Village of Frankfort, Illinois

Facilities Planning Report

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LIST OF ABBREVIATIONS

avg	-	average
BOD_5	-	five day biochemical oxygen demand
BPR	-	biological phosphorus removal
BNR	-	biological nutrient removal
$CBOD_5$	-	five day carbonaceous biochemical oxygen demand
CCA	-	Compliance Commitment Agreement
cfm	-	cubic feet per minute
CFR	-	Code of Federal Regulations
cfs	-	cubic feet per second
D.O.	-	dissolved oxygen
EAG	-	environmental advocacy group
FOG	-	fats, oils and greases
FPA	-	facilities planning area
ft	-	feet
ft^2	-	square feet
ft^3	-	cubic feet
GBT	-	gravity belt thickener
gcd	-	gallons per capita per day
gpd	-	gallons per day
gpm	-	gallons per minute
hp	-	horsepower
IEPA	-	Illinois Environmental Protection Agency
in.	-	inches
I/I	-	infiltration/inflow
IPCB	-	Illinois Pollution Control Board
IRSSW	-	Illinois Recommended Standards for Sewage Works
lbs.	-	pounds
max	-	maximum
MCC	-	motor control center
MG	-	million gallons
MGD	-	million gallons per day
mg/L	-	milligrams per liter (parts per million in dilute solutions)
MHI	-	median household income
min	-	minute
MLSS	-	mixed liquor suspended solids
MLVSS	-	mixed liquor volatile suspended solids
mo.	-	month(s)
MWRD-GC	-	Metropolitan Water Reclamation District of Greater Chicago
NH_3-N	-	ammonia nitrogen

NO_2-N	-	nitrite nitrogen
NO_3-N	-	nitrate nitrogen
NOV	-	Notice of Violation
NPDES	-	National Pollutant Discharge Elimination System
OTE	-	oxygen transfer efficiency
P	-	phosphorus
pcd	-	pounds per capita per day
PE	-	population equivalent
P.S.	-	pumping station
ppd	-	pounds per day (or lb/day)
psi	-	pounds per square inch
POTW	-	publicly owned treatment works
PW	-	present worth
RAS	-	return activated sludge
SCADA	-	supervisory control and data acquisition
scfm	-	standard cubic feet per minute
SOTE	-	standard oxygen transfer efficiency
SRT	-	solids retention time
SWD	-	side water depth
TDH	-	total dynamic head
TKN	-	total Kjeldahl nitrogen
TMDL	-	total maximum daily load
TN	-	total nitrogen
TP	-	total phosphorous
TSS	-	total suspended solids (or SS)
TWAS	-	thickened waste activated sludge
USEPA	-	U.S. Environmental Protection Agency
µg	-	micrograms
µg/L	-	micrograms per liter (parts per billion in dilute solutions)
VFD	-	variable frequency drive
VS	-	volatile solids
VSR	-	volatile solids reduction
VSS	-	volatile suspended solids
WAS	-	waste activated sludge
WER	-	Water Effects Ratio
WWTP	-	wastewater treatment plant

LIST OF DEFINITIONS

Aerobic digestion

Microbial decomposition of wastewater sludge in the presence of oxygen.

Anaerobic digestion

Microbial decomposition of wastewater sludge in the absence of oxygen.

Anoxic

A condition in which dissolved oxygen is not available and other forms of oxygen, such as NO_3-Oxygen or SO_4-Oxygen, are used by microorganisms.

Biochemical oxygen demand

Measurement of the oxygen utilized by microorganisms in the stabilization of the organic matter present in wastewater.

Denitrification

Anoxic conversion of nitrate to nitrate gas, which is removed from the wastewater.

Infiltration

Water other than wastewater that enters a sewage collection system (including sewer service connections) from the ground through such sources as defective pipes, pipe joints, connections, or manholes. Infiltration does not include, and is distinguished from, inflow.

Inflow

Water other than wastewater that enters a sewage collection system (including sewer service connections) from sources such as roof leaders, cellar drains, yard drains, area drains, foundation drains, drains from springs and swampy areas, manhole covers, cross connections between storm sewers and sanitary sewers, catch basins, cooling towers, storm water, surface runoff, street wash waters, or drainage. Inflow does not include, and is distinguished from, infiltration.

Nitrification

Aerobic conversion of ammonia to nitrate by microorganisms.

Sludge

Concentrated organic solids produced during wastewater treatment (also termed “biosolids”).

Suspended solids

Particulate matter suspended in wastewater.

Volatile suspended solids

That portion of the suspended solids that is destroyed at temperatures above 550°C and is an indicator of the organic fraction of the suspended solids.

EXECUTIVE SUMMARY

The Village of Frankfort owns, operates, and maintains three wastewater treatment plants (WWTPs). The WWTPs discharge treated effluent to Hickory Creek and its tributaries under three separate NPDES discharge permits issued by the Illinois Environmental Protection Agency (IEPA). The purpose of this report is to serve as a planning tool for the improvements required over the next twenty years for the Village's WWTPs. This includes evaluating the condition of the existing WWTPs and identifying the improvements needed to rehabilitate them; identifying the improvements needed to comply with potential future effluent regulations; and determining the wastewater treatment plant improvements needed to serve the Village for the next 20 years.

The capacity of the Regional WWTP is 3.0 million gallons per day (MGD), the West WWTP is 1.3 MGD, and the North WWTP is 1.35 MGD. The total system capacity of 5.65 MGD is adequate for the 20-year population projection based on the projected population growth and land use. The Regional WWTP, the newest of the plants, was constructed in the 1990s. It is generally in good condition and consistently meets its NPDES permit limits. However, both the West and North WWTPs are in failing condition and are struggling to meet current ammonia permit limits. The WWTPs require several modifications to come into compliance with current limits. Even still, the regulations continue to change. Maintaining regulatory compliance at these two facilities will be more difficult in the future, as current limits are reduced in the next permit cycle for each of the WWTPs and new contaminant limits are introduced. Upgrades to the West and North WWTPs are needed in response to regulatory changes.

According to IEPA, the Hickory Creek Watershed is impaired for ammonia, phosphorus, and chloride, among other contaminants. The Village is currently in discussions with IEPA regarding an appropriate compliance plan for its chloride limits. In addition to chloride limits, it is anticipated that all three WWTPs will have limits for phosphorus introduced in the next permit cycle as well as reductions to the current ammonia limits. The key dates for the NDPES permit renewals are summarized as follows:

WWTP	NPDES Permit Expiration	Compliance Date	
		Chloride	Ammonia/ Phosphorus
North[1]	November 30, 2012	January 2018	January 2018
Regional[2]	November 30, 2014	November 2018	November 2018
West[3]	May 2019	May 2017	May 2017

[1] North WWTP NPDES permit is pending renewal by IEPA. The permit is expected by January 2015.

[2] Regional WWTP NPDES schedule is based on IEPA issuance of the renewal in November 2015, one year after the current permit expires. This is unlikely to occur. Regional WWTP already has a Phosphorus limit.

[3] West WWTP NPDES permit is being revised and is expected to be reissued as a new permit in summer 2014.

In light of the condition of the existing facilities and pending regulatory changes, the Village will need to determine the best alternative to continue to provide wastewater treatment to its residents. This report evaluated several future alternatives in addition to improving its existing treatment plants, including land application of wastewater, transferring flows to alternative service providers, acquisition of additional land for expansion of the existing treatment sites, and non-compliance. Municipalities may also file for a variance to adjust permitted effluent limits. In Illinois, the only accepted variance is on the grounds of economic hardship. The Village does not qualify for regulatory relief in the form of a variance because the median household income of the Village exceeds the threshold allowable for a variance.

Because the existing WWTPs have sufficient capacity for the growth potential anticipated over the next 20-years, the Village will maximize the value of its existing assets by building out the existing treatment facilities. Finding alternative treatment options will not eliminate the need and cost to address deficiencies at the existing plants. Therefore, construction of new facilities that provide additional treatment capacity is not considered a necessity or a cost-effective solution within the planning period of this report. In the future when growth demands additional treatment capacity, the Village may choose to construct a new WWTP or work with other communities nearby to establish an agreement for an alternative treatment provider. The following were selected as the most feasible and cost-effective alternatives:

1. **Maintain all WWTPs:** Construct improvements at each facility to replace failing equipment and improve process performance. The North and West WWTPs require significant improvements immediately or in the five-year range to replace deteriorating facilities. Additional construction will be required to improve the North and West WWTPs in the future to meet lower ammonia limits and phosphorus limits. Improvements at the Regional WWTP will be required to replace equipment as it reaches its useful life in the future. The majority of the improvements at the Regional WWTP are expected in the 5 to 15 year range or beyond. It is worth noting that a substantial portion of the West WWTP site falls within the floodway; therefore, construction of improvements may be restricted by permitting challenges.

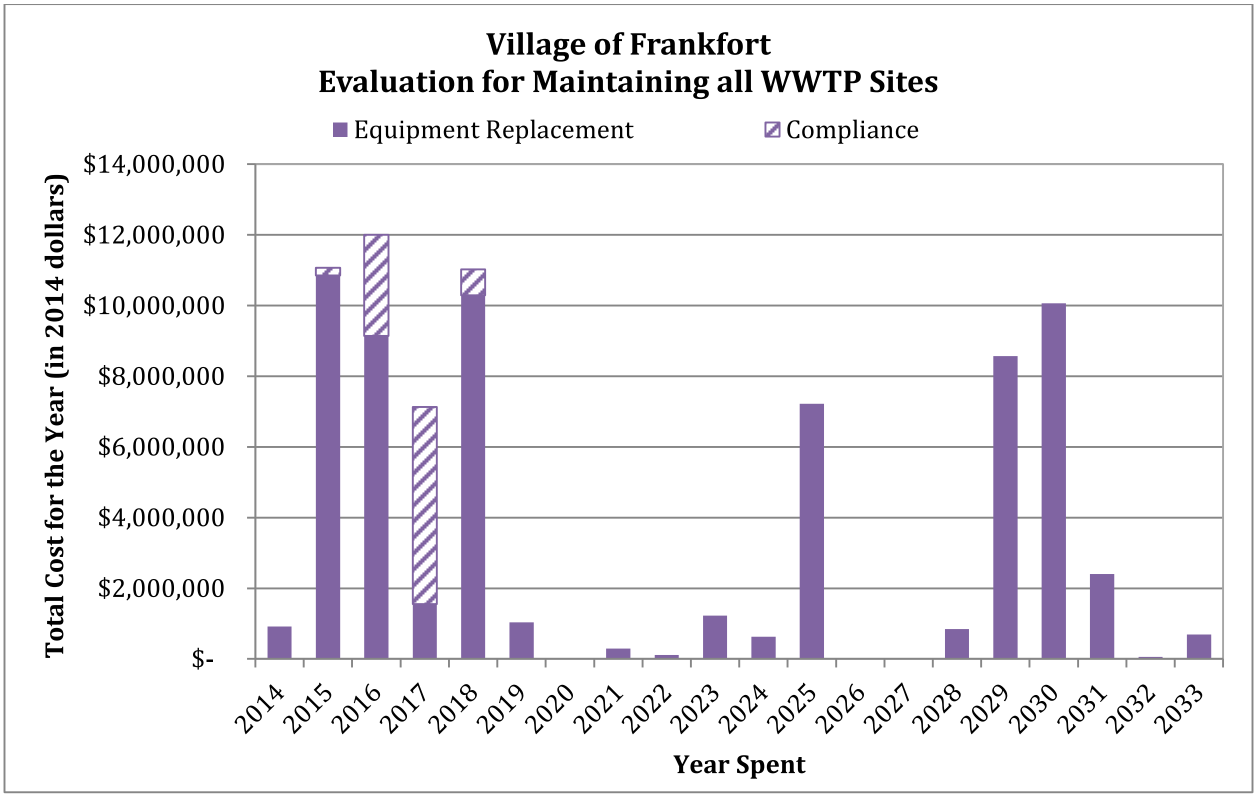
2. **Consolidate the West and Regional WWTPs at the Regional Site; Maintain the North WWTP:** The West WWTP has the ability to transfer flows to the Regional WWTP. The Regional WWTP already removes phosphorus and has capacity to meet lower ammonia limits. It is also underutilized and operating at only approximately half its permitted capacity. The Regional WWTP is operating far enough below its permitted design flow to accommodate flow from the West WWTP without triggering immediate expansion. By transferring the West WWTP flows to the Regional WWTP and abandoning the West WWTP, the Village can defer the major costs of construction at the West WWTP and instead utilize existing capacity at the Regional WWTP. Expansion at the Regional WWTP would not be needed for many years (projected for 2033). The immediate construction priorities

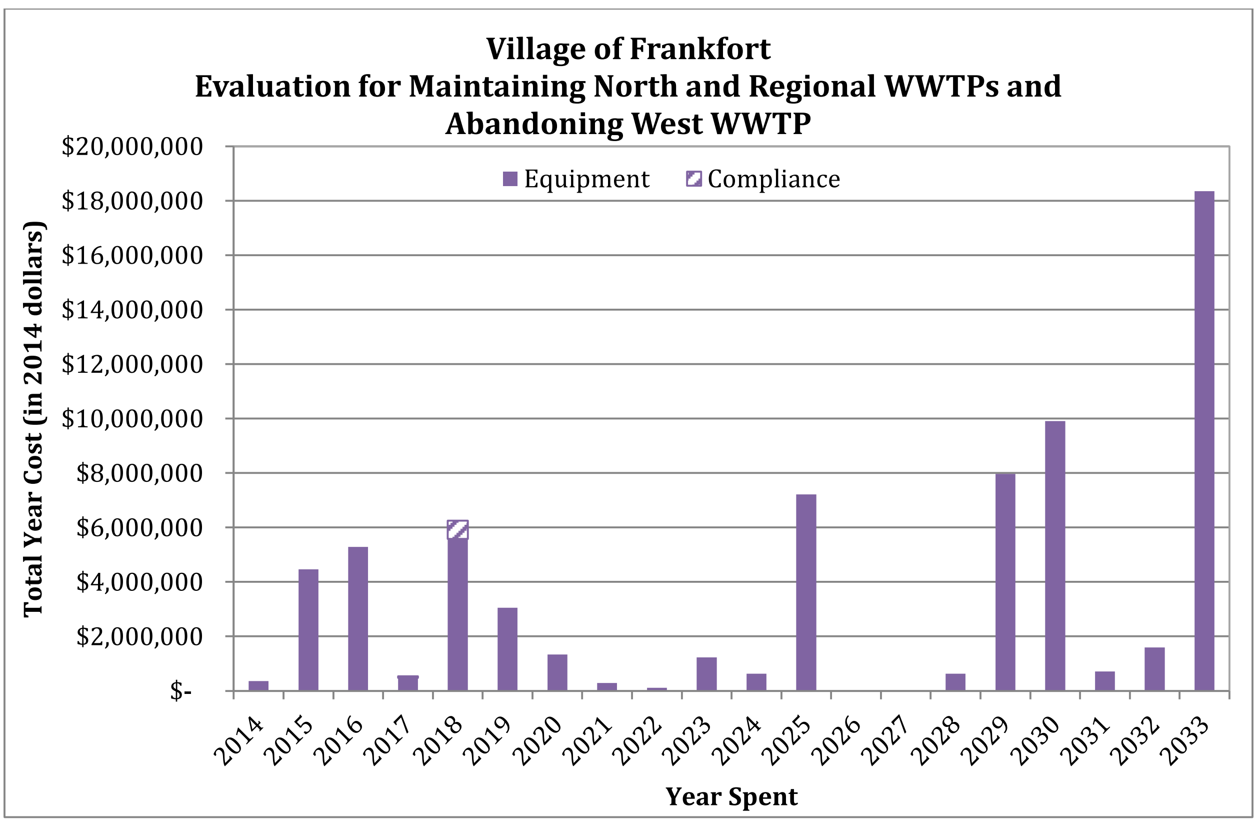
would be constructing improved facilities for transferring flow from the West WWTP and constructing improvements at the North WWTP to replace failing equipment and to meet future permit limits.

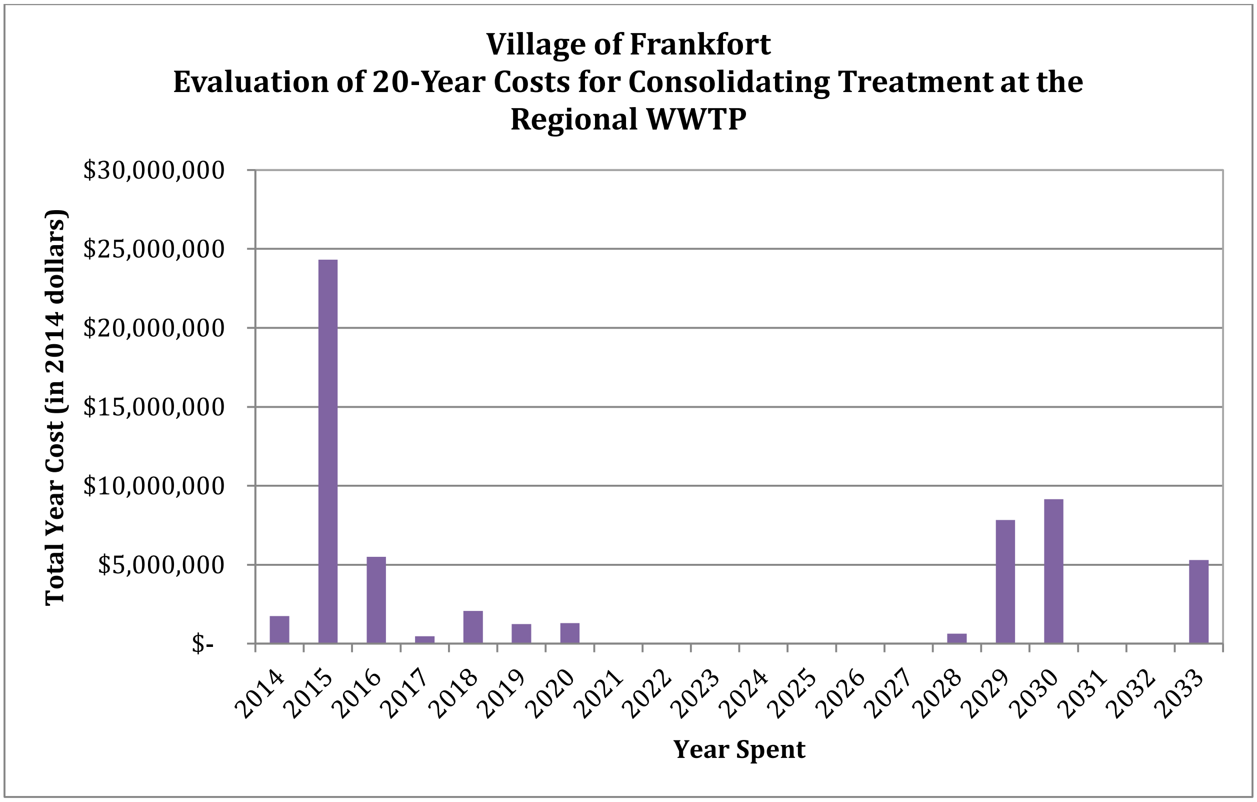
3. **Consolidate all three WWTPs at the Regional WWTP:** The Regional WWTP can be expanded to incorporate the capacity of the North and West WWTPs on the existing site. While the Regional WWTP is currently under-utilized, accepting flows from both the North and West WWTPs would necessitate immediate expansion of treatment capacity. This option presents a high immediate or five-year cost, making it difficult to phase over time and placing a large, short-term financial burden on the Village. However, this alternative ultimately has the lowest long term cost, since it can accommodate growth to the 20-year projected population and more easily expand to accommodate growth after 2035.

The 20-year cost of the three feasible options is summarized as follows:

Item	Total Capacity	Cost of Equipment Maintenance (in 2014$)	Cost of Compliance (in 2014$)	Total Facility Cost (in 2014$)	Compliance Deadline
Maintain All WWTPs	5.65 MGD	$63,030,000	$9,340,000	$72,370,000	2017 (North); 2018 (West)
Consolidate West/Regional: Abandon the West WWTP; Transfer West WWTP Flows to Regional WWTP for Treatment; Maintain North WWTP	4.35 MGD	$46,860,000	$730,000	$47,590,000	2017 (North); 2018 (West)
Consolidate All Treatment at the Regional WWTP: Abandon the North and West WWTPs; Increase Capacity at Regional WWTP	4.35 MGD	$54,260,000	-	$54,260,000	2017 (All)


Village of Frankfort
Evaluation for Maintaining all WWTP Sites
Equipment Replacement
Compliance
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$-
Total Cost for the Year (in 2014 dollars)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033
Year Spent


Village of Frankfort
Evaluation for Maintaining North and Regional WWTPs and Abandoning West WWTP
Equipment
Compliance
$20,000,000
$18,000,000
$16,000,000
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$-
Total Year Cost (in 2014 dollars)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033
Year Spent



The cost to replace failing equipment at the three existing WWTPs is high. The cost of compliance represents another major cost for maintaining all three WWTPs. In addition, the West WWTP is located in the existing floodway and existing residents. It is unlikely that this construction would be feasible due to site constraints and anticipated difficulties in permitting.

The two other options are to consolidate the West and Regional WWTPs and to consolidate all three WWTPs. For both options, the Regional WWTP would need to be expanded in the future to provide the capacity eliminated by the abandonment of the WWTPs. **The Regional WWTP can be expanded in the future to treat the full capacity of the North and West WWTPs on the existing site. Consolidating all three WWTPs will require expansion in the next five years, while maintaining the North WWTP will delay expansion until when necessitated by growth.**

Abandoning the West WWTP and transferring flows to the Regional WWTP is the least costly to construct in the planning period and can be phased over time. This option accommodates the total projected growth over the 20-year planning period. The improvements include:

1. **West WWTP:** Construct improvements to replace aged equipment for transferring flow to the Regional WWTP. Construct improvements to replaced aged equipment for treatment of excess flow at the existing West WWTP site. Abandon and demolish the remainder of the site.

2. **North WWTP:** Maintain the existing site through extensive equipment replacement. Construct improvements to comply with phosphorus and lower ammonia effluent limits.

3. **Regional WWTP:** Maintain the existing site through equipment replacement as equipment reaches the end of its design life. Increase the capacity of the Regional WWTP in the future to accommodate growth.

The 20-year opinion of probable cost for the recommended improvements is approximately $47.6 million in 2014 dollars.

Site Project	Cost of Equipment Maintenance	Cost of Compliance	Total Facility Cost	Compliance Deadline
North WWTP	$22,520,000	$730,000	$23,250,000	2018
West WWTP	$4,790,000	$0	$4,790,000	2017
Regional WWTP	$19,550,000	$0	$19,550,000	N/A
Total Cost (in 2014 USD)	**$46,860,000**	**$730,000**	**$47,590,000**	

The improvements to consolidate the West WWTP at the Regional WWTP while maintain the North WWTP can be phased over time. The improvements over the next several years are as follows:

Consolidate West Flow at Regional WWTP; Maintain North WWTP	2014	2015	2016	2017	2018	2019	2020
West WWTP							
Raw Sewage Pump Station		$200,000	$2,220,000				
Screen Building		$95,000	$1,055,000				
Disinfection System					$42,000	$468,000	
Abandon West WWTP					$59,000	$651,000	
Subtotal (in 2014 USD)	**$ -**	**$295,000**	**$3,275,000**	**$ -**	**$101,000**	**$1,119,000**	**$ -**
North WWTP							
Raw Sewage Pump Station		$138,000	$1,532,000				
Screening Building	$138,000	$1,532,000					
Primary Clarifiers	$21,000	$229,000					
Activated Sludge System (Alternative A)	$200,000	$2,220,000					
Aerobic Digester				$265,000	$2,945,000		
Sludge Storage				$213,000	$2,367,000		
Tertiary Filter					$163,000	$1,817,000	
RAS / WAS Pumps							$26,000
Phosphorus Removal				$60,000	$670,000		
Subtotal (in 2014 USD)	**$359,000**	**$4,119,000**	**$1,532,000**	**$538,000**	**$6,145,000**	**$1,817,000**	**$26,000**
REGIONAL WWTP							
Oxidation Ditch		$43,000	$477,000				
Sludge Thickening: Install Gravity Belt Thickener						$117,000	$1,303,000
Subtotal (in 2014 USD)	**$ -**	**$43,000**	**$477,000**	**$ -**	**$ -**	**$117,000**	**$1,303,000**
BUDGET YEAR COST							
TOTAL (in 2014 USD)	**$359,000**	**$4,457,000**	**$5,284,000**	**$538,000**	**$6,246,000**	**$3,053,000**	**$1,329,000**

The other major option evaluated is to consolidate all three plants at Regional WWTP. This option would require immediate expansion of the Regional WWTP and presents a considerably high 5-year cost. However, the advantages of this option are that it accommodates growth to the 20-year projected population and streamlines regulatory compliance based on treatment of flows at a single facility. Additionally, this option presents operational cost savings.

Abandoning the West and North WWTP and transferring flows to the Regional WWTP include the following improvements:

1. **West WWTP:** Construct improvements to replace aged equipment for transferring flow to the Regional WWTP. Construct improvements to replaced aged equipment for treatment of excess flow at the existing West WWTP site. Abandon and demolish the remainder of the site.

2. **North WWTP:** Construct improvements to replace aged equipment for transferring flow to the Regional WWTP. Construct improvements to increase the excess flow storage capacity of the facility.

3. **Regional WWTP:** Increase immediately the capacity of the Regional WWTP to accommodate all Village's wastewater flow. Install new equipment and improve existing facilities.

The 20-year opinion of probable cost for the recommended improvements is approximately $54.3 million. The improvements over the next several years are as follows:

Consolidate all Treatment at the Regional WWTP	2014	2015	2016	2017	2018	2019	2020
West WWTP							
Raw Sewage Pump Station		$200,000	$2,220,000				
Screen Building		$95,000	$1,055,000				
Disinfection System					$42,000	$468,000	
Abandon West WWTP					$59,000	$651,000	
Subtotal (in 2014 USD)	**$ -**	**$295,000**	**$3,275,000**	**$ -**	**$101,000**	**$1,119,000**	**$ -**
North WWTP							
Raw Sewage Pump Station		$138,000	$1,742,000				
Screen Building	$138,000	$1,012,000					
Disinfection System	$21,000	$489,000					
Hickory Creek Lift Station	$200,000	$3,790,000					

Consolidate all Treatment at the Regional WWTP	2014	2015	2016	2017	2018	2019	2020
Union Ditch Interceptor				$265,000	$1,475,000		
Abandon North WWTP				$213,000	$497,000		
Subtotal (in 2014 USD)	**$359,000**	**$5,429,000**	**$1,742,000**	**$478,000**	**$1,972,000**	**$ -**	**$ -**
REGIONAL WWTP							
Oxidation Ditch		$43,000	$477,000				
Sludge Thickening: Install Gravity Belt Thickener						$117,000	$1,303,000
Increase Capacity to 4.35 MGD	$1,395,800	$18,544,200					
Subtotal (in 2014 USD)	**$1,395,800**	**$18,587,200**	**$477,000**	**$ -**	**$ -**	**$117,000**	**$1,303,000**
BUDGET YEAR COST							
TOTAL (in 2014 USD)	**$1,754,800**	**$24,311,200**	**$5,494,000**	**$478,000**	**$2,073,000**	**$1,236,000**	**$1,303,000**

RECOMMENDATION

The recommended plan for the Village is to consolidate all three plants at Regional WWTP. Despite being a higher cost option initially, consolidation will reduce maintenance and operations, simplify permit compliance, largely reduce the impact of the West and North WWTP's on surrounding residents and accommodate future growth.

ADDITIONAL STEPS

The Village should also pursue improvements to the sanitary sewer system to reduce infiltration/ inflow (I/I). I/I reduction alone will not reduce the need for treatment-related improvements at the Village's WWTPs. It would, however, reduce the severity of excess flow events and problems experienced in the collection system. Therefore, a sanitary sewer evaluation study is recommended for the Village of Frankfort. The typical scope of an SSES includes flow monitoring, manhole inspections, rainfall simulations, household inspections for illegal connections, etc. A comprehensive study costs approximately $600,000. Improvements to reduce I/I take time but may have the potential to extend the timeframe for growth-related expansion at the WWTPs (currently projected for 2033).

The Village should also initiate a rate study to evaluate options for funding the recommended improvements.

1. INTRODUCTION

This Facilities Planning Report evaluates the Village of Frankfort's wastewater treatment facilities, including its three wastewater treatment plants (WWTPs) and major lift stations. The purpose of this report is to identify the condition of the existing WWTPs, to evaluate improvements to rehabilitate them, to identify potential effluent regulations and improvements to comply with them, and forecast the wastewater treatment needs for the next 20 years. The report provides recommendations to phase the improvements for capital planning and to accommodate projected wastewater flows.

The Village's three WWTPs (North, West and Regional) discharge treated effluent to various points within the Hickory Creek Watershed under three separate NPDES discharge permits issued by the Illinois Environmental Protection Agency (IEPA). The Hickory Creek Watershed is impaired for phosphorus, ammonia, and chloride, among other contaminants, and the Village has already seen limits for these contaminants begin to be incorporated into or lowered in the permits as they are renewed. The North and West WWTPs have struggled to meet ammonia limits, which will be reduced in the next permit cycle for each of the WWTPs.

The West WWTP, located south of Colorado Avenue at Birchwood Road, is the oldest facility and was constructed in 1959. Major improvement projects were completed in 1972 and 1987 to expand the plant to meet the growth needs of the Village. An emergency solids handling improvements project was constructed in 2010 after one of the digester covers failed suddenly. The North WWTP, located west of 80th Avenue, southwest of Hilda Walker Intermediate School and north of Mary Drew Elementary School, was originally constructed in 1970. Major improvement projects were constructed in 1980 and 1998. The Regional WWTP, north of Lincoln Way East High School, is the largest of Frankfort's three WWTPs and was originally constructed in 1998. An improvements project was constructed in 2007, expanding the daily average plant capacity to 3 million gallons per day (MGD) with a peak flow of 9 MGD. Many of the facilities and equipment at the West and North WWTPs have exceeded their design life and are in need of replacement or major overhaul. This report analyzes existing equipment, structures, and operational needs as part of a rehabilitation plan to meet future requirements of the Village.

This Facilities Planning Report identifies alternatives that will enable the Village to continue to consistently meet effluent requirements and provide enough capacity to treat wastewater flows for the next 20 years. The evaluation included meetings and interviews with Village staff and operators, discussion with IEPA staff, an onsite walk-through of the facilities, review of previous reports and design documents, and analysis of alternatives. The feasibility and cost of each alternative is evaluated and a recommended improvement plan is identified for the Village.

2. GENERAL FACILITY INFORMATION

2.1 Planning Area

The Village of Frankfort is located in Will County, approximately 35 miles southwest of the City of Chicago. The planning area for this study was designated as the Village's FPA. The general boundaries are Harlem Avenue on the East, Dralle Road on the south, Lincolnway Road on the west, and the Northeast Illinois Regional Commuter Corporation Railroad to 191st Street on the north. Exhibit A shows the Village's Facilities Planning Area (FPA), as it was last approved by IEPA, on United States Geological Survey (USGS) maps.

