expected to level off.

Most importantly, natural gas has increasingly become the fuel of choice in the United States. According to the EIA, there are a number of underlying conditions that characterize the U.S. gas market, including:

- Increased gas demand driven by 200 gigawatts of installed gas-fired generation investment since 1999, with limited amounts of alternative fuel capability;
- Declines in domestic gas production throughout the lower 48 states and in offshore areas that are under the control of the United States;
- Increased gas imports from Canada nearing current maximum capacity;
- Decreased gas supply deliverability in the current transportation infrastructure;
- Declines in the demand destruction that began during the sustained high price environment; and,
- Stabilization of gas demand due to the rebound in the U.S. economy beginning in 2003.

These conditions have led to supply constraints and a steadily increasing gas price floor, well above pre-2000 historical levels of below $3.00/thousand cubic feet (mcf) gas. The North American natural gas industry will face a critical period over the next 10 to 15 years when increased supply availability will be essential. Inevitably, failure to increase supply to domestic markets will lead to sustained and higher prices unless new sources of natural gas supply, including LNG, are developed and delivered to the market via import terminals and associated pipeline facilities.

The need for incremental sources of natural gas supply to meet growing demand is particularly acute in the Mid-Atlantic and surrounding regions of the United States due to distances from existing production areas and limited pipeline capacity from those production areas. The Sparrows Point Project will provide incremental gas supply directly into the Mid-Atlantic Region, an area of acute need. The Mid-Atlantic Region consists of New Jersey, Pennsylvania, Maryland, Delaware, the District of Columbia, the southern parts of New York, and the northern parts of Virginia. Baltimore is within the Mid-Atlantic Region and will receive the benefits associated with the incremental source of natural gas either through direct supply or displacement. The northern portions of the South-Atlantic Region that will also benefit from the incremental source of natural gas from the Project include the southern parts of Virginia and the northern parts of North Carolina. The benefits in the northern portions of the South-Atlantic Region will be realized primarily through displacement rather than direct supply.

Natural gas demand for the Mid-Atlantic Region, the area that will be most directly served by the Project, was approximately 2.4 trillion cubic feet (Tcf) in 2005, representing approximately 11 percent of total U.S. natural gas consumption. Natural gas demand for the Mid-Atlantic Region has remained between 2.3 Tcf and 2.5 Tcf over the last 10 years (i.e., 1995 to 2005), as shown in Figure 1.2-2 of Resource Report 1 - *General Project Description*. The EIA (EIA 2006) is projecting an approximate 1.3 percent compounded annual growth rate in natural gas demand for the Mid-Atlantic Region from 2005 to 2020, which will result in an increase from 2.4 Tcf in 2005 to 2.9 Tcf in 2020. For the period between 2020 and 2030, EIA has forecasted a modest decline in natural gas demand to 2.8 Tcf in 2030. Natural gas demand from the electric power generation and commercial segments has shown the most growth for the period 1995 to 2005. As shown in Figure 1.2-4 of Resource Report 1 – *General Project Description*, EIA projects that natural gas demand from electric power generation will continue to show the most significant growth for the period 2005 to 2030.

Due to its location in the heart of an area of high (and increasing) natural gas demand, the Project will result in a more reliable and cost-effective supply of gas to its target markets than gas supplies from the Gulf of Mexico or other domestic regions of production that would require significant pipeline expansion to provide the equivalent amount of natural gas to this market. Introduction of a new source of supply will have the effect of reducing the "basis" in the market intended to be served by the Project.[3] The Project will serve a need for additional natural gas by providing a new supply of LNG. While the LNG supplier will dictate many of the terms of delivery, natural gas will be supplied directly into the market area. AES expects the LNG delivered to the LNG Terminal will be priced at various market index price points, thus being priced competitively with alternative supplies at these points.

10.2 Objective and Applicability

The Project has undergone an analysis of need and routing that considered both environmental and non-environmental factors. In developing the Sparrows Point Project, AES has considered several alternatives to the proposed LNG Terminal and Pipeline, including the no action alternative, energy alternatives (including conservation), and system alternatives (including LNG terminal alternatives and pipeline system alternatives). LNG Terminal location alternatives, Pipeline Route alternatives (as well as alternative location and design of aboveground facilities associated with the Pipeline), and LNG Terminal design alternatives (including alternative methods for dredged material disposal associated with the LNG Terminal marine works), were also evaluated. Each of these alternatives is discussed in further detail in this Resource Report.

This Resource Report is divided into six sections. Section 10.3 describes the no-action alternative. Because demand for energy in the Mid-Atlantic Region is predicted to increase, analysis of the no-action alternative necessarily involves a review of other means, including conservation, to meet the growing energy demands. System alternatives (i.e., alternatives to the proposed action that would make use of other existing or proposed LNG or natural gas facilities to meet the objectives of the Project) are evaluated in Section 10.4. Section 10.5 evaluates aboveground site alternatives. Section 10.6 discusses alternatives to the proposed Pipeline, including different delivery points or delivery methods for the LNG upon its receipt at the LNG Terminal, and alternatives to the proposed Pipeline Route. Section 10.7 provides a summary of the alternatives analysis. Section 10.8 provides a list of references used in the preparation of this Resource Report.

10.3 No-Action Alternative

As noted above, total energy consumption in the United States is projected to increase by 27 percent (1.2 percent annually) by the year 2025, from 100 quadrillion British thermal units (Btu)/year in 2004 to 127 quadrillion Btu/year in 2025.[4] The North American natural gas industry is facing a critical period when increased supply availability will be essential to meeting a large portion of the expected increase in total energy consumption. Natural gas demand will widen the gap between that demand and available supplies unless new sources of natural gas supply, including LNG, are developed and delivered to the market. Delivery of natural gas via import terminals and associated pipeline facilities is a safe and economical method to meet a significant portion of the anticipated growth in natural gas demand.

The No-Action alternative involves consideration of the potential benefits and adverse impacts if the proposed Project were not approved and constructed. If the Project were not constructed, the potential direct environmental impacts associated with construction and operation of the Project would not occur. However, the primary purpose of the Project (i.e., introduction of a new incremental supply of natural gas into the Mid-Atlantic Region that can be sourced from numerous world-wide production centers) would not be met. Accordingly, customers in those markets would have fewer and potentially more expensive options available for obtaining natural gas supplies in the near future. Options available for bringing additional natural gas to the Mid-Atlantic Region involve (i) construction of new LNG terminals (or construction of LNG terminal expansions) and associated expansions of pipeline capacities

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[3] "Basis" refers to the differential between index prices for delivered gas in a given market and the index for prices in a supply region such as the Henry Hub prices of natural gas.
[4] A significant portion of the expected total energy demand will be met with use of natural gas. See discussion in Section 10.3.1 below. Expected contributions from other energy sources are noted in Section 10.3.2.

from outside the Mid-Atlantic Region[5] or (ii) increased production from sources outside the Mid-Atlantic Region and associated pipeline expansions. [6] Both of these options involve additional pipeline tariffs associated with the delivery of gas to the Mid-Atlantic Region. These tariffs are usually based on delivery areas throughout the interstate pipeline system; the tariff increases by rate zone the further away from the source where it is to be delivered. Assuming the gas is shipped from world production centers to either a LNG terminal outside the Mid-Atlantic Region or to the LNG Terminal proposed by AES at the same delivered cost, with transportation charges included, the delivered cost of gas from areas outside the Mid-Atlantic Region to customers inside the Mid-Atlantic Region would be higher than if it were to be delivered by the Project.[7] This same reasoning applies to new production sources (i.e., non-LNG) outside the Mid-Atlantic Region if one assumes that the market sets the price for both LNG and non-LNG sources of supply. Further, by introducing a new source of natural gas into the Mid-Atlantic Region, competition will be enhanced. In general, with all other factors being equal, increased supply competition has the effect of stabilizing or decreasing prices.

The No-Action alternative would require that the unsatisfied demand for energy supply in the Mid-Atlantic Region be met through energy conservation if not by some other energy alternative (e.g., increased pipeline transmission capacity from other areas of the United States or elsewhere in North America) where natural gas supplies are more readily available. As described in Sections 10.3.1 and 10.3.2, energy conservation and the use of alternative energy strategies will not fully satisfy the market needs of targeted consumers.

10.3.1 Energy Conservation

AES evaluated the feasibility of using energy conservation measures as an alternative to the proposed Project.

According to a Report of the National Petroleum Council, titled Balancing *Natural Gas Policy –Fueling the Demands of a Growing Economy* (dated September 25, 2003) while conservation measures are aiding in reducing current demand for natural gas, the reductions possible through conservation measures alone are not anticipated to meet total current or future demand for natural gas. Conservation methods are neither uniformly mandated nor followed. Current energy conservation efforts, including the ENERGY STAR program that is a joint effort between the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE) and identifies cost-effective, energy-efficient products that are designed to save consumers money, reduce energy consumption and help protect the environment (EPA 2006), will aid in reducing the amount of natural gas used in the production of a dollar's worth of economic output; however, conservation does not negate the need for the Project. These findings are supported by a report issued by the American Council for an Energy Efficient Economy (ACEEE) in 2003, cited at p. 3-3 of the Final Environmental Impact Statement on the Crown Landing LNG and Logan Lateral projects (FERC Docket Nos. CP04-411-000 and CP04-416-000) (Crown Landing FEIS), that analyzed projected energy demands in the Northeast, including New York, New Jersey, Pennsylvania, Delaware and Maryland (ACEEE 2003). The ACEEE concluded that energy efficiency and renewable energy measures could result in a 0.9 percent reduction in natural gas consumption by 2008 in the northeastern states, which would not meet the approximate 1.3 percent compounded annual growth rate in natural gas demand for the Mid-Atlantic Region. The ACEEE recognized that energy efficiency and renewable energy are not the only policy solutions required to

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[5] As noted in Section 10.4.1.1, recently approved LNG import projects in the Mid-Atlantic Region (i.e., the Cove Point expansion and the Crown Landing project) meet only a portion of the expected demand in the intended market area. The Broadwater LNG Facility might also be considered to be located in the Mid-Atlantic Region, but the intended market for natural gas delivered from that project is distinct from the market intended to be served by either Cove Point, Crown Landing, or the Project. Specifically, the Broadwater market is Long Island, Greater New York City, and Connecticut. No other import projects are proposed in the Mid-Atlantic Region at this time.

[6] Section 10.4.2.1 discusses the capacity constraints of existing pipelines currently serving the Mid-Atlantic Region.

[7] Shipping distances to the Project from Atlantic Basin LNG suppliers, however, are shorter than to the terminals in the Gulf States Region. This fact increases the likelihood that the all-in delivered cost of LNG to the Project will be less than the all-in delivered cost of LNG to terminals in the Gulf.

address the future natural gas needs of the United States, and that additional sources of natural gas will be required either from domestic sources or through the importation of LNG. Based on the projected increase in demand for natural gas within the Mid-Atlantic Region through the year 2030, AES has determined that energy conservation measures alone, coupled with the fact that these measures are not uniformly mandated, would not provide a sufficient alternative to the Project.

10.3.2 Energy Alternatives

AES evaluated the feasibility of using alternative sources of energy to satisfy the need intended to be served by the Project, such as the use of other fossil fuels, windpower generation, hydropower generation, and nuclear power. The use of these energy alternatives, whether alone or in combination, is not anticipated to provide a commercially viable and environmentally preferable alternative to the Project.

Several alternatives for meeting energy needs are available in the Mid-Atlantic Region; however, none is projected to be both as cost efficient and environmentally benign as natural gas. Other fossil fuels, specifically fuel oil and coal, are short-term viable alternatives to meet the growing demand for energy in the region, the greatest part of which is associated with electricity production. Compared to fuel oil or coal, natural gas is a relatively clean and efficient fuel that can reduce relative impacts on air quality (e.g., reduce emissions of nitrogen oxides, sulfur dioxide, particulate matter and carbon dioxide) to generate the same amount of electricity. According to the Crown Landing LNG FEIS, because there is no pipeline infrastructure in place to distribute these fuels to market in the Mid-Atlantic Region, use of these alternative fossil fuels would require more truck, barge and train trips to make up for the distribution of an equivalent amount of natural gas, which would increase air emissions and traffic congestion. The burning of coal would also require disposal of the resulting ash. Moreover, the policy underlying the Maryland Healthy Air Act of 2006, which mandates reductions from certain existing units at coal-fired power plants of carbon dioxide (10 percent cut by 2018), sulfur dioxide (83 percent cut by 2010, and 90 percent by 2015), nitrogen oxides (67 percent cut by 2010 and 80 percent by 2015) and mercury (90 percent cut by 2010), encourages the use of natural gas for power production over coal sources. Natural gas plants typically emit 43.7 percent less carbon dioxide, 99.6 percent less sulfur dioxide, 79.8 percent less nitrogen oxide, 99.7 percent less particulates and 100 percent less mercury than coal plants. Natural gas plants also produce significantly fewer emissions than oil plants (EIA, Natural Gas Issues and Trends 1998).

The contribution of renewable fuels to the U.S. electricity supply mix remains relatively small in the EIA's Annual Energy Outlook for 2006. Although conventional hydropower is projected to remain the largest source of renewable generation through 2030, a lack of available untapped large-scale sites, coupled with environmental concerns, limits its growth; its share of total generation is projected to fall from 6.8 percent in 2004 to 5.1 percent in 2030 (EIA 2006). See also the ACEEE Report.

While wind generation will become among the leaders in renewable energy generation, the anticipated expansion over current capacity is only projected to increase from a modest 0.4 percent of total energy generation in 2004 to 1.1 percent in 2030 (EIA 2006). Energy from wind power, while important to the overall energy mix, is not projected to grow significantly and become a commercially viable alternative to the Project. See also ACEEE Report.

Energy from nuclear power is not a commercially viable substitute able to replace or significantly offset the demand for natural gas over the next 20 years (EIA 2005). The EIA reports that even with modest increases in nuclear generation from improvements in plant performance and expansion of existing facilities, the share of generation from nuclear plants is projected to decline from 20 percent in 2004 to 15 percent in 2030, as total generation grows at a faster rate than nuclear generation. Furthermore, nuclear power energy involves its own distinct and significant environmental issues such as the disposal of radioactive materials (spent fuel), alterations to hydrological/biological systems and visual impacts. [8]

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[8] Crown Landing FEIS at 3-4.

10.4 System Alternatives

AES evaluated potential system alternatives to the proposed action to determine whether existing LNG projects or LNG projects that have recently been approved by the Commission (both expansions and new construction) would meet the stated objectives of the proposed Project. Next, AES evaluated potential system alternatives to the Proposed Action to determine whether existing or new natural gas pipeline systems would meet the stated objectives of the proposed Project. Based on the conclusions set forth below, none of these system alternatives would meet the stated objectives of the proposed Project.

The basis for evaluation of system alternatives derives from information supplied by the EIA and other sources referenced below. The EIA has indicated that the overall United States natural gas demand, as well as the natural gas market in the Mid-Atlantic Region, currently is supplied with natural gas from three main sources including gas produced in the United States, imports from Canada, and LNG imports. The Mid-Atlantic Region receives gas produced in the United States and Canada through the existing interstate pipeline network. Production areas in the United States that serve the Mid-Atlantic Region are found primarily in the Gulf Coast (onshore and offshore) and, to a much smaller degree, in the Northeast. Supplies from these production areas, and from Canada, are expected to decline in the immediate future. For example, by 2010, domestic supplies available to the Mid-Atlantic Region are expected to decline by four percent, while gas available from Canada is expected to decline by 19 percent. Combining forecasted declines in supply basin deliveries with expected increases in demand, the total natural gas needs in the Mid-Atlantic Region are expected to increase by approximately 1.98 bscfd by 2010, 3.03 bscfd by 2015, and 8.55 bscfd by 2030. The report prepared by Concentric Energy Advisors (CEA), included in Appendix 10A, provides further information regarding these forecasted declines.

10.4.1 LNG Terminal Alternatives

In order to bridge the gap between declines of existing supplies and increases in demand, LNG imports are predicted to increase significantly. Specifically, the LNG component of the national supply mix is predicted to increase from 0.6 Tcf of the total United States demand in 2005 (approximately three percent of the total 20 Tcf demand), to 4.4 Tcf of the total United States demand in 2030 (approximately 16 percent of the total demand for natural gas in the United States) (EIA 2006). Currently, the Mid-Atlantic Region receives vaporized LNG from the existing Dominion Cove Point LNG terminal in Calvert County, Maryland (all of the LNG imported at Cove Point is consumed in the Mid-Atlantic Region) and significantly lesser amounts from the existing LNG import terminals located in Lake Charles, Louisiana and Elba Island, Georgia.

Recognizing the need to increase the supply of LNG within the country, the Commission and the United States Coast Guard (USCG) recently approved applications to expand or construct 17 LNG import facilities, which, if all are brought on line, would increase United States LNG-import vaporization capacity initially by up to 16.0 bscfd. In addition to these approved projects (both new and expansion), there are numerous projects that have been proposed in various locations. These new and proposed facilities are summarized below. Because the majority of the projects are not in the Mid-Atlantic Region and are constrained by capacity-limited interstate pipeline systems into the region, none of the newly approved terminals, including approved terminal expansions, nor any of the proposed terminals, is capable of meeting the stated Project objective of introducing a new 1.5 bscfd (expandable to 2.25 bscfd) source of natural gas into the Mid-Atlantic Region.[9]

10.4.1.1 New LNG Terminals

Recently, the Commission and the USCG have authorized the construction and operation of 13 new LNG import terminals and related facilities as described below:

[9] The Final Environmental Impact Statement on the Crown Landing LNG and Logan Lateral Projects (FERC Docket Nos. CP04-411-000 and CP04-416-000) correctly notes that, "[f]rom a commercial perspective, the best location of an LNG terminal is close to the market it is intended to serve." The great distance of terminals in the Gulf of Mexico Region "effectively limits them from serving the Mid-Atlantic market."

Port Pelican Offshore Deepwater Port Project – (USCG Docket No. 14134) Chevron Texaco is authorized to construct the Port Pelican Offshore Deepwater Port in the Gulf of Mexico offshore of Louisiana. The terminal would have the capability to store up to 330,000 cubic meters (m3) of natural gas and have a send-out capability of an average of 1.6 bscfd. While USCG and Department of Transportation (USDOT) approvals were issued in November 2003, the project has been placed on hold indefinitely.

Gulf Landing Offshore Deepwater Port Project – (USCG Docket No. 16860) Chevron Texaco is authorized to construct the Gulf Landing Offshore Deepwater Port in the Gulf of Mexico offshore of Louisiana. The terminal would have the capability to store up to 200,000 m3 of natural gas and have a send-out capability of an average of 1.0 bscfd. The USCG and USDOT approvals were issued in February 2005.

Creole Trail LNG & Creole Trail Pipeline – (Docket Nos. CP05-360-000; CP05-357-000; CP05-357-001; CP05-357-002; CP05-358 and CP05-359) Cheniere is authorized to site, construct and operate the Creole Trail LNG import terminal in Cameron Parish, Louisiana. The terminal would include four LNG storage tanks that would have the capability to store up to 640,000 m3 of natural gas and have a send-out capability of an average of 3.3 bscfd. The Commission also authorized Cheniere to construct and operate the Creole Trail Pipeline comprising 116.8 miles of dual 42-inch diameter pipeline from the outlet of Creole Trail's proposed LNG terminal through Cameron, Calcasieu, Beauregard, Jefferson Davis, Allen and Acadia Parishes, Louisiana, to interconnect with markets throughout the United States through existing interstate pipelines.

