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PILOT TUBE MICROTUNNELING: INSTALLATION OF NEW PIPELINES IN HEAVILY DEVELOPED ENVIRONMENTS

By H. Robin Losh



For over three decades America has been facing the challenges of expanding utility infrastructure to accommodate both growing populations and demand. Much of this expansion has been in the form of placing larger transmission/collection lines in highly developed urban settings, where open trench installation was neither cost effective nor friendly to the public in their daily travels. What was needed was an installation procedure that was less damaging to existing improvements and less disruptive of the public's daily routine.

In answering this need, the engineering and contracting communities from around the world began developing trenchless installation methods for pipelines. One of the earlier installation methods was the conventional Jack and Bore Method. This method employs a tunneling technique where steel casing segments are pushed from a jacking pit at the beginning of the installation, through the earth, to a receiving pit located at the termination of the installation. A cutting head attached to augers inside the casing segments removes the soil from the leading edge of the first casing segment. The augers then transport the soil through the casing and discharge it into the jacking pit for disposal. This effectively produces a tunnel through which the casing can be pushed to its terminal point. Once the casing is in place, a carrier pipe is inserted

through the casing to convey the intended product. This process has been used extensively for installations that are under 200 feet long, and where slope or grade does not need to be maintained.

While conventional jack and bore installations can be cost effective for shorter trenchless installations, construction in an increasing number of highly developed areas signaled the need for added length and accuracy for the bores. This need was addressed by two totally different guided bore installation methods, each having a specific application and both eliminating the requirement for a casing. One of these methods is Horizontal Directional Drilling (HDD). HDD is a method that initially bores a small diameter tunnel from a launch site at the ground's surface, angling downward to a predetermined depth, then turning upward to a terminal site with the bore exiting again at the ground surface. To bore this initial tunnel, HDD utilizes a guided steering head with a drilling fluid delivery system that flushes the spoil back to the launch site for removal. Once complete, the initial tunnel is then expanded by pulling a reamer back through the tunnel with a jointless product carrier pipe attached. The HDD process has been successful in the installation of long runs; some several thousand feet in length. It also allows for an installation with accurate horizontal alignment, but does not allow for an installation with an accurate slope on grade.

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We have found that many of our government and private sector clients, alike, are facing serious financial challenges. This is making it difficult to implement critical planning, infrastructure, and economic development projects. To help our clients with these issues, Chastain-Skillman, Inc. has added a Project Funding Specialist to our staff. This individual has extensive experience identifying applicable grant funding options, preparing grant applications, and administering and documenting awarded grants to meet audit requirements. Our combined funding experience to date exceeds \$1.3 billion. In an upcoming newsletter, we'll provide more details of how we can help you identify and obtain grant funding applicable to your needs, and how to leverage available funds to expand your eligibility for additional money.

ANNOUNCEMENTS

- ◆ **Beth Blackmon** has received her Certified Industrial Hygienist (CIH) designation. This designation is the mark of true professionalism in the Industrial Hygiene industry and will allow Beth to better serve our growing list of clients.
- ◆ **CSI formalizes its "green" capabilities.** Although CSI has been incorporating green approaches into its designs for years, twenty-four CSI personnel recently completed official LEED training to prepare them to take the LEED Green Associate and/or LEED Accredited Professional exams.
- ◆ **Art Wade** has received his official Agent Authorization (AA) from the Florida Fish and Wildlife Conservation Commission to act as an Authorized Gopher Tortoise Agent. This allows him to conduct tortoise surveys and captures, and to mark, transport and release them to recipient sites.

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To address the need for accurate slope to provide for gravity flow pipeline installations, the Microtunneling Method was developed. Microtunneling combines the jacking technique used in the conventional Jack and Bore Method with the spoil removal technique of HDD. To maintain an accurate horizontal and vertical alignment, a laser and target are carefully set to line and grade at the centerline of the product pipeline being installed. The target is monitored remotely at the control center by the drill operator who makes necessary corrections at the steering head to keep the bore on alignment. The Microtunneling Method is very accurate but requires highly sophisticated equipment, a large jacking pit with stable walls and floor, and a large top-side footprint for the equipment and control center. These requirements tend to make this method very expensive, thus limiting its application to only the more difficult installations. Microtunneling also is typically limited to carrier pipes 12 inches in diameter and larger.

