BLOOMINGTON AND NORMAL WATER RECLAMATION DISTRICT AND CITY OF BLOOMINGTON

LONG-TERM COMBINED SEWER OVERFLOW (CSO) CONTROL PLAN

APRIL, 2003

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I. INTRODUCTION

The Long Term Combined Sewer Overflow (CSO) Control Plan, completed by Farnsworth Group, Inc. (FGI) and Staff of the Bloomington and Normal Water Reclamation District (BNWRD), on behalf of BNWRD and the City of Bloomington, is provided to fulfill requirements of the Federal Combined Sewer Overflow Control Policy and to fulfill facility planning requirements for partial funding from the Illinois Environmental Protection Agency (IEPA) Revolving Loan Fund.

This Plan culminates planning and partial implementation of CSO Improvements that have been ongoing by BNWRD since 1999. In August 1999, a report titled, "CSO Improvements and West WWTP Fine Screens" was completed to address CSO outfalls in the area of the Hungarian Club. Construction projects are ongoing to eliminate these outfalls and convey the overflow downstream to the Graham Street Sewer CSO location. The 1999 report and reports titled "CSO Improvements Facility Plan, November 15, 2000," and "Combined Sewer Overflow Facility Planning Study, August, 2002," also detailed improvements to screen overflows at the Graham Street Sewer CSO and West Slough CSO outfall prior to discharge to Sugar Creek. With subsequent planning efforts and the availability of property for additional CSO infrastructure, plans for screening overflows only are abandoned in favor of a more comprehensive CSO Collection and Treatment System as outlined in this Plan.

The Long Term CSO Control Plan submitted herewith incorporates, consolidates and amends subsequent planning efforts for CSO improvements to date and replaces previous reports and studies.

The Current Plan recognizes the need to provide further treatment, above that provided with screening only, to minimize and potentially eliminate any impairment of water quality realized by discharges of CSO to Sugar Creek. The Current Plan provides infrastructure to eliminate several major CSO outfalls and provides a minimum of primary treatment for those CSO outfalls which most frequently discharge to Sugar Creek. Minor CSO outfalls remaining in the existing combined sewer system will be monitored after improvements, as documented in this Plan, are in place to determine if the remaining CSO outfalls can be eliminated and which, if any, may require further improvement.

II. EXISTING SYSTEM CHARACTERIZATION

A. Sewer System and CSO Outfalls

Original sewers constructed in the Town of Normal and City of Bloomington were all combined sewers. Normal has separated many of its combined sewers with new construction projects, but storm drainage connections still exist. Downtown and older areas of Bloomington are still served by combined sewers. The combined sewers transport flow to a system of interceptor sewers maintained by BNWRD. Dry weather flow, first flush wet weather flow, and excess wet weather flow up to a total capacity of 87 MGD are transported by the interceptor sewers for treatment at the BNWRD West Plant. Combined sewer flow in excess of the rated capacity of the West Plant is discharged directly to Sugar Creek or one of its branches through a series of permitted CSO outfalls.

Interceptor sewers and CSO outfalls maintained by BNWRD and the City of Bloomington are listed in Tables 1 and 2. Locations of these CSO outfalls are shown in Figure 1. Additional details regarding permit requirements for each CSO outfall may be found in the NPDES permits in Appendices A and B.

The CSO Control Plan will eliminate several significant CSO outfalls with the construction of CSO relief sewers and CSO storage lagoons. These relief sewers will provide additional CSO transport capacity and significantly increase the storage volume available within the collection system. Reduced overflow frequency is expected at those CSO outfalls not eliminated. These CSO outfalls will be monitored after construction to determine which additional CSO outfalls may be closed.

CSO discharges to be eliminated as a result of this CSO Control Plan are as follows:

BNWRD CSO Outfalls Eliminated:

Graham Street CSO – 006

West Branch CSO – 008

Normal Valley CSO – 009

Division Street CSO – 010

East 48-inch CSO – 011

City of Bloomington CSO Outfalls Eliminated:

Cottage Avenue CSO – 006 – Eliminated with construction project that increased main interceptor from 27-inches to 36-inches

Division Street CSO – 011 - Eliminated with Emerson Street Bridge Improvements Improvements along Emerson Street from Mason to Franklin Street included separation of combined sewers with the installation of new storm sewer. It is anticipated that these improvements will reduce flow in combined sewers to allow this CSO to be eliminated. Monitoring will be performed prior to this outfall being blocked off.

Morris Avenue CSO – 018 - Temporarily plugged and monitored

All remaining CSOs will be monitored to determine frequency of overflow and if they can be permanently eliminated. The Locust Street CSO (015) will experience significantly reduced discharge frequency after eastside Bloomington flows are diverted to the new SEWWTP. Outfall 005, West Slough CSO, will remain a permitted outfall serving as an emergency system relief in the event of a major storm. Frequency, flow rate, and flow volume will be monitored at this outfall location. Additional details in this regard are enumerated in subsequent sections of this report.

TABLE 1 BNWRD CSO OUTFALLS

Figure 1

B. CSO Monitoring

CSO outfalls are regularly monitored and maintained in accordance with the CSO Pollution Prevention Plan dated 2-27-01 and the CSO Operational Plan dated 5-95 which are on file with the IEPA.

In addition to routine monitoring, flow monitoring was performed at the Graham Street CSO, Outfall 006, to assist with the design of the CSO System Improvements. Flow monitoring has also recently begun at the West Slough CSO, Outfall 005.

