January 23, 2020

Illinois Environmental Protection Agency
Attn: Chris Nifong, Infrastructure Financial Assistance Section
1021 North Grand Avenue East
Springfield, IL 62794-9276

Re: Biosolids System Upgrade, City of Collinsville, IEPA Loan Project: L173963

Dear Mr. Nifong,

In August 2018, the Crawford, Murphy and Tilly, Inc. on behalf of the City of Collinsville submitted a Project Plan for Biosolids Handling System Upgrades. Verification of receipt of the Plan was received by the City and the project has been assigned Loan Project Number L173963.

In January 2019, a revised Project Plan was submitted. Since the resubmittal, changes to the alternatives, recommended improvements and operations and maintenance costs have been made. Since the Plan has not yet been reviewed, I am resubmitting the entire Project Plan and request that the enclosed Project Plan replace the previously submitted Project Plans in their entirety.

Enclosed are three (3) copies of the updated Project Plan. If you have any questions or need additional information during your review, please let me know.

Thank you,

Adrianne P. Eilers

Adrianne P. Eilers
Project Manager
314-571-9090
aeilers@cmtengr.com

PROJECT PLAN

Biosolids Handling System Upgrade

City of Collinsville, Illinois
Wastewater Treatment Plant

By Crawford, Murphy & Tilly, Inc.

CMT 19040118.00
December 2018 (Revised January 2020)

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EXECUTIVE SUMMARY

The City of Collinsville, Illinois retained Crawford, Murphy & Tilly, Inc. to prepare a preliminary engineering report for upgrades to the City's biosolids handling system at the wastewater treatment plant. This report has identified capital improvements to the existing biosolids facilities that are driven by aging equipment and population growth. In addition to meeting future growth needs, CMT was tasked with ensuring that the alternatives analyzed address odor mitigation and provide flexibility and cost control for operations and ultimate biosolids disposal.

Existing Facilities

The City's existing biosolids handling system is liquid lime stabilization that provides for Class B pathogen reduction and reduced level of vector attraction. The system consists of two (2) lime silos, two (2) batch tanks, three (3) storage tanks and ancillary mixers and pumps to process sludge. The original liquid lime system consisted of one (1) lime silo, two (2) batch tanks and two (2) storage tanks and was placed into service in 1991. The second lime silo and third storage tank were constructed in 2007.

Ultimate disposal of the sludge is liquid land application on nearby farm fields by privately owned pumping and piping systems. The City currently has a contract with the landowner to apply the liquid biosolids to the neighboring fields.

While the lime stabilization process does provide odor mitigation by creating a high pH environment, the high pH level is not sustained during biosolids storage and odor generation generally resumes once the pH falls below 11. The existing system does not allow for additional lime to be added directly to the storage tanks to increase the pH of the biosolids to reduce odors following the stabilization process.

Alternatives Considered

Three (3) biosolids process concepts were evaluated for upgrading the existing biosolids handling system. The expansion alternatives were evaluated for meeting future flow and loads, cost effectiveness, ease of operation and maintenance and potential future disposal requirements. The three (3) biosolids handling concepts are as follows:

1. Dewater and Disposal to a landfill or resource recovery facility (Unstabilized biosolids)
2. Dry Lime Stabilization (Class B biosolids)
3. Dry Lime Stabilization and Pasteurization (Class A biosolids)

Recommended Alternative

The recommended alternative is the *Dry Lime Stabilization and Pasteurization* process which has the following advantages:

- Meets the City's project goals by providing the following improvements over the existing system:
  - Odor mitigation by:
    - Lime addition to provide long-term biosolids odor control
    - Installation of an odor control system for the new process building
    - Installation of a new odor control system for the existing biosolids buildings and storage tanks
  - Disposal flexibility and cost control by having the ability to dispose at multiple locations with no restrictions.
- Net annual operation and maintenance cost savings.

The improvements associated with the recommended alternative include:

- Reuse of the existing sludge stabilization batch tanks
- Installation of new mixing and aeration equipment in the existing 2,000,000 gallon storage tank
- New biosolids handling system and facility consisting of dewatering feed pumps, process building, truck loading bay, biosolids storage facility, dewatering equipment, polymer system, dry lime mixer and ancillary equipment, reactor vessel and ancillary equipment, lime silo, conveyance system, building odor control system and sidestream treatment
- Purchase of new front end loader, manure spreader and windrow machine
- New odor control system for existing tanks, buildings and structures.
- All miscellaneous and ancillary items, including associated site, civil, electrical, mechanical and structural work.

Estimated Project Cost

The estimated costs associated with the proposed improvements are as follows (expressed in 2020 dollars):

Engineering $710,000
Construction..... $5,640,000
Construction Contingency..... $560,000
Estimated Total Project Cost $6,910,000

Financing

Due to many advantages, primarily a low interest rate (currently 2.0%), the recommended method of financing the project is through the State of Illinois Revolving Fund (SRF) Loan program. The annual debt service for $6,910,000 would be approximately $423,000.

The current City ordinance establishes an annual fee increase of 3% for 2020. The annual biosolids handing system's operation and maintenance cost is expected to decrease as a result of the project with an estimated annual savings of $453,000 based on current loadings. The City has evaluated their rates and no change to the existing wastewater service charge is anticipated. The current revenue source with the existing 3% annual fee increase along with the annual operation and maintenance cost savings will cover the required debt service. If the need for additional revenue is required in the future, the City will take action to raise the rates if necessary.

Schedule

The preliminary schedule associated with the improvements has the following major milestones:

Item	Target Start Date	Target Completion Date	Duration
Project Plan Approval	January 2019	March 2020	6 months
Design Improvements	February 2020	May 2020	6 months
Permitting through IEPA	April 2020	June 2020	3 months
Financing Secured	N/A	July 2020	N/A
Advertisement of Bids	June 2020	July 2020	2 months
Bid Opening & Evaluation	N/A	July 2020	N/A
Award of Contract	August 2020	August 2020	1 month
Construction Phase	September 2020	November 2021	15 months

I. PURPOSE

The purpose of this Preliminary Engineering Report is to summarize the alternatives investigated for the City of Collinsville Biosolids Handling Improvement Project. The project includes the design of a new biosolids handling system to allow the City to continue to meet current and future biosolids handling needs. In addition to meeting current and future needs, the selected alternative should provide the following improvements over the existing system:

- Odor mitigation
- Operational flexibility and cost control
- Disposal flexibility and cost control

II. DESIGN BASIS

A. General

In order to determine the details of the various alternatives, an estimate of the current and projected future flow and loadings was completed. The concept behind the development of the design basis is to begin with the current wastewater flow and loadings and add the amount of additional flow and loadings that is anticipated to result from future growth and expansion.

B. Current Influent Flow and Loadings

Measured wastewater treatment influent flows, organic and solids data for the past five (5) years was analyzed and the averages are as follows:

2013 – 2017 Average Flow	=	3.82 MGD
2013 – 2017 Average Population	=	32,664
2013 – 2017 Average BOD5 Load	=	5,894 lb BOD5/day
2013 – 2017 Average TSS Load	=	6,244 lb TSS/day

C. Population Equivalent Projections

The Collinsville WWTP serves the City of Collinsville and the City of Maryville. U.S. Census data was obtained and analyzed to determine the current population and future population projections. To determine the current population for comparison to the current average flow and loadings, the average population from 2013 through 2017 was calculated. To determine the 2038 population projections, a best fit curve based on the census data was utilized for both communities. In addition to the population increase, development within existing undeveloped and unsewered areas within the city limits of Collinsville was also considered based on the *Capacity Study for the Wastewater Treatment Plant* completed by RJN Group, Inc. in September 2004.

2013 – 2017 Collinsville Population (Ave. Census Data)	=	24,811
2013 – 2017 Maryville Population (Ave. Census Data)	=	7,852
2013 – 2017 Collinsville Undeveloped Area Population	=	0
2013 – 2017 Service Area Population	=	32,664
2038 Collinsville Population	=	30,414
2038 Maryville Population	=	13,153
2038 Collinsville Undeveloped Area Population	=	7,502
2038 Service Area Population	=	51,069
Additional Population	=	18,405

Appendix A provides a summary of U.S. Census data and calculations for determining the service area population.

D. Projected Influent Flow and Loadings

In order to obtain the future influent flow and loadings, the population values obtained were converted to flow and loadings using the Population Equivalent (PE) values as required in the Illinois Recommended Standards for Sewage Works (Ill. Admin Code tit. 35, part 370). The additional flow and loads are derived from the increase in population (2038 values minus 2013-2017 average values) multiplied by the PE values (1 PE equals 100 gal/day, 0.17 lb BOD/day and 0.20 lb TSS/day, assuming no grinders). The additional flow and loads were then added to the current flow and loads to obtain the total values for the design period.

Additional Population	=	18,405
2013 – 2017 Average Flow	=	3.82 MGD
Additional Flow	=	18,405 PE * 100 gal/PE
	=	1.84 MGD
2038 Design Average Flow	=	3.82 MGD + 1.84 MGD
	=	5.66 MGD
Permitted Design Average Flow Capacity	=	5.85 MGD (5,850,000 gal/day)
PE Equivalent	=	5,850,000 gal/day / 100 gal/PE
	=	58,500 PE
2013 – 2017 Organic Loading	=	5,894 lb BOD5/day
Additional Organic Loading	=	18,405 PE * 0.17 lb BOD5/day/PE
	=	3,129 lb BOD5/day
2038 Average Organic Loading	=	5,894 lb BOD5/day + 3,129 lb BOD5/day
	=	9,023 lb BOD5/day
2038 Average Organic Concentration	=	9,023 lb BOD5/day / 5.66 MGD / 8.34
	=	191 mg/l
2013 – 2017 Solids Loading	=	6,244 lb TSS/day
Additional Solids Loading	=	18,405 PE * 0.20 lb TSS/day/PE
	=	3,681 lb TSS/day
2038 Average Solids Loading	=	6,244 lb TSS/day + 3,681 lb TSS/day
	=	9,925 lb TSS/day
2038 Average Solids Concentration	=	9,925 lb TSS/day / 5.66 MGD / 8.34
	=	210 mg/l

E. Biosolids Flow and Loadings

In order to determine the design criteria for the upgraded biosolids system, sludge production operations based on averages of the 2013 through 2017 plant data obtained from the City and the projected influent flow and loadings were utilized and calculations are included in Appendix B.

Sludge Production to Biosolids	=	9,780 lb/day
Sludge Flow Rate to Biosolids	=	37,930 gpd

Care should be taken during design to provide for treatment of a range of production and flow rate numbers to handle anticipated minimum and peak flow and loading conditions.

III. EXISTING SOLIDS HANDLING FACILITIES

The existing solids handling method utilizes liquid lime stabilization to satisfy Part 503 sludge regulations for land application. Lime is mixed with the liquid sludge to satisfy the use of Processes to Significantly Reduce Pathogens (PSRP), lime stabilization option, to meet the Class B pathogen reduction requirements and vector attraction reduction option 6, addition of alkaline material.

Waste activated sludge is transferred with pumps located in the Administration Building from the secondary clarifiers to the primary clarifiers for co-settling with the primary sludge. Adjacent to each primary clarifier is a primary clarifier sludge pit that contains a 6" telescoping valve. Primary sludge is pumped with sludge pumps located in the Headworks Building from the sludge pit to one (1) of two (2) sludge stabilization batch tanks. Each batch tank contains a mixer, pH monitoring unit and 25-ton lime silo with related lime feed equipment. As sludge is pumped from the primary sludge pit, lime is added to raise the pH to a minimum of 12.0, which must be maintained for 2 hours. Following the 2-hour period, the sludge must be held at a pH of 11.5 or higher for an additional 22 hours. The tank contents are mixed continuously during these periods.

Following stabilization, the contents of the batch tank are pumped through sludge transfer pumps located in the Sludge Transfer Pump Building to one (1) of three (3) sludge stabilization storage tanks. The tanks provide approximately 150 days of storage capacity to prevent having to pump sludge directly to land application during periods when it is unsuitable to land apply.

Directional nozzles are located near the floor bottom in each tank to keep the contents of the tanks mixed during storage periods and to provide mixing prior to pumping the sludge for disposal. Four (4) 60 horsepower sludge mixer pumps are housed in the Sludge Mixer Pump Building and are used in conjunction with the nozzles to mix the sludge in the storage tanks by recirculating the sludge in the tanks.

The City currently has a contract with a landowner to dispose of the sludge by means of liquid land application on the neighboring fields utilizing a privately owned pumping and piping system. The 125 horsepower sludge land application pump is located in the Sludge Transfer Pump Building and utilized to pump stabilized sludge from the storage tanks to the neighboring fields. Timing of the sludge disposal is currently restricted to when the landowner will allow the biosolids to be applied. Between 2011 and 2015, the average annual sludge disposal amount was 45,348 tons.

