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**Design-Build Project Delivery of HDD for the South Seaside Reinforcement
Project Part 1: Assessment, Engineering and Preliminary Design**

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1. ABSTRACT

As a result of several extraordinary major storm events that caused unprecedented damage to New Jersey's utility infrastructure, leaving millions of the state's residents without necessary utility service, New Jersey Natural Gas (NJNG) has proposed infrastructure investments to enhance and improve the Company's ability to withstand and recover from severe storms. Through the NJ Reinvestment in System Enhancement (NJ RISE) program, NJNG is pursuing several capital improvement projects to enhance its system in response to a future storm events. Through the South Seaside Reinforcement Project, NJNG plans to install a secondary feed from existing mainland natural gas infrastructure under the Barnegat Bay to the South Seaside Peninsula. This secondary main will improve reliability, integrity and future restoration efforts through redundancy of the system that serves approximately 20,000 customers. This paper highlights the challenges associated with route selection process and HDD design process of the South Seaside Reinforcement Project. In addition, this paper highlights the benefits of the design-build project approach that includes Laney Directional Drilling (Laney) in partnership with Stantec Consulting Ltd. (Stantec) for integrated HDD engineering and design, project management and construction services.

2. INTRODUCTION

The South Seaside Reinforcement Project includes the installation of a secondary feed from existing mainland infrastructure located in Berkeley Township, NJ under the Barnegat Bay to the South Seaside Peninsula. *Refer to Figure 1: Project Location Map* for the general project location. The selected crossing will be installed using the Horizontal Directional Drilling (HDD) Method which is ideal for large water body crossings. The proposed distribution main will consist of NPS 12" diameter x 0.375 inch wall minimum, grade X-52 steel pipe, designed for an MAOP of 250 psig. The target in-service date of the proposed distribution main is Q4 2017.

To execute this project, NJNG hired Laney, a globally recognized leader in both HDD Design and Construction, and Stantec, a respectable trenchless engineering firm, to provide the design-build delivery of both engineering services and project construction. The first step of the process included a route selection study which required a series of conceptual design activities, beginning with the selection of a preliminary preferred distribution main route. The design team began by preparing a route study that compared the constructability of these alternate routes provided by NJNG, including identifying permitting requirements, a permitting timeline, project estimates and a general summary of any other critical and intangible factors and risks which would affect the timeline of this project. Constructability, schedule, and inconvenience to the general public and local businesses were the primary factors in determining the preferred route.

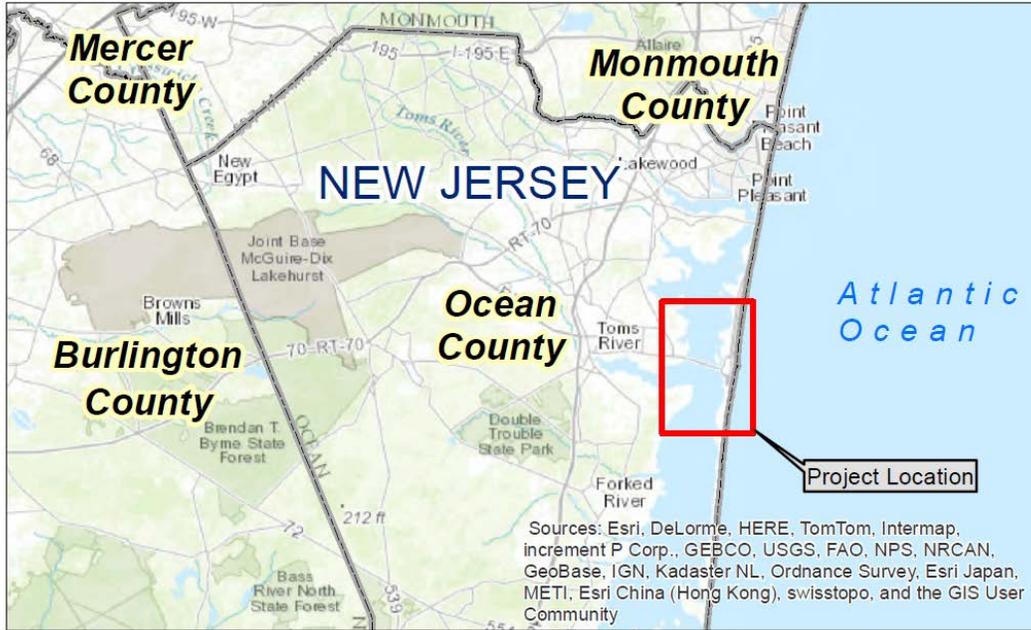


Figure 1: Project Location Map

Stantec and Laney performed site investigations to evaluate each as well as carried out a desktop route selection based on environmental impacts and technical knowledge in planning and design of distribution mains. The findings of these exercises were presented to NJNG in the “Project No.: 2067236300. South Seaside Crossing Project. Distribution main Route Assessment Report” dated April 22nd, 2016. The information presented in this paper is largely based on that report.