Flow monitoring at the Graham Street CSO was accomplished with ADS flow monitoring equipment. Rain data was provided with a tipping bucket rain gauge installed at the office of FGI. Both flow and rain data was collected and stored at the sites, with periodic download to the BNWRD office for processing.

At the Graham Street CSO, a 60-inch diameter pipe and a 60-inch box sewer come together in a box structure. A weir diverts flow to the Main Branch Interceptor via a 24-inch diameter pipe connection. Flow exceeding the capacity of the 24-inch pipe overflows the weir during wet weather and is discharged to a concrete paved slough that runs to Sugar Creek.

Flow monitors were installed in both the 60-inch pipe and 60-inch box. Flow monitors include three sensors: ultrasonic level transducer, pressure transducer and Doppler velocity sensor. These sensors provide depth and velocity measurements at 15 minute intervals. By knowing the shape of the pipe and box, the depth and velocity measurements are converted to flow.

Results from flow monitoring at the Graham Street CSO are shown in Figures 2 and 3. Data is also provided in Tables 3 and 4. Figure 2 displays the rate of discharge from the CSO versus the rain intensity. With a few exceptions, a relatively linear relationship was developed between the flow and rain intensity. During the monitoring period, a maximum discharge of 87.5 MGD was observed. A hydrograph of this maximum discharge event, which occurred on July 26, 2002, is provided in Figure 4.

Figure 3 displays the total volume of discharge in million gallons for an individual storm event as a function of the quantity of rain in inches observed in the individual storm event. Again, a linear relationship was extrapolated for these parameters. During the monitoring period, the maximum volume of discharge during any storm event was 6.5 million gallons. The maximum volume of discharge during any one-hour period was approximately two million gallons. Out of 37 overflows during the monitoring period, the average volume discharged during the storm event was 2.4 million gallons, which corresponds to an average rain of 0.84 inch.

FIGURE 2 – GRAHAM ST CSO

FIGURE 3 – GRAHAM ST CSO 2001

TABLE 3 – GRAHAM ST CSO FLOW DATA

TABLE 4 – GRAHAM ST CSO RAIN EVENT DATA

FIGURE 4 – GRAHAM ST CSO HYDROGRAPH

C. Assumptions/Extrapolations

Using a combination of available flow data and theoretical calculations, flows were estimated for each CSO discharge. A summary of these flows is provided in Table 5.

Peak Instantaneous Flow Rate

The peak instantaneous flow rate, observed from monitoring at the Graham Street CSO outfall, was 87.5 MGD. This rain event is shown in Figure 4. Currently, there is no peak instantaneous flow data available at the other CSO discharges.

Peak Hourly Discharge Volume

The peak hourly volume of CSO discharge, observed from monitoring at the Graham Street CSO outfall, was 2.0 million gallons.

Different methods were used for approximating the Hungarian Club CSO discharges versus the West Slough CSO discharge, due to the different characteristics of the two drainage areas. The Hungarian Club CSOs do not drain areas that contain strictly combined sewers, while the Graham Street CSOs and West Slough CSOs do drain areas primarily consisting of combined sewers. Thus, a ratio of maximum sewer carry capacity was used for the Hungarian Club CSO, while a ratio of drainage areas was used for he West Slough.

To approximate the peak hourly discharge volume from the Hungarian Club CSOs, a ratio of sewer carrying capacity was used. Using a ratio of the maximum sewer carrying capacity of Graham Street CSO to the maximum sewer carrying capacity of the Hungarian Club sewers, approximately 5:1, the peak hourly volume of discharge from the Hungarian Club CSOs is estimated as 0.4 million gallons. Individual sewer capacities at the Hungarian Club Area and Graham Street CSO can be found in Table 5 and Figure 6.

To approximate the peak hourly discharge volume from the West Slough CSO, a ratio of the drainage areas was used. The Graham Street CSO has a drainage area of approximately 0.6 sq. mile. The West Slough CSO has a drainage area of approximately

3.1 sq. miles. The characteristics of the two developed urban drainage basins are very similar. Using a ratio of the drainage areas, the peak hourly discharge volume from the West Slough CSO is estimated at 10.4 million gallons.

Peak Daily Discharge

The peak daily (24-hour) volume of CSO discharge observed from monitoring at the Graham Street CSO outfall was 6.5 million gallons. This rain event occurred on May 11, 2002, as shown on Table 4.

To approximate the peak daily discharge volume from the Hungarian Club CSOs, a ratio of sewer carrying capacity was used. Using a ratio of the maximum sewer carrying capacity of Graham Street CSO to the maximum sewer carrying capacity of the Hungarian Club sewers, approximately 5:1, the peak daily discharge volume from the Hungarian Club CSOs is estimated as 1.3 million gallons.

To approximate the peak daily discharge volume from the West Slough CSO, a ratio of the drainage areas was used. The Graham Street CSO has a drainage area of approximately 0.6 sq. mile. The West Slough CSO has a drainage area of approximately 3.1 sq. miles. Using a ratio of the drainage areas, the peak daily discharge volume from the West Slough CSO is estimated at 33.7 million gallons.

