

LIFT STATIONS

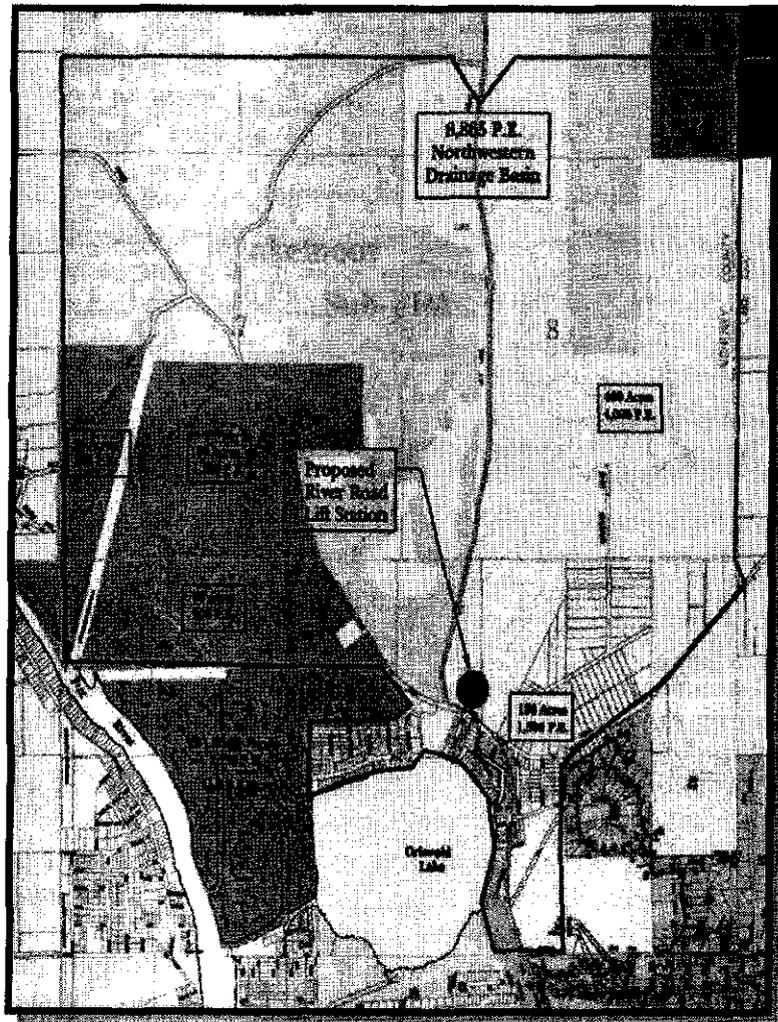
The District maintains eleven lift stations and the Village of Lakemoor maintains seven additional lift stations, two of which are tributary to the District's collection system.

Much like the collection system, the lift stations were constructed over the past 25 years and are also in very good condition. The District has completed upgrades to the instrumentation and control capabilities for several of these installations over recent years. It is recommended that the District continue these types of improvements within an annual Lift Station Capital Improvement Plan. Furthermore, it is recommended that the District fully fund the replacement account for the lift station infrastructure. Both of these recommendations have been incorporated into the updated user fees.

