PRELIMINARY ENGINEERING REPORT

FOR A

NEW WASTEWATER COLLECTON AND TREATMENT SYSTEM

FOR THE

KNOX COUNTY COMMISSIONERS ON BEHALF OF THE

UNINCORPORATED COMMUNITY OF FREELANDVILLE

KNOX COUNTY, INDIANA

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MARCH, 2010

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I. Introduction – Purpose and Scope

This Preliminary Engineering Report was performed to determine feasible solutions to the wastewater problems within the unincorporated community of Freelandville in Knox County. The report is being funded by a planning grant through the Indiana Office of Community and Rural Affairs. The scope of the report is to:

1.) Present background data and establish wastewater needs for Freelandville
2.) Identify and evaluate alternatives for providing wastewater collection & treatment facilities
3.) Provide detailed cost estimates for the feasible alternatives
4.) Review available funding sources
5.) Provide conclusions and recommendations for project implementation

The results of this preliminary engineering report and planning study are presented herein for use by the Knox County Commissioners in their efforts to provide needed wastewater facilities to the residents of the unincorporated community of Freelandville. The planning period for this report is 20 years with the design year being 2030.

II. Project Planning Area

A. Location

The unincorporated community of Freelandville is located in Northern Knox County. It is approximately 6 miles North of Bicknell and approximately 5 miles West of Westphalia. State Road 58 splits Freelandville in the Northwest to Southeast direction and State Road 159 intersects State Road 58 near the central portion of Freelandville from the South and is located in Widner Township. The land use within Freelandville is primarily residential and a few small commercial businesses. The areas outside of Freelandville are primarily rural residential, row crop farmland or mining operations. A project planning area map is presented as Figure 1.

B. Growth Areas and Population Trends

Historical population data for Widner Township and Knox County is presented in Table 1. This data was compiled from the US Census Bureau.

Table 1

Historical Population Data

	1980	1990	2000	% Increase since 1980
Widner Township	1,287	1,197	1,165	-10 %
Knox County	41,838	39,884	39,256	-7 %

The projected populations for Knox County are presented in Table 2. The Indiana Business Research Center, IU Kelley School of Business, compiled this data.

Table 2

Projected Populations

	2010	2015	2020	% Increase since 2000
Knox County	38,060	37,886	38,182	- 2.8 %

The actual population has declined since 1980 and according to County population projections is expected to decline in the next 20 years. However, for the purpose of this report, a growth factor of 10% will be used for the service area over the next 20 years. According to the 2000 census data, the median household income is $40,603 for Widner Township and $31,362 for Knox County.

GRAVITY SEWER COLLECTION SYSTEM
FOR THE COMMUNITY OF
FREELANDVILLE
KNOX COUNTY, INDIANA

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III. Existing Facilities/Need for Project

The residents in Freelandville currently have a potable water system by Freelandville Water Association and on-site septic tank technology with absorption field systems and direct discharge as a means of wastewater disposal. The closet municipal wastewater facilities are located in Bicknell, which is approximately 6 miles South of Freelandville.

Freelandville has many failed or failing septic systems throughout the community. The primary soil type within Freelandville is the Hosmer Silt Loam. This type of soil is very poorly drained and is classified as very limited for absorption fields by the Natural Resource Conservation Service. Small lot sizes are also a limiting factor in Freelandville's septic system problems.

IV. Development and Evaluation of Feasible Alternatives

A. No Action Alternative

An alternative, which can be applied to the wastewater needs, is to take no action. The alternative of no action to develop pollution control facilities offers neither short nor long term benefits. Currently, conditions within the unincorporated community are not conducive to on-site treatment systems. As time progresses, the condition of the on-site systems would only further deteriorate. The no action alternative would thus increase the potential for serious health hazards.

B. Wastewater Collection Alternatives

1. Conventional Gravity Sewer System

This type of sewer system is the most common, most widely used wastewater collection system. Conventional gravity sewers consist of 8-inch or larger diameter pipes constructed with specific slopes. Manholes are provided at least every 400 feet and at every change in direction, pipe slope or pipe size. The manhole is usually 4 feet in diameter, which allows sufficient room for a worker to reach the pipe for cleaning and inspection. The network of sewers allows sewage to drain by gravity to low-lying areas. Pump stations are required where sewers get excessively deep or gravity flow is no longer available. From the pump stations, the sewage is pumped through pipelines called force mains. Force mains, being under pressure, are constructed like water mains, buried approximately 4 feet deep and follow the terrain. A simplified sketch of a conventional gravity system is presented as Figure 2. Conventional gravity sewers have been and continue to be very economical in high population density urban areas. The deep construction and large pipe sizes make a conventional system very expensive in low population density rural areas, and in areas with shallow rock or high groundwater. An overall map that presents a possible gravity sewer collection system is located in Appendix A. Please note that the gravity sewer map is conceptual in nature and sewers shown in the middle of highways would actually be installed out of the pavement where lines parallel the highways.

2. Low – Pressure Grinder Pump Sewer System

Low – pressure grinder pump collection systems use one or more small pumps located in pump pits connected to one or more building gravity laterals. The pumps grind the sewage solids into small particles. The pumps discharge into a collection system consisting of small pressure force mains, generally 1.25 to 4-inches in diameter. The force mains follow the existing ground elevations and need to be only deep enough

to prevent freezing. Power for the pumps must come from one of the buildings connected to the pump pit or from a meter drop line. Figure 3 presents a simplified sketch of a grinder pump system. This type of wastewater collection system is economical in low density rural areas and in areas where the topography makes construction of gravity sewers unfeasible, such as areas around lakes.

3. Vacuum Sewer System

A vacuum-type collection system is a totally sealed system. A pumping unit at the treatment plant transfers wastewater to the treatment units and at the same time maintains a vacuum on the system. Homeowners have an injection station that empties their waste into the main lines. The collection system can be installed relatively shallow. The injector station and vacuum system must be maintained for the wastewater flows. Maintaining the injector stations and preventing leaks in the system is critical to keep the system operational. Figure 4 presents a simplified sketch of a vacuum sewer system. This type of sewer system is very maintenance intensive and is not recommended. For this reason, this alternative will not be considered further.

4. Septic Tank Effluent Pumping (STEP) System

The (STEP) collection system combines elements of the small diameter gravity sewer system and low-pressure pump system. The system uses septic tanks at each connection to remove the solids and grease from the wastewater prior to introduction into the collection system. This allows the use of low pressure non-grinder pumps. Small pumps are located either in the septic tanks or separate pump pits. Power for the pumps must come from one of the buildings connected to the pump pit or from a metered drop line. Figure 5 presents a simplified sketch of a STEP system. This type of system is also very maintenance intensive due to septic tanks having to be pumped out on a continued basis and pump maintenance considerations. Also, small lots make installation of individual septic tanks difficult. For these reasons, this alternative will not be considered further.

