

Galway Group

Advancing Energy Decisions

SUBMITS

Proposal

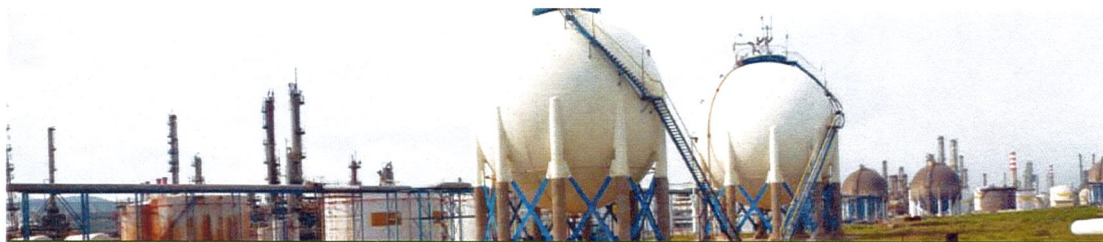
FOR

SAN LUIS FEASIBILITY STUDY FOR NATURAL GAS PROJECT

TO



16-May-19



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GALWAY GROUP PROFILE

Galway Group, LLC (Galway) is an energy advisory firm founded in 1995 by several former senior energy industry executives. Since 1995 Galway has grown to a full-service energy advisory firm with its head office located in Houston, TX and worldwide project operations supported by offices located in London, Bangkok, and Singapore. Galway has specialized in oil/gas/LNG sector with domestic as well as international projects starting with estimation of demand/supply, concept to detailed design of oil/gas pipeline and associated infrastructure, environmental impact assessment & mitigation, regulatory frameworks, and project management and commissioning. Compared to other typical engineering firms, in addition to engineering, Galway has functional expertise in strategy, commercial and financial aspects of projects. Therefore, Galway can package technical aspects of projects with strategy, commercial and financial aspects which leads to eventual realization of a project.

Galway is currently involved in a project that relates to export of natural gas from US to Mexico and production of basic chemicals in Mexico. As such, Galway is familiar with regulatory regime and infrastructure set up on both sides of the border. Galway representatives met with Mexican Energy Regulatory Commission (Commissions Reguladora de Energía) in Mexico City earlier this month. In regard to assessment of environmental and social conditions, Galway has always stressed upon using local expertise who have a better understanding of local milieu.

Feasibility Study Track Record: Galway has deep and extensive experience in providing technical and commercial advice to the Gas/LNG industry and particularly Natural Gas Infrastructure projects. **Galway has recently assisted several clients with feasibility of natural gas import (commercially and technically), infrastructure and assessment of gas market dynamics.** Galway's areas of expertise relevant to this assignment include:

- Conducting primary and secondary research for bottom-up gas demand estimation, identifying participants and stakeholders, developing market demand and price forecasts;
- Technical assessment and development of gas and LNG infrastructure projects. Galway has extensive experience in developing these infrastructure components including configuration and option selection, siting studies, procurement plan, spend curves etc.
- Conducting detailed techno-commercial feasibility studies in natural gas segment including upstream drilling, gas pipelines, LNG export terminals, LNG import terminals and floating LNG projects;
- Reviewing and developing gas pricing policies, commercial terms and infrastructure development requirements including regulatory and permitting process;
- EPC management, funding strategies, capital raising, project oversight and implementation;

It may be worth noting here that one of Galway's main skills is to provide an integrated and comprehensive view of the gas value chain, from both a technical and commercial perspective, which can be vitally important to any Government/private players who embark on an economic development plan based on gas as one of their primary fuels.



World Class Gas/LNG Team: Galway's principals are seasoned Gas professionals with many years of direct industry experience, combined with extensive consulting experience globally.

The Galway team assembled for this project has deep understanding and extensive experience in all aspects of gas market feasibility, siting and commercial studies. Short bios of the relevant have been provided.

Experience in supporting development initiatives: Galway's team has worked several government enterprises across the globe and international financiers such as World Bank Inter-American Development Bank (IDB) in the past for a number of projects and has good understanding developing gas, LNG and power projects, project requirements, operational policies, evaluation criteria, depth and scope of analysis required and reporting requirements. In past 3 years, Galway has conducted more than 10+ feasibility assessment and due diligences which makes Galway one of the most qualified parties to bid for San Luis Feasibility Study for Natural Gas Project

SCOPE OF WORK, DELIVERABLES AND FEES

SCOPE OF WORK

Communities along the U.S.-Mexico border where natural gas infrastructure is limited or non-existent are considering tapping into new or existing cross-border or nearby pipelines for commercial, residential, industrial, and governmental use. The City of San Luis, Arizona and San Luis Rio Colorado, Sonora are serviced by propane gas and would like to explore the possibility of bringing natural gas to the area.

As Galway understands, the purpose of the study is to review and evaluate the feasibility (principally from an economic perspective) of developing a project to install the necessary infrastructure for natural gas supply and distribution grid in the communities of San Luis, Arizona and San Luis Rio Colorado, Sonora, including the identification of the technical, environmental, social, and legal considerations and requirements for the development of such infrastructure.

With this objective in mind, Galway proposes to complete the following tasks:

TASK 1: ESTIMATE GAS CONSUMPTION

In the aftermath of the shale revolution, competitive gas price and vast natural gas pipeline infrastructure has resulted in gas displacing oil and coal in power generation and industrial use. However, San Luis is not located in a natural gas producing region and thus, has a low natural gas utilization rate. Because of this, other sources of energy such as electricity and propane are primary sources of energy for residential, commercial and industrial users.

In order to fully understand the nature of gas demand and its potential to substitute existing fuels in the region:

- Galway will develop a natural gas demand profile for existing potential stakeholders located in San Luis, Arizona and San Luis Rio Colorado, Sonora. This demand profile will be established by investigating: (a) current energy needs in these cities, (b) energy mix that is fulfilling current demand in the region, and (c) potential for switching by existing consumers.



Figure 1: Power generation facilities in the vicinity of San Luis

- For the purpose of this study, Galway will categorize the demand in five segments: power, industrial, commercial, governmental and residential. Each of these segments usually has different gas requirements categorized as baseload or peaking. Galway will identify the nature of demand from these categories and include the impact in estimation of demand (some potential consumers may or may not want to switch – such stakeholders will be indicated in the demand profiles).
- These demand profiles shall include a detailed list of potential users and required volume/pressure, modeled with two seasons (summer and winter). It is expected that industrial users mostly have a flat demand where as residential customer may have a seasonal demand

the above two tasks will detail the magnitude of gas demand that can be captured today based on conducive infrastructure and commercial aspects. In addition to this, to justify development of natural gas infrastructure,

a detailed forecast of future demand will be developed based on projections supported by the general plans and the economic development plans for both cities. Galway will estimate this future demand for at least 10 years for both the cities with the following components:

- Develop a primary energy forecast for the cities based on factors such as population, industrial growth, residential needs, fuel constraints, etc. and estimate potential penetration of natural gas in the primary energy mix. Some of the current fuel such as propane may be displaced by natural gas and commercial/industrial players may be open to switching for cost and environmental reasons. Galway will evaluate these possibilities.
- Conduct interviews with stakeholders (commercial, industrial, government, schools and residents) in the region and understand various needs and development plans that may require natural gas. For example, if current school buses are using diesel, they might be interested in switching their vehicles to natural gas, reducing emission.
- Regulatory drivers and guidance: Consider the impact of environmental policies that may result in limiting use of certain fuels
- The profiles shall address factors that affect demand for natural gas, including expected trends to steadily increase demand for natural gas for the foreseeable future, and the short term and long-term factors that could affect natural gas demand in the area, including but not limited to weather, fuel switching, pricing, population growth, and other factors that could affect the demand.

Galway believes for such demand estimation, it is appropriate to develop scenarios. Consequently, Galway will develop High, Base and Low demand scenarios to capture various uncertainty of demand in future. Galway will also prepare a detailed assumption book developed for the estimation of demand.

TASK 2: ANALYZE EXISTING NATURAL GAS INFRASTRUCTURE

With demand estimated in the previous task, this section will investigate the potential of existing infrastructure to meet the gas demand. City of San Luis lies 650 miles the west of the Permian basin, one of the most prolific

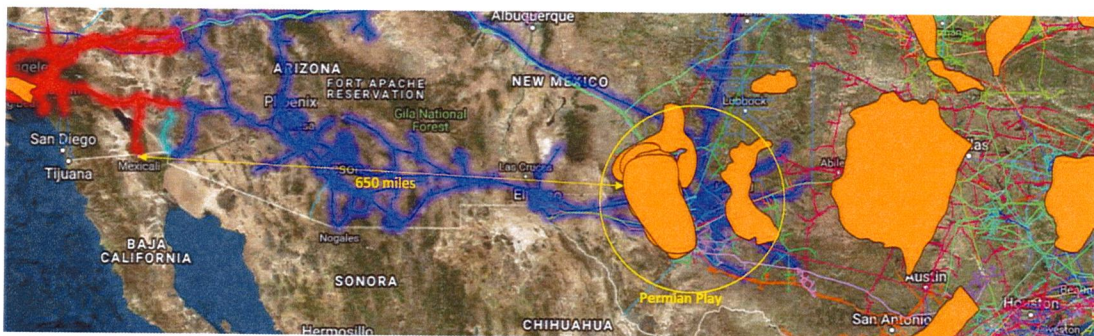


Figure 2: Pipeline Grids to San Luis

oil and gas basins, however, only three major pipelines reach close to San Luis – South California Gas company, Northern Baja Pipeline Co and El Paso Natural Gas Co pipelines. For the purpose of understanding the access to natural gas that can be acquired from these pipelines, Galway will:

- Identify existing infrastructure: Galway will identify existing gas pipeline network/ propose infrastructure in these two cities and associated spur lines connected to the above-mentioned gas pipelines. Galway will also analyze from public sources whether any contractual liabilities exist with the associated infrastructure
- Analyze capabilities and limitations of existing network: Galway will analyze the demand potential that can be served using existing infrastructure and will investigate limitations of the infrastructure
- Identify stakeholders: Galway will investigate potential LDCs in the region who are already serving the region and may be interested in expanding their services through expanded infrastructure. Galway will seek to interview the stakeholders to understand the dependence of existing infrastructure

With growth in development and population, it is likely that existing infrastructure will not be enough, and City of San Luis will require a reliable long-term source of gas supply. Galway believes that a likely solution may include construction of a pipeline connect to one of the three pipelines mentioned here (selection of pipeline

will depend on existing capacity and stability of source of gas). This pipeline may be a spur line fed from one of these pipelines to minimize construction and operations cost with effective utilization of the capacity. Connection point for proposed pipeline will be determined after determining stability of gas supply for the inter-

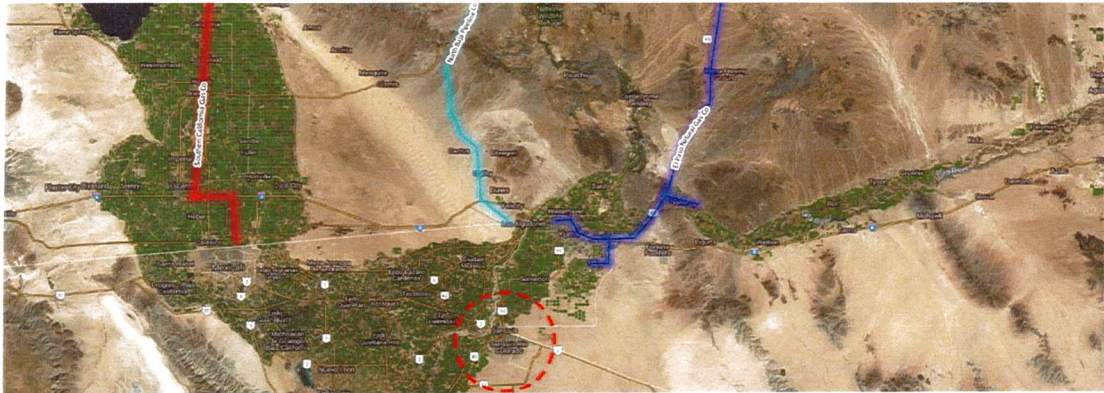


Figure 3: Natural Gas infrastructure near San Luis

-state pipelines. Based on above understanding and other findings, Galway will:

- Analyze the capacities available the inter-state pipelines and determine the following:
 - Capacity holders in the pipeline – Usually upstream gas players will hold capacity in these pipelines. These players then supply gas to the end consumers. Currently, from the maps, it appears that Yuma Cogen plant and Yucca power plant are receiving gas (it is not determined yet using which pipeline). Galway will identify these capacity holders for future expansion.
 - Pipeline utilization – To receive gas at the city gate, the pipeline needs to have sufficient capacity available. This capacity needs to be available not only at the existing lateral but also at the main trunk line as well (otherwise some expansion at the interstate pipeline level may be required). Galway will gather data on existing pipeline utilization and the interconnects that supply gas in the laterals.
 - Contract terms – Galway will analyze the contract duration with the existing pipelines along with type of contracts – fixed vs interruptible. This contract information will help the city analyze flexibility built in for use.
- Describe the operability of the existing natural gas infrastructure in the studied area (including above mentioned pipelines) and propose the best connection point for San Luis, Arizona natural gas system (SLNG),
 - This will include evaluating if the existing pipeline infrastructure has enough available capacity (not contracted under any long-term contracts) to support estimated current and future demand; or will it be required to upgrade the infrastructure to meet the new demands
- Propose a connection and termination point: including its coordinates, maximum allowable operating pressure, grade of steel, diameter, current pressure, liquid content and any other characteristic reliable for the design of the new pipeline. (This information will be collected from public and private sources. Such information plays a necessary role understanding flexibility and expandability of current infrastructure network).
- Identify any barring regulations that result in disqualifying one or multiple interconnect points and locations.

