There are two huge contaminated sediment dredging and dewatering projects under way in the US, on the Fox and Hudson rivers - and America's Editor Greg Miller will cover both, starting with Wisconsin's Fox River, where teamwork and technology take centre stage.

The Fox River PCB clean-up is one of the largest in the world, with more than 3.5M cubic yards (2.7M m³) to be dredged along 21.5km over the next eight years. But it's not just a story about quantity; it's ever more about quality through an integrated project approach, innovative hydraulic pipeline networks, high-tech management systems and a huge purpose-built dewatering plant. The $630M project was launched on 28 April after decades of planning, and the team is now solidly ahead of schedule and on track to remove 410,000m³ by the first quarter of 2010.

Tetra Tech is lead contractor and handles water treatment, dredging and capping is being done by Wisconsin's JF Brennan Co and Boskalis Dolman designed the dewatering system, while its sister company Stuyvesant Dredging oversees the processing facility.

The modified hull configuration of the Sin dredgers allows operation in water as shallow as 60cm, while their extended ladders provide for operation in up to 8.5m depth. Swing ladders are articulated allowing more accurate cuts. "The two Sin dredges do the precision work, removing very thin faces of material very accurately. They also do the final pass work behind the Mark Anthony," Smith added.

Several factors dictated the choice of dredging equipment, including:
- Heavy recreational use of the Fox, versus the conventional use of anchored wire: "You can imagine what that would be like, dealing with those cables out there with boats going by," noted Smith.
- The hydraulic dredges are connected to the dewatering plant by up to 10km of submerged pipeline that traverses two locks. Those locks posed a persuasive argument for hydraulic versus mechanical dredging.

The pipeline system - another innovative feature of JF Brennan's Fox River operation - is a 4.209km (13,830m) individual pipe system leading to the first booster, where it comes together at a Y connection and converges into a single 9km pipeline.

"That's unique. The reason we chose a pipeline is so we could avoid the locks and get the job done faster," Smith explained.
designed it that way is because if you'd used a larger line [after the two 8in pipes converged], you wouldn't be able to maintain your critical velocity if one dredge had a mechanical problem and shut down: all the material would settle in the pipe. This way, when we have two dredges running, the velocity doubles when the material hits the first booster — and we can continue to operate even if one dredge goes down," said Smith.

The trick to making the configuration work is to keep both dredgers the same distance from the 'Y' — "That's why each dredge is 4,500ft from the booster, not one 2,000ft and the other 5,000ft," he explained.

EXPERIENCE TELLS
JF Brennan has used a pair of 8in dredgers with a common line on past projects, but never at this distance. On the Fox River, the one-line-for-two-dredgers system has been used over 14.5km of pipeline with eight booster stations (the pipeline has operated at 16km with nine boosters with a single dredger operating).

"As a dredging contractor, you always pride yourself on the distance you can pump and 10 miles [16km] is a long way," said Smith.

The company is also handling the capping operations, which were originally to have begun in 2010 but have started a full year ahead of schedule. JF Brennan has designed its own capping spreader system that's both precise and efficient. Sand and gravel's placed in a slurry tank with river water, then pumped by pipeline to a barge, where it's watered. It then goes into a hopper and the volume is metered as it passes to a broadcast spreader. Custom software is used to gauge the volume, thickness and density of the material being spread for the cap, while automatic alarms alert the operator when the cap has been properly laid.

"It provides us a hydraulic transport and distribution method into very shallow areas and allows us to spread sand very accurately and at a high production rate," Smith said. "With our system, we're broadcasting sand or gravel into the river and each individual article is falling slowly to the bottom, building a cap on top of very soft sediment. If you were to do this with a conventional method, placing a bucket of sand in very shallow water, the soft sediment would just bellow out round it and settle on top — which is not the purpose of what you're trying to do."

ADVANCED TECHNOLOGY
Whether it's the capping operation or any other aspect of the Fox River work, technology and software are in heavy use — "We've always tried to be in the forefront when it comes to technology," said Smith.

The three dredgers, as well as the company's survey vessels (mounting two single-beam echo sounders and one multibeam), use RTK GPS systems and run HYPACK and DREDGEPACK software. And the entire JF Brennan operation on the Fox River is connected through a custom network system by Wisconsin-based 3RT.