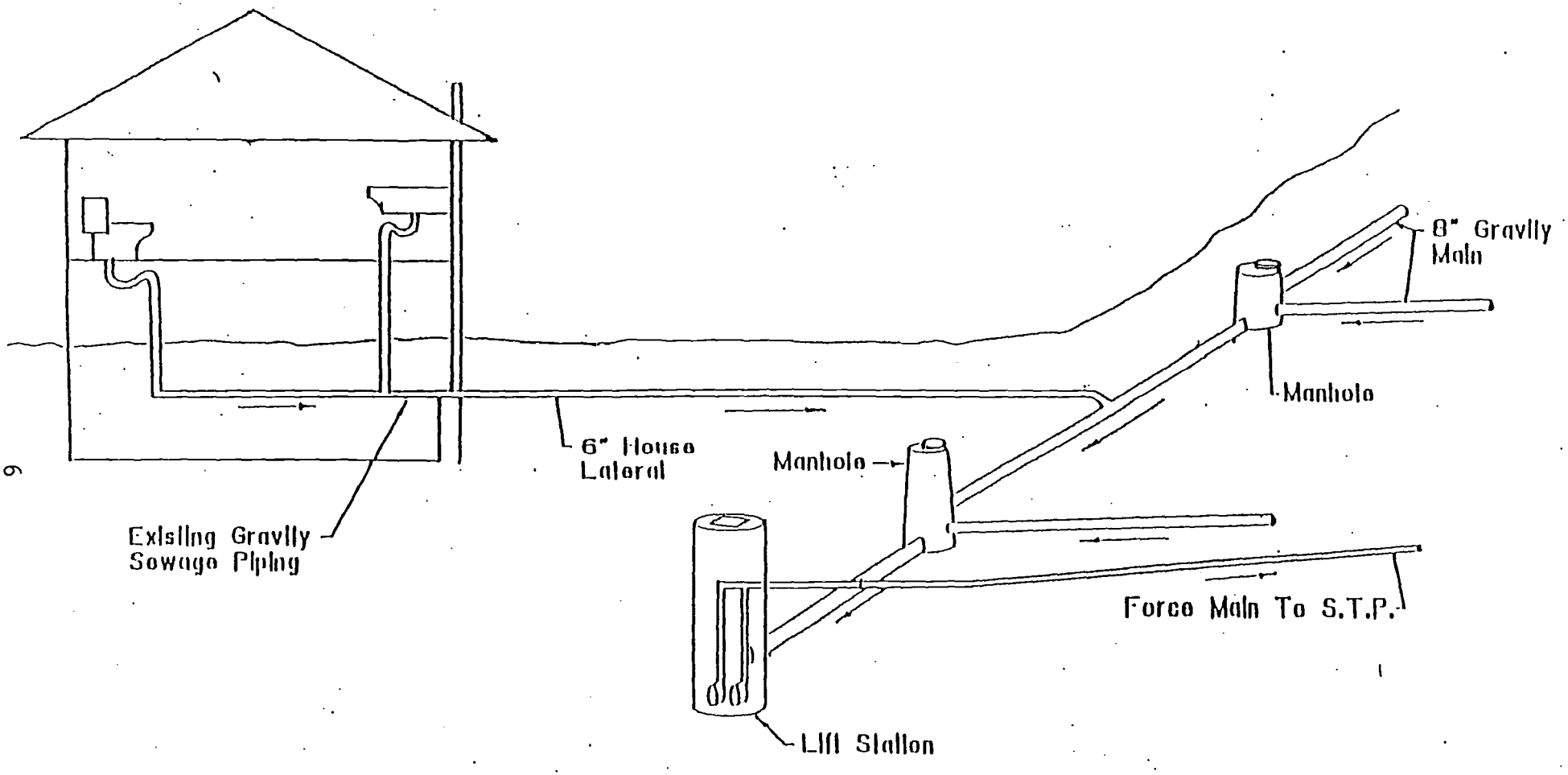


FIGURE 2
CONVENTIONAL GRAVITY SEWER SYSTEM

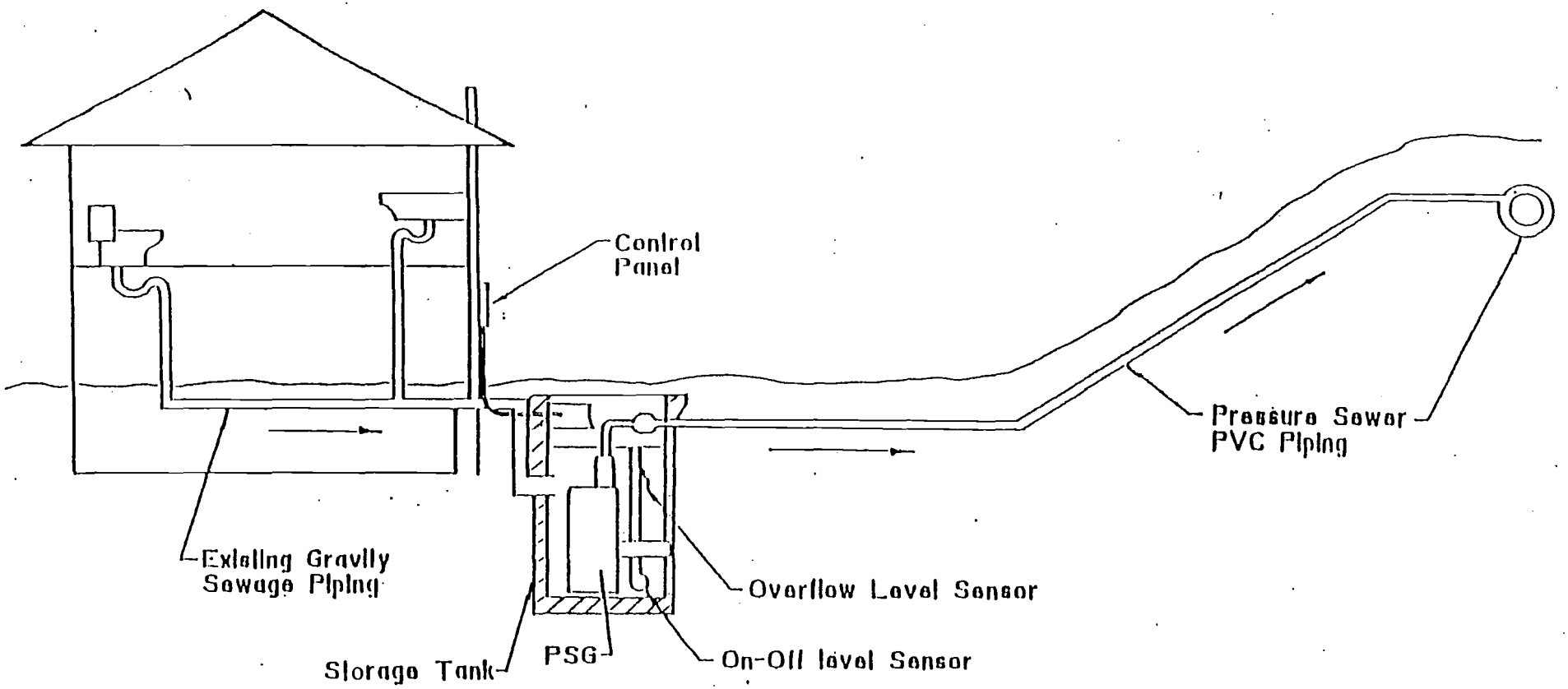
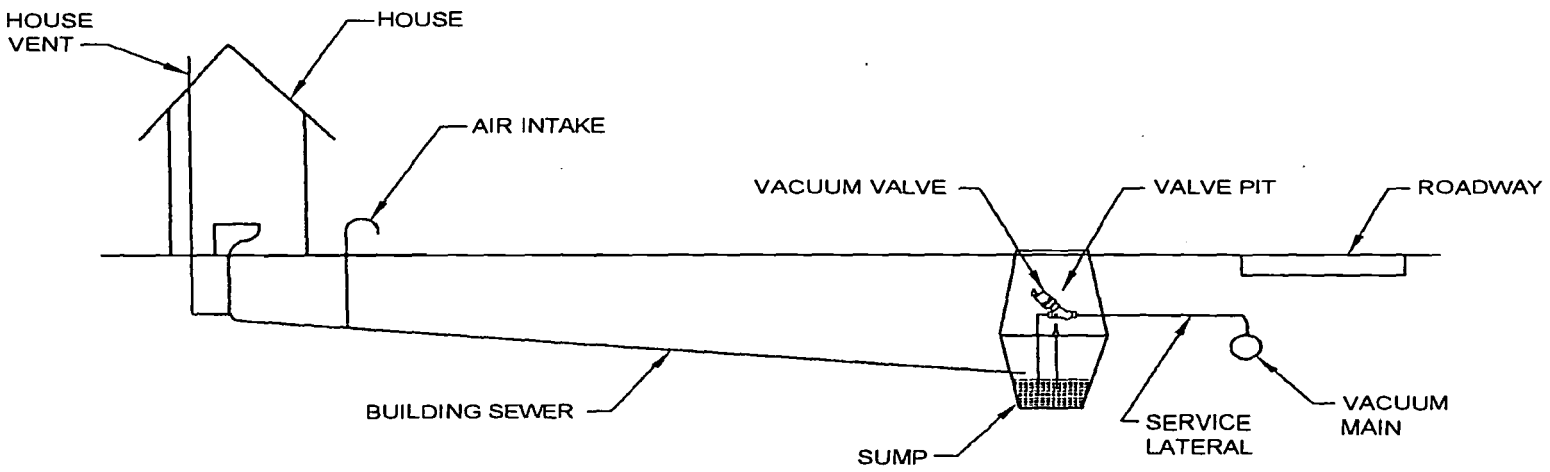


FIGURE 3
TYPICAL GRINDER PUMP INSTALLATIONS

(Adapted from Figure 1.2 "Alternate Sewer Systems" WPCF M.O.P. FD-12)



TYPICAL VACUUM SEWER SYSTEM

Figure 4
House / Pit / Main Relationship
(Courtesy AIRVAC)

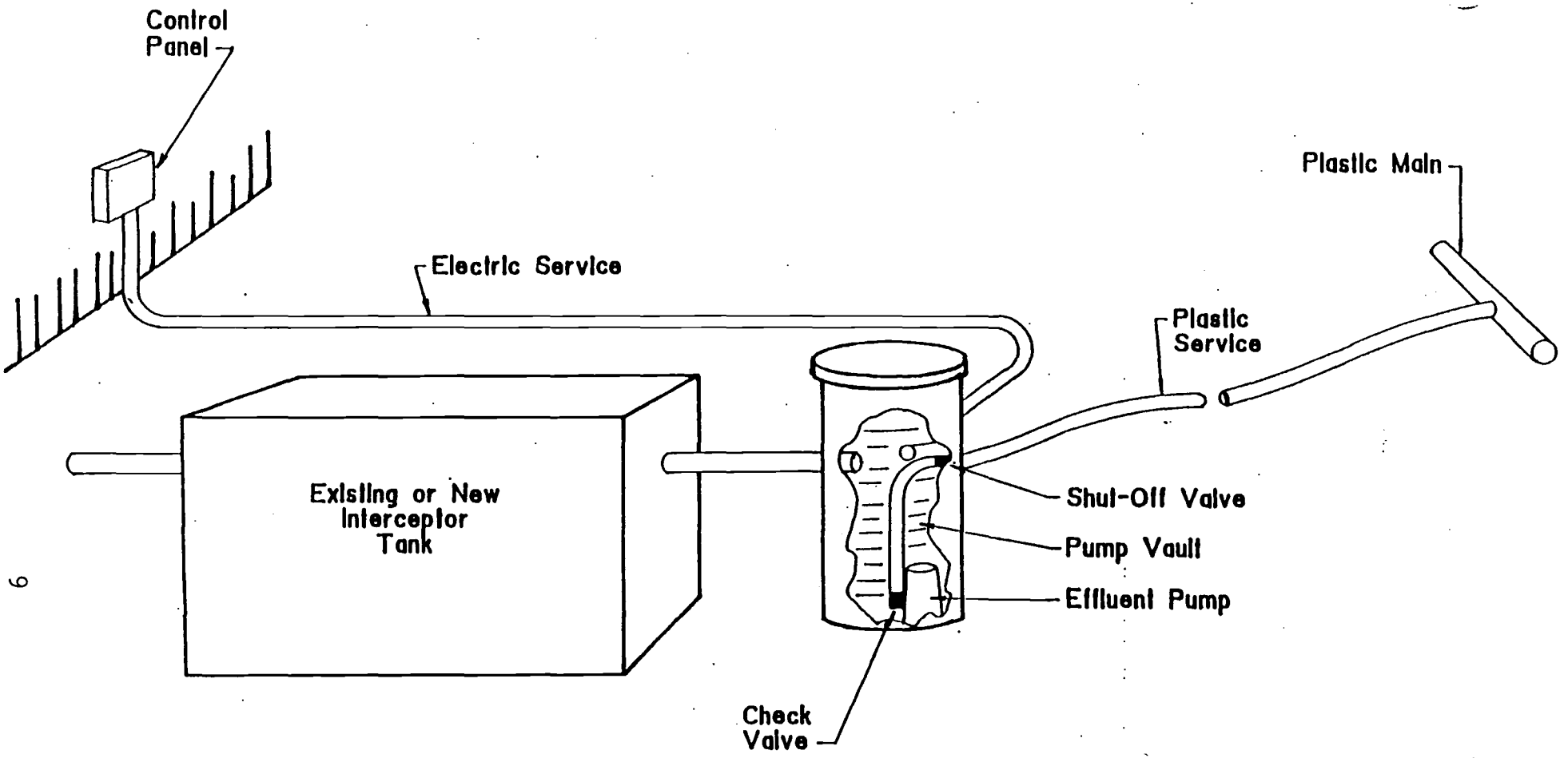


FIGURE 5
TYPICAL STEP SYSTEM

(Adapted from Figure 1.3 "Alternate Sewer Systems" WPCF M.O.P. FD-12)

C. Design Criteria For Wastewater Facilities

When planning for wastewater facilities, it is essential to estimate design wastewater flows and organic loadings. To estimate these, a "windshield survey" was conducted to determine the number of residential, commercial and industrial users within Freelandville. The survey revealed a total of approximately 298 users. This includes a few churches and small businesses. Also, aerial photos were studied and inquiries with Freelandville Water Association revealed this approximate number of users. A nursing home and housing unit in the community was estimated separately based upon water usage information. No industrial users were identified. Based upon past experience and water usage records, the average daily water demand is estimated at 200 gallons per day (gpd) per user, and the peak daily water demand is estimated at 2.5 times the average daily demand based upon water usage records for 2009. The infiltration allowance for the wastewater flows is based upon an allowable limit of 200 gpd per inch mile of pipe. Estimated length of 8" gravity mains was used for infiltration allowance and an estimated length of 100 L.F. per connection was used for service laterals infiltration allowance.

The projected wastewater flows are presented below.

	Average Daily Flow (gpd)	Peak Daily Flow (gpd)
296 EDU's (Equivalent Dwelling Units)	59,200	148,500
Nursing Home	4,600	11,500
Housing Unit	700	1,750
Infiltration Allowance (8" Gravity Mains)	8,600	8,600
Infiltration Allowance (6" Service Laterals)	6,800	6,800
Total	**79,900**	**177,150**

The historical growth figures for Knox County and Widner Township were presented in Table 1. For the purposes of this report, a growth factor of 10% over the next 20 years will be assumed. Therefore, the design flows for the year 2030 are presented as follows:

Projected Wastewater Flows

2030 Average Design Flow (79,900 gpd x 10 % Growth):	87,890 GPD	use 88,000 GPD
2030 Peak Design Flow (177,150 gpd x 10 % Growth):	194,865 GPD	use 195,000 GPD

Organic loadings to the wastewater treatment facilities consist of biochemical oxygen demand (BOD), suspended solids (SS) and ammonia (NH_3N). Theoretical values for each are based on the flow rate and the nature of the wastewater generated. All of the wastewater generated for this project will be of the domestic nature. Thus, for the purposes of this report influent wastewater concentration parameters of 220 mg/l for BOD, 220 mg/l for SS and 30 mg/l for NH_3H will be used. Based upon these parameters and an average design flow of 88,000 gpd, the organic loadings would be as follows:

BOD	=	0.088 MGD x 8.345 x 220 mg/l	=	161.6 lbs. per day
SS	=	0.088 MGD x 8.345 x 220 mg/l	=	161.6 lbs. per day
NH_3H	=	0.088 MGD x 8.345 x 30 mg/l	=	22.0 lbs. per day

For the purposes of this report the design effluent parameters were assumed to be 10 mg/l for BOD, 10 mg/l for SS and 1 mg/l for NH_3H. A wasteload allocation will be required to determine final design parameters.