As previously mentioned, one of the goals of the biosolids handling upgrade project is to provide odor mitigation. While the lime stabilization process does provide for odor mitigation by creating a high pH environment (greater than 11), this pH level is not sustained for the entire biosolids storage time and odor generation generally resumes once the pH falls below 11. Currently there is no way to add lime at the storage tanks to increase the pH of the biosolids to reduce odors following the stabilization process.

An activated carbon system with scrubber and carbon adsorber provides odor control for the existing biosolids facilities. Most of the odor control system equipment is housed in the Odor Control Building, adjacent to the Sludge Transfer Pump Building. The odor control system was installed in 1993 and was not upgraded when the 2MG storage tank was constructed in 2007. Thus, when the biosolids facilities are near capacity and the pH of the biosolids is below 11, the odor control system is not adequately sized.

IV. PROPOSED ALTERNATIVES

Three (3) biosolids process concepts are presented for upgrading the existing biosolids handling system. These expansion alternatives are evaluated for meeting the future flow and loads, treatment requirements, cost effectiveness, flexibility of disposal methods and ease of operation and maintenance (O&M). The three (3) biosolids handling concepts are as follows:

1. Dewater and Disposal (unstabilized biosolids)
2. Dry Lime Stabilization (Class B biosolids)
3. Dry Lime Stabilization with Pasteurization (Class A biosolids)

A. Common Elements

There are several elements that are common to the proposed alternatives and include reuse of the existing batch tanks and storage tanks, addition of sludge dewatering equipment, construction of an odor control system and construction of a sidestream treatment process. Each element is discussed in more detail below.

1. Reuse of Existing Batch Tanks and Storage Tanks

Each alternative is intended to allow operational flexibility such that the sludge wasting process from the liquid treatment side does not have to change. The existing batch tanks will be utilized to store sludge to allow for batch operation of the new biosolids equipment. Flexibility will also be provided to store liquid sludge within the existing 2,000,000 gallon storage tank in emergency conditions such as equipment outage. As is the current process, sludge will be transferred utilizing the existing sludge pumps from the primary sludge pits to the existing batch tanks where it will be mixed with the existing mixers to keep solids suspended.

2. Sludge Dewatering Equipment

Each alternative provides for sludge dewatering equipment to dewater sludge to approximately 20% - 25% solids. Biosolids dewatering is recommended to reduce the amount of biosolids stabilized and ultimately disposed.

A screw press dewaters sludge by a slow moving shafted screw enclosed in a basket that is constructed of wire mesh or perforated plate. Solids are compacted within the flights of the screw by increasing pressure and the water is removed by the basket.

The advantages of the screw press when compared to other dewatering equipment such as centrifuges and belt filter presses are (1) slow rotational speed, (2) enclosed system providing for odor containment and low noise level, (3) easy start up and shut down, (4) low power consumption, (5) long life on wear parts and (6) ease of O&M.

3. Odor Control System

Based on the proximity of the existing WWTP to the interstate system and nearby commercial/industrial area, odor is an issue that must be dealt with in the proposed improvements. Each alternative consists of a new odor control system to treat the odors produced within the proposed process buildings. For ease of operations, the new odor control system is proposed to be an activated carbon system like the existing odor control system. The equipment and chemical costs for the new system have been included in the initial capital cost and life cycle cost for each alternative.

As previously mentioned, the existing solids handling facilities consists of an undersized odor control system for the current operations. With the proposed changes to the biosolids handling system, a new odor control system is proposed. The equipment and chemical costs for a new system have been included in the initial capital cost and life cycle cost for each alternative. However, the current odor control system may be adequate to treat odors when just the existing batch tanks are in use. The existing system should be further evaluated during the design phase to see if the current system is suitable.

4. Sidestream Treatment Process

A common concern with upgrading to a dry biosolids system is the return of highly concentrated amounts of nutrients, including nitrogen and phosphorus, back to the liquid stream process during biosolids

processing hours. Since none of the alternatives produce or eliminate nutrients, the overall plant nutrient loading remains the same. Basically, the same amount of nutrients taken out of the liquid stream process is placed back into the liquid stream process but in a more concentrated form because of the intermittent operation of the biosolids system.

For all alternatives, filtrate from the dewatering equipment will be returned to the liquid stream. The filtrate may contain highly concentrated amounts of nutrients that could upset the existing liquid stream process. During design of the selected alternative, the location of the reintroduction of the return flows to the liquid stream system should be further evaluated to minimize the effect on the treatment process.

B. Dewater and Disposal

The dewater and disposal concept utilizes dewatering equipment to produce a dewatered unstabilized solid to be hauled to a landfill. The proposed dewater and disposal system is intended to allow operational flexibility such that sludge processing does not have to occur in times other than normal daytime shifts. The sludge processing equipment will be sized such that a day's worth of sludge can be dewatered in 12 hours with a single unit.

During operation of the dewatering equipment, sludge will be pumped from the batch tanks to the Process Building at a flow rate of 55 gallons per minute (gpm). The Process Building will contain two (2) screw presses that will dewater the sludge to approximately 20% - 25% solids. A screw conveyor system will transport the dewatered cake to a truck loading area where a semi-trailer or dumpster can be loaded. The dewatered cake can be hauled to the selected disposal facility either by the City or by a contract waste hauler. Assuming the dewatering equipment produces 25% solids, the estimated annual sludge disposal amount is 6,210 wet tons.

As previously mentioned, odor issues are a concern at the WWTP. This alternative has the potential to produce additional odor control problems as it requires short term storage of unstabilized sludge. In order to combat the additional odor control concerns, installation of a chemical feed odor control system is recommended. The chemical feed odor control system would apply chemical directly to the sludge prior to dewatering. There are several chemicals available that can be considered to accomplish odor control including:

- Ferric Chloride
- Potassium Permanganate
- Hydrogen Peroxide

A specific type of chemical feed odor control system has not been selected at this time in order for additional evaluation and possible pilot studies to be conducted during the design phase. However, a chemical feed odor control system is highly recommended, and costs have been included in the initial capital cost estimate and life cycle cost analysis for this alternative.

Table 1 provides a list of advantages and disadvantages of this alternative.

Table 1: Advantages & Disadvantages - Dewater & Disposal

Advantages	**Disadvantages**
Lowest initial capital cost	Odor concerns with storage of unstabilized sludge
Smallest space requirement	Highest annual O&M cost
Elimination of long term, on-site storage	Additional chemical feed system recommended
	Daily disposal operations
	Landfill may decide to stop taking material

See Appendix C for the process flow diagrams and site plans for each alternative.

C. Dry Lime Stabilization

The dry lime stabilization concept is similar to the existing liquid lime stabilization process. The main difference between this concept and the existing operation is during the dry lime process the sludge is dewatered before being mixed with dry lime, as opposed to mixing lime with liquid sludge.

During operation of the dry lime facilities, sludge will be pumped out of the batch tanks to the Process Building at a flow rate of 30 gpm. The Process Building will contain one (1) screw press that will dewater the sludge to 20% - 25% solids. A screw conveyor will transport the dewatered cake to a blender, where it will be mixed with dry lime to raise the pH above 12. The processed cake will then be conveyed to the Biosolids Storage Facility where it will be stored until final surface disposal. Based on the manufacturer's recommendation regarding anticipated lime usage and assuming the dewatering equipment produces 25% solids, the estimated annual sludge disposal amount is 6,580 tons.

As previously discussed, the existing biosolids system contains two (2) 25-ton lime silos that would provide 42 days of lime storage. In order to simplify construction and ease of keeping the existing biosolids system in operation during construction, a new 70-ton lime silo is proposed that will provide approximately 60 days of lime storage. Additional lime silo sizes are available and should be evaluated during the design phase along with the relocation and reuse of the existing lime silos.

Illinois Recommended Standards for Sewage Works (Ill. Admin Code tit. 35, part 370) requires a minimum of 150 days storage be provided to accommodate inclement weather conditions and cropping practices if land application for Class B biosolids is the only means of disposal. By maintaining the flexibility to utilize the 2,000,000 gallon existing storage tank, 50 days of liquid sludge storage is available. Therefore, a Dry Biosolids Storage Facility will be sized to provide 100 days of dewatered sludge storage with capability to windrow the dewatered sludge to promote additional drying.

Table 2 provides a list of advantages and disadvantages of this alternative.

Table 2: Advantages & Disadvantages - Dry Lime Stabilization

Advantages	Disadvantages
Operational familiarity with lime addition	Requires purchase and handling of lime
Increased flexibility on land application disposal locations over existing system	Cooperation required with landowner at disposal location
Lowest life cycle cost	Weather and ground condition dependent for disposal
Lowest annual O&M cost	Biannual disposal operations

D. Dry Lime Stabilization with Pasteurization

The dry lime stabilization with pasteurization concept is the same process as the dry lime stabilization concept with the addition of a pasteurization vessel to meet Class A pathogen reduction by Processes to Further Reduce Pathogens (PFRPs), pasteurization option. The pasteurization vessel consists of a sulfamic acid feeder and reactor vessel. Following the blender, the process cake will be conveyed to the pasteurization vessel where it will react with the sulfamic acid to provide the necessary temperature increase to meet the Class A requirements and produce a Class A biosolid. Processed cake will then be conveyed to the Biosolids Storage Facility until final reuse. Based on the manufacturer's recommendation regarding anticipated lime usage and assuming the dewatering equipment produces 25% solids, the estimated annual sludge disposal amount is 7,010 tons.

The upgrade to the Class A dry lime option requires additional lime usage over the Class B option. The existing lime silos would provide 19 days of lime storage while the proposed 70-ton lime silo would provide 27 days.

While both dry lime options provide for odor mitigation by increasing the pH of the biosolids, there is the potential to re-release odors if the pH drops during the storage period. There is also potential for re-release of the odors anytime the biosolids are worked during windrowing or disposal loading.

Since the proposed alternative will produce a dewatered, Class A biosolid, land application is not the only means of disposal, thus Illinois Recommended Standards for Sewage Works does not provide for a minimum storage time. To provide for operational flexibility in disposal, a Dry Biosolids Storage Facility will be sized to provide 60 - 90 days of dewatered sludge storage. By maintaining the flexibility to utilize the 2,000,000 gallon existing storage tank, 50 days of liquid sludge storage is also available. The combination of the two facilities will provide for a total of 110 - 140 days of storage.

Table 3 provides a list of advantages and disadvantages of this alternative.

Table 3: Advantages & Disadvantages - Dry Lime Stabilization with Pasteurization

Advantages	Disadvantages
Operational familiarity with lime addition	Requires purchase and handling of lime and sulfamic acid
Best flexibility of disposal locations, No restrictions	Highest initial capital cost
No time frame on disposal operations	Highest life cycle cost
Best option for odor control mitigation of biosolids	

See Appendix C for the process flow diagrams and site plans for each alternative.

V. LIFE CYCLE COST ANALYSIS OF ALTERNATIVES

Life cycle costs associated with each alternative is used in the comparison of the alternatives. Life cycle cost analysis utilizes initial capital costs along with the present worth of the annual uniform series of O&M costs and the present worth of the future salvage value costs to provide a basis of comparison. The present worth of the salvage value is subtracted from the initial capital cost and present worth of the O&M cost. The present worth was computed at six percent (6%) interest rate over a 20-year planning period with a 2.2% inflation rate. Each component is described in more detail in the following subsections.

Table 4 provides a summary of the life cycle costs for each alternative.

Table 4: Life Cycle Costs

Item	Dewater & Disposal	Dry Lime Stabilization	Dry Lime Stabilization with Pasteurization
Total Estimated Project Cost	$5,530,000	$6,750,000	$6,910,000
Annual O & M Costs	$360,000	$206,000	$267,000
Present Worth of O & M Costs	$4,785,000	$2,738,000	$3,549,000
20 Year Salvage Values	$1,157,000	$1,450,000	$1,488,000
Present Worth of Salvage Values	$361,000	$452,000	$464,000
Total Present Worth Cost	$9,950,000	$9,040,000	$10,000,000

A. Project Costs

The following guidelines were used to estimate the initial capital costs associated with each alternative:

- Use a preliminary layout for each structure to determine its floor plan.
- Use estimated quantities and unit price for sitework, excavation, concrete, backfill and piping costs.
- Use equipment supplier material quotes for all equipment costs.
- Use a multiplier for estimating the labor associated with the equipment installation.
- Use a unit price per square foot for estimating costs for buildings.
- Use a percentage of the subtotal for the estimated construction costs to determine the following components for each alternative:
    - Electrical, I/C & SCADA.
    - Mobilization, Bonds & Insurance.
- Add 10% of construction subtotal as a contingency to allow for items that were unforeseen currently and will be determined during design of the proposed improvements.
- Determine the following engineering services fees:
    - Design Engineering
    - Bidding Phase Engineering
    - Construction Phase Services, including Resident Engineering Services
- Initial costs are for current year construction.
- To handle the disposal of the biosolids, cost associated with the purchase of the following recommended equipment has been included:
    - Disposal option – 53 feet tractor trailer
    - Dry Lime options – front end loader, 17 cy manure spreader truck and windrow machine

See Appendix D for the Initial Capital Cost Estimates for each alternative.