The FPA has traditionally been defined as the area considered for possible wastewater treatment service by a community within a 20-year planning period, as designated by the IEPA. However, over the last five years, the IEPA has stopped enforcing FPAs. The Village of Frankfort's FPA consists of the Village of Frankfort, Frankfort Square, a portion of flows directed from Tinley Park, and a small portion of unincorporated Cook County. The total FPA consists of 21,560 acres, including approximately 4,500 acres of undeveloped areas.

A portion of Village-incorporated property falls within the FPAs of the Metropolitan Water Reclamation District of Greater Chicago (MWRD-GC) and Aqua Illinois at University Park.

2.2 Topography and Drainage

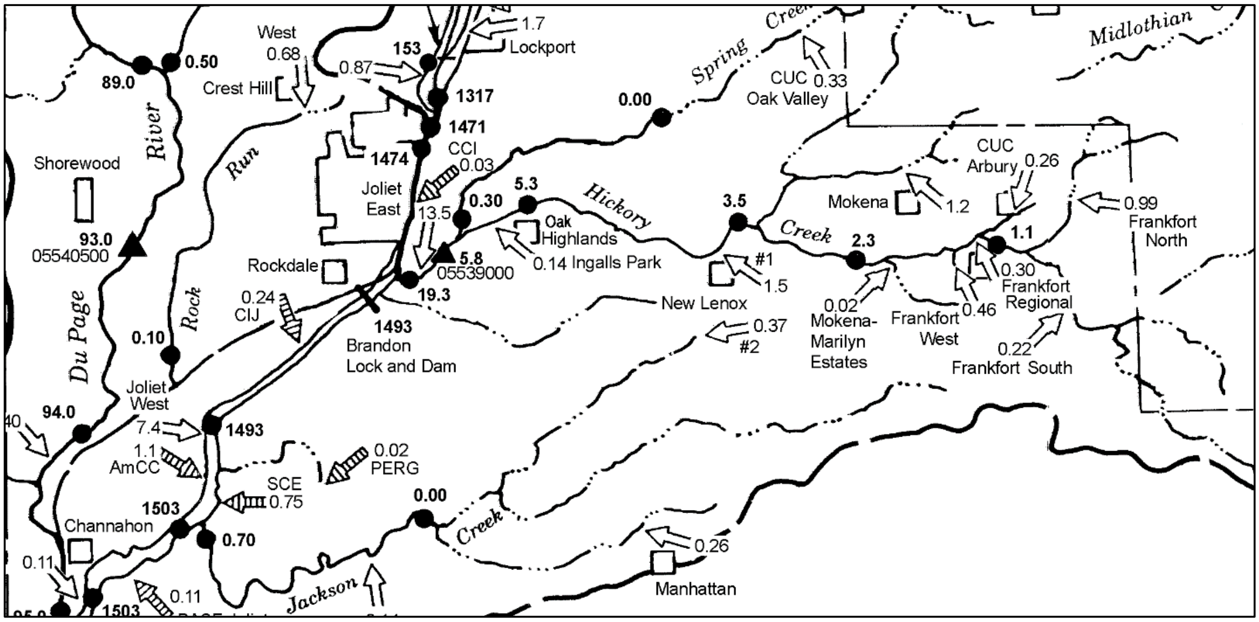
The topography in the FPA is varied, with a range in elevation of 670 to 790 USGS datum.

The Village's planning area is located within the watersheds of Hickory Creek, Jackson Creek, and Prairie Creek. Hickory Creek flows east to west across the northern portion of the planning area. Prairie Creek flows from east to west in the southwestern portion of the watershed. Jackson Creek flows from north to south on the east side of the planning area. While each of these watersheds is distinct, they all ultimately discharge to the Lower Des Plaines River.

According to the Illinois State Water Survey (ISWS), the 7-day, 10-year (7Q10) low flow for Hickory Creek downstream of the North WWTP is 1.1 cfs and downstream of the Regional WWTP and West WWTP is 2.3 cfs. The Union Ditch and Hickory Creek tributary to which the North and West WWTPs discharge respectively are both have a 7Q10 of zero.

FIGURE 1

7Q10 Exhibit



Although the Village of Frankfort's three WWTPs each have different receiving streams, the flows all ultimately discharge to Hickory Creek. Stream impairments are used to dictate the permitted pollutants and derive effluent limits. The IEPA publishes a list of impaired streams along with the pollutants in report known as the 303(d) list. Figure 1 shows the reach number for Hickory Creek according the IEPA and Figure 2 describes the receiving streams.

FIGURE 2

IEPA Stream Segment Map

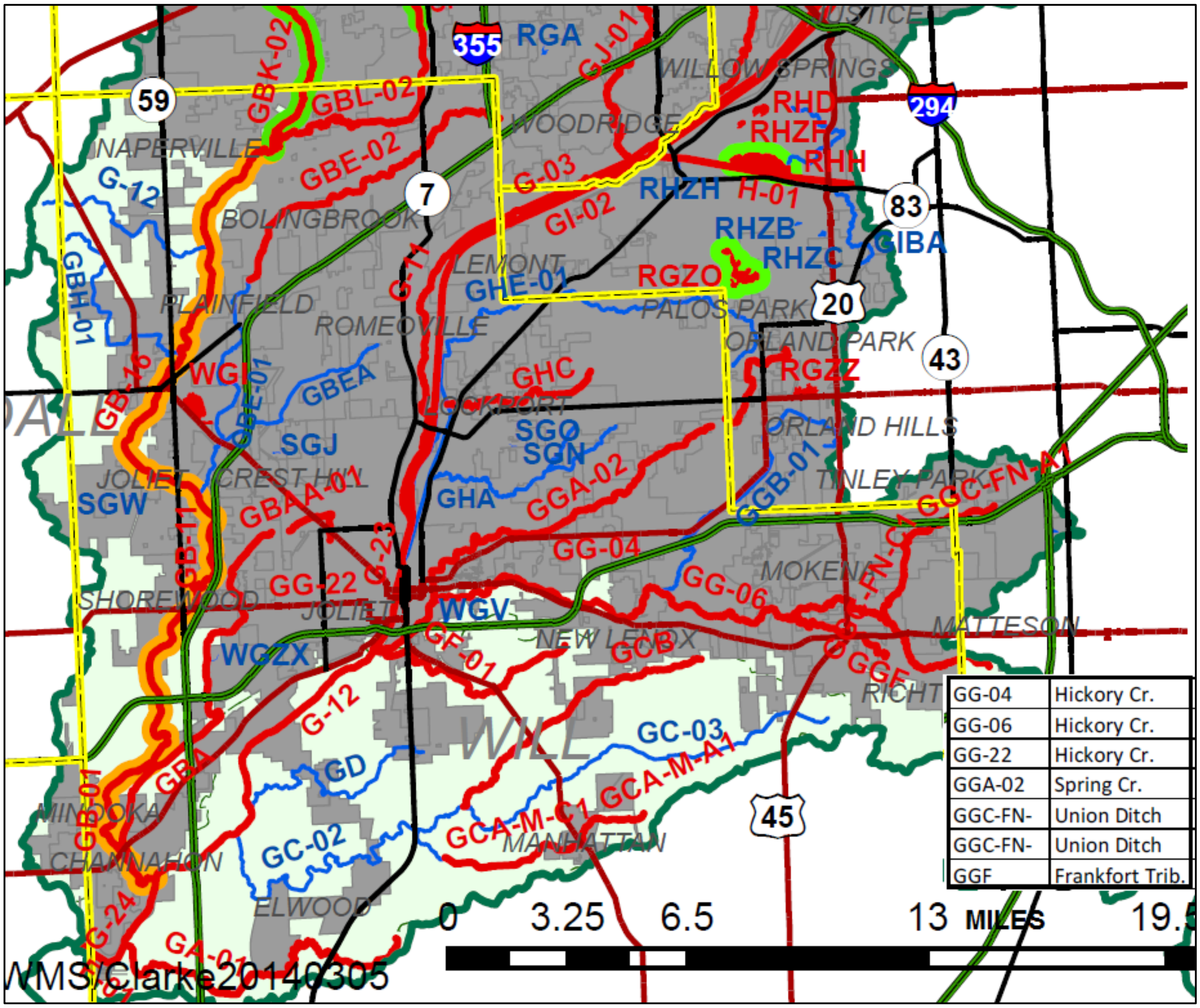


TABLE 1

Village of Frankfort Watersheds

Facility	West WWTP	North WWTP	Regional WWTP
Receiving Stream	Unnamed Tributary to Hickory Creek	Union Ditch (tributary to Hickory Creek)	Hickory Creek
7Q10 Low Flow (upstream)	0 cfs	0 cfs	1.1 cfs
303(d) Impairments			
2006 List	Total Phosphorus; Total Nitrogen; Total Dissolved Solids	Alteration in stream side or littoral vegetative cover; Chloride; Ammonia; Dissolved Oxygen; Sedimentation/ Siltation; Total Dissolved Solids; Total Phosphorus	Total Phosphorus; Chloride; Total Dissolved Solids
2008 List	Total Phosphorus	Ammonia; Chloride; Total Phosphorus; Sedimentation / Siltation	Total Phosphorus; Chloride
2014 Draft List	Total Phosphorus	Ammonia; Chloride; Dissolved Oxygen; Total Phosphorus; Sedimentation / Siltation	Total Phosphorus; Chloride; Dissolved Oxygen

2.3 Municipal Utilities

The Village of Frankfort's wastewater utilities include a sanitary sewer system and three WWTPs. The Village owns and maintains its sanitary sewer systems. The Village's wastewater users are mostly residential, with some commercial and industrial contributions. In addition, there are a number of schools served by the Village's sanitary system, including two high schools.

Wastewater from the northeast portion of the service area flows to the North WWTP mostly by gravity. The West WWTP services most of the western sector of the FPA. Flows from the southwest region are transferred to the West WWTP via the Jackson Creek Lift Station. In the late 1990s, the Village closed its South WWTP, which formerly had treated flows from the south and eastern parts of the Village. These flows are now transferred to the Regional WWTP via the Hickory Creek Interceptor and the Hickory Creek Lift Station. The existing system and WWTPs are shown in Exhibit B.

3. POPULATION & FLOWS

The Village of Frankfort's Wastewater Treatment Plants serve the Village of Frankfort, Frankfort Square, a small portion of unincorporated Cook County, and a small portion of the Village of Tinley Park.[4] Population data for the communities served were obtained from the U.S. Bureau of Census for the Village of Frankfort and Frankfort Square, and from water meter readings for Tinley Park.

During the period of 2000-2006, the Village of Frankfort had one of the highest community growth rates in the United States.[5] For example, the number of new building permits in 2006 skyrocketed to 450 per year, up from 110 per year in 1999. The economic decline in 2007 had a visible impact on construction. The number of new permits approved in 2007 dropped to a mere 22. However, since that time, growth has re-established at a moderate and more stable rate.

3.1 Population Projection

The current estimate for Village population is 18,600. The 2040 population projection from the Chicago Metropolitan Agency for Planning (CMAP), formerly the Northeastern Illinois Planning Commission (NIPC), for the Village of Frankfort is 54,907. However, this projection represents the addition of over 1,200 PEs per year. The CMAP projection appears to overestimate growth. Furthermore, community standards generally promote controlled, low-density growth while focusing denser development in key areas. Therefore, the Village's planning department has recommended a more appropriate growth factor of 2% compounded growth as the basis of growth projections presented herein. As actual growth will vary from projected values, the Village should continually monitor the timing and location of growth and adjust this plan accordingly.

The 2000 and 2010 population for Frankfort Square was obtained from census data. The 2010 population for Tinley Park was estimated from water use data. Data was not available previous to 2010. The current population for the unincorporated Cook County area was obtained from the Village. Data was not available previous to 2014. The growth potential for Frankfort Square and Tinley Park within Frankfort's FPA is limited. There is no growth potential for unincorporated Cook County, so its projected population matches the current population. The population data and projections are summarized in Table 2.

4 The Village serves approximately 770 homes in Timber Ridge Mobile Home Park in unincorporated Matteson/Rich Township.

5 The Village was ranked the 36th fastest growing suburb in the United States in 2007 by Forbes.com. (Woolsey, M. "America's Fastest-Growing Suburbs." Forbes. 16 July 2007. Accessed online 26 September 2013 at http://www.forbes.com/2007/07/16/suburbs-growth-housing-forbeslife-cx_mw_0716realestate.html.

TABLE 2

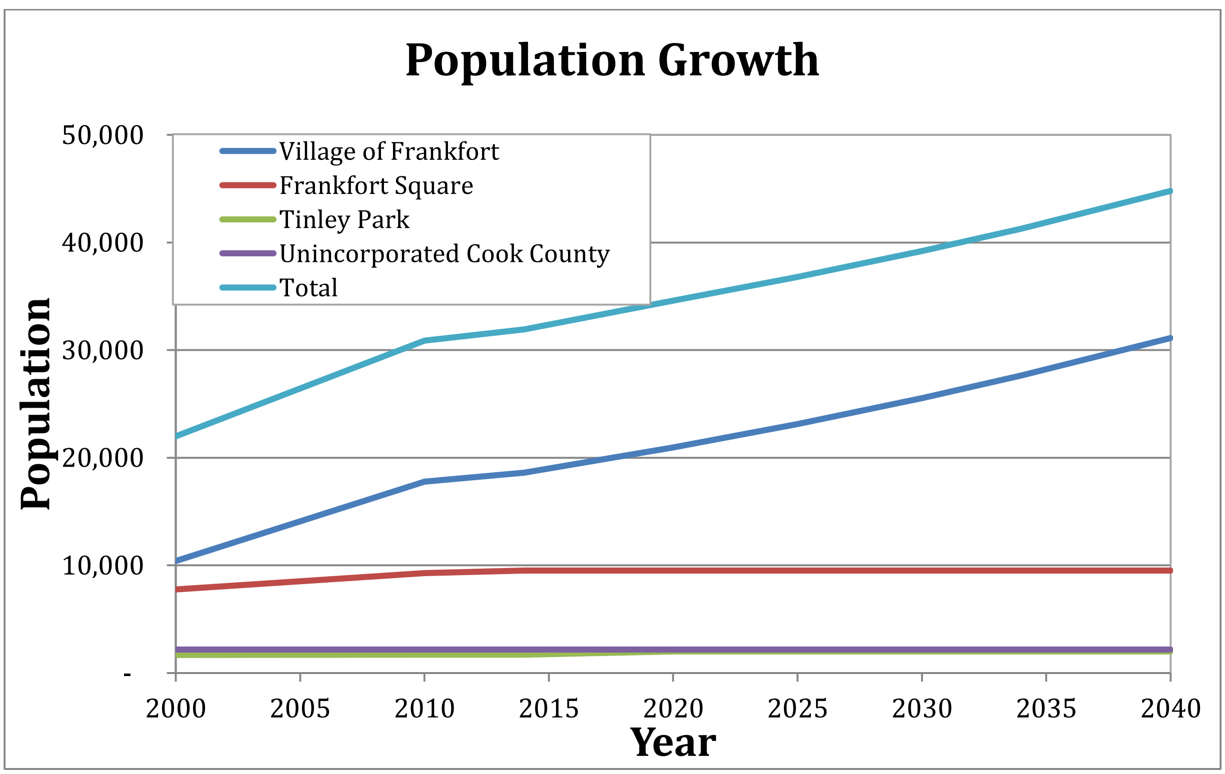
Population Data

Year/Area	Village of Frankfort	Frankfort Square	Tinley Park	Unincorporated Cook County
2000	10,391	7,766	No data	2,156
2010	17,782	9,276	1,680	2,156
2014 (current)	18,600	9,500	1,680	2,156[6]
2020	20,950	9,500	2,000	2,156
2025	23,130	9,500	2,000	2,156
2030	25,530	9,500	2,000	2,156
2034 (20-year)	27,640	9,500	2,000	2,156
2040	31,130	9,500	2,000	2,156

The 20-year population projection in Frankfort (year 2034) is 27,640, or a growth of approximately 9,400 people. Figure 3 and Figure 4 show the growth projections.

FIGURE 3

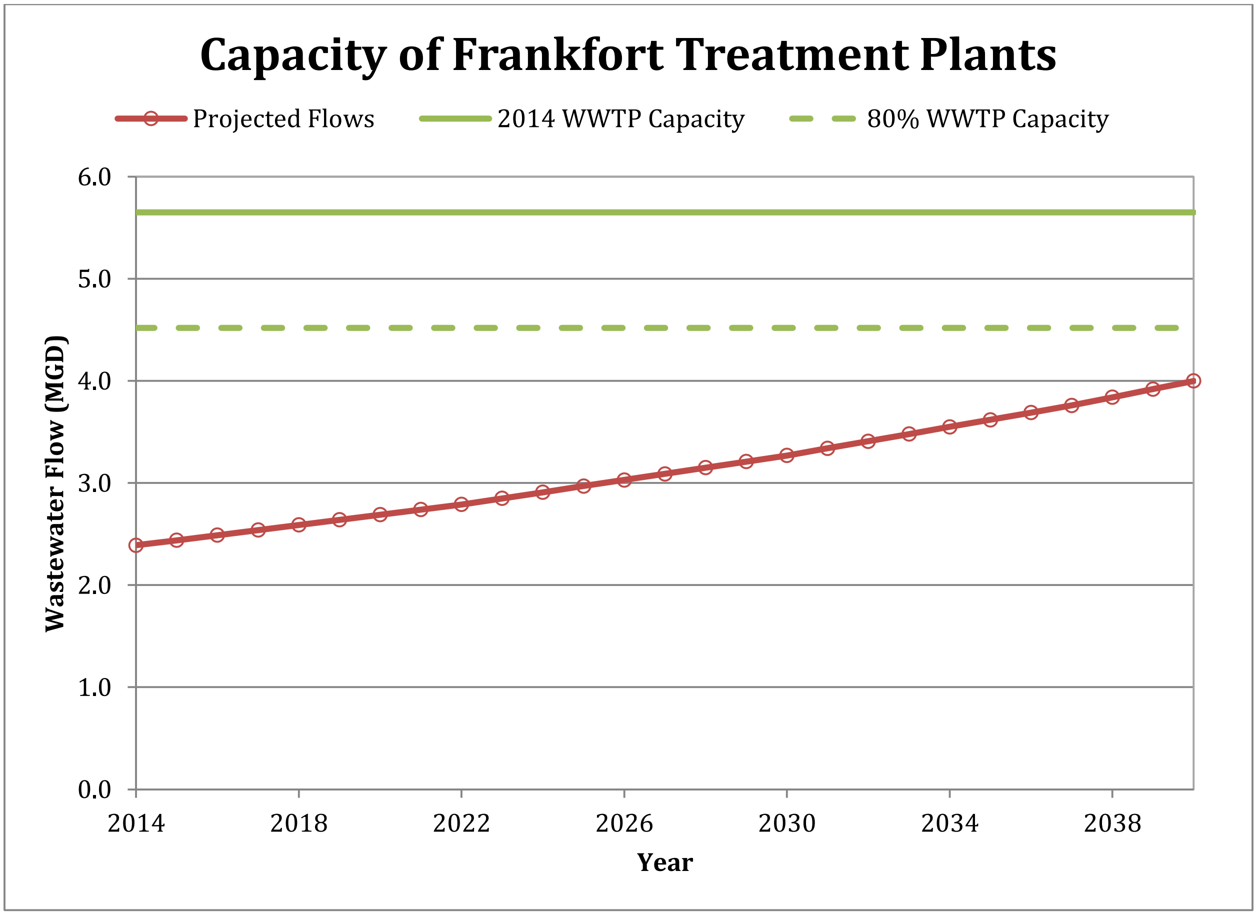
Planning Area Population Growth



[6] The unincorporated Cook County area serves 770 homes. The 2010 population is based on 2.80 PE per household, as determined in the 2010 U.S. Census.

FIGURE 4

Frankfort WWTP Capacity



3.2 Sanitary Sewer System

The Village owns and operates approximately 180 miles of sanitary sewer and over 4,300 manholes. Based on observed peak flowrates during wet weather conditions, there is a high likelihood that leakage in the sanitary sewer system is occurring. Dry-weather flow consists of normal daily sewage production plus baseline infiltration. Infiltration is groundwater entering the sewer system through sources such as open joints between sections of pipe, cracks in the mainline and building lateral pipes, connected foundation footing drains, and leaking manholes. In many sanitary sewer systems, infiltration is present even during dry-weather periods. The amount of infiltration in the sewer system is dependent upon groundwater level. Typically, groundwater levels are highest in late winter and early spring as snowmelt percolates through the ground. During this time, defects in pipes and manholes can allow groundwater to continuously enter the sanitary sewer system. This extraneous water is commonly referred to as baseline infiltration.

Inflow and infiltration, commonly referred to as I/I, that enters the sewers can cause collection system operational difficulties, including sewage backups in basements, sewer overflows, washout of solids, and permit violations at the treatment plant. Table 3 presents an estimate for infiltration at the Village's WWTPs. The United States Environmental Protection Agency (USEPA) sets standards for determining if I/I is within acceptable limits in their publication CG-85:

> *No further I/I analysis will be required if domestic wastewater plus non-excessive infiltration does not exceed 120 gallons per capita per day (gpcd) during periods of high groundwater, and if the total daily flow during a storm does not exceed 275 gpcd, and there are no operational problems, such as surcharges, bypasses or poor treatment performance, resulting from hydraulic overloading of the treatment works during storm events.*

TABLE 3

Estimated I/I

	North WWTP	West WWTP	Regional WWTP	Total
Design Flow rate (MGD)	1.35	1.30	3.0	5.65
Average Dry Weather Flow (MGD)	0.70	0.65	1.00	2.35
Average Flow (MGD)	0.87	0.77	1.41	3.05
Daily Maximum Flow (MGD)	3.55	9.21	7.44	20.20
Peak Dry Weather Flow (MGD)	1.86	0.99	4.13	6.97
Estimated Infiltration (MGD)	1.16	0.34	3.13	4.62

Average Dry Weather Flow - The average daily dry weather flow during the one-year period from January 2013 through December 2013, as determined by the three low flow months, was 0.70 MGD at the North Plant, 0.65 MGD at the West WWTP, 1.00 MGD at the Regional WWTP and a total of 2.35 MGD.

Based on the most recent data, the estimated current residential population is approximately 32,000 P.E. The average dry weather flow rate per P.E. is, therefore, 74 gallons per day per capita (gpdc).

Average Daily Flow - The two-year average daily flow rate from January 2012 through December 2013 was 0.87 MGD at the North WWTP, 0.77 MGD at the West WWTP, 1.41 MGD at the Regional WWTP and a total of 3.05 MGD. This flow rate corresponds to 95 gpdc.

Infiltration Flow Rate - During the the one-year period from January 2013 through December 2013, the peak daily flow observed during dry weather was 1.86 MGD at the North WWTP, 0.99 MGD at the West WWTP, and 4.13 MGD at the Regional WWTP for a total of 6.98 MGD. This flow rate corresponds to 219 gpdc (i.e., greater than the criterion value of 120 gpdc). Subtracting the average daily dry weather flow of 2.35 MGD from 6.97 MGD gives an estimate of infiltration at 4.62 MGD, or 145 gpdc.

Peak Flow Rate –The peak daily flow rate recorded at the WWTPs during the last 12 months was 3.55 at the North WWTP, 9.21 MGD at the West WWTP, 7.44 MGD at the Regional WWTP, and a total of 20.2 MGD. This results in a per capita flow rate of approximately 581 gpd (greater than the criterion valve of 275 gpd) and an inflow rate of 15.6 MGD (20.2 – 4.62).

3.3 I/I Analysis

Excessive I/I are those quantities of either infiltration or inflow for which the cost of removal from the system would be less than the cost of transportation and treatment. As stated in the USEPA rules and regulations, "the Infiltration/Inflow analysis shall demonstrate the non-existence or possible existence of excessive infiltration/inflow in each sewer system tributary to the treatment works". If the analysis demonstrates the possible existence of excessive infiltration/inflow, a more detailed study of the sewer system is required. The purposes of this type of study, commonly called a "sewer system evaluation survey," are to identify the defects that allow infiltration/inflow to enter the sewers and to determine which defects are economical to eliminate by repairs to the system.

Based on the flow data, and the criteria suggested in USEPA Publication CG-85, some excessive infiltration and/or inflow may exist in the sewer system. To determine if excessive infiltration or inflow exists in the system, the probable cost to locate and remove I/I sources must be compared to the estimated cost to transport and treat the I/I contributed by those sources. Common infiltration sources include defective sewer pipes, pipe joints, connections and manholes. Common sources of inflow are manhole covers and frames subject to inundation during rainstorms, footing drains, roof downspouts, area drains directly connected to the sewers, and direct and indirect connections between the sanitary sewers and storm water drainage system.

A sewer system evaluation survey (SSES) would be needed to identify the specific I/I sources in the community and to determine which sources are economical to eliminate from the system. The common field investigation tasks in the SSES work include flow monitoring at key locations in the sanitary sewer system, manhole inspections, smoke testing of the sanitary sewers to identify inflow sources, rainfall simulation to locate interconnections between the sanitary sewers and the storm water drainage system, television inspection to identify the specific I/I sources, and house-by-house inspections to identify inflow sources such as foundation drains and roof downspouts. Following the field investigation work, a comprehensive report would be prepared to list the sources and to determine which sources are cost-effective to eliminate.

I/I reduction alone will not reduce the need for treatment-related improvements at the Village's WWTPs. It would, however, reduce the severity of excess flow events and problems experienced in the collection system. Therefore, an SSES is recommended for the Village of Frankfort. A comprehensive study costs approximately $600,000.

4. FACILITY LIMITS & PERFORMANCE

This Section outlines the wastewater flows, influent quality, and effluent quality data at the Village's three WWTPs. The data was compiled from discharge monitoring reports for the two year period of January 2012 through December 2013. The influent wastewater consists of raw sewage generated primarily from domestic sources. The average concentrations of raw biological oxygen demand (BOD), total suspended solids (TSS) and ammonia for the WWTPs are shown in Table 4. The NPDES permit does not require the Village to measure influent ammonia-nitrogen, thus no data for this parameter is available.

TABLE 4

Summary of WWTP Operational Data

	West WWTP	North WWTP	Regional WWTP
Design Flow (MGD)	1.30	1.35	3.0
Average Flow (MGD)	0.77	0.87	1.41
Average % Utilized	59%	64%	47%
Max Monthly Flow (MGD)	1.33	2.26	7.44
Influent BOD – Average (mg/L)	103	133	114
Influent TSS – Average (mg/L)	53.2	60.1	52.8
Effluent BOD – Average (mg/L)	3.7	3.4	3.4
Effluent TSS – Average (mg/L)	6.4	4.5	6.3
Effluent NH_3-N – Average (mg/L)	0.31	1.34	0.38

At the estimated population equivalents tributary to the Village's WWTPs, the current wastewater flows generated are equivalent to 96 gallons per capita per day (gcd). At this estimated current PE, the BOD loading is 0.09 ppd/PE, as compared to the design value of 0.17 ppd/PE. The TSS loading is 0.04 ppd/PE, as compared to the design value of 0.20 ppd/PE. These values indicate that the wastewater loading is dilute, which may be due to I/I entering the collection system.

4.1 North WWTP

Figure 5 through 8, Table 5, and Table 6 demonstrate the facility loadings and performance for the period of January 2012 through December 2013.

The recorded influent flows at the North WWTP are considerably less than the recorded effluent flows. There is typically a small deviation between the two measurements; however, the differences at the North WWTP would tend to indicate measurement errors. The influent and effluent flowmeters should be checked for calibration and corrected as necessary. Typically, calibration is contracted to a third-party on a yearly basis. The meter was calibrated most recently in Spring 2013.

The North WWTP exceeded its ammonia limit five times between June and December 2013 due to various circumstances including loss of nitrifying population, equipment malfunctions and repairs, and inconsistent sludge hauling. The site has no sludge storage, which is not compliant with IEPA regulations. Therefore, the operational staff has limited ability to correctly operate the facility. Supernatant returns from the solids treatment process can have wide variability in ammonia concentrations. The inability to control sidestream returns can lead to intermittent shock loadings to the liquid stream process. In addition, the primary clarifiers have been inoperable which increases the loading to the aeration tanks, further contributing to the stress on the nitrification process.