3. ROUTE SELECTION

A total of eight (8) route options were considered for the South Seaside crossing. All routes were grouped within three (3) major corridors and are presented in *Table 1: Crossing Route Options*. Refer to *Figure 2: Crossing Route Options*.

Table 1: Crossing Route Options

NORTHERN CROSSING	CENTRAL CROSSING	SOUTHERN CROSSING
“Shelter Cove Park” (Bay Ave) in Toms River Township to “Bayfront Park” (Bay Blvd) in Lavallette.	Vicinity of Route 37 Bridge in Toms River Township to Route 35 & Bay Blvd in Seaside Heights & Seaside Park.	“Good Luck Point” (Pier Ave or East Bayview Ave in Berkeley Township to South Bayview Ave in Seaside Park.
Option 1A	Option 2A	Option 3A
Route between Shelter Cove Park and Bayfront Park (at Kerr Ave)	Route between Toms River and Seaside Heights north of Route 37	Route between Good Luck Point & South Seaside Park
Option 1B	Option 2B	Option 3B
Route between Shelter Cove Park and Bayfront Park (at Camden Ave)	Route between Toms River & Seaside Heights south of Route 37 Anchor Square	Route between Good Luck Point & the Seaside Park Yacht Club
Option 1C	Option 2C	
Route between Shelter Cove Park and Bayfront Park (at Washington Ave)	Route between Toms River and Seaside Heights south of Route 37 Morris Blvd	



Several factors contributed to the selection of the recommended route. Selection of the recommended route was achieved using in-house experience and technical knowledge in planning and design of distribution mains, and an integrated method that accounts for engineering, construction, environment, and other factors including the following constraints shown in *Figure 3: Route Evaluation Constraints*.



Figure 3: Route Evaluation Constraints

Permitting and Environmental Considerations

There were many constructability and schedule factors that were considered for drill path selection including length and depth of drill as well as corresponding drill duration. Other factors such as the need for compound and horizontal curves as well as access to entry and exit were also considered. However, permitting and environmental

considered proved to be the most important factor in final route selection having the longest potential lead times as compared to actual construction. The following describes the pertinent permits required based on Federal, State and Local levels.

FEDERAL - US Coast Guard / US Army Corps of Engineers (USACE): Although the New Jersey Department of Environmental Protection (NJDEP) assumes regulatory authority over the Clean Water Act, proposed construction under a navigable waterway requires a permit under the Rivers and Harbors Act. Because construction will be completed via HDD and no disturbance is proposed within the Barnegat Bay, the project will qualify for a Nationwide Permit (NWP) 12 for the construction of utility lines and the associated excavation, backfill, or bedding for the utility lines, in all waters of the United States. This means the permit package must be submitted to the USACE as a Pre-Construction Notification.

STATE - NJDEP CAFRA Individual Permit / Waterfront Development Individual Permit (N.J.A.C. 7:7): The Coastal Area Facility Review Act of 1973 (CAFRA) established the CAFRA zone, as the bounds of CAFRA regulation. All of the proposed natural gas distribution main routes fell within the designated CAFRA boundary. Therefore, a CAFRA Permit under N.J.A.C. 7:7 will be required for the Project. Furthermore, within the CAFRA zone, a Waterfront Development Individual Permit will also be required under N.J.A.C. 7:7 for any work within a tidal waterway and all lands lying thereunder, up to and including the mean high water line. Because these permits fall under the same regulatory guidelines, they will be submitted and reviewed concurrently by the NJDEP.