Two-Year Storm Peak Instantaneous Flow

The two-year storm flow was calculated using the Rational Method for the Graham Street CSO and the West Slough CSO. The Rational Method calculates peak instantaneous flow with the following equation: $Q = CiA$

Q = flow

C = Runoff coefficient (dependent on surface characteristics)

i = Rain intensity (in/hour)

A = Drainage area (acres)

The runoff coefficient was determined from flow monitoring data collected at the Graham Street CSO. Flow and rain intensity were measured. The drainage area is known. With these three parameters, the runoff coefficient was calculated (C = Q/iA). The "C" values were calculated for each storm event, shown in Table 3. The average "C" value calculated was 0.217. Since flow was calculated in "MGD units", this "C" value incorporates a conversion factor to convert flow to "MGD". In "CFS" units, the average "C" factor is 0.33.

Historical rain data was obtained from the Illinois State Water Survey (ISWS) Circular 172. The ISWS data provides a two-year storm rain intensity for McLean County of 1.42 in/yr.

Given the calculated "C" factor, the ISWS two-year rain intensity, and the drainage area, the calculated two-year storm flow for the Graham Street CSO is 118 MGD.

The West Slough two-year storm flow was determined by the same approach, using the "C" factor calculated from the Graham Street CSO. This assumption is based on the fact that both CSO drainage areas have very similar characteristics (same mix of homes, yards and pavement). The calculated two-year storm flow from the West Slough CSO is 613 MGD.

The Hungarian Club CSOs do not drain areas that contain strictly combined sewers, so the rational method approach could not be used for this site. Instead, a ratio between the 100-year storm flow at Graham Street and the two-year storm flow at Graham Street was used to approximate the two-year storm flow at the Hungarian Club CSOs. (Two-year Graham flow/100-year Graham flow x 100-year Hungarian flow = two-year Hungarian flow). This assumes that the 100-year storm flow at the Hungarian Club CSOs is equivalent to the pipe carrying capacity at that point. With this approach, the two-year storm flow from the Hungarian Club CSO is approximated at 23.5 MGD.

Maximum CSO Capacity

The maximum CSO capacity is calculated using Manning's equation with an "n" value of 0.013. The flow capacity of each pipe draining to the CSO outfalls was calculated with Manning's formula, given the pipe diameters and slope.

The sum of the pipe carrying capacity draining to the Hungarian Club CSO location is 90.7 MGD, Graham Street CSO location is 274 MGD, and the West Slough CSO location is 792 MGD. Of the 90.7 MGD draining to the Hungarian Club CSO area, 36.6 MGD is conveyed to existing 36-inch interceptors flowing to the West WWTP. The remaining 54 MGD will be conveyed to the new 60-inch Hungarian Club CSO interceptor. These flows were used for design purposes to size pipes from each CSO location to convey CSO flow to the CSO storage lagoon.

100-Year Storm Peak Instantaneous Flow

The 100-year storm flow at the Graham Street CSO and West Slough CSO was calculated using the same approach as that described above for the two-year storm flow calculation. One-hundred-year storm rain intensity of 3.25 in/hr was taken from ISWS data. Using the rational method, the 100-year storm flow for Graham Street CSO is 271 MGD and for the West Slough CSO is 1402 MGD.

The 100-year storm flow for the Hungarian Club CSO interceptor is assumed to equal the carrying capacity of the pipes draining to that location less the flow conveyed to the existing 36-inch interceptors. With that assumption, the 100-year storm flow for the Hungarian Club CSO is 54 MGD.

TABLE 5 SUGAR CREEK CSO FLOW SUMMARY

D. Sensitive Areas

Sensitive areas, as described by the CSO Control Policy, may include: Outstanding National Resource Waters, National Marine Sanctuaries, waters with threatened or endangered species, waters with primary contact recreation, public drinking water intakes and shellfish beds.

The CSO outfalls discharge to Sugar Creek or one of its branches. Sensitive areas, as defined above, do not exist on Sugar Creek.

The Hungarian Club CSOs discharge to a stretch of Sugar Creek upstream of White Oak Park. While primary contact in the form of public swimming or recreation in the creek at the park location is not permitted. The public does have access to the creek at this location. Higher priority is thus given to eliminating and/or reducing the overflow frequency at this location. The Hungarian Club CSOs will be eliminated with the construction of a 60-inch CSO interceptor sewer to convey CSO flow downstream of the park area.

III. COMBINED SEWER OVERFLOW TREATMENT AND COLLECTION SYSTEM PLAN

A. Goals

1. Meet and exceed existing mandated CSO permitting requirements.

2. Eliminate existing CSO outfalls to the maximum extent possible.

3. Eliminate combined sewer overflow events to the maximum extent practical.

4. Maximize storage and treatment of CSO

5. Convey and consolidate CSO discharges to a single location for treatment (Existing West WWTP), storage (CSO Lagoons) and overflow (West Slough).

6. Maximize use of existing treatment facilities and infrastructure

7. Minimize use of complex, maintenance-intensive CSO treatment equipment

8. Provide system flexibility and expandability for future needs and new regulatory standards.

9. Use SCADA for remote monitoring and operation as reasonably practicable. Provide ability to monitor and quantify system performance to allow the operator to evaluate/select treatment or storage options during storm events and to consider areas of system expansion and/or modification.

B. Detailed Plan

1. Overview Plan

An overview of the CSO Treatment and Collection System plan is as follows:

(a) All CSO flow at the major existing CSO locations (Hungarian Club Area, Graham Street Outfall, West Slough Outfall (Caroline Street) will be consolidated and conveyed by CSO interceptor sewers for storage and/or treatment.

(b) "De-coupling" of the CSO flows at the above major existing outfalls from creek backwater effects will maximize conveyance capacity of existing combined sewers.

(c) The system will provide 15.35 MG of storage (at full conveyance flow rate) to buffer storm peaks and contain the CSO flow. Storage will be provided in two lagoons and in the CSO interceptors.

