City of Anderson

CSO LTCP Alternatives Evaluation
"White Paper"
January 2014

DRAFT

A Wealth of Resources to Master a Common Goal

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ABSTRACT

The purpose of this document is to offer observations and recommendations pertaining to the subsequent phases of the City of Anderson's Long Term Control Plan (LTCP). The document contains the following basic elements:

A. A summary of and basis for the City of Anderson's (City's) approved Long Term Control Plan (LTCP), corresponding existing LTCP recommendations, and work status.

B. A summary of recommendations the City should consider prior to proceeding with additional approved LTCP work.

C. A summary of Commonwealth Engineers Inc.'s (Commonwealth's) work experience documenting our qualifications and how we have helped other communities with the same challenges facing the City of Anderson.

EXECUTIVE SUMMARY OF LTCP RECOMMENDATIONS

Planning, assumptions, and decisions made in correlation to the 2010 CSO LTCP assembly and submittal should be reviewed in 2014 to ensure that the current and anticipated future needs and interests of the City of Anderson are accommodated.

Several opportunities for review and development are noted below:

A. The City's LTCP was approved by IDEM in 2010 on the basis that upon full implementation a maximum annual average of eight (8) untreated overflows will result in a typical rainfall year from the most active CSO (007). Three additional CSOs (016, 003, and 022) are anticipated to activate at a lesser frequencies (1 to 6 overflows per year) in a typical rainfall year upon full implementation of the LTCP. The City's Financial Capability Analysis (FCA) was a critical component to the approval of this level of control as more costly controls would result in substantial and widespread social and economic burden.

Recommendation: It would be prudent at this time to revisit the FCA.

B. The estimated $161-million cost for full implementation of the LTCP is identified as being solely associated with capital improvements and equating to a 2% MHI increase to rate-payers. Typically, LTCP associated non-construction costs such as Engineering and Post-Construction Monitoring are included in this calculation, which would raise the burden on rate-payers well beyond the 2% MHI.

Recommendation: It would be prudent at this time to revisit LTCP project related costs with respect to the FCA estimated 2% of MHI.

C. The demands associated with running a City are dynamic. Since the date of the City's 2010 LTCP approval, opportunities and challenges not fully developed or known have likely come to light. Example opportunities and challenges include:

1. The disconnection of Town of Chesterfield / Town of Daleville / Mounds State Park and corresponding loss of flow and revenue.
2. The continued development of the Mounds Lake concept.
3. The fiscal demands associated with the upcoming water treatment facilities improvements projects.

<u>Recommendation</u>: It would be prudent at this time to revisit the LTCP Improvements with respect to the City's current needs, opportunities, and fiscal changes.

D. The City's LTCP was assembled utilizing model projected effectiveness of planned improvements. The XPSWMM sewer model was calibrated utilizing 2003 flow data. More than 10-years have passed since the model calibration. Over the past 10-years, significant changes have occurred that affect the performance, demands, and response of the collection system. Further, the sewer model was noted as having a margin of error of $^{+}/_{-}$ 20% when calibrated in 2003. Given the passage of time, corresponding improvements and modifications to the system, and natural deterioration of the system due to age (and corresponding effect on system performance), the model's ability to be used as a predictive tool has likely diminished.

<u>Recommendation</u>: It would be prudent at this time to revisit and update the assumptions and calibration of the model to more accurately predict the Combined Sewer System (CSS) response with respect to proposed and alternate improvements projects.

E. The City's LTCP was assembled with the assumption that 25% of the existing CSS, sewers greater than 24-inch diameter, will require and receive CIPP correction. Phase I Collection System Sewer Televising is complete. The development of a recommended improvements plan is scheduled to occur in 2014.

<u>Recommendation</u>: It would be prudent at this time to incorporate updated CSS remedial planning costs and updated assumed effects through review of the collection system sewer televising. Development of desired corrective actions and the potential incorporation of high-priority manhole remediation should also be considered.

F. The City's LTCP anticipated implementing a downspout and perimeter drain disconnection program. The LTCP estimated approximately 2,350 homes with downspout connections and 1,175 homes with perimeter drain connections. The LTCP further identified a plan to provide $400 / household with connected downspouts and perimeter drains to subsidize disconnection as part of Phase II improvements.

<u>Recommendation</u>: It would be prudent at this time to revisit this plan and the likelihood of homeowner participation. The implementation of a long-term sewer

lateral remedial component at the time a house is purchased is also recommended.

G. The City's LTCP developed alternatives focused solely on flow conveyance and storage. During the CSO LTCP assembly work sessions, many other options, such as satellite treatment, were eliminated through discussion without a cost to benefit analysis.

Recommendation: It would be prudent at this time to revisit available alternatives with respect to updated costs, updated CSS performance modeling, and current day innovative alternative technologies.

H. Maximizing peak wet weather treatment at the City's WWTP is required through the City's National Pollutant Discharge Elimination System (NPDES) permit; as administered through the City's CSO Operational Plan. Non-Rule Policy (NRP) Document Water-016 identifies that combined sewage flows associated with the one year, one hour design storm are indicative of the "first-flush" of pollutants from a combined sewer system. This 1-year, 1-hour storm approach, however, is non-applicable for the City due to the adoption of a "presumptive approach". However, the concept of quantifying the first flush is acutely applicable.

Recommendation: The first flush of the City's combined sewer system should be quantified (i.e. through the development of a solids loading curve during a rain event) to demonstrate at what point the first flush receives full treatment through the City's WWTP. This would afford further optimization and consideration of cost effective alternative technology solutions at satellite locations in the collection system.

I. During the CSO LTCP assembly workshops, the City noted a desire to incorporate "recreational facilities" in conjunction with above ground construction work. The current CSO LTCP plan does not clearly address this requirement.

Recommendation: It may prove beneficial to revisit "recreational facilities" opportunities associated with updated CSO LTCP Improvements Alternatives to boost public support of the LTCP project moving forward.

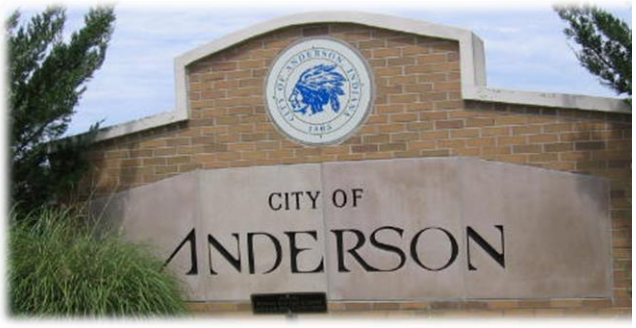
The City of Anderson has many viable opportunities to optimize the performance and cost-effectiveness of its LTCP. In addition, State and federal regulators have recently been taking a hard look at the matrix utilized to determine the financial ability for a CSO community to implement unfunded mandates, such as the City's LTCP. **Such flexibility did not exist when the City's LTCP was negotiated in 2010!**

Commonwealth's team of professionals ranging from professional engineers, environmental scientists, and environmental compliance managers has the experience and expertise to assist the City of Anderson with the next steps of your LTCP. **We welcome the opportunity to discuss cost-saving LTCP opportunities with you!**

SUMMARY OF EXISTING APPROVED LTCP

Introduction / Background

The City of Anderson is currently in the process of implementing their Long Term Control Plan (LTCP) to reduce the frequency and volume of discharge of combined sewage to the West Fork of the White River. The approved LTCP requires collection and treatment system improvements that primarily consist of:



A. Increasing the wastewater treatment plant (WWTP) design capacity from 21.25 MGD (biological) to 54 MGD: 34 MGD (biological) and 20 MGD (wet weather treatment).

B. Increasing conveyance / storage capacity within the collection system:

   1. Morton Street in-line storage.
   2. Athletic Park Conveyance – Combined Sewer Overflow (CSO) 026 to CSO 016.
   3. Tunnel Storage Conveyance (from CSO 013 to Emge Property) with a dewatering Pump Station / Screening Structure.
   4. Interceptor conveyance from CSO 014 & 015 to the proposed tunnel.

C. Existing Collection System Improvements:

   1. 25% cured-in-place pipe (CIPP) lining of all interceptors greater than 24-inch in diameter.
   2. Disconnection of all downspouts and perimeter drains.

The approved LTCP also acknowledges previous work efforts that facilitate a reduction in CSO frequency and volume:

A. CSO Structure Weir Modifications (raising of weirs to increase existing system storage capacity).

B. Effluent Filters Rehabilitation.

C. Lindburg Road Lift Station Improvements.

D. Park Road Lift Station and Force Main.

E. Separation of 53rd Street Lift Station from the combined sewer system (CSS) – i.e. pumping directly to the WWTP.

F. Miscellaneous “other” sewer separation projects.

The LTCP further identifies miscellaneous storm water improvements projects that are planned separate from the LTCP but would likely have a positive impact on the overall collection system.

