

Report
Conceptual Wastewater Facility Plan
Olivet Center
Town of Dover, NY

APPLICANT: Olivet Management LLC
73 Wheeler Road
Wingdale, NY 12594

LOCATION: NYS Route 22 and Wheeler Road
Wingdale, NY 12594
Town of Dover
Dutchess County
Tax Map #: 132600-7159-00-162702
Tax Map #: 132600-7159-00-065920
Tax Map #: 132600-7059-00-814768

PROJECT No.: 13-019

DATE: November 30, 2015

PREPARED BY:

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CIVIL ■ ENVIRONMENTAL ■ STRUCTURAL

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1.0 Introduction

Olivet Management has proposed a reuse of the Harlem Valley Psychiatric Center (HVPC) campus located in Wingdale, NY, as a campus for Olivet University, a private Christian institution of higher education, recently authorized by the New York State Board of Regents to offer courses of academic study. Currently a proposal has been made to the Town of Dover Planning Board to implement Phase 1 of a nine phase development plan for the project site. A copy of the project Site Phasing Plan that delineates the nine phases can be found in Appendix A.

The project site is located in the Hamlet of Wingdale near the southern end of the Town of Dover in Dutchess County, NY. The site consists of 513.75 acres within tax parcels 7159-00-162702, 7159-00-065920, and 7059-00-814768 which were previously part of the Harlem Valley Psychiatric Center (HVPC) campus. The HVPC and the formerly proposed Knolls of Dover project included over 850 acres of land on both the east and west sides of Route 22. The Olivet Center plan includes only the 513.75 acres on the east side of Route 22. The west side of Route 22 and the existing Wastewater Treatment Plant (WWTP) is still owned by the Dover Knolls Development Company, LLC. Therefore, Olivet Management, LLC and the Dover Knolls Development Company, LLC have agreed in concept to share the WWTP site through the existing formed Dover Knolls Sewage-Works Corporation.

The existing WWTP for the HVPC will require significant repair and upgrade in order to meet current standards and to comply with the anticipated amended effluent limits. Additionally the projected flows for the Olivet Site are projected to be 210,000 GPD, far less than the 1.2 million GPD used by HVPC or the 600,000 GPD proposed for the Dover Knolls project. Therefore we have proposed to replace the existing WWTP with a new facility that can be expanded over time for the Olivet site and is capable of being enlarged at a future date should Dover Knolls decide to pursue a project on the west side.

As part of the Olivet project it is anticipated that the original New York State Department of Environmental Conservation (NYSDEC), State Pollution Discharge Elimination System (SPDES) Permit (SPDES No: NY 003 2158) will be amended from 1.2 million GPD to 210,000 GPD and the effluent discharge limits will be modified based upon water quality requirements of the receiving stream. It is also anticipated that the existing treatment components will be replaced and that the original outfall to the Swamp River will be maintained.

