✓ 9/6/06

18C.3.5.2

VARIANCE REQUEST

Iowa Department of Natural Resources

1. Date:	March 30, 1999
2. Review Engineer:	Bill Graham
3. Date Received:	March 23, 1999
4. Facility Name:	Norwalk WWTP
5. County Number:	91, Warren
6. Program Area:	CP (wastewater)
7. Facility Type :	C05
8. Subject Area :	307, Lagoon GW elev.
9. Rule Reference:	567-64.2(9)a
10. Design Stds Ref:	18C.3.5.2
11. Consulting Engr:	Veenstra and Kimm, WDM
12. Variance Rule:	567-64.2(9)c

13. **Decision:** Approved
Date: 4/7/99

14. **Appeal:**
Date:

15. Description of Variance Request:

The City of Norwalk is requesting a variance from the design standard which requires the bottom elevation of a lagoon cell be no lower than the maximum groundwater table when a synthetic liner is used. The two new lined earthen basins will be used as aeration tanks for an extended aeration activated sludge process. The bottom elevation of the aeration cells will be 807.5 feet and the highest groundwater elevation measured 7 days after piezometers were installed at the site in September, 1998, was 809.6 feet.

From the GSB review:
The soils at the site belong to the Zook, Wabash, and Nodaway soil association. According to the Soil Survey of Warren County, these soils have severe limitations for sewage lagoons due to seasonal high water table and subject to flooding. The soils also have a moderate to high shrink-swell potential. The seasonal high water table is one to three feet for Zook and Wabash soils and three to five feet for Nodaway soils.

The water level information provided in the geotechnical report indicated the water levels from borings installed and measured in September 1998 was 811 to 814 feet above sea level, or 5 to 9 feet below ground surface. The seasonal high water table generally is observed from November to July months, and the September water levels are not the seasonal high water table for the site. Based on the soil survey information, the seasonal high water table is one to five feet....

The seasonal high water table of one to five feet below the ground surface indicates the high water table is not less than 818 feet above sea level at the northwest corner of the reed beds to 812 feet at the southeast corner. The seasonal high water table is not less than 813 feet at the northwest corner of proposed aeration basin 1 to 810 feet along the southern extent of the proposed basins.

16. Consulting Engineer's Justifications

The bottom elevation of the aeration basins was established so that wastewater can enter the plant by gravity flow as follows; the maximum high water elevation in the aeration basins allowing gravity flow

from the collection system is 817.5 feet; the minimum effective basin depth for a "Biolac" activated sludge process is 10 feet, so bottom elevation needs to be 807.5 feet. The optimum basin depth for operation of the aeration system is 12 feet. If the aeration basin bottoms were raised above high seasonal groundwater elevation it would be necessary to construct and operate a lift station at a high cost for a low lift.

A 6 inch diameter groundwater drain will be installed around the aeration basins and will control groundwater level during non-flood conditions. The groundwater will drain to an outlet tributary to the North River at elevation 805.0 feet and in normal conditions will lower groundwater in the vicinity to 805.0 feet.

The North River experiences a significant elevation differential depending upon flooding conditions. River elevation during preliminary project surveying was 798 feet. Seasonal river levels usually range from 795 to 803 feet and the groundwater drain will dewater the aeration basin area in normal years. Under flooding conditions the river level rises above the groundwater drain outlet elevation. The 25 year flood elevation is 814.5 feet and the 100 year flood elevation is 817.5 feet.

The only time groundwater will be higher than the basin bottom is during flood conditions. Because of the tight soils in the area, the groundwater level will increase slowly during flooding conditions and a short term flood may have little influence on groundwater elevations. During flooding conditions the basins will not be dewatered for maintenance or inspection. Wastewater treatment plants are commonly designed so that tankage cannot be dewatered during flood conditions.

The basins will be full at all times except for very occasional dewatering for maintenance and inspection. Maintenance can be scheduled during non-flooding conditions. The groundwater drainage system will keep groundwater elevations below the basin bottoms in all but flooding conditions. The aeration basins will have synthetic liners and all of the aeration equipment is removable without dewatering the basins. There is no need to dewater the basins for regular operation or maintenance.

17. Department's Justifications

Recommend variance approval since equivalent or better protection and reliability than required by the standards is provided based on the following:

Design Standard 18C.3.5.2 is intended to do two things;

(1) protect groundwater from contamination by leaking earthen basins and,

(2) prevent structural damage caused by seepage into the earthen basin by groundwater at higher elevation than water in the basin.