Basis of Proposed Work Scope

The City's CSO LTCP was approved by IDEM / EPA in 2010 on the basis that upon full implementation an annual maximum average of eight (8) untreated overflows will occur in a typical rainfall year as shown below in **Table 1 – LTCP Approval Performance Basis**.

Table 1 – LTCP Approval Performance Basis

CSO Location	CSOs / Typical Year
007	8
016	6
003	3
022	1

The City's Financial Capability Analysis (FCA) was a critical component to the approval of this level of control as more costly controls were demonstrated to result in substantial and widespread social and economic burden. This level of control was based on the 1994 Federal CSO Control Policy and is referred to as the "presumption" approach.

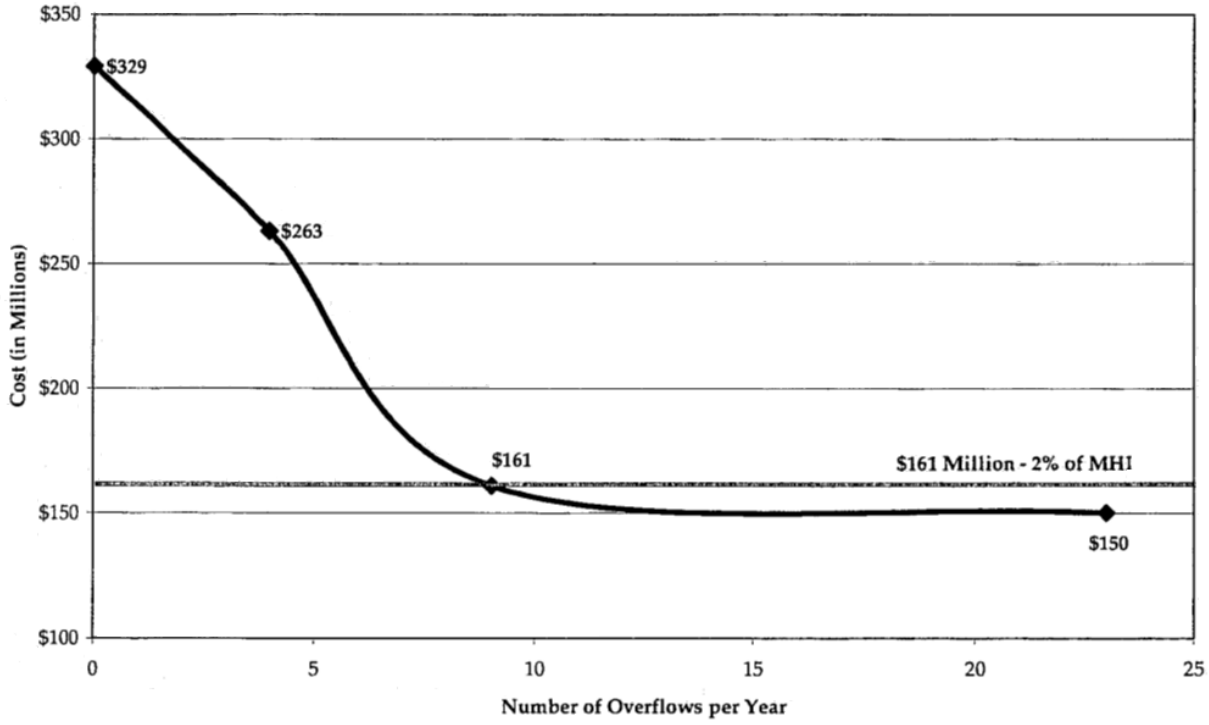
Figure 1 – LTCP Improvements Costs Versus Resulting Number of Overflows illustrates the City's costs of the LTCP alternatives capital improvements with respect to assessed effectiveness in reducing CSOs. From the referenced figure, the LTCP identified:

A. The "knee of the curve" (i.e. the most benefit achieved with respect to costs incurred) supports a cost-effective selection of a maximum of eight (8) overflow events per typical year.

B. The costs associated with implementing the LTCP outlined projects which limits overflows to a maximum of eight (8) per typical year is approximately $161-million (construction costs), which also correlates to 2% of the City's median household income (MHI).

The 2% of MHI is recognized by the regulatory agencies as the threshold between creating a medium financial burden on the community to creating a high financial burden on the community.

Figure 1 – LTCP Improvements Alternatives Costs Versus Resulting Number of Overflows (Note: Figure 8-1 obtained from 2010 CSO LTCP)



LTCP Assembly Resources

Significant effort and many varying resources were utilized in assembling the City's approved LTCP. The major resources and their corresponding applications / findings utilized in the assembly of the LTCP are noted below in **Table 2 – LTCP Resources and Applications**.

Table 2 – LTCP Resources and Applications

Resource	Date	Purpose
Flow Monitoring Program	2003	Data gathered and utilized to develop and calibrate collection system and receiving water models.
Stream Reach Characterization Evaluation Report (SRCER)	2005	Determination of pollutants of concern for CSO discharges to the West Fork of the White River. [1]
Receiving Stream and Sewer System Modeling Report	2007	Developed and calibrated models for CSO LTCP Alternatives Analysis. [2]
Financial Capability Assessment	2007	Contained in the LTCP based on 2007 Median Household Income and 2006 demographics (i.e. population). [3]

Notes:

1 ***Primary pollutant of concern is E-Coli; Secondary pollutants of concern are $CBOD_5$, Copper, Lead and Ammonia.***

2 ***Dry weather flow calibration and validation from data collected in 2003 (flow monitoring program).***

3 ***Identified the capital investment dollars equivalent to 2% of MHI ($161M).***

LTCP Coordination Workshops

The approach utilized to formulate the content of the LTCP relied heavily on project coordination workshops. Four (4) workshops were held with the Owner to pare down the potential LTCP alternative solutions. It is important to understand both the timeline and basis of decisions prior to examining the potential for alternative solutions. A summary of these workshops and the corresponding key outcomes are summarized below in **Table 3 – LTCP Workshops Summary**.

Table 3 – LTCP Workshops Summary

Wkshp	Date	Objective	Key Outcome(s)
1	5-9-06	Provide understanding of the alternatives evaluation process and screen potential alternatives with a primary goal of bacteria reduction in the river.	▪ Treatment technologies at the CSO were eliminated. [1] ▪ The option to completely separate the sewers was eliminated. [2] ▪ Two (2) alternative concepts were selected for further development and evaluation: Storage Tanks and Tunnel Storage / Parallel Conveyance Interceptors.
2	5-12-06	Identify potential satellite sites for CSO control facilities.	7 Sites were Identified, 1 of the 7 eliminated through discussion: 1. Emge Property 2. ~~Riverbend Park~~ [3] 3. Delaware St. Wetlands [4] 4. Athletic Park 5. 12th St. School 6. Speedway Property 7. Edgewood Park
3	10-12-06	Discuss flow maximization at the WWTP and integration of the CSO control technology concepts into three (3) or more alternatives.	▪ WWTPs will be upgraded from 21.25 MGD to 54 MGD. [5] ▪ Convey flow from Pittsford Ditch to Athletic Park (rather than a tank at Pittsford Ditch). ▪ Tunnel alternative to WWTP is preferred. [6, 7]
4	7-24-07	Integrate preliminary alternatives into two (2) final alternatives for development.	▪ Four (4) Tank Alternatives and Five (5) Tunnel Alternatives were reviewed. ▪ Tank Alternative 3 and Tunnel Alternative 5 were selected.