In 1995, the Pilot Tube Microtunneling (PTMT) Method of trenchless construction was introduced in the United States as a cost effective method of installing small diameter (4- to 12-inch) gravity sewer lines to accurate line and grade for distances up to 250 feet. Since the introduction of PTMT, this installation method has increased in popularity primarily due to reduced costs when compared to conventional microtunneling. Lower equipment costs, a smaller topside footprint and small, less complex jacking pits all contribute to the lower installation costs associated with PTMT.

The PTMT Method of installation employs trenchless boring techniques from the three methods previously discussed. Each method contributes the following concepts:

- Conventional Jack and Bore – auger-type spoil removal system
- Horizontal Directional Drill – slant-faced steering head
- Microtunneling – laser-type guidance system

The PTMT Method process, in detail, is as follows:

Preliminary Setup:

1. Excavate and prepare jacking and receiving pits. Small bore jacking pits can be as small as 8 feet in diameter.

2. Set up guided bore machine (GBM) to elevation, line and grade. Set up guidance system for monitoring bore position.

Bore Process:

1. Install small diameter pilot tubes on line and grade. Steering is accomplished with a rotating slant-faced steering head, advanced by pushing with a hydraulic jacking frame. Pilot tubes are hollow to provide an optical path for the guidance system and double walled to provide a channel for lubricating fluid transfer to the steering head. Once the pilot tubes reach the receiving pit, the guidance system is no longer required.
2. Attach reamer that matches the outside diameter of the product pipe to the last pilot tube. As the reamer advances, auger casings with internal augers are attached which transport the spoil material to the jacking pit for disposal. Once the reamer reaches the receiving pit, it is removed and spoil material is removed from the casing.
3. Once the spoil material is cleared from the casings, the product pipe is attached to the last casing with an adapter. The casings are pushed into the receiving pit by the product pipe for removal of each section. Once the product pipe reaches the receiving pit, the process is complete.

While initially PTMT was limited to 12-inch and smaller pipe installation, the demand for larger pipe diameters and longer installation lengths began to grow. Industry responded to these demands by developing better optics with digital monitors in the guidance systems, more powerful hydraulics in the jacking frame and combining PTMT guided bore machines with auger boring equipment. This combination of equipment results in increased power and productivity allowing longer installations of larger diameter pipes. Today, PTMT has the capacity to install up to 48-inch diameter pipe and drive lengths up to 400 feet. When properly employed, Pilot Tube Microtunneling is a cost effective method to meet the growing need for accurate trenchless installation of gravity flow pipelines in highly developed construction work zones.

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EOHS NEWS

OSHA Workplace Ergonomics - Proposed Recordkeeping Rule Change

- ◆ *Revise Occupational Injury and Illness Recording and Reporting (i.e. Recordkeeping) to restore a column to the OSHA 300 Log to record work-related musculoskeletal disorders (MSD)*
- ◆ *The proposed rule would require employers to record and track MSD cases that meet the Recordkeeping regulation's general recording requirements*
- ◆ http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=NEWS_RELEASES&p_id=17124

EPA – Renovation, Repair and Painting Rule (RRP)/Lead in Paint, Dust and Soil

- ◆ *After April 22, 2010, property owners and contractors who renovate, repair, or prepare surfaces for painting in pre-1978 child-occupied facilities and schools must be certified and follow the lead-safe work practices required by EPA's RRP rule*
- ◆ *These types of projects will also have to meet specific post activity lead clearance sampling requirements*
- ◆ <http://www.epa.gov/lead/> or <http://www.epa.gov/lead/pubs/renovation.htm>

Two New Construction Safety Standards from ANSI/ASSE

- ◆ *Work Zone Safety for Highway Construction (ANSI/ASSE A10.47-2009)*
→ *Establishes minimum requirements for the construction and maintenance of public and private highways and roads to prevent worker injuries/illnesses, establish safe work practices and prevent vehicular crashes in highway work zones*
- ◆ *Safety Requirements for Tunnels, Shafts and Caissons (ANSI/ASSE A10-16-2009)*
→ *Establishes safety requirements pertaining to the construction of tunnels, shafts and caissons with regard to environmental control, fire prevention, hoisting, haulage, electrical, drilling, blasting and compressed air work (not intended for mining or quarrying operations)*
- ◆ <http://www.ansi.org/> or <http://www.asse.org/> (and type code number in the search function)

BERNIE LITTLE DISTRIBUTORS OFFICE BUILDING PROVES THAT EVEN SMALL BUILDINGS CAN BE "GREEN"