(d) In the event of an extended wet weather period, and the 15.35 MG of "base" system storage is utilized, an additional 52.4 MG of "secondary CSO" storage is available in the upper levels of the CSO storage lagoon. CSO must be pumped to this storage. The initial system will utilize a 120-MGD pump rate.

(e) In the event of an extended wet weather period above the system base storage (15.35 MG), West WWTP excess flow treatment capacity (49.6 MGD) and the secondary CSO storage transfer rate (120 MGD), CSO will occur at the West Slough Emergency Overflow.

(f) After storm flows are reduced, and as dry weather treatment capacity becomes available in the West WWTP, the CSO lagoons will be drained down to a low level back to the West WWTP for full tertiary treatment.

(g) With conversion of the West WWTP Plant #2 to excess flow treatment and the existing West WWTP Excess Flow Treatment Facilities, up to 49.6 MGD of excess flow treatment (continuous during a storm event or during storage drain-down after a storm event) is available using existing infrastructure.

(h) Flow monitors will be installed to evaluate and quantify system performance for storms of variable frequency, duration and location over a two- to five-year period of record in the applicable drainage basin. Depending on the measured frequency and flow rate of any CSO occurrences at the West Slough, BNWRD will evaluate possible options for system expansion as follows:

(1) No further improvements warranted. CSO occurrences are rare and only associated with major storm events.

(2) Add CSO Screening at the West Slough Overflow to provide Preliminary Screening treatment of minor, infrequent overflows.

(3) Add CSO transfer pumps to secondary storage to further reduce CSO frequency.

(4) Add excess Flow Treatment Facilities at the West WWTP to increase treatment capacity and further reduce CSO frequency.

(5) A combination of (2), (3) and/or (4).

(i) Minor remaining CSO points in the City of Bloomington will also be monitored during the two- to five-year system evaluation period. With improved system conveyance capacity in the existing sewers provided with implementation of the CSO Collection and Treatment System, the goal will be to eliminate (block off) any and all remaining minor relief points.

2. System Components

Figure 5 provides a comprehensive schematic representation of the BNWRD CSO Collection and Treatment System. Each component will be reviewed in further detail below.

a. Hungarian Club

A location plan of existing CSOs in the Hungarian Club and Cottage Avenue Areas is shown in Figure 6.

A new 36-inch interceptor sewer, along with two other 36-inch interceptor sewers, convey dry weather flow to the wastewater treatment plant (WWTP) from the Hungarian Club Area. The additional capacity provided with these sewers allows elimination of City of Bloomington CSO Discharge 006 at Cottage Avenue and a BNWRD CSO Discharge 010 at Division Street.

A proposed Hungarian Club Area Junction Box will intercept flows from Discharges 010 and 011, via a new 48-inch sewer. Dry weather flow will be distributed proportionately to the three 36-inch interceptors flowing to the WWTP. Flow in excess of dry weather flow, which is established as the maximum carrying capacity of the three 36-inch interceptors, will overflow a rectangular weir. This overflow will be transported to the Graham Street Outlet Area via a new 60-inch Hungarian Club CSO interceptor sewer. A detailed site plan and plan of the junction boxes is shown in Figure 7.

Overflow from Discharge 008 and the entire flow from the Normal Valley Sewer (Discharge 009) will be combined in a junction box on the north side of Sugar Creek. Dry weather flow will be conveyed beneath Sugar Creek and into the Hungarian Club Area Junction Box, where the flow will then be transported to the WWTP via the three 36-inch interceptors. Flow in excess of dry weather flow will overflow a rectangular weir. This overflow will be transported beneath Sugar Creek and into the overflow chamber of the Hungarian Club Area Junction Box.

Total conveyance capacity from the area will be 90.7 MGD, of which 36.6 MGD flows directly to the West WWTP Headworks and up to 54.1 MGD conveyed to CSO storage and excess flow treatment.

BNWRD CSO Outfalls 008, 009 and 011 will be eliminated. City of Bloomington CSO Outfall 006 and BNWRD CSO Outfall 010 were eliminated with the upsizing of the 27-inch interceptor to a 36-inch interceptor.

Figure 5

Figure 6

Figure 7

b. Graham Street Slough

The existing Graham Street Slough CSO Outfall discharge 006 consists of an approximate 9'0" x 5'0" outfall chamber constructed in 1925, servicing an approximate 5'6" x 5'6" box sewer and a parallel 60-inch concrete pipe sewer that was constructed in 1946.

Calculated capacity of the two existing sewers, under full flow conditions and slopes indicated on available record drawings and a theoretical Manning's roughness coefficient of .013 for a smooth lined concrete pipe, is 167.4 MGD for the box sewer and 106.7 MGD for the 60-inch circular pipe, for a total peak discharge rate of 274 MGD. BNWRD has been monitoring flows in the two sewers for approximately two years. Recorded peak flow during this monitoring period was approximately 87.5 MGD. Peak conveyance capacity of the existing sewers is currently reduced due to backwater effects created by rising creek water levels at the outfall. With construction of the CSO improvements, the sewers will be decoupled from the Creek and full calculated pipe flows may be achieved.