Collating the information gathered in this task, Galway will present a comprehensive summary of existing gas infrastructure, limitations, expansion possibilities and flexibility.

TASK 3: ANALYZE POSSIBLE ALTERNATIVES

It is Galway’s understanding that City of San Luis is seeking to prepare and improve its industrial and community growth by promoting natural gas distribution system in the area. By providing/expanding the natural gas infrastructure in the region, the city will be able to support large industrial, commercial and residential projects. It must be noted, however, that there is a long list of considerations that must be evaluated to arrive at a decision

of moving forward with the pipeline. These considerations are categorized into four sections: General, Gas Pipeline options, Portable LNG/peak shaving facility and do nothing. Following section describes the components

General

Some of the key decision parameters include:

- FERC jurisdiction and oversight
- Federal, State and local regulatory requirements
- Proximity of existing and potential customers
- Constructability
- Availability of reliable gas supply
- Impacts on Land owners and existing use of land (Right of Way)
- Public safety
- Socio-Environmental impact (including impacts to historical and cultural sites)
- Project cost and economics

Taking above in consideration, Galway will submit to the City at least two (2) options for the proposed SLNG route; including a decision analysis tool for each one considering environmental impacts, right of ways, estimated cost and local benefits.

Gas Pipeline options

For each of the options, Galway will provide:

- (a) Connection point (source) – for example, the three interstate pipelines discussed in the previous tasks could be used for this connection
- (b) Upside potential from the source – will provide potential for future expansion for the infrastructure. This will also include stability of gas supply from the source (for example of gas is coming from Permian basin)
- (c) Dimension of the pipelines in terms of length, diameter, route, crossings, operating capacity, expansion capacity and costs
- (d) Advantages and disadvantages of each of the options

Galway will prepare a photograph file for each route propose indicating if the line would affect any other city infrastructure.

Portable LNG/peak shaving facility

Galway will evaluate use of portable LNG including design of a satellite LNG plant and associated distribution of LNG. Such an option will require a concentrated cluster for demand as the value chain infrastructure for LNG is usually higher than natural gas. It must be noted that this option does not have to be mutually exclusive with the natural gas pipeline infrastructure. Depending on the nature of demand, a peak shaving facility may be supplemented with LNG to meet the demand in a cost-effective manner. Galway will identify this option from both stand-alone as well as supplemental basis

Do nothing option

Galway understands that do nothing does not meet the objective of the study, however, it is imperative to understand this option in case stakeholders choose not to proceed with any of the available options. Galway will analyze this option to understand the lost potential for the region, which could have achieved if natural gas were available.

Above task will be used to compare incremental value added by each of the options and determine the superiority of the options. Galway, at this stage, will also select the superior option based on viability of infrastructure, cost effectiveness, expansion potential, least environment harm and stakeholder approval

TASK 4: PROVIDE A CONCEPTUAL DESIGN OF THE PIPELINE ROUTE

With the options determined from the previous sections, Galway will determine conceptual design for pipeline routing. Typical pipeline conceptual design parameters include (not limited to) (a) Land survey, (b) components determination, (c) development of preliminary drawings, (d) defining the component specification, (e)

developing cost estimates (CAPEX and OPEX) and preliminary construction schedule. These components are described below:

- GIS/Desktop Route Survey: A preliminary pipeline route survey is necessary to identify easements for the right of way. Identification of these easements will help identification of landowners for a legally binding agreement. Additionally, this preliminary survey will identify stream crossing, mountains, agricultural developments, animal habitat and historical area. Galway will undertake this study and gather this information through various public and GIS sources. This will provide a preliminary routing for the proposed gas pipeline.
- Conceptual design basis memorandum
- Components Determination: Based on estimates of demand profile and quantity, available gas quality, temperature, elevation changes, and route survey, Galway will provide outline of the specification of various equipment required. These equipment will include valves (sectionalizing), compressor stations, metering stations, etc. Pipeline diameter, wall thickness and grade will be provided following ASME B31.8 – 2018 Gas Transmission and Distribution Piping System. A component summary may describe:
 - Approximate length, diameter, wall thickness and grade of pipeline extending from terminus point to interconnect point on the interstate pipeline (including pipelines of various lengths and interconnects)
 - Numbers, locations and horsepower (HP) of compression stations along the route (this will include additional expansion planning)
 - Delivery and receipt meter stations
 - Valves, fittings, pig launcher and receiver locations
- Development of preliminary drawings: Based on the routing survey and components identified in the above tasks, Galway will prepare preliminary drawing of the pipeline route and components identifying each milepost, pipeline size, elevation, ROW and major crossings facilitating detailed engineering works

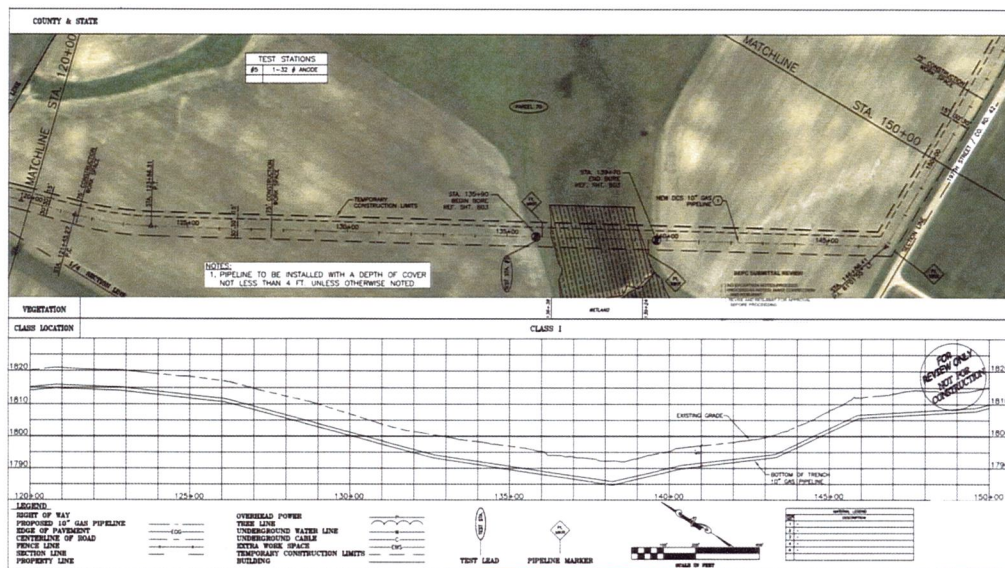


Figure 4: Preliminary drawing (for illustration purpose only)

- An outline of the following specifications will be provided:
 - Pipeline Specifications;
 - Valve Specifications;
 - Fittings Specifications;
 - Corrosion Specification for the pipeline;
 - Pipeline Coating Specifications;
 - Specification for various components of the metering station;
 - Compressor Specifications, and;

- Pig Launcher and Receiver Specifications
- Developing cost estimates: Based on above tasks addressing routing, component and specifications, Galway will construct a detailed component wise cost sheet for the project in line with the conceptual design stage of the project. Some of the cost components may include Environmental Studies, Endangered Species studies, Route Preliminary Survey, Courthouse work on ROW, Landman Activities, ROW payments and burdens, crop and timber damages, engineering and design of boring, crossings and pipeline, cathodic protection design, permitting (state, stream waterways, highways, railroad, etc.), procurement of valves, fittings, launcher receivers, meters etc. Following table shows how the information will be summarized for the pipeline

Pipeline Construction component	X" Pipeline (average cost/mile)	Total Estimated Cost/Component
Right of Way	\$ XX	\$ XX
Right of Way damages	\$ XX	\$ XX
Surveys	\$ XX	\$ XX
Material	\$ XX	\$ XX
Construction and Labor	\$ XX	\$ XX
Engineering & Inspection	\$ XX	\$ XX
Overhead	\$ XX	\$ XX
AFUDC	\$ XX	\$ XX
Contingency	\$ XX	\$ XX
Legal Fees	\$ XX	\$ XX
Other services	\$ XX	\$ XX

- Developing preliminary construction schedule: With engineering, design specification, and costing covered, Galway will prepare a preliminary construction schedule. some of the components of the schedule may include:
 - Beginning of a pilot (if acceptable)
 - Dates and duration for open season on the gas pipelines – to evaluate customer interest
 - Permitting timeline – may include permits from several stakeholders and authorities
 - ROW acquisition timeline
 - Long lead material procurement
 - Compressor station construction timeline
 - Pipeline construction timeline
 - Testing and commissioning
 - Project in service date

This will conclude the task of conceptually design of pipeline and will provide appropriate depth on engineering, land, cost and development requirements of the pipeline.

TASK 5: EVALUATE ENVIRONMENTAL AND SOCIAL IMPACTS

The Environmental and Social Impact (ESI) study will be prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 as amended (42 U.S.C. 4321 et seq.) and Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500–1508). The ESI study process will be carried out after discussions with officials of the City of San Luis, Arizona and will be limited to the extent it supports the conceptual design of the pipeline and associated facilities.

Methodology - Simplified Matrix Approach to Perform Environmental Impact Assessment

Following the recommendation on page 6 of the RFP, a simplified environmental and social impact assessment approach will be developed using a two-dimensional matrix and expert judgment based on Leopold matrix. The developed approach will be applied to set baseline values and to assess any potential impacts on a wide range of receptors including direct, indirect and cumulative positive and/or adverse impacts to the biophysical resources, social, human health and transboundary impacts.

As per environmental impact assessment principles, a number of factors will be identified as the susceptible elements for which the environmental impact during construction phase, operation period, and decommissioning will be assessed. Each impact factor will be evaluated separately for its magnitude and significance using the indices presented in Tables 1 and 2 (shown here as an example).

The assessment results will be presented as shown in Table 3 where each cell is diagonally split in two parts. In the upper left-hand side of each box, a number from -1 to -10 has been included, which reflects the magnitude of impact, whereas number -10, as indicated in Table 1, represents the greatest magnitude and number -1 the least.

Index for negative impact	Impact	Table 1
-10	Extremely High (Devastation)	
-9	Very High	
-8	Relatively High	
-7	High	
-6	Above Average	
-5	Average	
-4	Low	
-3	Very Low	
-2	Extremely Low	
-1	Not Significant (No observable impact)	

Index for negative impact (Latin Numbers)	Significance (Impact is felt at)	Table 2
-x	Global Level (Massive Impact)	
-ix	Country Level	
-viii	Regional Level	
-vii	Zonal Level	
-vi	Town Level	
-v	Village Level	
-iv	Project Level	
-iii	Subdivision Level	
-ii	Individual Level	
-i	Not Significant (No observable impact)	

j	Description	Impact Factor (No. or %)	Assessment condition (i)				Magnitude (M) $\sum_{i=1}^{10} X_i$	Significance (S) $\sum_{i=1}^{10} Y_i$
			Direct	Long term	Negative	Reversible		
1	Physical Environment	Landscape	-10 -10	-10 -10	-10 -10	-10 -10	-40	-100
2		Hydraulics of river	-10 -10	-10 -10	-10 -10	-10 -10	-40	-100
3		Water pollution	-10 -10	-10 -10	-10 -10	-10 -10	-40	-100
4		Air and noise pollution	-7 -7	-1 -1	-4 -4	-1 -1	-13	-30
5		Change of land use	8 -10	-10 -10	-7 -7	-10 -10	-30	-100
6		Downstream water users	-7 -7	-7 -7	-10 -10	-10 -10	-34	-100
7		Spread of Malaria	-2 -5	-4 -5	-4 -5	-2 -5	-12	-30
8	Natural Environment	Aquatic life and fisheries	8 -10	-10 -10	-10 -10	-10 -10	-38	-100
9		Natural habitats	-8 -10	-10 -10	-10 -10	-10 -10	-38	-100
10		Ecological balance	-10 -10	-10 -10	-10 -10	-10 -10	-40	-100
11	Economic Environment	Stress on biodiversity	-10 -10	-10 -10	-10 -10	-10 -10	-40	-100
12		Value of properties	-3 -10	-10 -10	-3 -10	-10 -10	-26	-100
13	Social & cultural Environment	Likelihood of conflicts	6 -10	-10 -10	-7 -10	-10 -10	-21	-100
14		Archaeological sites & artifacts	-2 -10	-10 -10	-10 -10	-10 -10	-32	-100
Overall sum of magnitude and significance of environmental impact of						$\sum_{j=1}^{14} \sum_{i=1}^{10} X_i$ = -444	$\sum_{j=1}^{14} \sum_{i=1}^{10} Y_i$ = -1020	

To perform the assessment for the project shown in Table 3 (which is an example), fourteen-impact factors were listed in horizontal axis (j) and four assessment conditions in vertical axis (i). This two-dimensional matrix, as could be viewed in Table 3, provides 56 cells, which accommodates all major environmental interactions for this scheme. The magnitude and significance of each impact factor has been weighed utilizing the information from field observation and expert judgment based on the indices presented in Tables 1 and 2. The last two columns in Table 3 present the sum of scores for **magnitude (M)** and **significance (S)** of each impact factor. The bottom row in Table 3 sums up the overall scores for both the magnitude and the significance.

In the next step, some threshold values will be required to be able to evaluate the magnitude and significance of the impact. Using the expert judgment, the acceptable and rejecting thresholds for both magnitude (M_a, M_r) and significance (S_a, S_r) of environmental impact of proposed project will be defined. Such acceptable and rejecting thresholds will produce a platform for comparison of magnitude and significance of the impacts.

The analysis of the result of assessment will show where the scores of proposed PNGS scheme lie when compared to the acceptable and rejecting thresholds. Appropriate mitigation measures will be suggested to control and reduce any negative and reversible environmental impact of the scheme

Potential Impact Factors to be considered for proposed PNGS project

Some of the impact factors that will be considered when evaluating environmental and social impacts are as follows. This list will be reviewed, and changes made if Galway is commissioned to perform the work.