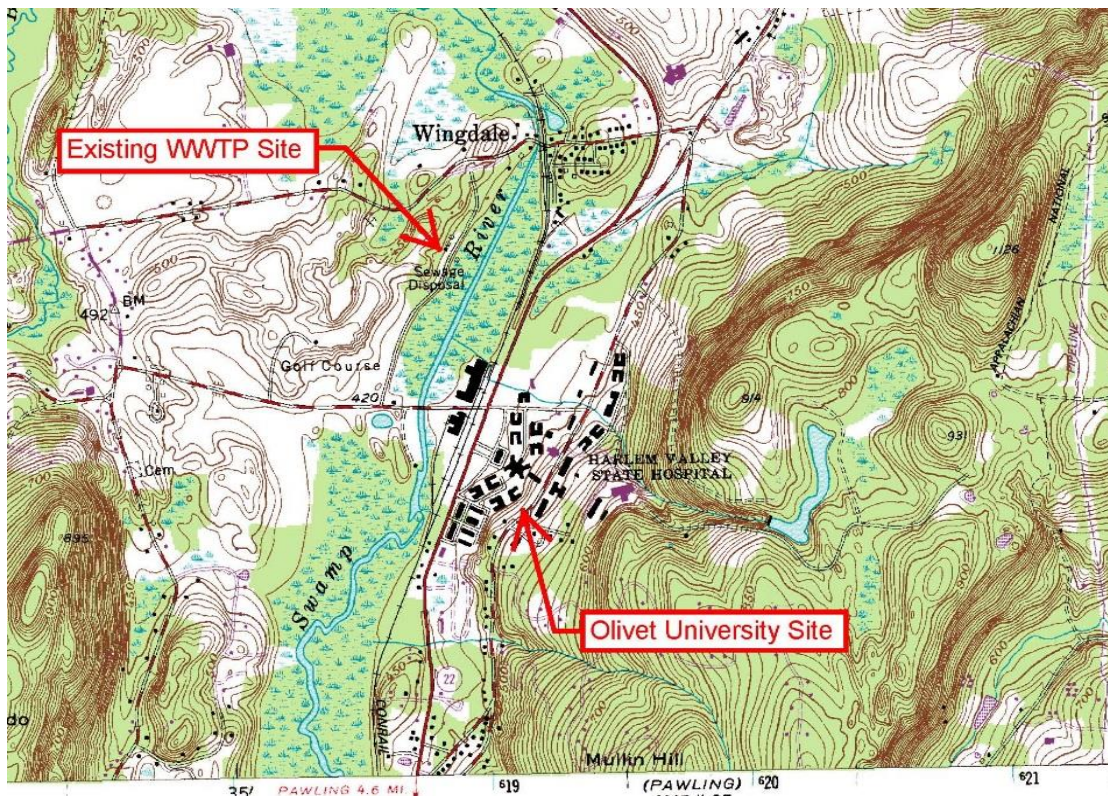
Olivet Center WWTP Conceptual Facility Plan

Due to the age and the known Inflow and Infiltration (I&I) issues the sewage collection system on the east side will be replaced or repaired on a phase by phase basis. Those portions of the system associated with later phases will be disconnected from those portions of the collection system that are required for the initial phase. The first phase will also include a new central pump station that will convey all sewage collected on the east side to the WWTP site.

1.1 Existing Site Conditions

The Olivet University site is located along NYS Route 22, in the Town of Dover, Dutchess County, NY. The campus will be located on a 513.75 acre parcel located on the East side of Route 22 and the existing WWTP site is located on a ± 344 acre parcel located on the West side of Route 22 owned by Dover Knolls. Figure 1-1 below shows the location of the project. The existing WWTP site has a sizable area available to locate all the proposed treatment units that are required for this project.

Figure 1-1 Project Site Location



1.2 Existing WWTP System Description

The existing system is permitted to discharge to the Swamp River under NYSDEC SPDES Permit No: 003 2158. This SPDES Permit allows a flow of 1.2 million GPD, however this level of flow has not been seen in multiple decades. The existing treatment facility was reportedly constructed in the 1930's with the last major repairs occurring in the 1990's. Currently flow is discharged from the central pump station force main into a manhole structure that is located to the west of the headworks. From this point it is gravity flow into the treatment facility.

Due to years of deferred maintenance the facility is minimally operational. Currently the facility is estimated to receive a flow of $\pm 5,000$ GPD. This very small flow is estimated to have a several week detention time through the existing treatment tanks.

The existing system is a conventional activated sludge process that consists of: Influent Chamber & Metering, Primary Clarification, Aeration, Secondary Clarification, Chlorination, and Post Aeration. Sludge Processing was accomplished through the use of two anaerobic digesters and 3 sludge drying beds.

1.3 Existing Sewage Collection System Description

The existing sanitary sewer system at the HVPC campus was originally installed in the 1920's and 30's. Since that time multiple additions were initiated in response to facility expansions. The collection system on the east side consists of a gravity system that is conveyed from the east side of Route 22 south of the train station, under the highway and the rail line, to the south end of the power plant building that is located on Dover Knolls Property. At the southwest corner of the power plant building sewage is directed into the screening room and to the central pumping facility. Sewage is reportedly conveyed from this pump station to the WWTP through a 20-inch cast iron force main. The force main exits the southwest corner of the power plant building, travels north to Wheeler Road where it turns west before the road and crosses under the Swamp River south of the Wheeler Road bridge. From this point the force main reportedly follows the access drive north to the WWTP.