B. Operation and Maintenance Costs

The following guidelines were used to estimate the O&M costs associated with each alternative:

- Energy cost of six and one-half cents ($0.065) per each kilowatt hour used; based on the average energy cost for the WWTP in 2015, including base charge, peaking factor, etc.
- Chemical cost based on equipment manufacturer's recommendation of chemical usage for polymer, lime, odor control media, etc.
- Disposal cost for each alternative is based on the following assumptions:
    - City personnel handle disposal.
    - Disposal for the Dewater and Disposal options is at the Republic Services Edwardsville, IL Landfill with a $35/ton tipping fee.
- Due to the uncertainty of the final disposal locations for all options, the annual O&M costs associated with the heavy equipment (i.e. tractor trailer, manure spreader, etc.) required for ultimate disposal has not been included.

Table 5 provides a comparison of the estimated annual O&M costs each alternative and the existing biosolids handing system.

Table 5: Estimated Annual Operation & Maintenance Costs

Item	Dewater & Disposal	Dry Lime Stabilization	Dry Lime Stabilization with Pasteurization	Existing System[1]
Electricity	$32,000	$46,000	$46,000	$88,000
Chemicals	$111,000	$160,000	$221,000	$91,000
Disposal Cost	$217,000	$0	$0	$450,000
Total	**$360,000**	**$206,000**	**$267,000**	**$629,000**
Cost per gallon sludge	$0.026	$0.015	$0.019	$0.069
2020 Estimated Total[2]	**$238,000**	**$136,000**	**$176,000**	**$629,000**

1. The existing system costs are based on the plant's current biosolids loading amount.
2. The 2020 estimated total is based on the plant's current biosolids loading (approximately 65% of estimated future loadings).

As shown in Table 5, in general O&M costs are expected to decrease because of the biosolids handling upgrade. In comparison to the existing system:

- Routine labor cost remains the same as it is assumed that no additional staffing will be required for any alternative.
- All alternatives provide a reduction in electrical usage.
- All alternatives require an increase in chemical costs due to the new odor control system for the process building and additional need for polymer, odor control chemical and lime.
- All alternatives provide a reduction in disposal cost. Upon implementing a new biosolids handling process, the plant will change from liquid land application to solid land application. The current annual cost for liquid land application on the neighboring fields is approximately $450,000. With the production of drier waste solids, the overall sludge volume will reduce and provide an opportunity to dispose of the sludge at other locations.

See Appendix E for additional information on the O&M costs used in the analysis.

C. Salvage Value

The following guidelines were used to estimate the salvage value associated with each component included in each alternative:

- Assume service life of 50 years for structures and buildings.
- Assume service life of 20 years for equipment.
- Assume salvage value of 0.6 times initial capital costs for structures after 20 years.
- Assume salvage value of 0.0 times initial capital costs for equipment after 20 years.

See Appendix F for the salvage value assigned to each component for each alternative.

VI. RECOMMENDED IMPROVEMENTS

Based upon the analysis and evaluation contained in this report, the recommendation is for the City to implement the Dry Lime Stabilization with Pasteurization option. The recommended alternative has the following advantages:

- Operational familiarity with lime addition;
- Most flexibility of disposal locations with no restrictions;
- Best option for odor mitigation of biosolids;

- Substantial sludge volume reduction when compared to the existing system by production of 20 - 25% solids;
- Net annual O&M cost savings when compared to the existing system;

The recommended improvements include, but are not necessarily limited to the following:

- Reuse of the existing sludge stabilization batch tanks
- Installation of new mixing and aeration equipment in the existing 2,000,000 gallon storage tanks
- New biosolids handling system and facility consisting of:
    - Dewatering feed pumps
    - Process building
    - Truck loading bay
    - Biosolids storage facility
    - Dewatering equipment with polymer system
    - Dry lime mixer and ancillary equipment
    - Reactor vessel and ancillary equipment
    - Lime silo
    - Conveyance systems
    - Building odor control system
    - Sidestream treatment process
    - Front end loader
    - Manure spreader truck
    - Windrow machine
- New odor control system for existing tanks, buildings and structures.
- All miscellaneous and ancillary items, including associated site, civil, electrical, mechanical and structural work. These items cannot be defined in detail during the planning stage and are typically identified during design. A budgetary cost for these ancillary items is included with the 10% contingency in the probable cost estimate.

The proposed upgrade will be constructed within the current treatment plant property boundaries at the southwest corner near the existing excess flow lagoon. The components of the upgrade will be located on the site considering the optimal layout for the new facilities within the property and topographical boundaries and in relation to the existing treatment plant process and plans for future treatment plant expansions. The final layout may differ from the conceptual layout presented as information determined during the design process could require changes. Considerations that will be involved in the final layout of the facilities include:

- Locations of soil borings and results from geotechnical analysis
- Ability to keep the existing plant in service during construction of the upgrade
- Provisions for future expansion (liquid and biosolids treatment)
- Presence of existing piping or utilities
- Amount of site work required based on existing topography including grading and mass site excavation and fill, drainage, etc.
- Accessibility by plant staff and trucks when considering layout of new roadways, sidewalks, etc.

See Appendix G for recommended alternative storage calculations.

VII. TOTAL ESTIMATED PROJECT COST

The total estimated cost for the recommended improvement is as follows in Table 6.

Table 6: Total Estimated Project Cost

Item	Estimated Cost
Design Engineering	$350,000
Construction Engineering (includes bidding)	$360,000
Other Professional Services (legal, admin, etc.)	$0
Construction	$5,640,000
Contingency (10%)	$560,000
Total Estimated Project Cost	**$6,910,000**

VIII. PROJECT FINANCING

A. General

Due to many advantages, primarily a low interest rate that will result in significantly less debt service requirements, the City desires to pursue financing of the project through the State Revolving Fund (SRF) Loan. The SRF program administered by the Illinois Environmental Protection Agency (IEPA) offers an attractive means of financing water and wastewater treatment improvements. The loans are typically for a 20-year period with semi-annual payments. The effective interest rate currently being used on an SRF loan is 2.0%. The estimated annual payment to finance the total project costs utilizing a SRF Loan at 2.0% interest over a 20-year term is provided in Table 7.

Table 7: Estimated Annual Payment for Financing

	SRF Loan
Total Estimated Cost (from table 7)	$6,910,000
Loan Period	20 Years
Annual Interest Rate	2.0%
Total Annual Payment	**$423,000**

B. Estimated Financial Impact

1. Existing Residential Rate Structure

The wastewater service charge for the use and services supplied by the wastewater facilities of the City consists of a basic user charge for O&M, replacement, sewer system reserve funds, a debt service charge and a surcharge, if applicable. The current fee is $6.83 per 1,000 gallons of water with the average customer using approximately 4,385 gallons; thus, the average residential customer pays a monthly sewer charge of $30.05 or 0.68% of median household income. The current City ordinance establishes an annual fee increase of 3% for 2019 and 2020.

In addition to the City of Collinsville residential and commercial customers, the City accepts sewage from the City of Maryville. A metering station is installed to record the average monthly sewage flow rate from the City of Maryville. The monthly flow rate is then compared to the WWTPs average monthly influent flow rate and the City of Maryville is charged based on their percentage of the total influent flow.

2. Proposed Rate Changes

The annual biosolids handing system's O&M cost is expected to decrease as a result of the recommended project. As shown in Table 5, at future buildout the estimated annual O&M cost is $267,000, which results

in an O&M cost of $0.019 per gallon sludge produced. At current loading, the estimated annual O&M cost is $176,000, which results in an estimated O&M annual savings of $453,000. This cost savings is more than the estimated total annual payment of $423,000 utilizing the SRF program as shown in Table 7. Also, as previously noted, the current City ordinance establishes an annual fee increase of 3% for 2019 and 2020.

The City has evaluated their rates and no change to the existing wastewater service charge is anticipated. The current revenue source with the existing 3% annual fee increase along with the annual O&M cost savings will cover the required debt service. If the need for additional revenue is required in the future, the City will take action to raise the rates if necessary.

IX. PROJECT IMPLEMENTATION

The preliminary schedule associated with the Biosolids Handling Improvement Project has the following major milestones as shown in Table 8.

Table 8: Preliminary Project Implementation Schedule

Item	Target Start Date	Target Completion Date	Duration
Project Plan Approval	January 2019	March 2020	6 months
Design Improvements	February 2020	May 2020	6 months
Permitting through IEPA	April 2020	June 2020	3 months
Financing Secured	N/A	July 2020	N/A
Advertisement of Bids	June 2020	July 2020	2 months
Bid Opening & Evaluation	N/A	July 2020	N/A
Award of Contract	August 2020	August 2020	1 month
Construction Phase	September 2020	November 2021	15 months

It should be noted that the above schedule dates are subject to change and can be affected by a variety of external factors. The dates shown are merely target completion dates and are not binding.

X. ENVIRONMENTAL IMPACTS ASSESSMENT

A. General Environmental Considerations, Easements, and Rights of Way

1. Threatened & Endangered Species

There are no threatened or endangered species that are known to exist in the vicinity of the WWTP where improvements are proposed.

2. State Historic Preservation Officer

A synopsis of this facility plan to sufficiently identify affected areas will be submitted to the State Historic Preservation Officer.

3. Wetlands

None of the construction proposed will take place in wetlands. There is no anticipated impact of the proposed construction upon known existing wetlands.

4. Flood Hazard

None of the proposed construction at the WWTP will take place within the floodplain.

5. Easements and Right of Way

Easement and right-of-way issues are not anticipated on the project. The WWTP Improvements will occur on the existing plant property owned by the City.

6. Agricultural Impacts

Existing farmland, prime or otherwise, will not be impacted by this project, which will be built on non-tillable City-owned property.

7. Archaeological Issues

Construction will occur on the existing plant site, where previous construction has not resulted in any archaeological findings. As such, there are no archaeological issues anticipated.

8. Early Coordination

Notification concerning this project will be submitted to the following State Agencies: Illinois State Historic Preservation Agency; Illinois Department of Natural Resources; Illinois Department of Agriculture. In addition, notification will be provided to the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, and other stakeholders as directed by the IEPA.

B. Considerations Regarding Surface Waters and Groundwater

The proposed biosolids handling system improvements will not affect the effluent water quality as the improvements are limited to the biosolids treatment process. The existing plant is currently designed to reliably and consistently produce effluent in compliance with State and Federal water quality standards. No adverse effects upon the aquatic biota or habitats of the receiving stream are anticipated to result from the proposed improvements. To ensure that erosion at the construction sites will be minimized and controlled during construction activities, proper measures will be utilized when conducting earthwork operations. These measures will also ensure that sedimentation and siltation of surface water does not occur and will be a contractual obligation of the contractor performing the work.

C. Considerations Regarding Air Quality

As previously discussed, odor is a major concern at the existing wastewater treatment facility. The selected alternative will include measures to mitigate existing odors and additional odors that may develop as a result of the process improvements. The frequency of occurrence of odors as well as the type of odors should decrease following the upgrade as compared with the existing treatment plant. None of the construction activities are expected to produce dust at levels that will create a nuisance.

D. Considerations Regarding Effects on Land

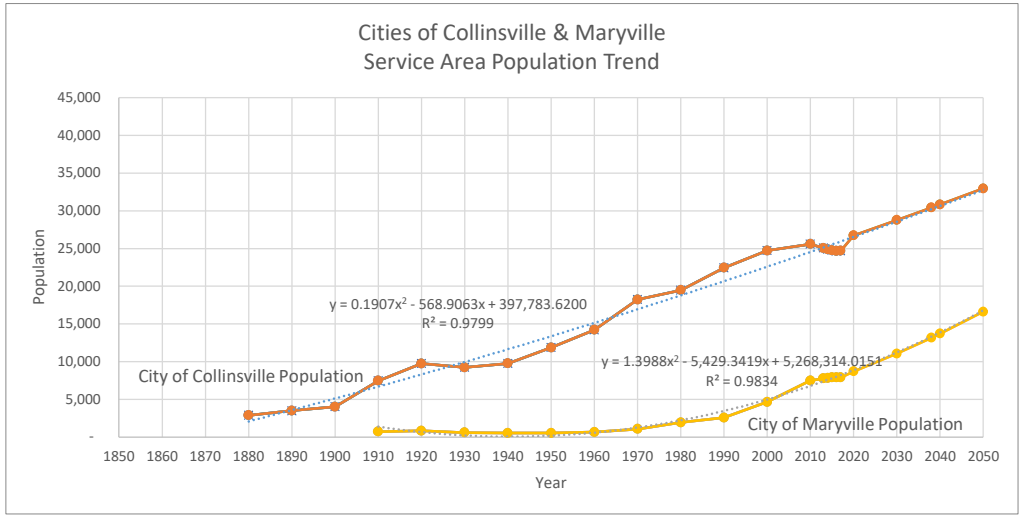
Because all proposed improvements would be constructed on existing City property, the project should not interfere with the expansion of the community. No negative effect on the land-based ecosystems near the site of the existing wastewater treatment facility is anticipated. Sludge disposal from the proposed facilities will be impacted by the project but will continue to be in strict accordance with the state and federal sludge regulations. The effect created by the disposal of sludge will be beneficial, and not detrimental.