STATE - NJDEP Flood Hazard Area Permit by Rule (N.J.A.C. 7:13): NJDEP regulates activities in streams, their flood hazard areas and riparian zones under the Flood Hazard Area Control Act rules (N.J.A.C. 7:13). According to the NJDEP, the Flood Hazard Area Control Act rules incorporate stringent standards for development in flood hazard areas and adjacent to surface waters in order to mitigate the adverse impacts to flooding and the environment that can be caused by such development. The regulated area within the Flood Hazard Area Control Act rules for this project will be landward of the mean high water line to the 100-year flood elevation. Based on current construction methodology it is anticipated that the Project will qualify for a Permit-by-Rule (N.J.A.C. 7:13-7.2(c)3) for jacking an underground utility line beneath a water. A regulated activity that meets the requirements of a permit-by-rule may be conducted without prior NJDEP approval. However, it would be prudent to obtain an applicability determination under N.J.A.C. 7:13-5.1 prior to commencing work, to document the Project components and confirm qualification of the permit-by-rule. Furthermore, a NJNG may wish to obtain an applicability determination in order to demonstrate to a local government that a proposed activity meets a permit-by-rule.

STATE - NJDEP Tideland Conveyance: Tidelands, also known as riparian lands, are all lands that are currently and formerly flowed by the mean high tide of a natural waterway. Barnegat Bay, a naturally tidal body of water, is an example of tidelands. The State of New Jersey claims ownership of these tidelands and holds them in trust for the people of the state. All tidelands are overseen by the Tidelands Resource Council, a board of twelve Governor appointed volunteers, along with the NJDEP Bureau of Tidelands Management. Since tidelands are public lands, written permission and a fee must be obtained and paid to the state in order to use these lands. A Tidelands License must be obtained for any of the proposed route crossings.

STATE - NJDEP Freshwater Wetlands General Permit (N.J.A.C. 7:7A): A Freshwater Wetlands (FWW) General Permit (GP) will most likely be necessary which requires a site visit and wetlands delineation to be completed to determine the extent of wetlands and wetlands impacts at the proposed route locations. In New Jersey, temporary and permanent impacts within wetlands and wetland buffers require the issuance of a Freshwater Wetlands permit from the NJDEP. Considering the HDD construction method as well as the temporary nature of the pullback workspaces and staging areas it is anticipated that the Project will qualify for a FWW General Permit 2 for construction of an underground utility line.

STATE - NJDEP Green Acres Diversion (N.J.A.C. 7:36): The Green Acres Program serves as the real estate agent for the NJDEP, acquiring land that becomes part of the system of state parks, forests, natural areas, and wildlife management areas. Green Acres works with the NJDEP's divisions of Parks and Forestry, Fish and Wildlife, and the New Jersey Natural Lands Trust to determine which lands should be preserved. Green Acres does not own the land it acquires; instead land is assigned to the divisions for management. The land encumbered by the Green Acres program is generally deeded in perpetuity. Any change in ownership from Green Acres to any other entity requires the acquisition of a Green Acres Diversion under N.J.A.C. 7:36. Green Acres Diversions must be approved by the

NJ Commissioner and State House Commission. In evaluating applications for the disposal or diversion of parkland, NJDEP will carefully weigh the competing public interests presented by the Project as opposed to the preservation of the parkland in its current condition. It is anticipated that the Project will qualify as a “Minor Diversion” of parkland. The Green Acres Diversion process is lengthy relative to the sum of the permits discussed in this route assessment. A decision generally takes 1-2 years to acquire.

STATE - Threatened and Endangered Species: All of the previously discussed permits, with the exception of the NJDEP Tidelands Conveyance require review and sign off by the USFWS as well as the NJDEP Natural Heritage Program with regard to threatened and endangered species habitats and individuals. For locations that propose to permanently impact any wetlands or known threatened or endangered species habitats’, additional agency follow up regarding threatened or endangered species is anticipated with the USFWS or Natural Heritage Program. The NJDEP Natural Heritage Program is required to determine the extent to which each species may be present or impacted. If warranted, the NJDEP may require a habitat assessment report to determine the projects potential impacts on threatened or endangered species.

LOCAL - Soil Erosion and Sediment Control: The construction of the new crossing will likely disturb more than 5,000 SF of earth; therefore, a Soil Erosion and Sediment Control Permit will be required regardless of which alignment is selected. The plans will include measures to limit sediment runoff from the site during construction. In addition, a 5G3 permit (construction activities permit) will be required if the disturbance is greater than 1 acre. These permits are standard for all projects that meet the listed criteria and will typically be granted within 30 days of the application being deemed complete.