- Land use patterns
- Soils
- Hydrology and groundwater
- Surface water – Water Use and water quality
- Vegetative habitats
- Wildlife
- Special Status Species
- Protected areas
- Air quality
- Noise pollution
- Aesthetics and visual effects
- Hazardous Materials (including Supply, Transport & Storage of Natural Gas)
- Change in current use of fuels
- Infrastructure & Utilities
- Traffic and Transportation
- Cultural resources
- Socioeconomics – Employment, Poverty Levels, Income

Cumulative Impacts

Council of Environmental Quality (CEQ) regulations implementing the procedural provisions of NEPA define cumulative effects as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions” (40 CFR 1508). Such cumulative impacts can result from individually minor, but collectively substantial impacts which may take place over a period of time. Cumulative impacts on resources in the project area may result from the impacts of the project together with other past, present, and reasonably foreseeable projects, such as residential, commercial, industrial, and other development. These land use activities may result in cumulative effects on a variety of natural resources, such as species and their habitats, water resources, and air quality. They also can contribute to cumulative impacts on the urban environment, such as changes in community character, traffic patterns, noise, housing availability, and employment

The cumulative effects analysis presented in this EIS will be based on the potential effects (direct and indirect) of the proposed PNGS project combined with other past, present, and reasonably foreseeable future actions that could have effects in the project area.

TASK 6: REGULATORY GUIDANCE AND REQUIREMENTS

Galway will review and prepare a list of relevant regulations, including federal, state and local government policies in Mexico and the U.S. to design, construct and operate a natural gas system. This list will include all environmental and social assessment documentation and clearances that may be required for the implementation of the project and their estimated costs. Following is a list of some of the guidance for the US and Mexico:

Regulatory Guidance in the US: Regulatory guidance in the US will be provided at the federal, state and county level.

Federal

- FERC: Authorization of Natural Gas Export Facilities under section 3 NGA
- PHSMA
- FWS-AESO: Endangered Species Consultation under section 7 of the ESA
- FWS-BANWR: General Special Use Permit under section 28 of the Minerals Leasing Act
- IBWC- U.S. Section: Permit/license for activities under the jurisdiction of the IBWC at the United States/Mexico border

State

- Arizona Department of Environmental Quality – Water Quality Division – Surface Water Section
- Arizona Department of Transportation

- AGFD – Project Evaluation Program
- ASLD – Right-of-Way Section
- Arizona State Parks – SHPO

County

- Yuma County Department of Environmental Quality – Air Program
- Yuma County Department of Transportation
- Yuma County Regional Flood Control District
- Central Arizona Water Conservation District – CAP Lands Department
- Native American Tribes, If Applicable

Regulatory Guidance in Mexico: Energy sector in Mexico is the exclusive jurisdiction of the Federal Government. Permissible activities in natural gas, petroleum, natural gas liquids, condensates and crude methane hydrates are governed by Comisión Reguladora de Energía (www.gob.mx/cre/). This includes Pipeline transportation, Pipeline distribution, Compression and Commercialization of natural gas. Some of the applicable Mexican Resolutions are RES/577/2015, RES/370/2015 and RES/048/2016

TASK 7: EVALUATE PROJECT ECONOMIC FEASIBILITY

With growth and concentration of population, new infrastructure services such as gas distribution networks are required. One advantage of developing gas infrastructure network in a high population region is that same infrastructure can be used by more consumer as compared with sparsely populated regions. Thus, rather makes economic sense develop gas distribution network with more consumer potential. In order to evaluate economic feasibility of gas distribution network, Galway will

- Galway shall evaluate the economic feasibility of the proposed alternative, including all identified planning, construction, operations and maintenance costs; as well as potential income generated by the consumption of natural gas by potential users as determined in the natural gas demand profile. feasibility for the project will be established by comparing the cost of natural gas to community as compared to the substitutes.
- To this end, an analysis will be made regarding the cost of selling and potential structure of tariffs based on current market conditions for alternative fuel sources, as well as the natural gas market in the region and any applicable regulations.
- A sensitivity analysis will be performed to evaluate potential impacts on the economic feasibility of the project by varying market conditions and variations on the estimated construction and operation costs.
- Galway will provide at least three (3) U.S.A and Mexico natural gas suppliers and their type of business structure that owns and operate natural gas service in communities like San Luis, Arizona and San Luis Rio Colorado, Sonora.
- Galway will consider at least the costs for the following:
 - Final design of the natural gas distribution pipelines.
 - Environmental and social studies, including international, federal, state and local clearances, permits and licenses in Mexico and U.S.
 - Mitigation actions that may be required.
 - Construction permits.
 - Land acquisition and right of ways if applicable.
 - Installation of natural gas pipelines, including any compression or metering stations or any other facility required for the distribution system.
 - O&M activities during at least ten (10) years.

- Galway will undertake a detailed cost benefit analysis to analyze the impact of natural gas in the community. In this section of the task, an annualized cost (with appropriate returns built in) will be estimated. this cost will be classified as tariff for using the natural gas services. The tariff will be divided into two components:
 - Capital recovery (fixed charge) – Minimum tariff charged with a built-in equity returns for use of infrastructure
 - Commodity Usage (variable charge) – this quantity will depend on price of gas sourced

This cost, for the next 10 years, will be compared against current of propane/gas/electricity usage to the customers and savings will be derived from such action. Each of the mentioned customer segments – Power, Industrial, commercial, Government and Residential segments are expected to get benefitted with low cost

The task will also consider environmental impact by assessing reduction in emissions from the community
- Upon the City’s request and if additional data necessary is made available by the city, Galway will also evaluate potential impact of such infrastructure in the two cities including additional direct, indirect and induced employment. An input-output method Matrix will be employed in this case
- Upon request of the City, Galway would prepare general specifications for the procurement of development and installation of the San Luis Natural Gas System including environmental and social review, local or state authorizations, right of ways and other required studies for the implementation of the project.

TIMELINE AND DELIVERABLES

Galway understands the City of San Luis’s needs of having the report delivered within four (4) months (16 weeks, assuming July kick-off). With this in mind, Galway proposes to provide a draft written report in MS word format (or as agreed to the City of San Luis, Arizona), with all supporting files as required and applicable, no later than nine (14) weeks after award of contract. In order to fulfill City of San Luis’s expected timeline, Galway will suggest that City of San Luis provide any and all comments/changes about the report within two (2) weeks after receiving the draft report. The timeline is expected to be fulfill as Galway will deliver a final report no later than 5:00pm CT on the last business day of week 16 and before 5th December 2019.

DETAILED PROJECT TIMELINE		July			August				September				November				December					
No.	Tasks	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	2	9	16	23
1	Review of Initial Study Results and Selection of Preferred Options																					
	<i>Project Kick-off Meeting</i>	◆ Kick-off Meeting																				
1	Estimate Gas Consumption																					
2	Analyze Existing Natural gas Infrastructure																					
3	Analyze Possible Alternatives																					
4	Provide a Conceptual Design of the Pipeline Route																					
5	Evaluate Environmental and Social Impacts																					
6	Regulatory Guidance and Requirements																					
7	Evaluate Project Economic Feasibility																					
	<i>Progress Report (Weekly)</i>																					
	<i>Progress Report (Monthly)</i>																					
	<i>Interim Report</i>	◆																				
	<i>Final Report</i>	◆																				
	<i>Final Presentation</i>	◆																				

- Legend**
- Work to be completed by Galway
 - ◆ Project Deliverable
 - ◆ Project Meeting

Following are the deliverables for each of the tasks and description of how they will be reached

Task ID	Deliverable/Milestones

Estimate Gas Consumption	A spreadsheet of collected (primary data) and estimated data will be provided by mid-September. Notes and assumptions for this will be tabulated in MS word format and will be submitted along with
Analyze Existing Natural Gas Infrastructure	A spreadsheet of collected (primary data) and estimated data will be provided by early-September. Notes and assumptions for this will be tabulated in MS word format
Analyze Possible Alternatives	A detailed report in MS comparing various options will be by end of August
Provide a Conceptual Design of Pipeline Route	A detailed MS word report, associated engineering drawing, maps, alignment sheets etc will be provided by early November
Evaluate Environmental and Social Impacts	A detailed MS word report will be provided for this task by end of September
Regulatory Guidance and Requirements	A word report section will be provided by middle of August
Evaluate Project Economic Feasibility	A detailed MS excel model evaluating the feasibility. Associated assumption book and operating manual will be provided in word
Final report	A final report compiling all the above information will be provided in MS word/PDF and MS excel format. Other documents such as drawing, and maps will be provided in PDF or JPG file format

The timeline is negotiable to better suit the City of San Luis's needs. Other formats will be entertained as per the request of City of San Luis.

GALWAY THREE RELEVANT EXPERIENCE

In Galway's 20+ years of experience in Gas and LNG markets, the company has various assignments gas distribution network (more references will be available upon request). Following are the three assignments:

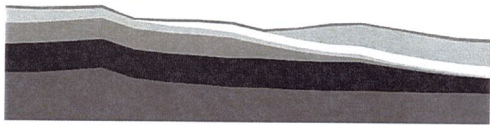

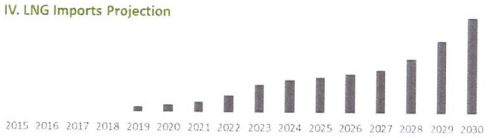
Reference 1: Gas Pricing Policy and Impacts: Bahrain

Assignment name: Gas Pricing Policy and Impacts: Bahrain	Approx. value of the contract (in current US\$): Confidential
Country: Bahrain	Duration of assignment (months): 8 Months
Name of Client: nogaholding (nogaholding is the investment and business development arm of Bahrain's National Oil and Gas Authority (NOGA))	Total No. of staff-months of the assignment: 32
Contact Person, Title/Designation, Tel. No./Address:	Adnan Saeed Al Mukhareq AMukharaq@NOGA.GOV.BH National Oil & Gas Authority
Start date (month/year): Oct 2018 Completion date (month/year): Jan 2019	No. of professional staff-months provided by your consulting firm/organization or your sub consultants: 32
Name of associated Consultants, if any:	Martin Paliga – Project Director Sud Haldar – Project Advisor Raquel Santos – Analyst Michael Sims - Analyst

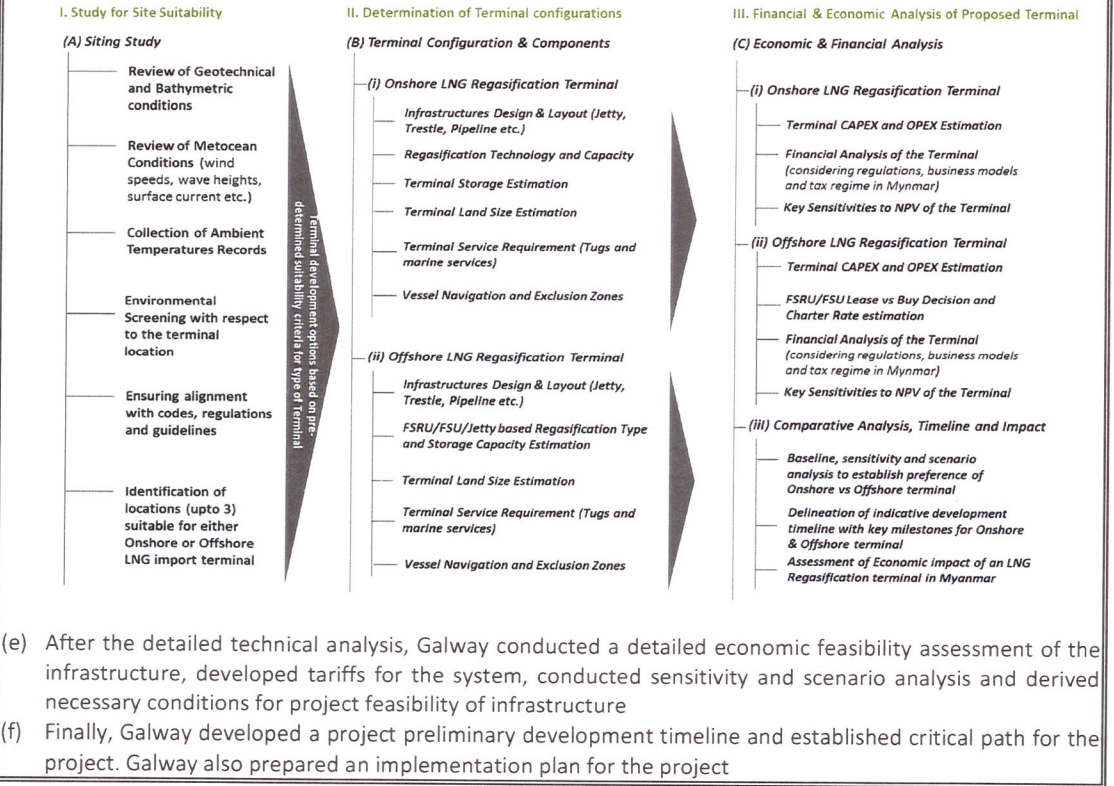
<p>Description of Project: The assignment was part of a larger LNG import terminal project in Bahrain. The government of Bahrain is in the final stages of commissioning an LNG terminal in the country. Because of difference in prices of LNG imported and domestic gas, and a cost benefit analysis of import of natural gas was required to understand profitability of industries and future development in the country.</p>	
<p>Description of actual services provided Galway staff within the assignment: Following are some of the actual services provided by Galway in this assignment:</p> <ul style="list-style-type: none"> (a) Reviewed Bahrain’s Economy & Energy Sector: Identified country’s main economic and energy sector features, including key stakeholders, to prepare ground for economic analysis phase. (b) Review of Bahrain’s Natural Gas Market: Reviewed Bahrain’s natural gas market covering domestic gas production, gas infrastructure, and gas consumption (allocation) with a focus on the country’s major gas consumers. This task was also a preparation for the next activity on the economic analysis of these gas users. (c) Economic Analysis: Analysed the critical issue of natural gas price affordability for the following large industrial customers: GPIC, ALBA, BAPCO, GIIC, SULB and ASC. Economic models were developed for all these gas customers to assess the impact changes in gas price would have on their industries. Analysis assessed the potential economic benefits in terms of employment and company earnings generated by different types industries for each unit of natural gas used. (d) Social & Political Analysis: Analysed the critical issue of energy subsidies, and the potential impact of removing or not removing these subsidies on the economy (e) Review of International Gas Pricing Policies: Reviewed regional and international natural gas pricing practices with a view to identifying potential lessons and implications for Bahrain (f) Gas Pricing Options: Focused on development of gas pricing policy options for Bahrain and follows on from the review of international gas pricing policies and the findings of the economic analysis. The pricing pool structure was presented and used to assess potential gas pricing options. (g) Impact of Gas Pricing Options: EBITDA margin was used as an indicator of the economic viability for both existing and post-expansion projects; whilst IRR is adopted as an economic indicator for new and expansion projects. The impact of different gas price levels resulting from the two gas pricing options, were assessed based on these economic indicators. (h) Recommendation & Implementation: Finally, drawing on the findings of the reviews and analyses; the extended consultation phase with the stakeholders and gas users; and, the working sessions with the Study Team and other stakeholders on the proposed gas pricing options, a set of recommendations regarding these gas pricing options and also the key elements for the development of an implementation plan were proposed. <p>Galway has been retained by nogaholding since 2013 to present. Galway also managed Front End Engineering Design (FEED) for the project and grid requirements. Galway is currently assisting in terminal commissioning and LNG procurement services</p>	