Figures 8 and 9 depict modifications at the existing outlet structure to transition from the box outlet to two (2) ea. 96-inch diameter pipes. These pipes will combine with the 60-inch Hungarian Club CSO interceptor from the Hungarian Club Area as depicted on Figure 7 and will continue as two parallel 96-inch diameter interceptors (Graham Street CSO Interceptors) to the West Slough Junction Box. Total conveyance capacity of the two 96-inch Graham Street CSO interceptors is 328 MGD. The existing Graham Street Slough will be filled to existing Berm elevations. With conveyance capacity of the new pipelines matched to the existing outfall, the BNWRD Graham Street Slough CSO Outfall 006 will be eliminated.

Figure 8

Figure 9

c. **West Slough**

The existing West Slough CSO (NPDES 005, BNWRD) outfall consists of two parallel approximate 8' x 6'-6" box sewers constructed in 1925 and a third parallel box added in 1946.

Calculated conveyance capacity of the existing sewers, under full flow conditions and slopes indicated on available record drawings and a theoretical Manning's roughness coefficient of .013 for smooth lined concrete, is 792 MGD. BNWRD has begun monitoring flows in each of the existing box sewers. Peak conveyance capacity of the existing sewers is currently reduced due to backwater effects created by rising creek water levels at the outfall. With construction of the CSO improvements, the sewers will be decoupled from the creek and full calculated pipe flows may be achieved.

Figures 10 and 11 depict modifications at the existing outlet structure to transition from the box outlets to 3 ea. 96-inch diameter pipes. These pipes will combine with the 2 ea. 96-inch Graham Street CSO interceptors from the Graham Street Area in a Junction Structure locate near the end of the existing West Slough. Four (4) parallel 96-inch interceptors (West Slough CSO Interceptors) will continue from the Junction Structure to the CSO Storage Lagoons with a total conveyance capacity of 1120 MGD or 1.12 Billion Gallons per day. The existing West Slough will be filled to existing Berm Elevations.

Existing storm sewers entering the slough and/or the existing CSO box culverts upstream of the outlet will be intercepted and routed via 48-inch and 42-inch storm sewer pipes on the north and south sides of the existing box culverts and 96-inch interceptors, and discharge directly to Sugar Creek.

The West Slough CSO Interceptors will cross Sugar Creek at the end of the West Slough, as indicated in Figure 12. Hydraulic losses created by the creek crossing are incorporated into the Hydraulic Model to ensure the Design conveyance capacity is not compromised.

The section of pipeline below Sugar Creek will have a minor backslope to the West Slough Junction box for drainage at the end of the storm conveyance event.

Figures 13 and 14 show the proposed West Slough Junction Structure. The structure will be designed with an approximately 1 – 3 MGD pump station that will be used to (1) draindown the pipelines below the creek; (2) transfer skimmed floating solids; and, (3) transfer pumpable grit and solids slurry. The pump station will discharge via forcemain to the existing Far West Sewer or 1985 Interceptor for transfer to the West WWTP headworks. It is anticipated the draindown/solids transfer pumps will be activated at the start of the storm and remain in operation through pipe draindown at the end of the storm event.

The Junction Box will be an open top structure, designed with the ability for floatable skimming, future addition of horizontal CSO screens and clamshell bucket or vactor solids pumpage of residuals grit or large solids. The Junction Box will be baffled to limit the floatables discharged to Sugar Creek in the event of an overflow.

It is planned to phase construction of the West Slough Improvements. The Junction Structure will initially be constructed to the elevations of the existing slough berms and the slough will be left open, allowing emergency relief overflow in the event of a flood event in excess of the Slough berm elevation. All other components of the CSO collection and treatment system will be constructed and monitored for performance.

On the basis of this monitoring:

(1) The Slough Outlet Transition Structure will subsequently be completed to the 100-year-flood elevation with installation of the 3 ea. parallel 96-inch sewers to the Junction Structure. The slough will then be backfilled to the existing berm elevations.

(2) An emergency overflow gate will be provided in the Junction Structure in the event of flooding in excess of the CSO conveyance and Treatment System Capacity. Due to the emergency overflow provision, the CSO Outfall Permit (005) for this location will remain.

(3) Based on system performance during the monitoring period, a CSO screen may be added for preliminary screening of minor, infrequent overflows in conjunction with other improvement at the CSO storage lagoons.

The alignment of proposed CSO Interceptors from the Graham Street CSO to the CSO Storage Lagoon site is depicted on Figures 15 and 16.

Figure 10

Figure 11

Figure 12

Figure 13

Figure 14

Figure 15

Figure 16

d. CSO Storage Lagoons

The proposed CSO Storage Lagoons and Inlet Structure are depicted on Figures 16 and 17.

Flows from the West Slough Junction Structure are conveyed via the 4 each 96-inch parallel West Slough CSO Interceptors to the Lagoon Inlet Structure. Flows entering the structure will pass under a baffle wall (Figure 17) for entrapment of floatable solids prior to flowing into the primary lagoon. As level in the influent structure rises, solids will be skimmed over a weir to a 60-inch transfer pipeline to the West WWTP Headworks. This same pipe will also serve to transfer CSO to excess flow treatment (up to 49.6 MGD) and/or for CSO storage draindown to the West Plant for full wastewater treatment via a gated outlet below the skimming weir. Due to the 60-inch pipe creek crossing, a small pump station and forcemain will be required for draindown of the transfer pipeline at the termination of the CSO event.

A 1 to 3 MGD pump station, similar in function to the draindown pump station at the West Slough Junction box, is required at the lagoon influent structure for post-storm draindown of the 4 ea. 96-inch interceptors and transfer of grit slurry solids. It is anticipated this pump station will be active throughout the entire storm event and will discharge to the 60-inch transfer pipeline downstream of the solids skimming weir.