FIGURE 5

North WWTP Flow Rates

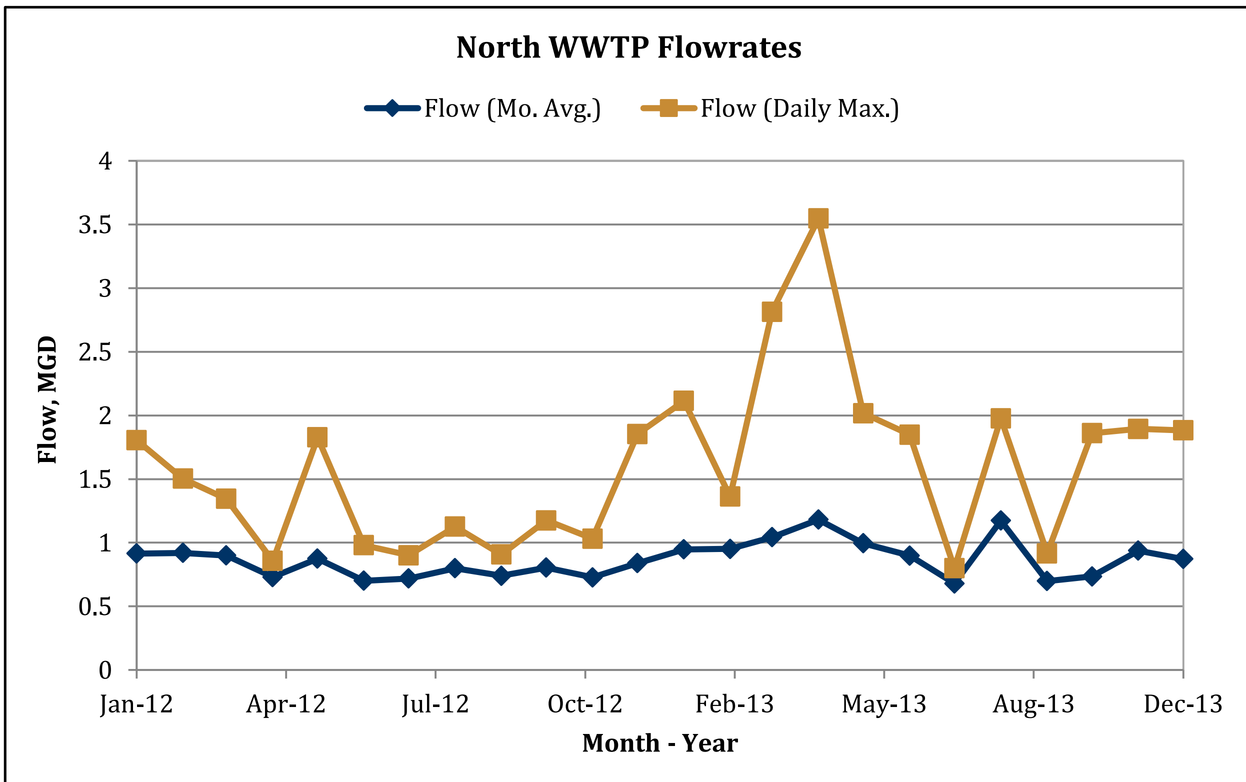


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FIGURE 6

North WWTP Influent Wastewater Quality

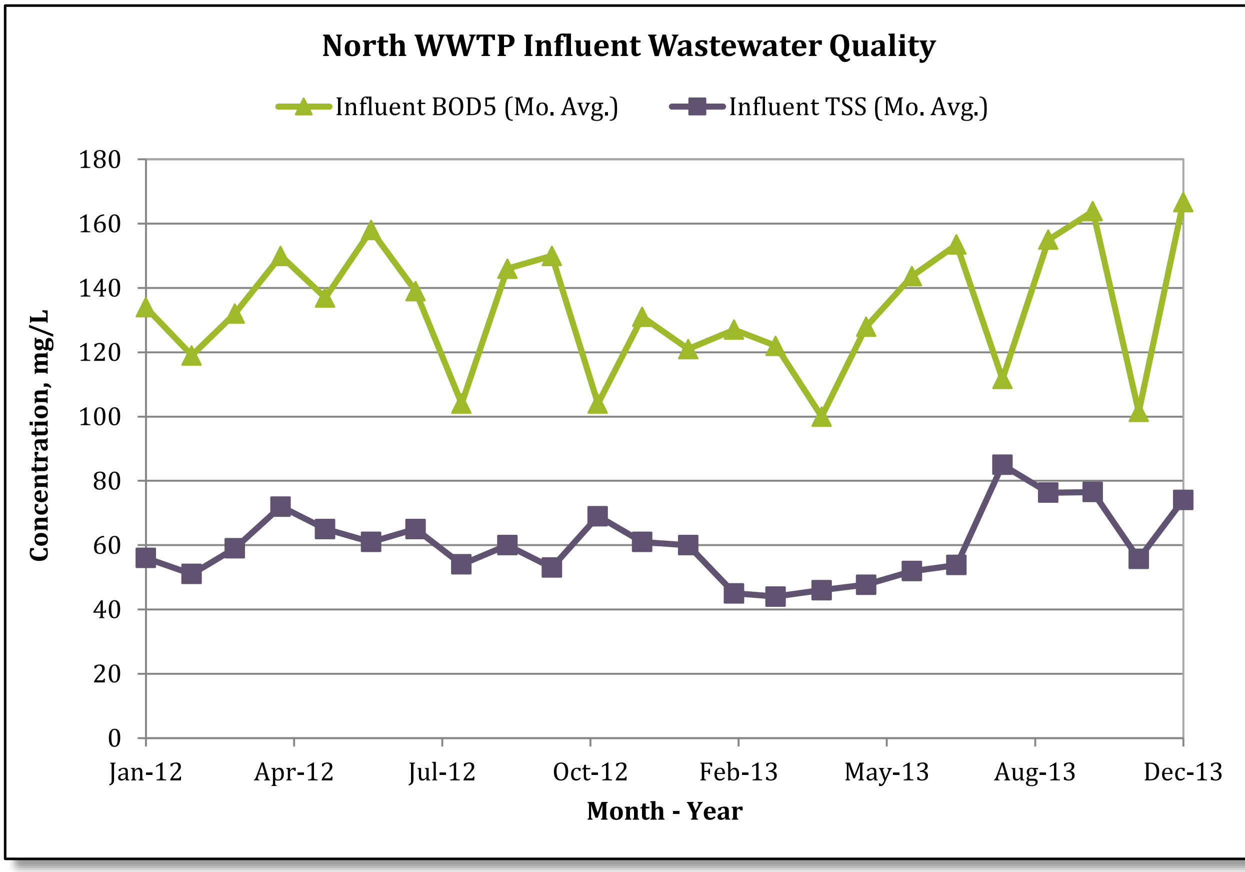


TABLE 5

North WWTP Influent Wastewater Quality

Month - Year	Monthly Average (MGD)	Daily Maximum (MGD)	Influent BOD (mg/L)	Influent TSS (mg/L)
January 2012	0.92	1.81	134	56
February 2012	0.92	1.50	119	51
March 2012	0.90	1.34	132	59
April 2012	0.73	0.86	150	72
May 2012	0.87	1.83	137	65
June 2012	0.70	0.98	158	61
July 2012	0.72	0.90	139	65
August 2012	0.80	1.13	104	54
September 2012	0.74	0.91	146	60
October 2012	0.81	1.18	150	53
November 2012	0.73	1.03	104	69
December 2012	0.84	1.85	131	61
January 2013	0.95	2.12	121	60
February 2013	0.95	1.36	127	45
March 2013	1.04	2.81	122	44
April 2013	1.18	3.55	100	46
May 2013	1.00	2.02	128	48
June 2013	0.90	1.85	144	52
July 2013	0.68	0.80	154	54
August 2013	1.17	1.98	112	85
September 2013	0.70	0.92	155	76
October 2013	0.74	1.86	164	77
November 2013	0.94	1.89	101	56
December 2013	0.87	1.88	167	74
AVERAGE	**0.87**	**1.60**	**133**	**60**

FIGURE 7

North WWTP Effluent BOD and TSS

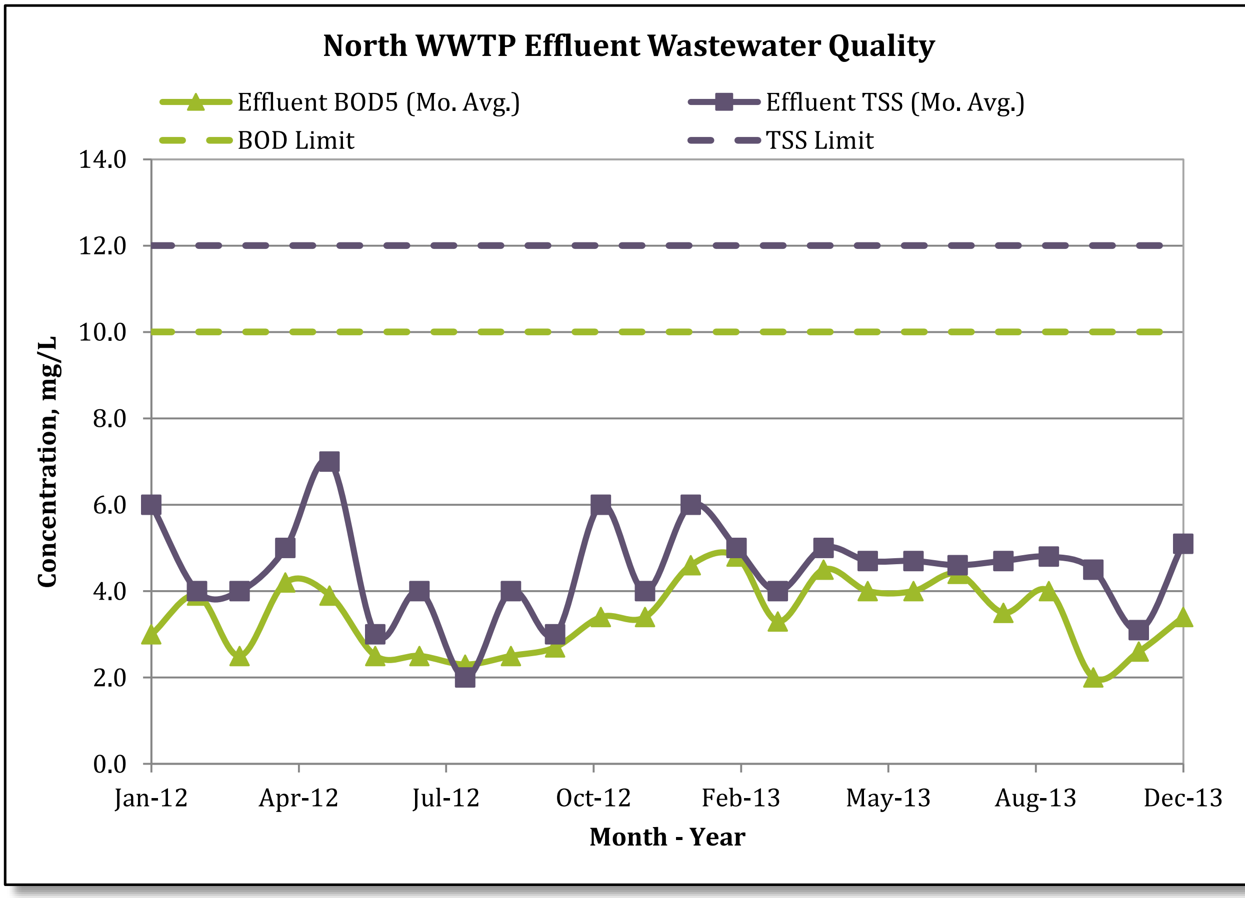


FIGURE 8

North WWTP Effluent Ammonia

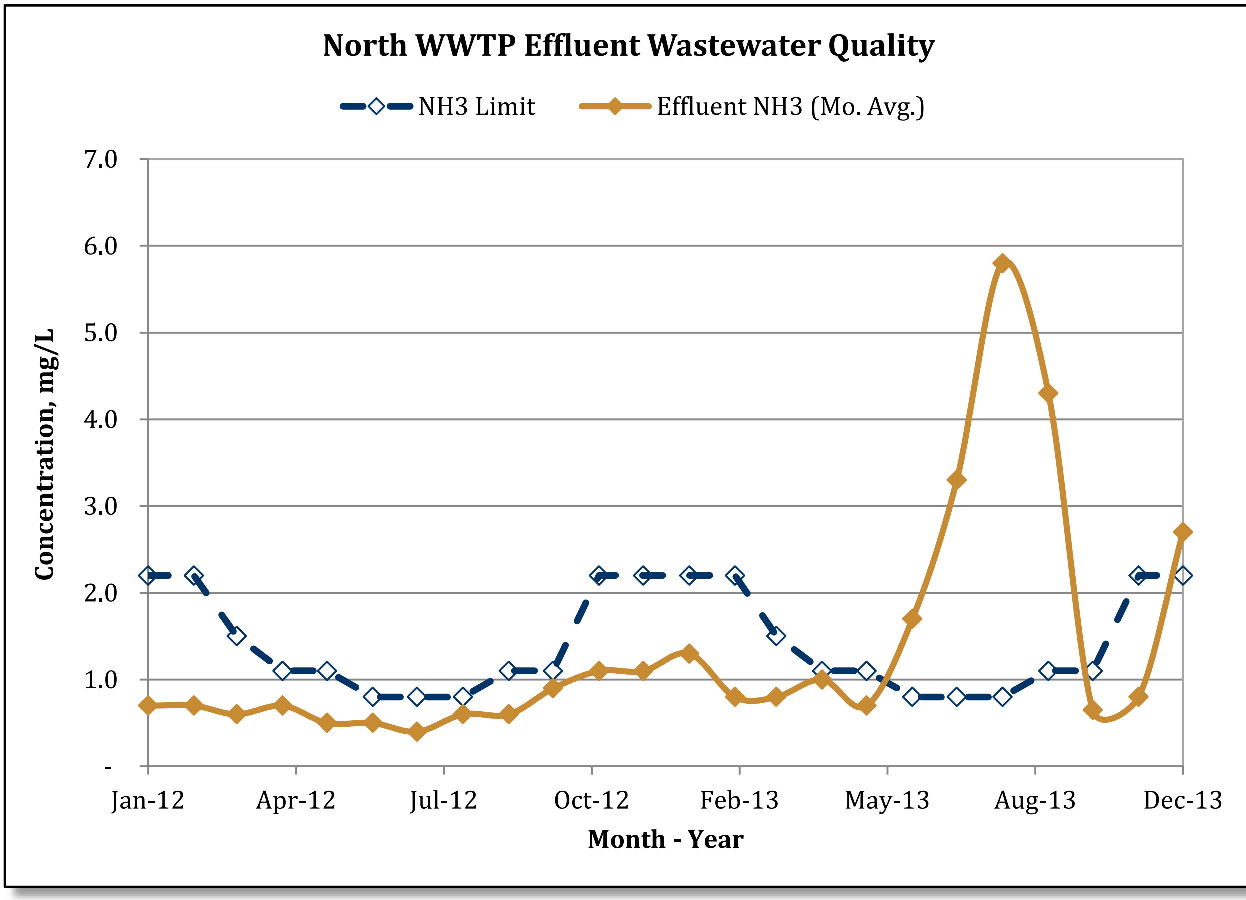


TABLE 6

North WWTP Effluent Wastewater Quality

Month - Year	Monthly Average (MGD)	Effluent BOD (mg/L)	Effluent TSS (mg/L)	Effluent NH_3-N (mg/L)
January 2012	1.33	3.0	6.0	0.7
February 2012	1.25	3.9	4.0	0.7
March 2012	1.11	2.5	4.0	0.6
April 2012	1.04	4.2	5.0	0.7
May 2012	1.91	3.9	7.0	0.5
June 2012	1.65	2.5	3.0	0.5
July 2012	0.84	2.5	4.0	0.4
August 2012	1.15	2.3	2.0	0.6
September 2012	1.11	2.5	4.0	0.6
October 2012	0.97	2.7	3.0	0.9
November 2012	0.90	3.4	6.0	1.1
December 2012	1.01	3.4	4.0	1.1
January 2013	1.15	4.6	6.0	1.3
February 2013	1.39	4.8	5.0	0.8
March 2013	1.67	3.3	4.0	0.8
April 2013	1.53	4.5	5.0	1.0
May 2013	1.54	4.0	4.7	0.7
June 2013	1.50	4.0	4.7	1.7
July 2013	1.22	4.4	4.6	3.3
August 2013	1.17	3.5	4.7	5.8
September 2013	0.99	4.0	4.8	4.3
October 2013	1.15	2.0	4.5	0.7
November 2013	1.19	2.6	3.1	0.8
December 2013	1.22	3.4	5.1	2.7
AVERAGE	**1.25**	**3.4**	**4.5**	**1.3**

4.2 West WWTP

Figure 9 through 12, Table 7, and Table 8 demonstrate the facility loadings and performance for the period of January 2012 through December 2013.

The West WWTP had a summertime ammonia effluent limit of 0.8 mg/L. The limit was reduced to 0.4 mg/L in the most recent permit revision. A 36-month compliance period was granted, such that the 0.4 mg/L summertime limit became effective in October 2013. Air fans were replaced in the nitrifying towers, which have assisted the Village in meeting the ammonia limit. However, nitrification tower technology is inherently limited in its ability to reduce ammonia below 1 mg/L. Though not impossible, the West WWTP will always struggle to meet its ammonia limit while using this technology. As with the North WWTP, the lack of sludge storage at the WWTP exacerbates the difficulties with ammonia removal.

The flow, BOD, and TSS information appears to indicate that the West WWTP is under-utilized in normal conditions. However, based on the inability to consistently meet current ammonia limits, the plant is actually operating at its capacity for ammonia-nitrogen removal.

FIGURE 9

West WWTP Flow Rates

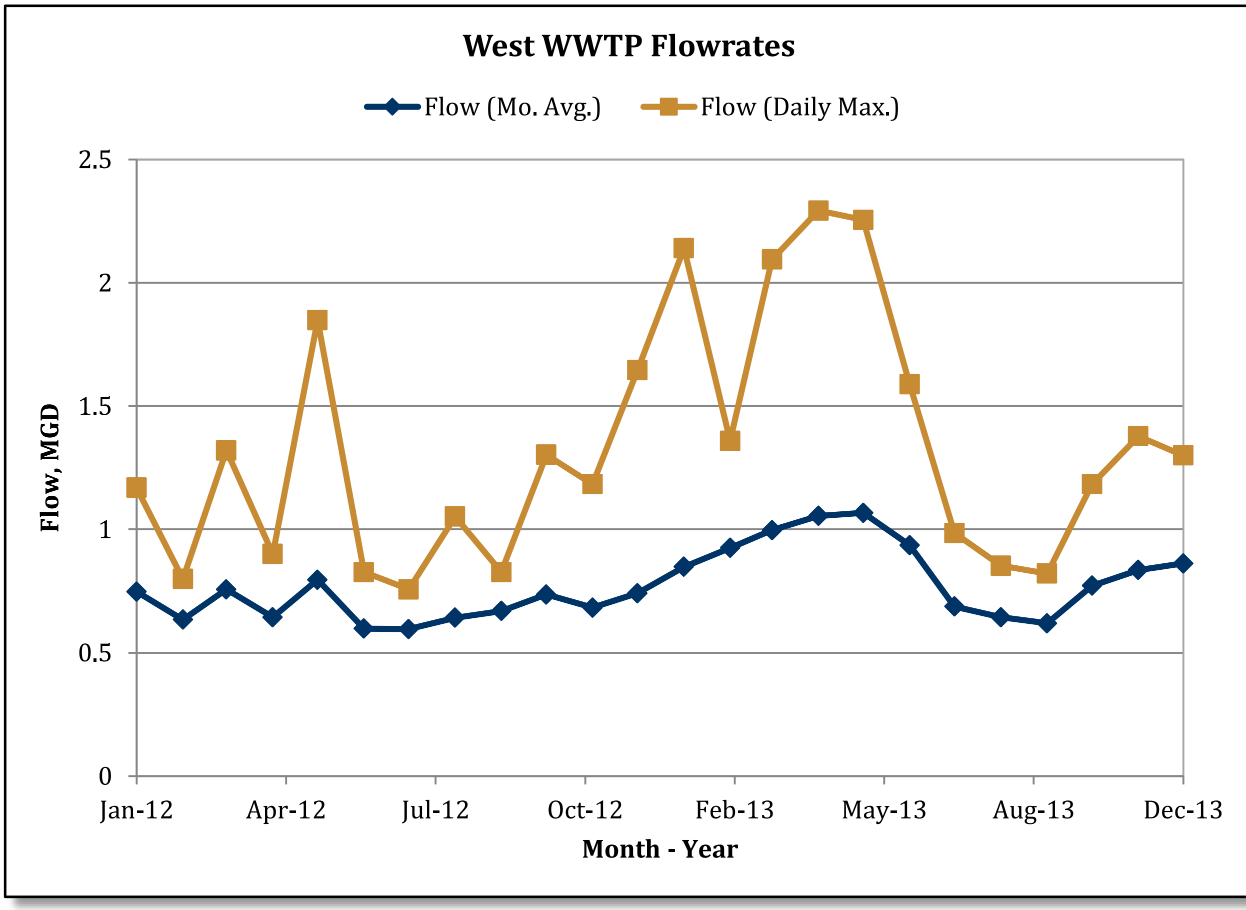


FIGURE 10

West WWTP Influent Wastewater Quality

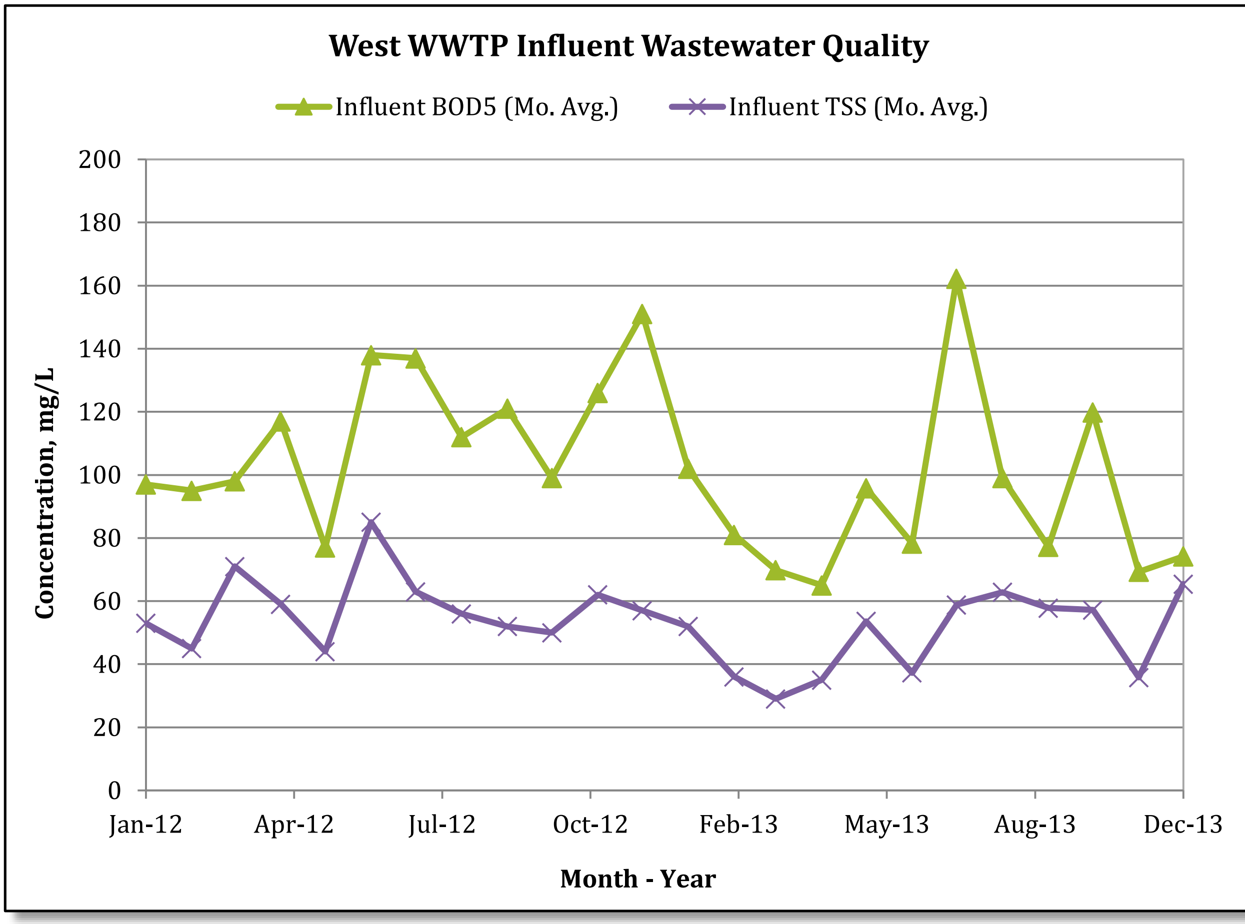


TABLE 7

West WWTP Influent Wastewater Quality

Month - Year	Monthly Average (MGD)	Daily Maximum (MGD)	Influent BOD (mg/L)	Influent TSS (mg/L)
January 2012	0.75	1.17	97	53
February 2012	0.63	0.80	95	45
March 2012	0.76	1.32	98	71
April 2012	0.64	0.90	117	59
May 2012	0.80	1.85	77	44
June 2012	0.60	0.83	138	85
July 2012	0.60	0.76	137	63
August 2012	0.64	1.05	112	56
September 2012	0.67	0.83	121	52
October 2012	0.74	1.30	99	50
November 2012	0.68	1.18	126	62
December 2012	0.74	1.65	151	57
January 2013	0.85	2.14	102	52
February 2013	0.93	1.36	81	36
March 2013	1.00	2.10	70	29
April 2013	1.06	2.29	65	35
May 2013	1.07	2.26	96	54
June 2013	0.94	1.59	78	37
July 2013	0.69	0.98	162	59
August 2013	0.64	0.85	99	63
September 2013	0.62	0.82	77	58
October 2013	0.77	1.18	120	57
November 2013	0.84	1.38	69	36
December 2013	0.86	1.30	74	65
AVERAGE	**0.77**	**1.33**	**103**	**53**

FIGURE 11

West WWTP Effluent BOD and TSS

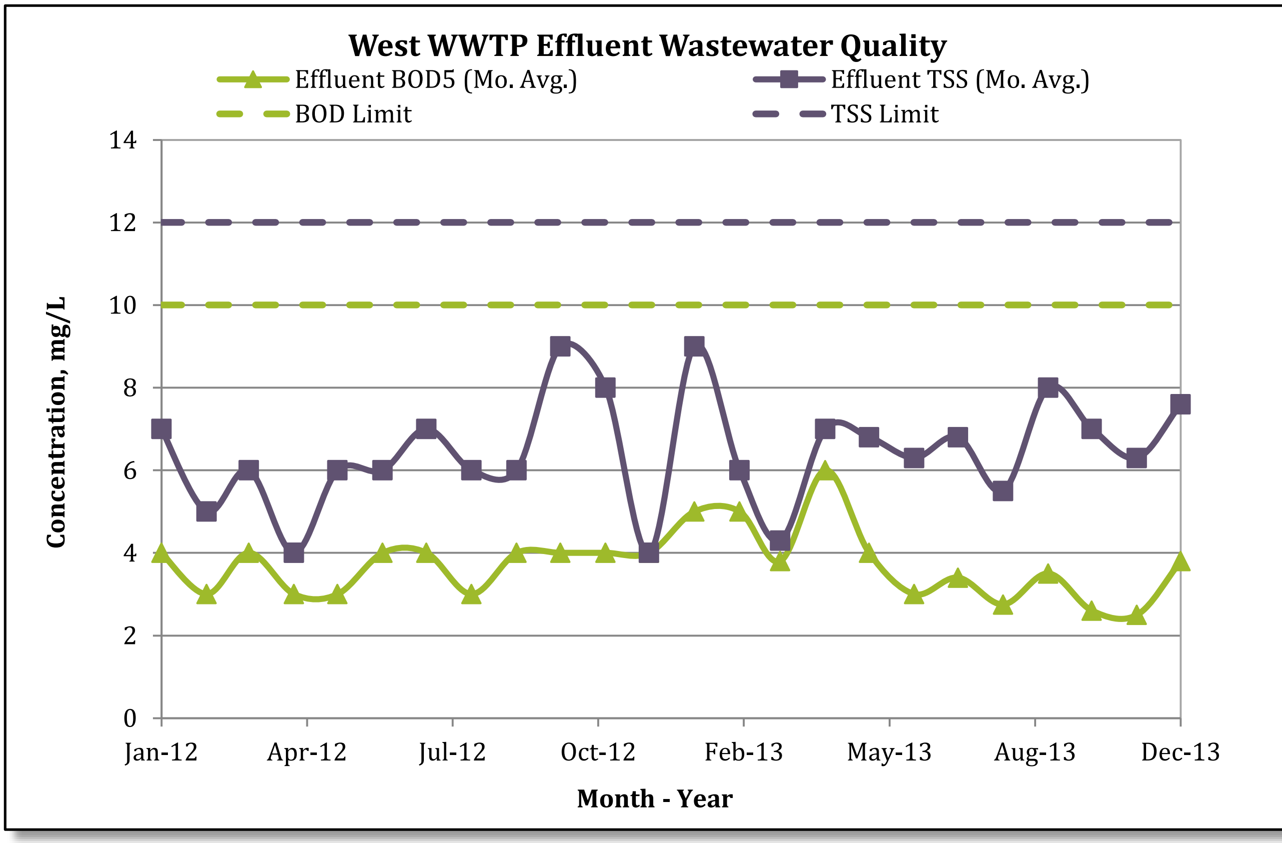


FIGURE 12

West WWTP Effluent Ammonia

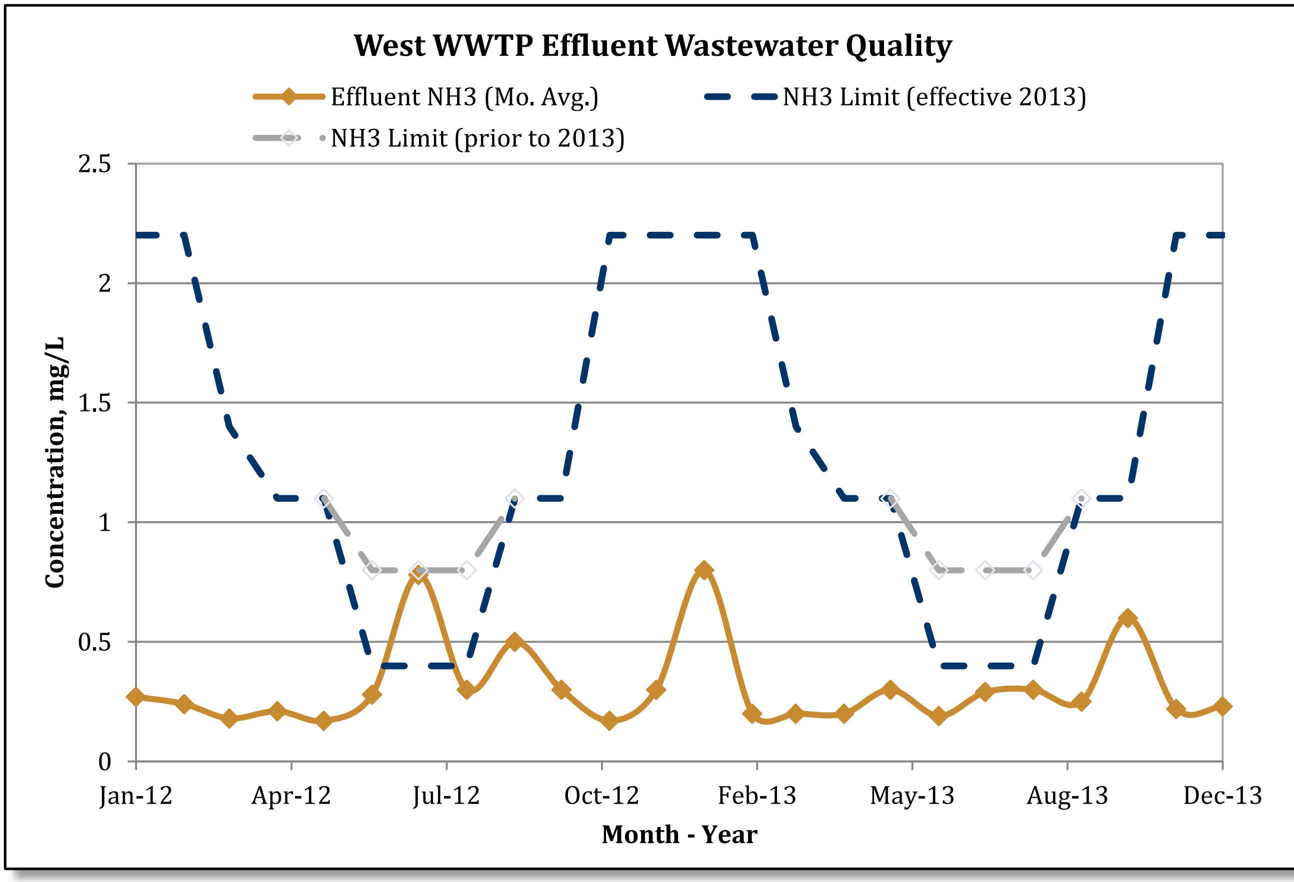


TABLE 8

West WWTP Effluent Wastewater Quality

Month - Year	Monthly Average (MGD)	Effluent BOD (mg/L)	Effluent TSS (mg/L)	Effluent NH_3-N (mg/L)
January 2012	0.95	4.0	7.0	0.3
February 2012	0.84	3.0	5.0	0.2
March 2012	1.01	4.0	6.0	0.2
April 2012	0.88	3.0	4.0	0.2
May 2012	1.13	3.0	6.0	0.2
June 2012	0.84	4.0	6.0	0.3
July 2012	0.83	4.0	7.0	0.8
August 2012	0.88	3.0	6.0	0.3
September 2012	0.91	4.0	6.0	0.5
October 2012	0.98	4.0	9.0	0.3
November 2012	0.92	4.0	8.0	0.2
December 2012	0.91	4.0	4.0	0.3
January 2013	1.01	5.0	9.0	0.8
February 2013	1.31	5.0	6.0	0.2
March 2013	1.45	3.8	4.3	0.2
April 2013	1.61	6.0	7.0	0.2
May 2013	1.40	4.0	6.8	0.3
June 2013	1.08	3.0	6.3	0.2
July 2013	0.92	3.4	6.8	0.3
August 2013	0.92	2.8	5.5	0.3
September 2013	1.21	3.5	8.0	0.3
October 2013	1.10	2.6	7.0	0.6
November 2013	1.14	2.5	6.3	0.2
December 2013	1.15	3.8	7.6	0.2
AVERAGE	**1.06**	**3.7**	**6.4**	**0.3**

4.3 Regional WWTP

Figure 13 through Figure 16, Table 9, and Table 10 demonstrate the facility loadings and performance at the Regional WWTP for the period of January 2012 through December 2013. The Regional WWTP exceeded its ammonia limit in June 2012.

