

U.S. DEPARTMENT OF THE INTERIOR  
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION  
PERTINENT AREAS FOR RESEARCH AND DEVELOPMENT  
STORM AND COMBINED SEWER POLLUTION CONTROL

May, 1967

The problem of pollution from storm and combined sewers is one which has only recently begun to receive proper emphasis as a significant pollution source. There are in the United States over 1900 communities with combined or partially combined sewerage systems serving some 59 million people.

The discharge of polluting wastes from storm drainage systems and overflows from combined sewers serves as a distinct challenge to the ingenuity of municipal officials, consulting engineers, universities and corporations engaged in research and development, as well as equipment manufacturers. Polluting discharges from combined storm and sanitary sewers occur during wet-weather periods when the carrying capacity of the sewers is exceeded due to the large amounts of storm water entering the sewers. The normal, or dry weather flow is prevented from overflowing continuously by means of overflow weirs, mechanical regulators, valves and other devices. They permit overflows to occur when sewer flows reach a predetermined level.

Separation of the storm water from the sanitary sewage can be at least a partial answer to the problem since if the systems are completely separated the most concentrated waste load can be conveyed to and treated at the waste treatment plant. We have come to recognize in recent years, however, that surface runoff also contains significant amounts of pollutants - some cases nearly as much as sewage - so that separation of sanitary wastes is now believed to be only a partial solution to the total problem.

Congress had these factors in mind when the current storm and combined sewer pollution control demonstration grants were authorized. Section 6 (a) (1) of the Federal Water Pollution Act authorizes "---- grants to any State, municipality, or intermunicipal or interstate agency for the purpose of assisting in the development of any project which will demonstrate a new or improved method of controlling the discharge into any waters of untreated or inadequately treated sewage or other wastes from sewers which carry storm water or both storm water and sewage or other wastes ----." The Federal Government can provide up to 75 percent of the estimated reasonable cost of individual research, development and demonstration projects. The applicant must provide assurances that local funds are or will be available to pay for the remainder of the cost. Application for contract support for pertinent research and development projects will also be considered.

The necessary application forms and more detailed information concerning the Program can be obtained by writing to:

Office of Research and Development  
Federal Water Pollution Control Administration  
U.S. Department of the Interior  
633 Indiana Avenue, N. W.  
Washington, D. C. 20242

By way of assisting those who wish to participate in the task of controlling or abating pollution from storm and combined sewers the following outline of technical areas for which applications are desired is provided:

A. DRAINAGE AREA CONTROL

1. Reduce and regulate stormwater input to sanitary sewers

- a. Diversion of surface runoff to the ground water by altering and controlling land use to increase infiltration
  - 1. Reduction of impervious areas - increasing open spaces
  - 2. Terracing and otherwise reducing land slopes through landscaping
  - 3. Planting grasses, trees and shrubbery
  - 4. Reducing extent and time of exposure of bare earth during land development and construction
- b. Shallow pervious basins for percolation to ground water or use sprinklers
- c. Ground water disposal wells (injection & others)
- d. Reduction of ground water infiltration to sewers
  - 1. Development of better methods of determining location and extent of sewer infiltration
  - 2. Development of better sewer joints, lateral connections, etc.
  - 3. Development of better methods of repairing existing lines, making new installations and closing of abandoned connections
- e. Storage of stormwater runoff
  - 1. Temporary storage of stormwater at building or immediate area through use of holding tanks, seepage pits, rooftops, or backyard storage (detention) facilities. Regulated discharge from storage to the groundwater, a watercourse, or sewer system
  - 2. Stormwater collection sumps (neighborhood) with regulated discharge to sewer system (includes storage facility under streets)
  - 3. "Upstream" storage or other control methods to decrease runoff effect on lower portions of the system
  - 4. Stormwater storage in urban area surface lakes, ponds, caverns, for subsequent discharge to watercourse or sewer systems
  - 5. Storage and operating characteristics necessary for snowmelt runoff
  - 6. Reuse of stored water for irrigation, street cleaning, sewer flushing and other purposes

2. Eliminate discharge of sanitary sewage and other wastes to storm sewers
  - a. Eliminate illicit connections of sanitary sewers where separate sewers exist
  - b. Reduce groundwater infiltration to storm sewers
  - c. Separation and collection of concentrated waste materials on the surface for discharge to sanitary or industrial waste sewers. (Animal waste, industrial materials and waste projects, sludges, etc.)
3. Reduce solids in storm runoff
  - a. Soil erosion control
    1. Highway, street, and utility construction methods and practices changes
    2. Use of solids retaining pond, basin, or other type unit with necessary treatment
    3. Grass seeding and other type plant coverage of exposed earth
  - b. Improved street cleaning and urban "housekeeping" methods to prevent solids from reaching the sewers
4. Pre-treatment of water entering storm sewers
  - a. Disinfection only
  - b. Primary clarification with modifications (with and without chlorination or other type disinfectants)
  - c. Lagoons, ponds, tanks with solids holding capacity for given period
  - d. Filtration
  - e. Treatment for nutrient removals
  - f. Treatment or storage in catch basins
  - g. Other treatment methods and processes or combinations of the above including chemical treatment