By Suzanne S. Hunnicutt, AIA, LEED-AP



Many business owners are interested in "greening" the buildings that they own or are planning to build. They see "sustainability" as the socially responsible way to operate their business and they also seek the long-term benefits for their company that "green" construction can provide. However, many small to medium size businesses are finding that actually going through the process of having a small building certified by one of the green building organizations like the United States Green Building Council (USGBC) or the Florida Green Building Coalition (FGBC) can be fairly costly relative to the overall project budget. Most commercial building projects that seek LEED certification through the USGBC are over 30,000 square feet and those that have achieved certification from the FGBC have averaged over 20,000 square feet. However, owners of smaller buildings can still do the right thing and reap the benefits of having a "green" building without the official designation.

Bernie Little Distributors, Inc. (BLD) recently retained Chastain-Skillman, Inc. (CSI) to design a small office building for their Sebring, Florida location. In the design phase, they expressed a desire to incorporate "green" building principles into the project. During the process, CSI investigated the possibility of seeking certification for the project from the FGBC. However, after looking at the associated costs, BLD decided to invest in additional "green" building features rather than seek certification.

CSI used the FGBC "Green Commercial Buildings Designation Standard" as a guideline in designing the 5,500 square foot facility and the associated site work. The Standard is subdivided into several categories, including Energy, Water, Site, Health, Materials, and Disaster Mitigation. Within each category are a number of strategies for achieving energy effi-

ciency and reducing environmental impact. All of the design professionals on the project worked together to incorporate as many of these strategies as technically and economically feasible.

In the Energy category, CSI used several different strategies to increase the energy efficiency of the building beyond what is required by the Florida Building Code. The exterior walls and roof are being constructed using insulated metal panels with additional standard batt insulation, yielding a building envelope that has twice the required "R-value." The windows have insulated, Low-E type glazing with a Solar Heat Gain Coefficient 30% lower than



BLD Sebring Office under construction

required. The general interior lighting fixtures utilize high-efficiency T5 fluorescent lamps, and the exterior building lighting is provided by compact fluorescent lamps that provide the same lighting level as standard fluorescent or incandescent lamps, but at a much lower level of energy consumption. Interior lighting is controlled by occupancy sensors in each room. The air conditioning system is also designed to reduce energy consumption with equipment that has an energy efficiency rating almost 40% higher than is required.

The Water category of the Standard focuses on reducing water consumption both inside and outside of buildings. On the BLD Office site, over 75% of the landscaping plants and trees will be drought-tolerant species, requiring significantly less irrigation than other types.

Inside the building, low-flow plumbing fixtures will use from 30% to 50% less water than required by code.

Several different strategies are addressed in the Site category of the Standard. One of those is to reduce what is called the "heat island effect," which is a microclimate temperature increase caused by the use of dark colored roof and pavement materials. For the BLD Office, CSI has specified white roof panels with a Solar Reflectance Index of 85. This will not only reduce the heat island effect, but will also decrease the cooling load, and therefore the energy consumption. Another site related strategy is the reduction of "light pollution," which CSI has addressed through the use of full cut-off type site lighting fixtures. Stormwater management is also a site related strategy that CSI incorporated into the BLD project design, controlling erosion and sedimentation during construction and providing on-site treatment in excess of the requirements of the FGBC Standard.

The Health category focuses on measures to enhance the well-being of building occupants, such as the use of low-emitting materials and the provision of day-lighting and views for regularly occupied spaces. To accomplish this, CSI specified low-emitting sealers and paints, carpet having the Carpet and Rug Institute (CRI) Green Label Plus rating, and composite wood products with 50% lower emissions than industry standards. The floor plan has been laid out such that over 80% of the regularly occupied spaces have windows providing day-lighting and views to the exterior.

Materials with a significant recycled content, that are able to be recycled at the end of their useful life, or that are locally produced, and durable, low maintenance finishes are all addressed in the Materials category of the FGBC Standard. CSI has incorporated these principles in the BLD Office by specifying carpet, floor tile, and ceiling tile with significant recycled content. The specified carpet and ceiling tile are also products with a documented recy-

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(Green—Continued from page 3)

cling program provided by the manufacturer, assuring they can be reclaimed and recycled at the end of their useful life. The exterior metal wall panels discussed earlier provide the added benefit of being locally produced (in Deland, Florida) and provide a durable, low maintenance finish.