) The proposed earthen aeration basins will have synthetic liners which will provide impermeability
ter than required by the design standards (1/16 inch per day at 6 feet head) for basins with soil liners.

This provides protection from groundwater contamination equivalent to that required by design standards. Groundwater higher than the bottom of the basin will not effect contamination potential unless there is structural failure of the liner.

(2) Potential seepage problems caused by high groundwater elevation will be mitigated or eliminated by removing the need to dewater the basins as follows:

- The groundwater drain will keep groundwater elevation below that of the basin bottoms in all but flooding conditions which will occur infrequently, maybe every 5 to 10 years. The drain outlet(s) will be required to have a valve(s) that can be closed in flooding conditions to prevent groundwater surcharging near the basins through the drainage system.
- Monitoring wells to determine groundwater elevation in the aeration basin area will be required so that, should the need arise to dewater a basin, it will be possible to make sure that groundwater elevation is below that of the basin bottom.
- All mechanical aeration equipment, including blowers and diffusers, will be completely accessible and removable without dewatering the basins thus eliminating the most likely reasons the basins would need to be dewatered.
- The design standards allow concrete aeration tanks to have bottoms lower than high seasonal groundwater. Concrete tanks would be in a similar operational and maintenance situation during high groundwater or flooding conditions as the proposed basins. Dewatering a concrete tank when the water level outside the tank is higher than the bottom can cause the tank to float. Relief valves are generally installed in the bottoms of concrete tanks to allow static pressure to equalize. This would make difficult and undesirable to try to dewater a concrete tank when groundwater is high.
- The facility is protected from the 100 year flood since the tops of all structures are at least 2 feet above the 100 year flood elevation.
- The project includes the reconfiguration of the two existing aerated lagoon cells to equalization basins. The basins can store 10 days of AWW flow (storage volume is 22.5 MG) providing a short term alternative for handling untreated wastewater.

18. Precedents Used
None

19. Staff Reviewer: William Graham — Date: 3-30-99
20. Supervisor: — Date: 4/7/99
21. Authorized by: Jack Riesser — Date: 4/7/99

VEENSTRA & KIMM, INC.
3000 Westown Parkway • West Des Moines, Iowa 50266-1320
515-225-8000 • 515-225-7848(FAX) • 800-241-8000(WATS)

March 22, 1999

William Graham
Iowa Department of Natural Resources
Wallace State Office Building
900 East Grand Avenue
Des Moines, Iowa 50319

NORWALK, IOWA
WASTEWATER TREATMENT FACILITY IMPROVEMENTS
AERATION BASIN ELEVATIONS
REQUEST FOR VARIANCE

This letter is a follow up to our telephone conversation of March 19, 1999 concerning the elevation of the high ground water level in the vicinity of the aeration basin of the Norwalk wastewater treatment facility. The high groundwater level is above the bottom elevation of the aeration basins. The City of Norwalk would request the Iowa Department of Natural Resources to issue a variance for the elevation of the basins with respect to the high groundwater level.

During the geotechnical investigation the high groundwater level was measured at several locations in the vicinity of the project. The high groundwater level at the location of the aeration basins is 809.5 The bottom elevation of the aeration basins is elevation 807.5 The bottom of the basins is approximately 2 feet below the high groundwater level measured during the geotechnical investigation.

During the geotechnical investigation groundwater elevations were measured at other locations on the site of the treatment plant. In particular, higher groundwater elevations were measured in the vicinity of the reed beds. The groundwater elevation in the vicinity of the reed beds was 814. The groundwater level varies with the ground elevation. The groundwater appears to follow the slope of the surface. The soils are relatively tight clay type soils and this appears to have an influence on the groundwater level.

The elevation of the aeration basins was established in order to provide a minimum depth and gravity flow through. The high water level in the aeration basins varies from 817.5 to 818.0. By establishing a high water elevation of 818.0, flow can enter the treatment plant by gravity. The bottom elevation of the basin is 807.5. The minimum depth of the aeration basins is 10 feet. This depth is considered the minimum elevation acceptable for a Biolac type system. The preferred depth of the aeration system is approximately 12 feet.

It would not be possible to decrease the depth of the aeration basin. The 10-foot depth of the basin is considered the minimum for acceptable process. The shallow depth already results in a lower level of aeration efficiency.

If the aeration basins were raised above the groundwater elevation, it would be necessary to pump to the aeration basins. This would result in a significant cost increase, for a relatively low lift of approximately 2 feet.