Port Arthur LNG and Port Arthur Pipeline – (Docket Nos. CP05-83; CP05-84; CP05-85; and CP05-86) The Commission granted Port Arthur LNG authority to site, construct and operate the new Port Arthur LNG terminal and related facilities near Port Arthur, Texas. The facilities include six LNG storage tanks with a nominal capacity of 160,000 m3 each. The project would be constructed in two phases and would ultimately provide an average of three bscfd to existing interstate pipeline systems in Texas and Louisiana, connecting to markets in the Midwest and Northeast. Port Arthur Pipeline may construct and operate a new 70-mile, 36-inch diameter pipeline from the LNG terminal to an interstate interconnection. The Commission also authorized the company to construct and operate a three-mile, intrastate pipeline from the LNG terminal to an interstate interconnection with facilities owned by Natural Gas Pipeline Company (NGPL in Jefferson County, Texas.

Crown Landing LNG Project – (Docket No. CP04-411) Crown Landing LLC, a wholly owned subsidiary of BP America Production Company, proposes to construct and operate a new onshore LNG import terminal in Logan Township, New Jersey. The proposed terminal would store up to 450,000 m3 of LNG equivalent to 9.2 bscfd of gas, vaporize LNG and send it out through a connecting pipeline at a base load rate of 1.2 bscfd. The entire capacity of the Crown Landing project is committed for the next 20 years (Crown Landing FEIS 2006). The project would interconnect with a new 11-mile pipeline that the Commission also approved. The pipeline would be constructed by Texas Eastern Transmission Company (TETCO) (Docket No. CP04-416) and would extend from the terminal through Delaware County, Pennsylvania, to transport the vaporized LNG to various markets in the United States. Crown Landing and TETCO also anticipate interconnections with facilities operated by Transcontinental Gas Pipe Line Corporation (Transco) and Columbia Gas Transmission Company (Columbia). Crown Landing hopes to begin service from the facility in late 2008. Operational service by 2008 is dependent upon a favorable decision by the United States Supreme Court concerning a challenge by the State of Delaware as to the jurisdiction of Delaware or New Jersey over certain improvements appurtenant to the New Jersey shore of the Delaware River. A special master was appointed on January 23, 2006 to hear testimony in the proceeding. There is no timetable for resolution of the challenge, and the outcome is uncertain.

Even if the Supreme Court rules in a manner that allows the Crown Landing project to be constructed, the addition of significantly greater new pipeline infrastructure, both directly related to the Crown Landing project (i.e., additional lateral pipelines, lateral pipelines of greater diameter, or some other means to accommodate additional volumes of natural gas) and within the interconnected pipeline systems, would be needed to fully meet the increased natural gas demands predicted in the Mid-Atlantic Region. As described in more detail in the CEA report in Attachment 10A, the fact that the forecasted demand in the Mid-Atlantic Region is large enough to require the construction of both the Project and the Crown Landing facility, as well as the fully subscribed volumes anticipated at the expanded Cove Point facility, the physical structures and equipment within the Crown Landing facility would effectively have to be doubled to account for the volumes anticipated to be brought into the region by the Project.

Golden Pass LNG Terminal Project – (Docket No. CP04-386-000 and CP04-400-000) Exxon Mobil Corporation proposed to construct an LNG import facility at Sabine Pass, Texas, comprising two phases – 1.0 bscfd (Phase 1), 2.0 bscfd (Phase 2). Commission approval was provided July 2005, and the facility is under construction. In addition, the Golden Pass Pipeline project, which is approximately 77 miles in length, would have the capacity to deliver up to 2.5 bscfd of natural gas. The pipeline would cross four counties in Texas and one parish in Louisiana. At this time, up to 11 interconnections with existing intrastate and interstate pipelines are possible.

Sabine Pass LNG Terminal – (Docket No. CP04-47-000) Cheniere Sabine Pass Pipeline Company proposed to construct an LNG import terminal at Sabine Pass Channel, Louisiana, with capacity of 2.6 bscfd via three 160,000 m3 tanks. Commission approval was provided December 2004, and construction began in March 2005. Terminal operations are expected to commence in 2008. The natural gas from the Sabine Pass LNG terminal will pass through the Cheniere Sabine Pass LNG pipeline into the natural gas transmission network. The Cheniere Sabine Pass Pipeline will run 16 miles from the Sabine Pass LNG terminal to Johnson Bayou. The proposed pipeline will interconnect with several interstate and intrastate pipelines. The pipeline is designed to transport 2.6 bscfd of natural gas.

Technip U.S.A. Corp., Saipem Technigaz SA and Zachry Construction Corp. – (Docket No. CP03-75-000) Technip USA Corporation proposed to develop a new LNG import facility at Freeport, Texas, comprising two phases of development – 1.5 bscfd in two 160,000 m3 tanks (Phase 1), and 2.5 bscfd in one 160,000 m3 tank (Phase 2). The Commission approved the proposal in June 2004 and Phase 1 is under construction. The first phase of the terminal will have a send-out capacity of 1.5 bscfd beginning in early 2008. The construction of the terminal's Phase I started on January 17, 2005, and is scheduled to be completed within 35 months. Phase II will incorporate a second marine berthing dock and associated unloading facilities, expanded vaporization, 7.5 billion cubic feet (Bcf) of underground storage and a third LNG storage tank. The current schedule envisages that the construction of Phase II will start in 2006 and that the expansion will be on stream in 2008 with the exception of the third tank, which will be completed in 2009. Engineering and planning for the Phase II expansion are underway, including building a 7.5 Bcf integrated underground salt cavern storage facility.

Cameron – (Docket No. CP02-374-000) Sempra Energy, LNG proposed a new LNG facility at Hackberry, Louisiana, comprising 1.5 bscfd of capacity in three 160,000 m3 tanks. Commission approval was provided September 2003, and construction is under way. In addition to the terminal, Sempra Pipelines & Storage will also be constructing a 35-mile pipeline to transport natural gas from the facility to connect with existing interstate pipelines to the north.

Weaver's Cove LNG Project – (Docket No. CP04-36-000 and CP04-41-000) Weaver's Cove Energy, LLC (Hess LNG) proposed a new LNG facility at Fall River, Massachusetts, comprising 0.8 bscfd of capacity in one 200,000 m3 tank. Commission approval was provided July 2005 and other required permits are still in process. Massachusetts recently issued its certificate finding the project in compliance with the state's environmental policy act. In addition to the terminal, Mill River Pipeline will also be constructing two 6-mile pipelines to transport natural gas from the facility to connect with existing interstate pipelines to the north.

Ingleside Energy Center LNG Project – (Docket No. CP05-13-000) Occidental Energy Ventures Corp. proposed a new LNG facility to be located at Ingleside, Texas and comprising 1.0 bscfd of capacity in two 160,000 m3 tanks. Commission approval was provided in July 2005. The Ingleside Energy Center LNG Project terminal and related facilities will be located in San Patricio County, Texas. The terminal is designed to provide an option for extracting natural gas liquids in addition to importing, storing and vaporizing one Bcf of gas per day. In addition to the terminal, Occidental Energy Ventures Corp proposes to construct and operate 26.4 miles of 26-inch diameter pipeline extending from the tailgate of Ingleside's LNG terminal to potential interconnections with nine interstate and intrastate pipelines located in San Patricio County.

Vista del Sol LNG Terminal Project – (Docket Nos. CP04-395-000, CP04-405-000, CP04-374-000) ExxonMobil Corporation proposed an LNG facility to be located at Corpus Christi, Texas, and comprising 1.0 bscfd of capacity in three 155,000 m3 tanks. Commission approval was provided June 2005, and construction was reported to be pending. Exxon Mobil announced on September 25, 2006 that it has dropped plans for this project and was exploring a sale with an unidentified party.

Cheniere Corpus Christi LNG Terminal Project – (Docket Nos. CP-37-000, CP04-44-000, CP04-45-000, CP04-46-000) Corpus Christi LNG, LP proposed an LNG facility to be located in Corpus Christi, Texas and comprising 2.6 bscfd capacity in three 160,000 m3 tanks. Commission approval was provided April 2005, and construction is pending. Cheniere began site preparation in the second quarter of 2006 and expects to commence terminal operations in early 2010. The natural gas from the Corpus Christi LNG terminal will pass through the Cheniere Corpus Christi LNG pipeline into the existing natural gas transmission network. The Cheniere Corpus Christi Pipeline will run 24 miles from the terminal to a connecting pipeline north of Sinton, Texas. The proposed pipeline will interconnect with several interstate and intrastate pipelines. The pipeline is designed to transport 2.6 Bcf per day of natural gas.

Excelerate Energy, L.L.C. – Excelerate currently owns and operates the only offshore LNG terminal in the United States. The terminal, which is based on a transport and regasification vessel, is located in the Gulf of Mexico offshore of Louisiana. The terminal requires use of a specialized LNG ship, which is able to dock at a mooring system made up of a submerged turret buoy and flexible riser connected to a natural gas pipeline on the seafloor. This design does not provide for LNG storage so it must be limited to an LNG fleet with regasification equipment on all of the vessels. Currently, there are only two such ships in the world, but a third ship was scheduled to be completed late in 2006, and two more ships have been ordered and are scheduled to be delivered in 2008 and 2009, respectively. Due to the travel times to and from LNG producing countries, more specialized ships would be necessary to ensure continuous delivery of natural gas to such offshore receipt points.

10.4.1.2 LNG Terminal Expansions

The Commission also authorized expansions at four previously authorized LNG facilities. In each case the Commission requires the applicant to deliver the LNG in a format that is compatible with the existing natural gas infrastructure. Descriptions for each of these projects were derived from the Final Crown Landing FEIS.

Elba Island - Southern LNG, Inc. (Southern LNG) – (Docket No. CP05-388-000). Southern LNG owns and operates an LNG import terminal located at Elba Island along the Savannah River in Chatham County, Georgia. Southern Natural Gas filed an application for an expansion, and for authorization to construct and operate, a total of 176.43 miles of 24-inch and 30-inch diameter pipeline, three new compressor stations (totaling approximately 31,050 hp) and other appurtenant facilities. The pipeline project, known as the Cypress Pipeline Project (located in Georgia and Florida), would be constructed in three phases with phased in-service dates of May 1, 2007; May 1, 2009 and May 1, 2010. On December 21, 2005, Southern LNG (through El Paso Corporation) announced proposals to further expand the Southern LNG terminal. The proposed expansion, referred to in the announcement as the Elba Island Expansion and Related Pipeline Project, would more than double the LNG storage capacity at the terminal and would add 0.9 bscfd of send-out capacity, increasing the total send-out capacity of the terminal to 2.1 bscfd. In addition, a new 191-mile interstate natural gas pipeline with a total capacity of 1.1 bscfd would also be constructed from Elba Island to markets in Georgia and through interconnections with other pipelines to the Southeastern and Eastern United States.

CMS Trunkline LNG Company, L.L.C. (Trunkline LNG) - (Docket Nos. CP02-60-000 and CP02-60-001) currently owns and operates an LNG import facility in Calcasieu Parish, Louisiana. The existing LNG terminal includes three 95,000 m3 storage tanks, a ship unloading dock with a full design capacity of 120 ships per year, and vaporization facilities with a maximum send-out capacity of 1.0 bscfd. In December 2002, the Commission approved plans to add a second ship unloading dock, a 140,000 m3 LNG storage tank, three first stage LNG pumps, four second stage LNG pumps, three vaporizers and two electric generators. With the addition of these facilities, which are currently under construction, the LNG terminal will have a sustainable send-out capacity of about 1.2 bscfd (1.3 bscfd maximum) and a ship unloading capacity of about 175 ships per year. In February 2004, Trunkline

LNG and a related subsidiary, CMS Trunkline Gas Company, L.L.C. (Trunkline Gas), announced plans to further expand send-out capacity of the terminal by adding pumps, vaporizers and new unloading facilities to a second dock at the terminal and constructing a new 23-mile-long, 30-inch diameter pipeline between the LNG terminal and Trunkline Gas's existing mainline pipeline system. If approved, these new facilities would increase the maximum send-out capacity of the terminal to about 1.8 to 2.1 bscfd.

Sabine Pass LNG – (Docket No. CP05-396) The Commission approved an expansion of the proposed Sabine LNG project, which was authorized in December 2004 to be constructed and operated in Cameron Parish, Louisiana. In its decision, the Commission also approved Phase II of the project, which includes three additional 160,000 m3 storage tanks and related facilities that would provide an average send-out capacity ranging from 2.6 bscfd to 4 bscfd. The Sabine LNG Phase II facilities are proposed to be adjacent to or within the boundary of the Phase I site.

Dominion Cove Point LNG – (Docket Nos. CP05-130-000, CP05-130-001, CP05-130-002; CP05-132-000, -001) Dominion Cove Point owns and operates an LNG import facility near Lusby, Calvert County, Maryland and a pipeline, known as the Cove Point pipeline (Docket No. CP05-131), that extends approximately 88 miles from the LNG terminal to connections with several interstate pipelines in Loudoun and Fairfax Counties, Virginia. Currently, the LNG terminal has a storage capacity of 7.8 Bcf and a peak send-out capacity of 1.0 bscfd. The Commission recently approved an expansion of the Cove Point facility to increase its storage capacity to 14.5 Bcf and its send-out capacity to 1.8 bscfd. The approved expansion will increase the expected number of ships calling at the terminal from 90 to 120 ships per year to approximately 200 ships per year. By agreement with the Sierra Club, including its Maryland Chapter and Maryland Conservation Council, Inc. dated March 1, 2005, Dominion Cove Point LNG, L.P. agreed to limit future expansion such that maximum future total capacity would be no more than 18.85 Bcf (4.35 Bcf above currently planned storage capacity).

Conclusions Regarding Approved LNG Terminal Alternatives

Given the forecasted decrease in production of natural gas in certain supply basins, LNG is projected to supply not only incremental natural gas demand, but it also could replace the projected reduction in other supply components (i.e., natural gas imports from Canada and certain United States production basins). Alternatives outside of the defined market area are not considered commercially feasible for serving the Mid-Atlantic Region due to tariff transportation charges and/or pipeline constraints. Delivery of natural gas from LNG terminals outside of the defined market would require construction of additional delivery capacity over significantly greater distances than required for in-area projects; thus, leading to greater human and environmental impacts. Finally, all of the LNG projects located outside of the Mid-Atlantic Region would not have the same Project benefit of introducing new natural gas storage capacity into the area.

By the 2020 time period, AES has forecasted that incremental design day demand of approximately 4.921 bscfd will not only require the 1.5 bscfd from the Sparrows Point Project but will also require approximately two additional natural gas supply projects that are larger than the size of the Sparrows Point Project. In other words, by 2020, the Mid-Atlantic Region would have sufficient demand of approximately 4.921 bscfd which would not only absorb the Sparrows Point volume of 1.5 bscfd, but also the Crown Landing volume of 1.2 bscfd, the Cove Point expansion of 0.8 bscfd, and still require approximately 1.4 bscfd of other supply. Further expansion of the Cove Point terminal or, if it is allowed to be constructed in the first instance, the Crown Landing terminal would likely require upgrades (or, in the case of Cove Point, further upgrades), to the accommodate the additional gas volumes required to fill in the expected shortfall in the Mid-Atlantic Region. Compression may also be required on connecting or downstream pipelines. These potential restrictions (including the associated environmental impacts) would limit the ability for expansions at these terminals to meet the anticipated natural gas needs in the Mid-Atlantic Region. Restrictions on the ability of Cove Point to further expand its facility beyond 18.85 Bcf might also impact the ability of that facility to meet the anticipated future natural gas needs. Finally, water depth restrictions applicable to the Crown Landing facility (see discussion below in Section 10.5.1.1), in conjunction with existing shipping traffic volumes on the Delaware River, might impact the ability of that facility to meet the anticipated additional natural gas needs in the Mid-Atlantic Region. In any event, as evidenced by recent natural disasters that temporarily-affected clustered energy production facilities, it makes good sense to allow for a certain amount of geographical separation so as to enhance the reliability of the nation's energy infrastructure.

For these reasons, neither the expansion of the existing LNG terminals nor the proposed construction of the approved LNG terminal projects listed above (inlcuding in light of the uncertainty of the recently approved Crown Landing project), would be a viable system alternative to the Project. The majority of the projects listed above propose to serve natural gas markets substantially farther north or south of those intended to be served by the Project. An LNG facility that is not located within the defined market analyzed by AES could not serve the Mid-Atlantic Region without substantial expansions of existing pipeline systems and possibly the addition of compression.

10.4.1.3 Proposed LNG Terminals

Several other proposals for LNG Terminals are pending before the Commission or USCG, including the following:

Northeast Gateway – (USCG Docket No. 22219) Excelerate Energy LLC is proposing to construct the Northeast Gateway deepwater port offshore from Gloucester, Massachusetts. The terminal would have a send-out capability of an average of 0.8 bscfd. No storage tanks are proposed. The USCG deemed the Northeast Gateway application complete on September 2005, and the FEIS was issued in October, 2006.

Neptune – (USCG Docket No. 22611) Tractebel (Suez Energy) is proposing to construct the Neptune deepwater port offshore from Gloucester, Massachusetts. The terminal would have a send-out capability of an average of 0.8 bscfd. No storage tanks are proposed. The USCG deemed the Neptune application complete on October 2005, and the FEIS was issued in November, 2006.

Main Pass Energy Hub Deepwater Port Project – (USCG Docket No. 17696) Freeport-McMoRan Energy LLC is proposing to construct the Main Pass Energy Hub Deepwater Port in the Gulf of Mexico offshore from Louisiana. The terminal would have a send-out capability of an average of 1.0 bscfd. Natural gas storage facilities have not been proposed. The NEPA review process was suspended in August 2005.

Compass Port Terminal Project – (USCG Docket No. 17659) ConocoPhillips is proposing to construct the Compass Port Terminal Project approximately 11 miles off the coast of Alabama near Dauphin Island. The terminal would have a send-out capability of an average of 1.0 bscfd with storage facilities for 250,000 m3 of natural gas. The NEPA review timeline was suspended as of August 2005.

Beacon Port Deepwater Port Project – (USCG Docket No. 21232) ConocoPhillips is proposing to construct the Beacon Port Deepwater Port Project off the coast of Louisiana, in the Gulf of Mexico. The terminal would have a send-out capability of an average of 1.0 bscfd with two natural gas storage tanks. The NEPA review timeline has been suspended.

Broadwater LNG Facility – (FERC Docket No. PF-05-4-000) TransCanada Corporation and Shell US Gas & Power LLC are proposing to construct the Broadwater LNG Facility within the Long Island Sound in New York. The terminal would have a send-out capability of an average of 1.0 bscfd with a floating regasification unit with 350,000 m3 of natural gas storage capacity. Broadwater LNG Facility was filed with the Commission in January 2006, and the FEIS for the project was issued November 17, 2006. Additional discussion of the Broadwater LNG Facility is provided in Section 10.5.1.1.

Casotte Landing LNG – (FERC Docket No. CP05-420-000) Bayou Casotte Energy LNG proposed an LNG facility at Bayou Casotte, Mississippi, comprising 1.3 bscfd of capacity in three 160,000 m3 tanks. The application was filed in October 2005, and environmental review is underway. The proposed Casotte Landing project, to be located adjacent to Chevron's Pascagoula Refinery, will process imported LNG for distribution to industrial, commercial and residential customers in Mississippi and the U.S. Southeast region, including the growing Florida market.

LNG Clear Energy – (FERC Docket No. CP06-12-000, CP06-13-000) Gulf LNG Energy, LLC has proposed an LNG facility to be located at Pascagoula, Mississippi and comprising 1.5 bscfd capacity in two 160,000 m3 tanks. The application was filed October 2005. The Project will be sited on land controlled by the Jackson County Port Authority and Jackson County. The site is adjacent to the Bayou Casotte ship channel (east harbor).