Notes:

1 ***The stated reason for the elimination of local CSO treatment local is "more complex, good option if space is limited."***

2 ***Separation was eliminated due a concern over the disruptive nature of the work.***

3 ***Site eliminated due to its close proximity to the Emge Property.***

4 ***Noted as a disposal site 30+ years ago. Concern if chosen environmental issues may arise.***

5 ***Many of the WWTPs upgrades are noted required due to both the Consent Decree and the age/condition of facilities.***

6 ***It was noted desirable to incorporate recreational facilities above the construction.***

7 ***It was later decided to also evaluate Enhanced High Rate Clarification at the Emge Site (in addition to storage facilities).***

LTCP Integrated Alternatives Developed

Two (2) alternatives, one supportive of off-line storage tanks and the other supportive of storage / conveyance tunnels and parallel interceptors were developed as a result of the coordination workshops. These two (2) alternatives were integrated into a plan supportive of upgrading the WWTP's design flow from 21.25 MGD to 54 MGD (34 MGD full treatment, 20 MGD wet weather treatment). These improvements are generally summarized below in **Table 4 - LTCP Integrated Alternatives.**

Table 4 – LTCP Integrated Alternatives

Alternative	General Description
WWTP Improvements	Biological Facilities (34 MGD) ▪ 34 MGD Headworks (26 MGD new 8 MGD existing) ▪ 34 MGD Primary Clarification (34 MGD new) ▪ 34 MGD Aeration (thru conversion of Old Plant Primaries) ▪ *54 MGD BioTowers* [1] ▪ *54 MGD Tertiary Filters (upgraded as part of early action projects)* [1] ▪ *54 MGD Disinfection (35 MGD existing 19 MGD new)* [1] Wet Weather Facilities (20 MGD) [2] ▪ 20 MGD Headworks (existing) ▪ 20 MGD Primary Clarifiers (existing) ▪ 20 MGD Primary Effluent Pump Station (existing) ▪ *54 MGD BioTowers* [1] ▪ *54 MGD Tertiary Filters (upgraded as part of early action projects)* [1] ▪ *54 MGD Disinfection (35 MGD existing, 19 MGD new)*[1]
Tunnel Alternative 5	▪ Parallel Interceptor from CSO 026 to Athletic Park ▪ CSO Storage at Athletic Park ▪ In-line Storage at Morton Street ▪ CSO Storage Tunnel from CSO 013 to Emge Property ▪ CSO Storage tank at Emge Property
Tank Alternative 3	▪ Parallel Interceptor from Pittsford Ditch to Athletic Park ▪ CSO Storage Tank at Athletic Park ▪ CSO Storage Tank at 12th Street School ▪ Parallel Interceptor from CSO 015 to Emge Property ▪ CSO Storage Tank at Emge Property
Notes: [1] ***The BioTowers, Tertiary Filters, and Disinfection are common to both biological and wet weather treatment.*** [2] ***The recombination approach required a no feasible alternative analysis.***	

The above integrated alternatives were then modeled supportive of 12, 6, 4, 3, 2, and 1 overflows per year (36, 18, 12, 9, 6, and 3 overflows per every 3-years) and costs for implementing said alternatives assembled. Through an iterative approach, a plan supportive of eight (8) overflows per typical year, adhering to a knee of the curve cost versus benefit analysis at 2% MHI was recommended.

LTCP Recommended / Approved Plan

Figure 2 – WWTP LTCP Improvements Schematic and Figure 3 – Proposed LTCP Improvements Aerial Location Map, recreated from information obtained in the LTCP (Figures 10.2-1 and 4.4-2) generally illustrate the recommended and approved LTCP improvements. As previously noted, the LTCP improvements are anticipated to provide a level of control of eight (8) overflows per typical year at a construction cost estimated to be $161M. The LTCP improvements generally consist of the following:

A. Upgrade of the WWTP from 21.25 MGD to 54 MGD: 34 MGD (biological) and 20 MGD (wet weather).

B. Storage and conveyance tunnel – 18-foot diameter tunnel from CSO 013 to Emge Property.

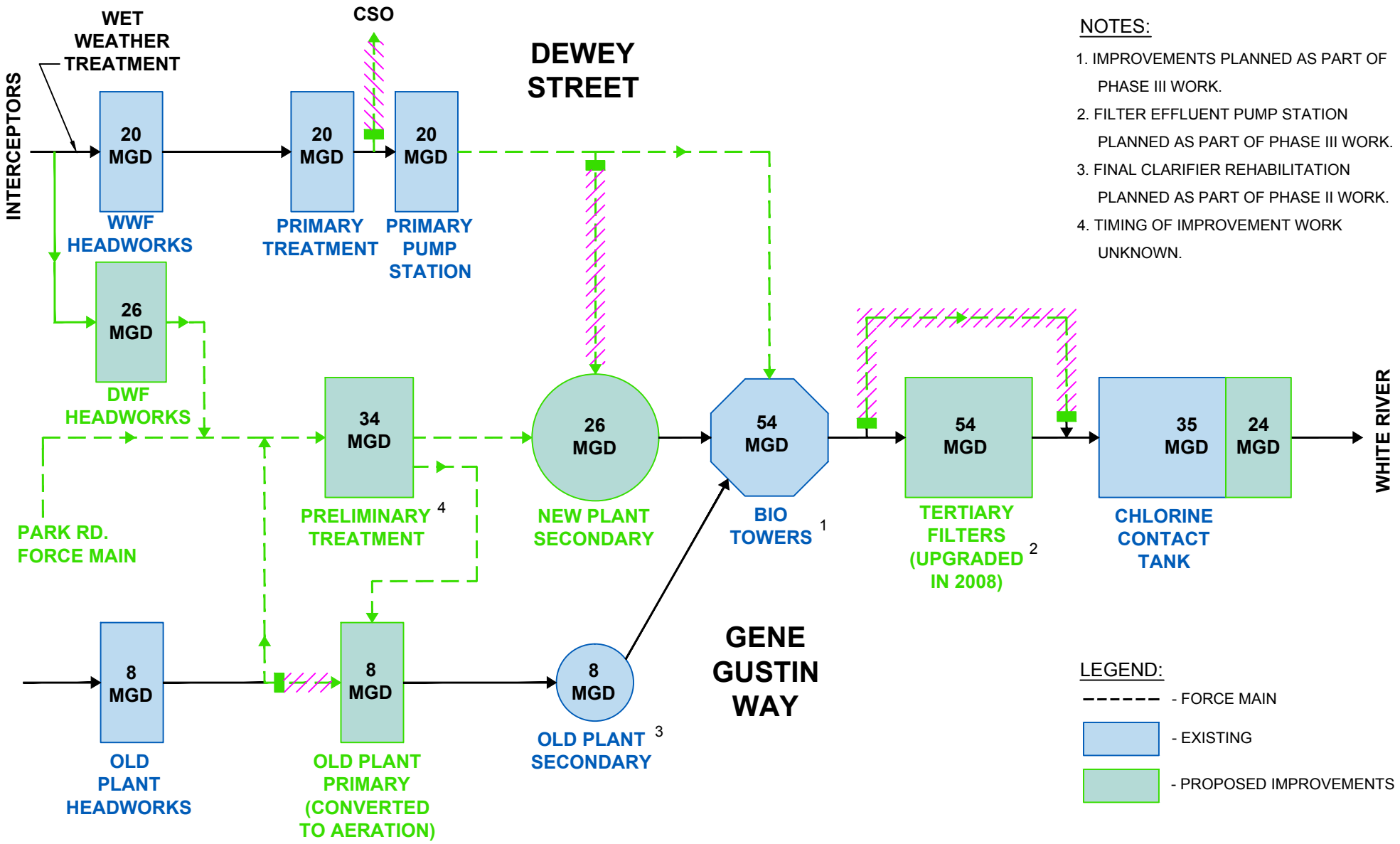
C. Parallel Interceptor (CSO 026 to CSO 22).

D. New Sewer (CSO 022 to CSO 016).

E. Inflatable Dam at CSO 013 (to provide storage in the existing 108-inch sewer).

Implementation Schedule, Work Status, & Estimate Costs

Three (3) work phases have been identified. The time frame and general description of the required work, the implementation status, and the LTCP estimated capital costs are summarized in below **Tables 5, 6, 7, and 8**.



COMMONWEALTH ENGINEERS, INC.

CITY OF ANDERSON, INDIANA
MADISON COUNTY

ANDERSON LTCP PEER REVIEW PROJECT

WWTP LTCP IMPROVEMENTS SCHEMATIC

FIGURE No. 2

LEGEND:

- EXISTING SEWER 3□"□
- EXISTING CSO LOCATIONS
- PROPOSED LTCP IMPROVEMENTS

SCALE: 1"□1□□□□

1□□□□ □ 1□□□□

CSO 005
CSO 006
CSO 007
CSO 009
CSO 011
CSO 012
CSO 013
CSO 014
CSO 015
CSO 016
CSO 017
CSO 019
CSO 020
CSO 021
CSO 022
CSO 025
CSO 026

PUMP STATION

DEWEY STREET FACILITY

18' STORAGE TUNNEL

48"

72"

30"

24"

72" SEWER

48" SEWER

30" SEWER

INLINE STORAGE

BROADWAY ST.

MADISON AVE.

JACKSON ST.

SCATTERFIELD RD.

8th ST.

8th ST.

COMMONWEALTH ENGINEERS, INC.

CITY OF ANDERSON, INDIANA
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ANDERSON LTCP PEER REVIEW PROJECT

PROPOSED LTCP IMPROVEMENTS
AERIAL LOCATION MAP

FIGURE No.