FIGURE 13

Regional WWTP Flow Rates

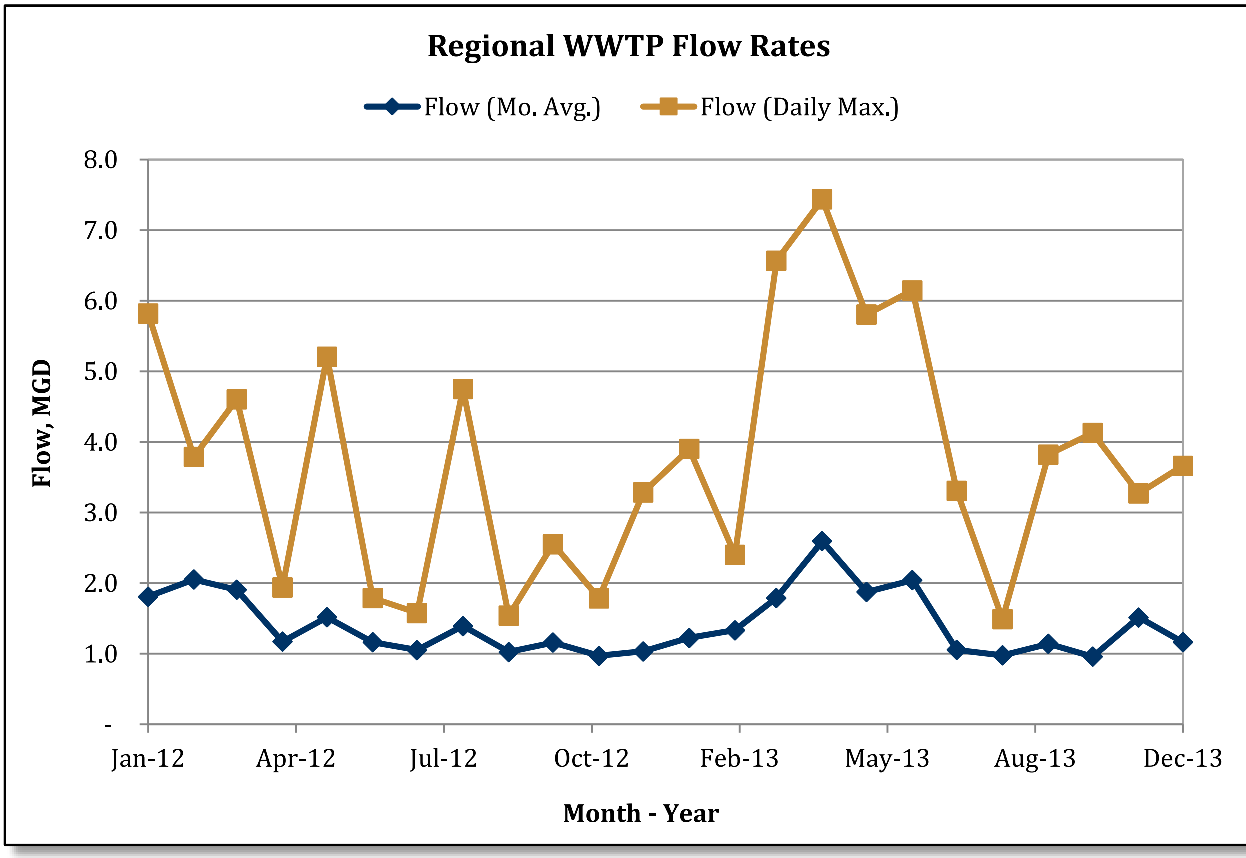


FIGURE 14

Regional WWTP Influent Wastewater Quality

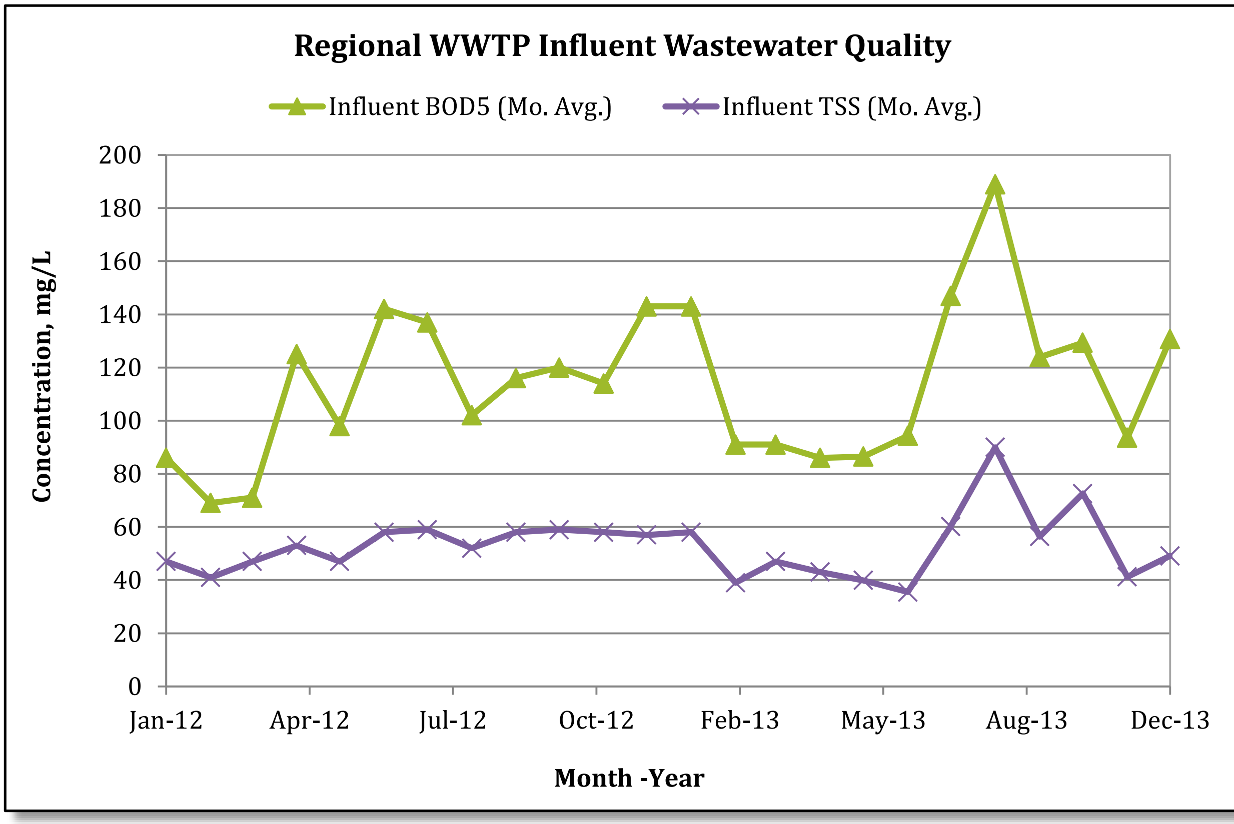


TABLE 9

Regional WWTP Influent Wastewater Quality

Month - Year	Monthly Average (MGD)	Daily Maximum (MGD)	Influent BOD (mg/L)	Influent TSS (mg/L)
January 2012	1.81	5.82	86	47
February 2012	2.05	3.79	69	41
March 2012	1.91	4.60	71	47
April 2012	1.17	1.94	125	53
May 2012	1.52	5.21	98	47
June 2012	1.16	1.79	142	58
July 2012	1.05	1.58	137	59
August 2012	1.39	4.75	102	52
September 2012	1.03	1.54	116	58
October 2012	1.16	2.55	120	59
November 2012	0.97	1.79	114	58
December 2012	1.03	3.29	143	57
January 2013	1.23	3.90	143	58
February 2013	1.33	2.40	91	39
March 2013	1.79	6.57	91	47
April 2013	2.60	7.44	86	43
May 2013	1.88	5.81	87	40
June 2013	2.04	6.15	94	36
July 2013	1.06	3.31	147	60
August 2013	0.98	1.49	189	90
September 2013	1.14	3.82	124	56
October 2013	0.96	4.13	129	73
November 2013	1.52	3.27	94	41
December 2013	1.16	3.66	131	49
AVERAGE	**1.41**	**3.78**	**114**	**53**

FIGURE 15

Regional WWTP Effluent BOD and TSS

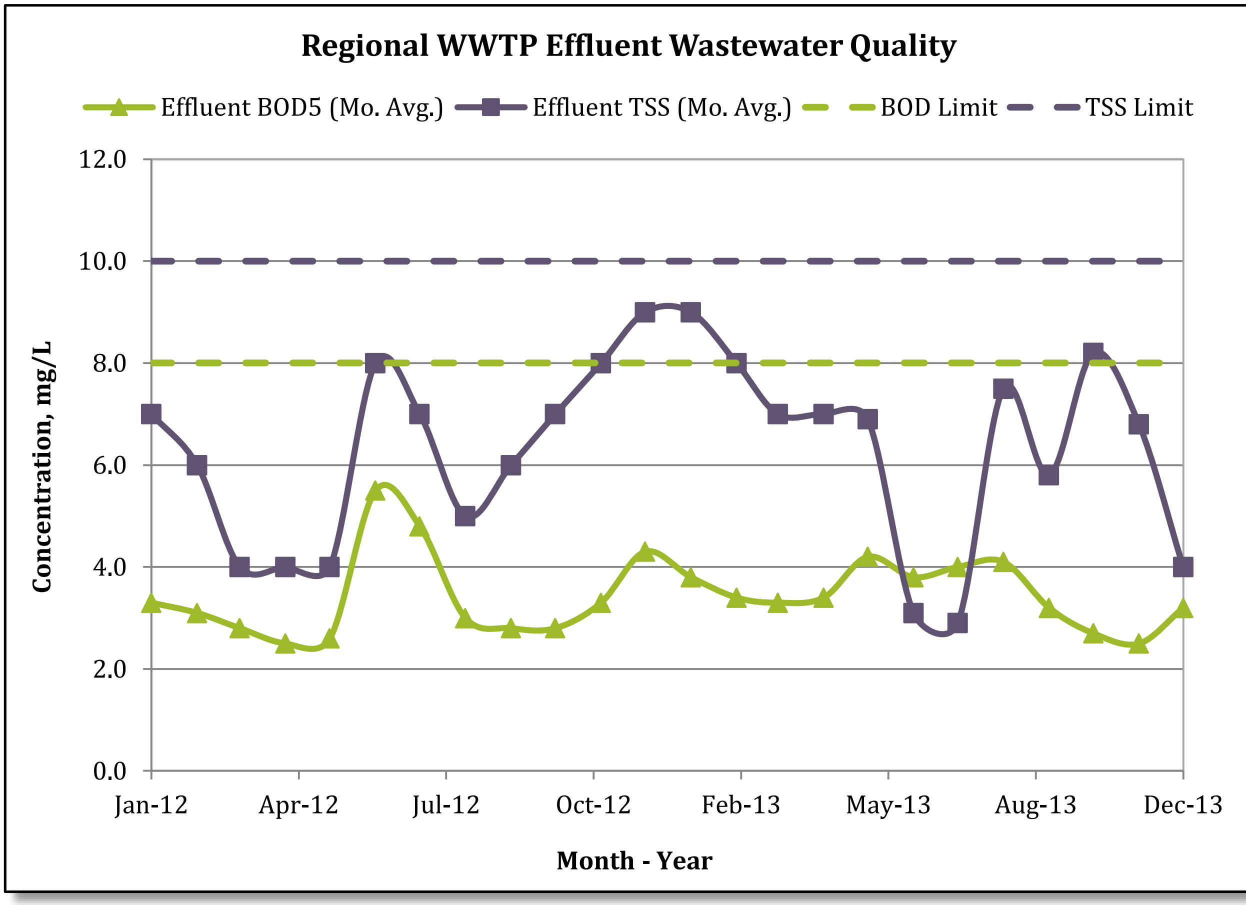


FIGURE 16

Regional WWTP Effluent Ammonia

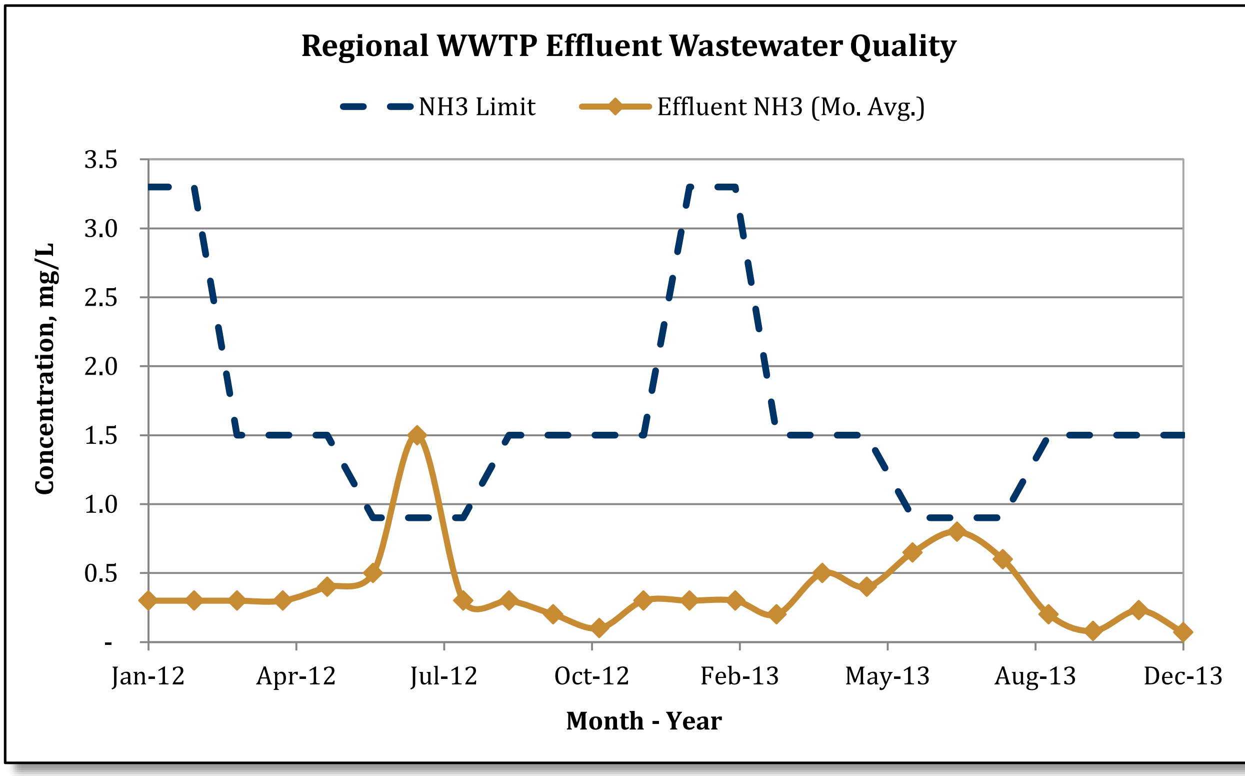


TABLE 10

Regional WWTP Effluent Wastewater Quality

Month - Year	Monthly Average (MGD)	Effluent BOD (mg/L)	Effluent TSS (mg/L)	Effluent NH_3-N (mg/L)
January 2012	2.09	3.3	7.0	0.3
February 2012	2.59	3.1	6.0	0.3
March 2012	1.98	2.8	4.0	0.3
April 2012	0.75	2.5	4.0	0.3
May 2012	1.50	2.6	4.0	0.4
June 2012	1.16	5.5	8.0	0.5
July 2012	0.72	4.8	7.0	1.5
August 2012	0.81	3.0	5.0	0.3
September 2012	1.56	2.8	6.0	0.3
October 2012	1.10	2.8	7.0	0.2
November 2012	1.21	3.3	8.0	0.1
December 2012	1.33	4.3	9.0	0.3
January 2013	1.53	3.8	9.0	0.3
February 2013	1.81	3.4	8.0	0.3
March 2013	2.36	3.3	7.0	0.2
April 2013	3.66	3.4	7.0	0.5
May 2013	2.10	4.2	6.9	0.4
June 2013	2.30	3.8	3.1	0.7
July 2013	1.12	4.0	2.9	0.8
August 2013	0.88	4.1	7.5	0.6
September 2013	1.03	3.2	5.8	0.2
October 2013	1.17	2.7	8.2	0.1
November 2013	1.75	2.5	6.8	0.2
December 2013	1.21	3.2	4.0	0.1
AVERAGE	**1.57**	**3.4**	**6.3**	**0.4**

5. NORTH WWTP ASSESSMENT

The physical condition of the accessible portions and equipment of the North WWTP was assessed to identify deficiencies and associated project costs and upgrades. The assessments were developed through on-site inspections, discussions with Village staff, and review of record documents. The project costs are based on historical data from similar construction projects, manufacturer's quotations, and industry estimating databases.

The North WWTP has a design average flow (DAF) of 1.35 MGD and a design maximum flow (DMF) of 3.79 MGD. The WWTP was originally constructed in 1970 and was upgraded in 1980 and again in 1998. The Village has completed smaller improvement projects intermittently throughout the years. A site plan of the facility is included in Exhibit C.

The Village operates the WWTP under NPDES Permit No. IL0045403, which permits discharge to Union Ditch, a tributary of Hickory Creek. NPDES permits are renewed every five years, and the current permit has an expiration date of November 30, 2012. The Village submitted for renewal of the permit in Spring 2012. A permit renewal has not been drafted. A copy of the North WWTP permit is included in Appendix A. Under the permit, the discharge must not exceed the effluent limits set forth in Table 11. Figures 5 through 8 demonstrate the actual performance of the WWTP.

TABLE 11

North WWTP Effluent Limits, NPDES IL0045403

Parameter	Monthly Average	Weekly Average	Daily Maximum	Units
$CBOD_5$	10		20	mg/L
Suspended Solids	12		24	mg/L
Dissolved Oxygen	Shall not be less than 6 mg/L			
pH	Shall be in the range of 6 to 9 standard units			
Fecal Coliform (May - Oct.)	Daily Maximum shall not exceed 400 per 100 mL			
Chlorine Residual			0.05	mg/L
Ammonia Nitrogen (as N)				
April – May/ September - October	1.1		2.9	mg/L
June – August	0.8	2.0	2.9	mg/L
November - February	2.2		4.6	mg/L
March	1.5	3.8	3.8	mg/L
Chloride	Monitoring Only			

The WWTP process currently consists of a raw sewage pump station, primary clarifiers, activated sludge process (single stage nitrification), final settling, RAS/WAS pump station, tertiary filters, and chlorination. The North WWTP disinfects seasonally for the period of May through October. The sludge is treated via aerobic digestion. There is no sludge storage on-site. Instead, sludge is hauled directly from the digesters on roughly a monthly basis. There is an excess flow lagoon for storage of excess flows.

Recently, the North WWTP has had difficulty meeting ammonia limits. In June 2013, after maintenance on a submersible mixer, the WWTP lost nitrification performance. Increased ammonia loadings were observed at this time as well. The North WWTP subsequently exceeded its effluent ammonia limit for the months of June, July, August, September, and December 2013. In addition, failures of the electrical system, air pipes, and blowers have each presented intermittent problems to exacerbate the challenges.

5.1 Equipment Conditions

The major operational concerns are equipment failure due to age. In addition, the electrical components are antiquated and replacement is recommended. The current condition of each process is summarized below.

Electrical – The electrical service to the North WWTP is 240 V B-phase ground. There is no generator or second feed for backup power. ComEd is currently evaluating upgrading the service to 600A. The Village is in the process of increasing the size of the main motor control center for the controls and the switchgear.

Raw Sewage Pump Station – The Raw Sewage Pump Station includes the original Smith & Loveless dry-pit lift station with pumps, an additional submersible pump, a bar screen and grinder. The lift station accepts flow from the north and east. The structure is corroded and leaking. The pumps include two 8-inch dry-well pumps installed in the original construction and one 10-inch submersible pump installed in 1998. The pumps operate at a single speed and do not have variable frequency drives (VFDs).

The original bar screen was removed a number of years ago by the previous owner of the plant. Rags and other debris cause considerable operational difficulties. Operators must take the 8-inch pumps offline weekly to remove clogged material from the pump impellers. The motors and impellers for these pumps have been replaced. However, piping and check valves for the pump discharges need to be replaced.

A grinder was installed during plant modifications in 1998 to help with the pump clogging. The grinder was taken from a different process and installed downstream of the raw sewage pumps with no bypass option. In the event of failure of the grinder, basement backups would occur in the collection system. Therefore, the grinder was removed from service in 2000. The use of in-line grinders without screening or a bypass is not recommended.

The influent flowmeter is a mag-meter located on the 14-inch diameter force main to the primary clarifiers.

Primary Clarifiers – The North WWTP has two, 50-foot diameter primary clarifiers that were constructed in 1998. The clarifiers have a surface settling rate of 967 gallons per day per square foot (gpd/ft^2) at the daily maximum flow of 3.79 MGD. At this settling rate, the design BOD removal is about 35%. The clarifier components are adequately sized.

The primary clarifier components include a sludge collector mechanism, weirs, piping and valves. The clarifier drive and scraper equipment was manufactured by Walker Process. The primary clarifiers were covered with fiberglass-reinforced plastic (FRP) covers after initial construction for odor control. The weight of rags on the collector mechanisms has caused the covers to interfere with the clarifier mechanism. This led to damage and subsequent failure of the clarifier drive and scrapers.

With the lack of screening at the headworks, the clarifiers routinely fill with rags and debris, causing the telescoping valves to plug. There is a submersible sludge pump in each primary clarifier pit. Each is a KSB vortex-type pump. The pumps cannot be installed because of considerable debris in the pit obstructing connection points. Operators have noted preference of positive displacement pumps in place of submersible pumps.

The primary clarifiers generate considerable odors. The primary sludge produced also generates significant odors as primary sludge enters the aerobic digesters. Neither the primary clarifiers nor the aerobic digesters are outfitted with odor control. The amount of primary sludge contributes to the overloading of the aerobic digesters as currently sized. It is for these reasons that the clarifiers are not currently functional.

Activated Sludge Process – The activated sludge tanks were originally designed as package plants (manufactured by Davco) and later upgraded to a single-stage nitrification process with anoxic center zones. Because the primary clarifiers are offline, the wastewater flows directly from the Raw Sewage Pump Station to the Aeration Tanks. The West aeration tank is 74-ft diameter, and the East aeration tank is 67-ft diameter. Each tank has two mixers in the center zone and multiple drop-legs for aeration piping. The mixers were originally installed in 1998. Diffusers have been modified throughout the years due to debris accumulation in the aeration tanks.

The hydraulic detention time of the aeration tanks is 15 hours at the permitted DAF. The design organic loading at the DAF is 13 pounds of BOD per thousand cubic feet per day (ppd BOD/kcf). The design organic loading complies with the 15 ppd BOD/kcf standard set by the Illinois Recommended Standards for Sewage Works (IRSSW) for single stage nitrification. However, with the primary clarifiers offline, the organic loading rate is higher than the design rate. The loading rate with the primary clarifiers offline is 21 ppd BOD/kcf. The tanks have insufficient space for single-stage nitrification at current operation.

The metal tanks that house the activated sludge process are beyond their design life. In addition, there have been structural modifications throughout the years that have affected performance, including re-configuration of baffles and flow control into various zones. Recently, the North WWTP has had difficulty meeting current nitrification limits. With these items to consider, the activated sludge tanks should be demolished. New tanks should be constructed to provide a single-stage nitrification process with provisions for biological or chemical phosphorus removal.

The North WWTP currently operates an activated sludge system. However, other process configurations are available for secondary treatment. The Regional WWTP, for example, uses an oxidation ditch for secondary treatment. An oxidation ditch is not an option for the North WWTP because of site space limitations. A sequencing batch reactor (SBR) system is an alternative configuration that the Village may explore. As compared to conventional activated sludge, in which treatment components occur in tanks dedicated to each process, SBRs undergo aeration and sedimentation in a single tank according to a time sequence. The level of treatment achievable from an SBR system is similar to that of conventional activated sludge.

Aeration System Blowers – The North WWTP has three multistage centrifugal blowers, each with a 75 horsepower (hp) motor for producing 1,900 standard cubic feet per minute (scfm) at 6.7 psi. The blowers provide oxygen and mixing energy to the aeration tanks and aerobic digesters.

Untimely blower or motor failures throughout the last several years have caused blowers to be out of service. This has impacted treatment performance and forced the plant to rely on two or three blowers at a time. ComEd electrical controls have interrupted blower power supply, further compounding operational challenges. Operators have noted shortages of process air that can be attributed to leaks in air piping that have subsequently been repaired.

Based on the influent wastewater characteristics, the blowers should have adequate capacity. However, the inadequate aeration tank volume limits the ability of the process to nitrify. Furthermore, the aeration tanks may be experiencing higher loadings than they are designed for due to high sidestream loadings. The blowers should be replaced promptly. During replacement, the Village should consider high-efficiency options for blowers to reduce power consumption and maintenance requirements.

Aeration System Diffusers – The aeration zone diffusers have been modified over time. The original diffusers in the East aeration tank were Sanitaire coarse-bubble diffusers (the same type used in the aerobic digesters). The original diffusers in the West aeration tank were square tubes with reeds. The existing aeration system provides coarse air, which produces turbulent mixing. Since construction of new aeration tanks is recommended, new diffusers must be provided. High-efficiency aeration system diffusers are recommended at the North WWTP for the aeration tanks to improve performance and reduce electrical usage.

Aeration System Piping – There are leaks in the aeration system piping. The piping should be completely replaced during the aeration system improvements.

Final Clarifiers – The North WWTP has two final clarifiers, each with a 75-ft diameter. The clarifiers have a 12-ft side wall depth, which meets the IEPA required minimum. The maximum recommended surface settling rate for intermediate settling tanks after an activated sludge process is 1,000 gpd/ft^2 based on the design peak hourly flow. The North WWTP final clarifiers have a surface settling rate of 450 gallons per day per square foot at the DMF.

The secondary clarifiers provide adequate settling and performance at current loadings. The North clarifier drive was replaced in 2008. The South clarifier drive was replaced more recently. The weirs are covered, and the covers must be replaced. Sludge collector mechanisms are in poor condition and must be replaced.

At some point, the center rings of the clarifiers were modified to have a larger pass-through zone. This was in response to excessive floating solids in the center ring. IEPA inspectors have noted that they do not approve of the foam, a result of the center-ring modifications. Adequate sludge digestion and handling facilities are needed to address the solids in the clarifiers.

The clarifiers must be taken down once to twice a month to clean the center well for rags. Operators can add polymer to the activated sludge to assist with settling in the clarifiers.

RAS/WAS Pumps – The North WWTP has three RAS pumps sized for 600 gpm, each. These pumps return activated sludge to the aeration tanks to maintain healthy biology. There are also two WAS pumps sized at 200 gpm, each. The WAS pumps transfer sludge from the clarifiers to the aerobic digesters. The RAS flowmeters were recently replaced.

The RAS and WAS pumps have significant problems with rags and are taken out of service frequently for maintenance. The pumps were installed as part of the most recent improvement in 1998 and should be replaced in approximately five years as they approach the end of their useful life.

Tertiary Filters – The two existing sand filters are in poor condition and severely corroded. Only one is operable and in use. The filters are part of the original construction and manufactured by Davco. Parts are obsolete. The existing units should be abandoned and replaced with disc filters. The electrical and HVAC in the filter building must be replaced entirely.

Disinfection – The North WWTP disinfects the effluent on a seasonal basis during the months of May through October. Gaseous chlorine is applied via cylinders housed on-site. The required contact time is 15 minutes, which the North WWTP meets through a combination of time in the effluent pipe and two chlorine contact tanks. Dechlorination is applied downstream of the filters.

Due to the proximity to residences and schools, UV disinfection should be considered as an alternative to chlorination.

Aerobic digestion – There are two aerobic digesters at the North WWTP, each with 44'-3" diameter. IRSSW standards require the equivalent of 67,500 cubic feet of digestion capacity. The existing capacity is only 45,600 cubic feet. The aerobic digesters do not have adequate capacity for digestion. In addition, regulations require 150 days of sludge storage on-site. The North WWTP has none. These solids handling limitations require a dependency on a third-party sludge processing contractor to be on-site at four-week intervals. When they are late, it results in solids backing up throughout the WWTP because operators are unable to waste.

In addition to the volume limitations, the aerobic digesters are in very poor condition. The steel structures are delaminating. Aeration equipment, including blowers and diffusers, are in poor condition and must be replaced. The access platforms and railings should be replaced. A wider decant range is desired for improving decanting operations.

There are problems with grading in this area. During wet weather events, stormwater accumulates at the front of the Digester Control Building and flows through the control room. Efforts are currently underway to regrade the site, which has helped to control stormwater runoff.

The HVAC is in poor condition and should be replaced entirely. The electrical in the Digester Control Building is all from the 1980 original construction, and the power feed type, Phase B ground (corner grounded delta supply) is obsolete. The motor control center feeding power to the blowers was recently replaced. Efforts are currently underway to improve the incoming power and electrical controls.

The aerobic digesters should be demolished entirely, and new aerobic digesters and a control/blower building should be constructed.

Sludge storage – As mentioned previously, the North WWTP has no sludge storage and therefore is out of compliance with IRSSW standards. Liquid sludge storage or thickening with dewatered sludge storage must be constructed.

Excess Flow Lagoon – The excess flow lagoon has surface aerators that originally served for polishing the excess flow. The aerators are not currently functional. The excess flow equalization pumps are currently functional and relatively new.

Administration Building, Laboratory, and Garage - The Administration Building was constructed in 1980. The building is small and has minimal functionality. The Village should consider replacing this building. The doors and frames to the building are flaking and need to be replaced. Brickwork around the building requires additional repairs. The roof was replaced recently. The ventilation units for the building are corroded and in poor condition. They should be replaced. The electrical transformer in the building needs to be upgraded to provide sufficient capacity for the unit heaters.

SCADA – The North WWTP has minimal SCADA alarming and no online monitoring. The alarmed items include a chlorine gas detector alarm, intrusion security alert, power failure alarm, and a high water alarm at the raw sewage pump station.

Site – The site pavement is in poor condition and in need of replacement. The nearest delineated floodplain has a 100-year elevation of 681-foot AMSL (at the confluence of Union Ditch and Hickory Creek). The North WWTP site is outside of the 100-year flood elevation.

Non-Potable Water System – The non-potable water system leaks and is not functional.

5.2 Rehabilitation Costs

Rehabilitation of the activated sludge aeration system, proposed as Activated Sludge System (Alternative A), will improve the North WWTP's ability to nitrify and continue to meet its current ammonia limit. The probable cost of rehabilitating the activated sludge aeration system is $2.42 million (in 2014 project costs). However, the Village should consider that the existing steel aeration tanks are over forty years old and will need to be demolished in the near future. The ultimate recommendation for the North WWTP is the abandonment of the existing aeration tanks for construction of new concrete tanks that allow for full nitrification. Non-destructive testing is recommended to evaluate the structural integrity and remaining operating lifetime of the tanks. If the Village chooses to construct interim improvements in the existing tanks, new tanks will need to be constructed likely in 2024. The results of structural evaluation should be used as the basis for planning the timeframe for new tank construction. The blowers would be able to be re-used; however, new diffusers would need to be installed.