Quoddy Bay LNG – (FERC Docket No. CP07-38-000) Quoddy Bay, LLC proposed an LNG facility at Pleasant Point, Maine and comprising 0.5 bscfd capacity in three 160,000 m3 tanks. The NEPA Pre-filing process was initiated December 2005 and the formal application was filed in December 2006. The LNG import terminal will be located at the Pleasant Point Reservation of the Passamaquoddy Tribe. The storage facility will be located in the Town of Perry. The Project includes a 35.8-mile natural gas send-out pipeline to transport natural gas from the LNG Terminal to the interstate natural gas pipeline in the Town of Princeton. The send-out pipeline originates at the import facility in Western Passage of Passamaquoddy Bay, and extends northwest through the reservation and the Towns of Perry, Pembroke, Charlotte, Cooper, Alexander and Princeton before reaching the interstate natural gas pipeline interconnect.

Conclusions Regarding Proposed LNG Terminal Alternatives

Given the forecasted decrease in production of natural gas in certain supply basins, LNG is projected to supply not only incremental increases in natural gas demand, but it also could replace the projected reduction in other supply components (i.e., natural gas imports from Canada and certain United States production basins). Alternatives outside of the defined market area are not considered commercially feasible for serving the Mid-Atlantic Region. Delivery of natural gas from LNG terminals and other sources outside of the defined market would require construction of additional delivery capacity, over significantly greater distances than required for in-area projects, with resultant additional environmental and landowner impacts, effectively limiting them from serving the Mid Atlantic Region10.

In addition, with respect to terminals proposed in the Northeast, it is highly unlikely that any natural gas delivered to those terminals could be delivered to the Mid-Atlantic Region, even assuming the additional pipeline infrastructure required was constructed, due to the tremendous demands in the greater New York City region and other nearby areas. Those demands would effectively siphon off all incremental supplies before they could reach the Mid-Atlantic Region. Similarly, LNG introduced into Maine or Massachusetts will be used to meet growing demand in New England, and therefore would not be available to the Mid-Atlantic Region.

Moreover, proposed projects without storage capability (e.g., Excelerate, Neptune) would only be able to provide interruptible service as compared to the firm service that likely would be available from the Sparrows Point Project. [10] Projects that make use of specialized ships are similarly prone to interruptions. These considerations make such alternatives even less viable than other fixed base facilities when determining their potential use in lieu of the Project proposed by AES.

10.4.2 Pipeline System Alternatives

An alternative to constructing the proposed Project is utilizing or expanding existing pipeline systems to provide an equivalent 1.5 bscfd of natural gas to the Mid-Atlantic Region. The first drawback to such an alternative is the fact that onshore conventional natural gas production is anticipated to decline from 4.8 Tcf in 2004 to 4.2 Tcf in 2030, while net pipeline imports are expected to decline from 2004 levels of 2.8 Tcf to about 1.2 Tcf by 2030, due to resource depletion and growing domestic demand in Canada. The decline in overall supply from the west coast of the United States and Canada is coupled with a projected increase in consumption from 22.4 Tcf of natural gas in 2004 to 26.9 Tcf in 2030 (EIA 2006). Not only does reliance on this alternative not meet the Project objective of introducing a new source of natural gas into the Mid-Atlantic Region, it also has a negative effect on the supply/demand equation as this alternative looks to decreasing supplies to meet increasing demands.

The second, more obvious, drawback to this alternative is the fact that it does not meet the stated Project objective of increasing access for the Mid-Atlantic Region to world natural gas production

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[10] Offshore terminals may experience interruptions caused by high seas or other inclement weather that affect the ships' ability to stay moored and off-load at open ocean moorings.

centers. The United States is expected to depend increasingly on imports of LNG to replace Canadian pipeline imports and tap the world supply of natural gas. Approximately 74 percent of the world natural gas reserves are located in the Middle East and Eurasia, compared with less than four percent within North America (EIA 2006). To meet a projected demand increase of 4.5 Tcf from 2004 to 2030, and to offset an estimated 1.6 Tcf reduction in pipeline imports, the United States is expected to rely on the world supply of natural gas through LNG.

Finally, the alternative of utilizing or expanding existing pipeline systems to provide an equivalent 1.5 bscfd of natural gas to the Mid-Atlantic Region would not carry the additional benefit of introducing new facilities for natural gas storage in the Region.

10.4.2.1 Existing Pipeline Systems

Existing pipeline systems in the Mid-Atlantic Region, including those owned and operated by TETCO, Columbia, and Transco (see Figure 10.4.2-1) were also evaluated. All of these pipeline systems primarily provide natural gas from production areas in Canada and the Gulf Coast. Because the production from conventional natural gas reserves in the United States and Canada is anticipated to decline, it is unlikely that pipeline alternatives connected to these reserves would be able to meet the Project objective of providing up to a maximum rate of an additional 1.5 bscfd of natural gas to the Mid-Atlantic Region (EIA 2006).

Furthermore, even if incremental supplies become available through the new and proposed Gulf Coast LNG relieving terminals, based on information obtained during its recent discussions with Columbia, Transco, and TETCO, AES has determined that the existing pipeline systems do not have sufficient forward haul capacity to deliver the incremental volumes proposed by AES without expansion. The Commission's evaluation of the Columbia and Transco pipeline systems conducted during the preparation of the Dominion Cove Point Expansion EIS (Dominion FEIS 2006), confirmed that the systems are fully subscribed and there is no capacity to transport additional gas supplies without substantial expansion or modifications similar or greater than those proposed by the Project. Deliveries by AES to these interstate pipelines in the Eagle, Pennsylvania area will allow delivery of natural gas closer to the market consuming areas. Volume from these interconnections will be able to be delivered on a firm back haul basis to markets south and west of these interconnects, and, at least initially, on an interruptible basis to markets north and east of these interconnects. In addition, existing firm shippers would have the ability to segment their existing long haul capacity by accepting additional supply from the Project, which greatly increases transportation options available. As the market requires more incremental firm forward haul delivery capacity expansions from the point of the proposed Pipeline and forward, those interconnects should be less costly and have less environmental impact.

It is anticipated that proposals to expand existing pipelines will continue to increase the capacity of existing natural gas pipeline systems to the Mid-Atlantic Region. However, these projects alone cannot meet the Project objective of providing access to new natural gas supplies from around the world in the Mid-Atlantic Region. Further, the significant pipeline expansion projects that would be required to deliver the same gas volumes to the Mid-Atlantic Region as proposed by AES would typically result in short and long term impacts on water resources, upland vegetation, wetlands, wildlife habitats, traffic patterns, and land use, as well as impacts to landowners. In addition to construction-related effects, the operation of such longhaul pipelines requires compressor stations that would result in permanent noise and adverse air quality impacts. Because this alternative does not meet the Project objective of providing access to new natural gas supplies from around the world, and there are a vast variety of expansion alternatives, it was not reasonably practical to attempt to quantify these impacts.

10.4.2.2 Proposed Pipeline Systems

Current proposals to deliver natural gas reserves from the western Unites States and Canada to the eastern market were evaluated by AES in its consideration of potential alternatives to the Project. No similar project proposals in the Gulf Coast region of the United States were identified.

Rockies Express Pipeline, which is being developed by Rockies Express Pipeline LLC, is a joint development between Kinder Morgan Energy Partners and Sempra Pipeline & Storage (Rockies

Express Pipeline 2006). The project consists of a proposed 1,663-mile natural gas pipeline system from Rio Blanco County, Colorado, to Monroe County, Ohio.

The Mackenzie Gas Project proposes to build an approximate 760-mile 30-inch diameter pipeline system along the Mackenzie Valley (Mackenzie 2004). The project will connect three discovered natural gas fields in the Mackenzie Delta - Taglu, Parsons Lake and Niglintgak to distribution systems in Alberta Canada for transmission to markets in Canada and the United States. The pipeline is also anticipated to be utilized by other companies exploring for natural gas in northern Canada to supply as much as 1.2 bscfd of natural gas through the Mackenzie Valley Pipeline.

While construction of these new pipelines could increase the amount of natural gas available to the Mid-Atlantic Region, and such new pipelines might originate at production centers not currently used to supply the Mid-Atlantic Region, such alternatives cannot meet the Project objective of increasing access to new natural gas supplies from around the world in the Mid-Atlantic Region. Further, significant new pipeline construction projects that would be required to deliver the same gas volumes to the Mid-Atlantic Region as proposed by AES, typically would result in short and long term impacts on water resources, upland vegetation, wetlands, wildlife habitats, traffic patterns, and land use, and impacts to landowners. In addition to construction-related effects, the operation of such longhaul pipelines requires compressor stations that would result in permanent noise and adverse air quality impacts. Because this alternative does not meet the Project objectives described above, no attempt was made to quantify these impacts.

10.5 Aboveground Alternatives

AES conducted an alternatives analysis of all major aboveground facilities, specifically the location for the LNG Terminal. Other major aboveground facilities associated with this Project are not anticipated, including compressor stations along the Pipeline Route. AES also evaluated design alternative options for the LNG Terminal, including pier design, regasification methods, and dredge method and dredge disposal alternatives.

10.5.1 LNG Terminal Site Alternatives

Following the system alternatives analysis, AES evaluated several factors to determine the extent to which alternative LNG terminal site locations would fulfill the purpose for the Project (i.e., introducing a new incremental supply of natural gas from world production centers into the Mid-Atlantic Region, which includes the Baltimore area market, to meet the growing demand for energy in those markets in a safe, reliable and economic manner). To meet this purpose, AES determined that, at a minimum, an LNG terminal site would need to satisfy the criteria below. The noted criteria are listed in no particular order of importance; rather, all of the criteria are considered important to the determination of site alternatives.

- Geographic Location. Given the impracticality of LNG Terminal System Alternatives to serve the intended markets (see discussion in Section 10.4.1), it is necessary to locate the Project within the Mid-Atlantic Region to allow adequate interconnection with existing natural gas pipeline systems in the vicinity of the Terminal Site. Furthermore, due to the projected increase in demand for natural gas throughout the country, the location of the project is crucial to ensure that the increase in capacity (or the great majority thereof) is used to satisfy the increased demand within the Mid-Atlantic Region.[11] Because the project also adds storage capacity in the region, it will ensure immediate availability without regard to pipeline capacity constraints in times of peak demands. The specific definition of the intended market area for this Project, and the basis for the

[11] It was noted in Section 10.4.1 that small amounts of natural gas imported through the LNG terminals at Lake Charles and Elba Island might find their way into the Mid-Atlantic Region, and that expansions of those terminals were recently approved by FERC. Regardless of the size of the approved expansions, existing pipeline capacities from those areas do not allow for the introduction of the same quantities of natural gas as proposed to be delivered through the Project without significant expansions of those existing pipeline systems, or construction of new pipeline systems. Pipeline systems alternatives are discussed in Section 10.4.2.

need for the Project are described in Resource Report 1, *General Project Description*, in Sections 1.1 and 1.2.

- Distance from Residential Concentrations. AES considered only locations for a terminal site and associated LNG transit vessel routes that were – at all times – greater than one mile from residential communities and population centers. Although the Commission has recently approved projects with ship transit routes closer to residential areas (Crown Landing – approximately 0.6 miles from Wilmington and similar distances from other cities or towns in both Delaware and New Jersey; Weaver's Cove – approximately 0.5 miles from Fall River), and while not required by any applicable regulations or recent practice, AES has made the corporate decision to follow this one-mile guideline in order to remove certain possible objections (regardless of merit) and thereby minimize potential public opposition to the project and the attendant costs associated with responding to each opposition. The guideline adapted by AES is based on recent studies conducted by Sandia National Laboratory (SNL) that sets out a worst-case marine-related thermal event as causing potential harm to persons within approximately one mile (5,280 feet or 1,600 meters) of an LNG spill. Studies cited by SNL corroborate this distance. [12] This distance is also addressed in comments submitted by the LNG Opposition Team wherein the group makes citation to Massachusetts legislation that would require a terminal set-back distance from residential areas of 5,000 feet and a ship transit set-back distance of 1,500 feet.

- Land Use Compatibility. Development of LNG projects has emerged as one of the most contentious energy infrastructure issues in recent years. There are several possible explanations for the attention such projects have drawn, including (i) the regulatory process has encouraged, and sometimes required, public participation often prior to the time the applicant has completed site-specific studies; (ii) the projects are generally of significant size (a project cost of $500 million is not unusual) so that they are difficult to ignore or overlook; (iii) a great deal of misinformation exists about LNG; and (iv) because of the relatively small number of major LNG import terminals in the United States, large scale LNG projects are perceived as unsafe. In such a situation, it is incumbent upon the applicant to identify areas for potential terminal location that are not inconsistent with existing land use and published community development plans. As described more fully in Resource Report 5, *Socioeconomics*, and Resource Report 8, *Land Use, Recreation and Aesthetics*, the Terminal Site was elected because it complied with the industrial zoning designation, and does not conflict with the Dundalk Renaissance Plan titled *Dundalk, A Second Century Vision*, and the Turner Station Community Conservation Plan.

- Technical and Economic Feasibility. AES investigated the technical and economic feasibility of constructing and operating an LNG terminal at the proposed site. Factors considered in this investigation included: site access to nearby deepwater port facilities (requiring a nominal 45-foot draft); access to adequate constructible land (requiring a nominal 40 acres); availability of adequate air draft under bridge crossings and distance of bridge locations from the proposed site; proximity to (or, preferably, location within) natural gas markets intended to be served by the Project[13]; ability of the site to

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[12] *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water*, Sandia National Laboratories SAND2004-6258 (December 2004), cited to four recent LNG spill-modeling studies that included reports by Lehr and Simicek-Beatty, Fay, Quest, and Koopman. The calculated "skin burn" distances (the point at which a heat flux value of $5kW/m^2$ could be conservatively measured) in each of these reports was listed as 500 meters (Lehr), 1,900 meters (Fay), 490 Meters (Quest), and 1,290 meters (Koopman). In a subsequent study, Fay indicated that the "skin burn" distance was 1,100 meters (*Spills and Fires from LNG and Oil Tankers in Boston Harbor*, March 26, 2003).

[13] See discussion in Section 10.4 regarding system alternatives. In summary, alternatives outside of the defined market area are not considered commercially feasible for serving the same market as the Sparrows Point Project due to the need to construct additional pipeline delivery capacity over significantly greater distances than required

accommodate LNG terminal facilities (*i.e.*, vessel berthing and off-loading facilities, LNG storage tanks, regasification plant, administration buildings and other associated facilities); and ability to avoid or minimize disruption of channel traffic while LNG vessels are in transit or at berth using the currently published security zones distance applicable to the Cove Point facility of 500 yards. 33 CFR § 165.502 and 503.

- Safety and Security. The selected site must be able to satisfy all applicable safety and security standards. As pointed out in the second criterion above, Distances from Residential Concentrations, it may be appropriate to consider going beyond the minimum safety and security standards established by the applicable regulations to facilitate community acceptance of the terminal.

- Site Acquisition. The ability of AES to gain site control in a reasonable and timely manner is an important criterion in selecting the terminal site as an appropriate location for the LNG Terminal. To meet the Commission's requirement that the applicant demonstrate site control before filing an application, the site must be available to AES (i.e., at open market commercial terms, without the need for extraordinary acquisition methods or condemnation required for site control).

- Environmental Impact. A siting criterion employed by AES is the ability to avoid or minimize potential impacts to the natural environment, cultural resources and stakeholders associated with the proposed Project. The information contained in Resource Reports 2 through 13 provides ample evidence that this criterion has been satisfied with the selection of the Terminal Site.

Consideration of the criteria noted above led to numerous site alternatives located both on and offshore within the Mid-Atlantic Region. Alternatives outside of the general geographic region were not considered feasible for the reasons described in Section 10.4.1, which described LNG terminal alternatives in the Gulf of Mexico and northeast areas of the United States. A discussion of the more important design features considered by AES, and a review of potential alternative offshore and onshore site locations based on these design features, is provided below.

10.5.1.1 Design Factors – Technical and Economic Feasibility

Deepwater Access

Of the design factors, the most important design factor considered by AES was site access to nearby deepwater port facilities. Without such access, the LNG ships required to bring the new source of natural gas to the Mid-Atlantic Region from world production centers could not unload their cargos. This would serve to frustrate the stated objectives of the Project. Dredging of any significant magnitude also presents the potential to seriously disturb or impair the human and natural environments in the vicinity of the dredging activities. [14] While other design factors (e.g., adequate constructible land, adequate air draft under bridges and distance from bridges, proximity to natural gas markets intended to be served by the Project and ability of the site to accommodate LNG terminal facilities) also have the potential to disturb or impair the human and natural environments, the impacts are considerably less than the impacts associated with significant dredging and are considered manageable. Accordingly, AES conducted a detailed review of vessel drafts and waterway depths.

Within the Mid-Atlantic Region, there are only two waterways with sufficient depth to potentially accommodate LNG vessel traffic for an onshore terminal: the Chesapeake Bay region and the

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for in-area projects. Resource Report 1, *General Project Description* (summary of the market to be served); and footnote 11, Section 10.4.2.

[14] It is recognized that dredging may also result in certain benefits to a particular waterbody. These situations occur where contaminated sediments may be safely and permanently removed and disposed of properly. See for example papers presented at ***"Environmental Forensics: Urban Ports & Harbors - Sediment Assessments in Complex Systems"***, conducted in Baltimore, Maryland on 26-27 September, 2006.

Delaware River region. The Chesapeake Bay region has shipping channel depths of 50 feet or more. The Delaware River region has shipping channel depths limited to 40 feet. In order to determine whether the limited depth of the Delaware River might impact the stated Project objectives, AES retained marine advisers to review the range of LNG transport vessels anticipated for use in connection with the Project and opine on the appropriate range of sizes that would provide the maximum flexibility with respect to supply source, both now and into the future.[15] Such vessels included both the existing world fleet of LNG ships and a limited number of larger vessels currently in design and/or under construction.

There are currently approximately 207 LNG carriers in service worldwide. These range in cargo carrying capacity from 1,100 m^3 to 149,172 m^3. A review of the current shipbuilding backlog indicates that there are currently 145 LNG ships on order (firm and options), out of which only four have a capacity less than 125,000 m^3. All four of those smaller ships are to be dedicated for Coastal and inter-Mediterranean trades. The remaining vessels on order have a capacity greater than 138,000 m^3. In light of this above trend, AES has designed the LNG Terminal to accommodate LNG carriers with a capacity ranging from 125,000 m^3 to 217,000 m^3. As outlined in Resource Report No. 1, the anticipated draft of vessels expected to call at the proposed AES LNG Terminal is anticipated to range from 37.7 to 40.5 feet.[16] AES believes that the use of smaller LNG carriers is not practical, as the current and aging fleet of small LNG carriers with a capacity less than 125,000 m^3 is heavily dedicated[17], and the vast majority of the proposed LNG carriers on order have a cargo carrying capacity greater than 138,000 m^3.

Figure 10.5.1-1 shows the distribution of the drafts for all of the vessels currently operating in the Atlantic Basin (except the seven vessels for which draft information was not available). It is important to note that the distribution shown below is also representative of the entire fleet of the currently operating LNG carriers in the above-referenced capacity range.

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[15] AES has not identified a supply source for the Project; neither does it own overseas natural gas reserves, liquefaction facilities, or a fleet of ships. Because it is not committed to any single source or supply, and its customer(s) will most likely receive supply from a new source due to long-term commitments of existing sources, additional consideration needed to be given to maintaining the maximum flexibility possible with respect to facility design. Should a new supply source commence operation, and should that supply source commit to build a fleet of vessels that required deeper drafts than the current fleet, AES would not be able to access that supply were it to build the LNG Terminal so as to accommodate only lesser draft vessels.