B. COLLECTION SYSTEM CONTROL

1. Improvements in gravity sewer system

- a. Catch basin improvements including operation and maintenance practices
- b. Sewer planning and controls to regulate time of flow during heavy stormwater periods, including sewer flood flow routing techniques, travel time, etc.
- c. Improved sewer shapes and materials to improve flow conditions, (lower "n") better sewer connections and manhole flow channels
- d. Increase trunk and interceptor design capacity
- e. Improved system design methods utilizing best hydrological practices

2. Special conveyance systems

- a. Limited separation of combined sewers with express sewer construction for sanitary waste
- b. Partial separation
  - 1. Separate drains for streets, yards, parking lots, new buildings, etc.
  - 2. Phased separation of sewer systems in all new areas to be sewerred and redeveloped. While this method could have significant long-range beneficial effects, demonstration grants for separation of sewers are not envisioned
  - 3. Preventing stormwater flows in separate systems from being discharged to combined sewers
- c. Separation of sanitary sewage and use of separate sewer inside larger sewers where available to convey sewage to treatment plant
- d. Use of vacuum conveyance systems for sanitary sewage & solid wastes
- e. Others

3. Reduce peak flows

- a. Diversion of excess flow from combined sewer to external facilities for storage and regulated feed back to system for treatment
- b. In-line treatment to improve flow conditions
- c. In-line detention through use of enlarged segment of sewer
- d. In-system detention of waste and stormwater through telemetering or other type signaling systems with remote control on flow.
- e. Reduction in water use through improvements in plumbing fixtures

4. Reduce infiltration and exfiltration

- a. Development of improved methods of locating sewer leaks; checking out new sewers, laterals and house lines
- b. Development of new and better methods and materials for making sewer repairs, closing abandoned openings and construction in general
- c. Development of methods of sealing sewers in place, internally and externally, to reduce infiltration.
- d. Improved means of implementing control of illicit "clearwater" connections to sewers

5. Systems analysis and control methods

- a. In-line (internal) storage with telemetering and remote or automatic flow control
- b. External storage in tanks, ponds, etc. for feed back with automatic control system
- c. In-system routing of stormwaters to utilize full storage capacity of system and subsequent treatment
- d. Others and combinations of (a), (b), (c) (Including periodic dry weather flushing to move solids deposited in sewers, and better sewer maintenance in general)

C. EXTRANEOUS (EXTERNAL) DISCHARGE CONTROL

1. Treatment of combined sewer overflow

- a. Treatment at or near point of overflow through use of conventional type primary treatment units or ponds, tanks, lagoons with chemical treatment and chlorination. Other types of treatment facilities or processes.
- b. Use of subterranean holding basins with treatment facilities
- c. Expansion or additions to existing treatment plants to treat excess flow
- d. Nutrient removal
- e. Treatment with return of concentrate to interceptor for further treatment at sewage treatment plant

2. Treatment of stormwater runoff

- a. Small drainage area plants vs. central plant utilizing new or improved methods of treatment
- b. Utilization of upstream storage to cut peaks and control plant input
- c. Pre-treatment and direct ground water replacement
- d. Irrigation by spreading, spray or other methods
- e. Treatment and use as supplement to raw water supply
- f. In-line treatment
- g. Others

D. MISCELLANEOUS

1. Determination of economic feasibility study of separation vs. combined sewer system and local vs. central treatment facilities for overflow and stormwater.
2. Development and demonstration of new or improved accurate instruments for flow measurement and water quality monitoring.
3. Development and demonstration of improved techniques of hydrologic analyses, to determine reasonable accurate rainfall - runoff relationships. Compilation of sources of existing data and development of improved statistical methods.
4. Management techniques geared to optimize control and/or treatment through utilization of new methods.
5. Development of improved construction materials and methods
6. Development of performance criteria needed in relationship to stream water quality standards

It should be noted that the above outline is not considered to be all-inclusive, since there may be numerous completely original ideas which could be added -- some of which may be more significant than any of those listed. Submission of such ideas to the Federal Water Pollution Control Administration is strongly encouraged.

Some of the technical areas outlined are currently under evaluation by means of either grant or contract projects, for example: Most of the

more conventional storage techniques including the use of tanks with pump-back to the interceptor, surface storage ponds, treatment lagoons are underway. More unique applications of storage principals such as localized "upstream" storage to prevent overloading of "downstream" sewers need further development. The use of chlorine to disinfect storm and combined sewer discharges is included in several projects, therefore new disinfection techniques suitable for application to high volume -- short duration flows need exploration. Similar examples can be found in any of the major technical areas listed.

The brief descriptions of existing demonstration projects will serve as additional examples of work being done. Any further duplication of these control methods will be minimized as much as possible to permit activation of projects designed to explore technical areas not now being evaluated. Some duplication will be in order so as to provide evaluation of function under a suitable variety of hydrological conditions.