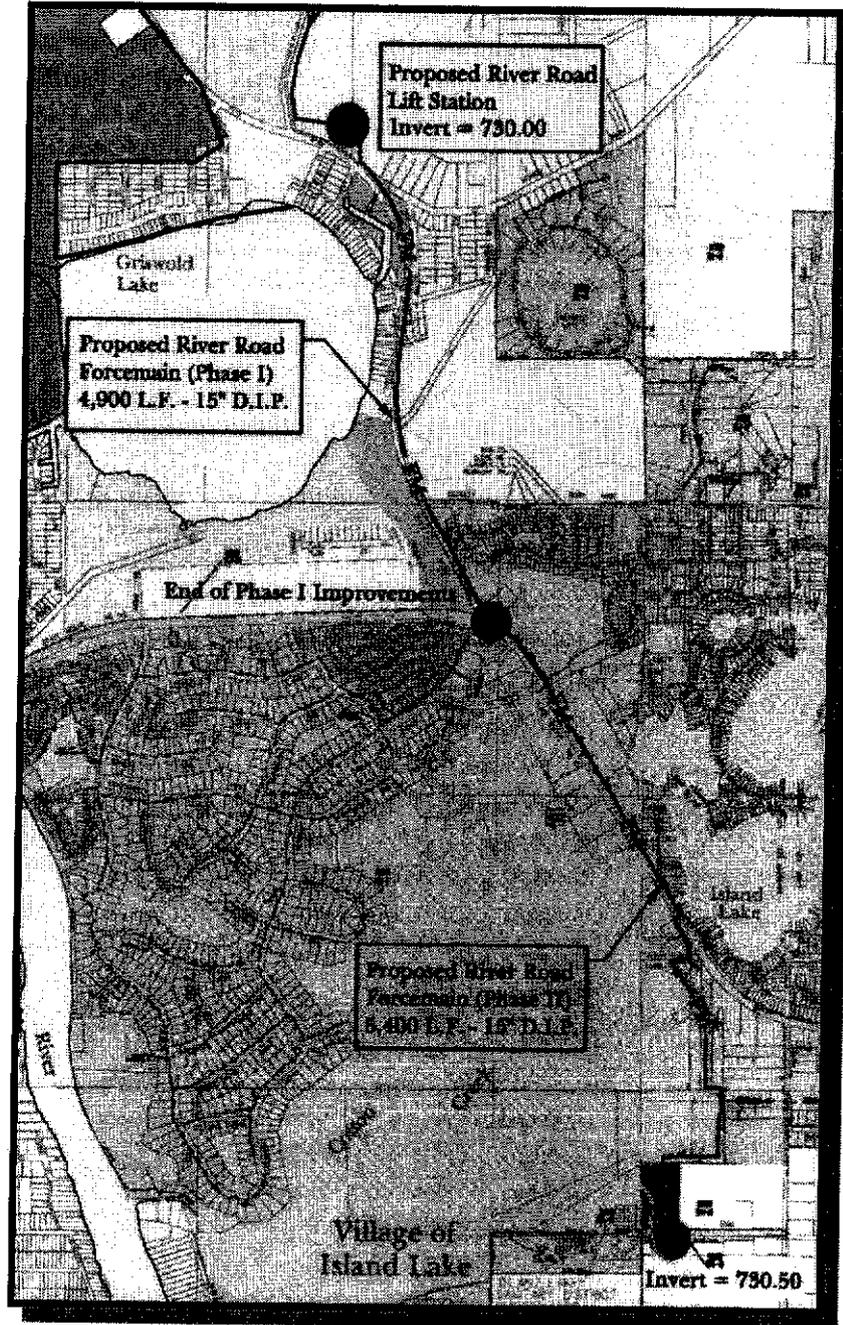
Section 4 provides a detailed discussion of the District's needs for regional lift stations to operate in conjunction with the interceptor sewer system. The location, requirements, and estimated costs for each lift station are described in the Section.

The Deer Grove North Lift Station is a regional lift station serving the Southern Expansion Area and is currently under construction.

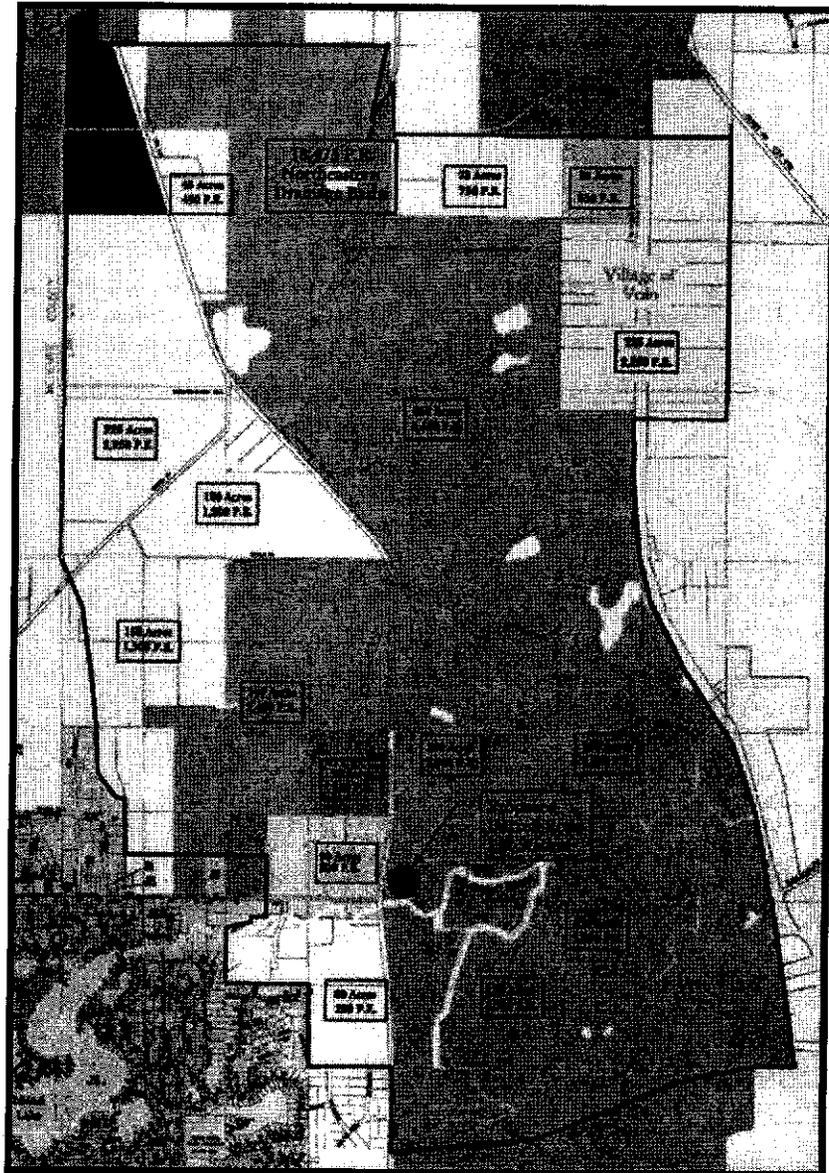
The River Road Lift Station and Phase I Forcemain will serve the Lily Lake Road Interceptor and Northwestern Service Area. The improvements would be constructed in phases as dictated by capacity needs. The first phase would include construction of the lift station and a forcemain to the existing 24" interceptor along Illinois 176. The estimated cost of the Phase I is roughly \$2.0 million dollars.