LOCAL - Road Closure Permission: It is likely that either a partial closure or complete closure of a County road will be required. The County Road Opening Permit process will be applied to secure permission for the project. This will require project plans, a narrative and a Traffic Control Plan (TCP) which may or may not include a detour plan. The TCP will be developed in compliance with County requirements and MUTCD standards. The County will require review by local police and municipal officials as an inconvenience to some residents is probable. If one direction must be closed perhaps that direction can be detoured as opposed to single lane alternating traffic using temporary traffic signals. Noise abatement must be achieved as local ordinances prohibit operations overnight without special permission. Notification of impacted residents will require the support of local officials as the short term inconvenience will not be viewed favorably by the residents.

Constructability

Constructability for each of the routes was thoroughly evaluated including layout areas, entry / exit pads, access routes, surface / subsurface conditions, minimal points of inflection in the design drill path and pipe string layout area. Workspace for an HDD may require clearing and grading, depending on the entry and exit sites selected for the drill. The mainline contractor establishes an all-weather vehicle access road that can withstand up to 80,000 pounds of semi-truck and tractor loads for ingress and egress to the entry and exit workspaces. In addition, the mainline contractor clears, grades and establishes a level hard standing work area for HDD equipment which is typically one to two acres in size. The hard stand should be a cover of gravel or wooden mats. Once the mainline contractor has prepared an adequate all- weather access road and hard stand workspaces, HDD equipment is mobilized to the site and setup for HDD operations.

The typical Directional Drilling equipment proposed for use on this project consists of the following major components including the drill rig (583,000 lbs. of pull-force. 93,500 ft. lbs. of torque), drill rig power unit and control cab, water pumps, 21,000 gallon mobile storage tanks, drilling fluid recycling system, high pressure drilling fluid pump, semi-trailers loaded with drill pipe and ancillary HDD tooling, excavator, diesel fuel storage tanks, vacuum truck and diesel generators. In addition, the “dead-man” comes with the drill rig and requires consideration. Refer to Figure 4: Drill Rig and Major Equipment. Typically, it is 2 feet deep x 30 feet wide x 4 feet long and is the primary anchorage device for the operation of the drill rig. The excavation for the dead-man must be accurate and the top of the dead-man must be relatively flush with the ground surface. Steel H-beam spuds or anchor piles are generally driven through or in front of the dead-man to provide adequate rig stability. If there is sufficient room behind the drill rig, a drilling fluid mixing tank will be connected to the rear of the rig to provide additional stability. The anchorage must be rigid and must not pivot.



Refer to Figure 4: Drill Rig and Major Equipment

Since the drill exit side is the location for the fabrication of the pipe string, and where the pipe string is inserted into the bore hole, the workspace required will be longer and may require extra temporary workspace outside of the public right-of-way. Equipment typically found on the exit or pipe side of the HDD includes exit mud containment tanks/pits, cuttings settlement tanks / pits, pipe racks and product pipe, rollers and distribution main handling equipment, side booms and other heavy equipment and distribution mains, welding, coating and testing equipment

The area required for the HDD rig must be sufficient for the rig and its ancillary equipment. In general, the size of the required area will depend upon the size of the HDD crossing, including length of bore and diameter of the pipe to be installed. The length of the crossing and diameter of the product pipe will dictate the size of the drill rig and the drilling equipment to be used. Preferably, each HDD site would allow an area of 200 by 200 feet for the entry side (drill rig) and adequate space of approximately 100- 175 feet long by 50-100 feet wide of dry, flat hard stand on the exit side (pipe side) to pull the pipe as one continuous length. In urban areas this is often not possible. Because of restrictions such as lane closures for roads or the need to work in alleyways, sidewalks, landscaped areas, or utility corridors, HDD equipment must often be configured in a linear arrangement. Other workspace considerations are the presence of overhead utilities and the possibility of restricted work hours due to peak travel times on roadways. Additionally, a Bentonite pit will be constructed to collect any bentonite/slurry discharged from the drill path. The pit will be similar to that excavated at the entry.

A typical large (maxi) rig may require several tractor-trailer loads to transport all the equipment to the HDD site. A workspace of approximately 100 by 150 feet is normally adequate for most large HDD operations. If necessary, a rig may be installed in a workspace of 50 by 100 feet. However, a workspace this small restricts the size and capability of the drilling rig. Sufficient space is needed at the side opposite the HDD rig, where the pilot bore will exit and the pipe is to be inserted, to accommodate a continuous straight length of prefabricated pipe. The space for the straight length should begin approximately 90 feet from the anticipated pilot-bore exit and extend at a width of 40 feet minimum for the NPS 12 pipe to be installed.