Activated Sludge System (Alternative B) includes construction of new concrete aeration tanks as part of the short-term aeration improvements. This results in a lower overall cost; however, it results in a higher short-term cost.

The engineer's opinion of probable cost for equipment rehabilitation at the North WWTP, shown in Table 12, is approximately $22.5 million, not including Activated Sludge System (Alternative B). Note that this cost considers only improvements required to continue treatment at the current limits.

An evaluation was performed to determine the staffing requirements to perform typical maintenance and operations maintenance. The evaluation took into account productivity and time not worked due to holidays, vacation time, sick time, and professional development. In order to provide sufficient man-power, the North WWTP requires three full-time operators. A more detailed outline of the staffing assessment is presented in Appendix G.

TABLE 12

20-Year North WWTP Equipment Replacement Costs

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
EQUIPMENT REPLACEMENT												
Raw Sewage Pump Station	Construct a Raw Sewage Pump Station for replacing the aged dry well. Replace the raw sewage pumps with three raw sewage Pumps, two excess flow pumps, influent flowmeter and sampler, piping, and valves. Demolish the existing Raw Sewage Pump Station and Valve Vaults.	1980; 1998	20	34; 16	Ø; 4	Significant Deterioration	Equipment Condition	0-5 years	$ 1,670,000	2015	2016	$ 1,880,000
Screening Building	Construct a Screen Building and install one mechanically-cleaned fine screen with a manual bypass bar screen. Demolish the existing grinder vault.	N/A	20	N/A	N/A	N/A	Operational Issues	Immediate	$ 1,670,000	2014	2015	$ 1,810,000
Primary Clarifiers	Cleanout, inspect and repair*	1998	20	16	4	Operational Issues (Not functioning)	Equipment Failure/ Current Non-Compliance	Immediate	$ 250,000	2014	2015	$ 271,000
Activated Sludge System (Alternative A)	Construct a new Blower Building, including three new blowers. Replace diffusers in the aeration tanks. Replace the electrical system throughout the WWTP. Construct an Electrical Building for feeding the new power supply and housing electrical components.	1980	20	34	Ø	Significant Deterioration	Equipment Failure/ Current Non-Compliance	Immediate	$ 2,420,000	2014	2015	$ 2,620,000
Aeration Tanks - Activated System (Alternative A - Phase 2)	Construct three aeration tanks for a single-stage nitrification activated sludge process. Provide activated sludge aeration equipment, including replacing diffusers and control instrumentation. Demolish the existing Aeration Tanks.	1970	30	44	Ø	Significant Deterioration	Equipment Condition	5-15 years	$3,940,000	2024	2025	$6,310,000

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
Aerobic Digester	Construct four Aerobic Digesters, including diffusers, digester feed and digested sludge pumps, and covers. Install one additional blower in the Blower Building. Demolish the existing Aerobic Digesters which are undersized.	1970	30	44	Ø	Significant Deterioration	Equipment Failure/ Future Non-Compliance	0-5 years	$ 3,210,000	2017	2018	$ 3,910,000
Sludge Storage*	Provide one Liquid Sludge Storage Tank with Jet Mixing System and Sludge Loading Pump.	N/A	20	N/A	N/A	N/A	Current Non-Compliance	0-5 years	$ 2,580,000	2017	2018	$ 3,140,000
Tertiary Filter	Remove the existing sand filters. Install two disc filters. Rehabilitate the Tertiary Filter Building, including replacing HVAC, lighting, repainting, and replacing all interior piping.	1970	20	44	Ø	Significant Deterioration	Equipment Condition	0-5 years	$ 1,980,000	2018	2019	$ 2,510,000
RAS / WAS Pumps	Replace the existing RAS/WAS Pumps.	1998	20	16	4	Minor Defects Only	Equipment Condition	5-15 years	$ 320,000	2020-2024	2021	$ 438,000
Secondary Clarifiers	Replace clarifier equipment and drives.	1998	20	16	4	Moderate Deterioration	Equipment Condition	5-15 years	$ 1,340,000	2022-2026	2023	$ 1,980,000
Disinfection	Remove the existing chlorination system, and demolish the existing chlorine contact tank. Construct a UV disinfection channel, and install UV disinfection equipment, effluent metering and sampling equipment.	1970	20	44	Ø	Moderate Deterioration	Equipment Condition	5-15 years	$ 1,540,000	2024-2028	2025	$ 2,470,000
Excess Flow Pumps	Replace two Excess Flow Lagoon flow equalization pumps.	2014	20	0	20	Excellent or New Condition	Equipment Condition	>15 years	$ 140,000	2029	2029	$ 262,000
Offices	Provide new office buildings for the North WWTP.	1970	50	44	6	Moderate Deterioration	Equipment Condition	>15 years	$ 750,000	2030	2030	$ 1,460,000
Non-Potable Water System	Provide three Non-Potable Water Pumps and one Non-Potable Water Building.	1970	30	44	Ø	Significant Deterioration	Equipment Condition	>15 years	$ 710,000	2031	2031	$ 1,440,000
									$22,520,000			**$30,480,000**
FUTURE COMPLIANCE												

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
Phosphorus Removal	Construct a Chemical Storage Building to house a phosphorus removal chemical storage tank with mixing system and two metering pumps.	N/A	N/A	N/A	N/A	N/A	Future Non-Compliance	N/A	$ 730,000	2017	2018	$ 888,000
									$23,250,000			**$31,370,000**
ALTERNATIVES												
Activated Sludge System (Alternative B)	Construct three aeration tanks for a single-stage nitrification activated sludge process. Provide activated sludge aeration equipment, including replacing diffusers and control instrumentation. Demolish the existing Aeration Tanks. Construct a new Blower Building, including three new blowers. Replace the electrical system throughout the WWTP. Construct an Electrical Building for feeding the new power supply and housing electrical components.	1970	30	44	Ø	Significant Deterioration	Future Non-Compliance	N/A	$ 6,060,000	2017	2018	$ 7,370,000

Notes:

* The Project Year Cost is calculated based on the anticipated project year for construction and assuming 4% inflation per year.

* Primary Clarifier assumes that equipment is found to be in good condition and only requires minor repairs.

* Activated Sludge System (Alternative A) does not include the cost of constructing new aeration tanks. The existing tanks are steel and must be replaced within the next ten years. The cost for tank replacement is presented as Aeration Tanks - Activated System (Alternative A - Phase 2)

* Sludge Storage Improvements will likely be required together with the Aerobic Digester Improvements and may be required as part of the Activated Sludge Aeration Improvements.

6. WEST WWTP ASSESSMENT

The physical condition of the accessible portions and equipment of the West WWTP was assessed to identify deficiencies and associated project costs and upgrades. The assessments were developed through on-site inspections, discussions with Village staff, and review of record documents. The project costs are based on historical data from similar construction projects, manufacturer's quotations, and industry estimating databases.

The West WWTP has a design average flow (DAF) of 1.3 MGD and a design maximum flow (DMF) of 3.9 MGD. The WWTP was originally constructed in the 1959 and was upgraded in 1972, 1987 and again in 2010. The Village has completed smaller improvement projects intermittently throughout the years. A site plan of the facility is included in Exhibit D, along with a general depiction of the location of the floodway.

The Village operates the WWTP under NPDES Permit No. IL0020532, which permits discharge to an Unnamed Tributary of Hickory Creek. NPDES permits are renewed every five years, and the current permit has an expiration date of September 30, 2015. A copy of the West WWTP permit is included in Appendix B. Under the permit, the discharge must not exceed the effluent limits set forth in Table 13. Figures 9 through 12 demonstrate the actual performance of the WWTP.

TABLE 13

West WWTP Effluent Limits, NPDES IL0020532

Parameter	Monthly Average	Weekly Average	Daily Maximum	Units
$CBOD_5$	10		20	mg/L
Suspended Solids	12		24	mg/L
pH	Shall be in the range of 6 to 9 standard units			
Fecal Coliform (May - Oct.)	Daily Maximum shall not exceed 400 per 100 mL			
Chlorine Residual			0.05	mg/L
Ammonia Nitrogen (as N)				
April – May / September - October	1.1		1.5	mg/L
June – August	0.4	1.0	1.5	mg/L
November - February	2.2		4.6	mg/L
March	1.4	3.8	3.2	mg/L
Total Phosphorus	Monitoring Only			mg/L
Total Nitrogen	Monitoring Only			
Chloride			500	mg/L

Dissolved Oxygen				
March – July		6.0	5.0	mg/L
August – February	5.5	4.0	3.5	mg/L

The WWTP process currently consists of a raw sewage pump station with grinder, raw sewage transfer pumps, primary clarifiers, activated sludge process for BOD removal, intermediate clarifiers, RAS/WAS pump station, nitrification in packed bed reactors, final settling, tertiary filters, and chlorination. The West WWTP disinfects seasonally for the period of May through October. The sludge is treated via aerobic digestion. There is no sludge storage on-site. Instead, digested sludge is either hauled directly from the digesters or transferred to the Regional WWTP via an influent transmission pipe. There is an excess flow clarifier.

A significant portion of the West WWTP site is located in the floodway. The floodplain elevation at the West WWTP is approximately 701'-6" AMSL. The wet well, aeration tanks, intermediate clarifiers, final clarifiers, filters, and chlorine contact tank are all in the floodway and susceptible to inundation at the 100-year flood. If the Village decided to improve the West WWTP, the construction would need to take place outside of the floodway and compensatory storage would be required for any filling in the floodplain.

The WWTP typically meets effluent limits but struggles with ammonia limits. Furthermore, effluent limits for ammonia are expected to be reduced by a factor of two in the next permit renewal. In addition, phosphorus limits will likely be added to the permit. The major operational concerns are equipment failure due to age. In addition, the electrical components are antiquated and replacement is recommended. The current condition of each process is summarized below.

6.1 Equipment Conditions

Influent Flowmeter – The influent meter is a Parshall flume with flow level transmitter. The West WWTP is subject to considerable I/I. The flowmeter does not provide adequate readings during high-flow events.

Grinder – The existing equipment effectively grinds incoming particles during average flows. However, the grinder is topped during high flow events. In addition, the use of grinders is only recommended when primary clarifiers are operated downstream, according to IRSSW requirements. As discussed later, the primary clarifiers are partially offline and abandonment is recommended. Therefore, the grinder should be replaced and a screening system should be installed to remove debris from the influent wastewater.

Control Building – The Control Building houses several functions including the laboratory, offices, raw sewage pumps, flood pumps, and primary sludge pumps.

Laboratory and Offices – The laboratory and offices are in fair condition. Recently, improvements have been made to partition the generator from the offices. The HVAC system was refurbished in 2010. The electrical system in this building should be replaced entirely.

Electrical Feed and Generator – The West WWTP has two separate electrical feeds with two different voltages. The west feed, at 480 V, serves the Packed Bed Reactors, Aerobic Digesters, and Intermediate and Final Clarifiers, Sand Filter Building, and Blower Building. The east feed, at 240 V, on the other hand, serves the Control Building, Primary Clarifiers, and Raw Sewage Pumps.

The generator in the Control Building only feeds the power for the east side of the WWTP**.** The generator was installed in 1983 as part of the improvements that year. It is undersized and only feeds 240V power. It should be replaced, and a new generator (with transformer) provided that can provide back-up power for the equipment that operates on 480V as well.

Raw Sewage Pumps – The West WWTP has three raw sewage pumps, each designed for 900 gpm at 29-ft TDH. The pumps are located in the basement of the Control Building in a dry-pit application. However, they were supplied with submersible motors in the event of a flooded basement and the motors are cooled by running tap water over the motor enclosure on a constant basis. The pumps were installed in 1983 and should be replaced because of age and condition (improper motor selection).

All original piping in the Control Building is still present. Pump inlet valves are not functional and must be replaced. Check valves are currently replaced every other year. Debris removal, such as screening, will reduce the check valve maintenance. All piping and valves for the Raw Sewage Pumps should be replaced.

Flood Pumps and Transfer Pumps – There are three existing, submersible flood pumps located in the Flood Pump Wet Well inlet structure. One pump serves to transfer flow to the Regional WWTP, one pump can transfer flow to Regional WWTP or back into the West WWTP, and one pump serves as an excess flow pump. The pumps are designed for 2,100 gpm each. One of these pumps was in use prior to the 1983 construction and was moved to the flood pump location. The other two pumps were installed new in 1983. These pumps have exceeded their useful life and should be replaced.

Primary Clarifiers – The West WWTP has three existing primary clarifiers. The clarifiers are 20-ft, 25-ft, and 40-ft diameter. The 40-ft diameter clarifier was constructed in 1983. The other clarifiers were constructed prior.

The allowable surface settling rate for primary clarifiers is 1,000 gpd/ft^2 at daily maximum flow rates. Instead, the clarifiers were designed to meet the allowable surface settling rate at the daily average flow rate. With all clarifiers online, the surface settling rate is 1,900 gpd/ft^2 at the daily maximum flow of 3.9 MGD. At this settling rate, the clarifiers are not adequately sized.

The allowable flow rate through the clarifiers should be based on the maximum flow rate. Using the allowable surface settling rate, the total allowable flow that can be sent through the primary clarifiers is 2.0 MGD. Therefore, the clarifiers can operate effectively only to a peak flow of 2.0 MGD.

The clarifier equipment for the two smaller clarifiers is not functioning, and these clarifiers are offline. The 40-ft diameter clarifier's bottom scraper was recently replaced after damage, and this clarifier is in service currently. However, the top air and gear reducer must be replaced due to condition. With only a single clarifier online, the primary clarifier process is far overloaded and performance is poor.

Due to the cost of constructing new primary clarifier facilities, odors generated from primary sludge, and need to expand the aeration tanks regardless (see below), the clarifiers should be abandoned.

Primary Sludge Pumps – There are two Watson-Marlow plunger pumps that pump sludge from the primary clarifiers to the aerobic digesters. These pumps were recently rebuilt.

Activated Sludge Aeration Tanks – The West WWTP operates aeration tanks with separate, fixed-film nitrification downstream. The hydraulic detention time of the aeration tanks is 4 hours at the permitted DAF. For this type of process, the allowable loading to the aeration tanks is 50 ppd per thousand cubic foot (kcf). The design loading exceeds this standard, at 55 ppd/kcf. In reality, since the primary clarifiers are not online, the design loading is over 84 ppd/kcf, far exceeding the allowable loading of the aeration tanks. At a minimum, two additional equally sized aeration tanks

would be required to meet loading limits with the primary clarifiers offline. IEPA does not recognize screening as a means to reduce aeration tank loading.

The existing aeration tanks are very shallow, which limits oxygen transfer and increases power consumption. Therefore, deeper tanks are recommended for any new construction.

This section of the report considers upgrading existing equipment to meet current standards. Another option is to demolish the activated sludge aeration tanks and construct new tanks to provide a single-stage nitrification process with provisions for biological or chemical phosphorus removal to meet current and potential regulations.

Aeration System Blowers – The West WWTP has three 75-hp multistage centrifugal blowers manufactured by Lamson. The blowers provide oxygen and mixing energy to the aeration tanks and air to the airlift pumps. Untimely blower or motor failures throughout the last several years have caused blowers to be out of service. This can impact treatment performance as the plant relies on two or three blowers at a time. Operators have noted shortages of process air. This is likely due to increased oxygen demand resulting from primary clarifiers being offline; however, leaks in the air piping to the airlift pumps contribute to loss of pressure and flow. At a minimum, the blowers and the leaking air pipes should be replaced promptly. The blowers should be replaced when new aeration tanks are constructed. During replacement, the Village should consider high-efficiency options for blowers to reduce power consumption and maintenance requirements.

Aeration System Diffusers – Process air to the aeration tanks is distributed by coarse-bubble diffusers. The drop legs for the diffusers are in poor condition and should be replaced. Four of the six original headers were replaced in 2011. Since construction of new aeration tanks is recommended, new diffusers must be provided. High-efficiency aeration system diffusers are recommended at the West WWTP for the aeration tanks to improve performance and reduce energy use.

Intermediate Clarifiers – The West WWTP has two, 50-foot diameter intermediate clarifiers. The By-Pass, Equalization, and Stand-By Intermediate Clarifier is identical to the other Intermediate Clarifiers but serves as an excess flow equalization and stand-by intermediate clarifier. The clarifier equipment is a tow-bro style that uses airlift pumps to lift sludge from the bottom of the clarifier. The tow-bro air piping is leaking and needs to be replaced. The clarifiers are taken out of service on roughly a monthly basis to remove rags and other clogging material.

In the future, these clarifiers can be converted to final clarifiers if the plant is converted to a single-stage nitrification process. Facilities that provide full filtration capacity have an allowable loading rate of as much as 1000 gpd/sq. ft. The two Intermediate Clarifiers and the By-Pass, Equalization, and Stand-By Intermediate Clarifier have a combined loading rate of 662 gpd/sq. ft. at peak flows. No additional construction would be required. However, the clarifier drive and equipment should be replaced.

Return Activated Sludge Pumps – The RAS pumps are airlift type and were part of the 1983 construction. Flow rates from these pumps are difficult to control, and the RAS flow rate is not metered. Furthermore, the pumps are in poor condition. They should be replaced.

Waste Activated Sludge Pumps – There are two, submersible, centrifugal-type WAS pumps manufactured by Flygt. The pumps and check valves on the discharge side of the pumps must be replaced.

RAS/WAS Flowmeter – The RAS flowmeter consists of a Parshall flume. While the flume is in good condition, the transducer is not operational. All RAS flow readings are manual. The flowmeter should be repaired or replaced. There is a WAS flowmeter; however, it is not functional and should be replaced.

Packed Bed Reactors – The packed bed reactors are a fixed-film nitrification process. Process water is pumped to the top of the reactor and trickles through media while simultaneously receiving treatment. Air is blown counter-current through the reactor to provide oxygen to the fixed biology.

The West WWTP has two packed bed reactors that operate in parallel. There is not functionality to operate the reactors in series. The media has not been replaced since it was installed in 1983. The distribution arms were also installed in 1983 but are in working condition. The ventilation fan was repositioned in 2012.

Because of the nature of the packed bed reactors, significant pumping is involved, including two lift, one recycle, and two effluent pumps. Each of these pumps has been replaced entirely in the last three years. The pump controller, installed in 1972, should also be replaced.

While the packed bed reactors are adequately sized for current effluent ammonia limits, the fixed-film technology has practical performance limitations. The permitted effluent limits for ammonia are expected to be reduced by a factor of two. The changes will likely take effect in the next permit revision cycle. The West WWTP is currently meeting the ammonia limits with the nitrification towers. However, the fixed-film nitrification process is not capable of reliably removing ammonia to the low anticipated levels.

At a minimum, the nitrification media and roof must be replaced. The electrical system, lighting, and painting should be replaced. The controls, dated from 1983, must be replaced.

The packed bed reactors require significant improvements to maintain. Furthermore, the process will not provide adequate performance to meet anticipated reductions in ammonia effluent limits. A cost is provided to rehabilitate the packed bed reactors, but the Village should consider converting to single stage nitrification instead of rehabilitation of the reactors.

Final Clarifiers – The West WWTP has three final clarifiers. One is a circular clarifier with 60-ft diameter and 8-ft SWD. This clarifier was constructed in 1983. The other two are rectangular clarifiers from the original WWTP construction. Each of the rectangular clarifiers has a surface area of 581 ft^2 and 9-ft SWD. The surface area is an important factor in determining the treatment performance. The two small, rectangular final clarifiers have a combined surface area of less than half that of the large final clarifier.

The flow split among the clarifiers is manual. The weirs are FRP. The metal moving parts of all clarifiers and walkway of the circular clarifier must be rehabilitated.

The rectangular clarifiers were rehabilitated in April 2014. Under the current treatment process, the WWTP requires that all the existing clarifiers are operational not only to meet minimum requirements for treatment but also to provide treatment redundancy.

The existing rectangular clarifiers could be repurposed to provide additional activated sludge aeration tank volume if a new, large clarifier were constructed. The additional activated sludge aeration volume required is approximately 133,000 cubic feet. The rectangular clarifiers provide only 9,300 cubic feet of aeration tank space. Conversion of this space to activated sludge aeration tank volume represents only a fraction of the overall need at a comparatively high cost.

As previously discussed, the nitrification towers should be abandoned for conversion to an activated sludge process. Fixed-film final clarifiers have a minimum allowable sidewater depth of 7 feet. Activated sludge clarifiers require a sidewater depth of 12 feet at a minimum. The circular clarifier could be used for excess flow and the rectangular final clarifiers should be abandoned if the plant is converted to single stage nitrification.

Tertiary Filters – The West WWTP has two large tertiary sand filters installed in 1983. There are also four smaller sand filters from the original construction, manufactured by Environmental Elements Corp. The backwash pumps are replaced about every five years. Otherwise, the sand filter equipment is antiquated. Bearings and wheels are defunct. Replacement parts are obsolete. The mud well for the sand filter backwash water is adjacent to the chlorine contact tank on the northwest part of the building. The roof of the building was replaced in the mid-1990s.

At a minimum, the painting, HVAC, electrical system, lights, and controls should be replaced entirely. The original small sand filters have been out of service for nearly two decades and should be abandoned. The large sand filters should be abandoned and replaced with disc filters. If filters are not provided, additional final clarifier construction will be required.

Disinfection – The West WWTP uses gaseous chlorine for disinfection and thiosulfate for dechlorination. The chlorine contact tank and equipment were part of the original West WWTP construction. The chlorine contact tank is located adjacent to the Sand Filter Building. The chlorination equipment is housed on the interior of the building and is in poor condition. The existing chlorine contact tank is undersized and requires additional tank construction.

Due to the proximity to residential neighborhoods and the high school, safety is a major concern. In addition, since new construction is required, the Village should consider conversion to UV disinfection instead of replacing the existing chlorine process.

The dechlorination system consists of a diaphragm-type chemical pump. The pump transfers thiosulfate from a chemical drum in the Packed Bed Reactor building to the effluent. Dechlorination facilities should be provided for thiosulfate addition, including a potable or non-potable water system hose connection for maintenance.

Sludge Thickener – The 25-ft diameter gravity sludge thickener was designed to thicken sludge from the primary clarifiers, WAS from the intermediate clarifiers, and fixed-film sludge from the nitrification towers. The sludge thickener was originally designed assuming constant flow and pre-thickening sludge prior to digestion. The thickener was intended to operate during decanting from the digester. It is undersized, and therefore is out of service. It is covered and includes a corrugated steel pipe intended to transfer odors into the nitrification tower for treatment. However, condensate accumulated in the odor pipe, leading to corrosion. The thickener should be abandoned.

Aerobic Digesters – The aerobic digesters were recently retrofitted. In 2009, one of the covers of the then-present anaerobic digesters failed. The digesters were converted to aerobic digesters in 2010. The aerobic digesters have aeration equipment including blowers, jet pumping system for sludge recirculation, and controls. The digesters, blowers, and mixers are in good condition. Operators report sufficient decanting. The blowers are operated at low speeds to avoid excessive shearing that has led to foaming. The jet mixing system, which was installed for sludge recirculation, is not used for mixing due to sufficient mixing energy in the blowers.

The pH in the digesters is low. Cycling the blower operation will result in alkalinity recovery and a more stable pH. The digester controls should be modified to include alkalinity recovery cycles based on the actual rate of change of pH.

Aero-Accelerator - The aero-accelerator was a supernatant polishing tank intended for the anaerobic digester return. This equipment has been offline for several years and was officially abandoned, per the Basis of Design, with the Digester Improvements in 2010. Rehabilitation of the aero-accelerator offers limited benefits and high operational costs. Therefore, it is not recommended to be placed back in service.

By-Pass, Equalization, and Stand-By Intermediate Clarifier (Excess Flow Clarifier) – The third Intermediate Clarifier also acts as the excess flow equalization clarifier. Flows over 3.9 MGD are pumped to this structure via the Flood Pumps. Effluent from this clarifier goes to the outfall. Sludge contents are returned to the influent wet well.

As mentioned in the Intermediate Clarifier section, this clarifier should be repurposed as Final Clarifier No. 3 if the facility is converted to single stage nitrification. Piping improvements would be needed to direct RAS to the aeration tanks and WAS to the aerobic digesters. In addition, for conversion to a final clarifier, the effluent flow must be redirected to the chlorine contact tank.

Sludge Storage – The West WWTP has no sludge storage on-site. The digester improvements of 2010 relied on sludge transfer conveyed with raw sewage to the Regional WWTP. For long-term planning, sludge storage must be provided on-site and will be triggered by phosphorus limits. Repurposing the nitrification towers is not possible because of the hydrostatic pressure of liquid contents. Liquid sludge storage may be provided where the existing nitrification towers are situated. Odor control should be provided due to proximity to the nearby residences.

SCADA – The West WWTP has minimal control and monitoring. The digesters have an operator interface terminal that allows for viewing and control of the equipment locally. There are five SCADA alarms, including gas detection and high water level alarms; however, there is no online monitoring otherwise at the facility.

6.2 Rehabilitation Costs

The existing Raw Sewage Pump Station is in need of substantial rehabilitation. The recommended alternative is presented as Raw Sewage Pump Station (Alternative A), which outlines the cost of constructing a new structure with new equipment. Alternative B considers replacement of equipment within existing structures. The engineer's opinion of probable cost for the recommended improvements at the West WWTP, shown in Table 14, is $23 million. Note that this cost considers only improvements required to continue treatment at the current limits. Additional improvements are required to come into compliance with future limits, which are expected to become enforced as soon as 2018.

While rehabilitating the primary clarifiers may help the West WWTP meet its current ammonia limit, it will not bring it into compliance with the future limit. To meet future ammonia limits, the West WWTP requires additional aeration tank space. Furthermore, primary sludge results in odors when it enters digestion. The ultimate recommendation for the West WWTP is the abandonment of the primary clarifiers and construction of additional aeration volume to accommodate the higher wastewater loading.

An evaluation was performed to determine the staffing requirements to perform typical maintenance and operations maintenance. The evaluation took into account productivity and time not worked due to holidays, vacation time, sick time, and professional development. In order to provide sufficient man-power, the West WWTP requires three full-time operators. A more detailed outline of the staffing assessment is presented in Appendix G.

TABLE 14

20-Year West WWTP Equipment Replacement Costs

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
EQUIPMENT REPLACEMENT												
Raw Sewage Pump Station (Alternative A) *	Construct a Raw Sewage Pump Station, including installing three Raw Sewage Pumps and two Flood (Transfer) Pumps. Replace the influent flowmeter and sampler, piping, and valves. Replace the existing Parshall flume for higher capacity. Demolish the existing Raw Sewage Influent Chamber.	1983	20	31	Ø	Significant Deterioration / Operational Challenges	Equipment Condition	Immediate	$2,520,000	2014	2015	$2,730,000
Screen Building	Construct a Screen Building and install one mechanically-cleaned fine screen with a manual bypass bar screen.	N/A	20	N/A	N/A	N/A	Operational Issues	Immediate	$1,580,000	2014	2015	$1,710,000
Primary Clarifiers	Replace clarifier equipment, drives, and covers.	1959; 1983	20	55; 31	Ø	Significant Deterioration / Operational Challenges	Equipment Condition	Immediate	$2,660,000	2014	2015	$2,880,000
Primary Sludge Pumps	Replace the two Primary Sludge Pumps.	2013	15	1	14	Excellent or New Condition	Equipment Condition	5-15 years	$220,000	2028	2028	$396,000
Activated Sludge Aeration System*	Replace the three existing aeration tank blowers. Install new aeration diffusers. Construct a new Blower Building, including three new blowers. Construct an Electrical Building for feeding the new power supply and housing electrical components.	1983	20	31	Ø	Significant Deterioration	Equipment Failure/ Current Non-Compliance	0-5 years	$2,150,000	2015	2016	$2,420,000
Intermediate Clarifiers and By-pass, Equalization, and Stand-by Intermediate	Replace clarifier equipment and drives. Replace air lift piping.	1983	20	31	Ø	Significant Deterioration	Equipment Condition	0-5 years	$1,440,000	2016	2016	$1,620,000

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
Clarifier												
RAS / WAS Pumps	Replace the two existing RAS pumps. Replace RAS and WAS meters. Replace valves at the WAS Pumps.	1983	20	31	Ø	Significant Deterioration	Equipment Condition	0-5 years	$240,000	2016	2016	$270,000
Packed Bed Reactors	Replace the nitrification media, distributor arm, roof, electrical system, lighting, and controls.	1983	20	31	Ø	Significant Deterioration	Equipment Condition	0-5 years	$3,790,000	2015	2016	$4,260,000
Packed Bed Reactor Pumps	Replace the two lift pumps, one recycle pump, and two effluent pumps.	2011	20	3	17	Excellent or New Condition	Equipment Condition	> 15 years	$610,000	2029	2029	$1,140,000
Final Clarifiers	Replace clarifier equipment and drives on the 60-ft circular clarifier and two original clarifiers. Replace walkways.	1959; 1983	20	55; 31	Ø	Significant Deterioration	Equipment Condition	0-5 years	$1,130,000	2018	2019	$1,430,000
Tertiary Filters	Remove the existing sand filters. Install two disc filters. Rehabilitate the Tertiary Filter Building, including replacing HVAC, lighting, repainting, and replacing all interior piping.	1959; 1983	20	55; 31	Ø	Significant Deterioration	Equipment Condition	0-5 years	$1,980,000	2017	2018	$2,410,000
Disinfection System	Remove the existing chlorination system, and demolish the existing chlorine contact tank. Construct a UV disinfection channel, and install UV disinfection equipment.	1983	20	31	Ø	Moderate Deterioration	Equipment Condition	0-5 years	$1,250,000	2018	2018	$1,520,000
Aerobic Digesters	Replace blowers, jet pumping system, sludge recirculation pumps, and controls.	2010	20	4	16	Excellent or New Condition	Equipment Condition	> 15 years	$1,850,000	2030	2031	$3,750,000
Generator	Replace the existing generator with a 480V that has capacity to power the entire WWTP. Install a transformer to be able to power 480V and 240V equipment.	1983	20	31	Ø	Moderate Deterioration	Equipment Condition	0-5 years	$750,000	2017	2017	$877,000
Control Building	Replace the electrical system throughout the building.	1983	50	31	19	Moderate Deterioration	Equipment Condition	> 15 years	$750,000	2032	2033	$1,640,000
									$22,920,000			**$29,050,000**
FUTURE COMPLIANCE												

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
Phosphorus Removal	Construct a Chemical Storage Building to house a phosphorus removal chemical storage tank with mixing system and two metering pumps.	N/A	N/A	N/A	N/A	N/A	Future Non-Compliance	N/A	$730,000	2016	2017	$854,000
Sludge Storage**	Provide one Liquid Sludge Storage Tank with Jet Mixing System and Sludge Loading Pump.	N/A	20	N/A	N/A	N/A	Future Non-Compliance	N/A	$2,580,000	2015	2016	$2,900,000
Construct new Aeration Tanks	Construct three aeration tanks for a single-stage nitrification activated sludge process. Provide activated sludge aeration equipment, including replacing blowers and diffusers and control instrumentation. Demolish the existing Aeration Tanks.	1970	30	44	Ø	Significant Deterioration	Equipment Failure/ Future Non-Compliance	N/A	$5,280,000	2016	2017	$6,180,000
									$31,510,000			**$39,000,000**
ALTERNATIVES												
Raw Sewage Pumps (Alternative B)	Replace the three existing raw sewage pumps, including all valves and piping. Replace the existing Parshall flume for higher capacity. Replace the two existing Flood (Transfer) Pumps.	1983	20	31	Ø	Significant Deterioration / Operational Challenges	Equipment Failure	N/A	$880,000	2016	2017	$1,030,000

Notes:

* The Project Year Cost is calculated based on the anticipated project year for construction and assuming 4% inflation per year.