The majority of the gravity collection system consists of Vitrified Clay Pipe (VCP). Such material was utilized extensively in the past for its low frictional characteristics, resistance to corrosion, relatively low cost and ease of handling. The primary drawback to this

Olivet Center WWTP Conceptual Facility Plan

material is its fragility and the fact that it is installed in 3 foot sections leaving numerous joints. Over time the joint seals fail and infiltration of groundwater into the system occurs. It is reported by the operator that large quantities of Inflow and Infiltration (I/I) are known to regularly enter the system.

2.0 Design Considerations

The design of a new WWTP will be based on the following influent and effluent analytical characteristics.

2.1 Influent Analysis

The following are the wastewater characteristics that have been determined to be most appropriate for this project. The influent composition will be similar to most typical municipal wastewater found in New York State.

- Maximum Design Flow Capacity: 210,000 GPD
- Peak Hour Flow: 510 GPM (3.5X)
- Influent BOD: 250 mg/L (medium strength)
- Influent TSS: 250 mg/L
- Influent TKN: 30 mg/L
- Phosphorus (total as P): 8 mg/L
- Fat / Oil / Grease (FOG): 50 mg/L

2.2 Effluent Requirements (NYSDEC SPDES Effluent Limits)

Based on a review of the Dover Knolls project it is anticipated that the NYSDEC will revise the effluent quality limits in an amended SPDES permit making the limits more stringent. The NYSDEC furnished the Dover Knolls project with a memorandum dated 12/6/2010 that outlined draft amended effluent limits for their project based on a water quality based effluent review, copy attached in Appendix B. Therefore the new wastewater treatment system will be designed to meet the following SPDES performance criteria:

- $BOD_5 \leq 5 \text{ mg/L}$
- $TSS \leq 10 \text{ mg/L}$
- $pH = 6.5 - 8.5$

Olivet Center WWTP Conceptual Facility Plan

- Settleable Solids ≤ 0.1 ml/L
- Dissolved Oxygen ≥ 7.0 mg/L
- Ammonia (NH₃) ≤ 1.3 mg/L (summer)
- Ammonia (NH₃) ≤ 2.9 mg/L (winter)
- Total Nitrogen ≤ 8.0 mg/L
- Total Phosphorus ≤ 0.5 mg/L

2.3 Flow Analysis

The design flows for the Olivet Project were estimated using the 2014 NYSDEC Design Standards for Intermediately Sized Wastewater Treatment Systems. Please note in order to remain conservative a reduction for new water saving fixtures was not utilized. The design flow for the full project build out was calculated as follows:

Full Build - Estimate

Description	Occupancy Classification	Quantity	Unit Flow (gpd) *NYSDEC	Total Flow (gpd)
University Dormed Students	Dormed Student	2000	75	150,000
University Day Students	Day Student	500	20	10,000
University Staff	Staff	500	15	7,500
University Staff Housing	3 Bdrm House	19	330	6,270
University Staff Housing	1 Bdrm Apartment	38	110	4,180
Cafeteria	Dining Seats	588	35	20,580
Partner Organization	Staff	200	20	4,000
K-12 Students	Day Student	210	20	4,200
K-12 Staff	Staff	42	15	630
			Total Estimated Flow (GPD)	207,360
			Say	210,000

For the purpose of design the full build out flow has been rounded up to **210,000** GPD.

The Olivet project will be phased in over many years (10 – 15 yrs.) as the university grows therefore full operational capacity is not required or recommended during the initial phases. The Town will require a site plan approval for each phase so the required capacity and the required infrastructure improvements to support each phase should be analyzed prior to its initiation. For the first phase we have prepared the below flow estimate that represents the number of occupants that Olivet wishes to have in its opening project phase.