[16] Current plans exist for LNG ship designs up to 250,000 m^3 in cargo carrying capacity. AES eliminated ships larger than 217,000 m^3 in capacity for reasons similar to the rationale for not limiting the project to use of ships with capacities less than 138,000 m^3 – the distribution suggests that the widest possible use of the LNG Terminal will be made up of ships between the 125,000 m^3 and 217,000 m^3 classes.

[17] Energy Information Administration (EIA – 2001 to 2006) indicates that spot market shipment availability is only recently becoming available, primarily due to new ship construction, indicating subscription for existing fleet vessels (including smaller capacity ships) is full to nearly full.

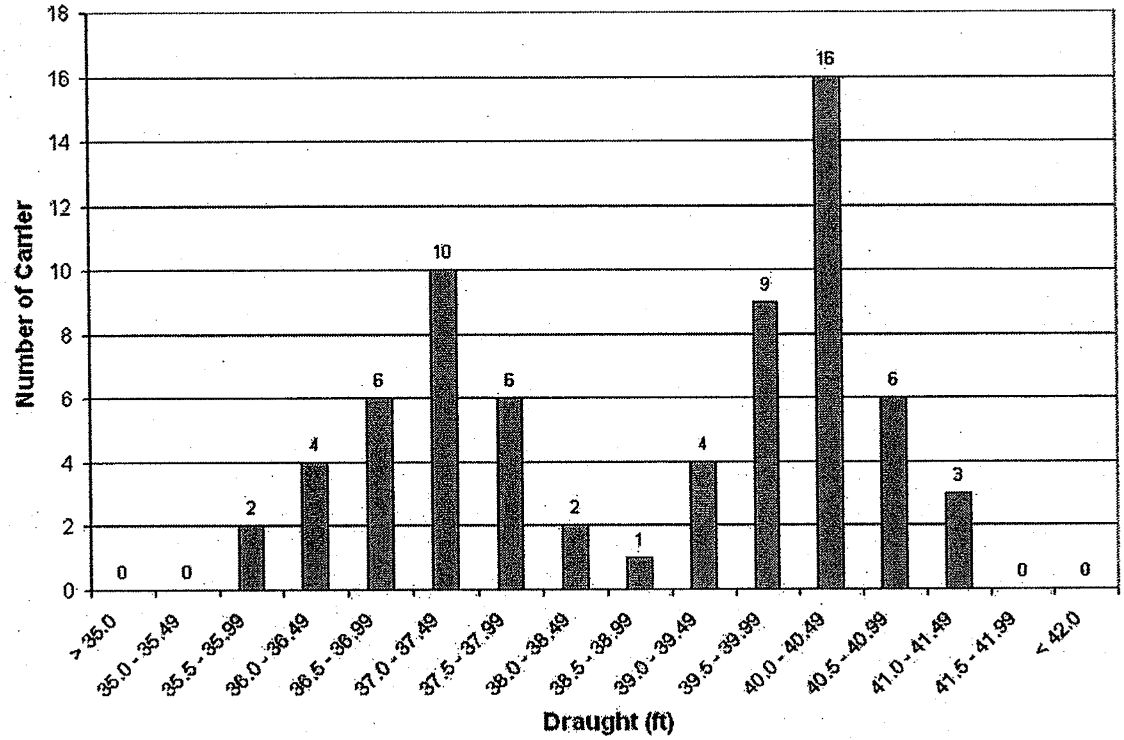

Figure 10.5.1-1 – Distribution of the Draft of LNG Carriers in the Atlantic Basin with a Cargo Carrying Capacity Greater than 125,000 m3

While it might appear that a vessel draft of 40.5 feet (12.3 meters), which is the deepest draft vessel proposed to call at the LNG Terminal, would fit within a 40 foot channel, this is not the case. The required navigational channel depth is a function of the static draft of the largest vessel expected to transit the waterway, squat, trim, vertical ship motion due to wave action, fresh water adjustment, under keel clearance, and tolerance for dredging and sounding accuracy. For security, economical and practical reasons, LNG carriers must be able to navigate at all tide conditions. As such, no tidal allowance must be considered in defining the required minimum channel depth (i.e., it cannot be assumed that a vessel will transit a waterway only at high tide). Table 10.5.1-1 shows, by way of example, the required minimum channel depth based on vessel transit speed to the proposed Crown Landing LNG terminal.

Table 10.5.1-1: Minimum Channel Depth Parameters for Safe Transit of LNG Vessels.

Parameters	Transit Speed (knots)		
	0 to 3.0 (1)	6 (2)	10 (3)
Static Draft	40.5	40.5	40.5
Squat	0	0.7	2.3
Trim	0	0	0
Exposure Allowance	0	0	0
Fresh water Adjustment	1	1	1
Under keel Requirement	3	3	5
Dredging Tolerance and Sounding Accuracy	0.5	0.5	0.5
Minimum Required Depth	45.0	45.7	49.3

Notes:

(1) Final approach to the terminal, turning, and docking

(2) Transit to the terminal while made fast to tugs
(3) Transit from the mouth of the Delaware to the proposed Crown Landing LNG terminal

According to the above, the minimum channel depth required for a slow transit speed is about 45.0 feet and 49.0 feet for a fast transit speed. Thus, a channel depth of 40 feet as available in the Delaware River would not be sufficient for Project purposes.[18] Note that drafts less than that required for a slow transit speed (i.e., during tug-assisted maneuvering and docking) are allowed. Given the discussion above, AES estimated that approximately 59.4 million yards of dredging would be required to obtain the required depth in the Delaware River to support the Project. This estimate is based on the current average depth of the channel of approximately 40 feet, that the required depth is 50 feet, and that the distance from the Brown Shoals to the Crown Landing facility is approximately 38 miles at a width of 800 feet. The 800 foot channel width is consistent with information provided in the Crown Landing FEIS at p. 3-34 (Crown FERC 2006).

Disruption of Maritime Traffic

Another important design factor considered by AES was the ability of the site to avoid disruption of maritime recreational and other commercial traffic while LNG vessels are in transit or at berth. AES has held meetings to discuss potential impacts associated with the proposed project with the Maryland Department of Natural Resources (DNR) Tidal Fisheries and Sport Fish Advisory Commissions, and with three fishing associations: the Maryland Waterman's Association, the Maryland Saltwater Sport Fisherman's Association and the Upper Bay Charter Captains Association. These three associations were selected in an effort to cover the range of fishing that takes place in the Chesapeake Bay – commercial, recreational and charter boat. The organizations expressed several common concerns, the most significant being the impact of a moving security zone that might impact their activities, alleged overly aggressive enforcement of the existing security zone at Cove Point by the USCG, and the fear that the same aggressive enforcement policies would be applied in the upper portions of the Chesapeake Bay. AES is currently working in conjunction with the USCG to develop LNG vessel transit schedules and security zones that would provide the maximum amount of protection for LNG vessels, while at the same time minimizing disruption to commercial and recreational traffic. Different approaches to establishing and enforcing a moving security zone around inbound LNG tankers were explored in an effort to accommodate as many waterway users as possible, without lessening security to an unacceptable degree. The potential strategies, including modified arrival schedules and modified moving security zones for LNG vessels, fall under the jurisdiction of the USCG. The ultimate strategies to be applied to the Project will be determined through the Waterway Suitability Assessment (WSA) process, which is further described in Resource Report 11, Reliability and Safety.

In a proactive effort to minimize disruption to communities and commercial and recreational vessel traffic, AES sought out a vessel transit route that would allow an LNG ship to maintain a minimum one mile distance from populated shore areas during transit and while at berth. Additionally, AES sought a berth site where the anticipated fixed security zone that will be enforced around the berthing area would not impact other vessels transiting the main shipping channels.[19] By locating the berthing area far from the designated transit routes, i.e., more than 500 yards, impacts to deeper draft vessels, including both commercial and recreational, will be minimized. The qualitative assessment of this design factor led to the same conclusion as the assessment of the need for deep water access for an onshore facility – the Chesapeake Bay is the only water body within the general vicinity of the Mid-Atlantic Region capable of accommodating the objectives of the Project.

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[18] According to NOAA/US Department of Commerce Navigation Chart No. 12312, the dredged depth for the navigation channel in the Delaware River is 40 feet, which is significantly less than the required minimum depth.
[19] While, as noted above, standoff distances around the LNG Terminal berth will ultimately be determined by a quantitative review performed by the USCG during the WSA process, AES performed this initial qualitative assessment using the currently published security zone for the Cove Point terminal of 500 yards to try to locate a terminal location that would minimize impacts to passing vessel traffic while the LNG vessels slow in their approach to the berth, while they are at berth, and after they leave the berth (assuming the security zone is fixed at all times ships are at berth, to the maximum extent practicable).

Conclusions Regarding Design Factors

Even if it were technically, economically and environmentally feasible to undertake the dredging required to access sites within the Delaware River region, AES determined that no site within this region would be capable of satisfying its other selection criteria, principally the ability to locate the site and conduct LNG vessel transit one-mile distant from residential communities and other population centers, and to minimize impact to other vessel traffic while at berth. In addition, AES is unable to determine whether it could obtain site control for any acceptable site in this region on acceptable terms. For these reasons, AES eliminated those sites within the Delaware River area from its alternatives evaluation, leaving for further consideration alternative sites within the Chesapeake Bay area.

10.5.1.2 Offshore LNG Terminal Sites

AES evaluated the feasibility of siting an LNG import terminal at a deepwater location offshore from the Atlantic Coast within the Mid-Atlantic Region. Such siting would be compatible with the range of LNG vessels intended for use in the Project.

AES estimates that construction and operation of an offshore LNG terminal within the open Atlantic Ocean of the Mid-Atlantic Region would be extremely difficult due to the wind, wave and current patterns experienced in this area. Extreme meteorological and oceanographic forces would result in a shortened construction season and anticipated, but unpredictable, setbacks due to weather. High wind, wave and strong current patterns would interfere with safely berthing and mooring LNG carriers and off-loading LNG, resulting in lost productivity and deliverability. Furthermore, damage from severe storm events to the LNG terminal and associated offshore pipeline would further complicate operation and introduce potential impacts to the environment. These concerns are especially pronounced in the winter season when storms (other than hurricanes) in the Atlantic Ocean are more severe. Because natural gas demands peak in the winter months, such severe weather would negatively impact the predictable, constant flow of natural gas to the intended markets.

Offshore locations within the Mid-Atlantic Region would also require construction of a lengthy offshore and onshore pipeline system to reach the Project's intended markets. Therefore, with certain limited exceptions, such a terminal location and pipeline system would not be considered a commercially viable alternative to the Project. [20]

Potentially feasible offshore exceptions within the Mid-Atlantic Region (i.e., offshore locations reasonably proximate to existing onshore or offshore natural gas pipeline systems) are those off of the south shore of Long Island and within the Long Island Sound. Locations off the south shore of Long Island are exposed to the Atlantic Ocean; thus, these locations likely would present the same wind, wave and current concerns noted for other offshore locations within the Mid-Atlantic Region. Long Island Sound, by comparison, is relatively sheltered from those meteorological conditions characteristic of the open Atlantic Ocean. However, to meet the stated objectives of the proposed Project, use of the Long Island Sound offshore alternative would require construction of a lengthy offshore and onshore pipeline system to reach the Project's intended markets. [21] Therefore, such a terminal location and

[20] In order to maintain the commercial viability of the Project, AES considered a pipeline length of 100 miles to be reasonable. See Resource Report 1, *General Project Description,* for definition of these elements. In comparison with the various transcontinental pipelines described above in Section 10.3.2, the 100-mile send-out pipeline scenario would have substantially smaller relative landowner and environmental impact. Siting of an offshore LNG facility would require several miles of offshore pipeline to reach shore (it would be reasonable to assume offshore siting distances in the range of 7 to 13 miles consistent with the siting of Northeast Gateway and Neptune mentioned above). In addition, the distance of an onshore pipeline route needed to reach the same interstate pipeline systems as will be served by the proposed Project is a minimum distance of approximately 100 miles inland. The combined environmental impact and disturbance to land and property owners on this combined length of off shore and onshore route can be reasonably concluded to be greater than that of the proposed Project.

[21] An offshore terminal in Long Island Sound would necessitate construction of a more lengthy natural gas pipeline that would extend from the offshore location (about 10 miles) to the onshore interconnection points (about 175 miles), thereby increasing the potential landowner and environmental impacts associated with construction and, as noted above, decreasing the economic viability of the Project.

pipeline system would not be considered a commercially viable alternative to the Project. Further, as described in more detail below with reference to the Broadwater Energy LNG Facility, connection to the more reasonably proximate pipeline systems near Long Island Sound still would not serve the intended market objectives of the Project.

Broadwater Energy filed an application with the Commission to site, construct and operate an LNG import terminal in Long Island Sound (January 2006) and a Final Environmental Impact Statement was issued November 17, 2006. That project proposes to serve natural gas markets in New York, New Jersey, and Connecticut through an interconnection with the existing Iroquois Gas Transmission System. These markets are located substantially farther north of those intended to be served by the Sparrows Point Project. Because Broadwater is located in a downstream market (i.e., Long Island Sound) it would be able to provide service only to certain markets that are within the defined market segment intended to be served by the Project (i.e., New York and New Jersey). It could not also serve markets that are at the southern limits of the defined market analyzed by AES, such as North Carolina. To set realistic boundaries on the market demand analysis, certain reasonable assumptions were therefore made regarding markets and supply sources in the CEA report.

AES also considered the feasibility of siting an LNG terminal at an offshore location within the Chesapeake Bay. However, if sited within an existing deep water channel, AES determined that such an alternative location could have a significant adverse impact on commercial maritime, recreational, and commercial and recreational fishing vessel traffic within the Bay, due to the safety and security zones that likely would apply to the offshore terminal location. [22] Outside of the main deepwater channel located in the center of the Chesapeake Bay, the Chesapeake is a shallow estuary with an average depth of approximately 21 feet (Chesapeake Bay Foundation 2006). A location within the Bay, but outside of an existing deep water channel, at a distance greater than 500 yards from the existing deep water channel for the security buffer, and north of the southernmost onshore alternative sites described in Section 10.5.1.2, was also eliminated from further consideration due to the need to undertake significant dredging to accommodate the anticipated draft of the LNG transport vessels and the proximity to population centers. The only other locations within the Bay wide enough to avoid significant impacts to vessel traffic when considering the applicable safety and security zones would be those located farther south than the proposed Terminal Site. Such locations would add significant length to the natural gas send-out pipeline, thereby increasing the potential environmental impacts associated with construction and decreasing the economic viability of the Project.

Based on the above considerations, AES concluded that an offshore terminal location, whether sited along the Mid-Atlantic seaboard or within the Chesapeake Bay, would not be a feasible alternative to the proposed Terminal Site.

10.5.1.3 Onshore LNG Terminal Sites

As noted above, AES determined that the only sites sufficiently proximate to the natural gas markets that the Sparrows Point Project is intended to serve, while providing a waterway having sufficient depth and capacity to accommodate LNG vessel traffic, would need to be located in the Delaware River or Chesapeake Bay regions. Upon further investigation, AES determined that the depth of the approach waterways in the Delaware River, and the narrowness of the Delaware River shipping channel to population centers, effectively ruled out any alternative site location within that area. Accordingly, AES limited its search of alternative onshore sites to locations within the Chesapeake Bay.

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[22] AES assumed a minimum safety and security zone of 500 yards around such offshore terminal facility. If the facility were placed within the existing deepwater channel the safety and security zone would effectively prohibit vessel traffic in the channel. However, vapor exclusion zones would need to be calculated to determine how far downwind natural gas vapors or a cloud could travel from an offshore LNG facility and still be flammable, which may be a greater distance than the assumed 500-yard safety and security zone.

Alternative Onshore Sites

Within the Chesapeake Bay area, AES identified several alternative locations to the Terminal Site for further evaluation, including: (1) two sites near Cove Point, Maryland; (2) Greenbury Point; (3) Fishing Point and other sites within the Baltimore Inner Harbor; (4) Swan Creek immediately south of the Key Bridge; (5) Kent Island; and (6) an alternative Sparrows Point peninsula site (Mittal Steel site). Each of these alternative onshore site locations is discussed below. Figure 10.5.1-2 identifies the locations of the proposed alternatives.

The analysis was conducted using existing resource information available on United States Geological Survey (USGS) 7.5-minute series topographic quadrangle maps; Maryland Geographic Information System (GIS) data layers; other available federal, state, and county resource maps; recent high resolution aerial photography; and unmapped data. The analysis focused on an evaluation of terminal site proximity to population centers, as well as factors applicable to a send-out pipeline, including route length, feasibility of using existing corridors, need for crossing existing transportation features, the presence of wetlands and waterbodies, threatened and endangered species and significant habitat, land uses and vegetation cover types, the presence of federal and state lands, and several other special land uses. A tabular summary of this analysis is included within Table 10.5.1-2: Comparison of Proposed LNG Terminal Location and Seven Alternative Locations for the AES Sparrows Point Project.

Locations for the AES Sparrows Point Project:

Proposed Sparrows Point Site

As compared to each of the alternative onshore sites, the proposed Terminal Site is located relatively distant – more than one mile – from the nearest residential community, but still within an industrially-zoned port area that is fully capable of supporting the facilities and vessel traffic proposed by AES (Figure 10.5.1-3). The separation distance of over one mile is maintained along the entire LNG vessel transit route up to the Terminal Site. In addition, the proposed Terminal Site is capable of satisfying all federal safety and security requirements applicable to the design, construction and operation of LNG terminal facilities and transit of LNG vessels. Construction of the LNG Terminal within an existing industrialized area will avoid and minimize the potential environmental impacts associated with the Project. Further, the relatively close access to an existing well-maintained, deep draft shipping channel will minimize potential impacts associated with additional dredging that is needed to accommodate the range of vessels being considered by AES for delivery of LNG to the proposed Terminal Site.

Finally, consideration was given to the environmental and economic feasibility of routing the Pipeline from the alternative LNG terminal sites to the intended interconnection points. The proposed Terminal Site, by comparison to the alternative sites considered, provides superior access to existing utility ROWs, and thereby would minimize the potential landowner and environmental impacts associated with construction of the Pipeline required to connect the LNG Terminal to both the local and the interstate natural gas pipeline grid. For these reasons, AES determined that the proposed Terminal Site at Sparrows Point, relative to any of the alternative terminal sites, would provide the most favorable location for the Project.

Two Sites Near Cove Point, Maryland

AES evaluated the area in the vicinity of the existing LNG terminal at Cove Point, Maryland to identify an alternative location that would satisfy its siting criteria. Specifically, AES was able to identify two locations north of Cove Point that have limited industrial zoning designations and for which the distance between the shipping channel and the shoreline is one mile or greater: (1) the existing Dominion Cove Point LNG terminal facility; and (2) the Calvert Cliffs Nuclear Power Plant. Figure 10.5.1-4 identifies the locations, zoning designations and key features (e.g., residential areas and shipping channel) for Calvert Cliff's Nuclear Power Plant, and Figure 10.5.1-5 identifies the same for the Dominion Cove Point alternative.

The existing Dominion Cove Point LNG terminal site would not satisfy several of AES's screening criteria (Table 10.5.1-2: Comparison of Proposed LNG Terminal Location and Seven Alternative Locations for the AES Sparrows Point Project). AES would be unable to maintain a distance of at least one mile between its onshore LNG storage tanks and the closest residential communities (the nearest residential communities are located less than one-third of a mile from the existing Dominion Cove Point LNG storage tanks). In addition, unless AES were to construct an offshore unloading platform similar to the existing Cove Point facility, along with all the accompanying environmental impacts associated with the construction and maintenance of such a structure, the final transit location of the LNG vessels would also be within approximately one-third of a mile from residential areas. The Cove Point unloading facility is approximately the same distance to residential areas as the onshore unloading facilities proposed by AES as part of the Sparrows Point Project. Finally, collocation of the Project adjacent to the Dominion Cove Point LNG terminal facilities also would result in greater potential environmental impacts as compared to the proposed Terminal Site because of the significantly longer length of the pipeline that would be required to reach the terminus point near Eagle, Pennsylvania, the absence of an existing utility corridor in this area through which the pipeline could be routed, and the need to clear undeveloped land to support the terminal facilities.

