

# Beijing Shougang International Engineering Technology Delivers Wanhua Chemical Seawater Desalination Project

Leveraging Bentley's Open Applications Shortened Design by 50% While Supporting Intelligent Plant Operations

## DESALINATION SUPPORTS WATER SUSTAINABILITY

Wanhua Chemical is a global chemical company with a production site in the city of Yantai, within the Penglai Industrial Park. Like many cities in China, Yantai is facing a serious shortage of water, possessing a per capita water resource of just 415 cubic meters, only 20% of the country's average level. However, with 12 districts and towns by the sea along a 1,071-kilometer coastline, Yantai boasts rich seawater resources, providing a unique opportunity for the development of seawater desalination. To alleviate the freshwater constraints in the Penglai district, support an environmentally friendly, low-carbon chemical park, and promote sustainable operations, water supply, and community development, Wanhua signed a contract for the seawater desalination project and retained Beijing Shougang International Engineering Technology (BSIET) as the engineering design firm.

The 300,000 tons-per-day desalination project supports the Chinese government's desalination initiatives and policies, as well as Wanhua's commitment to an eco-friendly chemical production model. "The project is a green and low-carbon smart seawater desalination plant," said Huali Liu, project manager and general manager of the water business department at BSIET. Upon completion, it will provide Penglai with 90 million tons of freshwater resources annually, effectively resolving water production issues for Wanhua and the whole Penglai Industrial Park.

## POOR GEOLOGY AND COMPLEX PROCESSES

Located on the seashore, the project presented poor geological conditions with many buried and overhead pipelines and complicated bridge cables,

making the pipeline works and overall design difficult. Compounding the site challenges were the complex desalination processes and equipment that required multiple engineering disciplines to design and coordinate. "The seawater desalination process, as a new process, involved complex process flows and up to 35 process systems, as well as complex supporting process equipment, mostly non-standard equipment, which made design collaboration highly difficult," explained Liu. To address these issues BSIET wanted to digitalize design and explore BIM as a potential solution.

With a total of 10 disciplines using different software, BSIET faced data integration and collaboration challenges piloting BIM workflows. "For the first time, BIM collaborative design was adopted for the whole plant, which involved a total of 10 disciplines, complicated interface and interaction process, and many kinds of professional BIM software, so there were challenges in the project's data integration and exchange," emphasized Liu. Confronted with data compatibility and conversion issues along with no prior BIM experience to rely on, BSIET realized that they needed user-friendly, integrated BIM applications to establish a connected digital design environment and successfully deliver the smart seawater desalination plant.

## ESTABLISHING A COLLABORATIVE BIM ENVIRONMENT

"Based on Bentley's platform, [we have] systematically researched the BIM design implementation system of the seawater desalination plant and solved the issues of BIM implementation, such as modeling, drawing, quantities calculation, analysis and calculation, design, collaboration, and digital delivery of design," explained Liu. Leveraging OpenFlows, AutoPIPE, and OpenPlant, BSIET modeled the plant and equipment, as well

## PROJECT SUMMARY

### ORGANIZATION

Beijing Shougang International Engineering Technology Co., Ltd.,  
Wanhua Chemical (Penglai) Co., Ltd.

### SOLUTION

Water and Wastewater

### LOCATION

Yantai, Shandong, China

### PROJECT OBJECTIVES

- ◆ To alleviate freshwater resource constraints in China's Penglai District.
- ◆ To introduce collaborative BIM workflows to deliver the Wanhua Seawater Desalination Plant.

### PROJECT PLAYBOOK

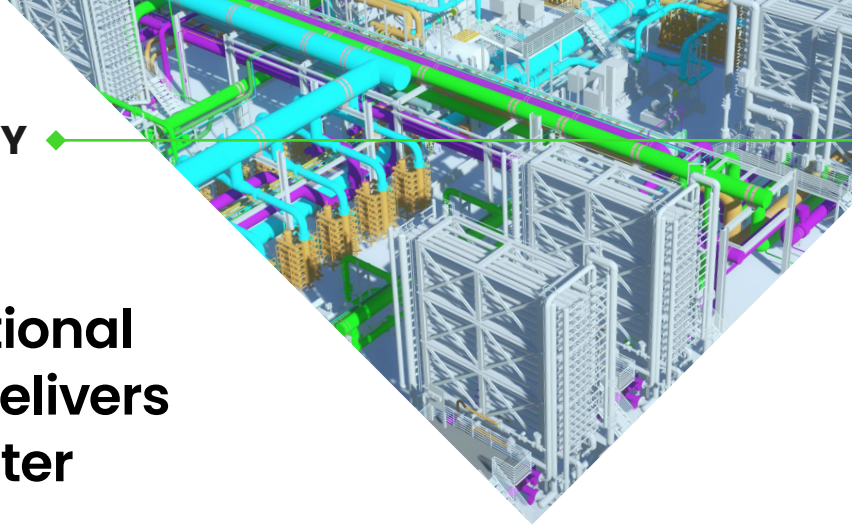
AutoPIPE<sup>®</sup>, Bentley LumenRT<sup>™</sup>, Bentley Raceway and Cable Management<sup>™</sup>, MicroStation<sup>®</sup>, OpenFlows<sup>™</sup>, OpenPlant<sup>®</sup>, OpenRoads<sup>™</sup>, ProjectWise<sup>®</sup>, SYNCHRO<sup>™</sup>

### FAST FACTS

- ◆ The seawater desalination project of Wanhua Chemical aims to support an environmentally friendly, low-carbon chemical park and alleviate freshwater resource constraints in China's Penglai District.
- ◆ As designers for the project, BSIET introduced digital BIM processes and established a connected data environment based on Bentley's applications.
- ◆ The 300,000 tons-per-day seawater desalination plant is the first BIM-designed project of its kind in China, providing an annual 90 million tons of freshwater resources for Penglai.