The tributary areas including the Central, Waterford and Northwestern Basins will ultimately require capacity for roughly 37,000 P.E. As the 24" interceptor sewer approaches capacity, the force main will be extended to the treatment facility in a future phase. This improvement is referred to as River Road Forcemain (Phase II). The estimated cost of the force main extension is \$1,057,000.

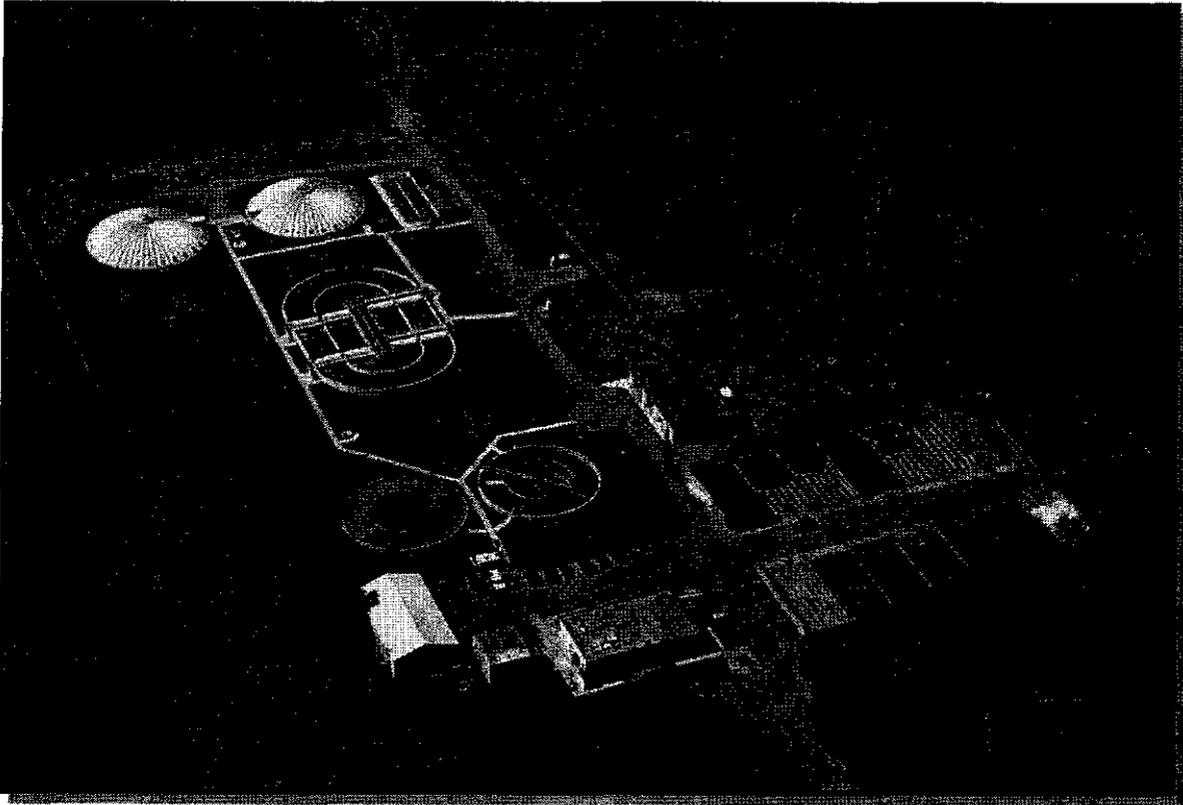


The Darrell Road Regional Lift Station will serve the Northeastern Basin and the northern half of the Eastern Basin. At build-out the Northeastern Basin is estimated to require 18,500 P.E. Similarly, the northern half of the Eastern Basin is projected to require 28,500 P.E. As such, the Regional Lift Station will serve roughly 47,000 P.E. The estimated cost of the Darrell Road Regional Lift Station is \$1.9 million dollars.



EXISTING TREATMENT FACILITY

Section 5 of the report details the performance and condition of the existing treatment facility. The Northern Moraine Wastewater Treatment Facility is located between the Villages of Island Lake and Port Barrington at the end of Timber Trail. The currently has facility capacity to serve 2.0 MGD (20,000 P.E.) The District has provided continuous compliance with the NPDES permit and continues to produce exceptional quality effluent.