CSO flows will enter the primary and secondary lagoons, interconnected by a series of box sewers, by gravity flow. Lagoon bottom elevation is at 727.0 with a static water level of 730.0. The CSO system will transfer up to 1120 MGD (assumes full pipe flow in the existing outfall sewers and new CSO Interceptors) to a lagoon elevation of 736.6. Available "Base CSO Storage" (Volume in lagoons above low water level) in the primary and secondary lagoons and the conveyance pipelines is 15.35 million gallons. As level in the primary lagoon increases above elevation

736.6, flow capacity in the 96-inch West Slough CSO Interceptors is reduced, due to reduction of hydraulic head. Base CSO storage can be increased as long as water levels monitored upstream indicate that upstream sewers are not surcharged.

Once the "Base CSO Storage" is exhausted, motorized gates on the box sewers interconnecting the primary and secondary storage lagoons can be closed and the CSO Storage Pumps activated, which will transfer flows from the Primary Lagoon to the Secondary Lagoon, providing an additional CSO storage capability of 52.4 million gallons. The "Secondary CSO Storage" capacity is, however, only available at the flow rate of the CSO Storage pumps, which will initially consist of 3 ea. 40 MGD pumps.

Continuous transfer of CSO to the West WWTP for excess flow treatment (49.6 MGD), or full wastewater treatment up to the remaining capacity of the plant can also be initiated at any time during a CSO event.

During design of the lagoons, options will be evaluated for aerating the lagoons to prevent septicity by maintaining dissolved oxygen levels.

Figure 17

e. West WWTP Plant #2 Excess Flow Conversion

Plant #2 at the West WWTP, rated for maximum flow of 4.2 MGD, consists of an activated sludge process designed to provide nitrification. The process includes four aeration tanks (1 MG total capacity) and two final settling tanks. Prior to aeration, flow is screened and grit is removed in a common headworks with Plant #1. A dry-pit, three-pump, centrifugal pump station pumps flow to the Plant #2 aeration tanks.

Plant #2 is presently rarely used, due to the efficiency and conservative design of Plant #3. Plant #1 and #3 are able to consistently treat the maximum permitted design flow of 45.0 MGD, without Plant #2 in operation. This is made possible by increasing the flow through Plant #3 that would ordinarily be treated through Plant #2. With this demonstrated ability to treat additional flows, BNWRD proposes to re-rate Plant #3 from an average Dry Weather Flow (DWF) of 7.2 MGD to 9.3 MGD, and from a Design Maximum Flow (DMF) of 14.4 MGD to 18.6 MGD.

By re-rating Plant #3, Plant #2 can be used for additional excess flow capacity. Plant #2 is limited in excess flow treatment by the IEPA design standard of one-hour detention. At a total capacity of 316,000 gallons, the Plant #2 settling tanks are limited to 7.58 MGD excess flow.

Few modifications would be required to allow Plant #2 to treat excess flow up to 7.58 MGD. The headworks, pumps and piping are adequately sized to handle this flow. Although Plant #2 influent pumps are adequately sized for 7.58 MGD, these pumps are 35 years old and are now obsolete. The existing pumps have a tangential discharge. Pumps currently manufactured have centerline discharge. As a result, replacement parts for the existing pumps require long delivery times and may not be available in the future. Due to the age and wear, these pumps should be budgeted for replacement with modifications to Plant #2.

Plant #2 settling tank effluent is currently combined with Plant #1 effluent and pumped to the tertiary filters before discharge to Sugar Creek. If Plant #2 is used for excess flow treatment, the effluent will be discharged directly to the creek instead of being filtered. Valving currently exists for direct discharge of Plant #2 effluent to the creek. With the direct discharge to the creek, the creek can potentially rise to a level at which it will back up into the Plant #2 settling tanks. The current high water level in the settling tanks is 737.97, which provides for 2'3" of freeboard. At this water level, the creek would have to rise to a level that would represent a storm frequency between 10 and 25 years, based on the IDOT flood study of Sugar Creek. With the creek at high level, Plant #2 could not be used. The influent pumps would be turned off and the slide gate closed. Due to the infrequency of this occurring, manual shutdown of Plant #2 may be warranted.

To operate Plant #2 during larger storm events, modifications to the plant could be considered. The weirs could be raised in the settling tanks to provide less freeboard. This would allow use of Plant #2 during a 50- to 100-year storm. Additional modifications could be made to provide pumping of Plant #2 effluent to the creek, but may not be justified due to the few times they would be used. Required improvements to Plant #2 will be evaluated on the basis of the CSO system performance monitoring.

f. West WWTP Excess Flow Facilities

The excess flows facility at the West WWTP, constructed in the mid-1970's consist of 2 ea. 1.74 MG (80 ft x 146 ft x 10 ft operating depth) concrete detention tanks providing a one-hour detention at 42 MGD. Flows in excess of the 45 MGD WWTP capacity are discharged over a weir following the Plant #3 aerated grit chambers. The flow is then transferred via 2 ea. 21 MGD capacity screw pumps to the detention tanks. A Parshall flume is used for excess flow monitoring. Sludge collection in the tanks consists of bridge rail-type solids raking mechanisms and sludge/solids augers located in a trough at the end of the sloped basins. The equipment is dated and no longer in production. Currently, the BNWRD Staff drains the tank at the end of a storm via a drain line to the far west influent sewer or by sludge transfer pumps and forcemain at the aerated sludge holding tanks. Residual solids after draindown are then manually removed by operations personnel.