APPENDIX A
POPULATION EQUIVALENT PROJECTIONS

	Collinsville City Limits			Maryville City Limits		
	Year	Population	% Change	Year	Population	% Change
1	1880	2,887				
2	1890	3,498	21.2%			
3	1900	4,021	15.0%			
4	1910	7,478	86.0%	1910	729	
5	1920	9,753	30.4%	1920	836	14.7%
6	1930	9,235	-5.3%	1930	602	-28.0%
7	1940	9,767	5.8%	1940	536	-11.0%
8	1950	11,862	21.4%	1950	539	0.6%
9	1960	14,217	19.9%	1960	675	25.2%
10	1970	18,224	28.2%	1970	1,067	58.1%
11	1980	19,475	6.9%	1980	1,949	82.7%
12	1990	22,446	15.3%	1990	2,576	32.2%
13	2000	24,707	10.1%	2000	4,651	80.6%
14	2010	25,579	3.5%	2010	7,487	61.0%
15	2013	25,065	-2.0%	2013	7,766	3.7%
16	2014	24,890	-0.7%	2014	7,818	0.7%
17	2015	24,751	-0.6%	2015	7,888	0.9%
18	2016	24,647	-0.4%	2016	7,890	0.0%
19	2017	24,703	0.2%	2017	7,900	0.1%
20	2020	26,725	8.2%	2020	8,707	10.2%
21	2030	28,759	7.6%	2030	11,065	27.1%
22	2038	30,414	5.8%	2038	13,153	18.9%
23	2040	30,832	1.4%	2040	13,703	4.2%
24	2050	32,942	6.8%	2050	16,620	21.3%

Sub FPAs from Capacity Study for the Wastewater Treatment Plant (Sept 2004)				
Number	Size (acres)	Housing Density	Number of Lots	Population
1	1646	70%	1152	4033
2	548	70%	384	1343
3	868	70%	608	2127
Total	3062		2143	7502
Lot Size	1	acre		
Population	3.5	cap/lot		

2038 Collinsville Population	30,414	
2038 Maryville Population	13,153	
2038 Sub FPAs	7,502	
2038 Design Value	**51,069**	
2013 - 2017 Collinsville Population	24,811	ave of 2013 -2017
2013 - 2017 Maryville Population	7,852	ave of 2013 - 2017
2011 - 2015 Sub FPAs	0	
2013 - 2017 Service Area Population	32,664	
2013-2017 Average Daily Flow (ADF)	3,820,000 gal	(DMR Data)
Per Capita Flow (ADF/Population)	117 gal/day/cap	



APPENDIX B
BIOSOLIDS FLOW AND LOADING CALCULATIONS

Client: City of Collinsville, IL
Plant: City of Collinsville WWTP
Biosolids Operating Parameters at Future Design Conditions

Wastewater Parameters

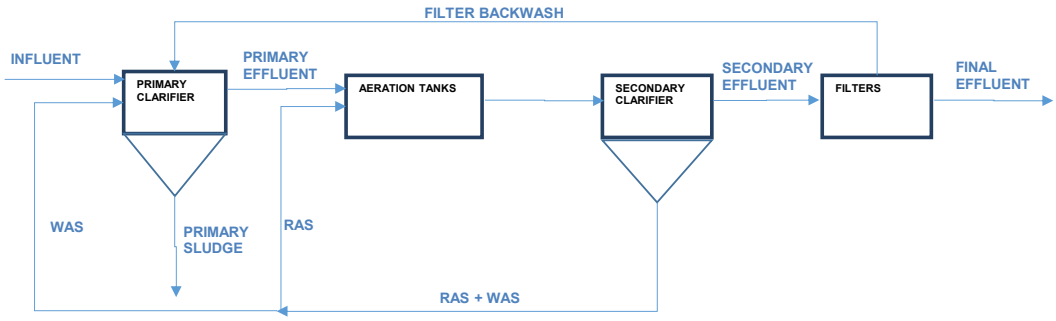
Flowrate		
Design Average Flowrate (DAF), MGD	5.8	(2038 flow and loading projections)
Design Maximum Flowrate (DMF), MGD	9.95	(NPDES Permit)
Return Activated Sludge (RAS), MGD	2.5	
Waste Activated Sludge (WAS), MGD	0.08	
Primary Sludge (PS), MGD	0.026	
Filter Backwash (FB), MGD	0.297	
Influent Concentrations		
CBOD, mg/L	191	(2038 flow and loading projections)
TSS, mg/l	210	(2038 flow and loading projections)
Primary Effluent Concentrations		
CBOD, mg/L	112	(removal efficiency as calculated)
TSS, mg/l	77	(removal efficiency as calculated)
Secondary Effluent Concentrations		
CBOD, mg/L	8	
TSS, mg/l	11	
Final Effluent Concentrations		
CBOD, mg/L	2.3	
TSS, mg/l	9	
Filter Backwash Concentration		
TSS, mg/l	39	
Total Solids, %	3.0	
SGps, Specific gravity of Primary Sludge	1.03	(table 5-21, 5th Edition Metcalf & Eddy)
Sludge Yield		
Sludge yield, lb VSS/lb BOD (15 d SRT, 20 deg C)	0.45	(figure 8.7a, 5th Edition Metcalf & Eddy)
Fraction of VSS/TSS, lb VSS/lb TSS	0.75	(assumed)
Primary Clarifier Removal Efficiency		
a, BOD	0.018	
b, BOD	0.020	
Removal Efficiency, BOD	41%	(equation. 5-45, 5th Edition Metcalf & Eddy)
a, TSS	0.0075	
b, TSS	0.0140	
Removal Efficiency, TSS	64%	(equation. 5-45, 5th Edition Metcalf & Eddy)

Existing Process Component Information

Primary Clarifiers		
Number of Units	3	
Diameter, ft	65	
Side Water Depth, ft	14	
Surface Area each, sf	3318	
Surface Area total, sf	9955	
Volume each, gal	347540	
Volume total, gal	1042619	
Detention time, hr	4.3	

Calculations

1) Mass Balance



2) Primary Effluent Flow (flow balance around Primary Clarifier)

$$Q_{PE} = Q + Q_W + Q_{FB} - Q_{PS}$$

Where:

Qpe =	Primary effluent flowrate, MGD
Q =	Influent flowrate to primary clarifier, MGD
Qw =	Waste sludge flowrate from return sludge line, MGD
Qfb =	Filter backwash flowrate, MGD
Qps =	Primary sludge flowrate, MGD

Qpe = 6.2 MGD

3) Waste Activated Sludge Production (based on BOD loading)

$$P_{W,TSS} = (Q_{PE} \times C_{PE,BOD}) \times \frac{SY_{VSS}}{f_{VSS,TSS}}$$

Where:

Pw,tss =	Net waste activated sludge produced, lb TSS/day
Qpe =	Primary effluent flowrate, MGD
Cpe,bod =	Primary effluent BOD5 concentration, mg/l
SY,vss =	Sludge yield, lb VSS/lb BOD
fvss,tss =	VSS/TSS fraction, lb VSS/lb TSS

Pw,tss 3,447 lb TSS/day

5) Primary Sludge Production (mass balance around Primary Clarifier)

$$P_{PS,TSS} = (Q \times C_{INF,TSS} + Q_{FB} \times C_{FB,TSS} - Q_{PE} \times C_{PE,TSS}) \times 8.34 + P_{W,TSS}$$

Where:

Pps,tss =	Primary sludge produced, lb TSS/day
Q =	Influent flowrate to aeration tanks, MGD
Cinf,tss =	Influent TSS concentration, mg/l
Qfb =	Filter backwash flowrate, MGD
Cfb,tss =	Filter backwash TSS concentration, mg/l
Pw,tss =	Net waste activated sludge produced, lb TSS/day
Qpe =	Primary effluent flowrate, MGD
Cpe,tss =	Primary effluent TSS concentration, mg/l

Pps,tss = 9,774 lb/day = 9,780 lb/day (rounded)

6) Primary Sludge Flowrate

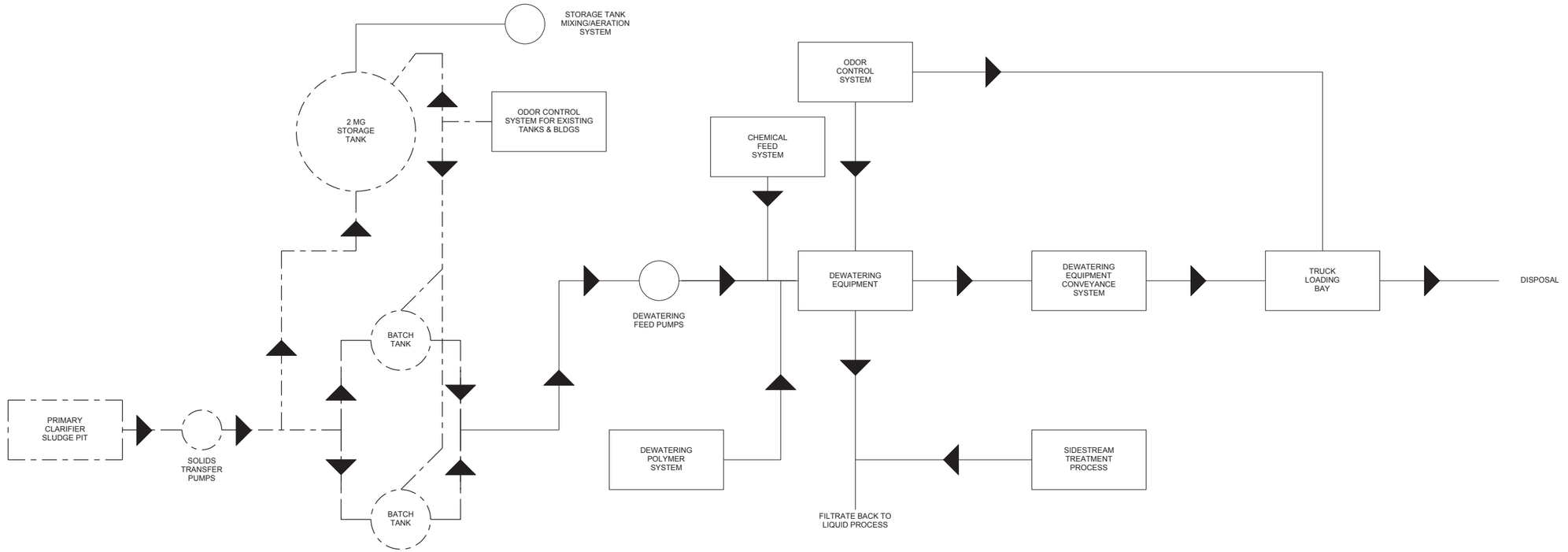
$$Q_{PS} = \frac{P_{PS,TSS}}{8.34 \times C_{PS} \times 10{,}000 \times SG_{PS}}$$

Where:

Qps =	Primary sludge flowrate, MGD
Pps,tss =	Net waste activated sludge produced, lb TSS/day
Cps =	Primary sludge total solids concentration, mg/l
SGps =	Specific Gravity of primary sludge

Qps = 0.038 MGD = 37,930 gpd

APPENDIX C
FIGURES



EXISTING PRIMARY CLARIFIER SLUDGE PIT (TO REMAIN)
- 3 UNITS
- 6" TELESCOPING VALVES
- 9,820 LB/DAY TSS REMOVED
- 39,100 GPD
- 3% SOLIDS CONCENTRATION
- 1.04 SPECIFIC GRAVITY

EXISTING SOLIDS TRANSFER PUMPS (TO REMAIN)
- 2 UNITS
- 10 HP EACH, VFDS

EXISTING BATCH TANKS (TO REMAIN)
- 2 UNITS
- ABOVE GRADE
- 31 FEET DIAMETER, 14.5 FEET SIDE WATER DEPTH
- 10,940 CF (81,850 GAL) EACH
- 21,880 CF (163,700 GAL) TOTAL
- 1 MIXER @ 15 HP, EACH TANK

PROPOSED DEWATERING FEED PUMPS
- 2 - PROGRESSIVE CAVITY PUMPS
- OPERATIONAL TIME: 12 HRS/DAY
- 55 GPM EACH
- 10 HP EACH, VFDS