D. Wastewater Treatment System Alternatives

Once sewage from the individual residences is collected and transported to a central location it must be treated. Over the years many methods of sewage treatment have been tried. Experiments with new alternative technologies have also been explored. The new alternative technology treatment processes have been broken down into primary treatment, secondary treatment and disposal alternatives. The best combination of these alternatives is then compared to an alternative consisting of a conventional mechanical treatment plant with surface discharge to an unnamed ditch. Midwestern Engineers, Inc. contracted with Williams Creek Consulting, Inc. to assist in evaluation of alternative treatment systems. The information presented herein was prepared by Mr. Ted Blahnik, P.E.

1. Alternative Treatment Facilities

Alternative or non-conventional wastewater treatment options refer to systems that are less mechanized and less energy-intensive than typical conventional plants. Alternative treatment systems are typically used to treat wastewater flows from smaller municipalities, industries, commercial or residential sites. Most conventional treatment plants and alternative systems are designed around the same biological processes. Alternative treatment systems generally operate at slower rates and longer retention times than conventional systems, but contain fewer mechanical parts and require less energy to operate. Depending on the design flow rates, alternative systems may require more area than conventional plants, but operation and maintenance of alternative systems is generally less complex and less costly than that of conventional systems. Alternative wastewater treatment systems can be designed for either sub-surface disposal or surface water discharge.

The alternative systems discussed in this report can be used alone, in series, or in combination with conventional treatment technologies, to meet treatment goals. The alternative technologies described here are categorized by the following treatment and disposal processes: primary treatment; secondary treatment; subsurface disposal options; proprietary alternative package systems; and tertiary treatment.

PRIMARY TREATMENT

Primary treatment systems screened in this report include concrete settling tanks and lagoons. External heat inputs or other temperature controls are typically not required for anaerobic pretreatment. Like residential septic tanks, these forms of primary treatment require periodic removal of non-digestible solids in order to maintain proper function.

Lagoons

Wastewater lagoons are constructed ponds that consist of one or more treatment cells. Lagoons are typically lined with clay, PVC, EPDM or other impervious materials to prevent leakage. While wastewater resides in the lagoon some solids settle to the bottom, and microorganisms reduce and digest many of the nutrients and other pollutants present in the water. This report examined three types of wastewater lagoons: anaerobic, facultative, and aerated.

Anaerobic lagoons typically are covered and have longer retention times than settling tanks (three or more days). The covers help to insulate the lagoon and block sunlight to minimize oxygen production by photosynthetic algae and phytoplankton. Common cover options are:

1. An air-tight, sealed cover, in which biogas collects while eliminating escape of odors. Sealed covers enable collection of biogas, which typically contains 60 to 70 percent methane - a valuable energy resource. Biogas vents should be fitted with carbon filters.
2. Four to six-inch diameter high density polyethylene (HDPE) balls, where methane recovery is not desired. HDPE balls allow rainwater to pass through the cover, avoiding the need for rainwater collection systems that may be required if a sealed cover is used. HDPE balls should provide complete coverage of the lagoon surface in order to minimize odor problems, insulate the lagoon against cold temperatures, minimize oxygen diffusion into the lagoon and discourage use of the facility by animals.
3. Vegetated cover using duckweed or other fast growing, dense cover. Vegetated covers are most useful in areas where annual temperatures do not fall below freezing.

Facultative lagoons do not have a cover. Their exposure to sunlight creates a two layer system – an upper aerobic layer oxygenated by photosynthetic organisms and a lower anaerobic layer where sunlight does not penetrate in sufficient quantity to support photosynthesis. They tend to be larger and shallower (3-8 feet) than anaerobic lagoons to allow for maximum diffusion of oxygen and algae growth. Facultative lagoons experience less odor problems than anaerobic lagoons, but function less efficiently when covered by ice during winter months.

Aerated lagoons incorporate mechanical aeration. Aerobic digestion is the primary treatment mechanism, but aerobic lagoons differ from mechanical aeration plants in that the amount of oxygen supplied is less and there is typically no mixing. Aerobic lagoons have the least amount of odor control issues among the three lagoon types, and can be covered to minimize photosynthetic algae production and maximize odor control.

Settling Tanks

Settling tanks are typically buried structures designed to hold untreated wastewater for up to 48 hours prior to discharge. Settling tanks can be pre-manufactured or cast-in-place, but they must be watertight and designed according to local and state regulations.

In Indiana, concrete or fiberglass tanks can typically be used, and selection of the material is a function of cost. Settling tanks are effective at removing settleable and floating solids, and provide up to 50% removal of BOD. Settling tanks alone cannot meet surface water discharge standards and tank effluent from municipal systems, and require secondary treatment prior to discharge to a sand mound or other onsite system.

SECONDARY TREATMENT

Alternative secondary treatment systems screened in this report include

1. Passive fixed media filters such as constructed wetlands and single pass sand filters
2. Anaerobic, recirculating fixed media filters such as upflow filters
3. Aerobic recirculating fixed media filters such as rapid sand filters and gravel nitrification filter beds
4. Proprietary low-energy, suspended growth technologies such as LEMTEC lagoon systems

Recirculating anaerobic filters such as upflow filters or recirculating wetlands can typically achieve BOD effluent limitations, but require additional nitrogen treatment prior to surface water discharge. Upflow filters are deeper than constructed wetlands and require about 20,000 square feet per 100,000 gallons of daily flow.

ReciRculating aerobic filters can be designed to meet both BOD and nitrogen requirements. However, they are more efficient when designed following BOD pretreatment. Recirculating aerobic filters require about 30,000 square feet per 100,000 gallons of flow if they are designed to treat both BOD and nitrogen, and require only about 5,000 square feet per 100,000 gallons if BOD is pretreated.

Constructed wetland systems

Constructed wetland systems are very effective at removing suspended solids, BOD and fecal coliforms, and are typically designed to remove >90% of these pollutants. Wetlands are also excellent at removing nitrate-nitrogen from wastewater. However, wetlands are not as efficient at removing ammonia-nitrogen as some other available non-conventional treatment options. If significant ammonia-nitrogen removal is required, then the wetland should be built in series with an aerobic technology, such as a recirculating nitrification filter bed.

Constructed wetlands typically require little or no energy input, but require more time to achieve a level of treatment comparable to that obtained in a conventional WWTP. Treatment wetland systems are classified into two major categories – surface water flow (SWF) wetlands and subsurface flow (SSF) wetlands. However, surface flow wetlands do not function as well as subsurface flow in climate with prolonged temperatures below freezing. Therefore, this report will speak more directly to subsurface flow wetland alternatives.

Water exiting a wetland is typically low in dissolved oxygen (D.O.). In areas where D.O. concentrations are a concern, a simple cascade can be used to re-oxygenate the water.

Subsurface flow wetlands typically contain no visible surface water. All flow is designed to occur beneath the surface in a 2 to 3-foot deep bed of media. Media may consist of gravel, tire chips or other material that meets design criteria. Subsurface flow wetlands can generally be fed wastewater at an HLR up to approximately 1.2 gpd/ft^2.

Subsurface flow wetlands also contain wetland plants. These plants perform several functions:

1. The plant roots provide homes for bacteria and other natural organisms that work together to consume, remove and otherwise convert pollutants to more desirable products. Bacteria also grow on the surface of the gravel within the wetland.
2. Plant roots also help to settle and filter out undesirable suspended solids, although the media bed is the primary mechanism for filtration.
3. Roots and decomposing organic matter trapped within the wetland absorb heavy metals and other pollutants.
4. Roots and decomposing organic matter provide a long-term food source necessary for some biological processes such as denitrification of nitrate.
5. The plants provide insulation during winter months.

Recirculating Media Filters

Similar to constructed wetland systems, recirculating media filters (RMFs) use naturally occurring biological and physical processes to remove pollutants from wastewater. A recirculation pump is used to filter the wastewater through sand, gravel, peat, textile, or other media multiple times. Suspended solids in the wastewater are trapped by the media in the filter, and bacteria growing on the media consume and convert pollutants in the wastewater to less harmful or more desirable forms. The purpose of recirculation is to increase the treatment of the wastewater prior to delivering it to a dispersal or tertiary treatment system.

RMFs are generally designed as subsurface systems that flow horizontally or vertically. For vertical-flow systems, wastewater can be pumped into the bottom of the RMF to create an upflow filter, or it can be designed to flow from top to bottom. RMFs can be designed to operate exclusively under aerobic or anaerobic conditions, or to combine anaerobic and aerobic treatment zones. Upflow RMFs can contain storage chambers at the bottom of the system, which allow solids to settle out of wastewater. Using storage chambers increases the size (depth) of the RMF, but can enhance treatment efficiency by distributing wastewater evenly throughout the system.

Aerobic RMFs are aerated systems that remove BOD at a high rate, and produce sludge as a byproduct of BOD removal. Aerobic RMFs are often designed as rapid sand or other media filters dosed by gravity or pumps. When used immediately following primary wastewater treatment, rapid sand filters must be backwashed to prevent clogging, and the large quantities of sludge produced by aerobic digestion require ongoing, regular management. Aerobic RMFs can convert some ammonia to nitrate, but do not significantly decrease the concentration of nitrogen in wastewater. Aerobic RMFs can generally be fed wastewater at a

HLR up to approximately 5 gpd/ft^2 if wastewater has not been pretreated, and up to 30 gpd/ft^2 if pretreatment has occurred.

A typical anaerobic RMF is similar to a SSF wetland, but includes pumps and a distribution manifold to recirculate wastewater back through the system. Wastewater is generally delivered to an anaerobic RMF at the bottom of the system, creating upward flow; the recirculation system distributes the wastewater back to the top or subsurface of the RMF. Continuous saturation of the media maintains the system under anaerobic conditions. Anaerobic RMFs are very efficient at removing BOD, and produce little sludge compared to aerobic RMFs. Most of the ammonia in wastewater remains after passing through an anaerobic RMF; if nitrogen removal is required, the anaerobic RMF should be used in series with an aerobic system, as a recirulating anaerobic / aerobic media filter. Anerobic RMFs can generally be fed wastewater at a HLR up to 30 gpd/ft^2.

Anaerobic / aerobic RMFs can be combined, with the addition of an unsaturated (aerobic) layer over the top of the anaerobic media filter. After wastewater flows through the anaerobic, subsurface media zone it is recirculated back to the aerobic media layer. The purpose of including an aerobic area in the RMF is to provide additional treatment for nitrogen and polish BOD. Under aerobic conditions, ammonia is converted to nitrate, which then undergoes denitrification as it flows back through the anaerobic zone of the RMF. Denitrification breaks nitrate down into nitrogen gas, which is a harmless atmospheric molecule. BOD removal also occurs in the aerobic zone, but the majority of BOD removal occurs in the larger anaerobic area. Anerobic / aerobic RMFs can generally be fed wastewater at a HLR between 15 - 30 gpd/ft^2.