The aeration basin is designed with a groundwater drain. The purpose of the groundwater drain is to control the groundwater level during non-flood conditions. The groundwater drain outlets to an existing catch basin at elevation 805. Under normal conditions the groundwater drain will lower the localized groundwater below elevation 805.

The groundwater drain discharges to an existing drainage system. The drainage system outlets to the North River.

The North River experiences a significant elevation differential depending upon the flooding conditions. At the time the preliminary survey for the project was undertaken, the water level in the North River was approximately 798. The seasonal river levels general range from approximately 795 to approximately 803. Under normal seasonal variations the river level is low enough for the groundwater drain to dewater the area of the aeration basins.

Under flooding conditions the river level rises above the elevation of the groundwater drain. Under a 25 year flood, the estimated flood elevation is 814.5. The 100 year flood elevation is estimated to be 817.5. Under flooding conditions the river level is above the seasonal high groundwater level. Even if the aeration basins were raised above the seasonal high groundwater level in the vicinity of the basins, it is quite possible groundwater levels may be surcharged above the floor of the basin during flooding conditions.

The aeration basins are constructed with a liner system. All of the aeration equipment in the basins is removable from the surface. There is no need to dewater the basin for regular operation or maintenance requirements. The only reason the basin would be dewatered would be in the event of a reconstruction or major failure. The basins may occasionally be dewatered for inspection.

The only time the localized groundwater should be above the floor of the basin is during flood conditions. Because of the tight soils in the area, the groundwater level is anticipated to increase somewhat slowly during flood conditions. A very short term flood may have little impact on the level of the groundwater. During flooding conditions the basins would not be dewatered for maintenance or inspection purposes. It is not uncommon for wastewater treatment plants to be designed in such a manner as to not allow for dewatering under flooding conditions.

In summary, the City of Norwalk believes it has provided adequate protection. The basins will be full at all times except for very occasional dewatering for maintenance and inspection. These periods can be scheduled during non-flooding conditions. The groundwater drainage system will function to keep the water level in the vicinity of the basin below the bottom elevation during non-flooding conditions.

Raising the elevation of the basin above the high groundwater level would increase the cost of the project significantly. The treatment plant is currently designed with a gravity flow design. Raising the basins would require the installation of a pump station to lift the wastewater to the aeration basins. It is not possible to shallow the basins to provide gravity flow with the bottom elevation above the normal high groundwater elevation.

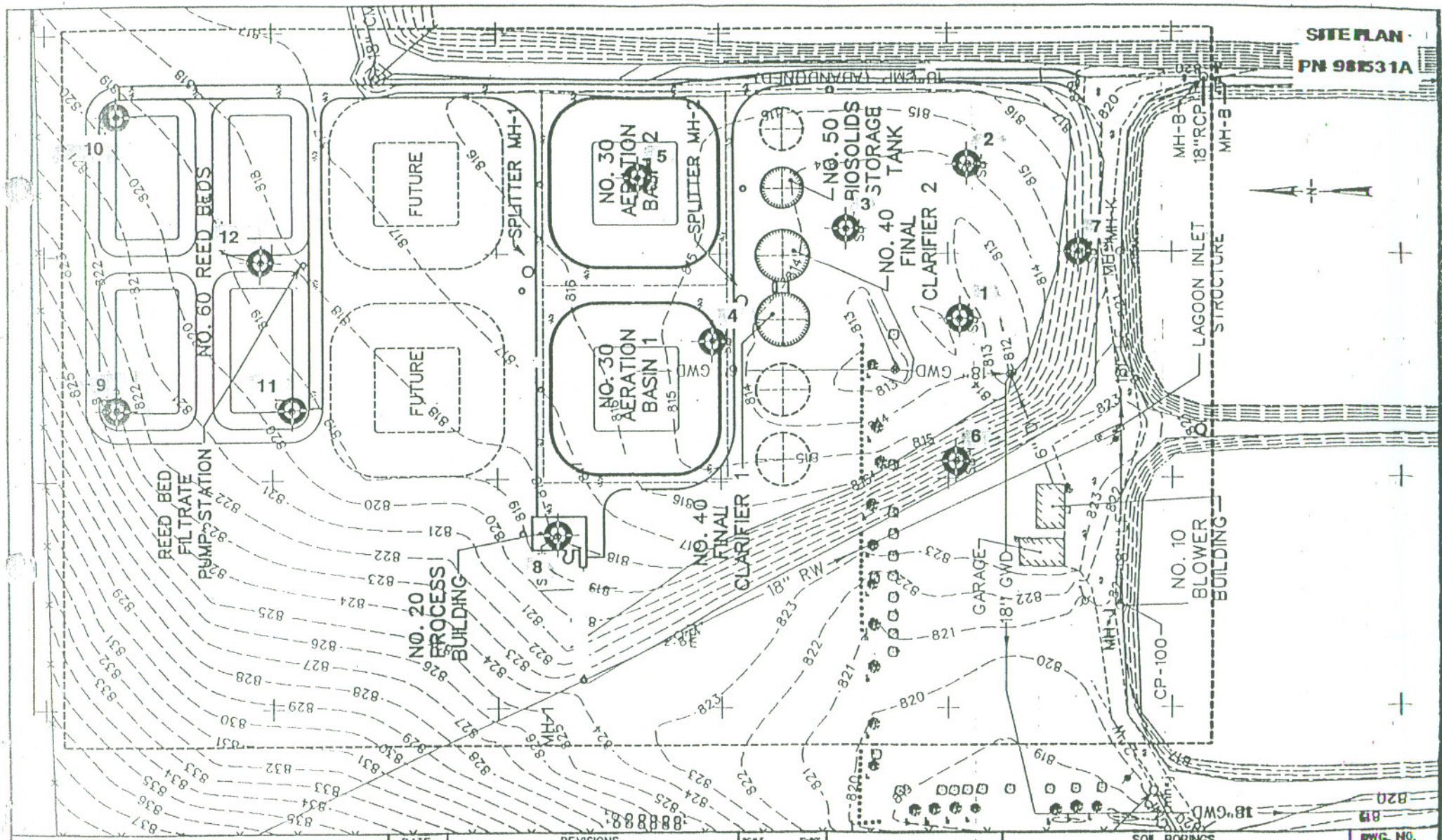
The City of Norwalk would request the Iowa Department of Natural Resources to review and issue a variance for the elevation of the aeration basins below the high groundwater level.