Land Acquisition

Land acquisition is another deciding metric used for the overall route assessment. The proposed permanent easement is 10 feet wide with the distribution main aligned down the center and the entry and exit location temporary workspace easements shall be sized accordingly with the needs of the work required mentioned above. This metric is of increased importance as acquisition will proceed immediately after route selection in order to maintain project schedule.

Parcels Encumbered by NJDEP Green Acres Restrictions: Generally take 1-2 years to acquire. Permanent easements and temporary easements will be required from the township for each parcel. Estimated acquisition time for township-owned properties is six months based on lead times for getting on the Toms River Township council agenda and scheduling the required public hearings.

Properties are owned by the Borough of Lavallette: A permanent and temporary construction easement will be needed and may require permanent and temporary easements from two separate tax parcels. These parcels are encumbered by NJDEP Green Acres restrictions which generally take 1-2 years to acquire. Estimated acquisition time for township-owned properties is six months based on lead times for getting on the Lavallette Borough council agenda and scheduling the required public hearings.

Right-of-Way's owned by NJDOT: A Highway Occupancy Permit issued by the NJDOT will be required for any work within the state highway right-of-way. Depending upon the complexity of the work and potential impact to existing and proposed facilities, it is estimated that a minimum six month review / approval process is required.

Properties zoned for Highway Business (HB): Public utilities require a conditional use permit for any above-ground structures. A permanent and temporary easement will be required from this property.

Properties that lack a current mortgage and/ or impacting multiple property owners: A permanent and temporary easement will be required from this property. Securing mortgage releases has become a difficult task in recent years. It is both time consuming and expensive, often requiring full property surveys, property re-appraisal, and payment of release fees.

Properties owned by a Township: Estimated acquisition time for township-owned properties is six months based on lead times for getting on the Township council agenda and scheduling the required public hearings.

Property owned by the Seaside Park Yacht Club: This property is public right of way and it appears there is no underlying zoning designation for the property. Estimated acquisition time for township-owned properties is six months based on lead times for getting on the South Seaside Park council agenda and scheduling the required public hearings.

Impact to the General Public and Businesses

Disruption to the public was considered in the assessment of all routes under consideration and in the determination of the top three (3) routes. Several critical considerations include the following. Some proposed routes would require an intersect method and the equipment on both the mainland side and auxiliary sides. In some cases, this would require the rig to be set up on the intersection and require street shut downs for the duration of the construction, with access allowed for local residents only. In addition, the pullback section staging requirements may restrict traffic to one lane in some instances and require either complete shut down or limited access during pullback operations.

Schedule

The main schedule differences for the top three (3) routes include the permitting approval process, easement acquisition, and the HDD construction duration. Easement acquisition from the private property owner could be time consuming. In addition, several crossings require a compatibility determination involving a federal approval process due to the National Wildlife Refuge, which is estimated to take approximately 12 months. Also, due to potential threatened or endangered species, there is scheduling and coordination impacts that may arise, which could add another 6 months to the permitting process. Another consideration is for those crossings that have entry and/or exit locations encumbered by Green Acres, which will require a Green Acres Diversion, which generally take between 1-2 years. However, it should be noted there is no guarantee in receiving approval. These factors, along with access to site, actual crossing length, application of the intersect method if required and presences of horizontal curves play a role into the overall schedule estimations used for evaluation.

4. EVALUATION MATRIX WEIGHTING

Risks & Risk Management

Risks identified for this project can generally be divided into two types: regulatory risks and construction risks: Regulatory Risk & Construction Risk. Regulatory risk can be encountered during both the application and approvals stage of a project as well as the construction stage. During the application and approvals stage, the project may be delayed or rejected if insufficient information is submitted for regulatory review. In the event that an application is approved, insufficient information may cause the regulatory agency to invoke restrictive conditions to ensure protection of the environmental resources. During construction, an inadvertent release of drilling fluid to the environment or other contravention of any regulatory rules may result in possible charges being laid by the regulatory agencies.