The existing Calvert Cliffs Nuclear Power Plant site is located approximately one mile from the closest residential communities, though any collocated LNG terminal facilities would be sited within this one-mile separation distance (Table 10.5.1-2: Comparison of Proposed LNG Terminal Location and Seven Alternative Locations for the AES Sparrows Point Project). This factor fails to satisfy AES's site screening criteria. In addition, this site also would require the use of a significantly longer length of pipeline (147.7 miles required to interconnect near Eagle, PA) and lacks availability of an existing utility corridor. In addition, the Calvert Cliffs Nuclear Power Plant owner has announced plans to expand its facility. The Board of County Commissioners (BOCC) for Calvert County voted to enter into an Agreement with Constellation Generation Group, LLC (CGG) that could add a third reactor at the Calvert Cliffs Nuclear Power Plant. Calvert Cliffs Nuclear Power Plant currently houses two nuclear reactors that came online in 1975 and 1977. The facility was originally designed for four reactors. Finally, AES does not anticipate that it would be able to obtain site control in this location within a reasonable and timely manner.

On the above bases, the two alternative sites located near Cove Point, Maryland were determined to be significantly less preferable than the proposed location at Sparrows Point.

<u>Greenbury Point</u>

AES evaluated the feasibility of siting its proposed LNG terminal facilities at Greenbury Point on the north side of the mouth of Severn River (Table 10.5.1-2: Comparison of Proposed LNG Terminal Location and Seven Alternative Locations for the AES Sparrows Point Project). This alternative location was determined to be significantly less preferable to the proposed Sparrows Point location because of the proximity (approximately less than 0.5 miles) of Greenbury Point to the closest population centers (this site is zoned for residential use), the need to construct a significantly longer natural gas pipeline (107.5 miles required) to reach the terminus point near Eagle, PA (thereby increasing the potential environmental impacts associated with construction of the Project), and the more remote location of this site from the Chesapeake deep water shipping route (greater than a three-mile distance), which would require a greater area affected by dredging. AES also determined that Greenbury Point's relatively close proximity to an existing Naval Air Station (1,100 feet to the west-northwest) and Naval anchor zones (4,200 feet to the west) likely could present potential conflicts with U.S. military installations and operations. Figure 10.5.1-6 identifies the location and key features of the Greenbury Point alternative site.

<u>Fishing Point and Other Sites Within the Baltimore Inner Harbor</u>

AES evaluated an alternative site in an existing industrialized area north of the Key Bridge at Fishing Point, which is situated on the north side of Curtis Bay. Figure 10.5.1-7 identifies this alternative site location and key site features.

AES determined that this site would be significantly less preferable to the proposed Terminal Site because transit of LNG vessels within the Baltimore Inner Harbor would have a greater impact on commercial and recreational vessel traffic and require substantially more dredging (Table 10.5.1-2: Comparison of Proposed LNG Terminal Location and Seven Alternative Locations for the AES Sparrows Point Project). Further, the Pipeline would need to be routed through highly congested areas within the City of Baltimore (thus increasing potential landowner impacts), and the overall length of the Pipeline would be longer in order to reach the terminus point near Eagle, PA (thus increasing construction-related impacts). Additionally, installation of the gas pipeline across the main shipping channel to the port of Baltimore at a depth that would avoid impact to maintenance dredging, potential expansions by the port, and shipping traffic during construction, cause this alternative to be cost prohibitive and technically not feasible. While the terminal would be located approximately 1.2 miles from the nearest residential communities, by necessity the turning basin would bring LNG vessels within 3,500 feet of the nearest residence. The factors described above have eliminated the Fishing Point site from further consideration.

The potential sites in areas north of the Key Bridge were eliminated generally from further consideration because such sites were (1) occupied by BG&E facilities, (2) slated for future expansion by the Port of Baltimore or (3) occupied or slated to be occupied by other commercial or industrial users. In other words, AES could not obtain site control at these potential alternative locations.

Swan Creek

The Swan Creek site, which is located in an existing industrialized area south of the Key Bridge and across the deep water channel from the proposed site at Sparrows Point (i.e. south of Hawkins Point and north of Cox Creek), was determined to be significantly less preferable than the proposed Terminal Site at Sparrows Point for the reasons set forth below. Figure 10.5-8 identifies this alternative site location and key site features. Table 10.5.1-2: Comparison of Proposed LNG Terminal Location and Seven Alternative Locations for the AES Sparrows Point Project, summarizes the siting criteria of this alternative.

The alternative Swan Creek site is located less than one mile from the closest residential communities. At this location, AES would need to locate its proposed berthing facilities in an area that would require greater dredging to avoid potential interference with shipping traffic in the channel (in this area, the distance from the Brewerton Channel is approximately 1.2 to 1.3 miles, and water depth is more shallow than that along the Sparrows Point marine channel). Extensive filling of wetlands (approximately 6.3 acres required) also would be required to accommodate the LNG Terminal facilities, which may interfere with the Maryland Port Authority's long-term dredge disposal plan that is being implemented. This site would require construction of a longer natural gas pipeline (91.3 miles required to access the Eagle, PA interconnections) that either would have to be routed through highly-congested areas to the south and west, or would require crossing of the Patapsco River in order to follow a route similar to the proposed route for the Sparrows Point site.[23] Even if the Pipeline were routed across the Patapsco River, the Pipeline would need to be installed at a depth and with a sufficient buffer on either side of the River to accommodate future deepening and widening of the River. Such a crossing likely would span several miles in length, and could not be completed using horizontal direction drill methods because of its length and depth. If the crossing were completed using conventional methods, construction of this segment of the pipeline would have considerable potential impacts on commercial and recreational traffic, in addition to increased environmental impact. The Swan Creek site thus was considered to be a significantly less preferable alternative to the proposed Sparrows Point site.

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[23] As indicated earlier in this Resource Report, interconnect locations near Eagle, Pennsylvania comprise the interstate pipeline tie-in locations in order to serve the target market of the Project. Siting an LNG terminal south of Sparrows Point, will increase the pipeline distance necessary to reach the same interconnection endpoints. Unless such a pipeline were to route through a water crossing of the Patapsco River (which adds approximately 2 miles of pipeline length, assuming environmental approvals could be obtained for such a crossing), the minimum length of pipeline added would be on the order of five miles (for a site at Fishing Point) to 20+ miles (for a site near the Patapsco-Chesapeake confluence) to reach a potential pipeline corridor from near the City of Baltimore and west of the Patapsco River/Port of Baltimore, then north to target interconnect locations. Connection with the Baltimore Gas and Electric (BG&E) local distribution system would still be feasible within this hypothetical route, however the remaining take-away capacity would not be feasible without the interconnect locations near Eagle, Pennsylvania, therefore the total length would be on the order of the 88-miles of the proposed Project, plus a minimum of 5 to 20 miles of additional pipeline length from the area south of Sparrows Point.

Kent Island

AES evaluated an alternative site located on the north end of Kent Island on the eastern side of the Chesapeake Bay. Figure 10.5.1-9 identifies this alternative site location and key site features.

This site also was eliminated from further consideration because the site is located relatively close (approximately less than 0.5 miles) to the nearest residence, and the size of the existing industrial zoned area is not sufficient to accommodate the proposed LNG terminal facilities, meaning that AES would need to obtain an industrial zoning designation for adjacent land (Table 10.5.1-2: Comparison of Proposed LNG Terminal Location and Seven Alternative Locations for the AES Sparrows Point Project). For these reasons, the Kent Island alternative was determined to be significantly less preferable than the proposed site at Sparrows Point.

Alternative Sparrows Point Site - Mittal Steel

AES investigated the possibility of siting its proposed terminal and berthing facilities at certain locations further south along the Sparrows Point peninsula, each of which currently is owned by Mittal Steel USA (Mittal). Figure 10.5.1-10 identifies this alternative site location and key site features. Table 10.5.1-2: Comparison of Proposed LNG Terminal Location and Seven Alternative Locations for the AES Sparrows Point Project, summarizes the application of AES's siting criteria to this alternative. AES determined that it could not obtain site control in these locations in a reasonable and timely manner because of ongoing corporate strategies at Mittal and its parent company that affect site ownership. Specifically, Mittal acquired the property from International Steel Corporation (ISC) in 2005, [24] and has been working since that time to coordinate the Sparrows Point operation into the operations of the larger company. In early 2006, a new plant manager was appointed. Then, in June 2006, Mittal officials announced that it had begun to showcase the steel mill to potential buyers, believing that it might have to sell the plant for antitrust reasons arising out of a takeover conflict for its biggest global rival, Arcelor SA. In July 2006, Mittal announced that it had successfully taken over Arcelor after a five-month battle. On September 27, 2006, Mittal announced that it planned to sell another mill rather than Sparrows Point if it were to be compelled to dispose of a property located in the United States to settle antitrust issues; however, the Justice Department must sign off on which plant is sold and to what buyer.

Given the ongoing corporate activities at Mittal, the uncertainty as to the timing of the resolution thereof, and the uncertainty as to the timing of (or even any expression of interest in) negotiations with AES for site use or acquisition, AES would not be able to demonstrate site control as required by Commission regulations for submittal of its application.

In addition to the ongoing corporate activities at Mittal, AES also understands that the State of Maryland is evaluating the feasibility of using a portion of the Mittal site for future dredged material placement activities in support of a long-term dredged material management plan and possible future marine terminal facilities for the Port of Baltimore. Such evaluation has been ongoing for more than 10 years. While dialogue with community, recreational, and environmental stakeholders to address a variety of issues is ongoing, no decision on this possible use of Sparrows Point is expected in the near future. Any decision to pursue Sparrows Point as a dredged material management project would initiate the multi-year NEPA process.

For the reasons provided above, location of the LNG Terminal and berthing facilities further south along the Sparrows Point peninsula is not considered to be a viable alternative for the proposed Project.

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[24] ISC bought the site in 2003 from Bethlehem Steel Corporation (BSC) in a bankruptcy proceeding that was initiated by BSC in 2001.

10.5.2 Terminal Design Alternatives

10.5.2.1 Pier Designs

AES originally considered a pier design that would require installation of pipe cylindrical piles that would support a concrete deck and unloading platform. The pier would extend approximately 1,000 feet from the shoreline and would require additional piles for mooring and breasting dolphins to moor the ships. Upon review of public and agency comments and consideration of potential environmental impacts, the pier design was changed to utilize an existing structure, Pier 1, thereby eliminating the need for installation of additional piles for the pier or the breasting and mooring dolphins. The locations of the proposed (preferred) and alternate pier locations are shown on Figure 10.5.2-1. A more detailed description of the proposed pier design is included in Resource Report 1, General Project Description. A discussion of the relative merits of the alternate pier designs is set forth below.

Preferred Design:

Advantages associated with the preferred pier design and location includes the following:

- The preferred pier design location will dramatically reduce the quantities of dredge material. AES estimates that the total dredge quantity will be reduced by approximately 1.7 million cubic yards to approximately 3.8 million cubic yards from the Alternate Pier design, which translates to overall less potential environmental impact while dredging and greater economic viability.

- The existing pier structure will need only to be resurfaced and existing piles repaired. Additional piles into the water bottom will not be required; therefore, there will be no permanent bottom impact caused by driving piles for the pier or dolphins.

- Security buffers at Pier 1 are provided by Pier 3. The existing Pier 3 essentially acts as a screen that prevents small craft from having access to the ships. The screen provided by Pier 3 also allows for better overall security of the ship while it is berthed.

- Environmental operating conditions are improved as this location provides for better shelter from environmental conditions, such as wind and wave action, which ultimately increases the berth availability of this location.

- Cost effectiveness is enhanced due to reduced dredging and lower overall construction costs of building a pier from scratch.

- A significant amount of wet bottom will be re-established as AES demolishes and removes Pier 2 in order to accommodate the vessels on the northern side of Pier 1.

There are also certain real or perceived disadvantages associated with the proposed location of the LNG pier as compared to a location further away. Perceived disadvantages associated with the preferred design include the following:

- The preferred design is located closer (approximately 5,808 feet from the nearest residence in Turner Station) to residential populations than the Alternate Pier design; however, the distance is still in excess of the one-mile guidance used by AES in its site selection criteria. The closest point of the turning basin associated with the proposed pier is located 4,950 feet from the nearest residence in Turner Station; however, the nearest residence in Turner Station to the bow of an LNG ship in the turning basin would still be 5,600 feet.

- Security control may be perceived to be lessened while ships are at the berth because the preferred location is closer to Pier 3, which is not anticipated to be controlled by

AES. This concern is mitigated by the fact that the security control or potential threats are not likely to change based on the slightly closer distance. Also, it is expected that the entire Sparrows Point peninsula will be an International Ship and Port Security code ISPS port facility and subject to similar safety procedures used by the LNG terminal.

- The preferred pier location is closer to Bear Creek, which may have some impact on deep-draft recreational/commercial boats should these vessels be required to transit outside of the security zone while the LNG vessels are maneuvering. In conjunction with the USCG, AES will establish a fixed security zone around the marine side of the Terminal Site that will offer the maximum level of protection for the LNG Terminal and minimize the potential for impacts to commercial and recreational vessel traffic. At this time it is not anticipated that the fixed safety/security zone will impact commercial and recreational traffic utilizing the Bear Creek entrance channel. However, the moving safety/security zone that will be established for loaded LNG ships in transit may have a temporary impact on deeper draft recreational or commercial vessels during incoming maneuvering operations in the proposed turning basin, depending on the size of the safety/security zone as determined by the USCG.[25] The incoming maneuvering operations are anticipated to last approximately 45 minutes based on real-time simulations performed for vessel transit evaluation from the Brewerton Channel to the dock at the LNG Terminal. Because the safety/security zone moves with the vessel, the potential disruption to deeper draft commercial or recreational vessel traffic transiting to or from Bear Creek (depending on the size of the zone as determined by the USCG) would be much less than the full transit time.

<u>Alternate Pier</u>: This is a pier located at the site in between Pier 1 and the Graving Dock. Advantages associated with the Alternate Pier design include the following:

- Location central to Terminal Site would allow for a shorter overall length of the unloading and vapor return lines. This would be an economic advantage.
- This design would have the pier located approximately 6,608 feet from the nearest residence in Turner Station. Because the preferred design also maintains a separation distance greater than one mile, this advantage was not considered to be significant. The closest point of the turning basin associated with this alternative is located 6,000 feet from the nearest residence in Turner Station, and the closest point in Turner Station to the bow of the LNG ship would be 6,400 feet.
- The Alternate Pier design contemplated removal of some of the finger piers along the shoreline. This would provide for establishment of additional wet bottom. Because the preferred design also contemplates the removal of approximately the same square footage by dismantling Pier 2 as the finger piers, this advantage is negated when comparing to the preferred design.
- Environmental operating conditions, such as wind and wave action, are generally favorable at this location, which ultimately increases the berth availability of this location, but they are slightly less favorable than the preferred location due to Alternate Pier's closer distance to more open water.

Disadvantages associated with the Alternate Pier design of the LNG pier include the following:

- The Alternate Pier location and design would require higher quantities of dredging than the preferred design (estimated quantities of dredging required for this design are 5.5 million cubic yards). Additional dredging would lead to additional bottom impact

[25] The safety/security zone restrictions only apply when the LNG vessel is loaded. Thus, when the vessel departs from the LNG Terminal, no restrictions will apply.

during construction from dredging, recycling process, temporary storage and transportation to a final disposal area.

- Installation of a new pier as contemplated by the Alternate Pier design would require installation of new piles to support the pier. Approximately 340 piles with an expected permanent bottom impact of 3,060 square feet would be required for installation of the pier, platform and dolphins. This additional permanent bottom impact compares quite unfavorably to no bottom impact (or positive bottom impact if accounting for the removal of Pier 2) associated with the preferred design.

- Site access to the pier due to the location of the pier in the center of the Terminal Site is more difficult than the preferred design. Such location would require that most maintenance work be performed off of barges. Due to the central location of the alternate pier alignment and proximity to the flood wall and LNG tank area, AES would have to design an access road to the pier over the top of the flood wall and down to the pier elevation. Because there is less than half of the area to accommodate such an access way compared to the preferred design, the access way would need to be made very narrow in comparison. The narrow access way and rather steep incline would limit vehicle access to the pier from the shore. Therefore, the majority of the maintenance required on the pier systems would need to be performed by using a barge as a working platform. This would increase the overall cost of maintenance as well as duration of the maintenance period. Although the preferred pier layout does not totally eliminate the need to perform barge maintenance on some pier systems, the design greatly enhances the ability to access pier systems from the shore using more conventional work equipment due to the width of the access way and gradual elevation change from the site road ways to the pier.

- The cost of the additional dredging and associated reclamation, as well as the capital cost for this installation, makes this option the more expensive option considered.

10.5.2.2 Regasification

Preferred Design

The preferred option for regasification methods involves the use of steam from a boiler to warm an intermediate High-Temperature Fluid (HTF) that will be circulated through a shell and tube vaporizer used to vaporize the LNG.[26] A schematic diagram of this process is shown in Figure 10.5.2-2. Advantages inherent in this design include the following:

- Operation. The preferred design allows ease of operation and transfer of heat into the LNG at relatively high efficiencies.

- Emissions for this process can be easily controlled and minimized to the lowest achievable levels using existing proven technology.

- The preferred design allows for the integration of other heat sources into the vaporization loop with little or no impact on the current operation. Additionally, this system allows for the addition and integration of the combined cycle cogeneration Power Plant, presently being considered by AES, which will produce power using the natural gas that would have been used in the boilers. Natural gas consumed in the Power Plant produces waste heat that may be used in the LNG vaporization cycle and generates needed power for the area, thereby improving the overall efficiency of both operations with little to no increase in overall environmental impacts. The Power Plant is consistent with the policy underlying the Maryland Healthy Air Act of 2006, which mandates reductions from certain units at existing coal-fired power plants of carbon

[26] The HTF is expected to be a mix of ethylene glycol.

dioxide (10 percent cut by 2018), sulfur dioxide (83 percent cut by 2010, and 90 percent by 2015), nitrogen oxides (67 percent cut by 2010 and 80 percent by 2015), and mercury (90 percent cut by 2010). Natural gas plants typically emit 43.7 percent less carbon dioxide, 99.6 percent less sulfur dioxide, 79.8 percent less nitrogen oxide, and 99.7 percent less particulates than coal plants. As more electric power is needed in congested areas of growing demand (such as this area of Baltimore), clean-burning options such as those summarized here are environmentally preferred over options with higher air emissions. Accordingly, whether the potential Power Plant displaces existing power generating sources or meets a portion of the increasing demand in the area, net air emissions will be less than would be experienced were a generating option with higher air emissions to fulfill that same demand.

- Intermediate fluid loop. There is an intermediate loop of HTF that provides for additional protection from freezing of the vaporizers and also provides another system barrier between the LNG and other plant processes.

There also are certain disadvantages associated with the use of steam from a boiler to warm an intermediate fluid that would be circulated through a shell and tube vaporizer used to vaporize the LNG. Perceived disadvantages include the following:

- Efficiency. Initial efficiency of this operating cycle might be lower than those presented as alternates; however, the longer term integration with the combined cycle facility far outweighs any options presented in terms of overall emissions and cycle efficiencies.

