ATTACHMENT 4

(TrAIL Brochure)

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Out of Sight, Out of Mind? Obstacles to Burying the TrAIL

Rather than placing a 500kV transmission line on 125-foot towers, wouldn't it be better just to bury it underground where nobody sees it? It's a fair question. Keep in mind, however, the purpose of the Trans-Allegheny Interstate Line is to strengthen the reliability of the power grid serving the Mid-Atlantic Region. Trusting crucial reliability to untested underground technology in order to avoid building towers is too risky.

Here are a few obstacles associated with burying the line:

- ***Limited experience.*** There is no U.S. experience with 500kV cable installed underground, and worldwide experience is limited to cable installed in utility tunnels, on bridges, or underwater.
- ***Less capacity.*** Underground cables carry far less power than overhead lines – as many as five or six might be needed to do the same job.
- ***Lengthy repairs.*** When there are problems, it could take longer than a month to repair an underground 500kV line. Prolonged outages of this duration could jeopardize the reliability of the grid.
- ***Additional equipment.*** More above-ground substations are required for underground lines.
- ***Disruptive digging.*** Underground cables require massive excavation that could severely impact streams, wetlands and other sensitive areas. The amount of excavated material greatly exceeds than that removed by digging foundations for towers.
- ***Not invisible.*** Underground cables require 30 to 50 feet ROW stripped of all woody vegetation, creating a very visible stripe along its path. Permanent access is required along full length of line for maintenance and repairs.

From a technology standpoint, high-pressure fluid-filled (HPFF) and extruded-dielectric (XLPE) cables are the most likely candidates for underground 500kV installation. However, there is no long-term experience with either cable type at 500kV, and there are shortcomings with each:

- HPFF requires more than 100,000 gallons of dielectric fluid in the cable pipe per 10-mile section of line – and four or five lines could be necessary – to cool and insulate the conductor. A major leak poses a significant environmental hazard.
- HPFF cables are susceptible to outages for hydraulic and electrical problems. Loss of fluid pressure from a leak could keep the line out of service for days or longer.
- Longest HPFF line is 17 miles. A 240-mile line would require numerous above-ground stations containing pressurizing plants and electrical equipment.
- There are no U.S. manufacturers of XLPE-insulated 500 kV cable.
- Because there is a risk of explosion if an XLPE cable fails, utilities often de-energize multiple lines within the same manhole/vault in order to repair a single line.
- XLPE lines require large concrete vaults measuring 35 feet long by 7 feet tall by 8 feet wide located every 1,500 feet along the line. If four or five lines are necessary, that would amount to four or five vaults every 1,500 feet.

For more information on the project visit our website at www.aptrailinfo.com
Or send us an email at: asktrail@alleghenyenergy.com

TrAIL℠ Trans-Allegheny Interstate Line
Securing a reliable energy future.

ATTACHMENT 5

(Olex – Internet Update)

INTERNET UPDATE Olex

Designs and reliability of underground cables and systems

By Hilary Marazzato and Ken Barber, Olex Cables

Abstract of the second article in a three-part series on underground cables published in *Australian Power Transmission & Distribution* magazine

Summary

The excellent electrical performance of XLPE is the reason it is now used almost exclusively for insulating low voltage, distribution and transmission cables. While XLPE has far better resistance to moisture than paper insulation or PVC, moisture can affect long term performance of XLPE under the influence of high electrical stress. All low voltage and distribution cables can be installed without precautions, but some moisture protection is advisable for medium voltage cables and cables for sub-transmission. The use of metal sheaths for transmission cables is considered essential.

Introduction

There were serious cable failures when XLPE was first introduced in the late 1960s in the USA. This was due to incompatible semi-conductive materials and lack of triple extrusion, but also water ingress and treeing in steam cured XLPE. The cable industry has since made significant developments in XLPE materials, cable design and processing, so that 500kV XLPE cables are now in service and XLPE is the most practical insulation material for the range of cables used by the electricity supply industry worldwide. However, while this material is highly moisture resistant, moisture can still cause electrical failure under the influence of high electrical stress.

Moisture mode of failure

The first XLPE cables were produced on steam cure CV (Continuous Vulcanisation) lines where moisture saturated the insulation due to the temperature and pressure of the steam (~200°C, 200 psi). Many of these early cables are now showing signs of water trees. For more than 10 years, all XLPE insulated cables produced in Australia have been processed in a 'dry cure' manner that ensures water absorption is less than 200 ppm. Very few of these cables have significant water treeing. While water trees may not cause breakdown, in cases where there is a high stress point or a space charge developed during DC testing, such trees may develop into electrical trees which subsequently cause premature breakdown.

Protection/prevention modes

- Radial protection – using a metal sheath on the cable to provide an impervious barrier to entry.
- Longitudinal protection – using solid fillers to fill all voids where water may enter or use of water swellable tapes, which fill the spaces only when the water is present and thereby prevent the longitudinal progress of any further water.
- Moisture resistant insulation material – such as Tree Retardant XLPE - TR-XLPE.

Solutions

<u>Low voltage cables</u>

Cables designed to function at voltage levels up to 1,000V have insulation thicknesses well above those required for purely electrical requirements. The voltage stresses in the insulation are therefore small and inadequate to promote the growth of water trees that lead to electrical failure of the cable. Thus, no protection is required from the effects of water or moisture.

INTERNET UPDATE Olex

Distribution cables

Various forms of distribution cable protection and their respective cable life expectancies are outlined below:

Circumstance	Cable life expectancy
Cable without protection and affected by water/moisture	>15-25 years
Use of water swellable tapes	>20-30 years
Use of insulation materials i.e. TR-XLPE	>30-35 years
TR-XLPE plus water swellable tapes	>35-40 years
Metal moisture barrier (i.e. lead sheath)	60 years

Sub-transmission and transmission cables

A metal moisture barrier such as an extruded lead sheath or a welded corrosion resistant sheath is the most secure design option for transmission cable and will ensure a life expectancy of 50-60 years.

Other factors reducing cable life

- Life expectancy is reduced when insulation is subjected to "over voltage" in the form of surges and impulses.
- Changes in the environment, for example, depth of cover, adjacent services and micro-biological effects in the soil, can increase operating temperatures and reduce cable lifetime (cables are designed for a maximum operating temperature of 90°C with limited overload periods as defined in the relevant standard).
- Poor supervision/management and adverse installation conditions may cause cable damage.

Conclusion

Olex believes technology has greatly improved since the early XLPE insulated cables, and the problems these early cables began to exhibit after 20 years or more in service have been addressed. New designs will not experience such problems. Olex confidently predicts cable lifetimes of at least 40 years for any modern XLPE insulated cable and suggests that 60 years is not an unreasonable expectation if the cables are correctly designed, installed and operated. This is particularly so for those cable designs utilising water blocking measures or where there is a welded or extruded corrosion resistant moisture barrier. Condition monitoring by DTS and the adoption of other condition monitoring technologies as they become available, is recommended to help achieve maximum lifetime. It is important to note that when optical fibres are to be included in cables a metal sheath can improve the life of the fibre.

Copies of this article in its entirety and more information is available from Olex Engineering and International Sales on +61 3 9281 4444 or email Ken Barber at kbarber@olex.com.au or Hilary Marazzato at hmarazza@olex.com.au

ATTACHMENT 6

(Shaw EDS Memo – Re: 500kV Line Costs)

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Shaw® Shaw Energy Delivery Services, Inc.

H&M HENKELS & McCOY

August 31, 2004

Mr. Michael Tochtrop
Bonneville Power Administration
P.O. Box 61409
Vancouver, WA 98666-1409

Re: Contract # 8941, Part II, Preliminary Financial Analysis
Comparison of All Project Costs of a Generic Transmission Line Project

We have additional fiscal data to augment the financial analysis provided to BPA on August 27, 2004. This information will help establish a generic benchmark for potential and future new transmission line construction project costs. The following data may be used to determine cost credibility of contractor bids on 500kV transmission line projects.

Shaw EDS reviewed construction costs per tower installed, material costs per tower installed and program costs for the Grand Coulee – Bell project using current historical and empirical data. Assuming Shaw EDS and H&M complete the project with the funds allotted in the newly revised budget, the total construction costs are $43,432,148. Dividing this total construction dollar value by 411 towers on the project results in an average tower costs **$105,674 installed**. This value does not assess or differentiate between tower types but is a good tool to use to estimate future BPA transmission line projects. The estimate includes construction of the line, along with items in Shaw EDS' budget such as access road construction, RoW clearing, dust abatement, erosion control, flagging, site safety, site QC and site construction management.

The materials budget for the project is $30,299,894 but does not reflect any credits due from the material's portion of the project such as reel deposits or scrap metal credits EDS can provide a final analysis of the project once construction is complete the project is closed out. However, assuming above number is credible; this cost can be divided by 411 towers, yielding an average tower cost of approximately **$73,722 installed.**

These numbers do not include programmatic costs such as logistics, procurement, quality assurance, program management, contract administration, facilities or equipment. Combining the two numbers yields a total cost of $73,732,042. The total value of the contract, calculated on a 5% fee for estimating purposes, is $79,052,800 yielding

$5,320,758 for complete programmatic services. When calculated on a per tower basis, this is **$12,945.**

The complete "installed tower cost", including program, construction and material costs, is **$192,341** per tower.

The same type of fiscal comparison can be performed on the Schultz – Hanford Area Project. This analysis yields an approximate "installed tower cost" of **$249,365** which includes program, construction and material costs. This per tower cost is higher when compared to GC-B due to the unique construction requirements and special tower configurations. That is, most towers were flown in for erection and a large double circuit section was required on this line. There were also several fiber optic sub-projects imbedded within the construction budget and other ancillary projects inclusive of the main line project.

Basic assumptions can be made on future projects by comparing the line to be built against the lines constructed in the past. Analogous costs can be assigned to the potential project yielding a valid estimate calculation.

For example, if 75% of a 360 tower "to be constructed" line resembles GC-B more closely, then 270 of the towers will be closer in cost to the $192,341 value. The remaining, 90 towers would more closely approximate the S-HAP $249,365 value.

This would yield the following:

(270 towers)($192,341/tower) =	**$ 51,932,070**
(90 towers)($249,365/tower) =	**$ 22,442,850**
Total Project Cost =	**$ 74,374,920**

Each project is unique and its characteristics will ultimately determine the actual cost to construct. However, we believe this data is realistic, since we are using financial data from 2003 and 2004. This analysis methodology uses current market conditions and costs for materials, program and logistics oversight as well as typical construction costs.

We hope this financial analysis is of value to BPA and will aid your organization when estimating and considering large projects for future construction.

Paul Viggiano
Contracts Manager
509-545-3702

ATTACHMENT 7

(ABB XLPErformance Cable Technology)

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High-voltage XLPERFORMANCE cable technology

Björn Dellby, Gösta Bergman, Anders Ericsson, Johan Karlstrand

Deregulation of the electricity supply markets and growing environmental awareness are creating exciting new markets for power transmission solutions based on extruded cable technology. At the same time, improvements on all fronts are extending the use of XLPE (cross-linked polyethylene) insulated cable systems up to 500 kV. Today's cable system applications are often competitive with overhead lines, while new manufacturing methods are enabling submarine cables with integrated optical fibers and flexible joints to be supplied in longer lengths than ever before. Further development of extruded insulation systems is also contributing to the success of ABB's innovative HVDC Light™ concept.

High-voltage cable systems rated 220 kV and above have become part of the very backbone of modern-day power transmission infrastructure. This importance carries with it, however, a special responsibility on the part of the suppliers to ensure that the systems exhibit the highest reliability and, because of the high electrical stresses at such voltage levels, that the cables and accessories are properly coordinated.

Deregulation – changing the rules

In today's deregulated electricity markets, the rules that used to govern generation, transmission and distribution have changed for both the power utilities and the suppliers. Suddenly, it is the customer who is in the spotlight. Accordingly, the market has to listen more to public opinion, and there is a strong possibility that this will include a call for a less 'visible' T&D infrastructure.

All the actors in this new market have to reduce their costs and at the same time guarantee high reliability for the transmission and distribution systems. A likely scenario is that new cable interconnections will be built and operational margins will be utilized more fully in order to get maximum technical and economic benefit from the electrical network.

Extruded cable systems have a major part to play in this new, competitive environment, especially when it comes to replacing overhead lines with underground cables. XLPE cable systems costs have decreased during the last decade and are likely to fall even further. At the same time, XLPE cable performance has increased enormously. The new message is therefore that XLPE cable systems are able to compete with overhead lines, technically, environmentally and commercially. This is particularly true in the voltage range of 12–170 kV 1.

Extruded insulation – performance and improvements

The well-established trend toward a smaller insulation thickness will continue, resulting in a leaner cable with many advantages, among them longer dispatch lengths, fewer joints, easier

1 Comparison of cost ratio (CR) for XLPE cable systems and overhead transmission lines

installation, and reduced thermal contraction/expansion of the insulating material. Experience accumulated during EHV XLPE cable system development, improvements made in materials and processes, and the excellent service record of XLPE, have reduced the thickness of cable insulation to 12–15 mm for 132-kV cable systems. This places the XLPE cable systems versus overhead line transmission scenario in a new light, where the cable solution often can be an attractive alternative.

Underground cables versus overhead lines

There are, of course, many operational, security, environmental, reliability and economic parameters that distinguish XLPE cable systems from overhead lines [1]. For modern XLPE cable systems, the reduced cost ratio and environmental and reliability benefits are the most obvious and important considerations. Due to their larger cross-sectional areas, cables usually exhibit fewer losses per MVA than comparable overhead lines. A summary of the benefits of XLPE cable systems is given in the table on page 52.

The ratings of the overhead lines are sometimes dictated by high winter loads, which include a lot of electrical heating equipment. During hot summer days the overhead line carries some 50% less electricity than in winter, making them less attractive if load profiles have to be smoothed out in the future. In areas where there are many air-conditioning units, for example, the benefits of XLPE underground cables make them a genuine alternative 2.

Underground transmission lines also have a better overload capacity for periods of time shorter than 90 minutes due to the high thermal mass of the surrounding soil.

Qualification of 400–500 kV cable systems

The IEC emphasizes the importance of reliability and coordination of the cables and accessories by recommending that the performance of the *total system*, consisting of cable, joints and terminations, be demonstrated. The comprehensive test program, including a 'prequalification' test, is described in detail in IEC 62067.

ABB qualified as a supplier of cable systems for the 400-kV voltage level in 1995.