Replacement of the existing solids collection equipment with an automated flushing type system is scheduled for process alternative analysis and cost study in BNWRD's 25-Year Capital Improvements Plan for the 2003/2004 timeframe.

g. System Operation; Controls; SCADA

Figure 5 indicates preliminary process sensor and control elements proposed for the CSO System. These remote sensors will be linked by telemetry to the West WWTP Control Facility and integrated into the existing plant process control operations. New operator interface screens will be developed with appropriate programming and sequencing for operating, monitoring and data logging/trending. Fundamental operational elements include:

(1) Flow Data Monitoring (rate) and totalization (volume) at various strategic points in the CSO collection system for system operation and performance monitoring/evaluation.

(2) Remote activation and status monitoring of all pump stations (West Slough Junction Chamber Solids Transfer and Draindown; 60-inch stored CSO Transfer Pipeline draindown pump station; CSO Lagoon Influent Structure solids transfer and draindown pump station; CSO Storage Transfer Pump Station).

(3) Remote Monitoring of Emergency Power Facilities

(4) Remote Actuation of Motorized Gates at the CSO Lagoon Interconnection Pipelines; CSO Transfer Pipeline; and Future West Slough Junction Chamber Emergency Overflow)

(5) Plants 1 and 3 Influent Flow Rate; Excess Flow Treatment Flow Rate/Volume

(6) Plant 2 Excess Flow Pump Station Monitoring/Activation; Aerated Detention Activation, Status Monitoring, D.O. Level Setpoint Modulation; Excess Flow Clarification Activation and Status Monitoring.

(7) Lagoon Level Monitoring and Volume (as a function of depth)

Additional monitoring systems and operational algorithms will be added as required during system design.

C. System Performance Expectations, Monitoring and System Expansion

1. CSO System Performance Capability Summary.

a. Hungarian Club CSO Interceptor - Hungarian Club Junction Area to Graham Street Transfer Capacity: 54.1 MGD

b. Graham Street CSO Interceptors - Graham Street to West Slough Transfer Capacity: 328 MGD

c. West Slough CSO Interceptors - West Slough to CSO Lagoons Transfer Capacity: 1120 MGD

d. Primary Lagoon Base Storage Capacity: 0.65 MG

Secondary Lagoon Base Storage Capacity: 7.9 MG

Pipe Storage Capacity: <u>6.8 MG</u>

Total System Base Storage Capacity: 15.35 MG

Available at System Flow Rate of up to 1120 MGD

e. Additional System Storage Capacity: 52.4 MG
(After Base Storage exhausted)

Available at Rate of 40 to 120 MGD

f. Stored CSO Transfer and Treatment:

(1) Up to 42 MGD existing excess flow preliminary (screening/grit removal) and primary (at one-hr detention) treatment

(2) Up to 7.6 MGD additional Plant #2 excess flow preliminary (screening/grit removal), aerated detention (3-hr) and primary (at 1-hr detention) treatment

(3) Delayed draindown (post storm dry weather period) with <u>full</u> treatment up to the residual available treatment capacity the West Plant.

2. System Performance Monitoring

System performance will be monitored to determine its capability and response to variable storm events over a period of two to five years with emergency overflow provided at the existing west slough berm elevation. At completion of the monitoring period, BNWRD will, as a minimum:

(a) Construct West Slough Outlet transition structure and 3 ea. 96-inch CSO sewers to the West Sough Junction box.

(b) Complete Construction of the West Slough Junction Structure to the 100-Year Flood elevation with a gated emergency overflow outlet.

Full performance capability of the CSO system is a function of numerous variables which cannot be fully quantified at this time, including:

(a) Frequency and duration of storm events

(b) The CSO volume associated with these events

(c) CSO flow impacts when fully decoupled from creek backwater effects.

(d) Response of the system to storms occurring over a variable area in the watershed.

(e) Response lag/correlation of flows at the West WWTP, Excess Flow Treatment; and CSO Flows

(f) Actual peak flows occurring at the Hungarian Club Area, Graham Street and West Slough outfalls. Flow volumes for variable storm frequencies and duration at these existing outlet points.

(g) The projected peak storm event at which the system has reached capacity.

As indicated on Figure 5 flow monitors will be installed at strategic points in the CSO collection system to allow quantification of actual flow rates/volumes and development of system hydrographs. The data collected will allow some reasonable level of analysis, extrapolation and risk assessment to determine additional system improvement, if required.

3. System Expansion

At completion of the System Performance Monitoring, BNWRD will evaluate options for system expansion as noted previously on the report. These options may include:

a. No further improvements warranted. CSO occurrences are rare and only associated with major storm events.

b. Add CSO Screens at the West Slough Overflow Structure for preliminary screening of minor, infrequent overflows.

c. Add CSO storage pumps at the CSO storage lagoons to further reduce CSO frequency.

d. Add excess flow treatment facilities at the West WWTP to increase treatment capacity and further reduce CSO frequency.

e. A combination of b, c, and/or d above.

f. Improvements at the Plant #2 Excess Flow Treatment Facilities.

