Hazen Memorandum

July 17, 2017

To: Greg Fedner, PE
Private Development Section Manager

Cc: Troy Branson, PE
Project Manager

From: Hazen and Sawyer

Re: J220 Biosolids Land Application Improvements – Stormwater Drainage Manual Variance Request

The J220 project includes improvements to increase storage, pumping, and load out capabilities of Class B liquid biosolids from the Jackson Pike Wastewater Treatment Plant (JPWWTP) for land application. There are two primary areas of site modifications: the Load Out Station (LOS), and the buried SS2 and SS3 tanks, as highlighted in Figure 1. All modifications will contribute their stormwater runoff to Whims Ditch and JPWWTP's main drain. The project is requesting a variance from the City of Columbus Stormwater Drainage Manual (SWDM) for water quantity.

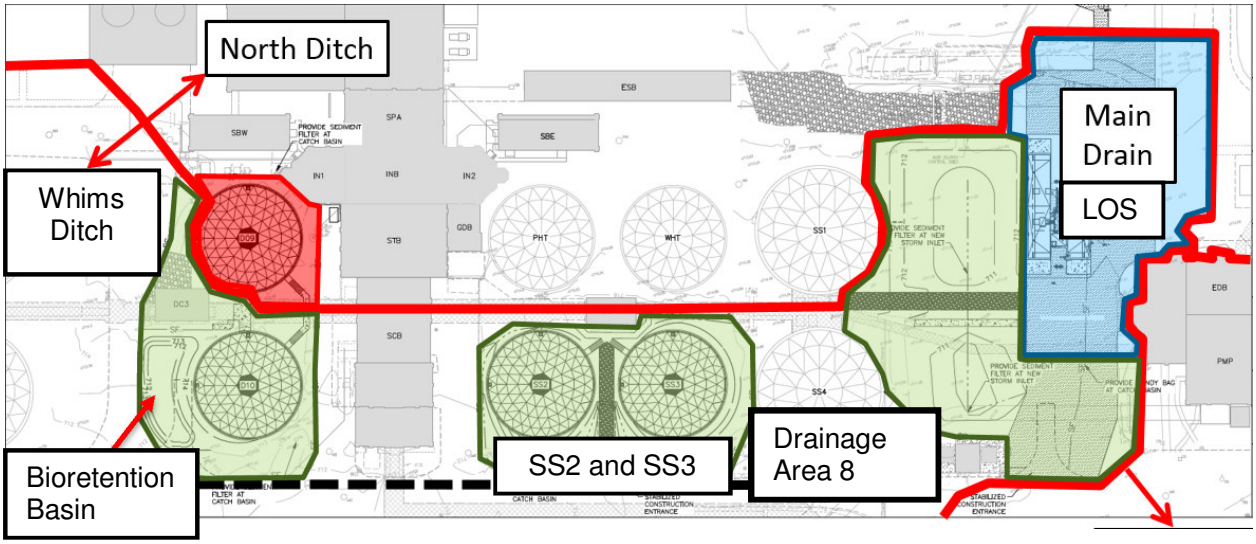

Figure 1: J220 Site Modifications

The project site is unable to provide sufficient detention volume due to site constraints and the high cost of providing underground storage. Based on these conditions, we are requesting a Type II Variance (Non-Stream Protection) from Section 3.2, for stormwater quantity controls. This memorandum presents a Full Compliance Alternative, a Minimal Impact Alternative, and a Preferred Alternative, as described in the SWDM.

Job no

Based on discussions with DOSD, the stormwater management strategy for the LOS improvements is to direct the stormwater to JPWWTP's main drain conveyance system, due to the likelihood of biosolids spills during truck loading and maneuvering at JPWWTP. Initially it was agreed that, because the stormwater would be routed to JPWWTP's main drain conveyance system, stormwater management improvements for quality and quantity control were not necessary for this area.

However, after review of the J220 Stormwater Management Report, DOSD stated that the stormwater draining to JPWWTP main drain (for the LOS area) should be included in the volume calculation for stormwater quantity control. Based on this change, the storage volume needed for LOS quantity control was calculated as summarized in Tables 1, 2 and 3.