In the Disaster Mitigation category, the Standard addresses such issues as hurricanes, flooding, and wildfires. CSI has incorporated hurricane protection into the BLD Office design through the use of impact-resistant doors and windows. Flood hazards have been mitigated by designing the floor slab elevation to be a minimum of two feet above the existing grade, and wildfire protection has been achieved by using non-combustible exterior finish materials, exclusively.

By using the FGBC “Green Commercial Buildings Designation Standard” as a checklist, CSI has designed the BLD Sebring Office with recognized strategies for construction of a “green” building project. Although the project will not be officially certified as such, BLD will reap the benefits of having a “green” building for years to come.

Suzanne Hunnicutt is Vice-President of Architecture, and works out of Chastain-Skillman's Sebring office. Her work focuses on the design of office, institutional and industrial buildings for both public and private clients. Suzanne received a Bachelor of Design degree in 1975 and a Master of Architecture degree in 1980 from the University of Florida. She can be reached at (863) 382-4160 or shunnicutt@chastainkillman.com.



Insulated wall panels with tongue & groove joints

RECENT PROJECTS AND CONTRACTS OF INTEREST

- City of Tarpon Springs** - CSI will provide project management, surveying, design, bid phase, and construction phase services for a vacuum sewer system to serve existing neighborhoods along Lake Tarpon. Over two phases, the project will add a total 9,500 linear feet of vacuum sewer, a vacuum pump station, and 250 linear feet of force main, providing sewer service to 150 additional homes and the City-owned Highland Nature Park. This project will be managed by CSI's Tampa Environmental Department.
- City of Frostproof/Phase 3 Sewer System** - This contract consists of providing construction phase services and limited Resident Project Representative (RPR) services for Phase 3 of the City's sewer system expansion. This includes approximately 18,700 linear feet of gravity sewer, three lift stations, and associated force mains and appurtenances. The work will be managed by CSI's Lakeland Environmental Department.
- Fields Motorcars/Lakeland Expansion** - CSI has completed the initial due diligence study for Fields Motorcars, and is now beginning the second phase of the project, which involves preliminary engineering and permitting services for the expansion of Fields' Lakeland facility. This will include topographic surveying services and a flood study, with additional tasks to follow. This work will be managed and supported by CSI's Lakeland Civil and Survey Departments, respectively.
- Watkins Retail Group/Phase II - Highland City Town Center** - This project consists of permitting services for Phase II of a shopping center development, and will be managed by CSI's Lakeland Civil Department.
- Highlands County Board of County Commissioners/Sheriff's Office** - This project involves conducting an Indoor Environmental Quality evaluation of the building's HVAC system, and providing electrical engineering, architectural services, and bidding and construction phase services for proposed improvements to the building. This project will be managed by CSI's Sebring Architectural Department with support from CSI's Tampa Environmental and Occupational Health Department.
- City of Auburndale/Utilities Relocation - SR559/Main Street Extension** - This contract consists of engineering design, permitting, bidding and construction phase services for the relocation of existing utilities under the proposed extension of Main Street/State Road 559 from Derby Avenue south across the CSX Railroad to Recker Highway. This project will be managed by CSI's Lakeland Environmental Department.
- Telogia Power/Industrial WWTP** - This contract consists of design, permitting, bidding and limited construction phase services for a constructed wetland treatment system and other wastewater treatment system modifications to treat cooling and blowdown waters from a power generation facility. This project will be managed by CSI's Lakeland Environmental Department with support from CSI's Tallahassee Environmental Department.
- Telogia Power/2010 Semi-Annual Groundwater Sampling and Reporting Activities** - CSI will perform semi-annual groundwater sampling and analysis, and prepare semi-annual groundwater monitoring reports summarizing and interpreting water quality and water level data for Telogia's biomass facility. In addition, CSI will prepare a 2-year Technical Report summarizing the results of the semi-annual events for submittal to the Florida Department of Environmental Protection. This project will be managed by CSI's Tallahassee Environmental Risk Department with support from CSI's Lakeland Environmental Risk Department.