Reference 2: Gas and LNG infrastructure Feasibility Study, Myanmar

<p>Assignment name: Gas and LNG Infrastructure feasibility Study</p>	<p>Approx. value of the contract (in current US\$): Confidential</p>
<p>Country: Myanmar</p>	<p>Duration of assignment (months): 5 Months</p>
<p>Name of Client: (confidential) A Korean steel manufacturer intending to import LNG in the country</p>	<p>Total No. of staff-months of the assignment: 55</p>

Contact Person, Title/Designation, Tel. No./Address:	Confidential (Available upon request)				
Start date (month/year): Jan 2019 Completion date (month/year): May 2019	No. of professional staff-months provided by your consulting firm/organization or your sub consultants: 55				
Name of associated Consultants, if any:	Matthew Tan – Project Director Sud Haldar – Project Manager Hal Miller – Project Commercial Advisor Muthu Chezhan – Project Technical Advisor JG Tan – Analyst Wu Tianyao - Analyst (several others)				
Description of Project: On the face of declining natural gas in production in Myanmar, a South Korean client was interested in supplying gas and power to the country by importing natural gas. To this extent, Galway was asked to undertake a study to estimated gas demand and supply gap, size the infrastructure requirement in the country including LNG terminal and gas pipelines and provide a detailed economic feasibility assessment of the project.					
Description of actual services provided by your staff within the assignment: Following is the assignment executed by Galway team:					
(a) Market Overview including economic, Regulatory and status of infrastructure: Galway conducted a detailed analysis of Myanmar and regional market with respect to economic building blocks, associated regulatory oversight, existing infrastructure, market participants and demand forecast. Some of the specific components included identification each of the market participants in power and non-power sector with a potential for using gas. Galway also conducted a detailed bottom-up analysis of existing gas fields and their potential depletion trend and duration to understand the timing of gas imports required for next 15 years.					
<p style="margin-left: 20px;">I. Myanmar Market overview, Infrastructure, Pricing and Regulatory oversight</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none; vertical-align: top;"> <p>(A) Economic Overview</p> <ul style="list-style-type: none"> Country Economic Overview Economic growth drivers and projections </td> <td style="width: 25%; border: none; vertical-align: top;"> <p>(B) Regulatory Overview</p> <ul style="list-style-type: none"> Market Regulatory Bodies; Roles and Responsibilities Gas Pricing and Legislation Myanmar Investment permitting </td> <td style="width: 25%; border: none; vertical-align: top;"> <p>(C) Market Overview</p> <ul style="list-style-type: none"> Profile of Gas market participants (producers and consumers) Infrastructure Ownership Business Models </td> <td style="width: 25%; border: none; vertical-align: top;"> <p>(D) Infrastructure Overview</p> <ul style="list-style-type: none"> Existing, planned and proposed gas and power infrastructure in Myanmar – special focus on Kyaukphyu </td> </tr> </table> <p style="margin-left: 20px;">II. Natural Gas Supply Projection</p>  <p style="margin-left: 20px;">Following are some activities/outcomes of this stage</p> <ol style="list-style-type: none"> 1 Projection of onshore gas production 2 Projection of offshore gas production 3 Development of Map of Basins, Upstream blocks, and pipelines <p style="margin-left: 20px;">III. Gas Consumption Projection (with granular focus on Kyaukphyu)</p>  <p style="margin-left: 20px;">Following are some activities/outcomes of this stage</p> <ol style="list-style-type: none"> 1 Projection of Power Supply Demand Balance in Myanmar 2 Projection of Gas Demand from Power sector 3 Projection of Gas Demand from Non-Power sector 4 Projection of Gas Export Obligations <p style="margin-left: 20px;">IV. LNG Imports Projection</p>  <p style="margin-left: 20px;">Following are some activities/outcomes of this stage</p> <ol style="list-style-type: none"> 1 Projection of LNG Demand in High/Base/Low Cases 2 LNG Procurement/Pricing Models for Myanmar 3 Suggestions on LNG import portfolio and sources 		<p>(A) Economic Overview</p> <ul style="list-style-type: none"> Country Economic Overview Economic growth drivers and projections 	<p>(B) Regulatory Overview</p> <ul style="list-style-type: none"> Market Regulatory Bodies; Roles and Responsibilities Gas Pricing and Legislation Myanmar Investment permitting 	<p>(C) Market Overview</p> <ul style="list-style-type: none"> Profile of Gas market participants (producers and consumers) Infrastructure Ownership Business Models 	<p>(D) Infrastructure Overview</p> <ul style="list-style-type: none"> Existing, planned and proposed gas and power infrastructure in Myanmar – special focus on Kyaukphyu
<p>(A) Economic Overview</p> <ul style="list-style-type: none"> Country Economic Overview Economic growth drivers and projections 	<p>(B) Regulatory Overview</p> <ul style="list-style-type: none"> Market Regulatory Bodies; Roles and Responsibilities Gas Pricing and Legislation Myanmar Investment permitting 	<p>(C) Market Overview</p> <ul style="list-style-type: none"> Profile of Gas market participants (producers and consumers) Infrastructure Ownership Business Models 	<p>(D) Infrastructure Overview</p> <ul style="list-style-type: none"> Existing, planned and proposed gas and power infrastructure in Myanmar – special focus on Kyaukphyu 		
(b) Additionally, Galway analysed roles and responsibilities of various ministries, permitting required in the country for new infrastructure, and provided pricing overview to ensure the technical and economic feasibility for the country					

- (c) Galway conducted a detailed forecast of gas and power demand in the region based on population, potential industrial activities and commercial development and GDP impact (along with various elasticities)
- (d) Additionally, Galway undertook a detailed technical feasibility assessment for the infrastructure required for natural gas imports in the country which included engineering studies, environmental screening, specification development, identification of potential configuration and CAPEX and OPEX development



Reference 3: Gas and LNG distribution Feasibility assessment, Philippines

Assignment name: Potential of gas supply through Small Scale LNG	Approx. value of the contract (in current US\$): Confidential
Country: Philippines	Duration of assignment (months): 5 Months
Name of Client: (confidential)	Total No. of staff-months of the assignment: 30
Contact Person, Title/Designation, Tel. No./Address:	Confidential (Available upon request)
Start date (month/year): Feb 2017 Completion date (month/year): June 2017	No. of professional staff-months provided by your consulting firm/organization or your sub consultants: 30
Name of associated Consultants, if any:	Mangesh Patankar – Project Director Tushar Raval – Project Manager Sud Haldar – Project Economist JG Tan – Analyst

<p>Description of Project: The Philippines is a large system of islands with limited gas infrastructure developed in the Luzon island. Other islands are scattered, and it will be expensive to develop a pipeline infrastructure crossing the ocean. Consequently, the project was conceived to offset decline of gas from the existing Malampaya gas field of the Philippines. The project required techno-commercial assessment of infrastructure required and feasibility assessment of such import in the country</p>	
<p>Description of actual services provided by your staff within the assignment: Following are some of the task undertaken during this assignment.</p> <ul style="list-style-type: none"> (a) Development Gas Supply and demand in the Islands: Galway developed a detailed bottom-up gas supply and demand picture for the client through primary and secondary research. Galway team visited to the Philippines and conducted interviews with Power, petrochemical, mining, Cement, Glass, brick and ceramic industries along with other commercial and government setups. (b) Based on existing demand, government plans and objectives, interviews with department of energy Philippines and reviewing private sector plans, Galway developed detailed demand forecast for the country and estimated gas need to ensure future development. (c) Identification of necessary infrastructure and Development of CAPEX and OPEX: Galway identified necessary infrastructure to ensure the demand of downstream market is met and sized the infrastructure for future needs. This estimation formed the basis of economic feasibility analysis (d) Economic feasibility analysis: Galway conducted a detailed economic analysis tool to compare cost of delivered gas (including switching cost) with substitutes using various logistics options available (e) study of regulatory requirements in the country: Finally, Galway analysed the regulatory needs and requirements in the country for LNG imports and develop new gas infrastructure. <p>It was determined as per this study that at that time oil prices (2017), the project will marginally worse the existing substitutes.</p>	

PROPOSED PROJECT TEAM

PROPOSED PROJECT TEAM STRUCTURE

The Galway team brings over 200 man-years of LNG experience in the areas of natural gas/ LNG market analysis, power (electricity) markets, market understanding, supply-demand modeling, commercial mechanisms for natural gas procurement, possible financing options and onshore/offshore LNG terminal feasibility and design analysis.

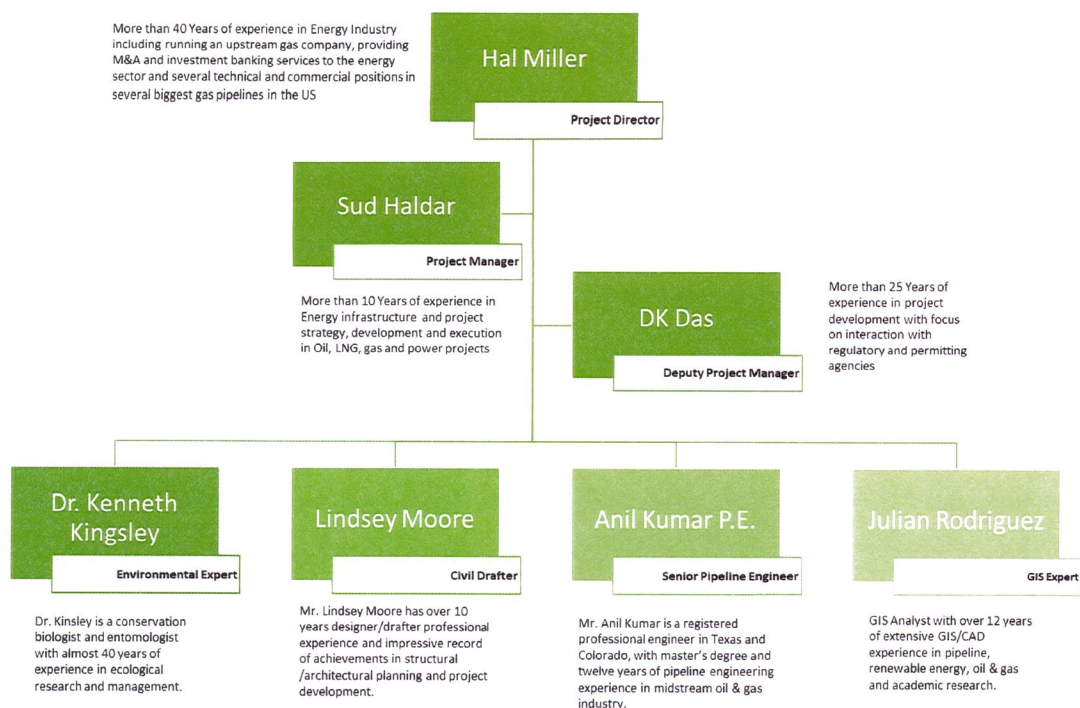


Figure 5: Project Team Structure

NOMINATION OF PROJECT MANAGER

Mr. Sudhanshu Haldar shall be nominated as Project Manager for this study. He shall be entrusted with the responsibility of coordination between various participants/interfaces and controlling the project, as well as being the interface between Client and the Galway Execution Team.

KEY PERSONNEL

HAL MILLER – PROJECT DIRECTOR

Hal is a 50+ year veteran of oil/gas industry. He has provided techno-commercial advisory services to various international clients related primarily to technical feasibility of FSRU terminals, structuring of upstream LNG supply projects, LNG acquisition, LNG SPA negotiations, receiving terminal commercial structuring, TUA negotiations, downstream pipeline arrangements, pipeline tariff arrangements, and LNG ship acquisition and/or chartering, commercial and financial modelling and structuring and overall market analysis and investment banking activities. He led a US mid-stream natural gas company and was responsible for gas & NGL processing & marketing, planning, regulatory affairs, international supply acquisition and new midstream business development.