* Raw Sewage Pump Station needs to be constructed with the Screen Building for Construction phasing purposes.

* Activated Sludge Improvements are only to rehabilitate existing equipment. When any process modifications are made at the West WWTP, the activated sludge system will need rehabilitation to include larger tanks.

* Sludge Storage Improvements will likely be required when phosphorus removal improvements are constructed.

7. REGIONAL WWTP ASSESSMENT

The physical condition of the accessible portions and equipment of the Regional WWTP was assessed to identify deficiencies and associated project costs and upgrades. The assessments were developed through on-site inspections, discussions with Village staff, and review of record documents. The project costs are based on historical data from similar construction projects, manufacturer's quotations, and industry estimating databases.

The Regional WWTP has a design average flow (DAF) of 3.0 MGD and a design maximum flow (DMF) of 9.0 MGD. The WWTP was originally constructed in the 1998 and underwent substantial upgrades in 2007-2008. The Village has completed smaller improvement projects intermittently throughout the years. Flow enters the facility from an interceptor from Hickory Creek Lift Station and pumping from the West WWTP. A site plan of the facility is included in Exhibit E.

The Regional WWTP operates under NPDES Permit No. IL0072192, which permits discharge to Hickory Creek. NPDES permits are renewed every five years, and the current permit has an expiration date of November 30, 2014. A copy of the Regional WWTP permit is included in Appendix C. Under the permit, the discharge must not exceed the effluent limits set forth in Table 15. Figures 13 through 16 demonstrate the actual performance of the WWTP.

TABLE 15

Regional WWTP Effluent Limits, NPDES IL0072192

Parameter	Monthly Average	Weekly Average	Daily Maximum	Units
$CBOD_5$	8		16	mg/L
Suspended Solids	10		20	mg/L
Dissolved Oxygen	Shall not be less than 7 mg/L			
pH	Shall be in the range of 6 to 9 standard units			
Fecal Coliform (May - Oct.)	Daily Maximum shall not exceed 400 per 100 mL			
Ammonia Nitrogen (as N)				
March – May/ September - October	1.5		3.5	mg/L
June – August	0.9	2.3	4.4	mg/L
November - February	3.3		4.6	mg/L
Total Phosphorus	1.0			mg/L
Total Nitrogen	Monitoring Only			

The Regional WWTP process currently consists of mechanical screen with bar screen bypass, grit removal, odor control, oxidation ditch, chemical phosphorus removal facilities, final clarifiers, tertiary filters, re-aeration tank, and ultraviolet disinfection. The Regional WWTP disinfects seasonally for the period of May through October. Sludge is digested aerobically and can be thickened with a centrifuge. The centrifuge was designed to be able to pre-thicken sludge as necessary, but it is primarily used to dewater sludge for sludge hauling/land application purposes. There is a liquid sludge storage tank and dewatered sludge storage pad.

The WWTP has consistently met effluent limits. The major operational concerns are related to grit accumulation in tanks, hydraulic challenges, and sludge thickening equipment. The current condition of each process is summarized below.

7.1 Equipment Conditions

Preliminary Treatment Building – The Preliminary Treatment Building includes the influent splitter box, sampling station, flowmeter, pump station, mechanical and manual bar screens, grit removal system, and biofilter. Hydraulic gates in the headworks structure were replaced in 2008 and are in good condition. The building's gas safety detectors were recently replaced. Operators have noted that the screening and grit removal systems are effective at removing rags.

No hydraulic issues are reported at this building. However, there are grading problems in the area. The building is located in a low area causing rain, ice, and snow to accumulate at the entrance of the building. Due to the slope to the building entrance, waste haulers are unable to pull dumpsters at the building. Instead, operators must move dumpsters to the main road for removal. Dumpster removal in wet-weather conditions can be a difficult and hazardous operation.

Influent Sampler – The influent sampler is manufactured by ISCO. Composite samples of BOD and TSS are collected. There is no influent ammonia or phosphorus sampling.

Influent Flowmeter – The influent flowmeter consists of a Parshall flume and a level transducer. The flowmeter is in good condition, but the range is limited. The maximum reading is 15.8 MGD. There is space adjacent to the existing flowmeter for a redundant unit.

Preliminary Treatment Pump Station – The Preliminary Treatment Building houses a pump that returns flow from sidestream processes and building drains. The pump is in good condition.

Mechanical screen – The Regional WWTP has a single mechanical screen that was installed in 2008. The screen is a Parkson Aquaguard self-cleaning screen with plastic teeth, a washer, and a compactor. The high-speed agitator washer sends organics back into the process, and the compactor screw dewaters screenings. The compactor screw's shaft clogs after several days of high flow events.

Initially, the screen required cleaning every other day. Operators now leave the knife gate for the screenings open to improve operations. This has reduced cleaning frequency to about once a week. The mechanical screen is effective at removing rags and other debris, although maintenance can be a messy operation.

Bar Screen – Sewage is diverted to a bypass channel when the mechanical screen is out of service for maintenance. The bypass includes a manual bar screen, which has 1-inch clear spacing. No operational problems are noted with this bypass screen.

Grit removal – The grit removal system consists of a grit cyclone with concentrator and dewatering screw. The system was manufactured by Pistagrit as part of the 2008 improvements. The grit system has simple maintenance and effectively removes grit. A second redundant channel was constructed north of the channel that is currently operating. The screenings and grit removed fill about one dumpster a month.

Biofilter – The Preliminary Treatment Building has a large biofilter for odor control. The biofilter is a wood chip media that requires a nutrient solution and water feed for biological odor removal. Biofilters are effective for removal of hydrogen sulfide. Other odor-causing compounds found in headworks, such as mercaptans, are not typically removed with biofilters.

Oxidation ditch – The original oxidation ditch was part of the original WWTP construction. The original ditch had three passes, three sets of mechanical aerators (six aerators total), and ran from the inner-most ring out.

In 2002, the ditch was expanded to include a fourth ring and increase to a total of twelve mechanical aerators on six shafts. The three inner shafts, which hold aerators for the two innermost rings, are constant speed. The three shafts for the two outer rings are on VFDs. The flow through the ditch was reversed to an outside-in configuration. The hydraulic detention time of the ditch is 26 hours at the permitted DAF. This process has an allowable loading of 15 ppd/kcf. The design loading is within this range, at 11 ppd/kcf. The oxidation ditch supports both total phosphorus and lower future ammonia limits.

The ditch has two submersible mixers, each located in one of the outer rings. The mixers, manufactured by Flygt, were part of the 1998 expansion but are in good condition. The mixers run at full speed continuously. The Village should plan to replace the mixers in approximately five years due to age.

The ditch is designed for enhanced biological phosphorus removal. The outer ring acts as an anaerobic zone, and the following ring in anoxic conditions. It operated effectively removing phosphorus for several years. In the last year of operation, operators had to switch to chemical phosphorus removal for several months because the biological phosphorus removal process was lost. However, the WWTP is currently operating for biological phosphorus removal.

Operators desire improved control of the ditch. Currently, the ditch can be controlled manually or automatically using D.O. and pH control algorithms. Dissolved oxygen (D.O.) probes are located in each ditch. There are also ORP probes in the two outer rings for maintaining anaerobic or anoxic conditions required for biological phosphorus removal. The D.O. probes are located downstream of the disc aerators, and operators noted preference for the probes to be relocated upstream. The D.O. probes in the inner rings were recently repaired. In manual, the inner aerators run continuously at full speed and the outer aerators operate at 15% speed. Table 16 shows the typical oxidation levels of the ditch rings.

TABLE 16

Oxidation Ditch Typical Operation

WWTP	Oxidation State	D.O. Concentration, mg/L	ORP, mV
Outermost	Anaerobic	~0	-354
Outer	Anoxic	~0	-242
Middle	Aerobic	0.2	N/A
Inner	Aerobic	2.2	N/A

Operational Challenges

The ditch configuration does not allow for simple access of the inner ring aerator shafts.

Hydraulic Challenges

There are four sluice gates on each ring. These gates control the flow among channels and also allow operators to waste from different ditch locations into the secondary clarifiers. Operators have indicated that the transfer gates do not seal well; therefore, they are open or ajar at all times.

The ditch has hydraulic challenges. The low weir is not functioning, and therefore the high weir plate is the set level. This causes the water level to top the maintenance platforms during high flow.

There are two drain pumps that drain each inner ring and act as the drain for the centrifuge. The outer ring does not have a drain and portable pumps must be used. Therefore, thickened solids tend to accumulate in this ring.

Solids Challenges

The centrate from the sludge dewatering process and decant from the aerobic digesters return to the outer ring of the ditch. The centrate return includes some polymer residues, and solids run very high in the ditch, especially the outer ring. The target mixed liquor concentration is 3,500 – 3,800 mg/L. The innermost ring has a mixed liquor concentration of approximately 6,000 mg/L.

RAS/WAS Pump Station – There are four variable speed pumps that return flow within the ditch. The pumps are in good condition and provide sufficient flows, according to operators. However, the pumps have wafer check valves on the discharge to prevent backflow. These valves bind, and the operators have expressed a preference for swing-type check valves on all pumps.

Phosphorus Precipitant Mixing Tank – While the Regional WWTP was designed for biological phosphorus removal, a chemical phosphorus removal system was provided as a backup. The chemical feed system includes a mixer and tank adjacent to the Mixed Liquor Splitter Box.

The aluminum sulfate (alum) chemical feed system is housed in the Sludge Processing Building. Previously, alum was fed to the ditch directly. More recently, operations were changed such that alum is fed to the Mixed Liquor Splitter Box instead.

The Mixed Liquor Splitter Box was constructed to allow for the addition of a fourth (future) secondary clarifier.

Final Clarifiers – There are three final clarifiers, each 80-ft diameter. The clarifiers are traditional suction clarifiers. The collector mechanisms are delaminating. However, the scrapers are in good condition.

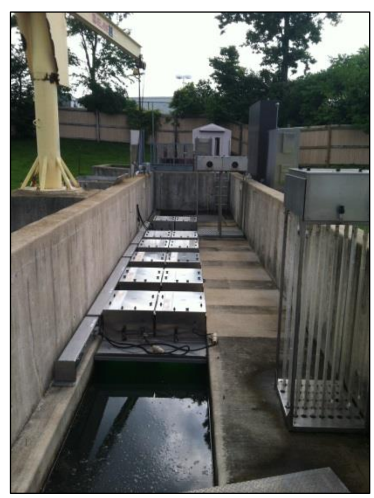
The clarifiers each have a telescoping valve intended to regulate RAS from the clarifier and into the scum pit. Ragging and clogging of the telescoping valves forces operators to drain sludge instead through the clarifiers' drain valves. The clarifiers are currently planned to be taken out of service one at a time for maintenance.

Scum Pump Stations – Scum from the clarifier beaches flows by gravity into one of two Scum Pump Stations. The scum is pumped from there to the aerobic digesters. The original scum pumps were KSB vortex-type pumps. The pumps operated automatically by transducers mounted in the scum pits. The pumps were replaced with two screw-type EMU pumps that operate on floats. The pumps have problems with even small debris clogging the impeller and binding the pump. The pumps have sufficient capacity at about 57,000 gpd.

Tertiary Filters – The Tertiary Filtration Building includes three disc filters and space for one additional future filter. The units are Kruger Hydrotech Discfilters and were constructed as part of the last major upgrade in 2008. Each filter has 16 discs and a submerged surface area of 672 ft^2. The filter equipment includes backwash pumps with strainers.

Operators have the option to bypass the filters during high flow events; however, the bypass pumps are inaccessible. The filters have a very fine mesh, which causes the backwash pumps to operate frequently. Recent chemical washing trials have demonstrated improved filter media performance. Therefore, the Village should perform chemical washing of the filter media to reduce the frequency of backwashing and maintenance.

Post-Aeration – The Regional WWTP has a very stringent D.O. effluent limit, requiring post-aeration after the secondary treatment processes. The post-aeration process aerates tertiary effluent prior to disinfection. The system includes a 3-pass tank, blower, and Sanitaire fine-bubble disc diffusers. The post-aeration process was added in the 2008 improvements. The equipment is in good condition, and operators note no challenges with this equipment.



UV Disinfection – The Regional WWTP disinfects on a seasonal basis. Due to its proximity to the high school, UV disinfection is used in place of chlorine. The UV system has two banks in series for redundancy. Each bank has seven modules for a total treatable flow of 9 MGD. Each lamp has a 27 W output. Maintenance of the UV system is a costly process because of expensive replacement lamps and high energy consumption.

Outfall – The WWTP outfall is in good condition. The outfall splits the flow to a constructed wetland and a bypass. The wetland is operated as a natural ecosystem and minimally maintained.

Aerobic Digesters – The Regional WWTP has four aerobic digesters, each 154,000 gallons. The digestion equipment includes Sanitaire coarse-bubble air tube diffusers, five blowers, piping, and valves. The digesters are each equipped with FRP covers for odor containment and insulation.

The digesters were designed with capacity for thickened sludge. Because of sludge thickening limitations (discussed in the Centrifuge section), sludge is not pre-thickened prior to the digesters. Therefore, the digesters are undersized for the facility.

Typically, operators waste 45,000 - 75,000 gallons at a time. The digesters have a decant range limited to only 12-18 inches. In addition, the valves, reverse-threaded plug valves, are atypical for this application and several have failed. The decanting valves should be replaced with telescoping valves that have a larger decanting range.

The digester functionality is limited. Each digester has two valves – one inlet and one outlet. This means that operators do not have the ability to both decant (a several hour process) and operate the centrifuge. The digesters are set in pairs and drain together.

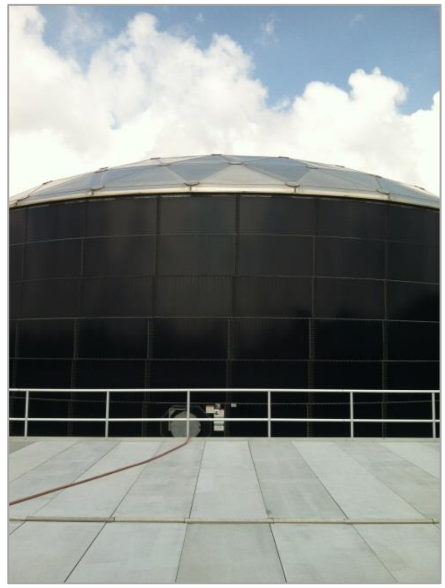
The aerobic digester blowers face variable backpressures due to frequently changing liquid levels related to sludge filling and drawdowns. The blowers surge at the extreme conditions. Blower No. 2 is currently being rehabilitated, which will provide redundancy. However, if additional aerobic digestion volume is required, the blowers should all be replaced with larger units that have VFDs and are more energy efficient.

Sludge Processing Building –The Sludge Processing Building was constructed in 2008. It includes the centrifuge equipment and chemical storage facilities. The building is in good condition and has extra space for additional equipment. There is one small tank that contains polymer for the sludge thickening process. Polymer is received in totes. The Regional WWTP uses about two totes every three months. There is one larger tank that contains alum for phosphorus removal. Each chemical storage tank is contained.

Centrifuge (Post-thickening) – Digested sludge from the aerobic digesters is dewatered using a centrifuge. The centrifuge, manufactured by Westfalia, was installed in 2008. The centrifuge was designed to be able to pre-thicken sludge as necessary but is not currently used for this function.

The centrifuge can be temperamental, requiring near continuous operator supervision that is not available due to other maintenance demands (both routine and emergency). Dewatering digested sludge takes 4-6 hours.

Polymer is used with the centrifuge for sludge thickening. Excess polymer is used for pumpability. The centrate return ends up with some polymer remnants, contributing to very thick sludge in the oxidation ditch. The Regional WWTP generates two trailers of sludge weekly, which are typically hauled on Tuesday and Thursday. The Village should consider installing dedicated thickening equipment and conversion of sludge dewatering equipment from the operator-intensive centrifuge to alternative dewatering equipment, such as a belt filter press.



Liquid Sludge Storage Tank – The Regional WWTP has one 1.7 million gallon liquid sludge storage tank. The tank equipment includes a mixer with four jet nozzles and a Wemco chopper pump for recirculating and breaking apart the contents. The liquid sludge storage tank is not currently in use.

Dewatered Sludge Storage Pad – The Dewatered Sludge Storage Pad is intended for storage of dewatered biosolids. The pad is a 68-ft square covered structure. It is in good condition, but it is rarely used. The storage pad drain flows by gravity to the Preliminary Treatment Building. However, the drain is undersized and clogs often.

Non-Potable Water System – Non-potable water is used at the centrifuge, mechanical screen, secondary clarifier scum pits, and filter backwash pumps. The non-potable water system is in a loop configuration. However, no yard valves were installed with the original construction.

Underground Piping – The WAS piping from RAS / WAS pump station to the Aerobic Digesters freezes in the winter.

Generator – The Regional WWTP generator is in good condition. It is routinely exercised, but has only been required to operate due to power failure once.

Hickory Creek Lift Station –The lift station accepts flows from the northeast part of the service area and from the former South WWTP (in the Prestwick subdivision at Aberdeen Road). There are two 75-hp submersible KSB centrifugal pumps with a capacity of 2,500 gpm each. The submersible wet well is in a separate vault from the check valves. Electrical service at the lift station is 480V. The Hickory Creek lift station has a permanent generator, a backup pump, and a transfer switch for managing high flow events or power outages.

7.2 Rehabilitation Costs

The engineer's opinion of probable cost for replacement of the Regional WWTP equipment, as shown in Table 17, is $17.6 million. Because the Regional WWTP already treats for phosphorus removal, no major regulatory-related improvements are anticipated within the planning period.

An evaluation was performed to determine the staffing requirements to perform typical maintenance and operations maintenance. The evaluation took into account productivity and time not worked due to holidays, vacation time, sick time, and professional development. In order to provide sufficient man-power, the Regional WWTP requires three full-time operators. A more detailed outline of the staffing assessment is presented in Appendix G.

TABLE 17

20-Year Regional WWTP Equipment Replacement Costs

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
OPERATIONAL CHALLENGES												
Oxidation Ditch	Drain each ring individually, and hire a third-party to remove, haul, and dispose of grit, rags, and other sludge.	N/A	N/A	N/A	N/A	Operational Challenges	Operational Improvements	Immediate	$520,000	2015	2016	$585,000
EQUIPMENT REPLACEMENT												
Screening Equipment	Replace the existing mechanically-cleaned fine screen and manual bypass bar screen. Replace Parshall flume to accommodate higher peak flows. Replace gates.	2008	20	6	14	Moderate Deterioration	Equipment Replacement	5-15 years	$840,000	2028	2029	$1,570,000
Grit Removal	Replace grit cyclone, concentrator, and dewatering screw. Replace Odor Control Equipment.	2008	20	6	14	Moderate Deterioration	Equipment Replacement	5-15 years	$840,000	2028	2029	$1,570,000
Oxidation Ditch	Replace the oxidation ditch aeration drives and all hydraulic gates. Replace the two existing submersible mixers. Replace instrumentation for BNR control.	2008	20	6	14	Moderate Deterioration	Equipment Replacement	5-15 years	$3,610,000	2028	2029	$6,760,000
Secondary Clarifier	Replace the clarifier equipment, scrapers, and collector mechanisms.	2008	20	6	14	Moderate Deterioration	Equipment Replacement	5-15 years	$2,030,000	2028	2029	$3,800,000
RAS / WAS Pumps	Replace the four existing RAS pumps and two existing WAS pumps. Replace the mixer in the Phosphorus Precipitant Mixing Tank.	2008	20	6	14	Moderate Deterioration	Equipment Replacement	5-15 years	$310,000	2028	2029	$581,000
Tertiary Filters	Replace the three existing tertiary filters.	2008	20	6	14	Moderate Deterioration	Equipment Replacement	5-15 years	$3,730,000	2029	2030	$7,270,000
Post-Aeration Equipment	Replace post-aeration blower and diffusers.	2008	20	6	14	Moderate Deterioration	Equipment Replacement	5-15 years	$290,000	2029	2030	$565,000
UV Disinfection	Replace existing UV disinfection equipment.	2008	20	6	14	Moderate Deterioration	Equipment Replacement	5-15 years	$940,000	2029	2030	$1,830,000
Aerobic Digesters	Replace the Aerobic Digester diffusers, blowers, covers, and sludge pumps.	2008	20	6	14	Moderate Deterioration	Equipment Replacement	5-15 years	$3,140,000	2029	2030	$6,120,000
Sludge Storage	Replace the Liquid Sludge Storage tank mixer and chopper pump.	2008	30	6	24	Excellent or New	Equipment Replacement	5-15 years	$710,000	2029	2030	$1,380,000

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
						Condition						
Non-Potable Water System	Repair leaking non-potable water system pipes and install system valves.	1998	30	16	14	Significant Deterioration / Operational Challenges	Equipment Replacement	5-15 years	$100,000	2029	2030	$195,000
Regional WWTP Generator Replacement	Replace the existing 1,000 kW back-up generator.	1998	30	16	14	Moderate Deterioration	Equipment Replacement	5-15 years	$1,070,000	2029	2030	$2,080,000
									$17,610,000			**$33,740,000**

Notes:

* The Project Year Cost is calculated based on the anticipated project year for construction and assuming 4% inflation per year.

8. REGULATORY ASSESSMENT

The Frankfort WWTPs require several modifications to come into compliance with current permit limits. An important element of a Facilities Planning effort is to also conduct a regulatory assessment to anticipate future changes in regulations that could impact the capital improvements needed to address equipment condition.

This section discusses current challenges and potential regulatory requirements for the Village of Frankfort. The regulatory assessment is based on discussions with IEPA, correspondence from USEPA, experience with other treatment plants, and involvement in Illinois nutrient workgroups. IEPA is in the process of issuing changes to NPDES permits for major facilities (i.e. discharge greater than 1 MGD), including ammonia reductions and introduction of phosphorus and chloride limits. Nitrogen limits and modifications to excess flow requirements are also being considered for inclusion in the future.

8.1 Nutrient Regulations – Current Status

Currently, USEPA is pressuring the Illinois EPA (IEPA) to impose nutrient limits on Illinois WWTPs. In its January 21, 2011 letter, USEPA demanded that IEPA put nutrient limits in all NPDES permits. IEPA responded with a proposal to impose nutrient limits only on those WWTPs that discharge into waters that are already exhibiting poor conditions due to nutrient overload. These conditions are termed "cultural eutrophication".

A number of Midwestern states have implemented or are considering nutrient limits under pressure from environmental advocacy groups (EAGs). Recently, the Wisconsin Department of Natural Resources (DNR) adopted phosphorus limits of 0.075 mg/L TP for wadeable streams. EAGs have approached the IEPA to request similar nutrient limits to those applied in Wisconsin. If not met, the EAGs have threatened to sue USEPA, as was done in Florida and Wisconsin, to force Illinois to impose nutrient limits. EAGs have filed suit against USEPA at the federal level, demanding that USEPA change the definition of "secondary treatment" to include the reduction of nitrogen and phosphorus. Although this suit was defeated, the potential for the EAGs to continue to push for nutrient limits remains.

IEPA is currently preparing a "Science Assessment to Support an Illinois Nutrient Reduction Strategy". The report will identify alternatives to achieve a 45% reduction in Nitrogen and Phosphorus loads from the State. Preliminary findings indicate that point sources produce approximately 48% of the total phosphorus load. Implementing a 1 mg/L limit on publicly owned treatment works (POTWs) will satisfy approximately half of the phosphorus reduction goal.

8.2 NPDES Permit Status

The North WWTP NPDES Permit expired in 2012. Issuance of a permit renewal is pending, as IEPA is currently awaiting USEPA's response to IEPA's proposal regarding nutrients. Until then, the Village's new permit is being held at IEPA for a resolution on nutrients.

The Regional WWTP permit will expire in November 2014. The Village applied for a permit renewal in June 2014.

The West WWTP permit is in the process of being re-issued to modify the ammonia, copper, and chloride limits. The summer monthly average ammonia limit will be raised to 0.4 mg/L as a result of a site specific study completed by the Village. The copper limit will be removed from the permit as a result of a copper translator study. The compliance period for chloride will be extended by 36 months. The permit was scheduled to expire in November 2015 but likely will be extended to five years from re-issuance.

The Village is a member of the Hickory Creek Watershed Planning Group, which is currently tasked with adaptively managing impairments to the Hickory Creek watershed to meet Clean Water Act goals. The group aims to meet those goals through establishing Total Maximum Daily Limits (TMDLs) specific to the local watershed. According to IEPA, the Hickory Creek Watershed is impaired for ammonia, phosphorus, and chloride, among other contaminants. In addition to lower ammonia limits, it is anticipated that all three WWTPs will have limits for phosphorus and chloride in the next permit cycle. The key dates for the NPDES permit renewals are summarized in Table 18.

TABLE 18

Key Compliance Dates

		Compliance Date	
WWTP	NPDES Permit Expiration	Chloride	Ammonia/ Phosphorus
North[7]	November 30, 2012	January 2018	January 2018
Regional[8]	November 30, 2014	November 2018	November 2018
West[9]	May 2019	May 2017	May 2017

7 North WWTP NPDES permit is pending renewal by IEPA. The permit is expected by January 2015. Compliance is required within 36 months of permit issuance.

8 Regional WWTP NPDES schedule is based on IEPA issuance of the renewal in November 2015. This is unlikely to occur.

9 West WWTP NPDES permit is being revised and is expected to be reissued as a new permit in May 2014. Compliance is required within 36 months of permit issuance.

8.3 Total Phosphorus Limits

The Village's Regional WWTP has a phosphorus limit of 1.0 mg/L, while the North and West WWTPs do not provide for phosphorus removal. Although many levels of removal have been discussed in the regulatory framework, the most likely future phosphorus standard is 1.0 mg/L. The Village can request an extension of 36 months from the date of permit issuance to comply with phosphorus limits. All alternatives discussed in this study include phosphorus removal at the North and West WWTP.

8.4 Total Nitrogen Limits

Limits for Total Nitrogen are less imminent than limits for total phosphorus. However, until IEPA has reached a final decision on nutrient limits, it has begun to require that WWTPs applying for expansions or major improvements be designed to comply with an effluent total nitrogen concentration of 8.0 mg/L. This is not yet an enforceable total nitrogen effluent limit. However, these facilities must be capable of meeting the target. The implication is that these facilities must operate to remove nitrogen, and the average effluent nitrogen concentration would have to be reported (monitor only) to IEPA.

8.5 Ammonia-Nitrogen Limits

In September 2013, the USEPA released new ammonia criteria, which reduces ammonia effluent limits to approximately two times stricter than the Village's current ammonia limits.

All of the Village's WWTPs have struggled to meet ammonia limits. The Regional WWTP has the most consistent ammonia removal. However, in their current condition, the North and West WWTPs will not meet limits of 0.4 mg/L (reduced from the current 0.8 mg/L) and 0.2 mg/L (reduced from the current 0.4 mg/L), respectively. A combination of factors is responsible for this, including lack of adequate nitrification volume, lack of sludge storage, and equipment that has exceeded its useful life. Any feasible alternative for these wastewater treatment plants must include improvements to meet lower ammonia-nitrogen limits at the North and West WWTPs.

8.6 Chloride Limits

The West WWTP permit includes a water quality based effluent limit for chloride of 500 mg/L monthly average. The WWTP regularly exceeds this limit. The permit included a 36-month compliance period which ended in November 2013. During this period, the Village performed a survey of major water users to identify significant sources of chlorides in the collection system. This survey identified that household water softeners are the main source of chlorides. No other significant sources of chlorides were discovered, although the process of evaluating potential sources continues. The Village received a Notice of Violation (NOV) dated March 31, 2014 for exceeding the chloride limit at the West WWTP. The Village responded to the NOV on April 16, 2014 and is currently in discussions with IEPA to establish a Compliance Commitment Agreement. The following sections outline options for achieving chloride compliance.

It is anticipated that both the Regional and North WWTP permits will contain chloride limits when they are renewed. However, since removal of chloride at the WWTP is not practical, the alternatives evaluated in this report do not consider chloride removal. It is anticipated that the Village will comply with the chloride limit through drinking water improvements, regulatory relief, or the TMDL process via the Hickory Creek Watershed Group.

8.6.1 Capital Improvements

Water treatment options for removing chlorides from drinking water include reverse osmosis, lime softening, and ion exchange. A review of potential treatment options that could be employed at the WWTP to reduce chloride concentrations determined that the least costly, feasible option is to install reverse osmosis treatment. This measure is anticipated to cost in the range of $40 million, not including the cost of disposing concentrated reject water.

Another option includes conversion to a Lake Michigan water supply, which has an anticipated cost in excess of $70 million. It may not be a feasible to obtain a Lake Michigan Water allocation from IDNR. Conversion of household water softeners at the point-of-use exceeds $100 million in cost.

Reverse osmosis is a proven technology, but it is costly both to construct and to operate. Therefore, we recommend the Village pursue alternative means of compliance before considering this costly construction.

8.6.2 Regulatory Relief: Variance

The Village has the opportunity to obtain a variance from the Illinois Pollution Control Board for removal of the chloride limit. The variance standards are outlined in 40 CFR Part 131.10(g) and include six factors. However, the IPCB has only ever approved a variance on the grounds of one of the six factors: economic hardship.

To demonstrate economic hardship, the Village must demonstrate that the cost of the improvement would increase the cost of wastewater service to more than 2% of the median household income (MHI). Furthermore, variances that have been granted in the past are on five-year cycles. The Village would be required to re-apply for a variance at five-year intervals when the NPDES permit is renewed.

The Village of Frankfort’s MHI is over $100,000. Based on the projected costs to install and operate reverse osmosis facilities or convert to Lake Michigan water, the Village would not qualify for a variance on the grounds of economic hardship.

8.6.3 Regulatory Relief: Site-Specific Limit

The Village has been in discussions with IEPA and USEPA to determine how it could obtain regulatory relief from the chloride water quality based effluent limitation. A stream assessment was completed to support regulatory relief efforts. The Village has also pursued opportunities to complete Water Effects Ratio (WER) testing to determine the toxicity of chlorides and justify higher site-specific limits.

The state of the science of chloride toxicity on aquatic life is not well understood. Therefore, regulatory agencies have been unable to indicate what testing parameters would effectively demonstrate adequate water quality. At present, the Village would be required to perform testing that may not completely capture the data of interest to the regulators. Testing is likely far less expensive than any construction of capital improvements. However, testing can be inconclusive and lengthy, and it may lead to no change in the limit or compliance schedule. From discussions with IEPA and USEPA, this option has a low probability of success.

8.6.4 Flow Augmentation

Some permitted effluent limits, such as suspended solids, are based on a mass loading and regulated on the basis of the pounds discharged per day. In contrast, the aquatic habitat responds to chloride concentration. Therefore, chloride limits are based on a concentration in the receiving stream.