PROPOSED DEWATERING EQUIPMENT
- 2 - SCREW PRESSES
- 3% INFLUENT SOLIDS CONCENTRATION
- 25% EFFLUENT SOLIDS CONCENTRATION
- 1.04 SPECIFIC GRAVITY
- OPERATIONAL TIME: 12 HRS/DAY
- INFLUENT FLOWRATE: 55 GPM EACH
- INFLUENT LOADING RATE: 770 LB/HR EACH
- 5 HP EACH

PROPOSED DEWATERING EQUIPMENT CONVEYANCE SYSTEM
- ENCLOSED SHAFTLESS SCREW CONVEYORS
- LOADING RATE: 1.9 CY/HR (WET BASIS)
- 1 - HORIZONTAL INFLUENT CONVEYOR
  - 40 FEET LENGTH, 2 HP
- 1 - INCLINED CONVEYOR
  - 45 FEET LENGTH, 5 HP
- 1 - HORIZONTAL TRANSFER CONVEYOR
  - 10 FEET LENGTH, 2 HP
- 1 - HORIZONTAL DISCHARGE CONVEYOR
  - 40 FEET LENGTH, 5 HP, 4 DISCHARGE LOCATIONS

PROPOSED DEWATERING POLYMER SYSTEM
- 1 - LIQUID POLYMER SYSTEM
- POLYMER RATE: 25 LB/DRY TON

PROPOSED BLDG & TRUCK LOADING BAY ODOR CONTROL SYSTEM
- 1 - ACTIVATED CARBON UNIT
- FLOWRATE: 10,000 CFM

PROPOSED CHEMICAL FEED SYSTEM FOR SLUDGE ODOR CONTROL
- 1 - LIQUID CHEMICAL FEED UNIT
- CHEMICAL FEED RATE: 82 LB/HR

PROPOSED SIDESTREAM TREATMENT PROCESS
- 1 - LIQUID PROCESS

PROPOSED TRUCK LOADING BAY
- 85 FEET LENGTH
- 25 FEET WIDE

SLUDGE DISPOSAL LOCATION
- HAULING TO LANDFILL
- 1 - 53 FEET LONG SEMI TRACTOR TRAILER
- 17 TON/DAY NET AVE SLUDGE PRODUCTION (WET BASIS)

EXISTING STORAGE TANK (TO REMAIN)
- ABOVE GRADE, GLASS-LINED
- 1 - 2,000,000 GALLON
  - 112 FEET DIAMETER, 27 FEET SIDE WATER DEPTH
- 50 DAYS STORAGE CAPACITY

PROPOSED MIXING/AERATION SYSTEM FRO EXISTING STORAGE TANKS
- 1 - FINE BUBBLE DIFFUSER SYSTEM
- 2 - AERATION BLOWERS
- 1 - NOZZLE MIXING SYSTEM
- 1 - MIXING AIR COMPRESSOR

PROPOSED ODOR CONTROL SYSTEM FOR EXISTING TANKS & BLDGS
- 1 - ACTIVATED CARBON UNIT

CMT
(IL) License No. 184000613-0015
CONSULTANTS

JANUARY 2020

BIOSOLIDS HANDLING SYSTEM UPGRADE PROJECT

OWNER

COLLINSVILLE, ILLINOIS

MARK	DATE	DESCRIPTION

PROJECT NO:	18401-18-00
CAD DWG FILE:	19040118 PFDS.DWG
DESIGNED BY:	APE
DRAWN BY:	TLL/APE
CHECKED BY:	KSK
APPROVED BY:	APE

SHEET TITLE

DEWATER & DISPOSE OPTION - PROCESS FLOW DIAGRAM

FIGURE 1

SHEET 1 OF 4

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EXISTING STRUCTURE NOMENCLATURE

A. INFLUENT CONTROL STRUCTURE
B. HEADWORKS
C. INFLUENT PUMP STATION
D. PRIMARY CLARIFIER
E. AERATION TANK
F. SECONDARY CLARIFIER
G. FILTER CONTROL STRUCTURE
H. FILTER BUILDING
I. BACKWASH TANK
J. EXCESS FLOW PUMP STATION
K. BAR SCREEN
L. EXCESS FLOW CLARIFIER
M. UV EXCESS FLOW CONTROL STRUCTURE
N. UV CONTROL STRUCTURE
O. UV SYSTEM
P. UV/POST AERATION CONTROL STRUCTURE
Q. CONTROL BUILDING
R. GARAGE
S. STORAGE BUILDING
T. SLUDGE TRANSFER PUMP BUILDING
U. SLUDGE STORAGE TANK - 1 MG
V. SLUDGE STORAGE TANK - 2 MG
W. SLUDGE MIXER PUMP BUILDING
X. SLUDGE STABILIZATION BATCH TANK
Y. ODOR CONTROL BUILDING
Z. LIME SILO
AA. SLUDGE TRUCK STATION

EXISTING SITE FENCE (TYP.)
EXISTING SITE FENCE (TYP.)
TRUCK LOADING BAY (85' X 25')
SCREW PRESS BUILDING (50' X 50')
22' WIDE ACCESS DRIVE
ADMIN. BUILDING
N
0 50' 100'

CMT
(IL) License No. 184000613-0015
CONSULTANTS

JANUARY 2020

BIOSOLIDS HANDLING SYSTEM UPGRADE PROJECT

OWNER

COLLINSVILLE, ILLINOIS

MARK	DATE	DESCRIPTION

PROJECT NO:	18401-18-00
CAD DWG FILE:	19040118 C SHEETS.DWG
DESIGNED BY:	APE
DRAWN BY:	TLL/APE
CHECKED BY:	KSK
APPROVED BY:	APE
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SHEET TITLE

DEWATER & DISPOSE OPTION - SITE PLAN

FIGURE 2

SHEET 2 OF 4

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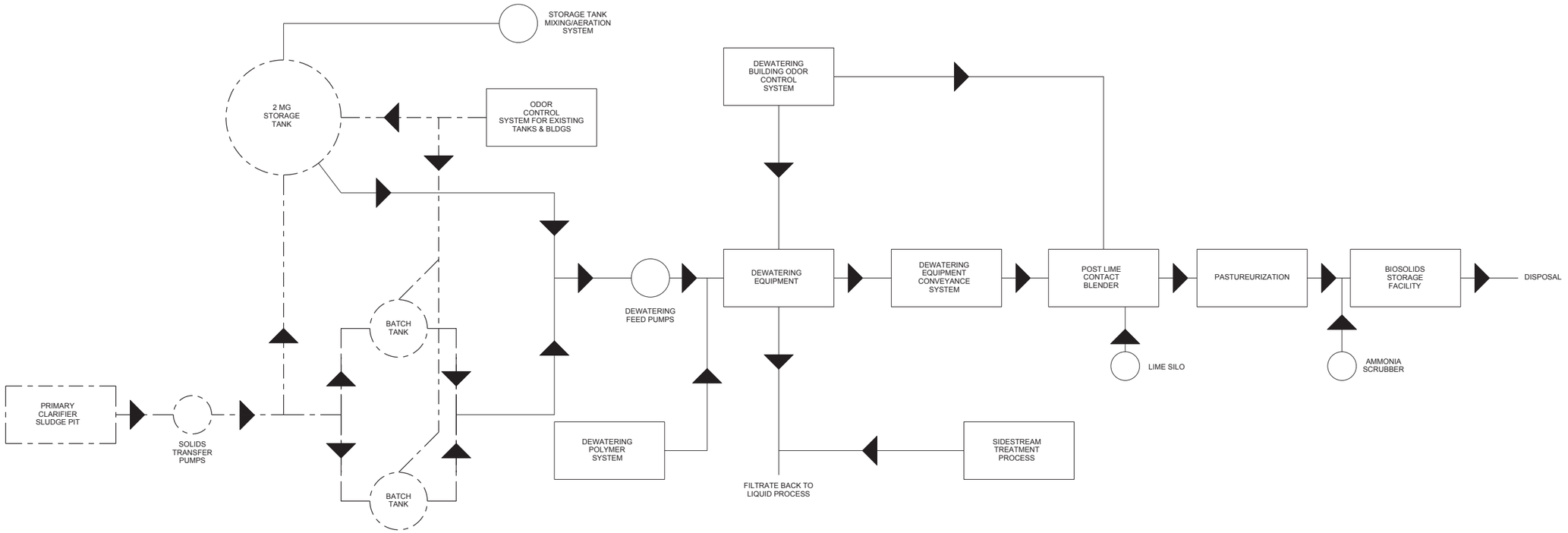

EXISTING PRIMARY CLARIFIER SLUDGE PIT (TO REMAIN)
- 3 UNITS
- 6" TELESCOPING VALVES
- 9,820 LB/DAY TSS REMOVED
- 39,100 GPD
- 3% SOLIDS CONCENTRATION
- 1.04 SPECIFIC GRAVITY

EXISTING SOLIDS TRANSFER PUMPS (TO REMAIN)
- 2 UNITS
- 10 HP EACH, VFDS

EXISTING BATCH TANKS (TO REMAIN)
- 2 UNITS
- ABOVE GRADE
- 31 FEET DIAMETER, 14.5 FEET SIDE WATER DEPTH
- 10,940 CF (81,850 GAL) EACH
- 21,880 CF (163,700 GAL) TOTAL
- 1 MIXER @ 15 HP, EACH TANK

PROPOSED DEWATERING FEED PUMPS
- 2 - PROGRESSIVE CAVITY PUMPS
- OPERATIONAL TIME: 24 HRS/DAY
- 30 GPM, EACH
- 10 HP EACH, VFDS

PROPOSED DEWATERING EQUIPMENT
- 1 - SCREW PRESS
- 3% INFLUENT SOLIDS CONCENTRATION
- 25% EFFLUENT SOLIDS CONCENTRATION
- 1.04 SPECIFIC GRAVITY
- OPERATIONAL TIME: 24 HRS/DAY
- INFLUENT LOADING RATE: 400 LB/HR
- 3 HP

PROPOSED DEWATERING EQUIPMENT CONVEYANCE SYSTEM
- ENCLOSED SHAFTED SCREW CONVEYOR
  - 1 - EFFLUENT CONVEYOR
  - 35 FEET LENGTH, 3 HP

PROPOSED DEWATERING POLYMER SYSTEM
- 1 - LIQUID POLYMER SYSTEM
- POLYMER RATE: 25 LB/DRY TON

PROPOSED DEWATERING BUILDING ODOR CONTROL SYSTEM
- 1 - ACTIVATED CARBON UNIT

PROPOSED SIDESTREAM TREATMENT PROCESS
- 1 - LIQUID PROCESS

PROPOSED POST LIME CONTACT BLENDER
- 1 - BIOSOLIDS PISTON PUMP
  - OPERATIONAL TIME: 24 HR/DAY
- 1 - HYDRAULIC POWER UNIT
  - 15 HP

PROPOSED POST LIME SILO & CONVEYANCE SYSTEM
- 1 - 70 TON SILO
  - 12 FEET DIAMETER, 36 FEET TALL
- 1 - ENCLOSED SHAFTED SCREW CONVEYOR
  - 20 FEET LENGTH, 2 HP

PROPOSED AMMONIA SCRUBBER
- 1 - BLOWER
- 500 CFM, 1 HP

PROPOSED PASTEURIZATION
- 1 - SULFAMIC ACID FEEDER
  - 90 LB CAPACITY HOPPER
  - LOADING RATE: 3 LB/HR
- 1 - MIXER, 1/4 HP
- 1 - REACTOR VESSEL
  - 36 INCH DIAMETER, 10 FEET LENGTH
  - 60 MINUTES RESIDENCE TIME

PROPOSED TRUCK LOADING BAY & BIOSOLIDS STORAGE FACILITY
- CLASS A: 19.2 TON/DAY NET AVE SLUDGE PRODUCTION (WET BASIS)
- TRUCK LOADING BAY: 85 FEET LONG, 25 FEET WIDE
- COVERED STORAGE FACILITY: 85 FEET WIDE, 100 FEET LONG
- DRY STORAGE CAPACITY: 60 DAYS (MINIMUM)

EXISTING STORAGE TANK
- ABOVE GRADE, GLASS-LINED
- 2,000,000 GALLON
- 112 FEET DIAMETER, 27 FEET SIDE WATER DEPTH
- 50 DAYS STORAGE CAPACITY

PROPOSED MIXING/AERATION SYSTEM FOR EXISTING STORAGE TANKS
- 1 - FINE BUBBLE DIFFUSER SYSTEMS
- 3 - AERATION BLOWERS
- 1 - NOZZLE MIXING SYSTEMS
- 1 - MIXING AIR COMPRESSORS

PROPOSED ODOR CONTROL SYSTEM FOR EXISTING TANK & BLDGS
- 1 - ACTIVATED CARBON UNIT

CMT
(IL) License No. 184000613-0015
CONSULTANTS

JANUARY 2020

BIOSOLIDS HANDLING SYSTEM UPGRADE PROJECT

OWNER

COLLINSVILLE, ILLINOIS

MARK	DATE	DESCRIPTION

PROJECT NO:	18401-18-00
CAD DWG FILE:	19040118 PFDS.DWG
DESIGNED BY:	APE
DRAWN BY:	TLL/APE
CHECKED BY:	KSK
APPROVED BY:	APE

SHEET TITLE

DRY LIME OPTION PROCESS FLOW DIAGRAM

FIGURE 3

SHEET 3 OF 4

EXISTING STRUCTURE NOMENCLATURE

A. INFLUENT CONTROL STRUCTURE
B. HEADWORKS
C. INFLUENT PUMP STATION
D. PRIMARY CLARIFIER
E. AERATION TANK
F. SECONDARY CLARIFIER
G. FILTER CONTROL STRUCTURE
H. FILTER BUILDING
I. BACKWASH TANK
J. EXCESS FLOW PUMP STATION
K. BAR SCREEN
L. EXCESS FLOW CLARIFIER
M. UV EXCESS FLOW CONTROL STRUCTURE
N. UV CONTROL STRUCTURE
O. UV SYSTEM
P. UV/POST AERATION CONTROL STRUCTURE
Q. CONTROL BUILDING
R. GARAGE
S. STORAGE BUILDING
T. SLUDGE TRANSFER PUMP BUILDING
U. SLUDGE STORAGE TANK - 1 MG
V. SLUDGE STORAGE TANK - 2 MG
W. SLUDGE MIXER PUMP BUILDING
X. SLUDGE STABILIZATION BATCH TANK
Y. ODOR CONTROL BUILDING
Z. LIME SILO
AA. SLUDGE TRUCK STATION

EXISTING SITE FENCE (TYP.)