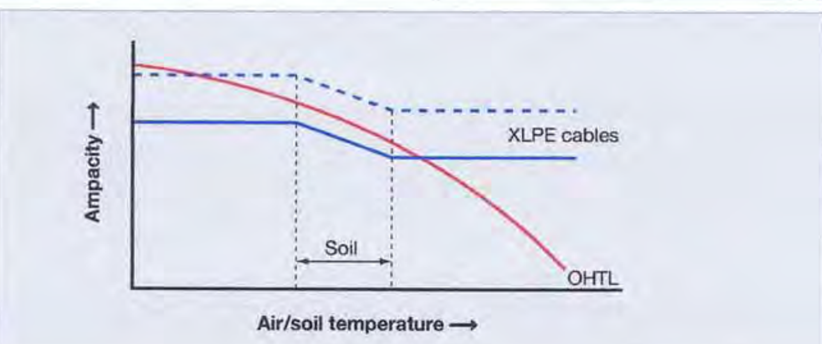
Quality, materials and manufacturing

Only certified suppliers are contracted to deliver essential materials. All ABB manufacturing sites for HV cables and accessories are ISO 9001 and 14001 certified. The XLPE cable core is produced on a dry curing manufacturing line. The cable insulation system, including the conducting layers, is extruded in a single process using a triplex extrusion cross head located, together with the three extruders for the insulating and conducting materials, in a clean-room 3.

Cable design

4 shows a 400-kV XLPE cable. The cable's copper conductor, which has a cross-sectional area of 2500 mm², is divided into five segments to reduce skin effect losses. ABB uses segmented (Milliken) conductors made of stranded wires for cross-sections greater than 1000 mm². For cross-sections smaller than 1000 mm², the conductors are highly compacted to obtain a rounder, smoother surface.

2 Rating of overhead line (OHTL) versus underground XLPE cable. The dashed line indicates that higher powers could be transmitted if the daily load cycle profile is taken into account.



The metallic screen consists of copper wires on a bedding of crepe paper to reduce the mechanical and thermal impact transferred to the insulation. The number of wires and the total cross-section depend on the short-circuit requirements of the network. Longitudinal water tightness is achieved by filling the gaps between the screen wires with swelling powder.

External protection against mechanical impact and corrosion is provided by a tough, extruded, laminated sheath made from HDPE (high-density polyethylene). A bonded metal foil on the inside of the sheath stops water from diffusing into the cable.

The resulting lean, low-weight cable has several advantages: a greater length of cable can be wound onto any given drum; high eddy-current losses in the cable sheath are avoided; the current-carrying capacity is optimized.

Possible oversheath options are:
- An extruded conductive layer for outer sheath measurements
- An extruded flame-retardant layer for extra safety in hazardous environments

Another option the cable design offers is space-resolved temperature monitoring with optical fibers. The fibers are contained in a stainless-steel tube, approximately the same size as a screen wire, which is integrated in the cable screen. Monitoring the temperature in this way enables the cable load to be optimized.

Cable accessories

In the early 1990s ABB developed prefabricated joints for HV and EHV cables which are totally dry, ie with neither gaseous nor liquid materials, and maintenance-free. The main electrical parts can therefore be pre-tested in the factory, speeding up on-site installation and reducing the attendant risks. The joints have integrated sheath insulation in order to comply with the CIGRE recommendation contained in Electra 128, which requires them to withstand impulse voltages of 125 kV between the two joint sections and 63 kV to earth. This permits cross-bonding of the cable screen, which reduces the induced screen currents and losses in the AC cable system. The complete cable system with joint, outdoor terminations and GIS terminations, fulfills the requirements of IEC 62067 in every respect.

Testing of 220–500 kV cable systems

In the case of medium-voltage cables it is usual to think in terms of components. Even if these come from different suppliers, they can be joined together

3 Vertical extrusion of XLPE cable insulation

4 400-kV XLPE cable. The copper conductor is divided into five segments to reduce skin effect losses.

and the system as a whole will still work. This is why limits are given for the electrical stresses in the construction requirements in IEC 60502.

HV and EHV cables and accessories, on the other hand, are designed as systems. No construction requirements exist for cables for these voltage levels, just the test requirements in IEC 60840 and IEC 62067.

400-kV XLPE cable projects

In 1996 ABB received an order from the public utility Bewag (now Vattenfall Europe) to supply and install a 400-kV XLPE cable system in a 6.3-km long underground tunnel in the center of Berlin. The ventilated tunnel is situated 25 to 35 meters below ground and has a diameter of 3 meters 5. The cable system, with a 1600 mm² segmented copper conductor, has a transmission capacity of 1100 MVA and forms part of a diagonal transmission link between the transmission grids west and east of the capital.

The cable is installed with the three phases arranged vertically, one above the other, on specially designed cable saddle supports 7.2 meters apart, with a short circuit-proof spacer in the middle of each span. The cable route was divided into nine sections, each approximately 730 meters long. GIS terminations were installed at the two substations and the new ABB joint was used to interconnect the cable lengths. The laid cable consists of three main cross-bonded sections, with three minor sections within each main section. The cable circuit went into service in December 1998.

> Greater lengths of low-weight XLPE cable can be wound onto any given drum, while high eddy-current losses in the sheath are avoided.

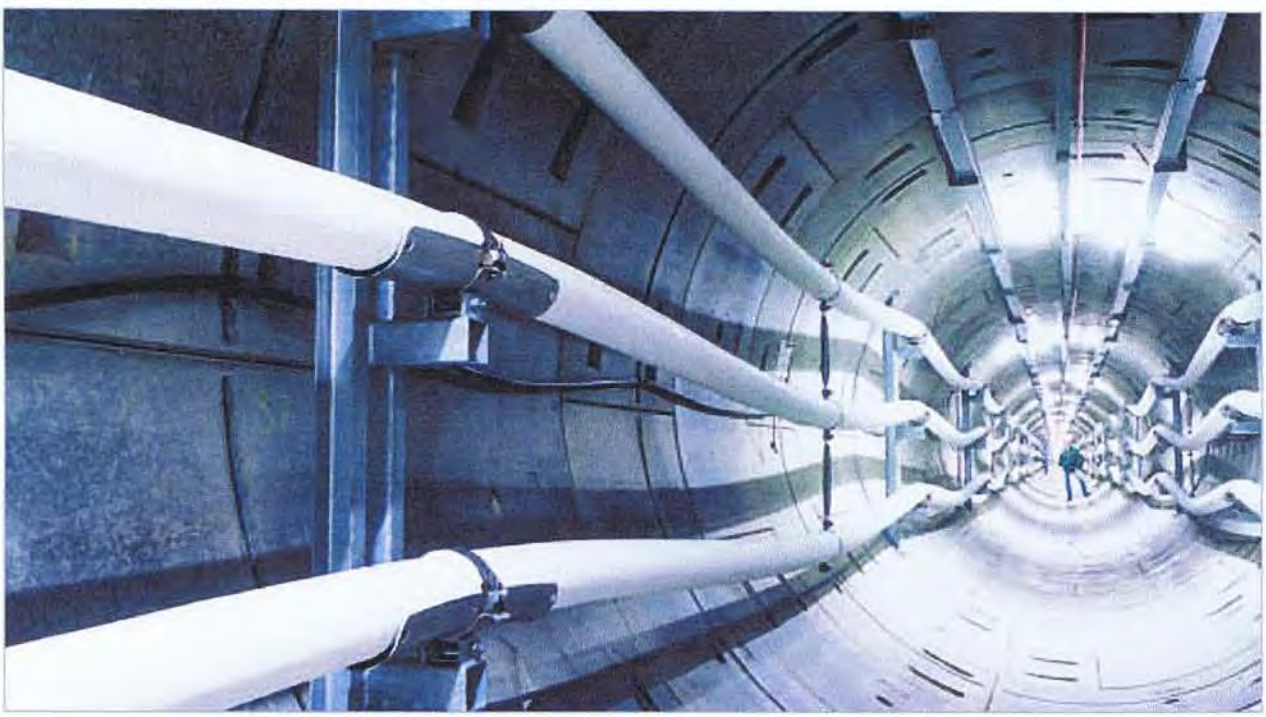
The Bewag utility subsequently awarded a second 400-kV XLPE cable contract to ABB, this time for a 5.4-km long system, again in an underground tunnel. This cable circuit completes the diagonal link between the transmission grids west and east of Berlin, and was handed over to the customer in July 2000.

Further 345–400 kV cable projects awarded to ABB include orders for 200-km XLPE cables, accessories and installation. Commissioning of these projects is scheduled to take place during 2003–2004.

New submarine cable projects

In 1998 ABB was awarded the Channel Islands Electricity Grid Project, which reinforces the power supply from France to Jersey and, for the first time, connects Guernsey to the European mainland grid. The submarine part

5 400-kV cable system in a 6.3 km underground tunnel running through Berlin's city center



of this project was completed in July 2000.

The main components delivered for the project were:

- Submarine cables between France and Jersey and between Jersey and Guernsey (approx 70 km)
- Underground cables on Jersey and Guernsey
- GIS substations
- New transformers and reactors

The two submarine cables are of the same basic design, ie three-core, separate lead-sheathed, and with triple-extruded XLPE insulation. Each has a fiber optic cable with 24 fibers integrated in it for system communication and inter-tripping. The cables have double wire armor (ie, an inner layer of tensile armor and an outer, so-called rock armor) to protect them from damage that could be caused by tidal currents and fishing.

The cables have a diameter of approximately 250 mm and weigh about 85 kg/m in air.

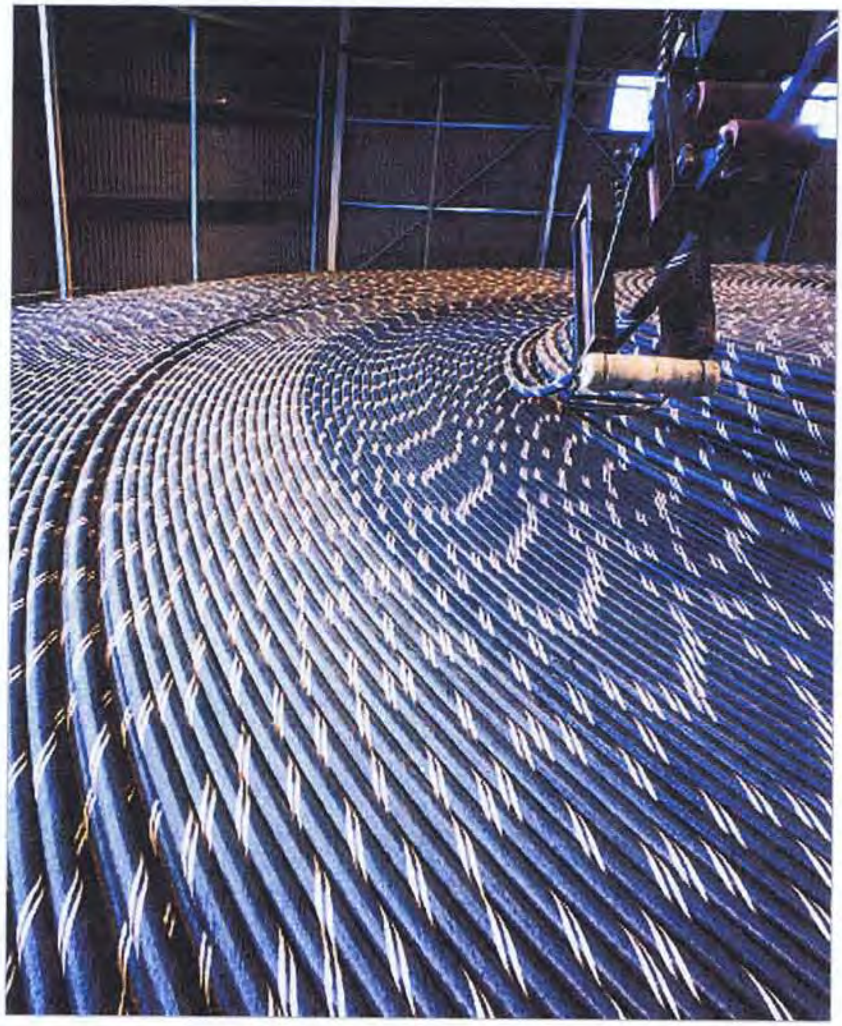
Both cables were delivered by the factory in their full lengths 6.

Because of the risks posed by fishing activities, the cables between Jersey and Guernsey and the fiber optic cables between Jersey and France were jetted into the seabed for extra protection.

Another submarine cable project is the Ma Wan and Kap Shui Mun Cable, which crosses a channel in Hong Kong. Due to the heavy traffic in this channel, it was decided to forgo conventional installation of the 132-kV and 11-kV systems, which would probably have disturbed shipping even if modern techniques were used. The problem was solved by drilling under the seabed and installing ducts through which the cables were pulled. This has the extra advantage of allowing upgrades to be carried out in the future.

Separate control systems were installed to monitor operation of the cable link, which was completed in 2003.

6 Storage of submarine cable prior to laying



A new submarine cable project has recently been awarded to ABB by Aramco. The cable, which is 53 km long, is rated 110 kV with 3×500 mm² copper conductors. It will be commissioned in 2004.

HVDC Light™

HVDC Light™, which was launched in 1997, is another ABB innovation in the T&D field that incorporates advanced HV cable technology. High Voltage Direct Current (HVDC) cables are employed for bulk power transportation over long distances, mainly underwater.

Traditional cable technology is based on paper insulation systems impregnated with highly viscous oil. While these cables have many technical advantages, the manufacturing process is slow and the end-product is mechanically sensitive. The industry had therefore been looking for a long time for an extruded HVDC cable of the kind used in AC systems.

With HVDC Light [2], ABB has introduced to the market an extruded cable system, together with new transistor-based converters, that makes HVDC

Environment	Grid security	Economy	Operation
No visual impact Low/no electromagnetic fields High level of personnel safety, low risk of flashover in air Good working conditions	Not affected by wind, snow, ice, fog, etc Nothing can be stolen	Low maintenance Minimum investment for lake/river crossings Land use minimized Value of land/buildings unaffected	High availability, few faults Usually low losses/MVA High short-time overload capacity

Benefits of underground transmission lines

transmission competitive even at low power ratings. The first commercial system, a link rated at 50 MW, was installed on the Swedish Island of Gotland, where it transmits power from a wind power plant to the town of Visby [3].

Other major projects that have been completed are:
- The Directlink, rated 180 MW at 80 kV, which transfers power between the states of New South Wales and Queensland in Australia.
- The Murraylink, rated 200 MW at 150 kV, built to transfer power between Victoria and South Australia [4].
- The Cross Sound Cable, rated 330 MW at 150 kV, which transfers power between New England and Long Island.

The latest HVDC Light project, to supply power to an offshore platform in the North Sea (Troll A), is due to be commissioned in 2004. (See article starting on page 53.)