LemTec™ Biological Treatment Process

The LemTec™ Biological Treatment Process (LBTP) consists of a covered, three-celled aerated pond followed by a settling pond and a fixed-film polishing reactor. The LBTP system is designed to rapidly remove BOD and nitrify ammonia in the aerobic reactor. Sludge produced in the aerobic pond is collected in the settling pond where a portion of it is digested, and is expected to require removal every six to eight years. The fixed-film polishing reactor is designed to further reduce BOD and ammonia. Similar to a conventional treatment plant, the majority of nutrients are not removed in the treatment process, and remain in the wastewater. Disinfection may be required after treatment in the LBTP to achieve NPDES requirements for surface water discharge.

SUBSURFACE DISCHARGE/INFILTRATION SYSTEMS

Treated wastewater must be disposed of according to the rules of the appropriate governing agency. The Indiana State Department of Health (ISDH) typically governs onsite systems for individual residential homes, clusters of residential homes, small flow commercial sewage discharges, and onsite discharges owned by county-run sewer districts. The Indiana Department of Environmental Management (IDEM) is the permitting agency for all offsite sewage discharges and municipal or privately-held sewer utility districts.

Subsurface discharge is dependent on soil conditions. Land available for the wastewater treatment plant and disposal fields is located on the northwest side of Freelandville. Soils in this area are Hosmer silt loams with varying slopes. The Hosmer soil series is described as well-drained, very slowly permeable upland soils, in hydrologic soil group (HSG) C. HSG-C soils typically infiltrate water slowly, even when wet.

As discussed, non-conventional wastewater treatment systems may be designed for surface discharge, or for subsurface infiltration. Surface-discharging systems require permits that specify concentration limits for pollutants of concern, for the geographic region in which the system will be operated. These permits typically require frequent monitoring for BOD, TSS, Ammonia-Nitrogen, and other pollutants. Subsurface discharge of treated wastewater generally makes use of a sand mound, infiltration trench or drip irrigation system. The space requirements of infiltration trenches generally make them impractical for larger flow volumes, such as those produced by municipalities. Therefore the options most often considered for infiltrating wastewater are sand mounds and drip irrigation.

Elevated Sand Mounds

Where shallow high water table conditions occur, a sand mound (also called a sand filter) must be constructed to prevent groundwater from intercepting the disposal system. The seasonal high groundwater table must be >20" below base of the sand mound or a perimeter drain must be installed to obtain such a condition. Based on the USDA Soil Survey for Knox County, soils in the vicinity of Freelandville appear to be amenable to onsite discharge with a sand mound. Depth to the seasonal high water table in Hosmer silt loams generally ranges from 36 to 72 inches below the soil surface.

Within the sand mounds, perforated PVC pipes distribute wastewater evenly over a given area. Surface area requirements range from ½-acre to 2-acres per 10,000 gallons of wastewater, depending on soil type. Sand mounds may be designed as single-pass or recirculating filters. Single-pass sand filters (SPSFs) are constructed as vertical flow systems similar to RMFs, but they differ in several important aspects:

- Media size is restricted to material with a finer grain than gravel
- They require 3 to 10 times more surface area than RMFs
- They require more frequent cleaning (at least annually, sometimes quarterly) and media replacement than RMFs or wetlands
- They do not require a recirculation pump

SPSFs are typically loaded with 0.3 (low-rate) to 5 (high-rate) gpd/ft2. In general, SPSFs are applied to low-flow commercial sites or to single-family residential wastewater flows. If pumping equipment is required for dosing to a disposal field, the same dosing pump can be used to modify the SPSF into a recirculating sand filter (RSF). RSFs can reduce the overall size of the system while improving wastewater treatment efficiency.

Sand Mound Treatment Capabilities

Like wetlands and RMFs, sand filter systems are very good at removing suspended solids and BOD, and are typically designed to remove >90% of these pollutants. These pollutants are filtered by the media and are consumed and digested by organisms attached to the media.

Sand filters are very effective at removing pathogens and ammonia-nitrogen from wastewater, but they are not as efficient at removing nitrate or phosphorus as other non-conventional treatment options. If significant removal of nutrients is required, then the sand filter should be built in series with other technologies, such as the ETS described above.

Pressure Drip Irrigation

Another method for dispersing treated wastewater is through pressure drip irrigation. Drip irrigation systems are pressurized, and are similar to sand mounds in that they distribute the water over a large subsurface area through a network of buried lines. Drip irrigation systems conform to existing topography. They differ from sand filters in a number of ways:

- More extensive pre-treatment is required when a drip system is used, compared to a sand filter. Drip systems require additional filters, which are not necessary for sand mounds.
- Drip lines require periodic backwashing to prevent clogging of the drip holes, whereas conventional pressurized dispersal fields do not.
- The capital costs for installing a drip system are less than costs for sand mounds, for flows greater than 2,000 gallons per day. However, long-term operation and maintenance costs are higher for drip systems.
- Drip irrigation requires less area than a sand filter system, but drip systems require more complex pumping and controls.
- Unlike sand filters, drip irrigation systems are subject to iron fouling. Municipalities typically remove iron from drinking water prior to distributing it for consumption. However, areas served by well water should pre-treat the water for iron if it will be discharged to a drip irrigation field.
- Drip irrigation systems require minimum separation distances > 20" from the base of the drip-line to seasonal high groundwater.

Vegetated Sludge Drying Beds

Vegetated sludge drying beds are used to dewater and settle sludge, and to polish wastewater effluent of remaining pollutants. A vegetated sludge drying bed can be a separate component of the treatment system, or it can be located on top of part of a SSF wetland or RMF. A separate sludge drying bed consists of a layer of coarse sand, blast furnace slag, or crushed and recycled glass above a layer of tire chips or gravel, with an underdrain and liner at the bottom.

If sludge is to be dried on top of a SSF wetland or RMF, wetland plants should be cultivated on top of the filter. Densely-growing, deep-rooted herbaceous vegetation is an important component of the vegetated

sludge drying bed. Plant roots prevent clogging and maintain open channels in the media for water flow, while plant stems help to break up sludge mats. Exposure to the air enables sludge to decompose aerobically, and accumulation of sludge occurs at a slow rate on the bed surface. Sludge removal is generally not required due to the vegetation's ability to keep the bed porous and well drained, and the relatively slow rate of sludge accumulation across the surface of the bed.

SIZING AND EVALUATION OF ALTERNATIVE WASTEWATER TREATMENT OPTIONS

Calculations were performed to determine the required sizes for, and costs of, the various alternative treatment technologies. Size, cost and treatment effectiveness were used to determine the feasibility of each option.

Primary Treatment

All primary treatment options were assumed to receive an influent with BOD concentration of 220 mg/L and TSS concentration of 220 mg/L.

Settling Tanks

Four settling tank dimensions are 20'W x 8'H x 30'L, each with a capacity of 35,000 gallons, provide a volume of 140,000 gallons. Effluent concentrations of BOD and TSS are expected to be approximately 120 and 42 mg/L respectively.

Facultative Lagoon

Calculations indicate a 10 feet deep lagoon, measuring 250 ft x100 ft at its surface, can produce an effluent BOD concentration of 120 mg/L.

Anaerobic Covered Lagoon

Calculations indicate a 10 feet deep lagoon, measuring 185 ft x 70 ft at its surface, can produce an effluent BOD concentration of 120 mg/L. The lagoon cover is expected to reduce algae production and improve odor control, compared to a facultative lagoon.

Secondary Treatment with Subsurface Disposal

Secondary treatment with subsurface disposal considered two options:

1. Subsurface flow wetland and sand mound
2. Subsurface flow wetland and drip irrigation

For both scenarios, subsurface flow wetlands were evaluated for secondary treatment of wastewater. The wetlands were assumed to receive an influent with BOD concentration of 120 mg/L, and were designed for an operating temperature of 5°C.

Subsurface flow wetlands were assumed to receive wastewater pre-treated in a settling tank, and were sized to achieve a theoretical effluent BOD concentration of 25 mg/L. The average subsurface water depth is 3 feet, with an additional foot of freeboard. The system concept includes two wetlands in parallel to facilitate

maintenance. The top length and width of each subsurface flow wetland is approximately 160 feet with 2:1 side slopes, providing a HRT of 3.5 days. The footprint required for the two wetlands is approximately 1¼ acres.

Sand Mound

A sand mound system was evaluated for subsurface disposal of wastewater treated in a constructed wetland. Eight sand mounds, each with an area of 0.86 acres, are required to accommodate a soil loading rate of 0.25 gpd/ft^2, appropriate for Hosmer silt loam soils. The design flow for each mound is 12,500 gpd, to account for peaking, and each sand mound contains an aggregate bed with four dosing zones. The total area required for the sand mound system with perimeter drains is 9 to 18 acres, pending the topography of available land.

Pressure Drip Irrigation

A pressure drip irrigation system was evaluated for subsurface disposal of wastewater treated in a constructed wetland. A drip area of 9 acres is required to meet the 0.25 gpd/ft^2 soil loading rate appropriate for Hosmer silt loam soils. Including 20' separation between drip line zones, the estimated area required for the multi-zone system is 13 acres. The anticipated area requirements and expense make a drip irrigation system unfeasible for wastewater disposal in Freelandville.

Alternative Systems for Surface Water Discharge

The two alternative systems discussed below are designed to provide wastewater to meet or be capable of meeting anticipated NPDES standards for surface discharge – a LemTec suspended growth system and a non-proprietary media filter. The two include many items identical to those in a mechanical package plant including: mobilization, access road, labaoratory and control building, UV disinfection, site piping, screening structure and associated equipment, a lift station at the plant, electrical work, and a stand-by generator.

LemTec™ Biological Treatment Process

Design of the LBTP assumed a minimum winter water temperature of 10°C and a maximum summer water temperature of 25°C. The LBTP was designed to achieve effluent BOD and TSS concentrations of 15 and 18 mg/L respectively, and an effluent ammonia concentration of 1.0 mg/L. The aeration pond is 12 feet deep with a HRT of 12.5 days, and the settling pond is 12 feet deep with a HRT of 4 days. The polishing reactor is contained in a 12-foot deep, 8' x 32' concrete tank. Primary treatment of wastewater is recommended by LemTec™, but not provided in the design. The approximate footprint of the LBTP, not including a pretreatment system, is approximately 0.69 acres.

Biological Media Filter Plant

Design of the Biological Media Filter Plant (BMFP) assumed a minimum winter water temperature of 10°C. The BMFP was designed to achieve effluent BOD and TSS concentrations less than 15 and 15 mg/L respectively, and an effluent ammonia concentration less than 1.0 mg/L. The footprint of the BMFP is approximately All tanks and filters in this BMFP are constructed using concrete cells,

each 8 feet deep and using shared walls to create a footprint measuring 170 ft x 120 ft. The BMFP includes, in series:

1. Screening
2. Settling tank
3. Recirculating anaerobic media filter
4. Recirculating anaerobic / aerobic media filter
5. Sand filter
6. UV disinfection

The BMFP was designed as a system with four treatment components in series followed by disinfection. The four components consist of: settling tanks, anaerobic recirculating media filters, anaerobic / aerobic recirculating media filters, and rapid sand filters.

Screening is placed at the head of the plant prior to discharging to four settling tanks (20'W x 8'H x 30'L) provide a volume of 140,000 gallons. Tanks are placed in two sets of two in series.