**Olivet Center WWTP
Conceptual Facility Plan**

Phase 1 - Estimate

Description	Occupancy Classification	Quantity	Unit Flow (gpd) *NYSDEC	Total Flow (gpd)
University Dormed Students	Dormed Student	105	75	7,875
University Day Students	Day Student	26	20	520
University Staff	Staff	50	15	750
University Staff Housing	3 Bdrm House	4	330	1,320
University Staff Housing	1 Bdrm Apartment	25	110	2,750
Cafeteria	Dining Seats	588	35	20,580
Partner Organization	Staff	100	20	2,000
K-12 Students	Day Student	20	20	400
K-12 Staff	Staff	4	15	60
			Total Estimated Flow (GPD)	36,255
			Say	40,000

For the purpose of design the phase 1 flow has been rounded up to **40,000** GPD. Therefore based upon the above a treatment system capable of processing 40,000 GPD shall be installed as part of the Phase 1 improvements.

2.4 Applicable Standards Review

A review of the following design criteria was completed as part of this report:

- NYSDEC "Design Standards for Wastewater Treatment Works, 2014"
- 10 States Standards "Recommended Standards for Wastewater Facilities, 2004"

3.0 Proposed Treatment System

Based on our site investigation it was determined that the current treatment system equipment & appurtenances are in poor condition. It was also determined that the existing system will require significant repairs and multiple upgrades in order to meet current standards and to comply with the anticipated amended effluent limits.

The projected flows for the Olivet site are 210,000 GPD, which is far less than the 1.2 million GPD that the existing tankage was designed for or the 600,000 GPD proposed for the Dover Knolls project. From an operational stand point we feel that there will be many issues to overcome with treating a fraction of the flow through a plant that was originally designed for a much larger flowrate. It is suspected that this would be a very labor intensive effort to manage especially during the initial phases.

Olivet Center WWTP Conceptual Facility Plan

Therefore we have proposed to replace the existing WWTP with a new facility that can be expanded over time as the Olivet Site grows and that is capable of being enlarged at a future date should Dover Knolls decide to pursue a project on the west side.

3.1 Treatment System Overview

The design will incorporate a new expandable package plant that will be installed in phases as the flow grows with the increase in population. The Ovivo MicroBLOX membrane bioreactor (MBR) has been chosen as the most appropriate technology for the Olivet project because it is designed to provide a very high effluent quality with varying pollutant loadings and because it can be expanded overtime by adding additional treatment trains. Additionally due to the multiple compartments (block's) built into the tanks, the system can be utilized for much smaller flows in the beginning by not putting all the compartments into service initially. Then once another phase comes online and the flows increase an additional MBR zone can become operational.