Applications for HVDC Light include:
- Feeding of isolated loads (eg, offshore platforms)
- Asynchronous AC grid connection
- Transmission of power from small generation units (eg, wind power plants)
- DC grids with multiple connection points
- Network reliability enhancement through voltage stability and black starts

Tomorrow's electrical infrastructure – here now

Extruded cable systems are available as total solutions, with a 'cradle to grave' supplier commitment. Such systems are turnkey offerings in the commercial as well as the technical sense. They may start with the permit application, continue with the removal of the overhead lines and the supply and installation of the cable system, and end with the environmentally friendly disposal of the old equipment.

Complete cable system applications can also be seen as intelligent combinations of monitoring equipment, converters, load-sharing devices, series and/or shunt compensation devices. Financing, too, can be arranged; here, leasing and a new type of availability guarantee could resolve several commercial uncertainties.

Together, these 'thumbnail' sketches of the future add up to a new customer-value-based market. Extruded insulated cable system applications are destined to play a key role in this evolving market by meeting not only the transmission and distribution network requirements of today but also those of tomorrow.

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[4] **T. Worzyk, et al:** The Murraylink Project – the first commercial 150 kV extruded HVDC cable system, JICABLE 2003.

ATTACHMENT 8

(Transmission & Distribution World Article
Gas Insulated Line Takes Power to the People)

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Gas Insulated Line Takes Power to the People

Apr 1, 2004 12:00 PM
By Naoki Takinami and Shin-ichi Kobayashi, Chubu Electric Power Co.

Gas insulated transmission lines (GILs) are composed of pipes that house conductors in highly insulative sulfur hexafluoride (SF_6) gas, which have high load-transfer capacity. The development of GILs in Japan started in 1964 when the late Professor Setsuo Fukuda at Tokyo University researched compressed gas insulation. The university, the Central Research Institute of Electric Power Industry (CRIEPI) and cable manufacturers jointly produced a demonstration GIL.

In 1979, Tokyo Electric Power Co. Inc. (TEPCO) commissioned Japan's first GIL, a 160-m (525-ft) double-circuit bus bar in a 154-kV, 2000-A substation. However, because GILs were much less flexible than cables and not capable of accommodating a displacement of terrain, they were only used for short transmission lines (such as a few hundred meters for bus ties in Japan's substations).

On a global front, in 1974, Siemens A.G. in Germany installed a GIL in a tunnel at Wehr hydropower plant, which was the world's longest GIL at that time.

The Decision-Making Process

To meet growing electric power demand, Chubu Electric Power Co. Inc. (CEPCO) needed to construct an additional thermal power station adjacent to the suburbs of Nagoya City and a transmission line capable of carrying 3000 MW of electricity from the power station to the substation. Because an overhead transmission line would have to be routed through the suburban area, CEPCO considered an underground cable system for the 3.3-km (2.1-mile) route between the planned thermal power station and the substation. If 275-kV XLPE cables had been used for this high-capacity transmission system link, at least five circuits (including one spare circuit) of the largest 2500-mm^2 copper-cored XLPE cable — each with transmission capacity of some 800 MW per circuit — would have been required.

The overall costs of laying XLPE cables was excessive when considering the costs of substation components, such as gas-insulated switchgear (GIS) at both ends of a cable and line reactors for cable capacitance compensation. In contrast, the use of a GIL would make it feasible to construct the large-capacity transmission link. It was possible to use conductors greater than those available in conventional 275-kV XLPE cables, because they allowed conductors to be larger in cross-section than XLPE cables. Furthermore, the installation of a GIL with transmission capacity of about 3000 MW per circuit would allow a double-circuit link to be installed.

Subsequent cost-benefit studies confirmed that when the cost of all substation components were taken into account, the expense of installing GILs would be less than the use of XLPE insulated cables. However, various pre-construction problems had to be solved before the large-capacity GILs could be installed, including:

- The difficulty of installing the GILs composed of large-bore aluminum pipes in a gently curved, long tunnel.
- Because the GILs were to be conveyed to site by truck, the length of each GIL section was limited; therefore, several sections would need to be connected in the tunnel. Thus, a low-cost connection method had to be developed.
- Because the transmission lines were to be laid in a dusty environment in a tunnel, contaminants might lower the insulating reliability of GILs.
- The earthquake-resistant design and performance of GILs had to be taken into consideration.

To solve these problems, CEPCO initiated a program to design a GIL system for a long tunnel application and to develop engineering technologies for manufacturing GILs. Japanese manufacturers Mitsubishi Electric Corp., Furukawa Electric Co. Ltd. and Sumitomo Electric Industries Ltd. supported the utility in its work.

Outline of the Shinmeika-Tokai GIL

A view and profile of the Shinmeika-Tokai GIL are shown in Figs. 1 and 2. This transmission line was wholly laid in a tunnel connecting the Shin-Nagoya Power Station in the suburbs of Nagoya City to Tokai Substation. The tunnel was built approximately 30 m (100 ft) below the public road and had four bends (the minimum bending radius being 150 m [490 ft]). Shafts were placed at each end of the tunnel, and a ventilation hole was provided in the middle of the tunnel. With an internal diameter of 5.6 m (18.3 ft), the tunnel was divided vertically into two sections. In the upper section, two circuits (single-phase design) GILs were installed, and in the lower section, a pipeline for liquefied natural gas was installed to supply Shin-Nagoya Power Station.

Design Features of the GILs

Figure 3 shows key characteristics of the GIL, while Fig. 4 has a cross-sectional view of the GIL.

The single-phase design GIL was selected to achieve ease of installation of the transmission lines in the gently curved tunnel and to accommodate the maximum diameter of manufacturable extruded aluminum pipes. The basic dimensions of GILs were determined based on current capacity derived from Fig. 3.

To develop the insulation design, the following factors were examined: the allowable electrical stress in SF_6 gas and insulators, the electric field of inner enclosures to prevent particles or metal foreign objects from floating up, and measures to make particles harmless.

The main components of GILs are described below:

1. **Conductors and Enclosures**

   Extruded aluminum alloys, which are widely used in aluminum pipe bus conductors at substations, were chosen as materials for conductors and enclosures. They satisfy conductivity, machinability and economic efficiency requirements. Considering the enclosures had to be transported to site by vehicles, the length of each section of the enclosure was 14 m (46 ft). Thus, some 1500 sections and joints are included in the GIL tunnel.

2. **Insulators and Particle Traps**

   Heat-resistant epoxy resin was selected as the material for insulators to meet thermal design requirements, with consideration to electrical and mechanical properties and casting workability of epoxy. Relatively inexpensive post-type and tri-post-type insulators were installed in the standard sections of GILs, and cone-type insulators were used in some parts of the lines to form gas sections.

   In the Shinmeika-Tokai GIL, there was the possibility that metal foreign objects (for example, particles of aluminum powder generated by contact of the enclosures when GIL sections were connected) might pollute the GIL. To avoid this, the GIL sections were connected in a strictly dust-controlled environment and by the highly precise connecting method that was developed for this particular application. Moreover, to prevent metal foreign objects from any sections from adhering to insulators, particle traps capable of catching these objects and making them harmless were fitted inside the enclosures where the insulators were installed.

3. **Plug-in Contacts**

   Two types of plug-in contacts were used: a standard-type plug-in contact, used to connect conductors in the field; and a long-type plug-in contact, capable of absorbing the thermal expansion of conductors and accommodating a seismic displacement. The long-type plug-in contacts with a sliding stroke of ±130 mm (±5.1 inches) and standard-type plug-in contacts (Fig. 5) with a sliding stroke of ±30 mm (1.2 inches) were specially developed. To absorb a seismic displacement, achieve ease in connecting conductors and secure workability of contacts, these plug-in contacts were manufactured so that their angles were axially variable within the limit of ±1.5 degrees.

4. **Aluminum Bellows**

   Bellows absorb the thermal expansion of enclosures and a seismic displacement. In addition, because the solid-bond type was adopted in the Shinmeika-Tokai GIL, an induction current flows through enclosures in a reverse direction to the conductor current. To secure adequate current-carrying performance, aluminum bellows were developed (Fig. 6). The aluminum bellows have an expansion stroke of ±120 mm.

5. **Enclosure Joints**

   For enclosure joints, expanded pipe joints with a ±1 degree variable angle performance and with high levels of air tightness were adopted. As expanded pipe joints allowed the tip of 14-m (46-ft)-long enclosures to move by 30 cm (12 inches), an error in the installation of units on a support in the field could be easily corrected. Double seals were provided at the unit joints to prevent metal foreign objects generated by the friction of adjacent sections when inserted from infiltrating the sections, and also to prevent spatter from flying into the sections during welding. After the sections were inserted into the joints, a fully automatic welding machine welded the joints.

Technologies to Facilitate Installation of the GIL

The tunnel afforded limited working space and, as it was located below the road, it had a 3-D gentle line configuration with a mixture of curves and gradients. In the summer, the tunnel became humid. Accordingly, the following technologies were developed:

GIL Layout Suitable for a Long Tunnel

In a thermal expansion design for GILs, fixed supports were arranged at intervals of 56 m (180 ft), which were regarded as one thermal expansion unit. Long-type plug-in contacts to absorb the thermal expansion of conductors and seismic displacement and aluminum bellows to absorb the thermal expansion of enclosures were installed in each fixed support. Obtuse-angled units were placed along the curves in the tunnel.

Development of Efficient Construction Technologies

To assure ease and quality of work, as well as work efficiency in the limited space of the tunnel, construction machines and equipment moving on the tracks laid in the tunnel were used. Installation work was carried out as follows:

Via the shafts at both ends of the tunnel, the sections were hoisted by gantry cranes and carried into the tunnel where they were conveyed in transporting cars to the designated support positions.

At the installation positions, the units were temporarily placed by lifts fitted to the transporting cars onto the supports. To connect conductors and enclosures, the units were centered by adjustment equipment capable of fine-tuning positions.

Next, conductors and enclosures were connected in a dust-controlled clean booth (Figs. 7a and 7b). Resin-coated tools and measuring instruments were used to prevent metal foreign objects from being generated by contact with the sections, in addition to preventing the sections from being damaged.

Enclosures were welded in equipment where humidity was regulated to stay below 80% and the wind velocity was less than 0.5 m/s (Fig. 8). The tungsten inert gas (TIG) used in the welding process limited spatter. For enclosure welding, an automatic welding machine with computer-controlled tool-up speed, current value and aluminum welding rod feed-out speed was developed. During welding, the machine continuously rotated circumferentially welding the 1500 points of enclosure satisfactorily. Following the welding, each joint was X-rayed to ensure the GILs were properly connected.

Pressure tests were performed to verify the welded enclosures were airtight. To overcome the problem of using several off-the shelf cylinders to supply the dry air, a carriage with an air dryer and filter to remove foreign objects was designed. This development proved to be a major labor-saving device.

GIL Commissioning Tests

The commissioning test plays an important role in checking the integrity of the GIL. Anticipated defects include metal foreign objects that adversely affect insulation performance; plug-in contacts that may loosen, affecting the electricity conduction; and improperly installed GILs. Hence, ac withstand voltage tests, partial discharge measurements and load current tests are undertaken.

AC withstand voltage tests are undertaken in conjunction with partial discharge measurements. However, because the majority of the Shinmeika-Tokai GIL is laid in the tunnel 30 m (100 ft) below the ground, it provides an environment in which external noise is low and a partial discharge can be measured with high sensitivity. The sensors used include the ultrahigh frequency (UHF) antenna system capable of catching electromagnetic waves generated by a partial discharge and the foil electrode system, which detects an electric current with impedance. Figure 9 illustrates the UHF antenna system and the foil electrode system. To measure the electromagnetic waves leaking from the GIL, the UHF antenna sensor was installed at the insulation cylinder in the enclosure and the foil electrodes were fitted on both sides of the insulation cylinder. Detection impedance was connected with the foil electrodes on both sides of the insulation cylinder, and a closed circuit was formed through electrostatic coupling between the conductor and enclosure to detect an electric current. To sensitively measure a partial discharge with both systems, noise in the tunnel was measured with a spectrum analyzer, a frequency band (narrow bandwidth) with a high signal-to-noise ratio was selected, and a partial discharge was measured at this frequency band.

The insulation cylinders are installed at eight positions in the tunnel: six positions within the length of the tunnel and at two positions near the joints at each end of the GIL. The GIL was subjected to a dummy pulse, similar to a partial discharge, and the pulse attenuation characteristic in the GIL was measured. This pulse attenuation characteristic enabled the spacing of the insulation to be determined so that the sensitivity to the detection of a partial discharge signal would have a margin greater than 3 dB, relative to ambient noise levels. Because the area near the joints of the GIL is just below ground level, the external noise is higher than inside the tunnel. Thus, AE sensors were installed in these sections, enabling the partial discharge to be measured (Fig. 10).

AC withstand voltage tests were done six times on each single phase of the GIL. A discharge locator was installed to find the position of a partial discharge. This equipment discharge detects a partial discharge with sensors, determines the difference in pulse arrival times and locates the position of the partial discharge from the previously measured pulse propagation speed. These tests confirmed that insulation levels within the GIL were acceptable.

Loading current tests consist of a heat-cycle whereby an electric current of 5100 A (80% of the rated electric current) is passed between the conductor and enclosure in each phase for eight hours during a 24-hour period. The heat-cycle test checks the integrity and ability of the complete GIL installation to absorb the thermal expansion, the expansion of each bellows, the deflection of the sections at the curve positions, and the movement on the supports. Repeating three heat cycles on the GIL and measuring changes in the heat cycles validated the measured expansion.

To detect unusual heat generation due to the loose connection of plug-in contacts, the temperature of enclosures was measured with a fiber-optic temperature profile sensor installed on the surface of enclosures in each phase of the GIL. As a result, the expansion measured during the three heat cycles was found to have come within the design limits. The surface temperature of enclosures was within acceptable limits of the design value, and no unusual rise in temperature was observed at the plug-in contacts.

Summary

CEPCO designed a GIL suitable for installation in a long tunnel. Then, together with three Japanese cable manufacturers, developed the engineering technologies, product quality control and testing methods for the completed GIL transmission link. After two years of construction of the 3.3-km (2.1-mile) Shinmeika-Tokai GIL, the world's longest GIL was commissioned in 1998. To date, this transmission line has been fault-free, operating in accordance with the design standards for the past six years.