BROWNFIELDS REDEVELOPMENT: A WIN-WIN SITUATION

By James D. "Duff" Stump, PG



Brownfield sites have been traditionally defined as abandoned, idled, or underused industrial or commercial properties where expansion, reuse, or redevelopment may be complicated by real or perceived environmental contamination. However, to encourage the cleanup and redevelopment of Brownfield sites, the definition has been broadened. Currently, the Florida Department of Environmental Protection's (FDEP) definition of a Brownfield Area is a contiguous area of one or more Brownfield sites, some of which may not be contaminated, that has been designated as such by a local government through resolution. The key aspect of this designation is that, in this context, Brownfields do not necessarily need to be contaminated to be designated as such.

Oftentimes there is a stigma attached to industrial or commercial properties due to perceived environmental problems or because of environmental concerns stemming from historical or current land usage. Such real or perceived problems can result in reluctance by local governments and developers to become involved in these properties in favor of more pristine and less environmentally impacted sites. The Brownfield designation can be used in these cases to level the playing field for redevelopment activities. Benefits to redevelopment of Brownfield properties include facilitation of job growth, increase in local tax bases, removal of development pressures on undeveloped open land, and improvement and protection of the environment.

The Brownfields program was initiated by the United States Environmental Protection Agency (EPA) on an experimental basis in 1995. The purpose of this program was to restore real or perceived environmentally challenged sites without the threat of legal and financial repercussions that are commonly associated with the ownership of contaminated properties. This experimental program was so successful that the "Small Business Liability Relief and Brownfields Revitalization Act" was signed into law in 2002. This Act provided communities with a tool to access federal funds which have been set aside for redevelopment purposes. The ultimate goal of the Brownfield activities is the redevelopment of abandoned, idled, or underused properties. Redevelopment and revitalization of these formerly used properties helps to conserve

undeveloped land and can have significant economic benefits to an area. In 1997, the State of Florida established its own Brownfield Redevelopment Act. It followed the same format as the 1995 federal Act, but added some additional language, including statutes that allowed the FDEP to oversee the State Brownfields program, while continuing to enforce environmental laws that the State had in place.

Prior to initiation of any Brownfield activities in an area, designation of a Brownfield site or Brownfield Area must be done by resolution through the local government. As of February 2010, a total of 238 sites had been designated as Brownfield sites or Brownfield Areas in the State of Florida. There are significant financial incentives involved in Brownfield redevelopment activities. Brownfield sites and Areas that enter into a Brownfield Site Rehabilitation Agreement (BSRA) with the State may be eligible for:

- A \$2,500 Job Bonus Refund for each new job created in a designated Brownfield Area by an eligible business (10 job minimum). These benefits may be greater if the Brownfield Area has other designations (e.g., an Enterprise Zone).
- A Sales Tax Credit on building materials purchased for the construction of an affordable housing project or mixed-use affordable housing project in a designated Brownfield Area.
- State Loan Guarantees for primary lenders of up to 50% on all Brownfield sites and up to 75% if the property is redeveloped as affordable housing, a health care facility, or health care provider.
- A 50% Voluntary Cleanup Tax Credit (applicable to Florida's corporate income tax or intangible personal taxes) annually on all eligible cleanup costs.
- A 25% Additional Voluntary Cleanup Tax Credit on all eligible costs when the cleanup is complete.
- A 25% Additional Voluntary Cleanup Tax Credit if the property is redeveloped with affordable housing, a health care facility, or health care provider.
- 50% One Time Voluntary Cleanup Tax Credit on eligible solid waste removal costs.

Additional federal financial benefits that may be available include:

- Site-specific activities grants to FDEP to conduct Phase I or Phase II Environmental Site Assessments and/or limited source removals for eligible recipients using federal grant funds.

- National Brownfields Assessment, Revolving Loan Fund and Cleanup Grants.
- A Brownfields Federal Tax Incentive that allows environmental cleanup costs to be fully deducted in the same year that they occur.

Additionally, there are significant regulatory benefits involved in Brownfield redevelopment activities. These regulatory benefits include:

- The use of Risk-Based Corrective Actions (RBCA) following FAC Chapters 62-785 and 62-777, which allow for expedient and cost-effective cleanup activities utilizing default cleanup target levels; risk assessment tools to drive alternative cleanup target levels; risk management options; institutional and engineering controls; and special relief for sites with groundwater target levels based on nuisance, organoleptic, or aesthetic considerations.
- Cleanup liability protection provided upon execution of a Brownfields Site Rehabilitation Agreement.
- Dedicated Brownfields staff in each FDEP district office whose primary responsibility is facilitating implementation of Brownfield Site Rehabilitation Agreements.
- Expedited review of all technical documents associated with Brownfield sites or Areas.
- EPA Comfort letters issued for Comprehensive Environmental Response, Compensation, and Liability Act sites.
- Lender liability protection.