- Ease of operation. The preferred design is slightly more complicated than the other alternatives presented but not so much that it creates an impediment to overall plant safety and reliability.

Emissions are presented below in Table 10.5.2-1 for comparison.

Table 10.5.2-1 Emissions Associated with Alternative Regasification Methods

Option #	Technology	Emission Controls	Annual NOx Emissions (TPY)
Preferred	Steam Boilers	Low NOx Burners, Flue Gas Recirc, SCR	23
1a	Submerged Combustion Vaporizers	Conventional NOx Design	167.5
1b	Submerged Combustion Vaporizers	Low NOx Burners	54
2a	Gas Fired Heaters	Conventional NOx Design	175.5
2b	Gas Fired Heaters	Ultra Low NOx	56
3	Sea Water Vaporization	N/A	0*

* Due to cold seawater temperature, supplemental heating would be required during cold months of the year; this table does not reflect NOx emissions associated with impacts from these differing emissions.

Alternative 1 (a & b): Submerged Combustion Vaporizers (SCV)

This system uses a burner to discharge heat from combustion directly into a water bath. A schematic diagram of this process is shown in Figure 10.5.2-3. The water bath is the medium to transfer heat to the submerged LNG heating coil. Once the exhaust gases have transferred their heat to the water bath they are exhausted out the stack. The water bath continually transfers heat from the warmed water to the heating coil thereby heating the LNG and causing a phase change from liquid to gaseous state. The use of SCV offers certain advantages and disadvantages as set forth below. Considering all factors, AES has determined that the disadvantages outweigh the advantages when compared to the preferred method of vaporization.

Advantages:

- Simple operation. Use of the SCVs allows for easy integration with the cycle to vaporize LNG. As a result, operation of these units is fairly common in the LNG industry.

- High efficiency. The SCVs have a relatively high efficiency rating that is slightly greater than that available from the preferred option.

Disadvantages:

- The environmental impacts associated with the SCVs are greater due to the fact that overall air emissions cannot be controlled as well as in the case of the preferred option using existing proven technology. This would lead to an overall increase in annual air emission levels at the Terminal Site to vaporize the same quantity of gas.

- The discharge system generates an acidic waste stream that needs to be neutralized prior to discharge, which increases overall maintenance requirements on the equipment.

- Integration. The system does not integrate with The AES Corporation's potential future plans to build the cogeneration Power Plant, which means that the SCVs will be required to vaporize gas regardless of whether or not the cogeneration Power Plant is operating. The LNG Terminal would not be able to take advantage of waste heat from the cogeneration Power Plant cycle. This would increase overall emissions on an annual basis and reduce efficiency overall.

Alternative 2 (a & b): Gas Fired Heaters (GH)

This system uses a closed loop circulating HTF system for transfer of heat from a gas-fired heater directly to the HTF. A schematic diagram of this process is shown in Figure 10.5.2-4. The HTF is circulated through the vaporizer where it transfers its heat to the LNG. The LNG enters the vaporizer in liquid form and due to the heat transferred from the HTF system, changes state and leaves the vaporizer in gaseous form. The use of GH offers certain advantages and disadvantages as set forth below. Considering all factors, AES has determined that the disadvantages outweigh the advantages when compared to the preferred method of vaporization.

Advantages:

- Simple operation. Use of the GHs allows for easy integration with the cycle to vaporize LNG. As a result, operation of these units is fairly common in the LNG industry.

- High efficiency. The GHs have a relatively high efficiency rating that is slightly greater than that available from the preferred option but less than the SCVs (Alternative 1).

Disadvantages:

- The environmental impacts associated with the GHs is greater due to the fact that overall air emissions cannot be controlled as well as in the case of the preferred option using existing proven technology. This would lead to an overall increase in annual air emission levels at the Terminal Site to vaporize the same quantity of gas.

- Integration. Because the system will operate at a higher temperature, the system does not integrate easily with AES's potential plans to build a cogeneration facility. This means that the GHs will be required to vaporize gas regardless of whether or not the cogeneration Power Plant is operating. The LNG Terminal would not be able to take advantage of waste heat from the cogeneration cycle, which would increase overall emissions on an annual basis and reduce efficiency overall.

<u>Alternative 3</u>: Direct Seawater Vaporization

This system uses an open loop that requires water to be drawn directly from the Chesapeake Bay, circulated through a shell and tube heat exchanger where heat is transferred from the relatively warm water to the colder LNG, and then returned back to the Bay at a much cooler temperature. A schematic diagram of this process is shown in Figure 10.5.2-5. The LNG enters the shell and tube heat exchanger in liquid form and due to the heat transferred from the water system, changes state and leaves the vaporizer in gaseous form. The use of a direct seawater vaporization system entails certain advantages and disadvantages as set forth below. Considering all facotrs, AES has determined that the disadvantages outweigh the advantages when compared to the preferred method of vaporization.

Advantages:

- Operation of this type of system is the simplest of all revaporization alternatives. Under this method, seawater would be withdrawn from the Patapsco River, run through a shell and tube heat exchanger or an open rack vaporizer where the LNG would be vaporized, then discharged back to the Patapsco River at a lower temperature.

- There are no combustion emissions from this process other than for the power required to run the pumps, and for the periods during the colder months where vaporization would need to be supplemented by other means of heating (e.g., SCVs, GHs).

Disadvantages:

- The volumes of seawater that would be required to be pumped out of the Patapsco River and then returned substantially cooler than their original condition would result in significant impacts to aquatic life. For this reason alone, this option was considered to be the least desirable of all presented.

- The overall available heat from the Patapsco River is limited to the warmer periods of the year; therefore, supplemental heating would be required during winter months from additional equipment installed at the facility such as SCVs or boilers to meet supply commitments of the facility. This unnecessary duplication of equipment would result in economic waste.

- The National Oceanic Atmospheric Administration National Marine Fisheries Service generally considers the aquatic impacts of this vaporization method unacceptable for locations within estuaries, due to the demand for high volumes of water and the associated impingement and entrainment impacts to aquatic life.

10.5.2.3 Dredge Method Alternatives

Construction of the proposed LNG Terminal will require offshore dredging to widen and deepen the existing approach channel and create a turning basin, both of which are necessary to safely accommodate the range of LNG ships intended to be used to deliver LNG to the Terminal Site. Dredging of the main approach channel is expected to be completed primarily with the use of mechanical clamshell dredge or, if and where required based on sediment composition and quality, an environmental bucket technology. These same techniques will be used for dredging the turning basin that will be located between the point where the approach channel reaches the floating dry dock, the graving dock and the berthing area. Limited near-shore areas will be excavated by backhoe dredge to create new water bottom area at the east end of the berthing pier.

AES evaluated the use of hydraulic dredging as an alternative to its proposed dredge methods. The use of hydraulic dredging was determined to be less preferable than the proposed methods due to several factors, including the increased volume of throughput, the large dewatering area required, decreased rate of dewatering due to increased mixing of dredge material in water, greater processing time, and greater potential environmental impact due to suspension and dispersion of sediment associated with the use of hydraulic dredging. As compared to hydraulic dredging, the use of clamshell or bucket dredging will involve a lower throughput volume, smaller dewatering area due to the use of barges to complete the majority of the dewatering process and a smaller upland area required to complete the processing of dredge material recycling, and shorter overall processing time. AES's proposed dredging method therefore was determined to be preferable to the use of hydraulic dredging.

Turbidity, a measure of water clarity that is sometimes used as a proxy for suspended sediment concentration, will be monitored during the dredging operation. Various governmental sources report that the highest turbidity production arises from dredging methods resulting from conventional clamshell bucket mechanical dredging (USACE, 2001). The lowest turbidity concentrations in dredging result from the use of suction dredging technology. Environmental bucket mechanical dredging methods result in turbidity levels between the suction dredging method levels and conventional bucket mechanical method levels. In terms of turbidity comparison for mechanical dredging utilizing a conventional clamshell bucket versus an enclosed environmental clamshell bucket, evidence indicates that the enclosed bucket will result in a 76-79 percent reduction in turbidity concentrations (USACE 2001).

Disposing of dredged materials in a confined disposal facility or at an upland processing facility would not result in any turbidity in open water other than that possibly generated by prop wash from tending vessels (generation of prop wash depends on draft of the vessels, power applied and depth of the waterway being traversed). No turbidity is generated from mechanically offloading dredged material into a processing system. Also, there is no turbidity generated by offloading scows hydraulically into a confined disposal facility (except within the cell itself). The only disposal method that would generate turbidity in the disposition/handling processes described above would be ocean disposal from bottom dump scows, and AES is not proposing open ocean disposal at this time but will continue to investigate this alternative method of disposal. Turbidity generated from dredge material dewatering activities will adhere to a maximum acceptable level set by permit.

10.5.2.4 Dredge Disposal Alternatives

AES evaluated three potential alternatives to the use of a dredged material recycling facility (DMRF) to handle dredge material, including disposal of dredge material at an approved offshore location, upland disposal of dredge material at a location other than the Terminal Site, disposal at existing fill site(s) for which expansion is planned, and innovative reuse as statutorily defined in Maryland law. A summary table (Table 10.5.2-2) of key elements of the disposal options that are described in detail below is attached, and includes potential final disposal sites, apparent capacities, disposal methods and relative costs. AES determined that the alternative of innovative re-use was preferred over the other alternatives.

A. *Offshore Disposal*

AES has evaluated the feasibility of offshore disposal from the standpoint of sediment quality relative to other dredge management projects performed in the Port of Baltimore and Sparrows Point area, for purposes of determining if offshore disposal may be viable for all or a portion of the dredge material management.

Sediment sampling has been performed in the area where the proposed dredging would take place. The sampling was performed during the period of May to June 2006, and the results are summarized in Section 2.4 of Resource Report 2, *Water Use and Quality*. The results show that sediment quality in the areas subject to dredging is comparable in chemical quality to other sediments that have been dredged from the Port of Baltimore for disposal in the area's Contained Disposal Facilities (CDFs: e.g., Hart-Miller Island; Cox Creek) and ocean disposal sites (e.g., Dam Neck Ocean Disposal Site). Environmental contaminants are present in the upper portion of the sediment profile, comprising primarily polycyclic aromatic hydrocarbons (PAHs – compounds formed by incomplete combustion of carbon-containing fuels such as wood, coal and diesel) and heavy metals. The sample results show that these compounds tend to decrease in concentration with depth and were generally not detected in sediments below approximately 10 to 15 feet or at the planned dredge depth of 45 feet below mean sea level (the new mudline surface that would remain once dredging has been completed).

Ocean placement at a designated ocean site could be a viable placement location for the relatively clean dredge material located below the shallow sediments containing typical Port of Baltimore contaminant compounds. Approval of such location would be subject to EPA and Army Corps of Engineers (ACOE) approval, and would require evaluation consistent with the ACOE *Dredging and Dredge Material Placement* manual.

AES has also determined in the course of dredge evaluation that the use of an approved offshore disposal site – assuming that sediment quality is determined to be acceptable for placement at an EPA approved offshore site - would be less preferable than the use of the DMRF. This is due to the potential time required for vessels to travel to and from the offshore placement site, taking into consideration potential weather and other delays, and the nature of and timeframe required to obtain authorizations necessary to place the dredge material at an offshore location. Relative cost associated with this offshore disposal is also unknown and would be dependant on vessel capacity and shipping distance to an approved disposal location. However, given the results of the sediment sampling for the lower layers proposed to be dredged, this alternative might still prove practical if used in conjunction with the DMRF for dealing with the relatively large volumes of cleaner material.

B. *Upland Disposal*

The Commission Staff requested that AES evaluate the potential for upland disposition of dredge material if it is determined that some of the contaminated dredge material cannot be disposed of in the manner otherwise proposed herein (i.e., innovative reuse and/or open ocean placement). Comparison of the sediment quality anticipated from the proposed dredge area for the Project to sediment historically removed for maintenance dredging from the Patapsco River and Bear Creek area indicates the sediment quality is consistent. Historically, sediment dredged from the Patapsco and Bear Creek has been contained at the Hart-Miller Island site or placed at the Dam Neck Ocean Disposal Site. It is therefore anticipated that upland disposal would be dependant on finding a facility or facilities with capacity to accept the material either unprocessed as a solid waste, or processed as a useable product. Given the relatively clean quality of the sediment from the lower dredge depths, disposition of this clean portion of the dredge material at Hart-Miller Island, other CDFs in the area, or solid waste disposal facilities, would not be a compatible use of capacity of those facilities (i.e. the facility capacity is intended for disposal or waste materials, as opposed to relatively clean sediment). Alternatively, the relatively clean sediment could potentially be appropriately dewatered and used for daily cover or capping. It is therefore assumed that the volume of dredge material that may be subject to contained upland placement would be only a portion of the total dredge amount. An approximate percentage calculation of relatively contaminated (shallow) material vs. the relatively clean sediment at depth was developed based on the portion of potential dredge volume represented by the shallow and intermediate dredge material samples obtained and analyzed, as reported in Resource Report 2, *Water Use and Quality*, relative to the total dredge depth. This comparison indicates these shallow contaminated samples represent from 30 percent to 60 percent of the depth range of total dredge depth (i.e., where the sample for 0 to 10 feet depth was obtained from a location where dredging will remove 30 feet of sediment, the more contaminated samples represent 33 percent of the depth range and therefore approximately 33 percent of the final dredge volume). Based on this type of analysis over the entire dredge area, it is reasonably assumed that sediment that may be subject to upland disposal would be limited to 30 percent to 60 percent of the total dredge volume.

Clean Earth Dredge Technology Inc. (CEDTI) is working with AES on dredge management options for the project. CEDTI has worked closely with numerous regional governmental and regulatory agencies to develop and implement programs for appropriately stabilizing dredged sediments for upland placement. Examples of these agencies include the New Jersey and Pennsylvania Departments of Environmental Protection, the NJ Department of Transportation, Office of Maritime Resources, the Pennsylvania Bureau of Abandoned Mine Reclamation, the New York State Department of Conservation and the Port Authority of New York & New Jersey. These engagements have provided CEDTI with significant experience in the range of research, development, and implementation of treatment and placement options for contaminated dredged sediments in the region. CEDTI has, in bench-scale and full-scale field operations, applied solidification/stabilization technology to numerous dredging projects, rendering the dredged sediments suitable for upland placement.

For purposes of this evaluation, the alternative upland disposal methods (applicable to contaminated sediments that could not be processed, stored and then sold from the facility) comprised reclamation and remediation of an abandoned mine facility, such as the Bark Camp Mine Complex, an abandoned coal strip mine located in Pennsylvania (a CEDTI project), or similar mine stabilization/reclamation in Pennsylvania and/or Maryland. The Bark Camp Mine has approximately 6 to 10 million cubic yards of capacity required to complete reclamation, and has been approved for acceptance of stabilized contaminated dredge material, and could comprise an upland placement site option for processed dredge material. The states of Pennsylvania and Maryland also have significant acreage requiring reclamation beyond the capacity present in the Bark Camp site. The stated goal of the Maryland Abandoned Mine Reclamation Program is to promote the reclamation of all abandoned mined areas in Maryland that have been left in an inadequately reclaimed condition and continue to endanger the health or safety of the public, degrade the quality of the environment or diminish the beneficial use of land and water resources. Land in Maryland impacted by surface and underground coal mining prior to state and federal mining and reclamation regulatory programs is estimated at approximately 9,500 acres of land and 450 miles of streams.

AES determined that the use of an upland disposal site would be less preferable than the use of a DMRF at the Sparrows Point facility for processing, storage and sale/shipment to end users. (See discussion below relative to the preferred DMRF alternative.) This is due to the difficulty anticipated in identifying one or two sites nearby that could accept the volume of dredge material, the transportation requirements necessary to access an upland site, the need for unloading and additional processing once the dredge material is delivered to an upland site, and the nature of and timeframe required to obtain authorizations necessary to dispose of the dredge material at an upland location. Such disposition options are technically feasible, but would be difficult to manage in a timeframe consistent with the Project. The cost of such an alternative is currently unknown, and would be dependant on cost of use or establishment of a stabilization plant facility at the mine location (such as Bark Camp), haul distance and capacity available.

C. Disposal at a Fill Site

AES evaluated the feasibility of disposing of dredge material at the existing Hart-Miller Island dredged material containment facility in the Port of Baltimore area, and determined that the disposal facility currently does not have capacity available to handle the dredge material associated with the Project. While other fill sites in the general vicinity of the Project are planning to expand capacity in the future, AES understands that these capacity expansions will be limited to current or planned projects being undertaken by the Maryland Port Administration and other marine terminals in the Port of Baltimore. The expansions therefore are not considered to be available or sufficient to handle the additional dredge material associated with the Project, especially when the annual capacity of any existing or planned placement site is considered. [27] For this reason, existing and planned dredged material placement facilities intended for material dredged from the navigational channels in the Chesapeake Bay outside of the Baltimore Harbor are not available to this material.

The State of Maryland has a public participation process as part of its Dredged Material Management Program. That process undertook a multi-year effort to identify and recommend options available for a long-term (20 years) plan for managing material dredged from the Baltimore Harbor channels. Known as the Harbor Team, community representatives and other stakeholders came together to consider options for managing up to 1.5 million cubic yards annually of harbor dredged material. Five hundred thousand cubic yards is the average amount of material generated from the maintenance of existing channels. The additional one million cubic yards allows for new dredging projects in the harbor. Options to accommodate this quantity of material over the 20-year period led to several site-specific placement (containment facility) recommendations, as well as a recommendation for the innovative reuse of meaningful quantities of dredged material by 2023. The amount of material likely to be generated by the AES project exceeds what was planned for in the state's public process. AES understands that any expectation that the state's existing, planned, or proposed containment facilities will be able to accommodate dredged material from the Sparrows Point Project is not supportable.

D. Innovative Re-use

The innovative re-use alternative would involve constructing an upland dredged material processing facility adjacent to the existing waterway at the Terminal Site (see Section 1.5.1.2 of Draft Resource Report 1, *LNG Terminal Offshore Construction* describing dredge plan and recycling facility layout). A 10,000 cubic yard per day DMRF would occupy approximately five acres of upland property within the boundaries of the Terminal Site. The recycling facility would consist of duplicate (parallel) processing systems including hoppers, conveyors, pugmills for mixing additives and stacking equipment. Emissions from each pugmill and additive delivery system would be equipped with and controlled by separate baghouse dust-collection devices. Existing site roadways would be used to transport the processed dredged material from the pugmill processing system to the temporary Processed Dredged Material (PDM) storage area. The temporary PDM storage area would consist of an approximately 10-acre area covered by bituminous paving or lined with a 10-mil HDPE liner covered by 6- to 12-inches of existing site soil or imported soil. A scale house and truck scale would be located adjacent to the temporary PDM storage area for weighing of the outbound shipments of the PDM product upon sale. Existing site roadways or railroads would be used for outbound shipments of the PDM product.

The recycling facility area and temporary PDM stockpile area would be graded as necessary and paved with bituminous concrete, and equipped with stormwater management controls tied to existing facilities for stormwater management (the existing Sparrows Point facility routes and manages stormwater for the exposed land area of the facility through several permitted outfalls associated with its operations). AES would occupy similar land area and would pursue stormwater permits through either the Maryland Industrial Stormwater Permit program (appropriate to the industrial code applied to the DMRF) or permitted discharge under a site-specific National Pollutant Discharge Elimination System (NPDES) permit to be applied for from the State of Maryland – see Resource Reports 2 and 13 relative to stormwater management, testing, and permitting to be associated with the terminal and DMRF site. After

[27] A statutory requirement for material dredged from within the Baltimore Harbor, as determined by an imaginary line between North Point in Baltimore County and Rock Point in Anne Arundel County, is that it be treated as contaminated material and disposed at a contained disposal facility, regardless of chemical quality of the material to be dredged. Contained disposal is not required if the material is beneficially reused or processed for innovative reuse.

civil work is completed, the DMRF would be erected at the site. All components of the processing systems would be fabricated off-site and delivered via truck to the construction site. Operation of the DMRF would occur during the LNG Terminal construction phase of the Project. Processing operations would commence following construction of the DMRF and simultaneously with the commencement of dredging operations.