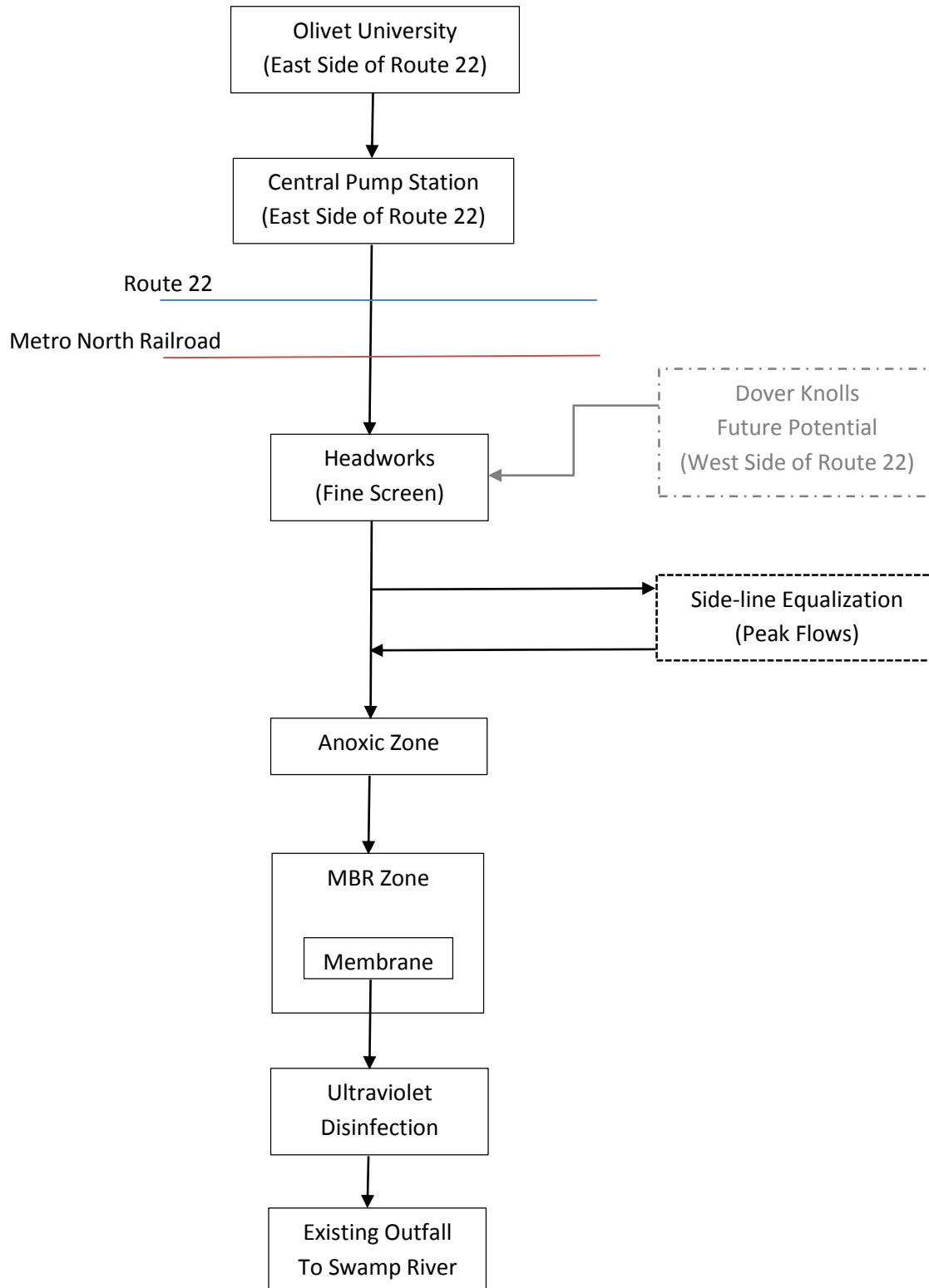
The MBR Facility will consist of two (2) package units each capable of treating up to 105,000 GPD of sewage for a total capacity of 210,000 GPD. The first phase will consist of the installation of a single 105,000 GPD MBR Unit that is initially set up to run at 40,000 GPD.

Wastewater will be biologically treated within an activated sludge bioreactor cell that is operated at high mixed liquor suspended solids (MLSS) concentrations then it will be filtered using Ovivo membranes to produce reuse quality effluent.

In addition the Ovivo system integrates solids thickening into the biological process to keep waste solids handling costs down. Partially digested, thickened solids will be wasted to a Waste Activated Sludge (WAS) tank as necessary. The WAS can be stored at 2% - 3% solids or further digested.

As shown in Figure 3-1 Schematic Treatment System below, wastewater will enter the headworks where it will pass through a fine screen, then during peak events it will pass into a sideline equalization basin, then it will flow into a dedicated Anoxic Zone. It is then pumped into the MBR zones where process oxygen is delivered to achieve nutrient removal. To produce a final filtered effluent the wastewater will then be pumped through the submerged membranes. Then it will pass through an Ultraviolet (UV) disinfection system and any required post aeration prior to release at the existing outfall at the Swamp River.

Figure 3-1 Schematic of Replacement Treatment System



3.2 Flow Equalization

Flow equalization would be used to dampen the diurnal flow variation seen in the daily wastewater flow, and thereby achieve a constant flow rate through all downstream treatment processes. This constant flow rate allows for improved efficiency, reliability, and control because the physical, biological, and chemical processes could be operated at near uniform conditions. The purpose of creating an equalization basin will be to store flows in excess of the average daily flow and to discharge them at times when the flow is less than the average daily flow.

The required volume will be determined during the design phase. At this time it is believed that one of the existing aeration basins can be retrofitted to become a side-line equalization basin.

