Memorandum

To: *Georgia Baxter*
J.H. Baxter & Company

From: *Patrick J. Evans, Ph.D.*

Date: *August 7, 2000*

Subject: *Interim Storm Water Treatment Evaluation and Recommendation*
Arlington Facility

Introduction

Storm water management at the J. H. Baxter site in Arlington, Washington (the site) is expected to be more difficult this fall and winter with the recent closure of the french drains in the treated wood storage and treatment area (Parcel A). Prior to closure, stormwater would build up during significant storm events and flood small portions of Parcel A. The ponded water would eventually infiltrate over a period of several days to several weeks, depending on the time of year.

Observations made earlier this year during a storm event and after the drains had been closed, showed that surface water ponded much more quickly and remained for a longer period of time than prior to drain closure. These observations suggested the french drains had been more effective than previously thought, and that serious flooding of Parcel A is likely this winter. Much of the flooding is expected to occur around the main treatment plant, posing a threat to operations and perhaps causing plant shutdown. Floodwaters could also potentially backup into the treatment plant itself, reducing tank farm containment capacity.

The purpose of this technical memorandum is to evaluate short-term "emergency" options for storm water management with the objective of implementing a selected option this fall prior to the onset of wet weather. The options are not intended to replace the existing stormwater infiltration system, which now works, but more slowly than it did prior to drain closure, but to provide some form of additional storage, infiltration, or discharge capacity to handle the larger storm events. This additional storage, infiltration, or discharge capacity is only expected to be in operation for an interim period - the winters of 2000-2001 and 2001-2002. After that, the final stormwater control and treatment program developed through the MTCA process will be implemented. It should therefore be understood that interim stormwater treatment options are in no way intended to interfere with the current MTCA process, or to prevent implementation of a final cleanup.

Description of Storm Water Management Options and Associated Regulatory Issues

Option 1: Diffuse Infiltration System/Redistribution

Description This option involves redistribution of accumulating storm water to either (a) unflooded portions of Parcel A or (b) to an engineered diffuse infiltration system.

Redistribution to unflooded portions of Parcel A would involve collection of water from existing trenches or other low-lying areas and conveyance to unflooded areas potentially along the eastern side of Parcel A. Regrading and modification of the land surface throughout the treated pole storage area would also be undertaken to increase the length of time water is detained in a particular area before draining to the perimeter ditches. Although this option is arguably the least expensive approach, it appears to have a low probability of success considering the silty nature of surficial soils and past observation of low infiltration rates. This subset of Option 1 is therefore not discussed further.

Alternatively, an engineered diffuse infiltration system would promote more rapid storm water infiltration, through the construction of one or more moderate permeabilty "windows" in the low permeability surface soils. The engineered infiltration system would be conceptually similar to a multimedia filter wherein coarse media overlie fine media so as to prevent plugging of the fine media while still enabling effective filtration. Such a system would require excavation of about two feet of topsoil over a broad area and refilling with different grades of sand and gravel. Up to four grades of materials would be used ranging from medium sand on the bottom to crushed rock on the top. Storm water would be collected from existing trenches or other low-lying areas and conveyed to the engineered infiltration system.

The system would be constructed at several locations around Parcel A so as to enhance infiltration and mimic a truly diffuse "natural" infiltration system. Potential locations include the low areas near drain numbers 23 and 25, near the northern edge of Parcel A where stormwater currently enters the perimeter ditch, and on the eastern side of Parcel A between the butt treating plant and the property boundary.

This approach has a low to moderate potential for success. The system would initially work but would eventually be clogged with silt as did the former french drains. Upon clogging, the filter sands and gravels would require replacement.

Regulatory Requirements The existing NPDES or proposed Waste Discharge Permit may need to be modified to reflect the engineered system. A determination would also be required from Ecology that the option does not comprise a class V injection well and thus does not require an injection well permit.

Option 2: Temporary Storage

Description This option involves pumping storm water from existing ditches and low areas within Parcel A to either a tank or a newly constructed lined lagoon for temporary storage. Storm water pumping and storage would only occur when site flooding became problematic. After a significant rain event was over, stored water would then be conveyed back to and spread on Parcel A in a controlled manner. The tank or lagoon would need to be sized to accommodate anticipated storm volumes likely to result in site flooding disruptive of facility operations.