D. Environmental Impacts

1. Existing Conditions

a. Sensitive Environmental Areas

No sensitive environmental areas or endangered species are known to exist within the areas affected by the project. Signoffs will be obtained from the Illinois Department of Natural Resources for endangered species.

b. Historical Areas

The project will be confined to the berm of Sugar Creek and the future lagoon site, which is currently farmed. No existing buildings are within the project limits. Signoffs will be obtained from the Illinois Historic Preservation Agency for historical and cultural resources.

c. Effluent and Water Quality Standards

CSO discharges are currently required by IEPA permit to meet the Nine Minimum Controls established by the CSO Control Policy, dated April 19, 1994. The CSO control plan will enhance compliance with these control measures. In addition, water quality of Sugar Creek will be improved with the proposed CSO Control Plan by the elimination of several CSO discharges and reduction of overflow frequency from the remaining CSO discharges.

2. Direct Environmental Impacts

a. The proposed CSO elimination and treatment project will not impact known historical, archeological, geological, cultural, or recreation areas. State signoffs will be obtained for historical, archeological, and cultural resources.

b. The West Slough overflow structure will be constructed within the floodway of Sugar Creek. This structure will be permitted through the Division of Water Resources. Hydraulic models of Sugar Creek will be performed as required for this permitting process to insure that the construction will not significantly effect flood levels in Sugar Creek. Due to the reduction of CSO overflow frequency and discharge volume, the effect of flooding may be reduced with the CSO project.

c. Crossing of Sugar Creek will be required at the West Slough. This crossing will be constructed and permitted within IEPA design standards.

d. The project will not impact sensitive ecosystems or wetlands.

e. The project will not impact wild or scenic rivers.

e. The proposed CSO storage lagoon will be constructed on a 28-acre property currently used as agricultural. This location is within the Facility Planning Area for BNWRD. Signoffs, if required, will be obtained from the Illinois Department of Agriculture for this construction.

f. The project will not adversely affect air quality.

E. Other Alternatives Considered

Additional alternatives were considered for elimination and treatment of the Hungarian Club, Graham Street, and West Slough CSOs. These alternatives are detailed in reports dated August 1999, November 15, 2000, and August 2000, as well as subsequent analysis performed prior to this report. These alternatives included:

1. Screening of CSO discharge with direct discharge to Sugar Creek

2. Screening and partial storage of CSO flow prior to discharge to Sugar Creek

Screening with direct discharge did not reduce the frequency of discharge from the CSO outfalls. While floatables would be removed, overall water quality of the creek would not be improved.

Detention of CSO flows at the individual CSO locations was considered with screening of flow that ultimately discharged to Sugar Creek. Due to the limited area available at the individual CSO sites, limited CSO detention could be provided. While these detention basins/tanks would reduce CSO overflow frequency, several CSO discharges at the Graham Street and West Slough CSO locations would still have the potential to occur each year.

Both of these alternatives fell short of the goals established by BNWRD for management of their CSO outfalls and were no longer considered.

IV. FINANCING PLAN

A. Budget Estimates

A summary of the cost estimates for the CSO Improvement project is found below in Table 6. Following the summary, in Tables 7, 8, and 9 are detailed cost breakdowns of major components of the CSO plan that have yet to be completed

Table 6
BNWRD/COB CSO Improvements
Summary Budget Estimate
3-24-03

CSO Improvements Completed to Date		
1.	Graham Street CSO Flow Monitoring	$60,000
2.	60-inch Hungarian Club CSO Interceptor	$1,620,000
3.	Lagoon Site Purchase	$707,000
CSO Improvements to be Completed		
1.	CSO Treatment Lagoons	$4,667,000
2.	West Slough CSO Interceptor – Ph. 1	$5,091,000
3.	West Slough CSO Interceptor – Ph. 2	$1,614,000
4.	Graham Street CSO Interceptor	$2,771,000
5.	Hungarian Club CSO Interconnections	$360,000
	CSO Improvement Project Total	**$16,890,000**

TABLE 7

TABLE 7 CONTINUED

TABLE 8

TABLE 9

B. Revenue/Financing Sources

The CSO Improvements will be financed with a combination of general revenue funds, a State Tribal Assistance Grant (STAG), and a low interest IEPA loan.

With the exception of the West Slough CSO Interceptor, the project will be financed strictly from general revenue and the STAG. The STAG issued to the BNWRD totals $1,838,900, of which approximately $1,300,000 will be used for the CSO improvements.

The West Slough CSO Interceptor will be financed with a low interest IEPA loan. Repayment of this loan will occur over a 20-year period. Dedicated payments will be made through an agreement with the City of Bloomington. The City will reimburse BNWRD through a new Storm Water Utility fee charged to all residential and commercial properties within the City. Property owners will be assessed a fee on monthly water bills for access to storm water utilities based on the drainage area and characteristics of the property.

V. IMPLEMENTATION PHASING AND SCHEDULE

A Financing Plan and Schedule is provided in Table 10. Construction of the Hungarian Club CSO Interceptor has already been completed, in order to have pipe installed through the White Oak Park area before improvements to the Park were complete. Remaining portions of the project will be completed starting with the CSO Lagoon and West Slough CSO Interceptor – Phase 1. With these portions complete, CSO discharges from the West Slough CSO will be diverted to the CSO Lagoons for treatment. The project will be completed by the end of 2006, with the construction of the Graham Street CSO Interceptor and Hungarian Club CSO Interconnections. After the entire CSO system is operated, monitored, and data collected on system effectiveness, a decision will be made regarding the timing of construction for the West Slough CSO Interceptor – Phase 2, which would enclose the existing paved ditch at this location.

A detailed schedule of CSO Improvements is also provided in Table 11.

TABLE 10

TABLE 11

APPENDIX A

BNWRD NPDES PERMIT

APPENDIX B

CITY OF BLOOMINGTON

NPDES PERMIT