In summary, the designation and redevelopment of Brownfield Areas is a valuable tool in rejuvenation of abandoned, vacant, or underused properties. Significant financial and regulatory benefits have been included in legislation designed to encourage redevelopment of these properties. A Brownfield designation opens the door to federal, state, and local incentives that otherwise may not be available to these potential at-risk properties. Assistance is available from firms such as Chastain-Skillman, Inc. to help stakeholders navigate the Brownfield designation process and obtain access to funding mechanisms.

James D. (Duff) Stump is a Senior Project Manager in Chastain-Skillman's Lakeland Office. He has over twenty-two years of experience in the environmental consulting business. Duff received a Bachelor of Science Degree in Geology from Eastern Illinois University in 1981 and a Master of Science Degree from the University of South Florida in 1984. Duff's work currently focuses on environmental site assessments. He can be reached at (863) 646-1402 or at jstump@chastainskillman.com.

PROPOSED WATER QUALITY STANDARDS: JUST ANOTHER REGULATORY CHANGE?

By James R. Chastain, Jr., PhD, PE, MPH



On January 26, 2010, the EPA published their proposed water quality criteria for Florida lakes and streams. In 52-pages of the Federal Register, the EPA states that excess loading of nitrogen and phosphorous are significant factors of water quality impairment for surface waters of the United States. Over-enrichment of the country's surface water significantly impacts aquatic life and the long-term ecosystem health, diversity and balance. This manifests itself through Harmful Algae Blooms (HAB), reduced spawning grounds, fish kills, and hypoxic (dead) zones; HABs can also diminish the aesthetic and recreational utilization of surface waters. In addition, potential public health concerns are raised for some situations.

Florida water quality standards were selected for EPA review following establishment of a consent decree with five environmental organizations. This consent decree was related to the development of numeric nutrient criteria as a means of compliance with Section 303(c)(4)(B) of the Clean Water Act (CWA). The EPA noted that the State has documented approximately 1,000 miles of river/streams, 350,000 acres of lakes, and 900 square miles of estuaries that are known to have nutrient contamination and they note that many other water bodies are currently listed as "unassessed." The two key objectives of the proposed standards are to: (1) develop criteria to protect the immediate water body to which they apply; and (2) ensure the criteria also provide adequate protection for downstream water bodies.

As a "tip of the hat" to the Florida Department of Environmental Protection (FDEP), the EPA acknowledges that Florida is a leader among other states in addressing nutrient reductions to its surface waters. The EPA praises the FDEP array of data collection programs, technology-based standards, and point and non-point source control authority. However, the EPA also believes that the complexity, time and cost of setting water quality standards on a case-by-case basis are an inefficient and insufficient system to protect the State's waters per their interpretation of the CWA. Consequently, the EPA is proposing numeric nutrient criteria for different water body categories. The proposed rule classifies Florida waters as *lakes*, *rivers and streams*, *springs and clear streams*, and *ca-*

nals. It should be noted that this rulemaking activity does not apply to wetlands.

Some Definitions

In order to understand the rule, it is necessary to grasp the distinction between the different water categories. The Federal Register proposes the following definitions. **Surface water** means water upon the surface of the earth whether contained in bounds created naturally, artificially, or diffused. **Lakes and flowing waters** are inland surface waters that have been classified as Class I or Class III water bodies pursuant to Rule 62-302.400 F.A.C. A **stream** is a free-flowing, predominantly fresh surface water in a defined channel. **Predominantly fresh water** is defined to be surface waters in which the chloride concentration at the surface is less than 1500 mg/L. A **clear stream** is a free-flowing water whose color is less than 40 platinum cobalt units (PCU). A **lake** is a freshwater body that is not a stream or other watercourse and has some open contiguous water free from emergent vegetation. A **spring** means the point where underground water emerges onto the earth's surface.

Criteria Categories

As might be expected, the theoretical approach and analysis of data to arrive at reasonable numeric criteria to cover all the different waters in the State is somewhat involved. The challenge is to strike a balance between protecting the State's surface waters per the CWA and yet not be overly stringent, which would result in misallocation of economic and technical resources. Whether the proposed rule strikes the appropriate balance will be vigorously debated.