Potential locations for the tank or lagoon include various locations on Parcel A or the wood waste landfill. Siting on the wood waste landfill would require an engineering evaluation to determine if the geotechnical properties of the landfill were sufficient to support such a tank or lagoon. The vendor that has provided a tank at the J. H. Baxter site in Eugene, Oregon (Environetics) has two successful applications where tanks have been constructed on landfills.

Regulatory Issues The Snohomish Health District would require a modification of the current solid waste facility permit if a tank or lagoon were placed on the landfill. This process would require submittal of a solid waste facility application for permit renewal and a State Environmental Policy Act (SEPA) checklist. The Snohomish Health District review would take about one month (however they are required to conduct the review in 90 days) and Ecology would be required to conduct a review within 45 days. The Snohomish Health District has verbally indicated that a tank or lined lagoon would be acceptable on the wood waste landfill provided that the engineering design is sufficient to prevent settling.

Potential dangerous waste implications are more onerous for lagoons or impoundments than for tanks. Treatment of dangerous wastes in tanks without a permit is allowed by Ecology as described in a Technical Information Memorandum titled Treatment by Generator (Publication Number 96-412, May 1999), whereas no such allowance is made for treatment in impoundments. Alternatively, treatment of storm water containing dangerous waste in tanks could be accomplished under the permit by rule standard (WAC 173-303-802(5)) since storm water discharge is currently regulated under a state waste discharge permit.

Following temporary storage in a tank, provided that storm water is not designated as containing a dangerous waste by the Department of Ecology, untreated storm water can be directly discharged to land surface under the current waste discharge permit. If storm water is determined to contain a dangerous waste, then storage for longer than 90 days would not be allowed without a permit and treatment prior to discharge. Treatment would likely involve flocculation and/or filtration to remove suspended solids followed by activated carbon treatment to remove pentachlorophenol (PCP) and dioxins. Monitoring of discharged stormwater and a determination by Ecology that treated storm water was no longer a dangerous waste would be required.

Option 3: Collection, Treatment, and Surface Water Disposal

Description This option involves collection of storm water in tanks followed by treatment using flocculation and/or filtration to remove suspended solids followed by adsorption of PCP and dioxin if present. Adsorption would likely be accomplished using activated carbon, but alternative media such as zeolites may be considered. Following treatment, water would be discharged to the ditch immediately east of the Baxter property.

Regulatory Issues Discussions with Ecology have indicated that discharge could be accomplished under an administrative order. Ecology would require approval from other interested parties prior to granting such an order. Likely interested parties would include the City of Arlington and the State Department of Fisheries. Fisheries would be particularly interested in the potential impact to salmon and the City would require a grading permit. Discharged water would be required to meet surface water quality standards, and monitoring would certainly be required. While this option is technically achievable, regulatory approval by this fall is highly unlikely.

Option 4. Collection, Treatment, and Arlington WWTP Disposal

This option involves collection and treatment of storm water, followed by conveyance to the Arlington wastewater treatment plant (WWTP). Discussions with City of Arlington Public Works have indicated they are not interested in taking storm water. Thus this option is not possible at this time.

Option 5: Treatment and Groundwater Infiltration

Description This option would involve collection and treatment of storm water as described in Option 3. Following treatment to groundwater quality standards, treated groundwater would be disposed of into the subsurface via a well. These wells would be subject to approval under the State Underground Injection Control (UIC) program.

Regulatory Issues Ecology approval of a UIC well would be required.

Screening of Options

Identified water management options were tabulated and initially screened based on the following criteria:

- Likelihood of regulatory approval
- Ability to meet schedule with regard to permitting
- Ability to meet schedule with regard to procurement and construction

The schedule assumes system startup by October 15, 2000.

Based on information provided above, **Table 1** shows the results of this screening. Options 1, 2, and 5 passed the screening.

Table 1
Stormwater Options Screening
Arlington, Washington

Option No.	Storm Water Management Option	Approval Likely	Meets Schedule (1)		Passed Screening
			Permits	Construction	
1	Diffuse infiltration system (DIS)/ redistribution	Maybe (2)	Maybe (5)	Yes	Yes
2	Temporary storage	Yes	Maybe (6)	Maybe (8)	Yes
3	Collection, Treatment, and Surface Water Disposal	Maybe (3)	No	NA	No
4	Collection, Treatment, and Arlington WWTP Disposal	No	NA	NA	No
5	Treatment and groundwater introduction	Maybe (4)	Maybe (7)	Maybe (9)	Yes

Notes:
NA - not applicable.