3

Table 5 – 20 Year Implementation Schedule Summarized
Phase I: Years 1 thru 5 (i.e. 2010 thru 2014)

Description	Status
Division I WWTP Improvements	Complete
Division II WWTP Improvements	In Construction
In Line Storage – Morton Street	Complete
Collection System Sewer Televising (program development, implementation, and recommendations)	Televising Complete
Park Road Force Main	Complete
Division I Athletic Park Conveyance	Complete
Post Construction Monitoring	Anticipated to be Required

Table 6 – 20 Year Implementation Schedule Summarized
Phase II: Years 6 thru 10 (i.e. 2015 thru 2019)

Description	Status
Downspouts & Perimeter Drain Disconnection (program development, implementation, and recommendations)	TBD
Division III WWTP Improvements	TBD
Division II Athletic Park Conveyance	TBD
Division IV WWTP Improvements	TBD
Division I Collection System Repair	TBD
Post Construction Monitoring	Anticipated to be Required

Table 7 – 20 Year Implementation Schedule Summarized
Phase III: Years 11 thru 20 (2020 thru 2029)

Description	Status
Storage Tunnel	TBD
Division II Collection System Repair	TBD
Emge Conveyance	TBD
Post Construction Monitoring	Anticipated to be Required

Table 8 – Estimated LTCP Capital Costs
Phase I: Years 1 thru 5 (2010 thru 2014)

Phase	Capital Cost
Phase I (Years 1 thru 5)	$38,483,000
Phase II (Years 6 thru 10)	$35,347,000
Phase III (Years 11 thru 20)	$87,096,000
Sub-Total (Years 1 thru 20)	$160,926,000
Total Estimated O&M (annual)	$2,015,000
Total Present Worth of O&M (20-years @ 5%)	$25,111,000
Total Present Worth	$186,037,000
Notes: ***Costs obtained from LTCP, Table 10.2-1*** ***Costs for the parallel interceptors, in-line storage, and storage tunnel account for $103M of the $161M estimated capital costs (i.e. approximately 2/3^{rds}).***	

LTCP RECOMMENDATIONS

In 2014, the City will complete Phase I of their LTCP Improvements. Remaining activities in 2014 are anticipated to include:

A. Finalization of the Division II WWTP Improvements.

B. Development of Recommended Collection System Improvements Projects.

C. Post Construction Monitoring.

Post Construction Monitoring provides an opportunity to assess the implemented projects efficacy, and fine tune and revisit the City's future LTCP project needs.

Summary of Recommendations

Planning, assumptions, and decisions made in correlation to the 2010 CSO LTCP assembly and submittal should be reviewed in 2014 to ensure the current and anticipated future needs and interests of the City are accommodated. Several opportunities for review and development are noted below:

A. The City's LTCP was approved by IDEM in 2010 on the basis that upon full implementation a maximum annual average of eight (8) untreated overflows will result in a typical rainfall year from the most active CSO (007). Three additional CSOs (016, 003, and 022) are anticipated to activate at a lesser frequencies (1 to 6 overflows per year) in a typical rainfall year upon full implementation of the LTCP. The City's Financial Capability Analysis (FCA) was a critical component to the approval of this level of control as more costly controls would result in substantial and widespread social and economic burden.

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<u>Recommendation</u>: It may prove beneficial to revisit "recreational facilities" opportunities associated with updated CSO LTCP Improvements Alternatives to boost public support of the LTCP project moving forward.

Financial Capability Analysis (FCA) Update Recommendations

As provided in the approved LTCP, the primary factor in determining the overall cost of CSO mitigation or level of control (i.e. % capture of CSO and/or number of CSOs in an annual average precipitation year) is the Financial Capability Analysis (FCA). The City's LTCP approval by the Indiana Department of Environmental Management (IDEM), the Environmental Protection Agency (EPA) and the United States Department of Justice (USDJ) on May 28, 2010 was based on a commitment to spend an estimated $161-million over the twenty (20) year implementation schedule.

The approved LTCP estimates that a maximum of eight (8) untreated overflows in a typical year of rainfall will occur upon full implementation. EPA and IDEM guidance dictates a wastewater cost per median household income indicator of 2.0% is adequately burdensome to ratepayers with respect to mitigating CSOs. As this criterion is woven in multiple guidance documents and is the basis of many LTCPs, it has become revered as the threshold in LTCP negotiations.

Though the FCA, as part of the approved LTCP, was prepared utilizing federal and state guidance documents, it is likely that future LTCP reviews and updates could effectively demonstrate a more realistic burden of the cost of the LTCP improvements on residential ratepayers. Such elements would allow the current LTCP schedule to be reorganized, larger

capital improvements requiring significant rate increases postponed, and total capital cost of the LTCP improvements reduced.

State and federal regulators have recently been taking a hard look at the matrix utilized to determine the financial ability for a CSO community to implement unfunded mandates, such as the City's LTCP. **Such flexibility did not exist when the City's LTCP was negotiated in 2010!**

As the LTCP is a dynamic document that is required to be reviewed every five (5) years from the date of approval, it is in the best interest of the City to revisit the costs and implementation schedule of the LTCP Improvements. Much of the data utilized in an FCA is based on US Census Bureau data. This Census Bureau data has been updated since the time the LTCP was submitted and subsequently approved. Given the magnitude of the LTCP Capital Improvements Plan, likely the largest capital improvements requirements in City history, it is recommended that the City incorporate the following into an updated FCA:

- Elimination of 26,000 jobs over the past 30 years (largely due to closing of the Auto Industry related manufacturing facilities).
- Over a five (5) percent reduction in City population (ratepayers) from 2000 to 2010.
- Over a six (6) percent reduction in Madison County population (partially comprised of ratepayers) from 2000 to 2010.
- Reductions in Industrial Flow and associated revenues that would further increase the burden of paying for LTCP improvements onto residents.

  Note: Oftentimes, as the cost of drinking water services increase, as they have and will continue to in Anderson, industries become more efficient in water usage which also reduces wastewater revenues.
- Increase in the number of low income, poverty customers, and / or those receiving public assistance.
- Inclusion of previously completed and planned stormwater improvements into the wastewater cost per household indicator, as both state and federal agencies have allowed this in previously approved LTCPs.
- Loss of customers associated with disconnections (i.e. Town of Chesterfield, Town of Daleville, and Mounds State Park).
- Inclusion of all eligible LTCP costs (inclusive of not only capital costs but also non-construction and post-construction monitoring costs) into the assessment of burden on the rate-payer resulting from the LTCP Projects.

  Note: It would not be out of the ordinary for these additional costs to boost the overall burden of the LTCP mandate by 15-20%!

Staged Improvements Recommendations

A fixed 20-year LTCP projected need-based improvements approach does not serve the City's best interests. Staged improvements better address current fiscal changes and offer attractive advantages. By staging improvements, the City is afforded the opportunity to prioritize needs and to better accommodate new challenges and potential opportunities.

In 2012, the Town of Chesterfield brought its new WWTP on-line. With that, the City of Anderson was presented with both challenges and opportunities; namely, a corresponding loss of revenue and flow. The City lost the revenue and customer base previously quantified in the FCA. However, the City also removed a maximum peak flow of 2,000 gpm (i.e. the capacity of the Chesterfield Lift Station) within their sewer system and at their WWTP and recognized corresponding flow equalization / storage benefits. Both should be quantified and incorporated into a CSO LTCP update.

In 2013, the study that confirms the feasibility and first steps of pursuing the Mounds Lake Project (a 2,100 acre reservoir drawing on the White River as its water supply) was completed. The efforts are anticipated to require construction of an earthen dam just east of Lynn and 18th Street in Anderson, backing water up in Delaware County to around 300 South and South High Banks Road.

Mounds Lake will likely provide economic stimulus enabling the entire region to grow for years to come. Currently, the Mounds Lake Project's Phase II feasibility study is underway. The study includes engineering and environmental reports. Public access points and mitigation sites are some of the planning components. Trails, recreational sites, new home and business construction are additional anticipated project components.

After completion of the Phase II feasibility study, several years will be required for preliminary design and permitting followed by several more years for final design and construction. The current project schedule implies a completion date of around 2020, assuming funding is obtained.

Figure 4 – Proposed LTCP Improvements with Mounds Lake Aerial Location Map illustrates the currently anticipated impact within the vicinity of the LTCP Recommended Improvements Area - solely associated with the reservoir surface area. Given the City's support for this project, it would be prudent at this time to revisit the planned LTCP Improvements to determine potential synergies with the Mounds Lake project. **This could serve a multi-faceted purpose - garnishing greater public support for the LTCP mandate while accommodating the requirements of the LTCP and complimenting the planned new Mounds Lake!**

In 2014, the City anticipates commencing with much needed water system improvements. The funding for these improvements represents a significant commitment of the City's resources and will undoubtedly represent an increase in the rate-payers monthly water bill. Cash flow considerations and associated corresponding overall burden on the rate-payers should be revisited holistically and incorporated into a phased LTCP Improvements schedule.