The needs of the existing facility are limited to rehabilitation of the existing aerobic digesters. During the last expansion the contact stabilization package plants were converted to aerobic digestion units. The steel components within the tanks have been in operation for over 25 years and are in need of replacement.

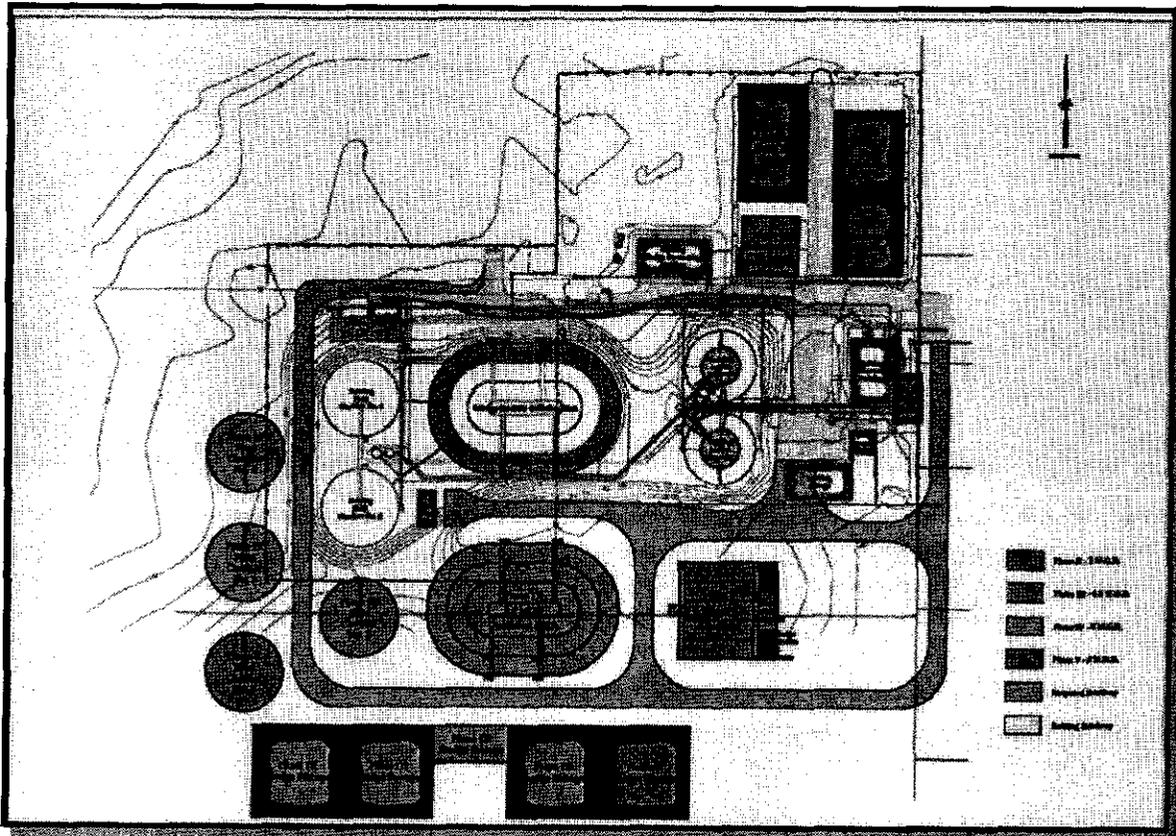
Similarly, the existing steel maintenance garages are reaching the end of their service life and should be replaced as the District moves forward with expansion. All other treatment processes and structures are relatively new and in sound operating condition. The existing units should be incorporated into the expansion-phasing plan to meet the needs of the Facility Planning Area.

WASTEWATER TREATMENT FACILITY EXPANSION

The District has developed a phased expansion plan for the wastewater treatment facility, which meets the long-term needs of the entire Facility Planning Area. The phasing plan and design criteria are discussed in detail in Section 6 of the report.

The 1998 Facility Plan detailed two phases of expansion. The first phase, constructed in 1999, increased the plant capacity to 2.0 MGD. The Phase II Expansion as originally proposed expands the treatment facilities capacity to 3.0 MGD. Three additional phases have been planned to accommodate the District's capacity needs. The WWTP expansion-phasing plan is summarized below:

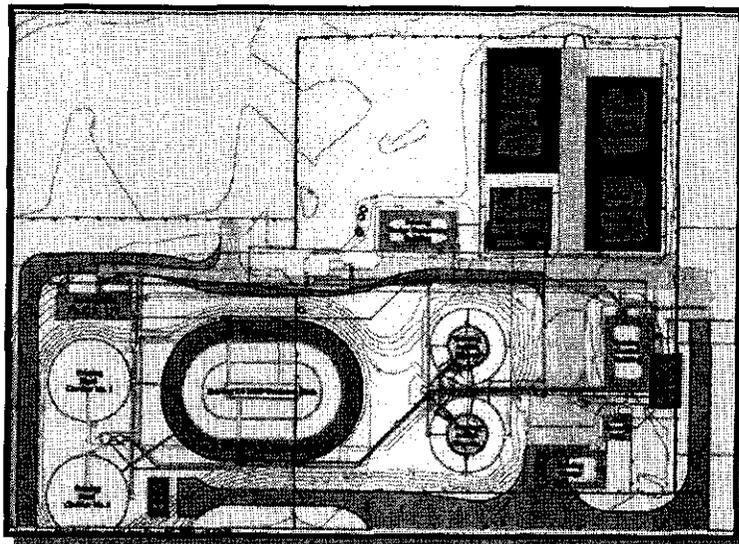
Phase I	2.0 MGD	Shown as Existing
Phase II	3.0 MGD	Shown in Orange
Phase III	4.5 MGD	Shown in Purple
Phase IV	6.0 MGD	Shown in Blue
Phase V	10.0 MGD	Shown in Green



Phase II Expansion – 3.0 MGD

The Phase II Expansion will increase the biological and solids handling capacity of the wastewater treatment facility from 2.0 to 3.0 MGD. Many of the required improvements were established during the previous phase. The District is able to capitalize on the phased expansion approach. Items that were not foreseen during the 1998 Facility Plan Amendment included nutrient removal requirements for phosphorus and total nitrogen. In addition, the headworks, and aerobic digestion complex will require substantial upgrades to meet the plant's long-term needs.

The Phase II expansion will include expansion of the headworks structure capable of treating the ultimate Peak Hourly Flow. Screening equipment will be installed within each phase as required to provide sufficient treatment. The expansion will also incorporate process upgrades for biological phosphorus and total nitrogen removal providing superior effluent. The aerobic digestion system will be completely rehabilitated in addition to incorporating continuous membrane thickening capabilities. The thickening system will allow the



District to waste and thicken biosolids on a continuous basis and better control the biological process. Furthermore, the higher solids concentration in the digesters will increase the operating temperature, detention time and efficiency of the process.

The Phase II Expansion improvements include:

- Site piping and roadway upgrades
- Expansion of the headworks
- Replacement of two raw sewage pumps
- Construction of a third ring on the oxidation ditch
- Construction of a RAS/WAS Pump Station
- Upgrades to the Aerobic Digestion Process

Other items incorporated into the Phase II Expansion to improve the District's Services include:

- New Sludge Storage Barn
- New Fleet Maintenance Garage
- Upgrades to the Operations Building
- New Administration Building

A summarized cost estimate for the Phase II Expansion is provided below.

SUMMARY	
GENERAL CONDITIONS	\$1,050,000.00
SITE WORK	\$1,520,000.00
RAW SEWAGE LIFT STATION	\$65,000.00
HEADWORKS	\$75,000.00
OXIDATION DITCH	\$130,000.00
RAS/WAS PS & DIV STRUCTURE	\$915,000.00
CLARIFIERS	\$8,000.00
AEROBIC DIGESTION	\$2,350,000.00
SLUDGE STORAGE BARN	\$720,000.00
FLEET MAINTENANCE GARAGE	\$8,000,000.00
OPERATIONS BUILDING	\$5,650,000.00
ADMINISTRATION BUILDING	\$9,000,000.00
CONSTRUCTION SUB-TOTAL	\$30,000,000.00
CONTINGENCY	\$3,000,000.00
ESTIMATED CONSTRUCTION COST	\$33,000,000.00
DESIGN ENGINEERING (7%)	\$2,310,000.00
CONSTRUCTION ENGINEERING (6.5%)	\$2,145,000.00
PROJECT TOTAL	\$37,455,000.00

Approximately \$3 million of the \$12 million dollar expansion cost is attributable to the Sludge Barn, Garage, Operations, and Administration Buildings. These items can be delayed to future phases if required by economic circumstances. The Phase II Improvements could be broken into two projects. Expansion of the process is estimated to cost roughly \$9 million dollars.

Phase II Process Expansion Only

SUMMARY	
GENERAL CONDITIONS	\$1,050,000.00
SITE WORK	\$1,520,000.00
RAW SEWAGE LIFT STATION	\$65,000.00
HEADWORKS	\$75,000.00
OXIDATION DITCH	\$130,000.00
RAS/WAS PS & DIV STRUCTURE	\$915,000.00
CLARIFIERS	\$8,000.00
AEROBIC DIGESTION	\$2,350,000.00
SLUDGE STORAGE BARN	\$720,000.00
FLEET MAINTENANCE GARAGE	\$8,000,000.00
OPERATIONS BUILDING	\$5,650,000.00
ADMINISTRATION BUILDING	\$9,000,000.00
CONSTRUCTION SUB-TOTAL	\$30,000,000.00
CONTINGENCY	\$3,000,000.00
ESTIMATED CONSTRUCTION COST	\$33,000,000.00
DESIGN ENGINEERING (7%)	\$2,310,000.00
CONSTRUCTION ENGINEERING (6.5%)	\$2,145,000.00
PROJECT TOTAL	\$37,455,000.00

Phase III Expansion –4.5 MGD

The Phase III Expansion would increase the hydraulic and biologic capacity of the facility from 3.0 to 4.5 MGD. The improvements would include the addition of one mechanical fine screen, two new raw sewage pumps, construction of a second 2.25 million gallon oxidation ditch, one new final clarifier, conversion of the chlorination system to U.V. Disinfection, sludge dewatering, and storage facilities.