### ROI

- ◆ Adopting ProjectWise as the collaborative digital design platform improved design efficiency by 70%.
- ◆ Bentley's Open applications optimized design and construction, shortening the design cycle by 50% and saving 10% in materials.
- ◆ Through BIM implementation, BSIET designed an eco-friendly plant, reducing annual carbon emissions by 30,000 tons.



“The project design team of Beijing Shougang International Engineering Technology finally completed the BIM design of the whole plant in four months, which realized a new breakthrough in BIM design of the domestic string-level process seawater desalination plants.”

– Huali Liu, Project Manager and General Manager of the Water Business Department, Beijing Shougang International Engineering Technology Co., Ltd.

as simulated and analyzed water hammer and pipeline stress to ensure the safety and reliability of the system. They established a connected data environment using ProjectWise to implement collaborative BIM design workflows, including data transfer, model assembly, and design inspection, review, and delivery. Working in an open and integrated BIM platform facilitated multidiscipline design to realize integrity and consistency of data exchange among all disciplines.

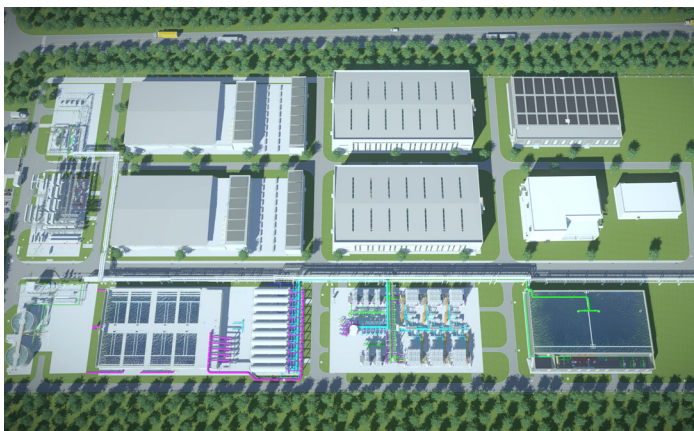
With Bentley's applications, BSIET carried out plant-wide BIM design of the Wanhua Seawater Desalination Plant and implemented standardized design concepts based on data integration and collaborative modeling. They adopted OpenPlant to visualize complex facility processes and model the whole plant's water supply, drainage, heating, and steam pipelines, performing collision detection to ensure a rational pipeline routing. Integrating OpenFlows, AutoPIPE, and Bentley Raceway and Cable Management, BSIET analyzed high-pressure pipelines, conducted stress analysis, and optimized design of the plant-wide cable tray. “This project is the first BIM-designed, string-level seawater desalination project in China which explored the design practice of seawater desalination projects on the Bentley platform,” said Liu.

### 3D MODELING GENERATES SAVINGS AND DRIVES SMART OPERATIONS

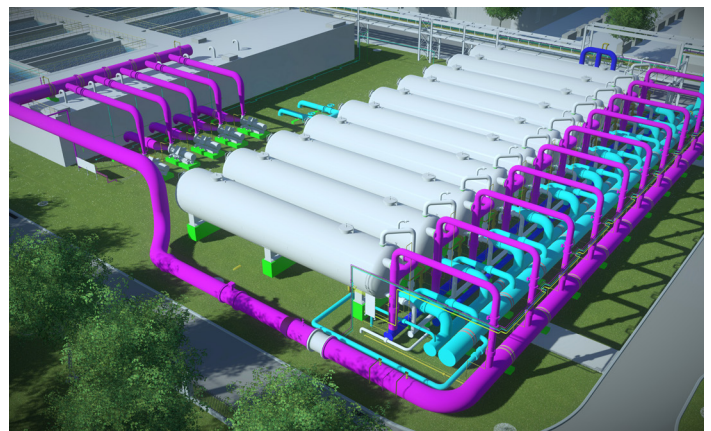
Bentley's integrated BIM solution streamlined multidiscipline workflows and standardized the design process, improving design efficiency by 70% and shortening the design cycle. “Each discipline used a unified modeling standard

and carried out model checking and model reference based on the unified DGN format, which greatly shortened the monomer design time of each discipline, thus promoting the efficiency of model integration, assembly and collision checking for all disciplines, and shortening the overall design time by more than 50%,” said Liu. Working in a connected digital modeling environment, BSIET identified and resolved 247 design conflicts, improving design quality by 80%, reducing rework and late construction modifications, and saving 10% in materials to reduce engineering waste.

BSIET completed the BIM design of the entire plant in just four months and shortened the construction period. They used Bentley's collaborative modeling applications to continuously support green design and construction solutions, setting up 8,000 square meters of photovoltaic panels on the roof of the plant capable of generating 50,000 megawatts per hour of electricity to reduce carbon emissions by 30,000 tons a year. By modeling and analyzing the operating conditions of the process system, BSIET ensured the stability and reliability of the facility operations. The 3D models provide the foundation for intelligent digital seawater desalination operations and management. “In the design process, we actively shared the model information with the constructor and the owner and integrated the concept of construction and operation in the design, which not only reduced the construction period and the environmental impact caused by the later-stage renovation, but also laid the foundation for the owner to build a digital and intelligent seawater desalination site,” concluded Liu.



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