Each set of tanks discharges to an anaerobic RMF. The RMF contains HDPE chambers at its base, overlain by washed gravel, overlain by topsoil. Wastewater flows by gravity up through the filter to a collection manifold beneath the base of the topsoil. Effluent is recirculated constantly at a rate equal to 1 to 3 times the daily flow to help prevent short circuiting and increase uniform contact through the filter.

Overflow from the upflow filter discharges to an anaerobic/aerobic RMF. This RMF contains EZ Flow chambers near its mid-depth. The RMF is constructed of washed gravel. First pass wastewater flows downward to a collection manifold and is recirculated at least 3 times per day to the just below the surface of the filter in the aerobic zone.

Effluent from the anaerobic/aerobic RMF discharges to a sand filter. From the sand filter, the effluent flows through a UV disinfection unit.

Effluent concentrations are projected to be less than 1 mg/L ammonia-nitrogen, less than 20 mg/L BOD, and meet coliform limits similar to those set for the conventional option.

EVALUATION OF ALTERNATIVES

Primary Treatment

Based on results, concrete settling tanks are the recommended primary treatment for the alternative systems. Costs for concrete tanks are comparable to those for facultative lagoons and covered lagoons that provide similar levels of treatment, odor control concerns are the lowest among the three options, and maintenance of concrete tanks is more easily accomplished.

Solids can be pumped from the primary treatment system on an annual (settling tank) or 3 to 5 year (covered lagoon) basis. Pumped liquid sludge can be applied to a vegetated sludge drying bed on site, where it will settle and be dewatered. Alternatively, sludge can be disposed of at a nearby POTW permitted for receipt of septage. Pumped liquid sludge volume typically comprises 33% of the settling tank volume, therefore pumped sludge volumes will be approximately 47,000.

Secondary Treatment

Technologies were analyzed alone and in combination in terms of their approximate physical size, capital cost to construct, ability to meet anticipated permit requirements, and long-term operation and maintenance needs. Like conventional treatment plants, non-conventional systems are sometimes best applied in combinations or series where they can be placed to take advantage individual efficiencies and avoid their inefficiencies. These combinations can help reduce capital costs, improve system performance, and significantly reduce long-term maintenance requirements.

Constructed wetlands and onsite disposal fields have similar construction costs to other technologies, but would require more land than is readily available (likely over 15 acres).

A biological media filter using an EPDM liner for treatment cells is a cost competitive alternative at $1.4M, has little to no odor concerns, and requires very little maintenance or energy relative to other options. However, the area requirements are approximately 4 acres.

Both the LemTec system and the BMFP with concrete cells and tanks are cost comparable at $1.7M and $1.7M respectively, however neither appears to yield a cost advantage over a conventional mechanical treatment plant.

CONCLUSIONS

Based on the results of this report, the EPDM lined Biological Media Filter Plant with an EPDM liner is the recommended non-conventional technology. The wetland and onsite disposal option requires too large of an area, and the LemTec and concrete BMFP are more costly to construct.

2. Conventional Mechanical Treatment Facilities

A conventional mechanical plant generally involves a process known as activated sludge. This process has several variations. In general, wastewater is directed to an aeration tank. The aeration tank contains a population of naturally occurring bacteria. Oxygen is provided to the bacteria by injecting air with blowers or paddles. The bacteria decompose the organic matter in the wastewater. In effect, the bacteria eat the organic matter and convert it to new bacteria cells. After a period of time, the wastewater and a portion of the bacteria population are directed to a final clarifier. In the clarifier, the bacteria and inert solids settle to the bottom, and clear water is discharged from the top. The clear water is then disinfected and discharged into a receiving stream. The bacteria and solids that settle to the bottom of the clarifier are pumped back into the aeration tank. This is called return sludge. Because the bacteria are consuming organic matter, the bacteria population is constantly increasing. Periodically, the excess bacteria are pumped into a digester as waste sludge. In the digester, the bacteria are provided with oxygen and given time to stabilize before drying and disposal.

In general there are two (2) types of conventional mechanical treatment facilities that are feasible for the size of treatment facility for this community. First, package treatment plant units with different compartments for the aeration tank, clarifier tank, and aerobic digester could be utilized for conventional treatment. Second, sequencing batch reactor (SBR) units, which incorporate the aeration and clarification processes in "batches" in the same tank with a separate aerobic digester tank, could also be utilized for conventional treatment.

The positive to the conventional treatment alternative is that it is a proven and reliable wastewater treatment facility. The negative is that it has a relatively high initial capital cost, with ongoing operation, maintenance and replacement costs associated with it. A certified operator is required by IDEM regulations.

E. Cost Estimates

One of the most important keys for successful implementation of any wastewater alternative will be the lowest possible capital, operation, and maintenance and replacement cost. Appendix B contains the cost estimates for the wastewater collection and treatment alternatives. Table 3 presents a summary of these costs and a present worth analysis for the wastewater collection alternatives.

TABLE 3

PRESENT WORTH ANALYSIS
WASTEWATER COLLECTION ALTERNATIVES

	GRAVITY SEWER	PRESSURE SEWER
Probable Construction Costs	$2,733,000.00	$2,825,000.00
Annual Operation And Maintenance Costs	$27,000.00	$71,000.00
Equivalent Present Worth of O & M Costs, i=8%, t=20 yrs., P/A=9.8181	$265,100.00	$697,100.00
Total Present Worth of Alternative	**$2,998,100.00**	**$3,522,100.00**

Table 4 presents a summary of costs and a present worth analysis for the alternative wastewater treatment alternatives.

TABLE 4
PRESENT WORTH ANALYSIS
ALTERNATIVE WASTEWATER TREATMENT ALTERNATIVES

PRIMARY TREATMENT ONLY	COVERED LAGOON	FACULTATIVE LAGOON	SEPTIC TANKS
Probable Construction Costs	$260,000.00	$168,000.00	$162,000.00
Annual Operation and Maintenance	$1,460.00	$500.00	$960.00
Equivalent Present Worth of O & M Costs, i=8%, t=20 yrs., P/A=9.8181	$14,334.00	$4,909.00	$9,425.00
Total Present Worth of Alternative	**$274,334.00**	**$172,909.00**	**$171,425.00**

DISPOSAL ONLY	SAND MOUND	PRESSURE DRIP IRRIGATION
Probable Construction Costs	1,399,000.00	$931,000.00
Annual Operation and Maintenance	$12,000.00	$13,000.00
Equivalent Present Worth of O & M Costs, i=8%, t=20 yrs., P/A=9.8181	$117,817.00	$127,635.00
Total Present Worth of Alternative	**$1,516,817.00**	**$1,058,635.00**

COMPLETE ALTERNATIVE TREATMENT SYSTEM	SSF WETLAND	LEMTEC SYSTEM	BIO FILTER (CONC)	BIO FILTER (EPDM)
Probable Construction Costs	$1,912,000.00	$1,723,000.00	$1,696,000.00	$1,343,000.00
Annual Operation and Maintenance	$27,500.00	$56,000.00	$47,000.00	$47,000.00
Equivalent Present Worth of O & M Costs, i=8%, t=20 yrs., P/A=9.8181	$270,000.00	$549,814.00	$461,451.00	$461,500.00
Total Present Worth of Alternative	**$2,182,000.00**	**$2,272,814.00**	**$2,157,451.00**	**$1,804,500.00**

As shown in Table 4, the most cost effective alternative treatment system is the EPDM lined Biological Media Filter Plant with an EPDM liner; however, the area requirements are approximately 4 acres for this alternative treatment system. The wetland and onsite disposal option requires too large of an area (likely over 15 acres), and the LemTec and concrete BMFP are more costly to construct. Concrete settling tanks are the recommended primary treatment for the alternative systems. Also, surface water discharge is recommended in lieu of sand mounds or drip irrigation due to the significant land requirements of 9 to 18 acres. Table 5 presents a summary of costs and a present worth analysis for the most feasible alternative treatment system versus a conventional mechanical treatment plant alternative.

TABLE 5
PRESENT WORTH ANALYSIS
ALTERNATIVE WASTEWATER TREATMENT ALTERNATIVE
VS.
CONVENTIONAL MECHANICAL TREATMENT ALTERNATIVE

	ALTERNATIVE TREATMENT	CONVENTIONAL TREATMENT
Probable Construction Costs	$1,343,000.00	$1,415,000.00
Annual Operation and Maintenance	$47,000.00	$57,000.00
Equivalent Present Worth of O & M Costs, i=8%, t=20 yrs., P/A=9.8181	$461,500.00	$559,600.00
Total Present Worth of Alternative	**$1,804,500.00**	**$1,974,600.00**

As shown in Table 5, the most cost effective alternative treatment system appears to be the EPDM lined Biological Media Filter Plant with an EPDM liner; however, since the range of present worth values is small, then non-monetary factors should be considered in determining which alternative should be selected. Due to the area requirements of approximately 4 acres for the alternative treatment technology system and available land for the treatment site, which is under 2 acres and the wastewater planning committee preferring the conventional treatment system to the alternative treatment technology systems, the conventional treatment system alternative is the recommended and selected alternative for this project.

V. Proposed Project

A. Wastewater Collection and Treatment Facilities

1. Project Description

A conventional gravity sewer is the most common type of sewer utilized for wastewater collection and in this situation the most economical. The sewer material will likely be gasketed PVC pipe, eight (8") inches in diameter, which is the minimum diameter for conventional gravity pipe. The pipe will be laid on a constant slope, not less than 0.4%. Six (6") inch wyes with service laterals will be run to each customer's property line. Lateral connections from the property line to the house will be the responsibility of the homeowner. Lateral lines must be installed in accordance with Local and State codes. Homeowners will be responsible for abandoning their existing septic tanks upon connection with the proposed collection system. Where gravity flow is no longer possible, lift stations will be utilized. The collection system for Freelandville will have four (4) lift stations. The pumps housed in each lift station will be duplex, solids handling submersible or suction lift pump stations. The force main for the lift stations will be four (4") in diameter and will be installed from each lift station to gravity sewers, which will flow to the treatment plant site.

The selected wastewater treatment facilities consist of construction of a conventional mechanical treatment plant system. The conventional mechanical treatment plant alternative had a slightly higher present worth than the most feasible alternative treatment system. However, due to the land requirements and land available for a treatment site, the conventional mechanical treatment plant is the chosen alternative. Also, the wastewater planning committee prefers the conventional treatment alternative to the alternative treatment systems.

2. Land Requirements

An area of approximately 35 feet by 35 feet will need to be purchased to construct each of the proposed lift stations. The conventional gravity sewer system requires four (4) lift stations. An area on the order of one (1) acre will need to be purchased for the proposed wastewater treatment facility. Private easements will be required for a portion of the collection system. However, some of the sewers will be located in the existing road right-of-ways.

3. Construction Problems

Construction is anticipated to be generally normal for this type of project. The most significant construction problems that could impact the project may be unweathered bedrock and a seasonal perched groundwater table.

4. Probable Project Costs

Probable project costs are presented below.