There are several major risks associated with the Permits/Regulatory category. Firstly, there is the risk related to permits delayed and not approved for working in wetlands or disturbing wetlands. The most appropriate approach/mitigation to this risk is limiting the disturbance to temporary work and only in the buffer zones and not the wetland will expedite the process. Another risk is related to permit delays and complications in the National Wildlife Refuge. The most appropriate approach/mitigation to this risk is limiting the disturbance and keeping the disturbance within the right of way or south of the dirt road will expedite the process. Further risk was identified related to the 12 to 24 month approval process for Green Acres land. The most appropriate approach/mitigation to this risk is avoiding Green Acres land as much as possible by shifting alignment and pulling working areas out of that land will lessen the impact. Finally, there was risk identified related to inadvertent release of drilling fluid to the environment or other contravention of an act may result in possible charges being laid by the regulatory agencies. The most appropriate approach/mitigation to this risk is temporary casing during drilling which was applied to all prospective crossing locations.

Construction Risk is directly related to the ability of an HDD installation team to minimize the causes of failure. The risks associated with each crossing will vary according to many factors. These include but are not limited to, inadequate planning, lack of contingency planning, inexperienced field personnel, overestimation by the contractor in the firm's abilities, insufficient quantity and size of equipment onsite and inadequate knowledge of subsurface conditions. One of the major risks associated with the Construction Risk/Constructability is related to stopping the pullback operation to weld the sections can result in stuck pullback section and failed crossing or rework. The most appropriate approach/mitigation to this risk is to minimize the tie-in welds, estimated at 2 to 3 for these crossings temporary casing during drilling. There was identified risk related to the failure of the crossing due to inadequate planning, lack of contingency planning, over estimation by the contractor in the firm's abilities and insufficient quantity and size of equipment on site. The most appropriate approach/mitigation to this risk is to allow sufficient time and budget to plan the work properly. In addition, there was risk is related to the failure of the crossing due to inexperienced field personnel. The most appropriate approach/mitigation to this risk is to deploy experienced personnel and provide chain of command and communication strategy. Finally, there is risk related to the failure of the crossing due to subsurface conditions. The most appropriate approach/mitigation to this risk is to carry out a comprehensive geotechnical investigation of the proposed crossings and design accordingly.

Evaluation Criteria

The route evaluation performed consisted of a quantitative analysis which involves the use of weighted metrics to assess viability in accordance with the criteria presented above – Permitting, Constructability, Land Acquisition, and Public Disruption. Schedule has also been factored into the permitting, land acquisition, and constructability metrics. To begin, a relative weight (percentage) was assigned to each evaluation metric as shown in Figure 5: Evaluation Criteria.

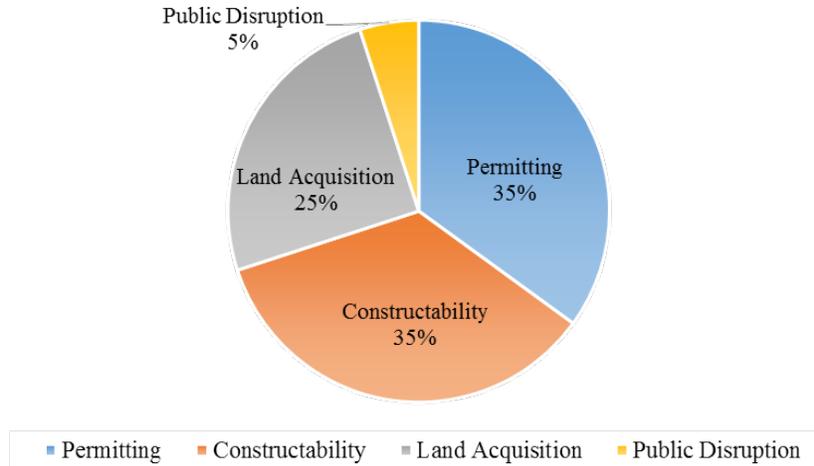


Figure 5: Evaluation Criteria

To assign values to each evaluation metric, a normalization calculation was used to assign each alternative route a value based on a scale of 0 – 100. The value of 0 was assigned to the alternative route with the lowest potential impact and 100 was assigned to the alternative route with the highest potential impact; all other alternative routes were assigned a value in between 0 – 100 based on their relative potential impact when compared to the lowest and highest scoring routes. The Weighted Total values for the entire process are summed at the bottom of the table in Appendix E on the line titled “Sum of Weighted Total.” The Sum of Weighted Total result effectively shows the route preference from lowest to highest value, with the best value being the score closest to zero.”