1 - October 15, 2000 startup.
2 - Depends on whether DIS is classified as a Class V injection well by State UIC program.
3 - Depends on determination by State Fisheries Department .
4 - Depends on potential impact on migration of dissolved contaminants in groundwater.
5 - Assumes that the DIS is not classified as a Class V injection well.
6 - Depends on whether storm water is designated as containing F032 dangerous waste.
7 - Depends on ability of Ecology to issue UIC permit within 2 weeks.
8 - Tank delivery is 4 to 6 weeks following approval of drawings.
9 - Possible only if engineering design report not required since procurement/construction will require 6 to 8 weeks.

Detailed Evaluation of Options

Evaluation of Option 1: Diffuse Infiltration

An engineered diffuse infiltration system would handle a portion of a design storm. A ten-year 24 hour storm is estimated to produce a total of 920,000 gallons based on rainfall data from the Arlington area. A two-year 24-hour storm was estimated to be two inches based on western Washington data, which translates to 800,000 gallons on the 14.8-acre Parcel A. The two-year 24-hour storm was selected as a design basis. Such a storm is more likely to occur within the next two years.

An infiltration rate of about 1.3 gallons per day per square foot (gpd/ft^2) would result in complete infiltration of 800,000 gallons in a 24 hour period. Previous experience has indicated that Parcel A could not accommodate this storm water volume even when the french drains were in place. Assuming an infiltration rate of 0.1 gpd/ft^2 would require about 13 days for complete infiltration of the design storm. This value appears too low given previous experience at the site. Thus, for purposes of this analysis, the actual infiltration rate is estimated to be about 0.2 gpd/ft^2, or 130,000 gpd over Parcel A. This rate should be field verified.

An engineered infiltration system was designed based on the above storm volume. **Table 2** presents the design basis for this design. The infiltration system was assumed to have an infiltration capacity of 11 gpd/ft^2 based on subsurface soil properties;

however, this capacity should be verified with a field infiltration test. As an initial case, the system was designed to accommodate 10 percent of the volume of the design storm volume per 24-hour period, less the infiltrating volume (800,000 - 130,000 gallons x 10%) per 24-hour period. Thus in this scenario the full volume of the storm would infiltrate through the system over a period of 10 days. The infiltration system area was calculated to be 0.14 acres based on this design. Doubling or tripling the size of the infiltration area would reduce the infiltration time to five days or three days, respectively. Developing multiple infiltration areas, for example in existing flood-prone areas will also be considered to create more natural site-wide infiltration conditions and utilize existing grades. Further, enhancing infiltration in existing flood-prone areas will provide consistency in further remedial evaluation.

Similar to a multimedia filter, the infiltration system would consist of 0.5-foot lifts of different particle size materials ranging from medium sand to crushed rock as shown in **Figure 1**. The total thickness of the system would be 2 feet. A total of 440 cubic yards of soil would require excavation based on the 10 percent accommodation criteria. Excavated soil would be spread on Parcel A.

Table 2
Engineered Infiltration System Design Basis
Arlington, Washington

	Unit	Quantity
Parcel A Area	acres	14.8
2-year 24-hour storm volume	inches	2
24 hour storm volume	gal	800,000
Site infiltration capacity	gpd/sq ft	0.2
24-hour capacity of site	gal	129,000
Volume to infiltration system	gal	671,000
Infiltration system capacity	gpd/sq ft	11.2
Percent of storm water accommodated by system per day	%	10%
Required infiltration system area	acres	0.14

Note:
gpd/sq ft - gallons per day per square foot.

Operation of the system would involve natural drainage across areas where the filter has been constructed combined with pumping water from existing ditches on-site through conveyance lines to upslope infiltration areas. In time, silt is expected to plug the system and excavation followed by replacement would be required. The required frequency of replacement is not known at this time. However, based on observed suspended solids concentrations ranging from 100 to 1,000 milligrams per liter (mg/l), the mass of solids being filtered by the system per 24-hour rain event ranges from 150 to 1,500 pounds. In general, multimedia filters are not used to filter water containing such high levels of suspended solids. Furthermore, multimedia filters are typically operated with a backwash system. Based on this rate of solids loading, the engineered infiltration system is expected to plug frequently and have high maintenance requirements.