SUD HALDAR – PROJECT MANAGER

Sud is the Director for Economics and Analytics at Galway Group focusing on opportunities across the natural gas and power value chain, including commercial and project development, market analysis, project structuring, cost estimation and economic valuation. He has a decade of experience working in infrastructure projects globally as a commercial and technical expert with hands on experience in project cost estimation. He has developed cost estimates of FSRU/FSU projects in Asia, Americas and Middle east. Mr. Haldar has undertaken numerous pre-feasibility/feasibility studies and configuration development studies for FSRUs and have provided guidance related with cost of buying or leasing and FSRU, jetty and trestle construction, subsea/on-trestle pipelines (gas and cryogenic), topsides and required components. Starting his career in engineering, Sudhanshu

has experience in construction and operations of oil and gas pipelines and refineries all across India. He also worked in LPG distribution, procurement and supply chain, and the retail interface of the downstream oil and gas segment in India and US. Sudhanshu holds a bachelor's degree in electrical engineering from the Indian Institute of Technology (IIT), Delhi and also holds an M.B.A. from Rice University.

DK DAS – PROJECT DEPUTY MANAGER

Over 20 years of experience in project management, pipeline engineering design, analysis and construction and environmental management in the energy and mining sectors in United States, Canada and 15 countries in South America, Asia and Africa. Energy sector experience covers a broad spectrum of pipeline engineering projects including basic, conceptual and detailed design, and installation projects for offshore (shallow and deep water) pipelines. Spent part of the career in environmental scoping studies, baseline studies, impact assessment, modeling, environmental management system design, interface with stakeholders, pro-active consultations with environmental regulatory agencies in the US, Canada, Tanzania, Chile, Argentina, Peru and Indonesia. Started career in structural engineering and performed design of pressure vessels, buildings, bridges, large tanks and pump foundations.

DR. KENNETH KINGSLEY – ENVIRONMENTAL EXPERT

Dr. Kingsley is a conservation biologist and entomologist with almost 40 years of experience in ecological research and management. My work has included surveys for invertebrates, mammals, birds, amphibians, fish, reptiles, and plants of many areas in the Southwestern and Eastern U.S. and Hawaii. He has worked in a variety of natural and human-influenced habitats including wilderness, subterranean, montane, wetland, desert, riparian, aquatic, agricultural, and urban environments. His background combines field skills, experience exploring challenging environments, natural history interpretation, technical writing, and critical analysis. He has conducted field surveys for wildlife and plants in Arizona, California, Colorado, Hawaii, Nevada, New Mexico, North Dakota, Utah, Virginia, and Texas.

He has published papers in the peer-reviewed scientific literature on endangered insects, birds, and mammals, and riparian ecology. Dr. Kingsley designed and managed a private 4,500-acre wildlife preserve and a natural history museum for a guest ranch in Arizona. He served as an adjunct professor for The Audubon Expedition Institute and Prescott College, and continue to engage in a variety of volunteer projects involving natural history interpretation, wildlife surveys, and ecological studies

ANIL KUMAR – SENIOR PIPELINE ENGINEER

Mr. Anil Kumar is a registered professional engineer in Texas and Colorado, with master's degree and twelve years of pipeline engineering experience in midstream oil & gas industry. His engineering experience includes work on multiple cross-country pipelines and pipeline replacement projects in United States; and oil sands pipeline projects in Canada. The key responsibilities included management, design, analysis, estimation, coordination, engineering reports, detail design and preparation of construction work packages. He also have a NCEES record and currently working towards registering himself as a Professional Engineer in multiple states of lower 48

LINDSEY MOORE – PROJECT DRAFTER

Mr. Lindsey Moore has over 10 years designer/drafter professional experience and impressive record of achievements within all facets of structural/architectural planning and project development. His experience combines with strong computer literacy and proficiency to implement strategic operational planned initiatives that enhance productivity, quality, customer service, and overall bottom-line performance. His specialization in Auto Cad 2018, Auto Cad Civil 3D, Cadworks 2016, Solid Works and Microsoft Word, Excel and Access

JULIAN RODRIGUEZ – GIS EXPERT

GIS Analyst with over 12 years of extensive GIS/CAD experience in pipeline, renewable energy, oil & gas and academic research. Support engineering staff, geologists, and environmentalist. Provide map production, GIS

models, data management, spatial analysis and drafting. Posses an A.A.S. degree in Geographic Information Systems (GIS). Certified Stormwater Inspector

PROJECT FEES

A. PROPOSED FEES

Lump sum labor fee of \$170,944 USD excluding taxes and additional expenses. As the funding of the project is subject to funding availability, we have included the fees for each task:

Proposed Fees	(USD)
Task 1: Estimate gas Consumption	31,360
Task 2: Analyze Existing Natural Gas Infrastructure	30,480
Task 3: Analyze Possible Alternatives	30,880
Task 4: Provide a Conceptual Design of the Pipeline Route	45,120
Task 5: Evaluate Environmental and Social Impacts	34,640
Task 6: Regulatory Guidance and requirements	12,640
Task 7: Evaluate Project Economic Feasibility	28,560

Total Fees before Discount	213,680
Discount Offered to Client (20%)	(42,736)
TOTAL FEES (AFTER DISCOUNT)	170,944*

* Excludes travel costs. Total lump sum cost in Cost Time Resource Sheet

B. PAYMENT SCHEDULE

Galway proposed that payments should be made as per following milestones, however, schedule is negotiable

Milestones	% of Total Fees
Project Kick-Off	20
Task 1 completion/Shortlisted options	10
Task 2 completion/Interim report	40
Task 3 completion/Final Report	30
Total	100

C. HOURLY RATES

Additional support required of Galway, outside of the Scope of Work as stipulated in section C2, shall be charged at the following Daily Rates:

Category	Daily Rate
Project Director	USD 1,440
Project Manager	USD 1,040
Project Deputy Manager	USD 1,200
Environmental Expert	USD 1,200
Senior Pipeline Engineer	USD 1,040
Project Drafter	USD 960
Project GIS Expert	USD 960
Analyst – I	USD 720
Analyst – II	USD 720

D. OUT OF POCKET EXPENSES

In addition to the tasks, out of pocket expenses including travel, accommodation and meals are provided in the Cost Time Resource Sheet.

E. COST TIME RESOURCE SHEET

COST TIME RESOURCE SHEET (CTR)				
Title	PROPOSAL FOR SAN LUIS FEASIBILITY STUDY FOR NATURAL GAS PROJECT			
Total Amount (USD)	178,944 (including Travel expenses)			
Resource(s) Labor				
Discipline	Job title/ Role	Man-hours	Rate/hr	Amount (USD)
	Project Director	80	200	14,400
	Project Manager	328	130	42,640
	Project Deputy Manager	152	150	22,800
	Environmental Expert	192	150	28,800
	Senior Pipeline Engineer	184	130	23,920
	Project Drafter	128	120	15,360
	GIS Expert	152	120	18,240
	Analyst – I	264	90	23,760
	Analyst – II	264	90	23,760
Total Fees before Discount				213,680
Discount Offered to Client				(42,736)
TOTAL FEES (AFTER DISCOUNT)				170,944
Additional Cost/ Software/ Expenses/ 3 rd Party				
Definition	Quantity	Value (USD)	Amount (USD)	
Travel for kick off /meetings (Project Manager)	3 trips	3,000	3,000	
Travel for kick off/meetings (other members)	4 trips	3,000	5,000	
TOTAL FEES (AFTER DISCOUNT) + ADDITIONAL COST				178,944

DETAILED CVS OF PERSONNEL

HAL MILLER – PROJECT DIRECTOR

Current Position	Chairman		
Nationality	United States		
Gender	Male		
Education			
Name of the Degree/ Qualification	Name of University/ College	Year	
BS Mechanical Engineering	South Dakota School of Mines	1961 - 1965	
MBA	University of Colorado	1969 - 1971	
Languages			
Name of the Language	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent

Professional Experience

Date (from - to)	City, state	Enterprise, organisation	Position	Description
2003 - present	Houston, Texas	Galway Group, LLC.	General Partner & Managing Director	Commercial advisory services to various international clients related primarily to structuring of upstream LNG supply projects, LNG acquisition, LNG SPA negotiations, receiving terminal commercial structuring, TUA negotiations, downstream pipeline arrangements, pipeline tariff arrangements, and LNG ship acquisition and/or chartering, commercial and financial modelling and structuring and overall market analysis and investment banking activities including merger & acquisitions and raising of private debt and equity.
1995-2003	Houston Texas	Cornerstone Ventures (predecessor to Galway Group)	General Partner & Managing Director	Energy related investment banking, including merger & acquisition and raising of private debt and equity.
1990-1995	Houston, Texas	Transfuel Resources	President	U.S. based up-stream oil and gas producer, and affiliate of Mitsubishi Corporation; responsible for operation of company.
1987-1990	Tulsa, Oklahoma	Willams Companies	VP Operational Planning & President of Willams Power Co.	Mid-stream natural gas company operating in U.S; responsible for coordination between various operating subsidiaries and development of independent power company.
1973 – 1987	Houston, TX	Transco Energy	Various EVP Transco Gas	Mid-stream natural gas company operating in U.S; responsible for gas & NGL processing & marketing, planning, regulatory affairs, international supply acquisition and new midstream business development.
1968 – 1973	Colorado Springs, Colorado	Colorado Interstate Gas Co.	Engineering & Marketing	Mid-stream natural gas company; responsible for design & construction of gas storage fields & processing plants and gas marketing.

1965 – 1968	Phillips Petroleum Company	Borger Texas	Field Engineer	Upstream oil and gas production; responsible for upstream oil and gas production operational support.
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SUD HALDAR – PROJECT MANAGER

Current Position	Director		
Nationality	Indian		
Gender	Male		
Education			
Name of the Degree/ Qualification	Name of University/ College	Year	
Master of Business Administration	Rice University	2012-2014	
Bachelor of Technology	Indian Institute of Technology (IIT), Delhi	2004-2008	
Languages			
Name of the Language	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent
Hindi	Excellent	Excellent	Excellent
Bengali	Native	-	-

Professional Experience

Date (from - to)	City, state	Enterprise, organisation	Position	Description
2015-Present	Singapore	Galway Group, LLC	Manager	Supporting commercial advisory engagements with clients involved in the LNG and natural gas sectors. Providing market research and analysis, assistance with structuring and economic evaluation for projects in the gas, power and petrochemical sectors.
2014 – 2015	Houston	Galway Group, LLC	Manager	Supported Commercial and Financial Advisory engagements with the clients in LNG, Power and Natural gas trading. Provided assistance with investment due-diligence, M&A transactions and valuation of assets across the oil and gas value chain in across the globe.
2013-2013	Houston	Energy Ventures	Summer Associate	Performed Quantitative analysis, financial modelling and valuation of oil field companies in early stages. Prepared investor presentation, reviewed business

				plans and wrote investment thesis for new investments. Also investigated potential investment opportunities United States and Canada
2009-2012	Ahmedabad	Bharat Petroleum Corporation Limited	Assistant Manager	Project Manager for construction of three cross country crude and petroleum products pipeline, a total of more than 1000 km. Carried out technical and commercial aspects of the projects at the site level, presented to and liaised with statutory authorities and government bodies for approvals. Ensured operation management with technical supervision and financial/billing/certifications.
2008-2009	Mumbai	Bharat Petroleum Corporation Limited	Engineering Executive	Worked in the Retail management and LPG distribution of Bharat Petroleum Corporation Limited in Mathura Product Installation and Piyala, Faridabad Liquefied Petroleum Gas Plant. Carried out feasibility analysis for 2 potential retail outlets in in Agra under the Sales Division in Agra. Designed a mechanical model to avoid the spillage losses. Analyzed and dug for various technical and commercial options for LPG Distributive system

Project Experience

Project title	Completion date	Contracting entity	Project description
LNG Procurement Business Model and Strategy	2015	ADWEC	Designed and forecasted long-term LNG prices of HH, NBP, JKM, Middle East and Brent and compared it with long-term LNG contracts. Investigated the capacity and availability of LNG export projects across the globe and presented possible sources of future LNG supply from Atlantic, Middle East and Pacific basins. Also presented current SPA quantities with each of the projects and identified possible traders and portfolio players for short-term supply options.

Evaluation of Canadian LNG Projects	2015	PTT	Carried out Due-diligence on three Canadian LNG export projects in Prince Rupert and Kitimat, BC, Canada to identify the best investment opportunity. Created economic and financial models for each of the projects including upstream, pipeline and liquefaction plant. Established tariffs and supply structure for the projects and presented a comparative ranking report of economics and viability of these projects.
Due-Diligence on upstream Asset in North America	2015	Confidential	Based on predetermined criteria of oil and gas field required, made a comparative assessment of required upfront capital of a low return field and a high return field. Also recommended the client about investment timeline for making appropriate return and aligned the supply hedging strategy
Shortlisting of suppliers for Long term LNG in South America	2015	Confidential	Assisted one of the clients, in South America, to shortlist the best LNG procurement bid, by providing comparative analysis of various bids. Provided various pricing benchmarks for evaluation of each bid, along with statistical analysis of pricing in case of cargo diversion and variation in pricing captured by confidence intervals. Also indicated the expected price of a cargo, in case it is diverted to a different region.
Due Diligence on Delfin LNG	2015	Enbridge	Provided a preliminary due diligence on the floating liquefaction project, commented on its feasibility and carried out the valuation of the project. Benchmarked the project with the comparative projects in the region, both floating and onshore. Also provided an analysis of regulatory frame work and approximate time for approval for such a project.
Valuation of Applied LNG	2015	Confidential	Carried out valuation of Applied LNG for a client in North America. Created a discounted cash flow model, a comparative market analysis and benchmarked the transaction value with similar transaction multiples. Provided views on future growth possibilities of Applied LNG and market penetration possibilities after the transaction.
South America Gas Market Analysis and FSRU deployment Opportunities	2014	IDB	Assisted the lender carryout the due-diligence on deployment of world's biggest FSRU in Uruguay. Carried out comprehensive global and regional (South American) LNG market analysis and predicted the future trend of LNG in these markets. Furnished a comprehensive outline of various floating solutions available and indicated costs of these solutions. Provided information on historical shipping industry and views on the growth of future shipping and FSRU industry. Estimated the charter rates for every tier of FSRUs and compared with estimated FSRU charter

			rates of Golar, Hoegh and Exceletrate Energy. Also investigated a possibility of redeployment of this FSRU as a LNGC and considered other downside risks
Valuation of CIMA Energy	2014	Mitsubishi	Helped the client with the valuation of one of the private crude and natural gas traders in United States and Canada. Provided a comprehensive Du-Pont analysis to identify margin fluctuations, and benchmarked it with other competitors to understand the strength and weaknesses of the trading company. Provided a cash flow, trading and transaction multiples valuation to the client.
SGA and Margin Analysis for new Trading Team	2014	Mitsubishi	Investigated the trading arms of companies ranging from bulge bracket banks to small units, to identify the optimum and most efficient combination of SGA and Margins. Also investigated possible risks and opportunities because of new regulations – BASEL III, Dodd-Frank and similar regulations in the commodities trading business.
Assessment of power costs for different fuels for greenfield Projects	2014	PetroSA	Created a comparative economic analysis of various scenarios: a LNG fired plant, a Diesel fired plant, a Coal fired plant with different coal qualities and an existing project. Calculated Tariff and power costs for each of the segments involved in the process and created stack of costs for each of these categories, based on a required return on the project.
Containerized LNG Study	2014	HECO	Created a summary of the viable, available (or soon to be available) shipping/container technologies associated with containerized LNG. Designed a conceptual articulation of relevant different full chain delivery concepts; an evaluation of these options, identification of issues and insights on their applicability to Hawaii. Investigated and presented a high level economic evaluation of these scenarios across the delivery chain and key technology providers that can support components within the containerized LNG delivery chain and parties that may be interested in participating in a RFP
Shale Play Valuation	2014	Toshiba	Created a summary of various types of models in shale plays in North America along with recent transactions in these plays. This study included production profile analysis, play as well as JV return analysis at different gas prices, A&D and Operating cost analysis and life cycle expenditure and cash flow analysis. Also compared the differences between dry gas and wet gas shale plays