In order to meet the concentration limit, a viable option is to augment the flow in the receiving stream by adding water with a low chloride concentration. Stream monitors would be used to monitor the addition of dilution water. This option was discussed with IEPA; however, approval of a flow augmentation plan is not guaranteed. In addition, flow augmentation would require water to be pumped from groundwater reserves and discharged, potentially unused. This alternative has a relatively low cost, but it results in wasted water and energy.

8.6.5 Hickory Creek Watershed Group

The West WWTP permit has been under revision during the time of writing this report. In the revision, the Village can expect a special condition requiring participation in a watershed group. The Village has already begun to evaluate the potential for assessing watershed water quality needs through the TMDL process with the support of other dischargers and public interest groups, including the Hickory Creek Watershed Group. The objectives of the group may include developing a means of satisfying the chloride limits within the watershed by offsetting chloride loading through reduced road salt application and public education. The group may also look at opportunities to control chloride discharges by regulating water softeners. Similar workgroups in the area have pursued opportunities to control aquatic contaminants through use ordinances.

Management of chloride at the watershed level is the least costly alternative and involves a comprehensive solution for the total watershed. However, it is unknown whether IEPA will approve the watershed group recommendations for chloride compliance. Therefore, the outcome of the watershed group work may not satisfy the regulatory bodies with regards to chloride compliance. Participation in the Hickory Creek Watershed group is not only the strongest option for the Village currently but also an anticipated permit requirement for operating the WWTP.

8.7 Heavy Metals

The West WWTP permit includes a copper limit of 21 µg/L. A site specific translator study was completed by the Village. The results of this study resulted in copper limits being removed from the permit. This change is expected when the permit is renewed.

The North WWTP permit will likely include a zinc limit when the permit is renewed. The Village has begun to sample for the translator study with the goal of preventing a zinc limit in the permit.

Since metals are not commonly removed from WWTPs, the alternatives evaluated do not consider treatment for metals. Should a permit contain a metals limit, the recommendation would be to identify the source and prevent its discharge to the sewer system.

8.8 Excess Flow

During periods of wet weather, flow to the WWTPs can exceed the capacity of the treatment units due to I/I in the sewer system. Common practice in Illinois is to either store the additional flow for treatment after the event subsides or to pump the flow to excess flow treatment units. These treatment units typically consist of primary clarification and disinfection. The treated excess flow can either be discharged directly to the receiving stream or blended with the effluent from main treatment process. The North WWTP has excess flow storage, the Regional WWTP has no excess flow facilities, and the West WWTP has excess flow treatment.

Typical permit limits for treated excess flow are 30 mg/L for both BOD and TSS. This equates to 85% removal of an influent concentration of 200 mg/L. A current proposal by USEPA would replace the 30 mg/L limits and require 85% removal of the influent concentration. Because influent concentrations are diluted in high flow events, the level of treatment required may, therefore, be significantly higher. For example, during the month of April 2013, the Regional WWTP had a maximum flow of 7.44 MGD and an average influent BOD concentration of 86 mg/L. At 85% removal required, the effluent limit would be only 13 mg/L, as compared to the current 30 mg/L limit. It is unlikely that excess flow treatment facilities could meet 85% removal on a consistent basis.

Since many facilities in Illinois utilize excess flow treatment, the Illinois Association of Wastewater Agencies (IAWA) is preparing a response to USEPA's proposal. IAWA believes that the 30 mg/L limits comply with the regulatory requirements and the 85% requirement represents an unnecessary and unlawful departure from IEPA and USEPA's past practices. For the alternatives considered in this report, it is assumed that excess flow treatment will be allowed to continue with 30 mg/L limits for BOD and TSS.

9. DEVELOPMENT OF FEASIBLE ALTERNATIVES

As demonstrated in Sections 5 through 7, the cost of equipment replacement and process rehabilitation to meet current limits at each of the Village's facilities is high. Furthermore, the practicality of simply rehabilitating the existing processes is impacted by limitations in the technology of the current treatment processes to meet future permit requirements and constructability considerations. Therefore, alternative treatment options may provide more appropriate and cost-effective solutions for the Village. In addition to upgrading the existing treatment facilities, alternative wastewater treatment and disposal solutions were evaluated as part of this study. These include consolidating facilities, constructing a new WWTP, land application of wastewater, alternative treatment providers, and non-compliance.

9.1 Upgrading Operation, Maintenance, and Efficiency of Existing Facilities

Many components of the existing WWTPs are in poor condition, particularly at the North and West WWTPs. Upgrading these facilities requires a substantial cost to replace equipment for ensuring the next 20 years of operation. The total treatment capacity of the three WWTPs is 55,100 PE. This provides sufficient capacity for the 20-year population projection and beyond. However, the existing treatment processes will not be able to consistently meet the anticipated effluent limits. With lower ammonia standards and the addition of phosphorus and chloride limits, the North and West WWTPs will not be able to meet the new standards through simply maintaining the existing facilities.

The recommended improvements for maintaining the Village's three WWTPs include major process changes at the West WWTP, major construction at the North WWTP, and modifications to ease the operation of the Regional WWTP. The Basis of Design for maintaining each facility is presented in Appendix D.

The process modifications required to bring the West WWTP into compliance with the Illinois Recommended Standards for Sewage Works standards are significant. The Packed Bed Reactors will not meet future ammonia limits, triggering significant process modifications. The site currently has no sludge storage, which would be required in the future.

In addition, a significant portion of the West WWTP site is located in the floodway. The floodplain elevation at the West WWTP is approximately 701'-6" AMSL. The wet well, aeration tanks, intermediate clarifiers, final clarifiers, filters, and chlorine contact tank are all susceptible to inundation at the 100-year flood. Approval for construction in the floodway would be required from the IDNR and FEMA. If the Village decided to commit to bringing the West WWTP to compliance, it is not guaranteed that construction of the improvements would be permitted.

Another option for the West WWTP is to relocate treatment or add property to the treatment plant site. The improvements recommended would require purchasing several acres of property outside of the floodway for construction. There is not green space available on or adjacent to the site. Therefore, the Village would need to acquire property from residents to be repurposed for treatment space. Land acquisition near the West WWTP site would be expensive and likely not well received by local residents. The time to acquire land and construct the improvements would exceed the available time to come into compliance with new ammonia and phosphorus permit limits. Therefore, land acquisition at the West WWTP site is not a viable option.

As presented in Sections 5-7, the costs to maintain each facility are high. The total cost to maintain the Village's three WWTPs is $59.1 million over the next 20 years. Table 19 summarizes those costs. To bring the existing facilities into compliance with future regulations will cost more than $9 million in additional capital improvements.

TABLE 19

20-Year Cost to Maintain Existing WWTPs

WWTP	Cost of Equipment Maintenance	Cost of Compliance	Total Facility Cost	Compliance Deadline
North WWTP	$22,520,000	$730,000	$23,250,000	2018
West WWTP	$22,900,000	$8,610,000	$31,510,000	2017
Regional WWTP	$17,610,000	$0	$17,610,000	N/A
Total (in 2014$)	**$63,030,000**	**$9,340,000**	**$72,370,000**	

In order to provide sufficient man-power to maintain and operate the Village's three WWTPs, nine full-time operators should be on staff. The operators would be responsible for preventative maintenance but corrective maintenance for more significant repairs would need to be contracted to a third party.

9.2 Consolidating Treatment at the Regional WWTP

The Regional WWTP site has capacity to accommodate a maximum of 5.65 MGD, the total combined flow of all three WWTPs. Therefore, the Village may maximize value of the site by consolidating some or all of the treatment at that site. In reviewing the opportunities for consolidation, the following may be considered:

1. **Consolidate the West and Regional WWTPs at the Regional Site; Maintain the North WWTP:** This option requires significant upgrades at the North WWTP. The Regional WWTP would need to be expanded to provide the capacity eliminated by the abandonment of the West WWTP, but this is not projected to occur until about 2033.

2. **Consolidate the North and Regional WWTPs at the Regional Site; Maintain the West WWTP:** This option was eliminated from further evaluation because of the challenges associated with improving the West WWTP as noted above.

3. **Consolidate all three WWTPs at the Regional WWTP:** The Regional WWTP can be expanded to incorporate the capacity of the North and West WWTPs on the existing site. This option requires significant upgrades at the North WWTP, Hickory Creek Lift Station, and Union Ditch Interceptor. This option is the least costly to maintain, accommodates growth to the 20-year projected population, and streamlines regulatory compliance.

The following chapters evaluate the costs for feasible flow consolidation scenarios, including consolidating flows from the West WWTP to Regional WWTP and consolidating flows from the West and North WWTPs to the Regional WWTP.

9.3 Construction of a new WWTP

The Village formerly owned and operated a South WWTP to service the southeastern segment of the facility planning area. The South WWTP was abandoned due to its condition and construction of the Regional WWTP.

Due to growth potential in the southern portion of the planning area, the question of constructing a new South WWTP surfaces. Construction of a new WWTP is comparatively expensive. For estimating purposes, $15 per gallon of new treatment capacity is a reasonable cost to anticipate. The new WWTP would likely receive opposition from environmental advocacy groups and obtaining an NPDES permit will be difficult. The NDPES permit will contain stringent limits if even issued by IEPA. Depending on the limits, the costs could increase significantly.

Because the existing WWTPs have sufficient capacity for the growth potential anticipated over the next 20-years, the Village will maximize the value of its existing assets by building out the existing treatment facilities. Additional capacity may be required based on future growth patterns; however, this is not expected to occur within the Village until approximately 2033. Constructing a South WWTP would not eliminate the need to rehabilitate the existing plants. Therefore, additional treatment capacity is not considered a cost-effective solution at this time.

In the future when growth demands additional treatment capacity, the Village may choose to construct a new WWTP. One potential location for this facility is to the south of the Village limits, illustrated in Exhibit F. This would allow flow to the treatment plant primarily by gravity.

9.4 Alternative Treatment Providers

As discussed previously, the existing WWTPs have sufficient capacity for the growth potential anticipated over the next 20-years. When growth demands additional treatment capacity, the Village may work with other communities nearby to establish an agreement for an alternative treatment provider. This would be in lieu of construction of a new facility. Similar to constructing a new plant, finding an alternative treatment provider would not eliminate the need to rehabilitate the existing plants.

The Frankfort Village FPA borders several other community and wastewater providers. These include the Metropolitan Water Reclamation District of Greater Chicago (MWRD-GC), the Aqua Illinois University Park facility, and the Village of Mokena. A portion of MWRD-GC in Tinley Park already is treated by Frankfort. The likely high cost of this option and requirement to comply with MWRD-GC's proposed I/I limits make this an unlikely option in the future. The Village of Mokena and Aqua Illinois could be contacted when additional growth occurs adjacent to these providers to determine if they have reserve treatment capacity. The cost to reserve or construct additional capacity would fall on the Village, which is not expected to differ significantly from the cost for the Village to expand or maintain its own facilities. Furthermore, the Village would be responsible for the cost of conveyance, which presents another significant capital and operational expense. These factors being considered, alternative treatment providers are not a cost-effective option.

9.5 Land Application of Wastewater

Land application of wastewater is a viable option under certain circumstances. However, large flows require a large application area. The West WWTP has the lowest flows and loadings. Therefore, it is used as an example to demonstrate that land application of even the smallest permitted flow requires a significant area to treat.

Land Distribution System:

Application Rate:	1.5 inches per week
Application Period:	150 days per year
Required Land Area:	223 acres

Storage Lagoon:

Required Storage:	215 days
Volume:	280 MG
Required Land Area:	66 acres

Treatment Lagoon:

Loading Rate:	0.3 ppd/kcf
Volume:	8.1 million cubic feet
Required Land Area:	14 acres

Using a 20% buffer area, approximately 370 acres would be needed to handle the volume of wastewater generated by the Village's West WWTP alone. The cost of the land would approach the cost of providing additional treatment capacity. The total land space to treat all the Village's wastewater flows exceeds 1,500 acres. There are no suitable land application sites of such size in the planning area. Therefore, agricultural application of wastewater is not considered feasible, and no further consideration has been given.

9.6 Non-Compliance

Non-compliance is not a long term feasible solution nor is it recommended. However, delaying compliance may be the preferred option for the Village to finance the improvements. This section outlines the schedule and cost for non-compliance.

Upon a permit violation, IEPA will issue a Notice of Violation (NOV). The NOV is issued after two violations if the discharge exceeds 1.4 times the permitted limit. If the discharge exceeds permitted limits by less than 1.4 times the permitted limit, the NOV will be issued after four violations.

After an NOV is received, the Village must respond within 45 days indicating whether it intends to enter into a Compliance Commitment Agreement (CCA). The response must include detailed steps to be taken to achieving compliance and proposed dates by which compliance will be achieved. If the terms are acceptable, IEPA will issue a CCA for each party to sign. IEPA will allow a compliance period of no more than three years.

If the Village decides not to enter a CCA, or if IEPA rejects the terms of the proposed CCA, the case is referred to the Illinois Attorney General. The Village will enter into a Consent Decree with IEPA in which fines will be imposed but the schedule can be negotiated. The fines can be in the amount of up to $10,000 per day for each day the facility is out of compliance. Therefore, non-compliance could come at the cost of $3.65 million each year for delayed compliance. This is in addition to the cost of the improvements, which must still be undertaken. While non-compliance may delay the Village's ultimate deadline for meeting permitted effluent limits, it only adds cost to the overall improvements.

10. RELOCATION OF TREATMENT FOR THE WEST WWTP

10.1 Description

There are substantial capital costs to maintain the Village's three WWTPs. In addition, the West WWTP will require process modifications to comply with future limits. A significant portion of the West WWTP site is located in the floodway, which may not be permitted for construction of future improvements. A pump station and piping already exists to allow transfer of flow from the West WWTP to the Regional WWTP. Therefore, relocating treatment from the West WWTP to the Regional WWTP offers a cost effective option for the Village to avoid capital expenditures and comply with future regulations.

The Regional WWTP has capacity currently to accept the entire flow from the West WWTP with minimal modifications. While this option could be implemented immediately, the existing system has no redundancy. Therefore, a new pumping and screening facilities is recommended at the West WWTP immediately to accommodate permanent flow transfer to the Regional WWTP. As discussed in previous sections, the pumping facilities have reached the end of their useful life and should be replaced. The West WWTP site would remain as an excess flow facility, with existing clarifiers re-purposed as excess flow facilities. In the future, the existing clarifiers should be upgraded, the disinfection facilities replaced, and the remaining structures and equipment on the site abandoned.

This evaluation includes the improvements required to rehabilitate existing equipment and come into compliance with effluent limits at the North and Regional WWTPs. The improvements recommended for the North WWTP are outlined in Chapter 5, and the total cost is restated herein. The proposed Basis of Design for each facility for this alternative is shown in Appendix E. The proposed WWTP layouts are illustrated in Exhibit G.

10.2 Improvements for Abandoning the West WWTP

This option includes improvements to close the West WWTP and transfer flow to the Regional WWTP. The recommended improvements would abandon the West WWTP and convert it to an excess flow treatment facility. The West WWTP has a dedicated excess flow outfall and thus would be permitted for excess flow treatment. Flows up to 3.9 MGD will be transferred to the Regional WWTP for treatment. Flows in excess of 3.9 MGD will be treated at the site. The West WWTP would be maintained as an excess flow treatment facility. The estimated capital cost of transferring flows from the West WWTP to the Regional WWTP is summarized in Table 21.

Transferring the West WWTP flows to the Regional WWTP has no immediate impact on permitted treatment capacity. However, once the West WWTP is abandoned and the NPDES permit modified to excess flow, the Village would stand to lose 1.3 MGD of treatment capacity. For facilitating the permitting process and coordination with EAGs, simultaneous abandonment of the West WWTP and expansion of the Regional WWTP would be preferred. This would allow the Village to demonstrate that flows are being simply transferred and that no additional loading will be applied to the receiving stream. However, the costs of Regional WWTP expansion are significant.

10.3 Improvements for Accepting Additional Flow at the Regional WWTP

The Regional WWTP utilization is about 32% of the permitted daily average flow during the three low flow months. Until the average flow exceeds 80% of the permitted DAF, or 2.40 MGD, and violates its permit, the facility can be operated without major changes to the process. At average flows over 80% of the permitted flow capacity, the facility would be placed on critical review by IEPA if it has excursions. If the facility does not have excursions then it can operate at flows up to the permitted capacity without being placed on critical review.

Currently, flows to the West WWTP are low enough that they can be transferred to the Regional WWTP without putting the Regional WWTP onto critical review. However, once additional growth occurs in the tributary area (projected for 2033), further expansion of the Regional WWTP capacity will be required. The scope and probable cost of each recommended improvement is outlined in Table 22.

10.4 Summary

Relocating the treatment from the West WWTP to the Regional WWTP represents a major opportunity for cost savings as compared to maintaining each existing treatment plant. The total cost to maintain treatment and come into compliance with permitted effluent limits is $47.6 million over the next 20 years as shown in Table 20.

TABLE 20

20- Year Cost to Relocate Treatment for the West WWTP

	Cost of Equipment Maintenance	Cost of Compliance	Total Facility Cost	Compliance Deadline
North WWTP	$22,520,000	$730,000	$23,250,000	2018
West WWTP	$4,790,000	$0	$4,790,000	2017
Regional WWTP	$19,550,000	$0	$19,550,000	N/A
Total (in 2014$)	**$46,860,000**	**$730,000**	**$47,590,000**	

An evaluation was performed to determine the staffing requirements to perform typical maintenance and operations maintenance. The evaluation took into account productivity and time not worked due to holidays, vacation time, sick time, and professional development. In order to provide sufficient man-power for maintaining the North WWTP and consolidating treatment of the West plant at the Regional WWTP site, the Village should employ seven full-time operators.

Additional operators would be required to perform corrective maintenance. A staffing evaluation is presented in more detail in Appendix G.

Once additional growth occurs in the tributary area, the Regional WWTP capacity will need to be expanded. This growth is unlikely to occur within this planning period; however, the Village should anticipate the second expansion for additional capacity in 20-25 years. This expansion to 4.35 MGD capacity at the Regional WWTP (for an overall capacity of 5.65 MGD between the Regional and North WWTPs) will cost in the range of $20 million.

TABLE 21

West WWTP Costs to Transfer Flows to the Regional WWTP

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
EQUIPMENT REPLACEMENT												
Raw Sewage Pump Station	Construct a Raw Sewage Pump Station, including installing three Raw Sewage Pumps and two Excess Flow Pumps. Replace the influent flowmeter and sampler, piping, and valves. Replace the existing Parshall flume for higher capacity. Demolish the existing Raw Sewage Influent Chamber.	1983	20	31	Ø	Significant Deterioration / Operational Challenges	Equipment Condition	0-5 years	$2,420,000	2015	2016	$2,722,200
Screen Building	Construct a Screen Building and install one mechanically-cleaned fine screen with a manual bypass bar screen.	N/A	20	N/A	N/A	N/A	N/A	0-5 years	$1,150,000	2015	2016	$1,293,600
Disinfection System	Remove and replace the existing chlorination system. Construct a new effluent metering flume.	1983	20	31	Ø	Moderate Deterioration	Equipment Failure	0-5 years	$510,000	2018	2019	$645,300
Abandon West WWTP	Demolish all abandoned structures.	1983	20	31	Ø	Various	Equipment Failure/Future Non-Compliance	0-5 years	$710,000	2018	2019	$898,400
									$4,790,000			**$5,560,000**

* Note: The Project Year Cost is calculated based on the anticipated project year for construction and assuming 4% inflation per year.

TABLE 22

20-Year Regional WWTP Costs to Accept Flows from the West WWTP

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
OPERATIONAL CHALLENGES												
Oxidation Ditch	Drain each ring individually, and hire a third-party to remove, haul, and dispose of grit, rags, and other sludge.	N/A	N/A	N/A	N/A	Operational Challenges	Operational Improvements	Immediate	$520,000	2015	2016	$585,000
Sludge Thickening: Conversion to Belt Filter Press	Install a 1.5-meter belt thickener and thickened sludge conveyor. Improve the polymer feed system. Additional staff will be required in the short-term to operate the existing sludge treatment system.	2008	20	6	14	Operational Challenges	Operational Improvements	5-15 years	$1,420,000	2019	2020	$1,868,600
EQUIPMENT REPLACEMENT												
Screening Equipment	Replace the existing mechanically-cleaned fine screen and manual bypass bar screen. Replace Parshall flume to accommodate higher peak flows. Replace gates.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$840,000	2028	2029	$1,573,300
Grit Removal	Replace grit cyclone, concentrator, and dewatering screw. Replace Odor Control Equipment.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$840,000	2028	2029	$1,573,300
Oxidation Ditch	Replace the oxidation ditch aeration drives and all hydraulic gates. Replace the two existing submersible mixers. Replace instrumentation for BNR control.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$3,610,000	2028	2029	$6,761,500
Secondary Clarifier	Replace the clarifier equipment, scrapers, and collector mechanisms.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$2,030,000	2028	2029	$3,802,200
RAS / WAS Pumps	Replace the four existing RAS pumps and two existing WAS pumps. Replace the mixer in the Phosphorus Precipitant Mixing Tank.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$310,000	2028	2029	$580,600
Tertiary Filters	Replace the three existing tertiary filters.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$3,730,000	2029	2030	$7,265,700
Post-Aeration Equipment	Replace post-aeration blower and diffusers.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$290,000	2029	2030	$564,900
UV Disinfection	Replace existing UV disinfection equipment.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$940,000	2029	2030	$1,831,000

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
Aerobic Digesters	Replace the Aerobic Digester diffusers, blowers, covers, and sludge pumps.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$3,140,000	2029	2030	$6,116,400
Sludge Storage	Replace the Liquid Sludge Storage tank mixer and chopper pump.	2008	30	6	24	Excellent or New Condition	Equipment Condition	5-15 years	$710,000	2029	2030	$1,383,000
Non-Potable Water System	Repair leaking non-potable water system pipes and install system valves.	1998	30	16	14	Significant Deterioration / Operational Challenges	Equipment Condition	5-15 years	$100,000	2029	2030	$194,800
Regional WWTP Generator Replacement	Replace the existing 1,000 kW back-up generator.	1998	30	16	14	Moderate Deterioration	Equipment Condition	5-15 years	$1,070,000	2029	2030	$2,084,300
									$19,550,000			**$36,190,000**
ALTERNATIVES												
Aerobic Digesters*	Construct two additional Aerobic Digesters. Install diffusers in the two tanks, two additional blowers, covers, and additional sludge pumps.	N/A	20	N/A	N/A	N/A	Operational Improvements	0-5 years	$2,880,000	2016	2017	$3,369,200

* Note: The Project Year Cost is calculated based on the anticipated project year for construction and assuming 4% inflation per year.

11. CONSOLIDATE TREATMENT AT REGIONAL WWTP

This section considers improvements to the Village's wastewater collection and treatment facilities to consolidate all treatment at the Regional WWTP site. Specifically, this includes expansion at the Regional WWTP and the Hickory Creek Lift Station to accommodate flows from the North and West WWTPs, extending the Union Ditch Interceptor Sewer, closing the North and West WWTPs, and converting those two facilities into satellite excess flow treatment facilities.

The proposed Regional WWTP improvements include adding capacity through redundant units and providing additional sludge handling facilities. The proposed bases of design for this alternative are shown in Appendix F. The proposed WWTP layouts are shown in Exhibit H.

11.1 Improvements at the North WWTP

The recommended improvements would abandon the North WWTP and convert it to an excess flow storage facility. IEPA and U.S. EPA are currently in discussions to determine requirements for excess flow treatment. Depending on the outcome of these discussions, the North WWTP may be converted to excess flow treatment rather than just storage. In the meantime, it is unclear whether IEPA will permit new excess flow outfalls. The North WWTP does not have a dedicated excess flow outfall. Therefore, if IEPA will not permit a new excess flow outfall at the North WWTP, the North WWTP will be used for excess flow storage only.

An existing 18-inch interceptor runs along Union Ditch from Hickory Creek to approximately St. Francis Road. The 18-inch interceptor does not have sufficient capacity to transport the total excess flow from the North WWTP to the Regional WWTP. Figure 17 shows the sewer hydraulics at the daily average flow of 1.35 MGD, demonstrating that the sewer is not surcharged at that flowrate. Figure 18 shows the hydraulics at the excess flow capacity of 4.35 MGD. The surcharge is up to 13 feet under these excess flow conditions. Therefore, the interceptor does not have sufficient capacity to transport the daily maximum flow of 4.35 MGD. A parallel 18-inch interceptor should be installed alongside the existing interceptor to provide sufficient flow capacity. In addition, the interceptor would need to be extended from St. Francis Road to the North WWTP. A 42-inch diameter pipe would be required.

FIGURE 17

Union Ditch Interceptor Profile at 1.35 MGD

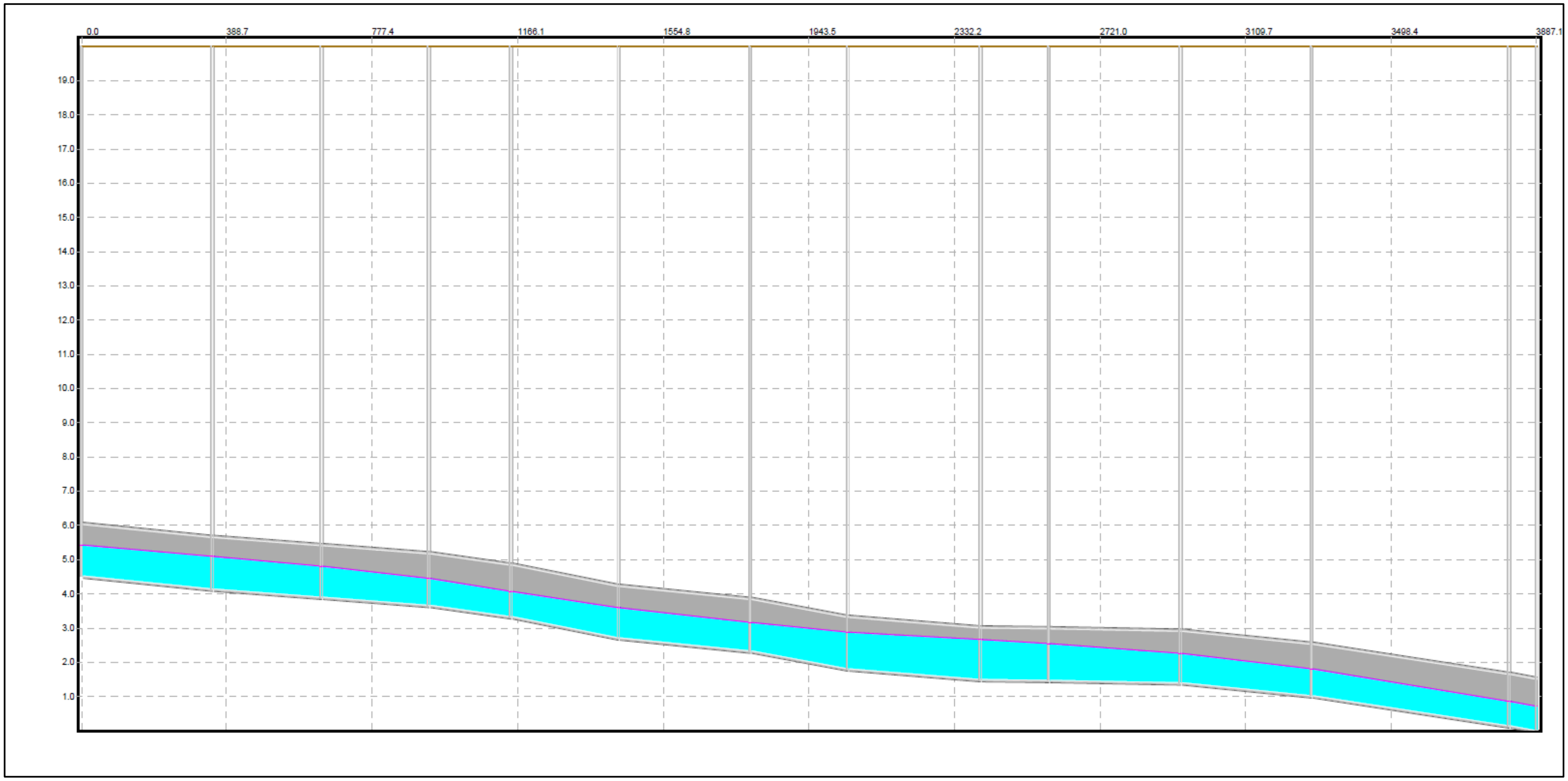
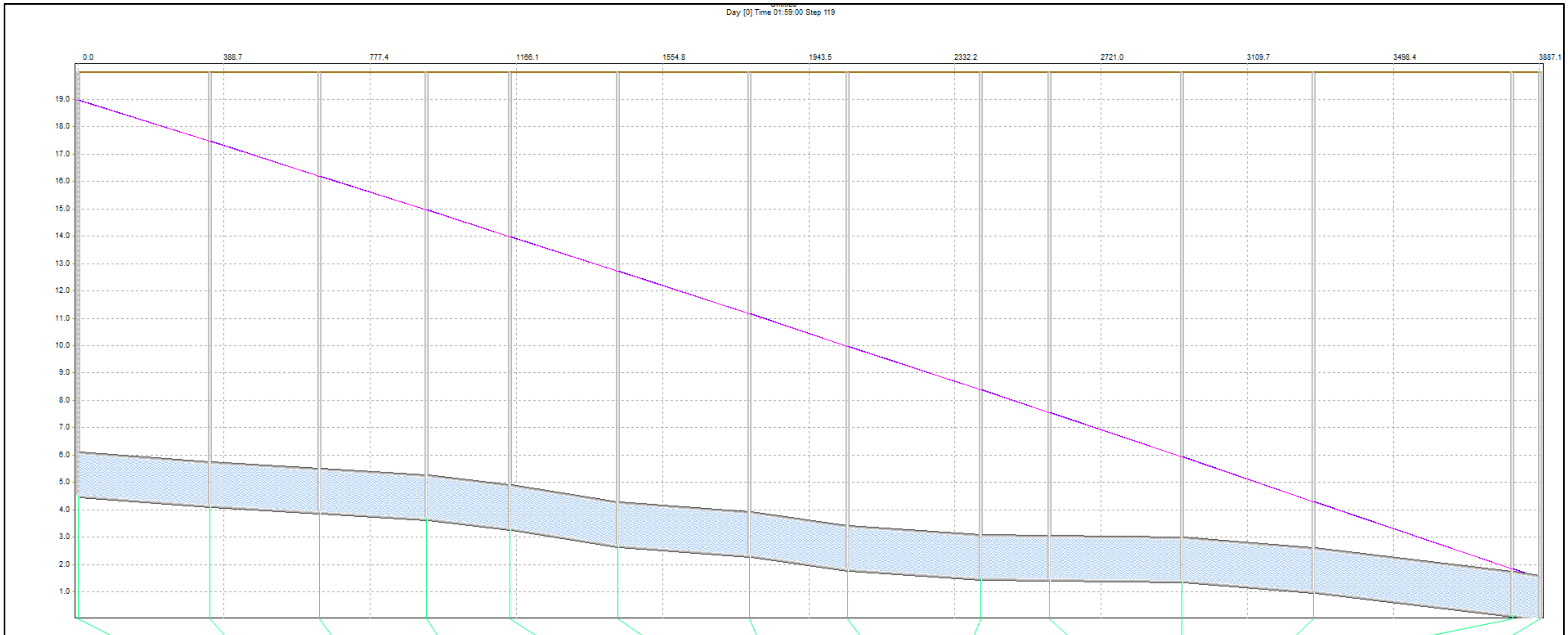


FIGURE 18

Union Ditch Interceptor Profile at 4.35 MGD



	1015	1013	1012	1009	1010	1011	1008	1007	1006	1005	1004	1003	1001	1000
Surcharge at Max HGL ft	12.954	11.809	10.780	9.774	9.147	8.506	7.305	6.654	5.377	4.555	3.008	1.769	0.181	0.000

The Hickory Creek Lift Station currently accommodates flows from the north and east portions of the service area. In order to accommodate the entire flow from the North WWTP, the pumps need to be replaced with higher capacity and a new force main to the Regional WWTP must be constructed. The overall scope of improvements at the North WWTP are outlined in Table 24.