To begin with, the EPA proposed rule applies only to Class I and Class III waters as defined in 62-302 F.A.C. Those classifications, however, cover the vast majority of Florida's surface waters. As mentioned above, the surface waters are broken into four categories: *lakes*, *rivers and streams*, *springs and clear streams*, and *canals in south Florida*. Estuaries are a separate category scheduled for review next year.

Because there is variability in *lakes* throughout the State, the EPA further divided *lakes* into three groups: Colored Lakes, Clear Alkaline Lakes and Clear Acidic Lakes. Clear Lakes are defined as *lakes* having a color level of 40 PCU or less while Colored Lakes have color levels greater than 40 PCU. Clear Alkaline Lakes have an alkalinity greater

than 50 mg/L as CaCO₃ while the alkalinity of Clear Acidic Lakes is less than or equal to 50 mg/L as CaCO₃. The two classification criteria (40 PCU for color and 50 mg/L as CaCO₃ for alkalinity) were the result of separate scientific and statistical studies and somewhat follow those proposed by the FDEP. At the time of this writing, these criteria are available for public comment through the published comment period ending April 28, 2010.

In the same way, *rivers and streams* that exist in Florida have fundamental variances in their characteristics. The EPA has elected to stratify the water bodies by geographical location in the State. This reflects their belief that the *rivers and streams* are most efficiently distinguished by the watersheds that feed them. The watershed classification system is also deemed useful when evaluating the effects of Total Nitrogen (TN) and Total Phosphorous (TP) from streams to downstream lakes and estuaries in the same watershed region. The four nutrient regions used for classifying the State's *rivers and streams* are: Panhandle, Bone Valley, Peninsula and North Central. It should be noted that the south Florida region is omitted from this category because it is included in Section III.E ("South Florida Canals").

The *springs and clear streams* category is handled in a little different fashion. It is estimated that Florida has over 700 *springs* and associated spring runs. The EPA notes that scientists over the past 20 years have identified two significant factors affecting spring water quality. As might be expected, these are groundwater pollution, principally in the form of nitrite/nitrate from land use changes, and increased population density. Somewhat related to that is the reduction in groundwater levels from human withdrawals, which exacerbates the increased nitrite/nitrate load. Consequently, the criteria for *springs* will be based on a primary indicator of human activity and impact on groundwater, which is the Nitrite (NO₂) and Nitrate (NO₃) level. *Clear streams* will have the same criterion, but also carry the TN and TP limits of colored streams in the watershed in which they are located.

Water Quality Criteria

For the purposes of this brief article, the proposed rule is far too involved to delineate the various strategies and analyses that were

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used to develop the proposed numeric criteria. However, it might be helpful to present the most generally applicable criteria and discuss a few points of interest on each. The first table presents the proposed numeric criteria for the lake category. The basic TN and TP for lakes are presented in columns C and D. If the *Chlorophyll a* in a particular lake is below the level in column B, the FDEP may adjust the TN/TP levels upward to within the limits listed in columns E and F, if certain conditions are met.

Long-term average lake color and alkalinity	Chlorophyll a (µg/L)	Baseline criteria		Modified criteria (within these bounds)	
		TP (mg/L)	TN (mg/L)	TP (mg/L)	TN (mg/L)
A	B	C	D	E	F
Colored Lakes > 40 PCU	20	0.050	1.23	0.050-0.157	1.23-2.25
Clear Lakes, Alkaline ≤ 40 PCU and > 50 mg/L CaCO ₃	20	0.030	1.00	0.030-0.087	1.00-1.81
Clear Lakes, Acidic ≤ 40 PCU and ≤ 50 mg/L CaCO ₃	6	0.010	0.500	0.010-0.030	0.500-0.900

The baseline criteria are developed from a scientific and statistical analysis of the FDEP database of Florida lake water quality. Because eutrophication of lake systems results from excessive algae growth following nutrient enrichment, a correlation between TN/TP and algae was sought. *Chlorophyll a* levels in the water column have been used in many scientific studies as an indication of algae growth, and the EPA has chosen to adopt it as a surrogate for algae growth. Using the State's water quality database and correlating *chlorophyll a* to various Trophic State Index (TSI) levels, the EPA concluded that a TSI value of 60 and the associated 20 µg/L *Chlorophyll a* represent the boundary between mesotrophy and eutrophy in colored and clear/alkaline lakes. In a related analysis, they assert that the division between mesotrophy and eutrophy in clear/acidic lakes occurred at a *Chlorophyll a* of 6 µg/L and stipulate that mesotrophic lake characteristics constitute an appropriate target level.