LNG Cargo Arbitration	2014	PeruPetro	Helped the client with an arbitration on LNG cargoes diversion and royalty disputes. Collected data of loaded and reloaded cargoes from South America, North America and other relevant countries and performed a quantitative analysis on LNG and gas flow in the region. This involved analysis of natural gas and LNG flow in Sabine pass, Freeport and other LNG import terminals to determine, if the cargoes were unloaded or diverted directly. A final report with complete analysis was provided to the client. The decision was given in favor of the client.
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DK DAS – DEPUTY PROJECT MANAGER

Current Position	Senior Director		
Nationality	United States of America		
Gender	Male		
Education			
Name of the Degree/ Qualification	Name of University/ College	Year	
MBA, Finance & Accounting	University of Chicago, Graduate School of Business	2005	
MS, Civil & Chemical Engineering	University of British Columbia (Canada)	1993	
MASc, Structural Engineering	University of British Columbia (Canada)	1989	
MTech, Building Science	Indian Institute of Technology, Roorkee (India)	1986	
BS, Civil Engineering	University of Gauhati (India)	1982	
Languages			
Name of the Language	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent
French	Intermediate	Intermediate	Basic
Spanish	Basic	Intermediate	Basic

Professional Experience

Date (from - to)	City, state	Enterprise, organisation	Position	Description
2018 - present	Houston, TX	Galway Group, LLC.	Senior Director	Search new LNG ventures; Interact with project sponsors, stakeholders and in technical, financial, commercial and regulatory & permitting affairs.
2008 - 2017	Houston, TX	Universal Pegasus International Inc.	Director, LNG Opportunities, Senior Engineer in Oil / Gas Group	Project development strategy formulation; Interface and preparation of documents for FERC, MARAD, NEB-Canada, CEAA-Canada; Conduct engineering project feasibility studies; LNG terminal/FSRU/FPSO siting; Marine Terminal vs FSRU usage; Stationary barge for

				<p>small scale LNG offloading; Detailed route analysis for gas delivery pipeline; Cost estimate for various options; Interaction with vendors for various components; Preparation of procurement, logistics and construction work plans, budgets and schedules; Advisory role and supervision of environmental & geotechnical consultants</p> <p>Leading member of a multi-disciplinary team conducting concept to detailed engineering for layout, design and analysis of offshore pipelines, subsea structures, risers, and controls for E&P and LNG/FLNG projects around the globe; Participate in commercial contract negotiations with Oil/Gas Service providers; Prepare capital cost estimates, EPC packages & Tender packages; Typical clients - BHP, Hess, Noble Energy, Anadarko, ENI, Shell, Murphy and Newfield</p> <p>For Pritchard Capital Partners – Analyzed financial statements, studied macro trends in the industry, assessed strengths & weaknesses of competitors and created a full model for Jacobs, a major EPC firm in energy sector.</p>
2005 - 2008	New York, NY ; Los Angeles, CA	PricewaterhouseC oopers LLP & KPMG LLP	Experienced Associate, Structured Finance Group	<p>Modeled CDOs and CLOs; Incorporated financial risk management measures; Assessed Credit Ratings; Corresponded with Portfolio Managers & Lawyers; Interacted with Moody's, S&P and Fitch. Typical Clients: Deutsche Bank, Bank of America, Alliance Bernstein, Morgan Stanley, RBS.</p> <p>Created and maintained cash flow models for Alt-As, Subprimes, Auto loans and Student loans. Typical Clients: Deutsche Bank, Bank of America, Alliance Bernstein, Morgan Stanley, RBS</p>

2004	Raleigh, NC	Progress Energy	Associate, Financial Analysis & Business Strategy	Created pro-forma financial models and conducted valuation analysis using DCF and multiples for oil & gas acquisition targets in Texas and Oklahoma.
1993 – 2003	Vancouver, Canada	ERM – Rescan Consulting Inc.	Started as Project Engineer and progressed to Project Manager	<p><u>Engineering Design & Strategic Sourcing:</u> Teamed with multi-disciplinary team of engineers, geologists, environmental scientists for technical projects; Performed design of pipelines, pumps & compressors; Strategic sourcing and logistics with manufacturers and vendors worldwide</p> <p><u>Financial Modeling:</u> Built/maintained EXCEL-based financial models for companies in oil/gas and mining sectors; Performed discounted cash flow analysis; Researched, gathered and analyzed data on corporate developments/earnings by using company contacts, research databases & financial reports; Performed company due diligence</p> <p><u>Oilfield Services:</u> Designed innovative & practical solutions for fixing damaged pipes in shallow offshore waters; Tested and fabricated repair clamps, pipe induction bends and griplock flanges; Used services of oilfield servicing firms such as Halliburton & Oceaneering for contracts worth > \$8 MM.</p> <p><u>Business Development & Networking:</u> Took strong initiatives to develop extensive industry contacts with firms such as BHP-Billiton, Husky Energy, Suncor, Newmont, Encana and Barrick; Generated > \$6MM in consulting fees.</p> <p><u>Negotiations with Regulatory Agencies:</u> Successfully undertook challenge of negotiating with top level officials in regulatory agencies such as USEPA, CCME (Canada), Bapedal</p>

				(Indonesia), and Secretaria de Minería (Argentina).
1989 – 1991	Vancouver, Canada	Hipp Engineering Ltd.	Civil & Structural Engineer	<u>Structural Engineer</u> : Designed a 3-storeyed masonry building for Quesnel River Pulp & Paper plant extension; Designed pump foundations, large steel tanks, large steel ducts, <u>Civil Engineer</u> : Performed municipal engineering design for Coquitlam Newsprint Recycling plant, B.C., Canada.

Relevant Experience

Project title	Project completion date	Contracting entity	Project description
Old Harbour LNG (Jamaica)	Oct 2017	New Fortress Energy	Mid-size LNG import project to supply natural gas to power plant, bauxite mine and other industries
Aurora LNG (Canada)	Jan 2016	Nexen / CNOOC	LNG liquefaction project in Western Canada with feed gas from Northern British Columbia, Canada
Delfin LNG (Gulf of Mexico)	April 2016	Delfin LNG	FLNG liquefaction project in Gulf of Mexico with feed gas from three different gas supply entities
Pacific Northwest LNG (Canada)	Sept 2014	TransCanada	LNG liquefaction project in Western Canada with feed gas from Northern British Columbia, Canada
WoodFibre LNG (Canada)	February 2017	FortisBC & Woodfibre LNG	LNG liquefaction project near town of Squamish (Vancouver) in Canada with feed gas supplied by FortisBC
Damietta LNG Project (Egypt)	February 2015	UEG Group Spain	LNG liquefaction project in Egypt on the Mediterranean coast. Plant owned partly by ENI of Italy
Richport LNG (Puerto Rico)	September 2013	Richport Group New York	LNG import project in Northern Puerto Rico to supply natural gas to three power plants
Manzanillo LPG Terminal (Mexico)	April 2009	ZETA Group	LPG import facility in Mexico.

DR. KENNETH KINGSLEY – ENVIRONMENTAL EXPERT

Nationality	United States	
Gender	Male	
Education		
Name of the Degree/ Qualification	Name of University/ College	Year
Ph. D., Ecology & Entomology	University of Arizona, Tucson	
Master of Science, Biology	University of Nevada, Las Vegas	
Bachelor of Arts in Biology	Prescott College	
Languages		

Name of the Language	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent

Professional Experience

Dr. Kingsley is a conservation biologist and entomologist with almost 40 years of experience in ecological research and management. My work has included surveys for invertebrates, mammals, birds, amphibians, fish, reptiles, and plants of many areas in the Southwestern and Eastern U.S. and Hawaii. He has worked in a variety of natural and human-influenced habitats including wilderness, subterranean, montane, wetland, desert, riparian, aquatic, agricultural, and urban environments. His background combines field skills, experience exploring challenging environments, natural history interpretation, technical writing, and critical analysis. He has conducted field surveys for wildlife and plants in Arizona, California, Colorado, Hawaii, Nevada, New Mexico, North Dakota, Utah, Virginia, and Texas.

He has published papers in the peer-reviewed scientific literature on endangered insects, birds, and mammals, and riparian ecology. Dr. Kingsley designed and managed a private 4,500-acre wildlife preserve and a natural history museum for a guest ranch in Arizona. He served as an adjunct professor for The Audubon Expedition Institute and Prescott College, and continue to engage in a variety of volunteer projects involving natural history interpretation, wildlife surveys, and ecological studies.

Date (from - to)	City, state	Enterprise, organisation	Position
2017-present	Houston, TX	Galway Group	Expert in Biological Sciences
2011 - present	Tucson, AZ	Independent	Consulting Biologist
1991-2011	Tucson, AZ	SWCA Environmental Consultants	Senior Environmental Scientist
1990-1991	Tucson, AZ	Southwestern Field Biologists	Project manager/ Zoologist
1986-1990	Arizona	Independent	Consulting Biologist
1985-1986	Arizona	Department of Entomology, University of Arizona	Post-Doctoral Research Associate
1982-1985	Arizona	Department of Entomology, University of Arizona	Graduate Research Associate
1981-1982	Arizona	National Park Service	Biological Technician
1978-1981	Nevada	National Park Service	Biological Technician
1974-1978	Prescott, Arizona	Prescott College,	Adjunct Professor
1972-1978	Wickenburg, Arizona	Wickenburg Inn	Natural and Wildlife Preserve Manager
1989-1990	Houston, TX	Solar Turbines Incorporated	Project Engineer

SELECTED REPRESENTATIVE PROJECTS

Land Use Planning

Ecological Constraints and Opportunities Study, 2002

Client: City of Tucson

Evaluated lands owned or regulated by the City of Tucson for potential to have threatened and endangered species. Wrote several reports and presented findings at meetings. This work informed managers and the public of specific concerns for wildlife on City owned and regulated lands.

Environmental Assessment for Water Exchange Agreement, 1998.

Client: ASARCO and U.S. Bureau of Reclamation

Compiled and reviewed historical literature and drafted sections of Environmental Assessment on area history and Biological Evaluation of water exchange agreement between mining company and Native American community.

Great Salt Lake Shorebird Preserve, 1993

Client: Kennecott Utah Copper Company

Evaluated a proposed 2,800-acre shorebird and wildlife preserve adjacent to the Great Salt Lake; Advised on potential management and design options as part of mitigation program component of Section 404 (Clean Water Act) compliance.

Wildlife Preserve and Management Plan, 1972-1972

Client: The Wickenburg Inn Tennis and Guest Ranch.

Conducted a survey of plants and animals on a 4,700-acre parcel surrounding a proposed resort development. Using data from the survey, designed a wildlife preserve on that land, including horseback and foot interpretive trails, wildlife waters, and a management plan to enhance wildlife populations. I participated in the design team for the ranch, and served as an environmental monitor during construction.

Paseo de las Iglesias Project, 2001-2004

Client: U.S. Army Corps of Engineers and Pima County (as a subcontractor to Tetra Tech, Inc and DMA, Inc.)

Participated in a major riparian restoration planning project. Beginning with conducting a survey of a 7-mile reach of the Santa Cruz River for wildlife habitat and species of concern, he mapped habitat conditions and locations of wildlife observations to form the basis of a GIS database. Wrote sections of the project EIS.

Irvington Landfill End Use Master Plan, 1999

Client: The Acacia Group (contractors to the City of Tucson)

Participated in the planning team designing a city park for the end use of a closed landfill. Conducted surveys for threatened and endangered species. Compiled a list of all plant species occurring on the site, with special consideration for conditions unique to a closed landfill and irrigation limitations.

Habitat Conservation Planning

Adaptive Management Science Team Member, Clark County Multiple Species HCP, Clark County, Nevada. For Clark County Planning Department. 2004-2006. As a consultant to Clark County, he served on a team of scientists that includes representatives of the Biological Resources Research Center, University of Nevada, U.S. Geological Survey, U.S. Fish and Wildlife Service. Functions of the team include monitoring science in the management of the HCP, review of proposals for funding (totaling \$44 million in 2006), and evaluating scientific needs of the program.