Naoki Takinami received a BS degree from Meiji University, Tokyo, Japan, in 1984, and joined Chubu Electric Power Co. Inc. the same year. He has been engaged in the development and installation of EHV underground transmission lines and GILs, and is currently manager of the Transmission Lines Section. Takinami is a member of the IEE of Japan.
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Shin-ichi Kobayashi received a BS degree from Yokohama National University, Yokohama, Japan, in 1989. He joined Chubu Electric Power Co. Inc. the same year. He has been involved in the installation of EHV underground transmission lines and GILs, and currently works as assistant manager of the Electrical Engineering Section. Kobayashi is a member of the IEE of Japan.
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ATTACHMENT 9

{2009 Correspondence – NPS to FPL (2)
Responses FPL to NPS (2)}

Patrick Engineering
4970 Varsity Drive
Lisle, IL 60532-4101

United States Department of the Interior
NATIONAL PARK SERVICE

Everglades and Dry Tortugas National Parks
40001 State Road 9336
Homestead, Florida 33034-6733

In Reply Refer to:

L1417

OFFICIAL CORRESPONDENCE
ELECTRONIC COPY – HARD COPY TO FOLLOW

August 10, 2009

Ms. Florette Braun
Florida Power and Light – JES/JB
700 Universe Blvd.
Juno Beach, Florida 33408

Dear Ms. Braun:

As a result of project scoping regarding the potential land exchange outlined in the Omnibus Public Lands Act of 2009, Everglades National Park is writing to gather additional information from Florida Power and Light ("FPL"). There are a few issues that have come up in project scoping that we need your input to help in the analysis in the environmental assessment.

1. There are concerns related to construction of two 500 kV and one 230 kV above ground transmission lines immediately adjacent to the Park (if the proposed land exchange was consummated). As such, it has been suggested that these lines be buried. Given your technical expertise on this subject, we are seeking additional information from you regarding the technical feasibility of burial of these powerlines. We are aware that 500 kV transmission lines have been undergrounded in other countries, but is this a technically feasible option in the Everglades/South Florida environment? If not, what are the barriers that would preclude this?

   If underground installation is technically feasible, please provide a description of the infrastructure, construction methods and the operation and maintenance requirements. Please also provide a description of potential environmental effects associated with construction, operation and maintenance of the underground lines and the potential costs of construction.

2. There are concerns about powerlines being constructed in either corridor within the park. As such, where would FPL locate the transmission lines if neither its existing property nor the exchange lands were available? We are seeking information to see if FPL has analyzed other potential locations. If so, where are the general locations FPL would site the lines, what type of construction would be used, and what impacts might be associated with lines in these locations?

3. In order to secure a relocated corridor, FPL would need to acquire lands, or interests in lands, from the South Florida Water Management District, the Trustees of the Internal Improvement Trust Fund, the U.S. Army Corps of Engineers and private landowners in

addition to the NPS exchange lands Please provide a map and description of the lands or interest in lands required, the status of their acquisition and any agreements executed with other agencies and private landowners regarding their acquisition. How many private landowners would be affected and how many residences and businesses would be located within 500 feet of the transmission lines if constructed on the replacement corridor.

4. Please provide the most recent detailed drawings, site plans and description of the overhead transmission infrastructure that would be constructed on the exchange lands, the methods of construction and requirements for operation and maintenance.

As always, Everglades National Park appreciates your time and commitment to this project, and we look forward to continuing our ongoing dialogue with you. Your prompt attention and feedback regarding the above questions would be greatly appreciated. Please feel free to contact me with any questions you may have at 305-242-7712.

Sincerely,

Dan B. Kimball

Dan B. Kimball
Superintendent

FPL responses to questions raised by ENP in letter of August 10, 2009

FPL has prepared a detailed response to each of the questions posed in the National Park Service (NPS) letter of August 10, 2009. FPL remains willing to address any additional issues relevant to completion of the National Environmental Policy Act analysis of the land exchange authorized by Section 7101 of the Omnibus Public Land Management Act of 2009. In providing this information, however, FPL does wish to emphasize an obvious point, but one that may be obscured in some of the comments submitted to the NPS through the scoping process. The decision to be made by the National Park Service under Section 7101 (i.e., the purpose and need for the decision) is a decision about park land management (i.e., removing an in-holding, transferring certain acreage to non-federal ownership, relocating a boundary). The decision to be made under Section 7101 is not a decision about construction of electric transmission infrastructure.

FPL does intend to eventually site new electric transmission infrastructure in western Dade County to meet its obligation to provide reliable electric service to its customers in south Florida. Subject to all relevant governmental approvals, FPL's preferred plan for any such new transmission infrastructure is to use the exchange right- of-way (ROW) located adjacent to the eastern periphery of the ENP which it would receive as a result of the land exchange with ENP and several other agencies. The resulting FPL property would be co-located with the South Florida Water Management L-31N canal ROW in an environmentally preferable area outside the Park. While not the preferred option, FPL must maintain the option of using its existing corridor to site new electric transmission infrastructure, subject to all relevant governmental approvals, until the land exchange is completed.

The question that NPS must address in deciding whether to use the authority granted by Section 7101 is whether, given the reasonably foreseeable uses of the lands at issue (i.e., electric transmission), and other relevant considerations (e.g., ENP restoration goals), ENP will benefit from the proposed land exchange, or not. Is ENP better off with private property slated for use as an electric transmission corridor within the park, or with such private property outside the park, adjacent to already-industrialized land? Assuming that the corridor owned by FPL will be used for transmission, which location is better for the park? The question at hand is one of park land use planning, not electric transmission planning.

The specifics of a current proposal for electric transmission will be considered in another federal review process, including preparation of an EIS, conducted by the Nuclear Regulatory Commission and the Army Corps of Engineers with participation by NPS. Detailed evaluation of proposed transmission facilities will be the purpose of that process and include consideration of appropriate measures to avoid, minimize or mitigate environmental effects associated with specific proposed transmission facilities. It would be premature to attempt to engage in that level of detailed analysis in an EA designed to evaluate the effects of the statutory land exchange outlined in § 7101.

NPS should not conflate the intensity of some commentors' opposition to new energy infrastructure for the scope of the decision properly before the agency. Opponents of new energy infrastructure in South Florida have a full, open, NEPA-driven venue to pursue their concerns. In deciding what to do in response to the authority granted by Congress in § 7101, the NPS is not deciding to build a power line. Nor is the agency deciding how to build one, where to build one, why to build one, or how to address the potential adverse impacts associated with building a power line. The NPS is deciding whether a corridor of private land intended to be used by the owner for a power line is best sited within the park, or outside of it in the proposed exchange location. The answer to that question will inform the decision whether to pursue the land exchange authorized by Congress.

ENP Questions

1. There are concerns related to construction of two 500 kV and one 230 kV above ground transmission lines immediately adjacent to the Park (if the proposed land exchange was consummated). As such, it has been suggested that these lines be buried. Given your technical expertise on this subject, we are seeking additional information from you regarding the technical feasibility of burial of these powerlines. We are aware that 500 kV transmission lines have been undergrounded in other countries, but is this a technically feasible option in the Everglades/South Florida environment? If not, what are the barriers that would preclude this?

If underground installation is technically feasible, please provide a description of the infrastructure, construction methods and the operation and maintenance requirements. Please also provide a description of potential environmental effects associated with construction, operation and maintenance of the underground lines and the potential costs of construction.

As provided in FPL's statement to the published notice regarding the land transfer authorized pursuant to Section 7107 of the Omnibus Public Land Management Act of 2009, and consistent with the congressional record, the purpose of the instant Environmental Assessment (EA) is to examine the direct and proximate impacts of the proposed real estate exchange ("...an environmental assessment needs to focus only on those factors arising from the land exchange itself [and] it is expected that the Park Service will move quickly to complete this assessment." Congressional Record at S332, January 13, 2009).

As a result, it is of critical importance that the EA, as directed by Section 7107, focus on the specific effects and consequences that would arise directly from the land exchange. Consummation of this real estate land exchange (unimproved land for unimproved land) would not constitute approval for any future possible use. As a result, an EA that attempts to examine in detail any potential or specific future uses of the corridor would be engaging in baseless speculation and would be contrary to law and the rule of reason(see for example, 43 CFR 46.100 and 40 CFR 1508.8).

At this stage, the sole federal action before the Department is the completion of a land exchange authorized in the Omnibus Public Land Management Act of 2009. Any specific questions or detailed evaluation regarding prospective transmission line development are properly handled within the federal and state permitting processes for any such proposed facilities. Since any proposed transmission facilities will likely be the same for either the existing ENP in-holding corridor or the exchange corridor on the periphery of ENP, the primary purpose (and benefit) of the trade is to ensure that no power line is built within the ENP Eastern expansion. Currently, applications addressing transmission facilities proposed for this FPL right-of-way have been filed with the NRC and USCOE. Consistent with 10 CFR Part 52, 10 CFR Part 51 and the Memorandum of Understanding entered into by the NRC and the ACOE on September, 2008, these agencies are engaged in a comprehensive environmental review of the proposed project facilities, including initiation of an EIS which will incorporate input from other government agencies (including NPS) as well as the public, and will address all pertinent aspects of the proposed facilities for this right-of-way.

Although the highly specific design issue of the proposed transmission lines will be properly addressed in the NRC/COE EIS, FPL is providing the following information regarding the technical feasibility of undergrounding in response to your inquiry on this subject.

Evaluation of Underground 500kV

Based on the question posed by the NPS above, FPL researched the feasibility of constructing underground facilities to replace a portion of the proposed overhead 500 kV (Clear Sky-levee 500 kV) lines adjacent to ENP, with underground facilities of equivalent and reliability. This would entail construction of two underground 6.5 mile long 500 KV lines with one contingency/maintenance line of the same length. The response below is based on an evaluation of this underground configuration.

Feasibility and Constraints

The three primary underground transmission cable types available are – pipe-type (high pressure fluid filled) (HPFF), self contained fluid-filled (SCFF) and cross-linked polyethylene (XLPE) – all could be technically considered for this portion of the project, although they all have very limited current application at 500kV.

HPFF

Tests at EPRI's Waltz Mill test facility in the 1970s proved the technical feasibility of 500 kV pipe-type cables, but there have been no commercial installations in North America and only one known installation overseas (a short generator lead in Japan that research suggests is no longer in service). In addition, the manufacturer that supplied the cable is no longer in business; additionally the cable was insulated with Kraft paper whereas laminated paper-polypropylene insulation would be used today.

SCFF

Self-contained fluid-filled (SCFF) cable is another potentially applicable cable technology. Two 500kV lines of this design, each a little over a mile long were installed in a tunnel in Grand Coulee Dam in the 1970's; one of them experienced a catastrophic failure and fire soon after installation, but the replacement cables have operated satisfactorily. There is a 525kV SCFF submarine cable system in the Vancouver, Canada area that is approximately 22 miles long and has been operating successfully since the 1980s. Although this is an available cable technology, SCFF cables generally are used only for long submarine cable installations where it is desirable to minimize or avoid cable splices. They are not common for conventional land installation such as FPL is researching for the Clear Sky – Levee 500kV project because the key advantage to SCFF cables is that they may be produced in long continuous lengths without splices, for submarine installations that unload from ships. The cables are generally heavier than extruded cables and therefore would have limitations for transport over roadways and shorter pulling lengths requiring more splices. There are no manufacturers of this cable type in the United States, and overseas manufacturers have informally stated that they do not expect to produce SCFF cables in the future except for long submarine installations.

SCFF cables have smaller quantities of dielectric liquid compared to pipe-type cables, and would require small fluid reservoirs (about the size of an oil drum), generally one per phase, located every couple of miles along the route.

XLPE

There are a handful of 400kV extruded dielectric cable (cross-linked polyethylene or XLPE) installations in Europe and Asia (primarily Japan). Similarly, there are a few 500kV XLPE circuits installed around the world:

1. In 1999-2000, the Shin-Toyosu line in Japan involving the installation of 2 x 24 miles of 500kV XLPE-insulated cable was installed in a special utility tunnel in Japan capable of carrying 900MW / circuit (two circuits); one of the circuits failed shortly after commissioning but was repaired. Both lines have been continuing to operate.

2. A 500kV XLPE cable system was built for the Long Tan Hydro Power plant in China, consisting of seven (7) short (~700m) circuits of 500kV cable installed in a tunnel and 100m vertical shaft; GIS terminations were used for this particular project.

3. A 500kV ac XLPE cable is being planned for the Sichuan Daduhe Pubugou Hydro-Power Plant, which will consist of six (6) circuits installed in a 250m vertical shaft.

Most of these 400kV and 500kV cable installations have been installed in special utility tunnels and either clamped to the interior of the tunnel walls or placed on the tunnel floor. This therefore, would be very different from the scenario being researched for the Clear Sky-Levee 500kV lines.

However, regardless of the cable system type, there is very limited commercial experience with 500kV underground cable systems, and no similar installations (i.e. environment, length and ampacity) to the one FPL is researching for the Clear Sky-Levee 500kV project. Though there are several tens of miles of 400kV ac XLPE cable systems installed in Europe and Asia, these installations are generally less than 10 years old and not sufficient to evaluate the long-term reliability of these systems or extrapolate to 500kV operation. North American standards (IEEE, ICEA, and AEIC) do not address XLPE cable systems above 345kV, this lack of guidance and criteria would require extrapolation using international standards (IEC, CIGRE) would be required to develop specifications relating to 500kV cable systems.

Since HPFF and SCFF are not viable options, the rest of the research is limited to XLPE systems.

Construction Methods

The two main construction methods are direct burial and duct banks. Horizontal Directional Drilling is not an applicable construction method for a project of this scale.

Most XLPE-insulated cables in the United States are installed using a duct bank and manhole system. While the initial installation cost for a direct buried system may be less costly than a duct bank, any future repair or the restoration effort would be more difficult and time consuming.

Considerations Common to either Duct Bank or Direct Burial.

Installation of these cables requires significant excavation along the entire length of the line. Due to the requirements for separation between cables and the number of cables needed to achieve the required ampacity, several very large trenches would be required. As a result crossings of any wetlands, highways, rivers, etc. would be more intrusive than for the installation of an overhead line where the main impact would largely be limited to the footprint of a structure pad every 800 to 1000 feet and the width of the access roads. Due to the very high power transfer requirements, the width of the required underground rights-of-way for an underground option would be significant because of the number of cables necessary; a conservative estimate would be between 125 and 140 feet for the trenching area; additional width would be required for the substantial access road and, during construction, for soil and equipment storage. Excavation materials (spoil) to be disposed of would amount to approximately 300,000 yd^3.