5. FINAL RECOMMENDATIONS

Based on the evaluation criteria and risks identified above, a decision matrix was created and valued to determine final route recommendations. Refer to *Table 2: New Jersey Natural Gas – NJ Rise South Seaside Reinforcement Evaluation Matrix* for calculated results.

As a result, this process, Laney / Stantec recommended the following. The primary route is the southern crossing location from Good Luck Point in Berkeley Township to Seaside Park Yacht Club, identified as Route 3B in the report. This route best satisfies the above constraints. The advantages of this route are that it minimizes potential environmental impact and inconvenience to the public while still being feasible to construct and meet the schedule requirements. The disadvantages with this route are that private easements will have to be obtained. Also, two pullback sections will be required along Bayview Avenue with one tie-in required during the pullback. Refer to *Figure 6: Option 3B - Good Luck Point in Berkeley Township to Seaside Park Yacht Club*.

The secondary route is the southern crossing location from Pier Avenue in Berkeley Township to South Bayview Avenue in Seaside Park running just north of the old rail line alignment, identified as Route 3A in the report. The main advantage with this route is constructability, as the pullback string can be laid along the old rail line in one section. The disadvantages with this route are that portions of the temporary workspace for the pullback are within National Wildlife Refuge. The National Wildlife Refuge area would require a Compatibility Determination and involves a federal approval process. Wetland mitigation is anticipated due to the disturbance area. Also, due to potential threatened or endangered species impacts, there are scheduling and coordination issues that may arise.

The tertiary route is the northern crossing location from Bay Avenue (Toms River Township) to Lavallette, identified as Route 1C in the report. The advantages of this route are that it minimizes potential environmental impact and is feasible to construct. The disadvantages of this route are that both the entry and exit locations are encumbered by Green Acres which will require a Green Acres Diversion. Due to the length of this crossing multiple pullback sections will be required to complete the pullback.

Table 2: New Jersey Natural Gas – NJ Rise South Seaside Reinforcement Evaluation Matrix

MATRIX / CORRIDOR	WEIGHT	Northern Crossing			Central Crossing			Southern Crossing	
		1A	1B	1C	2A	2B	2C	3A	3B
PERMITTING / ENV. PERMITS	35%								
NJDEP Green Acres Diversion	75%	100	100	100	0	0	0	100	0
<i>Weighted</i>		75	75	75	0	0	0	75	0
NJDEP Freshwater Wetlands General	20%	50	50	50	0	0	0	100	100
<i>Weighted</i>		10	10	10	0	0	0	20	20
*All Other Permits	5%	100	100	100	100	100	100	100	100
<i>Weighted</i>		5	5	5	5	5	5	5	5
TOTAL	100%	90	90	90	5	5	5	100	25
WEIGHTED TOTAL		31.5	31.5	31.5	1.75	1.75	1.75	35	8.75
CONSTRUCTABILITY	35%								
Length of HDD	25%	81	66	62	42	49	100	0	24
<i>Weighted</i>		20.17	16.58	15.47	10.38	12.21	25	0	5.96
Pullback Sections	35%	50	50	50	75	100	100	0	25
<i>Weighted</i>		17.5	17.5	17.5	26.25	35	35	0	8.75
Pullback Complexity	30%	57	43	29	71	100	86	0	14
<i>Weighted</i>		20	15	10	25	35	30	0	5
Intersect Method	10%	100	100	100	100	100	100	0	100
<i>Weighted</i>		10	10	10	10	10	10	0	10
TOTAL	100%	67.67	59.08	52.97	71.63	92.21	100	0	29.71
WEIGHTED TOTAL		23.68	20.68	18.54	25.07	32.27	35	0	10.4
**LAND ACQUISITION	25%								
Township-owned properties	75%	0	0	0	100	50	50	0	0
<i>Weighted</i>		0	0	0	75	37.5	37.5	0	0
State owned properties	5%	0	0	0	100	50	50	0	0
<i>Weighted</i>		0	0	0	5	2.5	2.5	0	0
Private Owners or Businesses	20%	0	0	0	0	25	75	0	100
<i>Weighted</i>		0	0	0	0	5	15	0	20
TOTAL	100%	0	0	0	80	45	55	0	20
WEIGHTED TOTAL		0	0	0	20	11.25	13.75	0	5
IMPACT TO PUBLIC & BUSINESSES	5%								
Residences Impacted	75%	0	0	0	100	100	100	0	50
<i>Weighted</i>		0	0	0	75	75	75	0	37.5
Businesses Impacted	25%	0	0	0	0	100	0	0	0
<i>Weighted</i>		0	0	0	0	25	0	0	0
TOTAL	100%	0	0	0	75	100	75	0	37.5
WEIGHTED TOTAL	100%	0	0	0	3.75	5	3.75	0	1.88
WEIGHTED TOTAL		55.18	52.18	50.04	50.57	50.27	54.25	35	26.02
		1A	1B	1C	2A	2B	2C	3A	3B