Multi-species Habitat Conservation Plan, Pima County, Arizona, 2000-2003

Client: Pima County (as a subcontractor to RECON Consultants and ESI, Inc.)

Collaborated with teams of scientists, planners, landscape architects, economists, and GIS experts in developing a multi-species HCP for Pima County, Arizona; Wrote or supervised writing of evaluations of status and available information for 78 species of concern, and detailed species accounts for 55 species. I participated in threats assessment, establishing vulnerable species goals, habitat data analysis, preserve design and management plan, habitat suitability modeling.

Habitat Conservation Plan, 1993

Client: Washington County, Utah.

Prepared a habitat conservation plan for desert tortoise and other special status species; Was involved in meetings of the Steering Committee and Technical Advisory Committee, manuscript review and preparation, and negotiations with agencies and individuals.

Invertebrate Surveys and Studies

Dakota Skipper Surveys. 2016-2018

Location: Fort Berthold Indian Reservation

As a member of the SWCA Environmental Consultants Bismarck, North Dakota team, he conducted surveys for this threatened butterfly on the Fort Berthold Indian Reservation.

Pollinators of Shenandoah National Park. 2015.

Assisted in a park-wide survey of pollinators throughout the summer; Contributing collector to the Blue Ridge Bumble Bee Mega-transect project, and served as Interpretive staff as a resource person, and information desk attendant, and assisted in a survey for ticks.

Arthropods of Great Basin National Park. 2008-2014.

Participated in annual Bioblitz activities, each year focused on a different insect order. In 2012, he served 10 days each month, May-September, as Park Entomologist. Duties included: participating in a multi-park pollinator survey in association with the USDA Bee Lab; collecting, curating, identifying specimens collected by himself and others.

Bioassessment of Aquatic Macroinvertebrates, 1998-2006

Client: ASARCO, Inc.

Developed a protocol and conducted annual surveys and analysis of aquatic macroinvertebrates in Mineral Creek, above and below a mining operation to assist ASARCO, Inc. in compliance with its NPDES permit; Collected samples of invertebrates using a timed kick net method, and analyzed the results statistically using standard EPA analysis methods; Prepared annual reports.

Invertebrates of Organ Pipe Cactus National Monument, 1987-1990

Client: U.S. National Park Service. 1987-1990.

Conducted a three-year study on the ecology of invertebrates of this National Monument in southern Arizona; Trained and managed two teams of researchers and developed methodology for observing and collecting invertebrates at 16 ecologically distinct sites.

Plant Surveys and Studies

Distribution of Vascular Plant Species and Current Conditions of the Vegetation Community – 2006, Verde River Greenway State Natural Area.

Client: Arizona State Parks.

Biological Assessment of Potential Impacts to Pima Pineapple Cactus from Development of a Safeway Shopping Center in Sahuarita, Pima County, Arizona.

Client: Safeway, Inc. 2000.

Forest Management Plan Environmental Impact Statement - Range Condition Survey of the Navajo Nation Forest.

Client: The Bureau of Indian Affairs and the Navajo Nation Forestry Department). 1997.

Fish and Amphibian Surveys and Studies

Aravaipa Creek Fish Survey. 2002-2005 - seining and electrofishing survey of native fish

Client: U.S. Fish and Wildlife Service, Bureau of Land Management, Arizona Game and Fish Department, University of Arizona, and Arizona State University.

Chiricahua Leopard Frog Baseline Survey, 2004.

Client: Chilton Ranch, Arivaca,

O'Donnell Creek Fish Restoration, 2003

Client: The Nature Conservancy and Arizona Game and Fish Department. 2003..

Cave Creek Fish Survey, 1996.

Client: Spur Cross Ranch in collaboration with biologists from the US Fish and Wildlife Service and Arizona Game and Fish Department.

Salamander Surveys, 1992-1994

. For various private landowners in central Texas. 1992-1994. Conducted surveys, above and below ground, for salamanders of various species. Found several species of salamanders, including some rare and special status species.

Mammal Surveys and Studies

Status Review of Merriam's Mouse (*Peromyscus merriami*) in Pima County, 2004-2005.

Client: Pima County Flood Control District. 2004-2005.

The study involved examination of specimens and field notes of collectors, review of data on specimens in museums, evaluation of existing habitat potential at the sites where the species has been historically found,

selection of potential locations for further study, and live-trapping at 19 selected sites to determine whether the species is still present. Samples were collected for DNA analysis.

Bat Surveys, continuing since 1978

Client: Various mining companies and other clients.

Conducted surveys of inactive mine sites for bats that use them as roosts. Surveyed several hundred inactive mines for use by bats in Arizona, Nevada, and California. This included complete surveys of all adits that were safe enough to enter, and twilight watches at unsafe sites using night vision apparatus and ultrasonic bat detectors, including the ANABAT system.

Black Mesa Wildlife Monitoring, 1997

Client: Peabody Coal Company

Conducted surveys for small mammals and bats on reclaimed coal mining land on the Navajo Reservation. Developed experimental design to test hypothesis that mammal use of surface depressions was not different from mammal use of other reclaimed areas. Participated in fieldwork and data analysis, reviewed reports.

Multiple Taxa Surveys and Studies

Preliminary Inventory of Wildlife Species for Posey Well, San Simon, Arizona, 2006

Client: U.S. Bureau of Land Management (BLM).

A wildlife habitat improvement project is planned to be conducted by the BLM at a 60-acre site known as Posey Well near San Simon, Cochise County, Arizona. A pre- and post- project inventory of wildlife species is needed to document the potential impacts of the proposed project. Dr. Kingsley conducted a pre-project inventory of birds, mammals, reptiles, amphibians, and plants present and detectable under conditions at the time of the inventory, 5-7 April, 2006, and prepared a report documenting findings. Live trapping for rodents was done along transect lines through each community. Pitfall trap arrays for reptiles were placed in each community.

Biological Considerations and Opportunities for the A7 Ranch Property near Redington in Pima and Cochise Counties, Arizona, 2002.

Client: City of Tucson. 2002.

Prepared a report that summarizes observations and available information on the A7 Ranch with regard to wildlife and plant species that are considered special status species.

Ecological Constraints and Opportunities, 1995

Client: Molokai Ranch, Molokai, Hawaii.

Conducted a general survey of a 50,000-acre ranch, with focus on water lines and intakes, for threatened and endangered species. I compiled data on 65 special status species of plants and animals and potential impacts to them.

Biological Evaluation of the Apache-Hayden Transmission Line, 1996.

Client: Arizona Electric Power Cooperative.

Conducted survey and review for 67 special status species of plants and animals, prepared vegetation map, and wrote report that reviewed potential environmental issues for 90-mile power transmission line.

Bird Surveys and Studies

Weekly Waterfowl Counts, 2010

Location: Laguna Atascosa National Wildlife Refuge in south Texas

Part of a team that conducted weekly counts of waterfowl and shorebirds for eight weeks.

Important Bird Area Monitoring Surveys, 2005-2006

Location: Sonoita Creek State Natural Area and Verde River Greenway State Natural Area

Conducted transect and point count surveys following IBA protocols of birds.

Southwestern Willow Flycatcher Surveys, 2005-2006.

Location: Sonoita Creek State Natural Area and Verde River Greenway State Natural Area

Conducted call playback surveys.

National Marsh Bird Surveys. As a volunteer for Arizona State Parks. 2006. I conducted call playback surveys following the U.S. Fish and Wildlife Service approved protocol for marsh birds in the Verde River Greenway State Natural Area, including Tavasci Marsh.

Avian Inventory of the Lower Santa Cruz River, 1999-2000

Client: U.S. Bureau of Reclamation.

Principal Investigator on a project to determine the species richness and relative species abundance for bird species along an effluent-dominated stretch of the Santa Cruz River from the Roger Road Wastewater Treatment Plant to the Pima/Pinal County line. Conducted transect surveys along five one-half mile long study reaches three times in each of four seasons; Prepared a report that detailed findings and related them to vegetation and water conditions.

Surveys for Endangered Bird Species, since 1980

Client: Various clients.

Conducted species specific surveys for the following species: cactus ferruginous pygmy-owl, Mexican spotted owl, Yuma clapper rail, southwestern willow flycatcher, golden-cheeked warbler, black-capped vireo, yellow-billed cuckoo, bald eagle, American peregrine falcon, northern goshawk, common black.

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Johnson, R. Roy; Carothers, Steven W.; Finch, Deborah M.; Kingsley, Kenneth J.; Stanley, John T., tech. eds. 2018. Riparian research and management: Past, present, future. Volume 1. Gen. Tech. Rep. RMRS-GTR-377. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 226 p.

Kenneth J. Kingsley, John T. Stanley, Steven W. Carothers, R. Roy Johnson, Deborah M. Finch, Duncan T. Patten, Anne Sands, Bo Shelby, and Frederick J. Swanson compilers. Appendix A: Western Pioneers of Riparian Study Through the 1980s. pp. 212-219.

Carothers, Steven W.; Johnson, R. Roy; Finch, Deborah M.; Kingsley, Kenneth J.; Hamre, Robert H., tech. eds. In Press. Riparian research and management: Past, present, future. Volume 2. Gen. Tech. Rep. RMRS-GTR, Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

R.R. Johnson and K.J. Kingsley. 2012. Amadeo M. Rea and Ethnobiology in Arizona: Biography of Influences and Early Contributions of a Pioneering Ethnobiologist. pp. 11-43 *In: Marsha Quinlan and Dana Lepofsky. Explorations in Ethnobiology: The Legacy of Amadeo Rea. Contributions in Ethnobiology. Society of Ethnobiology.*

K.J. Kingsley and A.J. Gaiennie. 2009. How to Get Good Help Cheap—Retired Professionals as Volunteers in Wildlife Programs. *The Wildlife Professional* Summer 2009. Pp 62-64.

R. R. Johnson, R. L. Glinski, S. W. Carothers, and K. J. Kingsley. 2004. Urban Environments and the Cactus Ferruginous Pygmy-owl (*Glaucidium brasilianum cactorum*): a Profile of Endangerment of a Species. Pp. 135-145 *In: W.W. Shaw, L.K. Harris, and L. VanDruff. Proceedings of the Fourth International Symposium on Urban Wildlife Conservation. May 1-5, 1999. Tucson, Arizona. 368 pp.*

Karpiscak, M. M., K. J. Kingsley, R. D. Wass, F. A. Amalfi, J. Friel, A. M. Stewart, J. Tabor, and J. Zauderer. 2004. Constructed wetland technology and mosquito populations in Arizona. *Journal of Arid Environments* 56: 681-707.

R. R. Johnson, J.-L. E. Cartron, L.T. Haight, R.B. Duncan, and K.J. Kingsley. 2003. The cactus ferruginous pygmy-owl in Arizona, 1872-1971. *Southwestern Naturalist* 48(3):389-401.

K. J. Kingsley and M. M. Karpiscak. 2002. A Plea for Gathering Data on Mosquito Populations for Areas with Proposed Aquatic and Wetland Projects. *Meeting Resource Management Information Needs: Fourth Conference on Research and Resource Management in the Southwestern Deserts, Extended Abstracts*. Edited by W.L. Halvorson and B.S. Gebow. 2002. USGS Sonoran Desert Field Station, The University of Arizona, Tucson.

K.J. Kingsley. 2002. Population Dynamics, Resource Use, and Conservation Needs of the Delhi Sands Flower-loving Fly (*Rhaphiomidas terminatus abdominalis* Cazier) (Diptera: Mydidae), an Endangered Species. *Journal of Insect Conservation* 6: 93-101.

K.J. Kingsley, T.R. Strong, E. L. Smith, and T. K. Snow. 2002. Caves and Mine Adits as Wildlife Resources in the Sonoran Desert Region. *Proceedings of the 15th National Cave and Karst Management Symposium*. Tucson, Arizona. October 16-19. pp. 138-140.

MEMBERSHIPS AND AFFILIATIONS

- Entomological Society of America
- Xerces Society
- Arizona Native Plant Society

- Society for Conservation Biology

LINDSEY MOORE – PROJECT DRAFTER

Nationality	United States		
Gender	Male		
Education			
Name of the Degree/ Qualification	Name of University/ College	Year	
A.A.S. Mechanical Technology Specialization	North Harris College, Houston		
Languages			
Name of the Language	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent

Professional Experience

Mr. Lindsey Moore has over 10 years designer/drafter professional experience and impressive record of achievements within all facets of structural/architectural planning and project development. His experience combines with strong computer literacy and proficiency to implement strategic operational planned initiatives that enhance productivity, quality, customer service, and overall bottom-line performance.

His specialization in Auto Cad 2018, Auto Cad Civil 3D, Cadworks 2016, Solid Works and Microsoft Word, Excel and Access.

Assignments

- Developed detailed civil and structural drawings for oil and gas construction to meet site conditions and client standards.
- Coordinated with engineers to design, lay out, and detail foundations, pipe supports, structural steel to carry specified loads of piping and equipment.
- Spectra Compressor Stations Lead Designer
- Dominion Compressor Stations Lead Designer
- Net Mexico Compressor Station Support Designer
- Enbridge Line 66 and 63 Pump Stations Lead Designer
- Spectra Buffalo Storage Terminal and Pump Stations Lead Designer
- Developed detailed design drawings and specifications for structural design and post-tension cable for buildings construction.
- Coordinated with engineers to design, lay out, and detailed components to resolve design or other problems.
- Coordinated with General Contractors to modify drawings per needs in the field.
- Managed outside vendors regarding company needs and deadlines. P
- Prepared detailed drawings of wood truss structures and plans for fabrication and assembly according to specifications.
- Consulted with Engineers and clients providing two- and three-dimensional views of finished structures.
- Prepared detailed drawings of canopy designs and plans for fabrication and assembly according to specifications provided by engineer or customer.
- Worked with architects to meet their design requirements.
- Drew rough and detailed scale plans for canopy footings/foundations, components and building attachments, based on preliminary concepts, and sketches.
- Utilized (CAD) program to produce designs, working drawings, and fabrication drawings. Ordered material for construction.