Evaluation of Option 2: Temporary Tank Storage

Option 2 involves use of a tank to temporarily store storm water. The tank would be used to store a portion of the peak flows resulting from an individual large storm event or succession of storm events, as typically occur during the winter. The exact amount of water needing to be stored in order to prevent flooding can not be calculated without knowing significantly more about site hydraulics and infiltration rates. A possible lower end estimate would be the volume of the 24-hour 2-year storm (800,000 gallons) minus infiltration over a 24-hour period (130,000 gallons) minus existing storage onsite in ditches, low areas, etc. (estimated to be 350,000 gallons). This translates to a requirement for storage of 320,000 gallons. A possible high-end estimate is that 20% of the annual rainfall of 47 inches (20% of 19,000,000) needs to be stored as removal of the "peak" storm volumes. This translates to approximately 3.8 million gallons. For purposes of this engineering evaluation, one million gallons of tank storage was selected. Very large storm events will still have the potential to overwhelm the one-million gallon tank.

Two vendors for large tanks were contacted: Environetics and Columbian Steel Tank Company. Only Environetics was capable of meeting schedule requirements. A one-million gallon tank from Environetics is currently being used at the J. H. Baxter Eugene, Oregon facility. The tank comprises a 10.83-foot high by 129-foot diameter bolted steel shell with a 30 mil liner. The tank is placed on a leveled and compacted surface. The tank does not include a cover or secondary containment. Columbian Steel Tank can provide a one million gallon tank measuring 32 feet in height by 72 feet in diameter, thus having a smaller footprint. However they require eight weeks to deliver following a two-week approval process and four weeks of construction. Thus their tank would not be operational until November or December. Potential tank locations are shown on **Figure 2**. Location on the neighboring Hanner property to the northwest would be contingent on purchase of this property by Baxter.

Diaphragm pumps would be used to pump water from ditches and/or flooded areas when necessary. Storm water would be pumped to the tank through buried PVC pipe. When the level in the ditches subsided, water from the tank would then be pumped back to the ditches at a controlled rate via a parallel PVC pipe with a separate pump. **Figure 3** shows a simplified process flow diagram of the system.

Treatment of collected storm water would be required if designated as containing dangerous waste. The treatment system design flow is 70 gpm based on a ten-day treatment time. A simplified process flow diagram for the treatment system is shown in **Figure 4**. An alternative method of treatment would involve use of an automatic backwashing filter instead of polymer flocculation followed by bag filtration.

Implementation of Option 2 with or without treatment would require the start of tank procurement no later than August 15 in order to insure startup by October 15.

Evaluation of Option 5

This involves treatment of collected storm water followed by direct infiltration through wells into the subsurface. A treatment system as in **Figure 4**, plus several infiltration wells would need to be installed.

The potential impact of injecting water into the upper aquifer on migration of existing dissolved contaminants would require evaluation. The water table would mound around each of the injection wells, causing changes in groundwater flow across Parcel A and through the existing contaminant plume. Evaluation of this impact would need to be made in the next two weeks in order to meet the schedule for implementing this option by October.

Summary and Recommendation

Several options were presented, screened, and evaluated. We recommend going directly to Option 2 for short-term storm water management. This option is considered to be more immediately certain for the following reasons:

- Simplest method with greatest likelihood of technical success
- Implementation schedule consistent with onset of rainy season
- Minimal regulatory review requirements thus expediting implementation
- Accommodates nonhazardous or hazardous waste
- Easily incorporated into likely final remedies

If the tank cost is prohibitive, then we recommend a combination of Options 1 and 2, where a smaller tank would be used with the diffuse infiltration system.

Option 5 is not recommended due to anticipated difficulties treating water with high suspended solids loads, potential for changing groundwater flow paths and spreading contamination into currently uncontaminated areas, and anticipated regulatory hurdles associated with the UIC program.

Figures

Figure 1 Engineered Infiltration System Design Cross Section
Figure 2 Potential Tank Locations
Figure 3 Process Flow Diagram Temporary Storage Tank System Without Treatment
Figure 4 Process Flow Diagram for Stormwater Treatment

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