PROCESS BUILDING (60' X 50')

BIOSOLIDS STORAGE FACILITY & TRUCK LOADING BAY (85' X 25')

FUTURE CLARIFIER

22' WIDE ACCESS DRIVE

ADMIN. BUILDING

N

0 50' 100'

Path: J:\Collinsville\19040118-00_Biosolids\UpgradeDesign\Draw\Sheets\19040118 C SHEETS.dwg
Date: Tuesday, January 21, 2020 12:58:46 PM

CMT

(IL) License No. 184000613-0015

CONSULTANTS

JANUARY 2020

BIOSOLIDS HANDLING SYSTEM UPGRADE PROJECT

OWNER

COLLINSVILLE, ILLINOIS

MARK	DATE	DESCRIPTION

PROJECT NO:	18401-18-00
CAD DWG FILE:	19040118 C SHEETS.DWG
DESIGNED BY:	APE
DRAWN BY:	TLL/APE
CHECKED BY:	KSK
APPROVED BY:	APE

SHEET TITLE

DRY LIME OPTION - SITE PLAN

FIGURE 4

SHEET 4 OF 4

APPENDIX D
TOTAL ESTIMATED PROJECT COSTS

Biosolids Handling System Upgrade
City of Collinsville, Illinois
January-2020

CONCEPTUAL ESTIMATE OF LIFE CYCLE COST

ESTIMATED INITIAL PROJECT COSTS

Item	Dewater & Disposal	Dry Lime Stabilization Class B	Dry Lime Stabilization Class A
Construction Subtotal	$4,380,000	$5,490,000	$5,640,000
Contingency (10%)	$440,000	$550,000	$560,000
Total Construction Cost	$4,820,000	$6,040,000	$6,200,000
Design Engineering	$350,000	$350,000	$350,000
Bidding Phase Services	$25,000	$25,000	$25,000
Construction Adminstration Services	$145,000	$145,000	$145,000
Construction Resident Engineer Services	$190,000	$190,000	$190,000
Other Professional Services	$0	$0	$0
Total Engineering Cost	$710,000	$710,000	$710,000
Total Estimated Project Cost	$5,530,000	$6,750,000	$6,910,000

Annual Loan Payment Estimate

Loan Type	SRF	SRF	SRF
Estimated Financed Amount	$5,530,000	$6,750,000	$6,910,000
Loan Period (Years)	20	20	20
Annual Interest Rate (%)	2.00%	2.00%	2.00%
Total Estimated Annual Loan Payment	**$338,000**	**$413,000**	**$423,000**

Biosolids Handling System Upgrade
City of Collinsville, Illinois
January-2020

CONCEPTUAL ESTIMATE OF CONSTRUCTION COST

Dewater and Disposal

Item	Unit	No. of Units	Unit Cost or Equip. Cost	Total Unit or Equip. Cost	Equip. Installation	Installation Cost	Total Item Cost	Total Structure Cost
DIVISION 1 - GENERAL REQUIREMENTS								
Mobilization, Bonds & Insurance	LS	1	$300,000.00	$300,000.00			$300,000.00	
DIVISION 1 - GENERAL REQUIREMENTS SUBTOTAL								**$300,000.00**
DIVISION 2 - SITE WORK								
Asphalt Access Road	SY	4,800	$80.00	$384,000.00			$384,000.00	
Electric Utility Extension	LS	1	$50,000.00	$50,000.00			$50,000.00	
Process Building								
Excavation	CY	1,050	$30.00	$31,500.00			$31,500.00	
Granular Bedding	CY	265	$35.00	$9,275.00			$9,275.00	
Backfill	CY	714	$30.00	$21,420.00			$21,420.00	
Truck Loading Area								
Excavation	CY	949	$30.00	$28,470.00			$28,470.00	
Granular Bedding	CY	232	$35.00	$8,120.00			$8,120.00	
Backfill	CY	571	$30.00	$17,130.00			$17,130.00	
Chemical Feed Containment								
Excavation	CY	103	$30.00	$3,090.00			$3,090.00	
Granular Bedding	CY	28	$35.00	$980.00			$980.00	
Backfill	CY	62	$30.00	$1,860.00			$1,860.00	
DIVISION 2 - SITE WORK SUBTOTAL								**$555,845.00**

Biosolids Handling System Upgrade
City of Collinsville, Illinois
January-2020

CONCEPTUAL ESTIMATE OF CONSTRUCTION COST

Dewater and Disposal

Item	Unit	No. of Units	Unit Cost or Equip. Cost	Total Unit or Equip. Cost	Equip. Installation	Installation Cost	Total Item Cost	Total Structure Cost
DIVISION 3 - CONCRETE								
Process Building								
Slab on Grade	CY	119	$425.00	$50,575.00			$50,575.00	
Walls	CY	86	$700.00	$60,200.00			$60,200.00	
Truck Loading Area								
Slab on Grade	CY	102	$425.00	$43,350.00			$43,350.00	
Walls	CY	45	$700.00	$31,500.00			$31,500.00	
Chemical Feed Containment								
Slab on Grade	CY	12	$425.00	$5,100.00			$5,100.00	
Walls	CY	8	$700.00	$5,600.00			$5,600.00	
DIVISION 3 - CONCRETE SUBTOTAL								**$196,325.00**
DIVISION 4 - MASONRY								
DIVISION 5 - METAL								
Process Building	SF	2,500	$135.00	$337,500.00			$337,500.00	
Truck Loading Area	SF	2,125	$100.00	$212,500.00			$212,500.00	
DIVISION 5 - METAL SUBTOTAL								**$550,000.00**
DIVISION 6 - WOOD AND PLASTIC								
DIVISION 7 - THERMAL AND MOISTURE PROTECTION								
DIVISION 8 - DOORS AND WINDOWS								
DIVISION 9 - FINISHES								
DIVISION 10 - SPECIALTIES								
DIVISION 11 - EQUIPMENT								
Dewatering Equipment Feed Pump	EA	2	$35,000.00	$70,000.00	0.05	$3,500.00	$73,500.00	
Dewatering Equipment w/ Polymer - Screw Press	EA	2	$480,000.00	$960,000.00	0.05	$48,000.00	$1,008,000.00	
New Mixing/Aeration System for Existing 2 MG Storage Tank	LS	1	$175,000.00	$175,000.00	0.10	$17,500.00	$192,500.00	
DIVISION 11 - EQUIPMENT SUBTOTAL								**$1,274,000.00**

Biosolids Handling System Upgrade
City of Collinsville, Illinois
January-2020

CONCEPTUAL ESTIMATE OF CONSTRUCTION COST

Dewater and Disposal

Item	Unit	No. of Units	Unit Cost or Equip. Cost	Total Unit or Equip. Cost	Equip. Installation	Installation Cost	Total Item Cost	Total Structure Cost
DIVISION 12 - FURNISHINGS								
DIVISION 13 - SPECIAL CONSTRUCTION								
Chemical Feed System	EA	1	$50,000.00	$50,000.00	0.10	$5,000.00	$55,000.00	
Process Building Odor Control System	EA	1	$75,000.00	$75,000.00	0.10	$7,500.00	$82,500.00	
Truck Bay Odor Control System	EA	1	$75,000.00	$75,000.00	0.10	$7,500.00	$82,500.00	
Existing Odor Control System Upgrade	EA	1	$25,000.00	$25,000.00	0.10	$2,500.00	$27,500.00	
Sidestream Treatment Process	EA	1	$50,000.00	$50,000.00	0.10	$5,000.00	$55,000.00	
Tractor Trailer	EA	1	$300,000.00	$300,000.00	0.00	$0.00	$300,000.00	
DIVISION 13 - SPECIAL CONSTRUCTION SUBTOTAL								**$602,500.00**
DIVISION 14 - HOIST SYSTEMS								
Inclined Conveyor	LF	50	$2,000.00	$100,000.00	0.05	$5,000.00	$105,000.00	
Horizontal Discharge Conveyor w/ multiple discharge locations	LF	40	$2,500.00	$100,000.00	0.05	$5,000.00	$105,000.00	
DIVISION 14 - HOIST SYSTEMS SUBTOTAL								**$210,000.00**
DIVISION 15 - MECHANICAL								
Plant Water Piping	LS	1	$25,000.00	$25,000.00		$0.00	$25,000.00	
Process Bldg Piping	LS	1	$15,000.00	$15,000.00		$0.00	$15,000.00	
Site Piping	LS	1	$200,000.00	$200,000.00		$0.00	$200,000.00	
HVAC - Process Building	SF	2,500	$10.00	$25,000.00		$0.00	$25,000.00	
HVAC - Truck Loading Bay	SF	2,125	$10.00	$21,250.00		$0.00	$21,250.00	
Plumbing	LS	1	$30,000.00	$30,000.00		$0.00	$30,000.00	
DIVISION 15 - MECHANICAL SUBTOTAL								**$316,250.00**
DIVISION 16 - ELECTRICAL								
Electrical/SCADA/Controls	%	10	$3,705,000.00	$370,500.00		$0.00	$370,500.00	
DIVISION 16 - ELECTRICAL SUBTOTAL								**$370,500.00**
TOTAL								**$4,380,000.00**

Biosolids Handling System Upgrade
City of Collinsville, Illinois
January-2020

CONCEPTUAL ESTIMATE OF CONSTRUCTION COST

Dry Lime Stabilization

Item	Unit	No. of Units	Unit Cost or Equip. Cost	Total Unit or Equip. Cost	Equip. Installation	Installation Cost	Total Item Cost	Total Structure Cost
DIVISION 1 - GENERAL REQUIREMENTS								
Mobilization, Bonds & Insurance	LS	1	$300,000.00	$300,000.00			$300,000.00	
DIVISION 1 - GENERAL REQUIREMENTS SUBTOTAL								**$300,000.00**
DIVISION 2 - SITE WORK								
Gravel Access Road	SY	4,800	$80.00	$384,000.00			$384,000.00	
Utility Extension	LS	1	$50,000.00	$50,000.00			$50,000.00	
Process Building								
Excavation	CY	1,862	$30.00	$55,860.00			$55,860.00	
Granular Bedding	CY	317	$35.00	$11,095.00			$11,095.00	
Backfill	CY	779	$30.00	$23,370.00			$23,370.00	
Truck Loading Area								
Excavation	CY	949	$30.00	$28,470.00			$28,470.00	
Granular Bedding	CY	232	$35.00	$8,120.00			$8,120.00	
Backfill	CY	571	$30.00	$17,130.00			$17,130.00	
DIVISION 2 - SITE WORK SUBTOTAL								**$578,045.00**
DIVISION 3 - CONCRETE								
Process Building								
Slab on Grade	CY	224	$425.00	$95,200.00			$95,200.00	
Walls	CY	122	$700.00	$85,400.00			$85,400.00	
Truck Loading Area								
Slab on Grade	CY	102	$425.00	$43,350.00			$43,350.00	
Walls	CY	45	$700.00	$31,500.00			$31,500.00	
Biosolids Storage Building								
Walls (Push Walls)	CY	70	$700.00	$49,000.00			$49,000.00	
DIVISION 3 - CONCRETE SUBTOTAL								**$304,450.00**