SOFTWARES

- Documentation Processing
- Auto-CAD Civil 3D 2017

- CADWorx 2016
- Auto-CAD 2017
- SolidWorks 2010

ANIL KUMAR P.E. – SENIOR PIPELINE ENGINEER

Nationality	United States		
Gender	Male		
Education			
Name of the Degree/ Qualification	Name of University/ College	Year	
Languages			
Name of the Language	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent

Professional Summary

Mr. Anil Kumar is a registered professional engineer in Texas and Colorado, with master’s degree and twelve years of pipeline engineering experience in midstream oil & gas industry. His engineering experience includes work on multiple cross-country pipelines and pipeline replacement projects in United States; and oil sands pipeline projects in Canada. The key responsibilities included management, design, analysis, estimation, coordination, engineering reports, detail design and preparation of construction work packages. He also have a NCEES record and currently working towards registering himself as a Professional Engineer in multiple states of lower 48.

Area of Expertise

Total installed cost estimates, pipeline engineering design, project planning and development, engineering and design management, Horizontal Directional Drill (HDD) design, alignment sheets and as-built drawings; pipe and valve specifications; technical bid evaluations, pipe stress analysis of buried pipelines, pig launcher, receiver & mainline valve design & stress analysis; pump/compressor stations & meter stations design and stress analysis; water-hammer & surge analysis and anchor block analysis

Professional Experience

Chief Discipline Engineer - Pipeline

Niobrara Pipeline Project

ConocoPhillips, Rockies Business Unit, Colorado

Lead pipeline engineering discipline on this midstream project involving detail design and development of construction packages for gas pipelines network of 4 miles from new well facilities to existing pipeline trunks. Key responsibilities included engineering and design of 4”, 8” and 12” gathering lines, alignment sheets, permit drawings and hydrotest plans.

Energy East Pipeline Study

City of Winnipeg, Canada

Investigated potential issues pertaining to conversion of 36 inch gas pipeline to liquids pipeline for transporting 988,000 barrels/day of crude oil by TransCanada and potential impacts on Shoal lake aqueduct. He summarized the coating issues of asphalt enamel and polyethylene tapes; potential impact of surge, risk analysis; stress corrosion cracking (SCC) issues on existing pipeline, line rupture calculations and spacing requirements, evaluation of leak detection and emergency response, comparison of ILI tools like MFL and UT etc.

P66 Transportation Engineering Practices (TEP) Project

Phillips 66 Midstream, Houston, TX

Lead pipeline engineering discipline on P66 project involving upgrading, consolidating and developing midstream specifications per ASME B 31.4 and 49CFR195. The engineering budget value of the project was \$1.2

million with duration of close to 6 months. Worked as subject matter expert on pipeline scope and revised specifications for mainline valve design, pipeline construction, survey, hot taps, pipeline coatings, pipeline excavations, purchase of line pipe; gate, ball, plug, check, butterfly valves; induction bends, non-metallic piping, developed datasheets for valves, line pipe, casing installation etc. Collaborated with P66 SMEs (Subject Matter Experts) on specifications and ensured the specifications to comply with federal and industry codes.

Shell, Falcon Pipeline FEED Project

Lead pipeline engineering discipline on 100 mile ethane pipeline involving 16", 12", and 10" pipelines. Developed total installed cost estimate for the project and developed cost comparisons for mainline valve configuration.

Palmetto Pipeline Project

Kinder Morgan, USA

Lead pipeline engineering discipline on 370 mile \$1 billion dollar liquid pipeline project with capacity of 167,000 barrels per day, going across South Carolina, Georgia and Florida. Key responsibilities included coordinating the project progress between survey, right-of-way, engineering, and design team. Coordinated in setting-up GIS viewer to track progress of the project in real-time. Performed engineering calculations for wall-thickness, road and railroad crossings, and buoyancy control. Developed design basis memorandum and the geotechnical scope of work, as well as the pipeline schematic, HDD design and drawings, alignment sheets, and permit drawings.

COP CDRH GS&T Project

ConocoPhillips, USA

Lead pipeline engineering discipline on 16" gas and 8" HDPE waterline for North China Draw, South China Draw and Red Hills Trunk Line with project duration of 6 months and engineering budget of \$600,000. Key responsibilities included coordinating design between pipeline and piping team for gas and water tie-in locations; performing calculation for wall thickness, field bend limits, API 1102 calculations, HDD calculations; development of alignment sheets, permit drawing and HDD drawings; evaluation of anchor blocks at launcher and receivers.

Sir Solomon Hochoy Highway Extension, Vance River Pipeline Crossing Project

Trinidad and Tobago

Investigated geofoam bridge impact on multiple pipeline crossings. Key responsibilities included providing recommendations based on engineering analysis at pre-construction and post-construction stage of a geofoam bridge; performed wheel and track load analysis at pre-construction stage of Geofoam Bridge; and API 1102 calculations, and FEM stress analysis at post-construction stage.

Cortez & Lobos CO2 Expansion Project

Kinder Morgan, USA

Lead pipeline engineering discipline on 70 mile 30" Cortez pipeline and 4 miles 16" dry gas pipeline. Performed workspace layouts and prepared hydrotest plans. Also prepared P&IDs and performed technical bid evaluation, launcher & receiver and tie-in design. Evaluated anchor blocks requirements using pipe stress. Performed buried pipeline stress analysis and pipe stress analysis of pump station on Lobos and Cortez pipeline. Evaluated nozzle loads and recommended mitigations; HDD design, prepared material requisitions for pipeline materials; coordinated design effort between pipeline, civil/structural, process, and electrical disciplines and the Kinder Morgan operations and engineering team.

Bayou Ethane Pipeline Project

Williams Olefins Feedstock Pipelines, LLC

Lead pipeline engineering discipline on pipeline, mainline valve replacement and maintenance project. Key responsibilities included preparing process flow diagrams, alignment sheets development, pump station lateral design, pig launcher and receiver design, pipe stress analysis of multiple sites including launcher & receivers and bi-directional piping, mainline valve design, material requisitions, TIC estimates, material summary, 14 valve replacements packages and settlement analysis. He coordinated design efforts within various disciplines and

interacted with Williams to capture any design changes, design recommendations and issued final IFC packages for multiple sites.

Cochina Oil & Gas Project

Anadarko Petroleum Corporation

Lead pipeline engineering discipline on gathering system development involving liquid and gas pipeline network in West Texas. Key responsibilities included pipeline engineering and design; alignment sheet for multiple oil & gas pipelines.

Miscellaneous FEED Studies

Developed multiple FEED Studies Projects involving cross-country pipelines. Key responsibilities included developing material summary, TIC Estimates, basis of estimate documents, project schedule and preliminary engineering designs.

Mildred Lake Mine Replacement (MLMR) Project

Syncrude Canada Ltd.

Lead pipeline engineering design of 48" and 36" process water buried pipelines; material take off summary estimates, preparation of hydrovac packages, structural design of sleeves, horizontal augering drawings of sleeves at access roads and haul roads; co-ordination of interfaces with other Syncrude projects in the area, third party pipeline crossing design; and co-ordination with other disciplines process, piping for pipeline routing, P&IDs and line Designation tables.

Kearl Oil Sands Project, Phase 1, Hydrotransport and Tailings Pipeline Corridor

Imperial Oil/Exxon Mobil Canada

Lead pipeline engineering drainage design of pipeline corridor and structural design of sleeves in the ODP pipeline corridor, hydrotransport and tailings corridor and reclaim water pipeline corridor; engineering analysis of pipeline corridors. He designed sleeve for carrier pipelines under heavy haul trucks on haul roads, vehicles on access roads, service roads and ramps; preparing final grading drawings for reclaiming water pipeline corridor; preparing civil scope of work for construction work package and material take off summary for bid packages.

Southern Access Expansion, Extension and Southern Lights Project

Enbridge Pipelines Inc., Wisconsin & Illinois, United States

He worked as Pipeline Engineer on 42-inch and 20-inch pipelines from Wisconsin to Illinois. He performed alignment sheet and as-built drawing review, pipeline routing, thrust force analysis of various degree bends, prepared construction and pipe estimate, developed soil parameter calculation for pipe stress models, performed pipe stress analysis of bends based on ASME B 31.4, HDD design and pipe stress analysis of HDD, liquid pipeline road and railroad crossing design based on API 1102, wheel and track load analysis of heavy equipments, identified valve site location and generated profiles from LIDAR data for hydro-test. He developed a formula sheet for converting geotechnical report data to soil data as input to pipe stress models which lead to detailed pipe stress analysis.

85 North Expansion Project

Transcontinental Gas Pipeline, Alabama, North & South Carolina, United States

Developed sedimentation and soil erosion control plans for various counties in Alabama, North and South Carolina for FERC filing; and doing a feasibility study of Horizontal Directional Drill at North Tyger and Pacolet River.

Arkoma Connector Pipeline Project

Markwest Energy Partners L.P., Oklahoma, United States

Analyzed 24-inch mainline valve site by performing static, dynamic and valve blow down analysis and resolved stress issues.

16-inch HDD Crossing Design of Calcasieu River Crossing Project
ANR Pipelines – TransCanada, Louisiana, United States

Developed geotechnical scope of work, HDD design and analysis, developed material & coating specification for 16-inch HDD Crossing; and estimated TIC for HDD installation.

Study of Sabine Metering Station No. 3 & 8 Project
Kinder Morgan Louisiana Pipeline Project, Louisiana, United States

Key responsibilities included performing stress analysis of Sabine metering station, checking stresses based on ASME B 31.3 “Process Piping” cod; and performing support analysis and nozzle loading analysis on both stations.

Fort Bend County DFIRM (Digital Flood Insurance Rate Map) Project

Key responsibilities included hydrology study for Oyster Creek, peak flow analysis, hydraulic modeling based on LIDAR data, QA & QC reports of LIDAR data, reviewing FIRM maps for Harris county, validation of BFE elevations, preparation of FIS reports, preparation of Topographic H&H TSDN, floodway profiles and floodway data table updates based on hydraulic models

JULIAN RODRIGUEZ – GIS EXPERT

Nationality	United States		
Gender	Male		
Education			
Name of the Degree/ Qualification	Name of University/ College	Year	
A.A.S. degree in Geographic Information Systems (GIS)	Houston Community College	2014	
Languages			
Name of the Language	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent

Professional Skills

- Proficient with ArcGIS Framework (Engine/Server/Desktop 10.2/10/9.3) ArcMap, ArcEditor, ArcCatalog, ArcGIS Server. SQL Server, ArcSDE, ArcGIS extensions, ArcObjects
- Excellent understanding and knowledge of coordinate reference systems and projection issues with ability to geo-reference data, transform coordinates, and resolve cartographic discrepancies
- Excellent communication skills with the ability to translate technical data into language appropriate to varied levels of stakeholders from Senior Executives to individual contributors
- Proficient in alignment sheet production, map production, geospatial data management & processing
- Proficient in performing complex queries and analysis of spatial data with ability to assist users in utilizing GIS applications, databases, and data to achieve results
- Proficient in loading, updating, editing, integrating, validating, and maintaining spatial data
- GIS model design, spatial analysis, site selection using multi-criteria evaluation
- Knowledge of programming languages: Python and VBScript in ArcObjects
- Highly proficient in Microsoft Office applications, in particular MS-Excel & MS-Word
- Considerable knowledge in AutoCAD, Google Earth, Google Maps (KML/KMZ)

Professional Experience

GIS Field Technician 18- July 2016 to Present, City of Galveston

- Collect various field data using portable Geographic Information System (GIS) equipment.
- Collect field data on City Infrastructure
- Set grades for culverts; performing topographic surveys; prepare maps and designs using AutoCAD or ArcMap software
- Create typical drawings for street and sidewalks
- Create alignments, surface, and profiles for drawings
- Create borders and templates for drawings standards
- Efficiently create/modify specific detailed drawings in accordance with the design or markups provide by Engineer

Sr. Designer 1- April 2015 to March 2016, Wood Group Mustang, Houston

- Produced CAD Drawings from conceptual planning through permitted construction plans and technical specifications
- Provided support to principle engineers, such as alignment sheets, horizontal directional drills and well pad schematics.
- Coordinated with project managers to determine necessary field data to ensure successful designs.
- Worked with project team to execute projects on time.

GIS Analyst- September 2011 to February 2015, Universal Pegasus International, Houston

- Designed, established, created, updated, and maintained pipe segmentation, appurtenance, silt fencing, and jurisdictional water crossing GIS layers for various projects (Florida southeast, Kinder Morgan, Keystone XL, and Williams Projects)
- Designed workspace for routes on several projects including Florida Southeast, Kinder Morgan, Keystone XL, and Williams Project
- Created and maintained data for alignment sheet issues for F.E.R.C. and I.F.C. (Florida Southeast, Kinder Morgan, and TransCanada)
- Created a variety of resource reports: crossing, workspace, wetlands, and pipeline route changes
- Worked with project managers, engineers, and GIS leads on project deliverables (maps, pipeline data, and report analysis)
- Generated and validated data accuracy on alignment sheets, alignment sheet production, and route map production
- Generated alignment sheets, created reports with metal loss features and other anomalies on pipeline's corridor; correlation of survey data, ILI and CIS data into GIS layers to update SDE

CAD/Mapping Design Specialist-May 2006 to August 2011, Universal Pegasus International, Houston

- Assisted in the completion of proposed, ongoing, and as-built pipeline alignments sheets while maintaining a set standard of high quality and accuracy
- Gathered, manipulated, compared, and compiled data information such as survey field notes, data points, existing drawings, plats, property deeds, and any and all addition information needed
- Created elevation profiles, pipeline aerial views, alignment stationing, material band and material summary along the pipeline
- Reviewed alignment sheets for accuracy and proficiency