"Each booster's connected through the internet to our office and to the dredges. We can monitor all the dredges' intake pressures, discharge pressures and engine rpms. We can remotely control the pumps at each booster. Data from the survey boats can be transferred to the office for processing and we can take that data, edit it in the office and shoot it out to the dredge with quick turnaround. That's important, because if we're not dredging deep enough, or we're dredging too deep, we've got to get that information to the foreman so we can dredge as accurately as possible," Smith explained.

The wireless links connecting the booster stations are crucial, given the scope of JF Brennan's pipeline operations. In late August, for example, the company was pumping sediment slurry from the Palm Beach and Ashtabula over 15km of pipeline to the treatment plant, pumping slurry from the Mark Anthony more than 3km, while simultaneously pumping capping materials through 6.5km of pipelines.

As Smith expressed it: "We have a lot of pumps on site!"
Meanwhile, Fox River project innovations are just as apparent on the dewatering front. The 200m³/hour Green Bay Processing Facility was designed by Boskalis Dolman and built in under nine months. "It’s one of the largest processing facilities of its kind in the world," noted Bastiaan Lammers, project development manager at Boskalis Dolman/Stuyvesant Dredging. It was necessary to construct the 2.6ha facility specially (rather than using mobile plant) because of the duration of the project and the sheer volume of the flow. The Boskalis design offered the client efficiency and cost-savings, said Lammers. "Our technique is based on volume reduction to save on disposal costs," he explained.

First, the slurry is passed over a single-deck vibrating screen, then through a 150μm coarse sand separation unit, and ultimately the thickened material goes through final dewatering via eight membrane plate and frame presses. Lammers said that the use of these presses is "likely unique" and was chosen because it delivers a very high dry solids content. The water treatment system, handled by Tetra Tech, is also housed in the Green Bay facility. Each part of the chain works hand-in-hand: dredging, dewatering and water treatment. "Our dewatering system is capable of dealing with fluctuations in flow as well as sediment composition," explained Lammers. When the dredged flow enters, it goes directly to the shaker screen, without a buffer (with the exception of a velocity reduction box). Rather, the buffer’s located after the flow passes through the screen, comprised of four 950,000-litre slurry holding tanks. "This means that if all the dredges stop, we still have six hours of redundancy," said Stuyvesant Dredging project manager Martijn Luth; similar redundancy’s built into Tetra Tech’s water processing.

"You can imagine that if the dredges run at 80% efficiency and we run at 80% and the water treatment is at 80%, then the whole system ends up at 50% efficiency, so it’s important that if one has idle time, the others can continue," said Luth. The co-dependency of the various players in the Fox River clean-up underscores why a co-operative design was essential. Lammers noted that Tetra Tech, Boskalis and JF Brennan worked on the plan as a team since the project was at the 30% design phase, up to the 100% stage. "The key to this project’s success is its integrated approach. We looked at it as one project and designed the whole project together."

The integrated approach proved particularly advantageous for the processing facility. Boskalis companies have designed, contracted and are now operating the plant. "Because we were going to be operating the plant for seven years, we wanted to make sure everything was perfect," said Luth, adding: "We weren’t building the plant to give it to somebody else and just make a few quick bucks."

FINALLY...
The co-operative approach is just as vital going forward. "When you’ve this many systems tied together, communication is the key, because we depend on one another," said Smith at JF Brennan, adding: "We’re all paid the same way, by cubic yards removed from the river, which gives us a common goal. If the dredges shut down, then the dewatering and water treatment plants can’t operate. Likewise, if either of those plants have issues, we can’t dredge," Smith added. "In a typical dredging operation, you would have a placement area you’d pump the material to and other than moving the pump around – unless you’re building a beach or an island – there’s not a lot of maintenance to do on the other end," he continued. "In this case, the project’s success takes continuous co-ordination and a huge team effort to marry these systems together," he continued.

"On some environmental jobs that require dewatering, you might have a dredge that never breaks down, but it can’t operate because of the dewatering side," he concluded. "On this job, luckily, we have a great team."