Biosolids Handling System Upgrade
City of Collinsville, Illinois
January-2020

CONCEPTUAL ESTIMATE OF CONSTRUCTION COST

Dry Lime Stabilization

Item	Unit	No. of Units	Unit Cost or Equip. Cost	Total Unit or Equip. Cost	Equip. Installation	Installation Cost	Total Item Cost	Total Structure Cost
DIVISION 4 - MASONRY								
DIVISION 5 - METAL								
Process Building	SF	3,000	$135.00	$405,000.00			$405,000.00	
Truck Loading Area	SF	2,125	$100.00	$212,500.00			$212,500.00	
Biosolids Storage Facility (Pre-Engineered Bldg & Foundation)	SF	8,500	$40.00	$340,000.00			$340,000.00	
DIVISION 5 - METAL SUBTOTAL								**$957,500.00**
DIVISION 6 - WOOD AND PLASTIC								
DIVISION 7 - THERMAL AND MOISTURE PROTECTION								
DIVISION 8 - DOORS AND WINDOWS								
DIVISION 9 - FINISHES								
DIVISION 10 - SPECIALTIES								
DIVISION 11 - EQUIPMENT								
Dewatering Equipment Feed Pump	EA	2	$35,000.00	$70,000.00	0.05	$3,500.00	$73,500.00	
Dewatering Equipment w/ Polymer - Screw Press	LS	1	$326,400.00	$326,400.00	0.05	$16,320.00	$342,720.00	
Class B Package - Dry Lime	LS	1	$773,000.00	$773,000.00	0.05	$38,650.00	$811,650.00	
New Mixing/Aeration System for Existing Storage Tanks	LS	1	$175,000.00	$175,000.00	0.05	$8,750.00	$183,750.00	
DIVISION 11 - EQUIPMENT SUBTOTAL								**$1,411,620.00**
DIVISION 12 - FURNISHINGS								
DIVISION 13 - SPECIAL CONSTRUCTION								
Process Building Odor Control System	EA	1	$75,000.00	$75,000.00	0.05	$3,750.00	$78,750.00	
Existing Odor Control System Upgrade	EA	1	$25,000.00	$25,000.00	0.10	$2,500.00	$27,500.00	
Sidestream Treatment Process	EA	1	$50,000.00	$50,000.00	0.10	$5,000.00	$55,000.00	
Front End Loader	EA	1	$200,000.00	$200,000.00	0.00	$0.00	$200,000.00	
Manure Spreader Truck	EA	1	$200,000.00	$200,000.00	0.00	$0.00	$200,000.00	
Windrow Machine	EA	1	$485,000.00	$485,000.00	0.00	$0.00	$485,000.00	
DIVISION 13 - SPECIAL CONSTRUCTION SUBTOTAL								**$1,046,250.00**

Biosolids Handling System Upgrade
City of Collinsville, Illinois
January-2020

CONCEPTUAL ESTIMATE OF CONSTRUCTION COST

Dry Lime Stabilization

Item	Unit	No. of Units	Unit Cost or Equip. Cost	Total Unit or Equip. Cost	Equip. Installation	Installation Cost	Total Item Cost	Total Structure Cost
DIVISION 14 - HOIST SYSTEMS								
Horizontal Transfer Conveyor	LF	30	$2,000.00	$60,000.00	0.05	$3,000.00	$63,000.00	
Horizontal Discharge Conveyor w/ multiple discharge locations	LF	40	$2,500.00	$100,000.00	0.05	$5,000.00	$105,000.00	
DIVISION 14 - HOIST SYSTEMS SUBTOTAL								**$168,000.00**
DIVISION 15 - MECHANICAL								
Plant Water Piping	LS	1	$25,000.00	$25,000.00		$0.00	$25,000.00	
Process Piping	LS	1	$15,000.00	$15,000.00		$0.00	$15,000.00	
Site Piping	LS	1	$200,000.00	$200,000.00		$0.00	$200,000.00	
HVAC - Process Building	SF	3,000	$10.00	$30,000.00		$0.00	$30,000.00	
HVAC - Truck Loading Bay	SF	2,125	$10.00	$21,250.00		$0.00	$21,250.00	
Plumbing	LS	1	$30,000.00	$30,000.00		$0.00	$30,000.00	
DIVISION 15 - MECHANICAL SUBTOTAL								**$321,250.00**
DIVISION 16 - ELECTRICAL								
Electrical/SCADA/Controls	LS	1	$400,000.00	$400,000.00		$0.00	$400,000.00	
DIVISION 16 - ELECTRICAL SUBTOTAL								**$400,000.00**
TOTAL								**$5,490,000.00**

Biosolids Handling System Upgrade
City of Collinsville, Illinois
January-2020

CONCEPTUAL ESTIMATE OF CONSTRUCTION COST

Dry Lime Stabilization with Pasteurization

Item	Unit	No. of Units	Unit Cost or Equip. Cost	Total Unit or Equip. Cost	Equip. Installation	Installation Cost	Total Item Cost	Total Structure Cost
DIVISION 1 - GENERAL REQUIREMENTS								
Mobilization, Bonds & Insurance	LS	1	$300,000.00	$300,000.00			$300,000.00	
DIVISION 1 - GENERAL REQUIREMENTS SUBTOTAL								**$300,000.00**
DIVISION 2 - SITE WORK								
Asphalt Access Road	SY	4,800	$80.00	$384,000.00			$384,000.00	
Electric Utility Extension	LS	1	$50,000.00	$50,000.00			$50,000.00	
Process Building								
Excavation	CY	1,862	$30.00	$55,860.00			$55,860.00	
Granular Bedding	CY	317	$35.00	$11,095.00			$11,095.00	
Backfill	CY	779	$30.00	$23,370.00			$23,370.00	
Truck Loading Area								
Excavation	CY	949	$30.00	$28,470.00			$28,470.00	
Granular Bedding	CY	232	$35.00	$8,120.00			$8,120.00	
Backfill	CY	571	$30.00	$17,130.00			$17,130.00	
DIVISION 2 - SITE WORK SUBTOTAL								**$578,045.00**
DIVISION 3 - CONCRETE								
Process Building								
Slab on Grade	CY	224	$425.00	$95,200.00			$95,200.00	
Walls	CY	122	$700.00	$85,400.00			$85,400.00	
Truck Loading Area								
Slab on Grade	CY	102	$425.00	$43,350.00			$43,350.00	
Walls	CY	45	$700.00	$31,500.00			$31,500.00	
Biosolids Storage Building								
Walls (Push Walls)	CY	70	$700.00	$49,000.00			$49,000.00	
DIVISION 3 - CONCRETE SUBTOTAL								**$304,450.00**

Biosolids Handling System Upgrade
City of Collinsville, Illinois
January-2020

CONCEPTUAL ESTIMATE OF CONSTRUCTION COST

Dry Lime Stabilization with Pasteurization

Item	Unit	No. of Units	Unit Cost or Equip. Cost	Total Unit or Equip. Cost	Equip. Installation	Installation Cost	Total Item Cost	Total Structure Cost
DIVISION 4 - MASONRY								
DIVISION 5 - METAL								
Process Building	SF	3,000	$135.00	$405,000.00			$405,000.00	
Truck Loading Area	SF	2,125	$100.00	$212,500.00			$212,500.00	
Biosolids Storage Facility (Pre-Engineered Bldg & Foundation)	SF	8,500	$40.00	$340,000.00			$340,000.00	
DIVISION 5 - METAL SUBTOTAL								**$957,500.00**
DIVISION 6 - WOOD AND PLASTIC								
DIVISION 7 - THERMAL AND MOISTURE PROTECTION								
DIVISION 8 - DOORS AND WINDOWS								
DIVISION 9 - FINISHES								
DIVISION 10 - SPECIALTIES								
DIVISION 11 - EQUIPMENT								
Dewatering Equipment Feed Pump	EA	2	$35,000.00	$70,000.00	0.05	$3,500.00	$73,500.00	
Dewatering Equipment	LS	1	$326,400.00	$326,400.00	0.05	$16,320.00	$342,720.00	
Class A Package - Dry Lime	LS	1	$917,400.00	$917,400.00	0.05	$45,870.00	$963,270.00	
New Mixing/Aeration System for Existing 2 MG Storage Tank	LS	1	$175,000.00	$175,000.00	0.05	$8,750.00	$183,750.00	
DIVISION 11 - EQUIPMENT SUBTOTAL								**$1,563,240.00**
DIVISION 12 - FURNISHINGS								
DIVISION 13 - SPECIAL CONSTRUCTION								
Process Building Odor Control System	EA	1	$75,000.00	$75,000.00	0.05	$3,750.00	$78,750.00	
Existing Odor Control System Upgrade	EA	1	$25,000.00	$25,000.00	0.10	$2,500.00	$27,500.00	
Sidestream Treatment Process	EA	1	$50,000.00	$50,000.00	0.10	$5,000.00	$55,000.00	
Front End Loader	EA	1	$200,000.00	$200,000.00	0.00	$0.00	$200,000.00	
Manure Spreader Truck	EA	1	$200,000.00	$200,000.00	0.00	$0.00	$200,000.00	
Windrow Machine	EA	1	$485,000.00	$485,000.00	0.00	$0.00	$485,000.00	
DIVISION 13 - SPECIAL CONSTRUCTION SUBTOTAL								**$1,046,250.00**

Biosolids Handling System Upgrade
City of Collinsville, Illinois
January-2020

CONCEPTUAL ESTIMATE OF CONSTRUCTION COST

Dry Lime Stabilization with Pasteurization

Item	Unit	No. of Units	Unit Cost or Equip. Cost	Total Unit or Equip. Cost	Equip. Installation	Installation Cost	Total Item Cost	Total Structure Cost
DIVISION 14 - HOIST SYSTEMS								
Horizontal Transfer Conveyor	LF	30	$2,000.00	$60,000.00	0.05	$3,000.00	$63,000.00	
Horizontal Discharge Conveyor w/ multiple discharge locations	LF	40	$2,500.00	$100,000.00	0.05	$5,000.00	$105,000.00	
DIVISION 14 - HOIST SYSTEMS SUBTOTAL								**$168,000.00**
DIVISION 15 - MECHANICAL								
Plant Water Piping	LS	1	$25,000.00	$25,000.00		$0.00	$25,000.00	
Process Piping	LS	1	$15,000.00	$15,000.00		$0.00	$15,000.00	
Site Piping	LS	1	$200,000.00	$200,000.00		$0.00	$200,000.00	
HVAC - Process Building	SF	3,000	$10.00	$30,000.00		$0.00	$30,000.00	
HVAC - Truck Loading Bay	SF	2,125	$10.00	$21,250.00		$0.00	$21,250.00	
Plumbing	LS	1	$30,000.00	$30,000.00		$0.00	$30,000.00	
DIVISION 15 - MECHANICAL SUBTOTAL								**$321,250.00**
DIVISION 16 - ELECTRICAL								
Electrical/SCADA/Controls	LS	1	$400,000.00	$400,000.00		$0.00	$400,000.00	
DIVISION 16 - ELECTRICAL SUBTOTAL								**$400,000.00**
TOTAL								**$5,640,000.00**

APPENDIX E
OPERATION AND MAINTENANCE COSTS

Biosolids Handling System Upgrade

City of Collinsville, Illinois

January-2020

CONCEPTUAL ESTIMATE OF LIFE CYCLE COST

ESTIMATED ANNUAL OPERATION & MAINTENANCE COSTS

Item	Dewater & Disposal	Dry Lime Stabilization Class B	Dry Lime Stabilization Class A	Existing System
Electricity	$32,000	$46,000	$46,000	$88,000
Chemicals	$111,000	$160,000	$221,000	$91,000
Disposal Cost	$217,000	$0	$0	$450,000
Total	**$360,000**	**$206,000**	**$267,000**	**$629,000**

Estimated 2037 Annual Cost with Loan Debt Service

Estimated Annual Debt Service	$338,000	$413,000	$423,000
2037 Estimated Annual O&M Cost	$360,000	$206,000	$267,000
Total Annual Cost	$698,000	$619,000	$690,000

Estimated 2020 Annual Cost with Loan Debt Service

Estimated Annual Debt Service	$338,000	$413,000	$423,000
2019 Estimated Annual O&M Cost	$238,000	$136,000	$176,000
Total Annual Cost	$576,000	$549,000	$599,000
Existing Annual O&M Cost	$629,000	$629,000	$629,000
Annual Cost Reduction	$53,000	$80,000	$30,000