TABLE 6
PROBABLE PROJECT COST
FOR A
NEW WASTEWATER COLLECTION AND TREATMENT SYSTEM
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

I. PROBABLE CONSTRUCTION COSTS		
	SUBTOTAL COLLECTION SYSTEM COST	**$ 2,733,000.00**
	SUBTOTAL TREATMENT SYSTEM COST	**$ 1,415,000.00**
	TOTAL PROBABLE CONSTRUCTION COST	**$ 4,148,000.00**
II. PROBABLE NON-CONSTRUCTION COSTS		
1.	Administration and Labor Standards	$ 48,000.00
2.	Permits & Advertising	$ 1,000.00
3.	Geotechnical (Soil Borings)	$ 3,000.00
4.	Legal	$ 30,000.00
5.	Rate Accountant	$ 25,000.00
6.	Bond Council	$ 25,000.00
7.	Preliminary Engineering -	$ 3,000.00
8.	Engineering	$ 330,000.00
9.	Inspection	$ 191,000.00
10.	Environmental Report & Archaeological	$ 12,000.00
11.	New Billing Software & Computer	$ 10,000.00
12.	Interest During Construction	$ 98,000.00
13.	Land	$ 15,000.00
14.	Easement Preparation & Acquisition (90 easements @ $200/ea.)	$ 18,000.00
15.	Non-Construction Contingencies	$ 40,000.00
	TOTAL PROBABLE NON-CONSTRUCTION COST	**$ 849,000.00**
III. PROBABLE PROJECT COST		**$ 4,997,000.00**
IV. PROBABLE ANNUAL O & M COSTS		
	SUBTOTAL COLLECTION SYSTEM COST	**$ 27,000.00**
	SUBTOTAL TREATMENT SYSTEM COST	**$ 57,000.00**
	TOTAL PROBABLE ANNUAL O & M COST	**$ 84,000.00**
V. PROBABLE ANNUAL SHORT LIVED ASSET RESERVES		**$ 9,750.00**

B. Project Financing

1. Indiana Office of Community and Rural Affairs

Local government that is non-entitlement communities are eligible to apply for the Community Development Block Grants funded through the Indiana Office of Community and Rural Affairs (OCRA). To qualify, at least fifty – one percent of the residents that benefit from a water or wastewater project must be low-to-moderate income families and the applicant must demonstrate need. Low-to-moderate income is 80% or less of the County's median income. A public or private non-profit agency or organization can receive funds through a local governmental agency as a sub- recipient. Based upon the last income survey, Freelandville qualifies for this program. The construction grant has a maximum award of $600,000.

2. USDA Rural Development

Wastewater and water projects may be funded through Rural Development (RD). Eligible applicants are public and not-for-profit organizations serving cities and towns with populations of less than 10,000. Rural Development has a grant and loan program. Their loan has a 40 year term with a current interest rate of 3.25 % for the moderate bracket, which Freelandville should quality for. According to the 2000 census median household income for Widner Township, Freelandville qualifies for a 45 % RD grant. It is possible that additional income survey work could be done in Freelandville to qualify for additional RD grant. However, these grant funds are limited and the community should make contact with the district RD office prior to pursuing this option.

3. IDEM State Revolving Fund

The Indiana Department of Environmental Management (IDEM) provides low-interest loans to communities to plan, design, and build water and wastewater systems. The interest rate is determined by the median household income of the project area. Freelandville currently qualifies for the tier II interest rate of 2.31% to 3.06%, which is dependent on the user rates. These loans have a 20 year term. In order for this funding option to be beneficial for Freelandville, it must be supplemented with a large portion of grant funding.

Table 7 presents possible funding scenarios and rate calculations for the wastewater project. A more complete rate study should be completed by the Community's rate consultant, which is also required by most funding agencies.

TABLE 7

POSSIBLE FINANCING SCENARIOS
FOR
WASTEWATER COLLECTION AND TREATMENT FACILITIES
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

	RURAL DEV. LOAN NO GRANT	RURAL DEV. LOAN OCRA CFF GRANT	RURAL DEV. LOAN RD GRANT	RURAL DEV. LOAN BOTH GRANTS
PRELIMINARY PROJECT COST ESTIMATE	$4,997,000.00	$4,997,000.00	$4,997,000.00	$4,997,000.00
GRANT	$0.00	$600,000.00	$2,248,650.00	$2,848,650.00
LOAN	**$4,997,000.00**	**$4,397,000.00**	**$2,748,350.00**	**$2,148,350.00**
DEBT SERVICE(1)	$232,295.12	$204,402.97	$127,762.31	$99,870.16
DEBT SERVICE RESERVE (2)	$23,229.51	$20,440.30	$12,776.23	$9,987.02
ANNUAL O & M	$84,000.00	$84,000.00	$84,000.00	$84,000.00
ESTIMATED TOTAL ANNUAL COST	**$339,524.63**	**$308,843.26**	**$224,538.55**	**$193,857.18**
Approximate number of users	298	298	298	298
ESTIMATED AVERAGE MONTHLY USER FEE	**$94.95**	**$86.37**	**$62.79**	**$54.21**

(1) Debt Service based upon a 40 year loan at 3.5% interest for USDA/RD funding
(2) Debt Service Reserve based upon 10% for USDA/RD financing

VI. Conclusions and Recommendations

The following conclusions can reached as a result of this Preliminary Engineering Report:

1. Based upon the numerous problems which are documented problems with failing septic systems within Freelandville, there is a need for wastewater collection and treatment facilities.

2. A conventional gravity sewer system with treatment by a conventional mechanical treatment system is the selected alternative for wastewater collection and treatment.

The following recommendations are provided for consideration:

1. The community must review the preliminary engineering report completely and address any questions pertaining thereto.

2. The community must determine if the report meets their goals and if it is acceptable to the residents.

3. Upon acceptance of the report, submit it along with an application for financing to USDA Rural Development for their review and approval.

4. Commence dialogue with property owners to select a site for the wastewater treatment plant facility.

5. After financing has been secured, proceed with the design phase of the project; submit all applicable permits to agencies for approval then proceed with construction.

Respectfully Submitted,
MIDWESTERN ENGINEERS, INC.

R. Derick Wiggins, P.E.
Project Engineer

APPENDIX B

COST ESTIMATES FOR WASTEWATER COLLECTION AND TREATMENT ALTERNATIVES

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
CONVENTIONAL GRAVITY SEWER COLLECTION SYSTEM
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY		ESTIMATED UNIT COST	ESTIMATED TOTAL COST
1.	8" SEWER, 0 - 6' DEPTH	1,270	L.F.	$19.00	$24,130.00
2.	8" SEWER, 6' - 8' DEPTH	11,970	L.F.	$22.00	$263,340.00
3.	8" SEWER, 8 '- 10' DEPTH	8,700	L.F.	$24.00	$208,800.00
4.	8" SEWER, 10' - 12' DEPTH	3,420	L.F.	$27.00	$92,340.00
5.	8" SEWER, 12' - 14' DEPTH	1,780	L.F.	$32.00	$56,960.00
6.	8" SEWER, 14' - 16' DEPTH	940	L.F.	$36.00	$33,840.00
7.	4" PVC, FORCE MAIN	8,500	L.F.	$11.00	$93,500.00
8.	6" SERVICE SEWER ALL DEPTHS	6,300	L.F.	$25.00	$157,500.00
9.	8" HIGHWAY BORING	240	L.F.	$190.00	$45,600.00
10.	6" HIGHWAY BORING	920	L.F.	$150.00	$138,000.00
11.	MANHOLE 0 - 6' DEPTH	105	EA.	$1,500.00	$157,500.00
12.	ADDITIONAL DEPTH OF MANHOLE	351	L.F.	$120.00	$42,120.00
13.	8" X 6" WYE	298	EA.	$65.00	$19,370.00
14.	4" CLEANOUT	9	EA.	$1,500.00	$13,500.00
15.	4" SHUT OFF ASSEMBLY	4	EA.	$1,000.00	$4,000.00
16.	BITUMINOUS RESURFACING	23,000	S.Y.	$19.50	$448,500.00
17.	GRADE "B" BORROW BACKFILL	56,000	TON	$6.00	$336,000.00
18.	LIFT STATIONS	4	L.S.	$80,000.00	$320,000.00
19.	PORTABLE GENERATOR	1	L.S.	$30,000.00	$30,000.00
				SUB-TOTAL	**$2,485,000.00**
				CONSTRUCTION CONTINGENCIES	$248,000.00
				TOTAL PROBABLE CONSTRUCTION COSTS	**$2,733,000.00**

CONVENTIONAL GRAVITY SEWER COLLECTION SYSTEM ANNUAL O & M COSTS

1.	LINE MAINTENANCE (44,040 @ $0.10/LF)	$4,404.00
2.	LIFT STATION ELECTRICAL (4 Sta. @ $100.00/Sta./Mo.)	$4,800.00
3.	INSURANCE	$2,000.00
4.	LIFT STATION MAINTENANCE (4 Sta. (2 pumps/Sta.) x $5,000/pump every 10 years) [1]	$4,000.00
5.	OPERATING LABOR AND BILLING	$10,000.00
6.	MISCELLANEOUS AND CONTINGENCIES	$1,796.00
	TOTAL ANNUAL OPERATION AND MAINTENANCE COSTS	**$27,000.00**

(1) Note: This item is short lived asset reserves required for Rural Development Funding

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
LOW PRESSURE GRINDER PUMP COLLECTION SYSTEM
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY		ESTIMATED UNIT COST	ESTIMATED TOTAL COST
1.	6" PVC, SDR-21 PIPE	2,200	L.F.	$15.00	$33,000.00
2.	4" PVC, SDR-21 PIPE	3,950	L.F.	$11.00	$43,450.00
3.	3" PVC, SDR-21 PIPE	7,860	L.F.	$10.50	$82,530.00
4.	2" PVC, SDR-21 PIPE	15,620	L.F.	$10.00	$156,200.00
5.	1-1/2" HDPE, SDR-9 SERVICE LINE (OPEN)	16,040	L.F.	$9.00	$144,360.00
6.	1-1/2" HDPE, SDR-9 SERVICE LINE (BORE)	1,840	L.F.	$20.00	$36,800.00
7.	CASED HIGHWAY BORING	240	L.F.	$190.00	$45,600.00
8.	6" CLEANOUT	8	EA.	$1,600.00	$12,800.00
9.	4" CLEANOUT	13	EA.	$1,500.00	$19,500.00
10.	3" CLEANOUT	26	EA.	$1,400.00	$36,400.00
11.	2" CLEANOUT	52	EA.	$1,300.00	$67,600.00
12.	6" PLUG VALVE	5	EA.	$750.00	$3,750.00
13.	4" PLUG VALVE	8	EA.	$700.00	$5,600.00
14.	3" PLUG VALVE	16	EA.	$650.00	$10,400.00
15.	2" PLUG VALVE	31	EA.	$550.00	$17,050.00
16.	1 - 1 1/2" SHUT-OFF ASSEMBLIES	298	EA.	$500.00	$149,000.00
17.	AIR RELEASE VALVE	20	EA.	$1,800.00	$36,000.00
18.	BITUMINOUS RESURFACING	15,000	S.Y.	$20.00	$300,000.00
19.	GRADE "B" BORROW BACKFILL	17,000	TON	$6.00	$102,000.00
20.	RESIDENTIAL SIMPLEX GRINDER PUMPS	296	EA.	$4,000.00	$1,184,000.00
21.	COMMERCIAL DUPLEX GRINDER PUMPS	2	EA.	$7,500.00	$15,000.00
22.	ELECTRICAL SERVICE LINE	8,940	L.F.	$7.50	$67,050.00
				SUB-TOTAL	**$2,568,090.00**
				CONSTRUCTION CONTINGENCIES	$256,910.00
				TOTAL PROBABLE CONSTRUCTION COSTS	**$2,825,000.00**