LEGEND:

- EXISTING SEWER 3□"□
- EXISTING CSO LOCATIONS
- PROPOSED LTCP IMPROVEMENTS
- PROPOSED MOUNDS LAKE

SCALE: 1"□1□□□□

1□□□□ □ 1□□□□

BROADWAY ST.

CSO 0□5

CSO 0□4

CSO 0□3

CSO 0□2

CSO 0□□

48"

□8□STORAGE TUNNEL

INLINE STORAGE

MADISON AVE.

□ACKSON ST.

CSO 00□

CSO 006

CSO 00□

CSO 005

PUMP STATION

DEWEY STREET FACILITY

8□□ ST.

CSO 0□6

□2"

CSO 0□□

CSO 0□□

CSO 020

30"

CSO 02□

CSO 022

□2" SEWER

48" SEWER

30" SEWER

24"

CSO 025

CSO 026

SCATTERFIELD RD.

8□□ ST.

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CITY OF ANDERSON, INDIANA
MADISON COUNTY

ANDERSON LTCP PEER REVIEW PROJECT

PROPOSED LTCP IMPROVEMENTS WITH MOUNDS LAKE
AERIAL LOCATION MAP

FIGURE No.

4

XPSWMM Sewer System Model Recommendations

XPSWMM is a software platform typically utilized to model combined sewer systems (CSS). The model is calibrated to mimic the response of the sewer system at the time of data collection. This calibrated model is then utilized as a tool to predict the systems response with various improvement alternatives.

As is the case with any model, there is a margin of error associated with its calibration. Many assumptions are built into its assembly. The CSS presumed response to "modeled" improvement alternatives further increases this margin of error as the projects are completed and the response varies from that modeled.

The City's XPSWMM model has been approved by IDEM and the EPA. This approved model was noted to have a $^{+}/_{-}$ 20% margin of error at its time of assembly (utilizing 2003 flow data). Since that time, as is typical for all communities, the system has changed:

- Flow contributors have been added and removed.
- Natural deterioration of the system has occurred increasing infiltration and inflow and altering the CSS's response.
- Development has occurred altering the modeled overland flow of stormwater and corresponding effect on the CSS.
- Improvements projects have been performed for which system response assumptions have not been accounted for within the calibrated system's model.
- LTCP Improvements projects have been completed, for which system response assumptions have been accounted for within the calibrated system model, but whose actual system response may vary from that assumed.

Given the changes throughout the system since the time of calibration, an update to maximize the model's predictive accuracy is prudent. The City is in the process of completing LTCP Phase I Improvements. Post Construction Monitoring is a requirement of Phase I and is scheduled to occur in 2014. It is assumed the flow metering performed to assess the effectiveness of Phase I will be incorporated into the XPSWMM model as the means of assessing projected versus actual effectiveness of the projects and changes to the CSS over the past 10-years. All factors affecting the CSS response since 2003 should be revisited and accounted for within the model update!

Once the model is recalibrated and the effectiveness of Phase I projects are assessed, it is recommended that the City then revisit the scheduled improvements and consider alternate improvements.

Collection System Improvements Recommendations

The LTCP anticipates 25% of the collection system sewers greater than 24-inch in diameter will require improvements. The LTCP also anticipates 2,350 households will have existing downspout connections removed and a corresponding 1,175 of these households will also have

perimeter drains removed. These anticipated improvements have likely been incorporated into the existing XPSWMM model and correlate to anticipated flow reduction assumptions.

Collection System Sewer Televising has been completed as part of the Phase I Improvements. A corresponding plan for remedying the identified defects is to be assembled in 2014. As this plan is assembled and the work prioritized, model assumptions should be altered to match the updated work scope.

It is likely that the collection system sewer televising has identified varying degrees of damage from the catastrophic (i.e. collapsed pipes) to the norm (i.e. cracked pipes and offset joints). Prioritization of this work will provide the City a means to schedule performance of the corrective actions in a manner that provides the largest anticipated cost-to-benefit first. Those improvements identified as "high priority" should then be scheduled and performed while those with lower priority should be deferred. This will allow for a subsequent update to the model to assess the anticipated versus actual response of the CSS to the "high-priority" CSS projects and afford further refinement to the plan for future improvements.

The nature of the City's CSS will likely dictate that only the identified "high priority" improvements will have a marked effect. The scope of improvements should be carefully considered to ensure limited resources are utilized appropriately. The current LTCP plan, performing sewer system improvements in both Phase II and Phase III on 25% of the sewers greater than 24-inch in diameter, is most likely not the best use of the City's limited resources based on our experience with other communities.

Based on our experience, a successful "separate" sewer system rehabilitation project may result in up to a 20% to 30% reduction in flows. Since the City's sewer system is combined, a significant difference in peak flows and maximum volumes should not be expected as a result of CIPP lining cracked pipe. **Therefore, it is recommended that the City consider reallocating these resources to the further assessment and remedy of defective "high-priority" manholes.**

Additionally, the LTCP anticipates implementing a downspout and perimeter drain disconnection program as part of the Phase II Improvements. The program identifies an assumed 2,450 downspout connections of which half (1,725 connections) are assumed to also contribute flow from perimeter drains. The LTCP further identifies a budgeted $400 per connection subsidy be provided to homeowners to insure disconnection. This plan / program should be revisited to determine if the City truly wishes to proceed as noted.

First, the arbitrary accounting of number of connections should be confirmed. Second, an assessment of the effectiveness in reducing flow to the CSS (via direct connection or overland flow) and availability of an alternate means of storm water disposal that does not result in localized ponding and/or overland conveyance back into the CSS should be considered. The likelihood of public acceptance of a $400 per connection subsidy for disconnection should be fully vetted. Further, an alternate and / or additional service lateral repair program is recommended.

Service laterals have the potential to be significant sources of infiltration and inflow (I&I). Typically, 60-70% of the I&I to a sanitary sewer system originates from service laterals. This is

in large part due to the often overlooked requirement for maintenance. Sewer lateral rehabilitation has several inherent challenges, primarily due to the fact that their ownership and responsibility are the homeowners. However, several communities have been able to overcome this challenge through the simple, thoughtful adoption of ordinance. By requiring a home have its sewer lateral inspected and remedied at the time of sale, the municipality avoids the need for imposing an undue immediate hardship on homeowners while providing a long-term mechanism for insuring remedy and a significant reduction of I&I.

LTCP Alternative Improvements Recommendations

At the time of the LTCP assembly, several workshops were held and technologies were examined for potential incorporation into the LTCP Improvements Plan. It was noted that the primary goal was to address bacteria (i.e. E-Coli) with the secondary goals of reduction of $CBOD_5$, Copper, Lead, and Ammonia.

At the first workshop, the goal of which being to provide an understanding of the alternatives evaluation process and screen potential alternatives, numerous CSO Control Technologies were eliminated from consideration and further development (See Table 4.3-2 of the City's LTCP). With the completion of the Phase I Improvements, it is recommended these technologies (initially screened) and other technologies (whose opportunities were not fully known at the time) be revisited. By revisiting alternatives, with a current-day perspective, alternate paths forward can be considered and vetted to determine the best approach for accommodating the needs of the City and their rate-payers.

The mandated LTCP Nine Minimum Controls include both maximizing the capabilities of the WWTP and maximizing the use of the collection system for storage of excess flow. Work performed in Phase I adhere to these requirements.