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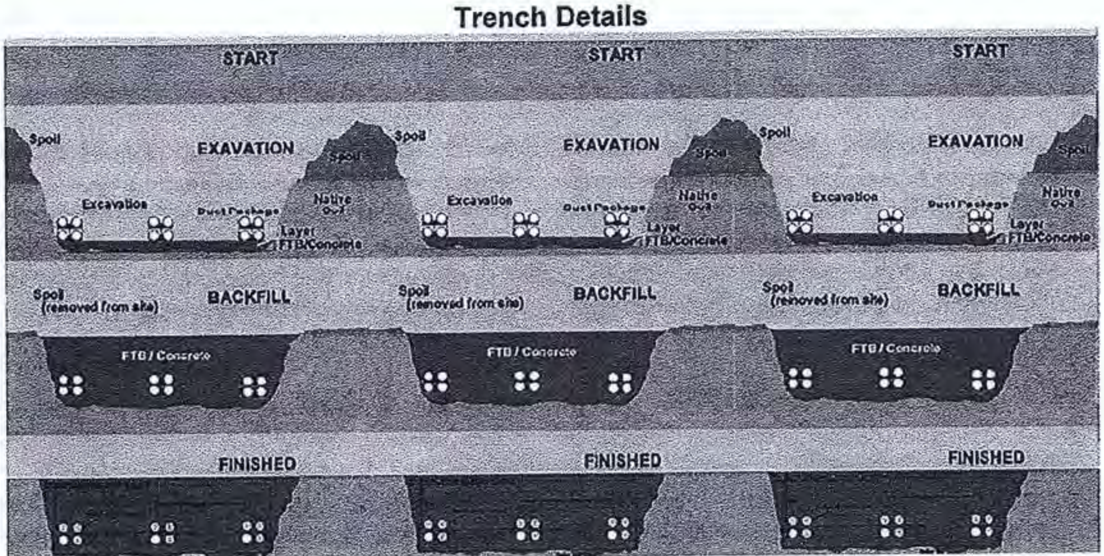
Trench Details



Stages of civil work for duct bank installation for all 3 circuits
Figure 1

Environmental Impacts

The environmental impact of the installation effort would be substantial from the standpoint of affected wetland environments along the selected cable route, particularly if the area is normally covered with water. A more substantial road in terms of width and construction design would be required than for overhead line construction in order to accommodate the heavy transport vehicles needed to move splice vaults/bays and concrete trucks (for Fluidized Thermal Backfill (FTB) or concrete) as well as to transport heavy reels to the pulling locations (whether direct buried or duct bank). The heavy transport requirements for cable materials, etc. would probably be much more significant – requiring a more robust road – than for comparable capacity overhead lines. The road would be required to be maintained for the life of the facility.

Cables generate heat during their operation – the area adjacent to the cables can be 70F° hotter than the surrounding environment, although the heat diminishes fairly rapidly with distance from the duct bank. Farmers have reported premature germination of seeds above cable trenches; potential effect, if any, on the environment in the Everglades are not known.

The cables themselves do not pose a significant environmental threat. Some utilities perceive a lead cable sheath as an environmental issue, but the lead is covered in a tough plastic jacket that is more than 1/8th inch thick. The main issue for the lead sheath is disposing of scrap cable, but this can usually be addressed without much of an issue. Other sheath materials could also be used and would be evaluated during the detailed cable system design.

Costs

The cost of an underground 500 kV system appears prohibitively expensive. Undergrounding the 500 kV system in this 6.5 mile area would cost the requesting third parties almost a billion dollars more than using the proposed and proven overhead technology for this stretch of the lines. Materials cost, most notably copper prices, have varied significantly in the last twelve months, and are currently lower than they have been traditionally. This means that the actual project cost could be substantially higher in the future. These costs are generally extensions of costs that were recently evaluated as part of a recent 345-kV XLPE cable project. The rough cost estimate for three 4200A circuits consisting of three 3-phase lines in this 6.5 mile stretch of ROW is over a billion dollars. This estimate does not include permitting costs, mitigation costs, cost of roads, land rights cost, switching stations at each end and AFUDC and sales tax.

Summary

All these factors suggest that while there is a limited technical feasibility in building these lines the very high cost, the significant associated environmental disturbance required to accommodate the underground facilities, the unproven technology and associated technical issues, combined with the significant impacts of any failures present risks that would not justify use of this technology.

2. There are concerns about powerlines being constructed in either corridor within the park. As such, where would FPL locate the transmission lines if neither its existing property nor the exchange lands were available? We are seeking information to see if FPL has analyzed other potential locations. If so, where are the general locations FPL would site the lines, what type of construction would be used, and what impacts might be associated with lines in these locations?

As previously noted above, FPL's preferred plan for any such new transmission infrastructure is to use the exchange right-of-way to be located along the eastern periphery, and outside, of the ENP. The resulting FPL property would be co-located along the South Florida Water Management L-31N canal in an environmentally preferable area outside the Park.

The purpose of the instant Environmental Assessment (EA) is to examine the direct and proximate effects associated with this proposed real estate exchange. This real estate exchange will enable the ENP to obtain ownership of an additional 60 acres of land for the park and remove the FPL land from its current location in the Expansion area where it presents complications for the implementation of the Mod Waters project Therefore the EA, as directed by Section 7107, should focus on the land exchange. Congress expressly authorized this exchange (i.e., to enable the existing FPL to be moved out of ENP) since it is evident that no other feasible and practical alternatives exist for location of a suitable north-south transmission corridor in heavily populated Dade County.

As concluded in the Environmental Report (2008) prepared by Parsons in consultation with the NPS, consummation of this real estate land exchange (unimproved land for unimproved land) while not having any immediate and proximate impacts, does offer an opportunity for reducing impact to the park and the environment at such time as development would occur in the ROW.

The following information demonstrates why other corridors or locations for the ROW are not feasible and the EA must properly focus on the specific exchange identified by Congress.

Alternatives development process for ROW exchange

With the objective of relocating FPL's existing utility ROW property interests outside of ENP a multi-agency group, including the NPS, the U.S. Army Corps of Engineers (USACOE), the Florida Department of Environmental Protection (FDEP), and the South Florida Water Management District (SFWMD) have worked together, and with FPL, since 2005 to specifically identify alternative locations and land acquisition methods and options. Collocation with nearby CERP projects, other government lands, and additional utilization of SFWMD rights-of-way were among the other options explored (see Attachment 1). Extensive effort and analysis revealed that the only feasible and practicable exchange alternative involves lands on the eastern periphery of the Park expansion. Relocation of the FPL ROW to this location and outside of ENP will ensure that no future utility facilities would be proposed, constructed or operated within the ENP Expansion Area. Such action would contribute directly to achieving the statutory purposes of the ENP Expansion Area (16 U.S.C. 410r-5). Furthermore, prompt relocation of FPL's existing interests in these lands would also facilitate the congressionally authorized Modified Water Deliveries Project (16 U.S.C. 410r-8) (Mod Waters).

<u>Alternative 1: No Action / The Currently Owned Right-Of-Way</u>

In 1989, the boundaries of the ENP were expanded to include a vital 7.4 mile portion of a contiguous 40-mile long FPL transmission line ROW that ranges from 330 to 370 feet wide. This ROW was acquired by FPL in the 1960s and early 1970s, well before the expansion, in anticipation of growth in the southeastern Florida region. The ROW is essential for the placement of critical infrastructure necessary for the transmission of high voltage electrical power for the benefit of the citizens of Florida. Under Alternative 1, this ROW would continue in its current location and accommodate features as described in the Site Certification Application submitted on June 30, 2009 pursuant to the Florida Electrical Power Plant Siting Act. As NPS knows, a No Action alternative is a mandatory feature of a NEPA document.

<u>Alternative 2: The Relocated Right-Of-Way</u>

The existing ROW would be relocated through a land exchange between ENP and FPL. The relocated ROW would be outside the eastern edge of the park. The ENP boundary would be modified to remove the relocated ROW from ENP. The physical dimensions of the ROW and the transmission and support infrastructure within the ROW would be similar to that described in Alternative 1, with the exception that the existing L31N levee road provides an opportunity for providing access to the ROW. The relocated ROW would no longer be located in the ENP and would be placed away from the primary area to be re-flooded by the Mod Waters restoration project. Additionally, a 90-foot non-native vegetation management easement would be established within the boundary of ENP and adjacent to the western boundary of the relocated ROW. This area, established via an easement from ENP to FPL, would allow FPL to control non-native vegetation that may pose a fire hazard to the adjacent facilities within the ROW.

Other Alternatives Considered and Dismissed

Other locations for and exchange ROW:
The multi-agency group and FPL sought to identify reasonable alternatives for relocating the ROW consistent with the purposes of ENP and the Mod Waters that provide the impetus for this proposed action. However NPS acquisition of a new ROW outside of the Park (i.e., farther east in Miami-Dade County) was rejected as being infeasible for the following reasons:

- ENP does not currently own lands outside of the Park that could be exchanged to make up a viable ROW,
- For ENP or DOI to purchase private lands outside of the Park that could be exchanged with FPL would be far too costly (likely to cost hundreds of millions of dollars to acquire land interests in populated and developing areas of central Miami-Dade County), beyond the agency's authority (it can only acquire lands within ENP boundaries), and untimely.
- Relocating the ROW to lands held by the State of Florida or its agencies was considered and rejected as well. No State entity possesses sufficient lands to provide FPL a complete replacement ROW. Moreover, there are no available mechanisms for NPS to compensate the State for a transaction that primarily benefits ENP.

ROW Acquisition without replacement
ENP acquisition of FPL's ROW, without providing any replacement, was also rejected. FPL would not be a willing seller and hostile federal acquisition under these circumstances would be a time consuming and exceedingly expensive proposition. It would also have adverse impacts on reliable electric service to citizens of Miami-Dade and Broward Counties and therefore be unreasonable and contrary to other legal mandates under which FPL operates.

Corridors for Turkey Point Units 6 & 7 Transmission

Separately, as part of FPL's preparation of its site certification application (SCA) and associated transmission line siting study for Turkey Point Units 6 & 7, FPL's corridor selection team made note of the existing ROW and the proposed exchange ROW both of which were independently identified by the team as feasible route alignments for the required project facilities based on the routing criteria (e.g. using existing FPL ROW and collocating along existing linear facilities). However, the siting team also looked for potential alternative route alignment opportunities for this project outside the park using the siting guidelines and criteria developed for the project. FPL's regional screening map, (depicted in the SCA - see enclosed DVD -as Figure W.9.3.1-1,) was used to map siting constraints and opportunities.

Krome Avenue which runs north-south just outside the park and L31N boundaries was initially identified as a potential siting opportunity. However, after review of all mapped data, driving Krome Avenue, and a helicopter flyover, no viable route following Krome Avenue was identified south of Tamiami Trail for this project. A route along Krome Avenue in this area presented a number of challenges including, extensive wetlands, mine pits, scattered residential development on both sides, and engineering considerations such as the necessary ROW width and access constraints. Additionally much of the land south of Tamiami Trail is conservation or Native American owned lands without existing FPL easements or other available ROW, thus siting opportunities were limited. North of Tamiami Trail however, FPL did select Krome Avenue and the L-30 Levee as a siting opportunity, and it was ultimately selected as the Preferred Corridor

3. In order to secure a relocated corridor, FPL would need to acquire lands, or interests in lands, from the South Florida Water Management District, the Trustees of the Internal Improvement Trust Fund, the U.S. Army Corps of Engineers and private landowners in addition to the NPS exchange lands Please provide a map and description of the lands or interest in lands required, the status of their acquisition and any agreements executed with other agencies and private landowners regarding their acquisition. How many private landowners would be affected and how many residences and businesses would be located within 500 feet of the transmission lines if constructed on the replacement corridor.

As previously noted above a multi-agency group, including the NPS, the U.S. Army Corps of Engineers (USACOE), the Florida Department of Environmental Protection (FDEP), and the South Florida Water Management District (SFWMD) has worked together to identify this exchange solution. Real estate agreements are in place with these agencies to provide for a contiguous replacement ROW for FPL. The executed agreements are identified below.

- **NPS:** July 24, 2008 "Contingent Agreement for an Exchange of Lands Between the United States of America and Florida Power & Light Company for Exchange and Relocation of FPL's Lands and Interests in Lands Located in or Adjacent to the ENP Park Expansion Area".
- **USACOE:** August 20, 2008 Agreement Regarding FPL's Utility Corridor within the ENP Expansion Area.
- **FDEP:** August 21, 2008, Memorandum of Agreement for the Relocation of FPL's Electrical Transmission ROW Corridor In or Adjacent to the ENP Expansion Area.
- **SFWMD:** August 21, 2008 Cooperation Agreement :
- FPL required and has secured easements from the following private landowners for the new corridor:
  - **Antonio A. Olivera, , Antonio J. Olivera and Norma Olivera**...(3058110004010; 30581100040880; 3058110004890; 3058110004960)
  - **Alfonso and Miriam Perez** (3058110000510).

A map reflecting the various land interests that will be exchanged pursuant to these executed agreements with the agencies and private landowners is attached.

Review of GIS data and aerial photographs of the area extending 500 feet from the exchange corridor suggest that there are 315 parcels within this area, of which 251 are government and are 59 in private non-FPL ownership. The area is very lightly developed with a total of only 18 building counted in this 500 foot area the majority of which appear to be sheds or other agricultural outbuildings. Of these buildings it appears that possibly up to 6 could be homes and two appear to be large commercial-type buildings.

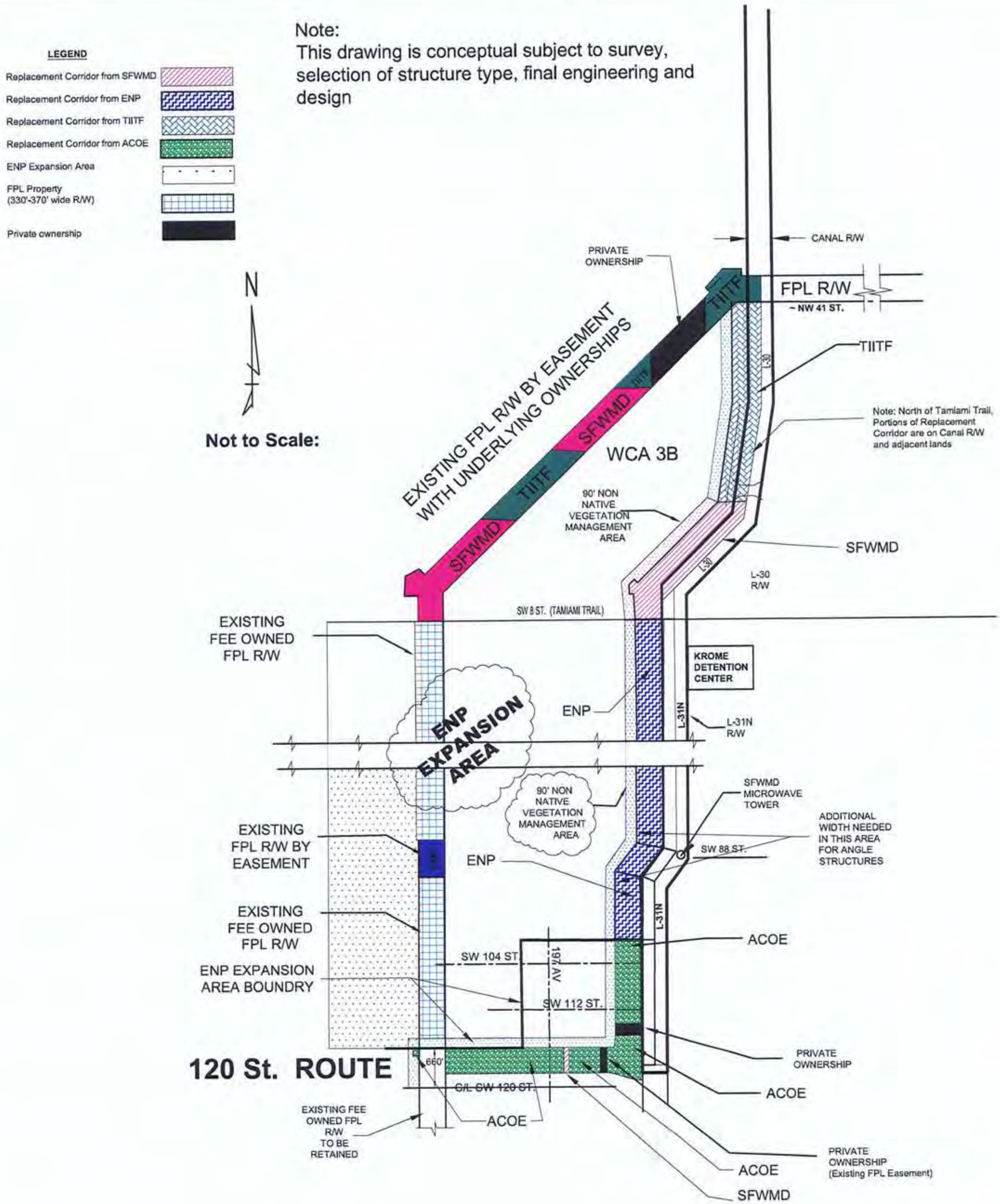
4. Please provide the most recent detailed drawings, site plans and description of the overhead transmission infrastructure that would be constructed on the exchange lands, the methods of construction and requirements for operation and maintenance.