The use of the DMRF would enable AES to manage the dredge material at an upland location adjacent to the dredge site, and stockpile processed material until it is sent to market by truck, rail or ship. This method also could be scaled up or down to accommodate the timing and quantity of the dredge material management needs during the dredging phase of the Project, for example, to allow for continuous processing of the dredged material even when the dredging is limited to certain windows as a result of permit conditions.

10.6 Pipeline Alternatives

AES took two different approaches to its review of pipeline alternatives. First, AES evaluated natural gas transmission alternatives to its proposed Pipeline vis-à-vis different delivery points or methods for delivering the LNG from the LNG Terminal. Next, AES evaluated route alternatives between the Terminal Site and the proposed terminus point in Eagle, Pennsylvania.

10.6.1 Delivery Alternatives

AES evaluated five natural gas transmission alternatives to its proposed Pipeline, including (1) an alternative interconnection point to the proposed interconnections near Eagle, Pennsylvania, (2) interconnection solely with the existing Baltimore Gas & Electric Company (BG&E) natural gas distribution system, (3) use of truck and rail methods instead of a natural gas pipeline to transport LNG from the terminal, (4) combined use of a single interconnection with the existing BG&E system and truck and rail transport of LNG from the LNG Terminal, and (5) connection only with the Columbia Gas pipeline system. None of these pipeline system alternatives is considered to be a viable alternative to the proposed Pipeline for the reasons discussed below.

AES first considered whether an alternative final interconnection point other than the proposed interconnections near Eagle, Pennsylvania would better serve the intended purpose of the Project. Because the Project is expected to be a high load factor facility, one of the main concerns regarding the final interconnection point is access to both substantial throughput and natural gas storage. In order to maximize access to markets and storage in the Mid-Atlantic Region, interconnection with the three existing Mid-Atlantic Region interstate pipeline systems near Eagle, Pennsylvania is necessary. Further, as noted in Section 10.3.2, connection into the major interstate natural gas transmission lines that pass through the Mid-Atlantic Region (Transco, TETCO, and Columbia) at any other locations further south than Eagle, Pennsylvania would require expansions of the existing lines to move the incremental gas to the market areas. This would result in significant additional environmental impacts, including an additional three to five crossings of the Susquehanna River and operating impacts associated with those expansions.

AES next evaluated the feasibility of connecting solely with the existing BG&E natural gas pipeline system. While this system alternative would allow local consumers to avoid certain transportation costs associated with existing natural gas supplies transported from the Gulf of Mexico and other regions in North America, interconnection with the BG&E system alone would essentially reduce the function of the LNG Terminal to an oversize peak-shaving facility, thus making the required investment in terminal and marine facilities economically infeasible. BG&E already has sufficient peak-shaving capacity for its system at Spring Gardens in Baltimore, Maryland, and displacement of BG&E's entire natural gas load was not considered to be viable (the highest daily natural gas delivery in the BG&E system was approximately 0.8 bscfd for January 23, 2003; the average is significantly less). This system alternative not only would be commercially impractical, due to the costs of the Project compared to the projected quantity of deliverable natural gas, but would fail to provide a new incremental supply of natural gas to markets in the entire Mid-Atlantic Region, which is the key component of the overall purpose of the Project.

AES also considered the feasibility of using truck and rail transport to distribute LNG from the proposed LNG Terminal. In certain areas of the country, particularly the Northeast, small quantities of LNG are transported by truck to outlying areas and to and from peak shaving storage facilities. These outlying areas typically are located in relatively close proximity to the LNG Terminal and one another, resulting in relatively short truck transport distances. This same situation does not exist in the Mid-Atlantic Region. In addition, there currently is no commercial scale rail transport of LNG cargo. For these reasons, truck and rail transport on the scale necessary to support the take-away capacity of the proposed LNG Terminal was determined to be impractical and no further consideration was given to this system alternative.

A combination of truck and rail transport of LNG to markets in the Mid-Atlantic Region and a single interconnection locally with the existing BG&E natural gas distribution system was determined not to be a viable transmission alternative to the proposed Pipeline because this alternative would not be sufficient to support the take-away capacity of the proposed LNG Terminal to interconnections with the pipeline grid serving the Mid-Atlantic Region, and the use of rail and truck transport, as discussed above, is not considered to be commercially viable since there is currently no commercial-scale rail transport of LNG cargo for the Project Area.

Finally, AES also evaluated the feasibility of connecting to the existing Columbia Gas Line 1278 pipeline system just outside of Baltimore. While this transmission alternative would reduce the required length of send out pipeline required, this transmission alternative was found to be unacceptable as Columbia's system was described as having insufficient capacity to move the volume to the market and replacing this line would have the same or greater landowner and environmental impacts as the proposed Pipeline, plus interruption in service during the construction period.

10.6.2 Route Alternatives

The proposed route for the Pipeline generally parallels rights-of-way for existing highways, overhead electric transmission lines, and pipelines. In considering alternatives to the proposed Project to determine whether it might be possible to reduce the human and environmental impacts, AES evaluated alternative pipeline routes. Alternatives that were considered include four major route alternatives and numerous route variations. Figure 10.6.2-1 identifies the location of the proposed route for the Pipeline. As proposed, the route consists of four main segments:

- The proposed route exits the former Sparrows Point Shipyard and steel mill property and travels north to northeast for approximately two miles (MP 0.0 to 2.0);
- For approximately six miles (MP 2.0 to 8.0), the proposed route follows Route I-695 in a north and northwest direction, except for minor deviations necessary to avoid highway interchanges (sections of this route will require coordination with Maryland Department of Transportation (MDOT) for scheduling of safety vehicles to support crossing activities. Due to the length and coordination required for these limited sections, less than 3 miles, AES does not anticipate that this will lead to any delays in construction or potential impacts to overall Pipeline completion);
- Near the Back River crossing, the proposed route heads north to northeast and follows a BG&E overhead transmission corridor for approximately 24.5 miles (MP 8.0 to 32.5); and
- At the intersection with the right-of-way (ROW) for an existing Columbia pipeline, the proposed route heads northeast and generally parallels the existing pipeline ROW for approximately 54 miles (MP 32.5 to 87.6) to its terminus near Eagle, Pennsylvania.

AES applied several screening criteria to identify a proposed route between the Terminal Site and the interconnection points near Eagle, Pennsylvania. Principal among its route screening criteria were the desire to maximize use of existing ROW in order to avoid or to minimize to the maximum extent possible construction-related impacts to the environment, landowners and other stakeholders, taking into consideration the technical and economic feasibility of constructing the Pipeline. Although not the only criterion to be used in route selection, the preference towards the use of existing corridors is an industry standard and is consistent with 18 CFR §380.15, which concerns siting and maintenance requirements for pipeline construction. Furthermore, this criterion is consistent with the objectives of most regulatory agencies, including the ACOE and the Commission. Using the standard screening criteria specified by the Commission in its guidance, AES identified four major route alternatives to the proposed route, which - as in the case of its proposed route - included following existing ROW and greenfield construction.

AES assessed each route alternative using a 100-foot wide corridor centered on the proposed alignment for the majority of the constraints. The analysis was conducted using existing resource information available on United States Geological Survey (USGS) 7.5-minute series topographic quadrangle maps; Maryland Geographic Information System (GIS) data layers; other available federal, state, and county resource maps; recent high resolution aerial photography; and unmapped data. The analysis focused on an evaluation of route length, feasibility of using existing corridors, extent of crossing existing transportation features, the presence of wetlands and waterbodies, threatened and endangered species and significant habitat, land uses and vegetation cover types, the presence of Federal and states lands, and several other special land uses. The major route alternatives are summarized on Figure 10.6.2-2. A tabular summary of this analysis is included within Table 10.6.2-1. AES also provided briefings to senior personnel of Maryland State agencies responsible for managing federally funded highways concerning routing that traversed federally funded highways, which are Interstates 95 and 695. Documentation of the briefings is included within Appendix B.

The following provides a summary of AES's initial screening analysis of the four route alternatives.

10.6.3 Major Route Alternatives

10.6.3.1 Dundalk West Alternative

The Dundalk West Alternative would deviate from the proposed route at North Road (approximate MP 0.8), and follow an existing roadway for approximately 1.2 miles before crossing Bear Creek (Figure 10.6.3-1). The Dundalk West Alternative would then be routed along an electric utility corridor through a densely populated area of Dundalk heading north for approximately 4.8 miles. The route would then rejoin the proposed route at MP 8.0.

A tabular summary of the environmental features along this alternative is included within Table 10.6.2-1. The greatest advantage of the Dundalk West Alternative is that it presents a straighter path through this area and is approximately one mile shorter than the proposed route. However, this alternative presents an apparent greater amount of environmental and land use impact than the proposed route. Specifically, this alternative would require a greater number of waterbody crossings, would cross a substantially longer length of wetlands, and would potentially impact more historic resources and residential properties. Additionally, the Dundalk West Alternative would be located through a greater amount of Dundalk residential neighborhood and encroach upon several school properties. While these latter considerations would not rule out this alternative by themselves, such proximity would likely cause greater disturbance to nearby or adjacent residents and necessitate specialized construction techniques in the more constrained areas. Public concern over locating another pipeline in a corridor already hosting two pipelines is another negative aspect associated with this alternative.

Special construction techniques, including a potential Horizontal Directional Drilling (HDD), would be required to cross Bear Creek. In addition, some restrictions due to existing utilities and bridge structure at the Bear Creek crossing location, could potentially push the alignment further to the north and potentially cause additional impact to Cheekwood Park and the associated wetlands to the west side of crossing. Congested areas near schools and businesses would require restricted workspace, and a potentially compressed/limited construction period, in order to minimize possible interference with local businesses and schools. Because the ROW is extremely congested with other utilities, it could require construction efforts to uncover and locate existing utilities and potentially require hand digging in certain areas to avoid interference with those utilities, adding time and cost to this overall routing.

Overall, the Dundalk West Alternative, while shorter and resulting in less total acreage of disturbance, has the potential for greater environmental and land use impacts, and is thus not recommended.

10.6.3.2 Western Corridor Alternative

The Western Corridor Alternative would deviate from the proposed route after the Back River crossing (MP 9.0) and traverse north for approximately 21.0 miles along a northern-trending, two-tower BG&E powerline corridor (Figure 10.6.3-2). Shortly after it crosses the Baltimore and Harford County, Maryland line, the alternative route would turn to the northeast and closely parallel the existing Columbia pipeline corridor, rejoining the proposed route at MP 32.5.

A tabular summary of the environmental features along this alternative is included within Table 10.6.2-1. While the Western Corridor Alternative is located almost entirely within existing utility corridors and would result in substantially fewer impacts to wetlands, the Western Corridor Alternative presented several disadvantages from a constructability standpoint. This existing corridor is already occupied by several utilities, including two powerline lattice tower alignments and one to two existing pipelines (depending on location along the corridor). The ROW for this segment of the alternative route also would be located closer to more densely populated areas than would the proposed route, meaning that pipeline construction activities, while temporary, nevertheless would impact more landowners than would construction activities along the ROW for the proposed route.

There are several areas along this route where houses, fences and sheds are built right up to the corridor, resulting in greater impacts to residences. Additionally, there are several buried utilities in these areas. All of these items lead to potentially constricted or reduced work space, and potential special construction techniques including exposing existing utilities and shoring them up to avoid damage during installation of the Pipeline. This would lead to greater overall construction time, cost and associated impacts. Additionally, where the pipeline crosses Gunpowder Falls State Park, crossing of Gunpowder Falls, a waterbody within the park, must be considered. Space for performing an HDD in this location is heavily constricted by residential housing, electric utility lines and substations at the south side of the park. This would be a difficult crossing to plan and execute due to the obstacles in this area.

Comparison of environmental impacts for this alternative route segment (Table 10.6.2-1) indicates that the two alternatives are largely comparable with the exception of a few elements. The proposed route is approximately 1.6 miles longer and crosses more forested wetland than the Western Corridor Alternative. Additionally, the proposed route has the potential to affect more potential archaeological sites than the Alternative. However, based on the various construction constraints posed by this alternative and the densely populated residential developments along its length, the proposed route offers the better alternative for the project insofar as the forested wetland and potential cultural resource elements are more manageable impacts to surmount. These elements can be mitigated such that the additional resource impacts associated with the preferred route will not result in a long-term negative effect.

10.6.3.3 State Route 136 Alternative

The State Route (SR) 136 Alternative would deviate from the proposed route at the intersection with the overhead electric transmission corridor and I-95 at approximate MP 19.0 (Figure 10.6.3-3). The alternative route would traverse northeast along I-95 for approximately 8.5 miles, and then turn north onto SR 136. For 13.6 miles, this alternative route would parallel, but not be adjacent to, SR 136 until rejoining the proposed route at approximate MP 40.0 at the existing Columbia pipeline ROW.

A tabular summary of the environmental features along this alternative is included within Table 10.6.2-1. The SR 136 Alternative was determined to be less preferable than the proposed route for a number of reasons. The majority of this route would require a new utility corridor and would be routed parallel and adjacent to I-95 and SR 136 corridors. As would be the case with any project adjoining or within the bounds of a major highway ROW (such as Rt. 95, Rt. 695, or similar highway), close coordination with the managing body (such as MDOT) and additional construction safety requirements would be needed due to vehicular traffic. Roadway construction requires substantially greater coordination and potentially would lead to additional time to construct due to restricted hours of construction imposed by the MDOT (such as the need to avoid rush hour periods), and possibility of delays if approved vehicles were not available. Additionally, there are several areas along SR 136 where construction techniques would require reduced CROW due to proximity of road and other utilities along side of the road. To avoid impact to local businesses and residences it is expected that time of day restrictions may be imposed that are more restrictive than much of the preferred route through this area. These restrictions would lead to extended construction time, cost and overall increase in associated impacts. Where insufficient space exists between SR 136 and the adjacent residences/commercial structures, it would be necessary to deviate from the roadway corridor and create new pipeline corridor behind the developed structures. Such creation of new greenfield ROW has an additional set of impacts that should be avoided if an alternative exists.

The SR 136 Alternative also potentially impacts a greater number of residential and historical properties, particularly structures along SR 136. This alternative route also traverses the Finney House Historic District in Churchville, Maryland, and could therefore affect considerable Rural Legacy District area prior to reaching the pipeline corridor.

Comparison of environmental factors (Table 10.6.2-1) indicates that the two alternatives are largely comparable, with the exception of a few elements. The proposed route crosses a longer segment of steep terrain, which could have some effect on the construction process. However, the SR 136 Alternative has several disadvantages including several construction constraints, the crossing of more historic properties and historic districts, and the overall impact associated with creation of 22 miles of new pipeline corridor through a rural residential area with localized congestion.

10.6.3.4 US I-95 & Greenfield Alternative

The US I-95 & Greenfield Alternative would deviate from the proposed route at the intersection with the overhead transmission corridor and I-95 at approximate MP 19 (Figure 10.6.3-4). The US I-95 & Greenfield Alternative would head north to northeast and follow I-95 for approximately 20.0 miles. At this point, the alternative would divert from I-95 and traverse 13.8 miles in a northerly direction cross-county, necessitating the construction of a greenfield pipeline right-of-way. Shortly after the pipeline crosses U.S. 1 in Harford County, Maryland, this alternative route would reach the Columbia pipeline, rejoining the proposed route at approximate MP 40.0.

A tabular summary of the environmental features along this alternative is included within Table 10.6.2-1. While this alternative crosses less steep terrain, the US I-95 & Greenfield Alternative was determined to be less preferable than the proposed route. The alternative impacts a greater number of wetlands and waterbodies, and a greater number of historical properties. As compared to the proposed route, the US I-95 & Greenfield Alternative would also impact a greater number of residential properties and would require over 13 miles of greenfield development from I-95 north to the Columbia pipeline.

The segment of the alternative route that follows I-95 also is significantly encroached upon by adjacent residential and commercial development, and thus would increase potential impacts on residences and construction-related constraints. The majority of this route would require close coordination with the MDOT along the I-95 corridor and additional construction safety requirements due to passing traffic. This coordination would potentially lead to additional time to construct due to restricted hours imposed by the MDOT (such as the need to avoid rush hour periods), and possibility of delays if approved vehicles were not available. This would lead to additional time, cost and related potential impacts. Once leaving the I-95 corridor, much of the proposed route is open agricultural land. This area would require seasonal restrictions as well as additional requirements for topsoil segregation and follow up mitigation efforts. Depending on sequencing of construction and actual timing of when this area is reached, this potentially could cause a temporary delay and additional associated impacts due to the increased CROW for topsoil segregation planning and follow up restoration and mitigation.

AES has consulted with the MDOT, Maryland State Highway Administration (SHA), and the Maryland Transportation Authority (MdTA) regarding routing along and crossing of I-95 and I-695. AES provided briefings to senior personnel of these Maryland State agencies responsible for managing these federally funded highways, and provided backup mapping to the agencies' technical staff to allow initial review and feedback of areas where the pipeline route may interfere with highway operation and safety. AES has coordinated with the Maryland State agencies responsible for managing federally funded highways during the surveying of the proposed route. AES requested and was granted permission to perform its surveys in or where the Project crosses segments of Rt. 695 and crossing locations of I-95 (AES will continue to coordinate with them throughout the process.

Overall, the primary advantage of the US I-95 and Greenfield Alternative is to follow a route that minimizes encroachment on commercially and residentially developed areas. While this Alternative does reduce impact to residential areas and reduces construction difficulties associated with developed areas along the other alternative segments, it has substantially greater environmental impact in almost every sensitive environmental resource category than the preferred route.

10.6.4 Route Variations

Minor route variations on the proposed route were identified in response to issues raised by the public, engineering and environmental constraints identified during field surveys, and other issues of concern. Figures 10.6.4-1 through 10.6.4-14 present 25 identified variations. Each potential variation on the proposed route was evaluated according to key environmental and engineering parameters to arrive at a preferred route through the area of concern. The purpose for developing route variations was to further refine the proposed route in areas of potential significant impacts, including heavily congested and environmentally sensitive areas. Areas for focused route variations were identified during the course of public meetings, by landowners, during AES field surveys, and through regulatory agency input. Route variations were considered at various stages of the Project routing and field survey phases.

The process of public meetings, landowner contacts, and agency input has resulted in numerous additional changes from the initial conceptual route. Variations identified during this process in some cases were incorporated into the Pipeline Route to improve overall routing from a construction standpoint, and to minimize the overall impact to landowners and environmental resources.

A summary of the route variations along the route is presented in Table 10.6.4-1, Summary of Variations, including an environmental analysis of each variation.

Route Variation 1

Route Variation 1, from MP 3.70 to MP 4.65 as shown on Figure 10.6.4-1, was developed as a potential alternative to 1.0 miles of the original pipeline route to provide the best crossing location for I-695, and to reduce environmental impacts to the area. This variation is located between the east and west bound lanes of I-695, while the preferred route is located between I-695 and railroad tracks.

While both routes follow the within the I-695 easement, this alternative would present some additional constructability and safety concerns, with a large section located between the traffic lanes. Upon visual inspection, it appeared that the alternative route contained additional wetlands. AES determined that the route variation does not reduce construction-related constraints or minimize impacts to wetlands. Therefore, due to environmental considerations, AES is not incorporating Route Variation 1.