Table 1: LOS Area Stormwater Drainage Criteria

Criteria	Units	Pre-Construction Stormwater Drainage	Post-Construction Stormwater Drainage
Pervious Area	(ac)	0.72	0.50
Impervious Area	(ac)	0.44	0.66
Sub-Area Drainage Area	(ac)	1.16	1.16

In accordance with Section 3.2.1 of the Stormwater Drainage Manual, the peak runoff rate during the 100-Year storm event following construction shall be released at a rate less than or equal to the peak runoff rate during the 10-Year storm event under pre-developed conditions. These runoff rates are shown in Table 2.

Table 2: LOS Area Pre- and Post-Construction Stormwater Flow Comparison

Rainfall Frequency	Maximum Flow (cfs)	
	Pre-Construction	Post-Construction
1-Year	0.76	1.00
2-Year	0.94	1.23
5-Year	1.13	1.46
10-Year	**1.26**	1.69
100-Year	2.46	**3.10**

The runoff volumes, presented in Table 3, were used to determine a 1-year critical storm. Based on these volumes, approximately 4,600 cu-ft of runoff would need to be detained.

Table 3: Pre- and Post-Construction Runoff Volume Comparison

Rainfall Frequency	Pre-Construction conditions	Post-Construction Conditions	Net Change
	Runoff Volume (cu-ft)	Runoff volume (cu-ft)	
1-Year	5,053	5,474	8%
2-Year	6,316	6,737	7%
5-Year	7,579	8,000	6%
10-Year	**8,421**	9,263	10%
100-Year	12,632	**13,053**	3%

The Hazen Team has investigated each accepted quantity control facility specified in the Stormwater Drainage Manual (SWDM), and has determined that it is impractical to achieve full compliance with quantity control at JPWWTP for the updated improvements to the LOS. See Table 4 for summary of investigations previously conducted for this project.

Table 4: Stormwater Quantity Control Facilities

Accepted Stormwater Quantity Facility	Constraints
Dry and Wet Detention Basin	• The only location where a large enough detention basin can be placed is directly next to the LOS area, which is at the topmost corner of the drainage area. Therefore, it cannot capture enough stormwater runoff to provide quantity control • This location cannot be connected to the catch basin due to the existing underground infrastructure • A 1,900 cu-ft bio-retention basin can be located next to digester 10, however, it cannot provide full stormwater detention to meet the requirement
Parking Lot Storage	• The improvements are confined to Drainage Area 8, which flows to Whims Ditch. There are no parking lots within our drainage area that also flow to Whims Ditch, which eliminates parking lot storage
Underground Storage Tank	• Due to site constraints a lift station would be required to transport flow from the storage tank to the storm inlet • Due to drainage boundary constraints, the storage tank would need to be placed on the road beside digester 10
Green Roof Technologies	• Structurally, the domes cannot accommodate the heavy loads associated with a green roof
Porous Pavement	• Due to heavy truck loads, only certain paved areas could be considered • The available roadways within the drainage area are newly repaired/designed due to the gate project • There is not sufficient area to provide quantity control
Rainwater Harvesting	• Only rooftop areas are to be harvested, as specified in the SWDM • The volume of runoff generated is too large to be practicable for rainwater harvesting

Full Compliance Alternative

The SWDM requires an alternative that fully complies with the quantity control measures listed in Section 3.2. To meet full compliance, an underground storage tank would be used to provide detention for stormwater runoff. Based on the runoff rates shown in Table 2, the volume of the underground storage tank would be approximately 50,000 gallons. Due to site drainage constraints, the underground storage tank cannot be located next to the LOS area, but would be constructed in the roadway next to Digester 10, as shown in Figure 2.