Any detailed evaluation or analysis of prospective transmission line development is properly handled under the comprehensive, yet separate, preparation of an EIS, conducted by the

Nuclear Regulatory Commission and the Army Corps of Engineers with participation by several other federal, state and local agencies, including the NPS.

Nonetheless, and for information purposes and to facilitate completion of the EA, FPL is providing the following regarding the development of transmission lines in the proposed corridors.

While applications for certification of a transmission corridor have been filed, no specific construction project has been approved. Design details are not finalized until after the corridors are certified. However, the site certification application filed with the FDEP under the PPSA contains typical drawings and cross sections for the corridors. Please refer to Section 9 West of FPL's Turkey Point Units 6 & 7 Site Certification Application (SCA) for descriptions of the construction, operation and maintenance methods as well as figures depicting typical structures, ROW cross sections, and road and pad design. A CD of Chapter 9 of this SCA which address the proposed transmission lines is enclosed for your convenience. The facilities and their construction operation and maintenance would be similar for any ROW location, adjusted as necessary to address site specific factors.



CONCEPTUAL PLAN VIEW WITH UNDERLYING OWNERSHIPS

RSH 9/29/08

United States Department of the Interior
NATIONAL PARK SERVICE

Everglades and Dry Tortugas National Parks
40001 State Road 9336
Homestead, Florida 33034-6733

In Reply Refer to:

L1417

OFFICIAL CORRESPONDENCE
ELECTRONIC COPY – HARD COPY TO FOLLOW

October 2, 2009

Ms. Florette Braun
Florida Power and Light – JES/JB
700 Universe Blvd.
Juno Beach, Florida 33408

Dear Ms. Braun:

Thank you for your response letter dated September 4, 2009. The information you provided was helpful, but we find that we have questions about the information you provided. Furthermore, we have additional questions that are critical to our understanding of your proposal and that have an important relationship to the National Environmental Policy Act (NEPA) analysis that the National Park Service (NPS) is required to complete for the proposed action.

Questions on FPL response letter (Pages cited below refer to locations in the FPL response letter/report)

1. Page 3, 2nd paragraph: What does "one contingency/maintenance line of the same length" mean? Please explain.

2. Page 3, SCFF: Please explain whether or not SCFF cables are available for this application?

3. Page 4, XLPE, item #1: Please describe in more detail the use of XLPE in the Shin-Toyosu line in Japan that is cited. This appears to be the example that most closely resembles the Clear-Sky-Levee 500kV lines.

4. Page 4, XLPE, 3rd paragraph: Please describe in more detail whether or not there are international standards for XLPE installation of 500kV transmission lines?

5. Page 4, 3rd paragraph: What options exist to modify the kV of the proposed transmission lines to provide better opportunities for undergrounding (e.g., modify plan to provide 345 kV lines where North American standards exist for XLPE cable systems)?

6. Page 4, Construction Methods: Please define "duct bank."

7. Page 4, last paragraph: Please identify the depth of the "very large trenches" that would be required.

8. Page 5, 1st paragraph: FPL states that "the width of the required underground rights-of-way for an underground option would be significant…". Does this mean that a 300' right of way would be sufficient or insufficient? Please explain.

9. Page 5, Trench Details graphic: Please include dimensions in these cross-sections.

10. Page 5, Environmental Impacts: Please indicate whether and how much the current canal road would have to be widened to meet the more robust road requirement described in this section?

11. Page 6, 2nd paragraph: Please provide a more detailed cost comparison of conventional overhead transmission lines and the three 3-phase XLPE system that would be required for the proposed exchange lands.

12. Page 6, 3rd paragraph: Please explain what is meant by "significant impacts of any failures."

Questions on project not related to FPL response letter

1. What options exist for modifying the profile/height of the proposed transmission lines adjacent to the Park?

FPL comments on the scope of NPS questions

We want to acknowledge your statements in the September 4 letter, regarding the appropriate areas of inquiry by the NPS in the course of its NEPA analysis of the proposed action. As an example, Florida Power and Light (FPL) expresses the concerns that NPS may be exceeding the scope of its NEPA obligations by examining "in detail any potential or specific future uses of the corridor…." (9/4/09 letter at p. 2). Also, FPL advocates a different "no action alternative" than was proposed by NPS. NPS will consider carefully these concerns, as well as similar concerns submitted by FPL during the scoping process. In certain aspects, NPS differs from FPL in its description of the scope of its statutory and NEPA obligations. Going through these differences in great detail would appear to be of little assistance to either FPL or NPS. However, the following brief description of the agency's obligation to take a hard look at the environmental effects of the proposed action may assist FPL in understanding the reasons for our questions.

NPS is obligated to consider "past, present and reasonably foreseeable future actions" as a part of its analysis of the cumulative impacts of a proposed project. 40 CFR §1508.7. In addition, Public Law 111-11 stated that the proposed land exchanged would be "subject to such terms and conditions as the Secretary may require." If, in the course of an environmental assessment, NPS identifies a significant effect of the proposed action, then NPS may consider changes or safeguards in the project which would reduce the impact. Thus, NPS is seeking to gather sufficient information to determine whether certain impacts are speculative or foreseeable. Further, in addition to taking a hard look at the environmental effects, NPS is gathering information to allow it to consider the feasibility and impacts of any terms, conditions, changes or safeguards which could improve the project or reduce impacts from the project. Your assistance in responding to our questions, has and will facilitate these investigations.

As always, Everglades National Park appreciates your time and commitment to this project, and we look forward to your written response and to continuing our ongoing dialogue with you. Your prompt attention and feedback regarding the above questions would be greatly appreciated. As we discussed recently, we feel it would be beneficial to both parties to have a meeting or conference call to discuss these questions and the project as a whole. Please feel free to contact me with any questions you may have at 305-242-7712.

Sincerely,

Dan B. Kimball

Dan B. Kimball
Superintendent

Florida Power & Light Company, P.O. Box 14000, Juno Beach, FL 33408-0420
700 Universe Boulevard

FPL

October 26, 2009

Mr. Dan B. Kimball
Superintendent
Everglades and Dry Tortugas National Parks
40001 State Road 9336
Homestead, FL 33034-6733

Subject: Response to October 2, 2009 Correspondence Regarding ENP-FPL Land Exchange (L1417)

Dan
Dear Mr. ~~Kimball~~:

This is in response to your request for additional information for the Environmental Assessment (EA) being prepared in support of the Congressionally-provided land exchange between Everglades National Park ("Park" or "ENP") and Florida Power & Light Company ("FPL"). In the attachment to this letter, FPL responds to the inquiries you posed related to technical matters. However, in order to facilitate execution of the exchange and ensure compliance with NEPA, in this letter FPL addresses the appropriate scope and focus of the EA.

As you know, Section 7107 of the Omnibus Public Land Management Act of 2009, Public Law 111-11 (the "Act") expressly authorizes the United States acting through the Department of Interior ("DOI"), to acquire via a land exchange a 7.5 mile utility corridor within ENP held by FPL. Section 7107 further provides in relevant part that, the 320 acres of the FPL corridor would be added to ENP Expansion Area and in return, FPL would be provided 260 acres of fee-owned lands and a vegetation management easement along the eastern periphery of the existing ENP Expansion Area. Following the land exchange, the boundary of the Park would be relocated to the western edge of the lands conveyed to FPL, placing FPL's new corridor outside of the Park, eliminating the possibility of a utility corridor bisecting the ENP Expansion Area. .

DOI and Congress recognized that the proposed land exchange: 1) is mutually beneficial; 2) is low cost and low impact; 3) will protect Everglades resources; 4) will greatly facilitate Everglades restoration by implementing a critical step in the Congressionally authorized Modified Waters Delivery Project ("Mod Waters") and Comprehensive Everglades Restoration Plan ("CERP") efforts; and 5) ensures that FPL will retain a north-south utility corridor in order to meet the demand for delivery of safe, reliable electrical service to the citizens of South Florida.

Notably, FPL continues to be committed to timely execution of the land trade. We hope that the ENP, mindful of the Congressional action on this exchange, also remains committed to timely execution of the land trade. As you are aware, the land trade is an environmentally beneficial, no-cost means of cooperatively resolving issues associated with FPL's utility corridor inholding within ENP that reflects the culmination of many years of effort by several federal, state and regional government agencies.

Unwarranted Focus on Not-Yet-Proposed Future Details

FPL continues to have deep concerns that a highly detailed evaluation of potential future uses of the lands and interests to be transferred to it pursuant to the land exchange is beyond the proper scope of this EA and not required by NEPA. In fact, the present foreseeability of the specific features of electric transmission development in the relocated corridor is remote and speculative as these features and details are contingent upon a number of intervening events, which are hard to predict at this time. These include federal licensing and permitting actions by the Nuclear Regulatory Commission (NRC) and the Army Corps of Engineers ("Corps") as well as a variety of Florida agency approvals. Highly detailed evaluation of these features now is unnecessary, intrudes on the statutory authority of other agencies (which will conduct thorough NEPA review of proposed transmission lines and features), will unduly delay the exchange, and could result in the imposition of unwarranted terms and conditions that would compel FPL to abandon this cooperative land transaction.

The purpose of the statutory land trade with ENP is to ensure that FPL's long established north-south utility corridor (which predates expansion of the Park in 1988) is removed promptly from inside the Park[1]. The impetus for this land exchange is to remove an impediment to implementation of the Modified Waters Delivery Project ("Mod Waters")[2] and secure the environmental benefits of relocating FPL's inholding to an area outside the park so that ENP resources and values. Specifically, relocation of the FPL inholding is needed to enable the long delayed Mod Waters to proceed and restore more natural water flows in the northeast Shark River Slough. Mod Waters is a cornerstone for the broader environmentally beneficial Comprehensive Everglades Restoration Project (CERP). Unfortunately, it appears that the environmental analysis for the simple land exchange is veering off track and focusing on the details of prospective, yet to be defined uses of the relocated utility corridor outside of ENP, without an equally exacting analysis of the environmental benefits of relocating FPL's inholding.

Focus on the details of prospective development of the relocated outside-the-Park corridor also intrudes on the specific authority of the NRC, the Corps and state agencies. The NRC and the Corps are jointly engaged in a comprehensive analysis of these issues and will be conducting a thorough environmental impact statement (EIS) to engage in the requisite "hard look" at the specific features and effects of prospective utility corridor development. As a matter of law, this hard look will entail examination of a reasonable range of alternatives including different forms and types of electric transmission facilities. ENP has full authority under applicable Council on Environmental Quality rules to fully participate in this process with a sister federal agency. FPL recommends that ENP deal with the details of not-yet-proposed electric transmission facility alternatives through the NRC/Corps-EIS process.

Consideration of Undergrounding 500 kV Lines is Not Necessary

The extraordinarily detailed questions regarding underground transmission lines, electric facilities in Japan, XLPE transmission facilities and the like are precisely the kind of issues that should be properly addressed by an agency actually permitting the placement of transmission lines on the land. Given the lack of a legal mandate under NEPA or any other statute or regulation for ENP to evaluate these kinds of technical electrical engineering issues, it is unreasonable to engage in such an analysis as part of this EA. Moreover, it

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[1] FPL acquired the corridor in the late 1960s and early 1970s, before there was any contemplation that the lands would be encompassed within an expanded ENP with the express expectation that it would be used as part of a larger 40 mile long north-south transmission corridor to serve customers in south Florida. Acquisition of this inholding must be part of a more comprehensive effort to provide FPL a replacement corridor enabling it to serve its customers and fulfill its service obligations under Florida law.

[2] Mod Waters was approved by Congress in 1988. 16 U.S.C. § 410r-8.

is likely that efforts to engage in such an analysis will delay completion of the EA and the significant environmental benefits to the region which would result from the transaction.

In a spirit of collaboration, however, FPL has responded to your questions and has examined again the concept of burying a high voltage 500 kV transmission line in some kind of impermeable underground vault in the relocated utility corridor. It is our considered expert judgment that an underground high voltage line here is not technically practical or prudent, would be prohibitively expensive, and could result in adverse environmental impacts to the Everglades' (and Shark River Slough) hydrology.

The pursuit of an underground alternative appears to be driven by concern about visual effects of future above-ground electric transmission facilities in the relocated corridor. However, once due consideration regarding the developed nature of the areas adjacent to ENP and the relocated corridor is given, such a concern can be reasonably dismissed given the surrounding infrastructure. In particular, western Miami-Dade County up to the ENP boundary is already heavily developed. The Park is presently abutted by roads, canals, commercial agricultural, housing, large gravel pits and related tall buildings, resorts and gambling facilities, and electric and utility lines among others. Several tall radio antennae, each more that 250 feet high, are also situated in the heart of the ENP expansion area adjacent to FPL's inholding. All of these existing structures and facilities have visual impacts on the Park and Park visitors. The addition of future transmission lines in the relocated corridor outside the Park can have only a minor incremental visual effect on the expansion area and no impact on the original more distant parts of the Park.