3.3 Sludge Processing

The existing treatment system includes two (2) anaerobic digesters and three (3) indoor sludge drying beds located at the north end of the facility. The dried sludge was then hauled offsite for disposal by the HVPC. Currently due to the low flow volume the treatment process does not result in any sludge being wasted therefore the digesters are currently inactive and will require further investigation. Similar to the Dover Knolls proposal the Olivet WWTP proposal will include revisions to the digesters to convert them to aerobic digesters.

Further it is proposed to convert the sludge drying beds to Reed Beds that will process the sludge onsite. The reed bed system is a natural system that reduces water content, minimizes solids, and provides sufficient storage time to stabilize biosolids prior to disposal. The Reed Beds will dewater the sludge, transform it into compost, and store sludge for a minimum of 10 years.

In the short-term it is anticipated that direct disposal of wet sludge from the Waste Activated Sludge tank will be the most viable disposal option. Therefore the conversion of the sludge drying beds to reed beds is most likely to occur in phase 5.

4.0 Proposed Collection System

The Olivet Center proposal will require the addition of some new sewage collection system lines in the areas with newly proposed buildings such as the new dormitories. Also due to its age and the known I&I issues the existing sewage collection system on the east side will be replaced or repaired on a phase by phase basis. All parts the existing sanitary collection system associated with later phases will be disconnected from the new collection system that is constructed for the initial phase. Appendix C contains a preliminary set of Sewage Collection Plans created for the Phase 1 application.

4.1 Gravity System

The entire east side of Route 22 is currently served by a gravity sewage collection system that drains to a single point, therefore it is anticipated that the entire Olivet Center including any expansions can be served by a gravity system as well. The majority of the existing gravity sewage collection system in the vicinity of the existing HVPC Buildings on the east side of Route 22 will be replaced or abandoned in place to accommodate the building renovations. Depending upon the interior configurations new service laterals from the buildings may be required, appropriate wye connections will be provided within the main lines to accommodate this.

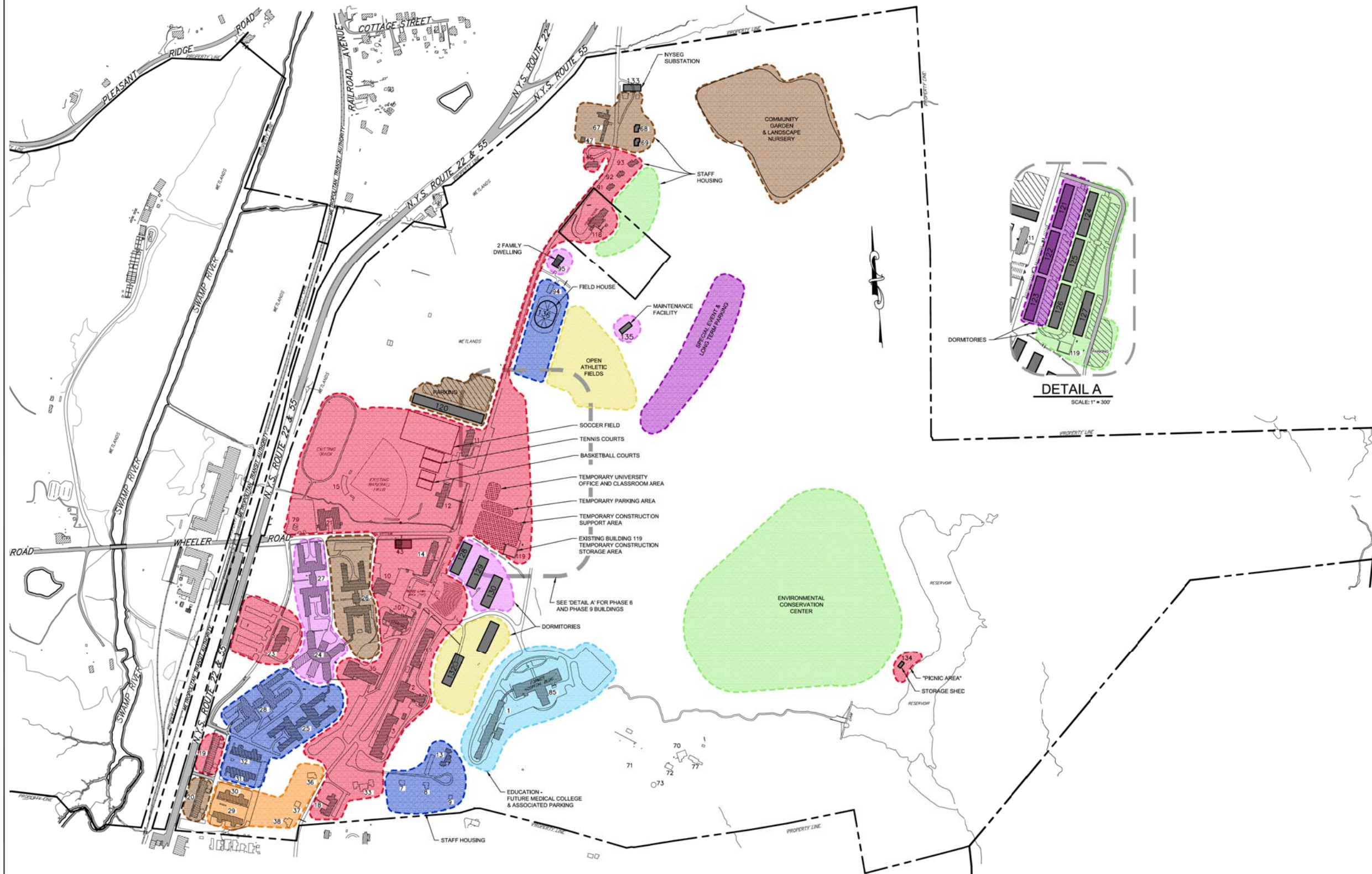
The proposed and replacement gravity collection system will consist of conventional SDR-35 PVC pipe and precast concrete manholes. The repaired gravity collection system will consist of using a trenchless technology similar cured-in-place-pipe relining, where the existing clay pipe is relined using a seamless PVC liner to seal in all the voids and cracks contained in the pipe. This process can only be used for the existing clay pipes that are found to be in a stable condition.