If you have any questions or comments concerning the project, please contact us at 225-8000.

VEENSTRA & KIMM, INC.

H. R. Veenstra Jr.

14211
cc: Dean Yordi, City of Norwalk



DATE	REVISIONS

SCALE	1"=80'
DRAWN	JPS
CHECKED	LAS, JPS
APPROVED	TJO
DATE	1/96

V&K

SOIL BORINGS
WASTEWATER TREATMENT
FACILITY IMPROVEMENTS
NORWALK, IOWA

DWG. NO.
A-2

VEENSTRA & KIMM, INC. 3000 Westown Parkway • West Des Moines, Iowa 50266-1320

MEMO (Draft)

TO: Bill Graham

FROM: Greg Fuhrmann, GSB West

RE: Aeration basins and reed beds addition to Norwalk WWTP

DATE: March 18, 1999

I have reviewed the geotechnical report for the proposed location for two aeration basins and a four-cell reed bed adjacent to existing sewage lagoons for the town of Norwalk, in Warren County. The site is along the northern bank of the North River, south of Norwalk.

Pennsylvanian shale bedrock is the primary bedrock at the site. No private wells were located in the general area. Potable aquifers may exist in the limestone bedrock underlying the shale and the shale should provide adequate protection from surface water contamination reaching underlying aquifers.

The soils at the site belong to the Zook, Wabash, and Nodaway soil association. According to the Soil Survey of Warren County, these soils have severe limitations for sewage lagoons due to seasonal high water table and subject to flooding. The soils also have a moderate to high shrink-swell potential. The seasonal high water table is one to three feet for Zook and Wabash soils and three to five feet for Nodaway soils.

The water level information provided in the geotechnical report indicated the water levels from borings installed and measured in September 1998 was 811 to 814 feet above sea level, or 5 to 9 feet below ground surface. The seasonal high water table generally is observed from November to July months, and the September water levels are not the seasonal high water table for the site. Based on the soil survey information, the seasonal high water table is one to five feet.

Conclusions:

The seasonal high water table of one to five feet below the ground surface indicates the high water table is not less than 818 feet above sea level at the northwest corner of the reed beds to 812 feet at the southeast corner. The seasonal high water table is not less than 813 feet at the northwest corner of proposed aeration basin 1 to 810 feet along the southern extent of the proposed basins.

The proposed bases of the aeration basins is to be near 807.5 feet and the bottom of the reed bed cells is proposed at an elevation of 811.5 feet. Although the aeration basins and reed bed cells are to fitted with synthetic liners, the base of all basins and cells as proposed are below the seasonal water table for the site.

If you need further assistance, my number is 2-6848.

Greg Fuhrmann
GSB West