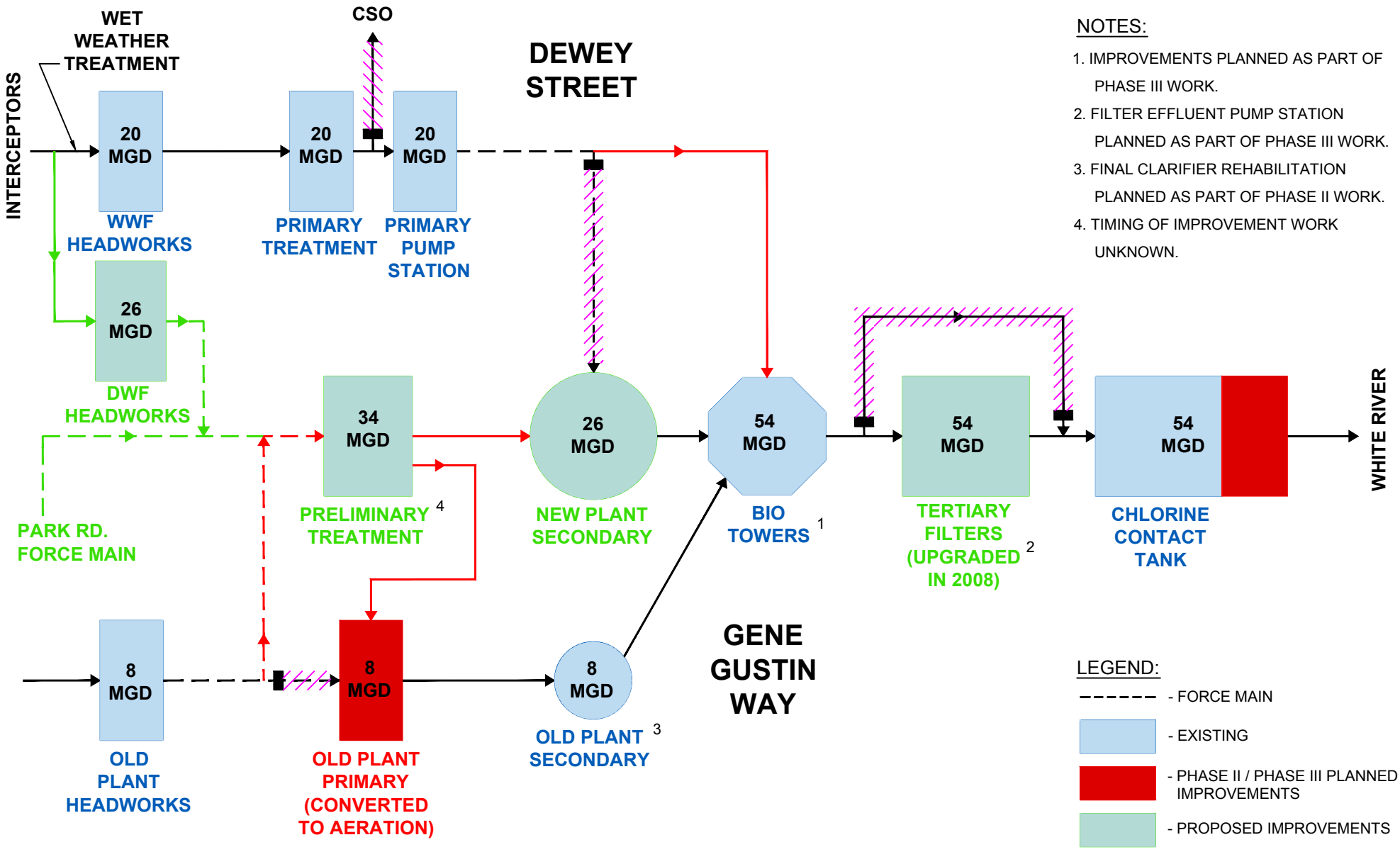
A. Maximizing WWTP Capabilities

The existing WWTP components and early action project upgrades set the path for a 54 MGD maximization of the existing WWTP. As noted in **Figure 5 – Wastewater Treatment Plant LTCP Improvements Schematic**, the existing facilities support 54 MGD through both the BioTowers and 2008 Upgraded Tertiary Filters. Further, Phase I work performed and / or in process bring the lions-share of the facility to a 54 MGD Capacity (34 MGD Biological and 20 MGD Wet Weather).

Remaining process improvements are associated primarily with clarification, aeration, filtration, and disinfection upgrades.

Should the City desire to revisit these upgrades, options for abating the remaining WWTP Improvements work could be investigated through updated alternatives modeling with a focus on:

1. Reducing actual flow conveyed to the WWTP for the identified design storm.
2. Increasing the number of allowable overflow events per typical year.



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MADISON COUNTY

ANDERSON LTCP PEER REVIEW PROJECT

WWTP LTCP PHASED IMPROVEMENTS SCHEMATIC

FIGURE No.

5

B. Maximizing Use of Existing Collection System for Storage

The In-line Storage Morton Street Sewer Improvements Project performed in Phase I and the early action raising of CSO weirs have resulted in an effective and dramatic first step for maximization of the existing collection system for storage. Remaining work components associated with existing CSS rehabilitation and disconnections will further reduce I&I contributors and provide additional storage.

As previously noted, a cost-to-benefit analysis for remaining existing CSS work should be performed with an eye toward implementing only "high-priority" remedial requirements.

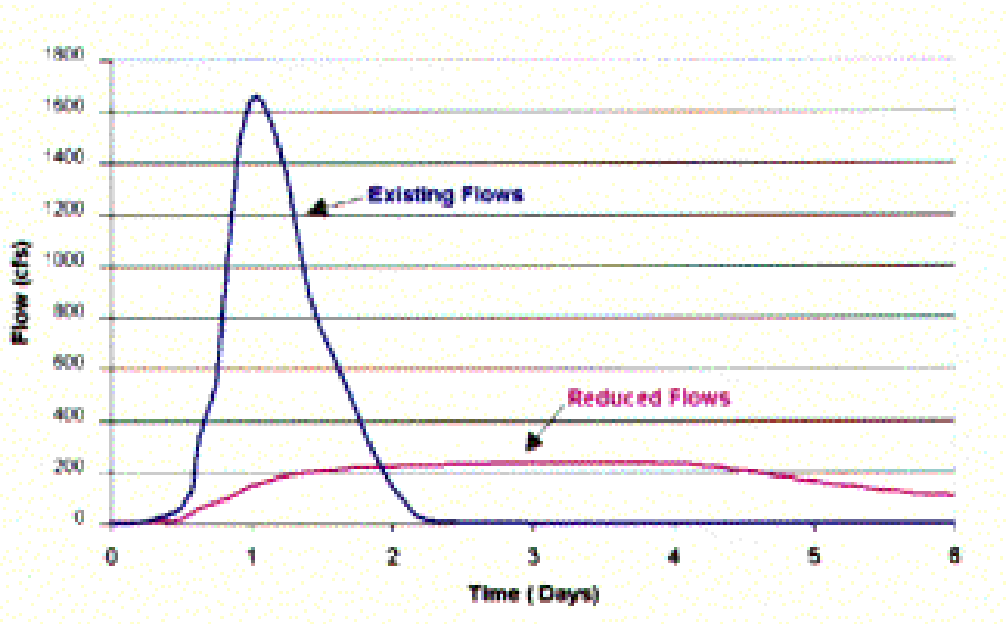
Additional planned collection system improvements consist primarily of providing new conveyance and storage facilities (sewer, interceptor, and tunnel). The majority of remaining LTCP Project costs are associated with the storage / flow-equalization / conveyance concept originally developed. This concept should be revisited.

C. Existing Storage / Conveyance

Currently, design storm flows are anticipated to be conveyed and equalized within existing and new pipe (i.e. sewer, interceptor, and tunnel) to the WWTP. The limiting factors in this concept include (1) the treatment capacity and rate of removal from the system at the WWTP, (2) the storage requirements within the system to equalize peak flows ensuring the limited number of overflows identified for the design event, and (3) conveyance of design flows currently occurring as overflows from the CSOs to the new sewers, interceptor, and conveyance / flow equalization tunnel.

Flows resulting from given storm events are reduced through added storage as illustrated below in **Figure 6 – Example Flow Hydrograph; Effect of Flow Equalization on Peak Flow**. The area between the blue "Existing Flows" and red "Reduced Flows" is representative of the storage volume needed to reduce the peak flow. Peak flows resulting from storm events are significant but through the addition of flow equalization / storage addition can be reduced significantly.

Figure 6 – Example Flow Hydrograph; Effect of Flow Equalization on Peak Flow



The planned Athletic Park and Tunnel Storage conveyance projects employ this flow equalization / storage / conveyance concept. As noted in the LTCP, 50% of the combined sewer areas are accounted by flows from CSOs 007 and 013. CSO 007 is in close proximity to the WWTPs; however, CSO 013 is some distance away.

The existing Tunnel Storage Conveyance Alternative, accounting for some $60M in capital costs for the tunnel alone with an additional $5-million + in structures / modifications, starts at CSO 013. It would be prudent to investigate the previously dismissed concept of satellite treatment, specifically in the vicinity of CSO 013, to determine if there is a more affordable means of addressing the City's CSO challenges.

D. Alternate Satellite Treatment Alternative

Two (2) alternative wet weather treatment technologies that are worthy of further evaluation to address the City's needs are High Rate Clarification (HRC) coupled with ultraviolet (UV) disinfection and vortex separation coupled with chemical disinfection.

By removing flows upstream of the planned tunnel, the need for additional sewerage can be diminished if not eliminated. It is recommended that an iterative approach be performed utilizing the updated model assessing combinations of site specific flow equalization and treatment. The solids loading curve discussed previously could then be employed to determine what type of treatment would be required. This analysis can further be expanded with respect to remaining Athletic Park work. **Figure 7 – Potential CSO Satellite Control Facilities Site Locations Map** illustrates where CSO treatment could be employed at remote locations in the collection system.