4.2 Central Pumping Station System

A new sewage pump station will be constructed north of the Wheeler Road entrance to accommodate the entire Olivet Center located on the east side of Route 22. The force main from the new pump station will run through an existing utility tunnel that is located under Route 22 and the Metro North rail line. Once across it will wrap around the former Storehouse Building on the north side of Wheeler Road and run west. Through a directional bore it will cross under the Swamp River north of the Wheeler Road Bridge to the WWTP access drive, where it will follow the gravel driveway to the WWTP headworks.

APPENDIX A

Olivet Center Phasing Plan



Phase	Building No.	Proposed Use
1	2	458 Seat Dining Facility
1	3	Partner Organization Office Building
1	10	Campus Ministry (office / meeting space)
1	11	Dormitory
1	12	Dormitory
1	14	WEA - Partner Organization Office
7	15	Baseball Grandstand
1	17	Partner Organization Office Building
1	18	Daycare Facility
1	19	Business Incubator / Research
1	21	Primary School (K - 12)
1	23	University Administrative Building
1	33	Family Center
1	35	Assembly Hall (Smith Hall)
1	43	100' Seat Dining Facility (large structure)
1	46	Staff Residence
1	79	Entrance Guard Shack
1	91	Staff Single Family Home
1	92	Staff Single Family Home
1	93	Staff Single Family Home
1	107	Chapel
1	118	Bethany House - Residence
1	119	Temporary Construction Storage
1	134	Storage Shed
2	20	Business Incubator / Research
2	26	Classrooms (Architecture, Engineering & Music)
2	47	Staff Garage
2	67	Staff Apartments
2	68	Staff Home (relocate due to Electric Substation)
2	69	Staff Home (relocate due to Electric Substation)
2	120	Dormitory
3	24	Student Union / Library / Bookstore
3	27	Classrooms (Education, Language, & Theology)
3	95	Staff House
3	128	Dormitory
3	129	Dormitory
3	130	Dormitory
3	135	Maintenance Building
4	7	Staff Home
4	8	Staff Home
4	9	Staff Home
4	13	5 Family Staff House
4	25	Classrooms (Business & Journalism)
4	28	Classrooms (Art, Design, & IT)
4	31	Business Incubator / Research
4	32	University Office Building
4	94	Staff House (relocate due to Athletic Fields)
4	136	Field House
5	121	Dormitory
5	122	Dormitory
5	123	Dormitory
6	29	Business Incubator / Research
6	30	Business Incubator / Research
6	36	Staff Home
6	37	Staff Home
6	38	Staff Home
7	131	Dormitory
7	132	Dormitory
8	124	Dormitory
8	125	Dormitory
8	126	Dormitory
8	127	Dormitory
8		Future Staff Housing
9	1	Education (Future Medical College)
9	85	Education (Future Medical College)