Notably, the issue of visual effects was reviewed as part of an environmental review conducted by FPL in cooperation with ENP in support of this land exchange[3]. The analysis concluded that FPL construction of transmission lines in the FPL inholding would have "small adverse effect on the visitors' experience and enjoyment of the vistas of the ENP Expansion Area." The report explained that "because of their distance from most visitors, [the transmission lines] would have a small adverse effect on the visitors' experience and enjoyment of the vistas of the ENP Expansion Area." Further, the report concluded that construction of transmission lines in the relocated ROW to the east of the ENP "would have impacts on visitor experience, but they would be less than similar development in [within FPL's inholding] because they would be close to other existing development and farther from park visitors in Shark Valley, Chekika, and on airboat tours."

FPL maintains that the bona fide alternatives before the Park are above ground transmission facilities using FPL's existing corridor within ENP or in a relocated corridor outside the Park. The latter clearly will create fewer visual effects on ENP assuring that it is the environmentally preferred approach.

Turning to technical issues, underground 500 kV cables have very limited use anyplace in the world. Moreover, placing these lines underground at this proposed location would rely on technology unproven for the project and site's features. Differences between 230 kV and 500 kV systems are substantial and the feasibility of underground location of the former (in appropriate locations) does not mean that a far larger more complex 500 kV line can be situated underground. The risks and costs associated with underground location of an unprecedented 500 kV line would both be substantial and the ability for FPL to execute maintenance or make repairs would be difficult and unnecessarily burdensome.

Regardless of the cable technology, there is very limited commercial experience with 500 kV underground cable systems, and no similar installations (when considering environmental factors, length, and capacity) to the one ENP has asked FPL to examine for the relocated corridor. Though there are some 400 kV ac XLPE cable systems installed in Europe and Asia, these systems are generally less than 10 years old and operating

[3] *Levee-Turkey Point Partial Rights-of-Way Exchange Environmental Report*, Parsons, July 2008.

experience is not sufficient to evaluate the long-term reliability of these systems or extrapolate to 500 kV operation.

As a 500 kV underground system, this would be a very large cable project, which would tax the capabilities of both manufacturers and installers. Notably, the high water table and highly permeable limestone substrate of the Everglades environment would add significant risk, and thus cost, to the project.

Failure of such an underground cable transmission system would present significant impacts to the operation of the system because of the extraordinary efforts needed to investigate failures combined with the amount of time needed to make repairs on such lines. It is expected that the duration needed to identify the problem, locate the appropriate materials (or lead time to manufacture) and restore service would be measured in weeks or months for such a system, whereas it would generally be hours for an equivalent overhead system. This means that an unprecedented, unproven 500kV underground system could have substantial negative impacts on South Florida's electric grid infrastructure.

Since these lines would be distributing power from the Turkey Point 6 & 7 units and helping ensure the stability of the grid in South Florida, long unplanned outages due to an underground cable failure would have a significant impact on the ability of the plant to operate at full power during the line outage, and would likely limit the plant's output, affecting the reliability of the grid as a whole.

Notwithstanding these engineering issues, the expected costs for these underground facilities would be excessive (nominally $1 billion more than overhead lines). See Attachment, Response to Question 11. The Florida Public Service Commission (PSC) regulated utility rate structure authorizes overhead lines. Under the current rate structure, it is not viewed as appropriate to have all ratepayers pay for a specific underground project that only benefits some customers. As such, if a jurisdiction insists on feasible underground construction, that benefiting jurisdiction or entity must bear the additional costs. The PSC, the Florida Legislature and the Florida Supreme Court have established this cost allocation requirement to ensure that landowners that benefit from extraordinary costs will bear those costs when other arrangements (e.g., above ground transmission facilities) are technically feasible. See § 366.03 Fla. Stat. (2002); Florida Power Corporation v. Seminole County, 579 So.2d 105 (Fla. 1991). It is our understanding that neither ENP nor NPS have the available financial resources to pay these extraordinary costs.

Lastly, the impacts of a major underground ductbank/vault system along the eastern edge of ENP, and Shark River Slough, are unknown and could adversely impact the hydrology of the region and interfere with restoration of more natural water flows as directed by Congress (see 16 U.S.C. § 410r-8). As you know, Everglades topography and hydrology is often measured in inches. The hydrologic changes wrought by dikes, canals, gravel pits and other terrain alterations caused many of the problems necessitating billions of dollars in Everglades restoration costs. The effects of a new six and a half mile (or longer) underground ductbank/vault system on this sensitive hydrology are simply unknown. With the substrate in this area, it's unknown if or how such construction would impact water flows.

Given the aforementioned adverse technical, environmental and reliability concerns, it is impossible at present to reasonably foresee that such an option is possible or warranted under these conditions and restrictions (e.g., restoration goals). Consequently, the consideration of a ductbank /vault system alternative for 500 kV underground high voltage transmission lines in the EA is not reasonable, is speculative and impractical and should be dismissed. "An agency need not analyze the environmental consequences it has in good faith rejected as too remote, speculative, or . . . impractical or ineffective." City of Aurora v. Hunt, 749 F.2d 1457, 1467 (10th Cir. 1984).

FPL has attempted to address ENP's concerns and interests in these matters and encourages ENP to focus on the primary purpose of the land trade: facilitate Mod Waters and Everglades restoration and realization of environmental benefits associated with removal of FPL's private inholding from within ENP, which will be subject to development absent the trade.

Inappropriate Terms and Conditions Could Prevent Completion of the Exchange

It also appears that ENP is contemplating imposition of terms and conditions on the relocated utility corridor outside the ENP boundary. Specific electric transmission facility terms and conditions are relegated to the jurisdiction of other agencies. This is especially true for lands that will be outside the boundary of ENP. Furthermore, inappropriate terms and conditions attached to the relocated corridor could well destroy the value of that corridor to FPL. In that unfortunate event, the company would have no choice but to abandon the land exchange and exercise its valid existing private property rights within the existing utility corridor. At that point, ENP would face an untenable choice: take steps to forcibly acquire the inholding at enormous cost to the taxpayers or seek to block FPL's exercise of its rights and trigger substantial takings liability. These options are not in our mutual interest or the interests of Florida's citizens and will hamper, not facilitate, the important Everglades restoration opportunity offered by the Mod Waters project.

Land Acquisition is Impractical and Prohibitively Expensive

Comments about land acquisition also indicate a fundamental misunderstanding about the consequences and costs of pursuing a forced acquisition of the FPL assembled transmission corridor. The approximately seven-mile segment of the existing corridor which crosses the ENP expansion is only a small part of a much larger parent parcel which includes a 40-mile plus transmission corridor and several contiguous destination points, one of which is the Turkey Point Power Plant property. Any proposed taking of the approximately seven-mile transmission segment would have a dramatic effect, not only upon the actual corridor area acquired, but also on the value of the remaining larger parcel. This remainder includes not only the remaining 33 plus miles of transmission corridor but the power plant site connected to and which will be served by the transmission corridor[4]. "When the government takes only part of a person's property, and when the value of the remainder depreciates because of the proposed use of the condemned parcel, the owner is entitled to compensation both for that which is physically appropriated and for the diminution in value of the non-condemned property." United States v. Dickinson, 331 U.S. 745, 750-51 (1947); United States v. Miller, 317 U.S. 369, 376 (1943); see also Ala. Power Co. v. FCC, 311 F.3d 1357 (11th Cir. 2002) and United States v. Va. Elec. & Power Co., 365 U.S. 624, 635 (1961).

The measure of total cost to ENP would be determined by estimating the total and complete "just compensation" due FPL for all interests acquired, along with damages resulting to the remainder. Special purpose properties such as the corridor in question may be valued utilizing the sales of other corridors having similar function and utility, and also by a method referred to as "at the fence" value or "across the fence" value. Commonly, corridors of this magnitude are valued incorporating a significant enhancement factor to reflect for the unique function, cost and difficulty associated with assembling such a parcel. Clearly, total compensation for the part taken and the resulting damages to the remainder is in excess of a hundred million dollars. These factors and costs render acquisition impractical.

[4] The taking of an approximately seven mile piece of the existing corridor renders useless the rest of the 40 mile transmission corridor which in turn precludes or severely impairs FPL's plans to enhance South Florida's electric grid infrastructure.

Land Acquisition is Not The No Action Alternative

During our recent conference call and in materials presented during public scoping in July, your staff has stated that the No Action Alternative in the pending EA would include ENP acquisition of the existing FPL utility lands. Without a doubt, this is wrong as a matter of law. It is well established that the No Action Alternative, as required by 40 CFR 1502.14(d), is the "status quo": "the intent of the no action alternative is to require a comparison between the potential impacts of the proposed action [i.e. the Congressional land trade] to the known impacts of maintaining the status quo." (emphasis added) Miccosukee Tribe of Indians of Florida v. United States, 509 F. Supp. 2d 1288, 1293 (S.D. Florida 2007) (citing Custer County Action Ass'n v. Garvey, 256 F.3d 1024, 1040 (10th Cir. 2001)); see also Association of Pub. Agency Customers, Inc. v. Bonneville Power Admin., 126 F.3d 1158, 1188 (9th Cir. 1997).

The status quo regarding the FPL corridor is private ownership and FPL's intention to exercise its valid existing rights to use its corridor unless it is able to acquire a suitable alternative corridor. In contrast, acquisition of these private lands and interests by ENP would require a series of significant actions, which would constitute a marked departure from the status quo. As you know, in order for ENP to purchase these lands the agency would have to secure specific funding from Congress (entailing a series of new actions)[5] and negotiate a subsequent purchase agreement with FPL. If ENP were to attempt to embark on a coercive taking, it would require not only funding but approvals from other federal entities (e.g., Department of Justice). And, coercive acquisition would trigger protracted litigation regarding the value of the just compensation (including damages to FPL's substantial remainder property) due FPL. All of these approaches, without question, would constitute a substantial departure from the status quo. Hence, acquisition of the FPL interests – on a mutual or coercive basis – cannot be considered the No Action Alternative under applicable law.

It may be appropriate to consider acquisition as another action alternative in the EA. It would then include three alternatives: (1) No Action (i.e., FPL retains its pre-ENP utility corridor with its valid existing rights); (2) Congressional Land Exchange; and (3) Acquisition. However, we would urge ENP to treat "acquisition" as an alternative considered but rejected. The NPS has had over 20 years to consider purchase of the FPL property, and rather than pursuing that expensive alternative[6], Congress has already expressed a preference for the cooperative no-cost land exchange as provided by Public Law 111-11 and its legislative history. It is highly unlikely that sufficient land acquisition appropriations will be made available to buy the FPL corridor or that Florida will contribute the required 20 percent share when a no-cost, Congressionally-authorized alternative exists. We are convinced that Congress and the public would strongly prefer that limited federal dollars be directed instead toward productive Everglades restoration. Accordingly, prompt execution of the land exchange ensures that restoration of more natural water flows into northeast Shark River Slough per Mod Waters will not be impeded by failure to relocate the FPL utility corridor.

Conclusion

Review of Congressional intent regarding the authorized land exchange, applicable NEPA law, and salient facts indicates that a focused two alternative EA (no action and the land exchange) remains the appropriate

[5] Acquisition of private inholdings within the 1988 ENP expansion also requires 20 percent participation by the State of Florida requiring additional actions by the State. 16 U.S.C 410r-6 (f)(2). ENP specific actions would include an appropriations request, preparation of an approved appraisal and purchase offer to FPL consistent with the Uniform Real Property Acquisition Policy Act. 42 U.S. § 4651.

[6] Note too that the 1988 ENP Expansion Act directed "it is the express intent of Congress that acquisition within the boundaries of the addition shall be completed no later than five years after December 13, 1989." 16 U.S.C. 410r-6(c)(2).

course of action. Focus should be re-directed to the original purposes and benefits of the exchange (Mod Waters, no-cost relocation of utility corridor) rather than on remote and speculative details of not-yet-proposed electric transmission facilities or inappropriate terms and conditions to be imposed on the exchange. Regarding alternatives, if the NPS EA staff is insistent on consideration of the extremely costly, protracted and impractical acquisition approach, we suggest it be treated as an alternative considered but rejected. These actions will enable the EA to proceed on the intended fast track for completion by year end, as previously committed, and enable ENP and FPL to execute the cooperative beneficial land exchange as provided for by Congress earlier this year and ensure that Mod Waters can proceed.

Please see the attachment for the responses to the specific technical questions presented in your October 2 letter.

Sincerely,

Florette Braun
Environmental Manager
Environmental Services

Enclosure

CC.
Don Jodrey

ATTACHMENT to KIMBALL 10-26-09 Letter

Questions on FPL response letter (Pages cited below refer to locations in the FPL response letter/report)

1. **Page 3, 2nd paragraph: What does "one contingency/maintenance line of the same length" mean? Please explain.**

   As stated in our initial correspondence:
   a. 500 KV underground is an unproven technology with limited operating experience.
   b. Repairs of an underground line will take a significantly longer period than overhead repairs

   Based on the fact that these lines will be critical to the transmission system and will be carrying base nuclear generation, this contingency/reliability line (a third parallel underground line) would be constructed to provide the ability to switch to this backup line in case of an outage to one of the primary lines.

2. **Page 3, SCFF: Please explain whether or not SCFF cables are available for this application?**

   Yes, SCFF are available, however, for the following reasons -- cable is heavier than XLPE, high maintenance, presence of oil which could pose an environmental concern, and need for fluid reserviors along the route -- this type of cable would not be technically viable for this type of installation. Commercial use of this technology is diminishing world wide for new installations and is limited to water crossings where the cable can be manufactured and placed on a ship for transportation and installation in a navigable waterway.

3. **Page 4, XLPE, item #1: Please describe in more detail the use of XLPE in the Shin-Toyosu line in Japan that is cited. This appears to be the example that most closely resembles the Clear-Sky-Levee 500kV lines.**

   The Shin-Toyosu line in Japan does not appear to resemble the Clear Sky-Levee 500 kV lines. The Shin-Toyosu line was a tunnel installation, not directly buried or in conduit as would be the case for the Clear Sky-Levee 500 kV project. There appears to be no world wide experience using 500kV XLPE cables in direct buried or ductbank installations, which is what the Clear Sky-Levee 500 kV project would utilize. Further, the capacity of the Shin-Toyosu lines is significantly less than Clear Sky-Levee lines. Each circuit of the Shin-Toyosuis consists of one 2,500mm^2 conductor per phase (three conductors total), whereas, the Clear Sky-Levee 500 kV project would require three similar sized cables for each phase (nine conductors total). Also, cable lengths for the Shi-Toyosu line were more than three times the length expected to be achievable on the Clear Sky-Levee project, resulting in fewer splice/manhole locations and potential failure points per mile. (Cables reels used on the Shin-Toyosu project were too large for inland transportation. Reels were tranported by sea to the project and transferred from a cable-laying base built specifically for the project into the tunnel.)

