ACTIVITIES OF THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO – PAST TO THE PRESENT*

By

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The state of Illinois and particularly the Chicago area have a history of pioneering the development of sewage treatment in the United States.

ERA OF NON-TREATMENT (1837-1899)

From 1837 through 1855, Chicago was incorporated as a city with the primary source of drinking water being Lake Michigan. The city of Chicago in an effort to manage the wastes being produced by its increasing population, implemented a major sewage project. The City began building sewers in 1856 to convey sewage to the Chicago River, which discharged into Lake Michigan. This project resulted in the construction of 54 miles of sewers by 1861.

Between 1860 and 1890 major epidemics of typhoid fever, cholera, and other water borne diseases occurred because storms flushed the city's wastewater into Lake Michigan, the area's drinking water. In 1885, about 12 percent of Chicago's population died due to outbreaks of cholera and typhoid fever. This tragic occurrence resulted in the Illinois legislature passing an act in 1889 establishing the Sanitary District of Chicago to keep sewage pollution out of Lake Michigan. In 1892 ground was broken to reverse the flow of the Chicago River by constructing the 28 mile main channel of the Sanitary and Ship Canal.

ERA OF TREATMENT BY DILUTION (1900-1918)

A major achievement from 1900 through 1918 was the opening of the 28 mile main channel of the Sanitary and Ship Canal in 1900, reversing the flow of the Chicago River. This project was considered one of seven engineering wonders of the world. Water was diverted from Lake Michigan to dilute the sewage as a method of reducing pollution of receiving waters. The North Shore Channel was constructed in 1907 to divert more lake water to aid dilution. Also, the construction of interceptor sewers was completed.

The Sanitary District of Chicago recognized the need to treat the sewage first, and discharge the purified effluents into receiving waters to realize the full

benefits of dilution as a solution to the problem of pollution. The first treatment plant, a trickling filter, was built in 1914 in Morton Grove.

ERA OF TREATMENT BY SEWAGE TREATMENT PLANTS (1919-1949)

In 1919 an ordinance was passed by the District's Board committing the District to construction and operation of sewage treatment plants. The first full-scale activated sludge plant in Illinois, Des Plaines River Sewage Treatment Plant, was built by the District in 1922 with a capacity of 5.5 MGD. This was eight years after the process was invented in England. The District constructed three of its main sewage treatment plants between 1927 and 1939. In 1928, the District constructed the first and largest activated sludge plant in the world at that time, North Side Water Reclamation Plant (WRP). During the next eight years, the District's West Side Plant (an Imhoff facility) at Stickney Illinois and the Calumet WRP were completed. In 1939, the construction of the Southwest Plant in Stickney, Illinois, an activated sludge facility adjacent to the West Side Plant, was completed. This facility was renamed the Stickney WRP in 1987, and it is the world's largest activated sludge treatment facility with a design flow of 1.2 BGD.

Construction of the Cal-Sag Channel was completed in 1922. Altogether the District built 56 miles of canals, all designed to divert water from Lake Michigan into the Des Plaines and Calumet Rivers, rather than having the rivers flow into the lake.

During this time the other Great Lakes states began to worry that Chicago's diversion of Lake Michigan Water would lower the water level of Lake Michigan. So, the District installed locks at the lakefront intake points to control the amount of diversion to an annual average of 1500 cubic feet per second in 1938.

ERA OF ENVIRONMENTAL ENHANCEMENT (1950-2001)

In order to meet the needs of an expanding service area and handle the increasing load of pollutants being discharged in the District's service area, four additional WRPs were built between 1961 and 1980 to supplement the existing Calumet, Stickney, and North Side WRPs. The four new WRPs constructed were Lemont (1961), Hanover Park (1964) John E. Egan (1975), and James C. Kirie (1980).

In 1970, a plan was developed to prevent raw sewage backflows to Lake Michigan, eliminate the water pollution caused by combined sewer overflows (CSOs), and significantly reduce the problem of basement and local flooding in Chicago and 51 older communities in the District's service area. Under the Tunnel and Reservoir Plan (TARP), 93.4 miles of huge underground tunnels were built to date, and 8.1 miles of tunnels are under construction in the greater Chicago metropolitan area to intercept the CSOs and convey them to three large

open surface reservoirs for storage. Following a storm, the captured CSOs are pumped out of the tunnels and reservoirs to WRPs for treatment and later discharged as WRP effluents to area waterways.

In 1972, the District proposed a system of in-stream aeration stations to maintain the dissolved oxygen concentrations at or above applicable Illinois in-stream water quality standards. Two in-stream aeration stations were built in the North Shore Channel and North Branch of the Chicago River, and became operational in 1979 and 1980, respectively, and they are still in operation today.

For the Calumet Waterways System, an improved aeration design called side stream elevated pool aeration (SEPA), was developed. Between 1992 and 1994, five SEPA stations were built and are operational along the Calumet Waterways System.

A direct result of the construction of the additional WRPs, capture of CSOs by the TARP system, and installation of the artificial aeration systems, at a total cost of approximately 3.3 billion dollars, has been a dramatic improvement in water quality along the Chicago and Calumet Waterways System.

BIOSOLIDS PROCESSING AND UTILIZATION PRACTICES

The District's biosolids processing and management system has evolved over time from the 1930's to the present. A brief overview of these practices is as follows:

- Imhoff air-dried sludge (1930 to 1987) – use was ended because of high metals and odors.
- Heat drying sludge (1939 to 1981) – use was ended because of high energy and maintenance costs.
- Lagooning (1943 to present) – ongoing processing method.
- Wet air oxidation (1961 to 1972) – use was ended because of high COD recycle stream and safety concerns.
- Heated anaerobic digestion (1964 to present) – ongoing processing method.
- Centrifuge dewatering at 12-17% solids (1981 to 1990) – use was ended due to entry of high solids machines into the market.
- Agitation/air drying (1983 to present) – ongoing processing method.

- Centrifuge dewatering at 20-30% Solids (1988 to present) – ongoing processing method.

- Heat dried pelletization – a contract to "design, build, and operate" a pelletization plant has recently been awarded to an independent contractor at the Stickney WRP through a 20-year lease with the District. The contractor under this contract will market Biosolids.

Currently, the end product of the District's sludge processing system is air-dried biosolids at a total solids content of 60% or higher. This final product meets the USEPA definition of "exceptional quality" with respect to metal concentrations, pathogen reduction, and vector attraction reduction in the Part 503 Sewage Sludge Regulations.

The current disposition practices being employed by the District for approximately 190,000 dry tons of biosolids produced yearly are as follows:

- Sludge application to land in Fulton County, Illinois.

- Sludge application to land on the Fischer Farm at the Hanover Park WRP.

- Distribution to large-scale private users (sod farms, cemeteries, golf courses, etc.) under a permit from the Illinois Environmental Protection Agency.

- Application of centrifuge dewatered cake to agricultural land for growing crops and sod.

- Daily cover at municipal solid waste landfills.

- Final vegetative cover at municipal solid waste landfills.

These management practices reflect the District's continuing goal of finding beneficial uses of biosolids on land when economically feasible, a policy that was adopted by the District's governing Board in 1967.

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*This presentation was prepared by Dr. Richard Pietz, Coordinator of Technical Services, Research and Development Department, Metropolitan Water Reclamation District of Greater Chicago, based on the luncheon speech given by Mr. Edmund Cook.