The 3.0 MGD facility operates as a single stage nitrification plant and is required to provide the equivalent of 4.5 cubic feet per P.E. in aerobic digestion capacity. When the plant is expanded to 4.5 MGD, the detention time within the biological process will be increased to 24 hours. The Illinois EPA recommended design standards for aerobic digestion on an extended aeration plant are 3.0 cubic feet per P.E. Therefore, the aerobic digestion facilities will not need to be expanded during the Phase III Expansion.

The estimated cost for the improvements is \$9.2 Million dollars. Land acquisition for the expansion is easily accomplished. The estimated cost of the land acquisition is \$600,000. A summary of the estimated costs is shown below.

SUMMARY	
GENERAL CONDITIONS	
SITE WORK	
RAW SEWAGE LIFT STATION	
HEADWORKS	
OXIDATION DITCH	
RAS/WASPS & DIV STRUCTURE	
CLARIFIERS	
ULTRAVIOLET	
SLUDGE DEWATERING IMPROVEMENTS	
EAST SLUDGE STORAGE BARN	
WEST SLUDGE STORAGE BARN	
SUB-TOTAL CONSTRUCTION	
CONTINGENCY 10%	
CONSTRUCTION TOTAL	
DESIGN ENGINEERING	
CONSTRUCTION ENGINEERING	
PROJECT TOTAL	

Phase IV Expansion – 6.0 MGD

Phase IV Improvements will increase the wastewater treatment facility capacity from 4.5 to 6 MGD. This phase will be a relatively inexpensive as the project will include very few additional structures.

It is intended that the headwork's capacity be upgraded by the addition of one mechanical fine screen. The screen will replace the two existing screens installed during the 1998 Phase I Expansion. The structure will not require modification.

The Peak hourly flow will be increased from 10.35 MGD to 13.2 MGD. It is proposed that the two raw sewage pumps installed during the Phase II Expansion will be replaced with units identical to those installed during the Phase III Expansion. Each of the pumps will be capable of flow pacing utilizing variable frequency drives.

The biological process, as constructed in Phase III, provided 4.5 million gallons of capacity. The volume of the reactors will be sufficient to meet the Illinois EPA requirements for single stage nitrification. Therefore, the process will revert back from extended aeration to single stage nitrification and not require construction of additional biological reactors.

During Phase IV will increase the Peak Hourly Flow to 13.2 MGD. While the District could meet the Illinois EPA requirements with one additional clarifier, two additional 85-foot diameter clarifiers will be constructed to maintain the quality of the effluent.

Several new technologies are emerging for biosolids stabilization. While aerobic digestion may continue to be used, it is recommended that the new technologies be revisited prior to finalization of the Phase IV Expansion project. The proposed land acquisition will provide ample space to implement any option that may provide the District and economic advantage.

Phase V Expansion – 10.0 MGD

Phase V Expansion represents the ultimate build-out of the Facility Planning Area. While the District does not anticipate development to exceed the Phase IV requirements within the Next twenty years, a conceptual plan for expansion has been developed to reserve space for expansion of the treatment facility as required in the future.

The conceptual plan includes replacement of screening equipment and raw sewage pumps. The project would reduce the loading to the biological process by incorporating primary clarification and anaerobic digestion. The details of the design will be discussed within future Facility Plan Updates.

ENVIRONMENTAL IMPACTS DETERMINATION

As the Designated Management Agency, the District is responsible for meeting the long-range goals of the Clean Water Act and to minimize the environmental impacts of pollution from the sanitary waste generated within the Facility Planning Area.

Based on the comprehensive plans provided by the surrounding communities, the wastewater treatment facility must be ultimately expanded to 10.0 MGD. As described in Section 6, expansion of the treatment facility will occur over four additional phases. While this report is required to address the next phase, a more appropriate and proactive approach is to identify the long-range impacts of growth, discuss potential alternative solutions and develop a plan of action that is appropriate and provides the greatest benefit to the environment and public served.

The existing facility has been producing outstanding effluent quality since completion of the Phase I Expansion. The BOD₅, suspended solids, ammonia, fecal coliform, pH, and temperature are continuously well below the NPDES Permit Limits as shown in the comparison below.

	Effluent Flow	BOD ₅	TSS	N-NH ₃
NPDES Permit	2.0	20	25	1.5
District Average	1.25	3.6	4.1	0.04

The District is committed to upgrading the wastewater treatment facility in a manner that will be a benefit to both the communities served and ecosystem surrounding the Fox River. The first step in the analysis is to identify the parameters of concern with an increase in discharge. The second is to discuss the parameters and impacts with stakeholders. The third is to develop alternatives to minimize the impact, or even better, to improve the existing conditions.