4. **Page 4, XLPE, 3rd paragraph: Please describe in more detail whether or not there are international standards for XLPE installation of 500kV transmission lines?**

There are international standards covering XLPE cables up to 500kV. For example, IEC 62067 addresses test methods for cables. IEEE Standard 404 covers extruded dielectric cable joints up to 500kV, and IEEE Standard 48 covers extruded dielectric terminations up to 765kV. However, designs of XLPE cable at 500 kV would require development of new or revised standards by the Insulated Cable Engineers Association (ICEA) and The Association of Edison Illuminating Companies (AEIC) for use in the United States. The precise length of time needed to develop or revise these standards is unknown, but may be on the order of years and subject to the approval schedules of the cited standards-making bodies. These standards would have to be issued before final design of the cable system could be finalized.

5. **Page 4, 3rd paragraph: What options exist to modify the kV of the proposed transmission lines to provide better opportunities for undergrounding (e.g., modify plan to provide 345 kV lines where North American standards exist for XLPE cable systems)?**

The Clear Sky-Levee lines have been designed for 500 kV overhead. Because FPL has not assessed the technical feasibility of transforming the voltage for this section of the proposed lines to a lower value such that it meets the project's system requirements, FPL can only speculate on the appropriateness of such an approach for this project. Such an approach would require additional in-depth engineering studies to be performed. However, it is expected that the environmental impacts and cost would be comparable to installing the proposed 500 kV facilities underground as described below. The mere existence of applicable standards does not suggest that underground at a different voltage would be a prudent path to follow.

There is not likely to be a significant savings in cable equipment necessary for installation of 500 kV cables versus 345 kV cables. In fact, the overall project cost would likely increase because two autotransformers (345/500 kV) would be added adjacent to each end of the underground section. In addition, several acres would be required for installation of the autotransformers at each end, resulting in additional environmental impact. To identify final dimensions would require a specific study. For a 345 kV application, there would be additional cost for spare components only useable on these facilities, as this voltage is not used elsewhere on the FPL system.

If 230 kV lines were utilized in place of 500 kV lines, it is anticipated that six additional large capacity (3000 amp) 230 kV lines would be required to match the capacity of the two 500 kV lines. As in the 345 kV case, two autotransformers (230/500 kV) would be needed adjacent to each end of the underground section. Several acres would be required for installation of the 230/500 kV autotransformers at each end, resulting in additional environmental impact. To identify final dimensions would require a specific study.

While FPL has existing HPFF underground cables operating at 230 kV, the amperage ratings are typically much less (approximately one third) the capacity the new lines would be required to handle (e.g. 1060 vs. 3000 amps). In addition to other issues, the higher current carrying capacity requires much higher heat dissipation capability, which must be factored into the underground design. As a result, a direct comparison existing 230 kV underground applications with this project is not appropriate.

FPL does not have any XLPE cable operating at 230 kV.

6. **Page 4, Construction Methods: Please define "duct bank."**

   A "duct bank" is an arrangement of conduits (also called "ducts") that are generally encased in concrete for the purposes of installing underground power and communications cables. The arrangement of conduits is installed along a route (called a "duct run" or "conduit run") between manholes or pull boxes which facilitate pulling the cables through the conduits. Manholes would be located approximately 1,400 to 1,600 feet apart, depending on final design. See figure below of a conceptual layout.

7. **Page 4, last paragraph: Please identify the depth of the "very large trenches" that would be required.**

   Each trench would likely have a bottom depth of 6.5 ft and a width of approximately 20 ft.

8. **Page 5, 1st paragraph: FPL states that "the width of the required underground rights-of-way for an underground option would be significant...". Does this mean that a 300' right of way would be sufficient or insufficient? Please explain.**

   The underground facilities addressed above (two 500 kV lines) could be accommodated within the 330 ft right-of-way, although the direct environmental impacts would be greater than an overhead line. However, as noted in the response to Question 5 above, additional land rights likely would be required for autotransformer stations at each end of the underground section.

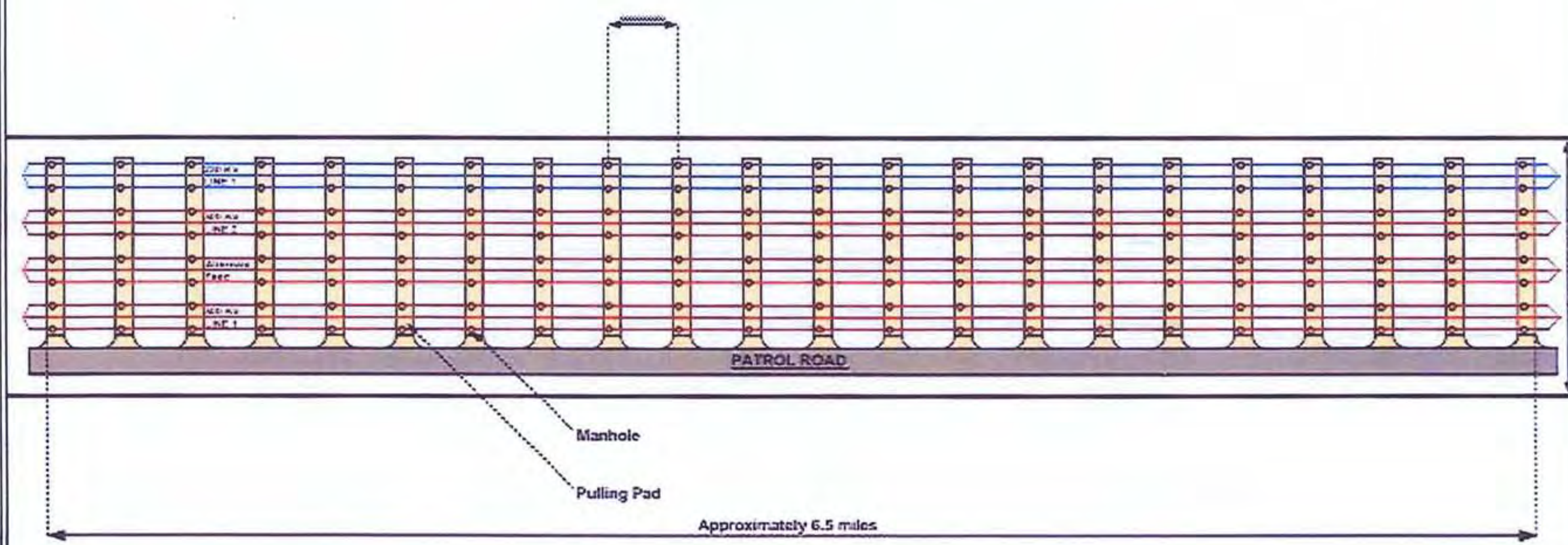
   NPS clarified that it was also their intent to place the Clear Sky-Pennsuco 230 kV line underground in this area. A specific design has not been prepared for such a 230 kV line and FPL does not have an underground 230 kV line of similar capacity. However, it is anticipated that the 330 ft right-of-way would be adequate to include this line as well.

9. **Page 5, Trench Details graphic: Please include dimensions in these cross-sections.**

   Each ductbank would have a minimum separation of 5.5 ft in a trench approximately 20 ft wide. Adjacent trenches would be separated by at least 25-30 feet to minimize mutual heating and provide some isolation from each other. A 230 kV ductbank system has not been designed but would require similar separation from adjacent circuits. A conceptual plan view of a duct bank system including two 500 kV circuits, one 500 kV alternate feed and one 230 kV circuit is provided below and illustrates the features of such a system and the location of resultant surface impacts.

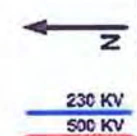
EVERGLADES NATIONAL PARK 6.5 MILE UNDERGROUND CONCEPT
CONCEPTUAL PLAN VIEW

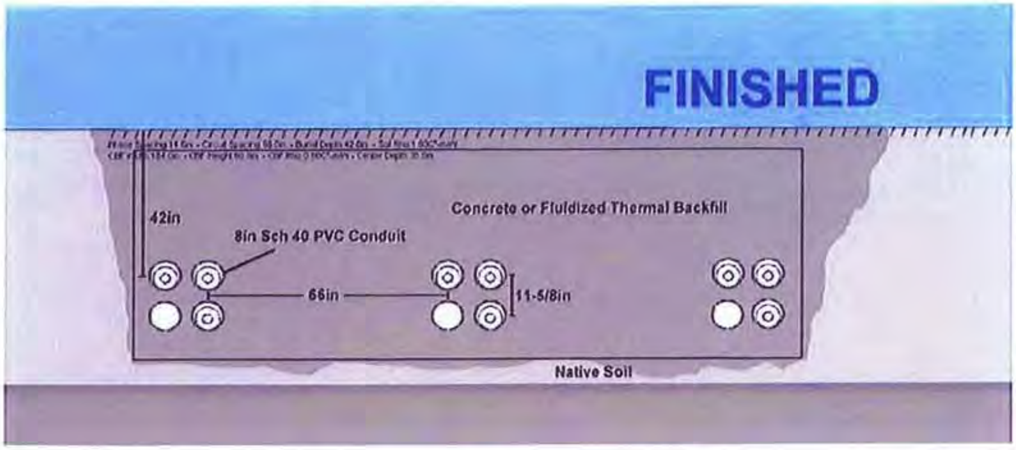
(ACTUAL DIMENSIONS MAY VARY)
NOT TO SCALE



NOTES:

1. Distance between manholes may vary from 1,400 to 1,600 ft. (1,500 ft depicted)
2. Approximately 22 pad locations between switching stations with 2-3 vaults for each circuit.
3. Height of Road/Pad varies, minimum 12" over mean or seasonal high water.
4. Typical Road is 18' top width. Top width of pulling pads will be 200-250 ft.
5. Patrol Road location is preliminary.





10. **Page 5, Environmental Impacts: Please indicate whether and how much the current canal road would have to be widened to meet the more robust road requirement described in this section?**

    The current canal road would be widened to eighteen feet. In the alternative, a new 18 ft access road may be constructed. The loading requirements for the underground option are expected to be greater than for an overhead option because of the size/weight of the underground components. Therefore, a more robust road would be required.

11. **Page 6, 2nd paragraph: Please provide a more detailed cost comparison of conventional overhead transmission lines and the three 3-phase XLPE system that would be required for the proposed exchange lands.**

    The costs for the overhead transmission facilities for the proposed project are under development. Final cost ranges will be developed incorporating a number of contributing factors including right-of-way preparation, the need for access road and pad construction, fill, mitigation, property rights acquisition, and engineering design and construction costs. The exact location of the transmission lines within a certified corridor and the number and types of structures necessary to complete those transmission lines will be determined following corridor certification and selection of the right-of-way within the corridor. The actual cost of the transmission facilities will depend on the final location of the right-of-way within the corridor, ultimate locations of structures, structure configuration, number and type of structures, mitigation costs, costs of right-of-way, other location-specific conditions, and conditions of certification.

    Since commencement of construction is 3 to 5 years from this time, the impact to final costs due to market variations in materials, equipment, and labor is difficult to predict. The costs to integrate and interconnect the new generation are the result of a series of transmission studies that will continue to be reviewed and revised closer to the time of construction. The detailed location and design of the transmission lines, including the technological option to be used in each location and the number and types of structures necessary to complete those transmission lines, will be determined following corridor certification and, where necessary, selection of the right-of-way within the corridor.

Similarly, the cost of underground facilities would be subject to detailed design and construction related variables. However, an approximate cost estimate is provided below to illustrate the order of magnitude of difference between an overhead and underground system:

Rough cost estimate for underground construction of all proposed transmission lines
(All costs in millions of dollars)

MAJOR COST COMPONENT	DUCT SYSTEM	TOTAL
Cable System and Accessories	$120 – $170	
Civil work (duct bank conduits and manholes)	$70 – $110	
Support structures, etc.	$5 – $10	
Engineering & Overhead	$30 – $40	
Stores Loading	$10 – $15	
Sub Total / Circuit	$235 – $345	
Sub Total (Two 500 kV Circuits and Alternate Feed)		**$705 – $1,035**
Two 500 kV Switching Stations		**$50 – $70**
500 kV Shunt Compensation[1]		**$25 – $40**
One 230 kV Circuit		**$90 – $120**
Total Underground Estimate		**$870 – $1,265**

MAJOR COST COMPONENT	OVERHEAD SYSTEM	TOTAL
500 kV overhead lines (Two 500 kV Circuits)	$30 – $50	
230 kV overhead lines (One 230 kV Circuit)	$10 – $15	
Total Overhead Estimate		**$40 – $65**

12. Page 6, 3rd paragraph: Please explain what is meant by "significant impacts of any failures."

Since these lines will be distributing power from the Turkey Point 6 & 7 nuclear units, long unplanned outages due to a cable failure would have a significant impact on the ability of the plants to operate at full power during the line outage, and would likely limit the plant's output, affecting the reliability of the grid as a whole.

Failure of underground cable transmission lines present significant impacts to the operation of a transmission system because of the extraordinary efforts needed to investigate suspected failures combined with the long amount of time needed to effect repairs on such lines. Typically the duration expected to identify the problem, locate the appropriate materials (or lead time to manufacture) and restore service

[1] Shunt Compensation – To properly assess if shunt compensation is required, a load flow and system stability study would be required.

would be measured in weeks or months for an underground system, whereas it would generally be hours for an overhead system.

The majority of FPL's underground transmission lines are between 69 and 138 kV and located in heavily congested area or across waterways. The 230 kV underground transmission lines were all constructed using high pressure fluid filled (HPFF) designs. FPL has no underground transmission facilities operating at 500 kV. In total, less than one hundred miles of FPL's nearly 7,000 miles of transmission lines are underground.

Questions on project not related to FPL response letter

1. **What options exist for modifying the profile/height of the proposed transmission lines adjacent to the Park?**

   The height of the proposed 500 kV transmission lines adjacent to the Park is shown in Figure W9.2.0-2 in the Site Certification Application as typically ranging from 135 to 150 feet. Structure height is directly related to the distance between poles and thus the number of poles. A lower profile (shorter poles) could be achieved through the use of additional poles (shorter spans) and the resultant additional fill pads. With a wider right-of-way (approximately 520 feet), the design of the proposed towers could be reduced even further (approximately a 30 foot reduction in height) for a similar span using a horizontal conductor configuration.

   Different design alternatives may result in slightly different pad sizes. During a recent telephone discussion, the NPS inquired about the use of lattice towers. Lattice towers would require a similar pad size and therefore similar wetland impacts. Final wetland impacts will not be known until the final design is developed. As referenced earlier, the SCA Application does contain typical pad layouts in Figures W9.4.1-5 and W9.4.1-6 and a typical 500 kV structure profile in Figure W9.2.0-2. It is anticipated that structures would be located approximately 1,000 ft apart for 500 kV and 500 ft apart for 230 kV. Final designs will be performed after the project is certified.