LEGEND:

- EXISTING SEWER 36"+
- EXISTING CSO LOCATIONS
- POTENTIAL CSO SATELLITE LOCATIONS

SCALE: 1"=1000'

1000' 0 1000'

DELAWARE ST. WETLANDS

RIVERBEND PARK

EMGE PROPERTY

ATHLETIC PARK

DEWEY STREET FACILITY

CSO 005
CSO 006
CSO 007
CSO 009
CSO 011
CSO 012
CSO 013
CSO 014
CSO 015
CSO 016
CSO 017
CSO 019
CSO 020
CSO 021
CSO 022
CSO 025
CSO 026

BROADWAY ST.
MADISON AVE.
JACKSON ST.
SCATTERFIELD RD.
8th ST.
8th ST.

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MADISON COUNTY

ANDERSON LTCP PEER REVIEW PROJECT

POTENTIAL CSO SATELLITE CONTROL FACILITIES
SITE LOCATIONS MAP

FIGURE No.

7

CONCLUSIONS & EXAMPLE SCHEDULE OF TASKS

Based on the aforementioned LTCP recommendations, the City of Anderson has many viable opportunities to optimize the performance and cost-effectiveness of its LTCP. One such alternate approach to the current schedule is presented below. This example schedule of tasks is intended to follow the City's current schedule of reviewing the LTCP and providing updates to the regulatory agencies for consideration before May 28, 2015.

Please note that the revised schedule overlaps into a portion of Phase II of the LTCP, the next 5 year phase of the LTCP (Years 6-10). The proposed path forward significantly reduces the currently identified capital improvements costs and provides a path forward to allow for updates to the LTCP that meet the City's evolving needs.

Table 9 – Example Schedule of Tasks

Activity	Date Completed
Collection System High Priority I/I Removal Project Planning and Cost Estimates	June 30th, 2014
Collection System High Priority I/I Removal Project Design	December 31st, 2014
XPSWMM Update & Calibration – Satellite Treatment Alternatives Analysis	December 31st, 2014
Financial Capability Analysis Update	March 28th, 2015
Amend LTCP Schedule	June 30, 2015
Collection System High Priority I/I Baseline Isolated Flow Metering	September 30, 2015
Collection System High Priority I/I Implementation	December 31, 2016
Collection System High Priority I/I Post Construction Monitoring	June 30th, 2017
XPSWMM Update & Calibration	December 31, 2017
Alternatives Evaluation Update	June 30th, 2018
Financial Capability Analysis Update	December 31, 2018

WE'RE HERE TO ASSIST YOU!

Commonwealth's team of professionals is ready to work with your community to develop cost-effective strategies for CSO mitigation just as we have with the following example clients.

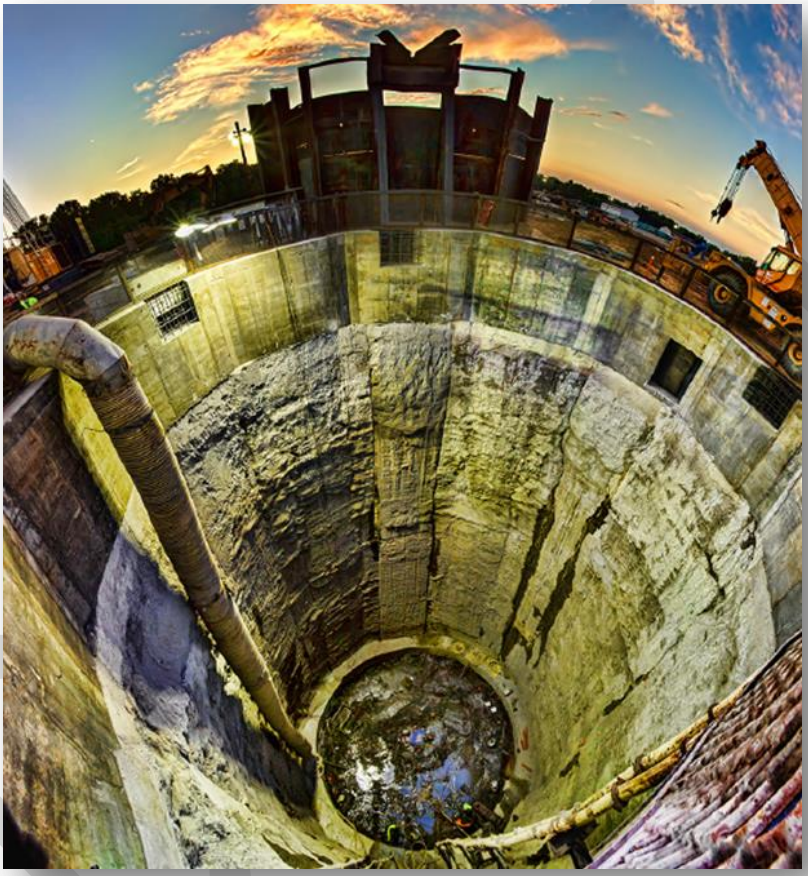
Citizens Water

Castleton Relief Sewer

Our team of Professional Engineers and experienced Residential Project Representatives, provided oversight to the installation of 13,600 Lineal Feet of relief sewer that utilized both open cut and microtunneling installation technologies. Our Team worked with Citizens Water officials, the Contractor and homeowners to minimize the inconvenience of large diameter sewer installation in a largely residential area.

Deep Rock Tunnel Connector

Perhaps the most complex project undertaken by Citizens Water (formerly Department of Public Works), our team of Residential Project Representatives and Professional Engineers has provided design services and construction inspection services for the installation of the Deep Rock Tunnel Connector (DRTC). The construction of the eighteen (18) foot diameter DRTC is performed by the use of tunneling equipment at depths of 250 feet and will extend approximately eight miles. On a daily basis our team is engaged in identifying and solving technical and environmental issues as they arise.

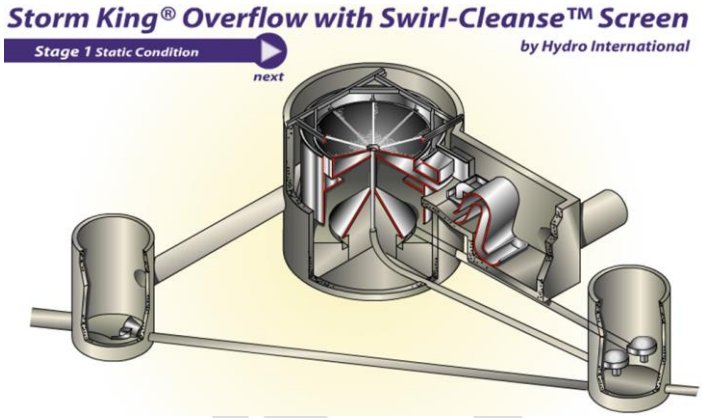


City of Crown Point

During a major flooding event, the residents and city officials in Crown Point realized drainage issues within their sanitary, storm and combined collection systems. While in the depths of implementing their LTCP, the City opted to take a fresh look at their implementation schedule to address these localized drainage issues with an I&I Study. Several high-priority I&I reduction projects were selected as part of the next phase of the LTCP, which allowed the City to postpone rate increases. In addition, this approach ensures that future conveyance and treatment projects as part of the LTCP are appropriately and cost-effectively sized through post construction monitoring efforts that are currently underway.

City of Rensselaer

Following years of gridlocked LTCP negotiations with the IDEM, Commonwealth Engineers, Inc. was brought on board to finalize and negotiate the City's LTCP. Through directives from the City's operations staff and by carefully ensuring that State and Federal CSO requirements were achieved, an affordable wet weather overflow mitigation solution comprised of conveyance and treatment technologies was approved by the regulatory agency. The first phase is currently under design and is comprised of an innovative and proven wet weather treatment system at the City's most active CSO outfall.



Richmond Sanitary District

Due to evolving state and federal CSO policies and Richmond Sanitary District's (RSD) former consultant's lack of cooperation with regulatory agencies, the Agency's approval of the RSD LTCP was delayed. The Commonwealth Team closely coordinated with the officials of the RSD to devise a plan to reach a goal of LTCP approval prior to intervention by EPA or the issuance of monetary penalties. As part of these efforts, a detailed XPSWMM model was created and used to develop the sizing of CSO mitigation options. As a result, a cost-effective LTCP was prepared that utilizes a combination of I/I removal, conveyance and treatment. RSD is wrapping up the installation of the final segment of the East Side Interceptor tunnel that conveys dry and wet weather flows to the RSD wastewater treatment plant. Commonwealth Engineers has performed both design and construction services for this project.