Environmental Areas of Concern

Areas of environmental concern include not only the river, but the wetlands and nature preserves within the area. The wildlife habitat and open space represent a significant portion of Facility Planning Area. Each community is responsible for creating and implementing criteria to protect the environment from development. The comprehensive plans prepared by the communities within the FPA recognize the importance of preserving open space and incorporating responsible development. Ordinances and development practices to minimize urban run-off from impacting the environment is encouraged.

The most significant concern for expansion of the treatment facility includes the quality of the final effluent. The plant's current effluent quality is exceptional. Growth within the Facility Planning Area can lead to higher pollutant loading from point and non-point sources alike. Concerns over impacts on the surrounding environment including wetlands, wildlife habitat and endangered species must be considered in development of comprehensive collection system and treatment plan.

Water Quality Concerns

The Northern Moraine Wastewater Reclamation District discharges to segment DT-22 of the Fox River. Segment DT-22 includes 8.15 miles of the river and has been identified as impaired on the medium priority list. The assessment was based on site-specific data and included physical/chemical ambient water quality data.

The designated uses for this segment that did not achieve Full Support include Aquatic Life, Fish Consumption and Primary Contact. When a segment is found to be Partial support or Nonsupport for a designated use, the segment is defined as impaired. The Illinois EPA then defines the potential causes and sources of impairment for those uses.

The causes cited include

- *Other Flow Regime Alterations* - defined as site specific barriers such as dams
- *Physical-Habitat Alterations* - refers to the conditions of the bank or channel.
- *Total Fecal Coliform Bacteria* - determined by a geometric mean.
- *Sedimentation/Siltation*. - sediment contains silt/mud in excess of 34% by volume or total suspended solids exceed 116 mg/l.
- *Total Suspended Solids* - based on water samples that exceed 116 mg/l
- *Excess Algal Growth* - based on documented site specific knowledge
- *PCB Contamination* - based on actual fish tissue samples.

The potential sources identified include:

- *Urban Run-off* - storm sewer discharges
- *Hydromodifications* - alterations of a channel
- *Flow Regulation/Modifications* - which identifies the dam.
- *Recreation and Tourism Activity* - turbulence or wave action caused by high boat usage

Interestingly, neither Municipal Point Sources nor On-Site Wastewater Systems were identified.

Threatened and Endangered Species

During the analysis an Agency Consultation Report was requested to determine if any endangered species would be affected by the implementation of the proposed expansion. Mike Branham of the Illinois Department of Natural Resources reviewed the proposed project. Mr. Branham terminated the Consultation Process and determined that the project is in compliance with the Interagency Wetlands Policy. Furthermore, Mr. Branham's notes on the report state the following, "*the project is unlikely to jeopardize the protected species.*"

Meetings with Stakeholders

The District has consulted with the Illinois EPA, Illinois DNR, Friends of the Fox, the Fox River Study Group and Sierra Club to help address the water quality concerns with expansion of the treatment facility.

During our conversations, it was recognized that while the District had an obligation to expand to serve the community, it could incorporate flexibility within the design to minimize the effects of the increased discharge. We discussed the positive effects of providing sanitary service to the homes along the Fox River and the removal of the septic systems. We also discussed the potential for wetland creation or other effluent reuse options that could be beneficial. Lastly, we discussed the need for the District to upgrade the process to improve the effluent quality and the District's progressive approach to removing specific parameters such as suspended solids, total nitrogen and phosphorus.

It was agreed that superior suspended solids removal was important to incorporate into to any NPDES permit that resulted in an increased discharge. The proposed limit would allow the District to maintain the current standard for weekly and monthly limits, but add an annual limit that equates to 10 mg/l. The existing plant performance has been able to meet this limit and all future expansions will ensure that the plant's performance will consistently provide superior effluent quality.

While dissolved oxygen within this segment was not listed as a source of impairment, low dissolved oxygen is an issue in segments further downstream. In addition, the listing for suspended solids concentrations is partially attributed to algal blooms. The essential nutrients for algal blooms can be related to phosphorus and total nitrogen. Based on discussions with Ms. Skrukud of the Sierra Club, it was determined that the treatment facility design should incorporate biological removal of both nitrogen and phosphorus.

Lastly, we discussed the potential for water reuse within the watershed. Currently, there are not any proposed golf courses or significant reuse sites planned close to the treatment facility. We also reviewed the existing wetlands and determined that it would be best to not interfere with the nature preserve.

The reuse of water for a practical application needs to be economically feasible. It was agreed that both stakeholders and the District should continue to look for opportunities to promote reuse within the Facility Planning Area. By partnering with the communities, conservation areas and development, the District may be able to incorporate beneficial reuse to its efforts toward anti-degradation.