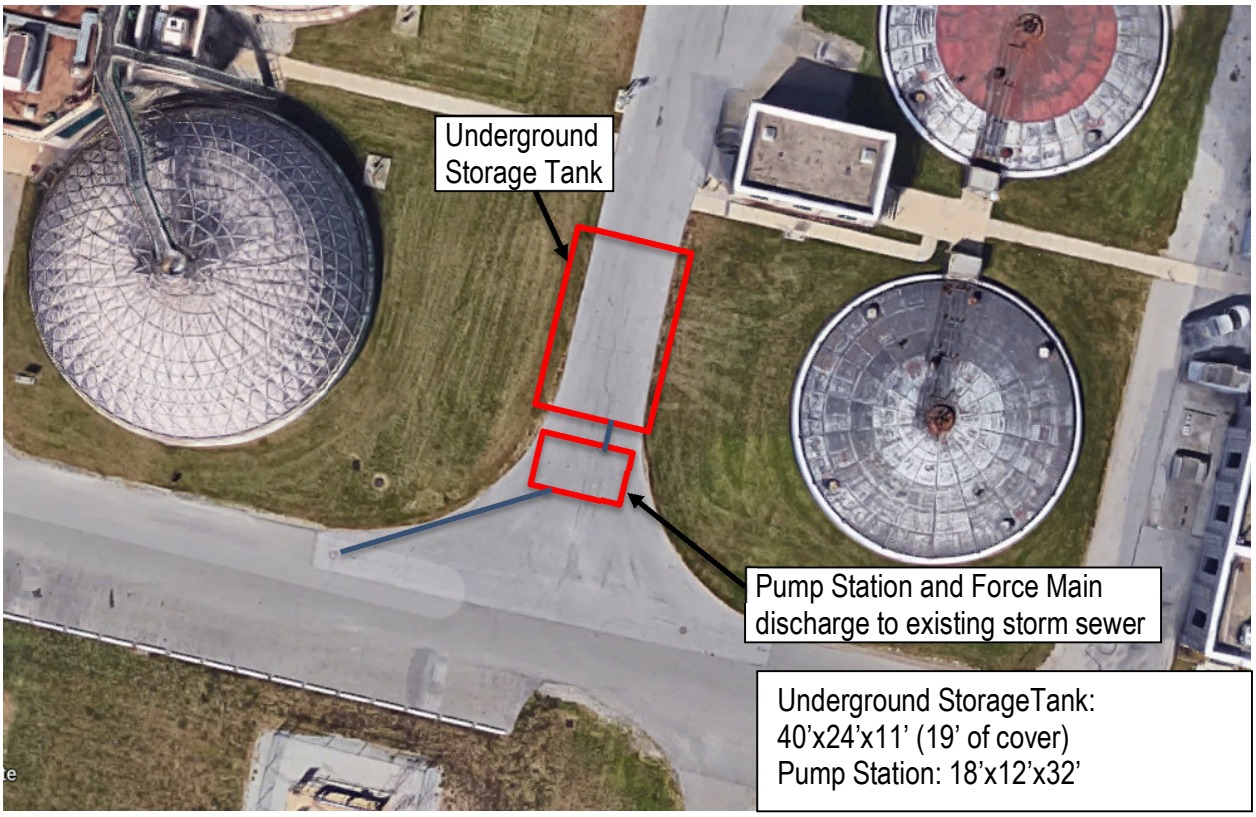

Figure 2: Underground Storage Tank Location

To prevent surcharging in other areas of Drainage Area 8, the storage tank would be located approximately 30-ft below grade. A pump station will be needed to lift flow to an existing storm sewer that drains to Whims Ditch. To meet an allowable release rate of 1.26 cfs, the 10-Year Pre-Construction rate seen in Table 2, a 0.7 mgd (490 gpm) pump station is required.

Approximately 4000 cu-yd of excavation would be required for the pump station and underground storage tank, with 2,400 sq ft of asphalt removal. Due to the excavation depth, sheeting and shoring will be required as well as dewatering, which increases the cost as seen in Table 5. The total opinion of probable construction cost associated with the Full Compliance Alternative is approximately $2,188,000.

Table 5: Full Compliance Opinion of Probable Construction Cost

Improvement		Cost
Excavation, sheeting/shoring, backfill, and dewatering		$885,000
Precast concrete stormwater detention		$190,000
Pump station concrete		$157,000
Pumps and piping		$169,000
Electrical and Instrumentation and Control		$46,000
Surface restoration		$11,000
A – Subtotal Base Construction Cost		**$1,458,000**
Contractor Overhead & Profit	15% of A	$219,000
Estimating Level Contingency	10% of A	$146,000
Mobilization	5.0% of A	$73,000
B – Subtotal Construction Cost		**$1,896,000**
Construction Contingency	5% of B	$95,000
C – Opinion of Probable Construction Cost		**$1,991,000**
Insurance	3.0% of C	$60,000
Bonding	3.0% of C	$60,000
Permitting	0.25% of C	$5,000
Escalation to Mid-Point of Construction (3% per Year)	3.6% of C	$72,000
D – Escalated Opinion of Probable Construction Cost		**$2,188,000**