LOW PRESSURE GRINDER PUMP SEWER COLLECTION SYSTEM ANNUAL O & M COSTS

1.	LINE MAINTENANCE (46,200/LF @ $0.10/LF)	$4,620.00
2.	INSURANCE	$2,000.00
3.	GRINDER PUMP ELECTRICAL (298 STA @ $1.50/STA/MONTH)	$5,364.00
4.	OPERATING LABOR AND BILLING	$8,000.00
5.	GRINDER MAINTENANCE AND REPLACEMENT (298/STA. @ $150/STA.) [1]	$44,700.00
6.	MISCELLANEOUS AND CONTINGENCIES	$6,316.00
	TOTAL ANNUAL OPERATION AND MAINTENANCE COSTS	**$71,000.00**

(1) Note: This item is short lived asset reserves required for Rural Development Funding

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
CONVENTIONAL WASTEWATER TREATMENT PLANT
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY		ESTIMATED UNIT COST	ESTIMATED TOTAL COST
1.	MOBILIZATION	1	L.S.	$30,000.00	$30,000.00
2.	ACCESS ROAD AND SITE WORK	1	L.S.	$25,000.00	$25,000.00
3.	LABORATORY AND CONTROL BUILDING	1	L.S.	$150,000.00	$150,000.00
4.	SBR AND DIGESTER CONCRETE TANKS	1	L.S.	$180,000.00	$180,000.00
4.	SBR AND DIGESTER EQUIPMENT AND INSTALLATION	1	L.S.	$432,000.00	$432,000.00
5.	UV DISINFECTION	1	L.S.	$60,000.00	$60,000.00
6.	SLUDGE DRYING SYSTEM	1	L.S.	$50,000.00	$50,000.00
7.	SITE PIPING	1	L.S.	$95,000.00	$95,000.00
8.	SCREENING STRUCTURE & EQUIPMENT	1	L.S.	$60,000.00	$60,000.00
8.	PLANT LIFT STATION	1	L.S.	$90,000.00	$90,000.00
9.	ELECTRICAL	1	L.S.	$75,000.00	$75,000.00
10.	STAND BY GENERATOR	1	L.S.	$40,000.00	$40,000.00
				SUB-TOTAL	**$1,287,000.00**
				CONSTRUCTION CONTINGENCIES	$128,000.00
				TOTAL PROBABLE CONSTRUCTION COSTS	**$1,415,000.00**

CONVENTIONAL WASTEWATER TREATMENT PLANT (SBR) ANNUAL O & M COSTS

1.	ELECTRICAL ($1,000.00/MONTH X 12 MONTHS)	$12,000.00
2.	INSURANCE	$2,000.00
3.	EQUIPMENT MAINTENANCE COSTS [1]	
	SBR	$1,500.00
	DIGESTER	$1,000.00
	PLANT LIFT STATION (2 pumps x $5,000/pump every 10 years)	$1,000.00
	SCREENING STRUCTURE	$500.00
	UV DISINFECTION	$1,250.00
	SLUDGE DRYING	$500.00
	(1) Note: These items are short lived asset reserves required for Rural Development Funding	
4.	SLUDGE DISPOSAL	$2,000.00
5.	OPERATING LABOR AND TESTING	$30,000.00
6.	MISCELLANEOUS AND CONTINGENCIES	$5,250.00
	TOTAL ANNUAL OPERATION AND MAINTENANCE COSTS	**$57,000.00**

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
SUBSURFACE FLOW WETLAND AND ONSITE DISPOSAL SYSTEM
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION		ESTIMATED COST
1	MOBILIZATION	$	30,000
2	ACCESS ROAD AND SITE WORK	$	25,000
3	SETTLING TANKS	$	146,964
4	SSF WETLAND	$	352,671
5	NITRIFICATION FILTER BED	$	73,694
6	SCREENING STRUCTURE AND EQUIPMENT	$	60,000
7	PLANT LIFT STATION	$	90,000
8	DRIP IRRIGATION SYSTEM	$	905,200
9	ELECTRICAL	$	15,000
10	STAND BY GENERATOR	$	40,000
	SUBTOTAL	**$**	**1,738,529**
	CONSTRUCTION CONTINGENCIES	$	173,471
	TOTAL PROBABLE CONSTRUCTION COSTS	**$**	**1,912,000**

SUBSURFACE FLOW WETLAND AND ONSITE DISPOSAL SYSTEM ANNUAL O & M COSTS

ITEM NO.	DESCRIPTION		ESTIMATED COST
1	ELECTRICAL ($500/MONTH X 12 MONTHS)	$	6,000
2	INSURANCE	$	2,000
3	EQUIPMENT MAINTENANCE		
	PLANT LIFT STATION	$	1,000
	RECIRULATING PUMP STATIONS	$	2,000
	DISPOSAL FIELD DOSING PUMPS	$	1,000
	SLUDGE DISPOSAL (40,000 GAL X $0.12 EVERY 5 YEARS)	$	960
4	OPERATING LABOR AND TESTING	$	12,000
5	CONTINGENCIES	$	2,540
	TOTAL ANNUAL O&M	**$**	**27,500**

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
LEMTEC TREATMENT SYSTEM
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION		ESTIMATED COST
1	MOBILIZATION	$	30,000
2	ACCESS ROAD AND SITE WORK	$	25,000
3	LABORATORY AND CONTROL BUILDING	$	150,000
4	PRIMARY AND SETTLING TANKS	$	180,000
5	LAGOON EXCAVATION AND LINER	$	161,000
6	LEMTEC EQUIPMENT AND INSTALLATION	$	448,000
7	SINGLE PASS AND FILTER	$	152,610
8	UV DISINFECTION	$	60,000
9	SITE PIPING	$	95,000
10	SCREENING STRUCUTRE AND EQUIPMENT	$	60,000
11	PLANT LIFT STATION	$	90,000
12	ELECTRICAL	$	75,000
13	STAND BY GENERATOR	$	40,000
	SUBTOTAL	**$**	**1,566,610**
	CONSTRUCTION CONTINGENCIES	$	156,390
	TOTAL PROBABLE CONSTRUCTION COSTS	**$**	**1,723,000**

LEMTEC SYSTEM ANNUAL O & M COSTS

ITEM NO.	DESCRIPTION		ESTIMATED COST
1	ELECTRICAL ($1,000/MONTH X 12 MONTHS)	$	12,000
2	INSURANCE	$	2,000
3	EQUIPMENT MAINTENANCE		
	AERATION LAGOON	$	1,500
	PLANT LIFT STATION	$	1,000
	SCREENING STRUCTURE	$	500
	UV DISINFECTION	$	1,250
	SLUDGE DISPOSAL (100,000 GAL X $0.12 EVERY 5 YEARS)	$	2,400
4	OPERATING LABOR AND TESTING	$	30,000
5	CONTINGENCIES	$	5,350
	TOTAL ANNUAL O&M	**$**	**56,000**

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
BIOLOGICAL MEDIA FILTER PLANT (CONCRETE TANKS AND FILTERS)
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION		ESTIMATED COST
1	MOBILIZATION	$	30,000
2	ACCESS ROAD AND SITE WORK	$	25,000
3	LABORATORY AND CONTROL BUILDING	$	150,000
4	CONCRETE TANKS	$	583,000
5	FILTER MEDIA INSTALLATION	$	194,000
6	RECIRCULATION PUMPING SYSTEMS AND CONTROLS	$	140,000
7	UV DISINFECTION	$	60,000
8	SITE PIPING	$	95,000
9	SCREENING STRUCUTRE AND EQUIPMENT	$	60,000
10	PLANT LIFT STATION	$	90,000
11	ELECTRICAL	$	75,000
12	STAND BY GENERATOR	$	40,000
	SUBTOTAL	**$**	**1,542,000**
	CONSTRUCTION CONTINGENCIES	$	154,000
	TOTAL PROBABLE CONSTRUCTION COSTS	**$**	**1,696,000**

BIOLOGICAL FIXED MEDIA FILTER SYSTEM ANNUAL O & M COSTS

ITEM NO.	DESCRIPTION		ESTIMATED COST
1	ELECTRICAL ($500/MONTH X 12 MONTHS)	$	6,000
2	INSURANCE	$	2,000
3	EQUIPMENT MAINTENANCE		
	RECIRCULATING PUMPS	$	1,000
	PLANT LIFT STATION	$	1,000
	SCREENING STRUCTURE	$	500
	UV DISINFECTION	$	1,250
	SLUDGE DISPOSAL (40,000 GAL X $0.12 EVERY 5 YEARS)	$	960
4	OPERATING LABOR AND TESTING	$	30,000
5	CONTINGENCIES	$	4,290
	TOTAL ANNUAL O&M	**$**	**47,000**

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
BIOLOGICAL MEDIA FILTER PLANT (CONCRETE PRIMARY TANKS AND EPDM LINED FILTERS)
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION		ESTIMATED COST
1	MOBILIZATION	$	30,000
2	ACCESS ROAD AND SITE WORK	$	25,000
3	LABORATORY AND CONTROL BUILDING	$	150,000
4	CONCRETE TANKS	$	151,000
5	EPDM LINERS	$	119,000
6	FILTER MEDIA INSTALLATION	$	186,000
7	RECIRCULATION PUMPING SYSTEMS AND CONTROLS	$	140,000
8	UV DISINFECTION	$	60,000
9	SITE PIPING	$	95,000
10	SCREENING STRUCTURE AND EQUIPMENT	$	60,000
11	PLANT LIFT STATION	$	90,000
12	ELECTRICAL	$	75,000
13	STAND BY GENERATOR	$	40,000
	SUBTOTAL	**$**	**1,221,000**
	CONSTRUCTION CONTINGENCIES	$	122,000
	TOTAL PROBABLE CONSTRUCTION COSTS	**$**	**1,343,000**

BIOLOGICAL FIXED MEDIA FILTER SYSTEM ANNUAL O & M COSTS

ITEM NO.	DESCRIPTION		ESTIMATED COST
1	ELECTRICAL ($500/MONTH X 12 MONTHS)	$	6,000
2	INSURANCE	$	2,000
3	EQUIPMENT MAINTENANCE		
	RECIRCULATING PUMPS	$	1,000
	PLANT LIFT STATION	$	1,000
	SCREENING STRUCTURE	$	500
	UV DISINFECTION	$	1,250
	SLUDGE DISPOSAL (40,000 GAL X $0.12 EVERY 5 YEARS)	$	960
4	OPERATING LABOR AND TESTING	$	30,000
5	CONTINGENCIES	$	4,290
	TOTAL ANNUAL O&M	**$**	**47,000**

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
SEPTIC TANKS PRIMARY TREATMENT SYSTEM
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY		ESTIMATED UNIT COST	ESTIMATED TOTAL COST
1.	ACCESS MANHOLES	8	EA.	$500.00	$4,000.00
2.	EXCAVATION	756	C.Y.	$8.00	$6,044.44
3.	4 X 35000 GAL DUAL CHAMBER CONCRETE SEPTIC TANKS	1	LS	$136,920.00	$136,920.00
				SUB-TOTAL	**$146,964.44**
				CONSTRUCTION CONTINGENCIES	$15,035.56
				TOTAL PROBABLE CONSTRUCTION COSTS	**$162,000.00**