RECOMMENDATIONS & IMPLEMENTATION

The Northern Moraine Wastewater Reclamation District Facility Planning Area serves several communities. The District is committed to developing a phased approach to extending service throughout the Facility Planning Area, which includes roughly 27 square miles. This commitment includes construction of interceptor sewers, regional lift stations and expanded treatment capacity.

The District is also dedicated to the continuous protection of the environment and has reviewed several approaches to offset the impacts of increased loading on the Fox River. The selected alternatives for minimizing the environmental impacts of growth include both advanced treatment and extension of service to existing developments that are currently using private septic systems.

Historically, the District has extended the collection system as parcels became contiguous to the corporate boundary. This approach has made sewer service financially impractical for several potential developments in remote locations. Several developments have been completed on individual well and septic systems due to lack of service availability. In addition, the District has allowed developers to install small lift stations to serve individual developments.

Previously, the Village of Lakemoor identified an alternative to convey its wastewater to the NMWRD from proposed development. The report recommended the construction of dedicated force mains from the northern sub-basins to the District. This solution neglected the benefit of sharing costs with undeveloped properties along the force main route. The interceptor sewers proposed within Section 3 provide capacity for all potential development within the Facility Planning Area, including the Village of Lakemoor.

The District has created an approach to provide a more economical solution to extending service to the entire Facility Planning Area. The proposed improvements would extend interceptor sewers to each major drainage basin within the Facility Planning Area. The District has revised its approach to promote regional lift stations in an attempt to minimize the number of sites where practical. This will enable District Staff to maintain and monitor the infrastructure more efficiently.

The Phase I Expansion completed in 1998 set precedence for the future expansion of the facility. It is proposed that the expansion to 10.0 MGD will be completed in a minimum of additional four phases. Therefore, the selected expansion-phasing program is as follows:

- **Phase I – 2.0 MGD - Completed 1998**
- **Phase II – 3.0 MGD**
- **Phase III = 4.5 MGD**
- **Phase IV – 6.0 MGD**
- **Phase V – 10.0 MGD**

As demonstrated in Section 5, the current loading to the treatment facility is between 70 and 80% of the design capacity. It is recommended that the District proceed with the Phase II design to ensure adequate capacity is available for continued development. Each subsequent phase (Phase III, IV and V) should be constructed as the facility reaches 75% of its design capacity. The design parameters and anticipated discharge requirements for each phase are identified in Section 6.

The user fees should fully fund the operation maintenance and replacement of the wastewater infrastructure. The estimated Average Daily Flow in year 2009 would be roughly 2.0 MGD. The estimated cost to operate the expanded facility is estimated to be 3,050,000. Based on an average billed volume of 2.0 MGD, the estimated revenue would be \$2,201,600

It is recommended that the sewer user fees be increased over the next five years to fully fund the operation, maintenance, and replacement needs of the system. Based on an average daily flow of 2.0 MGD, the sewer user fees would need to be increased by 39% over the next five years. This increase equates to a 7% increase per year for the next 5 years.

The current sewer connection fees are \$3,965 per residential unit. It has been agreed that the construction of the interceptor sewers, regional lift stations and treatment facility expansion should be incorporated into the connection fee.

The estimated costs for are summarized below.

Darrell Road Interceptor	\$9,100,000
Lily Lake Road Interceptor	\$3,500,000
River Road Lift Station (Phase I)	\$2,000,000
River Road Forcemain (Phase II)	\$1,060,000
Darrell Road Lift Station	\$1,900,000
Phase II Expansion	\$12,000,000
Total Construction Cost	\$29,560,000

The District currently treats 1.25 MGD. The available capacity after the expansion is 1.75 MGD, which equates to 17,500 P.E. If the District increased the connection fee to \$5,912 per residential unit the proposed improvements would be fully funded.

Lastly, the size of the Board should be increased from three to seven trustees by the legislature to provide representation for each of the communities served. The areas that are not currently annexed to the District could also be incorporated into the corporate boundary through legislative action. Two positions on the board would be reserved for at large members. The positions could be utilized to represent existing developments that are not annexed to one of the Villages served.

The District will be better able to fulfill its obligation to the affected communities through implementation of these legislative changes. The benefits of the changes include:

- Elimination of sanitary service agreements
- Fair representation for each of the affected communities
- Consistent user and connection fees
- Better tracking of approved development and available capacity

The original Water Quality Management Plan (WQMP) identified regionalization as the preferred solution. The updated water quality management plan is consistent with the original WQMP. The plan allows for phasing of the required improvements, which reduces the initial investment required for implementation. The proposed connection fees incorporate the cost of interceptor sewers, regional lift stations and treatment facility expansion. The connection fee is determined on a larger population base and provides a more economical solution.

Regionalization of treatment at the existing site has multiple benefits including:

- Minimizing environmental impacts on the Fox River
- Phased expansion of the treatment capacity
- More efficient operation
- Consolidation of operational staff
- Reduced Operation, Maintenance and Replacement Costs
- Reduced user fees

Lastly, implementation of the phased plan can be readily executed without fully funding all of the proposed improvements prior to commencement of construction, extensions of service to proceed without delay.