STRUCTURE PHASING SCHEDULE

LEGEND

EXISTING PROPERTY LINE
WETLAND BOUNDARY

PHASING LEGEND

PHASE 1	PHASE 6
PHASE 2	PHASE 7
PHASE 3	PHASE 8
PHASE 4	PHASE 9
PHASE 5	

DATE	REVISION

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THE OLIVET CENTER					
TOWN OF DOVER			DUTCHESS COUNTY, NY		
SITE PHASING PLAN					
DATE	SCALE	DESIGNED BY	DRAWN BY	CHECKED BY	JOB NO.
5/21/15	1"=300'	RAR	RED	RAR	13-019
					1 of 1

APPENDIX B

Draft Amended Effluent Limits
(NYSDEC Memorandum dated 12/6/2010)



MEMORANDUM

To: Vijay Gandhi
From: Lorraine Holdridge
Subject: Dover Knolls Permit Review - SPDES # NY 003 2158
Date: December 6, 2010

Per your request I have conducted a Water Quality Based Effluent Limit (WQBEL) review for the proposed Dover Knolls Development project at the former Harlem Valley Psychiatric Center. The existing facility does operate an existing wastewater treatment plant (WWTP) which has an existing SPDES permit, permit no NY 003 2158.

The client, Dover Knolls Development Co II, LLC is requesting a revised SPDES permit for the existing WWTP. While the original permit limits were 1.2 MGD with better than secondary treatment for CBOD, the revised permit is requesting a flow of 0.6 MGD. The WQBEL has shown that because of the relatively small natural flow in the receiving stream, and it's sluggish flow, intermittent stream limits are needed to maintain dissolved oxygen water quality in the stream. The stream is classified as a C(T).

In addition to the intermittent stream limits, a limit for phosphorus and total nitrogen are also appropriate. The proposed phosphorous limit of 0.5 mg/l is proposed because there is a ponded water downstream of this discharge in Connecticut (Lake Lovely) which is on their 303(d) list as being impaired for nutrients.

The proposed nitrogen limit is consistent with the level of nitrogen control required of WWTPs in New York to comply with the 2000 Long Island Sound Total Maximum Daily Load for Nitrogen.

As such, the following limits are proposed;

BOD5	5 mg/l, daily max
TSS	10 mg/l, daily max
pH	6.5 – 8.5
Settleable solids	0.1 ml/l, monthly average
Dissolved oxygen	7.0 mg/l, daily min
Ammonia (May 1 – Oct 30)	1.3 mg/l, monthly average
Ammonia (Nov 1 – April 30)	2.9 mg/l, monthly average
Total Nitrogen	8.0 mg/l, 30 day rolling average
Total Phosphorous	0.5 mg/l, monthly average

I see that the PJSC limit has a disinfection requirement. We would not require disinfection since the class of the receiving water is C(T), however disinfection would be required to reuse the effluent for the golf course. I'm just not sure to what degree disinfection would be required. That's why the consultant needs to follow up on what Lake Placid and Canton are doing. Regarding the request for reusing the effluent for irrigation of the golf course, I suggest the consultant talk with the operators of the Lake Placid WWTP and the Village of Canton WWTP to see what they have been required to do. Once they get a feel for that, they would need to propose what they would do following the models set by Lake Placid and Canton and then they would need to submit the design and technology limits to us and the DOH for approval..

Please feel free to contact me with any questions or comments ((518) 408-5718, or laholdri@gw.dec.state.ny.us)

APPENDIX C

Phase 1 - Sewage Collection System Plan Set