* Includes (U.S. Army Corps of Engineers Nationwide Permit, NJDEP Flood Hazard Area Individual Permit (N.J.A.C. 7:13), NJDEP Tideland Conveyance, NJDEP Waterfront Development Individual Permit (N.J.A.C. 7:7), Ocean County Soil Conservation District Soil Erosion and Sediment Control Plan Approval, Road Opening Permits)

** Excluding deed restricted land

Alternative routes that have been proposed may be pursued if the primary method is ultimately not deemed feasible. During the next phases of the project, a geotechnical study will be conducted at the primary location which will assist in determining subsurface conditions and HDD feasibility. During future stages of routing, all newly available information related to the route will be assessed, and realignments will be evaluated where required. Such new information could include, but is not limited to environmental assessment corridor permitting and field study results, geotechnical field study results, landowner concerns and verified utility locations. Following the final route assessment report, the next steps for the project involve easement acquisition, design of the submarine crossing, preparing and submitting permit applications, and construction of the crossing.

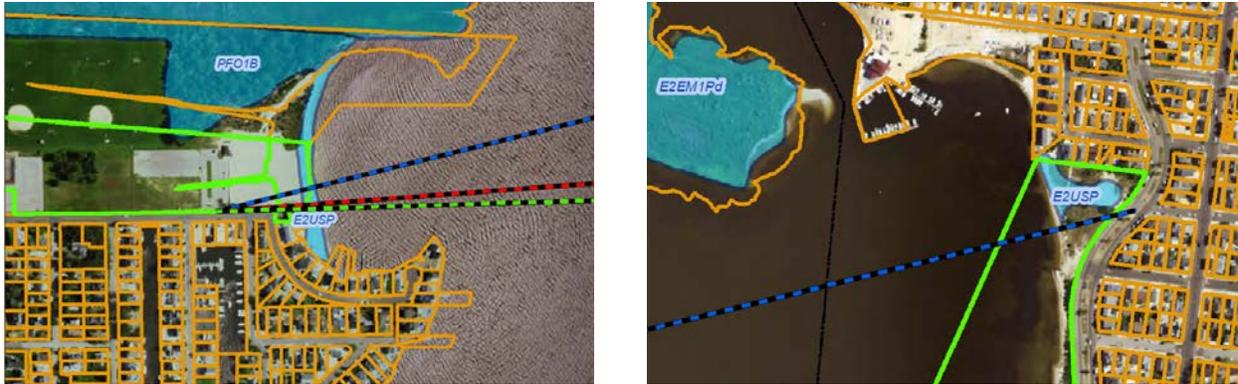


Figure 6: Option 3B - Good Luck Point in Berkeley Township to Seaside Park Yacht Club.
 (a) Entry Location & (b) Exit Location

6. SCHEDULE THROUGH CONSTRUCTION

Moving forward, the schedule of activities for 2017 is expected as follows. Final easement acquisition is expected no later than Tuesday 02/28/17 with final geotechnical investigation scheduled to begin Monday 04/17/17 in order to have all testing and reporting complete by late June 2017. Engineering survey and drafting is scheduled to be complete by the end of July 2017 which will also include the final HDD design submittal for permitting construction. With regards to permitting, all preliminary assessments including Wetland Delineation & Habitat Assessment and Environmental Permitting Packages have been completed and submitted to the governing authority. It is expected that all Environmental Permit Approvals will be received no later than Friday 09/01/17 to allow mainline mobilization to the jobsite in late July for start of pad site development early August. The total duration expected for the HDD Crossing is 59 days which is scheduled to begin 10/01/17 and last through completion on 11/28/17. This includes 20 days for carrier pipe fabrication, 56 days for HDD operations and 3 days for HDD demobilization and site restoration. It is anticipated that the results of this construction process will be presented in a complimentary study discussing the complete design-build process of this project at the 2018 NASTT No-Dig Conference.

7. REFERENCES

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