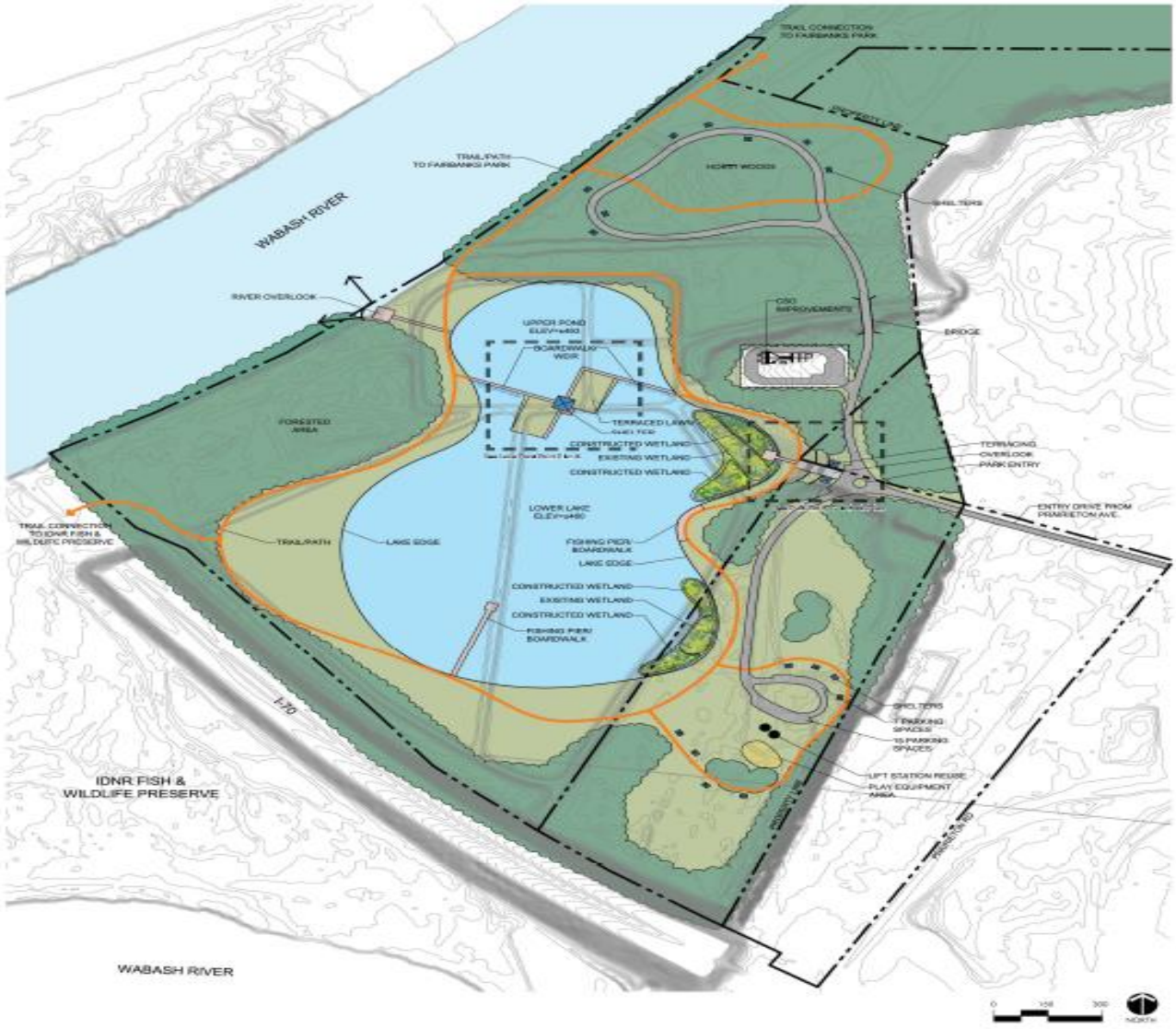
Town of Speedway

The Town of Speedway was in the unique position of coupling their redevelopment efforts with the planning of their CSO LTCP. With a major sewer separation and utility relocation project along Main Street, the Town was primed for evaluating I&I reduction projects in the older sections of the Town. This resulted in the incorporation of green infrastructure technologies to complement those attributes previously incorporated into the Main Street project. New storm sewers were installed on several blocks in Old Town Speedway, and the project consisted of strips of pervious pavement and bioswales that were all seamlessly incorporated into the existing infrastructure. In addition, improvements at the WWTP consisted of the construction of 1.25 MG of CSO storage to meet the Town's designated level of control.

City of Terre Haute

The City of Terre Haute was facing LTCP improvements that mandated the design and construction of two (2) 30-Million-Gallon CSO retention/storage basins in proximity to downtown (at the old International Paper (IP) site).

Commonwealth assembled a White Paper illustrating an alternate path forward. This alternative consists of treatment versus storage at the IP site and an integrated development of the site to a park-like natural setting. **This alternate path provides an increase in the level of control for mitigating the discharge of untreated CSO at less than 1/3 of the cost with the inclusion of the park!**



HIGHLIGHTS

- ◊ Commissioned to provide training to IDEM wet weather staff on LTCP hydraulic review/ modeling, and to review LTCP models on behalf of IDEM.
- ◊ Assisted in development of IDEM CSO Non-Rule Policy (NRP) documents.
- ◊ Renegotiated LTCPs to fully apply NRP documents resulting in millions of dollars in cost savings.
- ◊ Successfully renegotiated LTCP implementation schedules.
- ◊ Installed first high-rate clarification system in state; negotiated secondary equivalency with IDEM resulting in community being removed from list of CSO communities.
- ◊ Successfully completed numerous anti-degradation demonstration projects.
- ◊ Proven working relationship with State and Federal Regulators.
- ◊ Actively involved in CSO Program Development and Wet Weather Technical Advisory Group.

COMMONWEALTH ENGINEERS, INC.
COMBINED SEWER OVERFLOW (CSO) EXPERIENCE

Classified as a *Leader in Environmental Engineering*, Commonwealth Engineers, Inc. (Commonwealth) has played an integral role in the development of the Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP) Strategy and other wet weather programs with the Indiana Department of Environmental Management (IDEM) and the Environmental Protection Agency (EPA). Commonwealth offers communities seeking to rehabilitate aging sewer systems a resource with extraordinary levels of experience, skills, and knowledge of both the regulatory landscape along with current and emerging technologies.

Commonwealth provides expertise in all phases of designing, maintaining, evaluating, and rehabilitating combined sewer systems. In fact, Commonwealth has aided over one-third of Indiana's 104 CSO communities in planning and implementing affordable solutions. Example clients include:

- Town of Akron [1,2,3,4,5,7]
- City of Anderson [7]
- City of Berne [4,5,7]
- City of Bluffton [5,7]
- City of Cannelton [7]
- Town of Chesterfield [4,7]
- Town of Clinton [1,2]
- City of Columbus [4,5]
- Town of Connersville [*,5]
- Town of Crothersville [1,2,4,5]
- City of Crown Point [1,2,3,4,5,7]
- City of Decatur [1,2,3,4,5,7]
- City of Elwood [3,4,5,6,7]
- City of Evansville [5]
- Town of Fairmount [1,7]
- City of Fort Wayne [5,7]
- City of Greenfield [1,2,7]
- City of Hartford City [*,5]
- City of Huntington [*,5]
- IDEM [*,5]
- City of Indianapolis [5,7]
- Town of Lowell [1,2,3,4,5,7]
- City of Ligonier [5]
- City of Madison [1,2,3,4,5,7]
- City of Montpelier [4,5,7]
- City of Nappanee [1,2,3,4,5,6,7]
- City of New Haven [1,3,4,5,7]
- City of Noblesville [*,5]
- Town of Paoli [1,2,3,4,5,7]
- City of Peru [*,5]
- City of Plymouth [1,2,3,4,5,7]
- City of Rensselaer [5,6,7]
- City of Richmond [4,5,6,7]
- City of Rockport [1,2,3,4,5]
- Town of Speedway [4,5,7]
- Town of Summitville [1,2,3,4,5,6,]
- City of Tell City [5]
- Terre Haute [4,7]
- Town of Winamac [1,2,3,4,5,7]

1 CSOOP
2 SRCER
3 CSO PN Rule
4 AO/SJA Negotiation
5 LTCP/Modeling
6 UAA (UAA Underway or planned)
7 LTCP Implementation LTCP (Full or partial implementation)
***** LTCP Model review as part of IDEM Training & Permittee review contract

Due to changes in Indiana's political administration, advancements in technology, and a host of other factors, the CSO program in Indiana is quite dynamic. With 40 years' experience working in CSO communities across Indiana, Commonwealth is uniquely positioned to review and provide your community with cost effective and environmentally sound solutions to your CSO issues.

COMMONWEALTH™ ENGINEERS, INC.
A wealth of resources to master a common goal.