SEPTIC TANK ANNUAL OPERATION & MAINTENANCE COSTS

1.	SLUDGE REMOVAL (per 5 years)	40,000	GAL	$0.12	$960.00
				TOTAL ANNUAL OPERATION AND MAINTENANCE COSTS	**$960.00**

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
15 DAY FACULTATIVE POND PRIMARY TREATMENT SYSTEM
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY		ESTIMATED UNIT COST	ESTIMATED TOTAL COST
1.	EXCAVATION FOR POND	2,971	C.Y.	$8.00	$23,767.08
2.	EMBANKMENT FOR POND	2,971	C.Y.	$8.00	$23,767.08
3.	EPDM LINER	28,000	S.F.	$3.00	$84,000.00
4.	4" SAND UNDERLAYMENT	385	Ton	$25.00	$9,625.00
5.	UNDERLAYMENT VENTING	1,197	LF	$10.00	$11,970.26
				SUB-TOTAL	**$153,129.43**
				CONSTRUCTION CONTINGENCIES	$14,870.57
				TOTAL PROBABLE CONSTRUCTION COSTS	**$168,000.00**

FACULTATIVE POND ANNUAL OPERATION & MAINTENANCE COSTS

1.	VENT AND DISTRIBUTION LINE MAINTENANCE	$500.00
	TOTAL ANNUAL OPERATION AND MAINTENANCE COSTS	**$500.00**

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
COVERED ANAEROBIC LAGOON PRIMARY TREATMENT SYSTEM
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY		ESTIMATED UNIT COST	ESTIMATED TOTAL COST
1.	EXCAVATION FOR LAGOON	2,026	C.Y.	$8.00	$16,206.13
2.	EMBANKMENT FOR LAGOON	2,026	C.Y.	$8.00	$16,206.13
3.	EPDM LINER	33,000	S.F.	$3.00	$99,000.00
4.	6" SAND UNDERLAYMENT	605	Ton	$25.00	$15,125.00
5.	UNDERLAYMENT VENTING	1,510	LF	$10.00	$15,100.98
6.	BIRD BALLS	0.69	AC.	$108,000.00	$74,880.91
				SUB-TOTAL	**$236,519.17**
				CONSTRUCTION CONTINGENCIES	$23,480.83
				TOTAL PROBABLE CONSTRUCTION COSTS	**$260,000.00**

COVERED ANAEROBIC LAGOON ANNUAL OPERATION & MAINTENANCE COSTS

1.	VENT AND DISTRIBUTION LINE MAINTENANCE				$500.00
2.	SLUDGE REMOVAL (ONCE PER 5 YEARS)	40,000	GAL	$0.12	$960.00
				TOTAL ANNUAL OPERATION AND MAINTENANCE COSTS	**$1,460.00**

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
SUBSURFACE FLOW WETLAND AND NITRIFICATION FILTER BED SYSTEM
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY		ESTIMATED UNIT COST	ESTIMATED TOTAL COST
	SSF WETLAND TREATMENT				
1.	EXCAVATION	4,582	CY.	$8	$36,653
2.	GRAVEL AND SAND	4,061	TONS	$25	$101,526
3.	EPDM LINER	47,000	S.F.	$3	$141,000
4.	INLET SUMPS	2	EA.	$1,320	$2,640
5.	LINER PERFORATION WELD KITS	6	EA.	$264	$1,584
6.	PLANTS	9,996	EA.	$3	$29,988
7.	WATER LEVEL CONTROL STRUCTURES	2	EA.	$1,320	$2,640
8.	4" PERFORATED PIPING	720	L.F.	$25	$18,000
9.	4" DISTRIBUTION PIPING	720	L.F.	$25	$18,000
10.	FITTINGS	40	EA.	$16	$640
				SUB-TOTAL	**$352,671**
	NITRIFICATION FILTER BED (NFB)				
1.	GRAVEL	527	TONS	$25	$ 13,184
2.	PUMPING SYSTEM	1	L.S.	$40,000	$ 40,000
3.	2" PERFORATED PIPING	658	L.F.	$15	$ 9,870
4.	4" DISTRIBUTION PIPING	400	L.F.	$25	$ 10,000
5.	FITTINGS	40	EA.	$16	$ 640
				SUB-TOTAL	**$ 73,694**
				CONSTRUCTION CONTINGENCIES	$108,635
				TOTAL PROBABLE CONSTRUCTION COSTS	**$535,000**

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
SAND MOUND DISPOSAL SYSTEM
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY		ESTIMATED UNIT COST	ESTIMATED TOTAL COST
1.	PUMPING SYSTEMS	1	EA.	$100,000.00	$100,000
2.	PERIMETER DRAIN TILE	9216	L.F.	$2.00	$18,432
3.	PERIM. GRANULAR BACKFILL	461	TONS	$25.00	$11,520
4.	PERIM. DRAIN NO. 8 STONE	986	TONS	$25.00	$24,653
5.	AGGREGATE BED NO. 8 STONE	2252.8	TONS	$25.00	$56,320
6.	PERIM. GEOTEXTILE	9216	S.F.	$0.25	$2,304
7.	SAND INDOT NO. 23	18424	TONS	$15.00	$276,358
8.	SOIL COVER (ONSITE BORROW)	9109	CY.	$8.00	$72,875
9.	SEEDING AND EROSION CONTROL	321152	S.F.	$0.03	$9,635
10.	MONITORING WELLS	96	EA.	$30.00	$2,880
11.	4" FORCEMAIN	4418	L.F.	$20.00	$88,350
12.	3" FORCEMAIN	7155	L.F.	$15.00	$107,327
13.	2" FORCEMAIN	9893	L.F.	$12.00	$118,713
14.	1.5" FORCEMAIN	1452	L.F.	$10.00	$14,518
15.	1.5" PERFORATED LATERALS	25302	L.F.	$10.00	$253,022
16.	4" DISTRIBUTION LINE	3293	L.F.	$11.00	$36,228
17.	FENCING	25302	L.F.	$3.00	$75,907
18.	FITTINGS	1037	EA.	$3.00	$3,111
	SAND MOUND			SUB-TOTAL	$1,272,150
				CONSTRUCTION CONTINGENCIES	$126,850
				TOTAL PROBABLE CONSTRUCTION COSTS	$1,399,000

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
DRIP IRRIGATION DISPOSAL FIELD SYSTEM
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY		ESTIMATED UNIT COST	ESTIMATED TOTAL COST
1.	PREMANUFACTURED SYSTEM	200,000	L.F.	$3.00	$600,000.00
2.	RETURN FLUSH LINE TO TREATMENT	800	L.F.	$6.50	$5,200.00
3.	DOSING TANK	2	EA.	$150,000.00	$300,000.00
				SUB-TOTAL	$905,200.00
				CONSTRUCTION CONTINGENCIES	$25,800.00
				TOTAL PROBABLE CONSTRUCTION COSTS	$931,000.00

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
LEMTEC SYSTEM
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

CONCRETE TANKS AND EPDM LINED LAGOON CONSTRUCTION

Item	Description	Unit	Quantity	Cost	Total
1.	Septic Tanks	LS	1	$146,964.44	$ 146,964
2.	EPDM Liner	SF	32000	$ 3.00	$ 96,000
3.	Sand Underlayment	TONS	640	$ 25.00	$ 16,000
4.	Cast-In-Place Concrete Footings	LF	80	$ 15.00	$ 1,200
5.	Cast-In-Place Concrete 12' Walls	SF	960	$ 25.00	$ 24,000
6.	Cast-In-Place Concrete Slab	SF	256	$ 15.00	$ 3,840
7.	Cast-In-Place Concrete Footings SAND FILTER	LF	318	$ 15.00	$ 4,770
8.	Cast-In-Place Concrete 8' Walls SANDFILTER	SF	2544	$ 25.00	$ 63,600
9.	Cast-In-Place Concrete Slab SAND FILTER	SF	3120	$ 15.00	$ 46,800
10.	Washed Coarse Sand	TONS	1498	$ 25.00	$ 37,440
11.	Excavation	CY	8170	$ 8.00	$ 65,359
12.	4' x 4' Concrete Box (valve box outside of system)	EA	2	$ 1,953.00	$ 3,906
				SUB-TOTAL	**$ 509,880**

LEMTEC SYSTEM

Item	Description	Unit	Quantity	Cost	Total
1.	LEMNA EQUIPMENT PER QUOTE	LS	1	$ 298,700.00	$ 298,700
3.	INSTALLATION	LS	1	$ 149,350.00	$ 149,350
				SUB-TOTAL	**$ 448,050**

SUB-TOTAL	**$ 957,930**
CONSTRUCTION CONTINGENCIES	$ 96,070
TOTAL PROBABLE CONSTRUCTION COSTS	**$ 1,054,000**

PROBABLE CONSTRUCTION COSTS - ALTERNATIVES CONSIDERED
FOR A
BIOLOGICAL MEDIA FILTER PLANT WITH CONCRETE CELLS
FOR THE
KNOX COUNTY COMMISSIONERS ON BEHALF OF THE
UNINCORPORATED COMMUNITY OF FREELANDVILLE
KNOX COUNTY, INDIANA
MARCH, 2010

CONCRETE

Item	Description	Unit	Quantity	Cost	Total
1.	Cast-In-Place Concrete Footings	LF	1110	$ 15.00	$ 16,650
2.	Cast-In-Place Concrete Walls	SF	9200	$ 20.00	$ 184,000
3.	Cast-In-Place Concrete Slab	SF	20400	$ 15.00	$ 306,000
4.	Cast-In-Place Concrete Septic Tank Top	SF	2400	$ 30.00	$ 72,000
5.	4' x 4' Concrete Box (valve box outside of system)	EA	2	$ 1,953.00	$ 3,906
					$ 582,556

FILTER MEDIA

Item	Description	Unit	Quantity	Cost	Total
1.	Washed Crushed Aggregate	Ton	4860	$ 25.00	$ 121,500
2.	Tire Chips	Ton	0	$ 70.00	$ -
3.	Clean Coarse Sand	Ton	702	$ 25.00	$ 17,550
4.	1/8" Crushed Glass Cullet	Ton	0	$ 20.00	$ -
5.	Tire Chips	Tons	100	$ 70.00	$ 6,993
6.	Excavation	CY	6044	$ 8.00	$ 48,356
					$ 194,399

PIPING AND CHAMBERS

Item	Description	Unit	Quantity	Cost	Total
1.	6" Schedule 40 PVC Pipe	LF	240	$ 35.00	$ 8,400
2.	4" Schedule 40 PVC Pipe	LF	360	$ 25.00	$ 9,000
3.	3" Schedule 40 PVC Pipe	LF	480	$ 15.00	$ 7,200
4.	2" Schedule 40 PVC Pipe	LF	0	$ 10.00	$ -
5.	2" Pre-Drilled Perforated Schedule 40 PVC Pipe	LF	1200	$ 15.00	$ 18,000
6.	1.5" Schedule 40 PVC Pipe	LF	0	$ 8.00	$ -
7.	1.5" Pre-Drilled Perforated Schedule 40 PVC Pipe	LF	1800	$ 12.00	$ 21,600
8.	Chambers (Infiltrator Quick 4 Standard, 12" height)	LF	1200	$ 12.00	$ 14,400
9.	PVC Pipe fittings	EA	750	$ 16.00	$ 12,000
10.	7" (3" pipe) EZ Flow	LF	720	$ 6.00	$ 4,320
					$ 94,920

RECIRCULATION PUMP STATIONS

Item	Description	Unit	Quantity	Cost	Total
1.	Pumps, Assemblies, Controls	EA	4	$ 35,000.00	$ 140,000
					$ 140,000

SUB-TOTAL	$ 1,011,875
CONSTRUCTION CONTINGENCIES	$ 101,125
TOTAL PROBABLE CONSTRUCTION COSTS	**$ 1,113,000**