Route Variation 2

Route Variation 2, from MP 4.65 to MP 5.15 as shown on Figure 10.6.4-1, was developed as a potential alternative to 0.50 mile of the original pipeline route paralleling I-695, to avoid impacts to forested area and reduce environmental impacts. This variation is located between I-695 and an area of commercial development. This variation would follow along an existing commercial lot for the first portion of the route, cross a forested wetland before crossing Beachwood Road, and turn back toward the main route.

In the process of completing the evaluation of Route Variation 2a (discussed below), surveys have indicated that both routes will pass through a forested wetland area. AES determined that Variation 2 is longer, has more bends, and does not significantly minimize impacts to wetlands. Therefore, due to primarily environmental considerations, AES is not incorporating Route Variation 2.

Route Variation 2a

Route Variation 2a, from MP 5.60 to MP 6.00 as shown on Figure 10.6.4-1 and located at the Cove Road I-695 Interchange, was developed as a potential alternative to 0.40 miles of the original pipeline route, to avoid impacts to residential properties and to address constructability concerns.

The original proposed route would stay to the east of the interchange where the crossing of Cove Road would be complicated by topography and the railroad track to the east of the route; it would be located in a forested area. While the variation would involve some tight working conditions, it would avoid potential impacts to residences along the original proposed route and reduce the impacts to forested areas. AES determined that this route variation will reduce construction-related constraints, the crossing of forested lands and impacts to residences, and has incorporated this variation into the preferred route.

Route Variation 3

Route Variation 3, from MP 9.40 to MP 10.80 as shown on Figure 10.6.4-2, was developed as a potential alternative to 1.38 miles of the original pipeline route to reduce constructability concerns and environmental impacts. The variation would leave the original proposed route and continue to follow the southbound lane of I-695 until it turned north along the high-speed railroad tracks until it reconnects with the original route near the I-695 crossing.

AES has conducted a desktop survey of this route and determined that the route is slightly longer and appears to utilize more commercial areas. While this route appears to have some additional constructability concerns, it may impact less wetlands and waterbodies. AES is still in the process of evaluating Route Variation 3 to determine if the route will reduce constructability issues and impacts in this congested corridor.

Route Variation 4

Route Variation 4, from MP 10.80 to MP 18.75 as shown on Figure 10.6.4-3, was developed as a potential alternative to 8.0 miles of the original pipeline route through this congested area, and parallels the north-bound lane of I-695 before turning to the east, following the north bound lane of I-95 until it connects with the originally proposed route on the south side of the I-95 crossing.

AES has conducted a desktop survey of this route and determined that the route is slightly longer, may impact less wetlands and waterbodies, and appears to utilize more commercial and agricultural areas. However, this route appears to be much more congested and has some additional constructability concerns. AES is still in the process of evaluating Route Variation 4 to determine if the route will reduce constructability issues and impacts to this congested corridor.

Route Variation 5

Route Variation 5, from MP 14.35 to MP 14.70 as shown on Figure 10.6.4-4, was developed as a potential alternative to 0.30 miles of the original pipeline route to reduce environmental impacts, and is located along an abandoned section of the overhead electrical transmission line route.

AES found that the original route through this area crossed forested wetland areas with standing water and had additional waterbody crossings. Route Variation 5 was located within the cleared area of an abandoned power line corridor with much less wetland impacts. Route Variation 5 significantly reduces wetland and waterbody impacts, and therefore AES has incorporated this route variation into the preferred route.

Route Variation 6

Route Variation 6, from MP 15.00 to MP 15.50 as shown on Figure 10.6.4-4, was developed as a potential alternative to 0.50 miles of the original pipeline route to reduce environmental impacts, and would be located on the northern side of the existing overhead electrical transmission line.

AES evaluated Route Variation 6 and found that it would cross a large open water pond/quarry as well as paralleling a section of Whitemarsh Run. While this alternative would result in two less crossings of Whitemarsh Run, the crossing of the large pond/quarry significantly limits the constructability of this variation. Therefore, due to environmental considerations, AES is not incorporating Route Variation 6.

Route Variation 7

Route Variation 7, from MP 17.80 to MP 17.90 as shown on Figure 10.6.4-5, was developed as a potential alternative to 0.10 miles of the original pipeline route in this congested area. This route variation was originally developed to avoid potential structures located near the existing power line ROW.

AES evaluated Route Variation 7 on the ground and found that it did not aid in the avoidance of residential structures. Therefore, AES is not incorporating Route Variation 7.

Route Variation 8

Route Variation 8, from MP 18.50 to MP 18.75 as shown on Figure 10.6.4-5, was developed as a potential alternative to 0.25 miles of the original pipeline route through this utility line congested area, and is located to the west of the proposed route; it would pass through an agricultural field to connect to an existing power line corridor.

While both route variations involve creating new ROW, this area is owned by BG&E and contains numerous power line crossings. The route variation would involve one extra 90-degree bend in the pipeline route as well as create a crossing of Rafael Road. Therefore, because of these engineering and construction constraints, AES is not incorporating Route Variation 8.

Route Variation 8a

Route Variation 8a, from MP 33.65 to MP 34.00 as shown on Figure 10.6.4-6, was developed as a potential alternative to 0.30 miles of the original pipeline route to reduce environmental and residential impacts along the existing pipeline easement. This variation turns north leaving the existing pipeline easement and travels through an actively cultivated field. The variation then turns to the east and crosses Grier Nursery Road and connects back into the existing pipeline easement.

AES evaluated Route Variation 8a and found that the variation avoided crossing a wetland area adjacent to a farm pond, created a better crossing of the small unnamed tributary in the area, created a better crossing of Grier Nursery Road, and avoided a very congested residential/commercial area. Therefore, due to primarily landowner and environmental considerations, AES has incorporated this route variation into the preferred route.

Route Variation 9

Route Variation 9, from MP 35.30 to MP 35.60 as shown on Figure 10.6.4-7, was developed as a potential alternative to 0.30 miles of the original pipeline route, and would parallel the north side of the existing pipeline easement. This alternative was identified after evidence of new construction was noted near the existing pipeline ROW.

During the survey of the area, it was found that the landowner had built a new garage very close to the existing pipeline easement, reducing the potential area for a second line along the southern side of the existing ROW. The variation does not result in greater environmental impact, thus AES has incorporated Route Variation 9 to avoid a newly constructed garage.

Route Variation 10

Route Variation 10, from MP 36.20 to MP 38.10 as shown on Figure 10.6.4-7, was developed due to public comment as an alternative to 1.5 miles of the original pipeline route. At MP 36.20, this route variation would turn north towards Mine Branch Road and then head northeast on the north side of

Mine Branch Road past Ady Road. Continuing northeast, the route variation would be located south of Dublin Road to MP 38.10 where it would rejoin the proposed route.

AES is in the process of performing an engineering evaluation of Route Variation 10 to avoid residential structures, steep terrain, waterbodies and wetlands. Upon completion of this analysis, AES will provide its recommended routing through this area to the Commission.

Route Variation 11

Route Variation 11, from MP 36.50 to MP 39.00 as shown on Figure 10.6.4-8, was developed as a potential alternative to 0.50 miles of the original pipeline route through a residential area along the south side of the existing pipeline easement. This variation would leave the existing ROW and traverse the Scarboro Landfill Property passing the current borrow pit location.

This variation would involve two larger tributary crossings and would still be located near the residential area. In addition, it would be a longer route involving all greenfield location, This variation also conflicted with the future plans of the landfill. Therefore, AES is not incorporating Route Variation 11.

Route Variation 12

Route Variation 12, from MP 38.85 to MP 39.90 as shown on Figure 10.6.4-8, was developed as a potential alternative to 1.05 miles of the original pipeline route, and would parallel the north side of the existing pipeline easement. This route variation involves turning north off of the existing pipeline easement and following the edge of an actively cultivated field before entering a forested area. Once in the forested area the variation would then turn back to the easement. This variation was identified to avoid a residential area with some structures in close proximity to the existing easement.

AES was not able to fully evaluate route Variation 12 in the field due to denial of access by landowners. The pipeline is still able to be sited along the existing pipeline corridor with minimal additional impact to residential areas. The variation would involve greenfield development through forested areas. In addition, the variation is longer, involves three large bends in the pipeline, and has additional waterbodies mapped along the route. Therefore, due to increased environmental and construction constraints, AES is not incorporating Route Variation 12.

Route Variation 13

Route Variation 13, from MP 51.50 to MP 53.00 as shown on Figure 10.6.4-9, was developed as a potential alternative to 1.35 miles of the original pipeline route through this congested area partly based on public comment. The variation would turn north after the Brabson Road crossing into an open field prior to crossing Kirks Mill Road. The variation would then continue north into a pasture area prior to turning east to cross Brow Road and connecting with an existing power line easement. The variation would then follow this easement until it connects back with the existing pipeline easement.

AES evaluated Route Variation 13 and found that it did avoid residential structures and congested areas while traversing mostly pasture and existing utility ROW, and thus has incorporated this variation into the preferred route.

Route Variation 14

Route Variation 14, from MP 64.90 to MP 65.10 as shown on Figure 10.6.4-10, was developed as a potential alternative to 0.25 miles of the original pipeline route in this lightly residential area and continues along the existing pipeline easement.

A portion of this variation was not able to be evaluated due to lack of landowner permission to access the property. The variation would involve placing the pipeline in closer proximity to one residential structure creating a constructability concern. In addition, it appears that there will be additional wetland and waterbody impacts associated with this variation. The preferred route utilizes the edge of agricultural fields and allows for a perpendicular crossing of Faggs Manor Road. Due to primarily environmental considerations, AES does not find that this variation will result in an environmentally preferable route, and is not incorporating Route Variation 14.

Route Variation 15

Route Variation 15, from MP 74.85 to MP 76.50 as shown on Figure 10.6.4-11, was developed as a potential alternative to 1.25 miles of the original pipeline route through this congested area. This variation would be located partially along the existing pipeline easement, and then veer to the northwest of the existing pipeline easement through fields and forested areas until connecting back with the original proposed route north of Romansville Road.

Although this alternative would involve some greenfield development through forested and light residential areas, AES found that the route avoided planned developments, residential structures, and had less impact to wetlands and waterbodies. Although greenfield development is often not preferred, overriding environmental and landowner impact concerns justify incorporation by AES of Route Variation 15 into the preferred route.

Route Variation 16

Route Variation 16, from MP 74.85 to MP 76.50 as shown on Figure 10.6.4-11, was developed as a potential alternative to 1.25 miles of the original pipeline route located though planned and existing residential areas, and is located along the existing pipeline easement.

AES conducted a desktop and site survey of this route and determined that this variation would involve crossing heavily residential areas, and would involve additional wetland and waterbody impacts. AES has determined this variation will not result in a lesser environmental impact. Therefore Route Variation 16 is no longer under consideration.

Route Variation 17

Route Variation 17, from MP 77.00 to MP 78.10 as shown on Figure 10.6.4-12, was developed as a potential alternative to 1.1 miles of the original pipeline route through this congested area, and would be located to the east of the proposed route along the existing pipeline easement.

Although this variation runs through the middle of a residential community, AES will be able to site the line with minimal impact to residential structures. The originally proposed route crossed a Town Park in an area that contains forested walking paths and a children's play area, as well as impacted additional residences. This route variation would follow the existing pipeline easement, avoid new ROW impacts to the Town Park playground and wooded walking trails, have less impact on surrounding residences, and is the shorter route. Route Variation 17 has been incorporated into the preferred route.

Route Variation 18

Route Variation 18, from MP 78.70 to MP 79.70 as shown on Figure 10.6.4-12, was developed as a potential alternative to 1.0 mile of the original pipeline route through this congested area, and would be located to the east of the proposed route. This is an area where there are two existing pipeline easements that separate at this point.

While both routes follow existing pipeline corridors, the proposed route takes advantage of additional commercial areas, but does impact a greater amount of wetland and waterbody. A portion of the pipeline easement along the route variation is located in King St. through a heavily populated residential area. Based on the surveys completed to date and public comments, AES believes that the proposed route through the minor commercial area would result in fewer impacts and is not incorporating Route Variation 18.

Route Variation 19

Route Variation 19, from MP 80.70 to MP 81.10 as shown on Figure 10.6.4-13, was developed as an alternative to 0.60 miles of the original pipeline route through this congested area, and is located to the north and west of the original proposed route. This route would separate from the existing pipeline easement prior to crossing Rock Raymond Road, and head north up a steep hill to connect to a second pipeline easement where it would turn to the east to connect back to the first easement.

The originally proposed route through this area traverses a fairly steep hill with some areas of severe side slopes. According to public comments, this area has been prone to severe erosion events and flooding during previous construction projects in the area. Although AES has been unable to review this route in the field due to denial of access by landowners, at this time AES believes that Route Variation 19 would avoid residential structures, avoid an area of side slope construction, still utilize an existing pipeline ROW for a portion of the route, and therefore would likely result in less impacts. Therefore, subject to completion of field reviews, AES has incorporated Route Variation 19 into the preferred route at this time.

Route Variation 20

Route Variation 20, from MP 81.10 to MP 81.70 as shown on Figure 10.6.4-13, was developed as a potential alternative to 0.75 miles of the original pipeline route through this congested area, and would be located to the east of the proposed route. This variation would follow a second pipeline easement to the east to the end of the residential area, and then turn to the north and join the first pipeline easement.

AES has conducted a desktop survey of this route and determined that the route is almost twice as long, contains three additional large degree bends, would require a greenfield easement through a significant section of forested area, but would reduce impacts to a fairly populated residential area. AES is in the process of evaluating Route Variation 20 to determine if the route will reduce constructability issues and impacts to this residential area through a congested corridor.

Route Variation 20a

Route Variation 20a, from MP 84.80 to MP 86.30 as shown on Figure 10.6.4-14, was developed as an alternative to 1.75 miles of the original pipeline route through this congested area, and is located to the east of the proposed route. This variation is in an area where the existing pipeline easement splits and would leave one branch and turn east to the second branch of the easements south of the Town Park. The variation would then go through the park and cross I-76 (PA Turnpike) and follow Park Road to US-1 (Pottstown Pike), where it would turn north and meet back with the proposed route.

This variation would involve additional greenfield construction through a forested area and traverse the center of the Town Park, and there is not a significant reduction in construction-related constraints. The proposed route follows an existing pipeline easement but traverses a heavily residential area. AES is in the process of performing an engineering evaluation of Route Variation 20a to determine if the route will reduce constructability issues through a congested corridor. Upon completion of this analysis, AES will provide its recommended routing through this area to the Commission.

Route Variation 21

Route Variation 21, from MP 85.25 to MP 86.30 as shown on Figure 10.6.4-14, was developed as a potential alternative to 1.75 miles of the original pipeline route through this congested area, and is located to the east of the proposed route along Park Road and Pottstown Pike. This route variation was developed in response to a comment made by the Township of Upper Uwchlan at a public hearing on June 6, 2006.

Since that public hearing, AES has met with the Township on June 20, 2006, and has been working with the Township to develop a viable route variation as represented on Figure 10.6.4-14. This variation (combined with portions of Route Variation 20a) would limit the impacts to the Town Park, and residential areas, and would maximize the use of roadways and commercial areas. Although there is a church and school located along this variation, at this point, AES believes that Route Variation 21 would reduce residential and environmental impact, and has incorporated it into the preferred route.

Route Variation 22

Route Variation 22, from MP 86.50 to MP 87.30 as shown on Figure 10.6.4-14, was developed as an alternative to 0.50 miles of the original pipeline route through this congested area, and would be located to the west of the proposed route. This route was developed partially based on public comment. This variation would leave the preferred route on the north side of the Catholic Church property and cross Fellowship Road. The variation would then travel along the back of the Lexus Dealership, across the landscape supply business, and continue north around the wastewater treatment facility. At this point, the variation would turn to the east and rejoin the original proposed route.

AES evaluated Route Variation 22 and would be able to site the line to avoid residential and commercial development. The original route is shorter and contains fewer large turns, but it does travel along a highly congested road where workspace is limited and close to a residential subdivision. Although Route Variation 22 is longer, at this point, AES believes that it would reduce residential and environmental impact, and has incorporated this route variation into the preferred route.

10.7 Summary

The North American natural gas industry is facing a critical period over the next 10 to 15 years when increased supply availability will be essential. Given that the unsatisfied demand for energy supply available from natural gas is not considered to be acceptable to consumers (i.e., consumers demand natural gas due to the efficiencies and environmental benefits it offers) alternatives not meeting the purpose and need of the Project were not considered viable, including the No-Action alternative.

System alternatives for the proposed LNG Terminal were considered. These alternatives include the expansion of existing or approved LNG terminals, including Crown Landing LNG and Dominion Cove Point LNG. In addition, AES evaluated trans-continental pipeline projects such as the Rockies Express Pipeline and the Mackenzie Gas Project. Given the forecasted decrease in production of natural gas in supply basins that serve the Mid-Atlantic Region, LNG is projected to supply not only incremental increases in natural gas demand, but also to replace the projected reduction in other supply components (i.e. natural gas imports from Canada and certain United States production basins). For this reason, neither the expansion of existing or proposed LNG terminal projects nor the proposed trans-continental pipeline projects would be an adequate system alternative to the Project. In addition, trans-continental pipeline projects, without accompanying construction of one or more LNG terminals, would not serve the Project purpose of accessing supplies of natural gas from world production centers, and would likely result in greater landowner and environmental impact. The commercial feasibility of serving the Mid-Atlantic Region from sources outside the Region (whether those sources are production basins in North America or LNG terminals) further limits the acceptability of such alternatives. Finally, the additional Project benefit of introducing new natural gas storage facilities into the area would not be realized.

AES used seven criteria to evaluate locations of an LNG terminal, including alternatives for offshore and onshore options. Consideration of design features, including deepwater access, distance to residential areas so as to provide a wide margin of safety for the public in any worst-case event, and minimization of disruptions to maritime traffic, led to the conclusion that only projects sited along the Mid-Atlantic seaboard or within the Chesapeake Bay would be a feasible LNG terminal site alternative to the proposed site at Sparrows Point. Once all offshore terminal locations were eliminated from further consideration, seven onshore alternative locations within the Chesapeake Bay were evaluated in detail. Four of the alternative sites were eliminated due to close proximity to residential areas. Two other alternatives were eliminated because obtaining site control within a reasonable and timely manner did not appear likely. Finally, one alternative was eliminated because it would require routing the associated natural gas pipeline through more densely populated areas than the preferred location at the proposed Terminal Site.

Four pipeline system alternatives to the proposed Pipeline were evaluated, none of which is considered to be a viable alternative. In accordance with conventional pipeline routing principles, collocation with existing utility corridors to the maximum extent possible was the primary routing strategy. The primary strategy was supplemented by evaluation of a range of environmental, engineering, and socio-economic variables. An existing natural gas pipeline corridor controlled by Columbia, which traverses northeasterly across northeastern Maryland and southeastern Pennsylvania, was identified as the primary route corridor for the northern portion of the Pipeline. This portion of the proposed Pipeline Route would comprise approximately 65 percent of the total Pipeline length. The Columbia corridor offers the proper direction and shortest distance, thereby decreasing potential physical, natural and human resource impacts. The proposed Pipeline Route and four route alternatives were evaluated south of the Susquehanna River in Maryland. Based on a combination of variables, a combination of route alternatives having the least overall environmental and socio-economic impact was selected for the southern portion of the route. AES also has evaluated 25 minor route variations along the preferred route, and has incorporated many of those into its proposal.

LNG terminal design alternatives, dredging methods and dredged material management alternatives were also evaluated in order to avoid or minimize environmental impacts, and impacts on waterway users based on public input received, and consistent with local available options such as access to land. Based on the analyses presented above, AES believes that the identified preferred alternatives meet the goals of implementing a Project that avoids or minimizes potential human resource and environmental impacts.

10.8 References

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