11.2 Improvements at the West WWTP

The recommended improvements would abandon the West WWTP and convert it to an excess flow treatment facility. The West WWTP has a dedicated excess flow outfall and thus would be permitted for excess flow treatment. Flows up to 3.9 MGD will be transferred to the Regional WWTP for treatment. Flows in excess of 3.9 MGD will be treated at the site. This alternative assumes that the permit limit for excess flow will continue to be 30 mg/L for BOD and TSS. The overall scope of improvements for the West WWTP are outlined in Table 25.

11.3 Improvements for Accepting Additional Flow at the Regional WWTP

The Regional WWTP site has the capacity to accept the total flows from the West and North WWTPs with construction of improvements. The total wastewater flows from the three WWTPs currently exceed 80% of the Regional WWTP's rated capacity. Therefore, expansion of capacity to 4.35 MGD would be required immediately. The scope and probable cost of each recommended improvement is outlined in Table 26.

11.4 Summary

Consolidating treatment of the Village's total wastewater flows at the Regional WWTP represents an opportunity for operational cost savings. However, this plan would require significant capital spending over the next five years. The total cost to maintain treatment and come into compliance with permitted effluent limits is $54.3 million over the next 20 years as summarized in Table 23.

TABLE 23

20- Year Cost to Consolidate All Treatment at Regional WWTP

	Cost of Equipment Maintenance	Cost of Compliance	Total Facility Cost	Compliance Deadline
North WWTP	$9,980,000	N/A	$9,980,000	2018
West WWTP	$4,790,000	N/A	$4,790,000	2017
Regional WWTP	$39,490,000	N/A	$39,490,000	N/A
Total (in 2014$)	**$54,260,000**		**$54,260,000**	

An evaluation was performed to determine the staffing requirements to perform typical operations and maintenance. The evaluation took into account productivity and time not worked due to holidays, vacation time, sick time, and professional development. In order to provide sufficient man-power for operating the Regional WWTP with flows consolidated from the West and North WWTP sites, the Village should employ five full-time operators. Additional operators would be required to perform corrective maintenance. A more detailed outline of the staffing assessment is presented in Appendix G.

Once additional growth occurs in the tributary area, further expansion of the Regional WWTP capacity will be required; however, this growth is unlikely to occur within this planning period. The Village should anticipate the second expansion for additional capacity in 20-25 years. This expansion to 5.65 MGD capacity at the Regional WWTP is expected to cost in the range of $5-6 million.

TABLE 24

North WWTP Costs to Transfer Flows to the Regional WWTP

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
EQUIPMENT REPLACEMENT												
Raw Sewage Pump Station	Construct a Raw Sewage and Excess Flow Pump Station, including two Raw Sewage Pumps and three Excess Flow Pumps. Replace the influent flowmeter and sampler, piping, and valves. Demolish the existing Raw Sewage pump vault, valve vault, and grinder vault.	1970	20	44	Ø	Significant Deterioration / Operational Challenges	Equipment Condition	0-5 years	$1,880,000	2015	2016	$2,114,700
Screen Building	Construct a Screen Building and install one mechanically-cleaned fine screen with a manual bypass bar screen.	N/A	20	N/A	N/A	N/A	N/A	0-5 years	$1,150,000	2015	2016	$1,293,600
Disinfection System	Remove and replace the existing chlorination system. Construct a new effluent metering flume.	1970	20	44	Ø	Moderate Deterioration	Equipment Failure	0-5 years	$510,000	2017	2018	$620,500
Hickory Creek Lift Station	Increase the capacity of the lift station and force mains to accommodate flows from the North WWTP.	2002	20	12	8	Moderate Deterioration	Increase Capacity	0-5 years	$3,990,000	2017	2018	$4,854,400
Union Ditch Interceptor	Extend the existing interceptor to the North WWTP. Increase the capacity of the existing interceptor to accommodate up to 4.35 MGD.	2002	20	12	8	Moderate Deterioration; Incomplete Construction	Increase Capacity	0-5 years	$1,740,000	2017	2018	$2,117,000
Abandon North WWTP	Demolish all abandoned structures.	1970	20	44	Ø	Various	Equipment Failure/Future Non-Compliance	0-5 years	$710,000	2018	2019	$898,400
									$9,980,000			**$11,900,000**

* Note: The Project Year Cost is calculated based on the anticipated project year for construction and assuming 4% inflation per year.

TABLE 25

West WWTP Costs to Transfer Flows to the Regional WWTP

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
EQUIPMENT REPLACEMENT												
Raw Sewage Pump Station	Construct a Raw Sewage Pump Station, including installing three Raw Sewage Pumps and two Excess Flow Pumps. Replace the influent flowmeter and sampler, piping, and valves. Replace the existing Parshall flume for higher capacity. Demolish the existing Raw Sewage Influent Chamber.	1983	20	31	Ø	Significant Deterioration / Operational Challenges	Equipment Condition	0-5 years	$2,420,000	2015	2016	$2,722,200
Screen Building	Construct a Screen Building and install one mechanically-cleaned fine screen with a manual bypass bar screen.	N/A	20	N/A	N/A	N/A	N/A	0-5 years	$1,150,000	2015	2016	$1,293,600
Disinfection System	Remove and replace the existing chlorination system. Construct a new effluent metering flume.	1983	20	31	Ø	Moderate Deterioration	Equipment Failure	0-5 years	$510,000	2018	2019	$645,300
Abandon West WWTP	Demolish all abandoned structures.	1983	20	31	Ø	Various	Equipment Failure/Future Non-Compliance	0-5 years	$710,000	2018	2019	$898,400
									$4,790,000			**$5,560,000**

* Note: The Project Year Cost is calculated based on the anticipated project year for construction and assuming 4% inflation per year.

TABLE 26

20-Year Regional WWTP Costs to Accept Flows from the North and West WWTPs

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
OPERATIONAL CHALLENGES												
Oxidation Ditch	Drain each ring individually, and hire a third-party to remove, haul, and dispose of grit, rags, and other sludge.	N/A	N/A	N/A	N/A	Operational Challenges	Operational Improvements	Immediate	$520,000	2015	2016	$585,000
Sludge Thickening: Conversion to Belt Filter Press	Install a 1.5-meter belt thickener and thickened sludge conveyor. Improve the polymer feed system. Additional staff will be required in the short-term to operate the existing sludge treatment system.	2008	20	6	14	Operational Challenges	Operational Improvements	5-15 years	$1,420,000	2019	2020	$1,868,600
EQUIPMENT REPLACEMENT												
Screening Equipment	Replace the existing mechanically-cleaned fine screen and manual bypass bar screen. Replace Parshall flume to accommodate higher peak flows. Replace gates.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$840,000	2028	2029	$1,573,300
Grit Removal	Replace grit cyclone, concentrator, and dewatering screw. Replace Odor Control Equipment.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$840,000	2028	2029	$1,573,300
Oxidation Ditch	Replace the oxidation ditch aeration drives and all hydraulic gates. Replace the two existing submersible mixers. Replace instrumentation for BNR control.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$3,610,000	2028	2029	$6,761,500
Secondary Clarifier	Replace the clarifier equipment, scrapers, and collector mechanisms.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$2,030,000	2028	2029	$3,802,200
RAS / WAS Pumps	Replace the four existing RAS pumps and two existing WAS pumps. Replace the mixer in the Phosphorus Precipitant Mixing Tank.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$310,000	2028	2029	$580,600
Tertiary Filters	Replace the three existing tertiary filters.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$3,730,000	2029	2030	$7,265,700
Post-Aeration Equipment	Replace post-aeration blower and diffusers.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$290,000	2029	2030	$564,900
UV Disinfection	Replace existing UV disinfection equipment.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$940,000	2029	2030	$1,831,000
Aerobic Digesters	Replace the Aerobic Digester diffusers, blowers, covers, and sludge pumps.	2008	20	6	14	Moderate Deterioration	Equipment Condition	5-15 years	$3,140,000	2029	2030	$6,116,400
Sludge Storage	Replace the Liquid Sludge Storage tank mixer and chopper pump.	2008	30	6	24	Excellent or New Condition	Equipment Condition	5-15 years	$710,000	2029	2030	$1,383,000
Non-Potable Water System	Repair leaking non-potable water system pipes and install system	1998	30	16	14	Significant Deterioration /	Equipment Condition	5-15 years	$100,000	2029	2030	$194,800

Project Title	Description	Year Installed (Overhauled)	Estimated Life Expectancy (years)	Calc. Age (Years)	Calc. Life Remaining (Years)	Condition	Project Purpose	Recommended Replacement Period	Total 2014 Project Cost	Anticipated Project Year (Design)	Anticipated Project Year (Construction)	Project Year Cost*
	valves.					Operational Challenges						
Regional WWTP Generator Replacement	Replace the existing 1,000 kW back-up generator.	1998	30	16	14	Moderate Deterioration	Equipment Condition	5-15 years	$1,070,000	2029	2030	$2,084,300
									$19,550,000			**$36,190,000**
CAPACITY												
Increase Capacity to 4.35 MGD	Install a second mechanical screen. Provide a second vortex grit removal system with classifier, compactor, etc. Modify the oxidation ditch to accommodate the increased flows and aeration loadings. Replace the RAS Pumps and provide an additional WAS Pump. Provide one additional Tertiary Disc Filter and one additional Re-Aeration Blower. Replace the UV Disinfection Structure and equipment to accommodate higher flows. Construct four additional Aerobic Digesters with diffusers, pumps, and covers. Replace the five existing blowers. Provide one Liquid Sludge Storage Tank. Construct a Laboratory and Office Building.	2008	20	6	14	Moderate Deterioration	Growth / North WWTP Closure	5-15 years	$19,940,000	2014	2015	$21,567,100
									$39,490,000			**$57,760,000**
ALTERNATIVES												
Aerobic Digesters*	Construct two additional Aerobic Digesters. Install diffusers in the two tanks, two additional blowers, covers, and additional sludge pumps.	N/A	20	N/A	N/A	N/A	Operational Improvements	0-5 years	$2,880,000	2016	2017	$3,369,200

* Note: The Project Year Cost is calculated based on the anticipated project year for construction and assuming 4% inflation per year.

12. SUMMARY OF ALTERNATIVES/RECOMMENDATIONS

The alternatives presented as part of this Facilities Planning Report include the cost and phasing requirements to, among others, maintain the Village's existing three WWTPs, transfer flows to alternative treatment providers, construct a new treatment facility, and consolidate treatment. This section summarizes the three major alternatives evaluated: maintaining all WWTP sites, consolidating treatment of the West and Regional WWTPs while maintaining the North WWTP, and consolidating treatment of all flows at the Regional WWTP.

Construction of a new WWTP would likely include stringent permit limits including phosphorus, ammonia, and potentially nitrogen. Support from EAGs would be recommended to streamline the permitting process. Since the existing sites can accommodate the 20-year population, it recommended that construction of a new WWTP be delayed until beyond the 20-year planning window. A new WWTP in the southern portion of the planning area should be considered when the existing treatment capacity is reached.

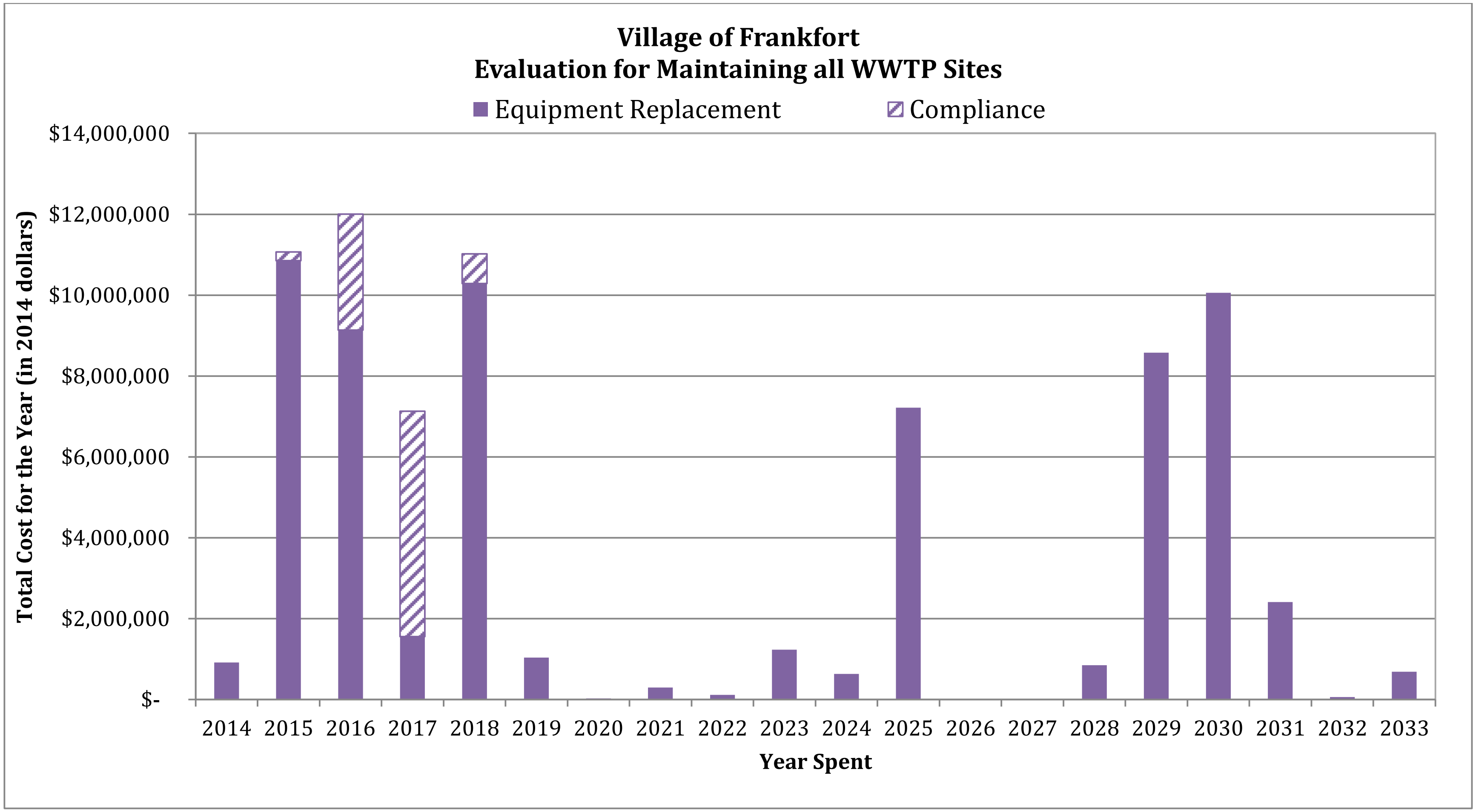
12.1 Maintain All WWTP Sites

Maintaining the existing facilities has significant obstacles to implementation. The West WWTP requires significant construction to replace deteriorating facilities. In addition, maintaining the West WWTP would require converting to an activated sludge secondary treatment process in order to meet lower ammonia limits. Constructing these necessary improvements may not be feasible at the West WWTP based on the location of the floodway on the site. The North WWTP would also require significant construction to replace deteriorating facilities and to meet future permit requirements. The improvements at the Regional WWTP would be minimal. The cost to maintain the Village's three existing WWTPs is estimated at $63.5 million. The staff required to operate and maintain the three facilities is nine full-time operators.

Figure 19 shows the budgeting requirements for this option.

FIGURE 19

20 Year Equipment Replacement & Compliance Costs (Maintaining all WWTP Sites)



12.2 Consolidate Treatment of the West and Regional WWTPs; Maintain North WWTP

The Regional WWTP site has sufficient space to expand to accommodate the total flows from the West and North WWTPs. However, because the flows to the Regional WWTP are currently low, the Regional WWTP has capacity to accommodate flows from the West WWTP immediately. The West WWTP's existing flow transfer pumps have no redundancy. Therefore, for flow transfer to the Regional WWTP to be a permanent improvement, a new Raw Sewage Pump Station would need to be constructed immediately for flow transfer.

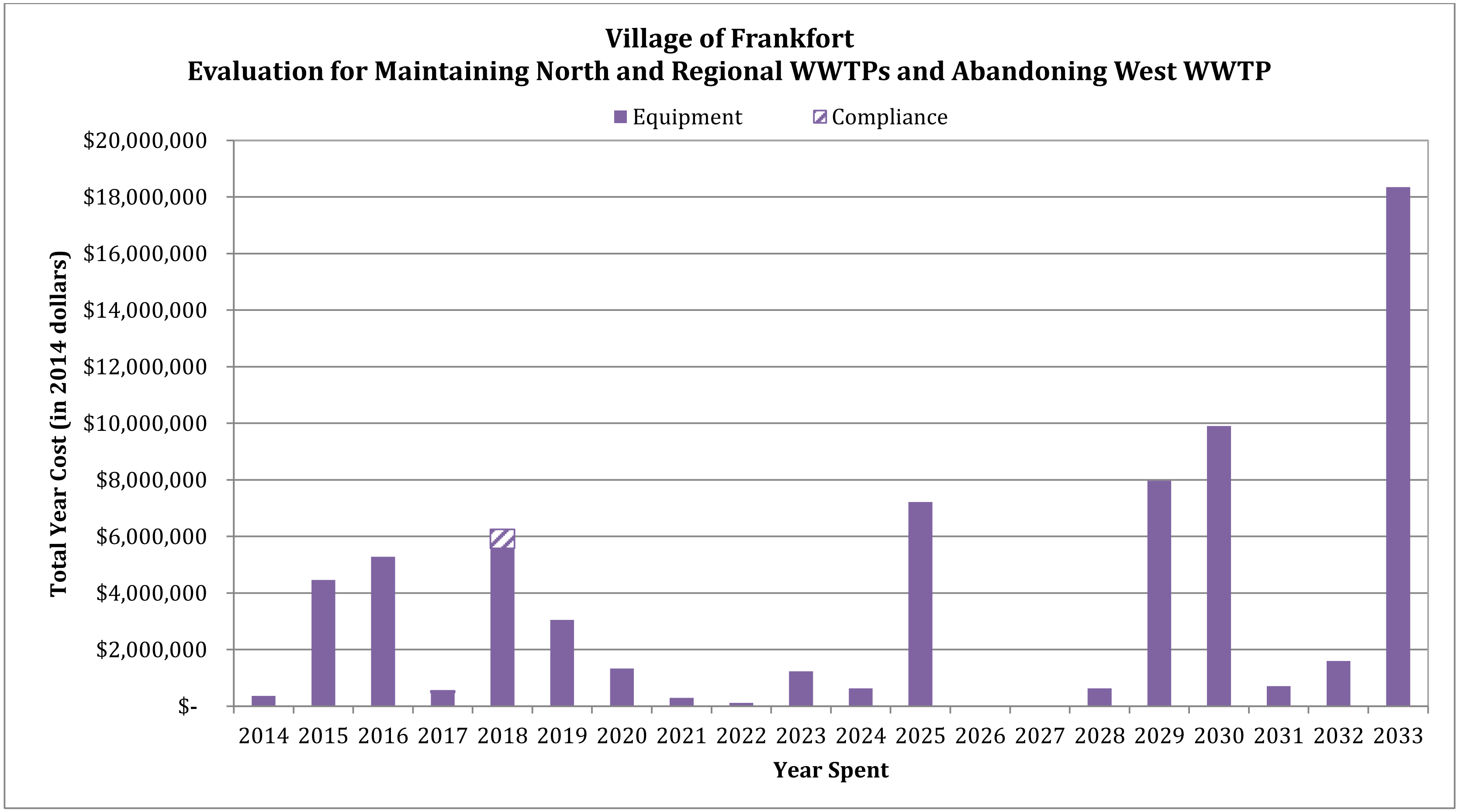
Consolidating the treatment of flows from the West WWTP at the Regional WWTP provides an opportunity for capital cost savings in the short-term and opens the door for many phasing options. As part of this recommendation, the West WWTP would be abandoned over time. The Village should consider pairing abandonment with a future increase to permitted capacity when needed at the Regional WWTP.

The cost to transfer flows from the West to Regional WWTP and maintain the North WWTP is estimated at $47.6 million. The staff required to operate and maintain the two facilities is seven full-time operators.

Figure 20 shows the budgeting requirements for this option.

FIGURE 20

20-Year Costs for Maintaining North and Regional WWTPs and Abandoning West WWTP



Note: The large project cost in 2033 includes the cost to expand the Regional WWTP based on growth within the Village.

12.3 Consolidate Treatment of All Flows at the Regional WWTP

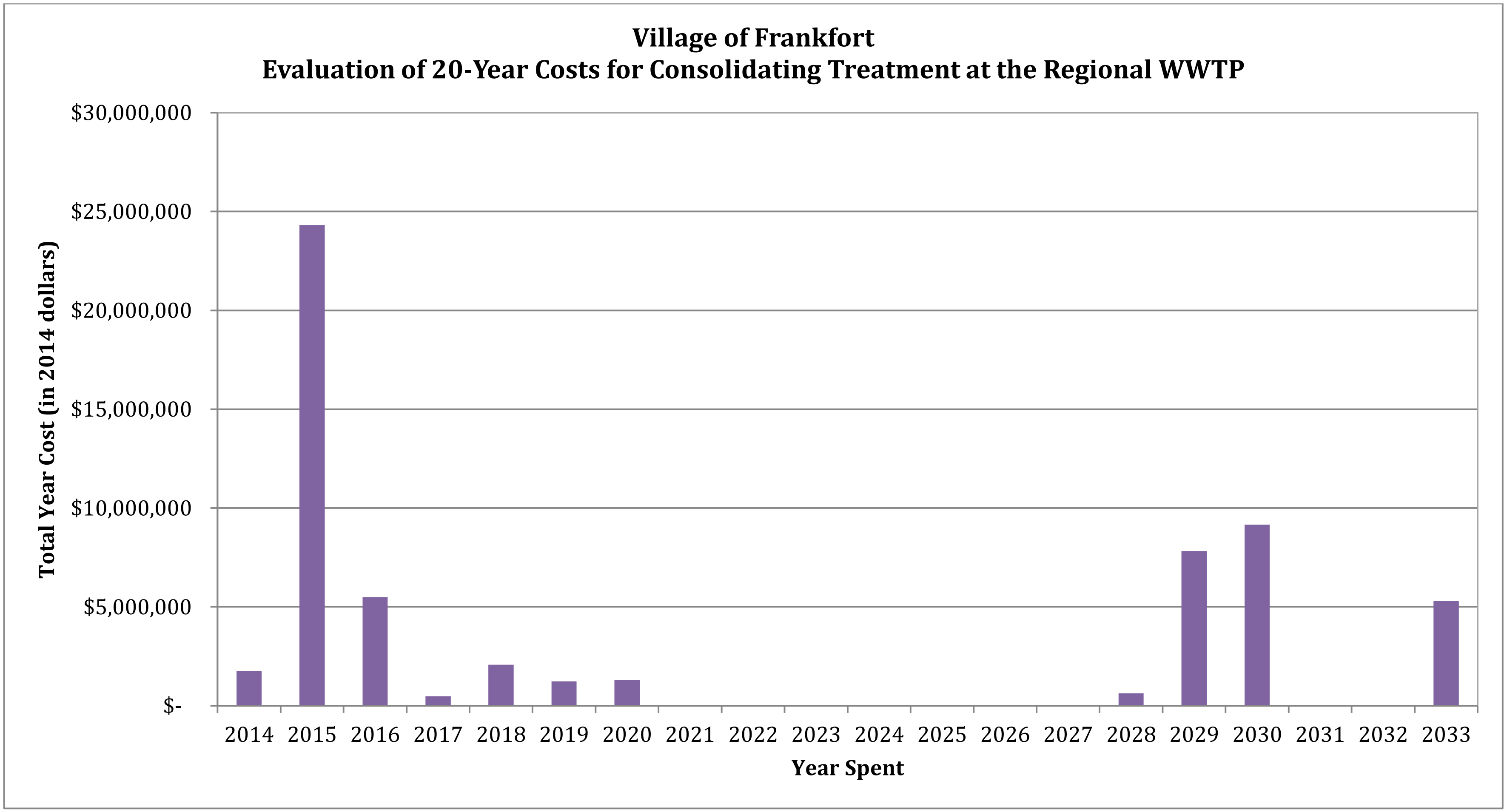
As previously stated, the Regional WWTP site has the potential to accept flows from both the North and West WWTPs and represents an opportunity for operations cost savings. This option presents a higher five-year cost and has more difficult phasing over time. However, this alternative is anticipated to have the lowest long term cost due to consolidation of operations and maintenance to one WWTP as well as accommodating growth to the 20-year projected population. Lastly, removing the West and North WWTPs has the advantage of reducing impact on nearby residents.

Transferring flows from the West WWTP requires rehabilitation of already-existing facilities. The Village can also consolidate flow from the North WWTP at the Regional WWTP by increasing the Regional WWTP capacity, increasing the size of the Union Ditch Interceptor, increasing the capacity of the Hickory Creek Lift Station, and constructing new pumping facilities at the North WWTP as well as improving the excess flow pond.

The cost to consolidate treatment at the Regional WWTP is estimated at $54.3 million. The staff required to operate and maintain the facility is five full-time operators. Figure 21 shows the budgeting requirements for this option.

FIGURE 21

20-Year Costs for Consolidating Treatment at the Regional WWTP



12.4 Recommended Plan

Maintaining the existing WWTPs provides the Village with few opportunities to meet future permit limits based on the limitations in the existing treatment processes. The Regional WWTP has capacity to accept flows from other facilities. Transferring flows from the West WWTP provides a low-cost opportunity for short-term regulatory relief. Transferring flows from the North to Regional WWTP requires immediate major capital construction that would be difficult to phase. The alternative for transferring the West WWTP to the Regional Plant but maintaining the North WWTP was considered in depth. However, ultimately the Village determined that its best long term interests are to consolidate operations at one facility.

Consolidating all three facilities into the Regional WWTP has a higher 5-year cost, as the Regional WWTP would require immediate expansion. However, consolidating the Village's wastewater flow presents the lowest operational and long term capital costs. Additionally, this alternative allows the Village to start constructing improvements at the Regional WWTP and easily accommodate growth when the demand triggers after the 20-year projected plan. Therefore, the recommendation for the Village is to consolidate all three WWTPs at the Regional WWTP. Table 27 summarizes the recommended plan.

TABLE 27

Summary of Recommended Alternative: Consolidate Treatment at Regional WWTP

Site Project	Cost of Equipment Maintenance	Cost of Compliance	Total Facility Cost	Compliance Deadline
North WWTP: Construct Flow Transfer Facilities; Improve Excess Flow Storage Facilities; Abandon Treatment	$9,980,000	$0	$9,980,000	2018
West WWTP: Construct Flow Transfer Facilities; Abandon Treatment	$4,790,000	$0	$4,790,000	2017
Regional WWTP: Maintain Existing Site; Increase Facilities and Lift Station Capacity; Extend Interceptor Sewer	$39,490,000	$0	$39,490,000	N/A
Total Cost (in 2014 USD)	**$54,260,000**	**$0**	**$54,260,000**	

12.5 Phasing

The recommended plan requires substantial planning and phasing in order to accommodate NPDES permit requirements and include equipment upgrades in a timely manner to avoid costly emergency repairs.

The Regional WWTP permit is anticipated to be re-issued in November 2015. The permit already has a Phosphorus limit and it is expected to contain a three year compliance period for chlorides. The Regional WWTP has capacity to meet lower ammonia limits, but will need immediate expansion in order to treat all Village's wastewater flows. The first major steps for implementing the recommended plan are:

- Install redundant equipment units and additional sludge handling facilities in order to accommodate all Village's wastewater flow at the Regional WWTP. Design of these improvements should begin immediately.
- Construct pump stations, sewers, and improvements at the West and North WWTPs to transfer flows to the Regional WWTP. Design of these improvements should also begin immediately. However, transfer of flow will not occur until the additional Regional WWTP facilities are on-line.

In the future, as the Village's planning area builds out, the Regional WWTP will be required to expand. Future improvements at the Regional WWTP will be required in approximately 2033 to increase the capacity to the Village's total current design flow of 5.65 MGD. Growth will be the factor that drives the timing of this improvement. A detailed phasing plan for the recommended improvements is included in Table 28.

TABLE 28

Phasing Plan for Recommended Alternative: Maintaining Regional WWTP and Abandoning North and West WWTPs

Project Title	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
West WWTP																			
Raw Sewage Pump Station		$200,000	$2,220,000																
Screen Building		$95,000	$1,055,000																
Disinfection System					$42,000	$468,000													
Abandon West WWTP					$59,000	$651,000													
Subtotal (in 2014$)	**$ -**	**$295,000**	**$3,275,000**	**$ -**	**$101,000**	**$1,119,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
North WWTP																			
Raw Sewage Pump Station		$138,000	$1,742,000																
Screening Building	$138,000	$1,012,000																	
Disinfection System	$21,000	$489,000																	
Hickory Creek Lift Station	$200,000	$3,790,000																	
Union Ditch Interceptor				$265,000	$1,475,000														
Abandon North WWTP				$213,000	$497,000														
Subtotal (in 2014$)	**$359,000**	**$5,429,000**	**$1,742,000**	**$478,000**	**$1,972,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
REGIONAL WWTP																			
Oxidation Ditch		$43,000	$477,000																
Sludge Thickening: Conversion to Belt Filter Press						$117,000	$1,303,000												
Screening Equipment															$69,000	$771,000			
Grit Removal															$69,000	$771,000			
Oxidation Ditch															$298,000	$3,312,000			
Secondary Clarifier															$168,000	$1,862,000			
RAS / WAS Pumps															$26,000	$284,000			
Tertiary Filters																$308,000	$3,422,000		
Post-Aeration Equipment																$24,000	$266,000		
UV Disinfection																$78,000	$862,000		
Aerobic Digesters																$259,000	$2,881,000		
Sludge Storage																$59,000	$651,000		

Project Title	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Non-Potable Water System																$8,000	$92,000		
Regional WWTP Generator Replacement																$88,000	$982,000		
Increase Capacity to 4.35 MGD	$1,395,800	$18,544,200																	
Subtotal (in 2014$)	**$1,395,800**	**$18,587,200**	**$477,000**	**$ -**	**$ -**	**$117,000**	**$1,303,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$630,000**	**$7,824,000**	**$9,156,000**	**$ -**	**$ -**
BUDGET YEAR COST																			
TOTAL (in 2014$)	**$1,754,800**	**$24,311,200**	**$5,494,000**	**$478,000**	**$2,073,000**	**$1,236,000**	**$1,303,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$630,000**	**$7,824,000**	**$9,156,000**	**$ -**	**$ -**