Chlorophyll a was then correlated to TN and TP levels using a multi-regression analysis. Using a 50% prediction interval (log scale), the acceptable levels of TN and TP were estimated. Using the prediction interval (as opposed to confidence interval), this procedure categorizes lake data into three categories or zones. The EPA asserts that the lakes above the 50% prediction interval for TN and TP levels generally exhibit *Chlorophyll a* levels into the eutrophic range, while lakes less than the lower limit of the 50% prediction interval generally exhibit *Chlorophyll a* levels associated with high-quality oligotrophic lakes. Lakes between the 50% prediction limits, tend toward the mesotrophic states. To establish these levels for a particular lake, at least three years of data must be

collected with a frequency that characterizes seasonal variation (generally quarterly).

Recognizing that the data don't always fit this computational model, the EPA proposes that the TN/TP concentrations can be modified by lake-specific levels if protective *Chlorophyll a* levels exist with slightly higher TN/TP values. The scientific premise for the lake-specific modified values is that if ambient lake data show that a lake's *Chlorophyll a* levels are below the established criteria and its TN and/or TP are between the upper and lower prediction limits, then the

ambient TN and TP levels represent protective conditions. The modified values in columns E and F represent the flexibility allowed under these conditions.

The proposed numeric limits for rivers and streams were developed using a different analytical strategy than that used for lakes due to the increased variability in structure and function of streams. The EPA chose a 3-step analysis of available stream data within the four watershed regions. Using the Stream Condition Index (SCI) scores as a basis for evaluation, stream TN and TP were categorized into statistical distributions. The 75% percentile of the log normal distribution of nutrients was deemed to provide reasonable protection for state rivers and streams. The following table presents the proposed values segregated into the four regional watersheds (excluding south Florida).

Nutrient watershed region	Instream protection value criteria	
	TP (mg/L)	TN (mg/L)
Panhandle	0.043	0.824
Bone Valley	0.739	1.798
Peninsula	0.107	1.205
North Central	0.359	1.479

Responding to the indications that the degradation of springs and clear streams results to a great extent from groundwater contamination, the EPA is establishing a Nitrite/Nitrate maximum level at 0.35 mg/L (annual geometric mean not surpassing long term average of geometric means). In addition, clear streams will meet this criterion, plus they must meet TN and TP criteria for streams within the watershed that the clear stream is located.

The canals of south Florida have a target *Chlorophyll a* concentration of 4.0 µg/L, with associated nutrient limitations of TP = 0.042 mg/L and TN = 1.6 mg/L.

Downstream Protective Values

In addition to these "instream" protective values, the EPA is proposing an additional class of regulations that considers the downstream cumulative effect of state waters. While it is beyond the scope of this brief article to outline this process, suffice it to say in many state waters the values listed above could provide only the starting point for the applicable criteria. The analytic and numeric modeling techniques used to develop the values is sure to generate vigorous discussions as to its accuracy, applicability and economic viability.

Just Another Regulatory Change?

Environmental regulations, when developed responsibly, have clearly been shown to be in the public interest in industrialized economies. Also, it can be demonstrated that nutrient enrichment of many lakes and waters of the State should be addressed to allow them to recover. That being said, the impact of these proposed criteria, if enacted and enforced, have the potential to so thoroughly dominate compliance efforts as to distort and disrupt public and private expenditures on other needed environmental projects. The ability to consistently meet these criteria in many urbanized and agricultural areas is doubtful due to technological or space limitations. In addition, passive systems will begin to yield to active treatment which will exacerbate energy and residual disposal difficulties. Thus the compliance implications of these proposed criteria are staggering in terms of cost, land use, and impact on the financial viability of other needed environmental and infrastructure improvements. Clearly this is not just another incremental regulatory adjustment...it is a tectonic shift that will have implications far beyond its stated goal and should be monitored as such. Again, public comment will be received by the EPA until April 28, 2010 if anyone wants to weigh in on the debate...pro or con.

References: <http://www.epa.gov/waterscience/standards/rules/florida/>

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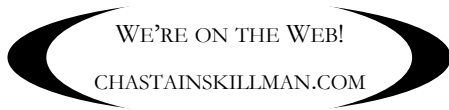
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