Biosolids Handling System Upgrade $ 0.065 $/kw-hr

City of Collinsville, Illinois

January-2020

CONCEPTUAL ESTIMATE OF LIFE CYCLE COST

ESTIMATED ELECTRICITY REQUIREMENTS

Item	Quantity	Motor HP (each)	Motor HP (total)	Operating HP	Annual Hours of Operation	kW-hr
Dewater & Disposal						
Batch Tank Mixing (Reuse Existing Pumps)	1	15	15	15	8760	98,024
Sludge Feed Pump (Reuse Monyo Pump)	1	25	25	25	8760	163,374
Screw Press	1	5	5	5	3591.6	13,397
Dewatering Equipment Polymer System	1	0.5	0.5	0.5	4368	1,629
Inclined Conveyor	1	5	5	5	3591.6	13,397
Horizontal Discharge Conveyor	1	5	5	5	3591.6	13,397
Process Bldg Odor Control System	1	15	15	15	8760	98,024
Truck Bay Odor Control System	1	15	15	15	8760	98,024
					Total Usage	499,266
					Total Cost	**$ 32,452**
Dry Lime Stabilization Class B						
Batch Tank Mixing (Reuse Existing Pumps)	1	15	15	15	8760	98,024
Sludge Feed Pump (Reuse Monyo Pump)	1	25	25	25	8760	163,374
Screw Press	1	3	3	3	8760	19,605
Dewatering Equipment Polymer System	1	0.5	0.5	0.5	8760	3,267
Dewatering Equipment Screw Conveyor	1	3	3	3	8760	19,605
Flocculation Tank Mixer	1	1	1	1	8760	6,535
Lime Silo Bin Activator	1	0.75	0.75	0.75	8760	4,901
Lime Conveyor	1	2	2	2	8760	13,070
Hydraulic Power Unit	1	15	15	15	8760	98,024
Hydraulic Power Unit Heat Exchanger	1	0.5	0.5	0.5	8760	3,267
Ammonia Scrubber	1	1	1	1	8760	6,535
Gravimetric Feeder	1	1	1	1	8760	6,535
Dust Collector	1	0.33	0.33	0.33	8760	2,157
Horizontal Discharge Conveyor 1	1	5	5	5	8760	32,675
Horizontal Discharge Conveyor 2	1	5	5	5	8760	32,675
Process Building Odor Control System	1	15	15	15	8760	98,024
Truck Bay Odor Control System	1	15	15	15	8760	98,024
					Total Usage	706,298
					Total Cost	**$ 46,000**
Dry Lime Stabilization Class A						
Batch Tank Mixing (Reuse Existing Pumps)	1	15	15	15	8760	98,024
Sludge Feed Pump (Reuse Monyo Pump)	1	25	25	25	8760	163,374
Screw Press	1	3	3	3	8760	19,605
Dewatering Equipment Polymer System	1	0.5	0.5	0.5	8760	3,267
Dewatering Equipment Screw Conveyor	1	3	3	3	8760	19,605
Flocculation Tank Mixer	1	1	1	1	8760	6,535
Lime Silo Bin Activator	1	0.75	0.75	0.75	8760	4,901
Lime Conveyor	1	2	2	2	8760	13,070
Hydraulic Power Unit	1	15	15	15	8760	98,024
Hydraulic Power Unit Heat Exchanger	1	0.5	0.5	0.5	8760	3,267
Ammonia Scrubber	1	1	1	1	8760	6,535
Sulfamic Acid Feeder	1	0.5	0.5	0.5	8760	3,267
Gravimetric Feeder	1	1	1	1	8760	6,535
Dust Collector	1	0.33	0.33	0.33	8760	2,157
Horizontal Discharge Conveyor 1	1	5	5	5	8760	32,675
Horizontal Discharge Conveyor 2	1	5	5	5	8760	32,675
Process Building Odor Control System	1	15	15	15	8760	98,024
Truck Bay Odor Control System	1	15	15	15	8760	98,024
					Total Usage	709,566
					Total Cost	**$ 46,000**

Item	Quantity	Motor HP (each)	Motor HP (total)	Operating HP	Annual Hours of Operation	kW-hr
Existing System						
West Sludge Batch Tank Mixer	1	15	15	15	2288	25,603
East Sludge Batch Tank Mixer	1	15	15	15	2288	25,603
Sludge Pump - Monyo	1	25	25	25	468	8,728
Sludge Pump - Vaughn	1	15	15	15	175.5	1,964
Storage Tank Mixing Pump #1	1	60	60	60	7000	313,320
Storage Tank Mixing Pump #2	1	60	60	60	7000	313,320
Storage Tank Mixing Pump #3	1	60	60	60	7000	313,320
Storage Tank Mixing Pump #4	1	60	60	60	7000	313,320
Land Application Pump	1	125	125	125	72	6,714
Sludge Slurry Pump	1	1.5	1.5	1.5	0	-
Sludge Air Scrubber	1	5	5	5	8760	32,675
					Total Electrical Usage	1,354,566
					Total Electrical Cost	**$ 88,047**

Biosolids Handling System Upgrade
City of Collinsville, Illinois
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CONCEPTUAL ESTIMATE OF LIFE CYCLE COST

ESTIMATED CHEMICAL COSTS

Item	Feed Amount (lb/hr)	Feed Amount (lb/dry ton)	Annual Operational Time (hr)	Daily Biosolids Amount (dry ton)	Annual Biosolids Amount (dry ton)	Annual Chemical Usage (Ton)	Chemical Cost ($/Ton)	Total Annual Cost ($)
Dewater & Disposal								
Dewatering Equipment Polymer	N/A	25	N/A	5	1,825	23	$2,000	$46,000
Chemical Feed System	82	N/A	4,380	N/A	N/A	180	$300	$54,000
Proposed Odor Control System	0.5	N/A	8,760	N/A	N/A	2	$2,500	$5,000
Existing Odor Control System	N/A	N/A	N/A	N/A	N/A	N/A	N/A	$6,000
							Total	**$111,000**
Dry Lime Stabilization Class B								
Dewatering Equipment Polymer	N/A	25	N/A	5	1,825	23	$2,000	$46,000
Lime	100	N/A	8,760	N/A	N/A	438	$235	$103,000
Proposed Odor Control System	0.5	N/A	8,760	N/A	N/A	2	$2,500	$5,000
Existing Odor Control System	N/A	N/A	N/A	N/A	N/A	N/A	N/A	$6,000
							Total	**$160,000**
Dry Lime Stabilization Class A								
Dewatering Equipment Polymer	N/A	25	N/A	5	1,825	23	$2,000	$46,000
Lime	152	N/A	8,760	N/A	N/A	665	$235	$156,000
Sulfamic Acid	1.2	N/A	8,760	N/A	N/A	5	$1,600	$8,000
Proposed Odor Control System	0.5	N/A	8,760	N/A	N/A	2	$2,500	$5,000
Existing Odor Control System	N/A	N/A	N/A	N/A	N/A	N/A	N/A	$6,000
							Total	**$221,000**
Existing System								
Lime	N/A	N/A	N/A	N/A	N/A	360	$235	$85,000
Odor Control System	N/A	N/A	N/A	N/A	N/A	N/A	N/A	$6,000
							Total	**$91,000**

Biosolids Handling System Upgrade
City of Collinsville, Illinois
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CONCEPTUAL ESTIMATE OF LIFE CYCLE COST

ESTIMATED DISPOSAL COSTS

Item	Sludge Disposal Volume		Capacity of Disposal Equipment		Number of Loads	Disposal Cost	Total Annual Cost
	Ton/Day	Ton/Year	Cubic Yard	Ton	Loads/Year	($/Ton)	($)
Dewater & Disposal (Landfill)	17.0	6,205	24	20.0	310	$35	$217,000
Dry Lime Stabilization Class B	18.0	6,577	17	14.3	459	$0	$0
Dry Lime Stabilization Class A	19.2	7,012	17	14.3	490	$0	$0
Existing System (Average)	124.2	45,348	N/A	N/A	N/A	N/A	$450,000

Assumptions/Notes:
*Disposal is handled by City personnel and no additional labor cost is included
*Disposal equipment capacity is based on purchase of a semi-trailer for Dewater & Disposal option and Manure spreader truck for Dry Lime Stabilization options
*Other cost for Dewater & Disposal option is tipping fees
*Equipment required to handle ultimate disposal (i.e. dump truck, tractor, spreader, etc.) has been included in the initial capital cost estimate; however due to the uncertainty of final disposal location for all options, the annual operations and maintenance cost associated

APPENDIX F
SALVAGE VALUE

Biosolids Handling System Upgrade
City of Collinsville, Illinois
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CONCEPTUAL ESTIMATE OF LIFE CYCLE COST

ESTIMATED SALVAGE VALUE

ITEM	Cost	Service Life	Life After 20 Years	Salvage Value
Dewater & Disposal				
Structure (assume 40% of total estimated project cost)	$1,928,000	50	0.6	$1,157,000
Equipment	$2,892,000	20	0	$0
			Total	**$1,157,000**
Dry Lime Stabilization Class B				
Structure (assume 40% of total estimated project cost)	$2,416,000	50	0.6	$1,450,000
Equipment	$3,624,000	20	0	$0
			Total	**$1,450,000**
Dry Lime Stabilization Class A				
Structure (assume 40% of total estimated project cost)	$2,480,000	50	0.6	$1,488,000
Equipment	$3,720,000	20	0	$0
			Total	**$1,488,000**

APPENDIX G
RECOMMENDED ALTERNATIVE STORAGE CALCULATIONS

1. Determine Daily Volume of Dewatered Sludge Produced

Daily Solids Production ..... 9,780 lb/day

..... 37,930 gpd

Dewatered Solids Concentration following lime addition ..... 30% (per manufacturer)

Estimated Specific Gravity of 25% Solids 1.3

Estimated Density of 30% Solids ..... 68.0 lb/cf

$$Solids\ Density + Water\ Density = \ 62.4\frac{lb}{cf} \times 1.3 \times 30\% + 62.4\frac{lb}{cf} \times 1.0 \times 70\% = 68.0\frac{lb}{cf}$$

Daily Volume of Dewatered Sludge Produced ..... 3,910 gpd

..... 523 cf/day

..... 17.8 ton/day

$$\frac{Solids\ Production\ \left(\frac{lb}{day}\right)}{Solids\ Concentration\ \times 8.34} = \frac{Solids\ Production\ \left(\frac{gal}{day}\right)}{7.48\ \left(\frac{cf}{gal}\right)}$$

$$= \frac{Dewatered\ Solids\ Production\ \left(\frac{cf}{day}\right) \times Density\ \left(\frac{lb}{cf}\right)}{2000\ \left(\frac{lb}{ton}\right)}$$

$$\frac{9{,}780\ \left(\frac{lb}{day}\right)}{0.30\ \times 8.34} = \frac{3{,}909\ \left(\frac{gal}{day}\right)}{7.48\ \left(\frac{cf}{gal}\right)} = \frac{523\ \left(\frac{cf}{day}\right) \times 68.0\ \left(\frac{lb}{cf}\right)}{2000\ \left(\frac{lb}{ton}\right)} = 17.8\ \left(\frac{ton}{day}\right)$$

2. Determine Daily Volume of Lime Used

Lime Usage (Class A Option)

Estimated Lime Usage ..... 3,640 lb/day (per mfr)

Estimated Density of Lime ..... 60 lb/cf

Daily Volume of Lime ..... 16 cf/day

..... 1.8 ton/day

$$Lime\ Usage\ \left(\frac{cf}{day}\right) = \frac{Estimated\ Lime\ Usage\ \left(\frac{lb}{day}\right)}{2000\ \left(\frac{lb}{ton}\right)}$$

$$Lime\ Usage\ \left(\frac{cf}{day}\right) = \frac{3640\ \left(\frac{lb}{day}\right)}{60\ \left(\frac{lb}{cf}\right)} = 60.7\ \left(\frac{cf}{day}\right)$$

3. Determine Total Volume of Processed Sludge

Total Volume of Processed Sludge (Solids + Lime)..... 583 cf/day

..... 19.6 ton/day

4. Determine Dry Storage Time – utilize proposed Biosolids Storage Facility

Storage Area Width..... 85 ft

Storage Area Length..... 100 ft

Total Covered Storage Area (W x L)..... 8,500 sf

Estimated utilization of Total Storage Area..... 75%

Storage Area Pile Height ..... 6 ft

Total Storage Volume (Area x Pile Height x utilization %)... 38,250 cf

Total Dried Storage Time..... 65 Days

$$Total\ Storage\ Time\ (Days) = \frac{Storage\ Volume\ (cf)}{Processed\ Sludge\ Volume\ \left(\frac{cf}{day}\right)}$$

$$Total\ Storage\ Time\ (Days) = \frac{38{,}250\ (cf)}{583\ \left(\frac{cf}{day}\right)} = 65\ Days$$

5. Determine Liquid Storage Time – utilize existing 2 MG storage tank

Storage Volume ..... 2,000,000 gal

Total Storage Time ..... 53 Days

$$Total\ Storage\ Time\ (Days) = \frac{Storage\ Volume\ (gal)}{Daily\ Solids\ Production\ \left(\frac{gal}{day}\right)}$$

$$Total\ Storage\ Time\ (Days) = \frac{2{,}000{,}000\ (gal)}{37{,}930\ \left(\frac{gal}{day}\right)} = 53\ Days$$

6. Determine Total Storage Time Available

Total Storage Time (Dry Storage + Liquid Storage)..... 118 Days