Minimal Impact Alternative

The minimal impact alternative proposes to provide stormwater quantity control below the level that is required by the SWDM. This alternative would utilize a bioretention facility adjacent to Digester 10, as seen in Figure 1. The maximum storage that can be provided within drainage area 8 is 1,900 cu-ft at the designed bioretention area. An orifice plate would be installed in the overflow structure to control flow into Whims Ditch.

Table 6 shows the pre- and post-construction flows from surrounding Digester 10 and the LOS area, with the post-construction volume incorporating the bioretention basin.

Table 6: Pre- and Post-Construction Flow Rates for LOS Area with Bioretention Facility

Rainfall Frequency	Maximum Flow (cfs)	
	Pre-Construction	Post-Construction
1-Year	0.99	0.87
2-Year	1.22	1.13
5-Year	1.47	1.39
10-Year	**1.64**	1.60
100-Year	3.17	**3.10**[1]

The post-construction stormwater volumes shown in Table 6 include flow that is being diverted to the main drain (as requested by DOSD), although that flow will not actually reach Whims Ditch.

A cost estimate was developed using the City of Columbus's Blueprint Preliminary Design Unit Costs. The opinion of probable construction cost associated with the minimal impact Alternative is approximately $535,000.

Preferred Alternative

The Preferred Alternative is for no stormwater infrastructure to be constructed, since stormwater runoff generated at the LOS area will be captured and routed to the plant's main drain for full treatment. This alternative would impose no additional construction cost and is believed to meet the intent of quality and quantity requirements of the SWDM, since the post-construction stormwater flow to Whims Ditch will be reduced.

Table 7: Projected Flow Conditions to Whims Ditch from LOS Area

Rainfall Frequency	Maximum Flow to Whims Ditch (cfs)	
	Pre-Construction	Post-Construction
1-Year	0.76	0.36
2-Year	0.94	0.41
5-Year	1.13	0.47
10-Year	**1.26**	0.54
100-Year	2.46	**1.01**

The flow rates in Table 7 show the projected flow that will reach Whims Ditch, and excludes the runoff being diverted to the plant's main drain. The 100-Year Post-Construction release rate (1.01 cfs) is less than the 10-Year Pre-Construction release rate (1.26 cfs).

[1] The Post-Construction Bioretention Facility assumes full infiltration for the 1-Year event through the sump area within the modified manhole with orifice place installed. The 100-Year storm will flow through the overflow structure directly to the storm pipe.

Summary

Table 8 summarizes the stormwater control alternatives considered. As requested by DOSD, the Full Compliance and Minimal Impact alternatives were conceptualized to handle stormwater flow that will actually be directed to the main drain and will not reach Whims Ditch. Accordingly, these alternatives are presented in Table 8 based on the assumption that the stormwater flow would reach the stormwater control facilities.

The columns in Table 8 labeled "Minimal Impact with the Main Drain Removed" and the "Preferred Alternative" do *not* include the stormwater flow that is routed to the main drain.

Table 8: Summary of Alternatives

	Baseline Construction		Full Compliance Alternative	Minimal Impact Alternative	Minimal Impact with Main Drain Removed	Preferred Alternative
	Pre-Construction	Post-Construction	Post-Construction	Post-Construction	Post-Construction	Post-Construction
10-Year	1.26 cfs	1.69 cfs	1.26 cfs	1.60 cfs	0.45 cfs	0.54 cfs
100-Year	2.46 cfs	3.10 cfs	1.26 cfs	3.10 cfs	1.01 cfs	1.01 cfs
100-Post / 10-Pre	2.46		1.0	2.46	0.80	0.80
Volume Reaching Whims Ditch (cu-ft)						
10-Year	8,420	9,260	9,260	9,260	5,430	5,430
100-Year	12,630	13,050	13,050	13,050	7,790	7,790
Additional Cost over Baseline Opinion of Probable Construction Cost			**$2,188,000**	**$535,000**	**$535,000**	**$0**